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Forecasting U.S. Value & Growth Stocks Future Performance

Development & Implementation of a statistical model predicting this performance according to the economic and financial conditions

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Abstract

This thesis aims at forecasting the future performance of Growth and Value Stocks through the development and implementation of a statistical model capable of predicting these performances through macroeconomic data.

In order to optimize the development of this model, some research was conducted on the existing literature related to this topic. The main point is that all the shares available on the markets can be either in the value category, they are therefore characterized by high valuation ratios (BV/P, EP, CF/P and D/P) because these stocks are often considered undervalued on the market or in the growth category, in this case, they are characterized by low valuation ratios because these stocks are often overvalued compared to their true value. In addition, trends in outperformance have been investigated. The results show that the U.S. markets experienced a Value Premium until the 2007 financial crisis but Growth Stocks tended to outperform after the financial crisis. Furthermore, economic cycles were also explained as having an impact on the performance of Value and Growth equity returns. There are two schools of thought but both theories could be observed and confirmed in the research results, which makes it difficult to determine which theory is the most accurate.

Afterwards, a forecasting model was created and tested on 4 different indices: two representing the U.S. markets for large cap and mid-small cap, one for the European markets and one for the Japanese markets. The result was that the model was able to predict which stock style would outperform the next day with a confidence level close to 50%, which is not enough to be a relevant model.

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List of Acronyms

- AIC : Akaike Information Criterion
- BV/P : Book Value per Share
- CAPM : Capital Asset Pricing Model
- CF/P : Cash Flow per Share
- DCF : Discounted Cash Flow
- D/P : Dividend yield
- EBITDA : Earnings before Interests, Taxes, Depreciation & Amortization
- E/P : Earnings per Share
- ETF : Exchange Traded Fund
- Fed : Federal Reserve System
- IPO : Initial Public Offering
- M&A : Merger & Acquisition
- P/BV : Price to Book ratio

- P/CF : Price to Cash Flow ratio
- P/E : Price to Earnings ratio
- P/S : Price to Sales ratio
- PEG : Price to Earnings to Growth ratio
- PMI : Purchasing Managers Index
- U.S. : United States

Part I

Introduction

On the financial markets, there are many investment opportunities when building a portfolio like equities, bonds, ETFs, indices, real estate and many more. Thanks to all these assets available, an investor has to choose which strategy to follow in order to reach his main goal : generating profits. One of these strategies is very known and concerns investing in style stocks, more commonly called Growth or Value Stocks. This report therefore focuses on these two styles of stocks and tries to forecast their performance for the future and to identify the factors impacting this performance.

These two styles of stocks will be developed in more details further on but a little insight is required. On the one hand, Growth Stocks are defined as securities of a company with potential growth opportunities which can provide high returns in the long term. The decision to invest in this class of shares therefore depends on the estimated growth rate of the company's future earnings (Rowley & Sharpe, 1993).
On the other hand, Value Stocks can be described as stocks that are traded at a lower price than the company's performance indicates, which means that these stocks are often undervalued in comparison to their fair value. In this case, the price at which the share can be sold is therefore lower than the estimated value of the company (Rowley & Sharpe, 1993).

As a result, investing in one of these two kinds of stocks is considered as an investment strategy. By definition, Value Stocks are considered undervalued compared to Growth Stocks but which style investing is likely to produce higher returns? To answer this question, an investigation of their historical performances and their individual risk has to be done.
Some studies already carried out, whose authors will be referred to throughout the report,

show that, on average, Value Stocks outperform Growth Stocks over the long run on a risk-adjusted basis (Merill Bank of America, 2017). Through this research, the reasons for the outperformance of Value Stocks over Growth Stocks will therefore be studied, but also the cases where Growth Stocks can outperform Value Stocks.

The main subject of this research will therefore be to forecast the future performance of U.S. Value and Growth Stocks based on their historical performance and the current economic cycle in order to choose the right investment with the aim to beat the market. This can be achieved through the development and implementation of a statistical model capable of predicting the returns of these two styles of stocks on the basis of macroeconomic and financial data representative of the business cycle.

In order to solve this problematic in the most appropriate way, it will be necessary to divide the report into two distinct parts.

The first part will be dedicated to a theoretical section developing the two types of strategies in more details as well as other important concepts. This section will go through some studies that have already been carried out on the subject and will put forward different opinions on these two styles of stocks.

In the second part, an empirical research will be performed with the development of a statistical model trying to predict which kind of stocks will outperform the other one depending on some economic and financial data. This model, if successful, will allow to choose the most appropriate investment between growth or value investing according to the economic conditions.

Afterwards, the results of the research will be compared to some experts' opinions in order to identify similarities and discrepancies.

Finally, the conclusion will provide a synthesis of the research and potential suggestions for improvement will be made for future research.

Part II

Literature Review

This study begins with a review of literature. In this section, the results of some studies already carried out on the subject will be developed. This will be useful for understanding the objective of the research and relevant for optimizing the prediction model. Therefore, the most important concepts from the existing literature around Value and Growth Stocks are analyzed in this part.

Before beginning the analysis of the studies already made, the structure of this section will be outlined.

First of all, two very known valuation models useful for the pricing of the stocks are developed. The two models are the Discounted Cash Flows method and the Comparables approach.

Then, the two main subjects of this report, Growth and Value Stocks, will be defined in the most accurate way since different definitions have already been formulated. Moreover, some examples of stocks on the market will be provided with their returns since their IPO for each of the two styles.

Afterwards, these two kinds of stocks will be defined based on accounting data. Indeed, many authors, who will be mentioned later, classify them according to valuation ratios. It is therefore a more mathematical definition and an interesting way to classify the shares between the two styles. The accounting fundamentals are articulated around four different ratios, which all compare the share price with a well-defined accounting figure. These four valuation ratios are (a) Book Value per Share; (b) Earnings per Share; (c) Cash Flow per Share; (d) Dividend yield.

Thereafter, an analysis of the performance of the two styles will be performed. This part will begin with a review of the historical performance of both kinds of stocks and continue with an analysis highlighting the factors having an impact on this performance. Then, the two styles will be compared and their convergences and divergences will be developed.

Furthermore, it is impossible to talk about Value and Growth Stocks without mentioning the Value Premium, which is defined as the difference in returns between these two stocks (Athanassakos, 2009). Indeed, as already explained, Value Stocks have a tendency to outperform Growth Stocks. Therefore, this part will try to explain this differential in returns between the two styles. In this section, it will also be important to address the notion of risk.

Finally, the review of the literature will end with the analysis of the selection of an investing style and the optimization of the decision-making process. Indeed, following an investment style is very useful to help investors for the selection of securities on the financial markets.

1 Valuation Models

In the field of finance, there are different methods to derive the correct value of a share. The two most important methods are 1) The Discounted Cash Flows model and 2) The Comparables. These two methods allow to compute the share price based on the company's fundamentals. To find out whether a share is well-priced on the markets, following one of these two methods will derive the intrinsic value of the company and compare this value with its current market price. Sometimes, the markets may over- or undervalue the share.

1.1 Discounted Cash Flows

The first method concerns the Discounted Cash Flow model allowing to compute the present value of the estimated future cash flows of assets. Indeed, it derives the current value of a free cash flow that an asset can generate in the future based on a discount rate. This method is very detailed but requires a lot of assumptions. An investor will assess whether the value obtained is above or below the current market price and the difference will indicate whether the stock is over- or undervalued. Usually, an investor will focus on an undervalued stock in the hope that the stock will converge towards its fair value in the future (Nie, 2018).

1.2 Comparables

The Comparables is the second method. This method compares the current value of a business with the current value of other businesses in the same industry through trading multiples like P/E, P/S, P/BV, P/CF, PEG ... (Bodie et al., 2018). The majority of investors use this method for its speed and ease of use.

It is relevant to discuss both methods in the debate on Value and Growth because some valuation ratios are used to compare these two styles. Indeed, accounting fundamentals taking into account Cash Flows, P/E and P/B to differentiate both styles will be discussed later.

2 Growth Stocks

2.1 Definition

As already explained earlier, according to Rowley & Sharpe (1993), Growth Stocks are securities that can be purchased at a price higher than the company's estimated value. Growth Stocks are therefore defined as "a share in a company that is anticipated to grow at a rate significantly above the average for the market" (Chen, 2018).

These stocks are therefore associated with successful companies of high quality whose earnings are expected to grow faster than the market. Such stocks are seen as expensive and overvalued by the market (Busch Investments, 2020). This statement will be confirmed by comparisons of data in *Subsection 5.2*. This expectation to grow faster than the market is due to their high future potential thanks to the development of a product or line of products, a service, a business model or because they do better than their competitors (Cussen, 2019).

The particularity of Growth Stocks with regard to Value Stocks is that growth investors should generally expect not to receive dividends because earnings are often reinvested in the company to promote its own growth. While it can happen that some growth companies may distribute dividends, they will remain lower compared to the dividends of value companies.

The only way for growth investors to make a profit is through capital gains when they resell their shares. It is therefore a risky investment since the only way to create a benefit from this investment is if the share price increases. This investment is therefore only based on the speculation that the share price will rise. If the company is not doing well, the investor may make losses. This statement relates to an investment theory: the castle-in-the-air theory. This was developed by John Maynard Keynes and refers to an extremely overvalued stock or market. Its price only rises as investors speculate that it will continue to rise indefinitely,

trying to build a castle in the air. But at some point, the price collapses, so it can be called a market bubble. According to this theory, the intrinsic value of a stock is therefore not important, what matters is the current trend. As a result, investors try to predict how the crowd of investors is likely to behave in the future. If many investors follow this theory, then the result is a bubble followed by a crash like the internet boom and its crash in the years 1990-2000 (Malkiel, 1985).

Since growth investing is considered as a risky investment, investors obviously have a potential for higher returns. This kind of stocks is expected to continue to grow quickly through the earnings and sales that are expected to grow faster than the benchmark. Indeed, they are perceived as having the potential to outperform the market with their strong growth opportunities. These stocks are therefore considered overvalued by the market. The issuing companies are usually young innovative companies, whether in new technologies, telecommunication, energy, healthcare, biotech and so on (Chen, 2018).

In short, the main characteristics of such stocks are the higher valuation than the broader market with the hope that it will continue to increase, but also the high earnings growth even in slower economic conditions and a higher volatility of the price due to a higher sensibility to news about the company (Merill Bank of America, 2017).

2.2 Examples

To illustrate the Growth Stocks category, the 5 largest Growth Stocks from the *S&P500 Pure Growth Index* representative of the U.S. markets have been listed in Table 1 as well as the 5 largest European Growth Stocks from the *MSCI Europe Growth Index*. These 10 securities are listed with the total returns since their initial public offering including the dividends or not. An analysis of these figures will be made in *Subsection 5.2*.

Table 1: Growth Stocks - Number current as of July 27, 2020

Stocks	**Market**	**Returns**	**Returns (div.incl.)**
ServiceNow Inc. (NOW US)	U.S.	2310.66%	2310.66%
Paycom Software Inc. (PAYC US)	U.S.	1835.27%	1835.27%
Fortinet Inc. (FTNT US)	U.S.	2086.40%	2086.40%
Facebook Inc. A (FB US)	U.S.	514.47%	514.47%
DexCom Inc. (DXCM US)	U.S.	3428.58%	3428.58%
Nestlé (NESN SW)	Europe	1207.46%	2660.85%
Roche Holding Genuss (ROG SW)	Europe	1796.55%	3375.69%
Astrazeneca (AZN LN)	Europe	1239.49%	3252.49%
ASML HLDG (ASML NA)	Europe	22443.95%	33375.49%
Sap (SAP GY)	Europe	3936.25%	5327.33%

Source: Bloomberg (2020)

3 Value Stocks

3.1 Definition

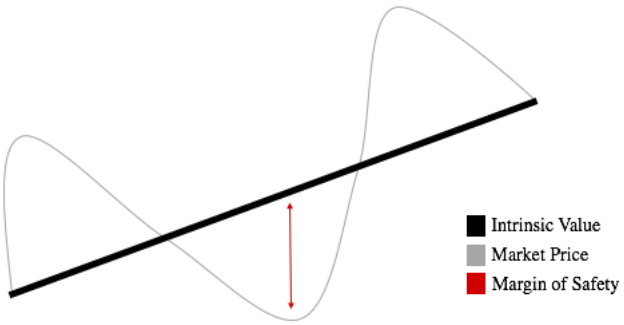
A Value Stock is defined as "a stock that trades at a lower price relative to its fundamentals, such as dividends, earnings, or sales, making it appealing to value investors" (Smith, 2019). Moreover, according to Rowley & Sharpe (1993), Value Stocks are, as already defined, stocks that are sold at a level below the company's estimated value. Value firms therefore distribute dividends to shareholders as they have fewer opportunities for growth than to reinvest their earnings in the company. Managers thus prefer to opt for the distribution of dividends to investors.

Value investors therefore invest in this kind of stocks with the hope that the share price will increase when the market recognizes their full potential. Indeed, they are seen as undervalued by the market (Busch Investments, 2020). This statement will be supported through numbers in *Subsection 5.2*.
Actually, and as already explained previously, the share price of Value Stocks is traded below what it is really worth and will therefore provide a superior return in the future (Cussen, 2019). The particularity of Value Stocks is that the return does not only depend on the potential gain made by selling the share but also depends on the dividends received. It is therefore essential not to forget to account for the dividends received when calculating the return of a Value Stock.

Investors thus benefit from market inefficiencies by choosing this strategy because the price of the underlying shares may not match the company's performance (Smith, 2019). The issuing companies are often old firms which have already reached maturity. Moreover, according to Graham (2006), the gap between the current value of a Value Stock on the market and its fair value based on its fundamentals is called the Margin of Safety. A value investor should invest only if the gap is one-half and not less than one-third of the fundamental value. This margin

of safety is represented in Figure 1. This margin is therefore satisfied when an investor buys a share on the markets at a price considerably below its intrinsic value. This margin takes into account potential human error, bad luck or extreme volatility according to Graham (2006).

Figure 1: Margin of Safety



In short, the main characteristics of such stocks are the lower valuation than broader market with the hope that it will bounce back in time, but also the price below similar companies in the industry and the lower risk than the broader market. (Merill Bank of America, 2017)

3.2 Examples

A non-exhaustive list of Value Stocks can also be drawn up. In Table 2 are the 5 largest Value Stocks from the *S&P500 Pure Value Index* representative of the U.S. markets and the 5 largest European Value Stocks from the *MSCI Europe Value Index* with their respective returns from their IPO including the dividends or not. An analysis of these figures will be made in *Subsection 5.2*.

Table 2: Value Stocks - Number current as of July 27, 2020

Stocks	**Market**	**Returns**	**Returns (div.incl.)**
Berkshire Hathaway (BRK.B US)	U.S.	728.19%	728.19%
Kroger Co (KR US)	U.S.	2399.60%	14815.81%
Centene Corp. (CNC US)	U.S.	5666.00%	5666.00%
Archer-Daniels-Midland Co. (ADM US)	U.S.	1812.47%	3277.57%
General Motors Company (GM US)	U.S.	-22.12%	0.74%
Sanofi (SAN FP)	Europe	868.81%	1773.67%
GlaxoSmithKline (GSK LN)	Europe	108.34%	401.96%
HSBC Holdings (HSBA LN)	Europe	259.75%	1101.79%
Novartis (NOVN SW)	Europe	773.14%	1692.54%
British American Tobacco (BATS LN)	Europe	541.92%	1763.79%

Source: Bloomberg (2020)

4 Accounting Fundamentals

Several authors, who are mentioned hereafter, have identified different valuation ratios that can be used to classify a share between the value or growth dimension. Currently, investors make use of four major ratios in order to classify stocks in these two categories. This section is articulated around these 4 different financial ratios. By classifying stocks, researchers are trying to separate stocks with high average returns and those with low average returns. By doing this, they are looking for dispersion in average returns (Davis & Lee, 2008).

4.1 Book Value per Share

The first ratio, which is often used to classify securities along a value/growth dimension, is the Book Value per Share (BV/P). In this case, the Book Value (BV) refers to the accountant's representation of its past costs and the Share (P) represents the current stock price quoted on the markets (Rowley & Sharpe, 1993).

This ratio can also be called the Book-to-Market ratio. If low, it represents a Growth Stock and if high, it classifies the stock in the value category (Penman & Reggiani, 2018). Moreover, it has also been found that high BV/P ratios are linked to higher risks. Indeed, this ratio explains the potential of growth as well as the risk included in that growth but this notion of risk will be developed further (Penman & Reggiani, 2018). Therefore, the association between returns and BV/P is consistent with efficient pricing in the financial markets (Harris & Marston, 1994). Furthermore, Davis & Lee (2008) developed that this ratio has a very good stability since it represents the accumulation of earnings over the whole history of the firm.

The Price-to-Book ratio (P/B), the opposite of the BV/P ratio, can also be used to classify the shares in the two styles (Fama & French, 2007).

4.2 Earnings per Share

The second valuation ratio is the Earnings per Share (E/P), where the share (P) still represents the price quoted on the market. This ratio represents the market's expectation of future earnings growth (Penman & Reggiani, 2018). Chahine (2008) defines this ratio as an "indicator of investors' beliefs about the future growth opportunities of a company".

For Value Stocks, the ratio is expected to be high since the quoted price must be undervalued. For Growth Stocks, this ratio must be low since these securities are often overvalued (Thune, 2020). According to Chahine (2008), an investor must therefore make the choice between investing in undervalued or overvalued stocks.

This ratio can also be used the other way around by employing the Price to Earnings ratio (P/E). A low P/E represents therefore a Value Stock and a high P/E refers to a Growth Stock (Athanassakos, 2009). Moreover, according to Basu (1977), this ratio represents the future performance of a stock. He argues that securities with low P/E ratios will tend to outperform securities with high P/E ratios on a risk-adjusted basis. This assumption suggests that the prices of securities are biased and that this P/E ratio is an indicator of this bias, which is due to market imbalances. According to the Efficient Market Hypothesis, public information should directly be reflected in the price of securities, but this bias shows that lags and frictions in the adjustment process are possible. Consequently, publicly available P/E ratios appear to have "informational content". Therefore, he suggests that P/E ratio information is not fully reflected in the stocks prices on the markets.

4.3 Cash Flow per Share

The third financial ratio is the Cash Flow per Share (CF/P). This ratio is defined as "the amount of free cash flow per ordinary share outstanding at the financial year end" (Nwude & Agbo, 2017).

It measures the operating cash flows attributable to each stock and the financial strength of the firm. This financial ratio is sometimes seen as more reliable than the Earnings per Share ratio thanks to more concrete figures (Nwude & Agbo, 2017).
As already developed in the section *Valuation Models*, the price of a stock can be computed in several ways. In the Discounted Cash Flows method, the stock price depends on two variables : the cash flows and the discount rate. This is derived from the following formula :

$$DCF = \frac{CF_t}{(1+r)^t}$$

where CF_t represents the cash flow in t and $(1+r)$ the discount rate.
From this formula, value companies tend to have a cash flow highly sensitive to permanent movements that are driven by the shocks on aggregate cash flows. On the other hand, the cash flows of growth companies are vulnerable to temporary movements caused by shocks on market discount rates (Campbell et al., 2010). Therefore, the β relative to Value Stocks, indicator of the level of volatility, is called "bad beta" since investors look for a high price to hedge the risk. The β relative to Growth Stocks and discount rate shocks is called "good beta" because the price of its risk is low. These βs are determined by the cash-flow fundamentals of the companies concerned (Campbell et al., 2010).

According to Tijjani & Sani (2016), the Free Cash Flow measure is positively correlated to the dividend policy. This explains why a high CF/P ratio refers to Value Stocks while a low CF/P ratio invokes a Growth Stock (Fama & French, 1998).

4.4 Dividend Yield

The last valuation ratio is the dividend yield, which is represented as the Dividends per Share (D/P) and which refers to the bonus per present value of assets (Zhao et al., 2011).

A high dividend yield means a distribution of higher dividends for the same share price. Therefore, this ratio is more applicable to Value Stocks since growth companies usually do not distribute dividends (Thune, 2020).
It is important not to confuse the dividend yield with the payout ratio. The former shows the shareholders' dividend return, while the latter represents the dividend distribution rate, which means the proportion of net profits that the company distributes in the form of dividends (Bodie et al., 2018).

Davis & Lee (2008) found that the dividend yield ratio also has a greater stability, which is certainly due to the fact that firms have the tendency to smooth dividends. Indeed, managers do not like to cut dividends in order not to make investors nervous. Thanks to this, dividends are relatively stable and so does this ratio.

One disadvantage of this ratio is the limitation in the stocks that can be tested. Indeed, Fama & French (2001) reported that only 20.8% of the publicly traded companies in the U.S. paid dividends to investors in 1999. Therefore, this ratio is less accurate because it can only be attributed to a small proportion of the companies listed on the stock exchange (Davis & Lee, 2008).

4.5 Ratios Complementarity

All the ratios developed in this section must be used complementarily. To illustrate this statement, an example is needed.

As an example, a value investor would prefer to buy a stock with a high E/P ratio which is seen as an undervalued stock with low growth expectations (Thune, 2020).
For a given E/P, the corresponding Book-to-Price ratio can be analyzed. If the investor observes a low B/P, the growth is valued in the price and if he observes a high B/P ratio, it can refer either to a stock with low growth expectations or to a stock with high growth expectations but for which the growth is risky.
Therefore, the risky growth is not valued in the price, which refers to the Value Trap developed later. This risk can thus only be understood thanks to the B/P ratio (Penman & Reggiani, 2018).
For a given E/P, a high B/P has therefore a higher likelihood that growth will not be realized as can be observed in Figure 2 (Penman, 2011).

Figure 2: Impact of B/P ratio on the Average Earnings Growth Rates

		E/P Portfolio				
		1 (low)	2	3	4	5(high)
B/P Portfolio	1 (low)	15.2%	−4.8%	−4.6%	−5.9%	−11.5%
	2	19.6%	−1.6%	−3.2%	−1.6%	−5.6%
	3	25.8%	3.3%	−3.6%	−0.1%	−5.9%
	4	30.1%	5.8%	0.6%	0.6%	−3.1%
	5 (high)	38.0%	18.7%	10.7%	3.6%	−2.0%

Source: Penman (2011)

The separate use of valuation ratios can therefore be misleading. It is thus important to use these ratios simultaneously to evaluate a stock and not draw conclusions on a single ratio.

4.6 Value & Growth Indices Methodology

Several indices have been created in order to replicate one of the two style strategies between investing in Growth or Value Stocks. This allows investors to invest easily in one of the two styles while diversifying their positions.

Specifically, the U.S. markets have the *S&P500 Pure Value Index* and its counterpart the *S&P500 Pure Growth Index*.
The methodology used to build these two indices is to compare the style scores for each security. This score is based on different factors.
The growth factors are (1) Three-Year Change in Earnings per Share (Excluding Extra Items) over Price per Share; (2) Three-Year Sales per Share Growth Rate; (3) Momentum (12-Month % Price Change) (S&P Dow Jones Indices, 2019).
The *S&P500 Pure Growth Index* therefore concentrates stocks responding positively to these growth factors and is designed to track the performance of stocks with the strongest growth characteristics using a style and attractiveness weighting scheme (Zone Bourse, 2020).
Its counterpart, the *S&P500 Pure Value Index*, is therefore a value-style stock index created to follow the performance of stocks with the strongest value characteristics using the same scheme as for growth (Zone Bourse, 2020). The value factors to define these Value Stocks are (1) BV/P Ratio; (2) E/P Ratio; (3) Sales to Price Ratio (S&P Dow Jones Indices, 2019).

The U.S. markets also use the *Russell 2000 Value Index* and *Russell 2000 Growth Index*. The former is composed of the small-cap stocks in the U.S. equity that are in the value segment defined by the lower price-to-book ratio with lower growth expectations.
This index is fully reconstituted annually to ensure that the most important stocks do not distort performance and that the stocks in the index always meet the value characteristics (FTSE Russell, 2020b).

The *Russell 2000 Growth Index* includes small-cap stocks from the Russell 2000 part of the growth segment identified with higher price/value ratios and higher growth expectations. This index is also fully reconstituted each year for the same reasons as for its counterpart (FTSE Russell, 2020a).
To assess whether a stock belongs to Value or Growth, the FTSE Russell uses different factors: the BV/P ratio, the medium-term growth expectations and the historical sales per share growth (FTSE Russell, 2020b).

As for the European markets, the *MSCI Europe Value Index* and *MSCI Europe Growth Index* have been created. These indices represent large and mid-cap securities across the 15 developed market countries in Europe (MSCI, 2020b).
The *MSCI Europe Value Index* tracks stocks with value style characteristics defined along three variables: BV/P ratio, 12-month forward earnings to price and the D/P (MSCI, 2020b).
The *MSCI Europe Growth Index* captures stocks displaying growth style characteristics. These characteristics are defined using five parameters: long-term EPS growth rate, short-term EPS growth rate, current organic growth rate, long-term historical EPS growth trend and long-term historical sales per share growth trend (MSCI, 2020a).

Then, the Japanese financial markets use, for example, the *MSCI Japan Value Index* and *MSCI Japan Growth Index*.
The former only considers stocks that meet the value characteristics defined by three variables: BV/P, 12-month forward E/P, and D/P (MSCI, 2020d).
The latter only includes stocks depending on five variables: long-term forward EPS growth rate, short-term forward EPS growth rate, current internal growth rate, long-term historical EPS growth trend and long-term historical sales per share growth trend (MSCI, 2020c).

4.7 Summary

As a conclusion, Value Stocks are linked to high valuation ratios (a high BV/P, high E/P, high CF/P and a high D/P). However, when these ratios are low, it refers to Growth Stocks (Fama & French, 1998).
Some studies (Bauman & Miller (1998), Patel (2018), Davis & Lee (2008)) showed that the Book-to-Market ratio is the most effective ratio to forecast returns for small firms but also the most stable one since it reduces the portfolio turnover compared to the other ratios.

Thanks to all these elements, it is now possible to easily list the specific drivers of Value and Growth Stocks.

On the one hand, Value Stocks mainly meet the following characteristics : (a) a low demand; (b) a low price which appears to be undervalued; (c) a high expected return in the future; (d) a high Book value per Share ratio (BV/P ratio); (e) a high Earnings per Share ratio (E/P ratio); (f) a high Cash Flow per Share ratio (CF/P ratio); (g) a high dividend yield (Smith, 2019).

On the other hand, Growth Stocks share the following properties : (a) a high demand; (b) a high price which appears to be overvalued; (c) a high expected growth for the future; (d) a low Book value per Share ratio (BV/P ratio); (e) a low Earnings per Share ratio (E/P ratio); (f) a low Cash Flow per Share ratio (CF/P ratio); (g) a low (or null) dividend yield (Smith, 2019).

5 Stocks Analysis

5.1 Historical Performance

Numerous authors, who are mentioned hereafter, have analyzed the performance of Value versus Growth Stocks during the past decades. It is important to highlight that the main result is that their respective performance depends on economic cycles. This section describes how a stock can perform depending on its classification (Growth vs. Value) and the economic cycle.

5.1.1 Overall Trend

Fama & French (1998) have studied Growth and Value Stocks for the period 1975-1995. The stocks have been classified with high and low BV/P ratio and they found evidence that Value Stocks have higher returns than Growth Stocks. Indeed, the difference between the returns is 7.98% per year. This outperformance of Value Stocks is confirmed for 12 of 13 markets.

Rowley & Sharpe (1993) also studied the performance of Growth and Value Stocks but for the period 1981-1992. Even if they observed that the returns can vary from month to month, quarter to quarter and year to year, they found that, for this period, Value Stocks outperformed Growth Stocks most of the time after adjustment of risk, which confirms the claims of Fama & French (1998).

According to Chan & Lakonishok (2004), value investing also generates superior returns than Growth Stocks in general. But they also found that during the 90's, the performance of Growth Stocks improved and even raised doubts for value investors.

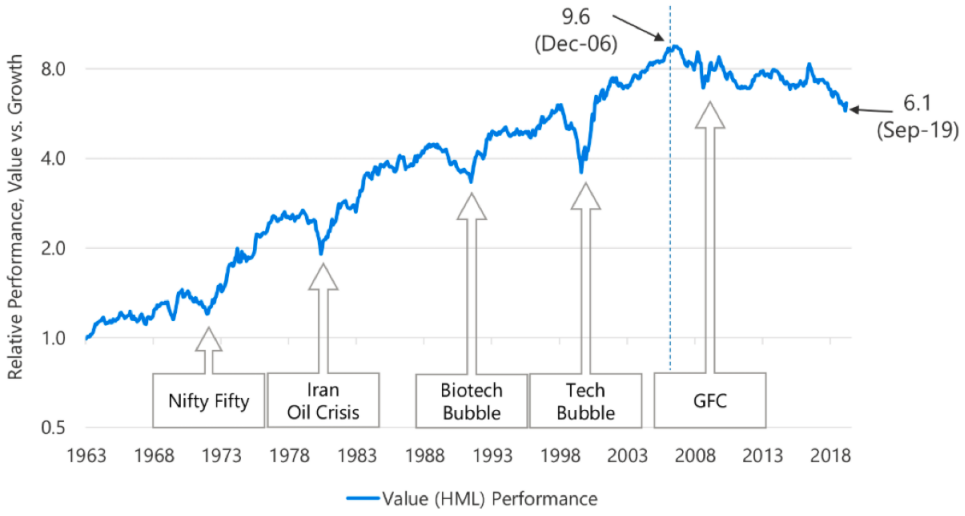
Barberis & Shleifer (2003) also reported the result of their studies about the performance of Value & Growth Stocks and pointed out that value investing brings higher returns over time by

a large margin but they also confirmed this outperformance for all sizes of firm capitalisation except for small caps. This can be explained by the fact that the stability of certain factors (share price, earnings, dividends) is more difficult to achieve. Moreover, the overall performance of both styles of stocks may differ between markets in which investors behave differently.

Toniato et al. (2019) argue mixed performance of two styles of stocks for the period 1995-2000, with a general outperformance of Value Stocks, the small outperformance of Growth Stocks being due to the tech bubble. They also indicate a Value Mega-Cycle outperformance from the beginning of 2000 until the 2007 financial crisis.

According to Authers (2020a), Value Stocks outperform Growth Stocks most of the time but there were a number of times in the history when Growth Stocks outperformed Value Stocks. There are 5 big events that allowed this outperformance of Growth Stocks observable in Figure 3 : the Nifty Fifty, the Iran oil crisis, the biotech bubble, the tech bubble and the general financial crisis. But since this financial crisis, there has been a tendency for Growth Stocks to continue to outperform Value Stocks.

Figure 3: Historical Performance Value vs Growth Stocks, U.S.

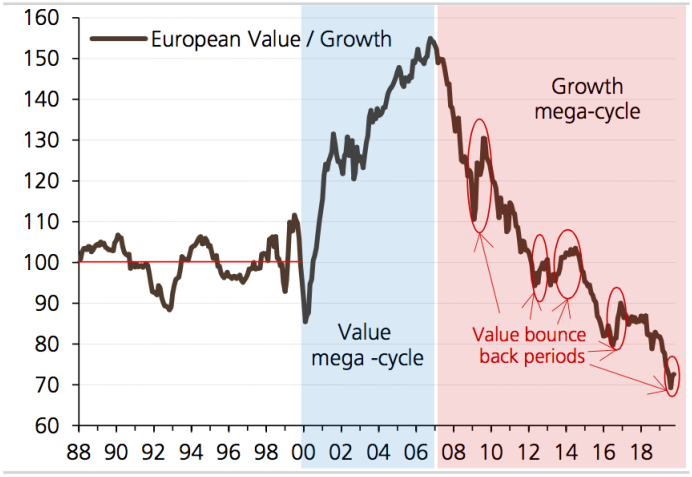


Source: Authers (2020a)

Murray (2020) also confirms that, since the financial crisis in 2007, U.S. Growth Stocks have had a tendency to outperform their value peers.

According to Toniato et al. (2019), Europe faced a "Growth Mega Cycle" for 13 years with occasionally some value bounce back. Indeed, since the financial crisis, a rather constant outperformance of Growth Stocks can be observed. Value Stocks only performed better during 5 periods visible in Figure 4.

Figure 4: Value & Growth Mega Cycles with Value Bounce Back Periods



Source: Toniato et al. (2019)

The average duration of the value bounce back during this Growth Mega-Cycle has been eight months altogether. But, Growth Stocks are more and more expensive and Value Stocks have become cheaper. Therefore, the authors saw an upside potential for value investing (Toniato et al., 2019).

In order to challenge these statements, the cumulative returns of the indices developed in *Subsection 4.6* have been analysed and the result observed is different from the result put forward by the existing literature.

The comparative table (Table 3) available below shows the outperformance of Value and Growth Stocks over different periods and for different geographical areas.
The U.S. markets are therefore represented by the *S&P500 Pure Value Index* and the *S&P500 Pure Growth Index*, the European markets by the *MSCI Europe Value Index* and the *MSCI Europe Growth Index* and the Japanese markets by the *MSCI Japan Value Index* and the *MSCI Japan Growth Index*.

Table 3: Outperformance tendency between Value and Growth Stocks based on the graphs in Appendix A.1

Years	**U.S.**	**Europe**	**Japan**
1990 - 1995	/	/	Value
1995 - 2000	Growth	Growth	Value
2000 - 2005	Growth	Value	Value
2005 - 2010	Growth	Value	Value
2010 - 2015	Growth	Value	Value
2015 - 2019	Growth	Value	Value

Source: Bloomberg (2020)

The outperformance analysis was carried out on the basis of the graphs available in Appendix A.1 where it is easily observable that, for the U.S. markets, Growth Stocks experienced an outperformance over the entire period with some periods where the difference in returns is almost non-existent. The graph and the literature agree in stating that Growth Stocks have outperformed since the financial crisis. The rebound of Growth Stocks in the 1990s described by Chan & Lakonishok (2004) is also confirmed in the graph. On the other hand, the graph contradicts the outperformance of Value Stocks before the crisis, a statement supported by the literature. As for the European and Japanese markets, Value Stocks tended to outperform for the majority of the period, even after the financial crisis.

5.1.2 Value Trap

The possibility of a value trap must also be taken into account. Indeed, when Value Stocks perform better than Growth Stocks, this trend can turn against the value investor. This is what has happened in the last few years, Value Stocks have performed poorly since the return spread between Growth and Value Stocks is 25.2% (Patel, 2018).

This value trap can be due to the fact that value investors are buying earnings growth that is potentially risky because it may not be realized. In short, for them, buying Value Stocks can be the same as buying risky earnings growth (Penman & Reggiani, 2018).

During 1998 and 1999, the returns of Value Stocks were exceptionally weak widening the gap with those of Growth Stocks. This poor performance is, according to Barberis & Shleifer (2003), due to the impressive performance of Growth Stocks during this period.
Based on Bauman & Miller (1998), when Growth Stocks outperform Value Stocks, the margin of difference is small compared to situations where it is the opposite, which means that the value trap is often smaller than the Value Premium.

5.1.3 Economic Cycles

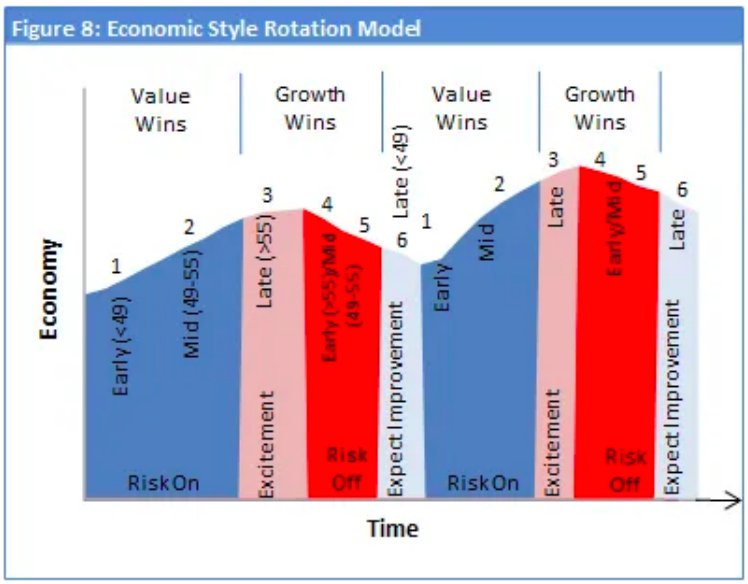
After analyzing the behavior of the returns, it is now time to consider the impact of the economic and financial environments on these returns.

Some studies showed that the economy moves through economic cycles depending on corporate, consumer and government spending. The impact of the different economic cycles on the returns depends on the companies which have a different sensitivity to these cycles due to their various financial profiles. The different economic cycles are articulated along two trends : recession and expansion (Spellman, 2017).

The National Bureau of Economic Research (2020) (NBER) is responsible for determining U.S. business cycles on a monthly basis and for publishing economic cycle change dates. For this purpose, they mainly use the evolution of the GDP, but since it is a quarterly value, they also employ two other factors: personal income minus transfer payments; and BLS payroll employment. Factors such as interest rates, real personal consumption expenditure, industrial production, and other factors can also be good indicators for determining the business cycle.

Chappelow (2020b) has also divided the economy in different phases to track which style outperforms at each period but this time according to the PMI, which is an indicator of the direction of economic trends in the manufacturing and service sectors.
There are 6 phases : (1) early expansion, (2) mid expansion, (3) late expansion, (4) early pause, (5) mid pause, and (6) late recession.
The first three phases face an increase in the PMI while the last three phases show a decrease of the PMI (Spellman, 2017). The different phases can be observed in Figure 5 :

Figure 5: Economic Cycles Rotation Model



Source: Spellman (2017)

The expansion phase is described by an economy experiencing rapid growth and low interest rates. In addition, as the economy does well, production increases as well as inflation. When this growth reaches its maximum, the cycle has peaked. This expansion often creates imbalances, in particular because of the central bank manipulating credit and interest rates. Consequently, these imbalances are corrected in periods of recession. During this period, prices stagnate, employment falls and interest rates are high. This recession ends when the economy reaches its bottom (Chappelow, 2020a).

During the "risk-on" phases, the first two, investors usually tend to buy Value Stocks, which have the capability to generate earnings growth above average.
During phase 3, where expansion is maturing and the late cycle approaches, a lower rate of companies can deliver a high level of growth. Therefore, there are more IPO's & M&A's and Growth Stocks can outperform the markets.
During phases 4 and 5, the economy begins to decelerate and the growth starts to slow. In this event, investors may be more inclined to buy Growth Stocks that are still trading.
Lastly, at the end of the recession period (phase 6), Value Stocks can outperform since investors anticipate the upcoming recovery (Spellman, 2017).

Therefore, according to Spellman (2017), during the early and mid stages of the expansion phases, Value Stocks have a tendency to perform better.
Then, when the economy slows down and during the first stages of the recession, Growth Stocks are more likely to outperform.
Afterwards, in case of market corrections, Growth Stocks react often worse than Value Stocks, which entails that Value Stocks often outperform during market corrections since they are less sensitive to surprise on the stock markets, but also at the end of the recession in anticipation for a recovery.

According to the Merill Bank of America (2017), Growth Stocks have a better potential to outperform when interest rates decrease and the company's earnings rise. But if the economy performs poorly, they are often the first to suffer the consequences. Otherwise, Value Stocks are often cyclical and so perform well in the early stages of an economic recovery but are usually more susceptible to underperformance in a strong bull markets.

According to Bauman & Miller (1997), the growth style was popular in the post-war period and has a tendency to outperform during strong economic growth. On the other hand, Bartram & Bodnar (2009) argue that growth portfolios tended to outperform value portfolios during the financial crisis, which is in line with Spellman (2017)'s claims.

In conclusion, the results of the various studies are therefore mitigated.
Some believe that Value Stocks outperform when the economy is doing well and at the end of a recession, in anticipation of recovery. While Growth Stocks outperform when economic growth begins to stagnate and at the beginning of the recession.
Others argue that Growth Stocks outperform when the economy is growing because they benefit from investors optimism, while Value Stocks tend to outperform when the economy is doing badly because they suffer less from economic downturns.

5.2 Growth & Value Stocks Comparison

5.2.1 Convergences

Value and Growth Stocks are both securities traded on the stock market and both represent a share in a company. All the shares traded on the markets can be classified in the growth style or value style. Both styles are sensitive to economic cycles and have their moments of success. The valuation of the two types of stocks may be carried out using similar methods, either the DCF or the Comparables as detailed earlier in this research.

5.2.2 Divergences

Firstly, each style has different advocates. The advocates of the growth style are Babson & Rowe. Indeed, they are the first ones to think that investing in well-managed companies whose industry is experiencing above average growth will bring superior portfolio performance.
However, Graham and Dodd, Dreman & Nicholson are the advocates of the value style and promote investing in equities with relatively low market prices compared to what they are actually worth (Bauman & Miller, 1997).

Secondly, value investors prefer to buy undervalued stocks and growth investors invest in securities with strong earnings growth opportunities (Merill Bank of America, 2017). In other words, Value Stocks are often undervalued while Growth Stocks are overvalued. Moreover, Growth Stocks offer high expected earnings growth as opposed to Value Stocks which offer low expected earnings growth (Asness et al., 2000).
The P/E ratio, already discussed in *Subsection 4.2*, is a good indicator to assess whether a security is over- or undervalued. Indeed, the lower the P/E ratio, the cheaper the stock is considered to be. Table 4 shows the largest Value and Growth Stocks already cited in *Subsections 2.2 & 3.2*. On a comparative basis, it can be observed that Growth Stocks are often characterized by a high P/E ratio, which means that they are overvalued whereas Value

Stocks are most often represented by a low P/E, meaning they are undervalued.

Table 4: Value & Growth Stocks Valuation - Number current as of June 20, 2020

Value Stocks		**Growth Stocks**	
Stocks	**P/E Ratio**	**Stocks**	**P/E Ratio**
Berkshire Hathaway	0.03	ServiceNow	119.15
The Kroger	15.80	Paycom Software	94.66
Centene Corp.	34.51	Fortinet	64.21
Archer-Daniels-Midland	14.79	DexCom	257.30
Novartis	17.31	ASML Holding	51.83

Source: Yahoo Finance (2020)

An additional divergence, resulting from the statement just above, is that when an investor buys a Value Stock, he actually buys a stock, the share in the company. On the contrary, a growth investor will rather buy future earnings (Penman & Reggiani, 2018).

Another difference is that growth companies mostly do not pay dividends to their shareholders while value firms often distribute high dividends (Cussen, 2019). In *Sections 2 & 3*, the total returns of some Growth and Value Stocks have been listed. From this panel, it is readily observable that U.S. Growth Stocks do not distribute dividends, while European Growth Stocks are more likely to distribute a small portion of their income as dividends. Concerning the U.S. value companies, some do not distribute dividends while others do and the European value companies distribute larger amounts of dividends to their shareholders.

Moreover, all the stocks can be classified in the growth/value dimension thanks to some valuation ratios already developed earlier (BV/P, CF/P, D/P & E/P). It is important to point out that low financial multiples define Growth Stocks while high financial ratios refer to Value Stocks (Fama & French, 1998).

Additionally, according to Hou & Moskowitz (2005), Value Stocks show a larger price delay than Growth Stocks. They attribute the delayed price adjustment to the limited stock market participation related to the value shares.

Furthermore, Growth Stocks are more sensitive to market information than Value Stocks both in up and down markets. Therefore, Growth Stocks are more easily and negatively impacted by worsening market conditions but also positively impacted by improving market conditions (Li, 2011). This comparison leads to the concept of volatility. Indeed, Value Stocks, being less sensitive to news on the markets, are considered to have a lower level of risk than Growth Stocks, as well as a lower level of volatility. This difference in volatility can easily be observed through the beta coefficient (β). This coefficient demonstrates the volatility of a security and its sensitivity to the market (Bodie et al., 2018). Table 5 therefore shows some stocks coming from *Subsections 2.2 & 3.2*, as well as their beta coefficients. The beta's of Growth and Value Stocks can therefore be compared.

Table 5: Value & Growth Stocks β Coefficient - Number current as of June 20, 2020

Value Stocks		**Growth Stocks**	
Stocks	β	**Stocks**	β
Berkshire Hathaway	0.77	ServiceNow	1.35
The Kroger	0.38	Paycom Software	1.54
Centene Corp.	0.73	Fortinet	1.01
Archer-Daniels-Midland	0.95	Facebook	1.20
Novartis	0.46	ASML Holding	0.92

Source: Yahoo Finance (2020)

On the one hand, Value Stocks usually have a beta much smaller than 1, which means that they replicate market variations but smooth them out. So, Value Stocks are less volatile and less sensitive to market variations. On the other hand, Growth Stocks generally have a beta larger than 1, which demonstrates that they replicate market movements but amplify them. It means that these stocks are more sensitive to the market and thus more volatile.

6 Value Premium & risk consideration

After having defined Growth and Value Stocks, compared them and evaluated their performance, it is now time to discuss their risk and the notion of Value Premium.

Both categories of stocks face a common risk : the investment risk. This risk occurs with any investment because it exposes the investor to a potential loss on the expected return. This risk comes from the uncertainty that prevails in the markets. Therefore, the investment risk is a measure of the level of uncertainty of achieving the expected returns. Unfortunately, a high return is often linked to a high risk (The Economic Times, 2020).

In this section, a comparison between the risk of both Value and Growth Stocks will be made, which will help to explain the Value Premium confirmed by the literature.

In *Subsection 5.1*, it was demonstrated that Value Stocks outperform generally Growth Stocks. There are several explanations to this observation depending on different authors. Indeed, there are different theories about the Value Premium, which is the difference in returns between Value and Growth Stocks (Athanassakos, 2009).

The Value Premium has been identified by several authors and in several markets. First, Fama & French (1992) found evidence for the Value Premium in the United States. Then, Fama & French (1998), Chan & Lakonishok (2004), Lakonishok et al. (1994) also identified this Value Premium in international markets. Drew & Veeraraghavan (2002) and Rouwenhorst (1999) also found the Value Premium on emerging markets.

For some other authors, the Value Premium only exists for the long run, meaning at least 10 years (Bauman & Miller, 1998; Chahine, 2008; Fama & French, 1998). But some claim that

the Value Premium is also visible for the short run, like monthly or quarterly (Bauman & Miller, 1998).

Penman & Reggiani (2018) show that it comes from a higher risk for Value Stocks through the fact that value investors may be buying risky earnings growth and so they must be compensated for taking that risk. Indeed, some financial experts develop that higher returns are only reachable by taking higher risks. For them, the only way to beat the market is by taking additional risk. Moreover, buying stocks with a high BV/P (i.e. Value Stocks) is riskier since these stocks are more prone to financial distress (Chan & Lakonishok, 2004).

Zhang (2005) also defends the possibility that Value Stocks are riskier than Growth Stocks. He explains the Value Premium through two factors: costly reversibility and the countercyclical price of risk. According to him, companies face higher costs in cutting rather than in expanding their capital, which represents the costly reversibility. Moreover, he argues that the Value Premium equals the risk dispersion between Value & Growth Stocks multiplied by the price of risk. Therefore, he experienced that the value style is riskier than the growth style when the price of risk is high, which happens when the market performs poorly. In his opinion, the earnings growth spread between Value & Growth is a positive indicator of the Value-minus-Growth return.

For Cussen (2019), Value Stocks are considered to be stocks with a lower level of risk and a weaker volatility in the stock price. This description is due to the fact that Value Stocks are often securities of large and well established companies. Moreover, Value Stocks' companies often distribute reliable and stable dividends which makes them less risky (Thune, 2020). However, Growth Stocks are riskier since the return only depends on the uncertain growth of the company but these stocks are often considered to have high potential for returns in the long run (Cussen, 2019). The risk can come from a higher volatility. Indeed, as already

developed, a Growth Stock is more sensitive to negative news on the company, which can have a bigger negative impact on the stock price (Merill Bank of America, 2017). But if Value Stocks are less risky than Growth Stocks, how to explain the Value Premium?

Chan & Lakonishok (2004) argue that investing in Value Stocks brings more returns. According to them, the return differential between Value and Growth Stocks does not support the argument that Value Stocks have a higher riskiness. They also observed that this difference in returns would be more pronounced for small-capitalization stocks. However, the high volatility of Growth Stocks over the past few years also raises questions about the argument that Growth Stocks are less risky investments than Value Stocks. Some factors, like volatility and beta, show evidence that Value Stocks are not riskier than Growth Stocks. Indeed, it has been shown that Value Stocks are less responsive when the economy performs poorly. As a reminder, beta represents the systematic risk in a portfolio/security and is a measure of the volatility of this portfolio/security compared to the market (Kenton, 2020a). For Kalogeropoulos (2019), Growth Stocks are seen as riskier since investors also pay more than what it is actually worth and are therefore more exposed to a potential decline in stock prices. Indeed, as already mentioned, Growth Stocks are more volatile.

Lakonishok et al. (1994) argue that the Value Premium refers to the difference in returns between undervalued and overvalued stocks. Therefore, according to them, the Value Premium is the result, not of the additional risk taken, but of the distortion created by the fact that the market undervalues the Value Stocks and overvalues the Growth Stocks. When the pricing error is corrected, value investors make a gain while growth investors suffer a loss.

According to Banz (1981), there is a stronger link between premium and size rather than between premium and valuation ratios, which means that the premium observed would be due to the size of the companies rather than to their classification in Value and Growth

Stocks. He developed that small capitalization earns more returns than larger capitalization.

Chan & Lakonishok (2004) argue that the Value Premium comes from cognitive biases in the investor's behaviour and from agency costs arising from investment management. From their study, it was discovered that the superior returns attributed to value investing were not linked to a higher risk. Indeed, according to Asness et al. (2000), since Value Stocks are defined as stocks with high E/P and Growth Stocks are the stocks defined with low E/P, the value spread should therefore be positive. For Klarman (1991), investors need a margin of safety and this is the reason why value investors have chosen this kind of stocks. As a reminder, a margin of safety is respected when an investor buys a stock at a price below the underlying value, considering that the stock must be undervalued. By respecting this margin of safety, investors increase the likelihood to reach higher returns. In his opinion, value style is a risk-averse approach. Therefore, he explains the Value Premium in another way than through risk. According to Cronqvist et al. (2015), behavioral models explain the Value Premium as a consequence of the overreaction of past performance or of non-standard preferences.

According to Fama & French (1998), a two-factor model in which one of the two factors represents the risk and the other one is the global market return can explain the Value Premium. In their research, they also cite different authors arguing that the Value Premium is due to the undervaluation of Value Stocks and the overvaluation of Growth Stocks. In case of correction, Value Stocks become more expensive and Growth Stocks cheaper, which explains that Value Stocks can have a higher return. This theory meets Lakonishok et al. (1994)'s.

For others, it can be due to arbitrage opportunity but Fama & French (1998) do not support this theory. They rather agree that it is a compensation for the risk missed by the Capital Asset Pricing Model (CAPM), which is a mathematical model to forecast the price of

a security taking into account risk and expected performance (Morningstar, 2020). Moreover, Fama & French (1998) argue that the undervaluation of Value Stocks is due to their financial distress. Therefore, investors must be rewarded for taking on the risk related to this distress. Bourguignon & de Jong (2003) agree to say that the Value Premium is related to a distress and a vulnerability to bankruptcy rather than, for example, stock characteristics as developed by other authors.

Ang & Chen (2007) developed that the Value Premium in the U.S. from 1926 to 1963 can be explained by the CAPM. They found no reliable evidence against the CAPM for the post-1963 period. The CAPM claims that any variation in β between stocks is compensated by an increase in the expected returns. From 1926 to 1963, Value Stocks had larger βs than Growth Stocks. So, the theory holds for this period. On the other hand, for the period after 1963, Value Stocks have smaller βs than Growth Stocks, the Value Premium can therefore not be explained by the CAPM (Fama & French, 2006).

For his part, Loughran (1997) showed evidence that there is Value Premium for small stocks only under some conditions : this is only the case for U.S. stocks during the post-1963 period and using only the Book-to-market ratio as an indicator to classify Value and Growth Stocks. By using the Earnings to Price ratio, he found little difference between Value Premium for small and large stocks for the 1963 to 2004 period. Therefore, the overall Value Premium for U.S. stocks from 1926 to 2004 is similar during the whole period. Fama & French (2006) therefore observed only a slight relationship between the Value Premium and firm size. Thus, small stocks should provide a higher return than large stocks but the Value Premium for both small and large stocks is rather identical for the 1926 to 1963 period. Therefore, according to the Fama & French (2006)'s research, the CAPM does not explain the Value Premium for the period 1926-1963. The explanation through the CAPM therefore depends on the authors.

Choi (2013) explicitly explains that many authors attribute Value Premium through β and risk premium but also with market volatility. It is clear to them that Value Stocks become riskier in case of economic downturns, which explains the Value Premium for such periods. But, according to Choi (2013), they ignored an important element : the role of time-varying leverage. Choi (2013) is therefore in line with Ang & Chen (2007)'s theory. Indeed, he found that the asset risk and the leverage of value companies during economic downturns increase, which increases the β coefficient. For growth companies, this β remains stable. Therefore, Value Stocks become riskier during downturns, which explains the high risk premium. According to Choi (2013), asset risk or leverage taken separately do not explain the Value Premium, but their dynamic interaction throughout the business cycle partly explains this Value Premium.

As a conclusion, different theories may explain the outperformance of Value Stocks. Some authors, cited above, argue that the Value Premium is a compensation for the higher risk of Value Stocks. Others state that this differential is due to some suboptimal market behavior (Bauman & Miller, 1998). Therefore, it can be concluded that this return differential reflects both a compensation for the risk undertaken but also a mispricing due to investors' behavioral biases. Moreover, the Value Premium can also be impacted by the overall composition of the population of investors (Cronqvist et al., 2015).

7 Style Investing

When an investor is seeking to invest, it is sometimes challenging to choose where to go when there are so many opportunities on the markets. The investor must first choose if he prefers to invest in bonds, shares, indices, ETFs, real estate,... He has a wide range of choices. Then, once he has chosen his category, other sub-categories are presented to him. In this case, if he is going to invest in equities, he will have to consider whether he prefers to invest in cyclical or non-cyclical, small or large, local or international and even growth or value stocks. Consequently, Value and Growth Stocks become an investment style that allows the investor, once he has chosen his strategy, to simplify his decision-making process.

According to Barberis & Shleifer (2003), the portfolio allocation which is based on a selection among styles rather than individual securities is called "Style Investing". Therefore, following an investment style allows investors to select securities for their portfolio. Thus, style investing is a strategy which facilitates investment decisions but also allows to easily compare the performance of growth portfolios and value portfolios. An investor develops therefore a preference for one of the two styles depending on his personal style investment and the current economic situation (Bourguignon & de Jong, 2003).

One school of thought holds that it is preferable to follow the growth strategy, which is more able to provide high returns by investing in a company with high growth prospects. Another school of thought holds that the best investment strategy is to invest in the value style where the shares are undervalued and can therefore potentially go back up to a fairer price providing higher returns (Asness et al., 2000).

Investors usually try to invest both in Growth and Value Stocks for portfolio diversification since these two styles are complementary. Moreover, the tendency is always changing

depending on the cycles in the economy. Indeed, Value Stocks move in line with the cycles observable (Authers, 2020b). Mixing Value Stocks and Growth Stocks in a portfolio can help to manage the risk and enhance the returns (Busch Investments, 2020).

Growth investors are willing to pay a high valuation to buy the stock because they are convinced that the company can grow rapidly and that the stock price will increase over time (Feroldi, 2019). However, value investors prefer to invest in this class of stocks because they are undervalued, and hope to earn a higher return if the stocks rise in value than if they are invested in better-priced stocks that would have risen slightly in value (Busch Investments, 2020). Klarman (1991) develops that buying undervalued securities also compensates for human error, bad luck or extreme volatility in the markets. According to Bourguignon & de Jong (2003), value investors rather invest in the short term, as they bet on price movements that are usually of short duration. On the other hand, growth investors invest in more structural changes in the company and take into account longer term considerations.

In Kalogeropoulos (2019)'s view, an investor should consistently follow the same strategy and avoid switching from one method to another depending on what is working most effectively at the time, as this type of action could be fatal to expected returns, and underperform the market in the long run. Moreover, by applying the strategy of Value or Growth Stocks, investors need a long-term horizon for the strategy to work properly.

According to Rowley & Sharpe (1993), the style of investment of a portfolio can be determined by taking the historical covariance of the returns of the overall funds and compare this covariance with those of portfolios of Value and Growth Stocks.

Cronqvist et al. (2015) found different factors explaining this investing style. First, they developed that investors with stronger behavioural investment biases, in particular with a

preference for speculative assets are more willing to buy Growth Stocks. Moreover, genetic characteristics among individuals are also an important factor to study the investing style : individuals with higher levels of human capital and whose labor income is more closely correlated with GDP growth tend to hold more Growth Stocks. According to them, the biological basis is important enough saying that the preference for Value and Growth Stocks could be partially embedded in an investor from birth. Finally, the life-course theory can also explain the investor's style. Indeed, an investor with poor macroeconomic experiences (e.g. the Great Depression) has stronger incentives to invest in Value Stocks, even after taking into account the differences in income and net worth.

Part III

Empirical Research

In this part, the idea is to forecast the future performance of value investing and growth investing depending on economical and financial data. To perform this research, the 1995 - 2019 period will be studied on the U.S markets. Then, others markets will also be studied to have a more global view over the world and to be able to compare divergences in performance across markets.

8 Methodology

The general purpose of this study is therefore to analyze the past performance of Value and Growth Stocks in order to build a model able to predict their respective performances in the future, based on economic cycles defined according to macroeconomic and financial data.
In order to be able to predict these performances, it will be necessary to go through different steps, which are detailed in this section.

The first step of the study is building the database by collecting and analyzing data.
It begins with the selection of the indices which are going to be used to represent the value and growth styles. These indices have been carefully chosen to represent different geographical areas and company sizes. Consequently, it will be necessary to download their prices over the period studied and to compute their respective returns. The study will be therefore based on the returns of the selected indices.
Then, the selection of macroeconomic and financial data will be necessary in order to represent the different economic cycles.

Once the database is created, it becomes necessary to perform statistical tests such as a univariate as well as bivariate data exploration to analyse the nature of the variables which will be employed and their correlations.

Once the database has been analyzed, the time has come to create a model capable of predicting stock performance over the economic cycle. Then, to be able to forecast the performance of Growth and Value Stocks, it will be necessary to proceed in two steps.
First, the database must be divided into two different parts. The first subset will pick 20 years randomly in the total of the 25 years studied. This subset will be used to build the statistical model and be useful for the **in-sample test**. The remaining 5 years will be useful for the **out-of-sample test** which tests the predictive capability of the model.
Secondly, once the database has been split, the model can be built. In this case, the Binary Logistic Regression will be the most appropriate approach given that the dependent/target variable of the model is binary. Indeed, the main goal of this research is to evaluate whether Value or Growth Stocks outperform. Therefore, the target variable has two event modalities : Growth outperforms or Value outperforms.
Afterwards, a Backward Stepwise Logistic Regression will have to be carried out in order to optimize the model. This method works through the AIC and allows to keep only the variables with a significant impact on the prediction, which helps to predict the results of the out-of-sample test as accurately as possible.
When the model is finally created and has been trained on the in-sample database, it can be tested on the out-of-sample part to attempt to predict the performance of the indices. The results of the research will therefore be displayed.

Finally, a discussion of the results will take place, as well as a comparison of the results obtained in the empirical part with the opinions of different experts in this particular field.

9 Index choice

9.1 American Market

9.1.1 Large cap

For this research, it was decided to focus primarily on the U.S. markets by using the *S&P500 Pure Value Index* and its counterpart the *S&P500 Pure Growth Index* which are representative of large capitalization stocks.
This pair of indices was chosen since its underlying index, the S&P500 is a good representation of trends in the U.S. markets. Indeed, the American index includes the 500 companies with the largest market capitalizations listed on the New York Stock Exchange and the Nasdaq (Zone Bourse, 2020).
These indices were first traded on the markets on June 30, 1995.

The *S&P500 Pure Value* and *S&P500 Pure Growth* indices are style indices measuring the value/growth dimension of a stock. The "pure style" index is used to avoid stock duplication and the stocks are weighted according to their relative propensity for the style (S&P Dow Jones Indices, 2019). The returns used for the *S&P500 Pure Value Index* take into account the distribution of dividends to shareholders.

The methodology used to build these two indices has already been developed in *Subsection 4.6.*

9.1.2 Mid & small cap

Then, the research was extended to the mid-small capitalization stocks on the U.S. markets by using the *Russell 2000 Value Index* and *Russell 2000 Growth Index* to assess the impact of the size of a value or growth company on its returns. Indeed, the underlying, the Russell

2000 index, includes the 2000 smallest companies in the United States from the Russell 3000 Index (Investing Answers, 2019).

The *Russell 2000 Value Index* is, as already developed in *Subsection 4.6*, composed of the small-cap stocks in the U.S. equity that are in the value segment and therefore tracks their performance. The returns used for the *Russell 2000 Value Index* take into account the distribution of dividends to shareholders.
The *Russell 2000 Growth Index* includes stocks from the Russell 2000 part of the growth segment identified with higher price/value ratios and higher growth expectations and described as small-cap companies.
The methodology for constructing this pair of indices is available in *Subsection 4.6*.

9.2 Search Extension

In order to analyze the impact of geography on the performance of Value and Growth Stocks, the research was extended to the European and Asian markets.

9.2.1 European Markets

Studying the trend in the European markets can be interesting for the study. For this purpose, the *MSCI Europe Value Index* and the *MSCI Europe Growth Index* have been chosen.
The methodology of these indices has also been developed in *Subsection 4.6*. As already explained, these indices represent large and mid-cap securities across the 15 developed market countries in Europe (MSCI, 2020b).

The *MSCI Europe Value Index* tracks stocks with value style characteristics taking into account the distribution of dividends in the returns. The *MSCI Europe Growth Index* captures therefore stocks displaying growth style characteristics, all defined in *Subsection 4.6*.

9.2.2 Asian Markets

Furthermore, to obtain a global view of the markets, it may also be of interest to continue the analysis on the Japanese financial markets. For this purpose, the *MSCI Japan Value Index* and the *MSCI Japan Growth Index* have been selected.

These two indices capture Japanese large- and mid-cap stocks. The *MSCI Japan Value Index* only considers stocks that meet the value characteristics and the *MSCI Japan Growth Index*, on the other hand, only includes stocks defined by growth factors which are all defined in *Subsection 4.6*.

10 Database

As a reminder, the purpose of this research is to predict the performance of Value and Growth Stocks according to the current economic cycle. The performance is studied thanks to the indices developed earlier and a business cycle should therefore be characterized by macroeconomic data which will be used as independent variables in the model.

10.1 Data Collection

10.1.1 Target Variable

First of all, the binary target variable, which is the variable to be forecasted, must be constructed. In order to build this variable, the prices of the indices (Table 6) already described earlier are required and come from the financial data provider Bloomberg (2020).

Table 6: Indices Summary

Index	Ticker Bloomberg	Observation Period
S&P500 Pure Value Index	SPXPV Index	1995-2019
S&P500 Pure Growth Index	SPXPG Index	1995-2019
Russell 2000 Value Index	RUJ Index	1995-2019
Russell 2000 Growth Index	RUO Index	1995-2019
MSCI Europe Value Index	MXEU000V Index	1999-2019
MSCI Europe Growth Index	MXEU000G Index	1999-2019
MSCI Japan Value Index	MXJP000V Index	1995-2019
MSCI Japan Growth Index	MXJP000G Index	1995-2019

Source: Bloomberg (2020)

When the prices are collected, a transformation is performed to obtain the daily returns thanks to the following formula :

$$r_{i,t} = ln(p_{i,t}/p_{i,t-1}) \tag{1}$$

where $r_{i,t}$ represents the return of the *index* i in time t and $p_{i,t}$ represents the price of the *index* i in time t. The returns are advanced by one day in order to be able to forecast the next day's return.

10.1.2 Explanatory Variables

Secondly, the macroeconomic data used for the study as explanatory variables are taken from the Federal Reserve Economic Data (2020b) website and from Bloomberg (2020).
The macroeconomic data have been carefully selected for their degree of popularity according to the Federal Reserve Economic Data (2020b) website or Bloomberg (2020). The majority of these data is frequently consulted and they all appear relevant to the study. In this section, it is assumed that the date on which the last value was published is the same date every month for the update of value. So, as an example, when a data was last published on the 29th day of the month, this date is chosen as the date for changes in value during the entire period under study. This value is valid for the entire month until the 29th day of the following month.

First of all, to reflect inflation representing the potential generalised increase in prices and which is therefore linked to the purchasing power, the Consumer Price Index has been selected (Banque Centrale Européenne, 2020). The most popular is the **Consumer Price Index for All Urban Consumers: All Items in U.S. City Average** [ConsPrice]. It represents the monthly change in the prices of goods and services. It is also a good measure for identifying periods of deflation and inflation, although it cannot be fully reliable because it includes the more volatile food and oil prices (Federal Reserve Economic Data, 2020a). This data is published monthly and is seasonally adjusted. It is released the following month on the 10th day. For example, the value for the month of April is released on May 10 and will be valid until June 10, when the new value is released. The values have therefore been delayed by 1 month and 10 days to capture the impact of the publication of the new value.

Second, the **real GDP** [rGDP] is selected but at the expense of the nominal GDP in order to avoid multicollinearity with the variable *ConsPrice*. It represents the inflation-adjusted value of the goods and services produced by labor and property located in the

U.S. (Federal Reserve Economic Data, 2020c). Since this data is published with a delay of 3 months, the variable has been delayed by 3 months in order to be considered when it is released.

Then, an indicator of consumer confidence has been selected : the **University of Michigan: Consumer Sentiment** [ConsSent], which is observed monthly (University of Michigan, 2020). This index represents the level of current and future economic conditions based on consumers' expectations about the economy. This indicator allows to determine whether the population is optimistic, pessimistic or neutral, which provides a great amount of information about future consumer spending (Kenton, 2020b). This data is published with a one-month delay every 29th of the month, making it necessary to lag the data by 1 month and 29 days.

The **CBOE Volatility Index** [VIX] can also be of interest. It is a good daily measure of this market volatility since it measures the market's expectations of the short-term volatility conveyed by the prices of stock index options (Chicago Board Options Exchange, 2020).

The **Unemployment Rate** [UnRate] is also a factor to be taken into account. It represents the number of unemployed as a percentage of the labor force. This data is published monthly and is seasonally adjusted (U.S. Bureau of Labor Statistics, 2020). Since this data is made public on the 5th of the following month, the variable has therefore been delayed by 1 month and 5 days in order to take into account its impact when the value is disclosed publicly.

Another interesting factor to consider is the **Moody's Seasoned Aaa Corporate Bond Yield** [BondYield], which is the performance of corporate bonds with the highest rating according to Moody's Investors Service and which is based on bonds with a maturity of 20 years or more. This data is released daily (Moody's, 2020).

The Federal Reserve System, also known as the Fed, which represents the central bank-

ing system of the U.S., sets interest rates for commercial banks. These rates are set on a daily basis and are the interest rates at which these banks can borrow.
To represent these interest rates, the **Effective Federal Funds Rate** [FedRate] has been chosen. It is the rate at which commercial banks lend or borrow funds from each other on the short term (Board of Governors of the Federal Reserve System (US), 2020a). This rate is very relevant since it also has an influence on other interest rates such as the prime rate, being the rate at which banks lend money to individuals with higher credit ratings, thus indirectly impacting mortgages, loans and savings, playing an important role in the wealth and confidence of consumers (Board of Governors of the Federal Reserve System (US), 2020a).

The **10-Year Treasury Constant Maturity Minus 2-Year Treasury Constant Maturity** [TreasuryYield] is also a widely used feature (Federal Reserve Bank of St. Louis, 2020). This 10-2 Treasury Yield Spread represents the difference between the 10-year Treasury rate and the 2-year Treasury rate. The closer the spread is to 0, the flatter the yield curve. If the spread becomes negative, this can be a good indicator of a period of recession (Y Charts, 2020).

The exchange rate of the dollar is also an interesting data. Therefore, the **Trade Weighted U.S. Dollar Index: Broad, Goods** [DollarExchangeRate] is going to be used in the analysis. This index is a weighted average of the foreign exchange value of the U.S. dollar against the currencies of a broad group of major U.S. trading partners (Board of Governors of the Federal Reserve System (US), 2020b).

Adding the gold share price to the variables may also be relevant as gold is considered a safe investment. According to Larousse, a safe investment is a secure value such as gold or real estate that is bought in times of crisis. It is a stable investment that depends very slightly on market conjunctures. Therefore, the **Gold Fixing Price 10:30 AM (London time) in London Bullion Market, based in U.S. Dollars** [Gold] has been selected to

represent the gold share price (ICE Benchmark Administration Limited (IBA), 2020).

In addition, the price of Crude Oil may also be a variable to consider. The **Crude Oil Prices: West Texas Intermediate (WTI)** [Oil] has therefore been selected. WTI is one of the crude oils produced in the U.S. used as a benchmark for pricing around the world (U.S. Energy Information Administration, 2020).

It is also of interest to integrate some forecasted data into the analysis. Therefore, some have been selected and are added to the database.
The **University of Michigan: Inflation Expectation** [InflExp] is thus a variable included in the model that represents the expected 12-month price change. This index is based on a consumer survey. Since the data is published on the second following month, the data has been lagged by 2 months to be taken into account when the data is released publicly.

The **Real Potential Gross Domestic Product** [rGDPExp] is the "CBO's estimate of the output the economy would produce with a high rate of use of its capital and labor resources", transformed to avoid the effects of inflation (U.S. Congressional Budget Office, 2020). These data are published 8 months prior to the relevant quarter. For example, data for Q4 are published on February 7 of the same year. The data have therefore been advanced by 8 months.

The **futures of the Oil** [OilFutures] **and the Gold** [GoldFutures] commodities are also taken into account. These data are taken from Bloomberg (2020) and are contracts to buy or sell an asset at a predetermined price and date in the future.

Since some data are published quarterly or monthly, they had to be adjusted daily for the homogeneity of the database. All macroeconomic data starts on 3rd July 1995 and ends on 31 December 2019 for the *S&P500 Pure Value Index* & *S&P500 Pure Growth Index*.

10.2 Database Construction

When all the data are collected, the database must be built. The first column of the database indicates the date. The study period begins on July 3, 1995 and ends on December 31, 2019 for the *S&P 500 Pure Value & Pure Growth* indices. The returns of both indices form the other two columns. Then, a column indicates "Value" if the value index outperform or "Growth" for the opposite. The next column represents the binary dependent variable which indicates "1" if the previous column indicates "Value" and "0" for the opposite. Macroeconomic data were also uploaded on a daily basis, sometimes requiring adjustments if reported at a different frequency. Some missing values are also found randomly in the database and are replaced by the preceding value. These data therefore represent the independent variables of the model and a summary of the 15 macroeconomic data can be observed on Table 7.

Table 7: Explanatory Variables Summary

Macroeconomic Data	Observation
ConsPrice	Monthly
rGDP	Quarterly
ConsSent	Monthly
VIX	Daily
UnRate	Monthly
BondYield	Daily
FedRate	Daily
TreasuryYield	Daily
DollarExchangeRate	Daily
Gold	Daily
Oil	Daily
InflExp	Monthly
rGDPExp	Quarterly
GoldFutures	Daily
OilFutures	Daily

Source: Federal Reserve Economic Data (2020b)

In short, the database exploited for the statistical analysis is composed of 6392 observations, covering the period from July 1995 to December 2019 and 20 columns : the date, the 2 indices returns, the value/growth outperformance, the target variable being "0" or "1" and 15 independent variables. To perform the search extension, the database is updated with other indices as well as their macroeconomic data specific to the geographical sector under study.

11 Data Analysis

The entire statistical analysis is performed on the RStudio (3.3.3) [Software] (2020). All reported results are therefore the output given from this software.

11.1 Univariate Descriptive Analysis

As a first step, an Univariate Descriptive Analysis will be performed allowing to explore each variable in the database separately before modeling.

11.1.1 Summary Statistics

This analysis allows to highlight the trend of the variables through their minimum, mean, median and maximum as well as their dispersion via the standard deviation.
The mean takes into account the extreme values while the median is insensitive to these values. The variables with the closest mean and median are therefore variables with few extreme values like the variables *BondYield*, *TreasuryYield*, *DollarExchangeRate* and *rGDPExp*. On the other hand, if the mean and the median are far apart, it means that a greater number of extreme values are found in the data collected. From Table 8, the variables concerned are easily observable.
The standard deviation has also been expressed as a percentage of the median for an easier interpretation. From this, it can be observed that the variables *FedRate*, *TreasuryYield* and *GoldFutures* are the most sensitive since their standard deviations are the biggest ones compared to the others while the variable *DollarExchangeRate* is the least sensitive followed by *rGDPExp*,*ConsSent*, *rGDP* and *ConsPrice*.

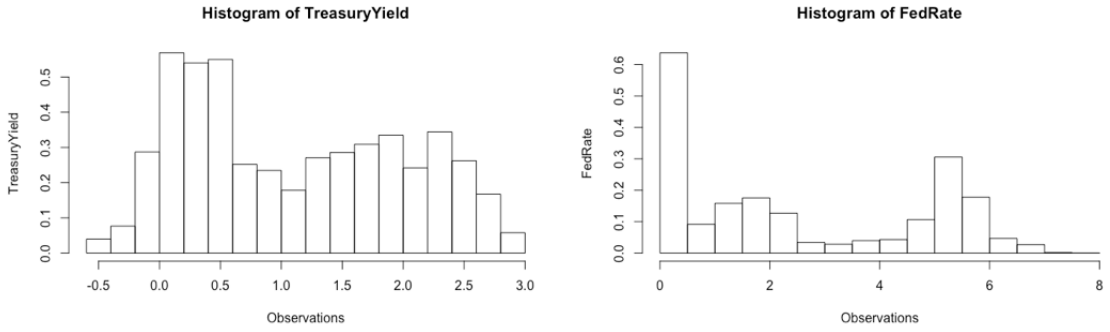
Table 8: U.S. Macroeconomic Data Summary

Variables	Min	Mean	Median	Max	Standard Deviation
ConsPrice	152.6	204.3	207.6	258.4	31.84 (15.34%)
rGDP	10665	14987	15328	19222	2315.73 (15.11%)
ConsSent	55.30	88.61	91.20	112	12.64 (13.86%)
VIX	9.14	19.64	18.30	80.86	7.96 (43.50%)
UnRate	3.50	5.69	5.20	10	1.68 (32.31%)
BondYield	2.81	5.44	5.44	8.12	1.36 (25.00%)
FedRate	0.04	2.53	1.91	7.80	2.22 (116.23%)
TreasuryYield	-0.52	1.12	1.12	2.91	0.89 (79.46%)
DollarExchangeRate	90.07	111.13	111.13	131.88	10.62 (9.56%)
Gold	252.90	814.70	759.80	1896.50	472.50 (62.19%)
Oil	10.82	53.29	51.83	145.31	28.56 (55.10%)
InflExp	0.40	2.92	2.90	5.20	0.53 (55.10%)
rGDPExp	10926	15498	15874	19393	2313.32 (14.57%)
GoldFutures	0	808.7	664.1	1888.7	479.74 (72.24%)
OilFutures	0	52.72	49.61	145.29	29.23 (58.92%)

11.1.2 Histograms

In order to have a visual representation of the distribution of the different variables included in the database, a histogram can be performed. Thanks to this function, it appeared that the variables employed do not follow a normal distribution. This condition is not necessary in the case of a logistic regression. Therefore, no transformation will be made at this stage but it is important to know the distribution of the variables. This statement can be observed with the example of two of the variables in Figure 6.

Figure 6: Distribution of the variables *TreasuryYield* & *FedRate*

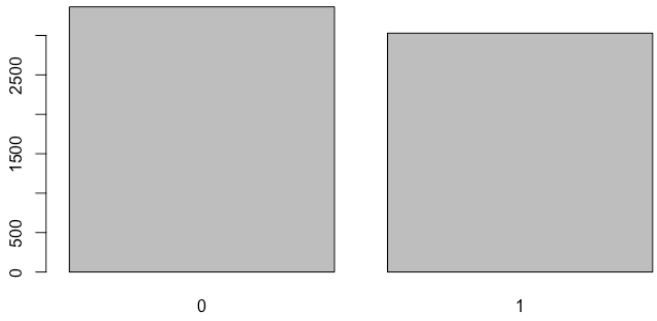


11.1.3 Plots

In this section, an analysis of different plots can be conducted in order to better understand the variables used for the research.

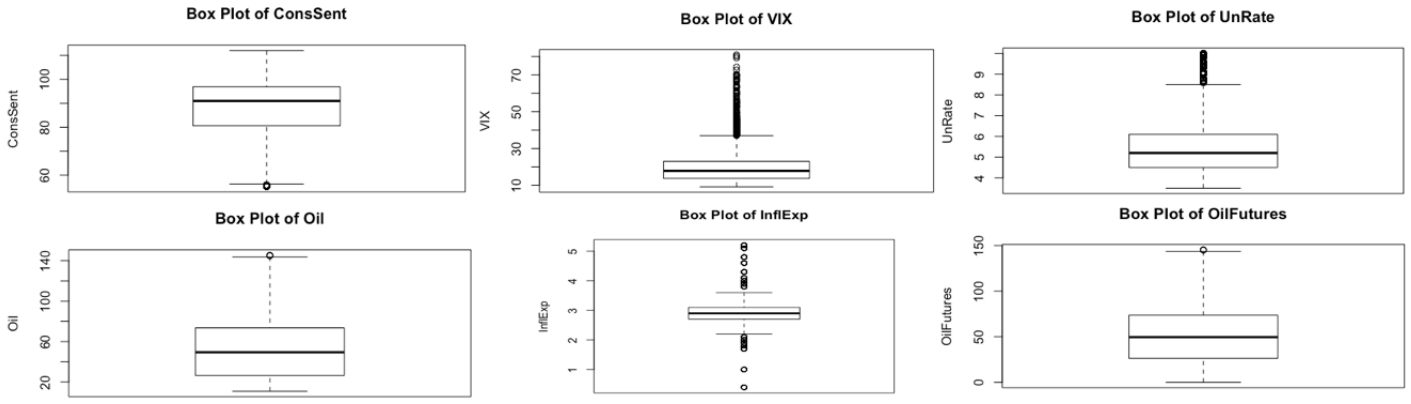
The Bar Plot makes it possible to highlight the distribution of the outperformance of Value and Growth Stocks thanks to the binary variable. Indeed, the growth outperformance is represented by the value "0" while the value outperformance is represented by the value "1". Figure 7 shows that Value Stocks outperform 3029 times and Growth Stocks outperform 3363 times over a total of 6392 days. Consequently, Growth Stocks outperformed slightly more than Value Stocks.

Figure 7: Bar Plot of the variable *BINARY*



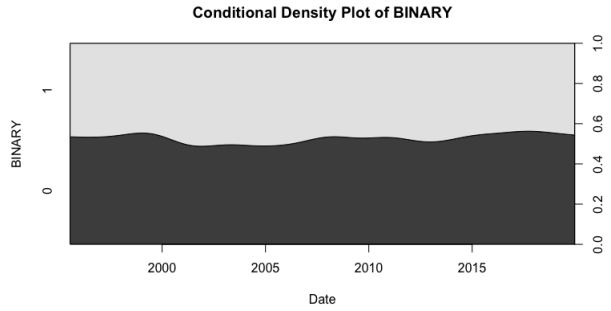
The Box Plot is used to interpret the dispersion of data. The median, which is represented by the line in the box, can be observed as well as the central half of the data represented by the box and the lower and upper 25% excluding outliers highlighted by the two vertical bars. The outliers are represented by the points on the Box Plot and are only present for a few variables, in particular *ConsSent*, *VIX*, *UnRate*, *Oil*, *InflExp* and *OilFutures*. Their Box Plots can be observed in Figure 8. Removing these outliers reduces the ability of the model to predict stock performance, so it was decided to keep them in the model.

Figure 8: Box Plots of *ConsSent*, *VIX*, *UnRate*, *Oil*, *InflExp* and *OilFutures*



Then, the Conditional Density Plot describes the distribution between Value & Growth Stocks over time. In Figure 9, it can be observed that this is rather constant. However, Growth Stocks outperform before the year 2000 and after the financial crisis while Value Stocks outperform between 2000 and the financial crisis.

Figure 9: Conditional Density Plot of the variable *BINARY*



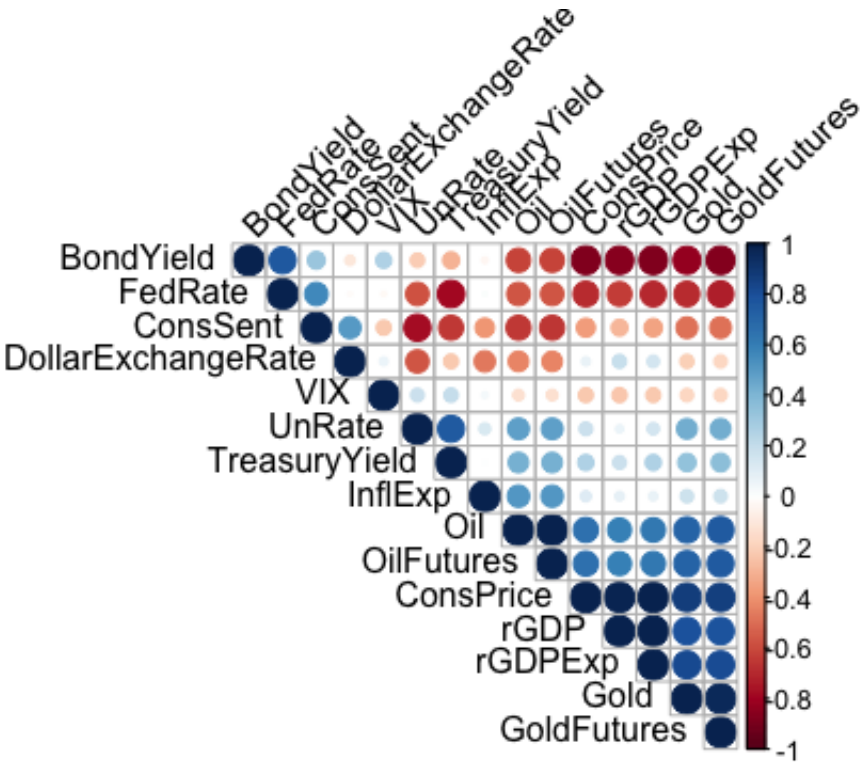
11.2 Bivariate Descriptive Analysis

A Bivariate Descriptive Analysis is also performed taking into account the interactions between the independent variables.

11.2.1 Correlations

The correlation coefficient is a statistic that measures the strength of the linear relationship between two variables. The correlations between all the variables used for the model are therefore available in Figure 10. Positive correlations are displayed in blue and negative correlations in red. The intensity of the color and the size of the circles are proportional to the correlation coefficients whose legend is in the bar to the right of the correlogram.

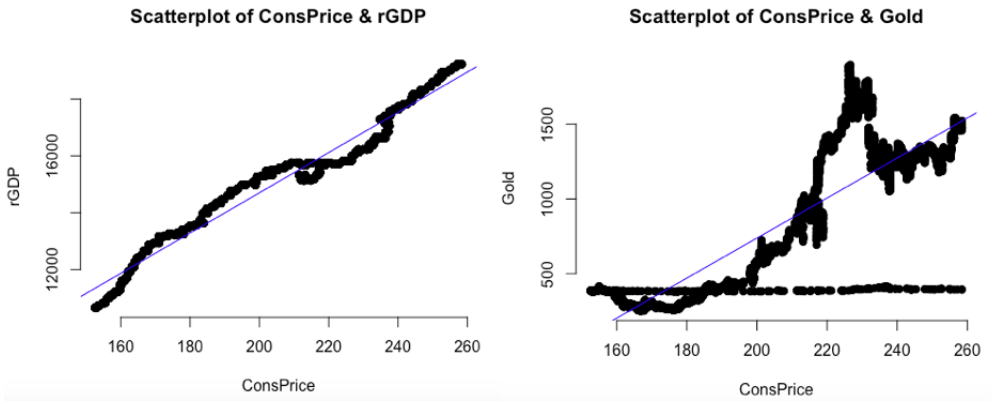
Figure 10: Correlation Matrix



11.2.2 Scatter Plots

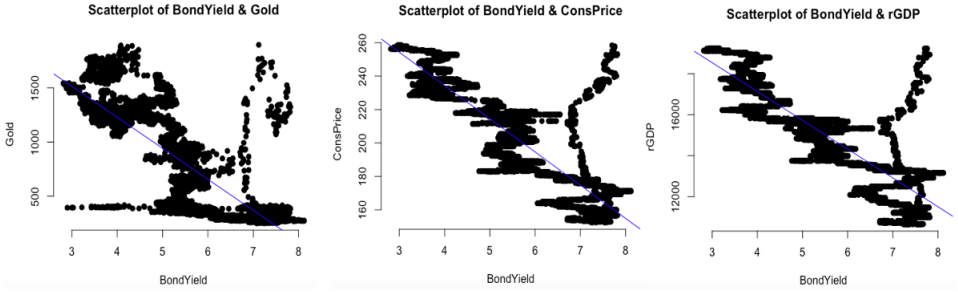
It can be observed in the previous point that some variables are highly correlated. The variable *ConsPrice* is positively correlated with the variables *rGDP*, *rGDPExp* and *Gold*. To represent this correlation, a Scatter Plot can be build as in Figure 11, which represents the correlation between *ConsPrice* and the variables *rGDP* & *Gold*. The positive correlations are readily visible.

Figure 11: Scatter Plot of *ConsPrice* with *rGDP* & *Gold*



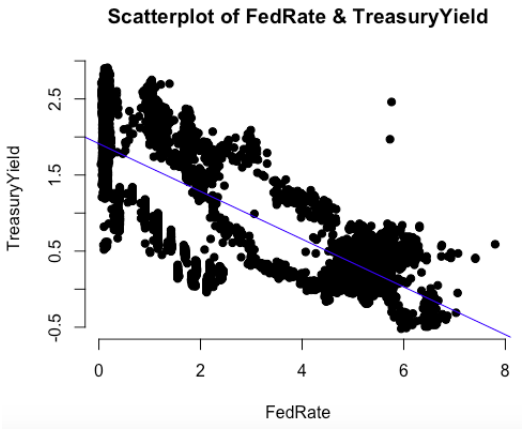
The variable *BondYield* is negatively correlated with the variables *Gold*, *GoldFutures*, *ConsPrice*, *rGDP* & *rGDPExp*. Some of these relationships are represented in Figure 12. The correlations are not as accurate but are still visible. Indeed, the negative relationship between the two variables is noticeable thanks to the blue line on the Scatter Plots.

Figure 12: Scatter Plots of *BondYield* with *Gold*, *ConsPrice* & *rGDP*



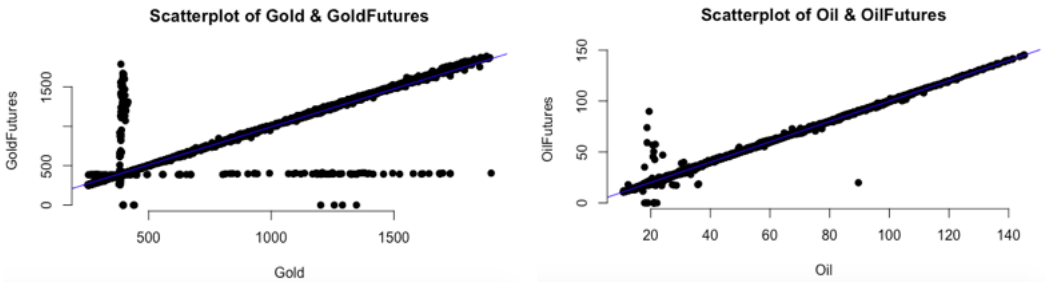
The variable *FedRate* is also negatively correlated with the variable *TreasuryYield*. The relationship is also less precise but it may be mentioned that the global trend is indeed a negative correlation as can be observed in Figure 13.

Figure 13: Scatter Plot of *FedRate* with *TreasuryYield*



In addition, *Gold* and *Oil* commodities are also strongly linked to their respective futures as can be observed in Figure 14.

Figure 14: Scatter Plot of *Gold* and *Oil* with *GoldFutures* and *OilFutures*



Therefore, all these Scatter Plots confirm the correlation matrix already exploited previously.

12 Binary Logistic Regression

12.1 Description

The binary logistic regression model enables to highlight the relationship between a binary dependent variable and a set of independent explanatory variables, which is convenient as the dependent variable of the model is binary. As a reminder, this variable has two modalities: "1" for value outperformance and "0" for growth. The independent variables of the model are all quantitative as already developed earlier. The logistic regression calculates the probability that one of the two modalities will be realized, thus being between 0 and 1. The results of the logistic regression make it possible to establish whether an event, in this case a macroeconomic data, has a positive or negative impact on the binary variable (Statistiques et Logiciel R, 2020). The logistic regression therefore follows the formula of a linear regression in which the dependent variable is replaced by the probability that the event with the highest value occurs, $P(Y = 1)$ corresponding to an outperformance of the value style (Morales Rodriguez, 2020).

$$P(Y = 1) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_m x_m \tag{2}$$

where Y represents the target variable taking "0" or "1" as value and x_m stands for the independent variables with $m \in [1, 15]$. In order for the expectation of Y to take only 2 values, it is necessary to use the logistic function :

$$Y = p = \frac{exp(x)}{1 + exp(x)} \tag{3}$$

At this stage, p can only appear between 0 and 1. In order to work with values between -∞ and $+\infty$, it is necessary to go through a logit transformation:

$$logit(p) = ln(\frac{p}{1-p}) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_m x_m \tag{4}$$

12.2 Application

The objective of the research is to predict the performance of Growth and Value Stocks. The database contains 52.61% of the observations with an outperformance of Growth Stocks and 47.39% with an outperformance of Value Stocks. To achieve the objective, it is necessary to divide the database into two distinct parts. In order to carry out the splitting, the software was asked to randomly select and separate 75% and 25% of the observations available in the database.

The first subset, called *Training*, is composed of approximately 20 years out of the initial 25 years, so 4795 observations all randomly selected with 15 explanatory variables and the target variable *BINARY* expressed by "0" or "1".

This subset is used as a sampling and the model will be trained on this in-sample database. It contains 2523 observations of outperformance of Growth Stocks and 2272 observations of outperformance of Value Stocks.

On the other hand, the second subset, called *Test*, contains approximately 5 years, so 1597 observations all randomly selected but no target variable since this variable has to be predicted and then compared to the observed value. This subset includes 840 observations of outperformance of Growth Stocks and 757 observations of outperformance of Value Stocks. This second subset is built for the out-of-sample test, and will be used to test the model and evaluate the forecasting performance. The model will therefore be used to make predictions on this out-of-sample data to determine whether its predictions are close to reality.

12.2.1 Subset *Training*

12.2.1.1 Logistic Regression Summary The first step thus consists in carrying out the Binary Logistic Regression containing all the variables on the subset *Training*. The software provides in output a table available in Appendix B.1.1 where the coefficient estimators can

be analyzed. The initial model containing the 15 variables is as follows :

$$\begin{aligned} Y =& \beta_0 - \beta_1 ConsPrice + \beta_2 rGDP - \beta_3 ConsSent - \beta_4 VIX + \beta_5 UnRate \\ & - \beta_6 BondYield - \beta_7 FedRate - \beta_8 TreasuryYield + \beta_9 DollarExchangeRate \\ & + \beta_{10} Gold + \beta_{11} Oil - \beta_{12} InflExp - \beta_{13} rGDPExp - \beta_{14} GoldFutures - \beta_{15} OilFutures \end{aligned}$$

where Y represents the variable *BINARY*.
The impact of the variables on the outperformance of Value and Growth Stocks can be easily interpreted thanks to the signs of the coefficients of the variables. At this stage, some variables are not significant. Their interpretation should therefore be taken cautiously until the selection has been made.

In particular, the variables *rGDP*, *UnRate*, *DollarExchangeRate*, *Gold* and *Oil* have a positive coefficient, which should mean that if their value increases, Value Stocks are more likely to outperform. Indeed, a rise in unemployment is a sign that the economy is not doing well, so investors are certainly moving to Value Stocks. In addition, gold and the dollar are safe haven. In the event of a recession, investors take refuge in these two securities as well as in Value Stocks, which confirms their positive correlation.

However, the variables *ConsPrice*, *ConsSent*, *VIX*, *BondYield*, *FedRate*, *TreasuryYield*, *InflExp*, *rGDPExp*, *GoldFutures* and *OilFutures* have a negative coefficient, which should mean that if their value increases, Growth Stocks are more likely to outperform. Indeed, the increase in inflation supports growth and thus the outperformance of Growth Stocks. The improvement in consumer sentiment suggests that the economy is in a growth phase and therefore favours Growth Stocks. The sign of volatility is more confusing because in ordinary times, the volatility is more easily absorbed by Value Stocks, which are less sensitive to the markets. In addition, increasing yields on corporate bonds and treasury bonds are also linked

to a good economy and thus to strong corporate growth. It is also relevant to notice that an increase in Fed rates should lead to an outperformance of Growth Stocks. Moreover, while the increase in current prices of gold and oil suggests an outperformance of Value Stocks, the increase in their futures suggests an outperformance of Growth Stocks.

Some coefficients are not significant and therefore cannot be taken into account in the analysis, but this selection will be made in the next step.

12.2.1.2 Backward Stepwise Logistic Regression The second step allows to take into account only the variables that are significant for the analysis. Indeed, the model developed just before takes into account all the variables without considering the correlations between variables. Therefore, the model can certainly be improved.
To determine the quality of the model, the Akaike Information Criterion (AIC) is a good indicator. The lower the AIC, the better the model. The AIC score rewards models that achieve a high fit quality score and penalizes if they become too complex. This score is useful for comparing models, but cannot be interpreted alone (Towards Data Science, 2019).
In order to improve the model, a well-known technique can be used : the Backward Stepwise Logistic Regression. This method consists in making a first model with all the variables, then removing the variable which reduces the AIC to a minimum to improve the model. The method therefore automatically removes the variable whose deletion improves the model the most and carries out this process until the quality of the model is optimized. When the deletion of an additional variable no longer improves the model, the process stops. This method therefore prevents the inclusion of irrelevant predictors (Analyse-R, 2020).
The Backward Stepwise Logistic Regression has removed variables progressively and the outputs can be observed in Appendix B.1.2. The initial model has an AIC of 6642. Table 9 shows the deletions of variables one by one in the same order as the model made these deletions as well as the AIC of the model considering the deletion of the variable concerned.

Table 9: Backward Stepwise Logistic Regression Summary

Variable Deleted	AIC
- FedRate	6640.00
- OilFutures	6638.07
- BondYield	6636.34
- rGDPExp	6634.89
- GoldFutures	6633.39
- Gold	6631.95
- InflExp	6630.76
- ConsSent	6629.31
- rGDP	6628.98
- TreasuryYield	6628.97

Source: RStudio (3.3.3) [Software] (2020)

The final model of the logistic regression after elimination of the insignificant variables is therefore :

$$Y = \beta_0 - \beta_1 ConsPrice - \beta_2 VIX + \beta_3 UnRate + \beta_4 DollarExchangeRate + \beta_5 Oil$$

All these remaining variables are therefore significant and make it possible to achieve an AIC of 6629 as observed in the Appendix B.1.3.

12.2.2 Subset *Test*

After having optimized the logistic regression on the subset *Training*, the time has come to test this model on the subset *Test* in order to predict the outperformance of both styles. The subset *Test* is therefore used to estimate a final assessment of the performance of this model. In order to measure this performance, the software analyses the difference between the results observed and the values predicted by the model. The results are discussed in the next section.

13 Empirical Results

13.1 S&P 500 Pure Value & S&P500 Pure Growth

The results are available in Appendix B.2. The confusion matrix available in Table 10 allows the predicted results to be compared with the results observed. The model therefore predicted 1321 growth outperformance & 276 value outperformance while the actual observations are 840 outperformance of Growth and 757 outperformance of Value .

Table 10: Confusion Matrix *S&P500*

	Actual : Growth	**Actual : Value**
Predicted : Growth	712	609
Predicted : Value	128	148

Source: RStudio (3.3.3) [Software] (2020)

Consequently, the accuracy of the model is determined, being **53.85%**. The model predicts a better performance for Growth Stocks as observed on the historical returns of the indices. The model is only partially reliable, so it is not possible to predict exactly which style of stocks will outperform based on economic conditions using this logistic regression-based model.

13.2 Additional indices

13.2.1 Russell 2000 Value & Russell 2000 Growth

The database based on the *Russell 2000 Value* and *Russell 2000 Growth* indices begins on January 3, 1995 and ends on December 31, 2019. It contains 6521 observations and 20 columns of which 15 are independent variables. These variables are exactly the same as those used for the *S&P 500 Pure Value* and *S&P 500 Pure Growth* indices because it also refers to the U.S. markets.

This database records 53.17% outperformance of Growth Stocks and 46.83% outperformance of Value Stocks.

The *Training* subset contains 4892 observations, including 2601 where the Growth Stocks outperform and 2291 where the Value Stocks outperform. The *Test* subset contains 1629 observations with 866 with Growth Stocks outperformance and 763 with Value Stocks outperformance.

The result of the Backward Stepwise Logistic Regression is the following :

$$\begin{aligned} Y =& \beta_0 + \beta_1 ConsPrice - \beta_2 FedRate + \beta_3 DollarExchangeRate + \beta_4 InflExp \\ & - \beta_5 rGDPExp - \beta_6 GoldFutures \end{aligned}$$

The confusion matrix can be observed in Table 11. The accuracy of this model is **54.82%** which indicates a slight improvement compared to the test on the S&P500. This demonstrates that it is easier to forecast the performance for mid-small capitalization Value & Growth Stocks.

Table 11: Confusion Matrix *Russell 2000*

	Actual : Growth	**Actual : Value**
Predicted : Growth	776	646
Predicted : Value	90	117

Source: RStudio (3.3.3) [Software] (2020)

13.2.2 MSCI Europe Value & MSCI Europe Growth

Afterwards, a third database was built based on the *MSCI Europe Value* and *MSCI Europe Growth* indices. The database begins on January 5, 1999 and ends on December 31, 2019. The variables used for the study of the European markets are developed in Appendix C and are 11, as some initially planned could not be found to cover the entire study period. The management of missing values is the same as the one used for the S&P500 indices and will be the same for subsequent indices.

From the database, 51.06% of the observations indicate an outperformance of Growth Stocks

while 48.94% of the observations indicate an outperformance of Value Stocks. Thereafter, the database must be split into two parts : the first subset *Training* contains 4107 observations including 2097 with an outperformance of Growth Stocks and 2010 with an outperformance of Value Stocks and the second subset *Test* contains 1369 observations including 699 with an outperformance of Growth Stocks and 670 with an outperformance of Value Stocks.
The result of the Stepwise Logistic Regression is :

$$Y = \beta_0 - \beta_1 ConsPrice - \beta_2 ConsSent - \beta_3 VIX - \beta_4 TreasuryYield$$

Therefore, all of these are the variables that are retained in the final model.
The confusion matrix can be observed in Table 12. The accuracy of this model is **53.03%**, which indicates that it is more difficult for the model to predict the performance of European Value & Growth Stocks than U.S. Value & Growth Stocks.

Table 12: Confusion Matrix *MSCI Europe*

	Actual : Growth	**Actual : Value**
Predicted : Growth	489	433
Predicted : Value	210	237

Source: RStudio (3.3.3) [Software] (2020)

13.2.3 MSCI Japan Value & MSCI Japan Growth

Afterwards, a fourth database was created based on the *MSCI Japan Value* and *MSCI Japan Growth* indices. The database begins on January 3, 1995 and ends on December 31, 2019. The variables used for the study of the Japanese markets are developed in Appendix D and are 13, as some initially planned could not be found to cover the entire study period.
Looking at the database, 56.42% of the observations indicate an outperformance of Growth Stocks, while 43.58% of the observations indicate an outperformance of Value Stocks.
Later, the database was divided into two subsets: the first subset called *Training* contains

4892 observations, 2760 of which with an outperformance of Growth Stocks and 2132 with an outperformance of Value Stocks and the second subset *Test* contains 1629 observations 919 of which with an outperformance of Growth Stocks and 710 with an outperformance of Value Stocks.

The result of the Stepwise Logistic Regression is :

$$Y = \beta_0 + \beta_1 rGDP - \beta_2 ConsSent - \beta_3 VIX + \beta_4 UnRate - \beta_5 TreasuryYield - \beta_6 Gold$$

Therefore, all of these are the variables that are retained in the final model.

The confusion matrix can be observed in Table 13. The accuracy of this model is **55.86%**, which indicates a slight improvement compared to the tests carried out on the S&P500, the Russell 2000 and the MSCI Europe. This shows that it is easier to predict the performance of Japanese Growth & Value equities than European and U.S. equities. But it is important to keep in mind that the accuracy of the models is too low to be able to use this model for prediction purposes.

Table 13: Confusion Matrix *MSCI Japan*

	Actual : Growth	**Actual : Value**
Predicted : Growth	710	510
Predicted : Value	209	200

Source: RStudio (3.3.3) [Software] (2020)

13.3 Discussion of results

In the results obtained for the U.S. markets, the significant variables are the CPI, representing the inflation rate, the volatility index, the unemployment rate, the dollar exchange rate and the price of oil. This result is very close to one of the two theories on economic cycles. Indeed, at the beginning of the economic expansion, Value Stocks are preferred and oil prices rise, which justifies the positive coefficient of oil. Then, the expansion of the economy starts to slow down and investors turn to Growth Stocks which are still traded although inflation continues. During the recession, volatility increases but investors continue to invest in Growth Stocks. After a while, companies start firing employees to deal with the blow of the recession, which increases the unemployment rate and investors take refuge in the dollar, which is a safe haven as well as in Value Stocks in preparation for the recovery. This theory therefore confirms Spellman (2017)'s statement.

For the analysis of mid-small caps on the Russell 2000, the interest rate established by the central bank is taken into account as well as GDP forecasts. If the GDP increases, it indicates an expansion and growth of the economy, so investors turn to Growth Stocks as explained by Merill Bank of America (2017) & Bauman & Miller (1997) in the literature review. On the other hand, if gold futures rise, investors also turn to Growth Stocks because it is a sign of recession, which is in line with Spellman (2017)'s theory which argues that in the event of a recession, Growth Stocks outperform. Therefore, in this case, the two theories are mixed.

As for the European markets, it takes into account the CPI (the inflation rate), the consumer sentiment, the market volatility and the government bond yield. If inflation and government bond yields are rising, it is a sign of expansion, so consumers are optimistic about the markets and investors decide to invest in Growth Stocks. This result is in line with the theory of

Merill Bank of America (2017) & Bauman & Miller (1997). On the other hand, if volatility increases so that the economy is in recession, investors continue to invest in Growth Stocks according to the statistical model, which rather confirms Spellman (2017)'s ideas.

The macroeconomic data used for predictions in the Japanese markets are the real GDP, the consumer sentiment, the market volatility, the unemployment rate, the government bond yield and the current prices of gold. The theory of Spellman (2017) can be confirmed because at the beginning of the expansion, the real GDP increases and investors turn to Value Stocks. Furthermore, during a recession, when volatility increases and the price of gold rises, investors will instead buy Growth Stocks. Towards the end of the recession, when the unemployment rate has risen, investors return to Value Stocks in anticipation of a recovery. The behavior of the variables based on consumer sentiment and government bond yields is more in line with the theory of Merill Bank of America (2017) & Bauman & Miller (1997), which advocates that investors take advantage of growth moments in the economy to invest in Growth Stocks.

The results of this research can also be compared with the ideas of different financial experts available in Appendix E.
According to the 4 people interviewed, all of them believe that it is impossible to create a model able to predict the returns of Growth and Value Stocks. According to Marchal (2020), this impossibility is due to the fact that it is possible to predict volatility but that the compensation that investors receive for the risk of volatility is extremely small. It is therefore only possible to predict a minor part of the return, which finally is not enough to be able to predict them at all. The majority of the compensation is, according to him, received to cover the risk of crashing, which is extremely difficult to predict. This theory therefore explains why it has certainly not been possible to build a model capable of predicting the returns of Value and Growth Stocks. According to Antoons (2020), a balanced approach between Value and Growth Stocks is necessary as well as a good diversification.

Also according to him, the returns are not only driven by economic cycles but also by the sector. Growth sectors such as IT and healthcare are highly valued, while value sectors such as energy and banking are less so. Deconninck (2020) somewhat agrees with this idea by arguing that value and growth cycles may be linked to Shumpetarian cycles based on innovation. According to Hanse (2020), MegaTrends are also important in terms of the popularity of Value or Growth Stocks. Indeed, according to him, it is necessary to consider the growth of market share as well as the growth of big data to separate Value and Growth Stocks. Their performance therefore also depends on their contribution to the 4 current MegaTrends: artificial intelligence, big data, blockchains and virtual/augmented reality. For example, Amazon and Netflix stocks are considered as Growth Stocks whereas Olivier would classify these stocks as Value Stocks because of their business model which aims at data collection. Ecological and demographic aspects are also important in his view.

From a size perspective, all respondents agree that small cap stocks are more likely to generate a better return. According to Antoons (2020), there is a small cap premium because they tend to grow faster, although attention must be paid to crashes. According to Marchal (2020), small caps are riskier and therefore generate a higher return in compensation for that risk.

From a geographical perspective, Antoons (2020) argues that Value Stocks perform better in Japan and on emerging markets. This confirms the analysis made on the *MSCI Japan Value & Growth* indices that Value Stocks have been outperforming since 1995. Deconninck (2020) also believes that the U.S. have better conditions for technology and therefore companies can grow more easily, which pushes Growth Stocks to outperform. Marchal (2020) supports this idea, believing that the U.S. have a more entrepreneurial spirit where access to capital is easier.

Part IV

Conclusion

This thesis aims at forecasting the future performance of Growth and Value Stocks through the development and implementation of a statistical model capable of predicting these performances through macroeconomic data.

In order to optimize the development of this model, some research was conducted on the existing literature related to this topic. The main conclusion was that all the shares available on the markets can be either in the value category, they are therefore characterized by high valuation ratios (BV/P, EP, CF/P and D/P) because these stocks are often considered undervalued on the market or in the growth category, in this case, they are characterized by low valuation ratios because these stocks are often overvalued compared to their true value. In addition, trends in outperformance have been investigated. The results show that the U.S. markets experienced a Value Premium until the 2007 financial crisis. Indeed, until that period, Value Stocks tended to outperform. It was easily observable that the returns studied on the *S&P500 Pure Value & Pure Growth* and the *Russell 2000 Value & Growth* show a completely different trend in the U.S. markets after 1995 : the returns of growth indices are above the returns of value indices. Consequently, theory does not always match practice, which makes the objective of creating a prediction model more challenging.
Furthermore, economic cycles were also explained as having an impact on the performance of Value and Growth equity returns. There are two schools of thought : one school of thought believes that Growth Stocks outperform when the economy is growing and perform poorly during recessions, which benefits Value Stocks, while others tend to say that Value Stocks are preferred when the economy is doing well and at the end of a recession in expectation of recovery and that Growth Stocks are preferred when the economy is slowing down and in the

early stages of a recession. Both theories could be observed and confirmed in the research results, which makes it difficult to determine which theory is the most accurate.
Afterwards, a forecasting model was created and tested on 4 different indices: two representing the U.S. markets for large cap and mid-small cap, one for the European markets and one for the Japanese markets. The result was that the model was able to predict which stock style would outperform the next day with a confidence level close to 50%, which is not enough to be a relevant model. This result is in line with the opinion of experts on the subject who are rather pessismistic about succeeding in developing a model capable of predicting returns.

As a result, it was not possible to build a model efficient enough to predict the trend of outperformance since this research has some limitations, but the model could be improved through various suggestions for improvements.
First, the period studied is 25 years, which is relatively short. It would therefore be judicious to increase the period studied if the data are available over a longer period. This will allow the model to improve the in-sample training in order to have a better prediction for the out-of-sample test.
Secondly, it was considered that the release date of the macroeconomic data is the same for each publication and the date used was therefore the latest release date available but it may not always be the same. An idea for improvement is therefore to use the exact and precise dates of data release.
Thirdly, the model works with some monthly and quarterly data. It was considered that these data remain the same throughout the period until a new data is released, which is not representative of reality. It would therefore be possible to calculate a linear growth over this period.
Fourthly, only about 15 data were used. It might be wise to use more to improve the quality of prediction. As advised by experts, demographic and ecological phenomena can be used

as well as MegaTrends and Shumpetarian cycles. Moreover, the study of the European and Japanese markets was obstructed by a lack of access to certain variables, which are therefore missing. In addition, the database for Europe only starts in 99 at the same time as the start of the euro zone, which further limits the use of data. For Japan, some variables start well after the start date of the database, all these missing values have been replaced by the first available value for the variable, which is not representative of the reality.

Finally, the database was selecting randomly the days whose the return of the next day have to be predicted, it might be wise to test it also over a longer period of time: for example predicting the returns of the next month or even the trend of the next year.

Part V

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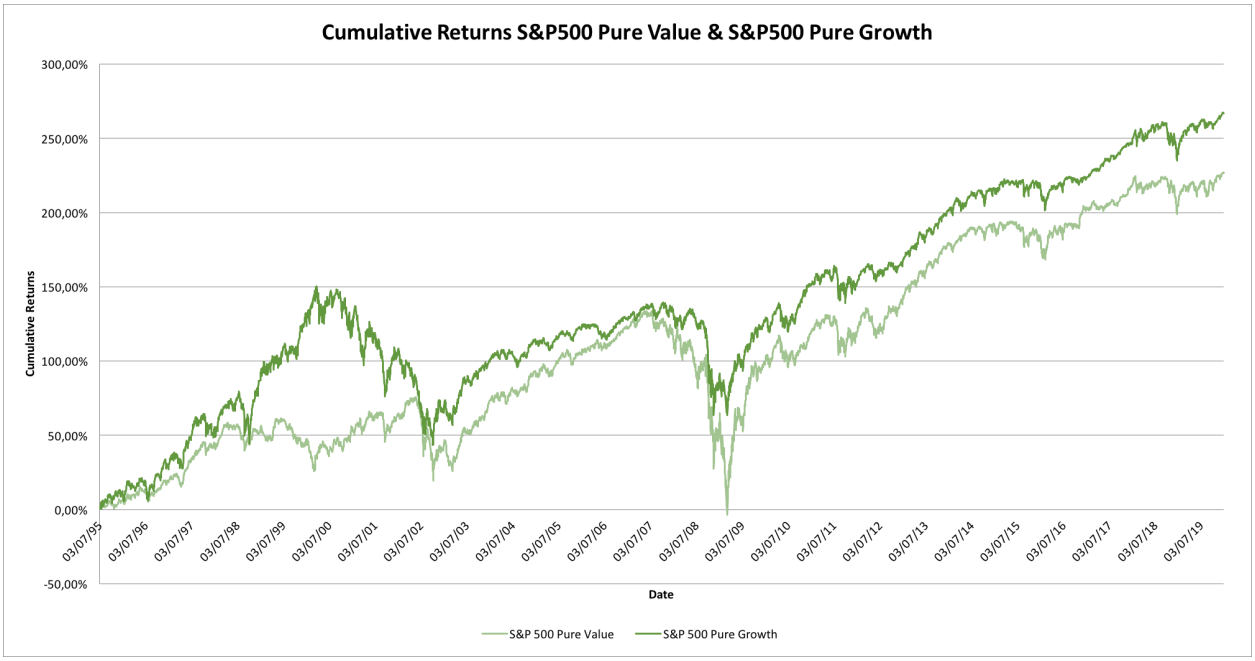
Part VI

Appendix

A Graphs

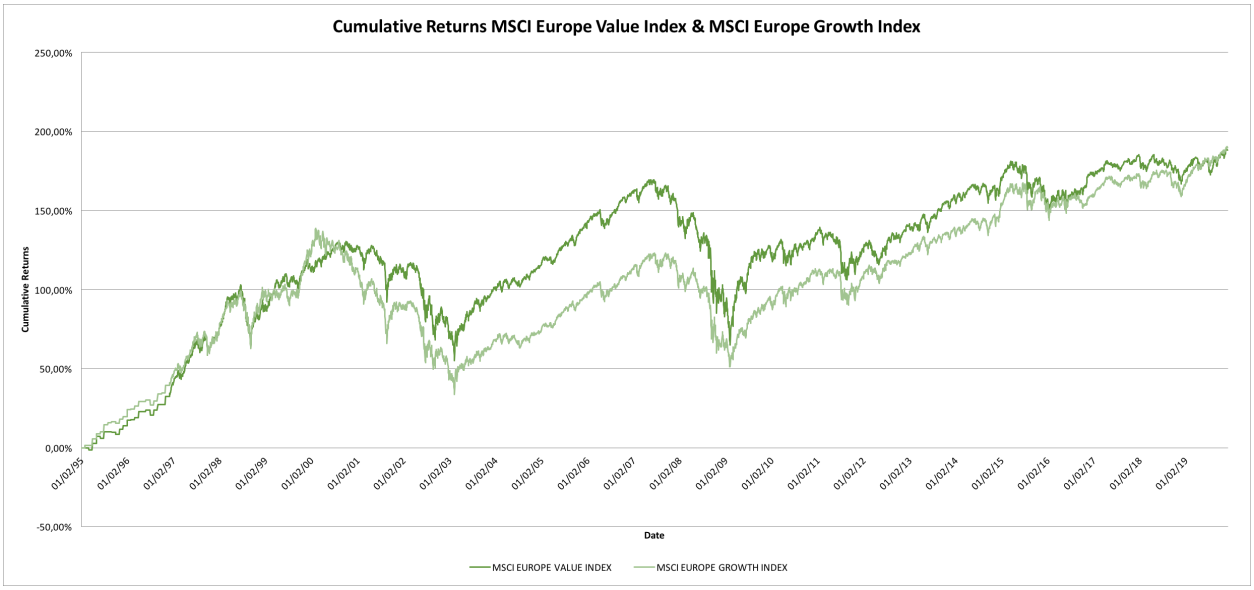
A.1 Cumulative Returns Indices

A.1.1 Cumulative Returns S&P500 Pure Value Index & S&P500 Pure Growth Index



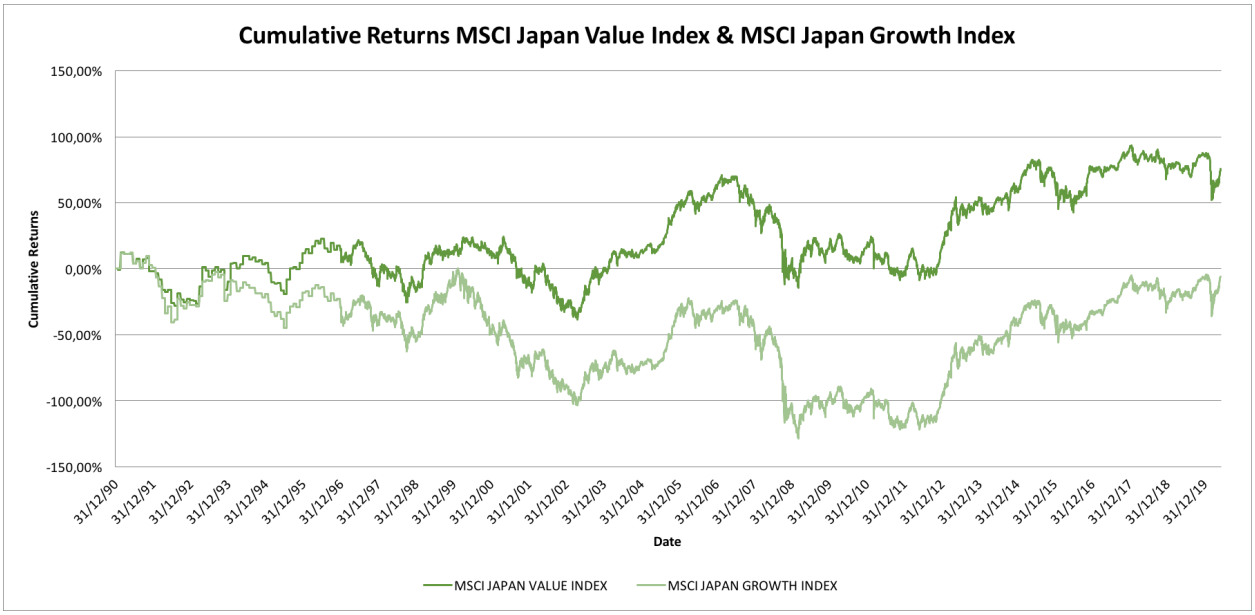
Source: Bloomberg (2020)

A.1.2 Cumulative Returns MSCI Europe Value Index & MSCI Europe Growth Index



Source: Bloomberg (2020)

A.1.3 Cumulative Returns MSCI Japan Value Index & MSCI Japan Growth Index



Source: Bloomberg (2020)

B R Software Outputs

B.1 Subset *Training*

B.1.1 Logistic Regression

```
Call:
NULL

Deviance Residuals:
   Min      1Q  Median      3Q     Max
-1.380  -1.134  -1.041   1.213   1.586

Coefficients:
                    Estimate Std. Error z value Pr(>|z|)
(Intercept)        0.0333555  1.2409327   0.027   0.9786
ConsPrice         -0.0105136  0.0129926  -0.809   0.4184
rGDP               0.0003962  0.0003551   1.116   0.2646
ConsSent          -0.0036962  0.0049702  -0.744   0.4571
VIX               -0.0121520  0.0048331  -2.514   0.0119 *
UnRate             0.1261949  0.0652147   1.935   0.0530 .
BondYield         -0.0213079  0.0747939  -0.285   0.7757
FedRate           -0.0121723  0.0558508  -0.218   0.8275
TreasuryYield     -0.0870513  0.1043463  -0.834   0.4041
DollarExchangeRate  0.0128494  0.0059505   2.159   0.0308 *
Gold               0.0002782  0.0002630   1.058   0.2900
Oil                0.0092856  0.0178192   0.521   0.6023
InflExp           -0.0797577  0.0814188  -0.980   0.3273
rGDPExp           -0.0003359  0.0003951  -0.850   0.3952
GoldFutures       -0.0003166  0.0003350  -0.945   0.3446
OilFutures        -0.0049129  0.0179074  -0.274   0.7838
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 6634.1  on 4794  degrees of freedom
Residual deviance: 6610.0  on 4779  degrees of freedom
AIC: 6642

Number of Fisher Scoring iterations: 4
```

Source: RStudio (3.3.3) [Software] (2020)

B.1.2 Backward Stepwise Regression

Deletion of the variable *FedRate* - AIC : 6640.00

```
Start:  AIC=6641.95
.outcome ~ ConsPrice + rGDP + ConsSent + VIX + UnRate + BondYield +
    FedRate + TreasuryYield + DollarExchangeRate + Gold + Oil +
    InflExp + rGDPExp + GoldFutures + OilFutures

                     Df Deviance    AIC
- FedRate             1   6610.0 6640.0
- OilFutures          1   6610.0 6640.0
- BondYield           1   6610.0 6640.0
- Oil                 1   6610.2 6640.2
- ConsSent            1   6610.5 6640.5
- ConsPrice           1   6610.6 6640.6
- TreasuryYield       1   6610.6 6640.6
- rGDPExp             1   6610.7 6640.7
- GoldFutures         1   6610.8 6640.8
- InflExp             1   6610.9 6640.9
- Gold                1   6611.1 6641.1
- rGDP                1   6611.2 6641.2
<none>                    6610.0 6642.0
- UnRate              1   6613.7 6643.7
- DollarExchangeRate  1   6614.6 6644.6
- VIX                 1   6616.3 6646.3

Step:  AIC=6640
```

Source: RStudio (3.3.3) [Software] (2020)

Deletion of the variable *OilFutures* - AIC : 6638.07

```
.outcome ~ ConsPrice + rGDP + ConsSent + VIX + UnRate + BondYield +
    TreasuryYield + DollarExchangeRate + Gold + Oil + InflExp +
    rGDPExp + GoldFutures + OilFutures

                     Df Deviance    AIC
- OilFutures          1   6610.1 6638.1
- BondYield           1   6610.3 6638.3
- Oil                 1   6610.3 6638.3
- ConsSent            1   6610.6 6638.6
- ConsPrice           1   6610.6 6638.6
- rGDPExp             1   6610.7 6638.7
- GoldFutures         1   6610.9 6638.9
- InflExp             1   6610.9 6638.9
- Gold                1   6611.1 6639.1
- rGDP                1   6611.2 6639.2
- TreasuryYield       1   6611.2 6639.2
<none>                    6610.0 6640.0
- UnRate              1   6613.8 6641.8
- DollarExchangeRate  1   6615.1 6643.1
- VIX                 1   6616.3 6644.3

Step:  AIC=6638.07
```

Source: RStudio (3.3.3) [Software] (2020)

Deletion of the variable *BondYield* - AIC : 6636.34

```
.outcome ~ ConsPrice + rGDP + ConsSent + VIX + UnRate + BondYield +
    TreasuryYield + DollarExchangeRate + Gold + Oil + InflExp +
    rGDPExp + GoldFutures

                     Df Deviance    AIC
- BondYield           1   6610.3 6636.3
- ConsSent            1   6610.6 6636.6
- ConsPrice           1   6610.7 6636.7
- rGDPExp             1   6610.8 6636.8
- InflExp             1   6611.0 6637.0
- GoldFutures         1   6611.0 6637.0
- Gold                1   6611.2 6637.2
- rGDP                1   6611.3 6637.3
- TreasuryYield       1   6611.3 6637.3
<none>                    6610.1 6638.1
- Oil                 1   6613.3 6639.3
- UnRate              1   6613.8 6639.8
- DollarExchangeRate  1   6615.2 6641.2
- VIX                 1   6616.4 6642.4

Step:  AIC=6636.34
```

Source: RStudio (3.3.3) [Software] (2020)

Deletion of the variable *rGDPExp* - AIC : 6634.89

```
.outcome ~ ConsPrice + rGDP + ConsSent + VIX + UnRate + TreasuryYield +
    DollarExchangeRate + Gold + Oil + InflExp + rGDPExp + GoldFutures

                     Df Deviance    AIC
- rGDPExp             1   6610.9 6634.9
- ConsSent            1   6611.0 6635.0
- GoldFutures         1   6611.0 6635.0
- ConsPrice           1   6611.2 6635.2
- InflExp             1   6611.3 6635.3
- Gold                1   6611.4 6635.4
- rGDP                1   6611.4 6635.4
- TreasuryYield       1   6611.5 6635.5
<none>                    6610.3 6636.3
- Oil                 1   6613.4 6637.4
- UnRate              1   6613.8 6637.8
- DollarExchangeRate  1   6615.5 6639.5
- VIX                 1   6617.3 6641.3

Step:  AIC=6634.89
```

Source: RStudio (3.3.3) [Software] (2020)

Deletion of the variable *GoldFutures* - AIC : 6633.39

```
.outcome ~ ConsPrice + rGDP + ConsSent + VIX + UnRate + TreasuryYield +
    DollarExchangeRate + Gold + Oil + InflExp + GoldFutures

                     Df Deviance    AIC
- GoldFutures         1   6611.4 6633.4
- InflExp             1   6611.7 6633.7
- rGDP                1   6611.7 6633.7
- ConsSent            1   6611.8 6633.8
- Gold                1   6611.9 6633.9
- ConsPrice           1   6612.8 6634.8
- TreasuryYield       1   6612.9 6634.9
<none>                    6610.9 6634.9
- Oil                 1   6613.7 6635.7
- UnRate              1   6614.6 6636.6
- DollarExchangeRate  1   6615.5 6637.5
- VIX                 1   6617.4 6639.4

Step:  AIC=6633.39
```

Source: RStudio (3.3.3) [Software] (2020)

Deletion of the variable *Gold* - AIC : 6631.95

```
.outcome ~ ConsPrice + rGDP + ConsSent + VIX + UnRate + TreasuryYield +
    DollarExchangeRate + Gold + Oil + InflExp

                     Df Deviance    AIC
- Gold                1   6611.9 6631.9
- InflExp             1   6612.1 6632.1
- ConsSent            1   6612.5 6632.5
- rGDP                1   6613.0 6633.0
- TreasuryYield       1   6613.1 6633.1
<none>                    6611.4 6633.4
- Oil                 1   6613.8 6633.8
- ConsPrice           1   6614.6 6634.6
- UnRate              1   6614.9 6634.9
- DollarExchangeRate  1   6615.5 6635.5
- VIX                 1   6617.9 6637.9

Step:  AIC=6631.95
```

Source: RStudio (3.3.3) [Software] (2020)

Deletion of the variable *InflExp* - AIC : 6630.76

```
.outcome ~ ConsPrice + rGDP + ConsSent + VIX + UnRate + TreasuryYield +
    DollarExchangeRate + Oil + InflExp

                     Df Deviance    AIC
- InflExp             1   6612.8 6630.8
- ConsSent            1   6612.8 6630.8
- rGDP                1   6613.0 6631.0
<none>                    6611.9 6631.9
- TreasuryYield       1   6614.5 6632.5
- ConsPrice           1   6614.9 6632.9
- Oil                 1   6615.1 6633.1
- DollarExchangeRate  1   6616.2 6634.2
- UnRate              1   6616.6 6634.6
- VIX                 1   6618.2 6636.2

Step:  AIC=6630.76
```

Source: RStudio (3.3.3) [Software] (2020)

Deletion of the variable *ConsSent* - AIC : 6629.31

```
.outcome ~ ConsPrice + rGDP + ConsSent + VIX + UnRate + TreasuryYield +
    DollarExchangeRate + Oil

                     Df Deviance    AIC
- ConsSent            1   6613.3 6629.3
- rGDP                1   6613.9 6629.9
<none>                    6612.8 6630.8
- TreasuryYield       1   6614.9 6630.9
- Oil                 1   6615.1 6631.1
- ConsPrice           1   6615.7 6631.7
- DollarExchangeRate  1   6618.1 6634.1
- UnRate              1   6619.1 6635.1
- VIX                 1   6619.8 6635.8

Step:  AIC=6629.31
```

Source: RStudio (3.3.3) [Software] (2020)

Deletion of the variable *rGDP* - AIC : 6628.98

```
.outcome ~ ConsPrice + rGDP + VIX + UnRate + TreasuryYield +
    DollarExchangeRate + Oil

                     Df Deviance    AIC
- rGDP                1   6615.0 6629.0
- TreasuryYield       1   6615.3 6629.3
<none>                    6613.3 6629.3
- Oil                 1   6616.4 6630.4
- ConsPrice           1   6617.0 6631.0
- DollarExchangeRate  1   6618.1 6632.1
- VIX                 1   6619.8 6633.8
- UnRate              1   6623.2 6637.2

Step:  AIC=6628.98
```

Source: RStudio (3.3.3) [Software] (2020)

Deletion of the variable *TreasuryYield* - AIC : 6628.97

```
.outcome ~ ConsPrice + VIX + UnRate + TreasuryYield + DollarExchangeRate +
    Oil

                     Df Deviance    AIC
- TreasuryYield       1   6617.0 6629.0
<none>                    6615.0 6629.0
- Oil                 1   6619.7 6631.7
- VIX                 1   6621.5 6633.5
- UnRate              1   6623.2 6635.2
- DollarExchangeRate  1   6624.9 6636.9
- ConsPrice           1   6626.1 6638.1

Step:  AIC=6628.97
```

Source: RStudio (3.3.3) [Software] (2020)

Final model of the Backward Stepwise Logistic Regression - AIC : 6629

```
.outcome ~ ConsPrice + VIX + UnRate + DollarExchangeRate + Oil

                     Df Deviance    AIC
<none>                    6617.0 6629.0
- Oil                 1   6620.7 6630.7
- VIX                 1   6623.9 6633.9
- UnRate              1   6624.2 6634.2
- DollarExchangeRate  1   6625.0 6635.0
- ConsPrice           1   6627.7 6637.7
```

Source: RStudio (3.3.3) [Software] (2020)

B.1.3 Summary of the final model

```
Call:
NULL

Deviance Residuals:
   Min      1Q  Median      3Q     Max
-1.259  -1.138  -1.052   1.212   1.515

Coefficients:
                    Estimate Std. Error z value Pr(>|z|)
(Intercept)        -0.686843   0.453173  -1.516  0.12961
ConsPrice          -0.004923   0.001513  -3.254  0.00114 **
VIX                -0.010837   0.004140  -2.617  0.00886 **
UnRate              0.062626   0.023384   2.678  0.00740 **
DollarExchangeRate  0.011412   0.004036   2.827  0.00469 **
Oil                 0.003360   0.001740   1.931  0.05349 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 6634.1  on 4794  degrees of freedom
Residual deviance: 6617.0  on 4789  degrees of freedom
AIC: 6629

Number of Fisher Scoring iterations: 4
```

Source: RStudio (3.3.3) [Software] (2020)

B.2 Subset *Test*

Predictions

```
> pred <- predict(reg1, newdata = test)
> print(table(pred))
pred
   0    1
1321  276
```

Source: RStudio (3.3.3) [Software] (2020)

Confusion Matrix

```
Confusion Matrix and Statistics

          Reference
Prediction   0   1
         0 712 609
         1 128 148

               Accuracy : 0.5385
                 95% CI : (0.5137, 0.5632)
    No Information Rate : 0.526
    P-Value [Acc > NIR] : 0.1642

                  Kappa : 0.0445
 Mcnemar's Test P-Value : <2e-16

            Sensitivity : 0.19551
            Specificity : 0.84762
         Pos Pred Value : 0.53623
         Neg Pred Value : 0.53899
             Prevalence : 0.47401
         Detection Rate : 0.09267
   Detection Prevalence : 0.17282
      Balanced Accuracy : 0.52156

       'Positive' Class : 1
```

Source: RStudio (3.3.3) [Software] (2020)

C European Macroeconomic Data

Equivalent of ConsPrice

The variable representing the inflation in Europe is the Consumer Price Index of the Eurozone for all items. This data comes from the Federal Reserve Economic Data (2020b) : **Consumer Price Index: All items: Total: Total for the Euro Area**, is monthly and has been lagged by 1 month and 10 days to be used when it is publicly disclosed.

Equivalent of rGDP

The quarterly real GDP of Europe used for the study is also available at /citefred and is registered under: **Real Gross Domestic Product for European Union (15 countries)**. This data has been delayed by 8 months and 20 days to be taken into account when it is published publicly.

Equivalent of ConsSent

The monthly European consumer confidence is represented by **Consumer Opinion Surveys: Confidence Indicators: Composite Indicators: OECD Indicator for the Euro Area**, data available at Federal Reserve Economic Data (2020b). This variable has been lagged to the 10th day of the following month in order to take it into account when it is made public.

Equivalent of VIX

The volatility index used to represent volatility in the European market is the **Euro Stoxx 50 Volatility Index**. The data come from Bloomberg (2020) and the index measures the volatility in the Eurozone. This data is traded daily.

Equivalent of UnRate

The European unemployment rate is represented by the data **Eurostat Unemployment Eurozone** available on Bloomberg (2020). This data is published on a monthly basis and has been delayed by 1 month to be taken into account when the data is publicly released.

Equivalent of BondYield

The corporate bond yield of European companies is represented by the **Bloomberg Barclays Pan-European High Yield Total Return Index** and measures the non-investment grade, fixed-rate corporate bond market. This data is published daily and comes from Bloomberg (2020).

Equivalent of FedRate

The interest rate set by the central bank, in this case the ECB, is the **ECB Main Refinancing Operations Announcement Rate**. This data is available on Bloomberg (2020) and is published daily.

Equivalent of TreasuryYield

The data used to represent European sovereign bond yields is the **Bloomberg Barclays Euro-Aggregate Treasury 7-10 Year ISMA Yield to Worst**. This data is published daily and is available on Bloomberg (2020).

Equivalent of DollarExchangeRate

To replace the dollar exchange rate, the **Euro/Dollar Exchange Rate** has been chosen to represent Europe. This data is available on Bloomberg (2020) and is published daily.

Equivalent of Gold

The price of gold in the Euro Area is represented by the **Gold Fixing Price 3:00 P.M. (London time) in London Bullion Market, based in Euros**. This data is published

daily and is available on the Federal Reserve Economic Data (2020b) website.

Equivalent of Oil

The price of crude oil in the euro zone is represented by the **Crude Oil Prices: Brent - Europe**. This data is published daily and is available on the Federal Reserve Economic Data (2020b) website.

D Japan Macroeconomic Data

Equivalent of ConsPrice

The variable representing the inflation in Japan is the Consumer Price Index of the Japan for all items. This data comes from the Federal Reserve Economic Data (2020b) : **Consumer Price Index of All Items in Japan**, is monthly and has been lagged by 1 month and 10 days to be used when it is publicly disclosed.

Equivalent of rGDP

The quarterly real GDP of Japan used for the study is also available at /citefred and is registered under: **Real Gross Domestic Product for Japan**. This data has been delayed by 6 months and 8 days to be taken into account when it is published publicly.

Equivalent of ConsSent

The monthly Japanese consumer confidence is represented by **Consumer Opinion Surveys: Confidence Indicators: Composite Indicators: OECD Indicator for Japan**, data available at Federal Reserve Economic Data (2020b). This variable has been lagged to the 10th day of the following month in order to take it into account when it is made public.

Equivalent of VIX

The volatility index used to represent volatility in the Japanese markets is the **Nikkei Stock Average Volatility Index**. The data come from Bloomberg (2020) and is traded daily.

Equivalent of UnRate

The Japanese unemployment rate is represented by the data **Unemployment Rate: Aged 15-64: All Persons for Japan** available on the Federal Reserve Economic Data (2020b) website. This data is published on a monthly basis and has been delayed by 1 month and 10

days to be taken into account when the data is publicly released.

Equivalent of BondYield

The corporate bond yield of Japanese companies is represented by the **Bloomberg Barclays Asian-Pacific Japan Corporate Yield To Worst**. This data is published daily and comes from Bloomberg (2020).

Equivalent of FedRate

The interbank interest rate set at which banks on the London money market are prepared to lend funds in Japanese yen is the **Japanese yen LIBOR interest rate**. This data is available on Bloomberg (2020) and is published daily.

Equivalent of TreasuryYield

The data used to represent European sovereign bond yields is the **Bloomberg Barclays Euro-Aggregate Treasury 7-10 Year ISMA Yield to Worst**. This data is published daily and is available on Bloomberg (2020).

Equivalent of DollarExchangeRate

To represent the local currency, the exchange rate of the Yen against the dollar was chosen. The data comes from Federal Reserve Economic Data (2020b) and is called **Japan / U.S. Foreign Exchange Rate**. The data is published daily.

Equivalent of Gold

The price of gold in Japan is represented by the **Gold Prices in Yen**. This data is published daily and is available on Bloomberg (2020).

Equivalent of Oil

The price of crude oil in Japan is represented by the **Crude Oil in Yen**. This data is published daily and is available on Bloomberg (2020).

Equivalent of GoldFutures

The daily **Gold Futures** have been downloaded in yen from Bloomberg (2020).

Equivalent of OilFutures

The daily **Oil Futures** have been downloaded in yen from Bloomberg (2020).

E Interviews

E.1 Wim Antoons - Head of Portfolio Desk at Portolani

1 – How would you define Value and Growth Stocks?

Value Stocks are defined as stocks that offer a margin of safety, meaning the price of the stock is lower than the intrinsic value of the stock. They are cheaper than Growth Stocks. Factors to measure Value Stocks are low price to earnings, low price to book, low price to sales and low price to (free) cash flow. Further on, they have a high shareholder yield (dividend yield + share buy backs). They have generally higher debt to capital than Growth Stocks. Growth Stocks by definition grow more than Value Stocks and are thus more expensive. Growth factors are high earnings growth, high return on equity, high enterprise value to EBITDA. Further on, higher return on capital employed.

2 – On which criteria would you rank Value and Growth Stocks?

See the factors above. These are the most common factors to measure valuation and growth.

3 – How would you explain the Value Premium? What do you think of this theory?

The value premium is the outperformance generated by Value Stocks over the equity market. Like other premiums described in literature, they do not work all the time. Value has outperformed from 1974 to 2007 (not all the time) and has underperformed since then. The theory is still intact, we have seen periods of underperformance of value (1999) that were the same, but now the duration is much longer. It is strange that people declare value premium death, growth has underperformed much more than the other way around. In a recent article of Research Affiliates, a t stat test was done to see whether the value premium was the result of luck instead of skill. A T stat of 2 or above indicates skill, under 2 is luck. The t stat was above 2 for the period 1974 – 2019.

4 – How would you explain investors' preference for Value Stocks before the financial crisis of 2008? And the preference for Growth Stocks since this crisis?

A theory often said that the decline in interest rates was better for growth than value, because growth stocks have a longer duration and thus profit more than value from declining interest rates. While this may be partly true, I think it does not entirely true, because interest rates peaked in 1981 and started to decline since then (exception 1994). In many of these years, value beat growth stocks. A certain influence came from higher interest in passive investing. If investors massively invest in capitalisation weighted indices, then the same stocks because more expensive (growth stocks) and are bought more, and thus become even more expensive. The inflows in ETF's declare also the preference of growth versus value. Last reason is that rising stocks attract money, much more than declining stocks. So momentum investors all chase the same group of stocks, being large cap growth.

5 – In your opinion, which macroeconomic data have a significant impact on the performance of Value and Growth Stocks? In other words, which economic cycles favour the outperformance of Value Stocks on the one hand and Growth Stocks on the other?

Value generally outperforms in crisis and surely when the crisis ends. Growth stocks generally outperform in normal and rising markets. Today, it is more driven by the sectors allocation. Growth sectors (IT, consumer staples, healthcare) are in favour, value sectors (energy, banks, utilities) are out of favour.

6 – What do you foresee for the future regarding the performance of Value and Growth Stocks? Why ?

Research shows that the value growth spread has never been this high (100 percentile following new research from AQR). In all asset classes depends expected returns from the actual valuation. So the expected return from value is much higher than the expected return from

growth. Further on, we are clearly for growth in an exaggeration phase. Most P/E are very expensive (30 – 35 for growth funds is the new normal), but are much higher than in history. Research also showed that the earnings growth of growth and 2019 was lower for growth than for value stocks, but investors kept chasing growth stocks. This can not continue forever. Stocks like Zoom (P/E 2000) and Tesla (P/E 5100) are good examples of the narratives supporting the leadership of growth. All factors, valuation, concentration of stocks in S&P500, value growth spread point in one direction : the future will be different.

7 – If you should invest in one of these two stocks, which one would you choose now? Why ? On what do you base your reasoning?

Value, based on the highest expected return. Instead of growth, you can chose also some quality funds, at a lower valuation than growth, but more expensive than value. The highest expected returns are in small cap value and emerging markets value.

8 – Do you think a statistical model could predict their future performance? Why? Under what assumptions?

No. A lot of research has been done on style timing, and it simply does not work. People are very bad in forecasting, but on the other hand very good in pattern recognition. So dumb investors look at graphs and try to predict the movements in the market by looking at the past. A balanced approach value / growth and a diversification is much better than trying to time the market or style cycles.

9 – Do you think that the small cap or large cap characteristics of these stocks can impact their performance? How and why?

There is also a small cap premium, meaning that small caps outperform large caps in the long run. This is because these stocks are less followed by analysts, the companies are more flexible to change their business model, and these companies can grow faster (low of large

numbers). Small caps do however underperform in crashes like now. Also, small cap value is a much better option than small cap growth, that loses money in the long run. Last, IPO's a bad investments, people lose money by investing in IPO's (Jay ritter).

10 – Do you think that the geographical area can have an impact on the performance of Growth Stocks and Value Stocks ? Especially for U.S., European and Japanese markets. Do you think investor behavior differs between these zones?

Some countries are more value than other countries, but I never found an explanation why this happens. In general, value works in every region, but it works for example better in Japan. It works also better in emerging countries, even if these countries are growing faster.

E.2 Laurent Deconninck - Head of Advisory & UHNW Clients at Candriam

1 – How would you define Value and Growth Stocks?

Value Stocks are defined as having more attractive intrinsic value ratios, either relative to other stocks or relative to their own historical average. Criteria such as P/B, P/E, EV/EBITDA can be used. The Growth Stocks will show much higher % sales growth, and therefore much higher average P/Es. Typically the technology sector will be represented, but also sectors such as new consumption patterns,...

2 – On which criteria would you rank Value and Growth Stocks?

P/E, P/B, EV/EBITDA, EV/Sales, Sales growth, Earnings growth & EPS growth.

3 – How would you explain the Value Premium? What do you think of this theory?

Not sure if this theory still applies. In a "disruptive" period when entire sectors of the economy are undergoing major adjustments, the risk of "value trap" seems to me to be greater than the advantage of "value premium". There is thus a gradual migration of shares whose business models will eventually be challenged by the digital incursion. Banks for example.

4 – How would you explain investors' preference for Value Stocks before the financial crisis of 2008? And the preference for Growth Stocks since this crisis?

For the 2001-2008 value cycle, I see there essentially the consequences of the bursting of the 2000-2001 technology bubble, with a "safe haven" status. Warren Buffet then got his revenge in his desire to avoid techno. China and the emerging markets are also beginning their exponential expansion, which implies an explosion in equipment needs, typically represented in the "value" sectors. After 2008, tech stocks benefited from the convergence of various factors not necessarily linked to the financial crisis itself. For example, acceleration of the

speed of processors (Moore's law), biotechnology/technology convergence (cf. DNA sequencing which requires high calculation speeds), drastic reduction in the cost of equipment linked to the globalisation of trade, miniaturisation, internet expansion, reduction in the cost of data subscriptions, etc. Some technology companies were also less "capital intensive", which favoured them in the context of the credit crunch.

5 – In your opinion, which macroeconomic data have a significant impact on the performance of Value and Growth Stocks? In other words, which economic cycles favour the outperformance of Value Stocks on the one hand and Growth Stocks on the other?

Growth = exponential megatrends with Schumpeterian cycles ; Value = Roosevelt's New Deal equipment phases. EM before 2008 and possibly post-2020 infrastructure.

6 – What do you foresee for the future regarding the performance of Value and Growth Stocks? Why ?

Value should be in a catch-up phase due to massive infrastructure spending, the support from central banks, the state tax policy and the revision of the way multinationals are taxed.

7 – If you should invest in one of these two stocks, which one would you choose now? Why ? On what do you base your reasoning?

Air Liquid for transition to hydrogen powered travel and Alstom for the electrification. Convergence between the Recovery Fund / Green Deal program.

8 – Do you think a statistical model could predict their future performance? Why? Under what assumptions?

I don't think so.

9 – Do you think that the small cap or large cap characteristics of these stocks can impact their performance? How and why?

Obviously. Small Caps will be more sensitive to the credit cycle and labour market conditions. Small Caps can also be embryos of new nuggets, even though the influence of private equity means that IPOs will occur later and later in the company cycle.

10 – Do you think that the geographical area can have an impact on the performance of Growth Stocks and Value Stocks ? Especially for U.S., European and Japanese markets. Do you think investor behavior differs between these zones?

The U.S. will typically have a reputation for providing better conditions for technology companies to expand. Access to capital will be easier and typically cheaper than elsewhere because of the greater diversity of private equity players, hedge funds and specialised funds.

E.3 Olivier Hanse - Director in the board of financial holdings and investment funds

Statements from the phone conversation.

1 – How would you define Value and Growth Stocks?

It is a school classification that would have the merit of being revisited. It is indeed a rather simplistic dichotomy. A company needs growth to achieve value. The current definition is therefore a little outdated and should be reviewed. For example, the majority of people classify Amazon and Netflix in the Growth category, whereas Olivier would rather put them in Value thanks to their business models that target useful data for the future.

2 – On which criteria would you rank Value and Growth Stocks?

Olivier takes into account growth elements in the calculation of PEGs and PERs. He uses the financial ratios for his analysis but finds that other data must also be taken into account, such as market share growth, growth of big data, etc. Indeed, a known graph shows that Amazon's revenue growth is negative because Amazon makes a lot of expenses. On the other hand, its value is increasing thanks to its market share.

3 – How would you explain the Value Premium? What do you think of this theory?

Olivier had no idea how to explain Value Premium. According to him, we are living in troubled times. So this is certainly due to the safe-haven mechanism. It would therefore be interesting to compare the values of gold, silver and real estate at the same time.

4 – How would you explain investors' preference for Value Stocks before the financial crisis of 2008? And the preference for Growth Stocks since this crisis?

Because growth is in constant evolution and there is a fall of traditional companies such as for example American Airlines.

5 – In your opinion, which macroeconomic data have a significant impact on the performance of Value and Growth Stocks? In other words, which economic cycles favour the outperformance of Value Stocks on the one hand and Growth Stocks on the other?

Business cycles are not so interesting anymore. According to Olivier, we need to focus on the Megatrends. Indeed, they redesign the future of the economy. In these Megatrends, there are four of them that concern technology: artificial intelligence, big data, blockchains and virtual/augmented reality. So there is a technological determining factor even if it is important to also take into account the macroeconomic data. Africa will also experience its hour of glory in the next twenty years or so. It is therefore important to take demographic and ecological phenomena into account.

6 – What do you foresee for the future regarding the performance of Value and Growth Stocks? Why ?

The value of high-growth companies will increase. Especially if technological and societal parameters are taken into account. It is the companies with promising schemes such as MPESA that will succeed because after having experienced growth, they will know the value.

7 – If you should invest in one of these two stocks, which one would you choose now? Why ? On what do you base your reasoning?

Growth is necessary before value is reached. If you look at the 500 largest companies in the world, of those that were there when the ranking was created, there is only one left. Olivier would therefore rather invest in growth stocks even if there is a greater risk of overvaluation because this risk can be diversified by investing in several Growth Stocks.

8 – Do you think a statistical model could predict their future performance? Why? Under what assumptions?

Quantitative methods are no longer so popular and there is still a statistical bias. So Olivier doesn't think this is possible.

9 – Do you think that the small cap or large cap characteristics of these stocks can impact their performance? How and why?

According to Olivier, a company needs to be agile in order to survive because its decision-making and the integration of new parameters will be easier. This facility to be agile is rather dedicated to small caps. So Olivier thinks that small caps have an advantage over large caps even if the latter have a greater facility to keep their values stable.

10 – Do you think that the geographical area can have an impact on the performance of Growth Stocks and Value Stocks ? Especially for U.S., European and Japanese markets. Do you think investor behavior differs between these zones?

According to Olivier, there are two markets that are promising: the African market and the Asian market. Inevitably, the companies that will succeed will be those with a more important technological factor. Japan is, according to him, at the end of its growth and we should rather focus on India or China which have a growth potential due to the high number of people living in poverty. Therefore, the Japanese market is no longer interesting in terms of Growth Stocks.

E.4 Alexis Marchal - PhD Candidate in Finance at EPFL

1 – How would you define Value and Growth Stocks?

Growth Stocks are generally those companies that have a growth rate above the market. Value Stocks, on the other hand, are companies with a low growth rate and trade at a low price in relation to their balance sheet value.

2 – On which criteria would you rank Value and Growth Stocks?

The most common criterion is to say that Growth Stocks are companies with a "low book-to-market ratio" or a "high price/earning ratio". Value Stocks will have a high book-to-market ratio or a low P/E.

3 – How would you explain the Value Premium? What do you think of this theory?

Premium value is more of an empirical observation than a theory. It is a fact that has been observed and subsequently several theories have been developed to explain it. I don't agree with behavioural explanations, so I'm going to go for a rational explanation. If the agents are rational, a riskier stock should generate a higher return on average. Starting from there, this suggests that the Value Stocks that have generated higher returns have done so because they are riskier. However, the HML (high minus low) portfolio is only a portfolio and not a risk factor in itself (it is only a proxy for a risk factor). So the whole problem is to find out what is this "risk" that is priced in the Value Stocks. It is not necessarily a risk of variance and there is no theory that explains precisely why Value Stocks are riskier. It may be related to other risks such as kurtosis risk, skewness, or other higher momentum. One theory that may be useful in this case is Merton's ICAPM (1973) which states that in addition to the market portfolio, as many factors are needed to explain the cross section of returns as there are stochastic "state variables". If the HML is a valued factor, it just means that this variable is highly correlated with a state variable that is important for investors. In other words, the

HML factor is correlated with a risk that is seen as important to investors (which is in their stochastic discount factor). Empirically, it seems that 3 types of risk: dispersion, downside, and tail risk are enough to explain the vast majority of the varia1on of returns (see Schneider (2019) An anatomy of the market return).

4 – How would you explain investors' preference for Value Stocks before the financial crisis of 2008? And the preference for Growth Stocks since this crisis?

I'm not familiar with this observation. However, if this is really the case, I would try to see if the type of investor would not have changed after 2008. Maybe before 2008 there was one type of investor (e.g. Hedge Funds) and they preferred Value Stocks, whereas after 2008 these investors may have disappeared (went bankrupt for example) and the remaining investors prefer Growth Stocks. Or the universe of investors has not changed but there has been a shift in risk appetite. After 2008, we realized that Value Stocks were too risky and investors preferred to disinvest. Be careful, what I have written for this question is not based on any data or observations. It's just an idea that came to me.

5 – In your opinion, which macroeconomic data have a significant impact on the performance of Value and Growth Stocks? In other words, which economic cycles favour the outperformance of Value Stocks on the one hand and Growth Stocks on the other?

The distribution of returns from Growth Stocks often has a negative skew. That is to say that in periods of expansion, Growth Stocks will have an exceptional performance (many positive returns) but from time to time when a crisis arrives their performance will be extremely bad. In contrast, Value Stocks are more in defensive sectors (less subject to the fluctuations of the economic cycle).

6 – What do you foresee for the future regarding the performance of Value and Growth Stocks? Why ?

I am expecting better performance for Growth Stocks as a result of the corona crisis. The simple reason for this is that a lot of Growth Stocks are in the technology sector and this sector will benefit from the fact that people are forced to work remotely. Social distanciation has driven the demand for conferencing platforms (such as zoom, slack), computing cloud services or online shopping rather than in physical stores.

7 – If you should invest in one of these two stocks, which one would you choose now? Why ? On what do you base your reasoning?

Growth Stocks (technology) for the reasons explained above.

8 – Do you think a statistical model could predict their future performance? Why? Under what assumptions?

Predicting volatility is (relatively) easy but predicting the returns themselves is extremely difficult. The reason is relatively simple. The compensation that investors receive for the risk of variance is small (and it is precisely this part that can be predicted and is persistent. Since the predictable part is weakly represented in the returns, they are difficult to predict. Most of the compensation received for holding stocks comes from the risk of crashing, which is not easily predictable. Again this comes from Schneider (2019) "An anatomy of the market return". Then I don't know exactly what you mean by a statistical model? Regression? PCA? Elastic-net? Random forest? Anything else? I personally used Long-Short Term Memory neural networks for this exercise and even with this technology it is difficult (but not impossible). In any case, it is necessary to avoid over-fitting and to test the out-of-sample predictions.

9 – Do you think that the small cap or large cap characteristics of these stocks can impact their performance? How and why?

Yes, because it is well known that the SMB factor is priced. Smaller companies are riskier and therefore have to offer a higher return on average. However, with the COVID 19 crisis, I am convinced that the smallest companies will have more difficulties and that it is precisely the big cap companies that show a better performance (they generally have more cash in reserve to survive a temporary crisis and will still be alive afterwards to recover the market shares of the smallest companies that have gone bankrupt in the meantime).

10 – Do you think that the geographical area can have an impact on the performance of Growth Stocks and Value Stocks? Especially for U.S., European and Japanese markets. Do you think investor behavior differs between these zones?

Yes, in the US they have a more entrepreneurial spirit and I expect that the Growth Stocks there will find it easier to find capital to finance their projects and therefore grow faster.

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