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The Diagnosis of the Value Factor's Underperformance

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Abstract

The poor performance of the value factor in the last decades, has lead to an extensive debate among academics and practitioners whether the strategy is still valid. While previous studies based their underperformance analysis on an outdated value measure, this research fills this gap in the literature by providing a diagnosis of the intagible-adjusted value factor drawdown. The diagnosis is made by testing several potential sources of underperformance and by decomposing the strategy returns in three components. The decomposition shows that the structural components have reinforced in the 1989-2021 period, suggesting that the strategy is suffering from a temporary rather than structural disorder. The temporary problem is reflected in the relative valuation measure of growth and value stocks being in its historically lowest ventile. As the structural component has reinforced and value stocks can not become infinitely cheap compared to growth stocks, I conclude that the value factor is still a valid strategy and is expected to recover. Moreover, the diagnosis shows that the appropriate value factor measure changes over time following fundamental economic changes, suggesting that the value metric requires a carbon emission adjustment in the near future.

Keywords: Factor investing, value factor, underperformance, decomposition.

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Chapter 1

Introduction

In the last decades, the value factor has experienced a poor performance, leading to an extensive debate among academics and practitioners whether the earliest and arguably most popular systematic investing strategy is still valid. In the literature, researchers contributed to the debate in three different ways. Firstly, Fama and French (2021), the precursors of the traditional value factor (HML), attempted to prove with a statistical analysis that their strategy is not outdated. Specifically, they state that the underperformance falls within the range of outcomes that can be expected based on regular statistical variation. Secondly, researchers (Israel et al., 2020; Lev & Srivastava, 2019) examined whether the value strategy is permanently impaired by focusing on the potential underlying causes of the prolonged underperformance. Lastly, several studies (Blitz & Hanauer, 2020; Li, 2021) supported the validity of the strategy by developing an alternative methodology which delivers significantly higher returns than the HML measure. However, even these alternative measures delivered a poor performance in the last decade (Arnott et al., 2021). As previous studies have not taken into account the underperformance of adjusted value measures when examining the strategy's troubles, I try to fill this gap in the literature with a more complete diagnosis of the value factor. Accordingly, my study focuses on the following main research question:

What is the diagnosis of the value factor's underperformance in the 1990-2021 period?

More precisely, I start my research by determining whether an intangible-adjusted value factor (iHML) delivers appropriate returns and outperforms the traditional measure (HML) with a statistical t-test. Since the test gives evidence that the iHML factor outperforms the traditional measure but performed poorly in the last decades, I continue my underperformance diagnosis based on the intangible-adjusted measure. With this metric, the outcome of my value strategy underperformance analysis is more accurate and reliable than previous studies which based their analysis on an outdated measure. The analysis is conducted by testing several potential sources of value's underperformance and by decomposing the iHML factor log-returns into two structural (migration and income yield) components and a temporary (revaluation) component. The examined potential causes for underperformance are: the obsolescence of the traditional value measure, the excessive popularity of the value strategy, the low-interest-rate environment, the migration slowdown of value and growth portfolios, and the better performing growth stocks. Finally, based on the identified underperformance source, three scenarios are discussed to determine the future validity of the value factor.

The diagnosis reveals that the iHML value factor's underperformance is caused by a temporary rather than structural disorder. More precisely, the structural return component of the strategy is still intact and has even increased from 3.2% in the 1963-1989 period to 4.6% in the 1990-2021 period. The underperformance is caused by a temporary term defined as the revaluation return component, which fluctuates over time but averages zero on the long-term (Arnott et al. 2021). This component negatively affected the value strategy returns since the relative valuation measure fell from the 82nd to the 4th percentile in the last three decades.

Following these findings, the strategy will only deliver negative future returns when the revaluation return component decreases at a higher rate than the 4.6% average structural value premium. Since the relative valuation measure is already in its lowest ventile and growth stocks can not become infinitely expensive compared to value stocks, this scenario can be considered as very unlikely. Moreover, historical data shows that the relative valuation measure has always rebounded, suggesting that the iHML strategy will deliver impressive returns in the future. Although this is the most likely scenario, historical data is not a guarantee for the future and the assumption made in previous studies of relative valuation mean reversion (Asness et al., 2000; Cohen et al., 2003) does not statistically hold at a 5% signficance level (see *Table A.2*). To conclude, given that the structural value premium has increased and the revaluation measure can not decrease infinitely, the iHML factor is still a valid strategy which is suffering from a temporary disorder and will recover someday.

This diagnosis of the value factor contributes to the literature in several ways. It is the first study examining multiple potential causes of the value factor's underperformance, which is based on the intagible-adjusted value measure. The added value of this approach is reflected by the fact that studies analyzing the outdated HML measure reported a lower structural value premium in the last decades, while this study shows that the structural value premium has even reinforced when intagibles are capitalized. Moreover, this is the first study which provides a deeper insight into the return drivers of the intagible-adjusted value measure by decomposing the returns in one temporary and two structural components. Furthermore, with respect to previous studies (Asness et al., 2000; Cohen et al., 2003), the provided expectations of the iHML factor's future performance are more realistic, as they do not rely on the assumption of relative valuation mean reversion, which does not hold at the 5% signficance level. Instead, my expectations are based on the more realistic assumption that value stocks can not become infinitely cheap compared to growth stocks. Finally, this study reveals that the appropriate value measure can change over time, showing investors the importance of periodical future research in this area to avoid another prolonged period of underperformance. Considering that companies have to meet the requirements of a world moving towards a net-zero carbon emission environment, the next required value measure adjustment is likely to be related to the carbon emissions of a firm.

The paper is organized in the following way. The second chapter reports a literature review; *Section 2.1* discusses the origin and evolution of the systematic value strategy, *Section 2.2* describes the strategy's troubles and *Section 2.3* several narratives that try to explain the underperformance of the strategy. In the third chapter, the data (*Section 3.1*) and methodology (*Section 3.2*) of the study are described. In the fourth chapter, the empirical results of the diagnosis of the iHML factor are reported; *Section 4.1* shows the difference in performance between the HML and iHML factor, *Section 4.2* shows whether the strategy has become too popular, *Section 4.3* shows the relationship between the iHML factor returns and different interest rates, *Section 4.4* reports the results related to the decomposition of the strategy's return, and *Section 4.5* assess the future performance of the strategy based on the previous results. Finally, the fifth chapter discusses relevant further research (*Section 5.1*) and includes the conclusion of the study (*Section 5.2*)

Chapter 2

Literature Review

2.1 Origin and Evolution of the Systematic Value Strategy

The main principles of the value investing strategy were established during the 1930s by Graham and Dodd (1952). They compared the intrinsic value of a firm with its market value and found that this approach was an efficient method to identify buying and selling opportunities. Basu (1977) was one of the first to imply this strategy empirically by demonstrating that high earnings-to-price ratio (E/P) stocks outperform low E/P stocks. In 1983, he enforces his previous findings by showing that the E/P ratio helps explain the cross-section of average returns on U.S. stocks in tests that also include size and market beta. In the following decades, various researches showed that almost any definition of value that compares the fundamentals of a firm to its price generates a significant return difference between value and growth stock portfolios. For instance, Stattman (1980) and Rosenberg, Reid, and Lanstein (1985) found significant abnormal returns for the book-to-market (B/M) value strategy by dividing the common equity per share of a company with its market price per share (including intangibles). In 1992, Fama and French published arguably the most important research on the value factor premium in the asset pricing literature. They study the roles of the market beta, size, E/P, leverage and book-to-market equity in the cross-section of average stock returns. Their main finding is that size and book-to-market equity combined seem to absorb the roles of leverage and E/P and explain the cross-section of average returns in the US stock market for the 1963-1990 period. One year later, they introduced the three-factor model (1993), which enhances the capital asset pricing model (CAPM) of Sharpe (1964) and Lintner (1965) with a size factor, SMB, and a value factor, HML. The HML factor is a hypothetical long-short portfolio, which combines long positions in stocks with high B/M ratios with short positions in stocks with low B/M ratios. In the following years, alternative value metrics have been examined. For instance, Barbee, Mukherji and Raines (1996) and Naranjo, Nimalendran, and Ryngaert (1998) show that sales-to-price ratio, debt-to-equity ratio and dividend yield have great explanatory power for stock returns. However, the academic consensus settled on the Fama and French (1992) book-to-market ratio as the leading value definition.

The academic literature provides evidence of the out-of-sample robustness of the B/M value factor strategy. Capaul, Rowley, and Sharpe (1993) found that high B/M stocks outperform growth stocks on average in France, Switzerland, Germany, U.K and Japan in the 1981-1992 period. Fama and French (2017) find that there are large average value premiums in Europe, Japan, and the Asia Pacific region during the 1990–2015 period. Davis, Fama, and French (2000) document strong value premiums in U.S. average stock returns for the July 1926–June 1963 period preceding the Fama and French (1992) sample. Moreover, value strategies have been found to deliver positive returns in almost all global asset classes where they have been examined (Asness, Moskowitz, and Pedersen 2013), including country equity index futures, government bonds, currencies, and commodity futures. Additionally, following the study of Beck, Hsu, Kalesnik, and Kostka (2016) the systematic value strategy does not require high transaction costs to execute.

Although there is a consensus on the existence of a value premium, the reasons why this phenomenon exists are still debated. One party, led by Fama and French (1992, 1993), views the premium as compensation for bearing the risk of financial distress since value strategies tend to overweight financial distressed stocks. The other party, led by Lakonishok, Shleifer, and Vishny (1994), argues that mispricing drives the premium. Following DeBondt and Thaler (1987), Lakonishok, Shleifer, and Vishny (1994), and Haugen (1995), the value premium stems from the correction of the initial investor overreaction to a firm's past performance. For instance, Lakonishok, Shleifer, and Vishny (1994) show that investors extrapolate past earnings and sales growth too far into the future. More precisely, value stocks have lower growth rates in subsequent years, and growth stocks have higher subsequent growth rates, but not to the extent needed to justify the differences in valuation assigned to them by the market.

2.2 Systematic Value Strategy’s Troubles

The first concerns about the validity of the value premium grew during the tech bubble in the late 1990s, when growth stocks greatly outperformed value stocks. However, the outperformance turned out to be driven by unsustainable multiple expansion, and the burst of the bubble in the early 2000s resulted in a strong comeback of the value premium (Asness et al. 2000). Nevertheless, in the subsequent two decades, the concerns were not completely vanished. For instance, Houge and Loughran (2006) did not find evidence of a value premium for equity indexes, mutual funds, and large-cap stocks in the 1963-2001 period. Moreover, after accounting for transaction costs and price impact also the small-cap value funds did not significantly outperform their growth counterparts. The failure of popular value indexes to outperform the growth indexes was also supported by Hsu (2014). The strongest concerns about the disappearance of the value premium arose in the last years as it has failed to materialize since the global financial crisis in 2007 and reached its historical deepest drawdown in 2020 (Arnott et al, 2021). Moreover, Blitz and Hanauer (2020) found that the annual average return of HML factor is not significantly different from zero in the past 30 years. Fama and French (2021), the precursors of the traditional HML factor strategy, attempted to refute the concern that the value premium might have disappeared permanently. They concluded that, albeit the value factor strongly underperformed in the last period, it still falls within the range of outcomes that can be expected based on regular statistical variation. More specifically, their analysis reports that the high volatility of monthly premiums allows them to not reject the hypothesis that expected value premiums are the same in the 1963-1992 and 1992-2019 periods. Arnott et al. (2021) came to a similar conclusion as their bootstrap analysis suggests that the current value drawdown would have been thought to be 2.3% probable, which they consider an improbable but not extreme outlier outcome. Additionally, they report that alternative value measures suffered as well in the last decade. More precisely, the earnings-to-price, the sales-to-price, and a composite value measure registered an average annual return of -2.2%, -1%, and -3.6% respectively over the last 13 years. Park (2019) proved that the traditional HML metric of Fama and French (1992) is outperformed by an adjusted metric that capitalizes intangibles. However, likewise the traditional value factor, the new value factor metric does strongly underperform in recent years. On the other hand, the study of Lev and Srivastava (2019) indicates that only unlikely scenarios can rebound the performance of the value factor. More precisely, to rise significantly in value, trapped value companies require large investments which most value firms can not afford. At the same time, restrictive laws and regulations adversely affecting internet and pharmaceutical companies are needed to see the growth stocks suffer. Finally, Israel et al., (2020) suggest that the strategy is still valid by showing that expectations of fundamental information have been and continue to be an important driver of security returns. However, they show that there is a temporal variation in the relevance of fundamental information in explain returns, and in the last decades the relevance has been relatively low.

2.3 Potential Causes of the Value Factor Drawdown

2.3.1 Outdated Value Factor Measure

The first possible explanation for underperformance is that, since the rise of intangible assets, the traditional value measure (HML) is unable to accurately distinguish between growth and value stocks. Fama and French (1992) developed this value measure at the beginning of the 1990s, when firms primarily owned physical assets such as property, plant, and equipment (PP&E). Since then, the US economy has shifted toward service- and technology-based industries, which has made intangible assets such as human capital, brands, patents, software, customer relationships and databases crucial for the future performance of a firm. The traditional B/M ratio does not account for this economic shift since it is based on the US Generally Accepted Accounting Principles (GAAP), which classifies R&D expenditures as an expense even though they generate long-term benefits. Specifically, following the GAAP accounting principles, book value can capture the value of intangibles only through a corporate acquisition, while internally generated intangibles are not added to the book value of a company. For example, if a company spends $50 million on R&D to develop a patent, the book value decreases immediately, but if a company spends $50 million on intangible assets in an acquisition, the investment in R&D shows up in book value. Therefore, the traditional B/M ratio may mislabel intangibles-heavy companies as expensive because book value understates the company's assets as long as the company seeks to grow organically rather than through acquisition. Consistently, book value may mislabel intangibles-light companies as cheap. For instance, Lettau, Ludvigson, and Manoel (2018) show in their research that, according to the traditional Fama and French value definition, many value funds hold more growth stocks than value stocks in their portfolios. The misclassification may be especially frequent in the last decades, as the U.S intangible investment rate of the corporate sector is roughly twice that of the tangible investment rate, and the gap keeps growing (Corrado and Hulten, 2010; Enache and Srivastava, 2018). Moreover, misclassification is probably more common for growth stocks compared to value stocks since intangible capital is 20% of the book value of equity for value companies, while for growth stocks the capitalized intangibles exceed 100% of the book value (Arnott et al., 2021). To determine whether the intangible-adjusted value factor performs significantly better than the Fama and French HML factor (1992), I compare the cumulative performance of the two measures with a statistical t-test reported in *Section 4.1*.

2.3.2 Crowded Trade

The second potential cause for underperformance may be that the value factor has become too crowded, with the consequence that value and growth stock prices are distorted. This narrative is supported by the study of Mclean and Pontiff (2016), which reports that anomalies tend to become smaller once they have been published in academic journals. This may apply even more to the value factor after the publication of Fama and French (1992), since it is one of the most popular researches in the asset pricing literature. Moreover, the impressive growth of smart beta ETFs, which are constructed based on alternative weighting schemes such as the value exposure of the securities, may have increased the popularity of value stocks even more. The market share of smart beta ETFs has risen from 1% to 6% over the last 15 years reaching a total assets under management of $1.6 trillion in 2021 (Deloitte, 2021). To determine whether the value factor has become too crowded, I analyse the relative valuation measure reported in *Section 4.2*.

2.3.3 Low-interest-rate Environment

The third possible reason for underperformance suggests that the level of interest rates has a positive relationship with the value strategy returns, meaning that the low-interest-rate environment of the last decade has negatively affected the value factor's performance. Since 2008, we have witnessed a low-interest-rate environment which culminated in December 2020 with a total value of $18 trillion of government bonds trading at negative yields (Bloomberg, 2020). Following previous studies (Lettau and Wachter, 2007; Gormsen and Lazarus, 2019), the falling bond yields of the last decade hurt the performance of value stocks and improved the performance of growth stocks since the value strategy can be interpreted as a negative duration asset. More precisely, as the value portfolio has a lower duration compared to the growth portfolio, the value duration minus the growth duration (HML) gives a negative overall duration. In contrast to long-term interest rates, Maria and Santa (2017) found that value stocks are more sensitive to changes in short-term interest rates and suggest this may be due to their weaker financial position and sensitivity to financing costs. This relationship was reflected by the U.S short-term interest rate increase and value strategy returns decrease during 2017 and 2018. These opposite sensitivities to short- and long-term rates may imply sensitivity to the slope of the yield curve. Mezrich, Wei and Gould (2019) attribute this sensitivity to differing debt characteristics of value and growth companies, suggesting value firms have more shorter-dated debt and are therefore more vulnerable to rises in short rates, while growth firms have more longer-dated debt and benefit more from falling long rates. This view is supported by the flattening yield curve during the 2017-2020 period and the contemporaneous value factor's underperformance. To determine whether the positive relationship between value factor returns and the level of interest rates has led to the value strategy's underperformance, I run several time-series regressions of the value's factor return on the interest rates variables reported in *Section 4.3*.

2.3.4 Migration Slowdown

The fourth possible reason for underperformance is that the migration process, which sees growth stocks migrate down into the neutral or value portfolios and value stocks migrate up into the neutral or growth portfolios, has slowed down. Fama and French (2007) attributed most of the value factor's performance to the migration of value and growth stocks, as both patterns contribute positively to the performance of the strategy. However, some recent narratives support the possible slowdown of the migration process. Lev and Srivastava (2019) suggest that the structure of many industries has become more monopolistic than a few decades ago, which makes it harder for new companies to gain market share while making it easier for established companies to retain market share. Specifically, large growth companies benefit from stronger entry barriers to their business models through their intangible assets like brands and patents, while value stocks have difficulty affording these expensive R&D investments. Value companies struggle to invest in R&D since they do not dispose of large internal funds, while external funds are hard to obtain because of R&D's uncertain outcomes, severe asymmetric information problems, and lack of collateral value (Hall 2002). Another narrative that supports the possible migration slowdown, states that market participants' increased sophistication in determining the relative valuations of companies stabilized the valuation of stocks (Arnott et al., 2021). To determine whether the migration process of growth and value stocks has slowed down, I examine the migration component of the log-returns value factor decomposition reported in *Section 4.4.1*.

2.3.5 Better Growth Stocks

The final potential explanation suggests that growth stocks in the last decades are performing better, in terms of stock appreciation and dividend yield, than the growth stocks in the previous decades. The better performing growth stocks would signficantly reduce the returns of the value strategy since it systematically shorts growth portfolios. Before the 1990s, growth companies tended to belong to capital intensive manufacturing and retail industries which operated in large and growing markets. In contrast, in the last decades growth stocks belong to companies that leverage the internet to scale their businesses. As these businesses are less capital intensive, they can grow even faster than the pre-1990s growth stocks. For instance, the popular FANMAG[1] stocks reached a combined capitalization of US$9.43 trillion in about two decades, exceeding the stock market capitalization of every country in the world except that of the United States and China. Arnott et al. (2021) showed that these six stocks

[1] FANMAG is an acronym for Facebook (now trading as Meta), Amazon, Netflix, Microsoft, Apple, and Google (now trading as Alphabet).

have a significant presence in growth portfolios, given that they represent 32% of the Fama–French large-cap growth portfolio as of 30 June 2020. Moreover, Lev and Sristaval (2019) found that growth stocks have experienced their highest median return on net operating assets (RNOA) during the 2007-2018 period, suggesting that the new growth stocks are also more profitable compared to the past. To determine whether growth stocks are performing better than in the past, I decompose the log-returns of the value factor reported in *Section 4.4.2*.

Chapter 3

Data and Methodology

3.1 Data

For the period December 1962 until December 2021, US individual stock data is obtained from the intersection of the NYSE, AMEX, and NASDAQ return files from the Center for Research in Security Prices (CRSP) and the merged COMPUSTAT annual industrial files of income statement and balance-sheet data. Monthly interest rate data is retrieved from the Federal Reserve Economic Data (FRED) library. I use the 3-month Treasury Bill yield to represent short-term interest rates, and the 10-year constant maturity Treasury Bond yield to represent long-term rates. The yield curve slope is defined as the 10-year yield minus the 3-month yield. The market factor and the size factor used as control variables in the time-series regression are retrieved from the Kenneth R. French Data Library. Since pre-1962 book value of common equity data suffers from a serious selection bias and is often not available, the sample period of this study starts in December 1962. Following Fama and French (1992, 2000) several companies are excluded from the sample. First, financial firms are not included because the high leverage that is normal for these firms does not have the same meaning as for nonfinancial firms, where high leverage more likely indicates distress. Secondly, regulated utilities and firms categorized as public service, international affairs, or non-operating establishments are also excluded. Lastly, only firms with a positive book value and ordinary common shares are included in the test. In order to estimate the depreciation of the knowledge capital of a firm, I take the industry-specific R&D capital depreciation rate retrieved from the U.S. Bureau of Economic Analysis (BEA). Finally, *Table 1* gives an overview of the variables used to decompose annualy the iHML factor returns in three components.

Table 1: *shows the definition of the variables used to decompose the returns of the intangible-adjusted value factor.*

Variable	Description
r_t	Return from time *t−1* to time *t* on the portfolio formed at time *t*−1
$Dt -$	Dividend distributions from time *t−1* to time t from the portfolio formed at time *t−1*
$Bt - 1$	Aggregate book value of equity at time *t−1* for the portfolio formed at time *t−1*
$Bt -$	Aggregate book value of equity at time *t* for the portfolio formed at time *t−1*

$Bt +$	Aggregate book value of equity at time *t* of the portfolio formed at time *t*
$Mt - 1$	Market capitalization at time *t−1* of the portfolio formed at time *t−1*
$Mt -$	Market capitalization at time *t* of the portfolio formed at time *t−1*
$Mt +$	Market capitalization at time *t* of the portfolio formed at time *t*

3.2 Methodology

3.2.1 The Traditional Value Factor

To assess the historical performance of the classic HML factor (Fama and French, 1992), I constructed 2×3 capitalization-weighted portfolios resulting from independently sorting on size in June of year *t* and B/M ratio in December of year *t-1*. Following Fama and French (1992), the book value (B) is the stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. Depending on availability, I use redemption, liquidation, or par value for the book value of preferred stock. If the stockholders' equity of a firm is unavailable, it is proxied by the book value of assets minus total liabilities. The market value of a firm (M) is the price times the shares outstanding. The B/M used to form portfolios in June of year *t* is the book value and market equity at the end of December of *t-1*. This time gap ensures that the accounting variables are known before the returns they are used to explain. The size measure used to form portfolios in June of year *t* is the market value at the end of June of *t*.

In June of each year, independent sorts are used to allocate the stocks to two size groups and three B/M groups. Small stocks are NYSE, AMEX, and NASDAQ stocks with an end-of-month market cap below the NYSE median, and big stocks are those above the NYSE median. Value stocks are NYSE, AMEX, and NASDAQ stocks with B/M at or above the 70th percentile of B/M for NYSE stocks, and growth stocks are those below the 30th percentile. Using only NYSE stocks when determining the breakpoints, avoids that portfolios are dominated by small stocks after 1973 when NASDAQ stocks are added to the sample. In June of year *t*, six portfolios are formed based on the previous sorts: Small Value, Small Neutral, Small Growth, Big Value, Big Neutral, Big Growth. Value-weighted monthly returns of the six portfolios are calculated from July of year *t* to June of *t+1*. Finally, the HML portfolio is defined as an equally weighted average of the big-cap HML B/M portfolio and the small-cap HML B/M portfolio:

$$HML = (Small\,Value + Big\,Value) - (Big\,Value + Big\,Growth) \tag{1}$$

3.2.2 The Intangible-adjusted Value Factor

To determine whether an intangible-adjusted value factor identifies more accurately growth and value stocks compared to the traditional value factor (Fama and French, 1992), I adjust the book value of a company every year by adding the intangible capital measure. Following the studies of Jorgenson (2014), Zhang (2013) and Peters and Taylor (2017), I measure a firm's intangible capital as the sum of its knowledge capital and organization capital.

The knowledge capital represents the intangible value of an organization made up of its knowledge, relationships and learned techniques. The knowledge capital is measured as the annual capitalized R&D expense added to the amortized cumulative R&D capital (the sum of the capitalized past annual R&D expenses):

$$Kcap_{i,t} = (1 - dxrd) * Kcap_{i,t-1} + XRD_{i,t} \tag{2}$$

where $Kcap_{i,t}$ is the knowledge capital of firm i at time t and $XRD_{i,t}$ is the R&D expenditures of firm *i* at time *t*. $dxrd$ is the industry-specific depreciation rate of the firm's R&D.

The organization capital represents the intangible value of an organization made up of its processes, methods, and techniques that allow it to operate and enable it to leverage its capabilities. The organization capital is based on selling, general and administrative (SG&A) expenses since many non-R&D intangible investments, such as brands, IT, business processes, and human resources are included in SG&A expenses in the income statement. However, following Peters and Taylor (2017), I only capitalize 30% of the SG&A expenses as they also include regular expenses, such as sales commissions and administrative salaries (Enache and Srivastava, 2018). Consequently, the organization capital is measured as a fraction of the SG&A expenses added to the amortized cumulative SG&A capital:

$$Ocap_{i,t} = 0.8 * Ocap_{i.t-1} + 0.3 * SG\&A_{i,t} \tag{3}$$

where $Ocap_{i,t}$ is the organization capital of firm *i* at time *t* and $SG\&A_{i,t}$ is the SG&A spending of firm *i* at time *t*. Following Falato et al. (2013) and Peters and Taylor (2017), an organization capital depreciation rate of 20% is implemented.

After calculating *Eq. (2)* and *(3)*, the intangible-adjusted book value measure can be computed as follows:

$$iBE_{i,t} = B_{i,t} + Kcap_{i,t} + Ocap_{i,t} - GDWL_{i,t} \tag{4}$$

where $GDWL_{i,t}$ reflects the goodwill of firm *i* at time *t*. Following Park (2019), goodwill is subtracted from the book value of a firm considering that there are some cases of subjectivity in estimating goodwill's current fair value and goodwill impairment that are not backed by economic fundamentals (Ramanna and Watts, 2012).

Finally, the intangible-adjusted HML factor (iHML) is computed similarly to the traditional HML factor in *Eq.(1)*, with the only distinction that the book value is adjusted with the intangible capital of a firm *Eq.(3)*.

3.2.3 The Relative Valuation Measure

To determine whether the value factor has underperformed because the strategy has become too crowded, I compute the relative valuation between a growth and value portfolio. The relative valuation at time *t* is the ratio of B/M for the growth portfolio to B/M for the value portfolio at time *t*:

$$Relative\ Valuation = \frac{B/M\ Growth}{B/M\ Value} \tag{5}$$

where $B/M\ Growth_t$ is the aggregate book value divided by the aggregate market value of a growth portfolio at time *t*, while $B/M\ Value_t$ is the aggregate book value divided by the aggregate market value of the value portfolio at time *t*. The relative valuation is computed monthly and measures the relative expensiveness of a growth portfolio to a value portfolio. If the value strategy has become too crowded, the relative valuation measure experienced a significant increase over time since value stocks have become more expensive with respect to growth stocks.

3.2.4 Interest Rate Dependence

To determine whether the level of the U.S short-term, long-term interest rate and yield curve slope can explain the underperformance of the value factor, I use a time-series regression. Following Maloney and Moskowitz (2021), I use the equity market excess return to control for general market exposure, while the monthly value factor return forms the dependent variable and the interest rate variable the independent variable:

$$R_t = \alpha_i + \beta 1(Rm_t - Rf_t) + \beta 2_i INT_{i,t} + \varepsilon_{i,t} \tag{6}$$

where R_t is the monthly value factor return at time *t*, $\beta 1$ represents the coefficient of the control variable, and $\beta 2_i$ reflects the coefficient of the interest rate variable *i*. I use three different interest rate variables to examine the relationship with the value factor returns: the U.S. 3-month Treasury Bill yield, 10-year constant maturity Treasury Bond yield, and the slope of the yield curve (10-year yield minus 3-month yield).

3.2.5 Decomposition of the Intangible-adjusted Value Factor Returns

To determine whether the underperformance of the value factor is caused by a migration slowdown and/or better growth stocks, I decompose the log-returns of the value factor using the accounting identity of Arnott et al. (2021). Following the idea of Arnott, Beck, Kalesnik, and West (2016) of decomposing the return of equity factors into structural and revaluation components, they propose an accounting identity that attributes the relative performance of value relative to growth portfolios to three elements: change in aggregate valuation, income yield and migration. As the income yield term is expected to persistently lower the value strategy returns over time and the migration term to persistently increase them, combined they form the structural value premium. The revaluation return component is a temporary component, which can generate positive as well as negative returns over time, but is expected to average zero over a sufficiently long period (Arnott et al., 2021).

The revaluation term captures the return of portfolio *i* at time *t* coming from the change in aggregate valuation of a portfolio in year *t*:

$$Change\ in\ Aggregate\ Valuation_t\ =\ log\ (\frac{Mt+}{Bt+})\ -\ log\ (\frac{Mt-1}{Bt-1})$$
(7)

The term $log\ (\frac{Mt+}{Bt+})$ represents the log market-to-book ratio of a portfolio right after rebalancing at time *t*, while the term $log\ (\frac{Mt-1}{Bt-1})$ reflects the log market-to-book ratio of a portfolio right after rebalancing at time *t-1*. By subtracting the two terms, we have the difference between the aggregate valuation right after rebalancing in time *t* and *t-1* of a specific portfolio. In economic terms, the revaluation return component measures the contribution to the value strategy returns of long-term changes in expected profitability, growth, and discount rates used to price stocks (Fama and French, 2007). If the change in aggregate valuation of the growth portfolio is positive and larger than the change of the value portfolio, the revaluation component of the iHML factor delivers a negative return and vice versa.

The second element of the decomposed value factor is the income yield term, which measures the returns coming from the change of the aggregate book value of equity (primarily driven by retained earnings[2]) and the dividend yield of a portfolio in year *t*:

$$Income\ yield_t\ = log(\frac{Bt-}{Bt-1})\ +\ log(1+\frac{Dt-}{Mt-})$$
(8)

The term $log(\frac{Bt-}{Bt-1})$ represents the growth rate of the book value of equity of the portfolio formed at time *t-1* in the period *t-1* to *t*, while $log(1+\frac{Dt-}{Mt-})$ represents the dividend yield at time *t* of a portfolio formed at time *t-1*. Combined, the two terms reflect the annual income yield of a specific portfolio. Following Fama and French (2007), since growth stocks are typically far more profitable than value stocks while growing faster, the income yield term contributes always negatively to the return of the value factor.

The third element of the iHML factor return decomposition is the migration term. Migration occurs when value stocks appreciate and no longer qualify for the value portfolio or when growth stocks drop and no longer qualify for the growth portfolio. Specifically, the migration term in the return decomposition captures the return of portfolio *i* at time *t* resulting from changes in valuations net of the revaluation term:

[2] Capital gains from earnings retention follow from the dividend irrelevance theorem of Miller and Modigliani (1961).

$$Migration = \underbrace{\left[log(\frac{Mt-}{Bt-}) - log(\frac{Mt-1}{Bt-1})\right]}_{Change\ in\ valuation} - \underbrace{\left[log(\frac{Mt+}{Bt+}) - log(\frac{Mt-1}{Bt-1})\right]}_{Revaluation\ term}$$

$$= log(\frac{Mt-}{Bt-}) - log(\frac{Mt+}{Bt+})$$

(9)

where $log(\frac{Mt-}{Bt-})$ represents the log market-to-book ratio at time *t* of a portfolio formed at time *t-1*, while $log(\frac{Mt+}{Bt+})$ represents the log market-to-book ratio at time *t* of a portfolio formed at time *t*. By substracting the two terms, the migration term captures the difference between the portfolio market-to-book ratio right before and right after rebalancing. As rebalancing decreases the market-to-book ratio of the value portfolio and increases the market-to-book ratio of the growth portfolio, the migration term always contributes positively to the iHML strategy returns and is therefore defined as a structural component (Fama and French, 2007).

By combining the three return components, following Arnott et al. (2021), the log-return of a portfolio at time *t* is obtained:

$$log(1 + r_t) = \underbrace{\left[log\left(\frac{Mt+}{Bt+}\right) - log\left(\frac{Mt-1}{Bt-1}\right)\right]}_{Revaluation\ component} + \underbrace{\left[log(\frac{Bt-}{Bt-1}) + log(1 + \frac{Dt-}{Mt-})\right] + \left[log(\frac{Mt-}{Bt-}) - log(\frac{Mt+}{Bt+})\right]}_{Structural\ component}$$

(10)

Because the value strategy was rebalanced annually at the end of June and because the decomposition used the observations between rebalancing points, the analysis focuses on the periods between July of year *t* and June of year *t+1*.

Chapter 4

Empirical Results

4.1 The Traditional and Intangible-adjusted Value Factor Performance

Figure 1 shows the cumulative returns of the traditional value factor and the intangible-adjusted value factor during the 1963-2021 period, while *Table 2* reports the annualized mean returns of the two value factor measures in different periods. The results give evidence that the intangible-adjusted value factor is a more accurate measure in identifying value and growth stocks. In fact, consistently with the internally generated intangible assets becoming more crucial over time (Arnott et al., 2021), the cumulative performance lines diverge increasingly. More precisely, before 1990 the HML and iHML strategy delivered an annualized return of 4.1% and 4.7% respectively, with the t-test showing that the difference in performance is not significantly different from zero. After 1990, when intangibles became important, the HML and iHML strategy delivered an annualized return of -2.5% and 0.3% respectively, with the t-test reporting that the difference is highly significantly different from zero. Over the full sample, the HML and iHML strategy delivered an annualized mean return of 0.4% and 2.2% respectively, with a highly significant difference of 1.8% annually. For the robustness test, I use a factor spanning test regression which examines whether the iHML factor can be fully explained by the HML factor. As the intercept of the regression is positive and highly significant, the iHML factor is not subsumed by the HML factor, while the HML factor is subsumed by the iHML factor (see Appendix *Table A.1*).

Figure 1: *shows the cumulative monthly returns of the iHML factor (blue line) and the HML factor (red line) over the 1963-2021 period.*

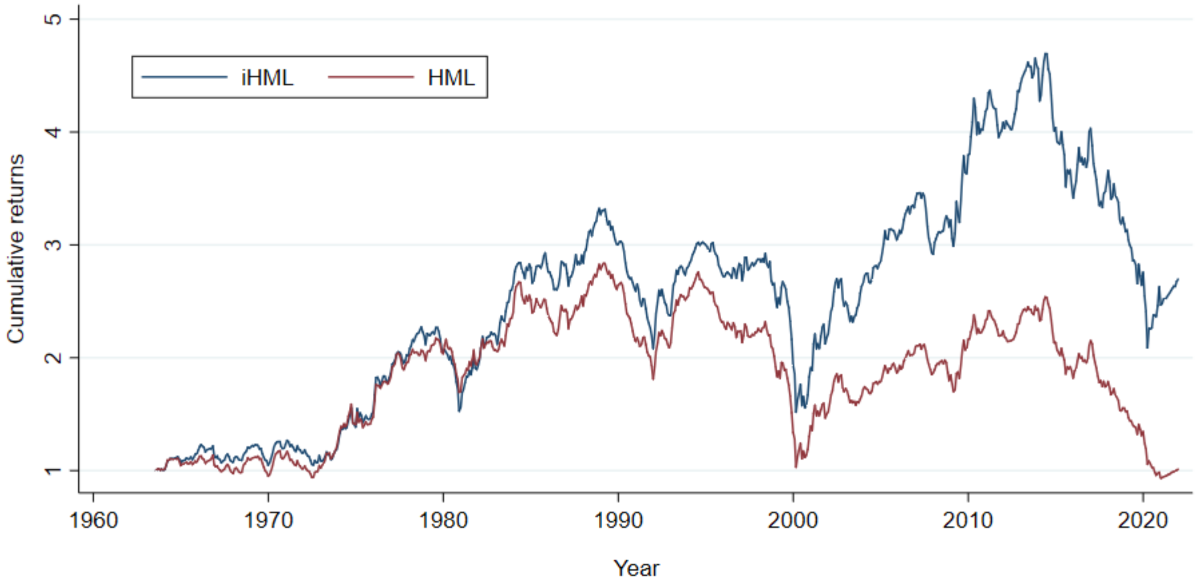


Table 2: *The first row shows the annualized returns of the iHML factor during the 1963-1989, 1990-2021, and the 1963-2021 period. The second row shows the annualized returns of the HML factor during the three different periods. The last row shows the difference between the annualized returns of the iHML factor and HML factor during the three different time periods. To determine whether the annualized returns and the difference between the two value measures are different from zero a t-test is conducted. Significance is defined as * p <0.10, ** p <0.05, *** p <0.01.*

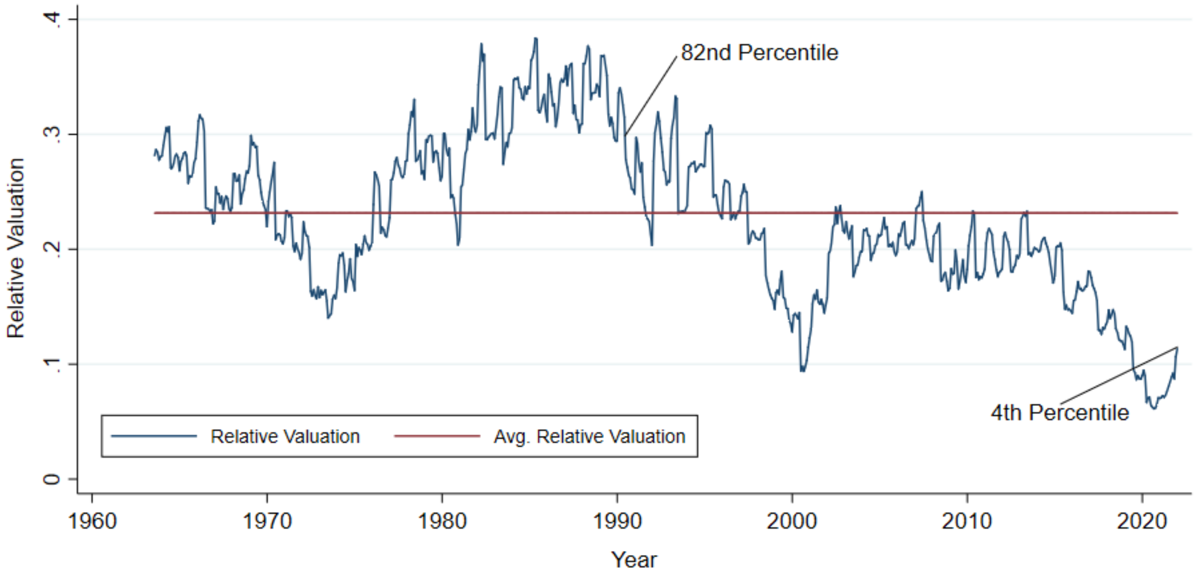
	1963-1989	1990-2021	1963-2021
iHML	**4.7%** **	0.3%	2.2%
HML	**4.1%** **	**-2.5%** **	0.4%
iHML - HML	0.6%	**2.8%** ***	**1.8%** **

Although the traditional HML factor measure is outdated and the intangible-adjusted HML factor is a more accurate measure to identify growth and value stocks in the current economy, also the iHML factor did not perform well in the last two decades. As shown in *Figure 1*, during the tech bubble the iHML factor suffered like the traditional measure, while experiencing a much stronger recovery after the burst of the bubble in 2001. However, since mid-2014 it is underperforming and experiencing an even steeper decrease than the traditional measure. Moreover, after 1990 the iHML strategy generated an annualized return of 0.1%. These findings evidence that capitalizing the intangible assets of a firm does not solve and explain completely the recent underperformance of the value strategy. Therefore, in contrast to the existing literature which examined the strategy's underperformance based on an obsolete value measure, the continuation of my diagnosis will be based on the intangible-adjusted value measure.

4.2 Crowded Trade

The relative valuation measure rejects the narratives suggesting that the underperformance of the iHML factor is the consequence of the strategy being too crowded. A crowded value strategy should boost the prices of value companies relative to those of growth companies, and therefore increase the relative valuation measure. However, the results show that the relative valuation measure has decreased drastically. More precisely, from January 1991 to December 2021, the relative valuation measure decreased from the 82nd to the 4th percentile, meaning that value stocks are extremely cheap relative to growth stocks.

Figure 2: *Shows the different levels of the monthly relative valuation measure (blue line) during the 1963-2021 period. The red line reflects the average monthly relative valuation measure over the 1963-2021 period. Moreover, the table reports the percentile of the relative valuation measure in January 1990 (82nd percentile) and in December 2021 (4th percentile).*



4.3 Low-interest-rate environment

The time-series regression analysis reported in *Table 3*, rejects the narratives suggesting that the positive statistical relationship between the level of interest rates and the iHML returns has led to the recent value strategy's underperformance. After controlling for different time periods and market exposure, neither the level of the U.S short-term interest rate nor the U.S long-term interest rate has a significant relationship with the returns of the intangible-adjusted value factor. Only during the 1990-2021 period, the slope of the yield curve has a positive relationship with the iHML returns, supporting the narrative suggesting that value firms have more shorter-dated debt and are therefore more vulnerable to rises in short rates, while growth firms have more longer-dated debt and benefit more from falling long rates (Mezrich et al., 2019). This positive relationship seems to have recently played out, given that the slope of the yield decreased significantly and the iHML factor performed poorly in the 2017-2020 period.

Table 3: *shows the results of the nine different time-regressions conducted to reveal the relationship between the value strategy returns and the interest rates. The 3-month Treasury Bill yield represents the short-term interest rate, the 10-year constant maturity Treasury Bond yield represents the long-term rate, and the difference between the 10-year yield and 3-month yield reflects the yield curve slope. The equity market excess return is included as control variable for general market exposure but is omitted from the table. To determine whether the dependence is signficantly different from zero a t-test is conducted. Significance is defined as * p <0.10, ** p <0.05, *** p <0.01.*

	1963-1989			1990-2021			1963-2021		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Long-term rate	0.022 (0.094)			0.025 (0.098)			0.043 (0.040)		
Short-term rate		-0.012 (0.055)			-0.07 (0.07)			0.009 (0.038)	
Slope Yield curve			0.144 (0.113)			**0.333**** **(0.157)**			0.179 (0.097)
Observations	330	330	330	372	372	372	702	702	702
R-squared	0.029	0.029	0.034	0.001	0.002	0.012	0.008	0.007	0.012

However, the robustness test points out that the positive relationship between the iHML returns and the slope of the yield curve in the 1990-2021 period has weak economic significance. *Figure 3* plots the 10-year rolling t-statistic from regressing the iHML factor returns on the slope of the yield curve, and shows that only for a brief period there has been a significant positive relationship. The 10-year rolling t-statistic has been very inconstant over time, suggesting that the iHML factor performing poorly during an extremely low-interest-rate environment may be a result of chance events. Moreover, the inconstant relationship between the iHML returns and the slope of the yield curve is supported by the fact that at the end of 2000 and 2006 the slope of the yield curve reached the low-level of the slope in 2020, but with opposite iHML returns. More precisely, the iHML strategy registered an annualized average return of 3.1% in 2000 and 10.8% in 2006, while in 2020 it registered -8.5%. These inconsistencies challenge the economic significance of the positive statistical relationship, while supporting the narrative of chance events. Nevertheless, even if the estimated dependence would be valid, the effect of the interest rate on the value factor returns is almost negligible; if the slope decreases with 100 bp in one year, which is rare, the iHML annual return only decreases with 33 bp. Given the regression results and the robustness test, I conclude that the level of interest rates has not caused the recent underperformance of the intangible-adjusted value factor strategy.

Figure 3: *shows the rolling 10-year t-statistics from regressing various the iHML returns on the slope of the yield curve. The rolling 10-year t-statistics (blue line) reflects the time variation of the relationship, while the black line reflects the t-statistic equal to 2. Consistently, when the blue line is higher than the black line, the relationship is positive and signficant at least at the 5%.*

4.4 Intangible-adjusted Value Factor Returns Decomposition

4.4.1 Migration Slowdown

The log-return decomposition of the iHML factor in *Table 4,* rejects the narratives suggesting that the value factor's underperformance is caused by the slowdown of the migration process. In fact, the average annual migration return component has increased from 12.2% in the 1963-1989 period to 15.6% in the 1990-2021 period. More specifically, the enhanced migration of the small-cap value portfolio is the main driver of the increased return contribution of the iHML migration term. In fact, while the large-cap growth and value portfolio and the small-cap growth portoflio have roughly the same average contribution during the two periods, the small-cap value portfolio saw its average annual contribution rise from 7.9% in the 1963-1989 period to 12.2% in the 1990-2021 period. In economic terms, this means that after portfolio formation, the expected profitability of the equity-financed investments of small-cap value stocks has increased significantly compared to the previous time period (Fama and French, 2007). Defining this change in expectations between the two time periods as rational or irrational is an interesting topic but beyond the scope of this research. To conclude, the migration slowdown narrative is rejected by the average annual migration return component increasing from 12.2% in the 1963-1989 period to 15.6% in the 1990-2021 period.

4.4.2 Better Growth Stocks

Table 4 shows that the log-return decomposition of the iHML factor rejects the narratives suggesting that the value factor's underperformance is caused by better performing growth stocks compared to the past. In fact, the average annual income yield return component of the growth portfolio has roughly been halved. Specifically, it decreased from 15% in the 1963-1989 period to 8.2% in the 1990-2021 period. However, the even stronger fall of the income yield return component of the value portfolio led to a more negative iHML income yield return component in the recent period. More precisely, the value portfolio income yield term contribution has decreased from 6% to -2.8%, and the income yield term contribution of the iHML factor has decreased from -9% to -11%. The decomposition shows that the lower income yield of value and growth portfolios is driven by a lower dividend yield as well as a lower growth rate of book equity value in the 1990-2021 period compared to the 1963-1989 period. To conclude, the better performing growth stocks narrative has been rejected by the average annual income yield of growth portfolios decreasing from 15% in the

1963-1989 period to 8.2% in the 1990-2021 period. However, overall, the income yield of the iHML factor has decreased since the income yield term of the value portfolios fell even more sharply than for the growth portfolios.

4.4.3 Temporary Rather than Structural Problem

The decomposition of the iHML log-returns in *Table 4* reveals a crucial finding for the diagnosis of the systematic value factor, as it shows that the strategy is suffering from a temporary rather than chronic disorder. Since the increase of the migration return component has outweighed the decrease of the income yield return component, the structural value premium has risen. More precisely, the structural value premium increased from 3.2% in the 1963-1989 to 4.6% in 1990-2021, indicating that the structural return component of the strategy is still intact and even reinforced. Therefore, the recent iHML factor's underperformance is caused by a temporary return component, defined as the revaluation premium. Consistently with the expectation of Arnott et al. (2021) that the revaluation premium should average zero in the long term, the average revaluation premium over the entire sample period is not statistically significant different from zero. However, while in the 1963-1989 period the annual revaluation premium averaged 0.1%, in 1990-2021 it averaged -3.6% annually. As the revaluation premium captures the return coming from changes in relative valuations between the growth and value portfolios, the extremely low premium reflects the relative valuation measure falling from the 82nd to the 4th percentile in the 1990-2021 period (*Figure 2*). Value stocks becoming extremely cheap relative to growth stocks, are therefore the reason that, albeit the structural value premium has increased, the yearly iHML average log-return fell from 3.4% to 1%. Since the decomposition returns are reported as log-returns and capture the average returns between rebalancing points, they slightly deviate form the average annualized returns reported in *Table 2.* Arnott et al. (2021) came to a similar conclusion, with the difference that they report a lower structural value premium in the recent period. This difference may be a result of basing their analysis on the traditional HML measure, which is outdated compared to the intagible-adjusted HML measure used in this study.

Table 4: *shows the results of the decomposition of the iHML factor log-returns in the 1963-1989, 1990-2021, and 1963-2021 periods. The returns are reported as average annual log-returns.*

July 1963 - December 1989						
Size	Valuation	Total Return	Revaluation Premium	Structural Premium	Income Yield	Migration
Small	Growth	9.15%	0.32%	8.83%	15.38%	-6.55%

	Value	11.63%	0.06%	11.57%	3.66%	7.91%
	iHML	2.48%	-0.26%	2.74%	-11.72%	14.46%
Big	Growth	8.73%	-0.54%	9.27%	14.58%	-5.31%
	Value	12.94%	-0.02%	12.96%	8.25%	4.71%
	iHML	4.21%	0.52%	3.69%	-6.33%	10.02%
Average	**iHML**	**3.35%**	**0.13%**	**3.23%**	**-9.01%**	**12.24%**

		January 1990 - December 2021				
Size	Valuation	Total Return	Revaluation Premium	Structural Premium	Income Yield	Migration
Small	Growth	2.36%	2.05%	0.31%	7.50%	-7.19%
	Value	7.32%	-0.75%	8.07%	-4.15%	12.22%
	iHML	4.96%	-2.8%	7.76%	-11.65%	19.41%
Big	Growth	7.9%	4.18%	3.72%	8.91%	-5.19%
	Value	4.98%	-0.28%	5.26%	-1.43%	6.69%
	iHML	-2.92%	-4.46%	1.54%	-10.34%	11.88%
Average	**iHML**	**1.01%**	**-3.63%**	**4.64%**	**-11%**	**15.64%**

		July 1963 – December 2021				
Size	Valuation	Total Return	Revaluation Premium	Structural Premium	Income Yield	Migration
Small	Growth	5.34%	1.22%	4.12%	11.02%	-6.90%
	Value	9.21%	-0.43%	9.64%	-0.66%	10.30%
	iHML	3.87%	-1.65%	5.52%	-11.68%	17.20%
Big	Growth	8.28%	2.09%	6.19%	11.43%	-5.24%
	Value	8.49%	-0.20%	8.69%	2.89%	5.80%
	iHML	0.21%	-2.29%	2.5%	-8.54%	11.04%
Average	**iHML**	**2.05%**	**-1.97%**	**4.02%**	**-10.11%**	**14.13%**

Note that the first column indicates whether the growth, value, and iHML portfolio is composed by small or big stocks based on the NYSE median. The second comlumn indicates whether the portfolio is a value, growth or iHML (value minus growth) portfolio. The third column reflects the total return of the different portfolios computed as the revaluation premium (column 4) added to the structural value premium (column 5). The structural value premium equals the income yield (column 6) added to the migration term (column 7) of a portfolio. Finally, as the iHML portfolio equals the average of the small iHML and big iHML portfolio, the average iHML is displayed.

4.5 The Future Performance of the Intangible-adjusted Value Factor

4.5.1 Assumptions

After identifying the extremely low valuation of value stocks relatively to growth stocks as the main source of the value factor's underperformance in the 1990-2021 period, I assess whether the strategy will recover in the future. Since an exact forecast does not exists in finance, I will evaluate the performance of the iHML factor based on two realistic assumptions and three possible scenarios.

The first assumption states that, like in the past 30 years, the structural value premium will on average generate a return of 4.6% annually. Secondly, I assume that the relative valuation will not decrease forever, which means that growth stocks can not become infinitely expensive compared to value stocks. This assumption is even more relaxed than the assumption of Cohen et al. (2003) or Asness, Friedman, Krail, and Liew (2000), which stated that the relative valuation measure is mean-reverting. Since the current relative valuation measure lies in its 4th percentile, a reversion to the mean would imply that the iHML factor would deliver outstanding returns in the upcoming years. However, the augmented Dickey–Fuller test (ADF) reported in *Table A.2* (Appendix), does not reject the null hypothesis that the process is non-stationary and thus non mean-reverting at the 5% and 1% critical values.

4.5.2 Three Future Scenarios

To determine whether the iHML factor will recover from its current underperformance, I assess its future returns based on three basic scenarios; (1) the relative valuation measure will increase, (2) the relative valuation measure will stay constant, or (3) the relative valuation measure will decrease in the upcoming years.

If in the upcoming years the relative valuation measure will rise from its extreme low level, the iHML value strategy will recover and earn great returns. Specifically, the revaluation component will generate positive returns in addition to the average annual 4.6% structural value premium. Historically, this is the only scenario that has played out after a downturn of the measure. *Table 5* shows three drawdowns of the relative valuation measure and the subsequent 3 and 5 year cumulative return of the iHML strategy. From the three events, the relative valuation measure during the tech bubble comes closest to the current level of the measure, which is equal to 0.11. In the 5 years following the tech bubble, the strategy delivered a cumulative return of 101%. Given that the relative valuation measure reached an even lower bottom (August 2020) than during the Tech bubble, a rebound of the measure may translate in even higher subsequent returns. Although this is the only scenario that has played out in the past, I have to consider other scenarios since historical data is not a guarantee for the future.

Table 5: *reports the three relative valuation measure drawdowns related to three different events. The first column reports the name of the event, the second column reports the level of the relative valuation measure at a specific date reported in column 3. Column 4 and 5 reported the 3-year and 5-year cumulative returns after the date specified in column 3.*

Event	Relative Valuation	Date	3-Year return	5-Year return
Tech bubble*	0.094	Aug 2000	57%	101%
Nifty Fifty**	0.142	Jul 1973	68%	103%
Iran oil crisis***	0.209	Dec 1980	69%	77%

Note that the tech bubble refers to the period in which internet-related growth companies experienced a period of massive growth. a period of massive growth in the use and adoption. More precisely, the bubble started in 1995, reached its peak in March 2000, and bursted in October 2002. The Nifty Fifty** refer to a group of roughly fifty large-cap growth stocks which drove the bull market of the 1970s. However, their growth was not backed by their fundamentals and resulted in a crash of their stock prices during the early 1980. The Iran oil crisis*** was an energy crisis caused by a drop in oil production in the wake of the Iranian Revolution. The higher oil prices caused a huge drop in the valuation of growth stocks relative to value stocks.*

In the second scenario, the relative valuation measure will remain on the actual level. In this case, albeit the relative valuation lies in its lowest historical ventile, the iHML value factor return will still earn positive returns due to the structural value premium. More precisely, while the return coming from the revaluation premium would be equal to zero, the structural value premium would ensure an annual average return of 4.6%. Although this scenario historically never played out, it shows that the iHML strategy does not necessarily require the rebound of the relative valuation measure to generate positive returns.

In the last scenario, the relative valuation measure will decrease even more in the upcoming years, breaking its all-time low level. It is important to note that this does not mean that the iHML factor would inevitably earn a negative return, since this would only be the case if the decrease of the relative valuation measure is steep enough to outweigh the annual average structural value premium of 4.6%. Given that value stocks can not become infinitely cheap compared to growth stocks, this improbable scenario can not hold for a prolonged period of time.

The three possible scenarios of the relative valuation measure future fluctuations, show that only a sharp decrease of the measure in the upcoming years would lead to negative future iHML returns. Moreover, given the assumption that the relative valuation measure can not eternally decrease, at a certain point in time the iHML factor will start delivering positive returns again because of its structural value premium. Historical data shows that the relative valuation measure has always rebounded, suggesting that the iHML strategy is going to deliver impressive returns in the future. However, as historical data is not a guarantee for the future, I can only conclude that the strategy is still valid and is expected to recover since it is suffering from a temporary trend that can not decrease infinitely.

Chapter 6

Further Research and Conclusion

6.1 Further Research

The diagnosis of the systematic value strategy underperformance reported in this study, paves the way to new research in several directions.

Firstly, while my study aims at detecting the reasons behind the value strategy's underperformance, it would be also relevant to examine the underlying causes for the observed differences in return drivers between the 1963-1989 and 1990-2021 time period. In this way, researchers can contribute to the long-lasting debate whether the value premium is a compensation for bearing the risk of financial distress (Fama and French, 1992, 1993) or a phenomenon driven by mispricing (DeBondt and Thaler, 1987; Lakonishok et al., 1994; Haugen, 1995). My results offer a starting point for researchers to further examine this topic. For instance, this study reports that the average yearly migration return component of small value stocks increased from 7.9% in the 1963-1989 period to 12.2% in the 1990-2021. This difference suggests that small value portfolios are migrating into neutral or growth portfolios at a significantly higher pace than in the previous period. The underlying reason for this difference may be related to mispricing or risk compensation. For instance, a potential explanation may be that small value stocks experience a stronger price correction than in the previous period due to a stronger market overreaction to the poor earnings results of value companies. The stronger overreaction may be explained by the higher presence of irrational retail investors in the latter period. On the other hand, the additional returns delivered by the small value portfolios in the latter time period may be a compensation for bearing a higher risk than during the 1963-1989 period. For instance, researchers may find evidence that small value stocks suffer from a significantly higher volatility during the 1990-2021 period or that the proportion of small value companies going bankrupt in this period is significantly higher than during the 1963-1989 period. Given that a yearly average increase of 4.3 percentage points is impressive, the mispricing narrative sounds more reasonable, however, only empirical evidence can prove this. Another striking difference between the two time periods which does not contribute to the value debate but requires further analysis, is the nearly halved return coming from the income yield term of growth and value portfolios. Since the income yield return component is driven by the dividend yield and the growth rate of the book value of stocks, the huge fall in returns coming from this source may evidence that the intangible-adjusted book value metric may still not capture completely the fair book value. However, it is also possible that growth and value companies pay less dividends and do less equity-financed investments compared to the 1963-1989 period, which would not necessarily be a threat to the value strategy's performance. This difference shows the relevance of detecting the underlying reason for a divergence between the two time periods, as it may bring to light an impairment of the value measure.

Secondly, this study shows that future research should review the measure that captures growth and value stocks for two main reasons. Firstly, the outdated value measure finding in *Section 4.1* exposes the necessity for future research examining periodically the validity of the value metric. In fact, as shown by the growing importance of intangibles for the firm's future profits in the last three decades (Arnott et al., 2021), the traditional asset structure of a company can change over time, meaning that the appropriate value metric differs over time as well. The intangible-value factor adjustment has been developed when the traditional value measure was already underperforming its adjusted counterpart for two decades. Therefore, in order to maximize the value strategy's performance, it is crucial that researchers periodically analyze the validity of the implemented measure, and do not wait for prolonged underperformance. Secondly, as stated by its authors (Peters and Taylor, 2017), the methodology to estimate the intangible-capital of a firm presents some limitations, meaning that the intangible-adjusted value measure has still room for improvement. For instance, when estimating the intangible-capital of a company, Peters and Taylor (2017) assume that the organization capital is based on 30% of the SG&A expenses of a firm. As it is an assumption, it may be that a different ratio of SG&A expenses provides a more precise distinction between value and growth stocks. Beside the ratio of SG&A expenses, also the implemented depreciation rates of knowledge and organization capital may not be the most accurate. To conclude, since the appropriate value factor measure changes over time and the iHML factor has still room for improvement, future research in this field would preserve and enhance the strategy's performance.

Lastly, since empirical studies show that value exposure is negatively related to ESG scores (Lioui, 2018), it is essential that future research monitors the effect of climate regulatory changes on the value strategy's performance and adjust the value metric accordingly. With the signing of the Paris Agreement, governments have committed themselves to a substantial reduction of the negative effects of climate change, suggesting that the corporate sector will face stricter climate related regulation like higher carbon emission taxes (Fujimori et al., 2016). Accordingly, the stock market may already have taken into account that high emission companies will pay more taxes, have a competitive disadvantage compared to low emission competitors, and hold assets which will likely become stranded assets. For these companies the high book to market ratio is high for a reason, and therefore represents a value trap. In order to avoid value traps arising from expected future climate change regulations, a value metric accounting for the effects of the Paris Agreement on the corporate sector should be developed. More precisely, while in this study I adjust the book value of companies upwards by adding unrecognized intangible assets, future studies should adjust the value metric downwards given that future carbon taxes present unrecognized liabilities. With this climate and intangible-adjusted value metric, value factor investors avoid stocks that are cheap for a reason and therefore harm the strategy's performance.

6.2 Conclusion

This study shows that the traditional value measure should be adjusted by capitalizing the intangible assets of a firm, since they have become increasingly important for the future profitability of a company. Although in the 1990-2021 period the iHML factor on average outperforms the HML measure (Fama and French, 1992) with 2.8% annually, the intangible-adjusted factor has delivered an annual average return of 0.3%, suggesting that the omission of intangible assets does not completely explain the prolonged underperformance of the strategy. Therefore, in contrast to the previous literature which based their value's underperformance analysis on an outdated measure, I base my diagnosis of the value factor on the iHML measure to provide a more accurate and reliable outcome. More precisely, I analyze several different potential underperformance sources with several different methodologies.

Firstly, the narrative suggesting that the iHML factor has underperformed because it has become a too crowded strategy, has been rejected with the current level of the relative valuation measure. A too crowded value strategy goes along with value stocks becoming excessively expensive relative to growth stocks, and thus a significant increase of the relative valuation measure. However, this research shows the opposite since the relative valuation measure decreased from the 82nd to the 4th percentile, meaning that value stocks are extremely cheap relative to growth stocks.

The narratives suggesting that the positive relationship between the level of interest rates and the value factor returns caused the strategy's underperformance, have been rejected by several time series regression analysis and a robustness test. Therefore, the extreme underperformance of the value strategy occuring during an extremely low-interest-rate environment seems to arise from a chance event rather than a causal consequence.

Secondly, the decomposition of the iHML returns rejects the narratives suggesting that the iHML factor is underperforming as a consequence of the migration process slowdown.

More precisely, the decomposition shows that the annual migration return contribution has increased from 12.2% in the 1963-1989 period to 15.6% in the 1990-2021 period. This increase is mainly driven by the average migration return component of the small-cap value portfolio, which is annually 4.3 percentage points higher than in the 1963-1989 period. Moreover, the iHML returns decomposition rejects the narratives suggesting that the iHML factor is underperforming because growth stocks in the last decades are performing better than in the previous decades. Also in this case the decomposition shows the opposite, given that the average annual income yield return component of the growth portfolio decreased from 15% in the 1963-1989 period to 8.2% in the 1990-2021 period. The decrease in income yield return was slightly stronger for the value portfolios, resulting in a lower overall income yield term in the latter time period. The lower income yield of growth and value portfolios is driven by a lower dividend yield as well as a lower growth rate of book equity value in the 1990-2021 period.

Finally, the decomposition of the iHML log-returns shows that the strategy is suffering from a temporary rather than structural disorder. More precisely, the structural iHML premium increased from 3.2% in the 1963-1989 to 4.6% in 1990-2021, indicating that the structural return component of the strategy is still intact and even reinforced. The underperformance is caused by the revaluation premium which is a temporary return component that in the long-term averages zero but since 1990 it averaged -3.6%, reflecting the fall of the relative valuation measure into its 4th percentile. Therefore, value stocks becoming historically cheap relative to growth stocks, are the reason that, albeit the structural value premium of the strategy has increased, the yearly iHML average annual log-return fell from 3.4% to 1%.

These findings answer the main research question: *What is the diagnosis of the systematic value investing strategy's underperformance?* The diagnosis reveals that, while the traditional method is outdated, the intangible-adjusted value factor suffers from a temporary rather than structural problem; value stocks being historically cheap relative to growth stocks. For the future, this diagnosis implies that the strategy will only deliver negative returns in the remote case that the relative valuation return component decreases at a higher rate than the 4.6% average structural value premium. As value stocks can not become infinitely cheap compared to growth stocks, the sharp decrease can not hold in the long run. Moreover, historical data shows that the revaluation return component has always rebounded, suggesting that the iHML strategy will deliver impressive returns in the future. Although this is the most likely future scenario, historical data is not a guarantee for the future and the assumption of mean reversion made in previous studies (Asness et al., 2000; Cohen et al., 2003) does not hold at the 5% level of signficance. However, even if the relative valuation measure does not rebound and stays in its 4th percentile, the iHML factor would still deliver an appropriate yearly return due to its 4.6% average structural value premium. Altogether, the iHML factor is still a valid strategy which is expected to recover in the short-medium term.

Besides giving evidence that the value factor is still a valid strategy, this research shows that the appropriate value measure can change over time, meaning that periodical future research in this area is crucial to avoid further prolonged periods of underperformance. Finally, as companies have to meet the requirements of a world moving towards a net-zero carbon emission environment, the next required value measure adjustment is likely to be carbon emission related.

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Appendix

A

Table A.1: *reports the results of spanning tests of HML and iHML. These regressions measure the extent to which HML or iHML subsume each other when one also controls for the market and size factors. The first column show the regression output with iHML as explanatory variable while the second column shows the regression output with HML as explanatory variable. To determine whether the dependence is signficantly different from zero a t-test is conducted. Significance is defined as * p <0.10, ** p <0.05, *** p <0.01.*

	Dependent variable: HML	**Dependent variable: iHML**
Mktrf	-0.026*** (0.009)	0.0171* (0.011)
Size	-0.075** (0.013)	0.0691*** (0.014)
iHML returns	0.910*** (0.013)	
HML returns		0.973*** (0.014)
Constant	**-0.001*** (0.0004)	**0.0011***** (0.0004)
Observations	702	702
R-squared	0.878	0.870

Table A.2 **Augmented Dickey-Fuller test*:*** *tests the null hypothesis that a unit root is present in a time series sample. The alternative hypothesis is stationarity. The examined variable is the relative valuation measure. As the test statistic is lower than the 10% critical value, at the 90 percent level the null hypothesis of a unit root can be rejected.*

	Test statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-2.676	-3.43	-2.86	-2.570
Observations	702			

Table A.3: *Show the descriptive statistics of the variables used to determine the intangible-adjusted book-to-market (iBookToMarket) of a company in different months over the 1963-2021 period.*

Variable	Obs	Mean	Std. Dev.	Min	Max
SIC	2120202	4214.274	1920.166	100	8900
Price or Bid/Ask Average	2120202	16.966	38.788	-820	4168.34
Shares Outstanding	2120202	48847.461	245913.73	9	17102536
Size	2120202	1874813.2	14963557	-1.300e+08	2.256e+09
ME	2120202	1885045.6	14962271	36.938	2.256e+09
Goodwill	2120202	197.192	1831.231	0	146370
In Process R&D Expense	2120202	-1.116	47.985	-11908	11
R&D Expense	2120202	39.053	416.506	-.648	42740
SG&A	2120202	227.67	1432.342	-283	111733
Preferred Stock	2120202	8.79	107.01	0	11903
BE	2120202	742.783	4857.779	.001	243723
dxrd	2120202	.179	.068	.1	.4
Kcap	2120202	.845	31.949	0	13362
Ocap	2120202	332.486	1580.724	-105.217	116690.81
iBE	2120202	878.923	4847.746	.003	239756
iBookToMarket	2120202	.002	.009	9.82e-09	4.296

Table A.5: *Shows the descriptive statistics of the variables used to determine the relationship between the iHML returns and the different interest rates during the 1963-2021 period.*

Variable	Obs	Mean	Std. Dev.	Min	Max
iHML returns	702	.002	.031	-.184	.124
Excess Market	702	.006	.045	-.232	.161
T10level	702	.061	.03	.006	.153
T3level	702	.046	.032	0	.163
Yield Curve Slope	702	.015	.012	-.027	.044

Table A.6: *Shows the descriptive statistics of the variables used to construct the relative valuation measure. Note that the variable P1vwiME stands for the aggregate market capitalization of a small-cap growth portfolio, and P1vwiBE stands for the aggregate intangible-adjusted book-to-market of the small-cap growth portfolio. Accordingly, P3 reflects the small-cap value portfolio, P4 reflects the big-cap growth portfolio and P6 reflects the big-cap value portfolio.*

Variable	Obs	Mean	Std. Dev.	Min	Max
P1vwiME	702	1.347e+08	1.074e+08	2718208.5	3.878e+08
P4vwiME	702	3.153e+09	3.494e+09	1.497e+08	1.939e+10
P3vwiME	702	1.021e+08	92776406	4531398.5	3.366e+08
P6vwiME	702	3.034e+08	3.122e+08	9441407	1.367e+09
P1vwiBE	702	45515.552	27438.422	1335.671	95551.438
P4vwiBE	702	741101.14	580633.96	57066.32	2061220.6
P3vwiBE	702	165536.72	129768.92	8378.178	427756.03
P6vwiBE	702	356549.06	281815.51	22788.74	1092688.9
iValuationValue	702	.002	.001	.001	.005
iValuationGrowth	702	.0004	.0002	.00009	.00105
iRelativeValuation	702	.231	.067	.061	.384

Table A.5: *Shows the descriptive statistics of the variables used to determine the decomposition of the iHML log-returns. Note that the included variables have been constructed with the variables of Table 1 in Section 3.*

Variable	Obs	Mean	Std. Dev.	Min	Max
TotP1Dividend	57	762968.8	536840.08	83663.352	2774798.3
TotP4Dividend	57	61074317	64598737	4279400.5	2.701e+08
TotP3Dividend	57	1559435.5	1180352.8	243384.41	5208554
TotP6Dividend	57	9774825	9063863.6	556478.44	36916388
SmallValueChAggVal	57	-.005	.206	-.539	.577
BigValueChAggVal	57	-.003	.249	-.671	.435
BigGrowthChAggVal	57	.021	.191	-.492	.528
SmallRevalPremium	57	-.019	.118	-.353	.406

BigRevalPremium	57	-.024	.203	-.608	.59
AvgRevalPremium	57	-.021	.144	-.481	.438
IncYieldValSmall	57	-.029	.069	-.213	.103
IncYieldValBig	57	-.012	.106	-.573	.133
IncYieldGrowSmall	57	.101	.078	-.147	.244
IncYieldGrowBig	57	.091	.064	-.103	.186
SmallValueIncYield	57	-.007	.075	-.203	.14
BigValueIncYield	57	.029	.108	-.529	.169
SmallGrowthIncYield	57	.11	.082	-.144	.267
BigGrowthIncYield	57	.114	.066	-.09	.208
SmallIncomeYield	57	-.117	.059	-.268	.045
BigIncomeYield	57	-.085	.075	-.438	.038
AvgIncomeYield	57	-.101	.055	-.3	.036
SmallValueMigration	57	.103	.077	-.015	.55
BigValueMigration	57	.058	.112	-.198	.371
SmallGrowthMigration	57	-.069	.075	-.219	.209
BigGrowthMigration	57	-.052	.079	-.221	.179
SmallMigration	57	.172	.068	.052	.341
BigMigration	57	.11	.099	-.123	.459
AvgMigration	57	.141	.065	.007	.353
TotHML	57	.019	.143	-.414	.509
AvgStructuralPremium	57	.04	.091	-.23	.206