THE VALUE AND MOMENTUM EFFECT IN THE PORTUGUESE STOCK MARKET

by

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Biographical Note

Marcos António Cerqueira Azeredo was born in Porto, Portugal, on the 6th of August, 1990.

In 2009, he entered in Faculdade de Economia do Porto where he got his economics bachelor degree in 2012. In the same year, he joined the Master in Finance at the Faculdade de Economia do Porto, with the objective to focus his studies on the financial side of business, both on corporate finance and financial markets. During the master, he was also a member of the FEP Finance Club, which allowed him to deepen his knowledge and skills on financial markets, while working on a professional and motivated environment.

Within the professional scope, he began his career in 2014, as an investor analyst in Sonae. Previously, he had been a high-school tutor.

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Abstract

Value and momentum are two well documented market phenomena that suggest the possibility of consistently achieving abnormal returns, challenging the Efficient Market Hypothesis and consequently, the reliability of most asset pricing models. With this study, we aim to better understand the relation between value and momentum effects by studying both effects together, contrary to the majority of financial literature available, including how the two strategies relate to each other and the common drivers of their behaviour. To the extent of our knowledge, this is the first work analysing both effects in combination for the Portuguese Stock Market. With a sample running from 1993 to 2015, we provide evidence of the outperformance of combined value and momentum strategies in the Portuguese Equity Market and registered statistically significant positive excess returns over the risk-free rate of 0.86% and 1.14% in our zero-cost combined value and momentum portfolios for a 1 month holding period. These findings hold across several holding periods, although decrease for longer maturities. Besides, in line with Asness *et al* (2013) conclusions, we found negative correlation between zero-cost value and momentum portfolios. Also, using value and momentum sorted portfolios, we were able to achieve raw returns of 2.3% monthly by buying winner and value and shorting loser and expensive stocks. Furthermore, we find that macroeconomic variables fail to explain value and momentum individual and combined returns, namely, equity risk premiums, real GDP growth and consumption growth. Consequently, our results suggest that an investor would be able to obtain abnormal positive returns by combining both strategies, which ultimately contradicts market efficiency at the weak form level and present a challenge to existing asset pricing theories.

Key Words: Value and Momentum strategies; Macroeconomic factors; Portuguese Stock Market

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1 Introduction

Value and momentum combined strategies consist on a jointly analysis of two phenomenon deeply studied in financial literature.

Value strategies aim to capture the outperformance of underpriced stocks based on certain financial ratios, such as: PER (price-to-earnings), PtB (price-to-book), price-to-cash-flow, among others. In our study we used the price-to-book ratio – one of the most common value measures.

> *"Statman (1980) and Rosenberg, Reid and Lansten (1985) find that average returns on U.S. stocks are positively related to the ratio of a firm's book value of common equity, BE, to its market value, ME."*
>
> Fama and French (1993, p.427)

On the other hand, momentum is the empirically observed continuation in asset prices. The idea of momentum is that assets that have risen in the past are more likely to continue rising in the near future and the opposite is true, assets that have underperformed in the recent past are more likely to continue underperforming.

> *"Trading strategies that buy past winners and sell past losers realize significant abnormal returns (...)"*
>
> Jegadeesh and Titman (1993, p. 89)

Both of these empirical effects, observed across several asset classes and present in markets all around the world, pose a challenge to the Efficient Market Hypothesis (EMH) proposed by Fama (1970), where he states that prices already incorporate and reflect all relevant information, making it unfeasible to systematically outperform the market and consistently achieve abnormal returns by taking into consideration past events, whether they are prices or accounting measures, such as earnings or book values.

There is a vast financial literature documenting and attempting to explain these anomalies, whether through rational theories in conformity with the EMH or by resorting to the irrationality inherent to human behaviour that are reflected in abnormal asset pricing mechanisms. The empirical work of Stattman (1980) and Jegadeesh and Titman (1993) initiated large amount of studies documenting value and momentum.

There have also been published several papers aiming to explain the effects, resorting to (i) empirical studies, such as the work of Chui *et al* (2010) who related the level of individualism within each culture with momentum returns or the work of Zhang (2005) which justified value premium with the increase in risk associated with those stocks; and (ii) theoretical models, mostly present on behavioural based explanations where data is mainly qualitative or hard to quantify, for instance, Hong and Stein (1999), Daniel *et al* (1998) and Barberis *et al* (1998) who developed theoretical models to justify momentum returns through behavioural biases of human behaviour and Berk *et al* (1999) and Gomes *et al* (2003) who constructed dynamic real options models to establish a relation between price-to-book ratios and risk that explains value premiums.

However, both effects are usually analysed and explained individually and independent from each other. There are a few studies analysing value and momentum in combination. One of the most prominent researchers is Asness, a pioneer in value and momentum combined analysis and who first suggested the negative correlation between both effects. He examined the independence of value and momentum strategies and found, for both, a relation between their respective returns according to the other variable. Asness most recent study co-published in 2013 (Asness *et al*, 2013) went further and found value and momentum returns co-movements across equity markets worldwide but also across several asset classes, namely government bonds, equity indexes, currencies, commodities futures.

In this paper, we intend to study the relation between value and momentum in the Portuguese Stock Market between 1988 and 2015, although in section 4, our sample runs from 1994, given data limitations for the risk-free rate, while following a similar methodology of Asnesss *et al* (2013). It is not a deeply studied market, since so far, to our knowledge, there has not been made a jointly approach to these anomalies, and given its characteristics - macroeconomic, legal, political and others - it may display a similar behaviour to what is observed in other markets, for example, with southern European countries such as: Spain, Italy, Greece and in some way to other European markets in general, as they all share a common currency for over 15 years. Further, we studied the relation of value and momentum returns to several macroeconomic variables.

The structure of this study is as follows. Section 2 presents a literature review of both, value and momentum individually, segmented for rational-based and behavioural theories and joint literature of both effects. In section 3, we detail our data sources and methodology followed to perform the study. Section 4 unfolds the core of our analysis by combining value and momentum portfolios across several observation and holding periods, as well as, measured individual performance of both effects. In section 5, we intersect value portfolios with momentum portfolios and measure the additional benefit that a solely value or momentum investor would have by taking into consideration the other respective effect. Then, we aim to explain excess returns achieved by our combined portfolio with macroeconomic variables. Lastly, section 7 discusses conclusions and makes final remarks.

2 Literature Review

In this section, we developed a comprehensive literature research of the two market anomalies: value and momentum. We divided it into 4 subsections: 2.1 and 2.2 individually analyse momentum and value effect respectively, including their presence and main explanations, whether risk or behavioural based; 2.3 approaches value and momentum combined; and lastly in 2.4 we present some studies using macroeconomic variables to justify both phenomena.

2.1 Momentum Effect

Momentum based strategies date back to the mid of the twentieth century where there was an open discussion among financial experts about the predictability of stock price returns. One side supported its statistical independence, claiming that prices followed a random walk and therefore, it would be impossible to predict future returns based on any public available information – eg: Alexander (1961), Fama and Blume (1966), Van Horne and Parker (1967) James (1968) (in Bennington and Jensen 1970). On the other side, it was claimed that past information contained in a stock price would be capable of predicting its future behavior - argument fueled by a controversial study published by Levy (1967). However, his paper was very much criticized for methodology errors, selection bias and for not accounting trading costs (see: Jensen, 1967 and Bennington and Jensen, 1970).

Fama (1970) formulated the theory of efficient markets. According to it, in an efficient market, "prices always fully reflect available information" (Fama, 1970), thus they are an unbiased estimators of the true value of an investment at any period, making it unfeasible to constantly register returns above the market.

By investigating the presence of momentum in stock returns, one is testing the weak form of efficiency which states historical price information is totally reflected on current market price. Therefore, no excess return should be earned by applying a strategy that looks solely at the price of a stock in previous periods, such as momentum based strategies.

2.1.1 Presence of Momentum

Momentum effect was introduced by Jegadeesh and Titman (1993). They documented that strategies based on buying stocks that have done better in the recent past and selling stocks that have underperformed the formers generate abnormal returns over holding periods from 3 to 12 months. With a sample extracted from the US stock market during the period between 1965 and 1989, their strategy realized a compounded excess return of 12% per year. This discovery came as a challenge for the Efficient Market Hypothesis developed by Fama (1970), since that excess return could not be properly justified by differences in systematic risk.

Studies on momentum effect have been replicated across the globe. After Jegadeesh and Titman (1993), there were several published studies regarding the presence of momentum in stock markets within and outside the US.

Following a similar strategy as Jegadeesh and Titman (1993), Foerster *et al* (1994/1995) found evidence of momentum abnormal returns in Canadian stocks between the period of 1978 and 1993. These results were later supported by Korkie and Plas (1995) and Kan and Kirikos (1996) (in Cleary and Inglis, 1998).

Rouwenhorst (1998) studied momentum within and across European stock markets. With a sample running between 1978 and 1995, he registered average excess returns of approximately 1% per month. The outperformance lasted for about a year and could not be justified by traditional risk measures.

Also, Rouwenhorst (1999) performed a study across 20 emerging markets and his findings suggested documented factors in developed markets, such as momentum and value effect, also influenced returns in emerging stock markets. Therefore concluding return factors were qualitatively similar across both markets.

The presence of momentum was also documented in Asian markets by Chui *et al* (2000), who studied momentum profits across eight Asian markets and, similarly to previous studies in US and Europe, found that momentum profits were higher for smaller market capitalization stocks with higher price-to-book ratios and higher turnover ratios.

In Australia, momentum profits were documented by Hurn and Pavlov (2003) and Demir *et al* (2004). Their findings suggested short and medium term momentum profits that could not be explained by traditional risk measures and prevail over time.

The Portuguese market was also the field for some studies aiming at identifying momentum returns. Soares and Serra (2005) analysed the profitability of momentum and value strategies for the Portuguese stock market between 1986 and 2003. Their results seemed to support the overreaction hypothesis, since they found long-term reversion in returns, even after adjusting for risk. Also, they found value strategies register positive excess returns not explained by risk factors, while after controlling for risk, there was weak evidence to support the profitability of momentum strategies. Nevertheless, most of their results lacked statistical significance.

Pereira (2009) also analysed momentum returns from 1997 to 2008 in the Portuguese stock market. His results suggested the profitability of momentum strategies for several observation (O) and holding (H) periods. The three most profitable strategies - O6-H3, O1-H6, and O3-H3 – yielded average monthly returns of 1.5%. In spite of being economically relevant, his results were not statistically significant.

Lastly, Lobão and Lopes (2014) studied return continuation strategies in the Portuguese Stock Market from 1988 to 2012. Using an extensive sample comprising 24 years, they analysed 32 different momentum strategies across several combinations of observation holding periods. Their findings go in favor of the profitability of momentum strategies with past winners significantly outperforming past losers by an average of 1.1% per month. Their results are statistically significant, even though their sample may be influenced by some survivorship bias.

2.1.2 Explanations for the Momentum Effect

Fama (1970)'s theory of efficient markets redefined return and risk as being tied together - two sides of the same coin – implying that riskier assets would tend to yield higher returns, while lower returns would be associated with lower risk levels. However, some authors identified return patterns that were unjustified by the CAPM, and therefore presented a challenge to the Efficient Market Hypothesis, developed by Fama (1970).

The justification for the profitability of momentum strategies falls mainly under two categories: risk-reward models, mostly consistent with the Efficient Markets Hypothesis, stating momentum abnormal returns are the result of higher risk exposure,

and behavioural models, which explain the price pattern identified with psychological biases.

A. Risk-Reward Models

Fama and French (1993) developed a three-factor model to better capture risk and better explain return patterns identified. However, despite explaining several anomalies, it was unable to explain momentum abnormal returns.

Conrad and Kaul (1998) analysed the sources of profits to momentum and contrarian strategies across several investment horizons. Their findings suggested that the profitability of momentum strategies in the medium term (3-12 months) was only statistically significant in the sub-period between 1926 and 1947. In addition, they suggested the cross-sectional variation in the mean returns of individual securities was the source of momentum abnormal returns and responsible for the general lack of success of contrarian investment strategies. As a consequence, momentum portfolio should register on average positive abnormal returns in any post-ranking period, instead of registering a mean reverting pattern.

Jegadeesh and Titman (2001) documented momentum abnormal profits during the 90s period, with similar magnitude and significance, thus confirming the results achieved in Jegadeesh and Titman (1993). Additionally, they analysed momentum returns during the period from 1965 to 1998 in US stocks and identified negative cumulative return of the momentum portfolio from month 13 to 60, therefore disproving Conrad and Kaul's (1998) results – according to the authors, justified by smaller sample biases.

On the other hand, Grundy and Martin (2001) found that asset pricing models, such as: the CAPM and the Fama and French (1993) three-factor model, industry effects and cross-sectional differences in expected returns did not explain momentum returns.

B. Behavioural Models

Contrary to risk-based explanations, some authors support that momentum profits happen regardless of risk exposure, and are originated by biases in human behaviour.

Chan *et al* (1996) behavioural model is based on the underreaction theory, particularly following earnings announcements, which states that investors gradually incorporate

new information in prices which generates return continuation until all news are incorporated.

Other authors have developed theoretical models based on biases of human behaviour that could justify momentum profits. Barberis *et al* (1998) resorted to two behavioural biases: representativeness and conservatism to explain two regularities identified in stock returns: under and over reaction to news. Daniel *et al* (1998) also proposed a model of investor sentiment to reconcile both reactions. In their model, investors' behaviour is influenced by two different psychological traits: overconfidence and self-attribution. Both support overreaction patterns in stock returns.

Chui *et al* (2010) supported Daniel *et al* (1998) theory by finding that momentum returns grew in proportion to the degree of individualism, which in turn is related with the degree of overconfidence and self-attribution biases, observed by the significantly higher trading volumes and volatility registered in more individualist cultures.

According to Hong and Stein (1999), Daniel *et al* (1998) and Barberis, *et al* (1998) models fail, since both assume prices are driven by a representative agent that is exposed to several cognitive biases that produce the observed patterns, therefore making them detached theories, instead of consistent in a single and structured model.

Hong and Stein (1999) proposed a unified model constituted by two types of agents, "newswatchers" and momentum traders with bonded rationality. Based on fundamental analysis, these "newswatchers" will trigger price movements. These movements will attract momentum traders that base their analysis on past prices, and will ultimately lead to the overpricing of the security.

Other studies confirmed the overreaction hypothesis. Lee and Swaminathan (2000) studied the relation between momentum profits and the level of investor's interest in a stock, captured by turnover volume. Their findings suggested the magnitude and persistence of momentum profits could be predicted by past trading volume - high (low) volume winners (losers) experience faster momentum reversals – and go in line with Jegadeesh and Titman's (2001) conclusions of delayed overreaction.

Cooper *et al* (2004) found that the momentum profits only occurred when the market was bullish, which could also be in favour of the overreaction hypothesis.

2.2 Value Effect

The value effect consists on the outperformance of value stocks, characterized by low prices relative to earnings, dividends, book assets or any other measure of fundamental value, versus growth stocks, with higher price ratios.

Growth stocks are usually associated with high potential firms or with favourable future growth profits. On the other hand, value stocks have lower market valuations relatively to their accounting values (eg: books value, sales or cash-flows) and are usually associated with firms in mature markets, characterized by low growth potential or in distressful situations.

The value effect was one of the anomalies discovered after the release of Fama's (1970) theory of efficient markets. However, its foundations date back to Dodd and Graham (1934), where they laid the pillars to what it would be later called value investing – a trading strategy which consists in buying underpriced stocks based on some form of fundamental analysis. Dreman (1977) also published a literature reference about psychology where he supported the outperformance of value strategies, without a corresponding increase in risk.

There are several measures which can determine a value stock: cash-flow yield, price-to-earnings ratio, dividend yield and price-to-book ratio were the most commonly used.

This effect goes against the efficient market theory proposed by Fama (1970), since according to it, prices should reflect future expectations, whereas cash-flows, dividends, sales or any other accounting measure took place in the past, therefore they should be already fully reflected in prices and their knowledge should in any case influence future price movements.

2.2.1 Presence of Value

Basu (1977) attempted to determine empirically the relationship between NYSE securities' performance and price-to-earnings ratios from 1957 to 1971. His results suggested an outperformance of the low price-to-earnings ratios stocks even after adjusting for risk. Basu (1983) and Jaffe *et al* (1989) further studied this relationship and their results were consistent with previous studies.

Using the price-to-book as a value signal, Stattman (1980) found a significant negative relation between abnormal stock returns and the degree to which market value of equity

exceeds its book value. Lanstein *et al* (1985) also studied the relationship between US stock returns and the price-to-book ratio and concluded they were positively related to each other.

Wilson (1986) and Bernard and Stober (1989) studied the relationship between cash-flows and stock returns. However, given some shortcomings in the analysis of accounting earnings, their event study recorded mixed results.

In Japan, Chan *et al* (1991) studied the cross-sectional differences in stock returns to the underlying behaviour of four fundamental variables: earnings yield, size, price-to-book ratio and cash-flow yield with a data sample from 1971 to 1988. His findings suggested a significant relationship between the fundamental variables and expected returns, with price-to-book ratio and cash-flow yield having the most significant impact on expected returns.

Within the US stock market, Fama and French (1992) found that NYSE stocks with high price-to-earnings ratios earned higher returns from 1962 to 1990. Lakonishok *et al* (1994) confirmed previous evidence of over performance of value stocks between 1968 and 1990 period for NYSE and AMEX listed stocks.

In addition, Chen *et al* (2008) found a value premium of 5.1% per year between 1941 and 2002 across US quoted firms. Also their findings suggested value premiums were countercyclical, through (i) a positive correlation with the default spread of 0.39, (ii) negative correlation with growth rate of real investment of -0.28, and (iii) significant positive reaction to macroeconomic shocks.

Extending their research worldwide, Capaul *et al* (1993) found similar results with a positive value-growth return spread across six countries[1] between 1981 and 1992. Also Fama and French (1998) confirmed the existence of an average value premium of 7.68% annually in 12 out of 13 stock markets[2] around the world between 1975 and 1995.

[1] Germany, UK, Switzerland, France, Japan and US.

[2] Previous 6 plus Italy, The Netherlands, Belgium, Sweden, Australia, Hong Kong and Singapore

2.2.2 Explanations for the Value Effect

As the outperformance of value strategies was being unfolded, some models emerged with the intention to explain the phenomenon.

Some authors simply defended these premiums result from sample selection biases or data snooping - Kothari *et al* (1995) argues that when the analysis is conditioned to assets displayed on CRSP and COMPUSTAT databases some biases arise that influence returns, although, Chan *et al* (1995) refuted this theory. Lo and MacKinlay (1990) and Conrad *et al* (2003) also warned against data snooping (in Phalippou 2007). However, the persistence of value premiums, both in and out of sample and after controlling for selection biases, has resulted in its general acceptance. Thus, the debate is divided in two central lines. Those who propose a rational explanation based on placing higher discount rates on low price-to-book stocks and some adaptations of CAPM to capture the premium. On the other hand, advocates of behavioural biases support low price-to-book premiums are a proxy of mispricing driven by a combination of certain systematic errors made by investors with limited arbitrage.

Empirical research provides evidence of some characteristics related to the value premium such as: low analyst coverage (Griffin and Lemmon, 2002), stocks with high idiosyncratic volatility (Ali *et al*, 2003), and stocks with low institutional ownership (Nagel, 2005).

A. Measure of Risk

Chan and Chen (1991) defended that the price-to-book ratio captured risk related with a distress factor and stocks with a lower ratio would be associated with poor investments. Also, Fama and French (1992) supported that value strategies are fundamentally riskier and price-to-book was a proxy for underlying common risk factors. Therefore concluding the outperformance of value strategies was just a fair compensation for the additional risk.

Fama and French (1993) constructed a three-factor model to capture additional risk by incorporating in CAPM a price-to-book ratio and size factors. This three-factor model

was better able to capture the patterns and, therefore explain stock returns in US. Although, it did not capture momentum effect found by Jegadeesh and Titman (1993). Nevertheless, the model was very criticized for being an ad-hoc model and for implying a premium on distressed firms.

Chen and Zhang (1998) argued value premium is a compensation for higher risk, captured by dividends, price-to-book ratio and the standard deviation of earnings, which could partially explain stock returns across US (NYSE and AMEX) and Asia[3].

Since 1999, with the introduction of real options, new risk-based explanations emerged. Berk *et al* (1999) constructed a dynamic real options model which justified time-series and cross-sectional relations between price-to-book ratios and returns through risk.

Also, Gomes *et al* (2003) built a theoretical dynamic equilibrium model that suggested growth stocks are riskier than value stocks, since the former drive their values from growth options, while the latter from assets-in-place, which are less sensitive to market conditions. Yet, historically, growth stocks have earned lower average returns.

Zhang (2005) also supports risk-based explanations. Although, contrary to Gomes *et al* (2003), his model suggests empirical regularities, such as: value stocks being riskier than growth. His conclusions are mainly supported by the risk dispersion between value and growth stocks driven from the costly reversibility of assets-in-place which increases risk associated with value stocks, particularly in bad economic times. Chen *et al* (2008) also confirmed some of Zhang's (2005) conclusions.

Choi (2013) investigated the interaction between asset risk and financial leverage and found that differences in leverage of value and growth stocks results in different risk exposure during economic downturns – value stocks registered higher risk which resulted in an increase in its respective betas, while growth stocks have usually lower leverage and their assets are usually less sensitive to economic conditions. His findings are consistent with the theoretical framework of growth options, particularly with Zhang's (2005) results - value stocks being riskier, especially, during downturns.

B. Behavioural Models

Basu (1977) made an initial attempt to justify value premiums with the exaggeration of investors' expectations when analysing past earnings performance.

[3] Japan, Hong Kong, Malaysia, Taiwan and Thailand

Shiller (1984) was also a pioneer in justifying value premium with the psychological trait of individuals to follow main social movements which in financial markets implies a preference for a certain group of stocks (growth stocks) instead of others (value stocks). As he concluded, this leads to the outperformance of the less demanded stocks, in which prices fall below their fundamental value, against high demanded growth stocks.

Black (1986) justified the anomaly with the "noise" present in financial markets which even though it allows trading and pricing of securities, it creates inefficiencies while preventing investors from taking advantage of them.

Lakonishok *et al* (1992) focused on the agency relation that arises through the money management. Growth ("glamour") stocks are easily justified to investors while value stocks go against mainstream and are harder to explain. Therefore, growth stocks are more prudent investments, since stocks that have done well in the past are less likely to be distressed in the future. The agency relation brings up career concerns to money managers leading them to tilt their investments toward growth stocks.

Two years later, Lakonishok *et al* (1994) supported that value strategies yield abnormal returns, not explained by higher risk. After analysing several explanations, they conjectured that results are best explained by the preference to hold growth stocks, driven by judgment errors, such as: extrapolating future growth rates and linking good firms to good investments. They also pointed out that institutional investors have usually shorter investment horizons than required for value strategies, which may explain their bias towards growth stocks.

La Porta *et al* (1997) measured stock price reactions around earnings announcements for value and growth stocks over a 5-year period after portfolio formation. Their results suggested that a significant portion of the return difference between value and growth stocks – approximately 25% to 30% annually – is attributable to earnings surprises that are systematically more positive for value stocks.

In line with mispricing explanations, Phalippou (2007) suggested value premiums are registered only in stocks held by individual investors. They reached a value premium in those stocks of 2% a month suggesting the premium is likely due to mispricing and arbitrage is costly and ineffective.

2.3 Value and Momentum Effect

The interaction of value and momentum was firstly documented by Asness (1997). Up to this point, the efficacy of value and momentum strategies was already documented (see: Fama and French 1992, Jegadeesh and Titman 1993, Lakonishok *et al* 1994), even though their explanation was still controversial. Asness's (1997) goal was to study the relation between both strategies by examining how value strategies perform among stocks exhibiting stronger (weaker) momentum and how momentum profits behave across low price-to-book (cheap) and high price-to-book (expensive) stocks. In order to do that, he analysed monthly data of US stocks between 1963 and 1994.

His findings suggest both strategies register abnormal returns in general and their returns are negatively correlated, which means momentum is stronger in high price-to-book stocks and value works best for weak momentum stocks. Nevertheless, his findings do not contribute to support any explanations of why these strategies work and whether we are in a rational or irrational asset pricing framework.

In line with Asness (1997)'s conclusions, Daniel and Titman (1999) found that momentum abnormal profits are stronger for growth stocks. Their interpretations falls in the framework of their model, which predicted that overconfidence is more likely to have effects when ambiguity is high, which could be the case for growth stocks.

By investigating the sources of momentum reversals, Nagel (2001) found they disappear after controlling for price-to-book ratios based on data from UK and US stock markets from 1965 to 2000. Consequently, he states these reversals are a price-to-book effect based on the premise that stocks which have experienced recent growth (winners) will exhibit higher price-to-book ratios while stocks recording weaker growth rates will tend to become value stocks.

Additionally, in line with the predictability of volume in momentum profits persistence or reversals documented by Lee and Swaminathan (2000), Nagel (2001) found volume has no predictable power after controlling for price-to-book which suggests this ratio is correlated with volume. Lastly, his findings suggest that the return spread between value and growth is mean reverting as he found those premiums diminish considerably after several years in US and UK.

In line with the previous work of Asness (1997), which suggested the superior combined profitability of momentum and value, as well as the work of Bird and

Whitaker (2004), which documented returns from momentum tend to be pro-cyclical while value returns tend to be counter-cyclical, Babameto and Harris (2008) implemented a combined value and momentum strategy using the portfolio optimization model of Black and Litterman (1990, 1991, 1992) in 177 national industry indexes for the US, the UK and Japan. As a result, they were able to outperform the market over their full sample by following a zero investment value and momentum strategy. However, the returns registered were more volatile and had several periods of underperforming. Nevertheless, the forecasting models for both strategies were able to capture this cyclicality enabling them to outperform the market by 0.7 percent per annum, net of transaction cost.

Brown *et al* (2008) analysed the returns to value and momentum among four Asian stock markets[4]. They conducted two distinctive experiences. First they have constructed and evaluated a portfolio constituted by a long position on both value and winner stocks and a short position on both growth and loser stocks in each Asian market analysed. Second, they combined all stocks into one basket and evaluated the return to momentum and value strategies. Their conclusions suggest that the combination of best value and momentum strategies does not provide a significant improvement over the value or momentum strategies evaluated separately.

The pro-cyclicality of momentum premium and the counter cyclicality of value premium associated with the fact that cross sectional dispersion in stock returns is countercyclical suggest that market cross sectional stock return dispersion may contain information about value and momentum premiums. Stivers and Sun (2010) studied the international relation between cross-sectional dispersion in stock returns and subsequent value and momentum premiums over the period between 1962 and 2005. Their findings suggest that market's recent cross sectional stock return dispersion is positively related to value premium. Their findings remain strong even after controlling for macroeconomic state variables.

Cakici *et al* (2013) studied value and momentum effect across 18 emerging stock markets between 1990 and 2011. Besides confirming the presence of momentum and value abnormal returns, they found that both effects are negatively correlated, in line with results for developed markets.

[4] Hong Kong, Korea, Singapore and Taiwan

Asness *et al* (2013) published a further study about the combined effect of value and momentum by analysing their jointly returns across eight markets: US, UK, Continental Europe and Japan; and asset classes: country equity index futures, government bonds, currencies and commodity futures between 1972 and 2011. Aligned with previous results, they found significant return premium for momentum and value strategies across all markets and asset classes and strong comovement of their respective returns and a higher cross sectional dispersion in average returns. As stated before value strategies are negatively related to momentum strategies and positively related with other value strategies.

Momentum in government bonds and value effect in currencies and commodities were documented for the first time in their paper, although, comovement across asset classes is one of its main findings as it suggests the presence of common global risk factors related to both effects.

They further investigated these common factors and found a modest link to macroeconomic variables such as business cycle, consumption and default risk. Also, liquidity risk seemed to be negatively related to value and positively related to momentum globally and across asset classes, implying that the negative relation between both effects is partially driven by this opposite relation with liquidity risk, even though it only explains a small fraction of their correlation. This relation goes in line with Pastor and Stambaug's (2003) findings and with Sadka's (2006) that found liquidity risk is positively related with momentum in US individual stocks.

2.4 Macroeconomic Explanations

In literature, there have been many authors attempting to capture risk factors sufficiently capable of justifying value and momentum abnormal returns. Since these were deeply studied phenomena, present on a worldwide level and across asset classes, yet with some local specific behaviour, macroeconomic variables emerged as a potential factor at justifying these abnormal price movements. Still, as far as we know, there have not been performed combined analyses with value and momentum excess returns against macroeconomic variables.

On the momentum side, Chordia and Shivakumar (2002) used macroeconomic indicators of market conditions such as: market dividend yield, default spread, term

spread and yield on 3 month T-bills and concluded that variations in these macroeconomic factors were the main drivers of momentum profits across US stock returns. However, Griffin *et al* (2003) contradicted their empirical work. They examined the linkage between macroeconomic risk and momentum profits using a data set comprising 40 countries worldwide and several methodologies. Their findings suggest neither an unconditional or conditional model of macroeconomic risks can explain momentum. Additionally, they also found weak comovement across countries and momentum reversals.

In addition, Cooper *et al* (2004) also contradicted these documented results as the authors found they did not hold after screening out illiquid and high-trading-cost stocks. They examined macroeconomic factors, such as: dividend yield, default spread, term spread, and short-term interest rates and concluded those are unable to explain momentum profits after mitigating microstructure-induced biases.

Chen *et al* (2008) tried to estimate the expected value premiums of US stocks, measured by the dividend yield ratio and future dividend growth rate, by regress them on a set of conditional macroeconomic variables, whether procyclical, such as growth in real consumption, and countercyclical variables like the default spread, between 1941 and 2002. Besides founding significantly positive value premium, the authors found those premiums tend to be positively correlated with countercyclical variables and negatively correlated with procyclical variables.

By examining consumption data, Maloy et al (2009) showed that long-run stockholder consumption risk better captures cross-sectional variation in average asset returns. In order to do that, he examined 25 size and price-to-book equity sorted portfolios of Fama and French (1996) which comprised US stocks and treasury bonds data from 1926 to 2004. His findings suggest US stock value strategies are positively related to long-run consumption growth in U.S. data. These results were consistent with previous studies, such as: Hansen et al (2008) who aimed at explaining the dynamics of value and growth stock returns within the framework of uncertain future cash-flow exposed to variable macroeconomic conditions.

Choi (2013) empirical model suggests that value premiums can be explained with the interaction of asset risk and financial leverage which increases equity risk in the time series. The author resorts to conditional asset and equity betas estimated from

instrumental variable regressions using various lagged conditioning variables: dividend yield, default spread, term spread and the short-term Treasury bill rate.

Lastly, Asness et al (2013) studied individually value and momentum across markets and asset classes, against 5 macroeconomic variables: long-run consumption growth, a recession indicator, GDP growth, U.S. stock market return in excess of the T-bill rate and the Fama and French (1993) bond market factor returns capturing default and term spread for US bonds. Nevertheless, their results suggested global macroeconomic variables were generally not significantly related to value and momentum returns, besides: (i) momentum profits, which are significantly negatively related to recessions; (ii) default spread, registering a consistent negative relation to momentum returns in all asset classes; and (iii) default spreads, which seem to be positively related to global stock value, but insignificantly related to value returns in other asset classes.

3 Data and Methodology

In this section we aim to describe the data and methodology used for constructing value and momentum portfolios in the Portuguese Stock Market. In the following subsection, we present the data collected in the formation of our sample and in the next we explain the methodology followed which allowed us to achieve our results.

3.1 Data

In our study, we have constructed our value and momentum portfolios with data from the enlarged index of the Portuguese Stock market – PSI Geral. Our sample period runs from January 1988 to February 2015, adding up to 27 years and comprising the longest data set of momentum and value returns analysed for the Portuguese market.

Our data is constituted by individual monthly adjusted stock prices (P), monthly price-to-book ratios (PtB) and monthly market values (MV) from the Datastream database. To control for the survivorship biases, we included in our sample dead and delisted stocks between the period of 1988 and 2015.

Our output totalled 132 stocks, in which we had fully information about the three variables, all running for the exact same period.

In order to perform a more realistic analysis, and in line with most authors, we restricted our portfolio to reasonably liquid assets. To minimize liquidity issues that would have jeopardize some transactions, we have removed from our sample the bottom quarter of less liquid securities. Given the inability to encounter volume information for all the observed securities, we used as proxy of liquidity, the proportion of zero daily returns, a methodology introduced by Lesmond *et al* (1999), and further developed in Lesmond (2005).

In addition, for a specific stock to be included in our sample, it must have been traded continuously at least for 25 months, since one of our strategies requires a 12 month observation period, 1 month of delay between the observation and the formation of the portfolio and 12 months of holding period – this methodology has also been followed by Lobão and Lopes (2014).

From the initial 132 stocks, and after restricting our sample to a reasonable set of liquid securities with a minimum of 25 months of observation period, we were left with a total of 96 stocks. Our sample varies between 20 in January 1988 and 45 in February 2015, reaching a maximum value of 75 during the first six months of 1999.

To assess the risk free rates, we used euribor for the period between 1993 and 2015 for the maturities of 1, 3, 6, 9 and 12 months – for 9 month it was estimated using the middle point between the 6 and the 12 month rate. Limitations in finding a consistent risk-free rate measure running from 1988 led us to start out analysis by December 1993 when studying excess returns, such as in section 4. Nevertheless, in other sections, when analysing raw returns, our sample runs from 1988.

3.2 Methodology

In our paper, we studied value and momentum in combination for the Portuguese stock market, initially for holding periods of one month and observation periods of twelve months and further, we show the analysis for other combinations of holding and observation periods – the latter used solely to form momentum signals.

To construct individual value and momentum portfolios for the Portuguese Stock market, we used the simplest and most standard measures, being our goal to maintain a simple and consistent approach in our analysis, to minimize the effects of data snooping bias[5].

Momentum measures were obtained by observing cumulative raw returns on the asset from past monthly periods, skipping the most recent month. Skipping the most recent month is standard in the momentum literature, to avoid the 1-month reversal in stock returns, which may be related to liquidity or microstructure issues (Jegadeesh, 1990; Lo and MacKinaly, 1990; Asness *et al*, 2013).

For value measures we used one of the most common value signals - the ratio of the market value of equity to book value of equity, or market-to-book or price-to-book ratio (PtB), at each stage. One problem with using current value measures is that investors may not have access to the book value of a company at all times, therefore, at this stage, we may incur in some look ahead bias. A way around it, used by Asness (1997) would

[5] Data snooping occurs when a given set of data is used more than once for purposes of inference or model selection, (White, 2000)

be to calculate price-to-book ratios using current market prices and lagged book value measures of 1 year, but that would also raise some inconsistency issues in the analysis, , especially around key events. Therefore, we decided to use current book values with the assumption that investors would, at all moments, be able to know or effectively estimate current book values.

Using the measures previously defined, we constructed individual value and momentum portfolios by ranking securities based on their value and momentum signals – low, middle and high - and sorted them into three equal numbered groups from which we constructed three distinct portfolios - P1, P2 and P3 respectively - for each measure of value and momentum.

In a first stage, we constructed individual value and momentum portfolios based on their respective signal – momentum signals took into consideration returns during the last 12 months while value signals were the PtB ratio observed in the current period. At this stage, we had 6 portfolios – P1, P2 and P3 for both measures with 1 month holding and 12 month observation period.

Then, we formed two zero-cost, long-short P3-P1 portfolios for each measure by shorting the one which displayed the lowest momentum (losers) and value (expensive/growth) signals and being long on the portfolios with highest momentum (winners) and value (value/cheap) signals.

Also, following the methodology used by Asness *et al* (2013), we constructed two additional zero-cost, long-short portfolios based value and momentum factors that use the entire cross section of securities. Factor portfolios were formed using the value or momentum signal (*S*) for any security *i* at time *t*. We weighted securities in proportion to their cross-sectional rank - the signal minus the cross-sectional average rank of that signal. Specifically, the weight on security *i* at time *t* is:

$$w_{it}^{S} = c_t(\text{rank}(S_{it}) - \Sigma_i \text{rank}(S_{it})/N) \quad (1)$$

Where the weights across all stocks sum zero which represents a euro-neutral long-short portfolio. We included a scaling factor *Ct* such that the overall portfolio is scaled to one euro long and one euro short. The return on the portfolio is then:

$$r_t^S = \Sigma_i w_{it}^S r_{it}, \quad \text{where } S \in (\text{value}, \text{momentum}) \quad (2)$$

Ultimately, we analysed value and momentum jointly, through P1, P2 and P3 portfolios which consisted in 50/50 combinations of the previous individual portfolios. Also included were two zero-cost, long-short portfolios constituted by 50/50 equal combinations (*Combo*) of value and momentum P3-P1 and factor portfolios, whose returns are:

$$r_t^{COMBO} = 0.5r_t^{VALUE} + 0.5r_t^{MOM} \quad (3)$$

In both return measures, we used the 50/50 weight combination because it was the methodology followed by Asness *et al* (2013), one of the pioneers and most significant researcher in value and momentum combined strategies, as well as, to keep a consistent and realistic analysis – any other weight distribution would raise significant questions and even after a convincing explanation, could be referred as data snooping or data dredging.

In the subsection 4.2, we analysed value and momentum in combination for the Portuguese stock market across several holding periods and observation periods. Following the same methodology described above for observation periods of 12 months and holding periods of 1 month, we extended our analysis to 1, 3, 6, 9 and 12 observation and holding periods – the chosen periods were inspired in the momentum analysis led by Lobão and Lopes (2014). This resulted in 90 individual portfolios: 75 (5x5x3) for momentum and 15 for value (5x3), from which we built 25 portfolios combining both measures – one for each observation and holding period.

Across all section 4, we use excess returns over the risk-free rate with a sample restricted to the sub-period between December 1993 and January 2015. Subsequent analysis resorts to the full sample available.

Table 1: Descriptive Sample Statistics

Table 1 displays some general statistical information regarding data used. In the first column we described the stocks comprising our sample, including its total amount, as well as, the total number of observation periods. Additional information, common to the remaining data, is: average, median, standard deviation and maximum and minimum values registered for aggregate number of stocks. Other data variables gathered include the outstanding shares of each security, adjusted prices, 1 month returns, price-to-book values, combined with market and book values of each security.

	Stocks	Shares outstanding (m)	Prices (€)	1 month returns (%)	Price-to-book	Market value (€m)	Book Value (€m)
Obs periods (m)	325						
Number of stocks	96						
Average	48.5	513.8	5.0	1%	1.8	840	448
Median	47.0	38.6	2.7	0%	1.3	98	86
Std Deviation	11.8	2,506.3	6.7	16%	5.0	1,980	1,050
Maximum	75.0	54,194.7	80.1	995%	175.4	16,857	7,880
Minimum	20.0	1.0	0.0	-85%	-36.0	0	-127

4 Value and Momentum Combined Returns

In this section we describe our results for the value and momentum portfolios formed from the Portuguese Stock Market. Value and momentum are analysed individually and in combination. Initially, in section 4.1, we aim to understand value and momentum portfolios for a single combination of observation (O) and holding (H) periods, O12-H1 (in months). Section 4.2 documents combined value and momentum returns for several combination of observation and holding periods, namely, 1, 3, 6, 9 and 12 months. Lastly, section 4.3 analyses individual performance of value and momentum portfolios for the same observation and holding periods.

4.1 Value and Momentum Combined Returns for a Single Maturity Period

In table 2, we report the average raw excess return over the risk-free rate (measured by euribor as proxy) for value and momentum portfolios, individually and in combination, between December 1993 and January 2015. Individual and combined portfolios are segmented across P1, P2 and P3 portfolios, representing low, middle and high value and momentum signals respectevely, as well as, zero-cost P3-P1 and Factor portfolios.

Table 2: Performance of Value and Momentum Portfolios Across the Portuguese Stock Market

Reported are the average excess returns over the risk-free rate (using euribor as proxy) for individual value and momentum portfolios from December 1993 to January 2015, as well as, for combined portfolios based on 50/50 weight for each measure. In each table, we divided our sample based on signals for value and momentum with P1, P2 and P3 representing low, middle and high signals respectively. P3-P1 are the zero-cost portfolios constituted by shorting portfolios with lowest signals and buying the ones with higher signals. We also constructed a factor zero-cost rank-weighted portfolio based on cross-sectional ranks for each security at each period. Also reported, are the respective t-statistics for each average excess return. Below them, we represent the standard deviations and Sharpe rations of each portfolio. In addition, we have the intercepts or alphas and their t-statistics from a time-series regression of each return series on the return of the market index (the value weighted PSI Geral returns) for each asset class.

Individual stock portfolios					
	Value Portfolios				
	P1	P2	P3	P3-P1	Factor
Mean	0.03%	0.10%	0.38%	0.35%	1.39%
(t-stat)	*0.08*	*0.27*	*0.64*	*0.68*	*3.00***
Stdev	5.9%	6.1%	9.4%	8.2%	7.4%
Sharpe	0.00	0.02	0.04	0.04	0.19

Alpha	0.0%	0.0%	0.3%	0.3%	1.0%
(t-stat)	*-0.29*	*0.13*	*0.63*	*0.61*	*2.24**

	Momentum Portfolios				
	P1	P2	P3	P3-P1	Factor
Mean	-0.81%	0.17%	0.55%	1.36%	0.90%
(t-stat)	*-1.72*	*0.44*	*1.47*	*3.30***	*2.22**
Stdev	7.5%	6.3%	6.0%	6.6%	6.5%
Sharpe	-0.11	0.03	0.09	0.21	0.14
Alpha	-0.9%	0.1%	0.5%	1.4%	0.7%
(t-stat)	*-3.04***	*0.45*	*2.47**	*3.39***	*1.78*

	Value and Momentum Portfolios				
	P1	P2	P3	P3-P1	Factor
Mean	-0.39%	0.14%	0.46%	0.86%	1.14%
(t-stat)	*-1.01*	*0.38*	*1.08*	*2.91***	*4.40***
Stdev	6.2%	5.8%	6.8%	4.7%	4.1%
Sharpe	-0.1	0.0	0.1	0.18	0.28
Alpha	-0.5%	0.1%	0.4%	0.9%	0.9%
(t-stat)	*-3.30***	*0.37*	*1.56*	*2.91***	*3.47***
Correl	0.69	0.69	0.67	-0.22	-0.29
(t-stat)	*15.2***	*15.1***	*14.4***	*-3.5***	*-4.8***

(*) Significant at the 5% significance level. (**) Significant at the 1% significance level.

Besides raw excess returns, variables displayed include the t-statistics of those returns, standard deviations and respective sharpe ratios. Also observed are the alphas representing the intercepts from a time-series regression of each portfolio return series with its expected returns (assessed through the CAPM), and their respective t-statistics. The observation period to calculate the betas runs from 1989, prior the formation of our excess return portfolios.

Our results suggest that for holding periods of 1 month, with 12 months of observation period in momentum portfolios, stocks with higher value and momentum signals (P3) register higher monthly returns than the ones with lower signals (P1) for each effect. Low value signal portfolios (P1) register average monthly excess returns of 0.03% while portfolios with higher value signals – lower price-to-book ratios – reach average monthly excess returns of 0.38%. The same relation is observed in momentum portfolios, although with stronger intensity. Portfolios constituted by low momentum stocks (P1) yielded average negative excess returns of -0.81%, while winner portfolios recorded 0.55% average monthly excess returns. Consequently, individual zero-cost,

long-short portfolios formed by shorting portfolios of securities with lower signals of both effects and buying portfolios constituted by high signal securities register average positive returns. Nevertheless, only momentum excess returns are statistically significant for a 99% confidence level. Also, individual factor portfolios registered significant positive excess returns of 1.39% and 0.90% for value and momentum respectively.

At an individual level our results go in line with most existing literature in Portugal, namely Pereira (2009) who suggested the profitability of momentum returns across several observations and holding periods by achieving average returns of 1.5% monthly for his 3 top performing strategies, as well as with the analysis performed by Lobão and Lopes (2014), who also registered positive momentum returns for several combinations of observing and holding periods with results pointing to an average outperformance of 1.1% a month. For a single set of periods and with a data sample running between distinctive timeframes, our results of 1.36% do not suggest an observable change in momentum abnormal profits.

In addition, value outperformance has been also documented by Soares and Serra (2005), although, only for periods higher than 24 months, which may explain our non-significant value excess returns.

When analysing 50/50 combination of value and momentum portfolios, we can also observe the same relation, with high signal portfolios of value and momentum outperforming its peers with low signal for both effects. Consequently, zero-cost, long-short portfolios formed with combined returns from value and momentum portfolios record statistically significant (at a 99% significance level) average monthly excess returns of 0.86%. Also, zero-cost factor portfolios of value and momentum display positive and statistically significant excess returns of 1.14% per month.

An individual analysis to both portfolios shows that value returns are slightly less robust: (i) standard deviations increase with value signals, which mean that despite registering higher returns, high (low) value securities come associated with higher (lower) risks – this partially supports rational-based explanations justifying value premiums with risk; (ii) Sharpe ratios are much higher for momentum portfolios than for value, driven mainly by the fact that standard deviations in momentum are decreasing while for value rising, hampering sharper ratio growth; (iii) zero-cost

portfolios (P3-P1) for value and momentum individually have positive returns on both measures, although, are only statistically significant for momentum, on the contrary factor portfolios are stronger on value measures.

Most of these conclusions are common to Asness *et al.* (2013) analysis in Europe. Although, contrary to their analysis, we suggest the outperformance of value factor portfolios compared with momentum factors.

On average, our combined portfolios performance was also superior to CAPM expected returns by 0.9% a month for P3-P1 and Factor, measured by alpha values. Both are statistically relevant for a 99% significance level. However, individual momentum P3-P1 portfolio registers an alpha of 1.4% and individual value factor portfolios registers an over performance compared with CAPM of 1 percentage point.

Additionally, in line with the Asness (1997) findings, correlations between value and momentum returns are negative, observed in the P3-P1 and factor combined portfolios negative correlations of-0.22 and -0.29 respectively. Current literature still lacks to explain this phenomenon and instead, focus on explaining both individually. Asness *et al* (2013) analysis, found these same negative correlation for all equity markets and for other asset classes globally. In our study, we limited our analysis to the Portuguese stock market, still, we found the same relation. Nevertheless, for this maturity, individual portfolios, P3-P1 outperform combined portfolios, which in Asness *et al* (2013)'s result is not common. This may be justified by the stronger negative correlations found by the authors.

4.2 Value and Momentum Combined Returns Across Several Maturity Periods

This section documents the average monthly excess returns of combined value and momentum portfolios in the Portuguese Stock market for the period between the December 1993 and February 2015. Using the 90 individual portfolios formed following momentum and value strategies, we calculated zero-cost, winners (P3) minus losers (P1), portfolios for each strategy by buying securities which registered higher value or momentum signals (P3) and short selling the ones with lower signals (P1). Then, we combined the zero-cost value and momentum portfolios for each respective holding and observation periods with equal weights (50/50).

Table 3 reports the average monthly returns of the zero-cost, winners (P3) minus losers (P1) combined portfolios formed, for different holding and observation periods, and the respective t-statistics. Also reported are the standard deviations of returns and the Sharpe ratios, as well as, the intercepts or alpha and their t-statistics.

Table 3: Monthly Average Returns of Combined Zero-Cost Value and Momentum Portfolios

Table 3 displays the zero-cost combined portfolios constituted by P3-P1 value and momentum portfolios, which are long positions on high value and momentum signal portfolios and short positions on the ones with low signals for both measures, across several holding and observation periods. Combined portfolios are weighed 50/50. Variables analysed include average excess returns, over the euribor, proxy of the risk-free rate, its respective t-statistics as well as standard deviations and Sharpe ratios. In addition, we represent the alphas (or the intercepts), which result from a time-series regression of the portfolio returns against the CAPM expected returns, considering the PSI Geral value-weighted returns as the market returns and the euribor as the risk-free rate, along with the respective t-statistics.

Observation periods		Holding periods				
		H1	H3	H6	H9	H12
O1	Avg return	0.57%	0.59%	0.54%	0.51%	0.40%
	(t-stat)	*1.96*	*3.48***	*4.34***	*4.89***	*4.11***
	Stdev	4.6%	2.7%	2.0%	1.7%	1.5%
	Sharpe	0.12	0.22	0.27	0.31	0.26
	Alpha	0.59%	0.54%	0.43%	0.42%	-0.24%
	(t-stat)	*2.04**	*3.11***	*2.87***	*2.76***	*-0.97*
O3	Avg return	0.53%	0.69%	0.65%	0.56%	0.49%
	(t-stat)	*1.97**	*4.03***	*5.08***	*4.95***	*4.78***
	Stdev	4.3%	2.7%	2.0%	1.8%	1.6%
	Sharpe	0.12	0.25	0.32	0.31	0.30
	Alpha	0.56%	0.69%	0.71%	0.77%	0.52%
	(t-stat)	*2.09**	*3.96***	*4.60***	*3.66***	*2.17**
O6	Avg return	0.74%	0.68%	0.62%	0.59%	0.47%
	(t-stat)	*2.70***	*4.18***	*5.01***	*5.63***	*5.31***
	Stdev	4.4%	2.6%	2.0%	1.7%	1.4%
	Sharpe	0.17	0.26	0.31	0.35	0.33
	Alpha	0.76%	0.67%	0.77%	0.92%	0.67%
	(t-stat)	*2.73***	*4.08***	*4.85***	*4.13***	*2.60**
O9	Avg return	0.75%	0.60%	0.62%	0.60%	0.43%
	(t-stat)	*2.52**	*3.63***	*4.69***	*5.67***	*4.99***
	Stdev	4.7%	2.6%	2.1%	1.7%	1.4%
	Sharpe	0.16	0.23	0.29	0.36	0.31
	Alpha	0.77%	0.62%	0.70%	0.84%	0.26%
	(t-stat)	*2.60**	*3.69***	*4.47***	*3.84***	*0.95*
O12	Avg return	0.86%	0.72%	0.68%	0.59%	0.45%

	(t-stat)	*2.91***	*4.41***	*5.44***	*5.91***	*5.51***
	Stdev	4.7%	2.6%	2.0%	1.6%	1.3%
	Sharpe	0.18	0.28	0.34	0.37	0.35
	Alpha	0.89%	0.73%	0.67%	0.61%	-0.08%
	(t-stat)	*3.03***	*4.29***	*4.22***	*3.10***	*-0.26*

(*) Significant at the 5% significance level. (**) Significant at the 1% significance level.

Our zero-cost, long-short portfolios register positive returns for all observation and holding periods. The top 5 performing portfolios were obtained through the following combination of observation (O) and holding (H) periods: O12:H1 – 0.86%, H9:H1 – 0.75%, O6:H1 – 0.74%, O12:H3 – 0.72% and O3:H3 - 0.69%

On the other hand, the bottom 5 worst performing portfolios registered were: O1:H12 – 0.41%; O9:H12 – 0.43%; O12:H12 – 0.45%, O6:H12 – 0.47% and O3:H12 – 0.49%.

All our top performing portfolios have holding periods equal or lower than 3 months while our worst performing portfolios all have holding periods of 12 months. This suggests that returns decrease for longer holding periods, as well as for shorter observation periods, although, this relation is not as strong and is mostly observed when comparing extreme values (1 month vs 12 months). This relation indicates some reverse in excess returns mainly driven by momentum profits, which revert over longer periods, as stated by several authors. Sharpe ratios follow the same trend.

Most of our returns are statistically significant, 21 and 3 are statistically relevant at a significance level of 99% and 95% respectively, with only 1 statistically insignificant for a 1 month holding and observation period.

In addition, our intercepts are also positive and mostly statistically significant at a 99% significance level, with only 3 insignificant returns concentrated for holding periods of 12 month.

Our results go in line with Asness's *et al* (2013), who also suggested the presence of consistent value and momentum return premium across the eight equity markets they studied. In their sample, they registered a P3-P1 return premium of value and momentum portfolios of 5.9%, in annualized terms, for European stocks with observation and holding periods of 12 and 1 month respectively, whereas for the same maturities, in the Portuguese stock market alone, our portfolio yields an equivalent annual return of 10.8%.

However, our standard deviation is significantly larger than the authors', 16.2% vs 6.8%, in annualized terms, which consequently reduces our Sharpe ratios when compared to the ones recorded by Asness *et al* (2013) sample portfolio, from 0.87 to 0.18.

In addition, Asness *et al* (2013) alpha is larger than ours, 6.1% vs 0.87%, which implies that their more diversified portfolio added return, compared to the CAPM, is bigger.

In table 4, we can observe that the correlation of two positive return strategies such as our zero-cost, long short portfolios of value and nomentum is moderately negative, averaging -0.21 across all holding and observation periods analysed.

Asness *et al* (2013) has registered negative correlations in their P3-P1 value and momentum equity portfolios of -0.43 in UK, -0.52 in Europe and -0.53 in US stocks, while the equivalent measures in our study reach -0.22%. Despite being all negative, our correlations are not as strong. Besides its sample being significantly larger than ours, 13% and 20% of the largest stocks in UK and Europe, it was also constituted by more liquid securities which can explain their more robust results.

Table 4: Correlations between Individual Value and Momentum Zero-Cost, P3-P1, Portfolio Returns

The following table represents the correlations between P3-P1 momentum and P3-P1 value portfolios for several combinations of holding and observation periods, as well as the correlations for the five holding periods, averaging across all observation periods.

	H1	H3	H6	H9	H12
Average	-0.26	-0.20	-0.13	-0.16	-0.28
O12	-0.22	-0.24	-0.14	-0.21	-0.44
O9	-0.21	-0.20	-0.07	-0.17	-0.35
O6	-0.30	-0.25	-0.16	-0.19	-0.32
O3	-0.35	-0.18	-0.13	-0.06	-0.10
O1	-0.24	-0.12	-0.16	-0.16	-0.18

4.3 Individual Performance of Value and Momentum

Our zero cost P3-P1 value and momentum portfolios, was built with individual zero cost P3-P1 value and zero cost P3-P1 momentum portfolios. The contribution to the combined portfolio of both value and momentum varies across time, as well as across portfolios with different holding and observation periods.

We display in Figure I.a, the different behaviour of individual value and momentum portfolios for the one month holding and 12 month observation period, indexed to the initial period, December 1993. We can observe that momentum strategy has more than eighteen fold since December 1993, reaching index returns in January 2015 of 1,830, while value zero-cost portfolios, ended the sample period 6.6% below its initial value. Moreover, momentum index returns were higher than value's on 215 periods, out of the total 254. Yet, largest growth rate in momentum accumulated returns were obtained since January 2008, where value portfolio dropped 12%, to 266 and momentum rose 19%, reaching 528 in just a month. From this period onwards, which corresponds to the beginning of the subprime crisis, value portfolios strongly underperform, while momentum enters in an upward period. Risk-free rate reached in January 2015 index returns of 184, representing a compound month growth rate of 0.24% monthly, equivalent to 2.9% in annualized terms, versus – 0.3% and 14.7% of value and momentum, respectively.

Figure 1: Value and Momentum P3-P1 Portfolios for 12 Month Observation and 1 Month Holding Period and Risk-Free Rate for Benchmark

(Index 100 corresponds to December 1993)

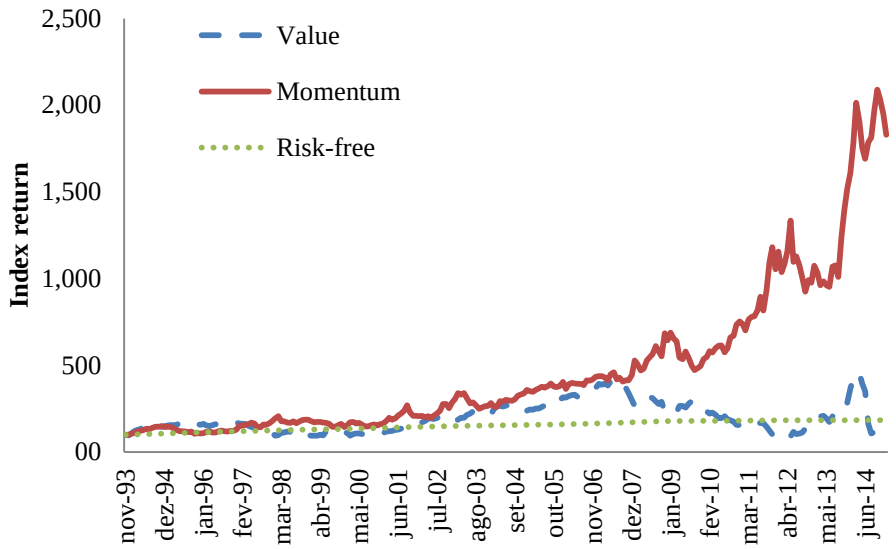
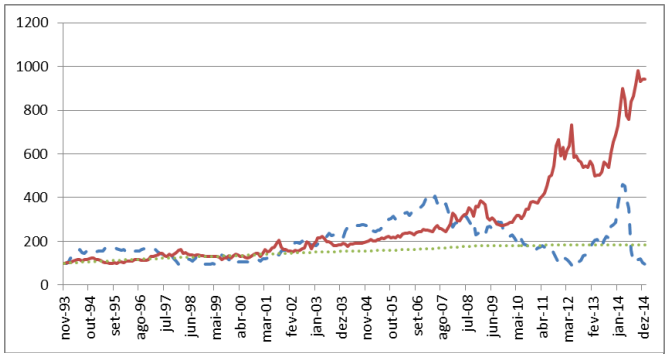


Figure 2: Value and Momentum P3-P1 Portfolios for each Holding Periods and Average Momentum Observation Periods, Risk-Free Rate for Benchmark and correlation of both Returns with the Market Portfolio (PSI Geral)

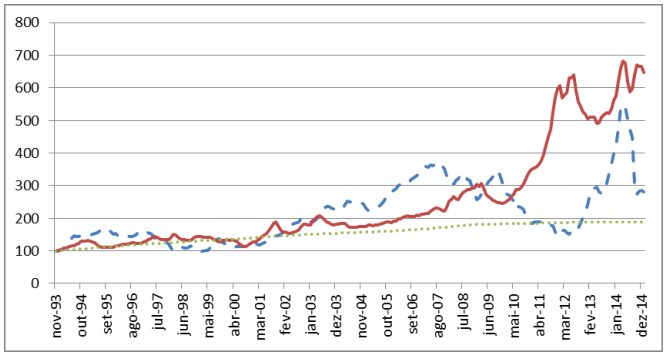
(Index 100 corresponds to December 1993)

2.1: Zero-cost value and momentum portfolios for 1 month holding periods across average momentum observation periods



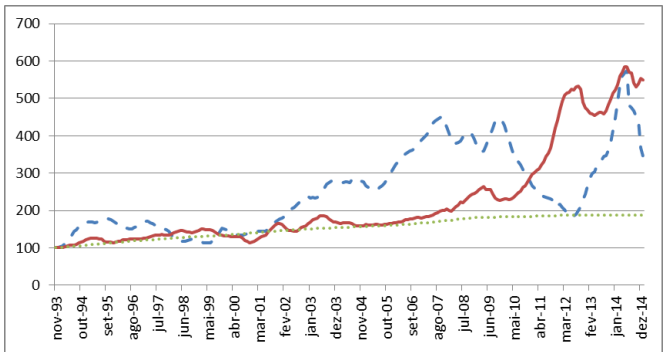
Correlation with market returns: Value: 0.41; Momentum: -0.06

2.2: Zero-cost value and momentum portfolios for 3 month holding periods across average momentum observation periods



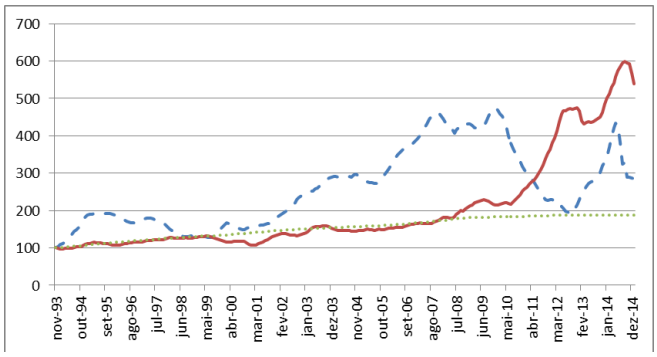
Correlation with market returns: Value: 0.29; Momentum: -0-07

2.3: Zero-cost value and momentum portfolios for 6 month holding periods across average momentum observation period



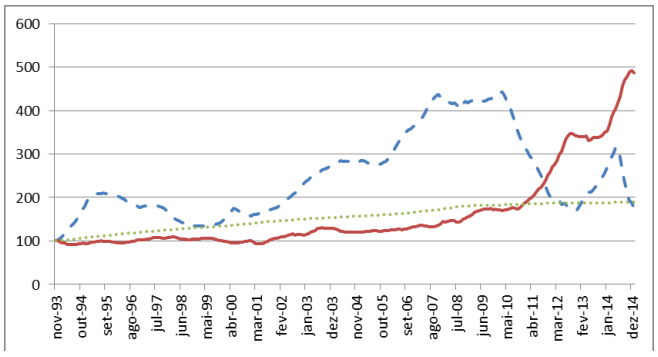
Correlation with market returns: Value: 0.31; Momentum: -0.09

2.4: Zero-cost value and momentum portfolios for 9 month holding periods across average momentum observation periods

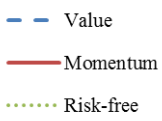


Correlation with market returns: Value: 0.39; Momentum: -0.07

2.5: Zero-cost value and momentum portfolios for 12 month holding periods across average momentum observation periods



Correlation with market returns: Value: 0.42; Momentum: -0.08



Furthermore, figure I.b extends the analysis for different holding value and momentum periods, averaging observation periods for momentum portfolios, so that we can observe the different behaviours of both portfolios across different holding periods. In line with figure I.a, it shows that momentum returns significantly outperform value returns for the 1 month holding period, as well as for every other holding period analysed. Using averaged index returns observed across 5 different observation periods (1, 3, 6, 9 and 12 months), momentum returns registered their highest value of 941 index returns for 1 month holding periods (the observation period with highest index return is the 12 month observation period with 1829 index returns – displayed in Figure I.a). Momentum index returns decrease with maturity to 646, 548, 289, 539 and 487 for 3, 6, 9 and 12 months holding periods respectively. This reverting behaviour of momentum returns goes in line with the delayed overreaction hypothesis. We can complement this statement with Nagel (2001) results that suggested momentum reversals were a price-to-book effect, and disappeared after controlling for it. According to his analysis, winner stocks tend to become growth stocks and losers tend to become value, hence, momentum reversals are a similar effect to the underperformance of growth stocks.

On the other hand, value returns grow from 93 index returns, for a 1 month holding period, to reach a peak of 345 index returns in January 2015, for a 6 months holding period. Then, value returns start decreasing for longer holding periods, up to 12 months, achieving index returns of 174 for 12 months sample.

Additionally, these results are related with Table 3 conclusions of decreasing returns for higher holding periods. In the previous analysis, our top performing portfolios had holding periods of 1 and 3 months matching momentum and value combined higher index return, that through this analysis allow us to conclude those were mainly driven by momentum strong performance.

Below each representation in Figure I.b, we added the correlation of value and momentum returns with the market portfolio, constituted by PSI Geral value-weighted portfolio comprising the entire cross-section of securities. Across all holding periods, value portfolio displays a statistically significant positive correlation, which indicates value returns are positively correlated with the overall market, thus being pro-cyclical returns. On the contrary, despite being negative, momentum correlations don't have statistical significance and therefore no conclusion can be drawn from them. Still, the

fact that value weighted proves to behave pro-cyclically are findings that go against existing literature which states that momentum returns are pro-cyclical while value returns are countercyclical, as suggested by Babameto and Harris 2008.

5 A Deeper Look on Value and Momentum Returns

In this chapter, we focus our analysis on the work developed by Asness (1997) where he first studied momentum and value strategies relation and how both variables behave according to one another. Since in this section we use raw returns, instead of excess returns over the risk-free rate, our sample runs from January 1988 until January 2015. In section 5.1, we build portfolios combining high and low value and momentum signals. Then, section 5.2 analyses value and momentum portfolio returns, conditional to a previous segmentation for one of both measures, by segmenting momentum portfolios based on value signals and value based portfolios according to their previous 12 months raw accumulated returns.

5.1 Sorted Value and Momentum Portfolio Returns

In his prior work, Asness (1997) developed a jointly analysis of value and momentum combined returns. He examined whether the marginal power of value or momentum varies depending upon the level of the other variable and concluded that value strategies work in general but are stronger among low momentum stocks and weaker in high momentum stocks while momentum strategies also work in general but are stronger for expensive stocks and weaker for value stocks.

We made a similar analysis and our results are displayed in Table 5. As demonstrated in the previous chapter for a smaller data set, value and momentum based strategies are, in general, effective, since, on average, value portfolios (P3 in column 5) returns outperform growth, and winner stocks (P3 in row 10) outperform losers. Additionally, we can observe that our largest combined returns of 1.5% monthly are registered by portfolios formed with long positions in high value and momentum signals, while our weakest returns are obtained on loser and expensive stocks, reaching -0.8% monthly. Consequently, we registered positive returns in all our zero-cost portfolios formed by shorting the ones with low value and momentum signals and buying high value and momentum portfolios. Most of these returns are statistically significant for 90% confidence level, at least.

Table 5: Portfolios Sorted on Value and Momentum Measures

Table 5 reports results of sorting firms both on momentum, using accumulated returns from past 12 months, skipping the most recent month, and value, measured by price-to-book ratios. That is, the intersection of momentum and value measures across 3 portfolios which represent low (P1) and high (P3) signals for both measures. Besides its average returns, we display the average signals for value and momentum for each portfolio, namely, accumulated returns from past 12 months and price-to-book ratios. Ultimately, we also represent the average number of securities across the entire sample.

Momentum	Value	P1 (expensive)	P2	P3 (value)	P1-P3 (t-statistic)
P1 (losers)	Returns	-0.8%	-0.2%	0.4%	1.17%
	Past (2,12)	-0.76	-1.25	-2.14	
	PtB	15.47	6.09	1.63	*1.87**
	Avg obs	3.00	4.87	7.61	
P2	Returns	0.2%	0.6%	1.0%	0.77%
	Past (2,12)	0.12	0.13	0.06	
	PtB	18.56	7.41	1.30	*1.36*
	Avg obs	5.18	5.59	4.65	
P3 (winners)	Returns	0.5%	0.9%	1.5%	1.07%
	Past (2,12)	3.94	2.74	1.51	
	PtB	25.19	7.04	0.60	*1.79**
	Avg obs	6.89	5.24	3.35	
Return difference		1.13%	1.11%	1.24%	
(t-stat)		*1.69**	*2.39***	*2.27***	

(*) Significant at the 10% significance level. (**) Significant at the 5% significance level.

However, and in line with Asness (1997) conclusions, this relation goes further. Value and momentum strategies work best if not forced upon another, meaning, value works in general, but it is stronger (weaker) among losers (winners), registering 1.17% in the former versus 1.07% in the latter, although, it performs even worst in middle portfolio with value premiums of only 0.77%.

In momentum portfolios the pattern is inversed, since they are stronger (weaker) for value (expensive) stocks, 1.24% versus 1.13%, respectively. However, the middle portfolios underperforms even more, reaching only 1,11%.

Asness's (1997) registered value premiums of 0.13% for winners and 0.97% for losers, and momentum premiums that went from 0.62% up to 1.47% monthly for more expensive stocks. Besides the obvious reasons justified by different samples, the author

segments securities in 5 portfolios, whereas we only divide them in 3, which emphasizes differences in both performances.

Also displayed are the accumulated raw returns for the past 12 months - "Past (2,12)", i.e. momentum signals – and price-to-book ratios - "PtB"; i.e. value signals. We can observe that momentum signals are higher for expensive stocks. However, returns follow an inverse pattern, growing from expensive to value stocks. Therefore, any investor looking solely to momentum signals would be underperforming its peers who took into consideration both effects.

Notwithstanding, this relation is not generally observed in price-to-book ratios, since they decrease as momentum increases among high value stocks and increase with momentum signals for expensive stocks. In other words, our analysis suggests that it would be preferable to invest on stocks registering the lowest value signals of the entire cross-section. However the contrary is not true since by investing on securities with high price-to-book ratios would mean to invest on winners, therefore for expensive securities, it is preferably to also take into consideration not going against winners.

Also displayed, are the average number of securities per period in each portfolio. This variable shows us the number of securities which belong to both portfolios in a given moment. For instance, in the top left position of the table, we display the portfolios constituted by stocks which ranked on the lowest third of value and momentum among the entire cross-section of securities analysed. On the other hand, the bottom right displays portfolios formed by stocks which ranked higher on both measures.

The portfolios which concentrate the higher number of securities across the entire sample are constituted by loser (P1) and value (P3), totalling an average of 7.61 per month, as well as, winner (P3) and expensive (P1) securities, reaching 6.89. In contrast, the ones who registered the lowest number of securities are loser (P1) and expensive (P1), plus, winner (P3) and value (P3), with average number of stocks per month of 3 and 3.35, respectively.

These results strengthen Lee and Swaminathan (2000) and Nagel (2001) conclusions that winner stocks tend to become growth stocks. As we can observe in Table 5, among growth stocks, the ones exhibiting higher PtB are winners, a difference from 25.19 to 15.47. On the other hand, we may also observe in our results, the opposite, which suggests that loser stocks tend to become value stocks. Among losers stocks, the ones

registering the worst Past (2;12) returns are value stocks. Their results suggests that after establishing this relation between value and momentum stocks, namely, that losers tend to become value and winners tend to become growth, we are able to justify any momentum reversals with value premiums.

These conclusions complement previous studies made in the Portuguese market. Soares and Serra (2005) found evidence of long term reversion in returns, even after adjusting for risk and other control variables, also they found value strategies earn positive returns that are not explained by ex-ante risk.

Lobão and Lopes (2014) conclusions, using an extended sample, do not seem to support overreaction hypothesis, since they found that there is no significant return reversal over long horizons. In our analysis, we could not obtain significant value returns over the 1 month period (see section 4.1): only 0.38%, statistically insignificant, which further enhances Nagel (2001)'s conclusion of the connection between value premiums and return reversals.

Lastly, contrary to Zhang (2008) results in Asian markets, we observe that combining value and winners produces significantly higher results (1.5% average monthly returns), than value and momentum strategies evaluated separately, as seen in Table 2 (see section 4.1), where individual value and momentum best strategies yield 0.86% and 0.75% respectively. Additionally, zero-cost value and momentum individual portfolios register 0.59% and 1.17% respectively, while a zero cost portfolio, long on winners and value stocks and short on losers and growth stocks yields the impressive returns of 2.3% a month.

5.2 Performance Improvement of the Combined Analysis

We extended the previous study and constructed conditional value and momentum portfolios to better examine value and momentum investing in practice. In order to do that, we took a dual analysis, assuming two distinct investing patterns. First, a momentum investor segmenting the cross-section of securities in P1, P2 and P3 based on momentum signals and then dividing each portfolio in three additional portfolios, P1, P2 and P3, based on their value signals. The second and opposite approach consists on dividing three value portfolios, P1, P2 and P3, according to their momentum signals.

So, for instances, in the second case, we segmented securities according to their value signals, which is what a solely value investor would do, forming three distinct portfolios, P1, with low value signals (growth stocks), P2 and P3, with high value signals (value stocks). Then, we ranked securities within each portfolio according to their momentum signal to observe return disparities within the same group of value stocks. So, from each P1, P2 and P3 value portfolios, we formed three additional portfolios by segmenting the former based on momentum signals.

Table V reports our main results. In the second row of both panels, we see average monthly returns of individual value and momentum portfolios with the same data set and sample period from previous section.

Table 6: Conditional Value and Momentum Portfolios

Table 6 displays two panels of conditional value and momentum investing. In Panel A, we segmented securities in three equal portfolios by their price-to-book ratios and we sub-divided them in three additional portfolios based on their momentum signals, i.e. their previous 12 month return. In Panel B, we made a similar analysis with the opposite approach, segmenting securities on their momentum signals and then through their price-to-book ratios. On each table, we also measured the zero-cost P3-P1 portfolio and the return difference between P3 and P1. Additionally we display the respective t-statistics of the zero-investment portfolio for the test of whether the average return is zero.

Panel A: Value returns conditional upon momentum portfolios

	P1	P2	P3	P3-P1	*t-stat*
Value H1	**0.2%**	**0.4%**	**0.8%**	**0.59%**	***1.24***
MOM O12-H1					
P1	-0.2%	-0.1%	0.1%	0.25%	*0.46*
P2	0.2%	0.5%	0.8%	0.56%	*1.00*
P3	0.6%	0.9%	1.8%	1.29%	*2.36**
Return difference	0.8%	1.0%	1.8%		
(t.stat)	*1.75*	*2.25**	*3.10***		

Panel B: Momentum returns conditional upon value portfolios

	P1	P2	P3	P3-P1	*t-stat*
MOM O12-H1	**-0.5%**	**0.4%**	**0.7%**	**1.17%**	***3.07***
Value H1					
P1	-0.5%	0.1%	0.6%	0.35%	*0.58*
P2	-0.1%	0.8%	0.8%	0.97%	*1.93*
P3	1.0%	0.6%	1.3%	1.15%	*2.31**
Return difference	1.5%	0.5%	0.7%		

(t.stat)	*2.55**	*0.90*	*1.43*

(*) Significant at the 5% significance level. (**) Significant at the 1% significance level.

Best performing value and momentum strategy individually register 0.8% and 0.7% average monthly returns respectively. Zero-cost momentum portfolio registered 1.17% whereas value portfolio average returns were not statistically significant, reaching only 0.59% a month.

In Panel A, we observe value portfolios ranked by momentum signals whereas Panel B displays momentum portfolios segmented by their value signals. As we can see, by taking into consideration both effects, can improve individual value and momentum raw returns from 0.8% to 1.8% and from 0.7% to 1.3% in value and momentum investing respectively.

Main conclusions we may draw from this analysis are as follows: (i) momentum premium is stronger than value premium when analysing both effects individually in the Portuguese Stock Market; (ii) value effect is stronger among winners (1.29%) than among losers (0.25%), while momentum premium is more robust among growth securities (P1), 1.15% versus 0.35%; and (iii) return difference between winner and loser among high value stocks (P3) is very significant, 1.8% monthly, as well as, return difference between value and expensive stocks within the high momentum portfolio, 0.7% monthly.

From those conclusions, (i) was already documented in section 4.1, even though the sample period was slightly smaller and instead of raw returns, we displayed excess returns over the risk-free rate. As a consequence, there were some disparities, particularly, in our previous analysis our value portfolio registered returns of 0.38% while in this sample, accounting with the sub-period of 1988 to 1993, value portfolio registered average monthly returns of 0.8%, indicating a strong performance of value securities during that period. On the other hand momentum has not recorded significant differences. In addition, (ii) confirms analysis performed on 5.1, that momentum premium is stronger among growth stocks, but states that value works best among winners, which contradicts previous results and goes against Asness (1997) conclusions. This happens because in the previous section we simply intersect the entire cross section of securities belonging to each previously formed P1, P2 and P3 portfolios while in this

section we constructed conditional P1, P2, and P3 based on momentum and value signals.

All in all, and as our (iii) documents, value and momentum solely investors can improve their overall returns by taking into consideration the other respective factor. This is in line with previous section conclusions, since investors would maximize their returns, achieving 2% average monthly raw returns, by opening long positions on winner stocks within portfolios formed by stocks with the lowest third price-to-book ratios and shorting loser securities which recorded the highest price-to-book ratios, as well as, through long positions on value stocks among top third winner portfolio and short positions on growth stocks within loser portfolios, which registered 1.9% average monthly raw returns. Still, those returns are not as large as the 2.3% achieved by taking into consideration the both effects at the same time, as seen on 5.1.

6 Macroeconomic Explanations for the Value and Momentum Effect

In this section we attempted to justify common factors driving value and momentum excess returns across the Portuguese stock market.

In Table VI, we report results from time-series regressions of value, momentum and value and momentum combined returns for a holding period of 3 months across Portuguese stocks. Sample period runs from first quarter 1995 to first quarter 2015, totalling 81 periods (quarters), or 20 years.

Coefficients used to explain excess returns are:

(i) GDP growth which represents the real per capita growth rate, measured quarterly;

(ii) Long-run consumption growth consists on the real per capita growth of final consumption expenditure, measured as the sum of log quarterly consumption growth as in Asness *et al* (2013), and;

(iii) ERP translates the Equity Risk Premium of Portuguese enlarged index in excess of the risk-free rate, measured as the 3-month euribor rate

Table 7: Macroeconomic Risk Exposure

Registered is the macroeconomic analysis of value and momentum returns, individually and combined, for 3 month holding periods. Variables analysed include real GDP quarterly growth, long-run consumption growth that consists on the real per capita growth of final consumption expenditure, measured as the sum of log quarterly consumption growth and Equity Risk Premium, measured by the market return minus the risk-free rate of return.

Value & Momentum	*Coefficients*	*Standard Error*	*t Stat*	*P-value*
GDP growth	-0.554	0.288	-1.922	0.059
Long-run consumption growth	0.182	0.110	1.655	0.103
ERP	-0.153	0.063	-2.430	0.018

Value	*Coefficients*	*Standard Error*	*t Stat*	*P-value*
GDP growth	0.276	0.498	0.555	0.581
Long-run consumption growth	0.226	0.190	1.193	0.237
ERP	-0.126	0.108	-1.160	0.250

Momentum	*Coefficients*	*Standard Error*	*t Stat*	*P-value*
GDP growth	-1.385	0.497	-2.788	0.007
Long-run consumption growth	0.138	0.189	0.727	0.470

ERP	-0.180	0.108	-1.660	0.102

Regression Statistics	*Val & Mom*	*VAL*	*MOM*
Multiple R	0.353	0.210	0.361
R Square	12.47%	4.41%	13.06%
Adjusted R Square	0.082	-0.001	0.088
F-Statistics	3.04	0.98	3.20
Significance F	0.04	0.41	0.03
Standard Error	0.059	0.101	0.101
Observations	67	67	67

Individual results suggest that momentum excess returns are negatively correlated with GDP growth. For each 1 percentage point increase in GDP growth, momentum excess returns decrease by 1.35 percentage point. ERP and long-run consumption growth are not statistically significant, measured by a p-value lower than 0.05. All three measures are pro-cyclical and, therefore, contrarian to current literature, our results indicate that momentum profits behave as a countercyclical variable. This result confirms our more superficial analysis developed on section 4.3, where we state, since momentum profits exhibited most of their return following the 2008 financial crisis period, the variable would mostly behave as a contrarian variable.

On the other hand, value returns are not significantly related with any of the three variables.

If we analyse value and momentum combined, ERP variable register negative coefficients, meaning 1pp variation in this variables will induce in a reduction of value and momentum excess returns in 0.15pp. GDP coefficient is also negative by -0.55 and it is relevant at a 90% significance level. Long-run consumption growth is not statistically significant.

This analysis partially confirms Babameto and Harris (2008) conclusions that state combining value and momentum into a single investment strategy provides investment performance that is less sensitive to market cyclicality. That is observed when we compare GDP growth coefficients of value and momentum versus momentum alone, -0.55 versus -1,39, while results with value individually are not significant.

Overall, our model is more effective at justifying momentum than value excess returns, measured by its R-squared of 13% for momentum, versus 4% for value. Combined returns reach an R-squared of 12%. Besides, F-statistics suggest that the overall model

is only significant for combined and momentum individually approach. Yet, these results are proof that the model is insufficient at justifying excess returns registered by the combined strategy of value and momentum, therefore, as in Asness *et al* (2013), GDP growth, consumer growth and ERP do not seem to be the source, or the only source, of the market anomalies identified.

7 Conclusions and Final Remarks

Value and momentum investing are phenomena widely studied in financial literature. These effects belong to a wider set of anomalies which corroborate the theory of efficient market proposed by Fama (1970). Therefore, they put into question the reliability of most asset pricing models and the rational behaviour of market agents. Ultimately, a failure in understanding asset pricing has negative consequences in capital markets and may be the source of pricing bubbles, market crashes, liquidity crisis and other pernicious effects.

With this study, we aim to better understand the relation between value and momentum effects and their common drivers. For that, we developed a combined analysis of both phenomena in the Portuguese Stock Market from 1988 to 2015, although, our main sample runs from 1994, given data limitations for the risk-free rate.

The distinctiveness of our study comes from analysing both effects together in the Portuguese Stock Market alone. In addition, we do not limit the analysis to a single combination of observation and holding periods, instead, our approach includes several observation and holding periods, as well as, individual performance of both effects. Further, we document the intersection of both portfolios and do a conditional analysis to better demonstrate the benefits of combining both effects in practice. Lastly, we also make an attempt to explain excess returns observed with macroeconomic variables, such as: real GDP growth, long-run consumption and equity risk premiums.

As a result, we provide some evidence of the outperformance of combined value and momentum strategies in the Portuguese Equity Market. Following the work of Asness *et al* (2013), we were able to obtain statistically significant positive excess returns over the risk-free rate of 0.86% and 1.14% in our combined value and momentum portfolios, namely in our zero-cost P3-P1 and factor-weighted portfolios respectively, for observation periods of 12 months and holding periods of 1 month. For the same maturity, Asness *et al* (2013) registered a return premium of 5.9%, in annualized terms, for European stocks, whereas for the same maturities, in the Portuguese stock market alone, our portfolio yields an equivalent annual return of 10.8%.

These findings hold across several holding and observation periods, being our top performing portfolios constituted by combinations of observation and holding periods

as follows: O12:H1 – 0.86%, H9:H1 – 0.75%, O6:H1 – 0.74%. These results go in line with Asness *et al* (2013) analysis which also documented excess value and momentum returns on a worldwide scale for several asset classes. Also in line with Asness *et al* (2013) conclusions, we found negative correlation between zero-cost P3-P1 value and momentum portfolios. Our results also suggested that return premiums reduce for higher holding periods from 1 to 12 months, which in turn derives from the fact that momentum effect is the major contributor of the combined portfolio excess returns, and as holding periods increase, momentum profits are negatively affected.

In addition, by intersecting portfolios based on momentum and value signals, we were able to achieve raw returns of 2.3% monthly in our zero-cost, P3-P1 portfolio, which held long positions on higher ranked securities of value and momentum signals and short positions on securities with low value and momentum signals. Also, we observe that winner stocks registered lower price-to-book ratios, as well as, among loser stocks, the ones support displaying the lowest monthly returns were value stocks. This, associated with the fact that stock concentration tilts towards value-loser/growth-winner, enables us to support Nagel (2001)'s conclusions of loser (winner) stocks tend to become value (growth) and therefore, conjecture the relation between value premiums and momentum reversals. These results also contradict Zhang's (2008) conclusions in Asian markets backing no added return from the combination of both measures. We also, found that value premiums are stronger for loser stocks while momentum premiums are stronger for growth stocks.

In the same section, we also perform a conditional analysis measuring returns achieved by solely value and momentum investors, and their returns if taking into account the other respective variable. We demonstrated that, value and momentum investors could increase their monthly returns from 0.8% and 0.7%, for value and momentum investing alone, to 1.8% and 1.3% respectively. Also, zero-cost portfolios formed by shorting the lowest signal portfolios, both growth stocks among previously selected losers and losers among previously selected growth stocks, enables to register raw average monthly returns of 2% and 1.9% for value and momentum respectively, contrasting with 0.59% and 1.17% for zero-cost portfolios of value and momentum individually.

Lastly, as in Asness et al (2013) and most of previous literature, our study suggested that macroeconomic variables fail to explain value and momentum individual and

combined returns, namely, equity risk premiums, real GDP growth and consumption growth. Even though our whole model was statistically significant, it could not justify premiums under current rational theories.

Our results shed some light in the overall discussion of market efficiency, as well as suggest a profitable practical investing strategy based on buying the fewer stocks who registered higher value and momentum signals among the entire cross-section of securities while shorting the ones who rank lowest in the cross-section of securities.

Still, our study has some limitations. First, and most importantly, we do not account for trading costs. Most of our best trading strategies require updating our portfolio on a monthly basis which may result on significant trading costs. Nevertheless, technology innovations are significantly reducing trading costs and there have been recently launched trading platforms which do not charge fees, such as: Robinhood and Loyal3, which could significantly alter our conclusions in the near future, as arbitrage restrictions decrease, allowing investors to benefit from these market inefficiencies.

Besides, our study includes securities from PSI Geral, which despite restricting the lower quintile of less liquid securities, it may still include a range of stocks which could not easily be traded. Also, and as stated previously, some measures, such as book values, may not be available at all moments.

Future research may perform an analysis of value and momentum combined for other asset classes in the Portuguese market. Similarly important would be to further develop the relation between momentum reversals and value premiums for the Portuguese Stock Market. Lastly and more challenging, would be to increase literature on possible justifications for the excess returns found under a new or within the existing behavioural or rational framework.

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Appendixes

Appendix A: Literature review summary – Value and Momentum

Author	Year	Countries	Period	Main results
Asness, Clifford	1997	US	1963-1994	Negative correlation between value and momentum, although each is positively correlated with cross-section of average stock returns
Nagel, Stefan (WP)	2001	US and UK	1965-2000	Momentum profits reversals at long holding periods are a price-to-book effect, consistent with the overreaction hypothesis
Babameto and Harris	2008	US, UK and Japan	1995-2004	Combined value and momentum portfolio using Black-Litterman portfolio optimisation framework and registered an average annual investment outperformance of up to 0.7%, net of transaction costs
Brown *et al*	2008	Hong Kong, Korea, Singapore and Taiwan	1990-2005	Value and momentum strategies combined (for each individual country and internationally integrated) do not provide a significant improvement over each strategy independently
Stivers and Sun	2010	US	1962-2005	Positive relation between the cross-sectional dispersion in stock returns and the value price-to-book premium and negative relation with the subsequent momentum premium

Cakici and Tan	2012	18 emerging markets in Asia, Latin America and Eastern Europe	1990-2011	Negative correlations between value and momentum returns across all studied markets which results in value and momentum equal-weighted portfolios with higher Sharpe ratios and lower volatilities
Asness *et al*	2013	US, UK, Continental Europe and Japan	1972-2011	Value and momentum return premium across eight diverse markets and asset classes, and a strong common factor structure among their returns

Appendix B: Literature review summary – Macroeconomic explanations

Author	Year	Measure	Countries	Macro variables	Period	Main results
Chordia and Shivakumar	2002	MOM	US	Market dividend yield, default spread, term spread and yield on 3 month T-bills	1926-1994	Momentum returns are explained by the set of lagged macroeconomic variables
Griffin *et al*	2003	MOM	40 countries worldwide	Unexpected and changes in expected inflation, term spreads and changes in industrial productions	1926-2000	Nether unconditional or conditional forecasting model suggests that macroeconomic variables are able to explain momentum
Cooper *et al*	2004	MOM	US	Dividend yield, default spread, term spread, and short-term interest rates	1929-1995	Macroeconomic factors are unable to explain momentum profits after screening out illiquid and high-trading-cost stocks
Chen *et al*	2005	VAL	US	Dividend yield, default spread, term spread, and 1 month Treasury bill rate	1941-2002	Value premium is positively related with countercyclical variables and negatively related with procyclical variables

Maloy *et al*	2009	VAL	US	Long-run consumption growth	1926-2004	Value strategies are positively related to long-run consumption growth
Choi	2013	VAL	US	Dividend yield, default spread, term spread and the short-term Treasury bill rate	1991-2007	Interactions of conditional betas with the market risk premium and volatility explain approximately 40% of unconditional value premiums
Asness *et al*	2013	MOM/ VAL	US, UK, Continental Europe and Japan	Long-run consumption growth, recession indicator, GDP growth, market excess returns, default and term spreads	1972-2011	Macroeconomic variables were not significantly related to value and momentum returns, except momentum profits negatively related to recessions and default spreads have positive relation with value stocks and negative related to momentum