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Finding socially responsible portfolios close to conventional ones

Clara Calvo, Carlos Ivorra *, Vicente Liern

Dep. Matemáticas para la Economía y la Empresa, Universidad de Valencia Spain

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ABSTRACT

An increasing number of investors are interested in sustainable, responsible and impact investment (SRI). However, there is a concern about the possible financial sacrifice associated to this kind of investments. The design of Decision Support Systems assisting socially responsible investors in their investment decisions can contribute to stimulate SRI. In this paper the financial content of a portfolio selection model is discussed in order to justify that it can be integrated into a Decision Support System designed for investors interested in socially responsible investment but initially reluctant to pay a financial cost in exchange for increasing the social responsibility of their portfolios. Investor's preferences are incorporated by means of adequate parameters of a utility function designed for handling subjective criteria in a reliable way. We show that these parameters can be determined by means of a non-technical questionnaire addressed to the investor, and that they can faithfully reflect his/her preferences about achieving an SRI performance as good as possible without going too far from the financial efficient frontier or even from an initial choice of an efficient pair of financial risk and return. The proposed procedure is illustrated by means of two examples. A first small example illustrates the decision making process followed in order to obtain the required parameters from the investor. The second example is intended to show how the proposed procedure can be applied to real world problems including financial constraints which are hard from a computational point of view.

1. Introduction

(Sustainable, responsible and impact investment (SRI) is an investment discipline that considers environmental, social and corporate governance (ESG) criteria to generate long-term competitive financial returns and positive societal impact (US SIF, 2015). This investment practice is gaining popularity among investors. As reported by the US SIF Foundation in its 2014 Report on Sustainable and Responsible Investing Trends in the United States, at the end of 2013, more than one out of every six dollars under professional management — $6.57 trillion or more — was invested in the United States according to SRI strategies (US SIF, 2014).

However, despite the growing interest among investors for this investment strategy, a large number of investors are still concerned about the possible financial sacrifice of being socially responsible (Barnett & Salomon, 2006; Bauer, Koedijk, & Otten, 2005; Guerard, 1997; Hamilton, Jo, & Statman, 1993; Renneboog, Horst, & Zhang, 2008; Sparkes & Cowton, 2004 etc.).

In this paper a procedure is provided to assist socially responsible investors in their portfolio selection decision-making process allowing them to know the possible financial penalty from being socially responsible. Investors can usually have access to a large number of financial and non-financial data as well as to a large set of investment alternatives. Nevertheless, individual investors have a limited capacity for handling by themselves all the available information and a mathematical procedure assisting them in their decision-making process could be of great help. This procedure must find a trade-off between three conflicting goals: financial return, financial risk and social responsibility. Such a procedure will only have practical applicability as long as it succeeds in reflecting the real investor's aims.

In Calvo, Ivorra, and Liern (2014) a fuzzy mathematical optimization model is presented for the above described purpose but that work is focused on the geometrical, fuzzy theoretical and computational aspects of the model. The aim of the present paper is providing a necessary discussion from the financial point of view, in order to show how the model can become the kernel of a Decision Support System for investors interested in SRI. This requires, firstly, a detailed explanation in financial terms of what the model seeks, in order to make apparent that the optimization criterion can really be

* Corresponding author at: Departamento de Matemáticas para la Economía y la Empresa Facultad de Economía, Universidad de Valencia Avda. Los Naranjos s/n 46022 Valencia, Spain.
E-mail addresses: clara.calvo@uv.es (C. Calvo), carlos.ivorra@uv.es (C. Ivorra), vicente.liern@uv.es (V. Liern).

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adjusted to fit the subjective criteria of a specific investor. Then, it is necessary to show that the parameters incorporating the investor's subjective preferences can be specified by means of some practical non-technical questions in a reliable way. Thirdly, it must be shown that the procedure can handle real-world problems with complex constraints, that the solutions obtained when the SRI goal is incorporated can be significantly different from the financially efficient ones and, finally, that all the process, in spite of being quite flexible to incorporate specific constraints, follows a general pattern that could be implemented as a software package ready to be used by investors without specific knowledge on computational issues.

There are several well-known possible strategies for handling multicriteria problems. In our context, as the proposed procedure is intended for those investors initially reluctant to invest in socially responsible products if this means a substantial financial sacrifice, a method not discarding a priori any financially efficient portfolio seems to be the most suitable. Such a procedure can be conceptually structured in two phases. In the first one, dominated portfolios (those being worse than others in all the decision-making criteria) are discarded and the efficient frontier (set of all non-dominated portfolios) is obtained. After dismissing all those portfolios that no investor would choose, the second phase consists of finally selecting a portfolio on the efficient frontier.

Computation of the efficient frontier (in an exact or approximate way) has been widely dealt with in the academic literature (some examples can be found in Merton (1972), Kolm, Tütüncü, and Fabozzi (2014) and more recently for the tri-criteria portfolio selection problem in Hirschberger, Steuer, Utz, Wimmer, and Qi (2013), Utz, Wimmer, Hirschberger, and Steuer (2014), and Calvo, Ivorra, and Liern (2012)). Obtaining the efficient frontier is a purely mathematical problem which does not require any subjective choice.

On the other hand, the practical selection of a particular portfolio on the efficient frontier is highly subjective as it involves fitting the investor's personal preferences. When the social responsibility criterion is included, subjectivity increases as this last criterion is by its own nature rather ambiguous and imprecise, depending on cultural and geographical aspects and personal convictions (Pérez-Gladish, Méndez Rodrguez, & M'Zali, 2012). In this situation comparison of the social criterion with the more objective financial criteria becomes a non-obvious question.

This paper is focused on the second phase of the above-described portfolio selection process. We are concerned with the problem of providing the investor with a small set of efficient portfolios aiming at reflecting as faithfully as possible the investor's preferences with regard to the financial and social criteria. This is usually done by optimizing a suitable utility function on the efficient frontier. However, the utility functions appearing in the literature for the tri-criteria case are usually adapted from those used for handling the financial goals, and hence they are not designed for capturing the peculiar characteristics of the non-financial goals. For instance, Hirschberger et al. (2013) present an algorithm for obtaining an exact analytic representation of the tri-criteria efficient frontier (i.e., for solving the phase 1 of the portfolio selection process) for problems with linear constraints, and in order to select specific portfolios from the efficient frontier (phase 2), they use a utility function consisting of a linear combination of the three goals, and so the investor's preferences are represented in the selection method through two general coefficients. This is completely adequate for their purpose, namely, evaluating the performance of the portfolios that can be reached by means of their algorithm, but it leaves open the problem of finding more specific strategies with more chances of fitting the actual investor's preferences.

The proposed strategy in this paper tries to overcome the previously described limitation. It firstly involves the selection of adequate parameters to be taken into account in order to accurately fit the investor's preferences. Then, it requires designing a non-too complex way of obtaining the parameters from the investor and, thirdly, it integrates all the information into a mathematical model, mainly through a proper utility function. Hence, what we present here is a new proposal of a specific selection criterion as an alternative to the standard ones usually considered by the multi-criteria theory. From a mathematical point of view, our proposal is expressed by means of a fuzzy optimization model. It should be fine enough to provide a good chance of finding satisfactory portfolios, but formally simple enough to be mathematically tractable by exact or heuristic procedures.

The paper is organized as follows: Section 2 contains a discussion of Modern Portfolio Theory to motivate the financial part of the proposed procedure; in Section 3 the aims of our proposal and the strategy we have followed are discussed; in Section 4 a real data set to be used for explaining and testing the procedure is introduced; Section 5 presents the utility function on which our procedure is based; in Section 6 a real case is solved and discussed and the paper ends with a brief section of conclusions. An appendix has been added discussing some geometrical aspects of the efficient frontiers.

2. The classical portfolio selection problem

H.M. Markowitz won the 1990 Nobel Price for his work in the foundation of Modern Portfolio Theory (MPT) (Markowitz, 1952, 1959), which has become a main tool in portfolio management as well as in other economic theories, such as asset pricing (Sharpe, 1964). MPT is a deep theory which can hardly be described in a few words (see Grinold and Kahn (2000) for a comprehensive account), but, roughly speaking, it aims to determine the best portfolio we can form from a given set of possible assets on the basis of two characteristics. The first one is the expected return. In order to measure it, the return of each asset is considered as a random variable and the expected return is often measured by its mean, which in practice is estimated by the arithmetical mean of the historical returns. The expected return of a portfolio is defined as the weighted sum of the expected returns of its assets.

Here we should face the critical question: to what extent can we trust that the future return of a portfolio will be similar to the expected return calculated from its past returns? This leads to the second characteristic to be considered in order to select a portfolio to invest in: the risk. It tries to estimate the difference between the expected return and the real future return of a portfolio.

Whereas the theoretical relevance of MPT is not questioned, several criticisms about its real world applicability have arisen (Taleb, 2007). However there are also renowned specialists supporting it (Kaplan & Siegel, 1994; Pfleiderer, 2012; Sharpe, 1994). Assuming that the expected return and an adequate measure of the risk are reliable, MPT establishes that a rational investor should select an *efficient portfolio*, i.e., a portfolio providing the least possible risk for a given expected return or, what is essentially the same, providing the greatest expected return for a maximum allowable risk.

The original (classical) Markowitz model is also called the mean–variance model (MV) since it takes as indicators of the expected return and the risk of a portfolio the mean and the quadratic form associated to the variance–covariance matrix of the returns of the assets, respectively, which in practice are estimated from the historical data by standard statistical techniques assuming that they are normally distributed.