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IMPACT OF CULTURAL FACTORS ON INVESTMENT STRATEGIES

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As a student in international management majoring in finance, I came up with the idea that culture must have an impact on investment behavior which could be measured using an econometric model. Since I always had an interest in culture and financial markets, I wanted to combine both in my Master's thesis. Both during my CEMS curriculum and my prior education in marketing, I discovered many different cultures, at home and abroad. I will always be thankful for this.

In order to complete this thesis I had to navigate through different topics and read a large number of research, which was very stimulating and enlightening.

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“If, as argued by the practitioners of behavioral finance, individuals have psychological biases that matter for finance, it would be surprising that individuals' view of the world as determined by their culture does not matter for how they view and act in financial markets.”

(Stulz and Williamson, 2003 p.347)

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INTRODUCTION

CONTEXT

In the context of neoclassical economics, rationality is the main assumption regarding *Homo œconomicus*' behavior. The theoretical framework is based on the hypothesis that economic decisions are made efficiently through a rational effort to maximize utility, which, for uncertain outcomes, is probabilistically conceptualized through Bayesian maximization of expected utility (Von Neumann & Morgenstern, 1947). Rationality implies optimization and thus, rational decision-making involve Cartesian computations in which there is a single set of solutions that is common to all. However, the process leading to this best option has been recently criticized on the ground of there being multiple perceptions of alternatives which cannot also leads to a single outcome. Behavioral finance was born. Kahneman and Tversky (1979)¹ are considered as the pillars of this new discipline, presenting an alternative to robotic Bayesian probabilities as a means of choice. Prospect theory postulates decision-making is based on the probable value of losses and gains, instead of the expected outcome, because of the human tendency to use heuristics to process choices after having framed the alternatives through bias. While behavioral economics enlightened the economic discipline with ideas based on psychology in addition to standard microeconomics, some of its theories, such as the aforementioned prospect theory, have been applied slowly to economics because of the additional research difficulties to frame and extrapolate personal perspectives (Barberis, 2013).

Meanwhile, finance as a discipline benefited from the contribution of transversal fields of research such as psychology, sociology and neurology that complement traditional economics in the explanation of paradoxes. The addition of new areas of research has led the path to behavioral finance. Behavioral finance has been primary aimed at investigating discrepancies regarding both market anomalies (e.g., stock's returns after dividend distribution) and puzzling topics in corporate finance (e.g., conglomerates performance). By doing so, behavioral finance brought to notice the impact of the overconfidence trap, the long-short

¹ Kahneman and Tversky (1979) work on the prospect theory is at the fundament of behavioral economics. Originally titled Prospect Theory: An Analysis of Decision under Risk, the paper is considered as a "Seminal paper in behavioral economics" by peers (Shafir & LeBoeuf, 2002). Kahneman and Tversky received the Nobel Prize in 2002.

fallacy and home bias on investment (e.g., French and Poterba, 1991; Tesar and Werner 1995; Chui, Titman & Wei, 2010).

As each field of research sees similar topics from their own point of view, which proceeds from their own definitions, why would not behavioral finance be seen as a multi-focal point of view, with regard to cultural differences and their impact on perception and behavior? It is clear that home bias has a subjective component that can be only objectivized by decomposing cultural component such as the longitudinal proximity, historical similarity and language commonality of countries that mainly underlies a notion of trust (Guiso, Sapienza & Zingales, 2006). Similarly, the long-short fallacy and overconfidence mainly arise from less perceivable components of cultures also known as cultural constructs (e.g., Lui, Lui & Ma, 2011).

As Kroeber and Kluckhohn (1952) worked on an anthropological summary to compile the list of their 164-culture definitions: “Culture consists of patterns, explicit and implicit, of and for behavior acquired and transmitted by symbols, constituting the distinctive achievements of human groups, including their embodiment in artifacts; the essential core of culture consists of traditional (i.e., historically derived and selected) ideas and especially their attached values; culture systems may, on the one hand, be considered as products of action, on the other, as conditional elements of future action.” Hofstede, whose cultural approach of psychology led him to suggest quantitative criteria to define, measure and compare country’s culture, based his approach on the previous anthropologic definition. Hofstede (1980) describes a 6-factors framework to model cultural differences. Among them, individualism has been regularly employed by finance behaviorists in order to understand different biases (i.e., long-short fallacy and overconfidence trap) across countries (e.g., Beckmann, Menkhoff & Suto, 2008; Chui *et al.*, 2010; Chang & Lin, 2015). Although this framework has been regularly used in user discipline, its use had been limited in the finance literature (Keswani, Miguel & Ramos, 2014).

PROBLEM STATEMENT AND RESEARCH ISSUES AND SUB-ISSUES

Thus, keeping in mind rational tactics, it is legitimate to wonder how culture can impact the performance of investment strategies. In order to tackle this general question, the thesis, which will mainly be based on behavioral finance through the prism of culture, will be presented in two parts. The first part draws up a theoretical background through the review

of scientific papers. The second part tests through empirical analysis whether different investment strategies have consistently different performances across countries. Both the theoretical and the empirical parts are fragmented into 3 main research topics that are going to be developed throughout this thesis, respectively in the first, second and third chapter of each part (see Figure 1):

- Which decisive factors, other than standard ones, from traditional finance framework, determine investment strategies performances?
- How do cultural factors explain investment strategies?
- What are the behavioral differences and similarities between investors from different countries?

FIGURE 1: MIRRORING OUTLOOK OF RESEARCH SUB-ISSUES INTO THE THEORETICAL AND EMPIRICAL PARTS



In the theoretical part, the first chapter will define and present the traditional framework of portfolio management theory. Therefore, first rationality will be defined along with its implications in traditional economics theories and finance frameworks, and then modern portfolio theory will be introduced, with a presentation of risk-based portfolios which will be used later in this thesis. The second chapter will pinpoint the limits of standard finance theory

and explain why it is not entirely rational to assume *Homo æconomicus* employs the classical rational decision-making process through the presentation of the evolution from standard economics to behavioral finance theory. On the one hand this chapter will introduce first the foundation of behavioral finance and second the heuristics and biases that impact investors and financial markets. Finally, in the last part, cultural factors will be shown to be determining with respect to the allocation and performance of investment strategies. To this end, first we will define the concept of culture. Second, a review of current theories involving culture and investment strategies will be presented. Third, we will emphasize the difference in risk perception across culture. Finally, we shall conclude that culture influences investment strategies.

In the empirical part, the first chapter scrutinizes the econometric model and data used, first presenting the research method and then the research design. The second chapter presents the outcomes from the naïve and the 3 risk-based investment strategies and 46 countries tested by the means of 5 panels and regressions. Finally, the third chapter closes the gap between the empirical results and previous theoretical research.

PURPOSE OF THE RESEARCH

The unique feature of this work is to base the cultural approach upon 4 different investment strategies^{2 3} that each deals with different concepts of risk-based equity portfolio⁴ in addition

² This thesis builds its econometric model on previous empirical studies of volume, volatility and momentum profits (Chui, Titman & Wei, 2010) with 6 additional countries that include the African continent. Besides, the portfolio strategies used in the analysis will be based on Guilmin (2015) work with the construction of 3 risk-based portfolios, namely minimum variance, equal risk contribution and maximum diversification, per country, in addition to a naïve portfolio. The cultural benchmark will be computed upon Hofstede (2010) cultural dimension indexes.

³ The portfolio optimization strategies used in this thesis are based on Guilmin (2015) risk-based approach and applied to another research project (i.e., the paper aims to use risk-based strategies in timing strategies while this thesis is about discovering anomalies related to culture in investment strategies). Besides, the risk-based and naïve portfolio of each country will be analyzed through different angles to see if culture influences consistently performance of investment strategies.

⁴ Risk-based strategies are newly used in the asset management industry and correspond to asset managers' expectation as it will be mentioned in Part 1, 1.4. Portfolio Construction Strategies p. 20.

to use the naïve portfolio diversification. Therefore risk-appreciation philosophy of each portfolio is different. The first strategy, global minimum variance portfolio, consists in minimizing the total volatility of the portfolio. This portfolio presents several advantage, the most important one being the minimum variance portfolio are on the efficient frontier without having the drawbacks of mean-variance portfolio in term of expected return forecasts. The second strategy equal risk distribution portfolio, also known as risk parity portfolio, optimization makes sure all the asset of a portfolio share the same risk. It is interesting to notice this method lies between the global minimum variance portfolio and the naïve diversification. The third strategy, maximum diversification outperform the other risk-based portfolio when returns are uncertain (Clarke, de Silva & Tholey, 2011). Finally the fourth used strategy, the naïve diversification is the most heuristic one because it doesn't consider return nor risk. This strategy is still of interest because of its popularity among investor (Bernartzi & Thaler, 2001; Chow, Hsu, Kalesnik & Little, 2011). Besides, those three risk-based investment combinations are not without any advantages. Indeed, the minimum variance, equal risk distribution and maximum diversification portfolios, as part of risk-based strategy, provide better return than equiponderate portfolio with lower risks (Guilmin, 2015)⁵.

LIMITS & SCOPE

Several limits can be found in the study of culture and its impact on investment performances in the theoretical review and empirical analysis.

The theoretical review shows some imperfection because of the novelty of the topic (Beracha, Fedenia & Skiba, 2014). Indeed, few research papers include culture as an impacting factor of investment strategies (Aggarwal & Goodell, 2014)⁶ although country differences are studied⁷.

⁵ Indeed, Guilmin (2015) demonstrates "[r]isk-based strategies provide better risk-adjusted returns and lower VaR and ES than the 1/N portfolio" when combined with timing strategies.

⁶ 3 papers relate to national culture among Aggarwal and Goodell's investigation (2014) while the rest covers cross-cultural characteristics.

⁷ See appendix 10: Literature overview of cultural analysis in market finance topics p. XIII

However, proxies could be found by decomposing investment strategies into their bare elements (i.e., risk) or by investigating into parallel topics (i.e., home bias). A last point that deserves to be mentioned is that some of the cited articles investigate culture in a superficial way. Indeed, it is important to understand the ins and outs of what culture means. For instance, if a Russian theater play (i.e., Tchekhov's masterpiece) is not successful in Western Europe, it will be considered as too old fashioned, whereas Russian critics that have seen the play abroad mention the lack of perspective. This perspective is probably not fully perceived by Western European scenarists. This is a rather good example of cultural bias. No one is immune to bias. Therefore, it would be interesting for future research to investigate deeper into the underlying variables of the research (i.e., culture). As Kahneman (2011, p. 26) has written about our selective capacity of attention: "[W]e can be blind to the obvious, and we are also blind to our blindness."⁸

The data has been collected through both public (i.e., World Bank and governmental websites) and private data sources (i.e., Datastream). It must be said that sporadic access to data and regular discontinuity complicated the definition of panels which is an inheriting issue regarding the use of this type of econometric model. Therefore, some data had to be collected via other sources, which introduces a discrepancy regarding the original data-collecting methodology. In addition, the data in the model are from different types (i.e., cross section, annual and monthly temporal series) that do not all take potential evolution into account. Moreover, the quality of data varied widely from country to country with a clear gap of quality for emerging markets. Besides, some macroeconomic data collected has been regularly questioned upon their veracity (i.e., Argentina). Those data are interpreted meticulously. Moreover, there are some discrepancies regarding the data collection from a cultural and an economic point of view. For instance, cultural data on South Africa are divided into 2 groups: one for the white and the other for the black population, whereas economic data are not. In

⁸ Kahneman's citation concludes the gorilla experiment. Chabris and Simons (2010) presented an experiment involving a gorilla dealing with intentional blindness. They tailored a short film in which two teams play basketball; one of the team was in white, the other in black clothes. Viewers were tasked to count the number of passes made by the white team. In the middle of the video, a woman dressed in a gorilla suit appears, walks through the field and makes noticeable moves. About half of the viewers did not notice the gorilla-dressed lady.

addition, linguistic groups are rarely fully represented among the mainly used cultural dimensions references. For instance, Switzerland is only viewed as a French-speaking or non-French speaking country by House *et al.* (2004) whereas 4 linguistic communities cohabit. Therefore, the study considers both groups as one. A last limit regarding the empirical analysis arises from the generalization of experimental data, which can only be tested *ex post* instead of *ex ante*.

This thesis deals with the cultural impact on the performance of investment strategies. It focuses on recently developed portfolio construction strategies for the stock asset class.

PART 1. THEORETICAL ANALYSIS

1. TRADITIONAL FINANCE FRAMEWORK AND THE ESSENCE OF STANDARD FACTORS

Many factors affect the performance of investment strategies. Here, we deem “standard” those factors which are usually taken into account by mainstream finance theories, which consider economic agents as purely rational, as opposed to more modern ones, such as behavioral finance, which take into account the more animal part of human nature. The following chapter is a reminder of those well-studied factors which were used as the foundations for classical economic science. The first part, Rationality, summarizes the concept of rationality in a general setting. The second part, Rationality in Economics Theory, develops how it is traditionally used in an economic setting. The third part, Finance Theoretical Background, gives several theoretical reminders. Finally, the fourth part, Portfolio Construction Strategies, reviews the strategies which are used to generate the sample portfolios which are used to build the econometric model for the empirical part of this thesis.

1.1. RATIONALITY

The word rationality comes from Latin *rationalis*, which is the genitive⁹ declension of *ratio* which means “reason, rationale” and more interestingly “reckoning, numbering, calculation; business affair, procedure” (Etymonline.com, 2015a). As such, rationality represents the ideal of reasoning by Cartesian computations, a means of reaching conclusions that can be easily double-checked. Moreover, rationality is the defining characteristics of the human species, also known as *Homo Sapiens*. In other words, people are rational in essence. As such, rationality has naturally been the central assumption of neoclassical economics, which aims to determine prices and outcomes through the efficiency of demand and supply equalization. Indeed, rationality is the basis of the microeconomics theory of choice in which preferences have to be complete, transitive and strict. Under this framework, preferences can be

⁹ Genitive is, among its other functions, used as a possessive form in case-based languages.

maximized through a Bayesian process, beginning from a rational probabilistic transformation to expected utility (Von Neumann & Morgenstern, 1947). As such, the normative expected utility theory predicts rational behavior under uncertainty while coping with risk. This decision process is itself based on the general equilibrium theory where all future price and demand data are known and adjust automatically. This equilibria then requires economic groups, as opposed to single individuals, to possess and process all the available information through complex rational analysis. (Arrow, 1986)

1.2. A BRIEF REVIEW OF RATIONALITY IN ECONOMICS THEORY

Classical economic theories assert the rational character of *Homo œconomicus*. The rational aspect of the individual originate from Descartes'¹⁰ (1637, in: Descartes - Discours de la méthode, 2012) mechanistic approach of nature. Following Descartes' theories, Adam Smith (1776, in: Smith, Cannan & Lerner, 1937), who inspired the theories of neoclassical economics, depicted Man as a part of nature. As such, he designed economic behavior from a mechanical perspective. While building on Smith's absolute advantages theory, Ricardo theorized competitive ones (1815, in: Irwin, 1989). Most interestingly, Ricardo considered each nation as having a competitive advantage, but did so taking into account only the natural resources provided by the macro environment without really considering the micro level (Pribram, 1983), in which individuals could be more inclined to do best because of their beliefs and traditions.

This mechanical approach influenced all the economic spheres, most notably neoclassical economists, which based their theories upon three main considerations. First, individuals have rational preferences that are complete, transitive and strict. Second, preferences can be classified based on their outcomes through utility functions. Third, individuals choose the preferences which best maximize their utility given full and relevant information. In a way to cope with the full information deficiency, which generates risks, the expected utility theory

¹⁰ While it has been mentioned in several economic papers that the rationality projection on individuals originates from Descartes, Aristotle first depicted human being as "rational animals", which indeed was consecutively adapted to a mechanistic point of view. Moreover, Descartes' characterization of human as a "thing" is still under debate among philosophers as some consider it to be a mere stage of his philosophical approach. (Encyclopédie de L'Agora, 2015)

(Von Neumann & Morgenstern, 1947) follows a Bayesian process and depicts how rational individuals should behave. Nevertheless, rational individuals can be inclined to accept more risk if they are compensated for it. Therefore a rational individual prefers the expected value of an outcome rather than the expected utility of a prospect. As such, any rational individual can be indifferent between a certain and an expected outcome whenever certainty equivalence is respected, which relates to risk premium, which among other things, compensates the risk that investors are willing to take on financial markets.

Traditional financial theories are built on neoclassical economics. As such they also stem from a rationalist approach and integrate mechanistic schemes in order to generate strategies that will best accommodate the financial market.

1.3. FINANCE THEORETICAL BACKGROUND

The Finance Theoretical Background chapter is composed of two main reminders, one about the demand side and the other about an exchange platform. On the one hand, individuals make rational investment decisions, and on the other hand, the market instantaneously reflects any new information into prices. Therefore, the Modern Portfolio Theory part will emphasize the rational individual investment strategies, while the next part, The Efficient Market Hypothesis, will focus on the exchange market reflection qualities.

1.3.1. MODERN PORTFOLIO THEORY

Also known as “the father of the modern portfolio theory”, Markowitz (1999) acknowledges investment diversification originates from centuries ago ¹¹. Before him, Fisher (1906) suggested using variance as a measure of economic risk and Marschak (1938) advocated the use of a covariance matrix as an approximation of utility (Rubinstein, 2002). Building on

¹¹ Markowitz (1999) gives an example from a Shakespeare play untitled *The Merchant of Venice* (1598, act 1 scene 1) where a protagonist called Antonio diversifies his assets across, what could be translated in a modern portfolio language, ships (i.e., securities), places (i.e., market) and time.

market efficiency, Markowitz was the first to theorize portfolio theory in his 1952-seminal paper “Portfolio Selection”, which the author expanded later with the expected return maximization through mean-variance analysis under uncertainty and risk for a whole set of securities, leading to the efficient frontier formulation (Markowitz; 1956; 1959). Thus, investors can choose their favorite portfolio on the efficient frontier drawn from the co-movement of securities, depending on their risk and return preferences.

Moreover, the efficient strategy benchmark allows investors to generate better expected returns than they would by selecting their portfolio only on a risk basis. The mutual fund separation theorem is a key implication from the efficient frontier and states that any portfolio on the efficient frontier can be generated using a combination of any two efficient portfolios. The mean variance portfolio construction was later improved by academics by using more moments such as skewness or by a more realistic description of returns (Fama, 1965; Elton & Gruber, 1974). However, Elton & Gruber (1997) attribute the long-lasting use of the Markowitz portfolio theory first to the lack of evidence of the relevance of adding more moments to the portfolio determination and second to the intuitiveness of the application of portfolio theory.

Portfolio theory emerges directly from microeconomics firm and consumer theories while only focusing on investors making decision under uncertainty. In an effort to approach a positive theory, Markowitz (1991)¹² specifies “[a] theory which can be used to direct practice, at least by large (usually institutional) investors with sufficient computer and database resources” which involves diversification in order to reduce uncertainty. Indeed, according to Savage (1954) and Von Neumann & Morgenstern (1947), uncertain outcome implies that the rational investor has to compute probabilities.

Moreover, Markowitz conceptualized a strategy in which investors should maximize their expected utility while repeating it for each period of their investment horizon (because of the single decision period nature of the formula) through an efficient mean-variance analysis (Levy and Markowitz, 1979)¹³. Thus, diversification decreases risk (although systemic risk cannot be

¹² (Grandin *et al.*, 2013)

¹³ Indeed, there is a discrepancy between the single-period horizon of the Markowitz’s (1952) framework and the multi-period nature of real life investment. Therefore, investors have to repeat the single period operation each time a new period appears. The use of repeated single period in order to fit the multiple period investment

eliminated) but consequently reduces returns in the case of the global minimum variance portfolio. In addition, Markowitz introduced that along with comparing the expected returns and variance to each other, investors would also combine this theoretical portfolio with other securities they specifically want to keep, selected by their own evaluation of securities prices (Rubinstein, 2002). Additional streams of research led to the one-fund separation theorem where the optimal portfolio is represented as a tangency point between a riskless and a risky-asset-portfolio combination, which is also referred to as the one fund theorem. Therefore, the tangency portfolio is independent of the investor expected return and risk preferences. Sharpe (1963, 1964) first verified this theory through quadratic computing, and one year later refined the Markowitz's portfolio theory by considering market optimization behavior and by suggesting the subtraction of systematic risk from the portfolio as an additional measure of an asset's risk (and as a consequence, valuation) with his famous CAPM theory. Lintner (1965) viewed the CAPM from the price-maker angle and came to similar conclusions. Black (1972) developed a CAPM framework which does not take the risk-free beta into account. The CAPM theory was also refined later by Fama and French (1995) through the introduction of additional types of risks.

1.3.1.1. THEORETICAL CRITICS

Modern portfolio theory¹⁴ as conceptualized by Markowitz (1952) has several weaknesses due to its exclusive mathematical and statistical approach under several assumptions that do not hold over time. Several assumptions have been proven to be unrealistic, such as the normal distribution of equity returns (Officer, 1972) and the invariance of moments across countries (Aggarwal & Rao, 1990; Aggarwal, Rao & Hiraki, 2014). Additionally, recent financial crises have proved the inconstant correlation of assets over time (Longin & Solnik, 1995). Moreover, according to Fama and French (1995) information asymmetry (i.e., insider trading) and other

horizons has been approved under various assumptions, such as the independence of return over time, by several academics (e.g., Fama, 1970; Merton, 1990). However, Fama and French (1989) showed the dependent character of mean return and variance among periods.

¹⁴ More interestingly, Markowitz revealed at a conference held in Chicago that even he was not using his own framework: "I should have computed co-variances of the asset classes and drawn an efficient frontier – instead I split my contributions 50/50 between bonds and equities". (Nocera, 2007; Stevenson, 2010)

externalities can occur in the market. For instance, Kahneman and Tversky (1979) proved the actual probability belief of investors to be different than which is predicted by the rational Bayesian framework and that investors can be impacted by bias, which contradicts the rational risk-adverse character of the modern-portfolio-theory investor.

1.3.2. THE EFFICIENT MARKET HYPOTHESIS

The efficient market hypothesis is one of most important theories for finance academics (Thaler & Barberis, 2010). Nowadays considered as “a father of modern finance” (Rolfes, 2013), Fama (1965, 1970) elaborated the efficient market hypothesis, which postulates that market adjusts instantly to new information and consequently that market prices would fluctuate in a random walk¹⁵ corresponding to updated news. Therefore, it is impossible to beat the market as market prices instantly incorporate all the adequate information so that stock trades are fairly priced on stock exchanges. The efficient market hypothesis comes from four main postulates (Fama, 1965) based on the pure and perfect competition theory in which investors are price-takers¹⁶. First, the security market engages a large number of participants that exchange their securities for profit and value. Second, news are independent from one another and are randomly distributed. Third, security prices automatically adjust to news. Fourth, security prices incorporate all the available news.

This last assumption leads to three versions of the efficient market hypothesis. As such, markets can be “weakly” efficient, meaning that securities reflect past public information, or “semi strongly” so, meaning that moreover, all public information is simultaneously incorporated into market prices, or even “strongly” efficient, which means that securities simultaneously incorporate all public and private information (Fama, 1991). With the refining of the efficient market paradigm, Fama (1991) acknowledges that some irrational investors act on the market; however, their respective irrational behaviors cancel one another.

¹⁵ Random walk reflects the no-memory aspect of prices; in other words, prices will fluctuate independently from past price changes.

¹⁶ Pure and perfect competition involves market atomicity, product homogeneity, free entry, perfect factor mobility and perfect information (Knight, 1921; Arrow & Debreu, 1953).

Therefore, irrational behavior exists but irrational influence is very limited on the market and if anomalies appear in the market, it is only due to imperfect information.

1.3.2.1. THEORETICAL CRITICS

After a more than a decade of popularity, academics started to see some imperfection in the efficient market theory, either because of the lack of statistical rigor or because of the lack of incentive for professionals to get access to information that is quickly incorporated into stock prices (Jensen, 1978; Grossman & Stieglitz, 1980). Indeed, anomalies could no longer be only interpreted as arising from a deficit in information efficiency (Sheller, 2002).

1.4. PORTFOLIO CONSTRUCTION STRATEGIES

Building on modern portfolio theories, several techniques were created to elaborate a portfolio and help financial market actors determine their investment style. Indeed, Markowitz' mean-variance framework has been proved to present major shortcomings because of the unstable expected return estimations (Merton, 1980) leading in practice to significant deviation from the efficient portfolio (Guilmin, 2015). The tangency portfolio is not the single efficient portfolio. The post-Markowitz portfolio concepts can be of several forms depending on maximization objectives and on the type of underlying relevant constraints for asset class allocation¹⁷.

In an attempt to improve the original mean-variance framework, and consequently optimizes risk/return, portfolio construction techniques evolved over time¹⁸ until the very recent risk-

¹⁷ However, although different asset classes can be allocated through the construction of a portfolio (because of their properties or simply because of investor preferences), only equities will be considered further.

¹⁸ See appendix 1: Historical evolution of portfolio construction techniques (from Carhart & Gabudean, 2012) p. II

based optimization method¹⁹. The common objective of all portfolios is to maximize performance given risks. Performance can be derived from expected returns and risks can be measured via several statistical means such as volatility. There are many risk-based portfolio construction methods which are only based on the risk criteria, such as minimum variance, equal risk contribution and maximum diversification. Newly introduced Risk-based portfolios (Kolm, Tütüncü, Fabozzi, 2014) are seen as a large improvement for the asset management industry (Guilmin, 2015). First and foremost, risk-based strategies are based on robust statistical estimations. Indeed, risk-based portfolios do not take into account expected return, which has been mentioned before as an important source of error, but only variance and covariance, which are stable over time and thus foreseeable (Merton, 1980). Even more interestingly, these risk-based frameworks are aligned with the financial industry's needs. Indeed, asset managers tend to concentrate more on portfolio risk management since the latest financial crisis.

In addition to their improvements with respect to Markowitz' (1952)²⁰ mean-variance portfolio, risk-based portfolios, which originate from the asset management industry, challenge the efficient market hypothesis by asserting the possibility of generating higher returns while taking less risk, especially when used in the long run (Guilmin, 2015). In the context of this thesis²¹, the naïve portfolio will also be added to the risk-based global minimum variance, equal risk contribution and maximum diversification portfolios.

¹⁹ Although portfolio construction techniques have evolved over time, the thesis will only talk about the last portfolio-building research trends. As such, certain risk-based strategies will be mentioned further: minimum variance, risk parity and maximum diversification. Also, naïve diversification will be introduced.

²⁰ Risk-based and naïve portfolios do not require expected returns predictions, which is a characteristic shared with the mean-variance portfolio. This attribute created "a particular fascination" among academics (Benninga, 2008)

²¹ The portfolio optimization strategies used in this thesis are based on Guilmin's (2015) risk-based approach and applied to another research project (i.e., Guilmin's paper aims to use risk-based concepts in addition to timing strategies in order to generate more efficient techniques while this thesis is about discovering anomalies related to culture in the performance of investment strategies). As such, the following computations and statements are also based from the previous author when no other is mentioned.

1.4.1. NAÏVE PORTFOLIO

The Naïve portfolio, also known as equally weighted, does not involve risk and return in its construction. Moreover, it does not involve any optimization. Indeed, the weight formula for each of its components is:

$$w_{eq} = \frac{1}{N}$$

With the assumption of N stocks in the selected sample of securities, w_{eq} is the weight of each stock that compose the equally weighted portfolio.

The Naïve portfolio strategy is considered as a heuristic portfolio because it ignores risk and return considerations. This strategy is popular among investors (Bernartzi & Thaler, 2001; Chow, Hsu, Kalesnik & Little, 2011), especially for those which do not believe in risk and return forecast (Demey, Maillard & Roncalli, 2010). More interestingly, the equally weighted portfolio outperforms sophisticated optimizations (DeMiguel, Garlappi, & Uppal, 2007) but only for short-term horizons (Fugazza, Guidolin & Nicodano, 2010).

However, this strategy very strongly depends on the selected security universe and can lead to inefficient risk diversification (Maillard, Roncalli & Teiletche, 2009).

1.4.2. GLOBAL MINIMUM VARIANCE

The Global Minimum Variance portfolio does not consider expected return in the optimization resolution, as the weights are a proportion of the variance-covariance matrix of the selected sample of securities. Together with the Naïve strategy, the Global Minimum Variance portfolio is considered as a solution involving heuristics (Maillard, Roncalli & Teiletche, 2009). Solving the following optimization problem solves the global minimum variance portfolio:

$$\text{Minimize: } \frac{1}{2} w^T \Sigma w$$

$$s.t.: \mathbf{1}^T w = 1 \text{ and } 0 \leq w \leq 1$$

With the assumption of N stocks in the selected sample of securities, w is the $N \times 1$ vector of weight that are the percentage of risk contribution of each assets, Σ is the $N \times N$ variance-covariance matrix, and $\mathbf{1}$ is the $N \times 1$ vector of ones. Moreover, in this version no short selling is allowed so each asset weight in the portfolio should be positive.

The Global Minimum Variance strategy presents several advantages. First, it aims to minimize portfolio volatility and requires only statistical measures to determine the covariance matrix. By taking variance as a measure of risk, the aim of this portfolio is to minimize risk while avoiding scrutinizing returns. Second, the Global Minimum Variance portfolio is located on the efficient frontier, without losing accuracy with expected returns measures (Roncalli, 2013).

However, the Global Minimum Variance portfolio is recognized to be only concentrated in a few assets, those with the minimal volatility among the selection. This is intuitive because of the minimization of volatility. Moreover, whenever a portfolio does not include short selling, very few assets are included in the portfolio which means that portfolio are not diversified from a weighting perspective (DeMiguel, Garlappi, Nogales & Uppal, 2009).

1.4.3. EQUAL RISK CONTRIBUTION (OR RISK PARITY)

With a strategy philosophy lying between the Naïve and the Minimum Variance Portfolios in terms of volatility, the Equal Risk Contribution portfolio is built in a way that each asset contributes equally to the total portfolio risk.²² The Equal Risk Contribution portfolio does not equalize the marginal contribution of each asset as in the Global Minimum Variance portfolio but the risk contribution of each portfolio's securities instead:

$$MRC_i = \frac{\partial \sigma(w)}{\partial w_i} = \frac{(\Sigma w)_i}{\sqrt{w^T \Sigma w}} = \frac{w_i \sigma_i^2 + \sum_{j \neq i} w_j \sigma_{ij}}{\sqrt{w^T \Sigma w}}$$

²² As suggested in Guilmin (2015), see Roncalli (2013) for more details.

$$RC_i = w_i \times MRC_i = w_i \frac{(\sum w)_i}{\sqrt{w^T \Sigma w}} = w_i \left(\frac{w_i \sigma_i^2 + \sum_{j \neq i} w_j \sigma_{ij}}{\sqrt{w^T \Sigma w}} \right)$$

Where MRC_i represents the marginal risk contribution of security i . Moreover, RC_i , the risk contribution, is composed of the marginal risk contribution multiplied by the allocation weight of asset i , w_i . As the risk contribution between assets should be the same, therefore:

$$\begin{aligned} RC_i &= RC_j \\ w_i \times (\sum w)_i &= w_j \times (\sum w)_j \text{ for all } i, j \\ s. t. : \mathbf{1}^T w &= 1 \text{ and } 0 \leq w \leq 1 \end{aligned}$$

Where $(\sum w)_i$ is the i^{th} of the $\sum w$ vector, meaning all assets have equal risk contribution. As before, the same non-negativity constraint is used. Maillard *et al.*, 2010, generated the following approach in order to solve the optimization problem:

$$\begin{aligned} \text{Minimize } & \sum_{i=1}^n \sum_{j=1}^n (w_i (\sum w)_i - w_j (\sum w)_j)^2 \\ s. t. : \mathbf{1}^T w &= 1 \text{ and } 0 \leq w \leq 1 \end{aligned}$$

Where $\sum_{i=1}^n \sum_{j=1}^n (w_i (\sum w)_i - w_j (\sum w)_j)^2$ is the variance of risk contributions.

Developed by the asset management industry in the 1990's (Clarke, de Silva & Thorley, 2011), the Equal Risk Contribution has several advantages such as laying on the efficient frontier whenever the underlying portfolio's assets have identical means, variance and correlation coefficient. (Maillard, Roncalli & Teiletche, 2009),

However, the endogenous character of the risk-contribution weights involves a unique solution per security universe. Therefore, the Risk Parity portfolio is as heuristic as the two extreme portfolios from which it is based, the Global Minimum Variance and the Naïve

portfolios. As Schoen (2013) mentioned, Risk Parity only offers maximum diversification “[w]hen all risk contributions are equal, but when all asset-portfolio correlations are equal. We call this solution Correlation Parity.”

1.4.4. MAXIMUM DIVERSIFICATION

Similar to the minimum variance portfolio, the Maximum Diversification strategy “[e]qualize[s] marginal contributions given a small change in asset weight” (Clarke, de Silva & Thorley, 2011). First considered by Choueifat (2006) and then improved 2 years later (Choueifat & Coignard, 2008) with the diversification ratio, the Maximum Diversification portfolio does not rely on expected returns but on statistical variance and covariance measures which, as mentioned previously, dramatically decrease forecast errors. Indeed, the diversification ratio, upon which the optimization program depends, is composed of the weighted average volatility over the total portfolio volatility:

$$DR(w) = \frac{\sum_{i=1}^N w_i \sigma_i}{\sigma(w)} = \frac{w^T \sigma}{\sqrt{w^T \Sigma w}}$$

With the assumption that σ represents a $N \times 1$ vector of securities’ volatilities. $w^T \sigma$ is the weighted average volatility of one asset and $\sqrt{w^T \Sigma w}$ is the portfolio volatility. For portfolios with more than one asset, the diversification ratio will be strictly higher than 1. Therefore, the diversification of a portfolio increases together with the diversification ratio. As a consequence, the optimization program is a maximization²³:

²³ Choueifat and Coignard, 2008 transformed the maximization program into a minimization via a simplification mean of the portfolio creation based on synthetic assets:

$$DR(w_s) = \frac{w_s^T \sigma_s}{\sqrt{w_s^T \Sigma_s w_s}} \Rightarrow \text{Maximize } DR(w_s) = 1/\sqrt{w_s^T \Sigma_s w_s} \Leftrightarrow \text{Minimize } w_s^T \sigma_s C w_s. \text{ Then to come}$$

from the synthetic assets to the investor horizon, the rescaling formula is given by $w_{MD} = \frac{w_s}{\sigma}$ (see Choueifat and Coignard, 2008; Guilmin, 2015 for more details).

$$\begin{aligned} & \text{Maximize: } DR(w) \\ & s. t. : \mathbf{1}^T w = 1 \text{ and } 0 \leq w \leq 1 \end{aligned}$$

As mentioned for the previous portfolio, the weight of a stock lies between 0 and 1 as the short-selling constraint is applied.

As claimed by its creators, the maximum diversified approach allows the investor to take the full benefit of the equity premium, as the portfolio is not diversifiable further. (Choueifaty & Coignard, 2013).

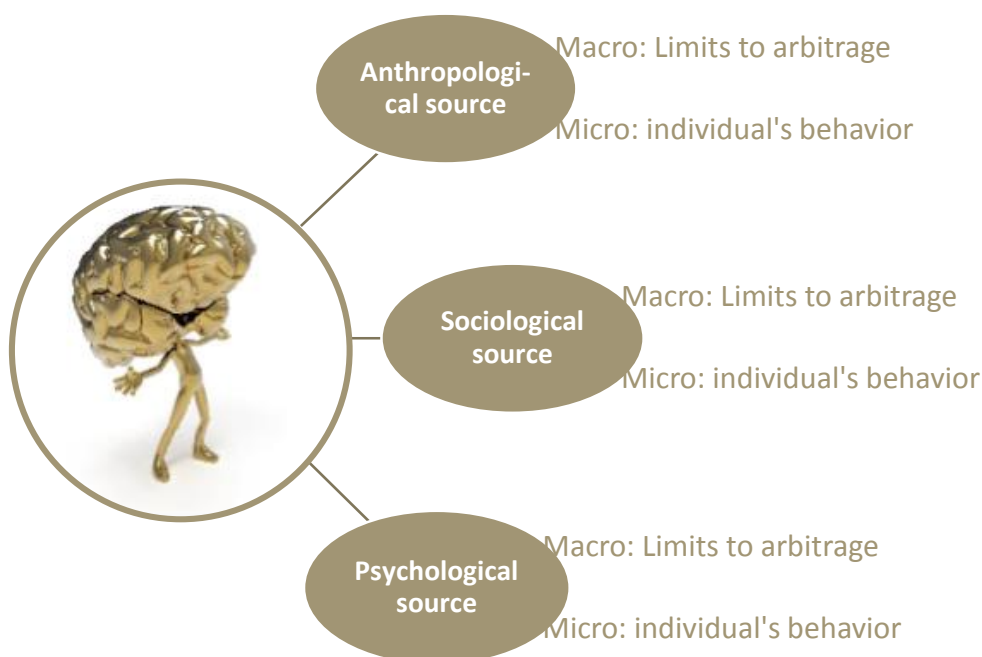
Although the Maximum Diversification portfolio outperforms other risk-based strategies, when returns can be forecasted, it is not optimal, and worse, it is on the left of the efficient frontier (Clarke, de Silva & Thorley, 2011).

2. LIMITS OF TRADITIONAL FINANCE FRAMEWORK AND FOUNDATIONS OF BEHAVIORAL FINANCE

As previously noted, the basis of traditional finance theory is rationality. However, as mentioned earlier, mechanistic models fall short of explaining observational facts. In an attempt to bridge the gap between traditional finance theory and the observed reality of market finance, behavioral finance appeared. Behavioral finance emerges from behavioral principles rooted in anthropological, sociological and psychological disciplines (Shiller, 1999; Thaler, 2005). Behavioral finance breaks down into a micro and a macro level, the former analyzing the deviation of the investor from rationality while the latter deals with market anomalies that traditional theories cannot explain.

The following chapter presents each root and pillar in a matrix format (see Figure 2). The first part, Foundations of Behavioral Finance, presents the psychological origins of the topic and at the same time the limits to both arbitrage and individual behavior, which are the two pillars of behavioral finance (Barberis & Thaler, 2002). On the one hand, the limits to arbitrage section will introduce market anomalies. On the other hand, the individual behavior section will pave the way for alternative decision-making processes. The second part, Cultural Impact on Behavioral Finance, deals with bias and heuristics while naturally considering psychology in addition to cultural factors which are explained by a sociological and an anthropological focus while keeping in mind financial market implications.

FIGURE 2: ROOTS AND PILLARS OF BEHAVIORAL FINANCE



2.1. FOUNDATIONS OF BEHAVIORAL FINANCE

Behavioral finance appeared as a complementary field in order to perceive empirical anomalies which could not be explained by the rational projection of modern portfolio theory on investors and markets (Frankfurter, McGoun & Allen, 2004). The essence of behavioral finance originates from Adam Smith (1759, in: Bikas, Jurevičienė, Dubinskas & Novickytė, 2013).

Indeed, Adam Smith already characterized how psychological elements such as egoism, uncertainty, ego and contempt, could explain the individual pursuit of profit. However, if classical economists already had a hint about behavioral elements, neoclassical economists did not scrutinize psychological aspect of Homo Œconomicus (Bikas, Jurevičienė, Dubinskas & Novickytė, 2013). As a result, behavioral finance as a science developed very recently, owing to psychologists Kahneman and Tversky (1974; 1979) who reconsidered probability framing at a micro stage. Building on previous behavioral studies, academics tried to solve market

anomalies while dealing with the macro stage. Indeed, behavioral finance lies on two building blocks, namely limits to arbitrage and cognitive studies. (Ritter, 2003)

2.1.1. LIMITS TO ARBITRAGE

Although modern portfolio theory is still a popular topic for attempts at enhancement (Thorsten, 2004), the efficient market theory makes academics and practitioners more circumspect. Indeed, the random walk attribute of return is not empirically confirmed (Barbers & Thaler, 2002). Therefore, there must be factors other than pure rationality to explain market behavior and subsequently investor's reactions (Barberis & Thaler, 2002).

As defined by Barberis and Thaler (2002), limits to arbitrage question the efficient market hypothesis (Fama, 1965). Indeed, since the efficient market hypothesis considers all the information as reflected into the price because of the rational nature of the investor, if irrational stockbrokers, also known as noise traders, happened to exchange in financial markets, their individual action would cancel one another and ultimately, rational investors would take advantage of noise traders through the means of arbitrage. Arbitrage is identified as the simultaneous purchase and sale of securities that are perfect substitutes in order to generate a riskless profit (Friedman, 1953).

Although early tests of market efficiency were mainly conclusive, recent empirical studies discovered anomalies, which are believed to be the result of market inefficiencies (Shiller, 2002). However, according to Fama (1997), observations of market oddities are either chance results or due to a flawed methodology. Nevertheless, irrational investors underestimate risk, which in turn generates excesses in the market. This irrational behavior disturbs the efficient market as the information is no longer reflected accurately into prices, which forces rational stockbrokers to proceed to arbitrage maneuvers. As a result, this vicious circle has a long-run impact on the market in which rational investors can forecast future returns.

According to Hirshleifer (2001; 2008), market anomalies can be elucidated by behavioral finance. Indeed, as discussed by Barberis and Thaler (2002) using Friedman (1953) terms, if the right price entails "no free lunch", the corollary does not hold as the value of stocks can be wrongly assessed away from their intrinsic value, which in turn, does not automatically

include any excess returns which could be arbitrated. Therefore, behavioral finance interests itself with explaining how deviation from fundamentals appears.

Another market anomaly involves twin shares, also referred to as “Siamese twins”. This term identifies companies with stocks which are traded worldwide on several national marketplaces. As the two (or more) listed stocks share the same cashflows, they should all move in lockstep together. However, the prices of the stocks are correlated with the movement of the market in which the most intensively traded twin appears. Several hypotheses could explain the situation. The first potential argument is related to the discretionary use of dividends and other corporate finance discrepancies. The second possible justification would emerge from noise traders, also known as irrational investors who misevaluate risks (Froot & Dabora, 1998; Barberis & Thaler, 2010).

A second remarkable market anomaly is index inclusions. Whenever a stock is admitted into the S&P500 index, the value of the security increases by an average of 3.5% and is never readjusted to fundamental value afterwards (Harris & Gruel, 1986; Shleifer, 1986). This market misevaluation tends to be significantly related to increased investor awareness, and as such, to information availability (Elliott, Van Ness, Walker & Warr, 2006).

One of the most documented anomalies (Jegadeesh & Titman, 1993) is that stocks have a tendency to have some degree of inertia with respect to their performance. It gives rise to the momentum strategy, which is based on buying stocks that performed well in the past and selling securities that generated poor past returns, and generates significant positive aberrant returns over 3 to 12 months holding periods. This finding is in contradiction with the efficient market hypothesis, which stipulates that prices pursue a random walk. Several inquiries indeed explore overreaction from investors as a possible cause of this market anomaly (DeLong, Shleifer, Summers & Waldman, 1990). Additionally, Jegadeesh and Titman (1993) suggest that there might be a misconception between short term and long run prospects, as investors could use the former in order to assess a firm’s perspective. Later on, Titman scrutinized the momentum anomaly worldwide and concluded to the cultural implication of this oddity (Chui *et al.*, 2010).

2.1.2. INDIVIDUAL'S BEHAVIOR

While the rational investor of the traditional finance theory processes information through Bayesian probability and then classifies their preferences under an expected utility framework, behavioral finance aims to relax the aforementioned rational postulates in order to explain the empirical inconsistencies observed when only the standard factors are taken into account. Indeed, the efficient market hypothesis has several well-documented flaws. Moreover, existing finance puzzles challenges standard factors, be they in the corporate world (e.g., preference for dividends) or from the market (e.g., momentum, home bias).

As previously mentioned, traditional finance theory is based on a Bayesian probabilistic process of expected utility, which implies a risk premium under uncertainty. However, this theory leads to violations of the independence axiom as depicted by Allais (1953). Indeed, as mentioned by behaviorists Kahneman and Tversky (1979), choice depends more on present gains and losses than on the final outcome when taking into account bounded rationality.

As discussed by Arrow (1986)²⁴, economic theories are not only based on rationality, which is used rather ritually and is not crucial. Extensive rationality hypotheses in economic theory require informational access, processes and applications which are incompatible with the cognitive capacities of any real economic agent, even if they are helped by technology as Simon (1957)²⁵ asserts in the bounded rationality theory (Arrow, 1986). Simon (1957; 1959) presented the bounded rationality theory, which hypothesizes investors as rational but with limited cognitive capacities that do not allow them to fully evaluate the outcomes of each

²⁴ "Rationality hypotheses are partial and frequently, if not always, supplemented by assumptions of a different character." (Arrow, 1986, p. 387)

²⁵ Simon first developed bounded rationality in 1947.

eventual decision. Nevertheless, those limitations are not only due to internal factors but also to independent environmental constraints²⁶.

As a result, prospect theory (Kahneman & Tversky, 1979) was developed, scrutinizing perception, frames and reference dependence. First, perception involves the design of cognitive systems, which improves the accessibility of differences (Palmer, 1999). In addition, perception is a relative concept which allows to analyze the environment in context. Therefore, decision making, which involves perception, should be related to contextual choices. However, the very idea of an alternative is contradictory with the Bayesian based expected utility theory (Von Neumann & Morgenstern, 1947). Kahneman and Tversky (2000) perceived the flaw there. Indeed, the expected utility framework does not take into account the initial wealth of the investor, which is an important contextual element.

In an attempt to correct the aforementioned framework, Kahneman and Tversky (1979) presented prospect theory as an alternative of risk theory. The disruptive element is the curvature of the value function on which the theory builds. Indeed, prospect theory is defined by an evaluation of gain and losses and describes the referential upon which an investor makes a decision. As such, the value function is sharply kinked at strategic point, in addition to being concave in the earning quadrant, which describes risk-aversion, and convex in the losing quadrant, which represents risk seeking. Additionally, the expected utility theory is proved to be flawed as it does not report any framing, despite it being crucial to investors when they investigate potential outcomes (Kahneman, 2002). Consequently, prospect theory validates that risk-averse investors will take further risk whenever they are confronted to risk which can generate losses for the investor later on (Ricciardi & Simon, 2000).

Thorsen (2004) quoted from the interview of a day trader by the Wall Street Journal (1988) who summarized his day: "Ninety percent of what we do is based on perception. It doesn't matter if that perception is right or wrong or real. It only matters that other people in the market believe it. I may know it's crazy, I may think it's wrong. But I lose my shirt by ignoring

²⁶ Subsequent work by Todd & Gigerenzer (2003) suggested a bounded rationality concept in which cognitive and environmental constraints are complementary as the individual takes advantage of them to make better decisions.

it. This business turns on decisions made in seconds. If you wait a minute to reflect on things, you're lost. I can't afford to be five steps ahead of everybody else in the market. That's suicide". Besides being an enlightening statement, the interview reflects two things. On the one hand, it confirms the aforementioned flaws of the rational investor's Bayesian decision-making process. On the other hand, this testimony depicts that price actually reflects investor perceptions better than full information. As Barberis and Thaler (2001) summarizes, rational traders quite often adopt rather risky strategies.

2.1.3. THEORETICAL CRITICS

The aforementioned developments in behavioral finance aim to provide a prescriptive theory in order to close the gap between investors' behavior and rational theory. Therefore, the assumption behind those is that whenever investors do not follow the rational theory, there must be something not rational about it. As such, according to Frankfurter, McGoun and Allen (2004), the rational financial model does not realistically emulate what happens in financial markets. Moreover, authors argues that behavioral finance only copes with rational model discrepancies by asserting that investors are the cause of the issue, rather than the rational paradigm itself.

2.2. CULTURAL IMPACT ON BEHAVIORAL FINANCE

The roots (anthropological, sociological and psychological) and pillars (the anomalies of the efficient market hypothesis and investors' behavior) of behavioral finance are extremely intertwined. As such, if there necessarily are cultural aspects in behavioral finance, those aspects should be explainable through economic anthropology. Therefore, the psychological nature of the heuristics and the bias of investors must also be found on a sociological level, more specifically on a cultural one.

2.2.1. ANTHROPOLOGICAL INSIGHT ON TRADITIONAL COST-BENEFIT MODELS

Anthropologists have long perceived the need to broaden the scope of *Homo œconomicus* beyond its rational aspect that traditional and later on behavioral economists were respectively trying to emulate and attempting to excuse. To the contrary, economic anthropologists attempted to explain human economic behavior either as restriction-based on a narrow definition of economy or as a wide notion involving all social relationships (Ensminger, 2002).

According to economic anthropologist Henrich (1999), a discrepancy exists between what economists consider to be a normal and rational behavior for individuals and what regular individuals actually do. Indeed, as stated before, it has been proved that individuals do not have the cognitive abilities required to perform the analyses demanded by theoretical economic cost-benefit models (Gigerenzer & Hoffrage 1995; Cosmides, 1996). Moreover, Henrich (1999) argues that behavioral patterns, even if they can be adaptive, cannot emerge from cost-benefit analysis. Even if individuals acted entirely according to their cerebral cortex which consciously processes information, the human brain evolved over time, as every other part of the body. As such, human behavior also evolved over time.

Part of this evolution comes down to imitation-born concepts developed through cultural abilities in order to process information more efficiently. Those cultural capacities have been passed on because they allow individuals to adapt on a temporal scale much longer than individual life, but the development of the modern world enacted much quicker changes. Because of this time scale discrepancy, anthropologists associate culture as “[a] product of biased social transmission acting over time in adaptive, and sometimes maladaptive, ways” (Henrich, 1999). Moreover, behavioral patterns and changes can only be explained by “psychologically-informed cultural evolutionary models” instead of “rational-actor individual models” (Henrich, 1999, p.73), which also brings a common ground between cognitive and social component from which behavioral finance originates (Zarri, 2010). The link between economics and culture is well documented indeed (Richerson & Boyd, 2005).

2.2.2. PSYCHOLOGY OF HEURISTICS AND BIASES

According to Hirschman, Kahneman, Slovic and Tversky (1983), individuals are willing to rely on heuristics when facing problems requiring complex judgment, be it because of incomplete information or because it requires probabilistic computations. Heuristics are simple rules, which can be defined as “rules of thumb” that help to reduce the considerations required to make a complex decision, thus making it simpler at the expense of accuracy. Myers (1989, p.286) confirmed that “all of us have a repertoire of these strategies based on bits of knowledge we have picked up, rules we have learned, or hypotheses that worked in the past” and as such, referred to heuristics as a cognitive shortcut (Ricciardi & Simon, 2000).

Slovic, Fischhoff and Lichsteinstein (1979) state two major types of heuristics and bias that can affect individual’s risk perception, namely the availability heuristic and overconfidence. Tversky and Kahneman (1973) studied the former, which regards information processing. The availability heuristic is an interpretation fallacy which consists in overestimating the frequency and likelihood of an event about which information is either easily accessible or easily recalled. Overconfidence, an emotional bias, has been depicted by Daniel and Titman (1999) as a “[b]elief in oneself and one’s abilities with full conviction”. It has been regularly analyzed to explain the risk-taking behavior of investors (e.g., Barber & Odean, 2001; Hirshleifer & Luo, 2001) as well as market anomalies (e.g., Daniel, Hirshleifer & Subrahmanyam, 1998; Scheinkman & Xiong, 2003; Chui *et al.*, 2010).

Other well-documented biases²⁷ regarding perseverance coexist with information processing and emotional biases. For instance, conservatism, as described first by Edwards (1968), is an information processing bias that makes people update their beliefs in a longer time scale than if they would with the new information they obtained if they were using a Bayesian model.

Moreover, social biases such as availability cascades (Kuran & Sunstein, 1999) results from a variation of information processing heuristics (i.e., the availability heuristic) in which information is perceived as more plausible because of the increased availability of the information in public discourse such as media. This bias has been tested negatively with finance professionals (Alevy, Haigh & List, 2007), which is surprising, as other studies

²⁷ See appendix 2: Examples of heuristics and bias p. III

mentioning training do not make professional immune to bias (Katarachia & Konstantinidis, 2014). According to Bikhchandani, Hirshleifer and Welch (1998), cascades bias could explain stock market crashes.

Heuristics and bias are depicted as universal. As Hirshleifer (2001) mentioned: "Economists often argue that errors are independent across individuals, and therefore cancel out in equilibrium. However, people share similar heuristics, those that worked well in our evolutionary past. So on the whole, we should be subject to similar biases". Therefore, investors from similar cultures are also supposed to share similar heuristics and biases. Indeed, Shiller (1999) suggests that the availability bias is reinforced by conversations, rituals and symbols that are the prerogative of cultures.

2.2.3. CULTURE'S IMPACT ON BIAS AND HEURISTICS

Individuals rely on various forms of cultural transmission to acquire their behavior. As such, economic decisions are partly influenced by culture. Indeed, *Homo œconomicus*' routine seems to rely primarily on cultural transmission, which as a consequence, affects their economic decisions. Moreover, utility preferences, constraints and level of satisfaction vary between ethnic groups (Henrich, 1999). Furthermore, some cultural insights might be used in order to capture the interesting concept of biases. As Henrich (1999) stipulates, cultural transmission models are concerned with the dynamics of cultural ideas and behaviors and try to understand the mechanisms behind some cultures evolving more quickly than others and the process that make ideas spread or not through populations²⁸. As such, the author states that individuals behave according to culture that has been transmitted via various means.

Indeed, people lack the cognitive abilities required to perform the Bayesian cost-benefit computation on each and every one of the choices they have to make. Therefore, individuals

²⁸ Anthropologists are still debating on whether *Homo œconomicus* follows culturally-prescribed rules or rational-actor models (Jones & Plattner, 1991; Wilk & Cliggett, 2007). However, the debate vanishes when applying a cultural evolutionary approach. Indeed, cultural evolutionary theory describes individual behavior as a cultural-acquired set of beliefs, ideas and values, but where psychological biases create distortions on cultural evolutionary time scales, which makes individuals approximate cost-benefit maximization and therefore makes individual behavior appear as rational. (Henrich, 1999)

do not behave as the positive economics theory prescripts. Henrich (1999) concedes that our judgments are predictably suboptimal as they are: “[f]raught with calibration misalignments, perception problems, memory biases, data processing errors, confirmation biases, learning obstacles, and subjective illusions”, which was also noticed by academics from other fields (Jolls, Sustain & Thaler, 1998). Nevertheless, Henrich (1999) suggested that cultural transmission processes, along with empirically observed adaptive behavioral patterns, do not require unrealistic assumptions regarding the rational cost-benefit of the standard economics approach. Therefore, the author prescribes to look at cultural background in order to bridge the gap between empirics and unobserved positive economics theories.

Since individuals rely on their cultural background in order to cope with their cost-benefit adjustments and since they are nevertheless most of the time biased according to behavioral economists, the concept of cultural bias emerges (Hansen, 2010), including in financial markets (Stiglitz, 2010; Bhamra & Uppal, 2013; Chang & Lin, 2015). A cultural bias is a set of orientations towards which individuals perceive the world through the prism of their cultural background. The notion of cultural bias, also associated to worldview, has been approached in the late 1970’s (Douglas & Wildavsky, 1982; Thompson, Ellis & Wildavsky 1990, Dake, 1991). Douglas (1978) conceptualized a generic grid in order to understand cultural risk perceptions across culture.²⁹ As social psychologists mentioned, individuals shape their personal set of values owing to their individual history and social context, which could also apply to cultural context. Individual sets of value help people appraise and behave in a given context (Hofstede, 1980; Feather, 1991). Therefore, heuristics and bias are either differently conceptualized across cultures or, alternatively, heuristics and bias are present at different levels of frequency/intensity within cultures.

²⁹ See appendix 3: Group model (from Oltedal, Moen, Klempe & Rundmo, 2004; Douglas, 1978) p. V

Douglas (1978) proposed a 4-dimensional model of culture (i.e., fatalism, hierarchism, individualism, egalitarianism). However, due to the lack of measure and interaction between the 4 dimensions, the empirical tests of the grid were not satisfactory (Sjöberg, 1997)

Also, this grid is very similar to Hofstede’s (1980) advancement regarding his cultural dimension measures, (see 3.2. Culture as a Set of Dimensions p. 40).

3. FOCUS ON CULTURAL FACTORS AND STATE OF THE ART LITERATURE REVIEW

As seen in the second part, Limits of Standard Factors, behavioral finance appeared relatively recently and considers the investors' biases and heuristics, such as home bias, which could explain several market anomalies. This third part builds on the two previous ones in order to introduce the empirical part of this thesis.

The first chapter, Views on Culture, introduces different points of views in order to apprehend and define the concept of culture. Then, the second chapter, Culture as a Set of Dimensions, reminds how culture may be quantified. The third and fourth, respectively Cross-cultural Influence on Investment Strategies and Culture's Impact on Risk Perception, present the state of the art regarding those respective topics. Finally, the fifth and last chapter, Culture's Impact on Investment Strategies, is a literature review of the developing research topic.

3.1. VIEWS ON CULTURE

A number of definitions of culture coexist in the scientific area of practice. As such, it has no single meaning among disciplines, let alone within a specific research field. More than this, even single authors evolve with equivocal definitions of culture. Whereas the term "culture" originates from crop work, the definition has shifted over time to a more figurative meaning of breeding and roots (Etymonline.com, 2015b). Anthropologists Kroeber and Kluckhohn (1952, p.181) worked on a summary to compile the list of their 164 culture definitions and came up with the conclusion that "[c]ulture consists of patterns, explicit and implicit, of and for behavior acquired and transmitted by symbols, constituting the distinctive achievements of human groups, including their embodiment in artifacts; the essential core of culture consists of traditional (i.e., historically derived and selected) ideas and especially their attached values; culture systems may, on the one hand, be considered as products of action, on the other hand, as conditional elements of future action." In other words, culture can be considered, as its etymology suggests, as a breeding element which is part of people's history. Thus we can postulate that culture is similar among people who share the same history, as it is supposed to be passed down from one generation to the next through all means of communication (i.e., implicit and explicit). As a consequence, the newest generations, as the

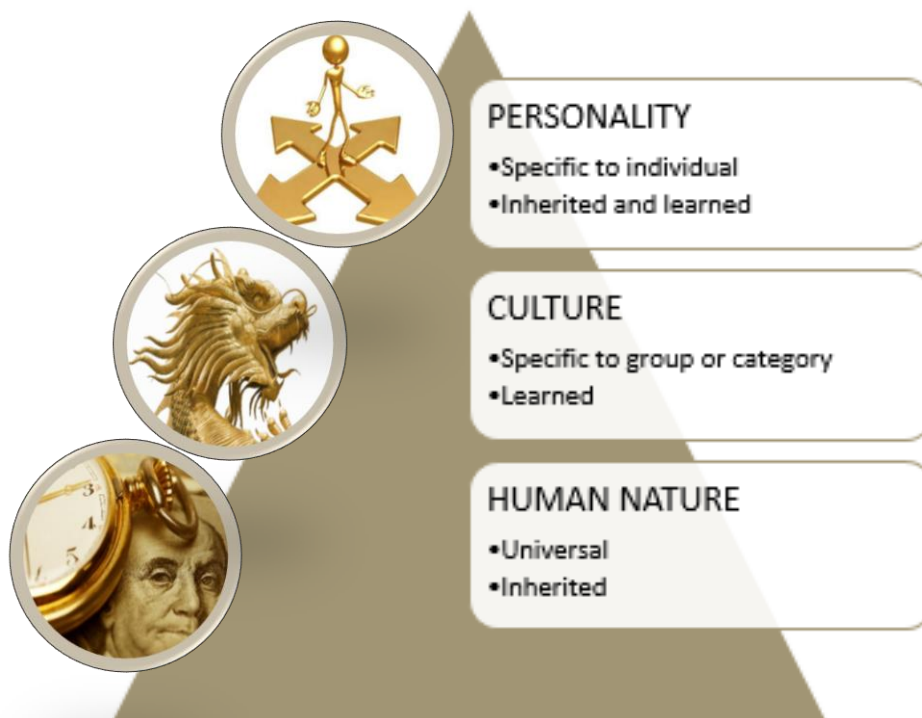
constituents of a group, are still mentally shaped by past generations' culture and transitively so will be the generations to come. Moreover, culture seems to be distinguishable and to be the result of some kind of trial and error process retaining the best practices among the group, meaning it evolves over time. The process of cultural evolution is gradual and is the result of discovery, innovation and cultural diffusion, the latter being the most important change factor. The borrowing of cultural traits can either be as such, or adapted to the local environment. According to Spencer-Oatey (2012) the wide majority of anthropologists agree that culture diffusion accounts for 90% of local behavioral patterns.

Indeed, because of timing and background constraints, culture has much more incentive to borrow from others than to create patterns from scratch (Spencer-Oatey, 2012). Regarding human resource management research, Ollie (1995) reexamined the list of 164 culture definitions and came up with their own view on the topic. Organizational behaviorist Adler (1997) argues that culture influence values, attitudes and behavior. This means people act in a consistent way directed by their culture whatever the field of application (i.e., personal or professional). Social psychologist Hofstede based his approach on Kroeber and Kluckhohn's (1955) definition of culture. Interestingly, Hofstede has notably provided ambiguous definitions of culture, which he momentarily described as mental (1991, p.4), to later on come back to the initial definition: "the collective programming of the mind which distinguishes the members of one group or category of people from those of another." (1980, p.25; 1994, p.5). This last definition highlights the collective meaning of culture and then clearly bridges the aforementioned insights.

As a consequence, culture can be considered as an inherited package which is the same among people and collectively transferred via all communication means. Moreover, culture refines people's actions and potentially people's perceptions. As in every science, an "ecological fallacy" (Hofstede, 1980) is to be avoided by defining the level of culture analysis. Culture is a concept that emerges from a group of individuals who are taught elements that are propitious for the cohesion of the group among other long-lasting benefits that will make the culture sound. As such, it is important to mention that personality traits are specific to individuals (see Figure 3) although they follow the laws of human nature, which is universal (i.e., cognitive bias and heuristics) and are influenced by culture, which is specific to each group and taught by

the group (i.e., uncertainty avoidance). That being said, it is now clear that culture is not homogenous inside a country (i.e., Black and White population in South Africa), nor it is uniformly distributed among a nation. (Avruch, 1998)

FIGURE 3 THREE LEVELS OF UNIQUENESS IN HUMAN MENTAL PROGRAMMING (HOFSTEDE, 1994, P.6)



Therefore, the thesis will rely on the previous comprehensive definitions of culture (Hofstede, 1980) while basing the rest of our approach on Hofstede's (1991) cultural dimensions.

3.2. CULTURE AS A SET OF DIMENSIONS

Hofstede (2010) defined one of the most used guides to assess culture with criteria based on psychology (Bhagat & McQuaid, 1982; Bond, 2002; Beracha, Fedenia & Skiba, 2014).

Hofstede's cultural dimension framework is considered as a seminal work^{30 31}. This cultural guide has been created from a positivist perspective³². In 1980, Hofstede started to analyze the interviews, made between 1967 and 1973, of over 60 000 IBM employees from over 50 countries, and gradually identified 4 bipolar dimensions (i.e., PDI, IDV, UAI, MAS) which were later completed by a 5th axe called "Confucian dynamism" (i.e., LTO) in an effort to match the uncertainty avoidance dimension into the Asian culture (Hofstede, 1991, 2001). In 2010, Hofstede added a 6th dimension, which originates from Minkov's (2007) interpretation of the World Value Survey regarding conformism to norms (indulgence versus restraint (IVR)).³³ They are as follows:

- Power distance index (*PDI*)
- Individualism vs. collectivism (*IDV*)
- Uncertainty avoidance index (*UAI*)
- Masculinity vs. femininity (*MAS*)
- Long-term orientation (*LTO*)
- Indulgence vs. restraint (*IVR*)

This type of data collection is the first attempt which was made to quantify qualitative factors in order to observe the differences between cultures (Spencer-Oatey, 2012). All the

³⁰ Hofstede's seminal book titled *Culture's Consequences: International Differences in Work-Related Values* (1980) has, contrary to anterior research, succeeded in enlarging international business research with a cultural perspective (Tung & Verbeke, 2010). Naturally, Hofstede (1980) became the basis of country culture characterization by a number of authors (see e.g., Dorfman & Howell, 1988; d'Iribane, 1997, among others).

³¹ As mentioned in the title, Hofstede (1980) first analyzes work-culture differences among countries, then he extrapolates the cultural dimension concept over time.

³² The positivist approach sees culture as an aggregate of different values which allow to better understand culture as part of a behavioral influencer. Additionally, this view postulates the universality of some issues such as relationships both between people (i.e., communication, learning) and to the environment (i.e., perception, belief). (Romani, Primecz & Bell, 2014)

³³ See appendix 5: Dimensions of Culture Measurement in Hofstede Model (from Xiumei et al., 2011) p. VII

aforementioned constructs are scored from 0 to 100, the maximum score in each dimension being attributed to cultures which have a higher propensity toward the corresponding behavioral trait.

That employees from only one corporate culture (i.e., IBM) were interviewed gave rise to some criticism about the assessment of culture being done using data from an information technology firm only and employees inside each department possibly having their own culture distorted by their functions (House *et al.*, 2004). In an attempt to improve the culture classification³⁴ of the positivist view for analysis purpose, the GLOBE project (House *et al.*, 2004)^{35 36} came into being. GLOBE expanded the 5 aforementioned cultural dimensions to 18 after interviewing local managers from non-multinationals³⁷ around the world. GLOBE's (2004) and Hofstede's (2010) culture dimensions methodologies require comparison to each other to be fully understood³⁸. Indeed, even if GLOBE's results originate from Hofstede's analysis, the way they see cultural dimensions differs and GLOBE most notably broke some of the agglomerated constructs inside the 5 dimensions to 2 pieces (i.e., Individualism becomes 2 dimensions: in-group collectivism and institutional collectivism).

³⁴ Currently 4 major reference co-exist inside the cross-cultural research field: Hofstede's 5 dimensions (2010), GLOBE project (House *et al.*, 2004), World Values Survey (Inglehart *et al.*, 1998, 2004) and Event Management (Smith *et al.*, 2002).

³⁵ See appendix 6: Dimensions of Culture Measurement in GLOBE Model (from Xiumei et al., 2011) p. IX

³⁶ A *caveat* is to be made regarding the different representations of the same dimensions (constructs) which are named similarly between GLOBE and Hofstede but then given different semantics. Indeed, for the uncertainty avoidance dimension (UA), Hofstede explores social stress whereas GLOBE measures the countries' "focal construct of concern" (Venaik & Brewer, 2013). Then follows an academic debate about what should be appropriately measured when talking about a qualitative perspective and split into what is automatically biased (see e.g., Kuckhohn & Strodbeck, 1961; Bartels, 1967; Peters & Waterman, 1982; Swchartz, 1994; Inglehard, 1997; Trompenaars & Hampden-Turner, 1997; Adler & Gundersen, 2008; Steers *et al.*, 2010; Schneider *et al.*, 2010, among others for a more enlarged vision on the positivist's culture constituents see Hofstede, 1994, p10-11 for more information about "the influence of researcher's national cultures on research outcomes").

³⁷ Three involved industries were: food processing, financial services and telecommunication services.

³⁸ See appendix 7: Difference between GLOBE Model and Hofstede Model (from Xiumei et al., 2011) p. X

GLOBE's model is relatively recent and received less criticism than Hofstede's³⁹. Despite of this, the original model is still widely used among researchers. Besides, GLOBE's model, with its 18 criteria, is less convenient to use and probably somehow redundant. Indeed, it would probably be wiser to use fewer criteria in order to accommodate brain processing (Miller, 1956). Therefore, following previous research, this thesis will concentrate on the 6-dimension Hofstede model while keeping abreast of the GLOBE model for discussion.

3.3. CROSS-CULTURAL INFLUENCE ON INVESTMENT STRATEGIES

As developed in the previous chapter, 3.2. Culture as a Set of Dimensions (p. 40.), culture is suspected by behavioral finance to have an economic impact and this could contribute to the attempt at explaining various unexpected results when it comes to analyzing empirical data departing from classical theory (for instance culture is a component in the explanation of the home bias puzzle).

The keystone of this past research could eventually been summed up by Stulz and Williamson's (2003, p.347) food-for-thought quotation: "If, as argued by the practitioners of behavioral finance, individuals have psychological biases that matter for finance, it would be surprising that individuals' view of the world as determined by their culture does not matter for how they view and act in financial markets."

The most documented financial puzzle that involves culture doubtlessly is home bias (Obsfeld & Rogoff, 2000). Home bias is defined as the investor's tendency to invest in domestic equity instead of fully diversifying the non-systemic risk with foreign equity that also have the benefit of diversifying their home systemic risk. French and Poterba (1991) were the first to document the equity home portfolio puzzle followed by Tesar and Werner (1995). Several papers completed initial work on the equity home bias puzzle (Lane, 2005; Strong & Xu, 2003). Additionally, while tempted to globally diversify their equity portfolio, investors significantly

³⁹ Hofstede cultural dimensions do not measure the femininity dimension directly but deduct it from the masculinity score (Parboteah, Bronson and Cullen, 2005). Moreover, China's score is derived from Taiwan's and Hong Kong's (Li, Qian, Lam and Wang, 2000).

resort to regionally close stocks, leading to cross-border local bias (Baltzer, Stolper & Walter, 2013). However, home bias is not limited to the international equity market. Coval and Moskowitz (1999) concluded that investors prefer to invest close to home while building their domestic equity portfolio. Other types of financial market assets are also impacted by home bias (Fidora, Fratzscher & Thimann, 2007; Kalok, Covrig & Ng, 2005). In order to complement the home bias paradox, several academics showed the phenomenon was not only presents in financial market portfolios. Indeed, foreign direct investment has become more and more approached under the home bias angle, which are still presents internationally (Antonczyk & Salzmann, 2014) and domestically (Wolf, 2000; Grote, 2006). The home bias phenomenon has noticeably been measured by comparing culture group decisions to macroeconomic factors and demographic criteria of each country (Karlsson & Nordén, 2007).

Home bias seems to imply a cultural impact on investment strategies. Indeed, investors seem to be more inclined to invest in their comfort zone, consciously or unconsciously via rational (i.e., transaction costs) or behavioral mechanisms (i.e., psychic distance). As such, it is worthwhile to wonder whether a cultural filter would enable investors to see opportunities under the prism of their own culture and at the same time, not considering foreign market as a single category (Beugelsdijk & Frijns, 2010). Therefore, on the one hand, investors invest mainly near their home (let it be a domestic or international investment of any kind), and on the other hand, investors' preferences are influenced by their cultural background.

Cultural differences have been more generally linked to economic outcomes via several factors determining trust gaps varying with longitudinal distance, common religion, common language, common law and common history. Although Kogut and Singh (1988) created an aggregate measure of cultural distance, one also refers to psychic distance in order to quantify and qualify cultural differences. Indeed, previous cultural factors have an influence on individual preferences, which necessarily evolve into choices in everyday life (Guiso, Sapienza and Zingales, 2003, 2006). In addition, Guiso, Sapienza, and Zingales (2004, 2006, 2008) and Guiso *et al.* (2009) repeatedly concluded that culture influences how groups trust others based on their similarities, which influences investment.

Additionally, new studies emerged in order to determine to which extent a national culture could influence investors' strategies, which are clustered inside their home countries. In other

words, those studies do not concern the interaction between different cultures with respects to their economic outcomes anymore, but instead locally analyze the effect of cultural traits as previously one could have only analyzed demographic values to explain investment behavior. Finance, which was more concerned about larger market aggregates studies, recently incorporated national culture impacts (i.e., individualism and market momentum, uncertainty avoidance and transaction costs) which imply there is little available literature on the topic (Aggarwal & Goodell, 2014). Moreover, authors' analyses are more and more sophisticated and include culture in their behavioral finance research (Aggarwal and Goodell, 2009; Beugelsdijk & Frijns, 2010; Stulz & Williamson, 2003).

3.4. CULTURE'S IMPACT ON RISK PERCEPTION

An interesting property of culture is its relative stability over time which, in respect to the long run horizon of genetic evolution, can generate irrational bias because of the discrepancy between the past it is born from and the threefold challenge of economic modernization, fast changing needs and the evolution of *Homo œconomicus*' cognitive features. As such, the slow adaptation process of *Homo œconomicus* results in different utility preferences from country to country, which automatically implies a variation of constraint factors appreciation under the basic instinct of minimizing efforts through heuristics (Henrich, 1999; Kahneman, 2011).

More and more research has been made since Keeney's (1992) analysis of cross-cultural risk perceptions. At that time, a bridge was already built between individual values and risk perception dimensions. Risk perception dimensions aim to approach the subjective nature of the decision making process through which people assess risk and uncertainty. Renn (1990, p.4) represents risk perception dimensions on 8 axes⁴⁰ that clearly highlight environmental context and by extension cultural context. Although studies had already shown the link between cultural differences and risk perception (Savage, 1993; Gustafson, 1998; Rohrmann, 2000; Bontempo, Bottom & Weber, 2006), those dimensions have not been formally

⁴⁰ See appendix 8: Risk perception dimensions (from Renn, 1990, p.4) p. XI

characterized through cultural components but only cross-culturally (Renn & Rohrman, 2000).

Renn (1992) characterized taxonomy of risk-perception⁴¹ depending on the risk sources, types and impact. The different approaches to risk perspective show a strict dichotomy between cultural theories as part of a structural and constructivist view in comparison to the rational actor implied by an objectivist and individualistic approach (Renn, 1992, p.68). Nevertheless, the classification and studies based on it revealed the clear influence of societal groups, such as cultural groups, on risk perception. Therefore, it would be surprising if culture had no impact on the decision making process, especially since, more than being subjective, risk-perception is also relative (Weber, 2004).

Finance took a normative path toward risk-taking behavior without taking into account a possible difference between individual approaches to risk (Weber & Ancker, 2010). Indeed, risk has been seen only through the means of statistical measure such as variance (Weber & Bottom, 1990). Although Bontempo, Bottom and Weber (1997) showed a difference of risk appreciation between a sample of finance students and analysts from two western countries (the Netherlands and the United States) and two Asian countries (Hong Kong and Taiwan). The results clearly showed a greater difference of risk perception between cultures than between professions, meaning that professional experience does not cancel cultural appreciations.

Recently, risk perception has been approached in market finance from a cultural perspective. As Apartsin, Maymon, Cohen and Singer (2013) concede, the stock market indices of different countries react differently to market conditions, which could be explained by the cultural differences in risk attitude and risk perception of investors. However, it is believed that cross-national risk perception in financial market has never been studied through a formalized cultural framework such as Hofstede (2010) or Globe (2004)⁴².

⁴¹ See appendix 9: Oriented taxonomy on Risk Perspective (from Renn, 1992, p.56-57) p. XII

⁴² The study of risk perception using the aforementioned constructs is widely practiced in other management areas such as marketing (e.g., Jarvenpaa, Tractinsky & Saarinen, 1999).

3.5. CULTURE'S IMPACT ON INVESTMENT STRATEGIES

Adler (1997) states that culture influences people's values, which is reflected in their attitudes and behavior. As noticed by Lucey and Zhang (2010), if culture influences individual behavior, the effect would replicate whenever individuals invest in financial assets. Besides, an abundant literature can be found on cross-cultural influence on investment strategies (i.e., home bias⁴³, and variations such as local bias, on several assets and activities) while few studies can be found on the cultural determinant of investment strategies⁴⁴

The aforementioned little literature available on cross-national analysis including culture regards mainly corporate finance (Aggarwal & Goodell, 2010; Zheng, El Ghouli, Guedhami & Kwok, 2011; Arosa, Richie & Schuhmann, 2014; Holderness, 2014; Lewellyn & Bao, 2014; Zheng & Ashraf, 2014; Chen, Dou, Rhee, Truong & Veeraraghavan, 2015). Regarding financial markets⁴⁵, literature offers highly heterogeneous concerns and methodologies. In all likelihood, research including cultural framework as an explanatory variable begun in the 2010's whereas research based on other societal topics such as religion started earlier (Stulz & Williamson, 2002). Also worth mentioning is the non-systematic use of the cultural dimension to explain national differences. Indeed, some studies use very advanced computations for the field without asserting anything about cultural dimensions (Apartsin, Maymon, Cohen & Singer, 2013).

⁴³ Google Scholar gives approximately 8 130 results to a "home bias" AND "financial markets" search. Alternatively, Elsevier's ScienceDirect database retrieves 9 926 results with the same keywords when the search is restricted to economics, econometrics and finance journals.

⁴⁴ While examining Aggarwal and Goodell's (2014) review of top ten academic accounting and finance journals, it is established there are fewer articles dealing with culture in the finance literature. Actually, the accounting field has included culture as a topic of research at least 20 year earlier. Moreover, among the paper cited by the authors, only 3 focus on cultural dimensions' impact on financial market (and among those 3, 2 deal with corporate finance, while the last one deals with trading outcomes).

⁴⁵ See appendix 10: Literature overview of cultural analysis in market finance topics p. XIII

Noticeably, cultural background was proved to have an impact on several component of investment strategies, for instance the performance and commercial strategies of mutual funds (Keswani, Miguel & Ramos, 2014), investors' trading frequency (Beracha, Fedenia & Skiba, 2014), and the volume, volatility and momentum profits (Chui, Titman & Wei, 2010) and of asset managers' views and behavior from selected countries⁴⁶ (Beckmann, Menkhoff and Suto, 2008). In order to focus on cultural-dimension impacts on financial markets, authors dealt with cultural dimensions using Hofstede's framework. Moreover, different asset classes has been studied, mainly equity from national markets (Chui *et al.*, 2010). Surprisingly, a large heterogeneity arises from the number of country scrutinized, going from 4 (Beckmann, Menkhoff & Suto, 2008) to 50 (Chang & Lin, 2015).

A possible explanation for the previous findings may relate to the methodology of data collection; indeed, Beckmann, Menkhoff & Suto (2008) collected asset managers' views from different organizational levels over a year. Moreover, the explanatory variables are heterogeneous depending on the regressing variable's focus for the econometric studies. Indeed, for the regressing variables, which were portfolios' returns, several portfolio construction strategies have been listed. For instance, asset-pricing models were used mainly in order to investigate returns (Cakici, Fabozzi & Tan, 2013; Keswani, Miguel & Ramos, 2014) while momentum has been studied in order to look more precisely at some market anomalies (Lui, Lui & Ma, 2011) or profits (Chui *et al.*, 2010)

In the light of previous research on the impact of culture on investment strategies, it would be interesting to study the impact of culture on risk-based investment strategies used on the national equity market of a wide selection of countries. Indeed, this type of portfolio construction has never been studied in the context of cultural impact. Moreover, the large sample of countries provides further insight regarding cultural differences. Finally, the choice of national equity markets is assumed to be representative of more global trends as all other studies including non-equity assets proved positive results.

⁴⁶ The interviewed asset managers come from the United States, Germany, Japan, and Thailand.

PART 2: EMPIRICAL ANALYSIS

4. METHODOLOGY

Through the means of the home-bias anomaly (see Part 1, 3.3. Cross-Cultural Influence on Investment Strategies p. 43), the following model aims to scrutinize whether cultural elements as described by Hofstede (2010) can have an impact on the return of risky portfolio. For that purpose, a complete econometric model was built based on existing literature (Chui *et al.*, 2010) in order to analyze the cultural impact on the log returns of both the naïve portfolio and the 3 risk-based portfolios for 46 countries. Indeed, this type of portfolios never was analyzed in this context before.

First, the Research Method part expands on the model to be used and the hypotheses to be tested. Second, Research Design gives more information on the data collection process, the panels and the econometric model.

4.1. RESEARCH METHOD

Based on an established econometric model, this thesis aims to investigate if culture can have an impact on investment strategies. The log returns of the aforementioned naïve and risk-based portfolios⁴⁷ will therefore be the endogenous variable to be explained by a set of different standards factors, namely micro and macro-economic factors, normally used in traditional finance models on the one hand, and cultural ones on the other hand.

4.1.1. ECONOMETRIC MODEL

As per the research questions, the project requires testing an econometric model on a variety of panels that will allow to measure whether or not culture has a more significant impact than traditional variables on investment performance over time:

⁴⁷ The stock market has been regularly used in order to search for bias in investors' behaviors toward risk (Kam, Benton & Pan, 1997; Keller & Siegrist, 2006; Fellner & Maciejovsky, 2007).

$$\text{Ln Return}_{sit} = \beta_i + \sum_{k=0}^{k=it} \beta_k X_{k,it} + \varepsilon_{it}$$

Where Ln Return_{sit} stands for the natural logarithm of the portfolio return s (see Part 1, 1.4. Portfolio Construction Strategies p. 20 for a reminder on computation) of country i over one time t . β_0 represents the intercept of country i . $\sum_{k=0}^{k=it} \beta_k X_{k,it}$ is the sum of the products of each panel explanatory variable k for each country i over time by the corresponding beta factor of that variable. ε_{it} contains all the unspecified variables and other errors that could not be removed.

4.1.2. HYPOTHESES

The panel econometric model will provide insight on several questions related to each culture construct which could impact the 4 portfolios. Furthermore, questions will be designed to know from which extent the 3 risk-based plus the naïve portfolios can be impacted by individualism as it was the most representative dimension for risk-takers in previous studies (Chui *et al.*, 2010). Additionally, the cultural-dimensions-based model's robustness will be tested with alternative cultural constructs.

The hypotheses⁴⁸ were built based on three main objectives. First, hypotheses 1 to 6 (H1-H6) aim to measure the global impact of cultural factors. As such, each cultural construct is tested on the performance of our 4 portfolios (simply sub named a, b, c and d). Second, H7-H10 allow us to investigate whether a specific cultural construct has a more differentiated impact on each portfolio strategy. Individualism is tested first and foremost as it largely impacts the risk-taking behavior of investors (Chui *et al.*, 2010), which matches perfectly with our risk-based and naïve strategies. As such, those hypotheses are oriented. H7 tests whether naïve diversification has a greater impact toward cultural constructs⁴⁹. H8 tests whether the global

⁴⁸ See Appendix 11: Hypotheses p. XVII

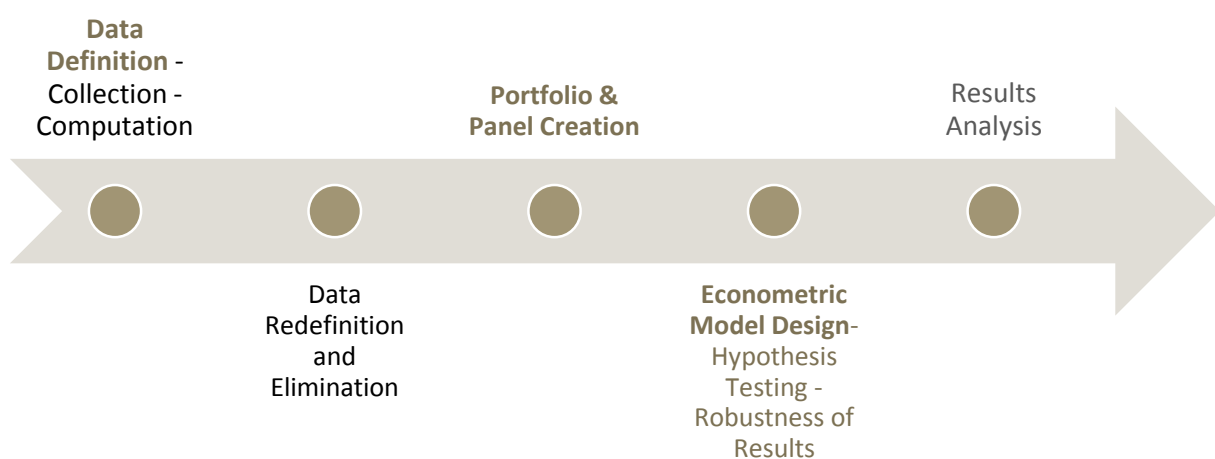
⁴⁹ In order to test H7, other cultural constructs will be added: power distance, uncertainty avoidance, long-term orientation, masculinity and indulgence.

minimum variance portfolio is less impacted with cultural dimensions than other portfolios. H9 tests whether the equal risk contribution portfolio is neutral toward culture. H10 tests whether the maximum diversification portfolio is less impacted from cultural factors than other portfolios. Last but not least, third, H11 scrutinizes whether alternative cultural constructs give comparable results.

4.2. RESEARCH DESIGN

The research design is composed of several steps (see Figure 4). First, data is defined, collected, and, if necessary, computed. Then, the scope of data is redefined. After this, portfolios and panels can be computed. Then, the econometric model is built using linear regression, tested for consistence, and provides results which will be later analyzed. The outline of this part is as follows. First, Data Definition and Collection is presented along with the redefinitions, eliminations and portfolio creation. Second, Panel creation is introduced. Third, the Econometric Model Design is exhibited. For the sake of clarity, the econometric model results and their analysis will be presented in the following chapters.

FIGURE 4 RESEARCH DESIGN



4.2.1. DATA DEFINITION AND COLLECTION

The explanatory variables⁵⁰ are related to cultural values, financial market development, institutional quality and macroeconomic risk factors. Another explanatory variable is directly linked with the performance of the stocks used to build the portfolios, and will be used as a benchmark.

Challenges were encountered during the data-collection. Indeed, the mix of cross-section and time-series data could be a problem, in case of government evolution for instance. Indeed, the institutional quality factors include cross-section data from 2005, which could easily be outdated 10 years later. However, the institutional quality data are not considered as critical in our model. The same problem arises for our cultural factors, which are the key of our analysis. For instance, Hofstede's country data are not complete for the two lately added dimensions: long-term orientation and indulgence. Nevertheless, it is not necessary to take into account all the cultural aspects of a country to determine the implication of those factors. Moreover, some proxies had to be defined for time-series that were missing for a whole country such as for Taiwan. Indeed, some databases were not freely accessible to collect data and some accessible databases were simply not including data from some countries. Additionally, the reader must be aware that some error may arise from poor data quality, but those will be taken into account by the ε factor.

To summarize, whenever data from a period were missing, it was ignored and the model was built based on those periods that were available. However, whenever missing data concerned all the data of a country for a variable, a proxy was used. The first criterion to keep a country in the sample was indeed to have enough market data freely available to build the portfolios.

The final elimination of incomplete regressand data led us from 52 to 46 countries⁵¹ in our sample from November 1997 to April 2015.

⁵⁰ See appendix 12: Explanatory variables p. XIX

⁵¹ Assuming dividend from the market price are reinvested. (Benninga, 2008)

All the data that is used for the regressions comes directly from the sources which are mentioned (Datastream, World Bank, etc.).⁵² All the necessary transformations (for instance, computing the log returns) were done automatically by the attached R code. Consequently, the results are fully reproducible using the same methodology.

4.2.2. PORTFOLIO CREATION

Our econometric model is based on risk-based and naïve portfolio as regressands⁵³. In order to build them, daily⁵⁴ quotes of a selected sample of stocks^{55 56} for 46 countries were collected and then converted to monthly means. Then the final weights that will constitute each portfolio were computed. After that, the log returns of each portfolio for each period of the panel were figured⁵⁷. In order to avoid stopped stock-quotation in the market, portfolios were

⁵² The only alteration has been done for the collectivism measure of GLOBE. In order to mirror Hostede Individualism data, GLOBE's collectivism scale were multiplied by -1 as previously done by Chui *et al.*, (2010). In addition, Change of exchange rate had been computed from Datastream data and Language matrix has been done based on official data from the CIA.

⁵³ See appendix 13: Regressands p. XXII

⁵⁴ In order to be more precise with the returns, daily data was collected.

⁵⁵ The selected sample is constituted by representative stocks from each country's national index. The choice of stocks is based upon their presence in the national index on the first day where historical data for this index was available. A recap table of each country's index which was selected for this analysis can be find in appendix 14: Contry's index and stock summary p. XXIII.

⁵⁶ Caveat: quality of Datastream stock data varies from country to country.

⁵⁷ The model hypothesizes independency of returns and variance over time. As such, it is possible to use repeated single periods to fit multiple periods. As previously mentioned, this assumption, though realistic, has been proved wrong by Fama and French (1989). However, due to the nature of the analysis which is not about predicting returns but scrutinizing if cultural factors have an impact on returns, this hypothesis is still reasonable for the purpose of this study.

made upon a continuous stock availability in each country. This technique has the advantage of generating portfolios based on several time frames from country to country. As such, the significance of a regressand can be tested to some extent over different periods, which is especially valuable for the cross-section aspect of cultural factors.

4.2.3. PANEL DESCRIPTION

The collected data already provides information about the panel used in the econometric analysis. Indeed, each cluster of data is considered as a separate panel that mainly incorporates standards economic factors along with measures of cultural factors:

TABLE 1 PANEL TITLE

Panel A	Culture (Hofstede, 2010)
Panel A'	Culture (House, 2004)
Panel B	Financial Market Development
Panel C	Institutional Quality
Panel D	Macroeconomic Risk Factors
Panel E	Benchmark MSCI

Panels B, C⁵⁸ and D have been reconsidered based on Chui *et al.* (2010) paper except for Panel A and E.

Panel A is deemed the most critical panel of the analysis, as it will cover much of our focus. Indeed, it will be used in order to test our hypotheses H1-H10 previously mentioned. Panel A is composed of cultural constructs from Hofstede (2010) whereas Panel A' is composed of similar cultural dimensions from GLOBE's (House, 2014) investigations and will be used to test the robustness of previous results upon cultural constructs (hypothesis H11).

Panel B is composed of financial market development indicators. They will cover the trend of a country towards welcoming foreign investors. However, as home bias has previously been demonstrated (Chan, Covrig & Ng, 2005), Panel B will enlighten the model from a relative point of view.

⁵⁸ Panel B and C additionally cover market efficiency. Indeed, integrity and integration of market increase the propensity of markets to integrate full information. However, this thesis does not cover macro factors, but investor's. As such, market anomalies won't be treated any further.

Panel C is composed of institutional quality data set. It will be a key ingredient in order to measure willingness to invest in the country. One more time, Panel C is related to home bias and will not be analyzed further than as a comparison with our cultural factors.

Panel D includes elements to describe the macroeconomic risk standard factors.

Panel E is composed of national MSCI indices. For each per-country portfolio, country based index will be the benchmark. Indeed, Panel E is required in order to benchmark the return of our different risk-based portfolios in addition to the naïve composition.

In order to make an informed opinion upon the results of our econometric model, a list of expected correlations was made⁵⁹.

4.2.4. ECONOMETRIC MODEL DESIGN

The econometric model and the data treatment (i.e., portfolio constructions) were computed using R⁶⁰. In order to enable comparison, panel A and E were aggregated with others.

Below, each econometric panels⁶¹ has been computed with each of the 4 portfolios *s*:

Regression 1 – Panel A: Culture and Panel E: MSCI Index were aggregated. Hypotheses will be tested upon them as they are at the core of the demonstration:

$$\begin{aligned} \ln Return_{sit} = & \beta_0 + \beta_1 PDI_i + \beta_2 IDV_{it} + \beta_3 MAS_i + \beta_4 UAI_i \\ & + \beta_5 LTO_i + \beta_6 ING_i + \beta_7 MSCI_{it} + \varepsilon_{it} \end{aligned}$$

⁵⁹ See appendix 15: Expected correlations p. XXXII

⁶⁰ See appendix 16: R code p. XXXIII

⁶¹ See appendix 13: Regressands p. XXII

Regression 2 – Panel A: Culture, Panel E: MSCI Index and Panel B: Financial Market Development were aggregated in order to measure the comparative impact of cultural elements and financial market development factors:

$$\begin{aligned} \ln Return_{sit} = & \beta_0 + \beta_1 PDI_i + \beta_2 IDV_i + \beta_3 MAS_i + \beta_4 UAI_i \\ & + \beta_5 LTO_i + \beta_6 ING_i + \beta_7 MSCI_{it} + \beta_8 Credit_{it} + \beta_9 Control_i + \beta_{10} Lang_i \\ & + \beta_{11} Open_{it} + \varepsilon_{it} \end{aligned}$$

Regression 3 – Panel A: Culture, Panel E: MSCI Index and Panel C: Institutional Quality were aggregated in order to measure the comparative impact of cultural elements and institutional quality factors:

$$\begin{aligned} \ln Return_{sit} = & \beta_0 + \beta_1 PDI_i + \beta_2 IDV_i + \beta_3 MAS_i + \beta_4 UAI_i \\ & + \beta_5 LTO_i + \beta_6 ING_i + \beta_7 MSCI_{it} + \beta_8 Crp_{it} + \beta_9 Protection_i \\ & + \beta_{10} Insider_i + \beta_{11} Own_i + \beta_{12} Political_{it} + \beta_{13} Tran_i + \beta_{14} Law_{it} + \varepsilon_{it} \end{aligned}$$

Regression 4 – Panel A: Culture, Panel E: MSCI Index and Panel D: Macroeconomic Risk Factors were aggregated in order to measure the comparative impact of cultural elements and macroeconomic risk factors:

$$\begin{aligned} \ln Return_{sit} = & \beta_0 + \beta_1 PDI_i + \beta_2 IDV_i + \beta_3 MAS_i + \beta_4 UAI_i \\ & + \beta_5 LTO_i + \beta_6 ING_i + \beta_7 MSCI_{it} + \beta_8 Gdppcgw_{it} + \beta_9 Cfx_{it} + \varepsilon_{it} \end{aligned}$$

Regression 5 – Panel A': Culture and Panel E were aggregated in order to check the robustness of the Regression 1 that includes Panel A and Panel E:

$$\begin{aligned} \ln Return_{sit} = & \beta_0 + \beta_1 G_FUO_i + \beta_2 G_CO1_i + \beta_3 G_CO2_i + \beta_4 G_PDG_i \\ & + \beta_5 G_UAG_i + \beta_7 MSCI_{it} + \varepsilon_{it} \end{aligned}$$

4.2.5. R

Several packages were used. The first difficulty was to find out the most efficient package to extract data from Excel, since the data file of daily stock returns for more than 10 years and 50 countries was quite large. After doing performance benchmarks, Openxlsx package was selected. For the portfolio construction the FRAPO package (Pfaff, 2013) was used. The portfolio returns were computed with the PerformanceAnalytics package (Karl, Peterson & Boudt, 2009). Finally, the Plm package (Croissant & Millo, 2008) was used in order to compute and test the panel econometric models.⁶²

⁶² See appendix 16: R code p XXXIII for the full code with comments.

5. SUMMARY OF OUTCOMES

The previously defined econometric model aims to determine whether cultural constructs have significant impact on risk-based and the naïve portfolio compared to traditional macro and micro economic factors. The previous chapter presented the experimental protocol and the regressions that were used. The following spell out the tests which were used in order to check the adequacy of the econometrics models and the significance of the results. Moreover, Results of Hypotheses Tests will detail the results of the hypotheses tests. Finally, Additional Results of the Robustness Regression will recount how additional interesting results were encountered.

5.1. SIGNIFICANCE OF THE REGRESSIONS

Regressions 1-4 gave satisfactory and consistent results with the OLS technique⁶³. Indeed, the 4 regressions are significant at 99% minimum probability for the 4 tested portfolio returns: naïve, global minimum variance, equal risk contribution and maximum diversification.

As expected, the MSCI returns are positively correlated⁶⁴ with the 4 portfolios' returns in every regressions 1-4 at a 99.9% minimum significance. Moreover, the macroeconomic risk factors *Gdppcgw* (Real domestic product per capita growth rate) and *Cfx* (Change of exchange rate against US Dollar) proved to be significant at a level of 99.9% (p-value = 0,001) for all the portfolios except the maximum diversification one, for which significance is 99% only. All the portfolio returns are significantly correlated positively to *Gdppcgw* and negatively to *Cfx*, which is consistent with investment incentives based on favorable economic environment for the investor. The other standard factors included in regressions 2 and 3 did not show significant correlations to portfolio returns at a 90% level of significance.

⁶³ See appendix 17: Summary of OLS regressions results p. XXXVIII and corresponding tables on different portfolios from p. XXXIX

⁶⁴ See appendix 18: Expected correlations and results p. L

Regression 5 was meant to test the robustness of results from previous regression for the hypothesis testing. Regression 5 also uses OLS regression techniques that have been proven to be consistent and previous literature, and is significant at a 99.9% level.

5.2. RESULTS OF THE HYPOTHESES TESTS

Hypotheses⁶⁵ were tested on regression 1. The computation of the regression over the 4 different portfolios gave different results in term of significance. However, they were comparable and consistent. The global minimum variance portfolio was the portfolio whose returns were least impacted by any of the factors, cultural or otherwise.

TABLE 2 HYPOTHESES RESULTS – GLOBAL CULTURAL IMPACT

GLOBAL CULTURAL IMPACT: each construct's impact on the 4 portfolios		Results
H1: Individualism impact returns significantly		H1 is rejected for all portfolios
H2: Masculinity impact returns significantly		H2 is rejected for all portfolios
H3: Power distance impact returns significantly		H3 is not rejected for all portfolios except GMV at a 90% significance level at least. Moreover all portfolios except GMV show a consistently similar positive correlation.
H4: Uncertainty-avoidance impact returns significantly		H4 is rejected for all portfolios
H5: Long-term orientation impact returns significantly		H5 is rejected for all portfolios
H6: Indulgence orientation increases returns significantly		H6 is rejected for all portfolios

⁶⁵ See appendix 19: Hypothesis results p. LII

Regarding the first set of hypothesis H1-H6 which was tested on the 4 portfolios, Hofstede's cultural constructs of Individualism (*IDV*), Masculinity (*MAS*), Uncertainty avoidance (*UAI*), Long-term orientation (*LTO*) and Indulgence (*ING*) were rejected as significant factors of performance at a 90% level of significance, as there is no proof about the impact of the aforementioned cultural factors on the portfolio returns. However, H3 was only rejected for the Global Minimum Variance portfolio and showed a correlation with a 90% at least ($p\text{-value} < 0.1$) significance level for the other free portfolio returns. Therefore, Power Distance (*PDI*) can be considered as impacting returns on naïve, equal risk diversification and maximum diversification portfolio upon on our sample of 46 countries over time.

TABLE 3 HYPOTHESES RESULTS - CULTURAL IMPACT PER STRATEGY

CULTURAL IMPACT PER STRATEGY: individualism	Results
comparative impact on the 4 portfolios	
H7: Naïve portfolio is more concerned with all the risky cultural constructs than other risk-based portfolios significantly	H7 is rejected
H8: Global minimum variance portfolio is less concerned with individualism than other portfolios significantly	H8 is rejected
H9: Equal risk diversification portfolio is significantly neutral toward individualism	H9 is rejected
H10: Maximum diversification portfolio is less concerned by individualism than other portfolios	H10 is rejected

The second set of hypotheses H7-H10, which was concerned with the extent of significance of Individualism (*IDV*) on the 4 portfolios, was wholly rejected, as this cultural construct gives no significant results. However, considering Power distance (*PDI*) instead⁶⁶, we can clearly see that the global minimum variance portfolio is the least impacted regarding its returns among the other 3. Then comes the equal risk contribution which is not as impacted as the naïve

⁶⁶ Results can be seen using the F-test of the regression 1 for all the portfolio in addition to the t-statistic and p-value of the *PDI* regressand. See appendix XXX

portfolio. Finally, the maximum diversification portfolio is more inclined to be impacted by cultural constructs such as Power Distance (*PDI*).

TABLE 4 HYPOTHESES RESULTS - ALTERNATIVE CULTURAL CONSTRUCT

ALTERNATIVE CULTURAL CONSTRUCT: Using Results alternative dimensions does not change results	
H11: Using House's cultural constructs does change the significance of the results in comparison with Hofstede's dimensions	H11 is rejected

The last hypothesis, H11, was meant to test the robustness of aforementioned results as deal with regression 5. Very surprisingly and despite of previous studies showing Hofstede (2010) and GLOBE (House *et al.*, 2004) matching results such as Chui *et al.* (2010), this hypothesis had to be rejected. Indeed, the results seem to show that Hofstede's and GLOBE's constructs are not as equivalent as previously believed. This is a very interesting and unexpected result, which will be commented at length in the next chapter.

5.3. ADDITIONAL RESULTS OF THE ROBUSTNESS REGRESSION

As previously mentioned, regression 5 provides unexpected results with respect to the conclusions of existing papers dealing with cultural impacts on investment. Indeed, a closer look at the outcomes provides shows consistent and significant impacts on selected GLOBE regressands *G_CO1* (Institutional individualism)⁶⁷ and *G_UAG* (Uncertainty Avoidance). Portfolios are significantly negatively impacted by Institutional Individualism (*G_CO1*) and positively impacted by Uncertainty Avoidance (*G_UAG*) at a 90% minimum level.

TABLE 5 REGRESSION 5 - MAIN FINDINGS

Regression 5 (<i>t</i> -values are in parentheses)	<i>G_CO1</i>	<i>G_UAG</i>
Naïve portfolio	0.0099421**	0.0061946*

⁶⁷ As a reminder *G_CO1* has been multiplied by -1 in the equation.

	(2.6548)	(2.0269)
Global Minimum Variance	0.00291328 (1.3874)	0.00268444 (1.5666)
Equal Risk Contribution	0.0083158* (2.4938)	0.0053249 . (1.9568)
Maximum Diversification	0.00570044 . (1.7637)	0.00680987** (2.5819)

P-value: 0 “****” 0.001 “**” 0.01 “*” 0.05 “.” 0.1 “ ” 1

The significance of G_CO1 and G_UAG is variable from portfolio to portfolio, but the respective values of the beta factors are similar enough to give additional evidence of consistency. As in regression 1, the global minimum variance portfolio is not impacted by the selected cultural factors as regressands. However, interesting results arise from the 3 remaining portfolios. Indeed, the naïve portfolio is the most impacted by Institutional Individualism (G_CO1) at a 99% level of significance, followed by the equal risk contribution portfolio at a 95% level of significance and finally the maximum diversification portfolio at a 90% level of significance. Regarding Uncertainty Avoidance (G_UAG), except for the global minimum variance portfolio, the naïve portfolio is mildly impacted with a 95% level of significance contrary to the maximum diversification portfolio which is impacted at 99%. Finally, the equal risk contribution portfolio is impacted at a 90% level of significance.

Moreover, regression 5 which uses GLOBE cultural factor shows more significant OLS regressions for the four portfolios than that which uses Hofstede’s cultural factors, despite that they are supposed to be mirroring.

As such interesting results arise from the 5th regression, a Fisher test was made after withdrawing the MSCI which showed significance at a 99.9% level. As a result, regression 5 with only the GLOBE cultural factors still gave correlations which were significant at a 95% level for all portfolios and even at a 99% level for the maximum diversification one. Therefore, it is reasonable to believe that the more (locally) diversified a portfolio is, the more impacted it is by cultural factors. It would be interesting to see if those results extend to the global level, but this goes beyond the scope of this thesis.

6. EXPLANATION OF THE RESULTS

As a reminder, the original objective of this research was to find a correlation between the return of one naive and 3 risk-based strategies portfolios on the one hand, and cultural constructs on the other hand. Emulating previous studies (Beckmann, Menkhoff & Suto, 2008; Chui *et al.*, 2010; Lui, lui & Ma, 2011; Keswani, Miguel & Ramos, 2014; Chang & Lin, 2015), Hofstede scale was used and the robustness of the regressands' results were then compared with GLOBE data, which had been only done in the Chui *et al.* (2010)⁶⁸ paper.

As mentioned before, all hypotheses were rejected except for hypothesis 3⁶⁹, and they were all rejected with at least a 90% level of significance. Following the scientific approach, even if the results were not those that were expected, the original hypotheses were kept for the record. Indeed, the absence of an expected correlation is a valid contribution in itself, and moreover, other noteworthy correlations were found. Especially, the last hypothesis, H11, which was supposed to test the robustness of cultural construct results, yielded very interesting results. Indeed, institutional individualism (*G_CO1*) and uncertainty avoidance (*G_UAG*) proved to be positively correlated with all of the tested portfolios' returns, except for the Global Minimum Variance portfolio, at a 90% minimum level of significance.

As such, Explanation for the Difference of Impacts between Portfolios will try to enlighten the results in order to explain what would cause the Global Minimum Variance portfolio to be less affected by culture as measured by cultural constructs. Then, Elaboration upon GLOBE's Construct Results will explain the GLOBE results through the existing theory related to bias and heuristics. After that, Discrepancies between GLOBE and Hofstede Outcomes will focus on the discrepancy between GLOBE and Hofstede constructs in order to explain the reason for the unexpected result of the fifth regression. Finally, Summary of the Findings will summarize the explanations of these outcomes.

⁶⁸ Noticeably, GLOBE constructs has never been used in order to directly measure the impact of culture on investment strategies. (see appendix 10: Literature overview of cultural analysis in market finance topics p. XIII).

⁶⁹ Hypothesis H3a, c and d show a positive correlation of power distance (*PDI*) at a 90% significance level except on the Global Minimum Variance portfolio.

6.1. EXPLANATION FOR THE DIFFERENCE OF IMPACTS BETWEEN PORTFOLIOS

Our results show that the Global Minimum Variance portfolio seems to be rather immune to cultural effects. Moreover, Equal Risk Contribution portfolio was less impacted by culture than the Naïve portfolio. Surprisingly, the Maximum Diversification portfolio was the most impacted by cultural factors among the other 3, despite the fact the naïve portfolio was supposed to be the most heuristic stock picking strategy.

The Global Minimum Variance portfolio aims to minimize the portfolio volatility in order to minimize risk. However, as seen in Part 1, 1.4. Portfolio construction (p. 20) Global Minimum Variance portfolio tends to be concentrated in a few assets that have the minimal volatility among the selected universe, which is intuitive because of volatility minimization. Therefore, the Global Minimum Variance portfolio cannot contain enough stocks to have be representative of cultural constructs impacts on its returns. Therefore, results that show a null reaction of the portfolio returns on cultural constructs is consistent with the composition methods of the Global Minimum Variance portfolio.

The Equal Risk Contribution, Naïve and Maximum Diversification portfolios are all affected by culture as measured by cultural constructs. The 3 portfolios are based on more risk contributions than that built using the Global Minimum Variance strategy. The Naïve, Equal Risk Contribution and Maximum Diversification portfolios are respectively based on equal-weight diversification that strongly depends on the selected security universe, on marginal risk contribution proportioned by an allocation weight that equalize all the risk contribution among asset, and on the full benefit of equity premium so that the portfolio cannot be diversified any further. Therefore, the 3 strategies involve a different philosophy toward the risk contribution of the assets in the portfolio.

Another point to be made is the Equal Risk Contribution reaction to cultural differences in comparison with the Naïve portfolio. The Equal Risk Contribution portfolio is meant by its computing approach to lie between the Global Minimum Variance and the Naïve portfolio strategies. It must be reminded that the Equal Risk Contribution and Naïve portfolio are prone to heuristics because of their high dependence on the selected security universe. Based on previous literature, the fact that the Equal Risk Contribution portfolio is less impacted by cultural factors than the Naïve portfolio is consistent. In other words, the hierarchy of those

portfolios' cultural dependence follows the hierarchy of their position with respect to risk. This hints that culture mostly impacts risk-taking behavior.

Finally, the Maximum Diversification portfolio is the most impacted by the cultural factors among the tested portfolios. The Maximum Diversification portfolio presents the characteristic to outperform the other 3 other strategies (Guilmin, 2015) in addition to be fully diversified and thus to incorporate what it is believed to be a representative sample of a selected universe. As it happens, the selected universe is specific to a country. Consequently, the Maximum Diversification portfolio is believed to be the strategy the most representative of a country. Therefore, the results of the regression 1 and 5 are largely respondent to cultural factors.

The aforementioned results would mean that risk reflects cultural constructs upon econometrics panel outcomes based on regression 1 and 5. This could be consistent with the differences in risk perception between cultures which is described in the adequate literature that has been reviewed in Part 1, 3.5. Culture's Impact on Investment Strategies (p.47).

6.2. ELABORATION UPON GLOBE CONSTRUCTS' RESULTS

The results of regression 5 show interesting findings with respect to GLOBE constructs, more precisely on the institutional individualism (G_CO1) and uncertainty avoidance (G_UAG) scales.

Regression 5 shows G_CO1 , which corresponds to institutional individualism, to be positively correlated to the log returns of all 3 responding portfolios at a minimal significance level of 90%. To be more specific, institutional individualism impacts the Maximum Diversification portfolio's returns at a 90% significance while the Equal Risk Contribution and Naïve portfolios' returns are respectively impacted at a 95% and a 99% significance level by that cultural factor. Interestingly, institutional individualism has been previously used in the literature as a proxy to measure overconfidence bias (Chui *et al.*, 2010) and herding behavior (Beckmann, Menkhoff & Suto, 2008).

Additionally, regression 5 shows a positive impact of G_UAG which deals with uncertainty avoidance. Besides, it is also interesting to notice that the portfolio whose strategy which most

diversifies the risk, named Maximum Diversification, show the most impact of uncertainty avoidance (i.e., the correlation is significant at a 99% level). Then comes the Naïve portfolio, for which uncertainty avoidance impacts returns at a 95% significance level. Finally, the Equal Risk Contribution portfolio's returns are impacted at a 90% significance level by that factor. Uncertainty avoidance has been linked with a risk-adverse behavior. Indeed, uncertainty avoidance is referred in the literature as a more passive behavior (Keswani, Miguel & Ramos, 2004) and thus negatively correlated to overconfidence bias, and its definition is positively linked to status quo and endowment heuristics (Samuelson & Zeckhauser, 1988; Kahneman, Knetsch & Thaler, 1991).

It must also be noted that Schmeling (2009) uses individualism and uncertainty avoidance as a proxy for measuring herding behavior and overconfidence. Interestingly, those two cultural constructs have been shown to be correlated with country GDP per capita in a risk-taking analysis (Li, Griffin, Yue & Zhao, 2013). Herding behavior is linked with the habit of closely following trends; therefore the impact of institutional individualism on the 4 portfolios is consistent with the means by which those portfolios are built. Indeed, the essence of those portfolios is to manage to get decent returns while minimizing risk-taking. Results could be linked with non-herding strategies, meaning that the investor does not follow the market trends. Nevertheless, the previous results also show a positive correlation of returns with the benchmark national MSCI, which puts the construction methods of these indices into question.

6.3. DISCREPANCIES BETWEEN GLOBE AND HOFSTEDE OUTCOMES

As previously mentioned, the results from regressions 1 and 5 were expected to be similar as per Chui *et al.* (2010) finding. This means that the results in regression 1 should not have been rejected by those of regression 5 which was only meant to support the prior results' robustness. However, while regression 1 showed sporadic impact of Hofstede's power distance (*PDI*) and none of his individualism measurement (*IDV*) nor of uncertainty avoidance (*UAI*), the regression 5 showed no influence of power distance (*G_PDG*) but conversely exhibited a rather strong correlation of returns with institutional individualism (*G_CO1*) and of uncertainty avoidance (*G_UAG*).

The aforementioned GLOBE presentation (p. 40) and research design data definition (p. 52) mentioned that the GLOBE results have been divided into practice data (which regards the interviewed sample) and value data (which refers to overall society). Following previous methodology, the inference for overall society (i.e., value data) has been taken into account. However seminal Hofstede's work is, it must be remembered that his data methodology is perfectible, as employees from only one company (i.e., IBM) were interviewed for the whole process of data collection. Therefore, differences in data gathering could explain the discrepancies in findings.

Nevertheless, the difference of impacts are probably not only due to a difference of data collection methodology. Indeed, the definition of data has also been mentioned as different. It is clear that the substance of the cultural constructs, while named similarly, explore different representations. They can be reconciled, of course, but they still were built from subtly different frames of reference. For instance, GLOBE broke some of the constructs used by Hofstede into 2 parts (i.e., Hofstede's Individualism is inversely referred to as institutional collectivism and in-group collectivism). Moreover, Hofstede's uncertainty avoidance dimension deals with social stress and extrapolate it from work-based data while GLOBE's uncertainty avoidance dimension explores a country focal construct of concern (Venaik & Brewer, 2013). Additionally, methods of power distance measurement differ between GLOBE and Hofstede. While GLOBE take results from a top-down view, Hofstede methodology concern a bottom-up perspective. This subtly difference between both approach could explain the discrepancy of results in regression 1 and 5.

Overall, critics of both methodologies do not allow to make any further appreciation of both construct interpretation (Gehrke & Claes, 2014). An attempt to link regression 1's and regression 5's results could be done using Chand and Lin (2015) that show herding behavior to be highly depending of cultural constructs, most noticeably power distance and individualism, based on Hofstede's data.

In different ways, both construct give satisfactory results based on the cultural impact on returns. However, the comparative significance of regression 5 and 1 without the MSCI benchmark seems to indicate that GLOBE's cultural constructs are more adequate for this kind of research.

6.4. SUMMARY OF THE FINDINGS

Despite the rejection of the wide majority of the initial hypotheses, the last and 5th regression unexpectedly lead to the following results:

1. The portfolio strategies that involve returns based on (1) risk and (2) efficient diversification seem to be more impacted by cultural constructs.
2. Individualism and uncertainty avoidance are inversely correlated to herding heuristics. Individualism and uncertainty avoidance are also positively significant on Naïve portfolio and on the Equal Risk Contribution and Maximum Diversification risk-based strategies. Thus, those 3 portfolios are less prone to heuristic bias.
3. GLOBE's data seems to be more adequate for interpreting culture's impact on portfolio returns. This is probably linked to the more global scope of data definition the GLOBE methodology uses.

CONCLUSION

SHORT SUMMARY OF THE STUDY

The purpose of this thesis was to measure whether cultural factors have a significant impact on the returns of naïve and selected risk-based strategies portfolios. Thus, this thesis articulates the impact of culture on investment strategies by bridging the gap between three very different frameworks: risk-based investment strategies (Guilmin, 2015), Chui *et al.* (2010), econometric model based on momentum, volatility and volume analysis. Moreover the Hofstede (2010) and GLOBE (House *et al.*, 2004) cultural dimensions were precious in the very context of this analysis. This thesis is directly connected with the financial outcomes of national culture and offers another perspective on behavioral finance.

THEORETICAL IMPLICATION OF THE STUDY

Three main findings are recounted over the last part of this thesis. First, the different portfolio strategies proved to be differently impacted by culture as measured by cultural constructs. Second, cultural impacts that the regression established to be significant suggest a link with herding heuristics. Third, seemingly equivalent cultural constructs from different positivist theorists exhibit subtle differences.

First, the study suggests that portfolio strategies whose returns are based on risk and efficient diversification seem to be more impacted by cultural factors. The regressions from the studied model show that maximum diversification, naïve equal risk contribution portfolios are respectively more to least impacted by cultural constructs. Additionally, the global minimum variance portfolio was not impacted by the cultural factors which were tested.

Second, Hofstede's power distance proved to be negatively correlated with the maximum diversification, naïve and equal risk contribution portfolios. Moreover, GLOBE's institutional collectivism (i.e.,,, the aforementioned institutional individualism with a factor of -1) and uncertainty avoidance proved to impact respectively negatively and positively the returns of the maximum diversification, naïve and equal risk contribution portfolios, which is along the lines of previous studies which linked individualism and uncertainty avoidance as negatively

correlated to herding heuristics. This result would then mean those 3 portfolios are less likely to be impacted by heuristics bias.

Third, unexpected results lead to consider GLOBE (House *et al.*, 2004) cultural factors as more adequate than Hofstede's because of the consistently more conclusive comparative regression significance. This might be linked to the difference of data collection methodology and of construct design between both theorists.

PRACTICAL IMPLICATIONS OF THE STUDY

This thesis finds a nearly immediate application to the asset management industry. If its findings can be confirmed, it opens the way to both arbitrage opportunities and new global portfolio construction strategies. Indeed, since the performance of stocks and predictably indices is shown to be correlated to cultural indicators, the former could be useful to forecast a modest but still significant part of performance which would be enough to generate alpha value for the investor.

SUGGESTIONS FOR FUTURE RESEARCH

Further extension of the analysis can be done via different methodologies such as investor surveys, microeconomic models, and applied statistical physics models (e.g., Ising model). Regarding the topic itself, further work can be done on the typology of cultural impacts on investment strategies (e.g., frequency), on the asset classes⁷⁰ (e.g., bonds), on the investment strategies themselves (e.g., using time-based or mixed strategies) and on the professional investor sub-culture and its consistency across cultures (e.g., family office versus "too-big-too-fail" trading style). Moreover, as research showed the cultural bias of security analysts (Daniel, 2007), another point of view could also be taken into account by investigating on previous papers. Current research could also be extended to a more detailed focus upon country-specific applications. Of course, these possibilities for future research are far from exhaustive.

⁷⁰ Although previous results regarding non-equity asset class states positive results regarding cultural impacts, it would be interesting to compare the amplitude of this impact between asset classes.

An important point must be emphasized. In the future, it will be more and more difficult to measure cultural impact from country data. Indeed, migration flows are increasing more and more in today's facilitating world. Although, as mentioned in the analysis, foreigners keep their culture of origin while acculturating (Guiso, Sapienza & Zingales, 2004; Bonin, Constant, Tatsiramos & Zimmerman, 2009), a new analytical method might be needed, for instance by updating cultural dimensions more frequently and maybe moving from cultural cluster to country clusters. This would represent a much larger amount of computations and data but as technology progresses, it will also be easier and easier to manage much larger databases.

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