Corso di Laurea magistrale in Amministrazione, finanza e controllo

Tesi di Laurea

Managed Volatility Funds
By Morningstar Investment Management

Relatore
Chiar. ma Prof. ssa Elisa Cavezzali

Correlatore
Chiar. mo Prof. Ugo Rigoni

Laureanda
Cristina Borghilli
Matricola 823589

Anno Accademico
2013 / 2014
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Introduction

The global assets of the mutual fund industry have grown more than sevenfold in the last two decades: from 4 trillion dollars in 1993 to 28.9 trillion dollars in September 2013, with an increase in each of the four broad regions, e.g. the United States, Europe, Asia Pacific and the rest of the world. The boom of mutual funds is favored by factors like the improving levels of economic development, deep liquid markets and the existence of a defined contribution plan system that enables participants to invest in mutual funds. Moreover, demographic factors like the aging of the population in developed and developing countries make retirement schemes increasingly unsustainable, driving investors to grow a demand for mutual funds as a savings vehicle (Plantier, 2013). In Italy, the mutual fund industry expanded between 1995 and 2000 with the reduction of interest rates of Italian Treasury Bonds (BOT, Buoni Ordinari del Tesoro), which led investors to look for investment instruments different from the traditional ones.

Mutual funds are extremely flexible instruments that are totally adaptable to the specific request of each investor. In fact they grant the advantage of allowing even to small household investors to get close to stock markets, investing in a diversified portfolio managed by a professional manager. Mutual funds classification in Italy is currently held by Assogestioni, the representative association of the Italian investment management industry, that classifies mutual funds according to the percentage of stocks held in the portfolio. The five broad categories of mutual funds are stock or equity funds, balanced funds, bond funds, money market funds and flexible funds. Equity funds invest at least 70% in stocks, balanced funds invest from 10% to 90% in stocks, bond funds and money market funds do not invest in stocks, and flexible funds do not have any constraint on the percentage of stocks to keep in the portfolio.

The mutual fund industry has become a highly competitive industry, and the range of products that are offered is constantly growing. It is necessary both for
individual investors and institutional investors that act on behalf of their clients to choose the best portfolio of assets. The concept of asset allocation has been a hot topic in the last decades, and the mean-variance (MV) analysis of Harry Markowitz (1952) with his Modern Portfolio Theory (MPT) is considered to set the birth of modern finance. The theory was further developed by Sharpe in the Capital Asset Pricing Model (CAPM). The idea behind the two cited models is the relationship between risk and return (higher expected returns are obtained increasing the level of risk of the portfolio) and the trade-off relationship between the maximization of portfolio returns and the minimization of portfolio risk. Besides, they are based on the notion that investors act rationally considering all available information, that markets are efficient and that security prices reflect all available information. These theories are still state of the art for most practitioners and many academic circles but are encountering critics by schools of thought like behavioral economics.

Our analysis studies the innovative target volatility approach that the investment management company Morningstar Investment Management applies to three portfolios of funds (funds of funds) to face the actual instability of financial markets. Morningstar Investment Management is a division of Morningstar, Inc., an investment research firm headquartered in Chicago that provides data on investment offerings and whose main activity is to supply information over mutual funds to Microsoft Money Central, American Online and Yahoo Finance. In addition to this, it also provides classifications of mutual funds and fund-ratings. Examples are the Morningstar Style Box, the Morningstar star rating and the Morningstar analyst rating for funds. The investment division of Morningstar, Morningstar Investment Management, has the advantage of having at its disposition a very large amount of information owned by the company itself, that is already selected and interpreted by researchers internal to the company.

The portfolios under analysis are managed since March 2013 by Morningstar Investment Management for the insurance company Clerical Medical. Clerical Medical is a British company specialized in insurance and financial products and it is part of the Lloyds Banking Group. The managed portfolios are three funds of funds with an increasing risk profile (defined by the increasing percentage of equity funds held in the portfolio): CMIG Euro Cautious Managed, CMIG Euro Balanced Managed, CMIG Euro Adventurous Managed. The portfolios are created with the innovative optimization model Markowitz 2.0, that is explained by Kaplan (2011), one of the main experts
behind the elaboration of the Morningstar rating and the Morningstar Style Box. The model is valuable for the current scenario where, after the crash of 2008, investors are growing skepticism towards financial markets. Markowitz 2.0 includes several developments to Markowitz MPT like: the scenario considers fat-tailed distribution; the single period expected return is substituted with the long-term forward-looking geometric mean that takes into account the accumulation of wealth; standard deviation is substituted with conditional value at risk; the covariance matrix is substituted with a Monte Carlo simulation that incorporates any distribution; it exploits the technologies pioneered by Savage (2009) in probability management. The portfolios are very diversified and the funds in each portfolio are chosen through a sophisticated qualitative and quantitative analysis that is peculiar to Morningstar management. Moreover, the funds are managed through the target volatility asset allocation strategy, which implies the rebalancing of the portfolio allocation between equity and bond funds to maintain the target portfolio volatility, keeping the risk under control in all market conditions and profiting from the upward movements of the markets.

The objective of our analysis is to test the efficiency and the value generated by the innovative professional management of Morningstar to the portfolios of funds. In order to test this, we concentrate on one of the three portfolios, the CMIG Euro Adventurous Managed Portfolio, that is the one with the riskier profile. The reason of this choice is due to the fact that we have a good proxy for this portfolio which has a longer history. The proxy is the fund BG Selection Global Risk Managed AX, a fund of a SICAV of Generali Bank that has been managed by Morningstar since October 2009.

The analysis proceeds with the creation of a comparison static portfolio created following the classical MPT by Markowitz and the CAPM by Sharpe and that invests in the same asset classes of the Morningstar portfolio. We expect the comparison portfolio to exhibit lower performance and to produce a lower value to the investment. The analysis shows that the comparison portfolio has higher expected returns and higher cumulated returns but it has a lower percentage invested in stocks, a higher percentage invested in Pacific area and Emerging markets funds, and a lower exposition to the dollar. The combination of these features might have played in favor of the performance of the comparison portfolio and against the performance of the BG portfolio and we do not have enough information to state with certainty that the comparison portfolio will have a higher performance also in the long run.
However, since returns mean nothing unless compared to the risk undertaken to get that return, and since the performance and risk of mutual funds are meaningful only if compared to the benchmark, we proceed our study deriving information over the performance adjusted to the risk and comparing the performance and risk of the funds to the benchmark of reference. Finally, with the use of performance and risk indices we find evidence that the portfolio that is professionally managed and constantly monitored by Morningstar generates greater value than the static comparison portfolio. In fact, even if the comparison portfolio performs higher expected and cumulated returns, it does not produce more value to the investment with respect to the benchmark.

Our analysis is organized in this way:

- In the First Chapter we provide information over the asset management industry, and over the mechanisms that drive mutual funds.
- In the Second Chapter we give a detailed explanation of the Modern Portfolio Theory (MPT) by Markowitz, of its development with the Capital Asset Pricing Model (CAPM) by Sharpe and of the main risk and performance indices.
- In the Third Chapter we describe in detail the strategy and techniques of investment of three portfolios of funds managed following the target volatility approach by Morningstar Investment Management for Clerical Medical.
- In the Fourth Chapter we use the main risk and performance indices to conduct a comparison analysis between the Morningstar portfolio and a comparison static portfolio.
Chapter 1

MUTUAL FUNDS

1.1 Introduction

The global assets of the mutual fund industry have grown more than sevenfold in the last two decades: from 4 trillion dollars in 1993 to 28.9 trillion dollars in September 2013, with an increase in each of the four broad regions, e.g. the United States, Europe, Asia Pacific and the rest of the world. This booming environment is favored by several factors like the improving levels of economic development, deep liquid markets and the existence of a defined contribution plan system that enables participants to invest in mutual funds. Other important causes of the success of mutual funds are demographic factors (the aging of populations) in developed and developing countries that make retirement schemes increasingly unsustainable. In this scenario, investors worldwide are expressing a demand for mutual funds as a savings vehicle, looking for professionally managed and well diversified products that allow them to have access to capital markets (Plantier, 2013).

In this chapter we provide definitions and descriptions of the asset management industry, together with the information necessary for a general comprehension of the mechanisms behind mutual funds.
1.2 Asset management

1.2.1 Asset management definition

The concept of investing part of the savings belongs to the culture of many countries. Investors see it as a necessity to grant profits to reach the goals of life more easily. This is why financial markets have recently experienced the birth of new financial instruments that satisfy investors’ different needs in the respect of their risk and return expectations. The panorama of investing solutions is wide and in continuous evolution. Investors are different from one another and the offer of financial products has to satisfy the different requests of investors with contrasting needs: a retiree might prefer an investment that offers periodic income payments, a worker might prefer to preserve the value of his original investment without a great capital gain and another investor might want to take some risk to take profit from the potential growth of the value of the stocks (Beltratti and Miraglia, 2001).

With regards to what just said, let us present some definitions that are of interest for the purpose of our analysis. Investment management is the discipline of professional asset management of securities (like shares, stocks and bonds) and other investments and it works in line with the specific goals and financial needs of investors. Investors can be private investors that sign investment contracts or collective investment schemes like mutual funds1, or they can be institutions like insurance companies, pension funds and corporations that delegate the management of their capital to a professional intermediary in the asset management industry (Beltratti and Miraglia, 2001). Since the term asset management is generally used to refer to the investment management of collective investment schemes, in this analysis we are going to use the words investment management and asset management interchangeably.

We define asset under management (AuM) as the market value of the assets that an investment company manages on behalf of investors, both private and institutions. With this expression we include the professional activities of mutual funds, SICAV2 (Société d’investissement à capital variable), together with all the activities of investment operated by pension funds and insurance companies for supplementary pensions (De Marchi and Roasio, 1999).

1 See Paragraph 1.3.1 for definition.
2 An open-ended collective investment scheme common in Western Europe.
Let us provide some data on the European market of asset under management. According to the sixth annual report on the asset management market in Europe written by Efama (the European Fund and Asset Management Association), AuM in Europe stood at 13.8 trillion euros at the end of 2011, with a slight decline with respect to 2010 when it amounted to 14.0 trillion euros, due to the effects of the crisis on the retail segment. This value is estimated to be 15.4 trillion euros in 2012, thanks to the reduced tensions on stocks and sovereign debt and thanks to the European Central Bank policy actions. Figure 1 shows the trend of the AuM industry in Europe from 2006 to 2012. Total AuM in the graph is distinguished between discretionary mandate assets and investment funds; the difference between the two is given by the fact that asset managers typically receive mandates from institutional investors and individuals, whereas investment funds serve the retail and institutional market. The graph also indicates the value of AuM in relation to GDP. These two values are often associated, there is in fact a cross-country statistical analysis that studies the correlation between the two values: the study shows that the ratio of long-term mutual fund assets to gross domestic product tends to grow as a country’s per capita income raises (Plantier, 2013).

Figure 1 – Total AuM in Europe (trillion euros)

As of 2011 there are more than 3,200 asset management companies registered in Europe which employ about 90,000 people directly and over 500,000 indirectly and the employment in this sector in predicted to increase. In Europe AuM is concentrated in three top countries that account for 67% of total AuM in Europe: the UK, France and Germany. The largest client category is represented by institutional investors (mostly
insurance companies and pension funds) that act on behalf of households and they account for 75% of total AuM in Europe.

1.2.2 The asset management market in Italy

The propensity to save of Italian families has recently decreased. A research held in 2013 by the Bank of Italy and the European system of Central Banks\(^3\) analyses the savings of Italian households and looks at their propensity to save before and after the recent financial crisis that started in August 2007 and sharpened in autumn 2008. The relevant tendency underlined by the macroeconomic analysis is that, in the last years, the propensity to save of Italian families has notably decreased and since 2009 it has become lower than the average of the euro area (Figure 2). In the past, savings of Italian households were a strength of the country, and Italy had higher savings than all other European countries, but Figure 2 shows that while in the 90s Italian households were willing to save almost 23% of their income, nowadays this percentage has fallen to 12%.

*Figure 2 – Propensity to save, an international comparison*

![Chart showing propensity to save in different countries over time.](chart.png)

*Sources: Eurostat for euro area nations, ONS for UK, BEA for US (Bartiloro and Rampazzi, 2013).*

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\(^3\) It is composed of the European Central Bank (ECB) and the national central banks of all 28 European Union Member States.
Italian asset management legislation is subject to the TUIF (Testo Unico delle disposizioni in materia di Intermediazione Finanziaria) and to the regulations issued by the Italian security and stock exchange commission, e.g. the Consob (Commissione Nazionale per le Società e la Borsa) and the Bank of Italy.

KPMG Advisory\(^4\) held a research in 2012 on asset management in Italy. The research was conducted with the help of the top management of 30 operators that work in the Italian asset management market (they represent almost 75\% of the Italian AuM), in order to study the recent trends, orientations and drivers that trace the development of this sector. This paragraph makes use of this research to focus on some important topics.

As reported by KPMG Advisory savings accumulated by Italian private investors in 2010 are about 50 billion euros, and the wealth of Italian families, net of monetary liabilities, is equal to 8.600 billion euros, the 40\% of which is represented by financial activities (about 3.200 billion euros). However, Italian households do not make great use of asset management: only 6\% of the portfolio of financial activities is devoted to mutual funds, while 30\% of wealth is liquid (cash, bank deposits and postal deposits). Furthermore, even pension funds, complementary pensions and financial/insurance products represent a small portion in the financial portfolio of Italian households (19\% of the total of financial activities)\(^5\). Nonetheless, the asset under management market in Italy is expected to grow. This is due to demographic factors like the extension of the average length of life of the Italian population but also to the recent reforms taken by the Italian government on the pension system that are reducing Social security. As a consequence of this, Italian households will probably tend to favor complementary pensions and long term investment.

The asset management market experienced many changes in the last years, with the birth of new financial instruments and new ways of distribution. It mostly developed in the last decade, but it recently faced several slowdowns due to the financial crisis, the competition of alternative products, asymmetries of the tax system and the loss of confidence of investors because of the unstable financial and economic situation. As of May 2013, the Italian market of asset management has a value of 1.264 billion euros but it has great potential to grow. The sector of asset management should promote savings devoted to Social security and at the same time it should lead the investments to finance

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\(^4\) KPMG Advisory S.p.a. is an Italian society and is part of the KPMG network.

\(^5\) All the data are taken from the Bank of Italy.
the growth of the industrial apparatus in Italy and the development of the domestic market. KPMG Advisory put strength on this market for its strategic role in the development of the country. Nonetheless, it is clear that the asset management sector can develop only with a proper financial education of investors, together with a set of clear and simple regulations, and with the creation of investment solutions that suit new investors needs. It is necessary to enrich the offer of services of advisory addressed to the single client, and to augment the transparence of information of the sector.

Figure 3 shows the trend of AuM in Italy from 2003 to 2013. Data refers to the fourth quarter of each year except from 2013 where we consider the third quarter (data of the fourth quarter is still not available). Each column of the graph represents total AuM for the year and is distinguished between investments in collective schemes and portfolio management investments.

*Figure 3 – Asset under management in Italy from 2003 to 2013 (billion euros)*

It appears that the trend of asset management in Italy reflects the trend of financial markets. AuM faced a boom between 2003 and 2006, where it increased at a rate between 6% and 17%. After 2006 it faced a heavy decrease due to the financial crisis, to the negative performance of stock markets and to investors’ lack of confidence in financial markets. In 2008, the reduction equaled -26% (290 billion euros), followed by a feeble recovery in the following two years and a sharp slowdown in 2011, due to
the worsening of the macroeconomic and financial situation. Since 2012 AuM is increasing and its value as of the third quarter 2013 is close to 1.300 billion euros. This is both because of the positive flows of investments towards the asset management industry but also for the good performance. The European and Global trend, with regards to AuM, is similar to the Italian one. The AuM decreased in 2008 with the sharpening of the economic and financial crisis.

If we look at the net value of inflows and outflows in the asset management market (calculated as the difference between new purchases and redemptions), net flows were positive (new purchases exceeded redemptions) between 2003 and 2006, when the market was in a boom phase. In 2006 the economic and financial crisis interrupted this trend both in Italy and in the rest of Europe, in particular in the market of collective investment schemes. The phenomenon was anticipated in Italy probably because of the higher cost of collective investment schemes in Italy than in other European countries, but also because of the lower inclination of Italian investors towards investments in mutual funds. Net flows were negative between 2007 and 2011 with the greatest contractions in 2007 and 2008, a recovery in 2009 and 2010, another slowdown in 2011 and another recovery in 2012. Again, the slowdown was lower for the portfolio management than for collective investment schemes, probably because of the longer term contracts incurred by investors in portfolio management.

The study of KPMG Advisory demonstrates that net flows in the asset management market are actually related to the trend of the real economy and of financial markets. In more detail, KPMG found out a quite high positive correlation between net flows and the value of the Italian stock exchange index FTSE MIB (correlation equals 0.687) and to the Global stock exchange index MSCI (correlation equals 0.578)\(^6\). This means that when variations of the FTSE MIB and of the MSCI are positive, Italian net flows to the asset management market are positive; on the opposite side, when financial markets decline, net flows are negative. We can conclude that the trend of net flows and investors’ choice of investment are strictly linked to financial markets, and in particular to the Italian one, since correlation with the Italian market index is higher.

\(^6\) KPMG research is conducted on the time period between 2003 and 2011.
KPMG also studied the correlation of net flows with the Italian real economy and found out a positive correlation with the Italian GDP (correlation equals 0.489). Even if the correlation is less significant than the one linked to financial markets, it shows that the investment choice of Italian investors is also related to the real economy.

1.2.3 A global comparison

According to the 6th annual review over asset management in Europe by Efama, Europe ranks as the second largest market in the global asset management industry. Europe in fact, at the end of 2011, managed 31% of the 45 trillion euros managed in the global asset management industry and in the recent years, it has demonstrated to possess approximately one-third of the asset under management of the global industry. The largest market is that of the United States, with an approximated 44% and 16.9 trillion euros. In 2011 growth remained flat in the United States and in other developed countries like Australia and Japan, while it was consistent in the emerging markets like Latin America (12%). Figure 4 represents the numbers of the asset under management market in the world at the end of 2011.

Figure 4 – Global Asset Under Management market at the end of 2011

1.3 Mutual funds

1.3.1 Mutual funds definition

A mutual fund is a trust that pools money collected from many investors for the purpose of investing in securities such as stocks, bonds, money market instruments and other assets. The portfolio of a mutual fund is very diversified and is run by a professional money manager or, in some cases, a management team, with the aim of producing capital gain and income for the fund’s investors. The manager is compensated by a fee directly deducted from the portfolio.

The manager follows a specific investment objective that is indicated in the fund contract and decides what types of securities to purchase according to this objective. Each mutual fund is a separate company and since the mutual fund corporation or trust is owned by its individual shareholders, it is the shareholders and not the asset management company who bear the fund’s investment risk. Besides, the fund’s assets are kept by an independent third party, typically a bank or trust company, in order to protect shareholders from theft by management.

The fund shareholders have equal rights and they participate to the fund returns and losses with respect to the number of shares held. Mutual funds are in fact divided in units (the shares) that are subscribed to investors and that grant equal rights. The numerical value of the shares subscribed by the investor gives the measurement of his participation to the fund.

The capital of the fund is separated by law from the capital of the asset management company and from that of the single participants. This characteristic entails an important consequence: creditors of the asset management company cannot satisfy their credits with the capital of the fund and so they cannot compromise the investors rights.

The UCITS Directive in 1985 gave another definition of ‘investment funds’ as:

“Vehicles the sole objective of which is the collective investment in transferable securities of capital raised from the public and which operates on the principle of risk spreading” (Directive 85/611/ECC).
1.3.2 Main actors in the market of mutual funds

A mutual fund works well if there are four main subjects:

- the management company;
- investors;
- the bank as an independent custodian;
- distributors.

Figure 5 synthesizes the basic structure of mutual funds. Generally, investors subscribe to a registered mutual fund through operators in charge of the placement of investments (distributors). The money of all the investors is pooled together and the fund manager (management company) invests it in securities. The returns (or losses) generated are passed back to investors. The operating of the fund manager is controlled by the custodian bank.

Figure 5 – How mutual funds work

An asset management company is usually created under the initiative of banks, insurance companies or financial societies. Its main task is that of managing the capital of the fund to make it grow, respecting the predetermined investment policy of the fund. It is in charge of the organization of the fund, of the trading, through buying and selling securities, of the administration of interest payments, of dividends and of the settling of...
account balances. It constantly monitors the development of the fund and selects stocks with the aim of keeping the portfolio at an optimal quality level.

Shortly, it operates in this way:

1. It studies financial markets in general through economic variables (GDP, inflation, interest rates) to define the background tendency that might influence the market in the medium-long term. This is defined as the macroeconomic analysis.

2. It studies each listed company through an analysis of balance sheets, periodic publications on financial websites and ratios (to calculate for example liquidity and returns), with the aim of getting an evaluation of the society and an estimation of the future trend of each company’s price. This is defined as the fundamental analysis.

3. It decides how to split the capital among the macro categories of securities (like stocks, bonds, short term investment instruments and hedging instruments), among geographic areas (like Italy, Europe, America and Pacific), among commodities sectors (like chemical, banks and real estate). This step is called asset allocation and this activity is defined both studying the macroeconomic scenario but also respecting the policy of the fund.

4. It selects the single stocks to buy (or sell) after a meticulous study of each stock. This is called stock picking activity.

5. Finally, it decides the best moment to buy or sell a group of stocks or single stocks after a technical analysis that makes wide use of statistics and estimates the trends of the market in general and some specific financial instruments. This is the activity of market timing that many experts of financial markets consider to be fundamental for the success of the fund.

Investors are the owners of the fund, since the fund represents their collective capital. Each subscriber to the fund invests a sum according to his possibilities: the sum of participation might be significant or modest. Nonetheless, the weight of the investment has no matter in terms of rights: all the investors have the same rights and all the investors benefit of the same performance realized by the fund in a certain time frame. So, if the fund performed a 10% increase in one year, all the investors that owned the shares of the fund since the beginning of the year will get a return of 10% at the end of the year, whether they invested 1,000 or 100,000 euros.
The independent custodian bank is in charge of the administration of the capital of the fund and it oversees on the asset manager operations to make sure that they are in line with the laws and regulation of the fund. It also keeps in custody the stocks and liquidity of the fund, it regulates the operations of the asset manager and the credit of interest payments. This is a guarantee for the investor because the money is in the custody of a third party and not of the asset manager society. The Italian regulation of the bank custodian is even stricter than in other countries and it is the form of investment most protected by law.

Fund distributors manage the subscription procedures but also help investors in their investment choices. They act as a wholesaler if they sell shares to securities dealers who then sell to investors, or they might deal directly with the public as a retailer (De Marchi and Roasio, 1993).

1.3.3 The scenario of development of mutual funds

The popularity of mutual funds investing is undeniable. Fredman and Russ write: “Making money is in vogue these days. [...] And investing is a big part of the money-making equation. Cash you don’t need now can be put to work –to finance everything from child’s education or a new home purchase to your retirement”. And mutual funds perfectly suit this statement.

Mutual funds grew explosively almost all around the world during the 1990s. In the United States, mutual funds total net asset grew from USD 1.6 trillion in 1992 to 5.5 trillion in 1998, with an average annual rate of growth of 22.4%. The rapid growth of mutual funds in the US is due to the increase in households’ ownership of mutual funds. The percentage of US households owning mutual funds grew from 6% in 1980 to 27% in 1992, to 44% in 1998 and to a peak of 52% in 2001, before falling back to 49.6% in 2002. This trend is the consequence of a positive orientation of investors towards the financial system: the strong performance of equity and bond markets, the increasing globalization of finance and the development of capital markets lead investors to increase confidence towards market integrity, liquidity and efficiency. Another phenomenon that contributed to the popularity of mutual funds is the demographic aging of the population of most high and middle-income countries and the consequent
growth of a segment of investors that look for financial instruments that grant long-term return like mutual funds (Fernando et al, 2003).

A very similar trend was experienced by the 15 countries of the European Union, where total net asset grew from USD 1 trillion in 1995 to 2.6 trillion in 1998, with an average annual growth rate of 17.7% (Fernando et al, 2003). Data of EFAMA confirm the success of the market of UCITS\(^7\).

Concerning Italy, mutual funds expanded between 1995 and 2000, when the number of mutual funds grew from 400 to 800 and money invested in mutual funds went from 120 trillion of Italian liras to 750 trillion. Their popularity started with the reduction of interest rates of Italian Treasury Bonds (BOT, Buoni Ordinari del Tesoro), which lead investors to look for investment instruments different from the traditional ones like the BOT, Treasury Bonds with long term maturity (BTp) and Treasury Credit Certificates (CcT). Moreover, it started to develop the concept of real diversification even among households. Whereas for many years investors diversified buying fixed rate BTp, variable rate CcT and some stocks, with the birth of mutual funds, people started to understand that the globalization of financial markets required to further diversify and they considered the possibility to include in the portfolio securities of different business areas but also of different geographic areas. In this scenario, the number of financial products grew all over the world, competition between banks and other financial intermediaries sharpened and the financial markets became more and more global (Bartiloro and Rampazzi, 2013).

The phenomenon characterized also developing countries in the Asia-Pacific world and so it follows that all the four broad regions (the United States, Europe, Asia Pacific and the rest of the world) faced a strong growth in the market of mutual funds. Global assets in mutual funds in fact increased from 4 trillion dollars in 1993 to 28.9 trillion dollars in September 2013 (Plantier, 2013).

To conclude we sum up the main factors responsible of the phenomenon of development of mutual funds on the global basis.

\(^7\) UCITS (Undertakings for collective investment in transferable securities) are a set of European Directives giving European passport to a financial product. As a consequence, a fund authorized by one member state could operate with no limits in Europe. In reality, however, every State established a set of rules to protect its local asset management. established to allow to collective investment schemes to operate freely around Europe unifying the legislation and
1. Households’ increased demand to invest in professionally managed investment products to indirectly access capital markets. By pooling the investment of many individuals in fact mutual funds allow to household investors to invest in a diversified exposure to securities that they might individually find too costly or unattainable.

2. The creation of an appropriate regulation of capital markets at the mutual fund level to provide an adequate disclosure and to limit potential conflicts.

3. The increased availability of deep and liquid capital markets. There is strong evidence that the size of a country’s capital market is correlated with the size of the mutual fund industry.

4. The availability of a large common market where mutual funds can be bought and sold, this is confirmed by the fact that the greatest market of mutual funds is that of the U.S. (that is by nature a common market) and the European, which are both large common markets.

5. Capital market returns. Even if in the short-run returns on the stock and bond market can vary significantly from year to year, in the long-run returns tend to be favorable. Thanks to mutual funds, investors can access these favorable returns through a diversified and professionally managed product.

6. The economic development of a country. This is fundamental since mutual funds are considered as a superior good (Fernando et al., 2003) and so ownership of mutual funds increases with households’ income.

7. Demographic changes that are making retirement schemes increasingly unsustainable. Retirement schemes were created when a large number of workers supported a smaller number of retirees. But the support ratio, that is the measure of the number of working-age people relative to those of retirement age fell sharply. By 2050, the support ratio in Japan, Australia, US, Germany, UK, France, is expected to be about 2.2 workers per retiree, compared to the 7.8 workers per retiree in 1950. This leads individuals to shift to private investments to finance their retirement.

8. The introduction of defined contribution (DC) plan systems. Changes in demography led states to adopt (DC) plan systems which make great use of mutual funds. DC plan systems differ around the world: in the US the level of contribution is chosen by employees and employers may match part of the contribution of the employees; in others, like Chile and Australia the government
establishes a minimum contribution and allows for additional contributions above the minimum level. Despite this, the important thing here is that these systems allow participants to choose investment, including investment in mutual funds (Plantier, 2013).

1.3.4 Mutual funds in Italy

The first Italian experience with mutual funds dates back to 1960, when it appeared the first Italian-Luxembourg fund called Interitalia, that was domiciled in Luxemburg but created by the Italian bank Banco Ambrosiano. The fund was not domiciled in Italy since there was not a norm that regulated mutual funds in Italy. The choice of Luxemburg instead of other countries was due to its favorable taxation (De Marchi and Roasio, 1999). A law of 1983 made it possible to buy funds of Luxemburg legislation and after that date the share of Italian households’ financial assets invested in mutual funds grew steadily.

It is interesting to consider the results of a research conducted by McKinsey Global Institute that makes a comparison on the elements taken into consideration when investing in funds in Italy and in the US. In Italy, the most relevant element influencing the choice of mutual funds is the brand of the selling society, followed by: capital guaranteed (we consider capital guaranteed as a low risk/return profile instead of a real guarantee on the money invested), clear information on the risk, clear information on the performance, the simplicity of the service, the liquidity of the investment and, at the last, the performance. The result of the research in the US market is totally different: performance is at the top of the list, followed by a simple and without problem service, advice in the fund selection, low commissions, brand, availability of the service twenty-four hours a day, advise on the asset allocation and wide availability of products.

The difference between the two lists is notable, in particular considering the positioning of the performance of the fund. Italian investors appear to be interested in elements that are not a guarantee of a good result of the investment, such as the brand. American investors instead, are interested in elements linked to the financial success of the investment, such as low commissions, advice on the asset allocation and variety of

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8 The research is discussed by Liera, 1999.
products offered. One of the main reasons of this difference might be explained by the different ways of distribution of mutual funds in the two countries. In Italy, mutual funds are sold by networks of financial advisors, by banks, directly by the asset management company or through the internet, with certain restrictions. In the US, instead, the distribution does not occur under the advisory of the bank that sells its own funds, but under the advisory of an independent expert (De Marchi and Roasio, 1999).

1.3.5 Advantages of mutual funds

Mutual funds are extremely flexible instruments that are totally adaptable to the specific request of each investor. The mechanism of investment, the rules of participation and interest payments are the same for each investor, but the way in which a fund is used to reach certain objectives is absolutely specific to each individual. Thanks to their organization and structure, they offer several advantages.

First of all mutual funds allow even to small household investors to get close to stock markets: the subscription to a mutual fund in fact requires a small initial sum. Moreover, investors have the possibility to accumulate money on, for example, a monthly basis; with this mechanism they accumulate capital through years without a huge sacrifice, because they periodically take a small amount of money from their monthly savings and invest it to make it grow.

Moreover, the portfolio of each fund is very diversified. Mutual funds invest in a dozen or so stocks up to several hundred in larger portfolios and as a consequence they contain very little company specific risk. To sum up, they allow a diversification that a small investor alone could never reach. Diversification is always the basis of a good investment, and it is even more important now that financial markets are global and it is difficult to reach full information about foreign investments.

Mutual funds popularity grew among small investors also because of the ease to convert the investment in liquidity. Mutual funds shares can be purchased but also redeemed quickly. The Italian legislation of mutual funds requires asset management companies to redeem shares to investors within 15 days from the request. Further, money can be efficiently switched between, say, a stock and a money market fund at little or no-cost.
Since their birth, mutual funds have always guaranteed a quite high return in the medium and long run. They are not an instrument for speculation in the short term but an instrument that invests and maximizes results in the long term. It is also relevant to say that, even if it is possible to experience a loss if the fund’s holding declines in price, the probability of fraud, scandal or bankruptcy involving the fund’s management company is very small. This is possible because the investment risk is shifted to shareholders, and because the legal structure and regulation is very strict. Moreover the management company and other affiliated parties cannot undergo certain types of transactions, so the risks faced in mutual funds arise only from fluctuations in the stock or bond market but not from foul play. As a consequence mutual funds are generally seen by investors as a safer investment compared to other forms of investment (Fredman and Wiles, 1993).

Also, investments in mutual funds are guaranteed lower taxation. In Italy, Italian law 461/97 granted a substitute tax of 12.5% on returns of the fund for Italian and Luxembourg funds. The recent legislative decree number 225 of 29th December 2010 established that from the 1st of July 2011, taxation of the returns is shifted from the fund to the single subscribers of the fund. This adjustment was made to recognize to Italian and Luxembourg funds the same taxation currently in use in all the other member States of the European Union (Assogestioni, 2011).

Lastly, mutual funds offer the possibility to invest in a low cost diversified portfolio managed by a skilled, experienced professional manager. Managers are periodically judged by the total return they generate and those who do not produce are replaced, since the choice of the best management is one of the key aspects of the success of a fund.

Italian mutual funds regulation is characterized by great transparency, there is no investment instrument in Italy that has similar regulation in terms of transparency. The Italian Security and Exchange Commission CONSOB (Commissione Nazionale per le Società e la Borsa) obliges mutual funds to publish a documentation that provides detailed information on the working mechanisms of the fund. The two main documents

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9 For ten years the asset management market experienced a flow from investments in Italian mutual funds towards mutual funds of the European Union. The main cause was the unfavorable fiscal treatment of Italian mutual funds. In fact, before 2011, Italian taxation of returns of mutual funds was in charge of the fund, without regard to the fact that investors collected the returns or not, while in the rest of the European Union the returns of harmonized funds were taxed directly to the subscriber when they actually got the returns (Assogestioni, 2011).
in the Italian legislation of mutual funds are the prospectus and the document of regulation of the fund management, together with other documentation like the double entry bookkeeping and the semi-annual and annual report.

The composition of the prospectus is fixed and easy to read and understand. The main aim of the prospectus is that of granting to the subscriber an easier comparison between the fund he is subscribing to and other mutual funds, and to provide all the information needed both for his prevention and knowledge. The prospectus answers most of the questions about the fund. It contains information on the legal status of the fund, on the independent custodian (usually a bank), on distributors, on the main characteristics of the fund and on the subscription policies. It also describes the objectives of the investment, the investment strategy, the investment risks, transaction costs and ongoing expenses, the benchmark, taxation and financial history and explanations on how to purchase and redeem shares. The document of regulation of the fund management instead is the document through which the management society creates the fund and it is the document that the subscriber undersigns to state that he is aware of the conditions and characteristics of the fund.

1.4 Categories and costs of mutual funds and life insurance plans

1.4.1 Mutual funds classification in Italy

Mutual funds classification in Italy is currently held by Assogestioni, the representative association of the Italian investment management industry. Assogestioni represents most of the Italian and foreign investment management companies operating in Italy, as well as banks and insurance companies involved in investment management, including pension schemes, with the main aim of fostering the investment management industry in Italy. The classification is intended to make the functioning of mutual funds clearer and to give the right placement to funds with different characteristics as a useful instrument for all the actors in the market of funds.

Assogestioni classification came in force on July 1st, 2003; its basic principle is that of looking at the final investor, the so called “weak party”, and it takes his point of view respecting the basic principles of financial markets. The classification should allow investors to understand immediately and in an easy way the most evident risky
factors of investing in funds and it should induce them to read carefully the prospectus and all the documents that are part of the contract of investment. It is not to be considered as an instrument to make an analysis on risk and return of each single investment.

The classification is precise and is based on objective parameters. The first division of mutual funds into five macro areas is on the base of the portfolio composition. We now list mutual funds according to this classification in a decreasing order, on the base of the percentage of stocks held in the portfolio:

1. Stock or equity funds;
2. Balanced funds;
3. Bond funds;
4. Money market funds;
5. Flexible funds.

Equity funds invest at least 70% in stocks, balanced funds invest in stocks only in a percentage that goes from 10 to 90, bond funds and money market funds cannot invest in stocks, and flexible funds do not have any constraint on the percentage of stocks to keep in the portfolio. Let us now describe in more detail the composition and basic features of each category.

Stock or equity funds invest in common stocks that represent ownership equity in corporations. Thanks to trading operations, these funds grant higher returns than other funds, but also higher risk. They are generally characterized by a main investment of 70% of the portfolio invested in stocks, and a residual investment of 30% invested in bonds or money market instruments. Generally, the specific sector or geographic area in which the fund is invested gives the name to the fund. According to this, they can be further divided into: equity fund Italy, Euro Area, Europe, America, Pacific, Emerging Markets, Country, international, energy and raw materials, industrials, common goods, health, finance, information technology, telecommunication, advertisement, other sectors and other specializations. Mutual funds that belong to the categories equity Italy, Euro area, Europe, America, Pacific and emerging markets are characterized by the main investment in stocks invested in the specific geographic areas of definition. Mutual funds of each State are characterized by the main investment in the State defined by the regulation; mutual funds that belong to the other sector categories are determined
by the main investment invested in stocks belonging to one or more of the sectors specified by the Global Industry Classification (GICS). Usually the sector categorization prevails on the geographic one.

*Balanced funds* invest in bonds and stocks. They can be further differentiated in balanced equity funds (with stocks in a proportion between 50% and 90%), balanced funds (with stocks in portfolio between 30% and 70%) and balanced bond funds (with stocks in portfolio between 10% and 50%).

*Bond funds* invest especially in fixed income or debt securities. Different kind of bonds can be included such as high-yield bonds, junk bonds, investment-grade corporate bonds, government and municipal bonds. The classification of bond funds is defined according to the combination of risky factors that we define with:

**Market risk:**

- Currency denomination: euro, dollar, yen or other currencies;
- Portfolio duration.

**Credit risk:**

- Issuer’s jurisdiction: developed or emerging markets;
- Type of issuer: State or firm;
- Credit merits: investment grade or high yield.

*Assogestioni* defines several specialized categories among bond funds: short/medium/long term government bond in euro area, euro corporate investment grade bond, euro high yield bond, short/medium/long term government bonds in dollars, dollar corporate investment grade bonds, dollar high yield bond, international government bond, international corporate investment grade bond, international high yield bond, yen bond, emerging market bonds, other specialized bonds. Non specialized bonds are mixed bonds and flexible bonds.

*Money market funds* invest in bonds and money market instruments, mostly short-term financial instruments like Treasury Bonds, certificates of deposit and long term bonds with a residual life not greater than six months. The main feature of this category is the level of liquidity of the investment and the necessity to continuously switch the composition of the portfolio to profit from the negotiation. According to
Assogestioni, financial instruments in the portfolio cannot have a rating smaller than A2 (Moody’s), A (S&P) or an equivalent rating given by an independent rating agency, and the duration of the portfolio should be smaller than six months. Liquidity funds differ according to the currency of emission of the securities in the fund: euro money market funds, US dollar money market funds, yen money market funds and other currencies money markets.

Finally, flexible funds are characterized by the fact that they do not follow a rigid investment scheme, they might change their investment strategies as they see fit. This means that they do not stick to one particular strategy as other categories of funds do, but they privilege investments in stocks or bonds according to market perspectives.

It is relevant to know that all mutual funds, with the exception of flexible mutual funds, have maxima or minima limits of investment in certain financial instruments and in the duration of the portfolio. These limits refer for example to the effects that financial derivatives have on the total risk of the portfolio. Table 1 summarizes the main characteristics of the five macro categories of mutual funds:

Table 1 –Classification of mutual funds by Assogestioni

<table>
<thead>
<tr>
<th>Category of funds</th>
<th>% of investment in stocks</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock or Equity</td>
<td>At least 70%</td>
<td>They generally take the name from the specific sector or geographic area of investment</td>
</tr>
<tr>
<td>Balanced</td>
<td>From 10% to 90%</td>
<td>Further differentiated in balanced equity funds (stocks between 50% and 90%), balanced funds (stocks between 30% and 70%) and balanced bond funds (stocks between 10% and 50%)</td>
</tr>
<tr>
<td>Bond</td>
<td>0%</td>
<td>Defined according to market risk and credit risk.</td>
</tr>
<tr>
<td>Money market</td>
<td>0%</td>
<td>Very liquid investment. They are distinguished by the currency of emission of the securities.</td>
</tr>
<tr>
<td>Flexible</td>
<td>No limits. From 0% to 100%</td>
<td>They privilege investments in stocks and bonds according to market perspectives.</td>
</tr>
</tbody>
</table>

Source: Assogestioni.

Each macro category is further subdivided in several categories according to the risky factors that characterize it. Equity funds are subject to the risk of the sector specialization and of the risk of jurisdiction of the stock issuer; balanced fund’s risk is linked only to the part invested in stocks; bond funds risk derives from market risk (currency and duration of the portfolio) and to credit risk; money market funds are subject to currency risk, credit risk and to the duration of the portfolio; flexible funds
instead do not have a type of risk that can be generalized for the category because they do not follow a fixed pattern.

As already said, the classification of Assogestioni is based on specific politics of investment and it is created with the aim of helping investors to understand mutual funds. To supplement this categorization, Assogestioni provides the definition of some qualifications proper to the politics of investment in mutual funds, that help to define the mechanisms of some funds but that are external to the basic classification. This means that these features are independent from the previously described classification, they only represent a supplemental description that is important to know. Before listing these characteristics, there are two important conditions to keep in mind: first, the fund denomination must contain the conditions that recall the qualification that the asset manager declares; second, the fund regulation should illustrate with precision the constraints applied to the policy of investment that justifies the declared qualification of the fund.

First qualification is that of ethic funds. The politic of investment of an ethic fund denies the purchase of certain stocks and privileges the purchase of others according to the fund ethical criteria. This means that ethic funds do not invest with the sole criterion of maximizing the return from the investment but also respecting ethical principles that are defined by the corporate governance of the fund. Usually, the decision of which stocks to buy is linked to the social effects that the activity of the issuer corporation has. Criteria can be “positive” or “negative”: funds that follow negative investment criteria do not invest in stocks whose issuing firm violates some moral principles (for example firms that produce weapons or firms in States that violate human rights); funds that follow positive criteria, instead, invest in firms that result to be the best according to a certain social criterion (for example a firm that has the lower level of pollution in its sector) or in firms with specific ethical objectives (the protection of the environment).

Another qualification is that of capital protection. Capital protection funds follow a policy of investment where the objective is the protection of the value of the investment. They apply quantitative techniques on the management of investment to limit losses. No more guarantees are granted other than the fact that the value of the investment do not go under the level of protection. The value of the investment depends on a quantity linked to the value of the share of the fund. It is important to notice that
capital protection funds have guaranteed capital but do not have certain return. *Capital guarantee funds* instead grant to each subscriber, independently from the results of the fund, the return of a predetermined percentage of the capital placed in the fund at maturity. In these last two types of funds any losses experienced by the underlying investments are absorbed by the fund company, this is why the majority of the fund capital is invested in very conservative securities. As a consequence of trying to limiting losses through investments in risk-free securities, these funds offer a very low rate of return.

The last qualification described by *Assogestioni* is that of *index funds*. Index funds policy of investment has the objective of duplicating the risk/return profile of a market index.

### 1.4.2 Other categories of mutual funds

There are other classifications of mutual funds different from that of *Assogestioni* and based on other parameters. Before talking about some of these categories that are of interest for the aim of our analysis, let us clarify a point.

In Italy, the two broad categories of investment funds are basically *mutual funds* and *SICAV*, e.g. the acronym for French *Société d’investissement à capital variable*. The difference between the two is the fact that mutual funds have a distinct and independent capital formed by the money invested by the subscribers and it is managed by an asset management society, SICAV instead are societies whose subscribers are shareholders with the relative rights, like the right to vote. The activity of asset management in a mutual fund is usually delegated to an asset management company while in a SICAV it is usually conducted by a team of managers of the SICAV itself. Sometimes even the SICAV delegates the management of the whole portfolio or of a part of it to an external asset manager. In this case, the board of directors of the SICAV defines to the asset manager the objectives of the fund and controls how the asset manager works. SICAV and asset management societies are the only two organizations that can exercise the activity of management in collective investment schemes. In Italy, they can operate only with the authorization of the Bank of Italy (and indirectly of the Consob). In practice, mutual funds and SICAV work for the same economic purpose.
that is the collective management of the money collected from the investors. This is why, for the intent of our analysis, we will talk about mutual funds and SICAV interchangeably.

Mutual funds can be distinguished according to the diversification of their portfolio. *Diversified funds* invest in corporations that belong to different economic sectors and to different geographic areas, *specialized funds* instead invest in societies that belong to the same business sector or to the same geographic area. Examples of specific business sectors are the pharmaceuticals, biotechnologies and common goods.

Another categorization is based on the technical subscription features. Investors can choose to invest in mutual funds through a one-time lump sum investment, a systematic investment plan or a systematic transfer plan. A *one-time lump sum investment* requires that investors put a lump sum amount and buy mutual fund shares at once; a *systematic investment plan (SIP)* is a system that allows to invest a fix amount at regular intervals in a particular scheme\(^\text{10}\). The other modality of investment is the *systematic transfer plan (STP)*, where the investor invests a lump sum in a scheme and a small amount at regular intervals in another scheme, allowing to adhere to the asset allocation suitable for the client and to earn higher returns from the scheme that performs better.

Depending on their organizational structure, mutual funds can be divided between closed-end and open-end funds. *Closed-end funds* are investment societies with fixed capital, this means that capital cannot change with new subscriptions and redemptions of shares, and the number of shares outstanding is pre-determined and cannot change. The only way to augment the number of shares is through an increase in capital subject to usual procedures of corporations. Closed-end funds shares can be listed on the stock exchange. *Open-end funds*, on the contrary, issue new shares to incoming investors at the current price or net asset value and repurchase or redeem shares from investors exiting the fund; the redemption takes place in a maximum predetermined period. The possibility to issue and redeem shares at any time is the main feature of open-end funds. As a consequence, the net asset value of an open end fund varies not only according to the financial activities in which it invests, but also according to the amount of existing shares, that is the number of subscriptions (the

\(^{10}\) A SIP is managed in a way that the investors buy more units when the stock market is down and a fewer units during an upsurge. This mechanism is also called Rupee cost averaging.
investors that invest in the fund) and redemptions (the number of investors that redeem their shares). Every share must be redeemed at the real value (that means the real value of the stocks owned, valued at the price of the day in which the redemption is demanded); as a consequence the number of shares in circulation cannot be prefixed but varies continuously. The choice of the structure is often functional to the different politics of investment. Closed-end mutual funds investments are long term and tend not to be liquid (real estate, credits) since the manager of the fund needs a certain stability of the fund capital for a certain period of time. Open-end funds instead usually invest in stocks, bonds and other quoted instruments that can be negotiated in the market. In fact they do not necessitate a stable capital, since in case of need of liquidity they sell the stocks of the portfolio.

In Italy, another important criterion of definition of mutual funds is given by the origin of the fund: there are funds of Italian legislation and funds of foreign legislations, e.g. constituted in States other than Italy, but sold in Italy. Funds in compliance with the European Union legislation are called harmonized mutual funds. They are constituted in the European Union that mostly invest in listed financial instruments. The word harmonized derives from the fact that they follow the rules and common criteria required by the European community.

The level of activity of the management of the fund is the discriminating factor for the distinction between funds under active management and passive management. The level of activity of a fund is defined by the difference between the return of the fund and the benchmark. The benchmark\footnote{Definition of “benchmark” in Paragraph 1.5.2; see Chapter 2, Paragraph 2.5 for more details.} is the standard used to measure the fund performance. The more the fund portfolio is close to the benchmark portfolio, the more the return of the fund is close to the return of the benchmark. In a perfectly passively managed fund, the fund return and the benchmark return are equal: the fund manager owns at any time a portfolio equal to that of the fund. Since the benchmark often corresponds to a stock market index, whether it is an equity market index, a bond market index or an average of indices, funds with a perfectly passive management are also defined index-funds (as already seen in Paragraph 1.2.5). An index fund does not necessarily invest in all the stocks that form the index, they can perform a semi-passive management choosing a subgroup of stocks that replicate the fund. The management of an index fund does not require an analytical structure and specific studies of the stocks.
and financial markets for the asset allocation, an automatic system of conversion is used for investments; this also makes index funds less costly. Actively managed funds allow a variety of investments instead of investing in the market and they give the possibility to follow different strategies of investment. They are more volatile since the fund manager aims at beating the benchmark and he is willing to undertake higher risks in order to do that.

Funds of funds are characterized by the fact that they invest in shares of other funds or SICAV and are non harmonized mutual funds. From the point of view of their structure and organization they are open-end funds, subject to daily publication of the value of its shares, and they have some restrictions. Still, the policy of investment of this instrument should be consistent with the fund objective. Funds of funds can be multi-brand, if they invest in funds managed by more than one asset manager, or mono-brand, if they invest in funds of one asset manager, and they have different risk/return profiles. One of the advantages of this category of funds is the higher level of diversification; even if certain mutual funds are conceptually close to stock or bond funds, they have lower idiosyncratic risk\(^\text{12}\) (De Marchi and Roasio, 1999; Beltratti and Miraglia, 2001; Santoboni, 2012).

1.4.3 Mutual funds costs

When talking about mutual funds it is always important to keep an eye on fees and shares that investors incur. These costs pay for expenses sustained by the fund manager when providing sales services, portfolio management services, fund administration, subscription to the fund shares, reimbursement and other costs related to the activity (Anolli, Del Giudice, 2008). Costs might erode the returns if the manager is not faring well, and high costs exert an even heavier weight when compounded over many years, in fact even a slight difference in costs can make a big difference if the life of the investment is quite long. In fact, it is evident that funds with lower costs put more money working for the investors.

The four basic types of fees or expenses associated with funds are:

\(^{12}\) Definition of “idiosyncratic risk” in Chapter 2, Paragraph 2.3.7.
1. Sales charges, that include front-end loads, back-end loads and ongoing asset-based sales charges. Front-end and back-end loads can be fixed or a percentage (constant or decreasing). Front-end loads tend to decrease as the capital is put into the fund, back-end loads instead can decrease, especially according to the length of adherence to the fund.

2. Ongoing services paid by a fund company to brokers and salespersons for personal assistance to the clients, that is mainly an investment advice.

3. Ongoing management and administrative costs. These include the costs of the management of the fund together with those for the custodian and the transfer agent.

4. Costs associated with the trading of the securities in the portfolio.

Portfolios with no charges in the first two categories are called no-load funds (Fredman and Wiles, 1993).

In order to understand the reason of costs in mutual funds it is necessary to think about their functioning. Mutual funds in fact give the opportunity to investors to redeem shares in every moment, this means that the manager of the fund has to keep a part of its portfolio in liquidities, in order to guarantee it whenever requested by the investors. After the request of redemption, the manager of the fund can use the existing liquidity, but at the same time he has to restore the liquidity to the optimal level selling some shares of the portfolio.

**1.4.4 The binomial insurance-mutual fund**

One of the marketing strategies of mutual funds is that of linking the fund with another product with different characteristics, with the purpose of offering to the subscriber the synergy of the two operations in one contract. A widely used solution is that of mixing a financial and insurance instrument together to realize a capital accumulation through investment plans with the coverage of risk of several life events (in particular the death or the injury of the subscriber) with one contract. One of the main reasons of this combination is due to the fact that the market is developing a strong demand for Social security instruments that grant the commercial success of these
integrated products. This combination is the first one to channel mutual funds into a specific strategy (Santoboni, 2012).

In more detail, the subscriber of the fund, in addition to signing the prospectus and choosing the formula of investment that he prefers (systematic investment or lump sum investment), signs a life insurance that insures the capital that he invested in the fund in a lump sum or the total capital that he will invest through regular investments. They work in this way: in the case of a lump sum investment, the first insurance premium is paid simultaneously to the investment and the others are directly taken by the asset manager firm disinvesting the shares of the fund. In the case of a systematic investment scheme, the periodic deposits are divided in two parts: one goes into to the fund to form the capital in little steps, the other one covers the life insurance premium and the first premium is usually paid together with the first deposit. The length of the insurance can be decided by the subscriber according to his needs, his age, his objectives and the sum he wants to deposit. The deposit is tax deductible up to a certain maximum threshold.

Every investor should be interested in such investing formulas because everyone should feel the need to benefit from a financial investment linked to an insurance coverage, since the need of making the money grow and that of protecting the capital match well together. It would be nonsense to start a systematic investment in a fund with the risk of stopping it because of the death of the subscriber (and heavy consequences on the family). The combination of two contracts in one is especially thought to satisfy the need of protecting the investment for Social security. In Italy, the problem of social and health care is a hot topic right: with the recent reforms of the pension system private investors have lost their confidence towards the State and they are more and more considering investments their Social security (De Marchi and Roasio, 1999).

### 1.4.5 Unit linked insurance plan

A type of life insurance plan that is growing popularity is the Unit Linked Insurance Plan (ULIP). This plan is a goal-based financial solution and combines the safety of insurance protection with wealth creation: a part of the investment is devoted
towards providing life cover while the residual portion is invested in a fund or a mix of funds that invests in stocks and bonds and the value of the investment changes with the performance of the fund chosen by the investor. Once decided the amount to invest, the insurance company deducts some portion of the ULIP premium upfront and the remaining amount is invested in one or more funds. The mortality and administration charges are deducted on a periodic basis by cancellation of units, while the ULIP fund management charges are adjusted from NAV on a daily basis. Say it in another way, the policyholder purchases units at their NAV but also contributes to another investment vehicle for the coverage of an insurance policy.

This solution offers higher flexibility, higher liquidity and shorter term bindings. Flexibility consists also in the possibility to choose the funds among those that the insurance provider offers and to switch between funds without the necessity to go out of the plan (Santoboni, 2012).

1.5 Financial markets

1.5.1 Regulated and OTC market

Financial markets are the theater where buyers and sellers trade assets like equities, bonds, securities and derivatives. Basically, financial markets are used to match those who want capital with those who have it. Financial markets do their trading through exchange or through Over-The-Counter markets (OTC). In the first case the market operates with exchange trading and transactions are coordinated by a centralized source that links the buyer and the seller. The mechanism of trading on a centralized system favors the security of transactions and there is very low chance of price manipulation by mediators. The typical example of an exchange traded market is the New York Stock Exchange. On the other hand, in over-the-counter markets there is not a central entity that coordinates trading, there are many mediators with the competence of linking buyers and sellers with the advantage of having the lower costs of intermediation possible. The pitfall is that there is no regulation and trading is subject to fraudulent behaviors by mediators together with price manipulation by competing mediators. An example of OTC markets are forex trading markets and markets for buying and selling debt.
The *efficient market hypothesis* (EMH) was formulated by Eugene Fama in 1970 and it asserts that well organized capital markets are efficient markets and that at any time, prices fully reflect all available information. In more detail, prices reflect the information given by financial news, politics, and social and economic events combined with investors’ perception. It is then useless to try to beat the market: no investor can beat and outperform anyone else since they all have the same information, and any investment approach or strategy would not be successful. Moreover, EMH school supports the “random walk” of prices: market prices are not predictable but random.

The efficient-market school has been the target of several criticisms. When it was first publicized it was criticized by words to the effect that “throwing darts at the financial page will produce a portfolio that can be expected to do as well as any managed by professional security analysis” (Malkiel, 2003). This statement proves that despite the great attention and attraction that the idea of efficient markets has demonstrated in the finance literature, there has also been a lot of confusion and misconception.

### 1.5.2 Market indices

If we are in line with the EMH, it would be more profitable to invest in an index fund that perfectly simulates the market than in any other type of fund. For this reason, we now focus on *market indices*. A market index is the price of a portfolio of several stocks or other investment vehicles. It might be composed of all the stocks listed on a market or it might choose the most representative stocks in a specific segment. Since they are meant to represent an entire stock market, they track the market changes over long periods of time. The composition of the portfolio of the index is subject to changes in cases of the economic slowdown of some societies in the portfolio and the emerging of others. There are many ways to construct an index but it is usually expressed as a change from a base value, e.g. a specific value at a specific date. Thus, the main function of an index fund is that of indicating the relative level of prices or value of securities in a market.

A *benchmark* is the reference point used by individual investors, market researchers and portfolio managers to measure the performance of a particular market or
market sector and it usually corresponds to market indices. Since each fund has a different goal and strategy, there are many benchmarks and it is very important to choose the right one and to use the appropriate time frame to understand if the portfolio manager is doing a good job. Thus, the quality of the management of a portfolio is not only the consequence of the capacity to offer a higher return with respect to the benchmark, but it is also given by the choice of the appropriate benchmark. In the case of funds whose portfolio invests in different asset classes, the benchmark is a combination of single indices. Let us make an example to make it clearer: if a fund invests 20% in liquidity and 80% in fixed income, a composite index like 20% JPMorgan 3 Month Global Cash Index (a money market index) and 80% JPMorgan Global Government Bond Index (a bond index) is more suitable to represent the trend than a single index.

Official market indices are usually established by the Central Bank together with the competent institution in each specific market and the construction of the index is done by a society called Index Provider. Market indices are classified in different ways, for example world or global stock market indices include companies without considering where they are domiciled, national indices contain stocks from a given nation and they are usually composed of the largest companies listed in the national stock exchange. There are also indices created with companies of a specific sector of the market like real estate and biotechnologies and some other linked to the type of management, size or other criteria.

There are different ways to calculate index prices. If price-weighted, the value of the index is only determined considering the price of each stock that compose the index. So, if for example the price of one stock increases more than others, automatically the weight of that stock in the index increases. The index is simply calculated as the sum of prices of the stocks that belong to the index. The pitfall of an index calculated in this way is that it does not reflect the trend of the portfolio in a correct way, in fact more “expensive” stocks have an higher weight. Market-value weighted (or capitalization-weighted) indices weigh each stock according to its stock capitalization, this means that a relatively small shift in the price of a large company heavily influences the value of the index. Capitalization weighted indices have traditionally used a full weighting, that

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13 The classes of financial investment characterized by peculiar features. The three main asset classes are equity, fixed income and money market.
means that all outstanding shares were included, but it has recently been introduced the float-adjusted weighting. With float adjustment, when calculating the index, the shares considered are only those available to investors rather than all of a company’s outstanding shares: shares closely held by control groups, publicly traded companies or government agencies are excluded and do not count. In this way, the value of the index mirrors the value available in the public markets. Moreover, reducing the relative investment that index investors have in stocks with limited float (that are usually less liquid), should lower the cost of index investing (S&P, 2012). Other methodologies used are the equal-weighted, that assigns the same value to all the components and the modified capitalization-weighted index, that is a hybrid between capitalization weighting and equal weighting: it works like capitalization weighting a part from the fact that there is a cap for largest stocks, that means that they can get up to a certain percent of the weight of the total stock index and the excess is distributed equally among the stocks under that cap.

Let us list some of the most used and known benchmarks. Concerning Italian stock market indices, the *Ftse Italia All-Share* is the stock index that since 2009 has substituted the *MibTel*. It represents the market organized by the Italian stock exchange *Borsa Italiana S.p.A.* and it is the aggregation of the stocks which are in turn part of other important indices: the *Ftse Mib*, (contains large capitalization stocks) *Ftse Italia Mid Cap* (middle capitalization stocks), *Ftse Italia Small Cap* (small capitalization stocks). Some relevant indices in the euro area are *Aex* (Amsterdam), *Bel 20* (Bruxelles), *Cac 40* (Paris), *Dax Xetra* (Frankfurt), *Ibex 35* (Madrid), *Psi-20* (Lisbon) and the *Eurostoxx 50* that is the index that contains the greatest stocks of the euro zone. Some noteworthy European indices that do not belong to the euro zone are *Bux* (Budapest), *Ftse 100* (London), *Omex Copenhagen 20* (Copenhagen), *Omex Stockholm 30 index*, *Rts-2 Index* (Russia), *Smi* (Zurich). In the US market, the Standard & Poor’s 500 is the most important stock index of north America since it is the principal benchmark related to the top 500 publicly listed stocks of Wall Street. The *Dow Jones Industrial Average* is the most renowned index of the New York Stock Exchange and it is a price-weighted of the 30 principal stocks of Wall Street. The choice of price-weighting lead the index to lose its relevance since it is not able to catch the trend of the entire American stock market. The *Nasdaq Composite* is the stock market index of the common stocks listed on the Nasdaq stock market and it is highly followed in the US as an indicator for the performance of stocks of technology companies and growth
companies. Other important indices of the international market are *Hang Seng* (Hong Kong), *Asx all ordinaries* (Sidney), *SseComposite Index* (Shangai), *Topix 100* (Tokio), *Nikkei* (Tokio 225).

Even if stock market indices are the most renowned, even bond market indices have their importance for measuring the value of the bond market. They are usually defined on the basis of their composition, that is government bonds, municipal bonds, high-yield bonds, mortgage-backed securities, etc. Bond market indices are usually harder to replicate than stock market indices, this is why portfolio managers tend to mix indices to create a suitable benchmark. The most used global bond market index is the *Barclays Capital Aggregate Bond Index*, for the US bond market the most widely used are *Barclays Capital Aggregate Bond Index*, *Salomon BIG*, *Merrill Lynch Domestic Master*, for government bonds is *J.P Morgan Government Bond Index*, for emerging market bonds is *J.P Morgan Emerging Markets Bond Index*, and for high-yield bonds are *Merrill Lynch High Yield Master II*. 
Chapter 2

CML, CAPM AND PERFORMANCE MEASUREMENTS

2.1 Introduction

Individuals’ retirement and savings are important decisions of life, and since any investment plan made today represents the major source of retirement income, it is important to make the best choice when choosing the portfolio of assets to hold. And this complex decision is not only faced by individual investors, but also by institutional investors that have to choose the best portfolio of assets on behalf of their clients (Campbell and Viceira, 2002).

The concept of asset allocation has been a hot topic in the last decades, the mean-variance (MV) analysis of Harry Markowitz (1952) is considered to set the birth of modern finance and is an approach that is still the state of the art for most practitioners and many academic circles. Markowitz theory of portfolio was in fact an earth breaking event of modern mathematical finance both for its innovative idea and for its practical applications.

In this chapter we provide a detailed explanation of the Modern Portfolio Theory (MPT) by Markowitz and its development with the Capital Asset Pricing Model by Sharpe. We also define the importance of the relationship between risk and return: a money manager can obtain higher returns increasing the level of risk of his portfolio, but, at the same time, increasing the possibility of incurring into losses. We also discuss the trade-off relationship between the maximization of portfolio returns and the minimization of portfolio risk and we define the most common performance measurements used to compare mutual funds. Finally, we provide details over the main theories developed as a critique of the modern portfolio theory, including behavioral economics, in order to provide all the tools to understand the analysis conducted in Chapter 3 and Chapter 4.
2.2 The modern portfolio theory (MPT)

2.2.1 Introduction to the MPT

Harry Markowitz introduces his modern portfolio theory (MPT) in an article published in the Journal of Finance in 1952. The theory defines a model to find the best investment portfolio of assets to hold. MPT considers investors to be independent agents that make choices in financial markets and strike a balance between maximizing the return and minimizing the risk of the investment. More precisely, investors want to maximize their portfolio expected return for a given amount of portfolio risk or, equivalently, to minimize the portfolio risk for a given level of expected return, choosing the best proportion of assets to keep in the portfolio. The greatness of the theory stands in the fact that it finds a way to translate a concept into a mathematical formula: returns and risk are respectively represented by the mean and the variance of the portfolio (Wang and Xia, 2002).

The best portfolio is not only chosen through the selection and study of each single asset individually, but also through the study of the relations among assets such as the asset price change relatively to one another. It follows that a collection of assets jointly has lower risk than any individual asset. If we see it from this point of view, the MPT is the mathematical formulation of diversification and it allows to find the best diversification strategy. In fact, the combination of different assets that are not perfectly correlated leads to a reduction of the total riskiness of the portfolio.

For its definition, the theory takes into account several assumptions. Since many of them are not correct in the real world, the MPT has been subject to several criticisms. Let us list the main assumptions implicit in the model.

- Asset returns are random variables that follow a normal or Gaussian distribution, the return of any portfolio is quantified as its mean (or expected value) and the risk is quantified as its variance or standard deviation\(^{14}\) of returns. The portfolio of assets is defined as a weighted combination of assets and the return of the portfolio is a weighted combination of the asset’s returns.

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\(^{14}\) The standard deviation of a random variable is the square root of its variance. Standard deviation is often used instead of variance because the scale of variance tends to be larger than the scale of the raw data; the standard deviation instead in on the same scale as most of the data.
• Utility functions are defined over wealth: investors maximize their one-period expected utility and their utility curves demonstrate diminishing marginal utility of wealth. This means that investors care about the mean and the variance of portfolio returns and they prefer higher returns for the same level of variance and lower risk for the same level of variance.

• Risk and volatility of assets and correlations between assets are fixed and constant forever and they are known in advance.

• Security prices are known, all investors are price-takers and their actions do not influence prices. Moreover all the agents have access to the same information.

• There are no taxes or transaction costs.

• Investors can lend and borrow an unlimited amount at the risk free rate of interest, which is the same for all investors and does not depend on the amount borrowed and lent.

The MPT is a single-period model, this means that it selects the best portfolio in just one period, seeking to reduce, through the combination of assets with different correlations, the overall variance of the portfolio return. The procedure followed by the classic\textsuperscript{15} mathematical model behind the theory can be summarized in three basic steps.

1. Selection of the efficient portfolios and inefficient portfolios according to the mean-variance criterion and definition of the efficient frontier. The efficient frontier is graphically represented by the curve that contains, in the return/variance graph, the optimal choice of investment discriminated according to the higher return achievable given a level of risk.

2. Identification of the set of utility curves specific to each investor according to the available portfolios, and given the investor’s risk aversion.

3. Determination of the best portfolio that satisfies the combination of risk/return chosen by the investor. The optimal portfolio choice graphically corresponds to the tangent point of the efficient frontier and the utility curves set.

\textsuperscript{15} There have been several extensions of the theory; for more details see Francis and Kim, 2013. Several extensions to the MPT are described in Paragraph 2.4.
2.2.2 Mean-variance and expected utility

According to the MPT, investors want to maximize their expected utility of end-of-period wealth. This means that investors have a von Neumann-Morgenstern\(^{16}\) (VNM) utility function. The VNM utility function is assumed to be increasing, implying that more wealth is preferred to less, and it is assumed to be concave, which means that individuals are risk averse. These properties are in line with the mean-variance criterion that is about maximizing returns (mean) for a given level of risk (variance) or to minimize risk for a given level of returns. According to Sinn (1983), if we suppose that all relevant random variables are in the same location-scale family (e.g. the distribution of each random variable is the same as the distribution of some linear transformation of any other random variable), then for any VNM utility function, the use of a mean-variance decision framework is consistent with the expected utility maximization.

Levy and Markowitz (1979) in fact, defining E as the expected return of the portfolio, V as the variance of the returns and EU as the expected utility, write: “[…] the right choice of E, V efficient portfolio will give precisely optimum EU if and only if all distributions are normal and quadratic” where. From now on in fact, we are supposing that utility is quadratic and that portfolio returns are normally distributed (and so any combination of such asset returns will also be normally distributed). Since the normal distribution is completely described by its first two moments that are the mean and the variance, the distribution of any combination of assets is also completely described by just these two.

Let us provide a mathematical explanation of what we have just stated. The mean-variance approach and the expected utility approach are two different methods that work well for portfolio selection but do not always lead to the same result: as stated before the result is the same only in the case in which utility is quadratic and portfolio returns are normally distributed (and utility is concave).

\(^{16}\) Von Neumann and Oskar Morgenstern proved that any individual whose preferences satisfy the four axioms of completeness, transitivity, continuity and independence has a utility function. Completeness: if A and B are any two situations, an individual can always specify exactly one of these possibilities: 1) A is preferred to B, 2) B is preferred to A, 3) A and B are equally attractive. Transitivity: if A is preferred to B, and B is preferred to C, than A is preferred to C. Continuity: if A is preferred to B, then situations “close to” A must also be preferred to B. Independence: this is the most controversial axiom that states that two situations mixed with a third one maintain the same preference order as when the two are presented independently of the third one (Neumann and Morgenstern, 1953).
Consider the quadratic utility function $U$ based on wealth $W$, where $A$ is the coefficient for risk aversion:

$$U(W) = W - \frac{1}{2} AW^2$$

(1)

Using the variance decomposition formula:

$$Var(W) = E(W^2) - E(W)^2$$

(2)

Expected utility is:

$$E[U(W)] = E(W) - \frac{1}{2} AE(W^2)$$

(3)

$$= E(W) - \frac{1}{2} A[E(W)^2 + Var(W)]$$

Formula 3 shows that expected utility $E[U(W)]$ is a function of the mean, e.g. the expected value of wealth $E(W)$ and of the variance $Var(W)$. In more detail, it is directly proportional to the expected value of wealth and inversely proportional to the variance of wealth. We can conclude that using the quadratic utility function, the representation of individual choices in terms of mean and variance is in line with expected utility.

As we have already said, the mean-variance model implies only the use of the first and second moments of the probability distribution. However, this is good only if the moments above the second are a function of the first two, as in the case of a normal distribution, otherwise it would only be good as an approximation. To prove this let us develop a Taylor expansion\(^{17}\) of the utility function $U(W)$, centered in $E[W]$:

$$U(W) = U(E[W]) + U'(E[W])(W - E[W]) + \frac{1}{2} U''(E[W])(W - E[W])^2 + R_3(W)$$

(4)

Where $R_3(W)$ is the remainder of the Taylor series and corresponds to:

$$R_3(W) = \sum_{n=3}^{\infty} \frac{1}{n!} U^{(n)}(E[W])(W - E[W])^n$$

(5)

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\(^{17}\) A Taylor expansion or Taylor series is the representation of a function as an infinite sum of terms that are calculated from the values of the function’s derivatives at a single point. Let $f: \mathbb{R} \to \mathbb{R}$ be a smooth function. The Taylor series is:

$$f(x) \approx f(x_0) + f'(x_0) \frac{(x-x_0)}{1!} + f''(x_0) \frac{(x-x_0)^2}{2!} + f'''(x_0) \frac{(x-x_0)^3}{3!} + ...$$

It can also be written in a more compact sigma notation:

$$\sum_{n=0}^{\infty} \frac{f^{(n)}(x_0)}{n!} (x - x_0)^n$$

So $f(x)$ can approximately be evaluated by looking at the value of $f$ at a point $x_0$, and making a correction involving the first $n$ derivatives.
If we consider the entire expansion, all the moments of the distribution of $W$ are considered. But the mean-variance criterion only uses the first two moments, so the Taylor series of second order is:

$$U(W) = U(E[W]) + \frac{1}{2} U''(E[W])(W - E[W])^2$$  \hspace{1cm} (6)

Since $\sum W - E[W] = 0$.

And hence:

$$E[U(W)] = U(E[W]) + \frac{1}{2} U''(E[W]) Var(W)$$  \hspace{1cm} (7)

We conclude that an efficient portfolio under the criterion of the expected utility is efficient also in the mean-variance criterion if utility is quadratic and returns are normally distributed (Levy and Markowitz, 1979).

Let us make an example. Consider a portfolio with return $R_p$ that invests $x$ in a risky bundle with return $R_M$ and $(1-x)$ in a risk free asset with return $R_f$. Consider the simple mean-variance utility function:

$$U = E(R_p) - \frac{1}{2} A Var(R_p)$$  \hspace{1cm} (8)

The expected return of the portfolio is:

$$E(R_p) = xE(R_M) + (1-x) R_f$$  \hspace{1cm} (9)

We now want to maximize the expected utility function to find the optimal weigh to invest in the risky asset and in the risk free asset:

$$\max_x U = \max_x [E(R_p) - \frac{1}{2} A Var(R_p)]$$  \hspace{1cm} (10)

$$= \max_x [R_f + x(E(R_M) - R_f) - \frac{1}{2} A x^2 Var(R_M)]$$

$$\Rightarrow [ E(R_M) - R_f ] - \frac{1}{2} 2 A x^2 Var(R_M) = 0$$

$$\Rightarrow x = \frac{E(R_M) - R_f}{A Var(R_M)}$$  \hspace{1cm} (11)

This means that the optimal position in the risky asset is inversely proportional to the level of risk aversion $A$ and the level of risk $Var(R_M)$ and it is directly proportional to the risk premium $E(R_M) - R_f$ (Maginn et al, 2007).
2.3 Measuring risk and return

2.3.1 Risk and return of a two-asset portfolio

Let us now measure the risk and return of a two-asset portfolio which invests an amount $x$ in asset 1 with return $R_1$ and $(1-x)$ in asset 2 with return $R_2$. The expected return of the portfolio is:

$$E(R_p) = E[xR_1 + (1-x)R_2] = xE(R_1) + (1-x)E(R_2)$$ \hspace{1cm} (12)

Since variance is:

$$Var(R) = E[(R - E(R))^2] = E(R^2) - (E(R))^2$$ \hspace{1cm} (13)

and the standard deviation is:

$$\sigma(R) = \sqrt{Var(R)}$$ \hspace{1cm} (14)

the variance and standard deviation of the portfolio are respectively:

$$Var(R_p) = E(R_p^2) - (E(R_p))^2$$ \hspace{1cm} (15)

$$= x^2 Var(R_1) + (1-x)^2 Var(R_2) + 2x(1-x) Cov(R_1, R_2)$$

where covariance between asset 1 and asset 2 is:

$$Cov(R_1, R_2) = E[(R_1 - E(R_1))(R_2 - E(R_2))]$$ \hspace{1cm} (16)

$$= E[R_1 \times R_2] - E(R_1)E(R_2)$$

and correlation\footnote{Correlation coefficients are widely used in portfolio management. This is because correlation standardizes covariance: differently from covariance values, correlation coefficient values are between +1 and -1, included.} between assets is:

$$Corr = \frac{Cov(R_1, R_2)}{\sigma(R_1)\sigma(R_2)}$$ \hspace{1cm} (17)

and so we can rewrite variance as:

$$Var(R_p) = x^2 Var(R_1) + (1-x)^2 Var(R_2) + 2x(1-x)\sigma(R_1)\sigma(R_2) Corr(R_1, R_2)$$ \hspace{1cm} (18)
We now want to find the best allocation among the two assets. In order to do that we find the minimum variance portfolio minimizing the variance:

$$\min_x Var(R_p)$$

$$\Leftrightarrow \frac{dVar(R_p)}{dx} = 0$$

$$\Leftrightarrow 2xVar(R_1) + 2xVar(R_2) - 2Var(R_2) + 2\sigma(R_1)\sigma(R_2)\rho(R_1, R_2) - 4x\sigma(R_1)\sigma(R_2)\text{Corr}(R_1, R_2) = 0$$

$$x = \frac{Var(R_2) - \sigma(R_1)\sigma(R_2)\rho(R_1, R_2)}{Var(R_1) + Var(R_2) - 2\sigma(R_1)\sigma(R_2)\text{Corr}(R_1, R_2)} \quad (20)$$

It follows that when choosing the combination of two risky assets, we should take into account expected returns, variances and covariance (or correlation) between assets’ returns (Maginn et al, 2007).

### 2.3.2 Asset allocation with two risky assets

To better understand the economics of a portfolio construction, it is useful to consider the effects of combining two assets. The combination of two risky assets in fact, can lead to different scenarios of diversification. Let us understand where these portfolios should lie in the mean-standard deviation space.

*Figure 6 - Correlation (covariance) between two assets: diversification gain*
1. Returns are perfectly positively correlated.
Correlation is: \( Corr(R_1, R_2) = 1 \)
The standard deviation of the portfolio is: \( \sigma(R_p) = x\sigma(R_1) + (1 - x)\sigma(R_2) \)
If we plot the mean and the standard deviation of the two assets, the straight line between the two points is the set of portfolios available in this situation. Point 1 in the graph represents the portfolio in which \( x=1 \) and on the opposite side, point 2 represents the point where \( x=0 \). The geometric interpretation of this case is easy to understand: there is no diversification gain at all.

2. Returns are perfectly negatively correlated.
Correlation is: \( Corr(R_1, R_2) = -1 \)
The standard deviation is: \( \sigma(R_p) = x\sigma(R_1) - (1 - x)\sigma(R_2) \)
In this situation, with the right choice of weights on each asset, it is possible to have a standard deviation of the portfolio equal to 0. Graphically, it corresponds to point y in the diagram: there is a full diversification gain.

3. Returns are imperfectly correlated.
Correlation is: \( Corr(R_1, R_2) \in [-1,1] \)
The standard deviation of the portfolio is the square root of the variance of Formula 18. More realistically, the correlation between assets tends to be between the positive and the negative one. The curve of the diagram plots the possible portfolios with correlation between 0 and 1.

Note that the weights of the portfolio do not have restrictions on the sign so a negative \( x \) can be considered as a short sale of asset 1. The dotted line extension of the line in Figure 6 represents short sales: through short selling it is possible to change perfectly positive correlation into negative correlation.

The graph of the lowest possible portfolio variance that is attainable for a given portfolio expected return is the \textit{minimum-variance frontier}. Investors, however, only care about a certain portion of the frontier, that is the portion with positive slope, because the part with a negative slope implies lower returns for greater standard deviation and investors would not buy this trade-off. Portfolios on the efficient frontier are mean-variance efficient since there is not another portfolio with the same expected return and lower standard deviation, or, equivalently, there is not another portfolio with
the same standard deviation and with a higher expected return. Individuals with mean-variance preferences choose a portfolio on the frontier (Ross, 2008).

The graph on the left of Figure 7 shows the minimum-variance curve on the mean-standard deviation graph. The graph on the right instead shows the minimum-variance curve and the bold blue line is the efficient frontier. Both figures also include the representation through the direction of the arrows of investors’ preferences: more return and less risk.

*Figure 7 - Minimum-variance frontier and efficient frontier*

Any part of the efficient frontier has to be concave. The concavity to the right is the consequence of the Cartesian system that we have adopted, since the values of returns are a function of the values of risk. Let us show why:

\[ \text{Cov}(R_1, R_2) = \sigma_1 \sigma_2 \text{Corr}(R_1, R_2) \]  
\[ \text{where Corr}(R_1, R_2) \in [-1, 1] \]  
\[ (21) \]

So, \[ \text{Cov}(R_1, R_2) \leq \sigma_1 \sigma_2 \]

Thus:

\[ \sigma(xR_1 + (1-x)R_2) \leq x\sigma_1 + (1-x)\sigma_2 \]  
\[ (22) \]

This implies that the efficient frontier is concave and so it begins with the minimum risk portfolio and extends to the maximum expected return portfolio (Kaplan, 2011).
2.3.3 Introducing a risk-free asset and the Tobin’s separation theorem: the CML

Let us consider the scenario in which investors are allowed to borrow or lend at the risk free rate $R_f$ while still investing in any single risky bundle on the efficient frontier. For each single risky bundle, there is a new set of risk-return combination known as the transformation line that is a straight line that goes from the risk free rate on the expected return axis to each single risky bundle and an investor can be anywhere on this line. The transformation line that is tangential to the efficient frontier is the Capital Market Line (CML). The tangent point defines the single composition of risky assets that the investor wants to hold (Sharpe, 1964).

Let us now provide a more detailed analysis about what we have just described. We take a risk-free security like a Treasury Bill and we take a portfolio that is a combination of a risky asset, asset 1, and a risk-free asset. The risk free asset has of course zero risk and so it has standard deviation equal to zero, moreover, there is no correlation with the risky asset:

$$\begin{cases} R_f \\ \sigma_{R_f} = 0 \\ Corr(R_1, R_f) = 0 \end{cases}$$  

(23)

Expected return of the portfolio is:

$$E(R_p) = xE(R_1) + (1-x)R_f$$  

(24)

And the variance is:

$$Var(R_p) = x^2 Var(R_1)$$  

(25)

From the precedent mean and variance expressions we obtain the expected return of the portfolio and the optimal weight, $x$, on the risky asset:

$$E(R_p) = R_f + x[E(R_1) - R_f]$$  

(26)

$$\rightarrow x = \frac{\sigma(R_p)}{\sigma(R_1)}$$  

(27)
From this formulation we get the Capital Market Line (CML):

\[ E(R_p) = R_f + \frac{E(R_M) - R_f}{\sigma(R_M)} \sigma(R_p) \] (28)

Where \( R_f \) is the intercept of the CML and \( \frac{E(R_M) - R_f}{\sigma(R_M)} \) is the slope of the line and \( E(R_M) - R_f \) is the measure of the risk premium. The slope of the CML is also called the Sharpe measure after William Sharpe (1994); the higher the Sharpe measure, the better the risky security looks.

Figure 8 shows the graph of the CML with one risky asset. At point \( R_f \) all wealth is invested in the risk-free asset, at point \( R_1 \) instead, all wealth is in the risky asset. At any point of the bold line the investor is lending at the risk-free rate, at any point on the right hand side of point \( R_1 \) instead the investor is borrowing at the risk-free rate.

Figure 8 - The Capital Market Line with one risky asset
Figure 9 shows how the Sharpe measure (or Sharpe ratio) works. We compare portfolios A and B: it is possible to combine a strategy of borrowing and buying portfolio A to achieve the same expected return as portfolio B but with a much smaller variance. As a result, portfolio A, that lies on the higher-slope transformation line is preferred to portfolio B. We confirm that our aim is to find the combination of the risk-free asset and some risky portfolio that delivers the highest Sharpe ratio.

*Figure 9 - Transformation lines and the Sharpe ratio*

Since the Sharpe ratio is just the slope of the line that starts from the risk free rate on the expected return axis, the portfolio with the highest obtainable Sharpe ratio is the line tangent to the efficient frontier, that is the CML.

*Figure 10 - The Capital Market Line: the best possible transformation line*
It is clear that the only portfolio on the efficient frontier that is desirable is the tangency portfolio. If we choose another portfolio like portfolio A in Figure 10, it would not be efficient because it is not maximizing the expected return for a given variance.

The CML dominates all other possible portfolios, so each agent chooses his optimal portfolio on the CML according to his risk preferences. The Separation Theorem by James Tobin (1957) proposes that the investment process can be separated in two different steps: the first one is the choice of an efficient portfolio following the MV optimization model suggested by Markowitz, the second step is about the decision to combine the efficient portfolio with a riskless investment. Besides this, the optimal allocation between the efficient portfolio and the riskless asset depends on investors’ preferences. The theorem is essentially the basis for modulating portfolio risk by either borrowing at the risk-free rate and leveraging the portfolio and its risk, or lending at the risk-free rate and reducing the risk. If we want to define the theorem in a more simple way, we can say that it defines the stock/bond asset allocation decision. Anyhow, since we are considering investors as being risk averse, they prefer to combine the risky basket of securities with risk-free bonds, lowering the risk of the portfolio.

Given that each portfolio on the frontier is efficient, the choice of the best portfolio is subjective to each individual and depends on individual preferences. The representation of individual preferences is given by indifference curves that link the points of the risk-return rectangular coordinate plan that are equally desirable for the individual. If we plot on the same graph the indifference curves set and the efficient frontier, we can determine an investor best portfolio that corresponds to the point of tangency between the efficient frontier and the indifference curve with the highest level achievable.
Figure 11 depicts the CML together with the indifference curves sets of investor A \((I_A, I'_A, I''_A)\) and of investor B \((I_B, I'_B, I''_B)\). Investor A is more risk averse than investor B and this is visible from the two sets of indifference curves.

*Figure 11 - Optimal portfolio choice for investor A and investor B*

Optimal portfolio for investor A is at point A and optimal portfolio for investor B is at point B. Assuming that the lending rates are the same, investor B, whose optimal portfolio is on the right of the tangency portfolio \(M\), is borrowing at the risk free rate. Investor A instead, since his optimal portfolio is on the left of the tangency portfolio \(M\), is lending at the risk free rate. If an investor invests on the point \(R_f\) on the y-axis, he has none of his money invested on the risky asset. If he is at tangency portfolio \(M\), all his money is on the risky asset and so \(x=1\) since in the economy total lending equals total borrowing. The weight invested in each asset of the market portfolio is equal to the total value invested in that asset divided by the total value of all risky assets.

### 2.3.4 From the CML to the SML: the Capital Asset Pricing Model

Let us go back to the formulation of the capital market line and to the Sharpe ratio term that is the slope of the CML:

\[
\frac{E(R_i) - R_f}{\sigma(R_i)}
\]  

\[\text{(29)}\]
We have said that we are assuming investors to be risk averse and to have mean-variance preferences and so they prefer a higher expected return and a lower portfolio return variance \textit{ceteris paribus}. As a consequence, investors want to maximize the Sharpe ratio of their portfolio.

From the CML formulation we can derive a further interpretation of the relationship between the return of the portfolio and that of the market portfolio provided by William Sharpe in 1964.

\[
E(R_p) = R_f + \frac{E(R_M) - R_f}{\sigma(R_M)} \sigma(R_p) 
\]

\[
= R_f + \frac{\sigma(R_p)}{\sigma(R_M)} [E(R_M) - R_f] 
\]

\[
= R_f + \frac{\sigma(R_p) \sigma(R_M)}{\sigma(R_M)^2} [E(R_M) - R_f] 
\]

Note that: \(\text{Corr}(R_M, R_p) = \frac{\text{Cov}(R_M, R_p)}{\sigma(R_M) \sigma(R_p)}\); and since: \(\text{Corr}(R_M, R_p) = 1\)

Then:

\[
E(R_p) = R_f + \frac{\text{Cov}(R_M, R_p)}{\sigma(R_M)^2} [E(R_M) - R_f] 
\]

Consider: \(\beta = \frac{\text{Cov}(R_M, R_p)}{\text{Var}(R_M)}\)

We get the Security Market Line (SML):

\[
E(R_p) = R_f + \beta [E(R_M) - R_f] 
\]

The SML is at the basis of the Capital Asset Pricing Model (CAPM), that is a model of equilibrium of financial markets developed by Treynor (1961, 1962), Sharpe (1964), Lintner (1965) and Mossin (1966), individually. Sharpe, Markowitz and Miller received a Nobel Memorial Prize in Economics in 1990 for the contribution of the CAPM to financial economics. The CAPM is based on a relationship between the return of an asset and its risk, measured by the \(\beta\) (Beta) factor. The \(\beta\) measures how the asset moves relative to the market.

The main difference between the CML and the SML is on how the risk factor is measured: the CML uses standard deviation that is a total risk factor, whereas the SML uses the beta coefficient that measures the security’s risk contribution to the portfolio. Moreover, while the CML represents only the set of efficient portfolios, the SML
defines every portfolio, both efficient and non-efficient. Figure 12 represents the SML and the CML lines.

*Figure 12 - The CML vs the SML*

While the y-axis of the CML shows the expected return of the portfolio, the y-axis of the SML shows the return of the securities. The x-axis of the CML shows the standard deviation of the portfolio and that of the SML shows the beta of the securities. The two lines basically have different uses: while the CML is used to show the rate of return that depends on the risk-free asset rate of return and on the risk of the specific portfolio, the SML represents the market risk and return at a given time. The beta coefficient measures how the return of a security moves with the return of the market. In other words, it is a measure of the systematic risk. Systematic risk is the risk that affects the entire market while unsystematic risk is the one that affects only a single security or a limited number of securities, we analyze it in more detail in Paragraph 2.3.7.

2.3.6 Asset allocation with N risky assets

2.3.6.1 Asset allocation with N risky assets and a riskless asset

We have seen that there are two types of efficient portfolios: efficient portfolios that contain both risky assets and a riskless asset (separation theorem) and efficient portfolios that contain only risky assets. We now want to study the mathematical procedure to find the optimal portfolio studying the case of an efficient frontier with a
riskless asset and \( N \) risky assets and the case of an efficient frontier with no riskless asset.

To proceed with the analysis of the first case we need to collect several data like expected returns on all assets, variances and covariances on all asset returns and the riskless borrowing and lending rate, in order to construct the CML. We define:

- \( X \): the generic vector of the weights of the portfolio (proportion of wealth invested in each asset);
- \( R \): the vector of returns of all the assets traded in the market;
- \( R_i \): the return of each asset in the market
- \( \Omega \): the variance-covariance matrix
- \( 1 \): a vector with all 1 such that \( 1^T X = \sum_{i=1}^{N} x_i \)

Let us illustrate the matrices:

\[
X = \begin{pmatrix}
x_1 \\
x_2 \\
\vdots \\
x_N
\end{pmatrix}, \quad R = \begin{pmatrix}
E(R_1) \\
E(R_2) \\
\vdots \\
E(R_N)
\end{pmatrix}, \quad \Omega = \begin{pmatrix}
\sigma_{11} & \ldots & \sigma_{1N} \\
\sigma_{21} & \ddots & \vdots \\
\sigma_{N1} & \ddots & \sigma_{NN}
\end{pmatrix}, \quad 1 = \begin{pmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{pmatrix}
\]

We want to find the optimal portfolio given by the combination of the risky assets with the risk-free asset, that is the tangency portfolio. We proceed maximizing the slope of the tangent line subject to the budget constraint, e.g. the sum of the portfolio weights is one:

\[
\max \quad \theta = \frac{E(R_M) - R_f}{\sigma(R_M)} \quad \text{u. c. } \sum_{i=1}^{N} x_i = 1 \quad (33)
\]

We set:

\[
R_f = \sum_{i=1}^{N} x_i R_i
\]

So:

\[
\max \theta = \frac{\sum_{i=1}^{N} x_i (R_i - R_f)}{\sqrt{\sum_{i=1}^{N} x_i^2 \sum_{j=1}^{N} x_j \sigma_{ij}}} = X^T (R - R_f) [X^T \Omega X]^{-\frac{1}{2}} \quad (35)
\]

\[
\frac{d\theta}{dx} = (R - R_f) [X^T \Omega X]^{-\frac{1}{2}} + [X^T (R - R_f)](-\frac{1}{2})2\Omega X [X^T \Omega X]^{-\frac{3}{2}} = 0
\]
Multiplying by \([X^T \Omega X]^{-\frac{1}{2}}\) we get:

\[
(R - \overline{R}_f) + [X^T (R - \overline{R}_f)] \Omega X [X^T \Omega X]^{-1} = 0
\]  
(36)

Define:

\[
\lambda = [X^T (R - \overline{R}_f)] [X^T \Omega X]^{-1}
\]  
(37)

Then:

\[
(R - \overline{R}_f) - \lambda \Omega X = 0
\]  
(38)

Define \(Z\) such that:

\[
\lambda X = Z
\]  
(39)

Then \((R - \overline{R}_f) = \Omega Z\):

\[
\begin{align*}
R_1 - R_f &= Z_1 \sigma_{11} + Z_2 \sigma_{12} + \cdots + Z_N \sigma_{1N} \\
R_2 - R_f &= Z_1 \sigma_{21} + Z_2 \sigma_{22} + \cdots + Z_N \sigma_{2N} \\
\vdots & \quad \vdots \\
R_N - R_f &= Z_1 \sigma_{N1} + Z_2 \sigma_{N2} + \cdots + Z_N \sigma_{NN}
\end{align*}
\]  
(40)

since:

\[
\sum_{i=1}^{N} X_i \lambda = \sum_{i=1}^{N} Z_i \quad \rightarrow \quad \lambda = \sum_{i=1}^{N} Z_i
\]  
(41)

solving the system we get the solution to the proportions invested in each risky asset that represent the weights of the market portfolio:

\[
X_i = \frac{Z_i}{\sum_{i=1}^{N} Z_i}
\]  
(42)

With the risk free asset, all investors choose the same portfolio for risky assets, that is the market portfolio in combination with the risk-free asset on the CML. Market portfolio contains all securities and the proportion of each security is its market value as a percentage of total market value. Risk premium on the market depends on the average risk aversion of all market participants. Risk premium on all individual security is a function of its covariance with the market (Levy and Roll, 2009).
2.3.6.2 Efficient frontier with N risky assets and no riskless asset

Let us suppose there is no riskless asset. In order to find the optimal portfolio we minimize portfolio variance subject to two constraints:

1. minimization occurs for a given level of expected return;
2. the budget constraint: the sum of the portfolio weights is one.

Expected return of the portfolio is:

\[ E(R_p) = R^T X = X^T R \]  

(43)

And the variance of the portfolio is:

\[ \text{Var}(R_p) = X^T \Omega X \]  

(44)

For a given level of portfolio expected return \( E(R_p) \) we want to minimize the variance. The quadratic programming problem is:

\[ \begin{align*}
\min_{X} & \quad \frac{1}{2} X^T \Omega X \\
\text{u.c.} & \quad X^T \bar{R} = E(R_p) \\
& \quad X^T \bar{1} = 1
\end{align*} \]

(45)

The Lagrangian is:

\[ \mathcal{L} = \frac{1}{2} X^T \Omega X + \lambda [E(R_p) - X^T \bar{R}] + \gamma [1 - X^T \bar{1}] \]  

(46)

The terms \( \lambda \) and \( \gamma \) are the Lagrangian multipliers. We solve:

\[ \begin{align*}
\frac{d\mathcal{L}}{dx} &= \Omega X - \lambda \bar{R} - \gamma \bar{1} = 0 \quad \text{Equation 1} \\
\frac{d\mathcal{L}}{d\lambda} &= E(R_p) - X^T \bar{R} = 0 \quad \text{Equation 2} \\
\frac{d\mathcal{L}}{dy} &= 1 - X^T \bar{1} = 0 \quad \text{Equation 3}
\end{align*} \]

(47)

We get:

\[ X = \Omega^{-1} (\lambda \bar{R} + \gamma \bar{1}) \quad \text{Equation 4 from Equation 1} \]
And:
\[
\begin{align*}
\begin{cases}
\begin{split}
\mathbf{R}^T \mathbf{X} &= \mathbf{R}^T \Omega^{-1}(\lambda \mathbf{R} + \gamma \mathbf{1}) = E(R_p) & \text{Equation 5 (from Eq. 4 and 2)} \\
\mathbf{1}^T \mathbf{X} &= \mathbf{1}^T \Omega^{-1}(\lambda \mathbf{R} + \gamma \mathbf{1}) = 1 & \text{Equation 6 (from Eq. 4 and 3)}
\end{split}
\end{cases}
\end{align*}
\]

We define some constants:
\[
A = \mathbf{1}^T \Omega^{-1} \mathbf{R} = \mathbf{R}^T \Omega^{-1} \mathbf{1} \tag{49}
\]
\[
B = \mathbf{R}^T \Omega^{-1} \mathbf{R}
\]
\[
C = \mathbf{1}^T \Omega^{-1} \mathbf{1}
\]
\[
D = BC - A^2
\]

Solving the system for \( \lambda \) and \( \gamma \) we get:
\[
\begin{align*}
\begin{cases}
\lambda = \frac{CE(R_p) - A}{D} \\
\gamma = \frac{B - AE(R_p)}{D}
\end{cases} \tag{50}
\end{align*}
\]

It follows: 
\[
X = g + h E(R_p)
\]

with
\[
g = \frac{Bn^{-1} \mathbf{1} - A \Omega^{-1} \mathbf{R}}{D} \tag{51}
\]
\[
h = \frac{C \Omega^{-2} \mathbf{R} - A \Omega^{-1} \mathbf{R}}{D} \tag{52}
\]

Portfolio \( g \) represents the optimal weights of a portfolio with \( E(R_p) = 0 \)

\( X = g + h \) represents the optimal weights of a portfolio with \( E(R_p) = 1 \) (Levy and Roll, 2009).

Finally, the formulation of the efficient frontier in this scenario is given by Formula 53:
\[
V(R_p) = \frac{CE(R_p)^2 + 2AE(R_p) + B}{D} \tag{53}
\]

This is a second order equation in \( E(R_p) \) that is indentified as an hyperbole in a Cartesian plan with \( V(R_p) \) on the x-axis and \( E(R_p) \) on the y-axis.
2.3.7 Systematic and unsystematic risk

The risk of an investment is the amount an asset deviates from its expected value. Total risk, however depends on two types of investment risk: systematic and unsystematic (or idiosyncratic) risk.

\[ \text{Total risk} = \text{Systematic risk} + \text{Unsystematic risk} \]

Systematic risk is associated to the risk inherent to the entire market, it is not linked to a particular stock or industry but it depends on factors associated to the market like business cycles, geopolitics, natural disasters and market-wide economic events like recessions, wars and interest rates. This type of risk is unpredictable and impossible to completely avoid so there is not a particular method to handle it. This is why it is also called non-diversifiable risk or market risk. A good way to measure the systematic risk (volatility) of a portfolio with respect to the whole market, is the Beta coefficient ($\beta$). Beta can be interpreted as the tendency of a security to answer to the swings of the market. A $\beta$ equal to one indicates that the price of the security moves with the market, in fact since all risk is measured relative to the market portfolio, the $\beta$ of the market portfolio must be one. A $\beta$ lower than one means that the security is less volatile than the market so the asset has less risk relative to the market portfolio and a $\beta$ greater than one indicates that the price of the security is more volatile than the market and it has more risk relative to the market portfolio.

Unsystematic risk is defined as firm-specific risk since it is related to a specific company or a specific industry sector. Examples of unsystematic risk are events like the management change of a company, competition, strikes, weather conditions and labor problems. Unsystematic risk can be reduced through diversification. Diversification is obtained through the creation of a portfolio that invests in various assets that are not affected by market events in the same way. A well diversified portfolio invests in stocks of different companies and industries and in different types of securities. The optimization strategy that we have seen in the previous paragraphs are all based on the concept of diversification when investing and on the idea that asset prices change in different, sometimes opposite, ways. The term “diversification” was born with Markowitz in 1952 while Gibson (1990), Perold (2004) and others introduced the term diversification effect to refer to the relationship between correlation among assets and portfolio risk. Diversification effect is the phenomenon of reduction of the portfolio
risk that is created by correlations (usually imperfect) between assets. The importance of diversification stays in the fact that it can help investors to manage and reduce their investment risk, without compromising the rate of return since correlations are independent of the rate of return. Correlation coefficients are widely used by financial analysts to measure the diversification effect in portfolio management. However, total riskiness of a portfolio cannot be totally eliminated because of systematic risk.

Let us see the effect that diversification has on variance in an equally-weighted portfolio with weight \( x_i \) on asset \( i \) and \( x_i = x_j = \frac{1}{N}, \forall i, j \). The general formula for calculating the portfolio return variance is given by the sum of each term variance plus all pair-wise covariances:

\[
Var_p = \sum_{i=1}^{N} x_i^2 Var_i + \sum_{i=1}^{N} \sum_{j=i+1}^{N} x_i x_j Cov_{ij} \tag{54}
\]

The portfolio variance then becomes:

\[
Var_p = \frac{1}{N} Var_i + (N-1) \frac{1}{N} Cov_{ij} \tag{55}
\]

And we get the asymptotic formula:

\[
\lim_{N \to \infty} Var_p = Cov_{ij} \tag{56}
\]

If \( N \) is large, \((1/N)\) is small and \((N-1)/N\) is close to 1. Hence \( Var_p \approx Cov_{ij} \).

This means that in an equally-weighted portfolio, the portfolio variance tends to the average of covariances between securities as the number of securities becomes large and portfolio risk is a sort of “covariance risk”.

65
Figure 13 demonstrates how standard deviation decreases if we increase the number of shares in the portfolio. It also shows that portfolio risk cannot be reduced to zero, there will always be a certain amount of risk due to market risk. However, it is visible that diversification provides substantial benefits.

*Figure 13 - The effect of diversification: diversifiable and non-diversifiable risk*

Figure 14 shows that it is possible to reduce risk only up to a certain level. When that level is reached, even if we add an arbitrary large amount of assets, we cannot go under that level of risk that corresponds to systematic risk (Hight, 2010).

*Figure 14 - Portfolio risk as a function of the number of securities*
2.4 Mean-variance optimization pitfalls

2.4.1 Behavioral economics’ critique

MPT makes several assumptions about investors and markets and this might compromise the theory to some degree. Greatest opponents of the CAPM theory are the studies of behavioral finance. Behavioral finance studies how psychology influences the behavior of financial practitioners and its effects on the market and so it concentrates on explaining how and why markets might be inefficient (Sewell, 2010). Behavioral finance argues that some financial phenomena can plausibly be understood using models in which some agents are not fully rational. According to Thaler and Barberis (2002) behavioral finance is basically divided into two building blocks: limits to arbitrage and psychology. Limits to arbitrage explains how prices may remain in a non-equilibrium state due to not fully rational investors that are not able to profit from market dislocations. Behavioral finance researches specify the form of agents’ irrationality, related to how they deviate to the expected utility theory. To do this, researchers use experimental evidence complied by cognitive psychologists on the biases that arise when people form beliefs, on people preferences, and on how they make decisions given their beliefs.

Criticisms of the MPT, however, do not only come from behavioral economics, and some other studies might not agree with it. Let us list the main critiques of the theorem.

1. MPT considers investors to be interested in the optimization problem of maximizing the mean for a given variance. Behavioral finance shows with experimental evidence conducted by cognitive psychologists that there are biases that arise when people form beliefs and proves that investors’ preferences are not always consistent with mean-variance preferences (Thaler and Barberis, (2002)).

2. MPT assumes that investors are rational and risk averse and that they aim at maximizing their expected utility and it assumes the efficient market hypothesis. Behavioral economics shows how market participants are not always rational or consistently rational, in fact the assumption does not take into consideration the “herd behavior” or investors that seek the risk for the sake of risk (an example are casino gamblers).
3. The assumption that asset returns are jointly normally distributed random variables is highly criticized since reality shows that returns in the equity markets are not normally distributed. A study of Mandelbrot and Hudson (2004) proves that market returns have a volatility that goes from 3 to 6 standard deviations from the mean with more frequency than in a normal distribution assumption. MPT is also proven by the assumption that any return distribution is jointly elliptical, however, studies of Chamberlain (1983) and Owen and Rabinovitch (1983) prove that all jointly elliptical distributions are symmetrical but asset returns empirically are not.

4. MPT assumes investors to have access to the same information. Anyhow, real markets show market asymmetry and insider trading since some actors in the financial market generally know more than others.

5. Behavioral economics criticizes the psychological assumptions made over investors whose probabilities of beliefs match the distribution of returns. Daniel, Hirshleifer and Subrahmanyam (2001) provide an alternative to the CAPM model based on behavioral economics. The model takes into account investor’s overconfidence about the precision of private information and investor misvaluation: investors use information incorrectly when they form portfolios and this leads to market under-reactions or overreactions causing equilibrium prices to be mispriced.

6. According to MPT, correlations between assets are constant and fix forever. However, this can be proved to be wrong. Correlation is linked to the systemic relationship between assets. But if we consider for example financial crisis, all assets become positively correlated because they all move down together. This shows that when investors need risk protection, the MPT breaks.

7. Another pitfall of the MPT is that it considers no taxes and transaction costs. But in reality, all financial products are subject to taxes and transaction costs and the fact that they are not taken into account might compromise the composition of the optimum portfolio.

8. Investors are price-takers and their actions do not influence prices. This assumption is subject to critiques if we consider that in reality, sufficiently large sales or purchases of a specific asset shift the market price for that asset. But the market price also shifts for other assets, because of the cross elasticity of demand.
It follows that, if the market is changing while investors are choosing the optimal portfolio, investors do not make an optimal choice.

9. MPT assumes that any investor can lend and borrow an unlimited amount at the risk free rate: in reality, only the government can borrow at the risk free rate. No other investor can borrow money at this rate unless there are special concessions. Moreover, short selling is illegal or severely restricted in many countries.

10. The fact that securities can be divided into parcels of any size is not strictly true since reality shows that fractional shares cannot be bought or sold and some assets have minimum order sizes.

11. It is not always true, as MPT states, that risk and volatility are known in advance and that they are constant: markets tend to misprice risk and the volatility might change rapidly. An example are financial bubbles and crisis.

### 2.4.2 The Single Index Model

Mean-variance needs a large amount of data (expected returns, volatility, correlations) and estimated portfolio weights are sensitive to estimation errors and so small changes in mean returns have large effects on the efficient portfolio weights (Jorion, 1991). Moreover, there is uncertainty about how long past time is necessary for estimates, since volatility and correlations change over time. Also, it is a single period model and does not consider rebalancing, it also does not consider transaction costs such as bid-ask spread, price pressure (market impact) and brokerage. All these leads to the definition of a non efficient portfolio and compromises the optimal choice of investment.

Let us concentrate on the very large number of input values required to apply the MV approach:

- N expected returns for N assets;
- N variances for N assets;
- N (N-1)/2 correlations for N assets (we divide by 2 since Corr_{ij} = Corr_{ji}).

To sum up we need 2N + N(N-1)/2 estimates for the mean variance analysis. This means that for a portfolio with 50 assets we need 1.325 estimations.
The single-index (SI) model developed by Sharpe (1964) is a good way to solve this problem. The model defines that the rate of return on a broad index of securities is a valid proxy for the common macroeconomic factor and so a market index is a common factor describing stock returns. The single-index model uses a similar equation to the MV model but it uses a proxy for the common or systematic factor. The excess return of stock $i$ is divided into two parts: a macro or systematic component and a micro or firm-specific component:

\[ r_i - r_f = \alpha_i + \beta_i(r_M - r_f) + \epsilon_i \]  \hspace{1cm} (57)

\[ R_i = \alpha_i + \beta_iR_M + \epsilon_i \]  \hspace{1cm} (58)

where $r_M - r_f$ is the market excess return and $\epsilon_i$ is the residual. The overall risk of each security has two components:

- a market-related part, $\beta_iR_M$ where $\beta_i$ measures the sensitivity of a stock to market movements;
- a non-market-related part, $\alpha_i + \epsilon_i$.

Therefore, the expected return can be written as:

\[ E(R_i) = \alpha_i + \beta_iE(R_M) \]  \hspace{1cm} (59)

since it is assumed that $E(\epsilon_i) = 0$.

As a consequence, also the overall risk of each security has two components: market or systematic risk and firm-specific risk. Hence, the variance of return on asset $i$ is:

\[ Var_i = \beta_i^2Var_m + Var(\epsilon_i) \]  \hspace{1cm} (60)

And it is obtained from taking the variance operator on both sides of the single index model.

Since securities are related only in their response to the market, they covary together only because of their relationship to the market index:

\[ Cov(R_i, R_j) = Cov(\beta_iR_M, \beta_jR_M) = \beta_i\beta_jVar_m \]  \hspace{1cm} (61)
Note that $E[\varepsilon_jR_M] = 0$ and $E[\varepsilon_i\varepsilon_j]$. Using this model the number of inputs required is substantially reduced. In fact we need:

- N estimates of the extra-market expected excess returns $\alpha_i$;
- N estimates of the sensitivity coefficients $\beta_i$;
- N estimates of the firm-specific variances $\sigma^2_i$;
- 1 estimate for the variance of the common factor $\sigma^2_M$;
- 1 estimate for the market risk premium $E(R_M)$.

For a total of $(3N+2)$ estimates. So in our example of a 50-security portfolio, we need 152 estimates instead of 1.325 estimates required if we apply the mean-variance procedure.

Regression analysis is often used to estimate an index model. In fact, we can summarize the result in a scatter diagram drawing the best fitting line through the scatter. Each point of the diagram is defined by a pair of excess return: the y-axis indicates the excess return of individual security in the portfolio and the x-axis indicates the excess market return. The best line is a regression line defined through the least squares approach: the overall solution minimizes the prediction error, e.g. the deviation of the data points from the prediction data points. Deviations are squared in order not to have positive and negative deviations to cancel each other out. Generally, in a single variable regression equation, the dependent variable plots around an intercept $\alpha$ and a slope $\beta$, the deviations (residuals, $\varepsilon$) from the line are assumed to be mutually uncorrelated as well as uncorrelated with the independent variable. These assumptions of regression models perfectly fit the single index model. Each residual is given by the difference between the actual stock return and the return predicted from the regression equation. The estimated regression equation of the single-index model is usually defined as the *security characteristics line* (SCL).
Figure 15 is an example of a scatter diagram with a security characteristic line, we take the Standard & Poor’s 500 as market index:

Figure 15 - The security characteristics line estimation of a sample portfolio

![Scatter diagram with security characteristic line]

The index model encountered a great attention of analysts that identified it as a convenient benchmark. For example, if the fund manager does not have information over a particular security nor it is available to public, he will set the security’s $\alpha$ equal to zero and will forecast a risk premium for the security equal to $\beta_i R_M$. And if a fund manager has a forecast for the market index $E(r_M)$ and knows the T-bill rate $r_f$, he can use the model to derive the benchmark expected return for any stock. The $\beta$ coefficient and the firm specific risk can be estimated from the regression of the security excess returns (Sharpe, 1964).

Moreover, it is common to estimate the $\beta$ from running a regression with the past data, and use this historical beta as an estimate for the future $\beta$. The problem with the use of historical beta however is that $\beta$ estimates have the tendency to regress towards one, besides beta can change over time and we would lose the benefits of it. So, in order to overcome this problem, analysts tend to adjust historical beta to get a better forecast of future betas or correlations. For example, Merrill Lynch adjusts beta estimates in a simple way taking the sample estimate of beta and averaging it with 1, using weights of two-thirds and one third:

$$\text{Adjusted beta} = \frac{2}{3} \text{sample beta} + \frac{1}{3} (1) \quad (62)$$
2.4.3 The Black-Litterman model

Institutional investors using the modern portfolio theory experienced the pitfalls of the model and elaborated several solutions. It is the case of Black and Litterman (1992) that created a development of the mathematical model for portfolio allocation for the investment banking firm Goldman Sachs. The model tries to solve the problem of non-realistic final allocations caused by the high number of inputs required in the MV approach: there may be frequent estimation errors that lead to the determination of non-efficient portfolios.

The Black-Litterman model solves the problem of non-efficient and non-realistic portfolios introducing a subjective component to the mathematical optimization model creating portfolios that are more intuitive and less unrealistic. This is done through the introduction of the “views” of the money managers about the asset returns. More specifically, the model assumes that the initial expected return is proportional to the market values of the available assets but it is later modified according to the specific opinion about the asset returns. Every institutional investor should state his assumptions about expected returns and the degree of confidence in the assumptions and see how they differ from those of the market. The level of confidence equilibrates the impact on the final asset allocation with respect to the prevision model: as the confidence increases, the distance to the optimal asset allocation of the prevision model increases.

This methodology is very flexible because the money manager does not necessarily have to express his opinion on all the activities stock classes of the provisional model and the final allocation does not necessarily have to be distant from the provisional model. Black and Litterman in fact start from the MV equilibrium expected returns as the necessary input for the formulation of the investment decision (Black and Litterman, 1992).

2.4.4 Roll’s critique

Roll (1977) suggests that the CAPM cannot be subject to an empirical proof. In fact, every test conducted on the CAPM needs to consider the hypothesis that the market portfolio $R_m$ belongs to the efficient frontier. However, the market portfolio should contain all the financial activities available in the market, this means that it does
not contain only stocks and bonds, but also other entities that are not easily identifiable like human capital, real estate and artworks. Since it is hard to include everything that has a marketable value, it follows that the market portfolio is just a proxy of the real market portfolio and does not provide a legitimate conclusion on the mean-variance efficiency.

Roll considerations also include that: the only testable hypothesis of the asset pricing model of Black is that the market portfolio is mean-variance efficient and that all the implications of the model, the best known of which is the linearity relation between expected return and beta, are not independently testable. Also, he says that using proxies might be mean variance efficient even when the true market portfolio is not:

“This is real danger since every sample will display efficient portfolios that satisfy perfectly all of the theory’s implications. For example, suppose there exist 1000 assets but only 500 are used in the sample. For the sample, there will exist well diversified portfolios of the 500 assets that seem to be reasonable proxies for the market and for which observed returns are exactly linearly related cross-sectionally to observe betas. On the other hand, the chosen proxy may turn out to be inefficient; but obviously this alone implies nothing about the true market portfolio’s efficiency” (Roll, 1977).

Roll’s critique makes us remember that the effort to know the market as a hole is only an attempt. Even if the Roll’s critique has a valid theoretical fundamental, however, the CAPM is still widely used and its supporters consider market indices as a proxy for the overall market. Also financial websites like Yahoo! Finance, Bloomberg and Morningstar frequently estimate the beta of the firms, taking into account the weaknesses associated with any empirical test.

2.5 The benchmark and the portfolio management strategy

As we said in Chapter 1, the asset management industry has recently widely developed and investors tend to delegate the management of their savings to institutional investors. In this scenario it grows the importance of performance evaluation through which it is possible to evaluate the portfolio management both from the side of the return from the investment and of the riskiness of the investment. For the
purpose of evaluation, it is necessary to choose the right benchmark to be taken as a reference point to estimate the performance of the fund considering the management style in that specific period.

The benchmark is an index or a mix of indices that synthesizes the movement of the markets in which a fund invests, and it is the parameter that allows a comparison of performance for a mutual fund. The introduction of the benchmark in Italy took place in 1998 with its imposition by the Consob\(^{19}\) as an objective reference parameter. The benchmark is a very useful instrument and it has several advantages:

- it helps in the identification of the investment: it explicitly defines the risk *ex-ante* of an asset class and of the type of investment, assisting investors in the choice of a coherent solution for their objectives;
- it is useful for the evaluation of the results of the fund: it allows to measure on a specific time frame the quality of the management;
- it is representative of a market: every index that belongs to the benchmark is representative of that specific market;
- it has a transparent construction: every index is composed and calculated with clear and simple rules accessible to investors.

When comparing the returns of the benchmark with those of the fund, it is important to keep in mind that the benchmark is a sort of virtual fund, since it would be impossible for a real fund to invest in all the titles of the market, also because they tend to have several constraints of accessibility to some market segments. Moreover, the benchmark is not subject to the costs that a real portfolio has, like management costs, distribution costs, negotiation costs and administrative costs. Furthermore, the time frame of analysis is fundamental for the comparison, if the comparison is made on a time frame that is not adequate to the type of investment, it loses the significance. The benchmark of a fund must always be indicated, and in the case in which it is impossible to identify it, the reasons of this impossibility must be indicated. Moreover, it is necessary to indicate which is the relationship between the benchmark and the objective of the fund. The benchmark can also be identified as a reference for the quality of the investment instrument. In Italy a benchmark is correct only if it respects the regulation of the Consob.

\(^{19}\)Consob Regulation n. 11522 of the 1st of July 1998, Art. 50, 2.
As far as the portfolio style is concerned, it basically defines the way in which a fund is managed. Firstly, we analyze the difference between active and passive management.

1. **Active management.** When a fund is actively managed, the portfolio composition of the fund is voluntarily different from that of the benchmark. The objective is to have a higher return than that of the market index chosen as benchmark by the fund manager. The choice of the benchmark is the consequence of an accurate selection of stocks (“stock picking”), of the anticipation of the movements of value of the stocks (“market timing”) and of the allocation on different markets and activities (“asset allocation”). The logic behind this is that of exposing the portfolio to a higher risk than that of the benchmark: if the strategy is successful the higher risk will generate a higher return from the benchmark, otherwise the return will be lower.

2. **Passive management.** When a fund is passively managed, the composition of its portfolio is chosen on the basis of a pre-established objective like the replication of an index (benchmark) and the number and volume of transactions is limited. A passively managed fund usually has lower commission costs since it needs a lower effort to be managed.

**Investment performance attribution** studies the causes of the active return of a portfolio through the decomposition of the active return into single components identifiable in the active management process. There are three main activities that contribute to the generation of active return:

1. **Strategic asset allocation** is the activity that identifies the level of specialization or diversification of the portfolio, the level of risk and liquidity, the areas of investment between stocks, bonds and liquidities, geographic areas and business sectors, and the correlation between the different financial instruments on the basis of a time period. Through the combination of the elementary asset classes it is possible to obtain an infinite number of combinations and create an asset class composite. Strategic asset allocation is all about targeting allocation and then periodically rebalancing with the change of the goals and needs of the client.

2. **Tactical asset allocation or market timing** sets a range of percentages (that is the maximum and the minimum acceptable percentage) in each asset class. Investors can move through this percentage, for example increase up to the upper threshold the percentage of stocks held in the portfolio if the markets are doing well, and diminish
it up to the minimum threshold when the economic outlook is bleak. Market timing is the act of attempting to predict the future direction of the market through the use of technical indicators and economic data but also the practice of switching among mutual fund asset classes in an attempt to profit from the changes of the market outlook.

3. *Stock picking* or *security selection* is the activity through which an analyst uses a systematic form of analysis to evaluate whether a particular stock is a good investment or not and to decide whether it should be added to his portfolio (Luenberger, 2006).

There are two management strategies that contribute to generate the active component: the top-down and the bottom-up approach. The *top-down approach* is conducted through a macro analysis that allows to define a portfolio. The objective of the analysis is to provide the indications linked to the evolutions of the market and sector and explains the risk about them. All these analysis are correlated and allow to define the strategic choices of investment. The approach is called top-down since it starts from the analysis of the macro economic variables that might influence the markets in a predetermined period. The *bottom-up approach* instead starts from the analysis of a single firm to find the opportunities of profit. In general, the analysts that follow this approach are specialized in a single sector, geographic area or State. When analyzing a firm they start from the study of the balance sheet, the strategic positioning of the firm, and the market in which it works. The analysis allows them to select the firms that provide higher expected profits.

A debate over actively and passively managed funds has developed in the last years. Of course each investor worries about the ability of money managers to create extra performance, asset management in fact is a valuable option only if the management of the fund is able to use the information in his possession to make previsions of the market movements and to generate a portfolio with greater returns than the benchmark. But this is not confirmed by several studies and researches, first of all the market efficiency hypothesis by Fama (1965) states that any attempt to look for information to find the mispriced assets is vain: when markets are efficient all the stocks in the market have the right price since they immediately reflect the available information to all market participants and consequently no one can beat the market. Jensen (1968) evaluates the performance of mutual funds and finds no evidence of
managers’ skills. Some other empirical researches confirm the superiority of passive management with respect to active management due to the high transaction costs. An important study by Brinson, Beebower and Singer (1991) conducted on 91 pension funds in the United States in the period 1974-1983 demonstrates that over 90% of the variability of returns in a typical mutual fund over time is a direct consequence of the long-term strategic asset allocation. Later, Ibbotson and Kaplan (2000) conducted a study over a sample of 94 balanced funds in the US over the period 1988-1998 and over a sample of 58 pension funds in 1993-1997. The aim of the research was to determine how much of the variation in returns among different portfolios is explained by strategic asset allocation differences through the use of cross-sectional analysis. The result of the study showed that 35% of the variation of returns across portfolios is explained by strategic asset allocation and the remaining 65% is explained by other factors like market timing, style within asset classes, fees and manager selection. Ippolito (1989) demonstrates the ability of active funds to beat the market but not if net of fees and expenses. Similar results are obtained by Cesari and Panetta (2002) with a study over Italian equity funds that finds no evidence of superior forecasting skills among Italian fund managers. The study concentrates on the possibility that money managers choose non-efficient benchmarks to compare their portfolios and that the phenomenon of “survivorship bias” (e.g. the tendency to exclude failing companies from the studies of performance because they no longer exist) should be considered because it causes results to skew higher because only successful companies are taken into consideration. They also consider the fact that there is not a persistency of the results of mutual funds: the identification of the asset management company that beats the market is not useful since money managers tend to shift from one company to another.

### 2.6 Performance and risk measurement

#### 2.6.1 Introducing performance and risk measurement

Since the market of mutual funds has continuously grown and the number of professionally managed funds has increased, the need for clear and accurate portfolio performance analysis has widened. Investors want to have information to choose where to invest, they want to know whether fund managers succeeded in reaching the objectives and getting returns sufficiently higher to reward the risk taken and they want
to understand whether the results of the portfolio are due to luck or to the real skills of the fund manager. Moreover, performance analysis generates information useful for money managers to alter decisions made about the portfolio’s design, since portfolio management is a dynamic process.

When making an investment it is important to keep in mind that returns mean nothing unless put side by side with the risk undertaken. Let us repeat a concept: total returns on an asset are the sum of the risk free return, that is the return from the time value of money, the beta return, which is the reward from additional volatility of the asset, also called risk premium, and the alpha return, that is the superior performance attributable to the asset manager security’s selection skill. While the risk free rate brings no volatility, the beta and alpha components carries volatility. The risk-adjusted performance (RAP) measures allow to analyze the results of funds or stocks taking into consideration at the same time the returns and the risk. The main feature of these measures is that they give a measurement of the return adjusted to the level of risk taken to obtain that level of return. Thanks to these measurements it is possible to compare the different funds or stocks in a simple way since the necessary information is summarized by this measure. The fund with the higher RAP is the best, since it has the best position in the risk-return framework. Absolute risk-adjusted performance measures evaluate funds’ risk-adjusted returns, without any reference to a benchmark, in the next paragraphs we are going to describe the Sharpe ratio, the Treynor ratio and the measures based on the VaR. Relative risk-adjusted performance measures instead evaluate returns in reference to a benchmark, we are going to describe the M2 measure, Jensen’s alpha and the information ratio.

2.6.2 The Sharpe index

The Sharpe index (also known as Sharpe measure or Sharpe ratio) is a reward-to-variability measure that evaluates the performance of an investment adjusted for its risk. The ratio measures the excess return (or risk premium) per unit of deviation in an investment asset. It is a very simple measure to define how well the return of an asset compensates the investor for the risk he takes and it is a widely used measurement. If we are comparing two assets with the same risk, the one with a higher Sharpe ratio
provides a better return (or equivalently if they have the same return but one has lower risk). The Sharpe ratio is the slope of the CML and its formula is defined as:

\[ S_p = \frac{R_p - R_f}{\sigma(R_p)} \]  \hspace{1cm} (63)

The main pitfall of the measurement is that returns have to be normally distributed but reality proves that not all asset returns are normally distributed. Abnormalities in the distribution like kurtosis, fatter tails, high peaks and skewness can make the ratio not to have the same effectiveness since they have effects on standard deviation (Sharpe, 1994).

### 2.6.3 The Treynor ratio

The Treynor ratio (also called Treynor measure) is a reward-to-volatility measure, named after Jack L. Treynor. It measures returns earned in excess of what could be earned in a riskless investment measuring the relationship between the return on the portfolio above the risk-free rate and its systematic risk. It differs from the Sharpe ratio for the fact that, instead of taking into account total risk, it only considers systematic risk. The formula of the Treynor ratio of a portfolio is similar to that of the Sharpe ratio, with the difference that the Treynor ratio uses beta as the measurement of volatility:

\[ T_p = \frac{R_p - R_f}{\beta_p} \]  \hspace{1cm} (64)

Like the Sharpe ratio, it allows to create a ranking of portfolios: the higher the Treynor ratio, the higher the performance of the portfolio in the analysis. This measurement derives from the CAPM and it requires the estimation of the beta of the portfolio choosing the proper reference index, it follows that the result can depend on the choice of that index. The Treynor ratio is a useful index if used to evaluate the performance of a portfolio that is well diversified since it takes into account only the systematic risk of a portfolio (Hübner, 2005).
2.6.4 Value at risk (VaR)

The Value-At-Risk (VaR) is an indicator that allows to sum up in a single value the set of risks associated with a portfolio diversified over several asset classes. It was introduced in the late 1980’s by American banks Banker’s Trust first and J.P.Morgan after. The VaR measures risk as the maximal potential loss that a financial product or portfolio can sustain for a given level of confidence (probability) during a defined period. To make this more clear, let us make an example. The value of a financial product can be represented by a probability distribution. The graph of Figure 16 depicts a hypothetic probability curve for the value of a financial instrument for the next business day. The average closing price is 100 euros and the vertical axis shows with which probability it occurs. The red area represents a cumulated probability of 10% and it means that there is less than 10% chance to have a price inferior to 75 euros. We can conclude that 1 day Value at Risk at 90% is 25 euros and it is related to the percentile at 10% (Manganelli and Engle, 2001).

Figure 16 - Value at Risk

2.6.5 Modigliani RAP index

Modigliani and Modigliani (1997) showed that the requirement to compare a portfolio to its benchmark is to have the same risk and they defined the following measure called $M^2$ measure:

$$M^2 = \frac{\sigma_M}{\sigma_p} (\bar{R}_p - R_f) + R_f$$

(65)
The index evaluates the risk-adjusted performance of a portfolio in relation to the market benchmark expressed in percentage terms. The aim of the index is to identify the return that a fund with any given risk would have achieved if it had the same risk as the market index. This means that the index allows us to define the performance of the fund in relation to that of the market. The most interesting funds are those with the highest $M^2$ value. This measure is directly derived from the CML and it can be expressed as the Sharpe ratio times the standard deviation of the benchmark index. The Sharpe measure and the Modigliani measure lead to the same ranking of the funds (Modigliani and Modigliani, 1997).

2.6.6 Jensen’s alpha

Jensen’s alpha takes its name from the economist Michael Jensen (1968) that first introduced it to evaluate mutual funds’ managers. It is a measure used to determine the abnormal return of a stock or portfolio over the theoretical return predicted by a market model, that is most commonly the CAPM. It makes use of statistical methods to predict the appropriate risk adjusted return of an asset and it is defined as the extra-return of a fund with respect to the return he should have at that level of systematic risk. It is basically the differential between the return on the portfolio in excess of the risk-free rate and the return explained by the market model. We can define the Jensen’s alpha ($\alpha_f$) as:

$$\alpha_f = R_t - [R_f + \beta_{im}(R_M - R_f)]$$

(66)

The statistical significance of alpha can be evaluated by calculating the t-statistic of the regression, which is equal to the estimated value of the alpha divided by its standard deviation. If the alpha values are assumed to be normally distributed, a t-statistic greater than two indicates that the probability of having obtained the result through luck and not through skill is strictly less than 5% and the average value of alpha is significantly different from zero. This ratio contains a benchmark and it takes into account only systematic risk. However, since it does not allow portfolios with different levels of risk to be compared, it is a good measure to rank portfolios within peer groups, that means groups that are managed in a similar manner and have comparable levels of risk (Jensen, 1968).
2.6.7 Portfolio’s beta

The beta of a portfolio is used to measure the sensitivity of the returns of a fund with respect to the market (or a benchmark) and it aims at determining whether the fund is more risky than the market (Markowitz, 1952). Its formula is:

\[ \beta = \frac{\text{Cov}(R_M, R_P)}{\text{Var}(R_M)} \]  

- \( \beta > 1 \) means that asset moves in the same direction of the market but in a higher amount;
- \( \beta = 1 \) means that the asset moves generally in the same direction as the movement of the benchmark and also in the same amount;
- \( 0 < \beta < 1 \) means that the asset moves in the same direction of the market but in a lower amount than the movement of the benchmark;
- \( \beta = 0 \) means that the movement of the asset is not correlated with the movement of the benchmark;
- \( \beta < 0 \) means that the asset moves in opposite direction with respect to the index.

2.6.8 Information ratio

The information ratio is defined by the residual return of the portfolio compared to its residual risk. The residual return of a portfolio corresponds to the share of the return that is not explained by the benchmark and results from the choice made by managers that choose the securities that they think will beat the benchmark. The residual risk instead is the measure of residual return variations and it is defined by the standard deviation of the difference in return between the portfolio and its benchmark. If the value is low, the risk of the portfolio is close to the risk of its benchmark. The definition of the information ratio is the following (we define the return of the benchmark with \( R_B \)):

\[ IR = \frac{E(R_P) - E(R_B)}{\sigma(R_P - R_B)} \]  

This measure allows to check whether the risk taken by the manager in deviating from the benchmark is sufficiently rewarded and allows to evaluate the skills of the manager in achieving a higher performance than an average manager. Managers want to
maximize the value of the ratio because they want high residual return and low residual risk.

Since it does not consider systematic risk, it is not useful for the comparison of the performance of a well-diversified portfolio with that of a portfolio that is not very diversified (Liberty, 2010).
Chapter 3

CLERICAL MEDICAL’S MANAGED PORTFOLIOS BY MORNINGSTAR

3.1 Introduction

“Past performance is not a predictor for future returns”, this statement should be familiar to most investors. However, things change when it comes to risk, since past volatility can be a good predictor for future volatility. While most portfolios are nowadays based on the false assumption that the volatility of each asset class remains stable, investors instead should actively manage volatility. The target volatility approach develops a strategy to protect a portfolio during volatile markets in contrast with the classical approach that implies constant risk for each asset class and consequently stable volatility. “ […] volatility is very volatile itself. Take the S&P 500 Index; its volatility has averaged 13.9% since 1950, but has ranged between 5.3% and 39.4% along the way” (Rose, 2014).

In this chapter we describe the strategy and techniques of investment of three portfolios of funds managed following the approach of target volatility by Morningstar for Clerical Medical, a British company specialized in insurance and financial products. For this purpose we also provide a detailed description of the main activities and services provided by Morningstar for the mutual fund industry. In particular, we concentrate on the description of Morningstar Style Box, Morningstar star rating and Morningstar analyst rating for funds. Moreover, we illustrate the steps of the process of management of the three portfolios: the strategic asset allocation with the optimization model Markowitz 2.0, the selection of funds, the portfolio construction, the dynamic asset allocation, the daily monitoring of the portfolio and the rebalancing of the portfolio.
3.2 Morningstar, Inc.

3.2.1 The company

Morningstar, Inc. is an investment research firm headquartered in Chicago, Illinois, United States. The birth of Morningstar dates back to 1982 when Joe Mansueto, while reviewing the reports he had requested to several fund managers, noticed some lack of information in the financial sector in the field of mutual funds. He noticed that there were tons of information on the equity market but there was not enough on mutual funds and in this context he had the idea about the creation of Morningstar. Mansueto started his company in 1984 in his Chicago apartment after a year working as stock analyst for Harris Associates, a local money management firm. By 1990 revenue reached 2 million dollars and since it encountered great success with investors and financial services companies who discovered the easy-to-follow analysis of mutual fund performance, in 1995 it reached a revenue of 31 million dollars. The name Morningstar derives from the last sentence of the book Walden by Henry David Thoreau: “the sun is but a morning star”. As of December 2008, Joe Mansueto owned approximately 57% of the outstanding shares of Morningstar.

As John Waggoner writes in an article of the “USA today”, “For investors, Morningstar is the brightest star in the mutual fund universe”. The company in fact provides data on approximately 433,000 investment offerings, such as stocks, mutual funds and similar vehicles and provides real-time global market data on about 10 million equities, indexes, futures, options, commodities and precious metals, in addition to foreign exchange and Treasury markets. The main field of activities of the company is that of supplying information over mutual funds like performance, statistics and analysis to Microsoft Money Central, American Online and Yahoo Finance, but it also provides classifications of stocks and mutual funds and fund-ratings that are very useful to investors and widely used worldwide. Some important academic studies motivate their analysis stating that Morningstar is the best-known and most popular ranking service among investors. For example, Blume (1998), Sharpe (1998), and Morey (2000) analyze Morningstar’s rating algorithm, while Blake and Morey (2000) test the predictive power of the star rating.

In addition to providing services like data feeds and investment management research, the company also develops several software for investment consultancy. In
1999 in fact, the division Morningstar Investment Management was created to develop consulting services to privates and financial institutions like banks, insurances and pension funds. Morningstar Investment Management creates an alternative and customized financial solution side by side with the client himself. Morningstar Investment Management is divided into three areas:

1. retirement solutions;
2. investment services, e.g. investment consultancy in the market of mutual funds, stocks and ETF\(^{20}\);
3. investment consulting that creates highly customized financial solutions, using innovative techniques.

The investment division of Morningstar has the advantage of having at its disposition a very large amount of information owned by the company itself, and that is already selected and interpreted by researchers internal to the company. Thus, the investment division exploits resources like data feeds and software tools and has direct access to the lists of funds and optimal portfolios already selected by researchers.

### 3.2.2 Morningstar Style Box

The Morningstar Style Box provides a graphical representation of the style of investment of stocks and mutual funds. It is composed of a nine-square grid with a vertical and horizontal axis. For stocks and stock funds the vertical axis classifies securities according to market capitalization, while the horizontal axis classifies securities according to growth and value factors. More specifically, the vertical axis defines three categories of size of capitalization: “large”, “medium” and ”small”. The horizontal axis instead defines three categories of style: the two extreme columns are “value” and “growth” and are in common for stocks and stock funds. The central column is the “core” style in case of stocks (e.g. the case of stocks in which neither value or growth characteristics dominate), and the “blend” style in case of stock funds (e.g. funds with a mixture of growth and value stocks or mostly core stocks).

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\(^{20}\) Exchange traded fund. It is a special type of fund that has two main features: it is traded in the Stock Exchange like stocks and it has the sole objective of replicating the benchmark through passive management. Thus, it is characterized by having the features of stocks and of funds together, benefiting from the strength of the two financial instruments.
Figure 17 shows Morningstar equity style box:

*Figure 17 - Morningstar Equity Style Box*

Source: Morningstar.com

The Style Box changes in the case of fixed income funds, in fact the vertical axis represents the credit quality of the fund and the horizontal axis represents the sensitivity to changes in interest rates. The credit quality is divided into: “low” credit quality that basically indicates that the asset weighted average credit rating is less than “BBB-”, “medium” credit quality that means that the asset weighted average credit rating is less than “AA-” but greater or equal to “BBB-”, “high” credit quality that means that the asset weighted average credit rating is “AA-” and higher. The three interest sensitivity groups are the “limited”, the “moderate” and the “extensive”. More specifically, funds under the limited section have duration that falls under the 75% of the three year average effective duration of the MCBI (Morningstar Core Bond Index). This means that, for example, if the three year average of the MCBI equals 5.935, limited funds would have a three year average effective duration lower than 4.45, and so they have limited sensitivity to interest rate. In the same way, for the moderate section the percentage falls between 75% and 125%, with a three year effective duration greater or equal to 4.45 and smaller or equal to 7.42, and the fund has moderate sensitivity to interest rate change. For the extensive section instead it is above 125%, and so the fund would have a three year average effective duration greater or equal to 7.42, and so extensive sensitivity to interest rate change.

*21 The rating of the credit quality of stocks, bonds and mutual funds is assigned by rating agencies and it varies from a maximum grade of triple A to a minimum grade of D, passing through a series of intermediate valuations. The three most famous and internationally recognized rating agencies are Moody’s, Standard & Poor’s and Fitch.*
Figure 18 shows the Fixed-Income Morningstar Style Box:

**Figure 18 - Fixed-Income Morningstar Style Box**

![Morningstar Style Box](source.png)

Source: Morningstar.com

Since a fund is the aggregation of individual stocks, the determination of the style of the fund starts from the stocks that compose it. Plotting all the stocks of the fund in the style grid, the style of the fund becomes clear. Furthermore, to determine with more precision the fund’s placement in the Style Box, it is necessary to define an asset-weighted average of the stocks’ style. Generally, a fund that is growth-oriented holds stocks of companies that the portfolio manager believes that will increase the earnings faster than the rest of the market; a fund that is value-oriented has most of the stocks that the manager considers for the moment undervalued in price but their worth will be soon recognized by the market; finally, a blend fund is a mix of growth stocks and value stocks. Looking at the vertical axis instead, large-cap stocks represent the group that accounts for the top 70% of the capitalization of each geographic area; mid-cap stocks represent the next 20%; and small-cap stocks represent the balance (Morningstar.com).

### 3.2.3 Morningstar star rating

The Morningstar rating for funds, also called the “star rating”, was introduced in 1985 and had a great success among investors and advisors that used it to identify funds that are worthy. It is a quantitative assessment of a fund’s past performance that rates funds assigning from one to five stars, where the five-star funds is the best performer within the peer group. Thus, Morningstar star rating measures how funds performed relatively to their peers in the past, and it is not an indicator of future performance. Since the rating is assigned according to the comparison of a fund with other funds in its
specific Morningstar Category, the rating is affected more by manager skills than by market circumstances or events that are not subject to the fund manager’s control. Peer groups reflect the investment opportunities for investors and so funds in a particular rating group should be substitute to one another when constructing a diversified portfolio. Moreover, the rating is developed using Morningstar Risk-Adjusted Return (MRAR), measured as the amount of variation in the fund’s performance, with more emphasis on downward variation, and based on the expected utility theory that recognizes investors to be risk averse. The rating is also cost-adjusted, since it takes into consideration all sales charges, loads or redemption fees.

In order to receive a Morningstar rating, funds must have at least 36 continuous months of total returns and a star rating is assigned to a category only if there are more than five funds in it. Besides, each share class of a portfolio is evaluated separately, this is because each share class has different loads, fees and total return time periods available. In order to avoid multi-share funds to have a disproportionate amount of space in any rating level, Morningstar assigns fractional weights to funds that are different share classes of the same underlying portfolio and so a fund with multiple share classes is only counted once within the rating distribution scale. The distribution of funds across rating is approximated to a bell curve. Top 10% of funds that has the highest MRAR receives five stars, the next 22.5% receives a four star rating, funds with a rank that meets but does not exceed 67.5% receive a 3 star rating, funds with a rank that meets but does not exceed 90% receive a 2 star rating, the remaining funds receive one star rating as it is shown in Figure 19:

Figure 19-Morningstar star rating

![Morningstar star rating chart]


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22 Total return is expressed in percentage terms, taking the change in price, reinvesting, if applicable, all income and capital gains distributions during the period and dividing by the starting price. It is important to note that total returns are not adjusted for sales charges but they do account for the expense ratio.  
23 A mutual fund can give investors different choices of combinations of front-end loads, back-end loads, 12b-1 fees (annual distribution fee). The different types of shares created are called share classes.
The rating of each fund is based over a three-year, five-year and ten-year period and then an overall star rating is calculated for each fund based on the weighted average of the number of stars assigned in the other rating periods. If there are changes in the investment categories, the fund’s historical information is given less weight, ensuring a fairest comparison and minimizing the incentive for fund companies to change a fund’s style in an attempt to receive a better rating. If the fund maintained its current category over the whole period of evaluation, the weights assigned to each period are shown in Table 2, where it is visible that the least three-year period has the greatest impact on the final rating:

Table 2 - Three-, five-, ten-year periods weights for Morningstar star rating

<table>
<thead>
<tr>
<th>Age of fund</th>
<th>Overall rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least three years, but less than five</td>
<td>100% three-year rating</td>
</tr>
<tr>
<td>At least five years, but less than 10</td>
<td>60% five-year rating</td>
</tr>
<tr>
<td></td>
<td>40% three-year rating</td>
</tr>
<tr>
<td>At least 10 years</td>
<td>50% 10-year rating</td>
</tr>
<tr>
<td></td>
<td>30% five-year rating</td>
</tr>
<tr>
<td></td>
<td>20% three-year rating</td>
</tr>
</tbody>
</table>

Source: Morningstar.it

It is important to keep in mind that the rating is totally objective and that it contains no subjective component. Moreover, a high rating does not necessarily mean that the fund is suitable for each investor, the rating is useful for the initial step of evaluation of mutual funds as a relative measure within groups with similar investment objectives and it is not an indicator of future performance (Morningstar.com).

3.2.4 Morningstar analyst rating for funds

Morningstar thinks that the funds with the best performance in the past are not necessarily those that will provide best performances in the future. According to this, when choosing the securities in which to invest, it is necessary not to limit the analysis to quantitative criteria based on historical data, but also to make a forward-looking analysis of a fund. This is why, in February 2009, Morningstar started an in-depth qualitative research over mutual funds, taking into examination fundamental criteria like
costs, the experience of the fund manager, the management team and the strategy of the investment.

Morningstar qualitative analysis is based on 5 pillars: people, process, performance, parent and price. For each of these pillars Morningstar collects information through its data bank, other instruments for the analysis developed by the company itself, questionnaires sent to the management of the investment management companies and direct meetings with fund managers to deepen the knowledge of the fund. The final judgment, that is reviewed on a semester basis, is developed in the European Committee of rating, that assures the homogeneity in the application of the methodology of evaluation.

Relative to “people”, the aspects taken into consideration are the competencies, the experience, the temperament and the internal organization of the team of investment, with the verification of the adequacy with the strategy of investment. The study of the “process” focuses on the coherence between the philosophy of the investment and the mechanism of selection of the stocks and studies whether the management has a competitive advantage that enables to execute the process well and consistently over time. Particular attention is devoted to risks, in terms of geographical concentration, business sector and style of investment. The analysis of the “performance” focuses on identifying how the strategy of the fund is translated into results for the investors. This means that it measures the consistency of the investment, of returns and of the risk with the strategy of investment declared. The pillar about “parent” focuses on the legal person that promotes the fund. The organizing structure, the available resources, the remuneration policy and the culture (what priorities prevail, like the policy of selling, salesmanship, or that of providing an excellent service, stewardship) are factors that influence the choice of the management of the fund. Lastly, the pillar of “price”, refers to the examination of the costs of the fund compared to similar funds sold through similar channels. This element is very important, it presents low uncertainty and consistently influences the future performance.

The qualitative rating by Morningstar released on the basis of the five-tier judgments, is composed of three positive grades that are Gold, Silver and Bronze, a Neutral grade, and a Negative grade, based on the analyst conviction in the fund’s ability to outperform its peer group and/or relevant benchmark on a risk-adjusted basis
over the long term. Let us describe the features of each evaluation of the qualitative rating:

- **Gold**, the best-of-breed fund that distinguishes itself across the five pillars and gained the analyst’s higher level of conviction;
- **Silver**, assigned to a fund whose advantages outweigh the disadvantages across the five pillars and gained a sufficient level of analyst conviction to be granted a positive rating;
- **Bronze**, for a fund that has advantages across several, but not all, pillars, and the strengths of the fund give to the analyst a certain level of conviction;
- **Neutral**, assigned to a fund that does not deliver exceptional returns but it is not likely to significantly underperform, according to analysts;
- **Negative**, for a fund that has at least one flaw that is likely to significantly obstacle a good performance and is considered to be an inferior opportunity with respect to its peers.

Morningstar does not receive any payment from the fund management society neither to provide the rating nor to produce the research report and it points at furnishing information independent to investors and consultants. The decision to produce a report over a particular fund is the fruit of the discretion of Morningstar analysts and of the interest expressed by investors.

Another interesting project by Morningstar is that of honoring managers, funds, fund managers and fund groups throughout the year with a series of awards known as “The Morningstar Awards”, given to those that outperformed competition over one, three and five periods. Examples are the award introduced in 2000 of the “CEO of the Year” where Morningstar recognizes the chief executive that demonstrates independent thinking, creates value for the shareholders and generally distinguishes with respect to others. Another important award is the “Fund Manager of the Year”, established in 1988, recognized to the portfolio manager that demonstrates excellent investment skills measured by the returns of the year and the long-term risk-adjusted performance (Morningstar.com).
3.3 Clerical Medical Managed funds by Morningstar Investment Management

3.3.1 Clerical Medical, the company

Clerical Medical is a British company specialized in insurance and financial products and it is part of the Lloyds Banking Group. The birth of Clerical Medical dates back to 1824, when a group of friends met in “The Freemason’s Tavern”, a tavern in London. The innovative idea of the group was to propose financial products specific to members of the clergy and doctors, and from this it takes the name. No other financial insurance company in fact wanted to insure these two categories of professionals because of their lifestyle. After almost two hundred years from its birth, Clerical Medical became part of the Lloyds Banking Group, one of the greatest providers of financial services in the United Kingdom.

In Italy, Clerical Medical opened its first office in 2002 and its main business is in insurance investment instruments. It operates in the Italian territory with multi manager instruments that are distributed by partner independent intermediaries. Products offered by Clerical Medical are mainly insurance and financial instruments, of the type unit-linked through a one-time lump sum investment or a systematic investment plan. These products allow to invest in a wide range of internal funds.

Table 3 contains the list of the 40 internal funds of Clerical Medical divided into open-end funds and closed-end funds.
### Table 3 - Clerical Medical Internal Funds

<table>
<thead>
<tr>
<th><strong>Open-end funds</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>CMIG GA 70% Flexible</td>
</tr>
<tr>
<td>CMIG GA 80% Flexible</td>
</tr>
<tr>
<td>CMIG Multi-Assets Global</td>
</tr>
<tr>
<td>CMIG Euro Adventurous Managed</td>
</tr>
<tr>
<td>CMIG Euro Balanced Managed</td>
</tr>
<tr>
<td>CMIG Euro Cautious Managed</td>
</tr>
<tr>
<td>CMIG Japan Enhanced Equity</td>
</tr>
<tr>
<td>CMIG Pacific Basin Enhanced Equity</td>
</tr>
<tr>
<td>CMIG US Enhanced Equity</td>
</tr>
<tr>
<td>CMIG European Enhanced Equity</td>
</tr>
<tr>
<td>CMIG Euro Bond</td>
</tr>
<tr>
<td>CMIG US Bond</td>
</tr>
<tr>
<td>CMIG Euro Currency Reserve</td>
</tr>
<tr>
<td>CMIG US Dollar Currency Reserve</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Closed-end funds</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>CMIG Guaranteed Access 80%</td>
</tr>
<tr>
<td>CMIG Continental European Equity</td>
</tr>
<tr>
<td>CMIG GA 90% Flexible</td>
</tr>
<tr>
<td>CMIG SR Euro Index Tracking</td>
</tr>
<tr>
<td>CMIG US Equity Index Tracking</td>
</tr>
<tr>
<td>CMIG UK Equity</td>
</tr>
<tr>
<td>CMIG UK Equity Index Tracking</td>
</tr>
<tr>
<td>CMI SR Pacific Basin Equity</td>
</tr>
<tr>
<td>CMI SR Continental European Equity</td>
</tr>
<tr>
<td>CMI SR UK Equity</td>
</tr>
<tr>
<td>CMI SR US Equity</td>
</tr>
<tr>
<td>CMI SR Japan Equity</td>
</tr>
<tr>
<td>CMI SR German Equity</td>
</tr>
<tr>
<td>CMI SR UK Equity Index Tracking</td>
</tr>
<tr>
<td>CMI SR US Equity Index Tracking</td>
</tr>
<tr>
<td>CMI SR Japan Equity Index Tracking</td>
</tr>
<tr>
<td>CMI SR UK Bond</td>
</tr>
<tr>
<td>CMI SR US Bond</td>
</tr>
<tr>
<td>CMI SR Euro Bond</td>
</tr>
<tr>
<td>CMI SR Japan Bond</td>
</tr>
<tr>
<td>CMI SR Euro Currency Reserve</td>
</tr>
<tr>
<td>CMI SR US Dollar Currency Reserve</td>
</tr>
<tr>
<td>CMI SR Sterling Currency Reserve</td>
</tr>
<tr>
<td>CMI SR Global Bond</td>
</tr>
<tr>
<td>CMI SR Global Equity</td>
</tr>
<tr>
<td>CMI SR Global Mixed</td>
</tr>
</tbody>
</table>

*Source: Clericalmedical.com*

The company manages all the funds apart from the funds highlighted in the table denominated “Managed” and indicated by the arrow. These funds are the object of our
analysis. The management of these funds is delegated to Morningstar Investment Management (Clericalmedical.com).

### 3.3.2 The funds

The managed funds of Clerical Medical, managed by Morningstar Investment Management are three funds of funds with an increasing risk profile: CMIG Euro Cautious Managed, CMIG Euro Balanced Managed, CMIG Euro Adventurous Managed. Table 4 summarizes the main characteristics of the three funds of funds:

<table>
<thead>
<tr>
<th>Table 4 - Clerical Medical Managed Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CMIG Euro Cautious</strong></td>
</tr>
<tr>
<td><strong>Investor Profile</strong></td>
</tr>
<tr>
<td><strong>Classification</strong></td>
</tr>
<tr>
<td><strong>Benchmark</strong></td>
</tr>
<tr>
<td><strong>Maximum Percentage of Stocks</strong></td>
</tr>
<tr>
<td><strong>Target Volatility</strong></td>
</tr>
<tr>
<td><strong>Range of Volatility</strong></td>
</tr>
<tr>
<td><strong>Reference Geographic Area</strong></td>
</tr>
<tr>
<td><strong>Currency</strong></td>
</tr>
<tr>
<td><strong>Management fee</strong></td>
</tr>
</tbody>
</table>

Source: Clericalmedical.com

The approach used by Morningstar to create and manage the portfolios of funds is based on 4 basic steps:

1. strategic asset allocation;
2. fund’s selection;
3. dynamic asset allocation;
4. daily monitoring.
We will now concentrate on Morningstar’s strategy developed to create the three portfolios of funds and focus on its distinctive features.

3.3.3 Morningstar strategic asset allocation

Morningstar strategic asset allocation starts with a reference portfolio where the management team decides in which asset classes to invest: for example equity Europe, equity North America, bond Europe, bond Emerging markets and so on. Once the asset classes are chosen, assumptions over risk and return are made and an optimization process is run in order to find the efficient frontier of portfolios. This is mainly what every institutional investor does. The greatness of Morningstar lies in the fact that every solution is highly customized and is elaborated step by step together with the client that in our case is the insurance company Clerical Medical and so the three portfolios of funds are created for a typical Clerical Medical client.

Morningstar believes that it does not exist a single model that is able to catch the complexity of the world and of financial markets and so it uses different approaches and different models and compares them. Examples are econometric models that study the actual economic conditions of the market (tax of growth of the economy, inflation and interest rates) to delineate the expected future macroeconomic scenario, but also the internal rate of return and the “views” of money managers over asset returns. After the comparison of all the approaches, it runs the optimization process.

3.3.3.1 Markowitz 2.0

Morningstar optimization model is called Markowitz 2.0. The model is explained in a book by Kaplan (2011), one of the main experts behind the elaboration of the Morningstar rating and the Morningstar Style Box. In his book “Frontiers of modern asset allocation” (Kaplan, 2011), Kaplan compares the Wright Brothers to Markowitz: the formers pioneered powered flight in 1903, while the latter pioneered the modern portfolio theory. The genius of the Wright Brothers lays in conquering the three axes of control: pitch, yaw and roll; the genius of Markowitz instead is based on the three principles of risk, reward and correlation among the assets in a portfolio. However, while the technology of aircraft has developed so much over the years that Wright’s
original plane is hardly recognizable, the portfolio optimization model has not evolved that much, although in a scenario where technologies are advancing incredibly and market crashed. As Kaplan says, after the crash of 2008 and the skepticism of investors towards financial markets, it was the perfect time to define a model built on the fundamentals of Markowitz, but with several developments. The final model, developed by taking advantage of the latest in economic thoughts and computer technology, is dubbed Markowitz 2.0.

Markowitz 2.0 is suitable to the twenty-first century financial markets, financial instruments and concerns of investors and it discusses five main enhancements:

1. the scenario considers fat-tailed\(^{24}\) distribution;
2. the single period expected return is substituted with the long-term forward-looking geometric mean that takes into account the accumulation of wealth;
3. standard deviation is substituted with conditional value at risk;
4. the covariance matrix is substituted with a Monte Carlo simulation that incorporates any distribution;
5. the technologies pioneered by Savage (2009) in probability management are exploited.

Let us analyze each point in more detail. First, we know that under the mean-variance optimization model, the distribution of returns is assumed to be a symmetrical bell-shaped curve. Kaplan criticizes this approach stating that in reality asset returns do not always follow a symmetrical bell-shaped curve and the distribution might be skewed to left or right, with skinnier or fatter tails.

Figure 20 shows the distribution of returns from 1996 to 2008 of different asset classes: it is evident that returns are skewed and do not always follow a bell-shaped distribution.

\(^{24}\) Probability distribution that exhibits large Skewness and Kurtosis (See Note 25 for more details).
Researchers tried to overcome the problem using distribution curves with skewness and kurtosis\(^{25}\) or using scenarios based on historical data or Monte Carlo simulation\(^{26}\).

\(^{25}\) Skewness is a measure of asymmetry of the probability distribution of a real-valued random variable about its mean and it can be positive or negative. Kurtosis is any measure of the peakedness of the probability distribution of a real random variable. Skewness and Kurtosis are two measures of the shape of a probability distribution.

\(^{26}\) Monte Carlo experiments are based on repeated random sampling to obtain numerical results. They typically run simulations many times in order to obtain the distribution of an unknown probabilistic entity.
In Markowitz 2.0 a scenario-based approach\textsuperscript{27} is applied instead of a distribution-curve approach; this has two main advantages: it is more flexible, allowing to model also nonlinear instruments like options, and it is more mathematically manageable since it considers portfolio returns to be weighted averages of asset-class returns in the scenario. This does not require to work on complex equations that might lack analytical solutions to derive the portfolio distribution, since it can be directly derived from the distribution of the asset classes.

Return distributions are not precisely graphically represented in scenario analysis since histograms are only approximations of the distribution, smooth curves are then used to get a more precise and easy to understand form of distribution. Figure 21 plots the scenario based distribution and the lognormal distribution on the same graph.

\textit{Figure 21 –Scenario-based distribution vs. lognormal distribution}

![Scenario-based distribution vs. lognormal distribution](image)

\textit{Source: “Frontiers of modern asset allocation” (Kaplan, 2011).}

The dotted line of figure 21 is the smooth curve of the distribution curve of annual return for large-company-stock under Morningstar scenario-based approach. It is

\textsuperscript{27} Portfolios that contain derivatives or options are exposed to credit risk and typically have skewed and fat tailed distributions. A scenario-based approach simulates the portfolio over a set of risk-factor scenarios and it represents risk factor distributions and non linear risky instruments in a more realistic way. The risk measures are computed from the empirical loss distribution obtained from the simulation. Since volatility is a poor measure of risk, in the case of not normally distributed losses, this approach favors the application of the VaR (Mausser and Rosen, 2002).
visible that the curve maintains the properties of the historical distribution of large-company-stock represented in the histogram of Figure 20. The solid line of Figure 21 instead represents the distribution of returns under the mean variance analysis and it follows a lognormal distribution. The area under the curve to the left of the vertical grey solid line is the 5\(^{th}\)-percentile under the scenario-based approach and is -25.8 \%, meaning a 5\% probability of return of less than -25.8 \%. Under the normal model instead, the probability of having a return lower than -25.8\% is only 1.6\%. This means that a mean-variance model underestimates by far the probability of tail events.

We can conclude, as Kaplan et al. (2009) state, that tail events have occurred more often than what has been expected throughout the history of capital markets in the world. This is why it is important to consider that tail events occur with higher probability than that expected by normal distribution.

The second aspect that we consider is the use of geometric mean instead of arithmetic mean which is used in MV optimization model. This is because if we consider a long period of time, investors are not concerned with simple averages of return, but they are concerned with the accumulation of wealth. For this, the use of long-term geometric mean is more suitable as a measure of reward, since investors who want to repeatedly reinvest their sum over an indefinite period look for the highest rate of growth for the portfolios as measured by the geometric mean.

The third point taken into consideration refers to risk. Kaplan is convinced that investors are more concerned in how much wealth they can lose than in the entity of the dispersion of returns and so he replaces standard deviation with downside risk\(^{28}\) measures. Markowitz 2.0 uses Conditional value at risk (CVaR). While the VaR describes the left tail in terms of how much capital can be lost over a given period of time, CVaR measures the likelihood that a specific loss is beyond the VaR, at a specific confidence level, that is the expected average loss of capital, if VaR is breached. Mathematically, it is a weighted average between the value at risk and losses exceeding the value at risk. As a consequence, CVaR is always greater than VaR and the 5\% CVaR in Figure 21 equals 35.6\%.

\(^{28}\)Downside risk estimates the potential loss of a security as the market condition changes. It measures risk only in the case of the “worst case” scenario, e.g. how much an investor stands to lose. This is important because standard deviation has the limitation that it measures deviations from the average, whether they are positive or negative, but investors are of course more concerned with negative divergences than positive divergences, and so they are more concerned with downside risk.
The fourth point modified in Markowitz 2.0 model is the correlation coefficient used to measure the pair-wise co-variation. As we have already seen in Chapter 2, pair-wise co-variation is not a good measure in particular in case of a global crisis, when all major markets move down together. Morningstar scenario-based approach models returns as moving apart from each other in scenarios that represent normal times, while it models returns as moving downward together in scenarios that represent global crises.

Finally, Markowitz 2.0 uses the new technology of probability management which extends data management to probability distribution. Savage invented the Distribution String that is the main component of probability management and it encloses thousands of trials as a single data element, eliminating the disadvantage of storing and processing large amounts of data. Savage’s Distribution String in fact contains thousands of trials of a single data element but it takes an incredibly short processing time and it allows to save on storage. Moreover, it is an interactive simulation technology and provides a deep intuition into the sensitivity of each portfolio, extreme events and black swans. Since scenario-based approach requires a large amount of data to represent the thousands of scenarios that model returns and to manage the data, Morningstar uses this technology.

Putting the five enhancements together, a new efficient frontier is obtained in the geometric mean-CVaR set. Kaplan believes that this new efficient frontier is more relevant to investors than the traditional one because it shows the tradeoff between risk and return that really concerns investors. To sum up, this is a representation of long-term potential growth versus short term potential loss.

\[29\text{The term black swan takes its name from Taleb (2004) who defined extreme events that have never occurred before with this name.}\]
Figure 22 shows the new efficient frontier on the C-Var set.

*Figure 22 – Markowitz 2.0 efficient frontier*

Source: “Frontiers of modern asset allocation” (Kaplan, 2011)

3.3.3.2 Asset allocation for Clerical Medical funds

The solution for Clerical Medical is highly diversified, this is confirmed by the number of slices into which the pie charts of Figure 23, Figure 24 and Figure 25 are divided. The asset allocation of the chart represents the allocation as of March 2013 for the three funds managed by Morningstar Investment Management for Clerical Medical.

*Figure 23 – CMIG Euro Cautious Managed*
The distinctive feature of the management of the three portfolios of funds by Morningstar is the great global exposure. In fact, most of the competitors in the investment management sector, when creating an instrument for an Italian investor, whose currency is the euro, would concentrate the asset allocation on European funds. Morningstar instead focuses in particular on North-American funds, both for the equity and bond side. This overweight to the dollar functions as a natural hedge: it implies the willingness not to totally profit from the rise in the market but to be protected from risk when the market collapses. Let us now comment the asset allocation of the three solutions.
As it is visible from the pie charts of Figure 23, Figure 24 and Figure 25, each fund is very diversified. The cautious solution invests 25% in equity and 75% in bonds. On the bond side, there is a conspicuous investment in Global Bonds, Euro Corporate and Euro Government, but also in the Euro Inflation Linked that contains securities that grow with the inflation and with the spread. This allocation is good for an investor with a risk averse profile, whose first objective is that of maintaining the value of money, preserving it against inflation. The balanced solution invests 50% on stocks and 50% on bonds. The bond percentage is invested in the same funds of the cautious solution but with different weights, and on the equity side the investment is more consistent, with the inclusion of funds like Equity North America Mid & Small Cap and Equity Asia Pacific. This investment suits an investor that looks for a superior performance, explained by the more consistent percentage of investment in equity and in particular in the Equity Europe Large Cap, but who does not want to take too much risk, explained by the conspicuous percentage of investment in Euro Corporate and Global Bonds. Finally, the adventurous solution has a 75% of the investment devoted to stocks and 25% devoted to bonds. The funds in the portfolio are the same of the balanced solution but with different weights and a great diversification and there is not anymore an investment linked to inflation, since the main objective of the investor is to see his capital to grow, assuming more risk.

3.3.4 Morningstar fund selection and portfolio construction

The process of fund selection starts from a qualitative and quantitative research and it proceeds with the phase of portfolio construction, where it is decided how to combine the funds in each portfolio. The qualitative analysis is the real strength of Morningstar since it has more resources in the fund selection than its competitors. Morningstar in fact was the first company that started to do funds’ analysis and consequently it has more experience than any of its competitors. Moreover, it receives on a monthly or quarterly basis a list of all the activities in the portfolios of mutual funds. This allows to the company to continuously monitor their portfolios in terms of risk, return, but also liquidity and to make calculations that its competitors cannot do. Also, it has direct access to fund managers, that is equivalent to say that it has direct access to all the information of each single fund, since it is the fund manager that
manages the fund. There are mainly two reasons why Morningstar has direct access to fund managers; the first reason is that Morningstar currently manages 150 billion dollars and fund managers want Morningstar to invest at least a portion of this amount on their funds. The second and most important reason is that Morningstar publishes on a daily basis information over fund management, and every fund manager wants that what is published about him and the fund he manages is representative of the truth. Morningstar star rating in fact is considered by investors to be a specific and observable packaging of information over the quality of a fund and so it has a certain impact on their decision over investment. In addition, the rating assigned by Morningstar to funds is a strength of the company and it should not be undervalued, there are academic researchers in fact that state that the rating by Morningstar has effects on the cash flows of the funds rated. A research by Del Guercio and Tkac (2001) that studies the effect of Morningstar Rating on mutual funds flows on a sample of 3.388 domestic equity mutual funds from November 1996 to October 1999, states that Morningstar has the most influential rating system in the mutual fund industry.

Also from the quantitative point of view Morningstar has several advantages with respect to its competitors. The company in fact is able to calculate with precision the liquidity of its portfolios, this is very important because the liquidity is associated to a risk premium: stocks that are less liquid tend to perform higher returns. If for instance we take two managers who generate two different performances, it is possible that the higher performance is performed by the manager with higher liquid stocks. Consequently this does not mean that the manager managed the fund in a better way, but he simply took a higher risk. Morningstar is able to check for this in order to attribute a real and concrete ability to generate a portfolio \( \alpha \), instead of attributing the ability to a manager that in reality does not have particularly good abilities but he is only performing higher risk. In this context, Morningstar also uses Active Share\(^{30}\), a measure used to define how much active management is being done by a fund manager, in order to find those who outperform. Basically, it measures the percentage of stock holdings in a manager’s portfolio that differ from the benchmark index, to conclude that a high Active Share means that the manager outperforms the benchmark. At the same time, Morningstar contemplates a strategy of momentum investing looking at capturing

\(^{30}\) Introduced by Martijn Cremers and Antti Petajisto of Yale School of Management in 2006.
gains by riding “hot” stocks and selling “cold” ones through detailed study of the stocks that it takes into consideration for its portfolio construction.

Quantitative measures have a great importance, however, in the phase of portfolio construction, Morningstar devotes great attention to the experience of the people that make the investment, e.g. the fund managers. The aim is that of creating a portfolio with the maximum diversification possible and for this, when associating funds to construct a portfolio, the company considers all the variables that characterize the fund, starting from the fund manager himself. Morningstar studies the past career of portfolio managers: every portfolio manager usually starts his career as a portfolio analyst and tends to concentrate on one or two business sectors maximum, like, for example, the pharmaceuticals and the financial. So, once he becomes a fund manager, he would tend to concentrate on these sectors, where he can make a difference and perform better than his competitors, meaning that he has a competitive advantage. This is what Morningstar aims at: the creation of a portfolio that combines managers with different abilities and competences in different business sectors to create a portfolio that has a competitive advantage.

In its strategy of portfolio construction, Morningstar does not only consider the complementarities among the different asset classes and the different strategies, but it also makes sure that there is no overlapping of stocks over the different styles once the funds are aggregated in a portfolio. Figure 26 represents a Morningstar style box that aggregates three equity funds that visibly have different styles, to create an example of a diversified portfolio. What Morningstar tries to do, is to create the most diversified portfolio from the point of view of the style and it does not choose funds with overlapping styles. In the example of Figure 26, *Equity Fund 1* invests in stocks with high capitalization, *Equity Fund 2* invests in stocks with medium capitalization and *Equity Fund 3* invests in stocks with small capitalization. The combination of these three funds ends up to be a very diversified portfolio of funds that spreads over all the styles. Again, Morningstar has the advantage of having direct access to all the information that its competitors do not immediately have.
3.3.4.1 Selection of funds and portfolio construction for the solution for Clerical Medical

The solution created by Morningstar for Clerical Medical offers an exposure to all the asset classes through the selection of the best managers (e.g. those who have a competitive advantage) on each asset class. Thus, the solution is open architecture, since it grants the possibility of choosing non internal funds, and so funds that are not managed by Clerical Medical, and multi-manager, since there is not only one fund managers but there are several. With this compromise, Morningstar reaches a high level of diversification over the asset classes, the judgment and the style.

Table 5 represents the equity, bond and index funds selected at the date of March 2013 for the solution for Clerical Medical. The table also indicates the stars attributed by Morningstar to each fund, according to the criteria explained in Paragraph 3.2.3.
To construct the three different portfolios, Morningstar attributes different weights to each fund and finds the appropriate weight according to the profile of each investor. Table 6 lists the funds selected by Morningstar with the relative weights to form the three portfolios with increasing risk profile.

### Table 6—Portfolio construction for the solution for Clerical Medical

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MFS Meridian European Research I1 EUR</td>
<td>Equity</td>
<td>Europe OE Europe Large-Cap Blend Equity</td>
<td>0%</td>
<td>8%</td>
<td>11%</td>
</tr>
<tr>
<td>Invesco Pan European Structured Eq C</td>
<td>Equity</td>
<td>Europe OE Europe Large-Cap Blend Equity</td>
<td>5%</td>
<td>7%</td>
<td>9%</td>
</tr>
<tr>
<td>Eurizon EasyFund Eq North America LTE Z</td>
<td>Equity</td>
<td>Europe OE US Large-Cap Blend Equity</td>
<td>7%</td>
<td>8%</td>
<td>9%</td>
</tr>
<tr>
<td>Robeco US Premium Equities D EUR</td>
<td>Equity</td>
<td>Europe OE US Large-Cap Value Equity</td>
<td>4%</td>
<td>6%</td>
<td>9%</td>
</tr>
<tr>
<td>Eurizon EasyFund Equity Europe LTE Z</td>
<td>Equity</td>
<td>Europe OE Europe Large-Cap Blend Equity</td>
<td>5%</td>
<td>4%</td>
<td>5%</td>
</tr>
<tr>
<td>Lazard Emerging Markets Eq Instl € Inc</td>
<td>Equity</td>
<td>Europe OE Global Emerging Markets Equity</td>
<td>1%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>Threadneedle Pan Eurp Sm Cos IN EUR</td>
<td>Equity</td>
<td>Europe OE Europe Small-Cap Equity</td>
<td>0%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>First State Asia Pacific Leaders B € Acc</td>
<td>Equity</td>
<td>Europe OE Asia-Pacific ex-Japan Equity</td>
<td>0%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Legg Mason Royce Smlr Coms A Acc €</td>
<td>Equity</td>
<td>Europe OE US Small-Cap Equity</td>
<td>0%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Aberdeen Global Emerging Markets Eq E2</td>
<td>Equity</td>
<td>Europe OE Global Emerging Markets Equity</td>
<td>1%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>DWS Deutchland</td>
<td>Equity</td>
<td>Europe OE Germany Large-Cap Equity</td>
<td>2%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td>Raiffeisen-Euro-Rent I VT</td>
<td>Fixed Income</td>
<td>Europe OE EUR Diversified Bond</td>
<td>9%</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>Eurizon EasyFund EUR M/T LTE Z</td>
<td>Fixed Income</td>
<td>Europe OE EUR Government Bond</td>
<td>7%</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>Invesco Euro Corporate Bond C Acc</td>
<td>Fixed Income</td>
<td>Europe OE EUR Corporate Bond</td>
<td>9%</td>
<td>6%</td>
<td>4%</td>
</tr>
<tr>
<td>BlueBay Inwm Grade Euro GovBd Acc I EUR</td>
<td>Fixed Income</td>
<td>Europe OE EUR Government Bond</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
</tr>
<tr>
<td>Allianz PIMCO Gbl Bd High Grd AT EUR</td>
<td>Fixed Income</td>
<td>Europe OE Global Bond</td>
<td>8%</td>
<td>6%</td>
<td>5%</td>
</tr>
<tr>
<td>Templeton Global Bond I Acc €</td>
<td>Fixed Income</td>
<td>Europe OE Global Bond</td>
<td>6%</td>
<td>5%</td>
<td>7%</td>
</tr>
<tr>
<td>Eurizon EasyFund Bond Intl LTE Z</td>
<td>Fixed Income</td>
<td>Europe OE Global Bond</td>
<td>3%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>AXA WF Global Inflation Bd IC EUR</td>
<td>Fixed Income</td>
<td>Europe OE Global Inflation-Linked Bond</td>
<td>11%</td>
<td>3%</td>
<td>0%</td>
</tr>
<tr>
<td>Robeco High Yield Bonds IH EUR</td>
<td>Fixed Income</td>
<td>Europe OE Global High Yield Bond</td>
<td>4%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Pioneer Fds Euro Bonds H EUR ND</td>
<td>Fixed Income</td>
<td>Europe OE EUR Government Bond</td>
<td>6%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Cash</td>
<td>-</td>
<td>-</td>
<td>4%</td>
<td>2%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Let us look in more detail at the funds chosen for this solution, providing a quick description of a few of them according to the report of Morningstar fund analysis\(^\text{31}\). On the equity side, each of the three portfolios of funds (cautious, balanced and aggressive) invests a percentage in the fund Invesco Pan European Structured, a fund managed in London with a 20-years experience and over 570 billion euros of asset under management, that concentrates its investment on stocks with low volatility that give good dividends. The objective of the fund is the growth of capital in the long term, investing in a diversified portfolio of stocks at high capitalization whose issuing society, that has legal head office in a European State, exercises its activity in a European State (UK included) and is listed in recognized European stock exchanges. The strategy that the fund is currently following is probably the consequence of the decrease of interest rates in 2012 and so the shift of concentration from the bond market to the stock market to look for returns. Both the managers of the fund, Michael Fraikin and Thomas Paarman have belonged to the team Quant Global since many years, the group is composed of over forty analysts and fund managers and is continuously involved in perfecting models. The fund tends to have a modest performance when financial market rises, but it has lower losses than the medium of its category of Equity Europe Large-Cap Blend during market downwards. The fund has performed well in a three-year and five-year basis with the lowest level of volatility of its category (Morningstar review). The rating assigned by Morningstar to this fund is Silver. Figure 27 represents the Morningstar style box for the fund Invesco Pam European Structured:

\[\text{Figure 27—Invesco Pam European Structured Style Box}\]

\[\text{Source: Morningstar.it}\]

Aberdeen Global Emerging Market is the fund of Aberdeen Asset Management, an international investment management group domiciled in the UK, in London, that manages about 230 billion euros. The fund mostly concentrates on investments in the

\(\text{31 At the date of March 2014.}\)
emerging markets. The main objective is to maintain an overall return in the long run, through the investment of at least two thirds of the capital in stocks or titles linked to stocks of societies with legal head office in Emerging Markets\textsuperscript{32}, of societies that mostly work in the Emerging Markets, or of holdings whose greatest part of the activities are in societies with legal head office in the Emerging Markets. The fund has an optimal investment process and its team has big resources, the fund managers are Devon Kaloo and Hugh Young. The team that concentrates on global emerging markets has 35 experts with a great experience in that region. The stability of the team and the low turnover of its components, confirmed by the permanence of the top management, is appreciated by Morningstar. The Pacific-Asian area of investment of the fund (Japan excluded) is managed in Singapore, under the supervision of Young, while a team in London, under the supervision of Kaloo, manages non-Asian emerging markets. The fund follows a bottom-up approach that underlines the importance that the company gives to the research of value and quality, looking for firms with sustainable and competitive business models, with a financial solidity, high returns of capital and a good corporate governance. The company invests in the long run and constructs the portfolio without giving a great consideration to the benchmark since it is convinced of the necessity to consider returns in an absolute way than in a relative way. This philosophy might lead to periods of underperformance, but it proved to be valuable in the long-run. The fund has the maximum Morningstar rating: Gold. Figure 28 shows the Morningstar style box for the fund Aberdeen Global Emerging Markets.

\textit{Figure 28 –Aberdeen Global Emerging Markets Style Box}

\begin{center}
\includegraphics[width=0.5\textwidth]{style_box.png}
\end{center}

\textit{Source: Morningstar.it}

\textsuperscript{32} Since there is no universally embraced definition of what constitutes an ‘emerging market’, we considered it as an economy that is progressing towards standards of market liquidity, transparency, accounting regularity and securities regulation. The term was first introduced in 1981 by Antoine W. Van Antmaal, that is an official of International Finance Corporation of the World Bank, who coined the name.
On the fixed income side, an interesting fund selected by Morningstar is the Templeton Global Bond that invests in a portfolio of debt securities and bonds with a fixed or variable interest rate issued by governments, state-controlled authorities, and issuing societies all over the world. It can also invest, within certain limits, in financial instruments of products linked to activities of currencies of whichever nation. Moreover, it can invest in bonds issued by state authorities or in bonds supported by national governments. The fund manager since 2002 (and since 2001 for the USA version) is Michael Hasenstab that boasts of solid competences in the macroeconomic analysis that are at the basis of the management of the fund. The length of his charge as fund manager demonstrates his devotion to a good management of the fund. Moreover, he is helped by a numerous team with competences in local key markets, that assures him the necessary resources for the management of the fund. Hasenstab invests in regions that he considers under-evaluated, after the study of a macroeconomic global analysis made by his team and the specific expectations for each State. Thus, the fund manager implements his certainties in his portfolio, with currency operations or assuming credit risk. His investments have almost no restriction, he might take positions that are not present in the benchmark and he might deviate neatly from the benchmark and other funds in the same category. The historical performance of the fund demonstrates a good management, in particular in periods of higher risk, that derives from the process of investment with no limits. Since the nomination of Michael Hasenstab as fund manager in 2002, the fund has over-performed his category and benchmark. Even if the TER (Total Expense Ratio) of the fund is quite high, Morningstar assigns to the fund the Silver rating, because of the positive evaluation of the fund manager and his investment process. Figure 29 shows the Morningstar Style Box for this fund:

*Figure 29 – Templeton Global Bond Style Box*

*Source: Morningstar.it*
Another interesting bond fund selected by Morningstar is Allianz Pimco Global Bond that invests at least two-thirds of its activities in a diversified portfolio of fixed return securities denominated in the main global currencies. The medium duration of the portfolio varies from three to seven years, according to the previsions of the consultant for interest rates. The main investment of the fund is on fixed-return securities “investment grade”\(^{33}\), but it can also invest up to 10\% of its activities in fixed-return stocks with a rating inferior to Baa (Moody’s) or BBB (S&P), but that are classified at least as B by Moody’s or S&P, or, if the rating is not available, the activities should be considered of analogous quality by the consultant for the investment. At least 90\% of the activity is invested in listed stocks, traded in a regulated market of the OCSE. The fund manager is Scott Mather who makes tactical moves as relative valuations fluctuate, for example he significantly changed the fund exposure to Japan. The fund has a more volatile profile compared to its rivals and the benchmark, and it is assigned a Silver rating by Morningstar. Figure 30 shows the Morningstar Style Box relative to the fund:

*Figure 30 –Allianz Pimco Global Bond Style Box*

![Morningstar Style Box](Morningstar.it)

Eurizon EasyFund Bond EUR Medium Term invests in bonds or monetary securities denominated in Euro, with a residual life between 2 and 5 years and issued by States that adhere to the euro. This fund is passive and it helps to keep the cost of the portfolio low because it has no commission costs. The fund is used in this solution to increase or decrease the risk of the portfolio: it is sold to increase the risk of the portfolio and it is bought to diminish it.

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\(^{33}\) “Investment grade securities” are those with higher credit merits (from AAA up to BBB for Fitch and S&P’s and up to Baa3 for Moody’s) and “non investment grade securities” are those with significant insolvency risk.
3.3.5 Dynamic asset allocation

Morningstar applies the target volatility asset allocation strategy which implies the rebalancing of the portfolio allocation between equity and bond assets to maintain the target portfolio volatility. More specifically, Morningstar calculates the market volatility of the past 30 days and studies its impact on the volatility of the three portfolios to establish whether to augment or reduce the stock exposition in order to respect the target volatility. Low risk is usually defined when volatility (or standard deviation) is lower than 10%, medium risk is defined when volatility is between 10% and 16% and high risk is defined when volatility is higher than 16%. On a daily basis, Morningstar evaluates risk and if the risk is low, it increases stocks in the portfolio but never exceeding the maximum threshold; if the risk is medium, it maintains the current allocation, and if the risk is high it decreases the percentage of stocks in the portfolio but never going below lower threshold. The strength of Morningstar lays in the fact that, differently from its competitors, it rebalances its portfolios on a daily basis and consequently it is always aware of the position of its portfolios in the market. Morningstar calculates the volatility using the concept of asymmetric volatility, based on the inverse trend of the volatility of the market and the return of the equity market. Morningstar in fact measures volatility with the VSTOXX\textsuperscript{34} index which has a perfectly inverse trend with respect to the returns of the European equity market. According to

\textsuperscript{34} VSTOXX Indices are based on EURO STOXX 50 real time options prices and are designed to reflect the market expectations of near-term up to long-term volatility (stoxx.com).
this, when the VSTOXX index is high, it decreases the exposition to stocks in the portfolios, when the volatility is low, it increases the percentage of stocks.

The peculiarity of this approach is that it considers every risk as an opportunity, and so volatility is not only a parameter of evaluation of the risk of the portfolio, but it is also a measure of market movements that hide big opportunities to catch. The objective is that of avoiding losses that are avoidable and to benefit from eventual rises in the market through flexibility. Dario Castagna, senior analyst at Morningstar Associates and one of the four portfolio managers of the solution for Clerical Medical, explains the strategy elaborated by the analysts of Morningstar Associates was born on the intuition of doing an asset allocation based on the study of expected volatility, in the light of the financial crisis of 2008, where neither the most defensive portfolios proved to be immune from losses.

To have information over future volatility, Morningstar uses the following model:

$$E(\sigma) = f(\sigma_{realized}, GARCH, VIX)$$ (69)

Let us explain each element in more detailed: $\sigma_{realized}$ is the volatility of the last thirty days using for simplicity the VSTOXX index. The GARCH (Generalized Autoregressive Conditional Heteroskedasticity) is an econometric process to estimate volatility in financial markets, providing a more real-world context than other models. It is composed of three steps: the first one estimates a best-fitting autoregressive model, the second one computes autocorrelations of the error terms and the last step tests for significance. The VIX index is an index of expected future price volatility implied by options contract prices. It is also called “fear index” since its value increases when investors are concerned about future volatility. In reality, high values of the index do not necessarily indicate a fall in the market but they indicate that investors predict that prices will go up or down substantially. The most important VIX index is the S&P 500 Vix Index that uses data from S&P 500 options contracts, calculating a weighted average of the prices of various S&P 500 index options contracts. The VIX index tends to spike when share prices plummet.

As already said, the expected volatility obtained with formula 3.1 is used to rebalance the allocation in the portfolio (whether to increase, decrease or keep constant the percentage of stocks in the portfolio). When changing the percentages of investment
among stocks and bonds, it is necessary to respect the target values proper to each portfolio. Table 7 indicates the declared benchmark composition of the three portfolios and it summarizes the parameters of volatility. The table also shows the values of the target volatility, the minimum and maximum threshold of volatility, the neutral stock exposition and the maximum stock exposition. To sum up, on a daily basis Morningstar takes the three reference portfolios, it calculates the expected volatility, it looks at the impact that the volatility has on the three portfolios and if the volatility falls out of the expected range, it rebalances the allocations.

Table 7 –Benchmark and volatility

<table>
<thead>
<tr>
<th></th>
<th>Cautious Managed</th>
<th>Moderate Managed</th>
<th>Aggressive Managed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target volatility</td>
<td>4%</td>
<td>6.5%</td>
<td>10%</td>
</tr>
<tr>
<td>Volatility range</td>
<td>3% to 5%</td>
<td>5% to 8%</td>
<td>8% to 12%</td>
</tr>
<tr>
<td>Neutral stock exposition</td>
<td>25%</td>
<td>50%</td>
<td>65%</td>
</tr>
<tr>
<td>Maximum stock exposition</td>
<td>35%</td>
<td>60%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Target volatility asset allocation has several key advantages for investors. First of all, it is a better representation of an investor’s risk tolerance. Conventional approaches establish a fixed percentage of equities in the allocation to measure an investor’s risk tolerance but this might not be a good representative of the investor’s risk tolerance under the current market condition, since investors review their maximum level of tolerance of loss and their expected range of gain or loss. By maintaining the target volatility of the portfolio instead, the portfolio returns meet the risk tolerance of investors with a higher probability. Another advantage of the target volatility approach is that it prevents from cash-lock situations. Cash-lock situations occur when, in order to protect the investment during a market downturn, 100% of investment is invested in bonds and there is no investment in stocks, precluding any participation in the equity market in the future. Target volatility instead allows future investment in the equity market when the level of volatility decreases, with the aim of profiting from the upward movements of the market (Chew, 2011).
In an article of Baselli for Morningstar (2014), Mr. Castagna explains this concept making an example with a classic moderate portfolio of 60% of stocks and 40% of bonds and a medium historical volatility of 11%, meaning that an investor with this type of asset allocation expects a volatility of this level. This is a right consideration if we consider the long run, but in the short run results might be very different: in October 2008, a sample moderate portfolio registered a volatility over 20%, while in 2006 volatility went down to 6-7%. This means that in some periods the risk is too high, while in others it would be better to be more aggressive and thus to invest more in stocks. According to Castagna, it is essential to put volatility under control: returns are difficult to calculate, while volatility is much more predictable, because it moves in a quite homogeneous way. The phenomenon of asymmetric volatility makes this even easier: volatility is high when markets lose and it is low when markets rise. In the example of the moderate portfolio, when the expected volatility is higher than 11% (the risk is higher), the portfolio becomes more defensive, on the contrary, when a lower volatility is predicted, the percentage of stocks is augmented. It is important to keep into consideration that in order to use this approach it is necessary to have a wide and very diversified portfolio. The great advantage of this approach, according to Castagna, is that apart from the diversification condition, it can be applied to every portfolio and to every type of investor.

3.3.6 Daily monitor and rebalancing

Monitoring and rebalancing are two constant activities in the management of the three portfolios for Clerical Medical. And even if officially it is said that the strategic asset allocation is reviewed on an annual basis, the monitoring of the funds takes place on a monthly basis, and dynamic asset allocation is applied on a daily basis, in reality the three activities are monitored and discussed on a daily basis (Castagna, 2013).

From the point of view of the strategic asset allocation, let us list some examples of the changes in strategy made by Morningstar. An important decision has been the introduction of the investment in Japan, by which Morningstar managers have been attracted after the operation of quantitative easing of April 2013 and from which they think they can catch a huge potential in the future. The introduction of this investment took place only after the study of the correlation of Japan with the other asset classes in
the portfolios. Another strategic move has been the shift of investment in April 2013 from Euro Government bonds, that showed low interest rates, to Euro Corporate and Global Bonds. Besides, on the European side, the investment focuses on high quality European stocks, in particular in Germany, maintaining the overweight to the dollar that helps to keep the value of the investment constant during financial markets downturns (Castagna, 2013).

Morningstar selects the funds and keep them into the portfolio for a certain period, since the portfolio managers think that the underlying funds should have the time to realize their strategy. Also, portfolio managers do not expect each fund to ‘win’ every time and every year in its category, but they expect that they have the possibility to keep doing well in the long term. If this is not the case, the funds are substituted. A practical example is the substitution of the fund Robeco with the fund Bluebay in April 2013. Other examples are the elimination of the fund American Small Cap and the substitution of the AXA WF Global Inflation with Fidelity Fund Global Inflation Linked Bond Fund. In the last example, the former has a duration of 12 years and the last one has a duration of 5 years; Morningstar researchers in fact expect an increase of interest rates and so they decided to reduce the duration of the portfolios. Following the same principle, the fund Pioneer Funds Absolute return Bond, a fund that tries to generate a performance independently from bond markets, was introduced in order to reduce the risk of the portfolio on the fixed income side (Castagna, 2013).

3.4 Performance

In the recent years, many investors tended to focus their attention more on mutual funds’ historical performance than on the underlying portfolio characteristics. We agree that investment returns are an important consideration, but it would probably be better to start from looking at the portfolio fundamentals. We think that the management by Morningstar provides a great added value and that top rated performances are usually the consequence of the quality of the investment. In the mutual fund industry, it is very important to consider all the characteristics of the funds and to concentrate in the way they are managed. This is the approach followed by Morningstar, also evidenced by its core business that concentrates on qualitative fund analysis and on the provision of fundamental tools to allow the screening of mutual
funds. Also Castagna, in the meeting of presentation of the three portfolios for Clerical Medical, put more evidence on the characteristics and fundamentals of the portfolios than on the performance. When it came the time to show the performance, he strengthened the importance of the techniques applied to the management of the funds than of the past performance.

Despite this, historical performance is important to complete our analysis. Considering that the three portfolios of funds analyzed so far have been managed by Morningstar since March 2013, their historical performance is quite short. For this reason we look at the performance of the three equivalent portfolios created for Clerical Medical in Germany, that have been managed by Morningstar since March 2012. The portfolios created for the Italian division and those created for the German division are identical and so the German ones are a good proxy for the Italian ones (Castagna, 2013).

In the German version, the portfolio corresponding to the Adventurous Managed Portfolio is the HLE AMP Dynamisch, the one corresponding to the Balanced Managed Portfolio is the HLE AMP Ausgewogen and the one corresponding to the Cautious Managed portfolio is the HLE AMP Konservativ. Figure 32, Figure 33 and Figure 34 represent respectively the performance of the three German portfolios from January 2012 until April 2014. The graphs in each figure indicate the growth of an investment of 10,000 euros. The lines catch the trends of the Clerical Medical fund, of the index (benchmark) and of the average of the funds in the same Morningstar Category to which the fund belongs. The benchmarks of the three funds are: 25% Barclays Euro Aggregate Bond Index and 50% FTSE World Index for the Adventurous Portfolio, 50% Barclays Euro Aggregate Bond Index and 50% FTSE World Index for the Balanced Portfolio and 75% Barclays Euro Aggregate Bond Index and 25% FTSE World Index for the Cautious Portfolio. The Morningstar categories to which they are compared are respectively: the Aggressive Balanced Funds Euro Global, the Moderate Balanced Euro Global and the Cautious Balanced Euro Global.
The Adventurous solution has performed better than the benchmark and the average of the funds in the same Morningstar Category in 2012. In 2013 it performed better than the category of 0.31% but it had a lower performance with respect to the benchmark (11.8% vs. 14.81%). In 2014, the YTD\(^{35}\) return is negative, differently from the category and the benchmark that show positive returns.

\(^{35}\) Year-to-date. Returns from the beginning of the current year and continuing up to the present.
The performance of the Balanced Portfolio is very similar to the one of the Adventurous solution. In 2012 the fund had a higher performance than the category and the benchmark. In 2013 the fund performed lower than the category (of -1.23%) and lower than the benchmark (of -5.18%). The YTD return is slightly negative.

Figure 34 – Performance Cautious Portfolio (German version)

![Performance chart](image.png)

<table>
<thead>
<tr>
<th>Year</th>
<th>Return (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>10.87</td>
</tr>
<tr>
<td>2013</td>
<td>1.35</td>
</tr>
<tr>
<td>04/14</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Source: Clericalmedical.com (April 2014).

In 2012 the Cautious Portfolio performed higher than its Category but lower than the benchmark. In 2013 it had a lower performance with respect to the category and the benchmark. The YTD return, differently from the other two portfolios of Clerical Medical, is positive.

To sum up, Morningstar succeeded to outperform its competitors (the category) for the first year of its management. In 2013 instead the portfolios performed slightly less than its competitors. This is due to the fact that the three funds have a greater exposition to the dollar with respect to the competitors and the depreciation of the dollar in 2013 penalized their performance relatively to the category. This is part of Morningstar strategy: the dollar is used as a natural hedge to cover a part of the losses when the markets go down and this happens because the dollar tends to appreciate with the fall of the market. The idea behind this is that of renouncing to some profit when the markets go well but to have lower losses when the markets go down.

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Considering that two years of performance do not say much, in the analysis conducted in Chapter 4 we will use the fund BG Selection Global Risk Managed, a fund managed by Morningstar for Generali Bank in Italy that was born under Morningstar management in October 2009. The fund is a proxy of the Clerical Medical Adventurous Portfolio.
Chapter 4

PORTFOLIO MANAGEMENT ANALYSIS

4.1 The CMIG Adventurous Managed Fund and the BG Selection Global Risk Managed Fund

4.1.1 The proxy of the CMIG Adventurous Portfolio

As anticipated in the previous chapter, the three portfolios analyzed so far have been managed by Morningstar since March 2013 and therefore they have a too recent history to analyze. Even if we consider the three corresponding portfolios of the German version that are managed by Morningstar since March 2012, the time period is not significant enough to test Morningstar management. In fact, any analysis of both their realized performance and effects of the management on the performance would be poor: there is not much history that allows us to determine with a certain precision whether the good or bad performance pursued by the fund is attributable to the management or it is the consequence of coincidences, i.e. good or bad luck. To solve this problem, we have chosen a good proxy of the Adventurous Managed Portfolio, represented by the fund BG Selection Global Risk Managed AX, that has been managed by Morningstar since October 2009 with the target volatility approach. When Mr. Castagna, one of the portfolio managers, presented the solution to the partners of Clerical Medical in fact, he referred to this fund to give an idea of how the portfolio has performed. Therefore, they consider the two solutions pretty much similar. Indeed, the CMIG Adventurous Managed fund and the BG Global Risk Managed fund are very similar in composition and identical in the way they are managed. Let us provide a quick comparison and description of the two funds to support our proxy.

The CMIG Adventurous Managed fund was created on the 23rd of July 2004 and Clerical Medical managed it until March 2013, when the management moved to Morningstar. The current portfolio manager is Robin Johnson, a senior investment consultant at Morningstar Investment Management Europe, who has a great experience on investment consulting as a portfolio manager for Fund of Fund multi-asset strategies. The objective of the fund is that of obtaining a growth of capital in the long term,
investing in a diversified portfolio characterized by different categories of financial activities, maintaining the target volatility around 10%. The benchmark declared by the company is the composite benchmark composed by 65% of the MSCI AC World and 35% of the BarCap Euro Aggregate. The best fitting benchmark used for the evaluation of the fund in Morningstar website, however, is the composite benchmark composed of 25% of the Barclays Euro Aggregate Bond TR EUR and of 75% of the Ftse World TR (Morningstar.it).

The BG Selection Global Risk Managed fund is a fund of the BG Selection Sicav, a SICAV of Generali Bank. The BG Selection Sicav is a multimanager Luxembourg Sicav whose divisions invest in other funds and Sicav. The Sicav mixes strategies of investment that are complementary one to other, accessing to investment management companies worldwide. In fact, in addition to the investment team of Generali Fund Management, the Sicav has access to the management and investment solutions of international partners like: Aberdeen Asset Management, AllianceBernstein Investments LP, Amundi, Barclays and of course, Morningstar Associated Europe, on which we are focusing our attention. The fund of our analysis has been managed by Morningstar Associates since its creation on the 12<sup>th</sup> of October 2009, with the target volatility approach. The fund is a little more aggressive than the CMIG Adventurous Portfolio since it can invest up to 100% in equity funds and volatility can reach but cannot go beyond 20%. The objective of the fund is to pursue an increase of value of the investment in the long run, performing better than the benchmark. The declared composite benchmark is composed of 24% MSCI Europe- Price Index in USD converted in EUR; 36% MSCI AC World ex Europe –Price Index in USD converted in EUR and 40% Barclays Euro Aggregate- Total Return Index in EUR, but the best fitting benchmark used by Morningstar website for its evaluation is composed of 25% of the Barclays Euro Aggregate Bond Index and 75% of the FTSE World Index. The fund has a three-star Morningstar rating (Morningstar.com and Bancagenerali.it).

The best fitting benchmark used by Morningstar for the analysis of both of the funds is the same. This is an immediate confirmation that the two portfolios are very similar in composition and in the percentage of investment in each asset class<sup>37</sup>, since a benchmark is a standard representative of the performance of the funds. Let us look at

<sup>37</sup>An asset class is a group of securities with similar characteristics that behave in a similar way in the marketplace. The three main asset classes are equities (stocks), fixed-income (bonds) and cash equivalents (money market instruments).
the data available on Morningstar website, in the section devoted to the description of the funds. First, we check for the composition of the two funds to look at which percentage is invested in each asset class. Table 8 shows the asset allocation of the two portfolios as of February 2014 and it distinguishes the position in which the securities are held, e.g. long or short position.  

<table>
<thead>
<tr>
<th>CMIG Euro Adv Mngd</th>
<th>%Long</th>
<th>%Short</th>
<th>%Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stocks</td>
<td>70.18</td>
<td>0.00</td>
<td>70.18</td>
</tr>
<tr>
<td>Bonds</td>
<td>18.58</td>
<td>1.32</td>
<td>17.26</td>
</tr>
<tr>
<td>Liquidity</td>
<td>20.12</td>
<td>8.14</td>
<td>11.98</td>
</tr>
<tr>
<td>Other*</td>
<td>1.39</td>
<td>0.81</td>
<td>0.58</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BG Selection Global Risk Mngd</th>
<th>%Long</th>
<th>%Short</th>
<th>%Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stocks</td>
<td>65.34</td>
<td>0.00</td>
<td>65.34</td>
</tr>
<tr>
<td>Bonds</td>
<td>37.74</td>
<td>4.02</td>
<td>33.72</td>
</tr>
<tr>
<td>Liquidity</td>
<td>16.09</td>
<td>15.95</td>
<td>0.14</td>
</tr>
<tr>
<td>Other</td>
<td>1.60</td>
<td>0.80</td>
<td>0.80</td>
</tr>
</tbody>
</table>

*Like real estate and precious metals.

Source: ClericalMedical.com and Morningstar.com (28/02/2014).

The two funds have a very similar asset allocation. The CMIG Adventurous Managed portfolio however invests 5% more in stocks and it invests a lower percentage in bonds (17.26% with respect to 33.72% of the BG Selection Global Risk Managed portfolio). Finally, the lowest percentage is invested in liquidity and it is almost null in the case of the BG fund. We remind that since we are analyzing funds of funds, the percentage invested in stocks is invested in equity mutual funds, the percentage invested in bonds is invested in fixed-income mutual funds and the percentage invested in liquidity is invested in money market mutual funds.

Both of the funds have a global exposition. Table 9 shows the percentage of investment in each geographic area for the equity side, that is the most consistent part of investment, for the CMIG fund and for the BG fund.

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38 A long position in a security is a traditional buy of that particular stock, where the owner profits from a rise in the price of the security if he sells it higher at a later date. A short position instead includes that the position holder adopts a “promise to sell” approach in order to profit from a decrease in the price of the security. The two positions cancel each other out and so a net position shows which position is greater.
Table 9–Geographic allocation of the equity investment

<table>
<thead>
<tr>
<th>Geographic allocation</th>
<th>% of stocks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CMIG</td>
</tr>
<tr>
<td>United States</td>
<td>33.15</td>
</tr>
<tr>
<td>Western Europe –Euro</td>
<td>21.09</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>13.11</td>
</tr>
<tr>
<td>Western Europe –Non Euro</td>
<td>10.52</td>
</tr>
<tr>
<td>Japan</td>
<td>9.15</td>
</tr>
<tr>
<td>Asia –Developed countries</td>
<td>3.39</td>
</tr>
<tr>
<td>Asia -Emerging</td>
<td>3.30</td>
</tr>
<tr>
<td>Canada</td>
<td>1.61</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>1.55</td>
</tr>
<tr>
<td>Latin and Central America</td>
<td>1.53</td>
</tr>
<tr>
<td>Africa</td>
<td>0.99</td>
</tr>
<tr>
<td>Middle East</td>
<td>0.00</td>
</tr>
<tr>
<td>Australasia</td>
<td>0.59</td>
</tr>
</tbody>
</table>

Source: Morningstar.it

The greatest percentage of investment of both of the funds is on the US but there is a consistent investment also in Western Europe (Euro area), United Kingdom, Western Europe (non Euro area) and Japan.

On the overall, looking at the asset allocation and at the geographic allocation, the composition of the two funds is very similar. Moreover, they are managed by the same investment management company Morningstar Associates, with the approach of target volatility. We can conclude that the BG Selection Global Risk Managed fund is a good proxy for the CMIG Adventurous fund and so we use its data for our analysis. For this reason, from now on we will refer to the two funds interchangeably.

4.1.2 The benchmark

The benchmark is a very important indicator for the evaluation of the performance of a fund. The benchmark of our analysis is a composite benchmark and it is composed by the Barclays Euro Aggregate Bond Index and the Ftse World TR Index. The Barcalys Euro Aggregate Bond Index includes fixed-rate investment grade Euro denominated bonds, that are included in the index on the basis of the currency of the issuer and not on the domicile of the issuer. The principal sectors in the index are the Treasury, the corporate, the government-related and the securitized. The FTSE All-World Index instead is the Large/Mid Cap aggregate, composed of about 2800 stocks.
from the FTSE Global Equity Index Series and it covers about 90-95% of the investable market capitalization. Besides, the Index is divided into Developed and Emerging segments.

The best fitting benchmark for the fund at the date of April 2014 is composed for 25% by the Barclays Euro Aggregate Bond Index and 75% by the Ftse World Index. The standard benchmark is composed of 50% by the Barclays Euro Aggregate Bond Index and for 50% by the Ftse World Index and is used as the best fit benchmark only when the percentage of stocks in the portfolio is reduced because of the increased volatility of the market. With respect to the standard benchmark, the best fitting benchmark is composed of a higher percentage on the equity index and a smaller percentage on the bond index. We should remind that Morningstar follows a target volatility approach and it increases and decreases the percentage invested in stocks according to the volatility of the market. If the volatility is high, the percentage invested in stocks decreases and if the volatility is low, the percentage of stocks in the portfolio increases. In the past five years, volatility maintained quite low and the fund maintained the greatest exposure possible to the equity investment. Only in summer 2011 (August) stock markets fell, the reason was the contagion of the European sovereign debt crisis to Spain and Italy, the concerns of the downgrade of the rating of France, and the S&P’s USA’s credit rating downgrade from AAA to AA+ (Reuters). In correspondence to this date until January 2012, the percentage of the fund invested in stocks notably decreased collapsing from a 90% investment in stocks to 35%.
Figure 35 shows the percentage invested in stocks from November 2009 until April 2013.

*Figure 35 - Stock exposition from 01/11/2009 until 30/04/2013*

The graph confirms that the investment in stocks has maintained close to high levels for the entire period, apart from summer 2011 when it suddenly fell from a value close to 90% to a value close to 35%, but it went back to the previous levels in February 2012. We remind that the fund is generally more aggressive than the one of Clerical Medical since it can invest up to 100% in stocks.

4.1.3 Performance

Let us see how the fund has performed since its inception date. Figure 36 shows the annualized returns of the fund from the 1st of January 2010 until the 30th of April 2014.
4.2 The analysis

4.2.1 The aim of the analysis

Our analysis proceeds with the evaluation of the performance, risk and management of the BG Selection Global Risk Managed fund, through a comparison with another portfolio of funds created by us. In other words, we want to test the efficiency and the advantages of the management of a professional investor that grants constant attention to the market development, with the support of adequate structures.
and competent working teams. For this purpose we create a comparison portfolio, that we suppose to create at the date of inception of the BG portfolio (October 2009), that is static, and not managed with the target volatility strategy and consequently it is subject to all the up and down of the market. Let us proceed telling how we construct the comparison portfolio. Before proceeding with this analysis we precise that we adopt a simplified scenario where there are no transaction costs and loads charged.

4.2.1.1 Asset allocation and fund selection of the comparison portfolio

The asset allocation is the first important step of creation of our comparison portfolio of funds. Since we want to create a portfolio similar to the one created by Morningstar, our asset allocation is exactly the same as the one of the Clerical Medical Adventurous Portfolio at the date of its creation. The Morningstar categories in which our portfolio invests are:

- Europe Large Cap Blend Equity;
- US Large Cap Blend Equity;
- US Large Cap Value Equity;
- Global Emerging Markets Equity;
- Europe Small Cap Equity;
- Asia-Pacific ex-Japan Equity;
- US Small Cap Equity;
- Germany Large-Cap Equity;
- EUR Diversified Bond;
- EUR Government Bond;
- EUR Corporate Bond;
- Global Bond;
- Global High Yield Bond39.

39 A high paying bond with a lower credit rating than investment-grade corporate bonds, Treasury bonds and municipal bonds. These bonds pay a higher yield than investment grade bonds since they have a higher risk of default. Their credit rating is below “BBB” from S&P’s and below “Baa” from Moody’s (Investopedia.com).
This asset allocation allows us to create a very diversified portfolio similar to the one created by Morningstar. Our portfolio in fact has a diversified geographic exposition and the funds differ for capitalization and style.

Once we have chosen the asset classes in which to invest, we select the funds to include in the portfolio within each asset class in a way that, for each fund in the Adventurous portfolio there is a corresponding fund in the comparison portfolio, chosen from the same Morningstar category. Since we are supposing that the creation of our portfolio dates back to October 2009, we choose funds whose inception date is prior to that date of at least five years in, order to calculate variables like expected return, variance (standard deviation) and correlation among assets with a certain precision. Moreover, we select only funds denominated in euro and that are traded in Italy. Apart from this, the choice of the funds is random, since we do not follow a precise strategy in the selection of the funds. The main reason of this random selection is the impossibility to go back to the date of creation of our portfolio without any biased data. The Morningstar star rating, the Morningstar analyst rating and the Morningstar analysis would be useful indicators to lead us in the choice of fund selection. However, we do not have the instruments to know the rating and analysis of the funds at October 2009 and the data available today are contaminated by the events that have occurred so far. Thus, it is impossible, for the instruments in our possession, to be stuck at October 2009 without any bias. Table 10 lists the 19 funds that we have selected for the comparison portfolio. The first column indicates the ISIN code \(^{40}\) of each fund, the second column indicates the name of the fund and the third column is the inception date of the fund, that is the date in which the fund began its operations.

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\(^{40}\) International Securities Identification Number, it is the code that uniquely identifies a security.
Table 10 – Funds selected for the comparison portfolio

<table>
<thead>
<tr>
<th>ISIN</th>
<th>Name</th>
<th>Inception Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>LU0094541447</td>
<td>ABERDEEN GL-EUROPEAN EQUA-2</td>
<td>01/02/1993</td>
</tr>
<tr>
<td>IT0000386588</td>
<td>ALLIANZ AZIONI EUROPA-L</td>
<td>11/03/1991</td>
</tr>
<tr>
<td>IT0001095469</td>
<td>ANIMA GEO EUROPA-A</td>
<td>02/06/1997</td>
</tr>
<tr>
<td>IT0001055075</td>
<td>AZIMUT AMERICA</td>
<td>23/10/1995</td>
</tr>
<tr>
<td>IE0003950965</td>
<td>BNY MELLON GL-EMRG MKT EQUITY V-A€</td>
<td>02/08/2002</td>
</tr>
<tr>
<td>LU0133352731</td>
<td>CANDRIAM EQUITIES L-EMERG MKT-N</td>
<td>28/02/2002</td>
</tr>
<tr>
<td>LU0115016643</td>
<td>CAPITAL INT GLOBAL BOND-B EUR</td>
<td>03/04/1998</td>
</tr>
<tr>
<td>AT0000631916</td>
<td>ESPA BOND EURO TREND-A</td>
<td>02/02/2004</td>
</tr>
<tr>
<td>LU0149505165</td>
<td>INVECO US STRUCT EQUITY-E</td>
<td>28/06/2002</td>
</tr>
<tr>
<td>LU0117860493</td>
<td>JPMORGAN F-GERMANY EQUITY-D</td>
<td>13/10/2000</td>
</tr>
<tr>
<td>LU0052032793</td>
<td>KBC BONDS CAPITAL FUND-D</td>
<td>01/08/1973</td>
</tr>
<tr>
<td>GB0030939994</td>
<td>M&amp;G ASIAN FUND -€-C-ACC</td>
<td>10/12/2001</td>
</tr>
<tr>
<td>LU0132602227</td>
<td>MORGAN STANLEY-EURO CORP BD-B</td>
<td>04/09/2001</td>
</tr>
<tr>
<td>LU0095343264</td>
<td>OYSTER EUROPEAN FIXED INCOME</td>
<td>04/03/1999</td>
</tr>
<tr>
<td>LU0131724808</td>
<td>PICTET-SMALL CAP EUR-I€</td>
<td>01/03/1991</td>
</tr>
<tr>
<td>LU0190658715</td>
<td>PIONEER-GLH HIGH YIELD-€ ND €</td>
<td>18/06/2004</td>
</tr>
<tr>
<td>AT0000785340</td>
<td>RAIFFEISEN GLOBAL RENT-VENT</td>
<td>26/05/1999</td>
</tr>
<tr>
<td>IE0002549826</td>
<td>RUSSELL US SML CAP EQ-C</td>
<td>31/03/1999</td>
</tr>
<tr>
<td>LU0106235889</td>
<td>SCHRODER INTL EURO BOND-C AC</td>
<td>17/01/2000</td>
</tr>
</tbody>
</table>

Our portfolio is composed by 8 fixed income funds and 11 equity funds, exactly like the portfolio created by Morningstar. Table 11 indicates for each fund the general asset class and the Morningstar asset class, that is more precise and gives an immediate idea of definition of the geographic area of investment, the style and capitalization of the fund.
For convenience we ordered the fund in numerical increasing order. In the next paragraphs we will address to the funds with reference to this number.

4.2.1.2 Portfolio construction

Once the funds to include in the portfolio are selected, we have to be sure that our portfolio is efficient. For this purpose we construct the efficient frontier, that is the set of the portfolios that maximize the return for a given variance or minimize the variance for a given return. Since we are supposing that the date of creation of our portfolio is October 2009, our dataset includes data prior to this date. In particular, it collects the returns of the funds, taken from the Bloomberg dataset, in the time frame October 2004 – September 2009.
The returns are calculated as:

\[ R_i = \frac{P_t - P_{t-1}}{P_{t-1}} \times 100 \]

Where \( R_i \) is the return of the fund \( i \), \( P_t \) is the price (or net asset value) of the fund at time \( t \) and \( P_{t-1} \) is the price of the fund at time \( t-1 \). The data set includes the business days only, for a total of 1162 observations for each fund. Figure 37 shows the returns of the 19 funds in our portfolio. Returns are calculated on a monthly basis and the return of each fund is indicated by a line of a different color.

*Figure 37 – Returns of each of the 19 funds in our portfolio for the time period 01/10/2004-30/09/2009*

*Source: Bloomberg database.*

Looking at the trend of the returns, we can visibly divide the time period in two sub-periods. The first one that starts in October 2004 and lasts until January 2008 is characterized by low volatility, the trend is quite stable and there are a few stocks with high negative returns. In the sub-period that goes from the beginning of 2008, volatility is higher: we notice that there are funds which incur in high losses performing high negative returns and that reach a peak of performance in April 2009. The great volatility of the second sub-period is the direct consequence of the subprime mortgage financial crisis.

Let us look with more attention at the trend of each fund of our portfolio. We notice that there are funds with a constant low volatility and that do not perform high
returns, like the one represented by the orange line that has a trend towards the zero, and there are other funds, like the one represented by the light blue line, that are more volatile (and so more risky) providing high returns (and high losses). We expect the funds with the greatest volatility to be the equity funds and those with lowest volatility to be the fixed income funds. In order to better understand where each fund is located, we plot them on an expected return-standard deviation plan to see where each fund is located. Expected return and standard deviation are calculated on a monthly basis.

*Figure 38 – The funds on the expected return-standard deviation plan*

![Graph showing the expected return-standard deviation plan for various funds.](image)

*Source: Bloomberg Database.*

Among the eight fixed income funds in our portfolio, seven of them are located on the low left hand side of the graph; as we expected they have lower volatility and lower expected returns than the equity funds. The only fixed income fund that does not position in the extreme left end side of the graph belongs to the category of the high yield bonds, and so by definition it carries a higher risk. The bond fund is located in the center of the graph where volatility is higher; in this case, however, the higher risk is not compensated by a higher return. If we concentrate on the upper right hand side, the three funds with the highest expected return also have the highest volatility. Two of them belong to the equity global emerging market category and the other one belongs to
the Asia Pacific ex-Japan equity. The remaining funds concentrate in the middle of the graph and two of them have negative expected returns.

4.2.1.3 The efficient frontier

We now want to find the set of the efficient combinations of the 19 funds. For this purpose, we use the Solver in Excel that allows us to maximize or minimize an objective function, modifying the values of some components of the objective function.

Let us explain in more detail the process of creation of the efficient frontier. As already said, the data used here are the daily returns of the 19 mutual funds selected for our portfolio, from the 1st of October 2004 until the 30th of September 2009, for a total of 1162 observations for each fund.

The first step is to compute the mean vector $R$ and the variance-covariance matrix $\Omega$. The mean vector contains the expected return of each fund, and the variance-covariance matrix consists of the variances of the funds along the main diagonal and the covariances between each pair of funds in the other matrix positions. The $R$ vector and the $\Omega$ matrix\(^{41}\) of our problem (remember that the variance-covariance matrix is symmetric with respect to the central diagonal) are respectively:

$$R:$$

\[
\begin{bmatrix}
-0.011 \\ 0.013 \\ 0.009 \\ -0.001 \\ 0.056 \\ 0.053 \\ 0.022 \\ 0.008 \\ 0.005 \\ 0.009 \\ 0.015 \\ 0.006 \\ 0.052 \\ 0.033 \\ 0.006 \\ 0.031 \\ 0.013 \\ 0.015 \\ 0.006
\end{bmatrix}
\]

$$\Omega:$$

\[
\begin{bmatrix}
1.184 & 0.640 & 0.306 & -0.002 & 0.378 & 0.112 & 0.676 & -0.010 & -0.018 & -0.031 & -0.031 & 0.004 & 0.920 & 0.566 & 1.696 & 0.513 & -0.041 & 0.009 \\
0.640 & 1.209 & 0.972 & 0.519 & 0.793 & 0.663 & 1.314 & -0.035 & -0.175 & -0.054 & -0.057 & 0.001 & 1.107 & 1.132 & 0.843 & 1.166 & -0.168 & -0.019 \\
0.306 & 0.972 & 1.876 & 1.216 & 1.439 & 1.406 & 1.039 & -0.022 & -0.212 & -0.054 & -0.076 & -0.068 & 1.388 & 1.132 & 0.528 & 1.468 & -0.146 & -0.091 \\
-0.002 & 0.519 & 1.216 & 2.285 & 1.234 & 1.555 & 0.573 & 0.006 & -0.040 & -0.025 & -0.050 & -0.076 & 0.733 & 0.598 & -0.049 & 0.856 & -0.010 & -0.060 \\
0.378 & 0.795 & 1.439 & 1.234 & 2.217 & 1.793 & 0.861 & 0.001 & -0.128 & -0.046 & -0.078 & -0.073 & 1.746 & 1.004 & 0.495 & 1.129 & -0.076 & -0.075 \\
0.132 & 0.663 & 1.406 & 1.555 & 1.793 & 1.980 & 0.720 & 0.013 & -0.112 & -0.042 & -0.060 & -0.092 & 1.407 & 0.868 & 0.224 & 1.018 & -0.061 & -0.127 \\
0.676 & 1.314 & 1.039 & 0.573 & 0.861 & 0.720 & 1.391 & -0.035 & -0.191 & -0.057 & -0.059 & 0.001 & 1.183 & 1.200 & 0.869 & 1.255 & -0.184 & -0.019 \\
-0.019 & -0.035 & -0.012 & 0.006 & 0.001 & 0.013 & -0.035 & 0.068 & 0.037 & 0.020 & 0.025 & 0.008 & -0.015 & -0.023 & -0.026 & -0.039 & 0.033 & 0.002 \\
-0.018 & -0.175 & -0.212 & -0.040 & -0.128 & -0.112 & -0.191 & 0.037 & 0.151 & 0.037 & 0.042 & 0.022 & -0.166 & -0.170 & -0.004 & -0.024 & -0.265 & 0.125 & 0.033 \\
-0.034 & -0.054 & -0.054 & -0.025 & -0.046 & -0.042 & -0.057 & 0.020 & 0.037 & 0.028 & 0.024 & 0.010 & -0.068 & -0.048 & -0.042 & -0.064 & 0.040 & 0.011 \\
-0.031 & -0.057 & -0.076 & -0.050 & -0.078 & -0.060 & -0.059 & 0.025 & 0.042 & 0.024 & 0.044 & 0.018 & -0.076 & -0.058 & -0.048 & -0.080 & 0.034 & 0.020 \\
0.004 & 0.001 & -0.068 & -0.076 & -0.073 & -0.092 & 0.001 & 0.008 & 0.022 & 0.010 & 0.018 & 0.103 & -0.052 & -0.018 & 0.004 & 0.000 & 0.101 & 0.057 \\
0.920 & 1.107 & 1.388 & 0.733 & 1.746 & 1.407 & 1.183 & -0.015 & -0.166 & -0.068 & -0.076 & -0.052 & 2.502 & 1.300 & 1.298 & 1.386 & -0.120 & -0.081 \\
0.566 & 1.132 & 1.132 & 0.598 & 1.034 & 0.868 & 1.200 & -0.023 & -0.170 & -0.048 & -0.058 & -0.018 & 1.300 & 1.301 & 0.787 & 1.233 & -0.149 & -0.035 \\
1.696 & 0.843 & 0.328 & -0.049 & 0.495 & 0.224 & 0.869 & -0.026 & -0.004 & -0.042 & -0.048 & 0.004 & 1.298 & 0.787 & 2.924 & 0.652 & -0.020 & 0.000 \\
0.513 & 1.166 & 1.468 & 0.856 & 1.129 & 1.018 & 1.255 & -0.039 & -0.246 & -0.064 & -0.080 & -0.029 & 1.386 & 1.233 & 0.652 & 1.823 & -0.188 & -0.050 \\
-0.041 & -0.168 & -0.146 & -0.010 & -0.076 & -0.061 & -0.184 & 0.033 & 0.125 & 0.040 & 0.034 & 0.010 & -0.120 & -0.149 & -0.020 & -0.188 & 0.138 & 0.013 \\
0.009 & -0.019 & -0.091 & -0.060 & -0.075 & -0.127 & -0.019 & 0.002 & 0.033 & 0.011 & 0.020 & 0.057 & -0.081 & -0.035 & 0.000 & -0.050 & 0.013 & 0.113 \\
0.127 & -0.105 & -0.068 & 0.133 & 0.112 & 0.129 & -0.132 & 0.031 & 0.145 & 0.014 & 0.008 & 0.003 & 0.105 & -0.075 & 0.252 & -0.147 & 0.149 & 0.003
\]

\(^{41}\) The values in the vector and matrix are round to the third decimal place.
In our optimization model we want to find the vector of weights \( X \) that maximizes the expected return for a given level of variance or, equivalently, that minimizes the variance for a given level of returns. Our optimization model is defined in this way:

\[
\min_x \frac{1}{2} X^T \Omega X \\
\text{u.c.} \begin{cases} 
X^T \bar{R} = E(R) \\
X^T \mathbf{1} = 1 
\end{cases}
\] (70)

The solution to this problem provides the vector of weights that optimize the variance for a given level of returns and vice versa. Since in the real market it is not always possible to have short positions and to invest more than 100% in one stock (or fund, like in our case), we impose to the solver of Excel the condition that each resulting component is non-negative. So, we plot different values of variance into the Solver in order to find the optimal weights that maximize, for each given value of the variance, the expected return of the portfolio. Table 12 shows the result of our optimization. On the top of the table there is the list of the 19 funds in numerical order and the first column of the table indicates the values assigned to the variance to run the optimization process. Each row of the table is the result of the optimization for that level of variance and so each row is a vector of weights \( X \).

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>0.3</td>
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</tbody>
</table>

With the results shown in Table 12 we can calculate which is the expected return for that given level of variance. In Figure 39 we plot the results on a mean-variance
plan; each point is represented by its mean and variance. If we connect all the dots we get the efficient frontier: all the portfolios on that curve are efficient.

*Figure 39 – The efficient frontier (first scenario)*

The graph of Figure 39 shows that with a proper allocation of the funds in the portfolio it is possible to reach a zero variance portfolio. Anyhow, the results of our optimization problem are not interesting for the purpose of our analysis since the solution of the solver does not allow us to invest in each of the 19 funds of the portfolio but restricts the investment to a few funds. And since we want to create a comparison portfolio with the same asset allocation and global exposition of the portfolio created by Morningstar, we run another optimization process, adding a new constraint. More specifically we want that each weight is greater than 0.02 but smaller than 0.11. In this way none of the weights is smaller than 2% and greater than 11%, like in the portfolio created by Morningstar. The new results are shown in Table 14.

*Table 14 – Weights for efficient portfolios (second scenario)*
We are more satisfied with this result since for each efficient portfolio we invest in each of the 19 funds. Following the same steps followed in the previous scenario, we calculate the portfolio expected return for each given level of variance and we plot the results in the mean-variance plan, as it is shown in Figure 40. Connecting all the points in the graph we get the efficient frontier.

*Figure 40 – The efficient frontier (second scenario)*

<table>
<thead>
<tr>
<th>Var</th>
<th>E(R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4</td>
<td>0.028221691</td>
</tr>
<tr>
<td>0.3</td>
<td>0.02597999</td>
</tr>
<tr>
<td>0.28</td>
<td>0.02537803</td>
</tr>
<tr>
<td>0.26</td>
<td>0.02473383</td>
</tr>
<tr>
<td>0.24</td>
<td>0.02405387</td>
</tr>
<tr>
<td>0.22</td>
<td>0.02333146</td>
</tr>
<tr>
<td>0.2</td>
<td>0.02255745</td>
</tr>
<tr>
<td>0.18</td>
<td>0.02172692</td>
</tr>
<tr>
<td>0.16</td>
<td>0.02083226</td>
</tr>
<tr>
<td>0.14</td>
<td>0.01986107</td>
</tr>
<tr>
<td>0.12</td>
<td>0.01878467</td>
</tr>
<tr>
<td>0.1</td>
<td>0.01756731</td>
</tr>
<tr>
<td>0.08</td>
<td>0.01612931</td>
</tr>
<tr>
<td>0.06</td>
<td>0.01425725</td>
</tr>
<tr>
<td>0.05</td>
<td>0.01315777</td>
</tr>
</tbody>
</table>

In this scenario, since we are imposing a constraint, it is not possible to reduce the variance to zero: the efficient frontier in fact is shifted to the right and does not touch the y axis, where the variance is equal to zero. Figure 41 plots on the same graph the two efficient frontiers of the two scenarios, the first one, with no constraints on weights, and the second one with the constraint of \( 0.02 \leq w \leq 0.11 \).

*Figure 41 – Efficient frontiers for the two scenarios*
The efficient frontier of the second scenario is lower and shifted to the right and so the portfolios on that efficient frontier are more risky and provide lower returns. We are aware of the negative results of the second scenario but we consider the second solution more appropriate to our analysis. In fact we want to create a comparison portfolio for the Adventurous portfolio, that is, among the three portfolios managed by Morningstar, the riskier. According to this, we are aware that an investor who decides to invest in a portfolio of this kind is willing to take more risk.

4.2.1.4 The optimal portfolio

Once the efficient frontier is determined, we want to find the optimal portfolio, that is the optimal allocation among the efficient allocations, that corresponds to the portfolio with the highest Sharpe ratio. We remind the formula of the Sharpe ratio that is equal to:

$$\text{SR} = \frac{\mu_{p} - r_f}{\sigma_{p}}$$ (70)

The risk free rate\(^{42}\) is equal to 0.01. We proceed calculating the Sharpe for each portfolio of the efficient frontier that we have found in the previous paragraph. The results are shown in Table 15:

<table>
<thead>
<tr>
<th>Var</th>
<th>Std Dev</th>
<th>E(R)</th>
<th>Sharpe</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4</td>
<td>0.6324555</td>
<td>0.028217</td>
<td>0.028803</td>
</tr>
<tr>
<td>0.3</td>
<td>0.5477226</td>
<td>0.02598</td>
<td>0.029175</td>
</tr>
<tr>
<td>0.28</td>
<td>0.5291503</td>
<td>0.025378</td>
<td>0.029062</td>
</tr>
<tr>
<td>0.26</td>
<td>0.509902</td>
<td>0.024734</td>
<td>0.028895</td>
</tr>
<tr>
<td>0.24</td>
<td>0.4898979</td>
<td>0.024054</td>
<td>0.028687</td>
</tr>
<tr>
<td>0.22</td>
<td>0.4690416</td>
<td>0.023331</td>
<td>0.028423</td>
</tr>
<tr>
<td>0.2</td>
<td>0.4472136</td>
<td>0.022557</td>
<td>0.028079</td>
</tr>
<tr>
<td>0.18</td>
<td>0.4242641</td>
<td>0.021727</td>
<td>0.027641</td>
</tr>
<tr>
<td>0.16</td>
<td>0.4</td>
<td>0.020833</td>
<td>0.027083</td>
</tr>
<tr>
<td>0.14</td>
<td>0.3741657</td>
<td>0.019861</td>
<td>0.026355</td>
</tr>
<tr>
<td>0.12</td>
<td>0.3464102</td>
<td>0.018785</td>
<td>0.025359</td>
</tr>
<tr>
<td>0.1</td>
<td>0.3162278</td>
<td>0.017567</td>
<td>0.02393</td>
</tr>
<tr>
<td>0.08</td>
<td>0.2828427</td>
<td>0.016129</td>
<td>0.02167</td>
</tr>
<tr>
<td>0.06</td>
<td>0.244949</td>
<td>0.014257</td>
<td>0.01738</td>
</tr>
<tr>
<td>0.05</td>
<td>0.2236068</td>
<td>0.013158</td>
<td>0.014122</td>
</tr>
</tbody>
</table>

\(^{42}\) Estimation of the average daily return of Italian Treasury Bonds based on the annual average return of 2008. The result is rounded to the second significant digit. Data taken from the website of the Italian Department of the Treasury (Dipartimento del Tesoro).
The row highlighted in the table corresponds to the optimal portfolio that corresponds to the point of tangency between the straight line (that starts from the y-axis at the risk free rate) and the efficient frontier in the expected return-standard deviation plan, as it is shown in Figure 42:

*Figure 42 – The optimal portfolio*

![Image of the optimal portfolio graph](image)

Since we are supposing that the investor invests his money only in our portfolio funds, he cannot choose a combination of the risky portfolio and of the risk-free asset, but he will invest just in the risky portfolio, that corresponds to the point of tangency between the straight line that starts from the y-axis at the risk-free level and the efficient frontier.

Moreover, we do not know with precision the shape utility curve of our investors; the only thing that we know is that they are less risk averse than an investor who would invest in the Cautious Portfolio or in the Balanced Portfolio and so he is willing to take more risk.
4.3 A comparison of the two portfolios

4.3.1 Asset allocation

Now that we have selected our optimal portfolio, let us see with more precision which is the asset allocation of our comparison portfolio. Table 16 shows the weights invested in each of the funds selected for our comparison portfolio.

Table 16 – Asset allocation in the comparison portfolio

<table>
<thead>
<tr>
<th>Name</th>
<th>Morningstar category</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZIMUT AMERICA</td>
<td>Equity US Large-Cap Blend Equity</td>
<td>2%</td>
</tr>
<tr>
<td>ALLIANZ AZIONI EUROPA-L</td>
<td>Equity Europe Large-Cap Blend</td>
<td>2%</td>
</tr>
<tr>
<td>ABERDEEN GL-EUROPEAN EQU-A-2</td>
<td>Equity Europe Large-Cap Blend</td>
<td>2%</td>
</tr>
<tr>
<td>INVESCO US STRUCT EQTY-E</td>
<td>Equity US Large-Cap Value</td>
<td>2%</td>
</tr>
<tr>
<td>M&amp;G ASIAN FUND - E-C-ACC</td>
<td>Equity Asia-Pacific ex-Japan</td>
<td>11%</td>
</tr>
<tr>
<td>BNY MELLON GL-EMRG MKT EQT V-A€</td>
<td>Equity Global Emerging Markets</td>
<td>11%</td>
</tr>
<tr>
<td>ANIMA GEO EUROPA-A</td>
<td>Equity Europe Large Cap Blend</td>
<td>2%</td>
</tr>
<tr>
<td>MORGAN ST-EURO CORP BD-B</td>
<td>Euro Corporate Bond</td>
<td>2%</td>
</tr>
<tr>
<td>CAPITAL INT GLOBAL BOND-B EUR</td>
<td>Euro Global Bond</td>
<td>2%</td>
</tr>
<tr>
<td>OYSTER EUROPEAN FIXED INCOME</td>
<td>Euro Diversified Bond</td>
<td>10%</td>
</tr>
<tr>
<td>SCHRODER INTL EURO BOND-C AC</td>
<td>Euro Government Bond</td>
<td>11%</td>
</tr>
<tr>
<td>ESPA BOND EURO TREND-A</td>
<td>Euro Government Bond</td>
<td>2%</td>
</tr>
<tr>
<td>CANDRIAM EQUITIES L-EMERG MKT-N</td>
<td>Equity Global Emerging Markets</td>
<td>11%</td>
</tr>
<tr>
<td>PICTET-SMALL CAP EUR-IE</td>
<td>Equity Europe Small Cap</td>
<td>2%</td>
</tr>
<tr>
<td>RUSSELL US SML CAP EQ-C</td>
<td>Equity US Small Cap</td>
<td>2%</td>
</tr>
<tr>
<td>JPMORGAN F-GERMANY EQUITY-D</td>
<td>Equity Germany Large Cap</td>
<td>2%</td>
</tr>
<tr>
<td>KBC BONDS CAPITAL FUND-D</td>
<td>Global Bond</td>
<td>11%</td>
</tr>
<tr>
<td>RAFFEISEN GLOBAL RENT-VT</td>
<td>Global Bond</td>
<td>11%</td>
</tr>
<tr>
<td>PIONEER-GLB HI YLD-E ND €</td>
<td>Bond Global High Yield</td>
<td>2%</td>
</tr>
</tbody>
</table>

The comparison portfolio invests a lower percentage in Equity funds than the portfolio created by Morningstar. We remember that the asset allocation between equity funds and fixed income funds of the Morningstar portfolio is subject to change according to the expected volatility of the market, while the asset allocation of our portfolio is static. Table 17 compares the asset allocation of the comparison portfolio and the neutral asset allocation of the Adventurous portfolio managed by Morningstar.

Table 17 – Asset allocation between stocks and bonds

<table>
<thead>
<tr>
<th></th>
<th>Comparison Portfolio</th>
<th>Morningstar Portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity</td>
<td>49%</td>
<td>65%</td>
</tr>
<tr>
<td>Bond</td>
<td>51%</td>
<td>35%</td>
</tr>
</tbody>
</table>

The data of the table confirm the difference in stock investment between the two portfolios. Remember that in the case of the comparison portfolio, the allocation will
remain the same for the whole life of the investment, whichever is the volatility of the market, differently from the portfolios created by Morningstar.

If we look with more attention at the asset allocation of Table 16, there are several peculiarities of our comparison portfolio that differentiate it from the Morningstar portfolio. There is in fact a greater investment in the Pacific area and in the Asia emerging and developed countries. The investment in these areas is of 33%\textsuperscript{43}, and it is consistently higher than that of the Morningstar portfolio that equals 11%. Moreover, the comparison portfolio is less exposed to the dollar (6%) with respect to of the Morningstar portfolio (21%).

To sum up, even if our portfolio invests in the same asset classes, the percentages invested in each asset class differ consistently from the allocation chosen by Morningstar.

\textsuperscript{43} This percentage includes investment in the Morningstar Categories Equity Global Emerging markets and Equity Asia-Pacific ex-Japan.
4.3.2 Performance

From now on, our analysis proceeds with the use of a new data set that includes the returns of the 19 funds selected for our portfolio, calculated on a daily basis. The dataset also provides the daily returns of the BG fund. The time frame of the data set goes from the 1st of November 2009 until the 30th of April 2014. From the daily returns of the single funds and the weights of the optimal portfolio choice, we are able to calculate the risk and return of the comparison portfolio. Figure 43 shows the monthly performance (% of returns) of the comparison portfolio and of the BG portfolio.

Figure 43 – Monthly performance of the comparison portfolio and of the BG Portfolio

The two portfolios have a very similar trend but the BG portfolio generally incurs in higher losses than the comparison portfolio because of the higher percentage of stock investment. The greatest loss experienced by the BG fund is the one of summer 2011, when stock markets fell because of the European sovereign debt crisis. In correspondence of this period also the comparison portfolio experiences a great loss but lower than the one of the BG fund. Figure 44 and 45 show with a column chart the returns of the Comparison Portfolio and of the BG Portfolio. In Figure 44 the returns are calculated on a quarterly basis, while in Figure 45 the returns are calculated on a yearly basis.
Our analysis includes 17 quarters. There are only two quarters (the 2nd quarter of 2010 and the 1st quarter of 2014) where the two funds have an opposite trend, in particular the BG fund experiences negative returns and the comparison portfolio performs positive returns. In all the other quarters the funds move in the same direction. Table 18 indicates the number of positive and negative quarters for the two funds.

Table 18 – Positive and negative quarters

<table>
<thead>
<tr>
<th></th>
<th>Comparison Portfolio</th>
<th>BG Portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Quarters</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Negative Quarters</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Worst Quarter</td>
<td>-6,106</td>
<td>-9,216</td>
</tr>
</tbody>
</table>

To sum up, there is a majority of positive quarters than negative quarters for both the funds. As anticipated, the comparison portfolio has two quarters of positive returns more than the BG portfolio, this is mainly caused by the greatest exposition to risk of the BG portfolio. The table also indicates the worst return performed by each of the funds (that in both cases corresponds to the third quarter of 2011). The loss of the BG fund is greater, so even if in correspondence of this period Morningstar consistently decreased the level of stocks in its portfolio, this operation did not totally control the losses. This is probably due to the fact that this loss is caused by a fall of the entire
market and so it is a systematic and non-diversifiable risk that is not eliminated by the diversification and management of an investment. Let us now look at the returns calculated for the two portfolios on an annual basis.

*Figure 45 – Portfolios returns on a yearly basis*

Of the four years of analysis, there are three years of positive returns and one year of negative returns. The only year characterized by negative returns is 2011, the year that is distinguished by the fall of stock markets.

As we have constantly repeated, the performance of a mutual fund is not significant unless compared to a benchmark. Since the comparison portfolio and the BG Portfolio are not identical, we cannot use the same benchmark. For this reason, we take the benchmark composed for 25% by the Barclays Euro Aggregate Bond Index and for 75% by the Ftse World Index for the BG portfolio, and the benchmark composed for 50% by the Barclays Euro Aggregate Bond Index and for 50% by the Ftse World Index for the comparison portfolio. The benchmark used for the BG fund is the same used by Morningstar for the majority of the life of the BG portfolio while the benchmark used for the comparison portfolio is composed by the same indices but with different percentages. This is due to the fact that the comparison portfolio is composed only of

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44 The benchmark calculated by Morningstar for the BG fund (and whose growth of 1000 euros is shown in Figure 36) is adjusted on a quarter basis according to the investment of the fund. More specifically, Morningstar rebalances the weights to assign to the indexes that constitute the benchmark according to the composition of the BG portfolio. Since we do not know the exact composition of the BG portfolio in each quarter, we do not adjust the benchmark and we maintain it constant for the entire period of evaluation. The same is done for the benchmark of the comparison portfolio.
49% of stocks and so a composition of 50% of the bond index and 50% of the equity index is more suitable.

Figure 46 represents the growth of 1000 euros invested in the comparison portfolio, in the BG portfolio and in the two benchmarks. The returns are calculated on a monthly basis.

**Figure 46 – Growth of 1000 euros**

![Graph showing the growth of 1000 euros over time for comparison portfolio, BG portfolio, benchmark 50-50, and benchmark 25-75.]

The graph is useful to give a general idea of the growth of the investments in the time frame of the analysis but it is not a good tool for the comparison of the performance of the two portfolios since they take different risk and they have a different stock/bond allocation. In general, the trend of the four investment instruments is similar and there are not relevant differences.

Let us proceed our comparison of the two portfolios with the use of the performance and risk measures, useful for the evaluation of mutual funds, defined in Chapter 2.
4.4 Performance indices and risk indices

4.4.1 The importance of the indices

The analysis conducted so far is only a simple comparison of the performance of the two funds but it does not explain anything more about the management. We remember that returns mean nothing unless compared to the risk undertaken to get that return, and so we proceed our study deriving information over the performance adjusted to the risk. For this purpose, we proceed with the use of performance measures and risk measures useful for the comparison of mutual fund investments. All the indices are calculated using the data available as of May 2014. Table 19 summarizes the data that we are going to use for the evaluation of the performance and risk indices in the following paragraphs.

Table 19 – Expected return, standard deviation, beta and risk free rate

<table>
<thead>
<tr>
<th></th>
<th>Comparison Portfolio</th>
<th>BG Portfolio</th>
<th>Benchmark 50-50</th>
<th>Benchmark 25-75</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E(R)$ annual %</td>
<td>5.557</td>
<td>4.142</td>
<td>6.934</td>
<td>7.077</td>
</tr>
<tr>
<td>$\sigma$ annual %</td>
<td>8.345</td>
<td>7.783</td>
<td>5.558</td>
<td>9.996</td>
</tr>
<tr>
<td>$\beta^*$</td>
<td>1.23</td>
<td>1.11</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*Source: Morningstar.it. The beta of the comparison portfolio is calculated as the weighted average of the betas of the single funds in the portfolio.

| Risk free rate (%)  | 0.258 |

The risk free rate corresponds to the one month Euribor\(^{45}\) rate and it is the same one used by Morningstar. Unless differently indicated, this is the rate used for the calculation of each index.

4.4.2 The Sharpe index

The Sharpe index is a reward to variability measure and it evaluates the performance adjusted for its risk. Table 20 summarizes the results of the Sharpe ratio

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\(^{45}\) Euro Interbank Offer Rate. It is the rate offered to prime banks on euro interbank term deposits and it is based on the average interest rates of around 50 European banks that lend and borrow from each other (Investopedia). The Euribor rate that we have used for the calculation of our indices is the one month Euribor rate at the date of the 26th of May 2014.
for the two portfolios and the two benchmarks. The ratio is calculated on an annual basis taking into consideration the last four years.

Table 20 –Sharpe ratio

<table>
<thead>
<tr>
<th>Sharpe Ratio</th>
<th>Comparison Portfolio</th>
<th>BG Portfolio</th>
<th>Benchmark 50-50</th>
<th>Benchmark 25-75</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.634953</td>
<td>0.498993</td>
<td>1.201197</td>
<td>0.682224</td>
<td></td>
</tr>
</tbody>
</table>

It follows that:

\[
SR_{50-50} > SR_{25-75} > SR_{\text{Comparison Portf}} > SR_{BG \text{ Portf}}
\]

The benchmark 50-50 has the highest Sharpe ratio, followed by the benchmark 25-75, the comparison portfolio and the BG portfolio. The interpretation of the Sharpe ratio is very simple: the higher the Sharpe ratio, the better the return for each unit of risk, meaning that the investment is more capable to generate satisfying results in terms of risk and reward (notice that if we considered the four investments only from the point of view of the returns, the benchmark 25-75 would have been the top performer –see Table 19).

The Sharpe ratio is a good indicator to compare peer groups and similar investments. It is relevant to consider that the Sharpe ratio of the two benchmarks is greater than that of the portfolios. This means that each of the two funds has a lower reward to risk with respect to the corresponding benchmark.

4.4.3 The Treynor ratio

The Treynor ratio allows us to identify the reward in excess of what is earned in a riskless investment like the Sharpe ratio, but instead of measuring the excess return against the total risk of the investment, it measures it against the systematic risk of the portfolio, explained by the beta. Table 21 shows the values of the Treynor ratio for the two portfolios. The ratio is calculated on an annual basis, taking into consideration the last four years.
Since the two portfolios are well diversified, the Treynor ratio is a good performance index, because it takes into consideration only the systematic risk of the portfolio. The two portfolios have a Treynor ratio greater than 1, meaning that they are producing more units of returns than of risk, and so they are capable of rewarding the systematic risk of the investment.

### 4.4.4 Modigliani RAP index

The Modigliani RAP index ($M^2$), that can be interpreted as a modification of the Sharpe index, evaluates how a fund would perform if combined with a risk free asset, in a way to reach the same standard deviation of the benchmark. The index is useful since it transforms the Sharpe ratio into an absolute performance measure. For the calculation of the Modigliani index, the risk free rate is the average return of the Treasury bonds for the year 2013\(^{46}\), that is equal to 2.08%. The results of the index are presented in Table 22.

#### Table 22 –Modigliani RAP index

<table>
<thead>
<tr>
<th>Modigliani RAP index (%)</th>
<th>Comparison Portfolio</th>
<th>BG Portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.39</td>
<td>4.73</td>
</tr>
</tbody>
</table>

The solution of the index represents the expected return of the portfolio in the case in which it has the same risk of the benchmark, so it is meaningful only if compared to the expected return of the benchmark itself. For this reason, we compare the results found to the expected return of the benchmark of reference.

Comparison portfolio:

$$M^2 = 4.39\% < \text{E(R) Benchmark 50-50} = 6.934\%$$

\(^{46}\) Source: Italian Department of Treasury website (www.dt.tesoro.it).
BG portfolio:

\[ M^2 = 4.73\% < \text{E(R) Benchmark} 25-75 = 7.07\% \]

In this case, both the portfolios generate a lower adjusted return than the benchmark of reference, meaning that if the investment had the same risk of the benchmark, the performance would be lower than the benchmark itself. In particular, the comparison portfolio would perform 2.544\% less than its benchmark, while the BG portfolio would perform 2.34\% less than its benchmark.

### 4.4.5 Jensen’s alpha

The alpha of the portfolio, that is basically the difference between the returns an investor expects from a fund given its beta and the return that it actually produces, evaluates the ability of stock picking of the managers, and so it evaluates the extra return provided by the investment above the expectation that the risk procured. The alpha of the two funds are respectively:

Table 23 – Jensen’s Alpha

<table>
<thead>
<tr>
<th></th>
<th>Comparison Portfolio</th>
<th>BG Portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha )</td>
<td>-2.912</td>
<td>-3.685</td>
</tr>
<tr>
<td>(&lt; 0; =0; &gt;0)</td>
<td>(&lt; 0)</td>
<td>(&lt; 0)</td>
</tr>
</tbody>
</table>

The two portfolios have a negative alpha. This means that the two investments are earning too little for the risk they are taking with respect to the benchmark. This result confirms what we have seen so far.

### 4.4.6 Volatility

Standard deviation is the most simple measure to evaluate the risk (volatility) of an investment and it is an interesting indicator to see the way in which the BG portfolio is managed. In this analysis, we do not use the volatility as a ranking instrument since we are aware of the differences between the two investments. However, we want to concentrate on how volatility changes through time. Table 24 shows the standard
deviation of the comparison portfolio and of the BG portfolio on a monthly, quarterly and annual basis.

Table 24 – Standard deviation

<table>
<thead>
<tr>
<th></th>
<th>Comparison Portfolio</th>
<th>BG Portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>σ monthly basis</td>
<td>1,886</td>
<td>&lt; 2,334</td>
</tr>
<tr>
<td>σ quarterly basis</td>
<td>3,233</td>
<td>&lt; 4,486</td>
</tr>
<tr>
<td>σ semester basis</td>
<td>4,373</td>
<td>&gt; 4,253</td>
</tr>
<tr>
<td>σ annual basis</td>
<td>8,345</td>
<td>&gt; 7,783</td>
</tr>
</tbody>
</table>

In the short run, the comparison portfolio has a lower volatility with respect to the BG portfolio, this is valid on a monthly and quarterly basis. On a semester and annual basis instead, the risk of the BG portfolio is lower than that of the comparison portfolio. To sum up, in the long run the volatility of the BG portfolio is smaller than the volatility of the comparison portfolio. This proves that Morningstar succeeded in targeting the level of volatility, controlling the risk of the portfolio and limiting the losses in the long run, while the comparison portfolio does not keep volatility under control.

4.4.7 Portfolio’s beta

The beta of the portfolio is a good measure to evaluate the sensitivity of the returns with respect to the market (benchmark). We calculate the beta of our portfolio as a weighted average of the betas of the single funds. We remember that the beta of the market portfolio is equal to 1. As it is shown in Table 19, the value of the beta of the comparison portfolio is 1,23 meaning that the portfolio moves in the same direction of the market, in a higher amount than the movement of the benchmark. The beta of the BG portfolio equals to 1,11 and so it moves in the same direction of the comparison portfolio with respect to the benchmark. To sum up, the two portfolios are more risky than their benchmark.
4.4.8 Information ratio

The information ratio is a good measure to compare funds with different benchmarks. Table 25 shows the values of the information ratio for the comparison portfolio and the BG portfolio.

Table 25 – Information ratio

<table>
<thead>
<tr>
<th></th>
<th>Comparison Portfolio</th>
<th>BG Portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information ratio</td>
<td>-0.49422</td>
<td>1.326624</td>
</tr>
</tbody>
</table>

The higher the ratio, the better. A negative ratio instead means that the portfolio is not producing value with respect to the benchmark. The resulting ratio of the comparison portfolio is negative while the one of the BG portfolio is positive. These results are the consequence of the fact that the BG portfolio has a lower expected return but lower risk with respect to the benchmark (less profitable but less risky), while the comparison portfolio has a lower expected return and a higher risk with respect to the benchmark (less profitable and more risky). The comparison portfolio does not produce any value compared to the benchmark since the higher reward does not fully satisfy the higher risk undertaken by the investment. The BG portfolio instead is producing value with respect to the benchmark since the value of the information ratio is positive.
Conclusions

This analysis wants to test the value generated by the investment management company Morningstar Investment Management to a portfolio of mutual funds. The reason why we are interested in the management of this specific company is its innovative approach of portfolio creation through the optimization model Markowitz 2.0 and its innovative management approach of target volatility. Moreover, the company is a division of Morningstar Inc., an investment research firm that supplies information, classifications and ratings of mutual funds to the main online platforms. Consequently, the investment management division of this society has several strengths with respect to its competitors, having direct access to all the information of each fund.

Our analysis starts with the study of three portfolios of funds (funds of funds) of the insurance company Clerical Medical, that are managed by Morningstar since March 2013. The portfolios, that have an increasing risk profile, are the CMIG Euro Cautious Managed, the CMIG Euro Balanced Managed and the CMIG Euro Adventurous Managed. The management process of the three portfolios is based on four basic steps: strategic asset allocation, fund’s selection, dynamic asset allocation and daily monitoring. More specifically, Morningstar first defines the strategic asset allocation of the portfolios and then chooses the funds to be included through a sophisticated analysis of the style, capitalization, geographic and business sectors of investment of each fund in order to create extremely diversified portfolios. The optimal portfolio is then chosen according to the Markowitz 2.0 optimization approach (introduced by Kaplan and the Morningstar research team). Moreover, Morningstar constantly monitors the portfolios applying the target volatility asset allocation strategy, which implies the rebalancing of the portfolio allocation between equity and bond funds to maintain the target portfolio volatility.

In order to test the efficiency of the management of this professional investor, we concentrate our attention on one of the three portfolios, the CMIG Euro Adventurous
Managed Portfolio, that is the one with the riskiest profile. We choose this portfolio because we have a good proxy for it. The proxy is the fund BG Selection Global Risk Managed AX, a fund of a SICAV of Generali Bank that has been managed by Morningstar since October 2009 and so it has a more significant time frame to test Morningstar management. Also the BG portfolio is managed with the target volatility asset allocation approach.

To proceed with the analysis, we create a comparison portfolio whose date of creation is October 2009, like the BG fund. The comparison portfolio is created following the classical Modern Portfolio Theory by Markowitz, it is static and it invests in the same asset classes of the Morningstar portfolio. The funds included in the portfolio are selected in a way that, for each fund in the Morningstar portfolio, there is a corresponding fund in the comparison portfolio that belongs to the same Morningstar asset class. In order to create the optimal allocation of the funds in the portfolio, we use a dataset that includes the returns of the funds selected in the time frame October 2004 – September 2009. With the use of Excel we calculate the mean vector $\mathbf{R}$ and the variance-covariance matrix $\mathbf{\Omega}$ and with the Solver in Excel we solve the optimization model that finds the vector of weights $\mathbf{X}$ that maximizes the expected return for a given level of variance. Plotting the results on a mean-variance Cartesian plan and connecting the points we graphically get the efficient frontier, that is the set of the portfolios that maximize the returns for a given level of variance or, equivalently, that minimize the variance for a given level of returns. The efficient frontier is calculated imposing the only constraints that the weights sum up to one and that each weight is non-negative (since we do not want short selling). Since the results are not satisfying as the resulting weights concentrate on a few funds of the portfolio, we calculate the efficient frontier another time imposing a further constraint. The added constraint imposes that the weight of each fund is greater than 0.02 but smaller than 0.11. In this way none of the weights is smaller than 2% and greater than 11%, like in the portfolio created by Morningstar. The second efficient frontier is lower and shifted to the right in the mean-variance plan but it provides more significant results for the purpose of our analysis.

Once the efficient frontier is determined, we find the optimal portfolio maximizing the Sharpe ratio. The optimal portfolio corresponds to the point of tangency between the straight line (that starts from the y-axis at the risk free rate) and the efficient frontier in the expected return-standard deviation plan. Since we are supposing that the
investor invests his money only in our portfolio funds, he cannot choose a combination of the risky portfolio and of the risk-free asset, but he invests just in the risky portfolio. Thanks to this procedure we are sure that our portfolio is efficient. If our portfolio had not been efficient since its creation, it would have been disadvantaged in relation to the Morningstar portfolio.

Before carrying out our analysis we expected the performance of the comparison portfolio to be lower than the one of the BG portfolio and we expected the BG portfolio to produce more value to the investment than the comparison portfolio. The first interesting result of our analysis lies in the optimal portfolio choice. With the funds that we selected, it is not possible to create a portfolio with the same equity/fixed income proportion of the Morningstar portfolio. Our portfolio in fact invests a lower percentage in stock funds (49% equity funds and 51% fixed income funds) than the Morningstar portfolio (65% equity funds and 51% fixed income funds –neutral allocation), keeping in mind that the equity/fixed income asset allocation of the Morningstar portfolio is subject to change according to the expected volatility of the market, while the asset allocation of our portfolio is static.

Our first expectation is not realized. On absolute terms, the performance of the comparison portfolio is higher than the one of the Morningstar portfolio. This is evidenced by the higher expected returns and the higher cumulated returns that it exhibits with respect to the Morningstar portfolio. However, it is important to notice that the quality of the two investments differs on several aspects. The comparison portfolio in fact has a lower percentage invested in stocks, a higher percentage invested in Pacific area and Emerging markets funds, and it has a lower exposition to the dollar. In the last two years the funds of the Asia Pacific and Emerging markets have performed high returns and this might have contributed to improve the performance of our comparison portfolio. In addition, the depreciation of the dollar in 2013 penalized the performance of the Morningstar portfolio relatively to its category. Morningstar strategy in fact envisages a high exposition to the dollar that for a European investor functions as a natural hedge, since it covers a part of the losses when the markets go down. In this way, Morningstar renounces to some profit when the markets go up but it has lower losses when the markets go down. The combination of the well performing Pacific Asia and Emerging Market funds and the depreciation of the dollar might have played in favor of the performance of the comparison portfolio and against the BG
portfolio and we do not have enough information to state with certainty that the comparison portfolio will have a higher performance also in the long run.

Since returns mean nothing unless compared to the risk undertaken to get that return and since the performance and risk of mutual funds are meaningful only if compared to the benchmark of reference, we proceed our study deriving information over the performance adjusted to the risk and with the comparison of the performance and risk of the fund relatively to the benchmark of reference. The benchmark that we use to evaluate the BG fund is the same used by Morningstar in its analysis (25% Barclays Euro Aggregate Bond Index and 75% Ftse World Index) while the benchmark used for the comparison portfolio is composed by the same indices but with different percentages (50% Barclays Euro Aggregate Bond Index and 50% Ftse World Index) since it is composed of a lower percentage of stocks.

We calculate the Sharpe ratio of the two portfolios to rank the reward to risk with respect to benchmark of reference. The Sharpe ratio of both the portfolios is lower than the Sharpe ratio of the corresponding benchmark, this means that each of the two funds has a lower return to variability with respect to the benchmark. Anyhow, the two Sharpe ratios are positive and so both the portfolios are rewarding in a certain measure the risk that they are taking and they are not destroying value. Moreover, both the portfolios are capable of rewarding the systematic risk of the investment since they have a Treynor ratio greater than one, suggesting that they are producing more units of returns than of risk. The Modigliani measure allows us to deduce that the portfolios would perform less than the corresponding benchmark even if they had the same level of risk of the benchmark. This is further confirmed by the value of the alpha that evaluates the extra return provided by the investment above the expectation that the risk procured, defining managers’ ability of stock picking. The alpha of the two funds is negative since they perform less than what expected. However, as most of the funds in the same category are currently performing negative alphas, we consider that this value might change in other market conditions.

Shifting the attention to the risk of the two investments, the portfolios have a beta greater than one and so they are more risky than their benchmark. Moreover, if we focus on the volatility (standard deviation) of the two portfolios, the volatility of the BG portfolio is higher than that of the comparison portfolio in the short run while it is lower in the long run. This proves that Morningstar succeeded in targeting the level of
volatility, controlling the risk and limiting the losses in the long term, while the comparison portfolio does not keep volatility under control. We remember on this subject that the main objective of the two funds is to beat the benchmark in the long run and not in the short run.

Finally, the last index analyzed in our study is the information ratio that allows us to compare the portfolios on the basis of the value added to each portfolio by the management. The resulting ratio of the comparison portfolio is negative while the one of the BG portfolio is positive. The negative ratio means that the comparison portfolio does not produce further value compared to the benchmark (since it is less profitable and more risky than the benchmark), while the positive ratio means that the BG portfolio is producing value with respect to the benchmark (since it is less profitable but less risky). Our second expectation is then satisfied, the fund managed by Morningstar is producing more value to the investment than our comparison portfolio if we compare the investments to the appropriate benchmark.

We can conclude that the portfolio that is professionally managed and constantly monitored by Morningstar generates greater value than our static portfolio. Moreover, the Morningstar portfolio is more successful in the long run, granting better results in terms of reward to risk with respect to the benchmark. Relatively to this, it should be kept in mind that the performance of a fund evaluated on its own, without taking into consideration the risk and the benchmark, is not significant. So, even if the comparison portfolio performs higher expected and cumulated returns, it is necessary to note that it does not produce more value with respect to the benchmark.
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