UNIVERSITÉ DU QUÉBEC À MONTRÉAL

UNE APPROCHE D'ANALYSE DE PORTEFEUILLE POUR ASSISTER LES INVESTISSEURS SOCIALEMENT RESPONSABLES À PRENDRE LEURS DÉCISIONS

MÉMOIRE
PRÉSENTÉ
COMME EXIGENCE PARTIELLE
DE LA MAÎTRISE EN ADMINISTRATION DES AFFAIRES

PAR
AHMED OUENNICHE

MARS 2008

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A PORTFOLIO ANALYSIS APPROACH TO ASSIST SOCIALLY RESPONSIBLE INVESTORS IN MAKING DECISIONS

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W1 *: being the weight attributed to the minimization of risk

W2*: being the weight attributed to the maximization of CSR.

RÉSUMÉ

La principale question de recherche à laquelle ce mémoire tente de répondre est de savoir si le fait d'être un investisseur socialement responsable se traduit ou non par un coût. L'objet de cette recherche consiste à proposer une approche d'analyse de portefeuille pour répondre à cette question dans l'esprit d'aider les investisseurs socialement responsables, y compris les gestionnaires de portefeuilles, à prendre leurs décisions d'investissement. Plus précisément, il est fait usage dans le cadre de cette recherche de la théorie moderne de portefeuille pour construire et comparer les frontières efficientes des portefeuilles et où chaque portefeuille constitue une solution au modèle mathématique de base de Markowitz ou à une certaine variante ou extension de ce modèle. En d'autres termes, le modèle de base de Markowitz utilisé dans cette étude consiste à maximiser le rendement d'un portefeuille tout en tenant compte de la contrainte d'un risque maximum acceptable. D'un autre côté, on propose une extension du modèle de Markowitz pour prendre en considération la composante "responsabilité sociale" en vue de générer plusieurs frontières efficientes de portefeuilles, chacune correspondant à une pondération différente de la composante sociale, sans filtrage social de l'univers d'investissement et de procéder à leur comparaison. Les résultats empiriques de cette recherche suggèrent que, de nos jours, être un investisseur socialement responsable demeure encore un choix coûteux.

Mots-clés: Analyse de portefeuille, responsabilité sociale, performance financière.

SUMMARY

The main research question addressed in this paper is concerned with whether being a socially responsible investor comes at a cost or not. The purpose of this research is to propose a portfolio analysis approach to address this question in an attempt to assist socially responsible investors, including portfolio managers, in making investment decisions. To be more specific, we use modern portfolio theory to construct and compare efficient frontiers of portfolios, where each portfolio is a solution to either the basic Markowitz's mathematical model or to some variant or extension of it. In other words, the basic Markowitz model used in this study consists of maximizing portfolio return subject to a constraint on the maximum acceptable portfolio risk. On the other hand, we propose an extension of Markowitz's model that takes account of a social responsibility component to generate several efficient frontiers of portfolios, each corresponding to a different weighting of the social component, without social screening of the investment universe and compare them. Our empirical results suggest that, nowadays, being a socially responsible investor is still a costly business.

Keywords: Portfolio analysis, social responsibility, financial performance.

INTRODUCTION

Corporate social responsibility has recorded since the last two decades and at the beginning of the new millennium a considerable development due mainly to the wide implication of the civil society activists whose increasing pressure on corporate and governments have led to the adoption of new compulsory regulations, especially with regard environment protection issues, good governance and shareholders' minority rights , while firms have progressively introduced in some extend moral values in their management, monitoring and production processes. Moreover, in the financial arena, socially responsible investment emerged and expanded rapidly, particularly with the apparition of ethical funds devoted to investors attaching great importance to social, moral and environmental values in the process of selection of their financial portfolios components.

In this context, academics and practitioners accompanied the movement by focusing on the various aspects of social responsibility with the purpose of better defining the attributes of this concept, checking the impact of incorporating social responsibility on the financial performance of corporates and financial portfolios or ethical funds versus conventional ones or market indices. In order to help portfolio managers and socially responsible investors in general in their decision-making process, specific or more general measures of social performance have been developed and specialized rating agencies and institutes have been created with the purpose of evaluating and rating the corporate social performance. With this regard, the KLD Ratings data base to which we rely upon in this study is certainly the most reliable measurement tool, given the exhaustiveness of the attributes retained, the corresponding weightings used, the great number of firms rated, and the regularity of its updating.

While some aspects of social responsibility concept and application seem to be more or less exhausted in the academic literature produced so far, others continue to preoccupy researchers and analysts despite the enormous and interesting studies conducted in those fields. Among those aspects, socially responsible investment through the financial markets and the comparison between financial performance and

social performance, that is, the relationship between the two remains a topic of concern in relation with the differences and ambiguities which persist with regard the outcomes of the numerous and various academic researches produced so far. This topic became all the more important that socially responsible investment records a considerable development throughout the developed nations and which is not ready to stop, on the contrary. No doubt, the methodologies adopted may explain to a large extend the differences of the results of these studies. However, it is widely admitted nowadays that there is ample empirical evidence on the existence of a relationship between corporate social performance (CSP) and corporate financial performance (CFP), which may impact the stock values in the financial markets and then the financial investment returns. Therefore, social criteria should systematically be taken into account alongside with financial criteria in assessing the overall performance of investments. Moreover, the integration of financial instruments of socially responsible corporates in the process of portfolio construction should preferably be taken into consideration by portfolio managers and individual investors.

Given the importance of this topic, we propose in this study a portfolio analysis approach to assist individual investors and portfolio managers in selecting investment vehicles which we limit to stocks only. To be more specific, we use modern portfolio theory to construct and compare efficient frontiers of portfolios, where each portfolio is a solution to either the basic Markowitz's mathematical model or to some variant or extension of it. In other words, the basic Markowitz model used in this study consists of maximizing portfolio return subject to a constraint on the maximum acceptable portfolio risk. On the other hand, we propose an extension of Markowitz's model that takes account of a social responsibility component to generate several efficient frontiers of portfolios, each corresponding to a different weighting of the social component, without social screening of the investment universe and compare them. Such methodological framework will be used to address the main research question of the study, that is, whether being a socially responsible investor comes at a cost or not.

The choice of this theme for the study seems the more relevant that we consider the main following factors:

- The financial sphere and particularly investment in the capital markets instruments has get so a great importance at the present time in terms of volume, innovation and sophistification over the world that investors have to be well aware of the transactions they may proceed at and given help to make the fair decisions.
- Capital markets has became so volatile and thus so risky that the traditional approach for investing based on the objectives of maximizing returns and minimizing risk without taking into account other stabilizing variables seems outdated.
- In the case that the existence of an evident relationship between CFP and CSP is categorically confirmed by new researches, this may help investors to take the right decisions in order to alleviate the market risks without affecting the expected returns.
- The domain of research regarding the socially responsible investment does not seem to be totally exhausted so far, and any effort to improve and clarify the researches outcomes should be welcomed by the community of investors and portfolio managers.

The remainder of this thesis is organized as follows. In **chapter 1**, we briefly survey the academic literature on social responsibility in finance and propose classifications of both research questions and methodological elements used by researchers including performance criteria and their measures. These classifications are meant to assist investors in making informed decisions with respect to their choices of criteria and measures to be used in assessing potential investment vehicles. In **chapter 2**, we outline our research proposal and describe our methodological framework. We also propose an extension of the Markowitz's model that is capable of modeling social responsibility or taking account of social performance; such model would allow us to appreciate how the addition of social responsibility criteria might affect the financial performance of portfolios. In **chapter 3**, we present our empirical results and main findings. Finally, we conclude this research and outline some future research directions.

CHAPTER I

LITTERATURE SURVEY AND CLASSIFICATION

In this section, we survey the academic literature on social responsibility in finance and propose two general classifications; namely, one for the *main research questions addressed in the literature* and the second is a *classification of the methodological elements used to address these research questions.*

1.1 MAIN RESEARCH QUESTIONS ADDRESSED IN THE SOCIAL FINANCE LITERATURE

The academic literature on social responsibility in financc evolves around two main research questions. The first one is concerned with whether a *relationship between corporate social performance (CSP) and corporate financial performance (CFP) exists or not and its direction, if any exists.* On the other hand, the second main research question is concerned with *whether social screening has an impact on portfolio performance and its diversification.* Thus, the academic literature on social responsibility in finance may be divided into two broad categories (**see Figure 1**).

1.1.1 Relationship between CSP and CFP

Studies dealing with the relationship between CSP and CFP may further be divided into three sub-categories depending on whether the relationship is ***positive, negative, or no statistically significant***. Each of these sub-categories may further be partitioned into three groups depending on the ***direction of the relationship between CSP and CFP***; namely, studies where the causal relationship is from social to financial performance; that is, CSP is used to explain CFP, studies where the causal relationship is from financial to social performance, and studies where both causal relationships are considered. One should note

that these former results can be obtained either from a single study or from a ***meta-analysis*** study.

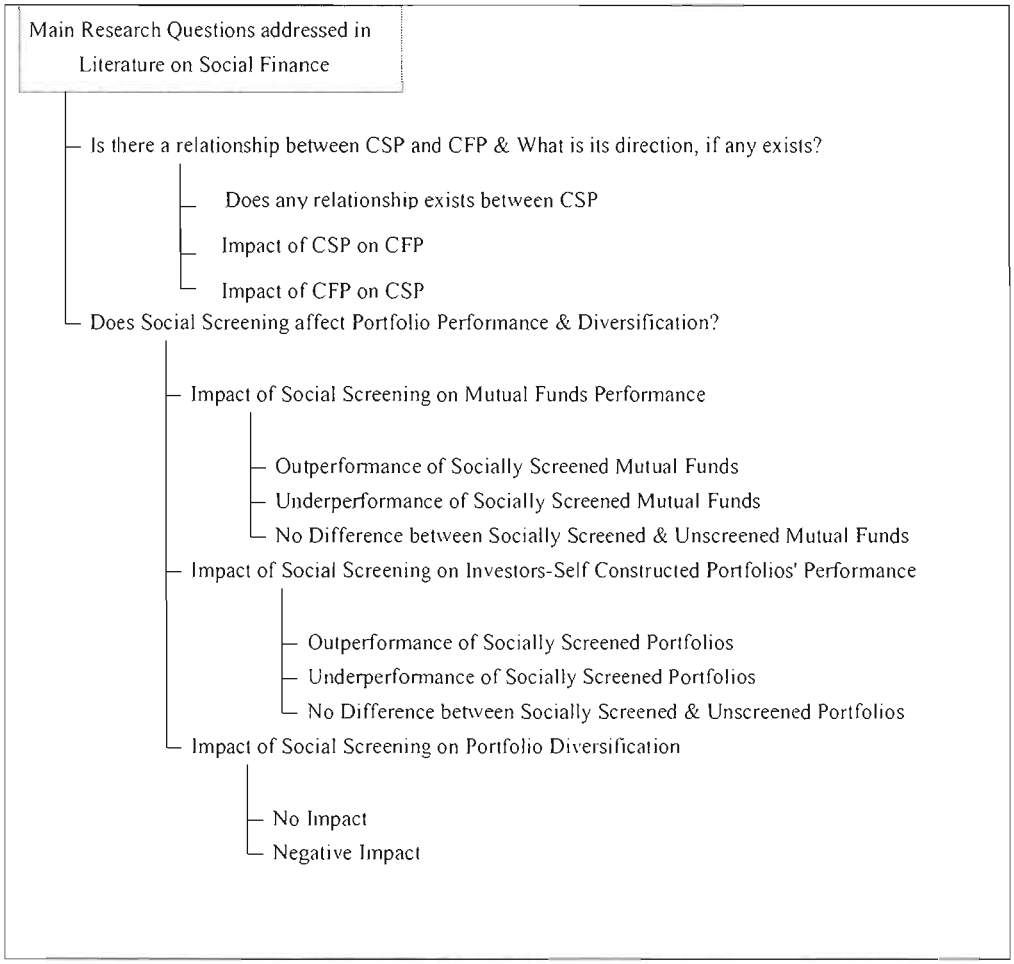

Figure 1: Classification of Literature on Social Responsibility in Finance

The literature review, relating to this first category of studies, is presented in the three following sub-sections according the aforementioned classification. It focuses on the results and measures of CSP and CFP. In sections 1.1.1.4 and 1.1.1.5, we will present some examples, respectively, of studies showing the direction of the relationship between CSP and CFP, and studies using the meta-analysis approach.

1.1.1.1 Positive Relationship between CSP and CFP

As far as the positive relationship between CSP and CFP is concerned, authors like Preston and O'Bannon (1997) adhere to the stakeholder theory arguing that CSP is positively related to CFP. To be more specific, meeting the needs of stakeholders, will ultimately lead to favorable financial performance. On the same vein, McGuire et al. (1988) supports the view that that there is a no significant cost of being socially responsible, and that firms can benefit from the loyalty of employees by improving productivity, innovation, and diminishing production costs, which are all actions that leads to more financial profitability. In the following table, we present the empirical evidence, through some studies, that confirm the stakeholders' theory:

Author(s)(year)	**Measure of CSP**	**Measure of CFP**	**Results**
Bragdon and Marlin (1972)	Pollution index developed by the Council of Economic Priorities (CEP)	EPS growth, ROE, ROC	The higher the pollution index the higher the Return on Equity (ROE)
Mc Guire and al. (1988)	Reputational Index: *Fortune magazine*: responsibility to the community and environment.	(1) Return adjusted to risk (2) alpha, (3) total return (4) ROA (5) Total assets (6) growth of sales.	(1) In the past, FP is correlated to SP, more than in the present time (2) Risk measure is correlated to SP.
Waddock and Graves (1997)	KLD weighed Index	ROA, ROE and ROS	(1) Tests results are significant: SP affects FP (hypothesis of good management) and (2) conversely, SP is affected by FP (hypothesis of available resources).
Russo and Fouts (1997)	Franklin Research and Development corp. environmental performance ratings	ROA, firm growth	(1) A high FP is associated with a high environmental performance and this relation is stronger when the industry growth increases.
Preston and O'Bannon (1997)	Three reputational indexes for the SP on the basis of	(1) ROA. (2) ROE. (3) ROI	(1) No negative correlation between SP and FP.

	Fortune survey: (1) responsibility towards community and environment. (2) Capacity to retain and select the appropriate persons. (3) Product and service quality.		(2) Strong evident positive correlation between SP and FP: complying with the Stakeholders theory. (3) Strong evidence of a positive relation between FPt and FPt-1 on one part and SPt on the other part: support the hypothesis of available funds and positive synergy.
Waddock and Graves (1999)	(1) KLD: Equi-weighed index, connected to primary PP: relationship with communities, environment, consumers and employees. (2) Management quality: *Fortune reputational data.*	(1) Total return for 10 years. (2) ROA and ROS.	(1) Strong positive relation between management performance and FP. (2) Measured by primary shareholders, SP has insignificant effect on FP.
McWilliams and Siegel (2000)	KLD Index (1991)	Research and Development (R&D)	(1) Strong correlation between SP and the intensity of R&D variable. (2) With the introduction of the R&D as a control variable, the effect is nil on FP.
Hillman and Keim (2001)	Creation of 2 equally-weighed social performance variables through KLD indexes: (1) Social issue participation. (2) stockholders' management.	Additional market value: market value - capital	(1)Positive relation between the primary shareholders (PS) management and the creation of stockholder's wealth. (2) Direction of the causality: PS management is positively related to the creation of value. (3) The use of the company resources without connection with primary PP has a negative impact on the stockholders`` wealth. (4) Direction of the causality:

			PS management is negatively related to value creation. The inverse causality is not supported in the two cases.
Jones and murrell (2001)	List of *America's Most Friendly Companies* published by Working Mother according to Moskowitz and Townsend criteria, 1994.	Change of the averaged cumulative return (opportunity window : -1,0 and -1,1)	(1) Signals are an important function of SP. (2) The effect of SP signals on FP is the more important when there are little information and when the market is less complex.
Ruf and *al.* (2001)	Multidimensional measure of SP using KLD 8 dimensions (taking into account the difference of performance between the PP).	(1) ROE (2) ROS (LT) (3) growth of sales (ST).	(1) Improvement of SP has an immediate and sustained impact on growth: comparative advantage (2) The impact on profitability is less evident in the short term; outlays reduce profits, but the effect is recorded in the periods ahead.
Simpson and Kohers (2002)	(1) Community Reinvestment Act (CRA) Index: dummy variable (0: CRA Index needs to be improved and 1 if it is exceptional). (2) Firm belonging to ASPI index (1: Yes; 0: No)	(1) ROA (dependant variable) (2) Loan losses/total loans: indicator of the success of credit function.	Positive relation between SP and FP
Verschoor and Murphy (2002)	Business Ethics lists Best Corporate Citizens according to 6 measures of SP (consumers, employees, community, environment, minorities and non US PP) and a measure of FP (total averaged return for 3 years).	(1) Classification of Business Week (6 financial criteria) (2) Classification of Fortune 500 (total operational revenue). (3) Fortune classification of the more admired	Companies implied in social and environmental stakes, which are important for their shareholders, are more financially beneficial and have a better reputation.

		companies (8 reputational attributes).	
Seifert, Morris and Bartkus (2004)	Corporate philanthropy as a dimension of SP (exclude non monetary donations).	(1) Return adjusted to industry (2) Cash-flow	(1) Available resources in the form of cash-flow have a positive impact of the firm's donations: *doing well enables doing good*. (2) No significant effect of the firm's generosity on its profits.
Tsoutsoura (2004)	(1) KLD Index (2) DSI 400: dummy variable.	(1) ROA (2) ROE (3) ROS (dependant variable)	(1) Significant positive relation between SP (DSI 400) and FP (except for ROE). (2) Significant positive relation between SP (KLD) and FP.
Parvez, Nanda and Schnusenberg (2005)	Fortune Magazine publishes a list of the 100 *Best Companies to Work For on the basis of 7 criteria*: (1) Number of employees. (2) Returns (3) Minorities percentage (4) Women percentage (5) Growth rate of labour. (6) Classification of voluntary rotation of employees. (7) Training hours per year.	(1) Averaged cumulative return.	(1) Enterprises that show a high degree of SR towards their employees are positively awarded by the market. (2) Classification within Fortune Magazine is somewhat connected to pre and post FP.
Guenster, Derwall, Bauer and Koedijk (2006)	Eco-efficiency Index (Innovest Strategic Value Advisors)	(1) ROA (2) Q of Tobin (captures the value that the investor gives to environmental policies) (3) Market return.	(1) No relation between social and environmental disclosure and the market return (2) Longitudinal study reveals a positive relation between return and the predisposition to social and environmental disclosure.

1.1.1.2 Negative Relationship between CSP and CFP

With regard to the studies concluding a negative relationship between CSP and CFP, Friedman (1970) adheres to the view that there is a significant cost of being socially responsible, and therefore, making socially responsible firms disadvantageous. More specifically, Friedman's view suggests that a company's basic social responsibility is to make as much money as possible for its shareholders. In the following table, we present the empirical evidence, through some studies, that confirm Friedman's view.

Author(s)(year)	**Measure of CSP**	**Measure of CFP**	**Results**
Vance (1975)	Reputational Index	Return/ Stock	Negative relation between Corporate Social Performance (CSP) and Corporate Financial Performance (CFP).
Kedia and Kuntz (1981)	social audit, process and outcome measures	Return on assets	Negative relation between Corporate Social Performance (CSP) and Corporate Financial Performance (CFP).
Shane and Spicer (1983)	The release of externally produced information about companies' pollution-control records: Dichotomized pollution-control Abnormal mean-adjusted performance index	Abnormal mean-adjusted returns	Negative relation between Corporate Social Performance (CSP) and Corporate Financial Performance (CFP).

1.1.1.3 No statistically significant relationship between CSP and CFP

Other academics, namely Aupperle et al (`985), Waddock and Graves (1999), and D"arcimoles and Trebucq (2002), deny the existence of any statistically significant relationship between CSP and CFP , suggesting in other words a neutral impact of socially responsible behavior of firms on their financial performance. More details on these academics' studies are reflected in the table below.

Author(s)(year)	**Measure of CSP**	**Measure of CFP**	**Results**
Aupperle et al. (1985)	Carroll's Concern for Society (economic, legal, ethical and discretionary)	Long Term (LT) and Short Term (ST) ROA (some risk-adjusted).	No statistically significant relationship between Carroll's concern for society and profitability
Waddock and Graves (1999)	(1) KLD: Equi-weighed index, connected to primary PP: relationship with communities, environment, consumers and employees. (2) Management quality: *Fortune reputational data.*	(1) Total return for 10 years. (2) ROA and ROS.	(1) Strong positive relation between management performance and FP. (2) Measured by primary shareholders, SP has insignificant effect on FP.
D`arcimoles and Trebucq (2002)	A multi-dimensional measure constructed from the arithmetic mean of 5 attributes of social responsibility of ARESE.	(1) ROA (2) ROE (3) Cash flow to sales ratio	(1) No relation between SP and FP. (2) Neutral impact of SP on FP. (3) R&D is considered an important variable with regards to the specification of the model.

1.1.1.4 Direction of the relationship between CSP and CFP

Academic research on the *causal* relation between CSP and CFP – what is sometimes referred to as the "virtuous circle"- generally concludes that the two are directly related.

For example, with regard to those studies reporting a positive relationship between CSP and CFP, Preston and O'Bannon (1997) as well as Hillman and Keim (2001) use CSP to explain CFP, McGuire et al. (1988), Kraft and Hage (1990) and Preston and O'Bannon (1997) use CFP to explain CSP, and Preston and O'Bannon (1997) and Waddock and Graves (1997) consider each variable to explain the other one.

1.1.1.5 Meta-analysis studies

Differences between studies explain the disparity in the results across the studies. These differences are either reflected in the relationship between CSP and CFP or in the nature of the research process. The main objective of meta-analysis studies, therefore, is to assess the competing claims made about the impact of CSP on CFP. More details on some of these meta-analysis studies are reflected in the table below.

Author(s)(year)	Measure of CSP	Measure of CFP	Results
Griffin and Mahon (1997)	(1) Reputational Index: Fortune reputation. (2) KLD (3) Selection (4) Corporate Philanthropy.	(1) ROE. (2) ROA. (3) Size: Log of sales. (4) Age of assets. (5) ROS (-5 years).	(1) Positive relation between SP and FP (2) The use of a priori measures (perceptual method) allows for the predetermination of the relation between SP and FP: KLD and Fortune Survey connected to the FP measures. (3) Selection and Corporate philanthropy are not correlated to FP measures.
Orlitsky, Schmidt, and Reynes (2003)	(1) Reputational Indexes, (2) Social information disclosed by firms, (3) Social audits, (4) Corporate behaviour, values and pledges (5) Philanthropic contributions, (6) Environmental information disclosed, (7) governance	Return on assets, return on equity, market returns, and sales growth	(1) Positive relation between SP and FP through different industries and contexts of studies. (2) The positive relation changes because of contingent factors (effect of reputation, measures of SP and FP). (3) SP better predicts FP with accounting measures than the market. (4) Bidirectional positive relation between SP and FP.

Meng-Ling Wu (2006)			1) Studies using market measures reveal a weaker relation between SP and FP than those using profitability measures, assets measures and growth. (2) No significant relation between size and the FP. (3) No relation between SP and size. (4) Size effect on FP is more important when using Fortune Index rather than KLD Index.

1.1.2 Social screening of investments and portfolio analysis

The second category of studies on social responsibility in finance is concerned with studies on social screening of investments and portfolio analysis (see Figure 1), where social screening is implemented through exclusion rules such as operating in a specific sector of industry; for example, gambling (e.g., Sauer, 1997; Stone et al., 2002), through additional constraints; say on the minimum acceptable score on social responsibility as measured, for example, by an index (e.g., Dupré, Girerd-Potin and Kassoua, 2004), or by using a classification made available by some authority in the field (e.g., Brammer, Brooks and Pavelin, 2006). This category may be partitioned into three sub-categories; namely, studies concerned with the impact of social screening on mutual funds performance, studies focusing on the impact of social screening on portfolio managers- and authors-self constructed portfolios, and finally studies assessing the impact of social screening on portfolio diversification.

1.1.2.1 Impact of Social Screening on Mutual Funds Performance

The studies of the first sub-category are devoted to researches that compare the performance of socially responsible mutual funds with the performance of either conventional mutual funds or the market; in sum, researches within this sub-category is concerned with whether social screening has an impact on mutual funds performance.

This sub-category may further be divided into three groups depending on whether there is ***no impact***; that is, social screening does not make any difference in performance, there is an impact and such impact is ***positive***, or there is an impact and it is ***negative***.

1.1.2.1.1 No impact

Author(s)(year)	Measure of CSP	Measure of CFP	Results
Hamilton, Jo and Statman (1993)	The authors give only an insight of the principal social criteria without determining which ones they are going to use in order to form the SRMF.	Excess market return using the Alpha of Jensen, standard deviation	• No significant relationship between the return of SRMF and CF • The excess return of SRMF is not statistically significant.
Travers (1997)	The authors give only an insight of inclusion and exclusion criteria	Return	• International socially responsible portfolio offer attractive returns. • The return of International socially responsible portfolio is superior to the return of MSCI EAFE. • Nevertheless, the return of International socially responsible portfolio is not different from the return of international non-socially responsible portfolio.
Sauer (1997)	The Domini Social Index (DSI) – strongest on the environment. Exclusion criteria: alcohol, tobacco, gambling, nuclear power, military	Average monthly return, Variance, Jensen's alpha, and Sharpe index	• The application of social responsibility screens does not necessarily have an adverse impact on investment performance. • The performance of the Domini Social Equity Mutual Fund compares favorably to the performance of the Vanguard S&P 500 Index and Vanguard Extended Market Index Mutual

			Funds which suggests that application of social-responsibility investing is accessible to the individual investor.
Grieb at al. (1998)	The authors do not describe how investors use social screening to form their SRMFs.	Average monthly return, standard deviation, Sharpe ratio	• Social responsibility characteristics are not priced by the market. • No significant relationship between the return of SRMF and CF
Bauer et al. (2002)	The authors do not describe how investors use social screening to form their SRMFs.	Return, standard deviation, fund expense ratio	• No significant relationship between the return of SRMF and CF
Stone et al. (2002)	4 KLD screens: alcohol, tobacco and gaming; environmental; defense; and nuclear power.	Forecasted security return which is a function of four value variables: the earnings-price ratio, the cash-price ratio, the sales-price ratio, and the book-price ratio	• There is no significant costs to social screening in sub-periods of the 1984-'97 period

1.1.2.1.2 Positive impact

Author(s)(year)	**Measure of CSP**	**Measure of CFP**	**Results**
Luther et al. (1992)	Varies depending on the fund	Fund returns	There is weak evidence that of some outperformance, on a risk-adjusted basis, by ethical unit trusts.
Luther and Matatko (1994)	Varies depending on the fund	Fund returns	ethical trusts have returns which were at least as highly correlated with a small-company index as with a comprehensive market index

Mallin et al. (1995)	Varies depending on the fund	Fund returns	The trend is in favourable to ethical funds.
Cummings (2000)	Varies depending on the fund	Fund returns	Ethical trusts performance slightly outperform their respective average industry indexes
Derwall et al. (2003)	Selection criteria are mainly environmental	Fund returns	High-ranked portfolio outperform Low-ranked portfolios after adjusting for risk and investment style
Vermeir and Corten (2005)	A sustainability score as the summation of the scores of each of the following criteria that are assigned by viego agency: Human resources, environment, Customers and suppliers, Community and society, corporate governance	Return	High-sustainability rated portfolios have performed better than low-ranked portfolios on a style adjusted basis.

1.1.2.1.3 Negative impact

Author(s)(year)	**Measure of CSP**	**Measure of CFP**	**Results**
Hoggett and Nahan (2002)	Varies depending on the fund	Fund returns	Ethical funds generally under-perform when compared with the market

With respect to this category of studies, it is worth noting that different conclusions on the impact of social screening might be reached depending on whether one adjusts for risk or not (Edwards and al., 2003), which suggest that from a practical perspective one has to take risk into account to avoid any surprises!

1.1.2.2 Impact of social screening on portfolio managers- and investors-self constructed portfolios

The studies of the second sub-category are concerned with the impact of social screening on portfolio managers- and authors-self constructed portfolios, where such impact is established by comparing returns on these socially responsible constructed portfolios with those on a market index such S&P 500, NYSE, and FTSE All-Share Index. Again this sub-category of studies may be further divided into groups depending on whether the social screening impact is negligible (Rudd, 1979; Travers, 1997), non-negligible and positive (Grossman and Sharpe, 1986; Cohen, Fenn and Konar, 1997; Dupré et al., 2004; Bauer et al., 2005), or non-negligible and negative (Brammer et al., 2006). Note however that a negligible social screening impact might result from a lack of an effective system to drive corporations to take socially responsible actions; for example, by imposing non-negligible penalties or financial costs to corporations that neglect their social responsibilities.

1.1.2.3 Impact of social screening on portfolio diversification

With regards to the third sub-category of studies; that is, those studies concerned with the impact of social screening on portfolio diversification, it may be divided into two groups depending on the conclusions reached by these studies; namely, social screening has no impact on portfolio diversification (Bello, 2005) and social screening has a negative impact on portfolio diversification (Kurtz, 1997; Rudd, 1981; Girard et al., 2005).

1.1.3 Conclusion

To conclude with the classification of research questions related to social responsibility the reader is reminded that although the above two questions are different, they are closely related in that elements of answer to each of them could be used to gain more insight into the other.

1.2 Methodological frameworks, performance criteria and their measures, and benchmarks

In addressing the above-mentioned research questions, several methodological elements have been used by researchers (see Figure 2); namely, methodological frameworks, performance criteria and their measures, and benchmarks.

1.2.1 Methodological frameworks

As far as methodological frameworks are concerned, they may be divided into two broad categories; namely, *statistical analysis* and *mathematical programming-based analyses*.

The statistical analyses category may further be divided into four sub-categories: *correlation analysis, regression analysis, structural equation modeling analysis, statistical hypotheses testing*, and *event studies*. On the other hand, mathematical programming-based analyses category may further be divided into two sub-categories: *portfolio analysis* and *data envelopment analysis*.

Studies using these different kinds of methodologies are reported in the sub-sections below with a brief description of the research question/issue and the methodology adopted.

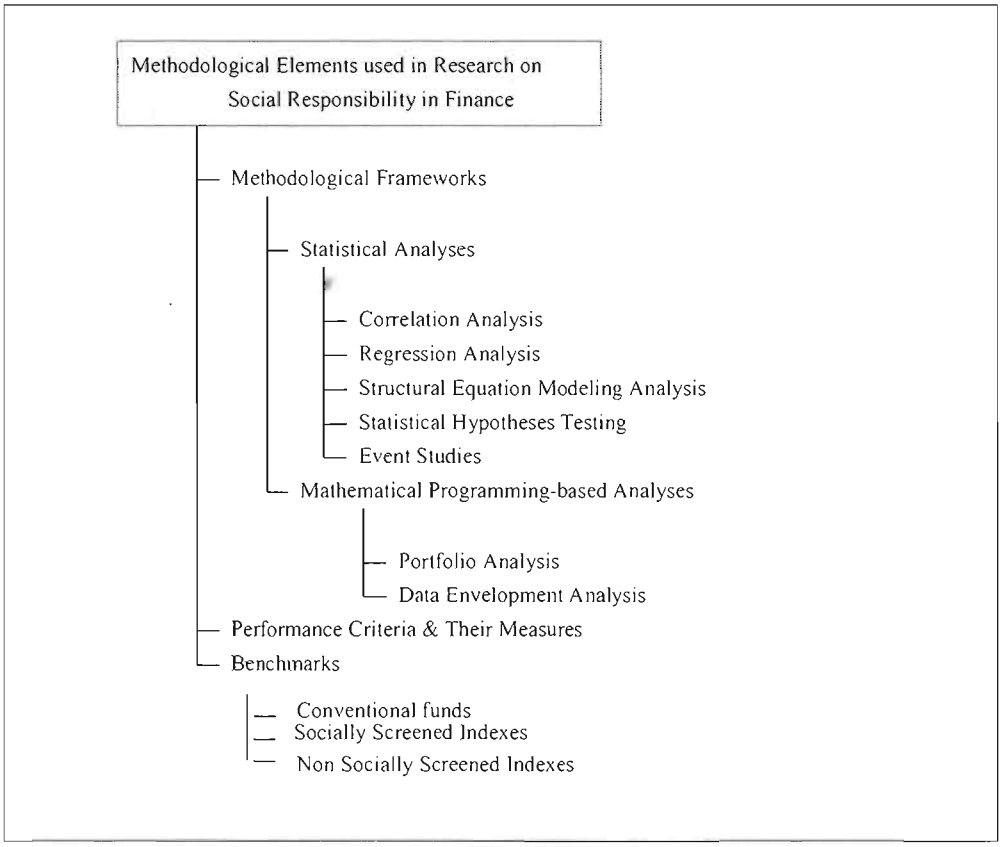

Figure 2: Classification of Methodological Elements used by Researchers on Social Responsibility in Finance

1.2.1.1 Statistical analysis

1.2.1.1.1 Correlation analysis studies

Author(s)(year)	Research question/issue	Methodology
Aupperle et al. (1985)	Examining the relationship between Corporate Social Responsibility and Profitability	• Each Carroll's concern for society component is assigned a different weight depending on CEO's orientations. • Carroll suggested a weighting of 4-3-2-1 to the economic, legal, ethical, and discretionary component, respectively. • Correlating orientation toward social responsibility, concern for society, and profitability
Mc Guire and al. (1988)	Assessing the causal relation between Social Performance (SP) and Financial Performance (FP)	Correlation analysis and multivariate analysis.
Waddock and Graves (1997)	Assessing the causal relationship between Social Performance (SP) and Financial Performance (FP) (virtuous circle)	Multivariate analysis: correlation analysis
Russo and Fouts (1997)	Assessing the relation between environmental performance and FP.	Multivariate analysis: correlation analysis
Preston and O`Bannon (1997)	Assessing the causal relation between SP and FP: what is the most often observed relation between SP and FP and how to explain it.	Correlation analysis
Waddock and Graves (1999)	Assessing the relationship between the variable 'relation with shareholders', as a dimension of Social Responsibility (SR), and FP.	Multivariate analysis: correlation analysis
McWilliams and Siegel (2000)	Assessing the causal relation between SP and FP.	Multivariate analysis: correlation analysis

Ruf and *al.* (2001)	Assessing the impact of SP on FP by answering the following question: how SP change may affect FP change (ΔPS-ΔPF).	Multivariate analysis: correlation analysis
Moore (2001)	Assessing the causal relation between SP and FP over time.	Correlation analysis
D'arcimoles and Trebucq (2002)	Assessing the causal relation between SP and FP on the basis of a French enterprises sample: existence, sign and direction of the relation.	Multivariate analysis: correlation analysis
Tsoutsoura (2004)	Assessing the relationship between SP and FP and test the sign of the relation.	Multivariate analysis: correlation analysis
Nelling and Webb (2006)	Assessing the causal relationship between SP and FP	(1) Causal Model of Granger with fixed effects (2) Tobit regressions.
Guenster, Derwall, Bauer and Koedijk (2006)	Assessing the relation between environmental performance and FP.	Cross section: multivariate analysis. Longitudinal study.
Murry, Sinclair, Power and Gray (2006)	Assessing if there exists a relationship between social and environmental disclosure and FP (Stock market performance) of the British biggest enterprises.	(1) Pearson correlation: studying of the degree of linearity; (2) Statistics chi-square: explore the existence of non linearity; (3) model of linear regression.

1.2.1.1.2 Regression analysis studies

Author(s)(year)	**Research question/issue**	**Methodology**
Vance (1975)	Assessing the relationship between the Corporate Environmental Performance (CEP) and the Corporate Financial Performance (CFP).	Linear regression
Mc Guire and al. (1988)	Assessing the causal relation between Social Performance (SP) and Financial Performance (FP)	Regression analysis.

Waddock and Graves (1997)	Assessing the causal relationship between Social Performance (SP) and Financial Performance (FP) (virtuous circle)	Multivariate analysis: regression analysis
Russo and Fouts (1997)	Assessing the relation between environmental performance and FP.	Multivariate analysis: regression analysis
Waddock and Graves (1999)	Assessing the relationship between the variable 'relation with shareholders', as a dimension of Social Responsibility (SR), and FP.	Multivariate analysis: regression analysis
McWilliams and Siegel (2000)	Assessing the causal relation between SP and FP.	Multivariate analysis: regression analysis
Russo and Fouts (1997)	Assessing the relation between environmental performance and FP.	Multivariate analysis: regression analysis
Ruf and *al.* (2001)	Assessing the impact of SP on FP by answering the following question: how SP change may affect FP change (ΔPS-ΔPF).	Multivariate analysis: regression analysis
Hillman and Keim (2001)	Assessing the causal relation between SP and FP. More precisely, test the relation between the stockholders wealth management of shareholders and their participation in the social stakes.	Regression lagged effect
Barnett and Salomon (2002)	Does the number of selection criteria affect the financial performance?	Multivariate analysis: regression analysis
Simpson and Kohers (2002)	Assessing the relationship between SP and FP in the banking sector.	Multivariate analysis: regression analysis

D'arcimoles and Trebucq (2002)	Assessing the causal relation between SP and FP on the basis of a French enterprises sample: existence, sign and direction of the relation.	Multivariate analysis: regression analysis
Tsoutsoura (2004)	Assessing the relationship between SP and FP and test the sign of the relation.	Multivariate analysis: regression analysis
Parvez, Nanda and Schnusenberg (2005)	Assessing the relationship between the degree of firm's responsibility and its performance: examine the market reaction at the announcement by Fortune Magazine of the list of the 100 *Best Companies to Work For*.	Multivariate analysis (regression of return in surplus on the specific variables of firms.
Murry, Sinclair, Power and Gray (2006)	Assessing if there exists a relationship between social and environmental disclosure and FP (Stock market performance) of the British biggest enterprises.	(1) Pearson correlation: studying of the degree of linearity; (2) Statistics chi-square: explore the existence of non linearity; (3) model of linear regression.
Nelling and Webb (2006)	Assessing the causal relationship between SP and FP	(1) Causal Model of Granger with fixed effects (2) Tobit regressions.

1.2.1.1.3 Structural equation modeling analysis studies

Author(s) (year)	**Research question**	**Methodology**
Seifert, Morris and Bartkus (2004)	Assessing the causal relationship between SP (philanthropy) and FP.	Structural equations (AMOS)

1.2.1.1.4 Statistical hypotheses testing studies

Author(s) (year)	**Research question**	**Methodology**
Simpson and Kohers (2002)	Assessing the relationship between SP and FP in the banking sector.	Multivariate analysis: regression analysis
Verschoor and Murphy (2002)	Are companies that are socially and environmentally responsible benefit more in terms of financial performance?	Classification: Mann-Whitney U tests

1.2.1.1.5 Event studies

Author(s) (year)	Research question	Methodology
Jones and murrell (2001)	Assessing how public recognition of SP of a company may be considered as a positive signal of its FP.	Event study
Parvez, Nanda and Schnusenberg (2005)	Assessing the relationship between the degree of firm's responsibility and its performance: examine the market reaction at the announcement by Fortune Magazine of the list of the 100 *Best Companies to Work For*.	Multivariate analysis (regression of return in surplus on the specific variables of firms.

1.2.1.2 Mathematical programming-based analyses

1.2.1.2.1 Portfolio analysis studies

Author(s) (year)	Research question	Methodology
Dupré, Girerd-Potin and Kassoua (2004)	What is the cost of social screening?	• The aim is to build efficient portfolios with and without a social criterion and to calculate the financial risk of an ethical choice. • The first phase was to construct efficient portfolios for companies rated by ARESE ignoring the ethical component. For this, the authors used an optimization program of the type of Markowitz where only the expected return and the variance are taken into account. • The second phase was to use the same methodology, but this time, adding an additional constraint to the model, namely the ethical constraint. • This ethical constraint is

		viewed in two ways: • By excluding shares with a score below 2 out of 4. • By introducing a social score in the function to be optimized. • Comparing the two efficient frontiers with and without the exclusion criteria.

1.2.1.2.2 Data envelopment analysis studies

Author(s) (year)	Research question	Methodology
Basso and Funari (2003)	Which DEA models are more appropriate to use to assess the relative performance of ethical mutual funds?	• The authors propose a DEA approach to ethical mutual funds performance analysis • Two DEA models were proposed to capture the ethical component of the investment, where the first one uses a binary variable to describe a mutual fund as ethical or non-ethical, whereas the second one uses general categorical variables to model situations where a mutual fund could be classified, for example, as highly ethical, medium, or low. • Both models consider a cost component, as measured by subscription and redemption costs, and a risk component as inputs, where risk could be measured by the standard deviation of returns, the semi-variance of returns, or the beta coefficient. On the other hand, they use returns and an ethical behavior component as outputs.
Vitaliano and Stella (2006)	Does the achievement of an outstanding rating from bank regulators in making home mortgage loans in low and moderate	• A DEA approach was used. The authors use an input oriented cost minimization model under the variable to scale assumption to determine the cost efficiency of each large savings bank.

	income neighborhoods involves a significant cost?	• They consider 4 inputs; namely, loanable funds (primarily deposits), equity capital, labor, and office capital (i.e., premises and equipment). They consider 4 outputs; 3 desirable; namely, mortgage loans, non-mortgage loans, and investments, and 1 undesirable; namely, loan risk.

1.2.2 Performance criteria and their measures, and benchmarks

Within these methodological frameworks, several performance criteria and measures have been used by both academics and professionals. These criteria and their measures are classified in **Figures 3 and 4**, respectively, and surveyed hereafter. Performance criteria may be divided into two broad sub-categories; namely, **financial criteria** and **non-financial criteria (see Figure 3)**. Financial criteria are further divided into two groups; namely, **accounting-based criteria** and **market-based criteria**. On the other hand, non-financial criteria may be further divided into two groups; namely, **operations-related criteria** and **social-oriented criteria**. Each of these later two groups of criteria could be further divided according to whether the criteria are **internal environment related** or **external environment related**.

Note that some of these criteria might be used as inclusion or exclusion criteria to allow investors to express their values and preferences by discarding some investment possibilities from further consideration. For example, one might use the sector of activities as an exclusion criterion such as alcohol, tobacco, or gambling industries. To the best of our knowledge, the literature on social performance does not take account of supply chain or operations-oriented criteria.

As far as financial criteria are concerned, most contributions use both accounting-based criteria such as profitability and asset utilization, and market-based criteria such as stock valuation, where the **profitability** criterion is measured by metrics such as Return on Equity (e.g., Bragdon and Marlin, 1972; Waddock and Graves, 1997; Griffin and Mahon, 1997, Preston and O'Bannon, 1997; Ruf et al., 2001; D'arcimoles and Trebucq, 2002; Tsoutsoura, 2004), Return on Sales (e.g., Waddock and Graves, 1997; Griffin and Mahon, 1997; Waddock and Graves, 1999; Ruf et al., 2001; Tsoutsoura, 2004), Earning per Share

(Moore, 2001), Price to Earnings ratio (e.g., Bowman and Haire, 1975; Heinze, 1976; Chen and Metcalf, 1980), Profit margin (e.g., Heinze, 1976; Parket and Eilbirt, 1975), Net Income (e.g., Parket and Eilbirt, 1975), Operating Earnings to Sales ratio (e.g., Heinze, 1976; Spicer, 1978; Cochran and Wood, 1984), Return on Capital (e.g., Bradgon and Marlin, 1972; Moore, 2001), Earnings per Share growth (e.g., Bradgon and Marlin, 1972), Sales growth rate (e.g., Heinze, 1976) or Earnings per Share growth relative to industry (e.g., Sturdivant and Ginter, 1977), the **asset utilization** criterion is measured by

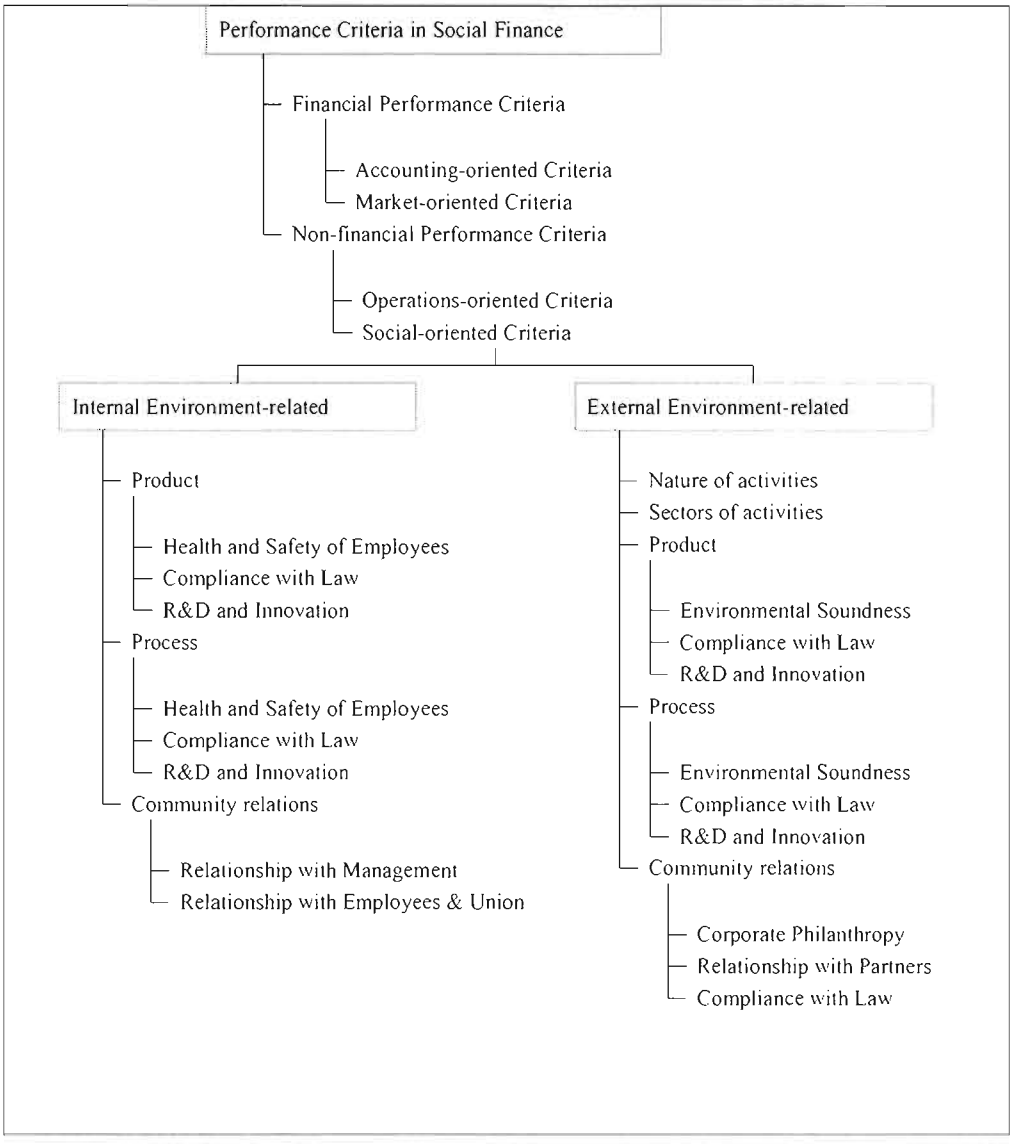

Figure 3: Classification of Performance Criteria in Social Finance

metrics such as Return on Assets (e.g., Vance, 1975; Aupperle et al., 1985; Mc Guire et al., 1988; Waddock and Graves, 1997; Russo and Fouts, 1997; Griffin and Mahon, 1997; Preston and O'Bannon, 1997; Graves and Waddock, 1999; Simpson and Kohers, 2002; Tsoutsousa, 2004; Nelling and Webb, 2006; Guenster et al., 2006) or Operating earnings to Assets ratio (e.g., Cochran and Wood, 1984), and the **stock valuation** criterion is measured my metrics such as changes of price per share plus dividends (e.g., Abbott and Monsen, 1979), market return on security adjusted for risk (e.g., Alexander and Buchholz, 1978; Mc Guire and al., 1988), excess market return of stock (e.g., Belkaoui, 1976), monthly stock returns (e.g., Anderson and Frankle, 1980), changes in price per share (e.g., Anderson and Frankle, 1980), abnormal mean-adjusted return (Shane and Spicer, 1983) and Tobin's Q (e.g., Guenster et al., 2006).

Finally, as outlined in **Figure 3**, the social criteria concerned with the internal environment of the corporation may be further divided into product-related criteria, process-related criteria, and community relations criteria, which mainly deal with the relationships with management and employees, where the criteria related to the relationship with employees may further be divided into social advantages (e.g., health care facilities and services including insurance, training and education program, career advancement and promotion program, mass transportation and commuting of employees, childcare program and centres, housing program, food program, vacation and holidays program, maternity and paternity leave programs, sick leave program, job security programs, employee stock ownership and profit sharing program, retirement benefits and income program, Employment of the Disabled Program), human or labour rights (e.g., equal treatment of employees across categories such as workers, women, and ethnical minorities; exploitation of children; respect of cultural differences; respect of intellectual property) and compliance with law with regards to several issues (e.g., remuneration, discrimination). On the other hand, criteria related to the characteristics of both the products produced by the corporation and its production process(es) and their social impact on the internal environment of the corporation may further be divided into criteria concerned with employees' health and safely, criteria having to do with the corporation compliance with law, and criteria reflecting the benefits of innovation through research and development. The social criteria concerned with the external environment may also be divided into several sub-criteria; namely, nature of corporation activities (e.g., military

vs. civil; polluting vs. environment friendly), sector(s) of activities the corporation is involved in (e.g., nuclear energy, gambling, tobacco, alcohol, adult entertainment, firearms), product-related criteria (e.g., environmental soundness and recycling, compliance with law regarding consumers and competition; that is, antitrust laws, benefits of innovation through research and development), process-related criteria (e.g., environmental soundness and pollution prevention, compliance with law, benefits of innovation through research and development) and community relations (e.g., corporate philanthropy, relationship with partners, compliance with law). As far as the corporation relationship with the external environment community is concerned, corporate philanthropy, relationship with partners, and compliance with law are multidimensional sub-criteria. In fact, corporate philanthropy could reflect the corporation's support of education or educational institutions, health and community welfare agencies, cultural activities, recreational programs, job creation, etc. On the other hand, the corporation relationship with its partners depends on the specific categories of partners the corporation has to deal with. For example, the criteria regarding the corporation relationship with its shareholders could reflect corporate governance issues such as the extent to which the management of the corporation welcomes socially responsible resolutions, etc. The social criteria related to the corporation relationship with its suppliers could reflect whether the corporation requires them to adhere to a specific code of conduct with respect to issues related to prevention measures against pollution, employees working conditions, etc. Finally, compliance with law could reflect whether the corporation pays taxes to the different levels of government, whether the corporation has any tax disputes with the government, whether its management complies with law regarding shareholders' voting rights, etc. In sum, the number of sub-criteria to use in practice – or equivalently, the extent to which a classification like this may be refined – depends on the extent to which one wants to take into account the views of different groups within the internal and the external environments of the corporation as well as the extent to which one wishes to compensate a corporation for doing more than the minimum as required by law; for example, minimum requirements with respect to both health and safety of consumers and environmental soundness of products are usually set by law; however, assessing them explicitly encourages the corporation to do better than the minimum.

As to the assessment of the social behaviour of a corporation or a portfolio of financial assets, several metrics have been proposed to measure social-oriented criteria (**see Figure 4**). These metrics may be divided into several categories depending on, for example, the extent to which the multidimensional nature of social responsibility is taken into account. In fact, some measures are one attribute of social responsibility oriented (e.g., Rudd, 1979; Grossman and Sharpe, 1986; Cohen et al., 1997; Bauer and al., 2005), whereas others are several attributes oriented (e.g., Guerard et al., 1997; Hutton et al., 1998; Dupré et al., 2004; Van de Velde et al., 2005; Brammer et al., 2006). The literature might also be classified into two categories depending on whether the focus of the measure is general such as KLD Ratings (Waddock and Graves, 1997, 1999; Mc Williams and Siegel, 2000; Hillman and Keim, 2001; Ruf and al., 2001; Tsoutsoura, 2004; Nelling and Webb, 2006) or area-specific such as environment. Example of area-specific measures are the indices proposed by the Council of Economic Priorities (Bragdon and Marlin, 1972; Russo and Fouts, 1997), Franklin Research and Development Environment Performance Ratings (Russo and Fouts, 1997), Pollution Control Records (e.g., Spicer, 1978; Shane and Spicer, 1983), Complying with Air Pollution Regulation (e.g., Marcus and Goodman, 1986), Annual Report Pollution Disclosure Index (Freedman and Jaggi, 1982), Pollution Control Expenditures in Firms Annual Reports (Belkaoui, 1976) and Eco-efficiency Index (e.g., Guenster et al., 2006). Finally one might classify these measures based on their degree of objectivity into **behavioural measures**, also referred to as outcome-based measures, and **perceptual measures** and their extensions. Examples of behavioural measures are the Generosity Index (e.g., Seifert, Morris and Bartkus, 2004) and the Toxic Release Inventory Index (e.g., Bragdon and Marlin, 1972; Chen and Metcalf, 1980). On the other hand, examples of perceptual measures and their extensions are: KLD Measure (e.g., McWilliams and Siegel, 2000; Ruf and *al.*, 2001; Tsoutsoura, 2004; Nelling and Webb, 2006), Waddock and Graves Index (Waddock and Graves, 1997), Reputational Indices such as Moskowitz Ratings (e.g., Sturdivant and Ginter, 1977; Cochran and Wood, 1984; Jones and murrell, 2001), Fortune Reputation Index (e.g., Mc Guire and al., 1988; Griffin and Mahon, 1997; Preston and O'Bannon, 1997), Carroll's Concern for Society Ratings (e.g., Aupperle et al., 1985), and National Affiliation of Concerned Business Students Ratings of Social Involvement (e.g., Heinze, 1976).

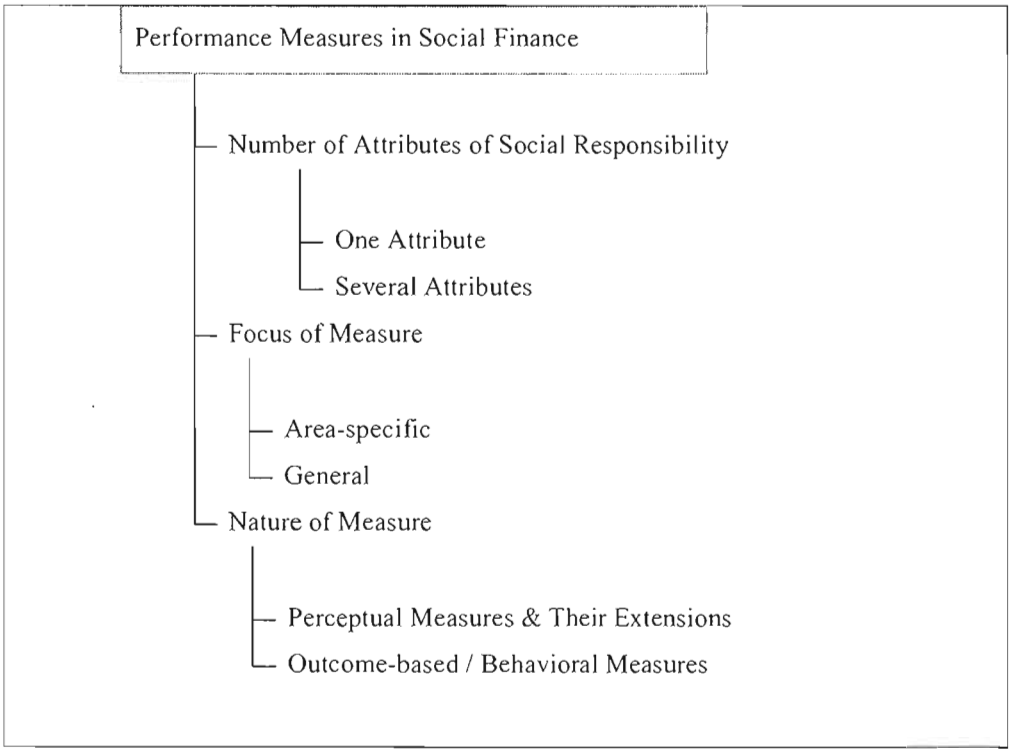

Figure 4: Classification of Performance Measures in Social Finance

In the literature, most measures have been designed using the same methodological framework, which consists of the following four main steps:

1. Choose a set of social criteria that reflect the decision maker social values;
2. Gather either perceptual information or scores on each criterion using a questionnaire with an ordinal scale or numerical data on the performance of the corporation on each criterion depending on whether one is concerned with designing a perceptual measure or a behavioural one;
3. Choose an appropriate weighting scheme;
4. Compute a weighted "combination" of the data elements gathered in the previous step.

Note that , in practice, the most commonly used tools to gather information and collect data necessary to implement the above mentioned measures of social performance are the **forced-choice survey instruments** (e.g., Aupperle, 1984, 1991), also used to measure the

corporate social orientation of executives, **content analysis** of annual reports (e.g., Wolfe, 1991), also used to measure written expressions of corporate social attitudes, and **case studies** along with the stakeholder management model (Clarkson, 1991) are used to measure corporate social programs and policies. Note also that, in practice, the evaluation exercise of CSP is done by means of the corporate social audit, also referred to as the social impact audit (e.g., Wokutch and Mckinney, 1991).

Regarding the third and last methodological element of the literature; that is, benchmarking, the most commonly used benchmarks are indexes. Indexes used within studies related to social responsibility may be divided into three broad categories; namely, socially screened indexes, non-socially screened indexes, and conventional funds. Examples of socially screened indexes include the indexes developed by the Council of Economic Priorities (e.g., Bragdon and Marlin, 1972) and the Franklin Research and Development Environment performance ratings (e.g., Russo and Fouts, 1997), the annual report pollution disclosure index (Freedman and Jaggi, 1982), the eco-efficiency index (e.g., Guenster, Derwall, Bauer and Koedijk, 2006), the Fortune reputation index, the Domini Social Index (DSI), the Calvert Social Index (CSI), the Citizens Index (CI) and the Dow Jones Sustainability Index (DJSI), with DSI, CSI, CI and DJSI being the most commonly used socially screened indexes. Obviously, the decision as to what index to use as a benchmark depends on the relative weights that one assigns to different criteria or dimensions of corporate social responsibility. For example, one would choose DSI if he or she put more emphasis on environment, CSI if more emphasis is put on corporate governance, and CI if corporate governance, employee relations, diversity, environment, and human and animal rights are privileged dimensions. As far as the design of these commonly used indexes is concerned, one needs to be aware that DSI, CSI and CI use some industries related to alcohol, tobacco, gambling, nuclear power, and military as exclusion criteria, whereas DJSI does not exclude all firms belonging to these industries as such but rather includes the best performing companies in each industry with respect to economic, environmental, and social criteria as well as industry-specific sustainability trends; in sum, the aim of this index is to reduce the cost and risks associated with social responsibility. On the other hand, examples of non-socially screened indexes include market indexes such as S&P 500 (Edwards and al., 2003) and the Chicago Center for Research in Security Prices Value Weighted Market Indexes (Sauer, 1997). With regards to conventional funds, those funds vary depending on the selected social criteria.

1.2.3 Literature review conclusion

In summary, our review of the literature on corporate social responsibility in finance reveals the existence of ample empirical evidence on the existence of a relationship between CSP and CFP. However, whether the relationship between CSP and CFP is positive or negative and whether it is strong or weak seem to depend on the dimensions of the constructs taken into account, the metrics used to measure these dimensions or criteria, the sample of organizations under consideration, and the time period covered by the data sample. Methodological frameworks as well as the benchmarks used by researchers might also have contributed to this difference in conclusions. Finally, we would like to stress out the fact that, as far as academic research is concerned, one needs to be aware that both the criteria or dimensions as well as the weighting schema used to compute measures such as the KLD one as well as the popular social indexes do vary in time and this may introduce another important bias.

CHAPTER II

RESEARCH PROPOSAL AND METHODOLOGY

2.1 Research Proposal

The main research question addressed in this paper is concerned with whether choosing to invest in a socially responsible fashion is a costly decision or not. As highlighted in the previous section, several authors attempted to address this question using different methodological frameworks, where correlation and regression analyses frameworks prove to be the most popular in finding out whether a relationship between CSP and CFP exists and its direction, if any. Benchmarking seems to be the second most popular approach to address this question when one is concerned with financial portfolios, including mutual funds, and the extent to which these portfolios' performance is affected by social screening. To the best of our knowledge, the only portfolio analysis approach to address this question that is mathematical programming-based is due to Dupré et al. (2004). These authors use a basic Markowitz's mathematical program to generate efficient frontiers of portfolios with and without social screening of the investment universe and compare them; to be more specific, the Markowitz model used by the authors consists of maximizing portfolio return subject to a constraint on the maximum acceptable portfolio risk. On the other hand, they propose an extension of Markowitz's model that takes account of a social responsibility component to generate several efficient frontiers of portfolios, each corresponding to a different weighting of the social component, without social screening of the investment universe and compare them. Using French data, they conclude that social responsibility comes at a cost. However, their results are industry-biased, what they refer to as efficient frontiers are actually risk-return relationships, the so-called efficient frontiers are made of only ten portfolios, and no formal statistical tools are used to compare these so-called efficient frontiers. In this paper we intend, on one hand, to overcome some of these methodological drawbacks. On the other hand, we intend to assess the extent to which different approaches to take account of social responsibility could have on conclusions. In the remainder of this section, we describe and discuss our methodological framework.

As far as data is concerned, our sample includes all the companies rated on social performance by Kinder, Lydenberg and Domini (KLD), but (1) companies no more listed in COMPUSTAT database at any time within our period of study (1992-2006), (2) companies that, for some reason, ceased to exist at some point in time within our period of study (e.g., went bankrupt or have been bought by other companies), (3) companies without enough historical data to compute monthly returns adjusted for dividends; that is, with less than sixty months of relevant history of monthly market prices of stocks, recorded at the closing session of the stock exchange on the last day of each month, and ex-dividend amounts paid monthly, (4) companies with stock prices less than U.S. $2, referred to as penny stocks, and (5) companies considered as outliers in that their stocks average monthly returns adjusted for dividends over a period of 60 months preceding each year of the overall period of study (1992-2006) exceeds 500%. Note that penny stock companies are usually small companies whose market capitalization and liquidity are weak; thus, leading to speculation, price manipulations, frauds, etc. Therefore, we discarded these companies to avoid any bias resulting from considerable and erratic monthly fluctuations. Recall that KLD rates companies based on eight equally weighted broad dimensions of social performance (see figure 5). In sum, each dimension is rated separately with regards to its "strengths" and its "concerns" and a global rating – as measured by an equally weighted sum of the eight KLD attributes – is assigned annually to each company in the database. The reader is referred to Table 1 for detailed counts of our final sample data ranging from 409 to 2244. At this stage, we would like to draw the reader attention to the fact that the sample size of each year is large enough to allow for interesting results and appropriate statistical sampling.

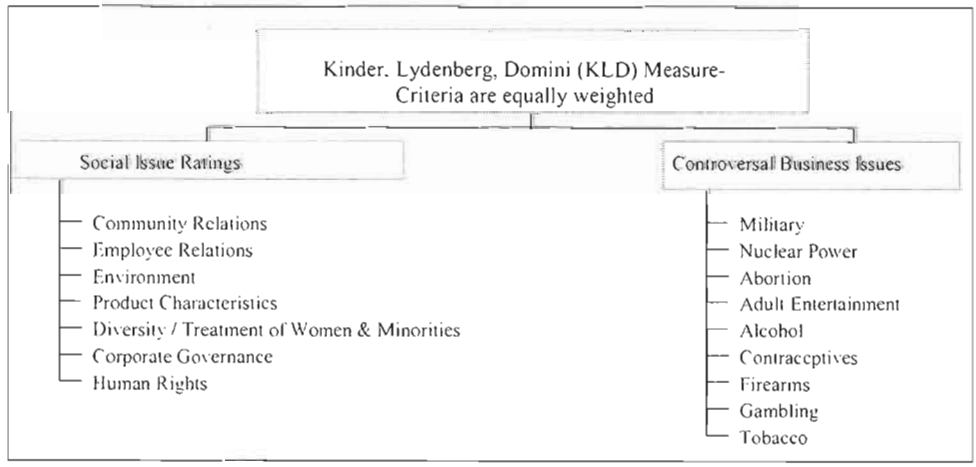

Figure 5: Classification of Social Performance Criteria

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
KLD sample size	652	651	643	648	652	653	658	662	660	1107	1108	2963	3034	3009	2962
Compustat rejections	42	38	34	32	29	29	25	21	15	22	15	22	16	0	0
Nb. of companies that ceased to exist	53	59	57	50	46	37	37	26	18	22	13	27	17	0	0
Nb. of companies with missing data	107	45	48	53	50	41	44	44	57	166	113	666	497	481	510
Nb. of penny stock companies	41	37	33	29	25	17	13	14	13	28	33	30	289	283	246
Nb. Of companies considered as outliers	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1
Final sample size	409	472	471	484	502	529	539	557	557	869	934	2216	2215	2244	2205
Total Nb. Of discarded Companies in %	37.27	27.5	26.74	25.3	23	19	18.08	15.86	15.6	21.5	15.7	25.2	27	25.4	25.5

Table 1: Summary Statistics on Sample Data

In order to address the above mentioned research question, we use a mathematical programming-based approach to modern portfolio analysis and the efficient frontier technology. To be more specific, we compute and compare efficient frontiers of portfolios, where each portfolio is a solution to either one of the basic Markowitz's mathematical programming models or to some variant or extension of it. In sum, we perform two types of experiments.

The first type of experiment considers a socially screened investment universe and uses a basic Markowitz's mathematical program to construct portfolios, where the optimization objective consists of minimizing risk, as measured by the portfolio variance, subject to three constraints; namely, a minimum portfolio return constraint, a constraint requiring that all available budget is invested, and non-negativity constraints on the decision variables; that is, the proportion of budget invested in each security within the investment universe (see figure 6). Two efficient frontiers will be computed, one corresponding to an investment universe that consists of the best 100 CSR rated companies and the other corresponds to an investment universe that consists of the worst 100 CSR rated companies. These two efficient frontiers, viewed as samples of portfolios, are then compared to each other by performing a paired t-test on the performances of the corresponding portfolios, where portfolio performance is measured by the Sharpe ratio:

$$S_p = \frac{(R_p - R_f)}{\sigma_p}$$

Where Rp denotes the portfolio observed return, Rf denotes the observed risk-free return, and Sp denotes the estimated portfolio total risk, and the null hypothesis of the statistical test states that the mean of the difference between the Sharpe ratios of those portfolios corresponding to the same level of return on the two efficient frontiers is not statistically significantly different from zero. This experiment aims at finding out whether social screening of the investment universe affects, in a statistically significant fashion, the risk-return relationship; that is, the null hypothesis is rejected, in which case one would conclude that there is a non-negligible cost to being a socially responsible investor.

$$\text{Minimize} \quad \sum_{i=1}^{N} \sigma_i^2 x_i^2 + \sum_{i=1}^{N} \sum_{\substack{k=1 \\ k \neq i}}^{N} \sigma_{ik} x_i x_k$$

$$\text{s. t.} \quad \sum_{i=1}^{N} \hat{R}_i x_i \geq R_P^{\min}$$

$$\sum_{i=1}^{N} x_i = 1$$

$$x_i \geq 0; \forall i$$

Parameters

N = cardinality of opportunity set

$R_{i,t}$ = return on asset i at time t

$\hat{R}_i$ = expected return of asset i = $\frac{1}{T} \sum_{t=1}^{T} R_{i,t}$

σ_i = std. dev. of asset i return = $\sqrt{\frac{1}{T-1} \sum_{t=1}^{T} \left(R_{i,t} - \hat{R}_i \right)^2}$

σ_{ij} = Covariance of assets i and j = $\frac{1}{T-1} \sum_{t=1}^{T} \left(R_{i,t} - \hat{R}_i \right) \left(R_{j,t} - \hat{R}_j \right)$

R_P^{min} = minimum expected return generated by portfolio

Decision Variable

x_i = proportion of budget allocated to asset i

Figure 6: The Mean-variance Optimization Model of Markowitz without Social Responsibility Objective

On the other hand, the second type of experiment considers a non-socially screened investment universe and uses an extension of the basic Markowitz's model to construct portfolios; that is, a mathematical program that optimizes a weighted combination of the portfolio risk and the portfolio score on corporate social responsibility subject to the same set of constraints described above (see figure 7). Several efficient frontiers will be computed, one for each of the following weighting schema:

$w_1 = 1, w_2 = 0;$

$w_1 = 0.9, w_2 = 0.1;$

$w_1 = 0.8, w_2 = 0.2;$

$w_1 = 0.7, w_2 = 0.3;$

$w_1 = 0.6, w_2 = 0.4;$

$w_1 = 0.5, w_2 = 0.5;$

Where w1 denotes the weight assigned to portfolio risk and w2 is the weight assigned to the portfolio CSR score. Note that one could consider other weighting schema, but we assume that investors would hardly be interested in loosing money for the sake of being socially responsible as, in a realistic world, investors look for increasing their wealth instead of giving it away! On one hand, to avoid the heavy computational requirements of using a relatively large investment universe (e.g., years 2003, 2004, 2005, 2006) and, on the other hand, to increase the reliability of our results, from a statistical perspective, we randomly select 30 investment universes of 100 companies from our final data set, as described above, and for each of these investment universes we compute six efficient frontiers corresponding to the above mentioned weighting schema. Then, we compare each of the last five efficient frontiers with the first one (i.e., only the risk component is optimized); such comparison is performed in the same way it is done within the first type of experiment described above.

$$\text{Minimize} \quad \sum_{i=1}^{N} \sigma_i^2 x_i^2 + \sum_{i=1}^{N} \sum_{\substack{k=1 \\ k \neq i}}^{N} \sigma_{ik} x_i x_k - \sum_{i=1}^{N} x_i \alpha_i$$

$$\text{s.t.} \quad \sum_{i=1}^{N} \hat{R}_i x_i \geq R_p^{min}$$

$$\sum_{i=1}^{N} x_i = 1$$

$$x_i \geq 0; \forall i$$

Parameters

N = *cardinality* of opportunity set

$R_{i,t}$ = return on asset i at time t

$\hat{R}_i$ = expected return of asset i = $\frac{1}{T} \sum_{t=1}^{T} R_{i,t}$

σ_i = std. dev. of asset i return = $\sqrt{\frac{1}{T-1} \sum_{t=1}^{T} \left(R_{i,t} - \hat{R}_i\right)^2}$

σ_{ij} = Covariance of assets i and j = $\frac{1}{T-1} \sum_{t=1}^{T} \left(R_{i,t} - \hat{R}_i\right)\left(R_{j,t} - \hat{R}_j\right)$

α_i = Corporate Social Resposibility Score of Asset i

R_p^{min} = minimum expected return generated by portfolio

Decision Variable

w1 : the weight attributed to the minimization of risk
w2 : the weight attributed to the maximization of CSR
x_i = *proportion* of budget allocated to asset i

Figure 7: The Mean-variance Optimization Model of Markowitz with Social Responsibility Objective

Note that, to make the efficient frontiers comparable, one needs to use the same grid, referred to as the constant grid. To be more specific, for each investment universe, we compute the minimum and the maximum values of returns and use a grid of equally spaced values to compute one portfolio for each point of the grid and each weighting scheme.

CHAPTER III

RESULTS ANALYSIS

In this section, we report on the results corresponding to year 2006. Note however that the same conclusions are reached for each year of our period of study; that is, 1992 to 2006. Based on year 2006 data, we found no significant statistical difference between the Sharpe ratios of the portfolios on the efficient frontiers generated by solving the basic Markowitz's model using the best and the worst 100 CSR rated companies, respectively, as a universe of investment which suggest that being a socially responsible investor is not a costly choice – see Tables 1 and 2, and Figure 8. The reader is referred to appendix 3 for information corresponding to years 1992 to 2006.

On the other hand, when the investment universe is not socially screened and our model is used to generate portfolios, whereby we optimise a weighted combination of risk and CSR components, the difference between the Sharpe ratios of portfolios belonging to different efficient frontiers with different weights assigned to risk and CSR components is statistically significantly different from zero suggesting that being a socially responsible investor is costly – see Tables 3 to 8 and Figure 9. The reader is referred to appendix 4 for information corresponding to years 1992 to 2006.

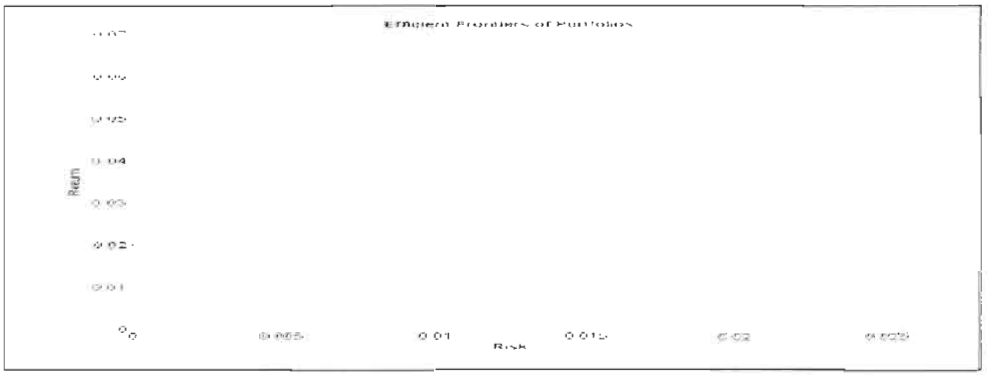

Figure 8: Efficient Frontiers of Best-in-class Portfolios (Blue line) and Worst-in-class Portfolios (Red line)

Return	Risk	CSR	Z*	Sharpe Ratio
0.00928735	0.00024752	0.45849776	0.00012376	**29.7988466**
0.0132989	0.00029883	0.4507053	0.00014942	**38.1057143**
0.01731045	0.00045378	0.43746565	0.00022689	**33.9344042**
0.021322	0.00073398	0.40226292	0.00036699	**26.4454949**
0.02533355	0.00118267	0.35685179	0.00059133	**19.8042756**
0.0293451	0.00186304	0.33158821	0.00093152	**14.7251131**
0.03335665	0.00289599	0.3031171	0.00144799	**10.8581223**
0.0373682	0.00452696	0.27580544	0.00226348	**7.83231163**
0.04137975	0.00883016	0.25329162	0.00441508	**4.46969095**
0.0453913	0.01739586	0.23076923	0.00869793	**2.49942456**

Table 2: Portfolios on the Efficient Frontier Corresponding to an Investment Universe of 100 Best CSR Rated Companies

Return	Risk	CSR	Z*	Sharpe Ratio
0.00997501	0.0003804	-0.48314624	0.0001902	**21.1971411**
0.01587388	0.0004453	-0.45798093	0.00022265	**31.3548851**
0.02177275	0.00066156	-0.45113774	0.00033078	**30.0214795**
0.02767162	0.00111636	-0.45046425	0.00055818	**23.0748827**
0.03357049	0.00199811	-0.45679356	0.00099906	**15.8443692**
0.03946936	0.00368882	-0.45775291	0.00184441	**10.1814823**
0.04536824	0.00664562	-0.44845977	0.00332281	**6.53912637**
0.05126711	0.01240469	-0.4697684	0.00620234	**3.97877278**
0.05716598	0.02245851	-0.49662	0.01122926	**2.46028338**
0.06306485	0.04495109	-0.53846154	0.02247554	**1.36043833**

Table 3: Portfolios on the Frontier Corresponding to an Investment Universe of 100 Worst CSR Rated Companies

Z*: being the Weighted Combination of Risk and CSR = w1*Risk – w2*CSR. Note that the CSR component is subtracted from rather than added to the risk component because it should be maximized whereas the risk component is minimized.

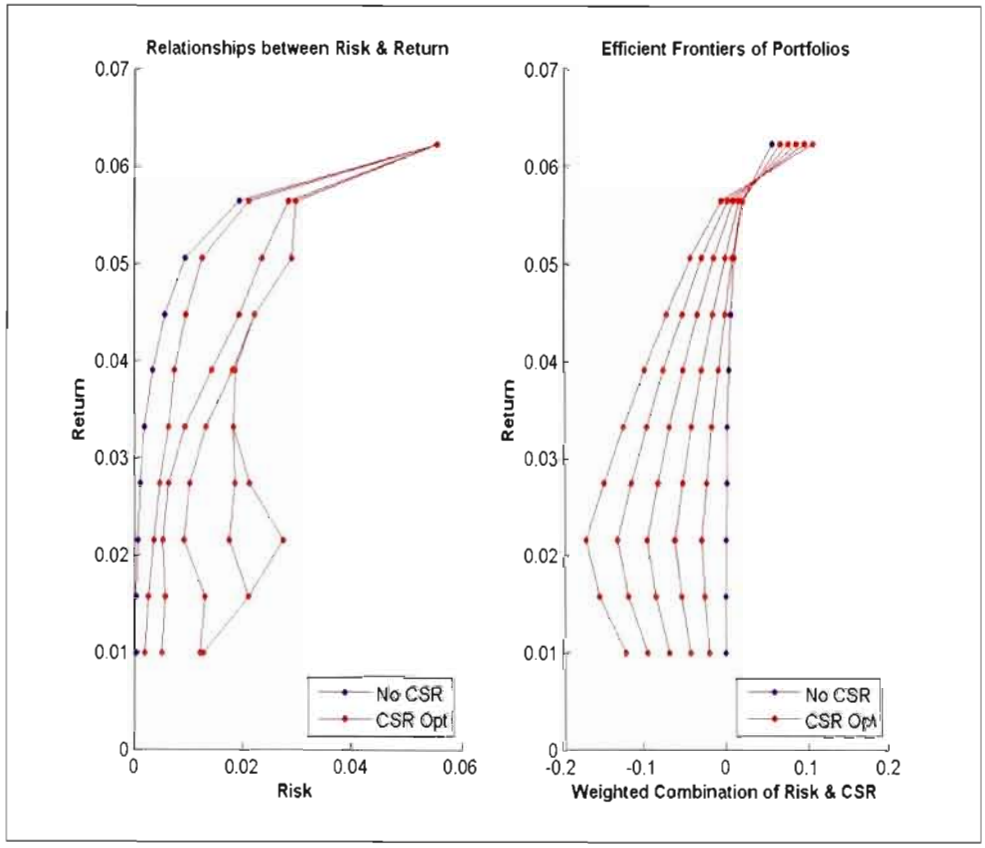

Figure 9: Efficient Frontiers obtained when CSR is optimized and when CSR is not optimized

Return	Risk	CSR	Z	Sharpe Ratio
0.00990586	0.00034081	0.00302451	0.00034081	**23.4562057**
0.01571884	0.00040436	0.03205373	0.00040436	**34.1455016**
0.02153183	0.00062846	0.0380149	0.00062846	**31.2192749**
0.02734481	0.00106982	0.04489339	0.00106982	**23.7733122**
0.0331578	0.00194079	0.03803959	0.00194079	**16.0996751**
0.03897078	0.00342124	0.02385743	0.00342124	**10.8320569**
0.04478377	0.00568373	0.01341282	0.00568373	**7.54295544**
0.05059675	0.00933517	-0.01595618	0.00933517	**5.21523565**
0.05640974	0.01941779	-0.03673628	0.01941779	**2.80660582**
0.06222272	0.05540987	-0.15384615	0.05540987	**1.08845331**

Table 4: Portfolios on the Efficient Frontier Generated when W1*= 1 and W2*= 0

W1*: the weight attributed to the minimization of risk

W2*: the weight attributed to the maximization of CSR.

Reject H0; i.e., There is a cost to being a socially responsible investor				
Return	Risk	CSR	Z	Sharpe Ratio
0.00990586	0.00204127	0.21610428	-0.01977329	**3.91628692**
0.01571884	0.00264514	0.27490647	-0.02511002	**5.2198295**
0.02153183	0.00367079	0.32264173	-0.02896046	**5.34494428**
0.02734481	0.00474187	0.28124263	-0.02385658	**5.36352312**
0.0331578	0.0063776	0.22922695	-0.01718285	**4.8993523**
0.03897078	0.00743121	0.16438316	-0.00975023	**4.98695554**
0.04478377	0.00943155	0.10022316	-0.00153392	**4.54560512**
0.05059675	0.01247737	0.03647619	0.00758202	**3.90186939**
0.05640974	0.02124519	-0.00384294	0.01950497	**2.56519535**
0.06222272	0.05540987	-0.15384615	0.0652535	**1.08845331**

Table 5: Portfolios on the Efficient Frontier generated when W1 = 0.9 and W2 = 0.1

Reject H0; i.e., There is a cost to being a socially responsible investor				
Return	Risk	CSR	Z	Sharpe Ratio
0.00990586	0.00515002	0.23332201	-0.04254438	**1.55226252**
0.01571884	0.00578047	0.29232416	-0.05384046	**2.38859125**
0.02153183	0.00527744	0.33154011	-0.06208607	**3.71774214**
0.02734481	0.00634852	0.29014101	-0.05294938	**4.00615083**
0.0331578	0.00937055	0.24874192	-0.04225195	**3.33450433**
0.03897078	0.01433748	0.2073172	-0.02999346	**2.58477232**
0.04478377	0.01936706	0.1585574	-0.01621783	**2.21366083**
0.05059675	0.02349848	0.10019672	-0.00124056	**2.07183941**
0.05640974	0.02849972	0.03678914	0.01544195	**1.91223199**
0.06222272	0.05540987	-0.15384615	0.07509713	**1.08845331**

Table 6: Portfolios on the Efficient Frontier Generated when W1 = 0.8 and W2 = 0.2

Reject H0; i.e., There is a cost to being a socially responsible investor				
Return	Risk	CSR	Z	Sharpe Ratio
0.00990586	0.01217547	0.2542653	-0.06775676	**0.65658143**
0.01571884	0.01301836	0.31379822	-0.08502662	**1.06059274**
0.02153183	0.00915913	0.34298087	-0.09648287	**2.14214251**
0.02734481	0.01023021	0.30158178	-0.08331338	**2.48608155**
0.0331578	0.01325224	0.26018268	-0.06877824	**2.35780051**
0.03897078	0.01816608	0.2186015	-0.05286419	**2.04001714**
0.04478377	0.02219957	0.16900864	-0.03516289	**1.93121306**
0.05059675	0.02912273	0.11845478	-0.01515052	**1.67172138**
0.05640974	0.02988182	0.04197552	0.00832462	**1.82378668**
0.06222272	0.05540987	-0.15384615	0.08494076	**1.08845331**

Table 7: Portfolios on the Efficient Frontier Generated when W1 = 0.7 and W2 = 0.3

Reject H0; i.e., There is a cost to being a socially responsible investor				
Return	Risk	CSR	Z	Sharpe Ratio
0.00990586	0.01279589	0.25568854	-0.09459788	**0.62474676**
0.01571884	0.02121498	0.32999333	-0.11926834	**0.65082185**
0.02153183	0.01751271	0.35823523	-0.13278647	**1.12033853**
0.02734481	0.01858379	0.31683614	-0.11558418	**1.36856605**
0.0331578	0.01827975	0.27011636	-0.09707869	**1.70933055**
0.03897078	0.01858524	0.2195625	-0.07667385	**1.99400749**
0.04478377	0.02219957	0.16900864	-0.05428371	**1.93121306**
0.05059675	0.02912273	0.11845478	-0.02990828	**1.67172138**
0.05640974	0.02988182	0.04197552	0.00113889	**1.82378668**
0.06222272	0.05540987	-0.15384615	0.09478438	**1.08845331**

Table 8: Portfolios on the Efficient Frontier Generated when W1 = 0.6 and W2 = 0.4

Reject H0; i.e., There is a cost to being a socially responsible investor				
Return	Risk	CSR	Z	Sharpe Ratio
0.00990586	0.01279589	0.25568854	-0.12144632	**0.62474676**
0.01571884	0.02121498	0.32999333	-0.15438917	**0.65082185**
0.02153183	0.02759524	0.37122407	-0.17181442	**0.71099786**
0.02734481	0.02128308	0.32067022	-0.14969357	**1.19499359**
0.0331578	0.01827975	0.27011636	-0.1259183	**1.70933055**
0.03897078	0.01858524	0.2195625	-0.10048863	**1.99400749**
0.04478377	0.02219957	0.16900864	-0.07340453	**1.93121306**
0.05059675	0.02912273	0.11845478	-0.04466603	**1.67172138**
0.05640974	0.02988182	0.04197552	-0.00604685	**1.82378668**
0.06222272	0.05540987	-0.15384615	0.10462801	**1.08845331**

Table 9: Portfolios on the Efficient Frontier Generated when W1 = 0.5 and W2 = 0.5

Therefore, one might be tempted to jump to the conclusion that the use of different methodologies leads to different conclusions as to whether being a socially responsible investor is a costly choice or not. Note however that such difference in results might be due to other reasons. In fact, some of these reasons might be data related; for example, data might substantially differ in characteristics from one year to another or from one industry to another leading to risk, return and CSR figures that favour one type of results over the other regardless of the methodology under consideration. Second, portfolios with substantially different distributions of CSR scores and/or risk would look the same from an optimization perspective, because of the smoothing effect of using averages in the objective function, which might again favour one type of results over the other regardless

of the methodology under consideration. Finally, the relationships between risk and CSR, risk and return, and return and CSR and the nature of these relationships might again favor one type of results over the other regardless of the methodology under consideration.

CONCLUSION

Our empirical results seem to be different depending on whether the CSR component is taken into account implicitly through investment universe screening or explicitly in the mathematical programming model.

In fact no significant statistical difference was found between the Sharpe ratios of the portfolios generated by solving the basic Markowitz's model, using as a universe of investment the best and the worst 100 CSR rated companies, respectively, indicating that socially responsible investing is not costly. On the other hand, when the investment universe is not socially screened and our model is used to generate portfolios, whereby we optimize a weighted combination of risk and CSR component, the difference between the Sharpe ratios of portfolios belonging to different efficient frontiers with different weights assigned to risk and CSR component is statistically significantly different from zero, suggesting that being a socially responsible investor is a rather risky business.

In sum, while methodological differences might lead to differences in conclusions, one should be aware that other factors might explain such differences such as data related factors and the nature of the relationships between risk, return and CSR.

The comparison of these results with those of mutual funds and portfolio-oriented studies included in the literature review may prove difficult since the approaches are in general different and the outcomes of our research are divergent according to the experiment tested. However, if we limit this comparison to the studies screening all the aspects of social responsibility as we did in our model and subject to less biases, our first experiment results which indicate that socially responsible investing is not costly, are particularly identical to the conclusions of the studies conducted by Hamilton, Jo and Statman (1993), Travers (1997), Guerard (1997), Grieb and Reyes (1998), Bauer et al. (2002), and Stone (2002), Barnett and Salomon (2006), who all found no significant relationship between the return of Socially Responsible Mutual Funds (SRMF) and Conventional Funds or the other benchmarks used. With regard the portfolio-oriented studies, a similarity of results is also observed in comparison with mainly the studies led

efficient frontier corresponding to high return show a stronger social rating, revealing that socially responsible investing is not costly. In the same direction, the studies focusing on the environmental aspect only (Cohen, Fenn and Konar, 1997; Bauer, 2005) suggested a non existence of any penalty when investing in environmental portfolios. On the contrary, this first experiment results pre-empt the outcomes of the other studies concluding to a negative relationship between CSP and CFP.

Of course, if we consider the second type of experiment, based on a non-socially screened investment universe, the use of an extension of Markowitz's mean-variance model and a program for optimizing weighted combinations of risk and corporate social responsibility, the outcome, that is, being a socially responsible investor is costly, differs from the results of the studies mentioned above.

In sum, while methodological differences lead to different conclusions, one should be aware that other factors might explain such differences such as data related factors and the nature of the relationship between risk, return and CSR.

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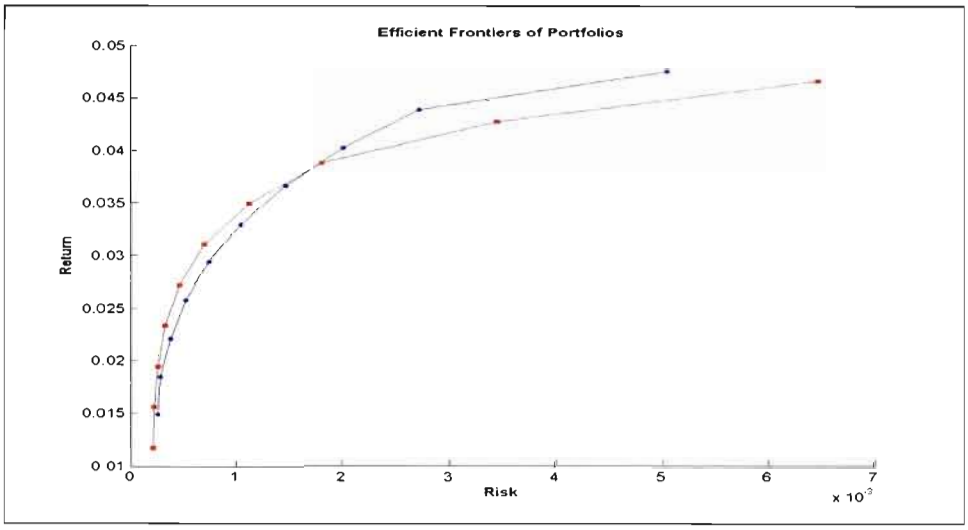
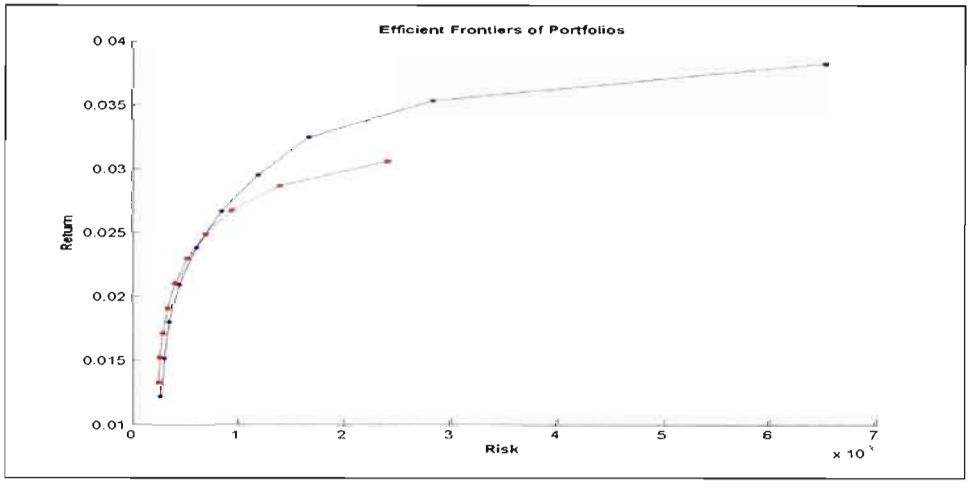
APPENDIX 1

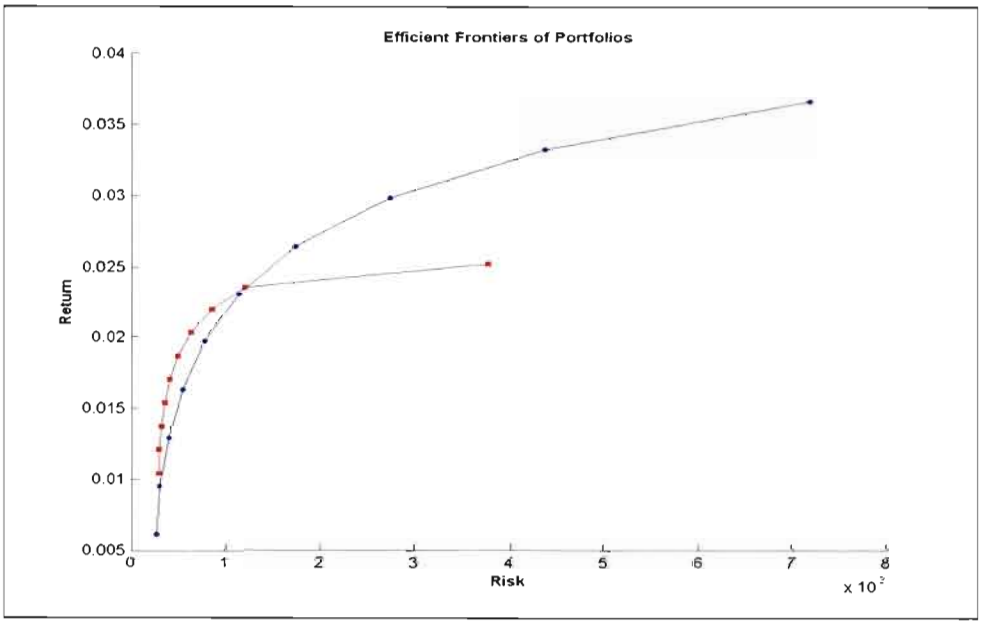
Efficient Frontiers of Best-in-class Portfolios (Blue line) and Worst-in-class Portfolios (Red line) for each year of our period of study (1992-2006)



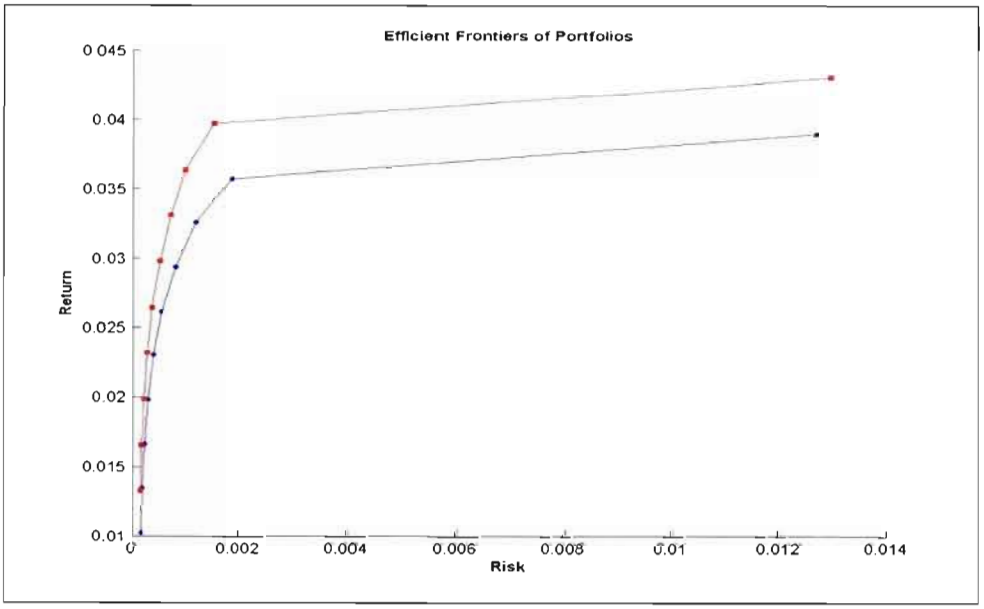
Year 1992



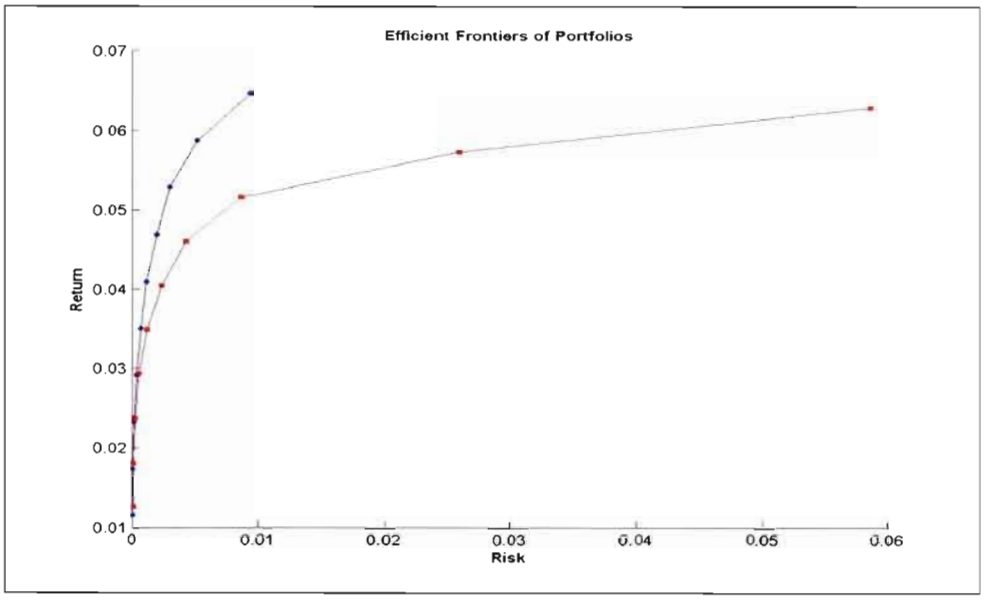
Year 1993



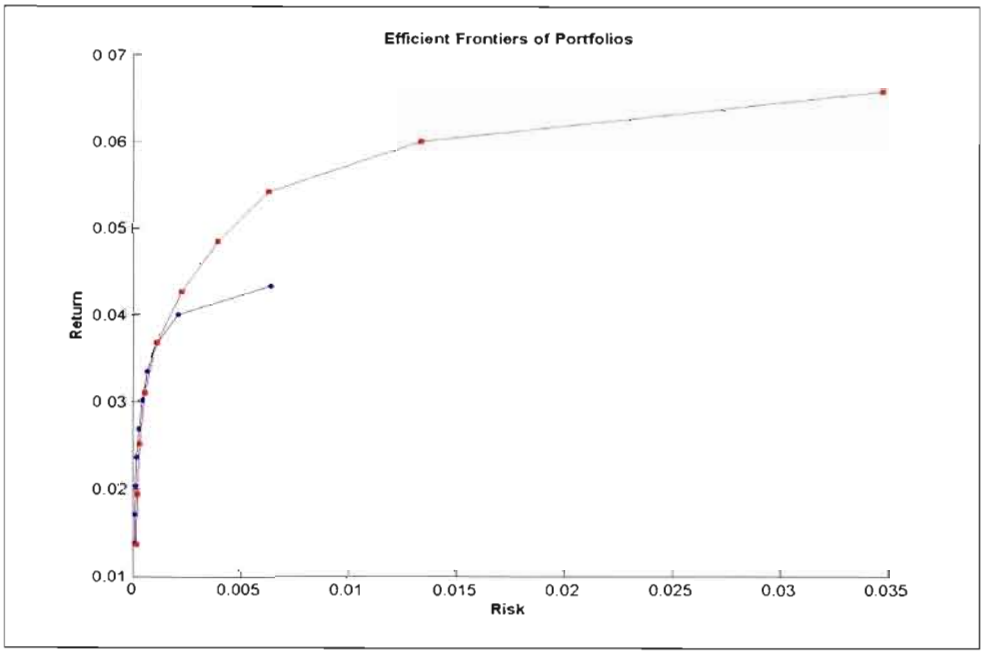
Year1994



Year 1995



Year 1996



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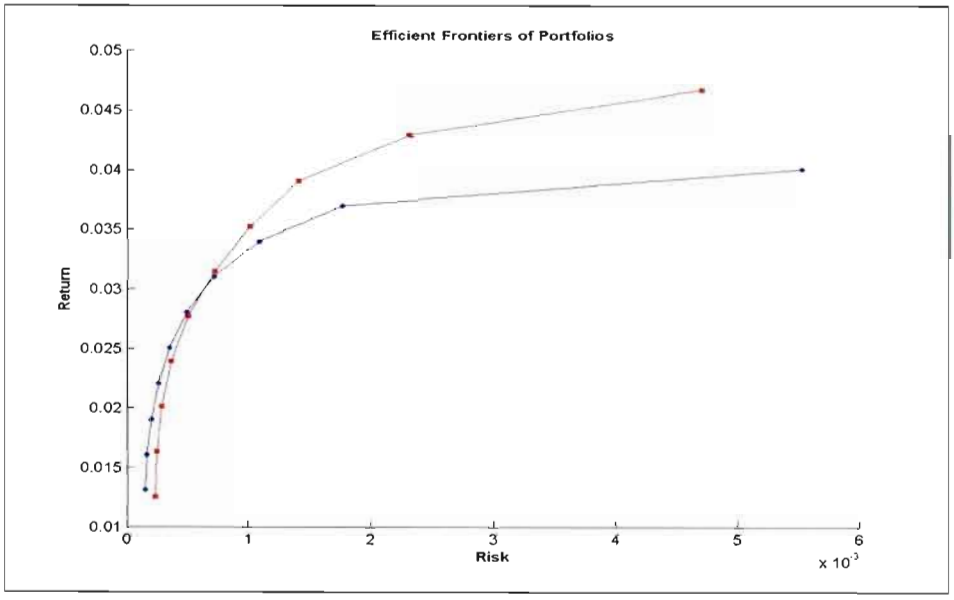

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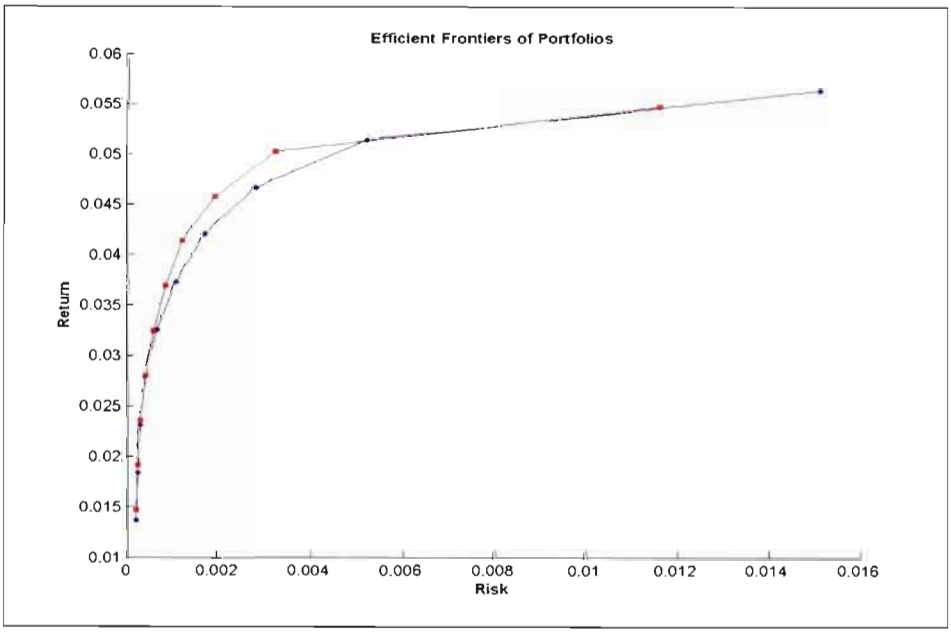

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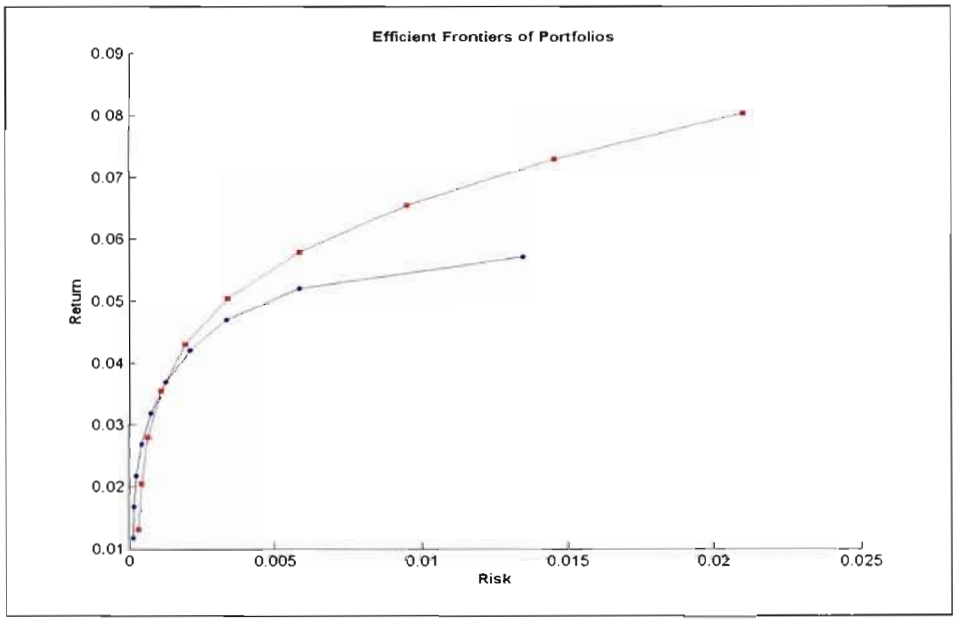

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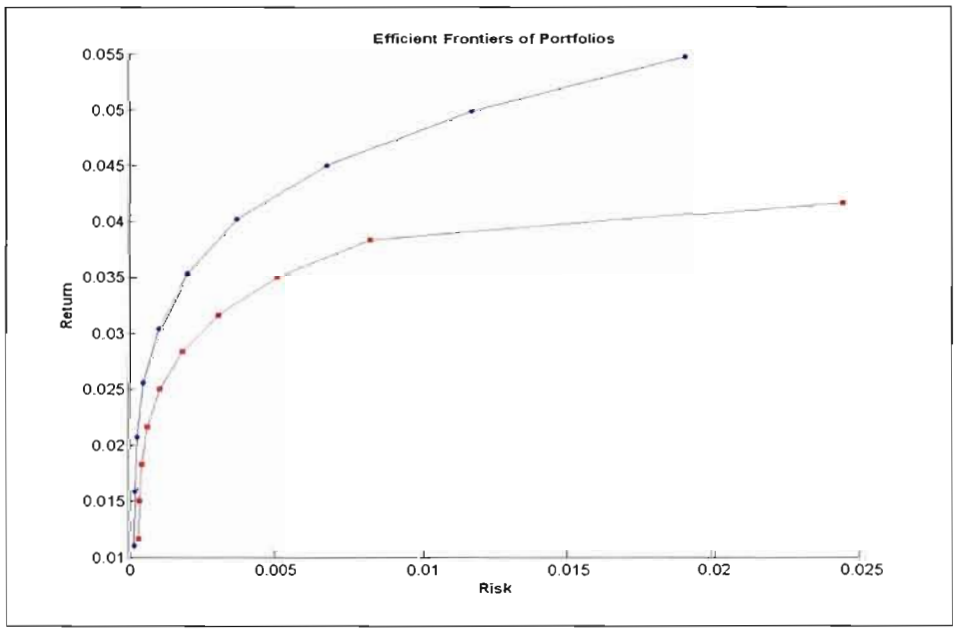

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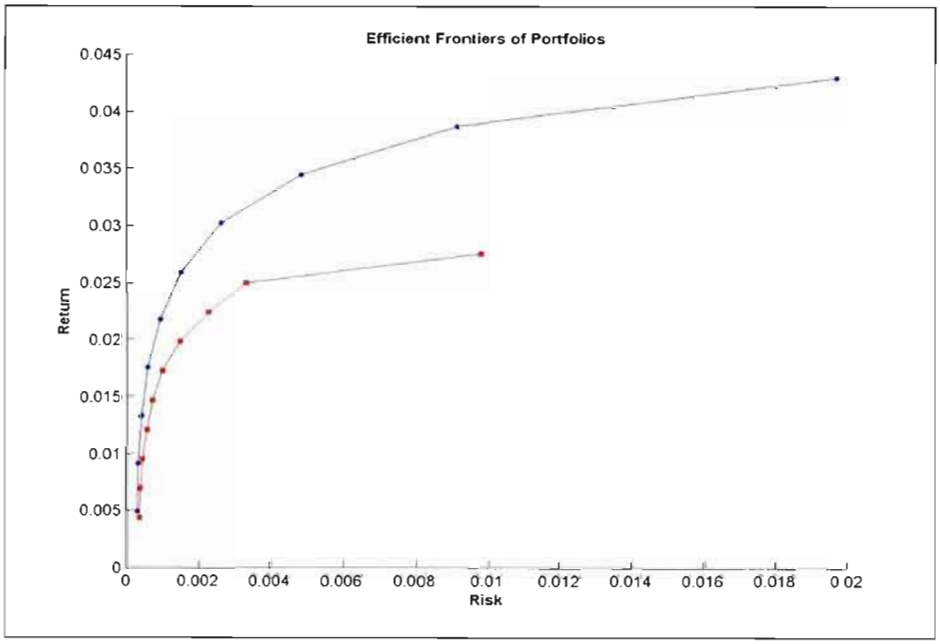

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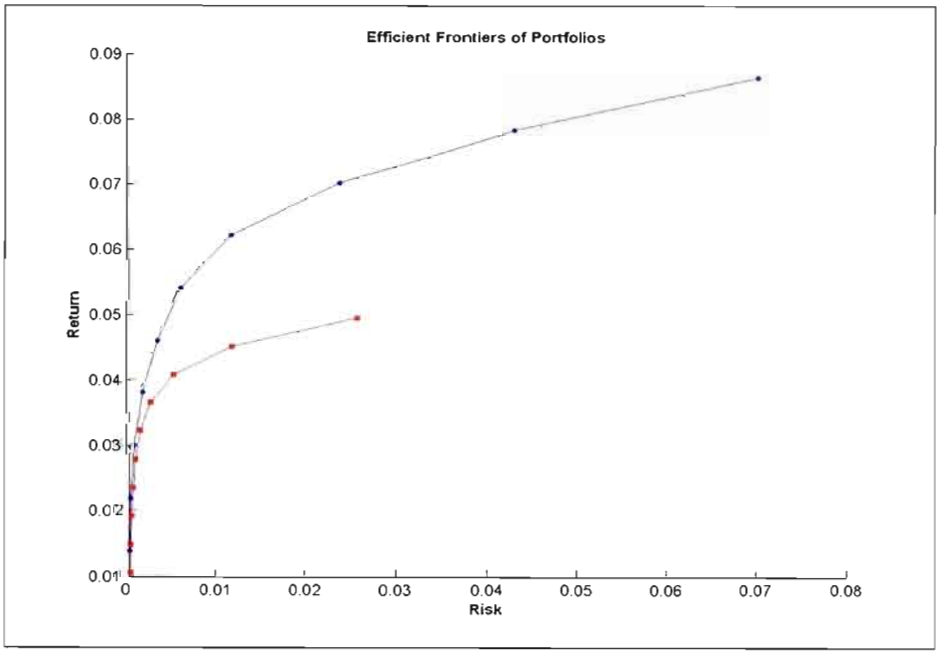

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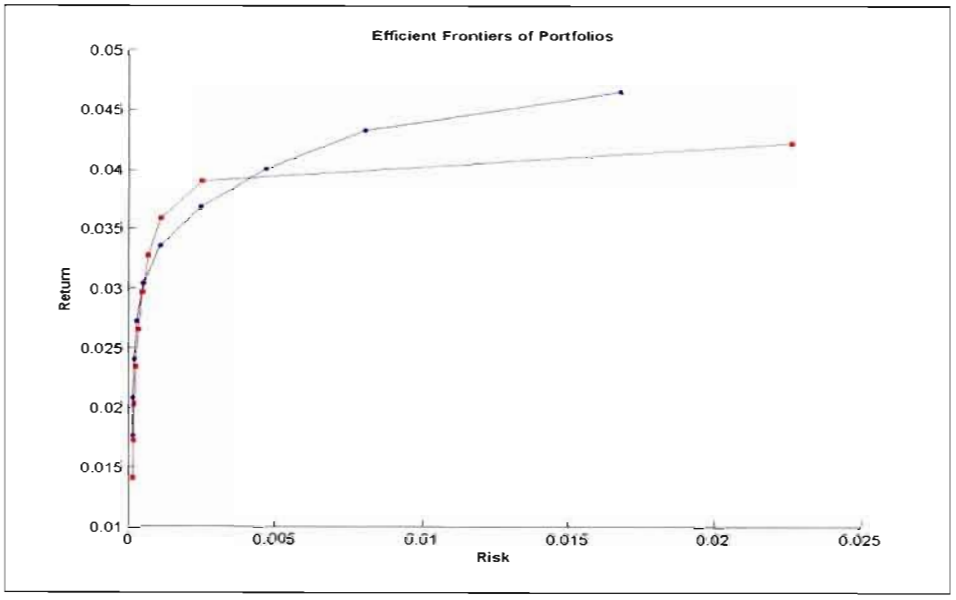

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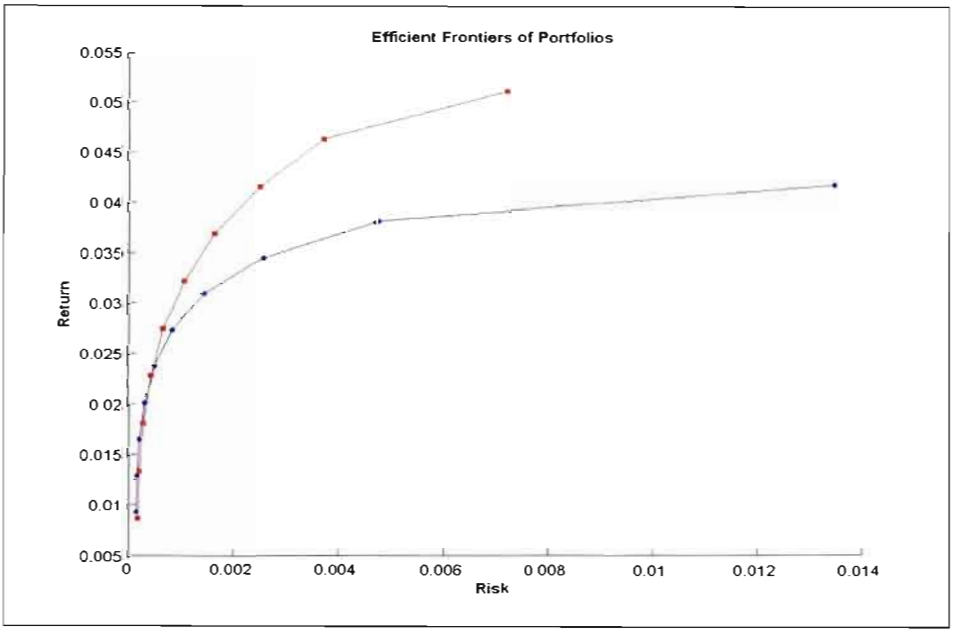

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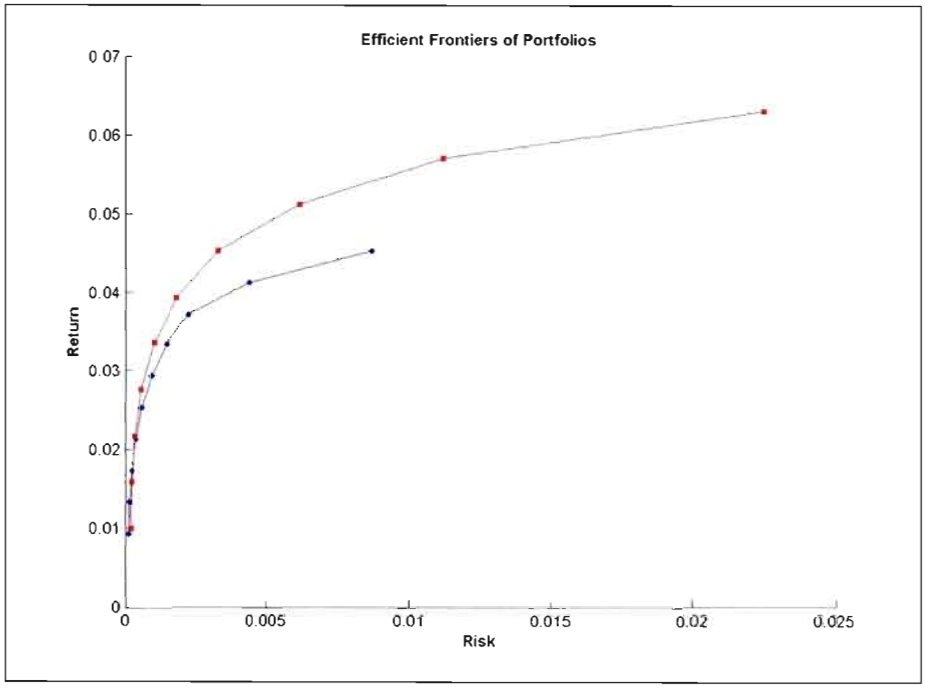
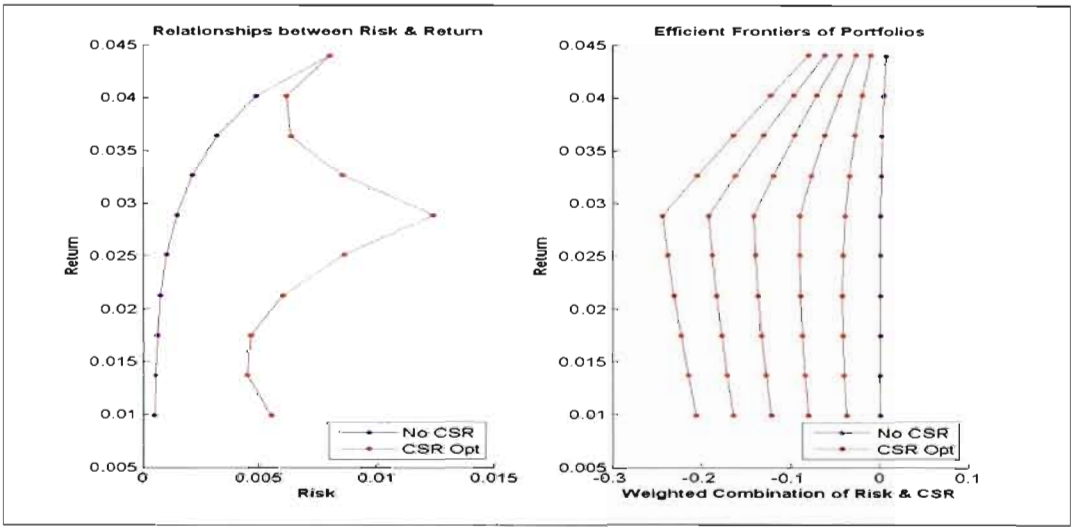

Efficient Frontiers of Portfolios
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Return
0
0.005
0.01
0.015
0.02
0.025
Risk

Year 2006

APPENDIX 2

Efficient Frontiers obtained when CSR is optimized and when CSR is not optimized for each year from 1992 to 2006 (30 randomly generated samples of 100 companies each for each year)



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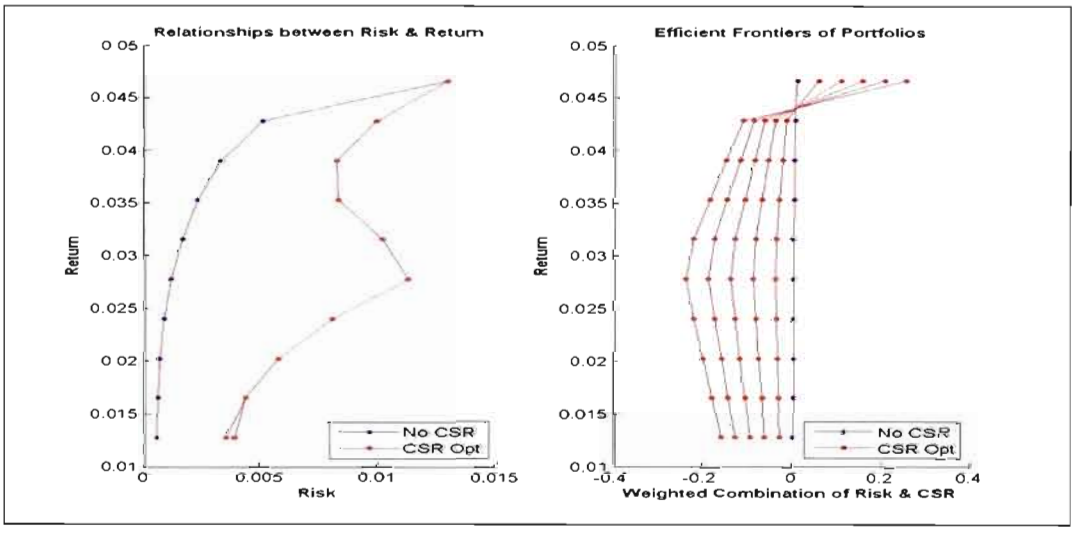
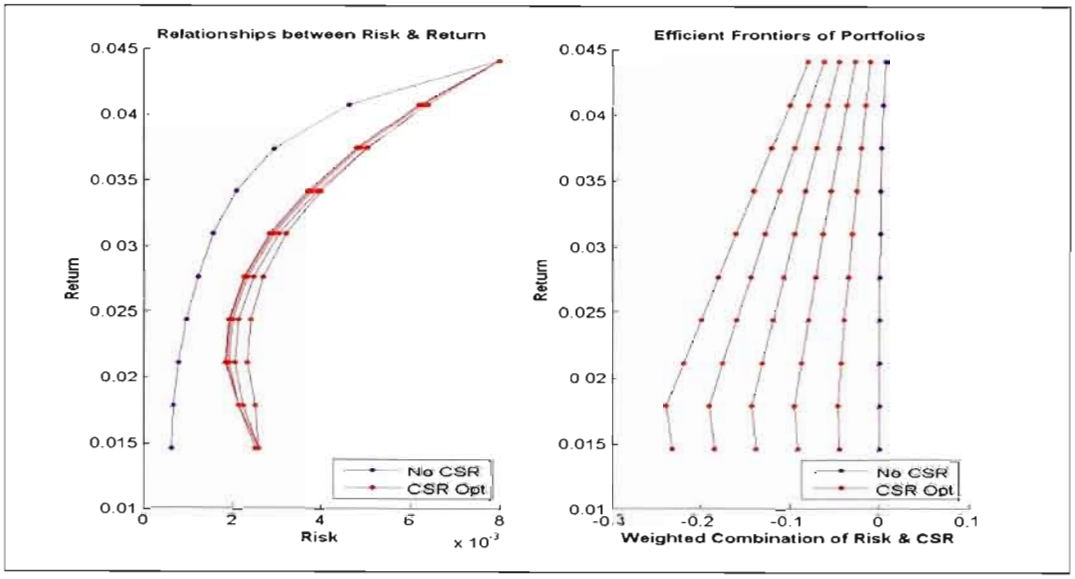


1992graph2



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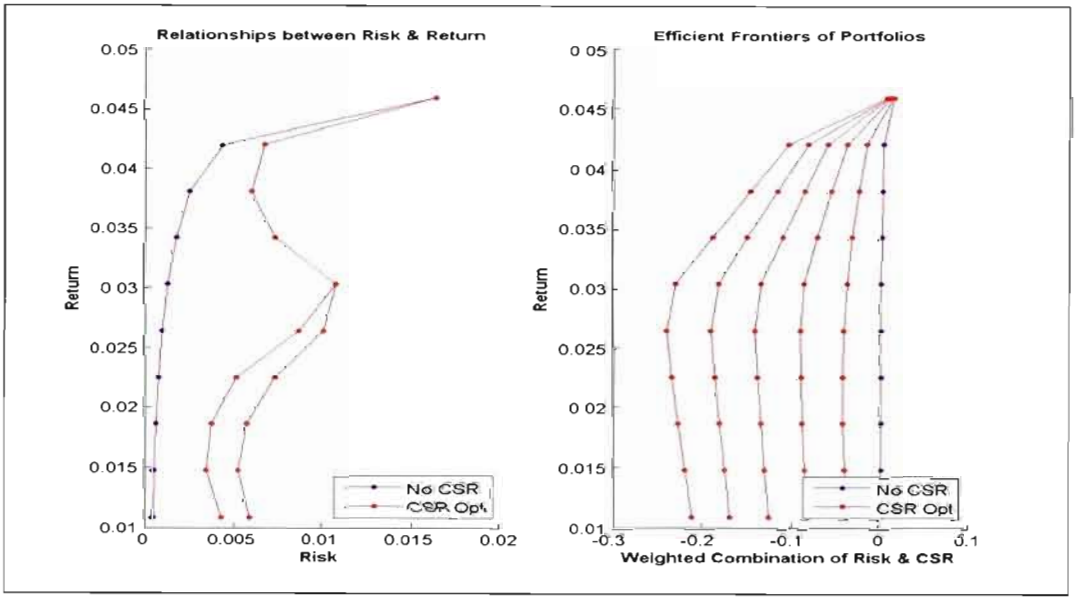

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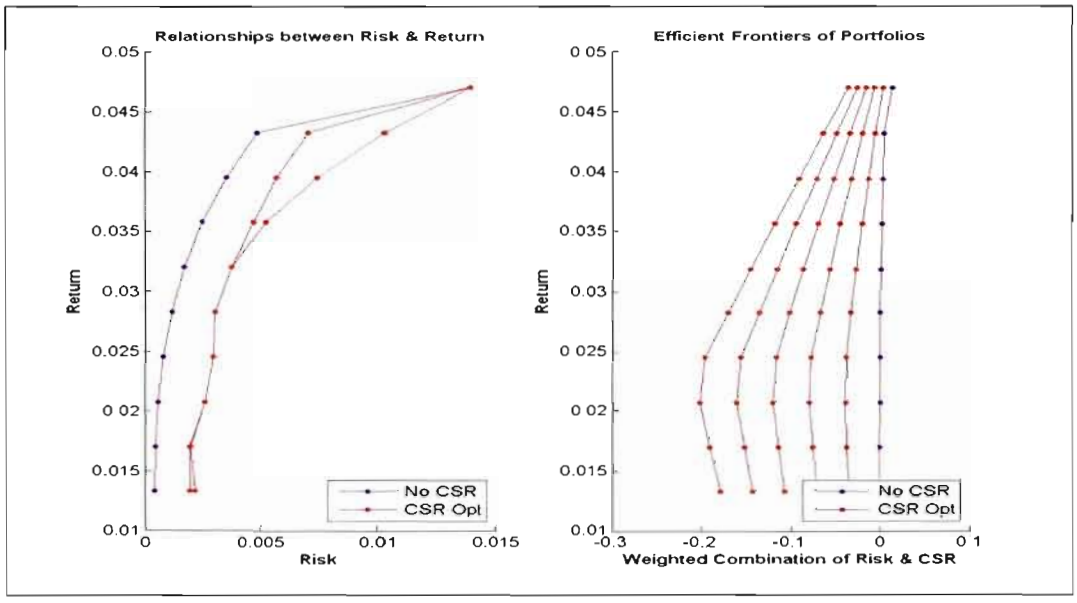

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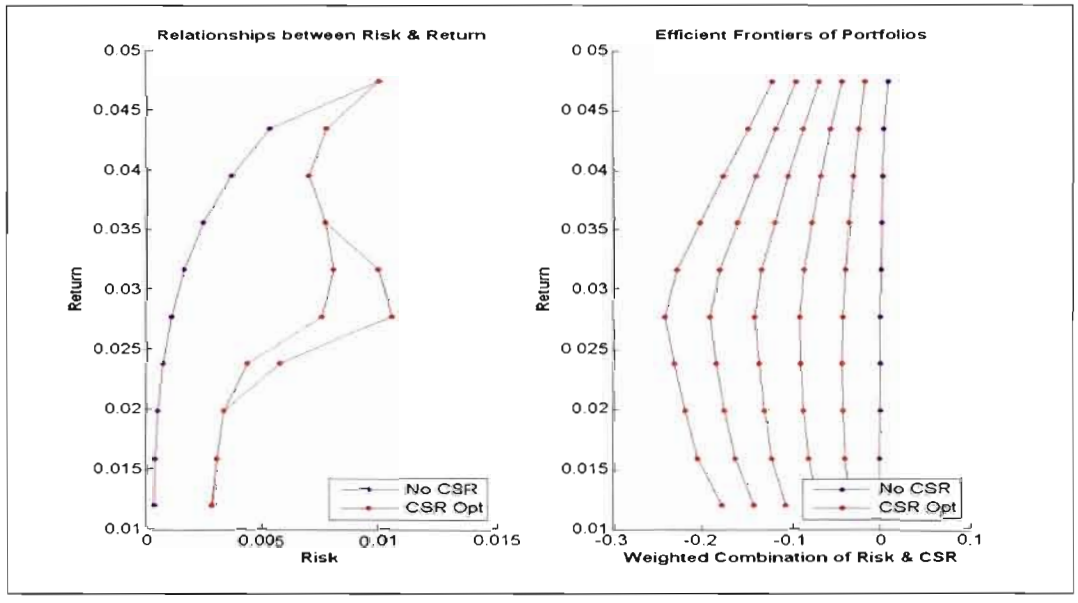
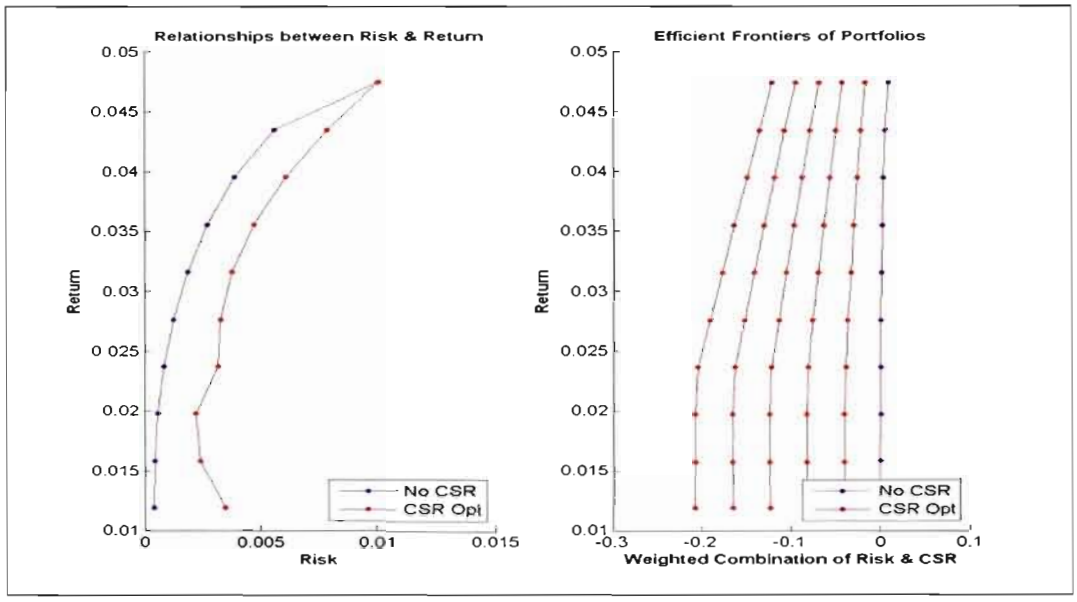


1992graph6



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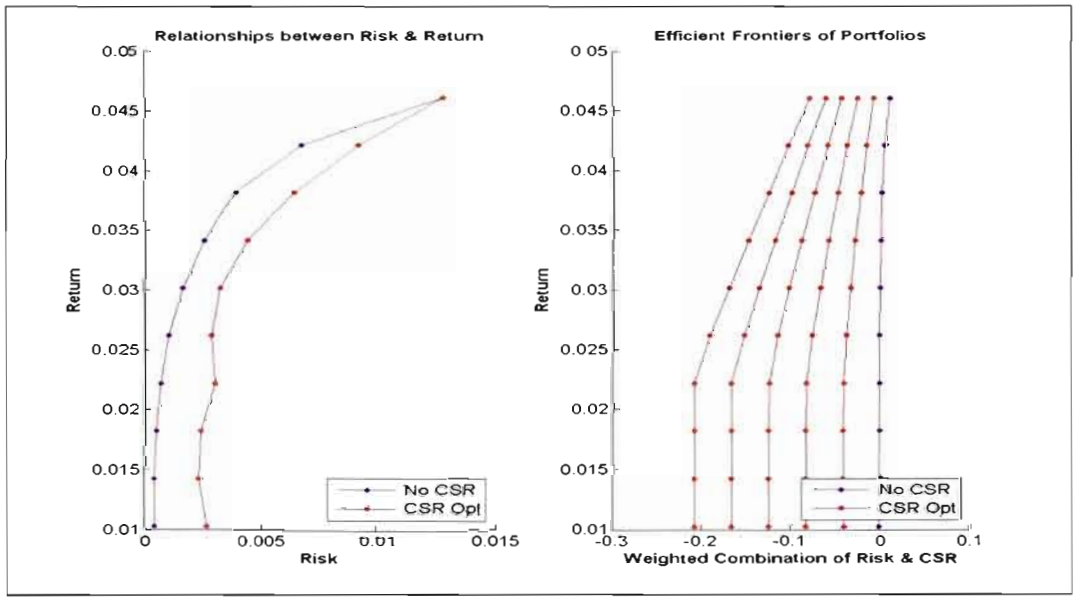

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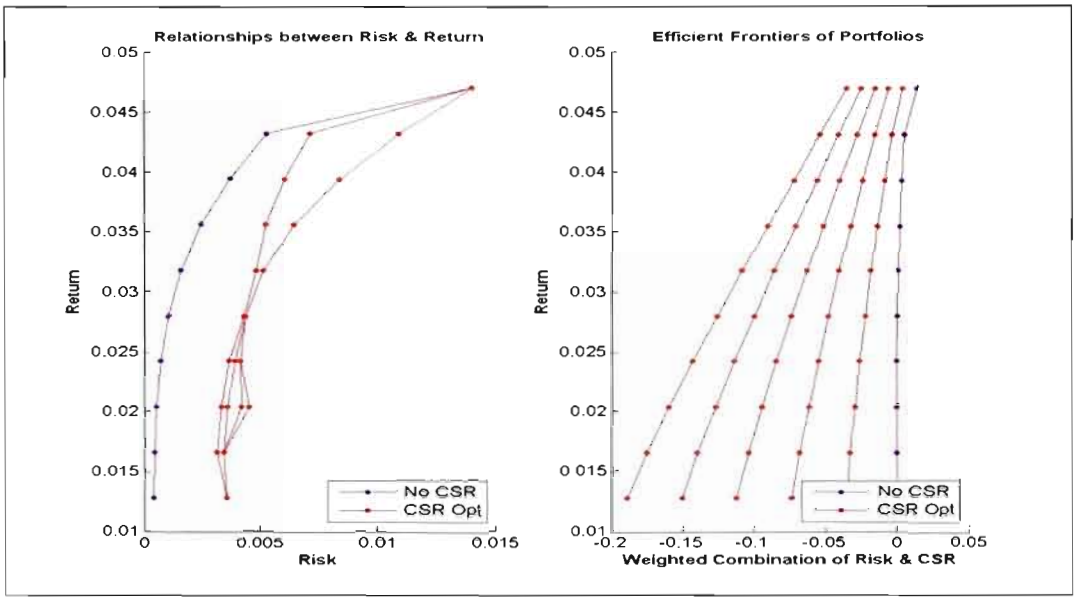

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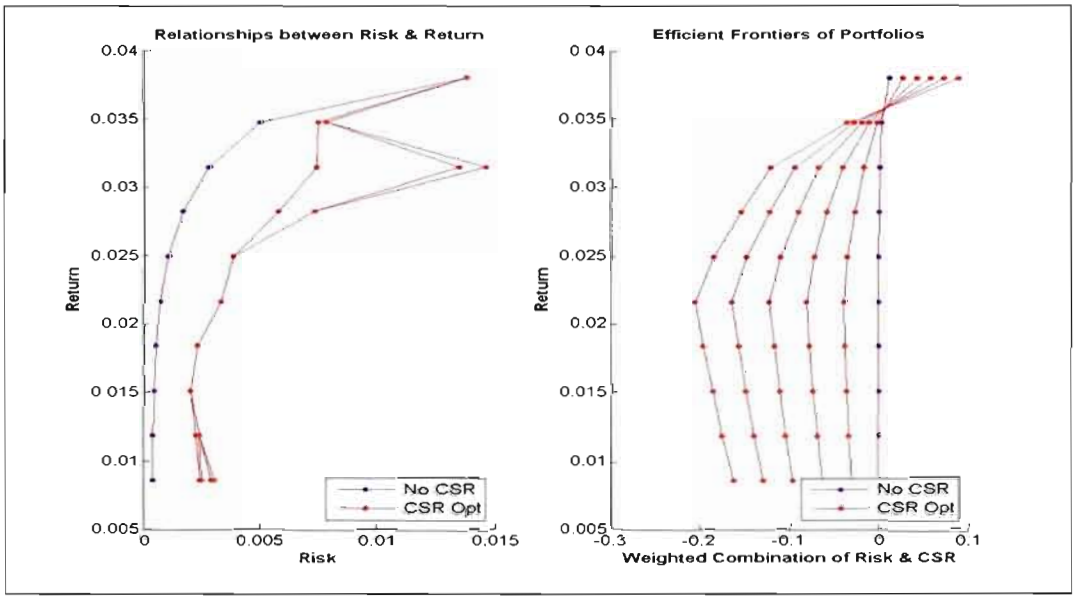

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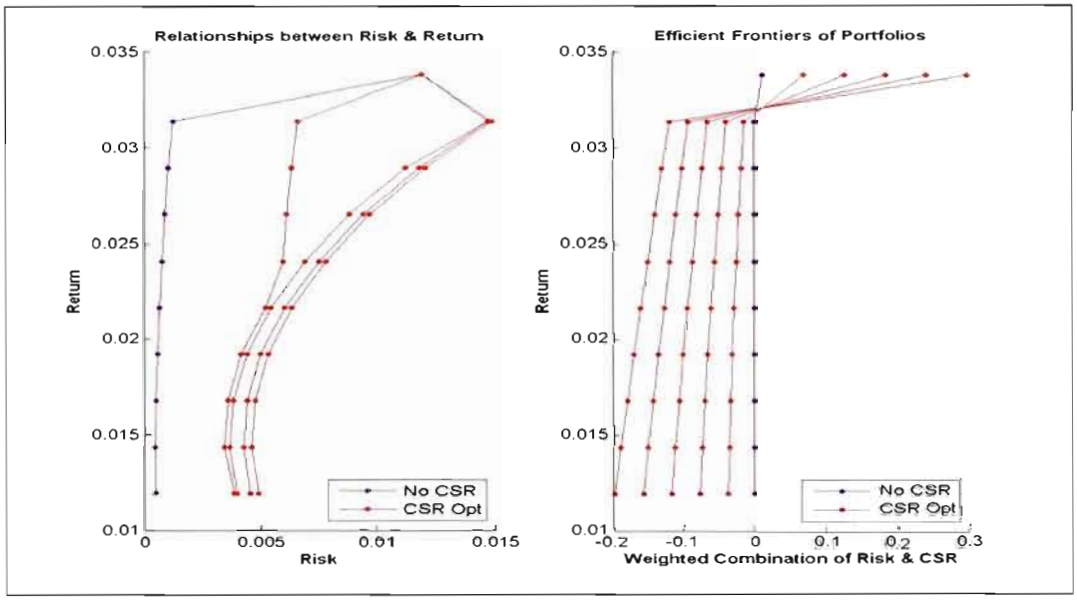

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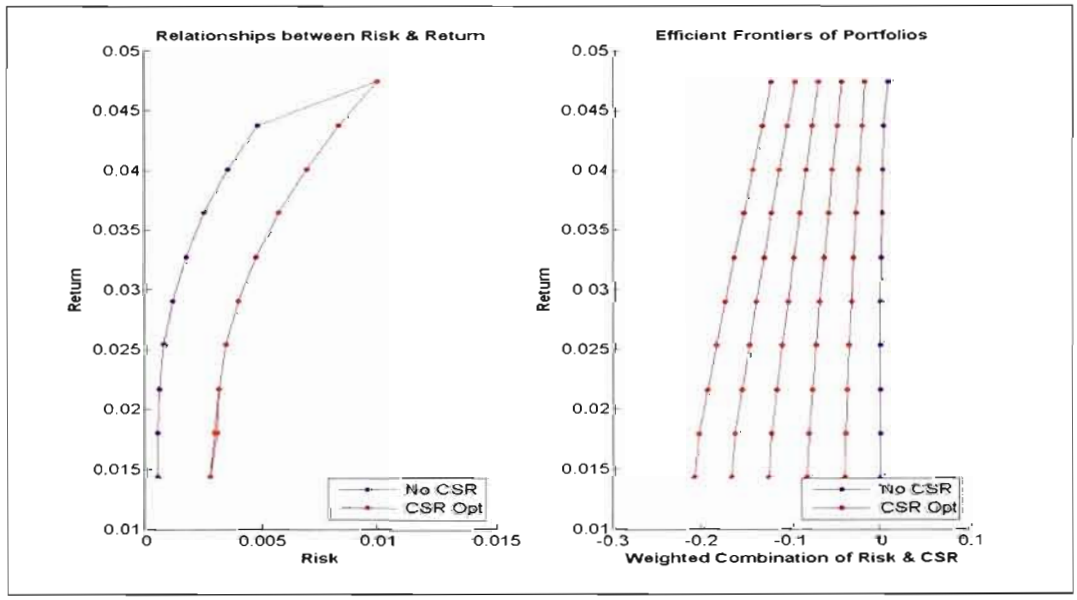

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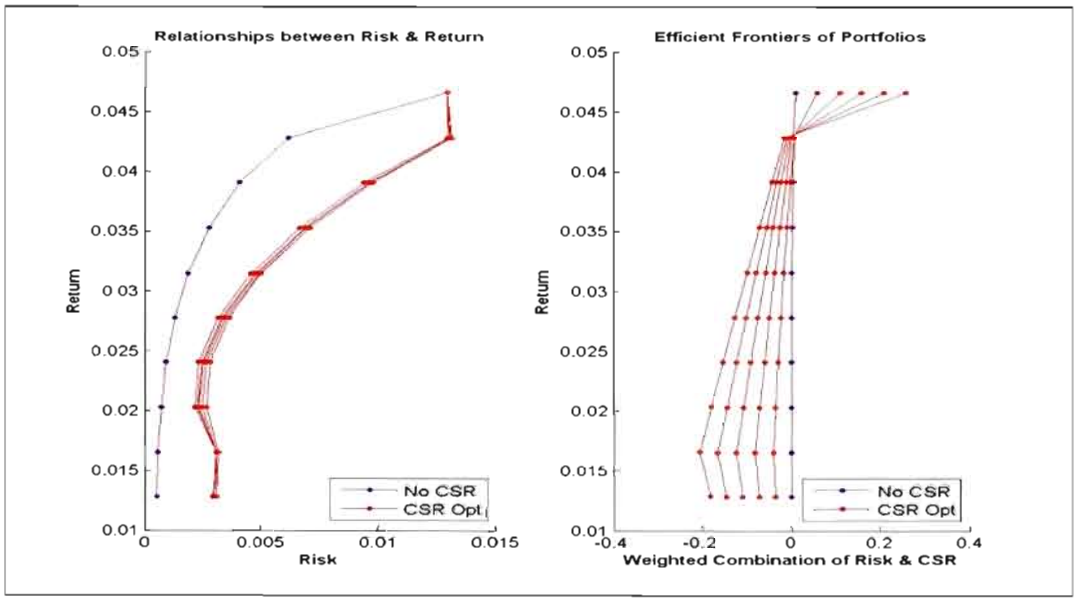

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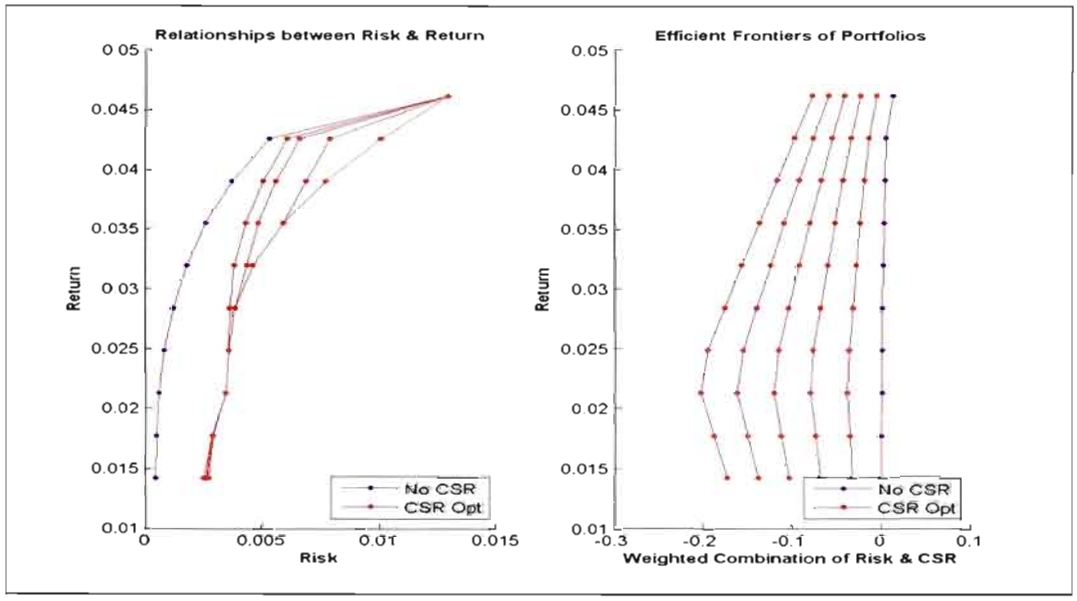

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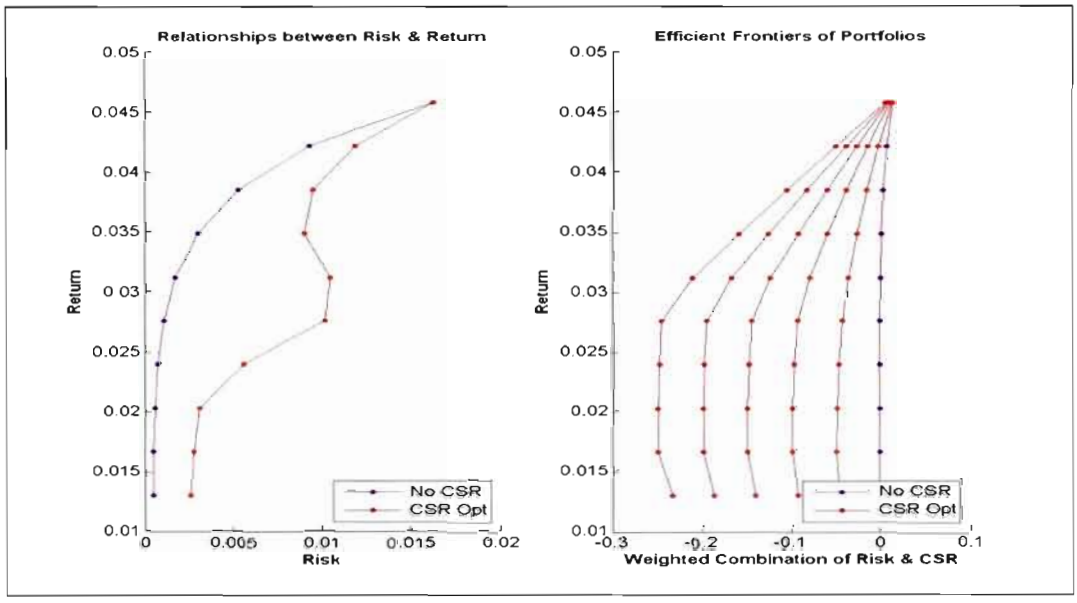

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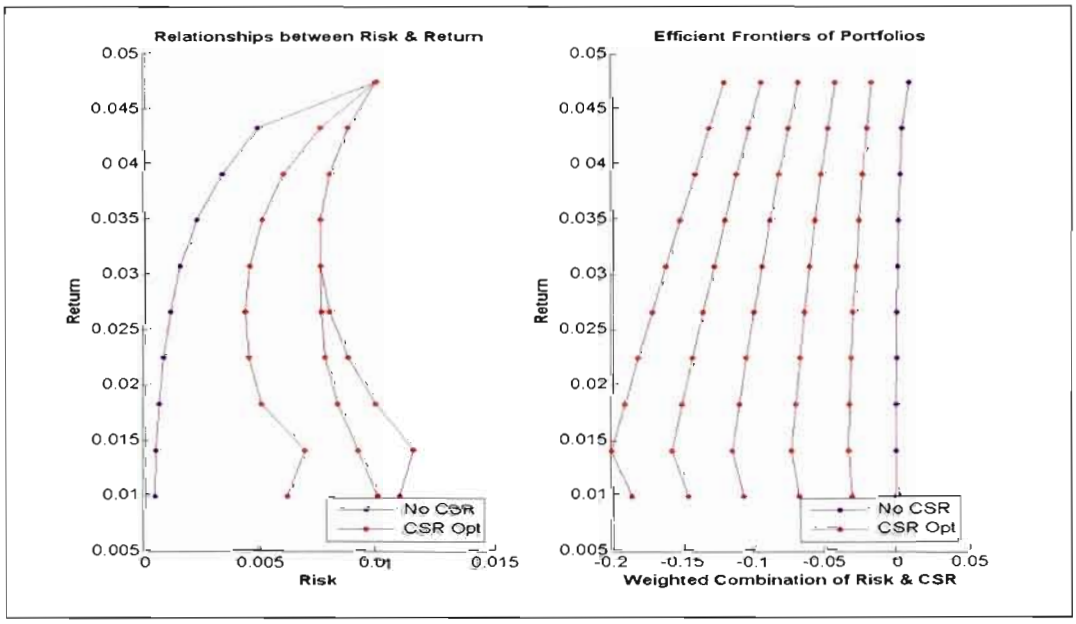

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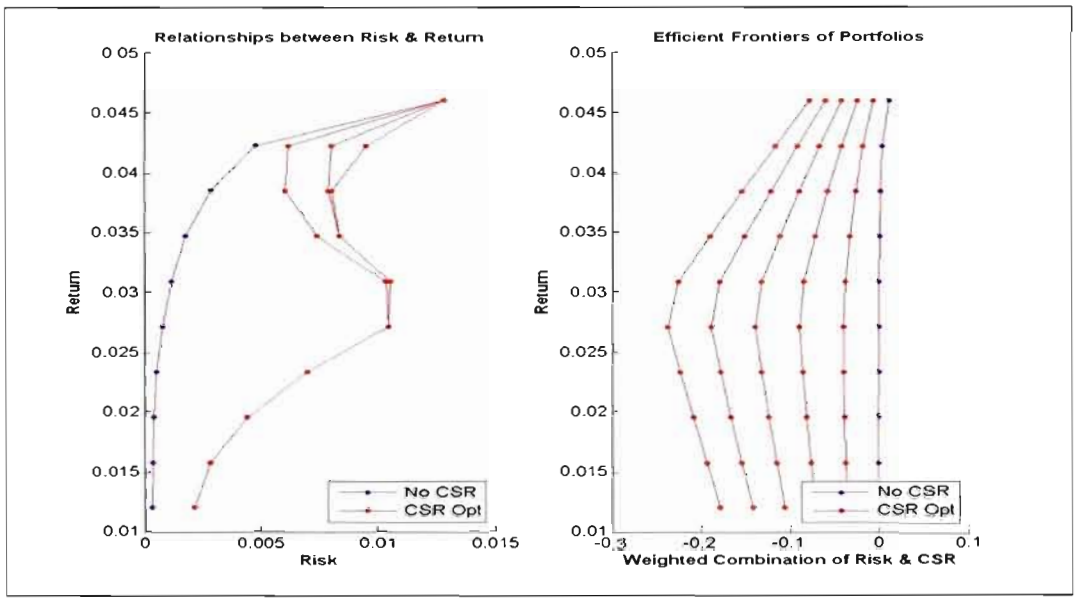

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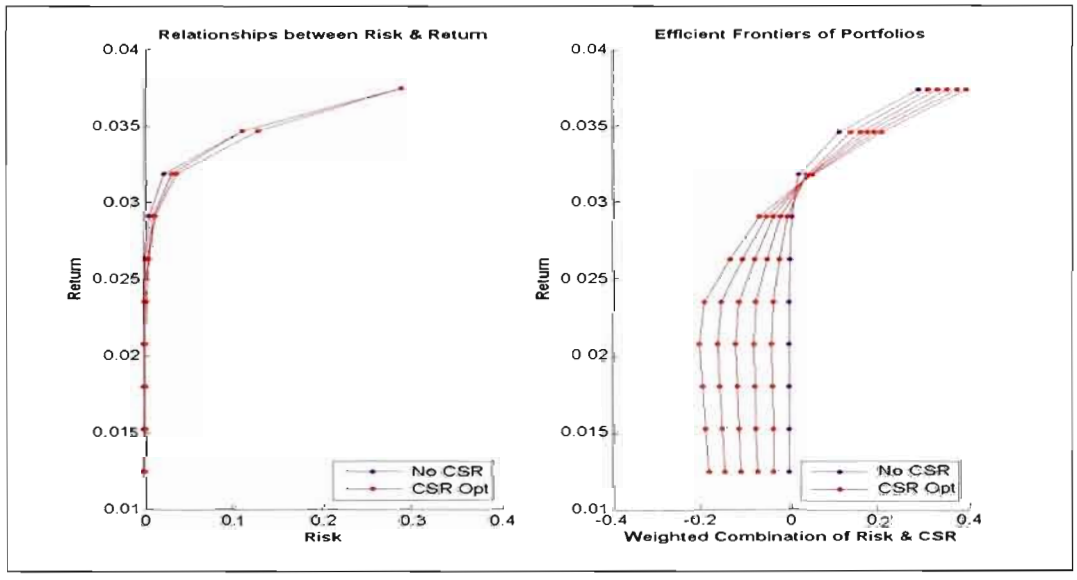

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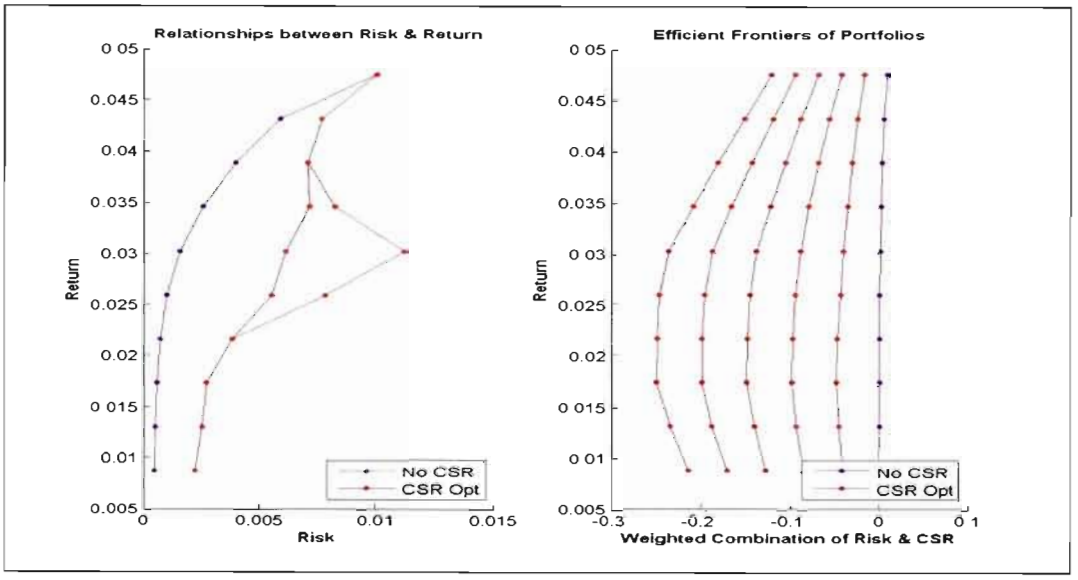

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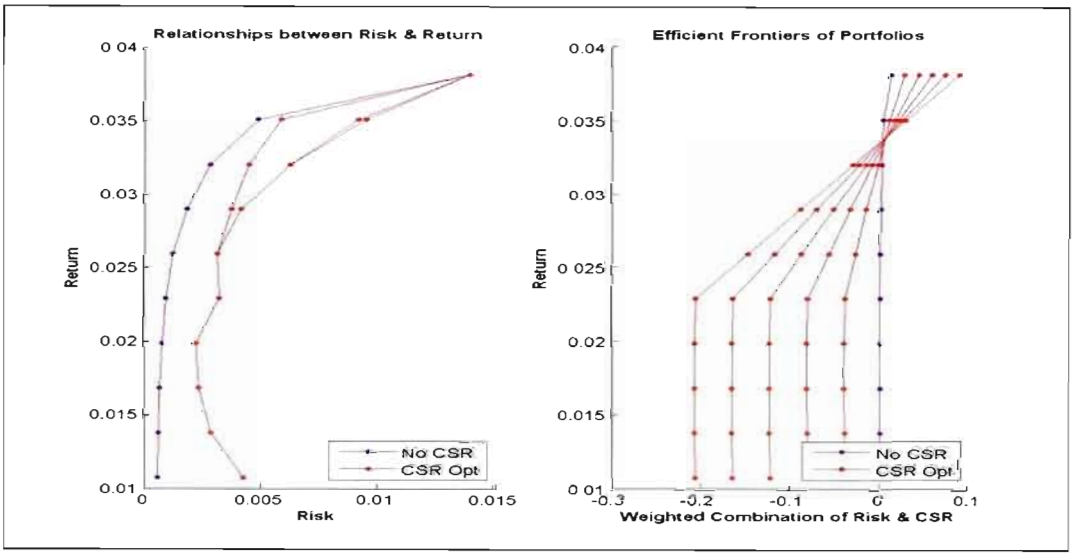

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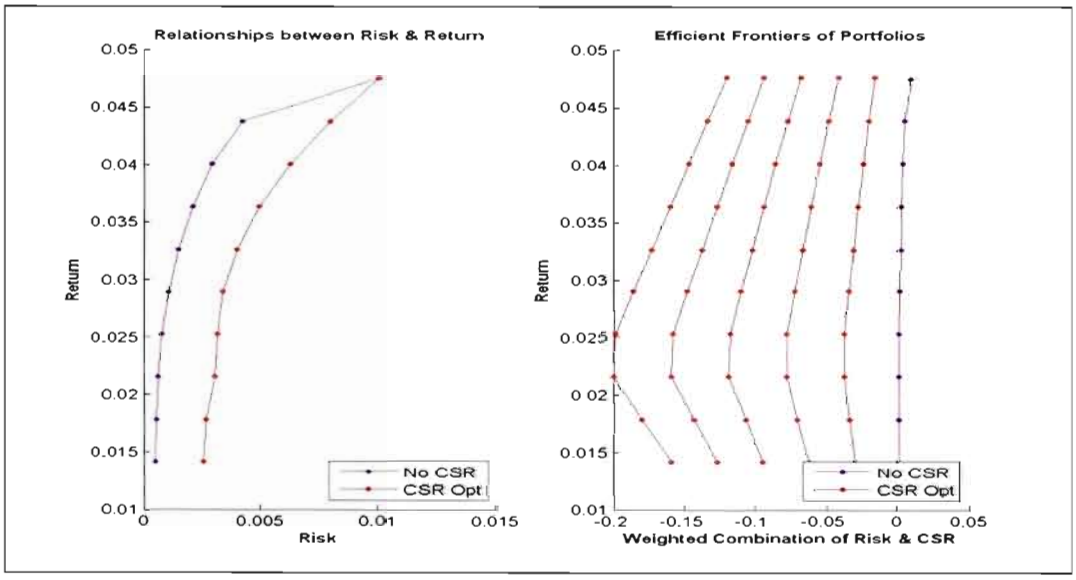

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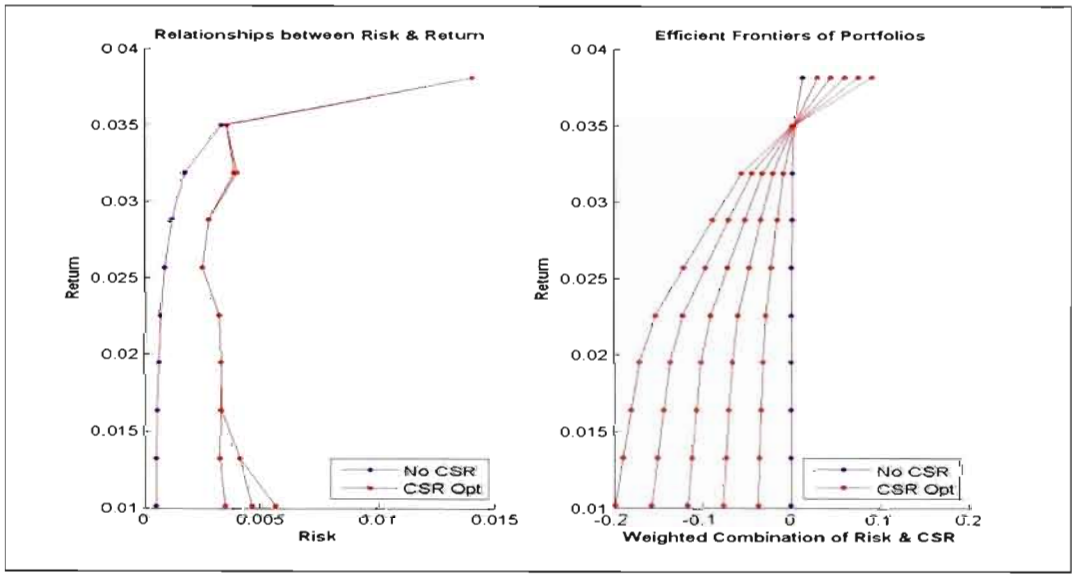

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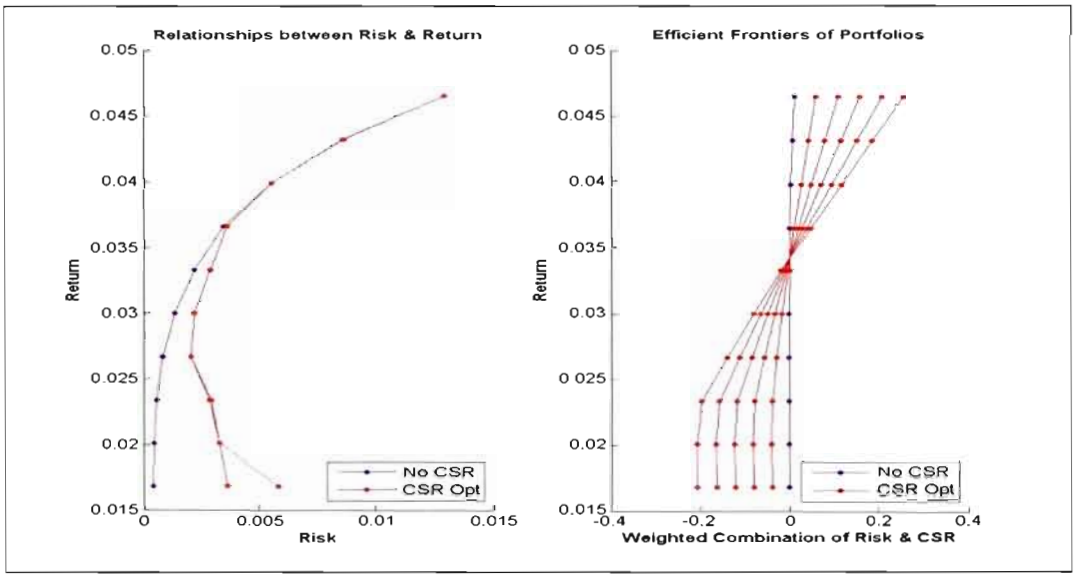

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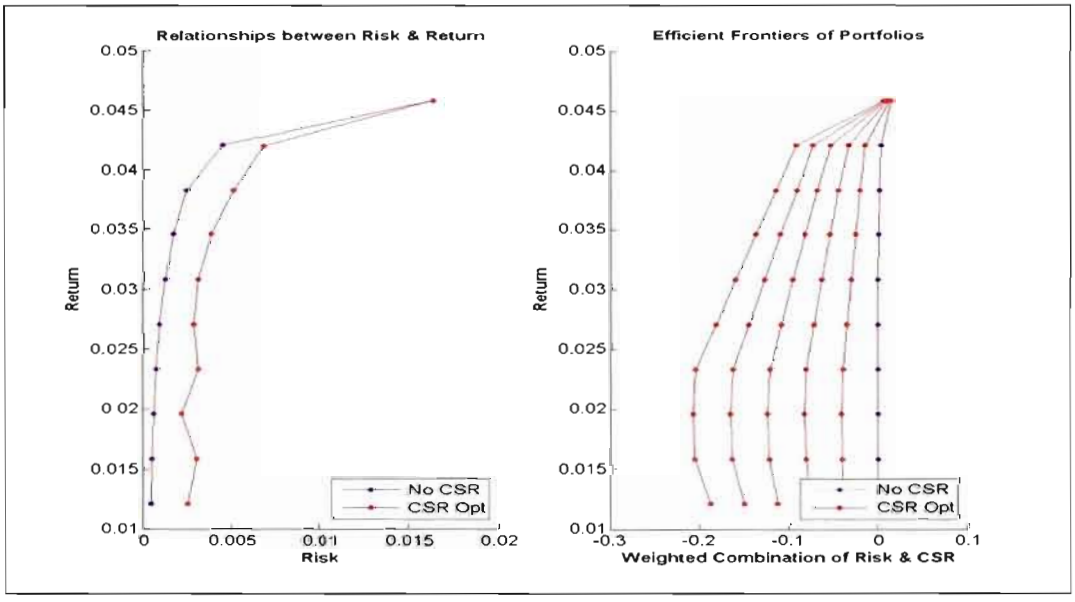

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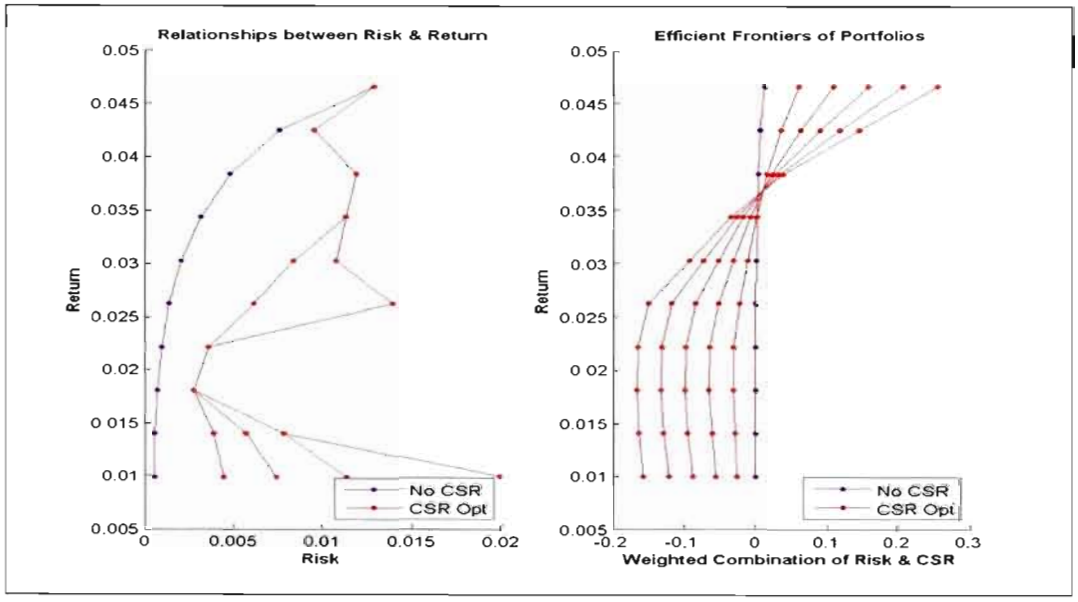

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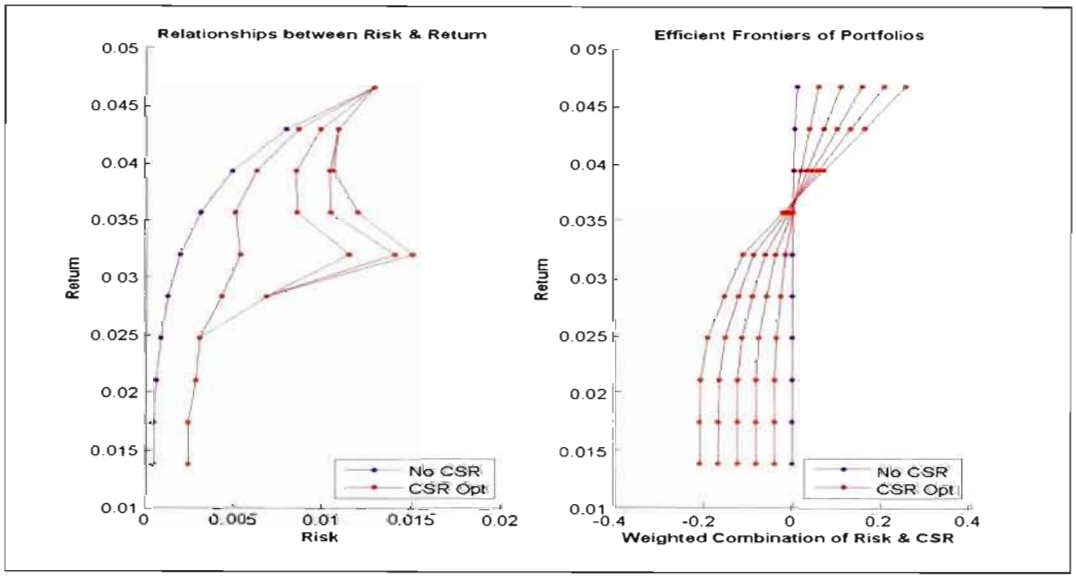

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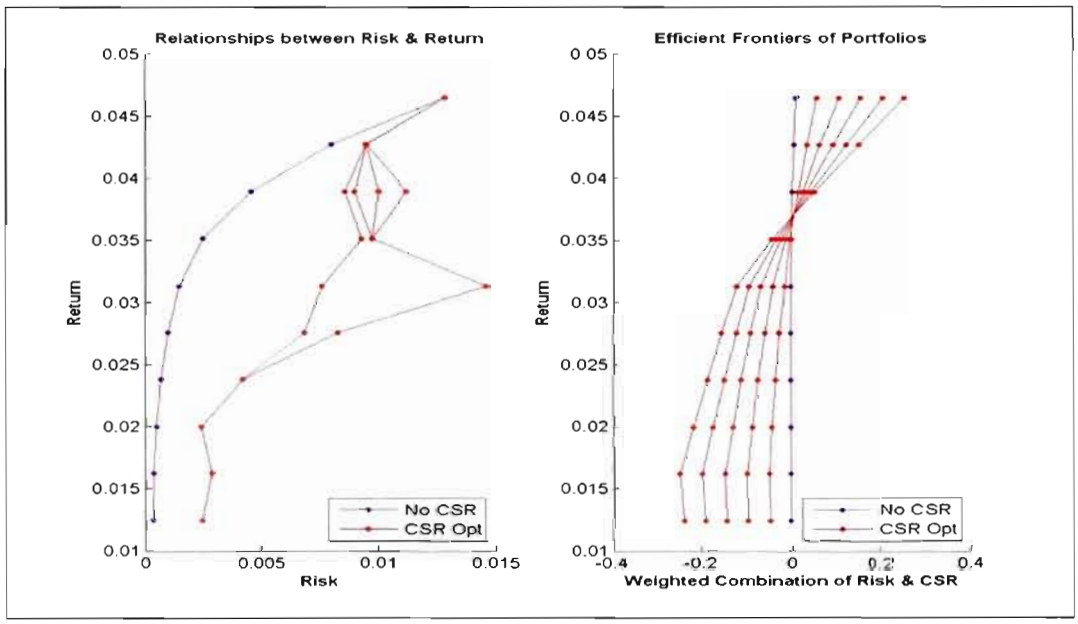

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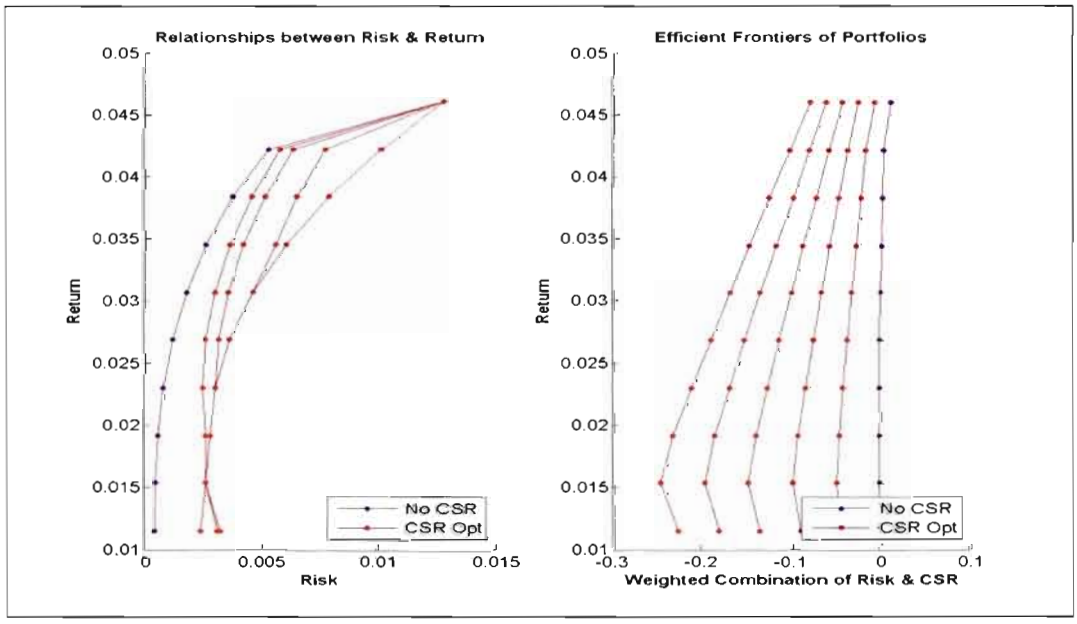

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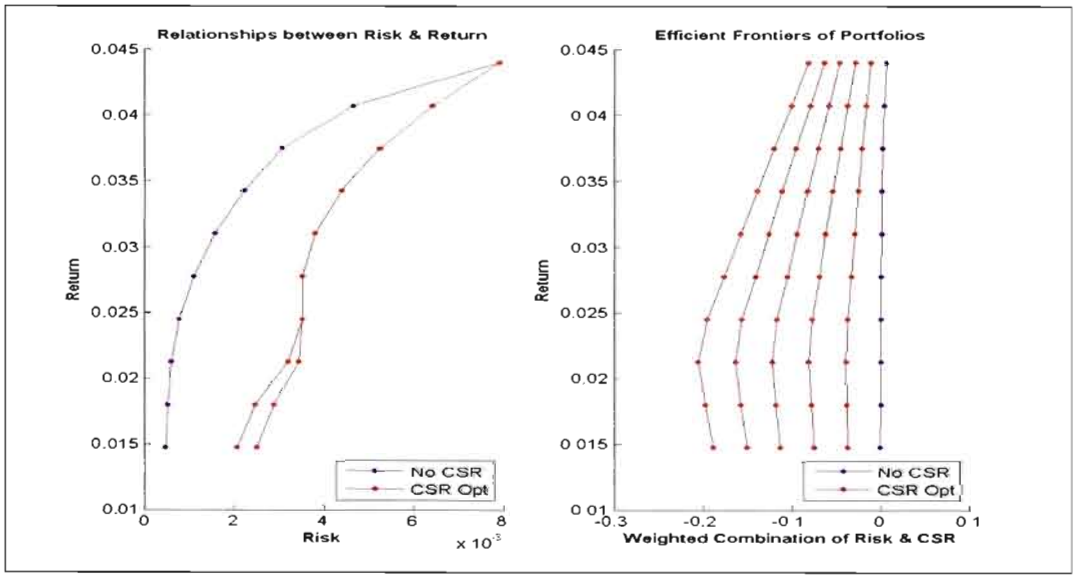

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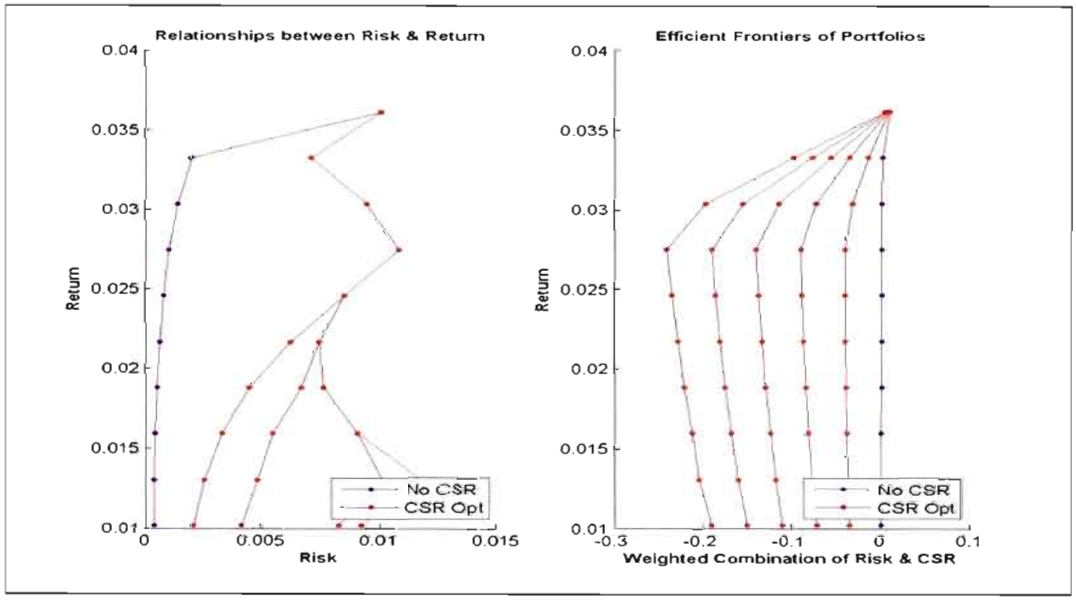

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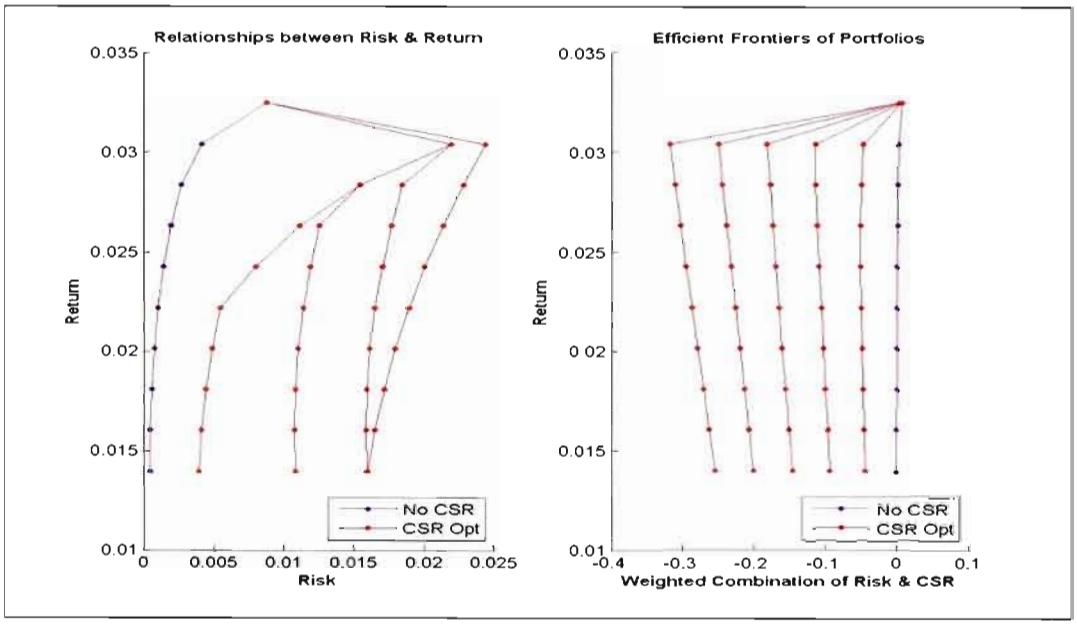

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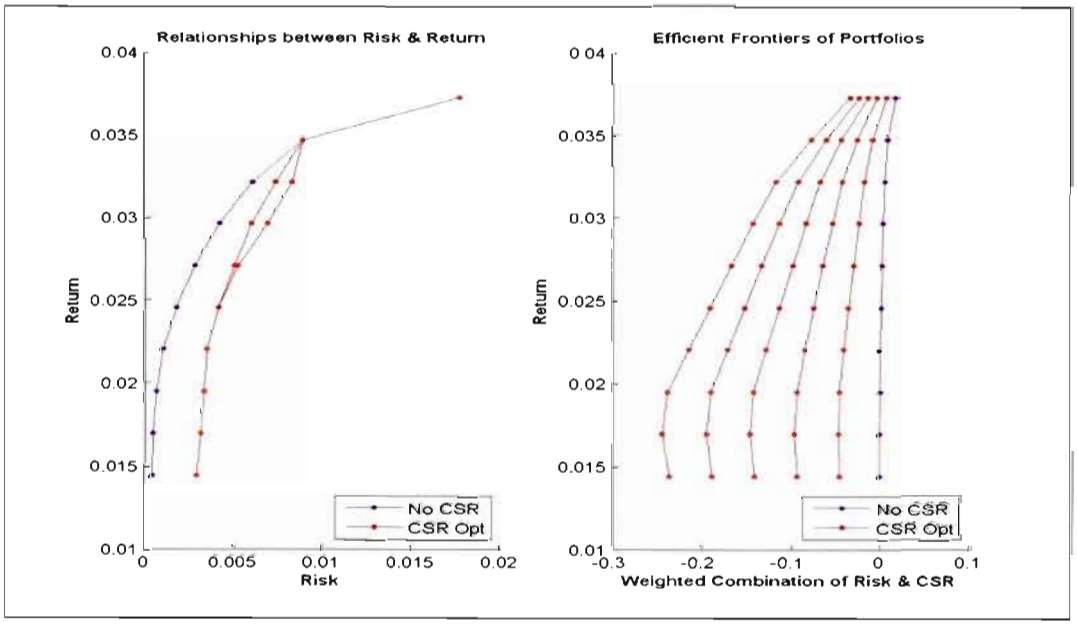

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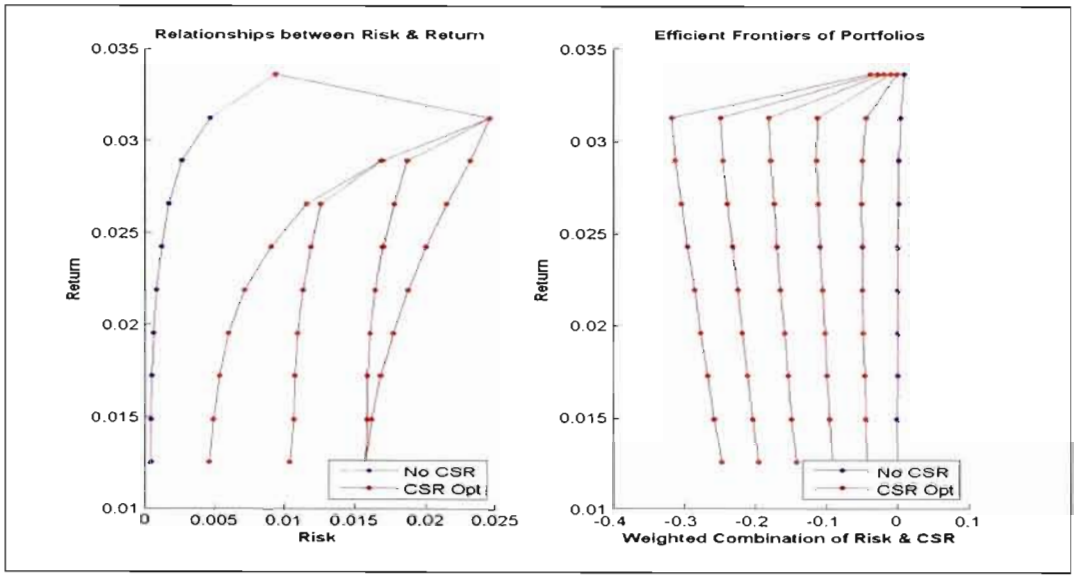

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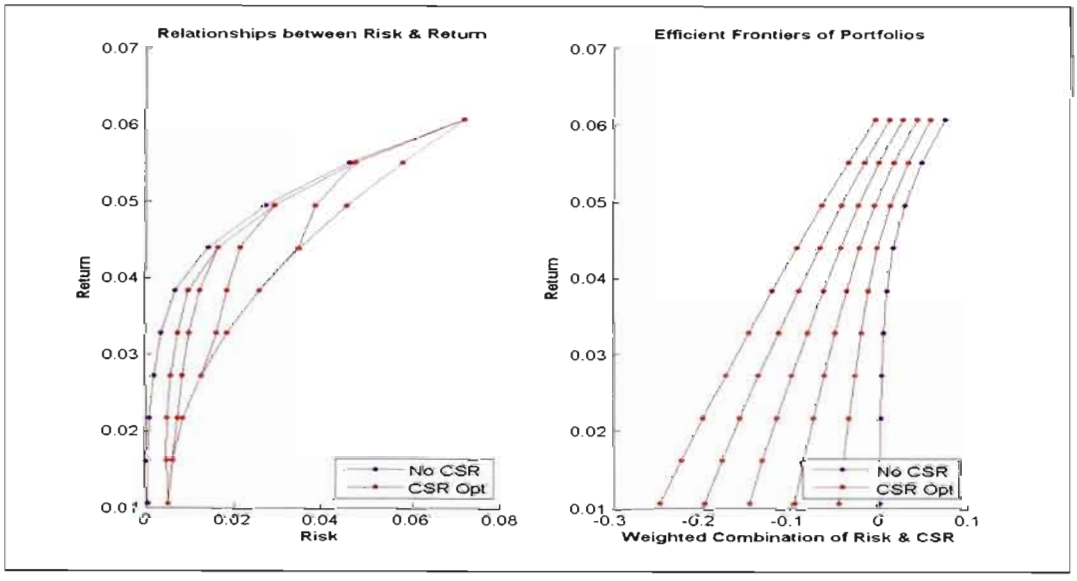

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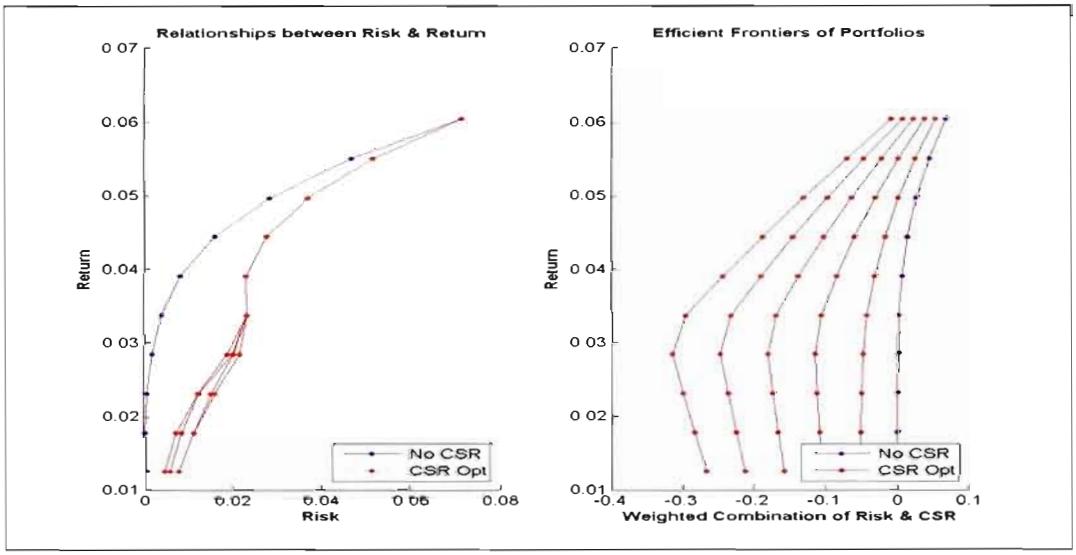

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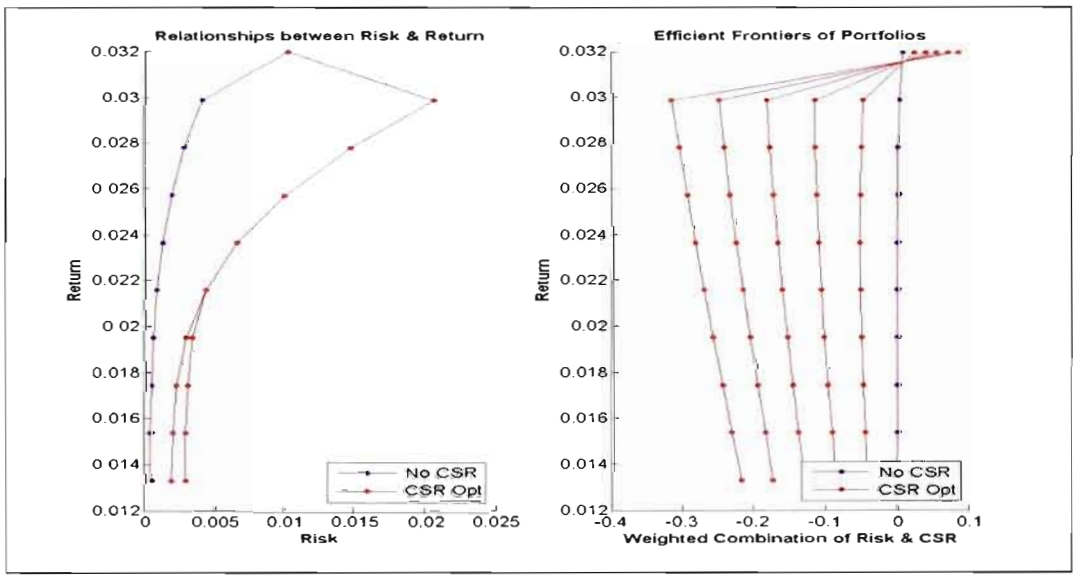

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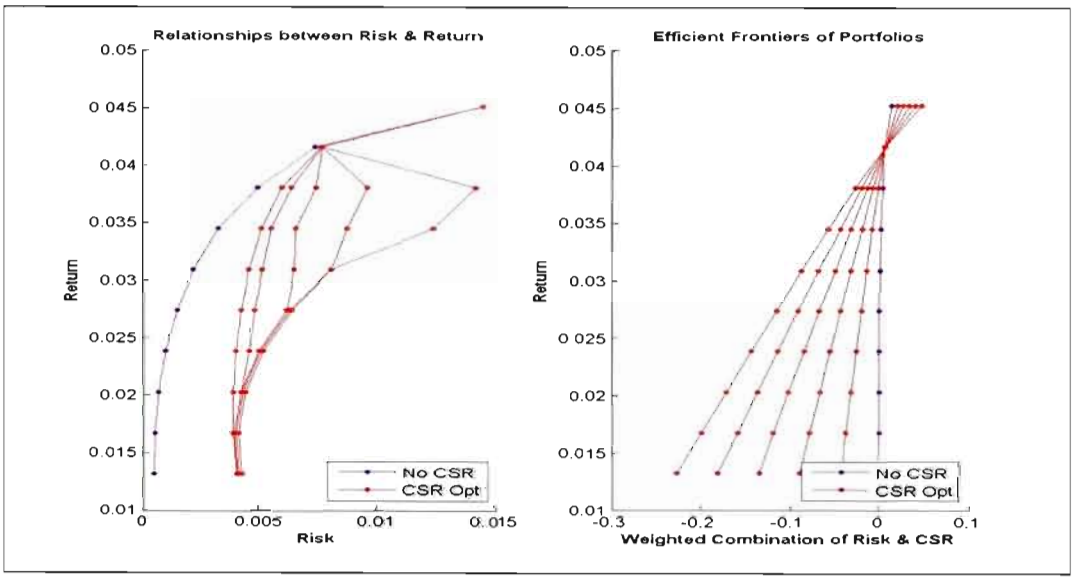

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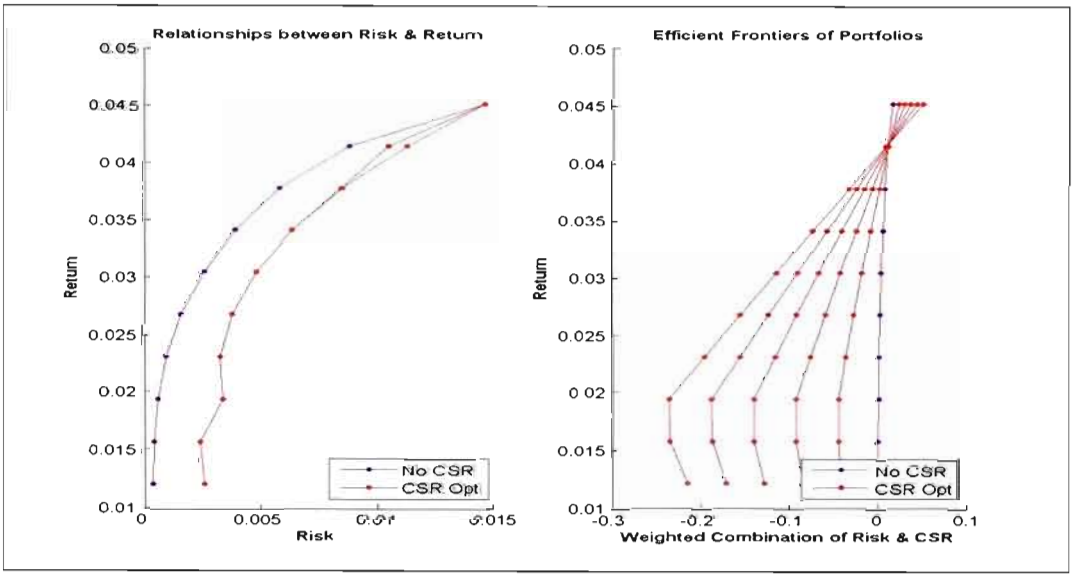

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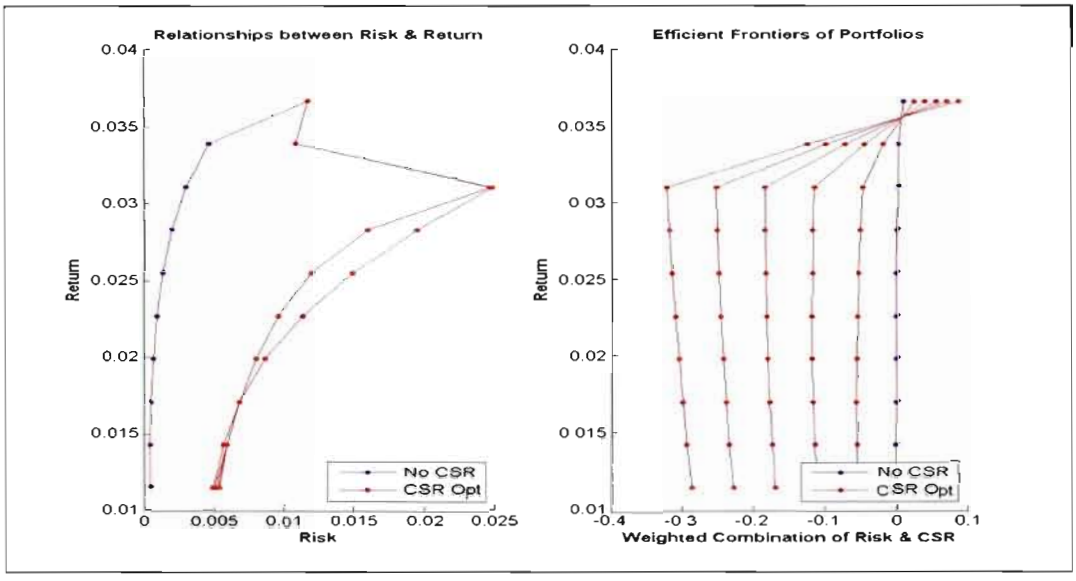

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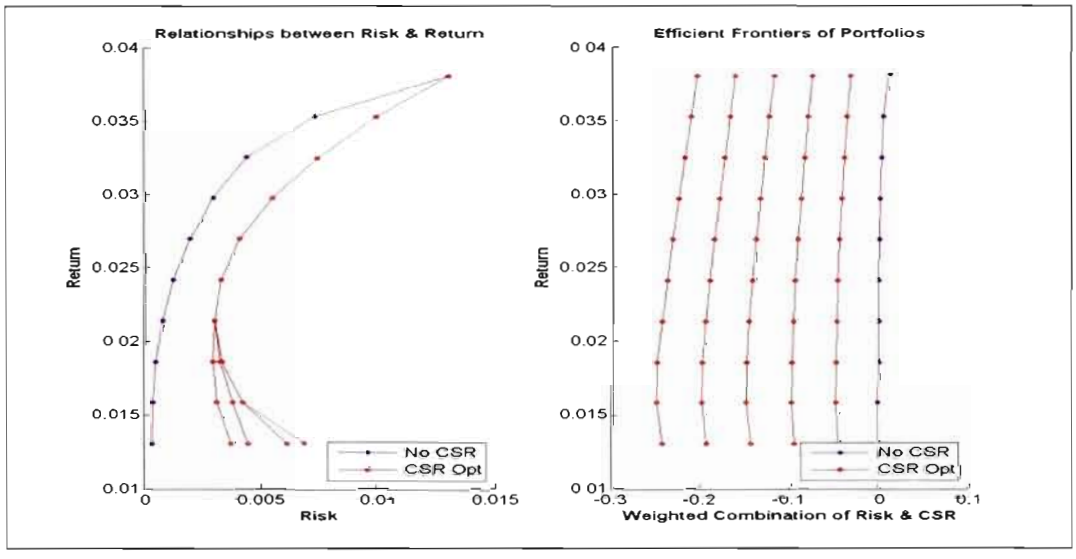

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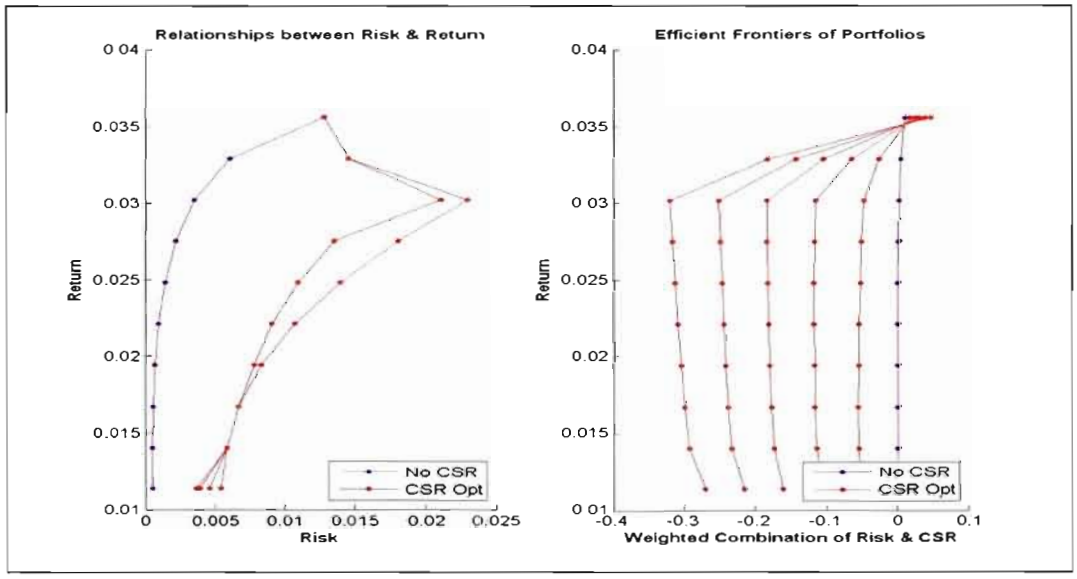

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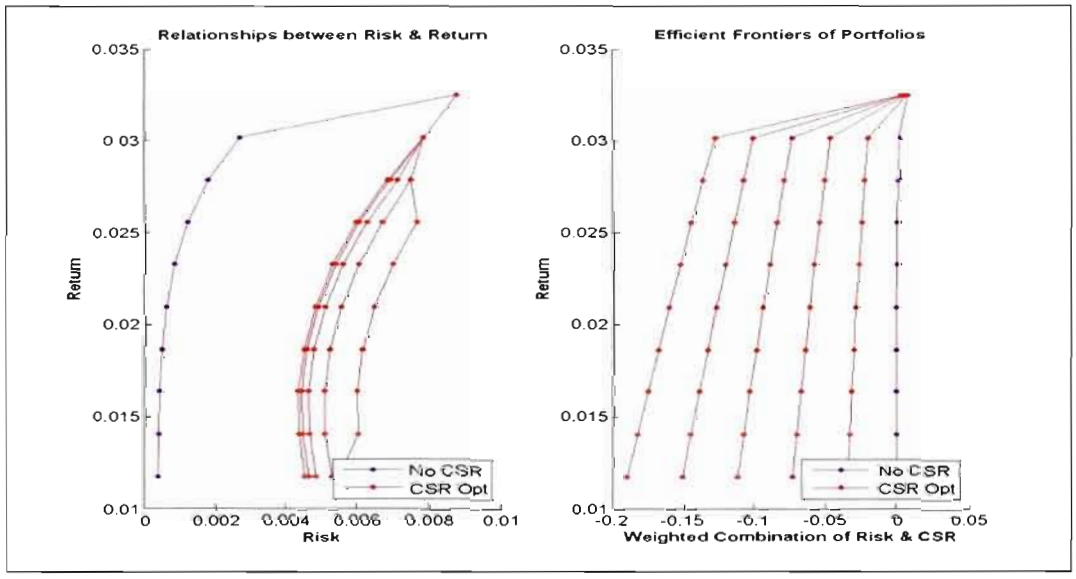

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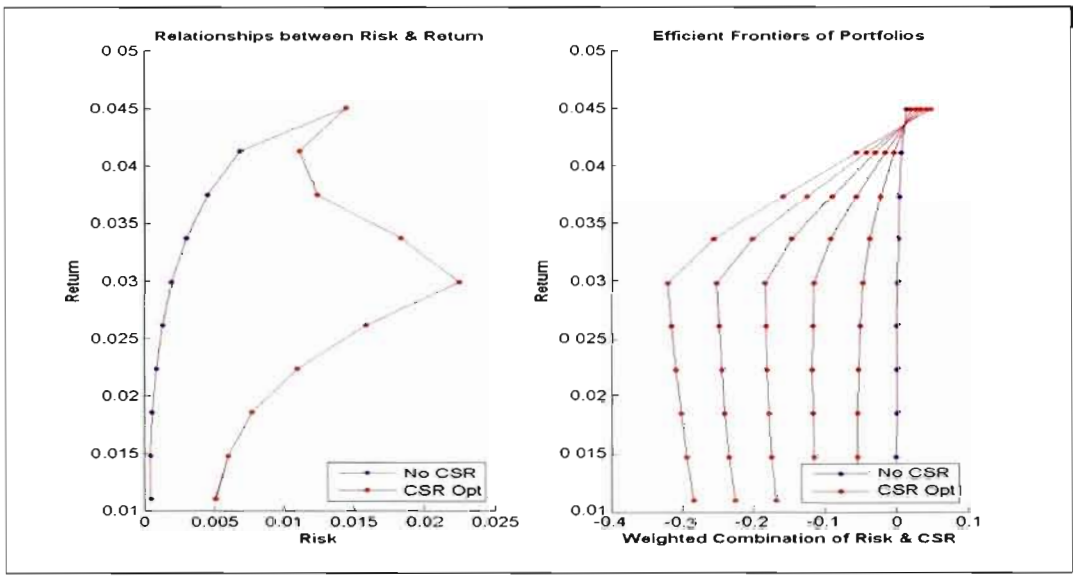

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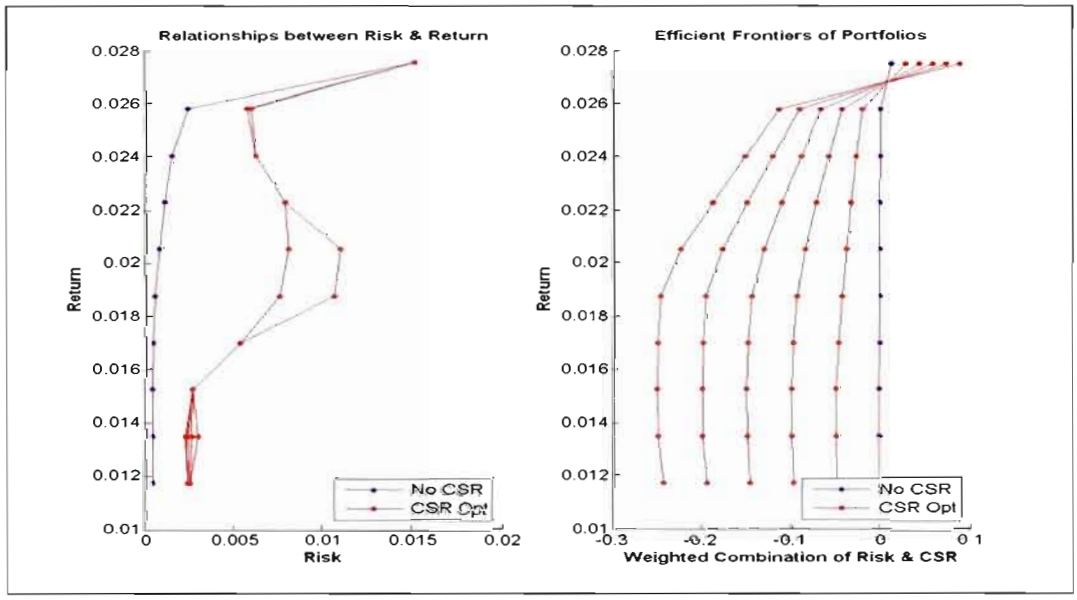

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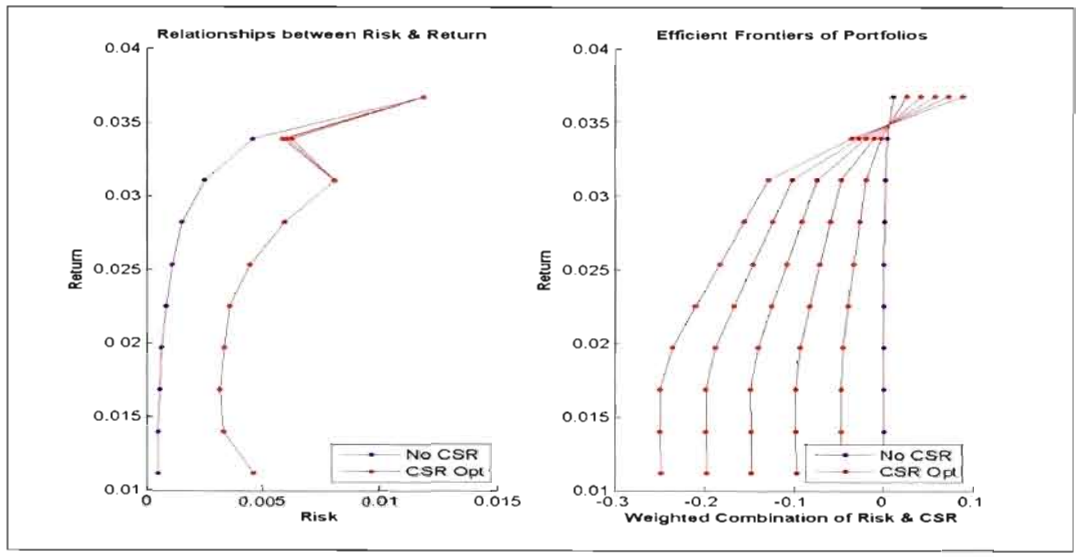

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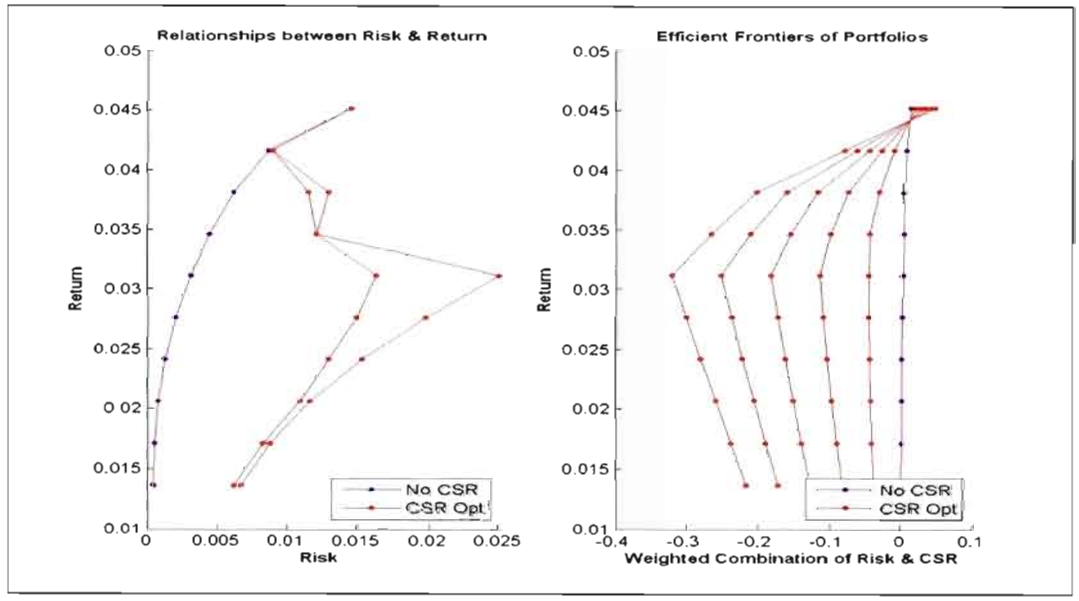

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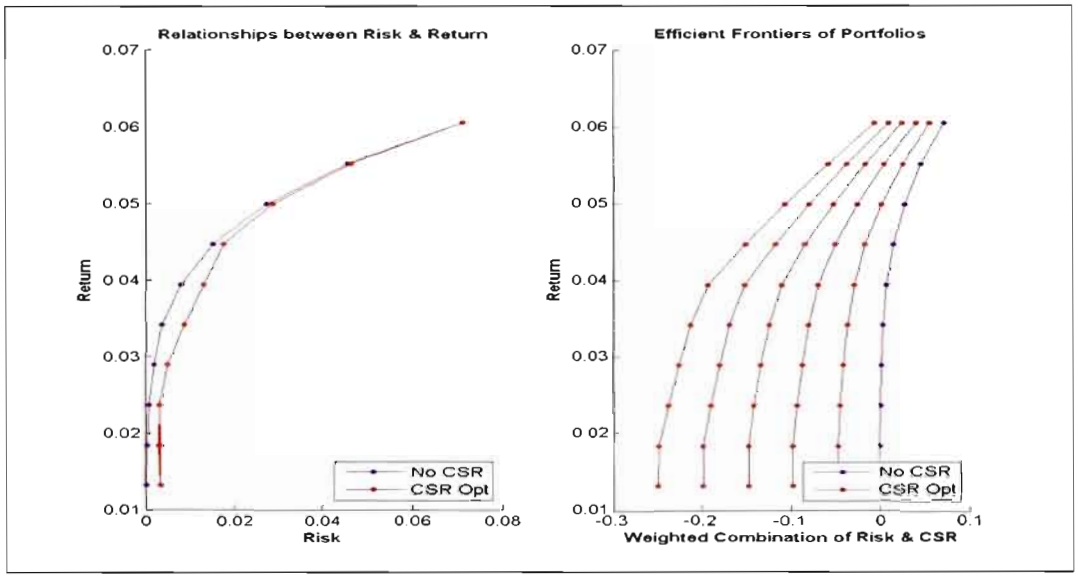

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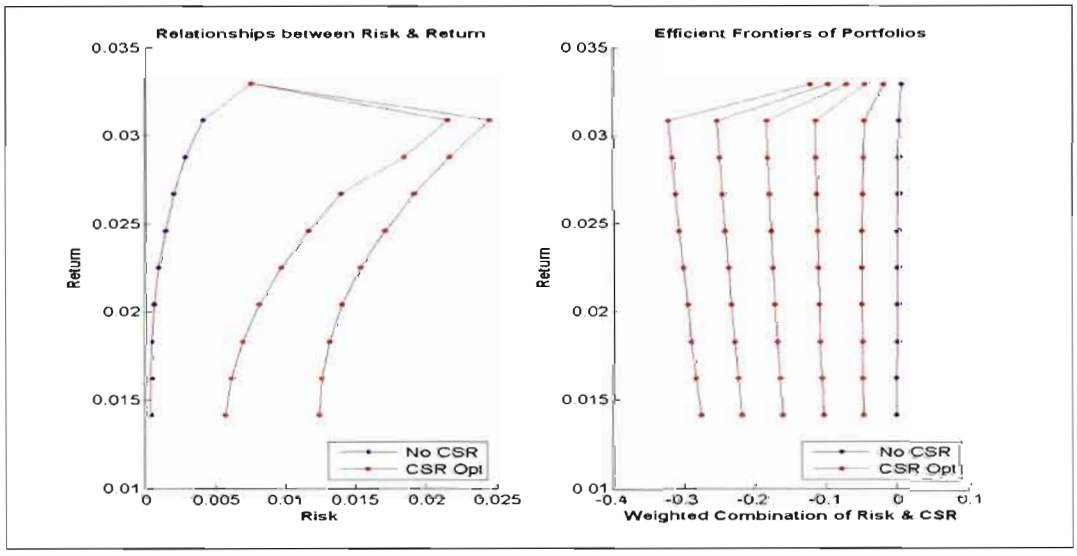

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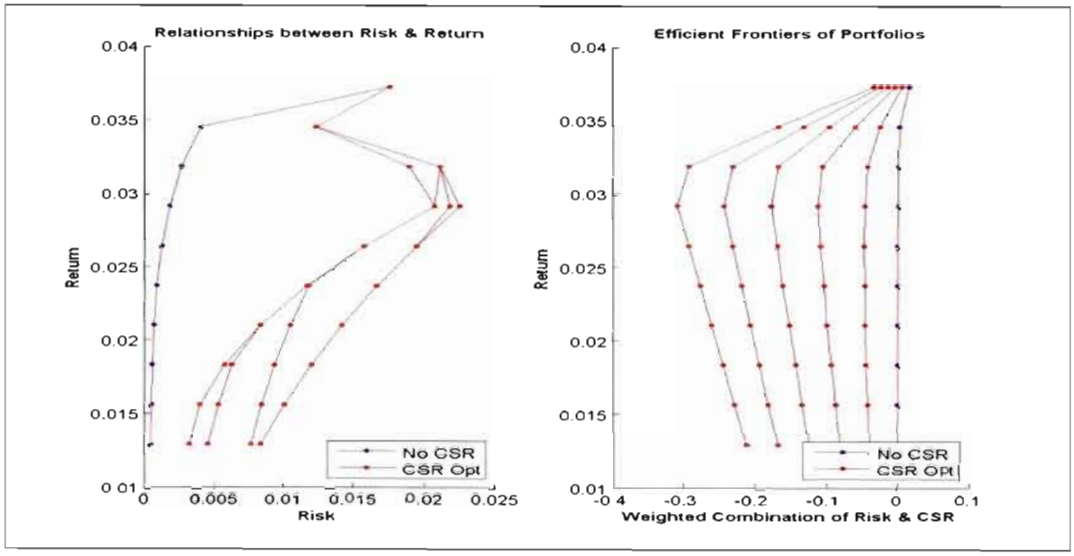

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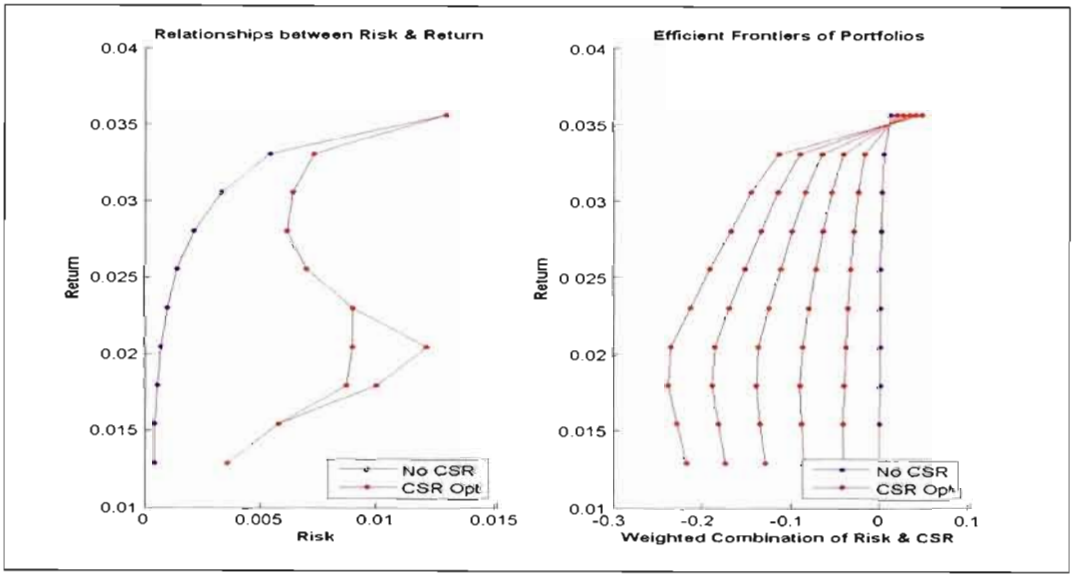

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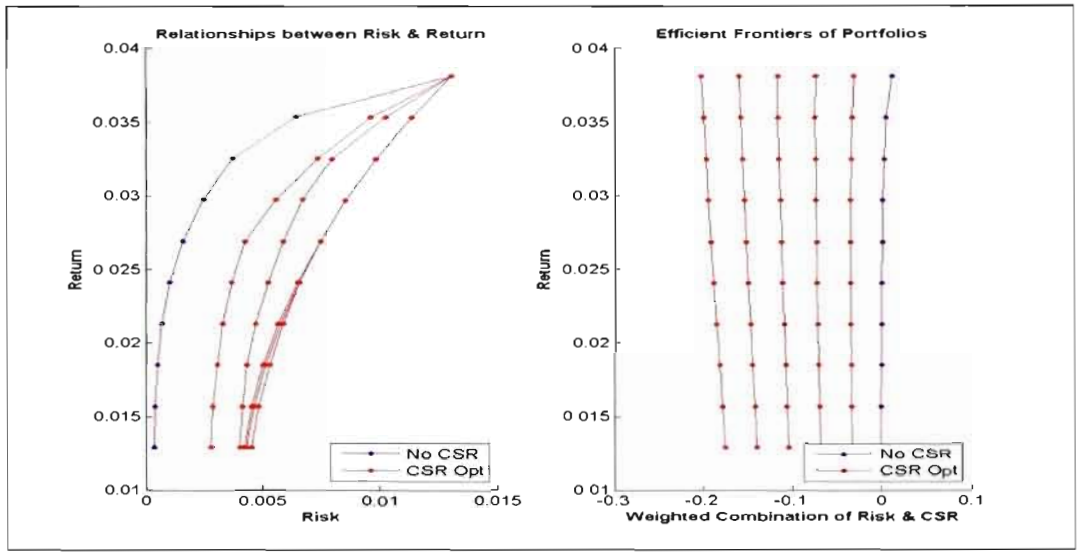

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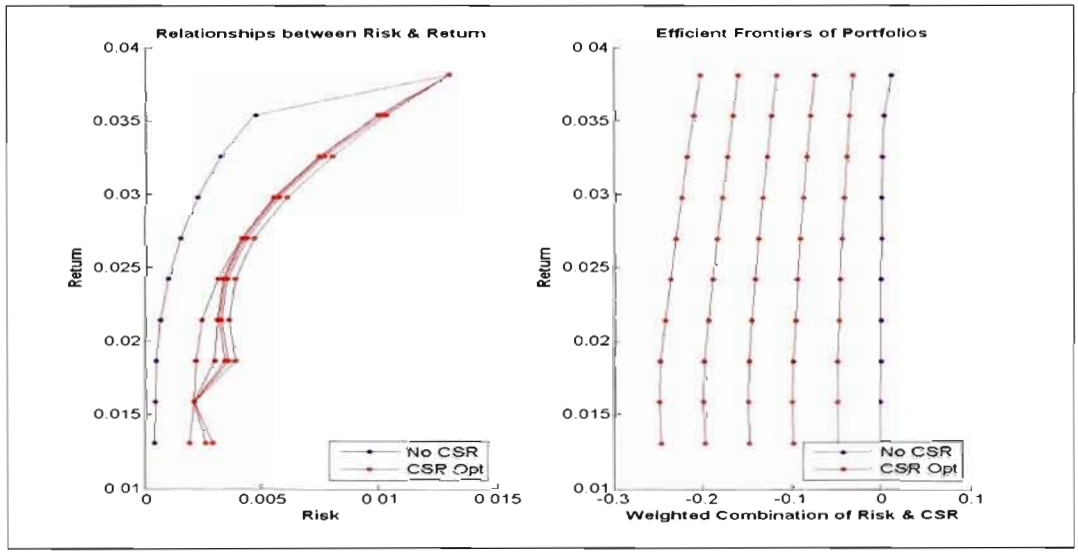

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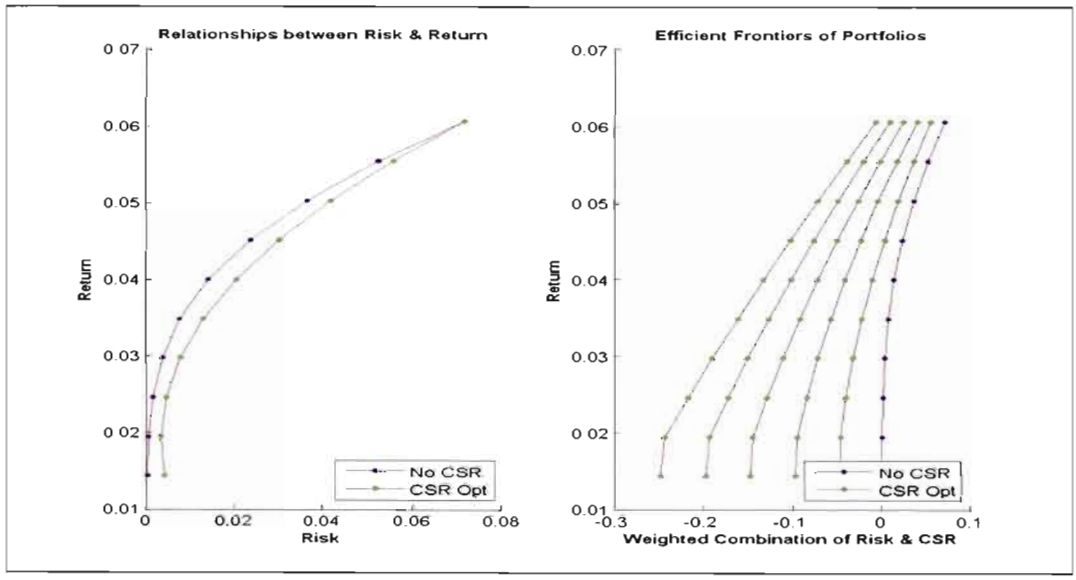

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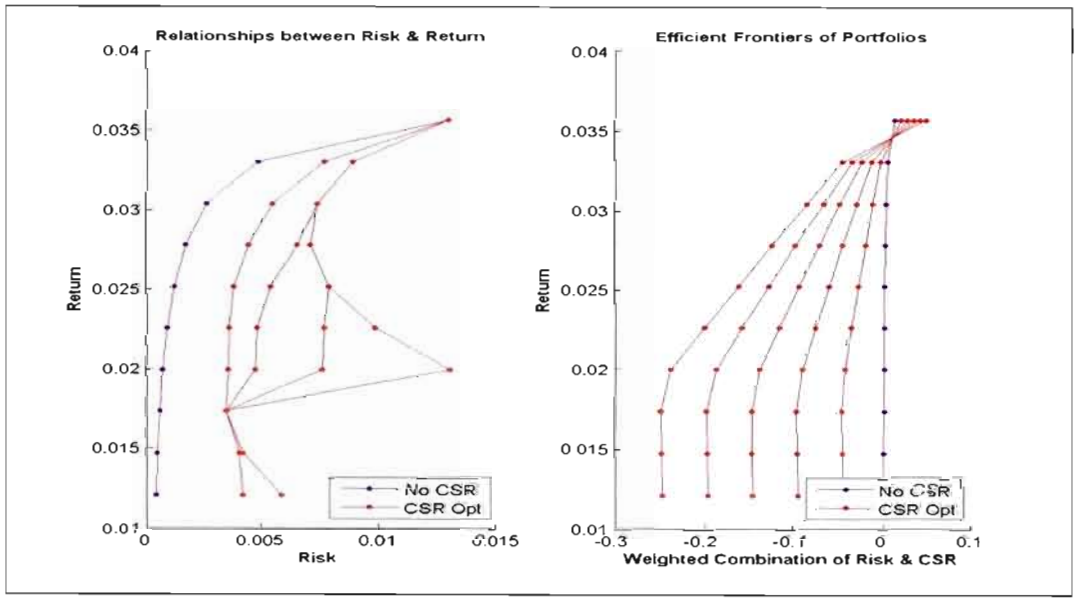

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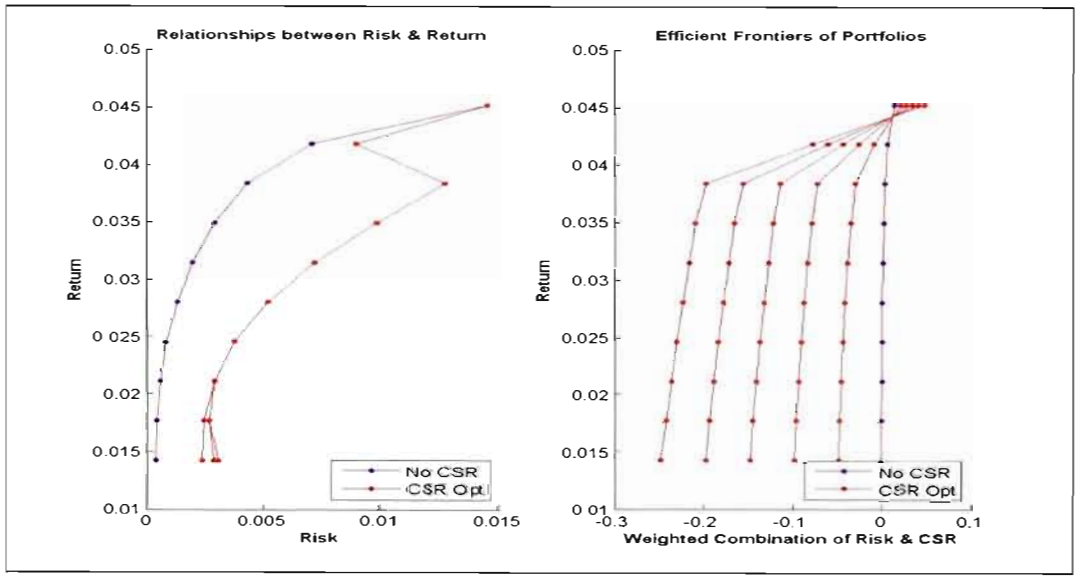

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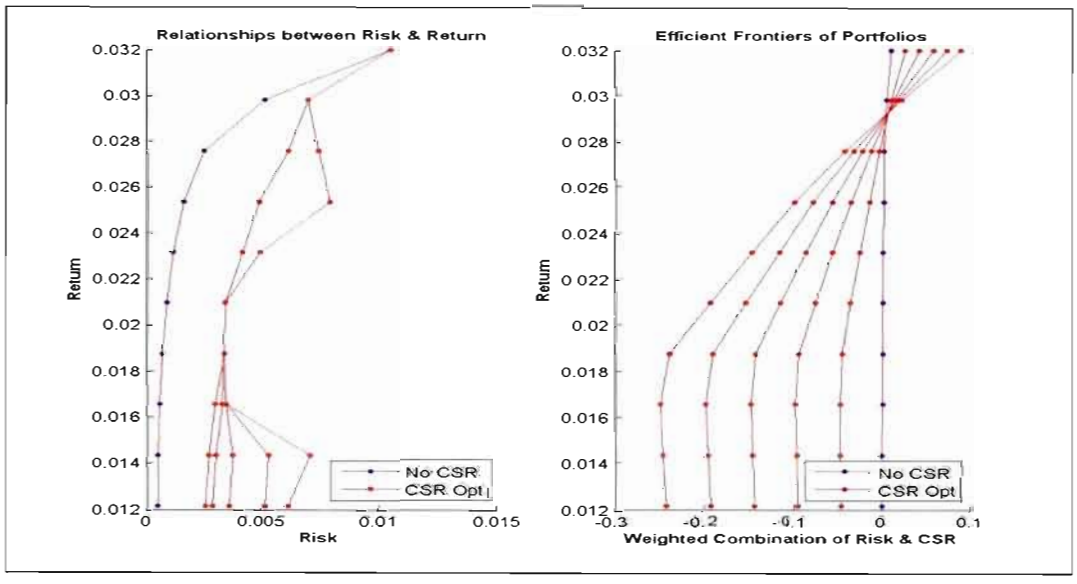

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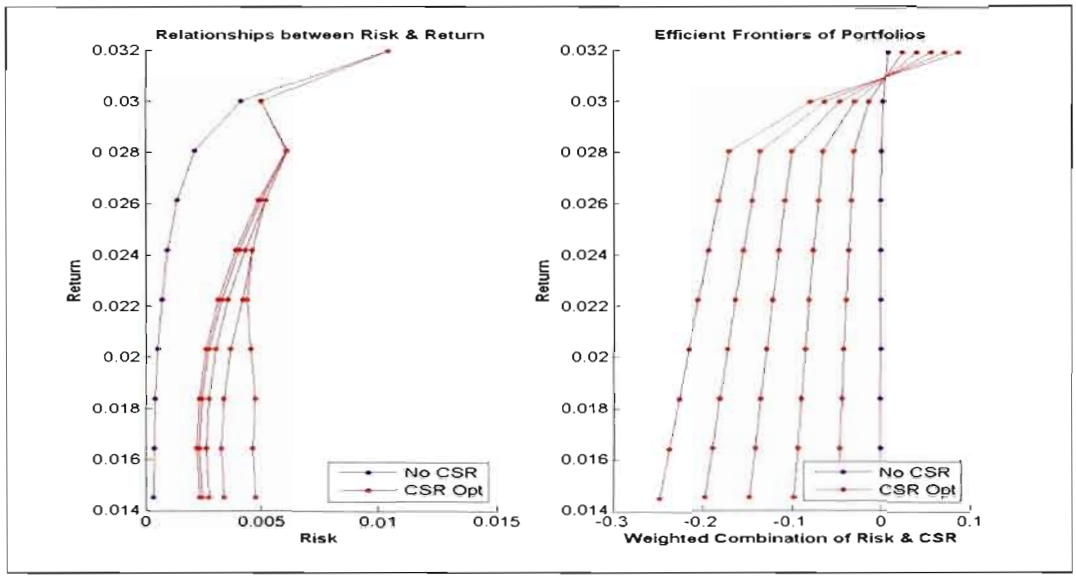

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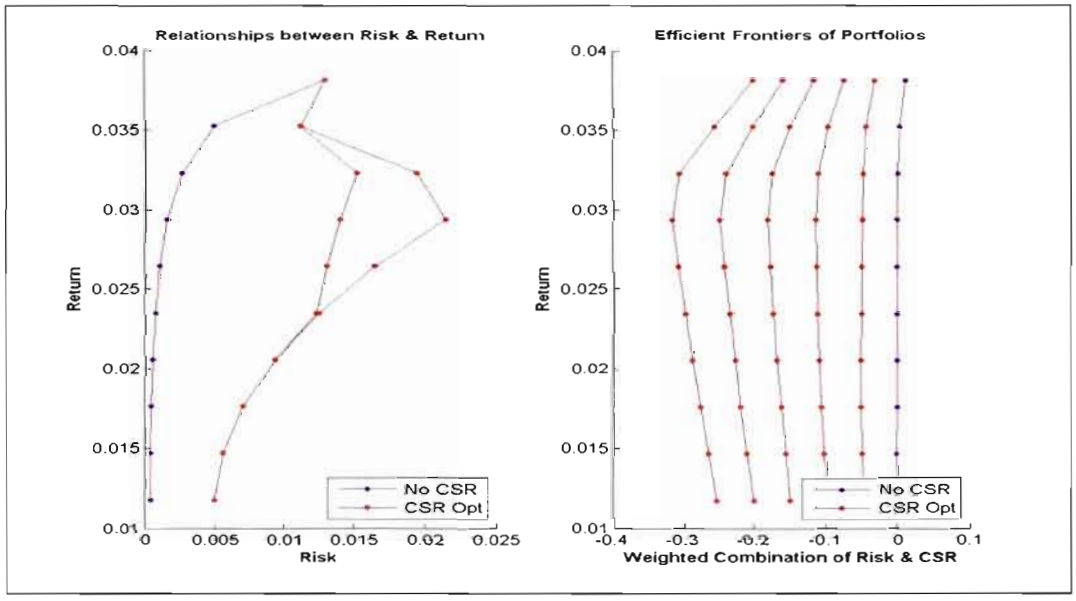

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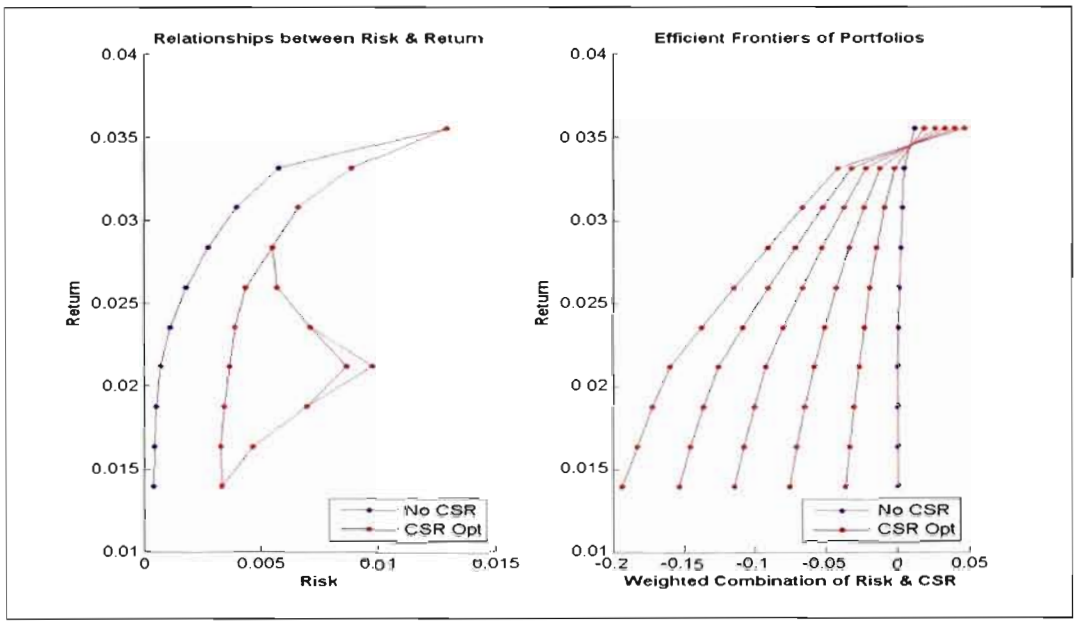

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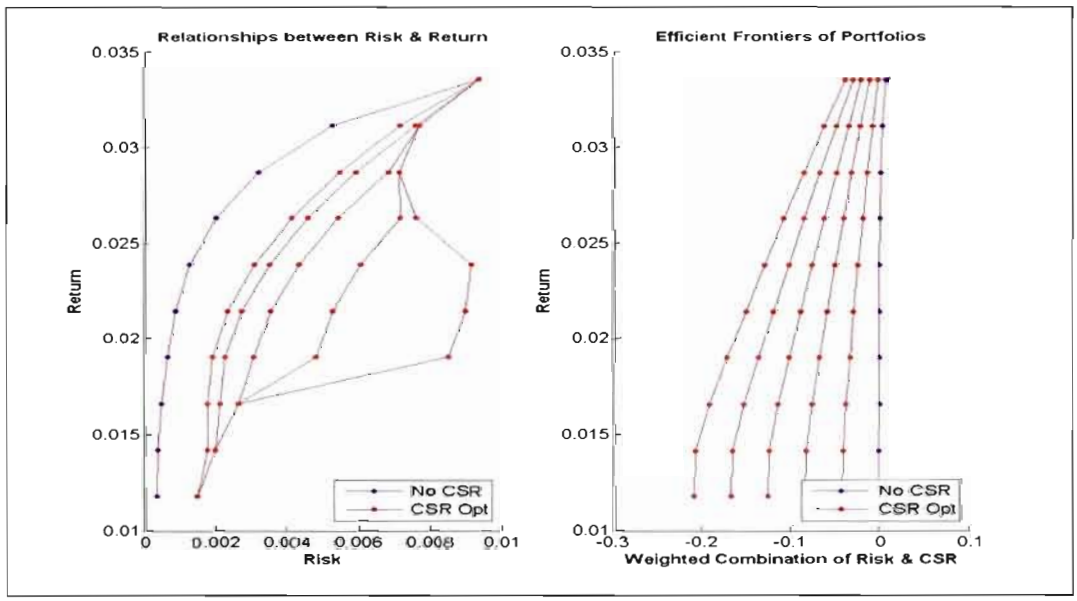

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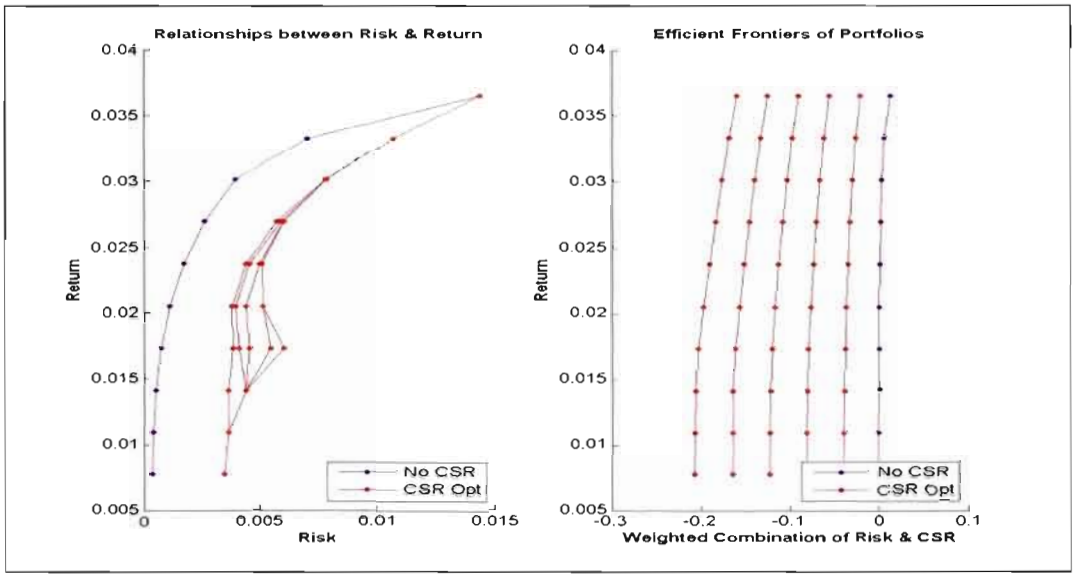

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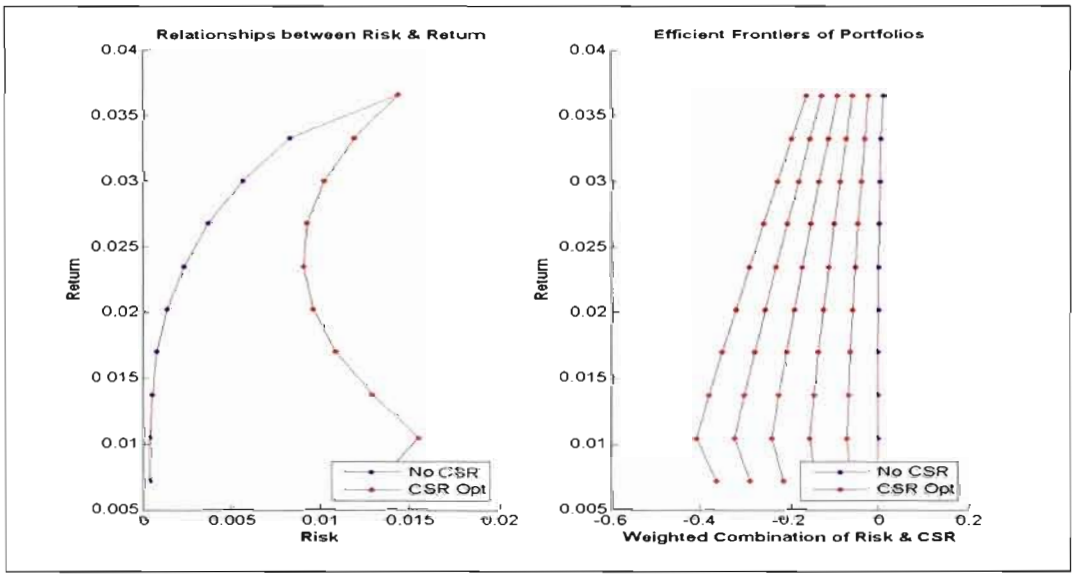

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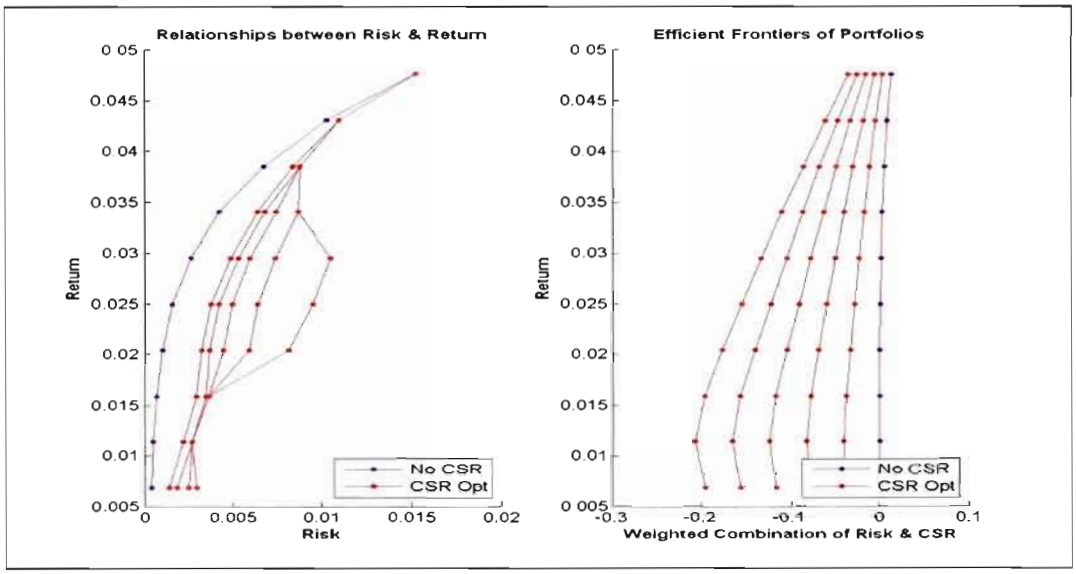

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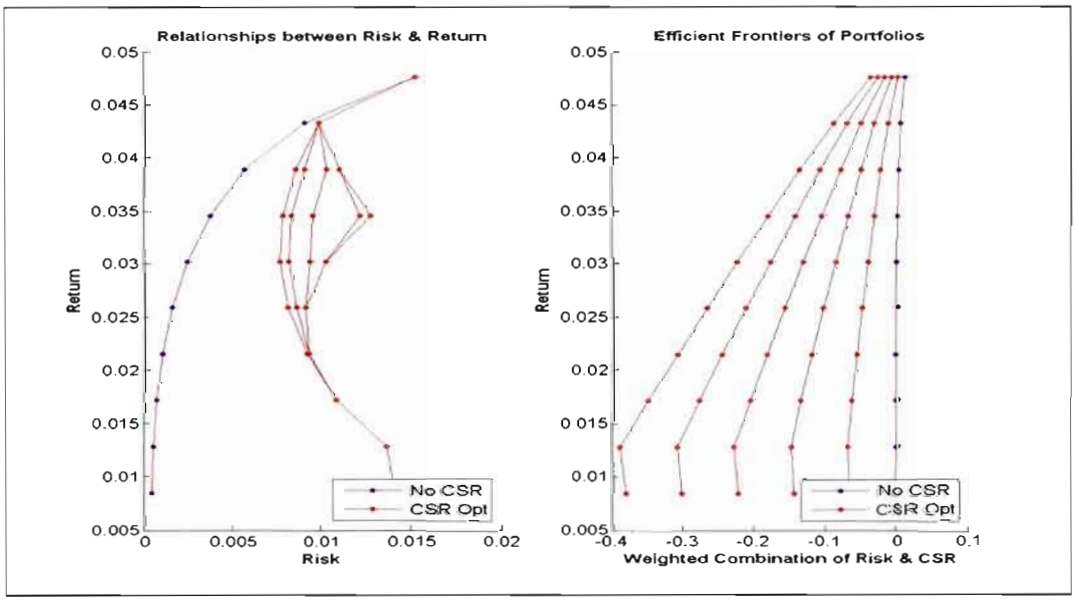

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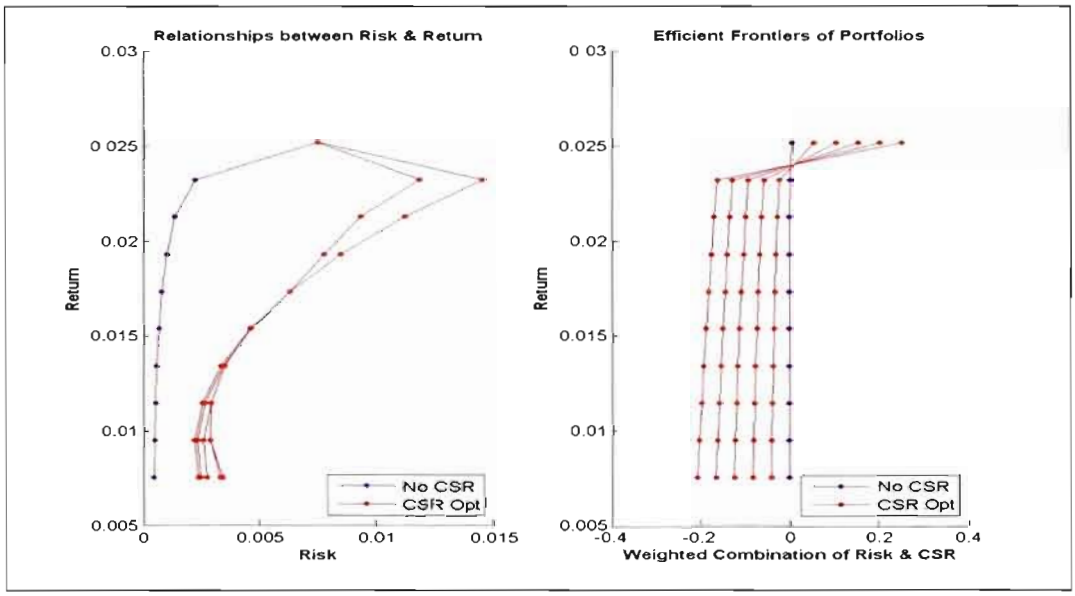

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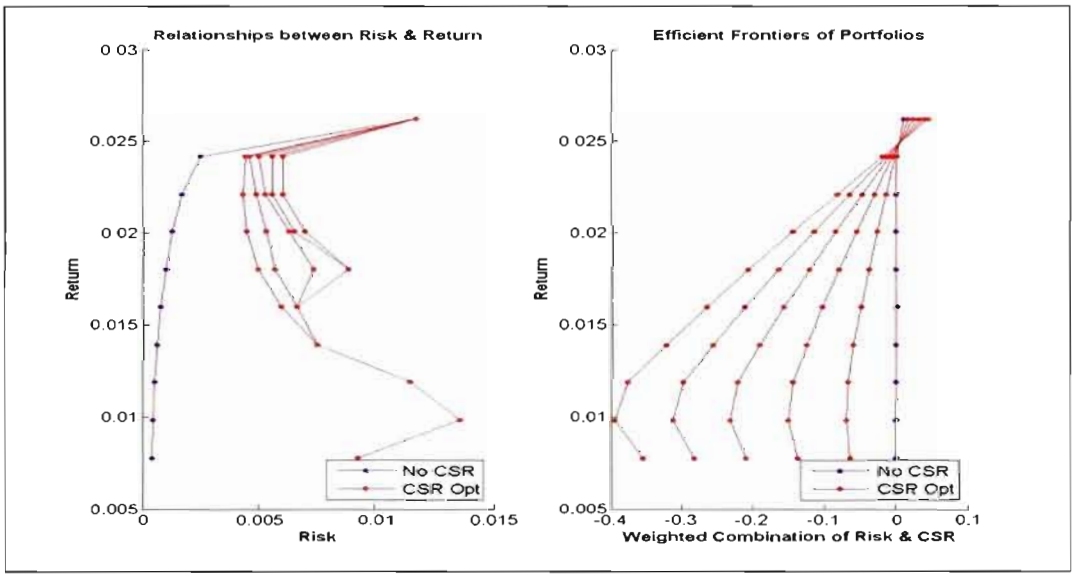

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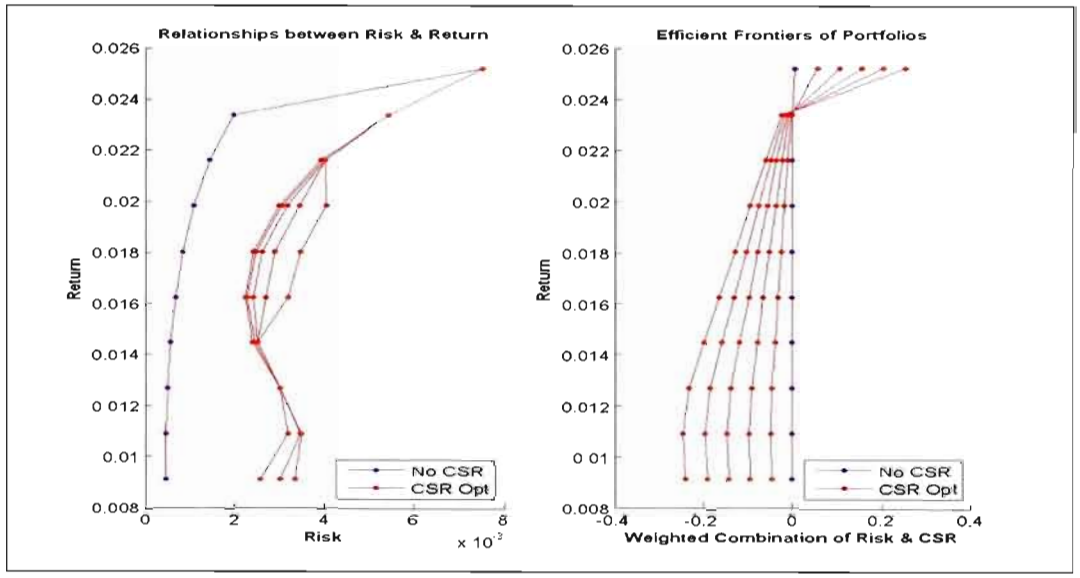

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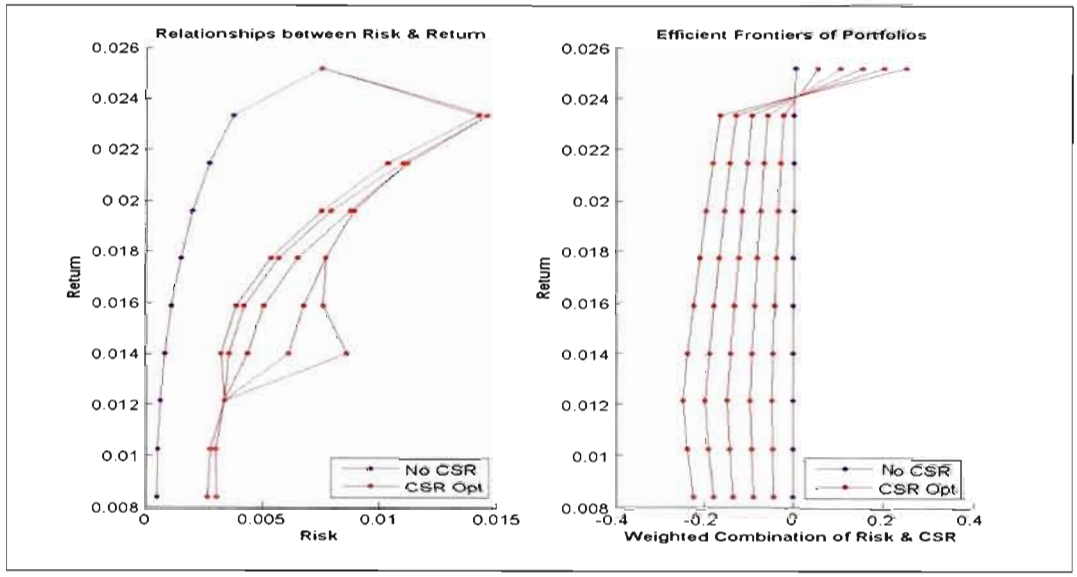

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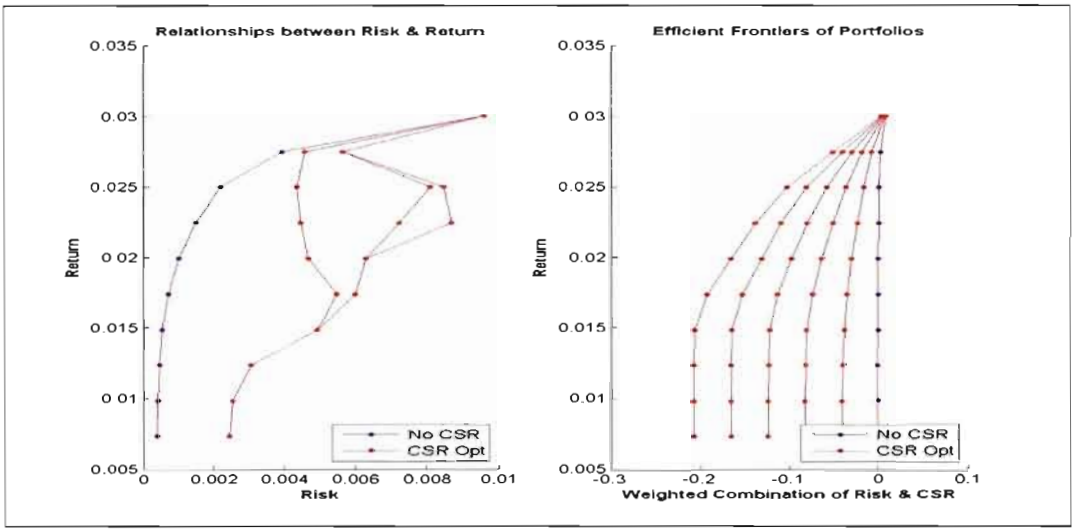

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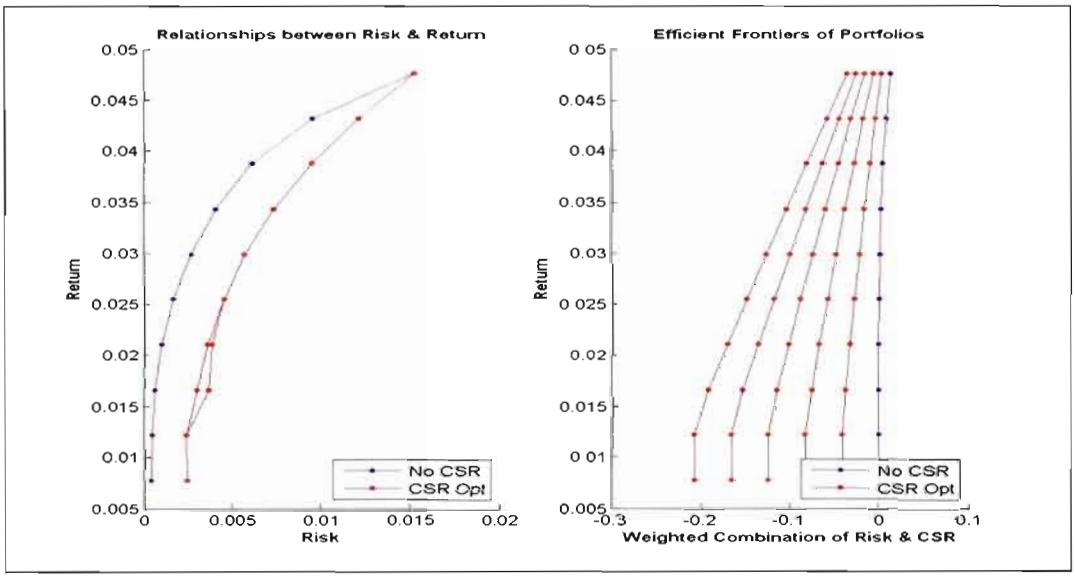

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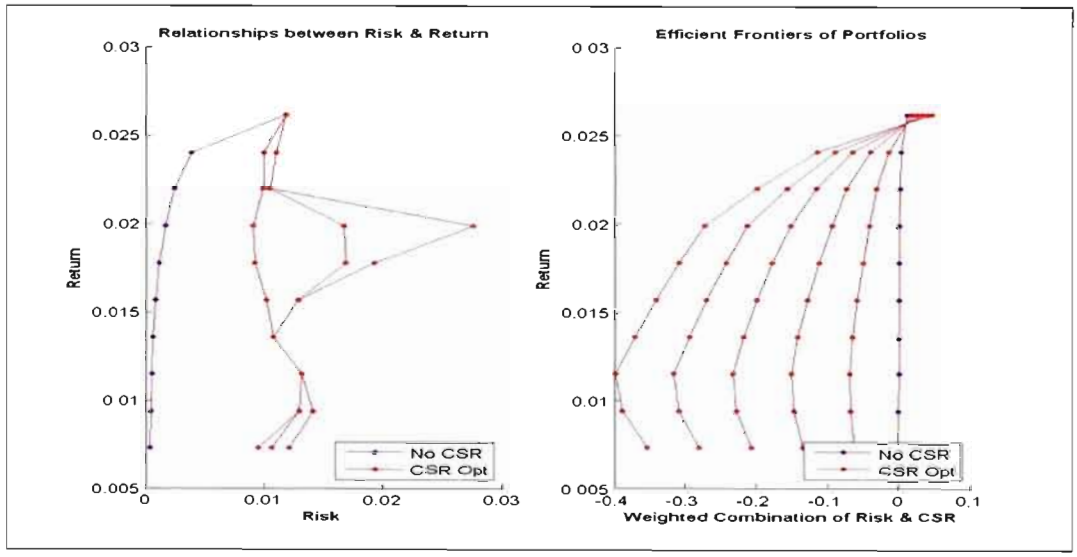

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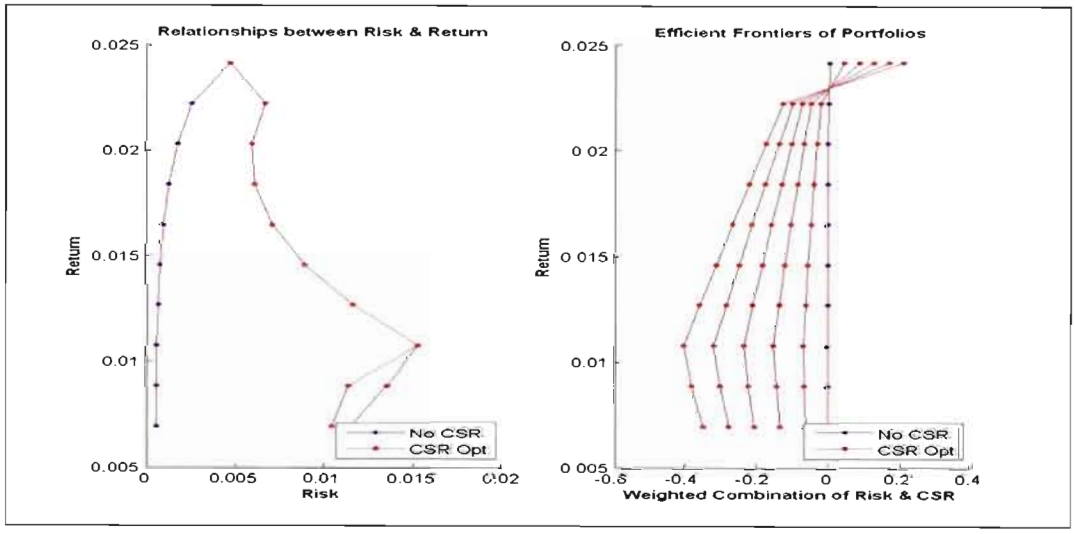

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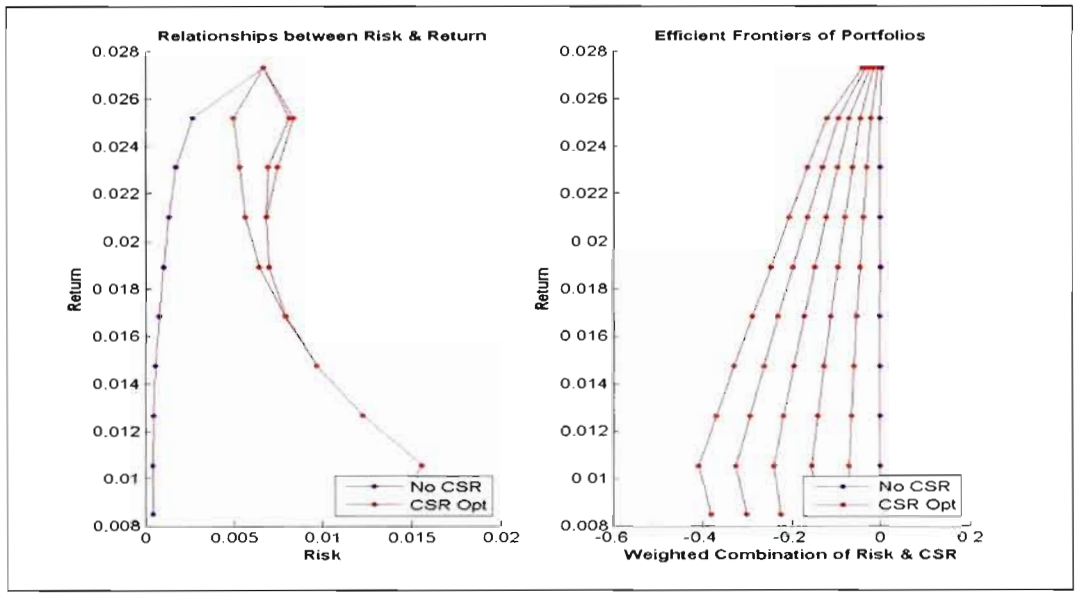

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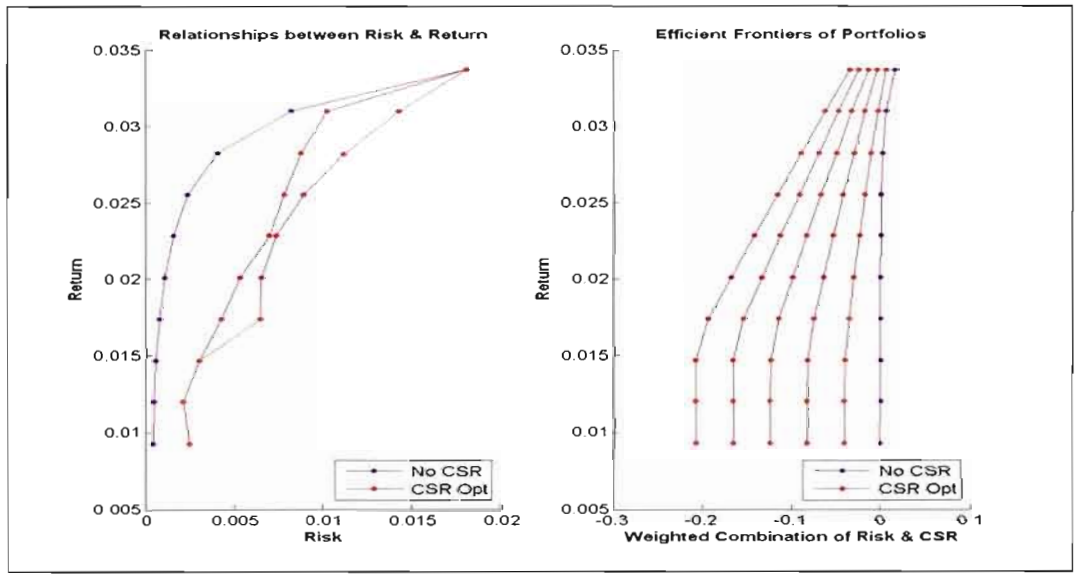

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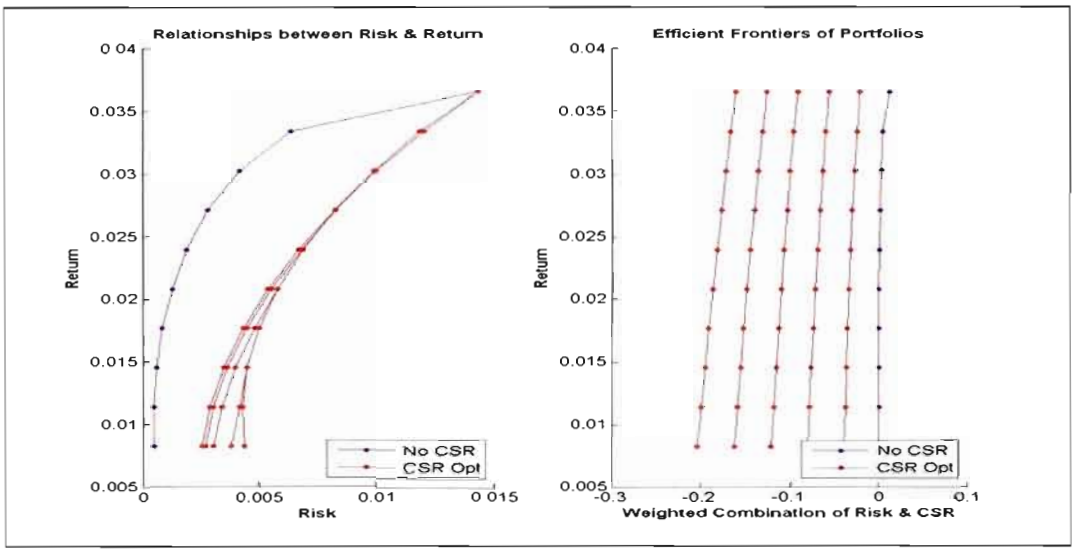

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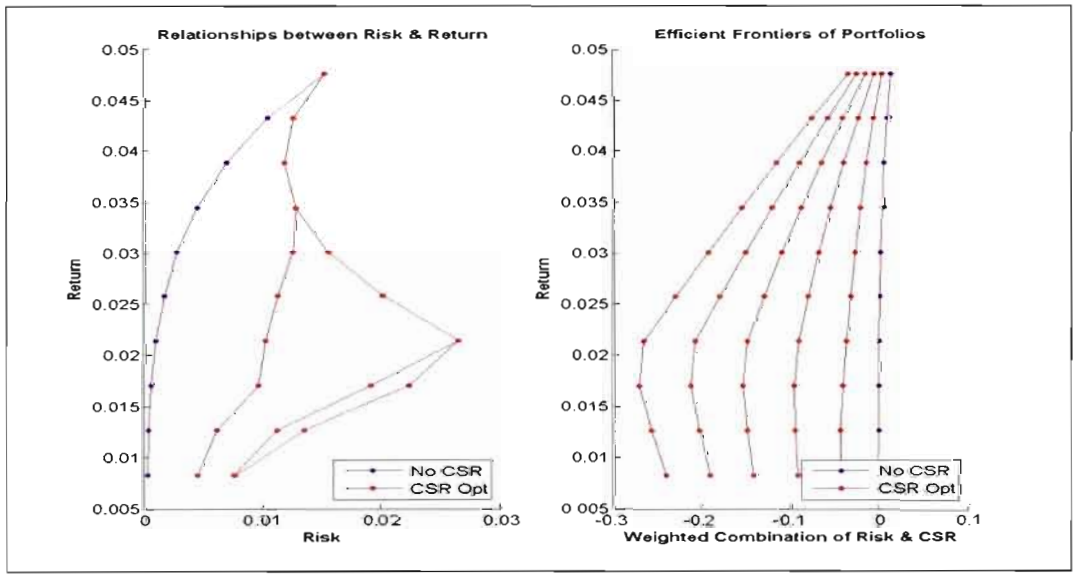

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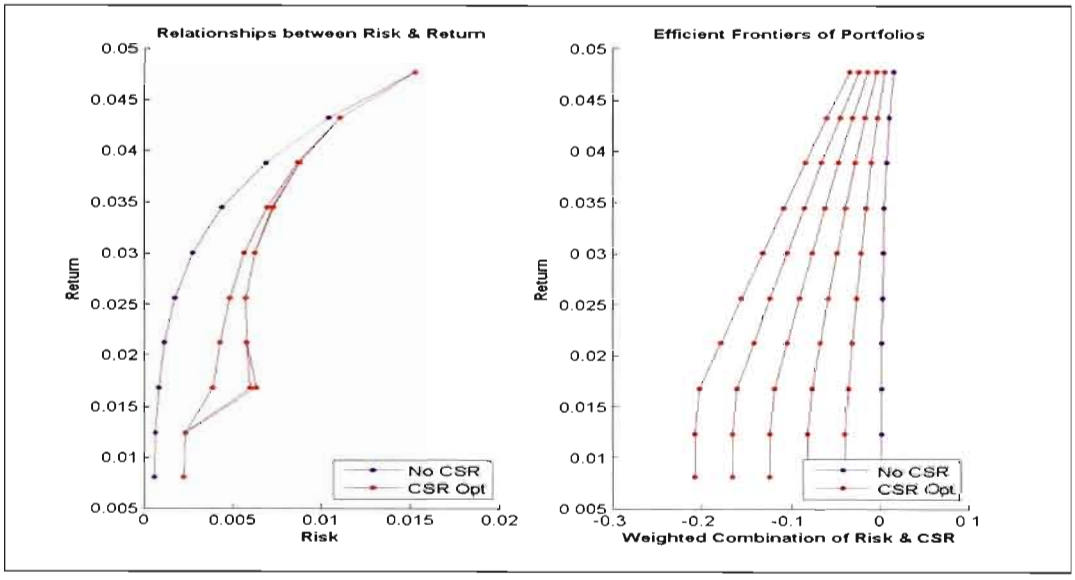

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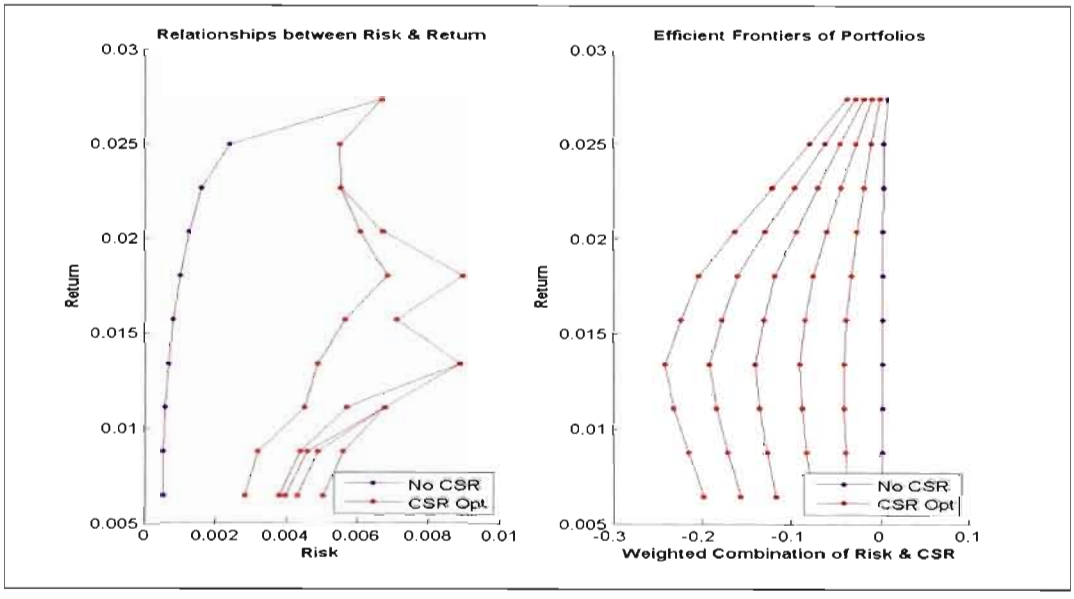

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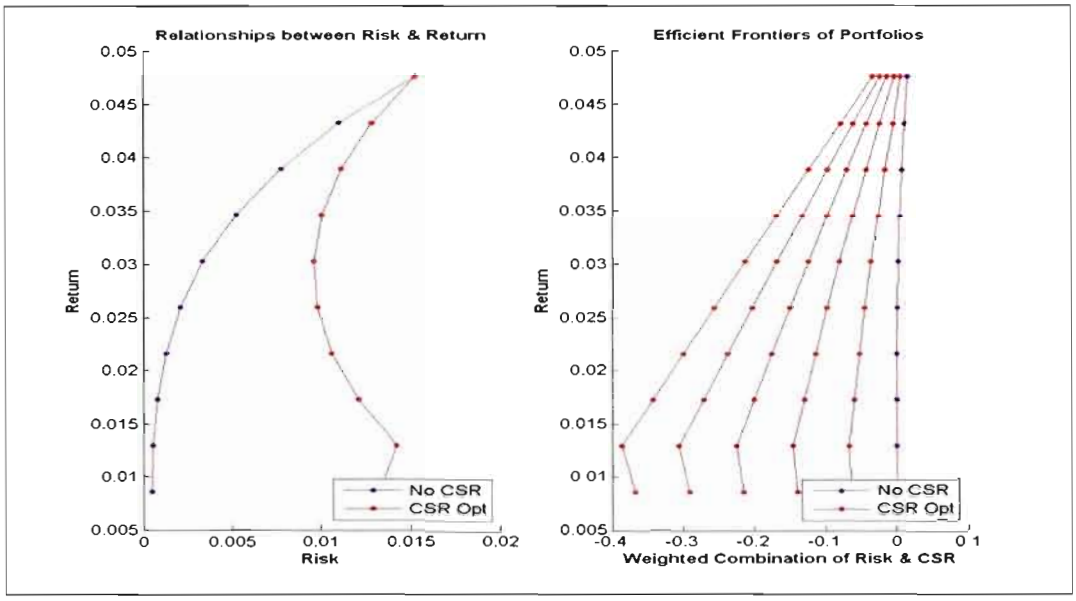

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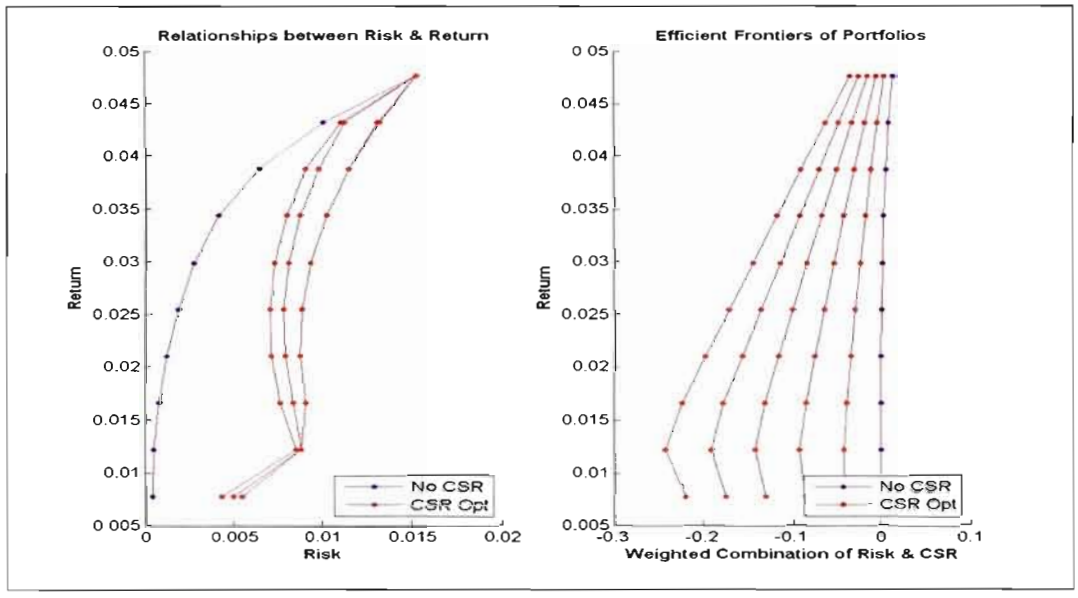

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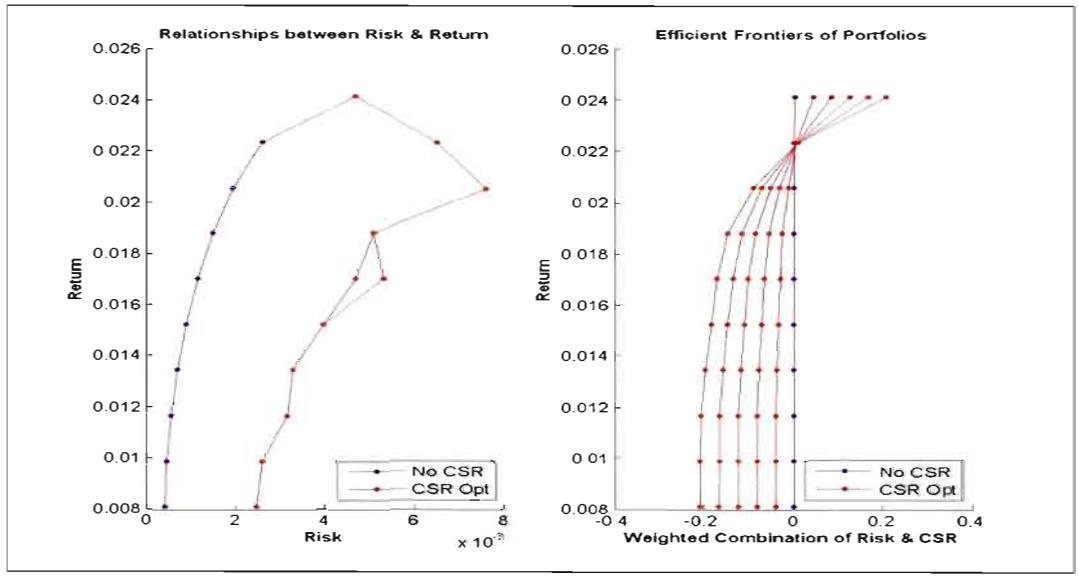

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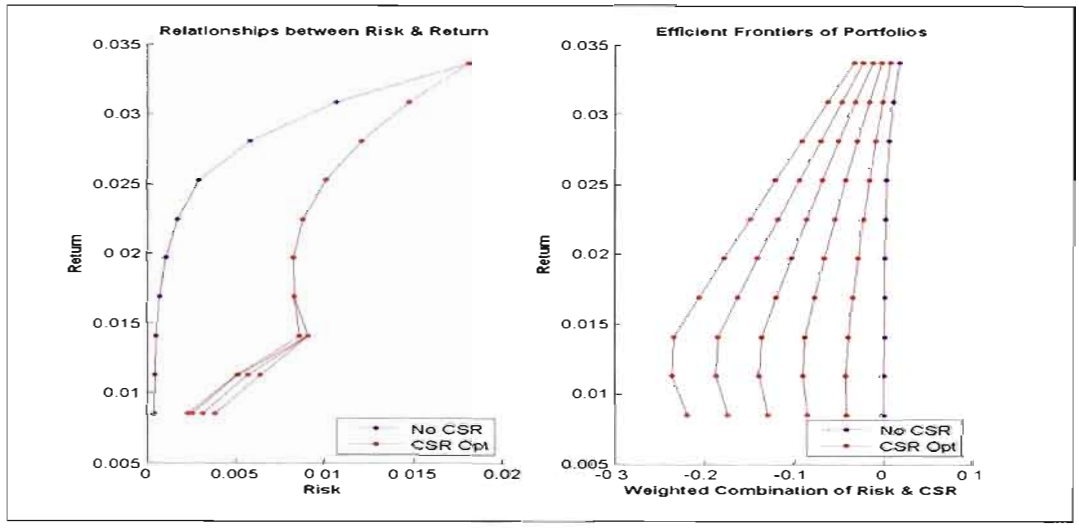

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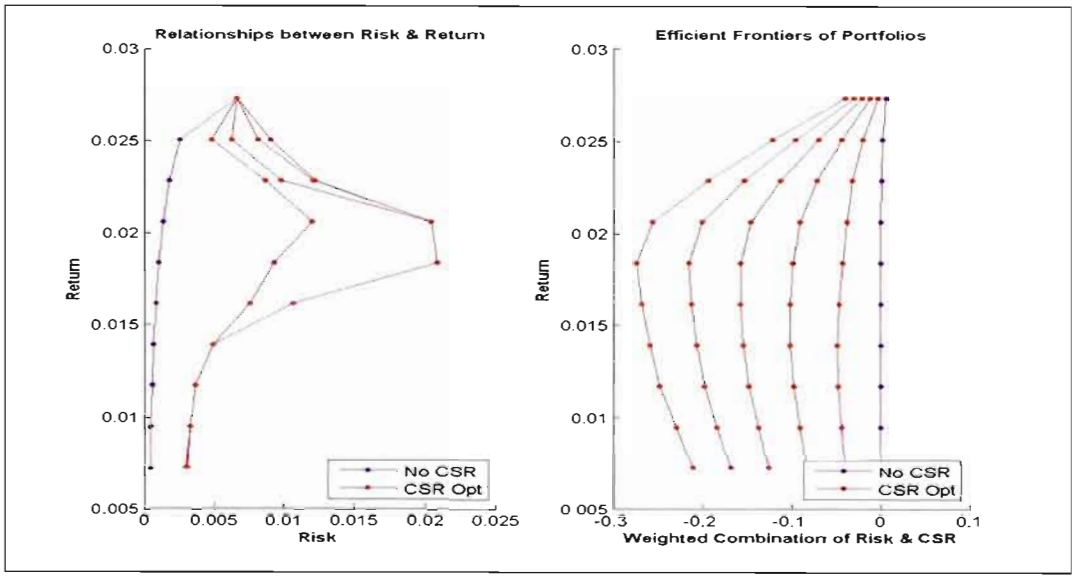

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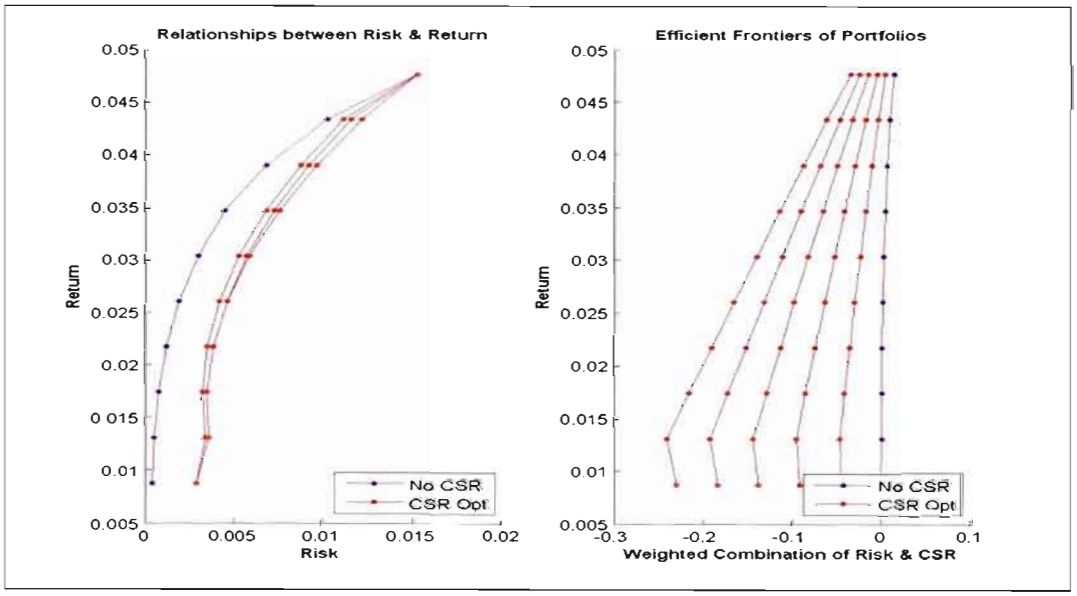

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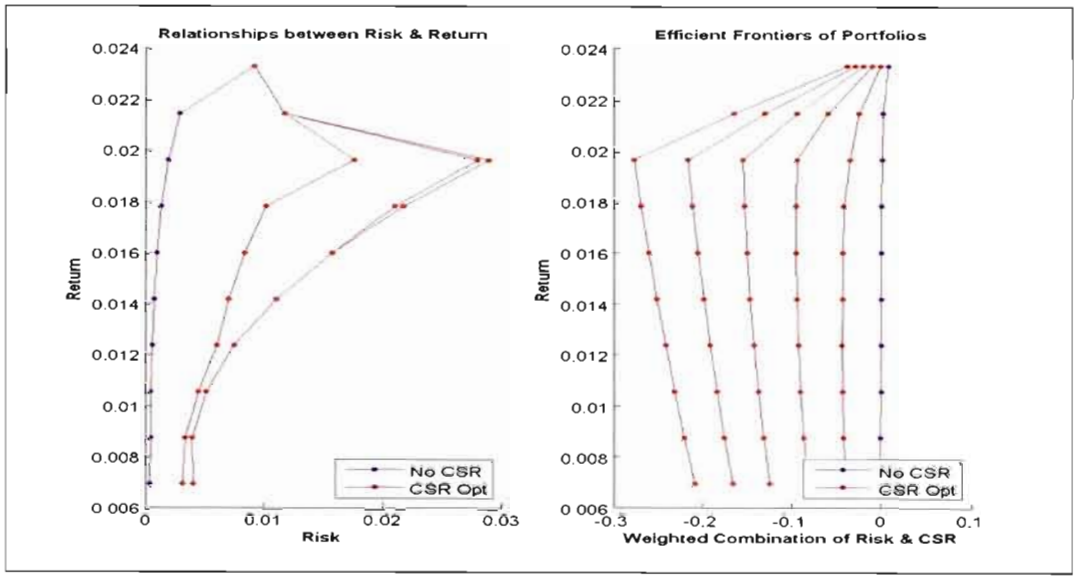

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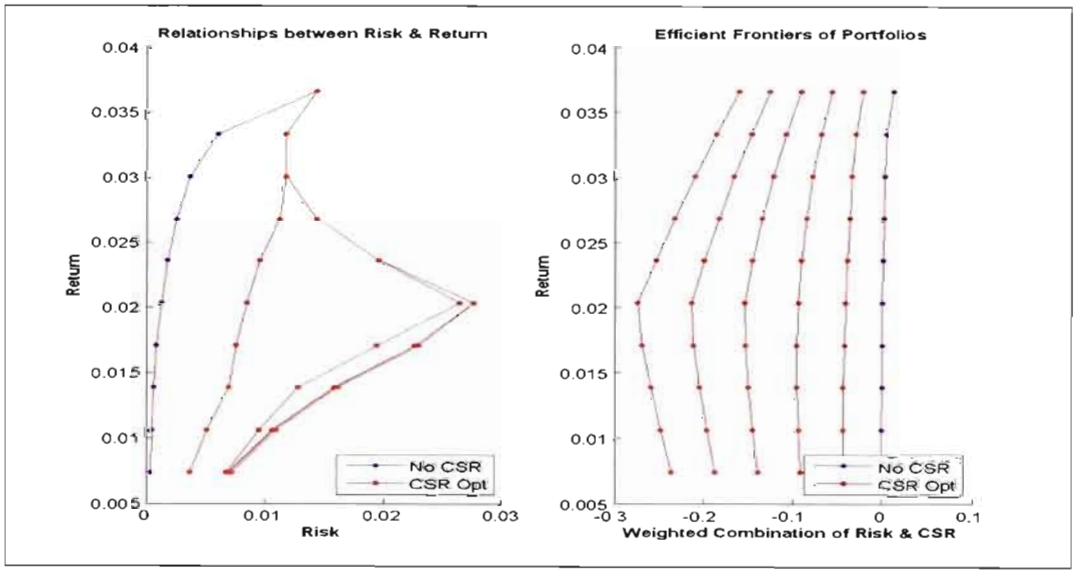

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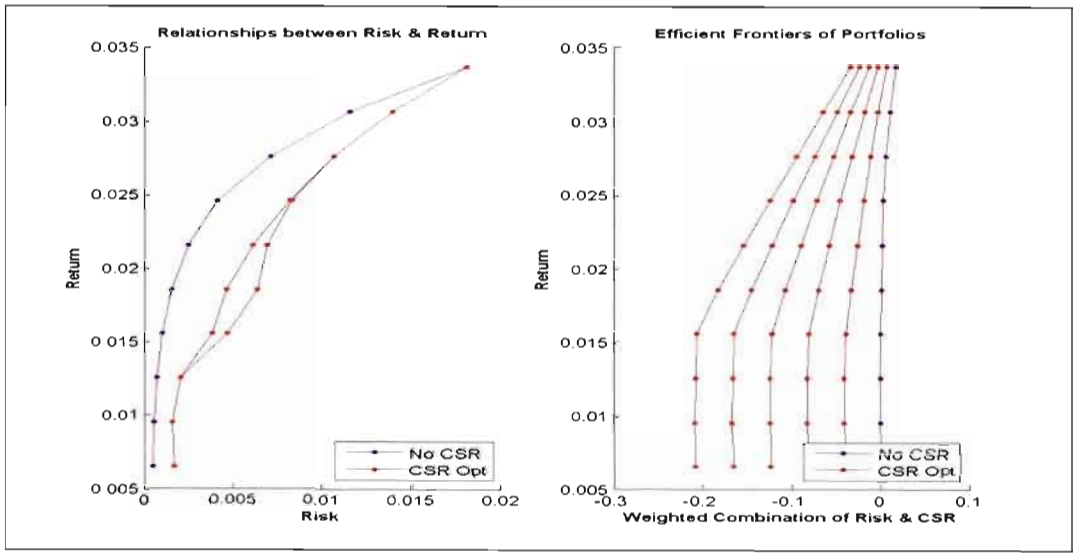

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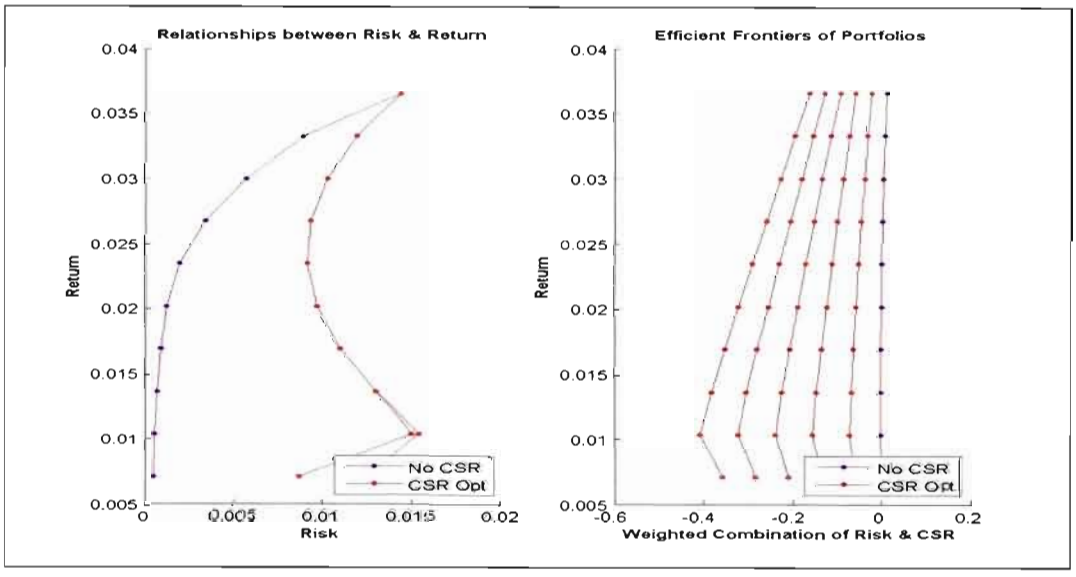

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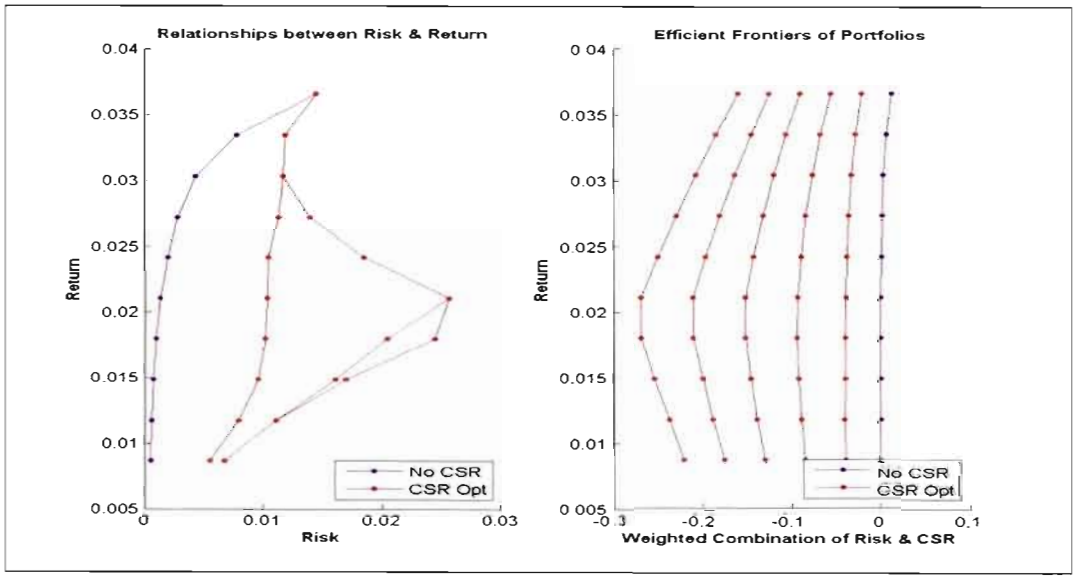

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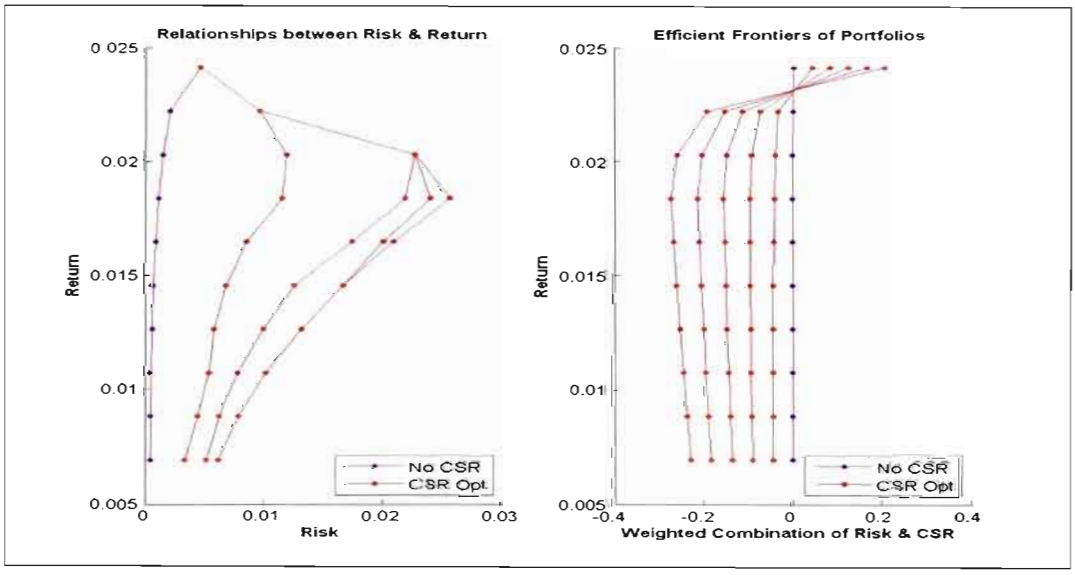

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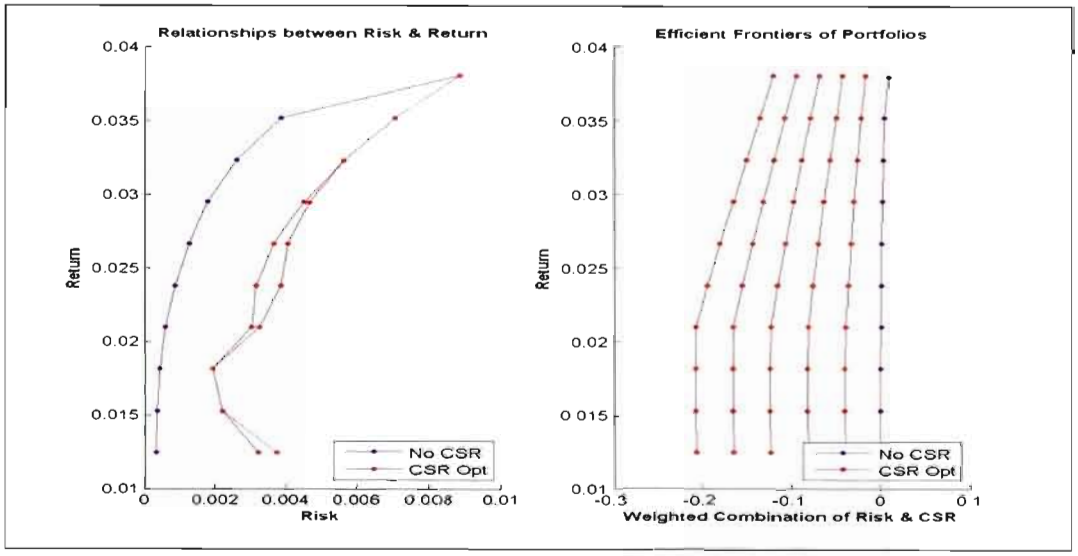

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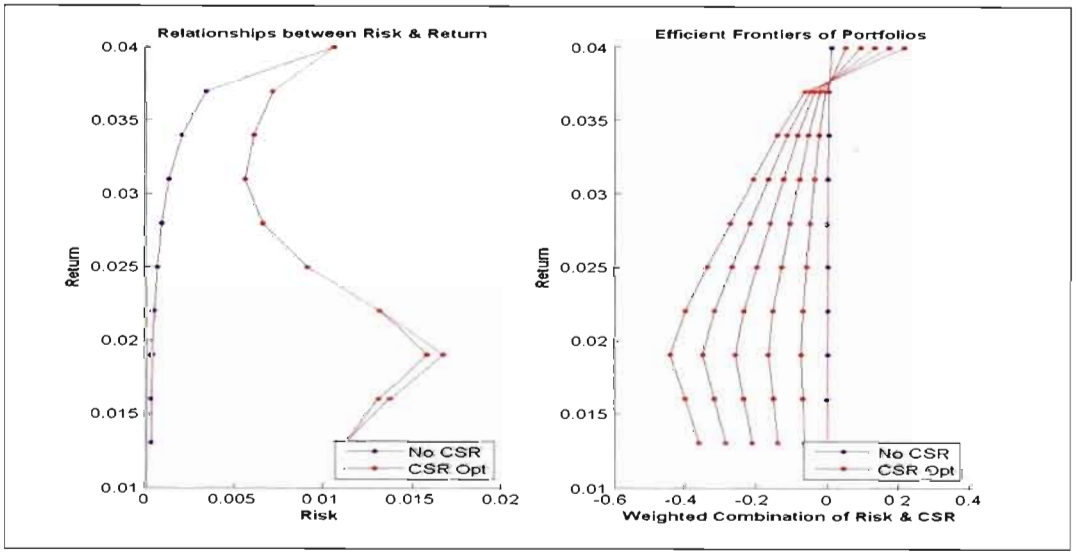

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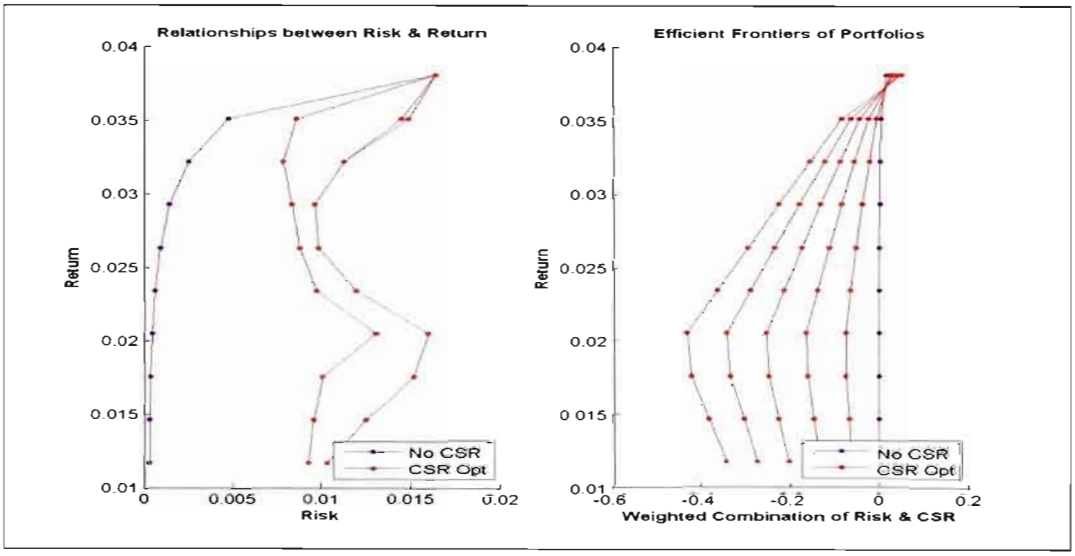

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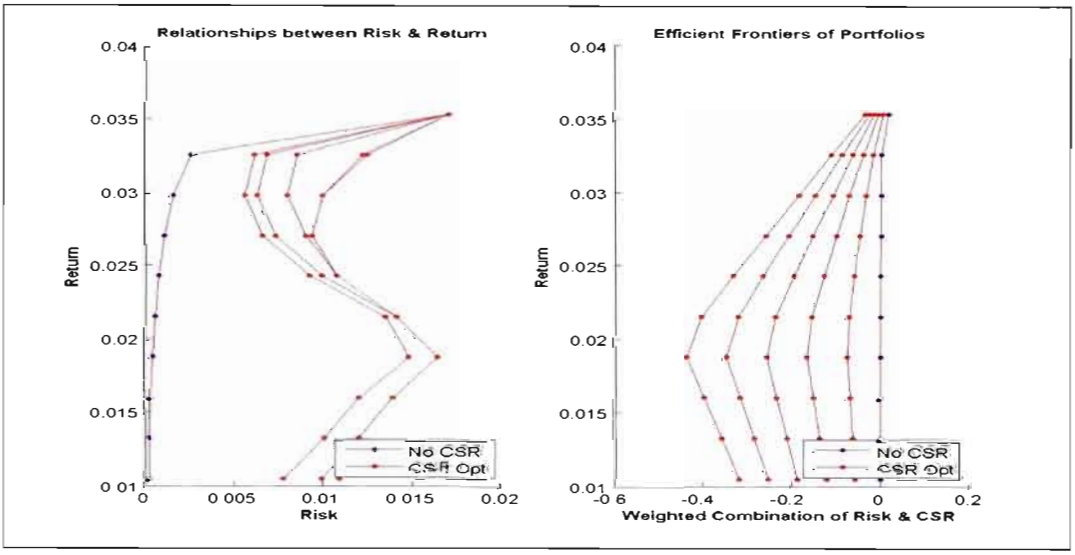

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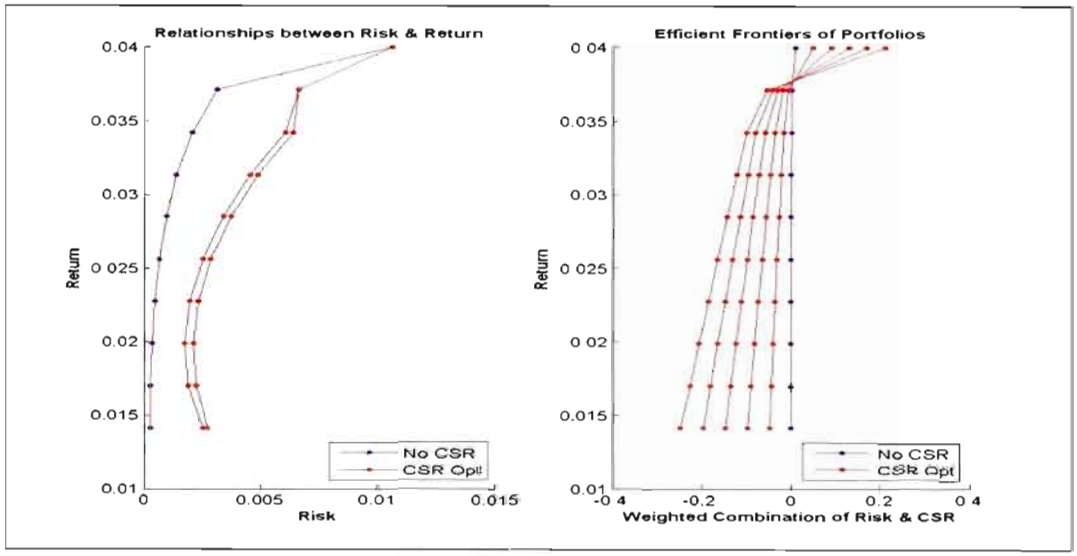

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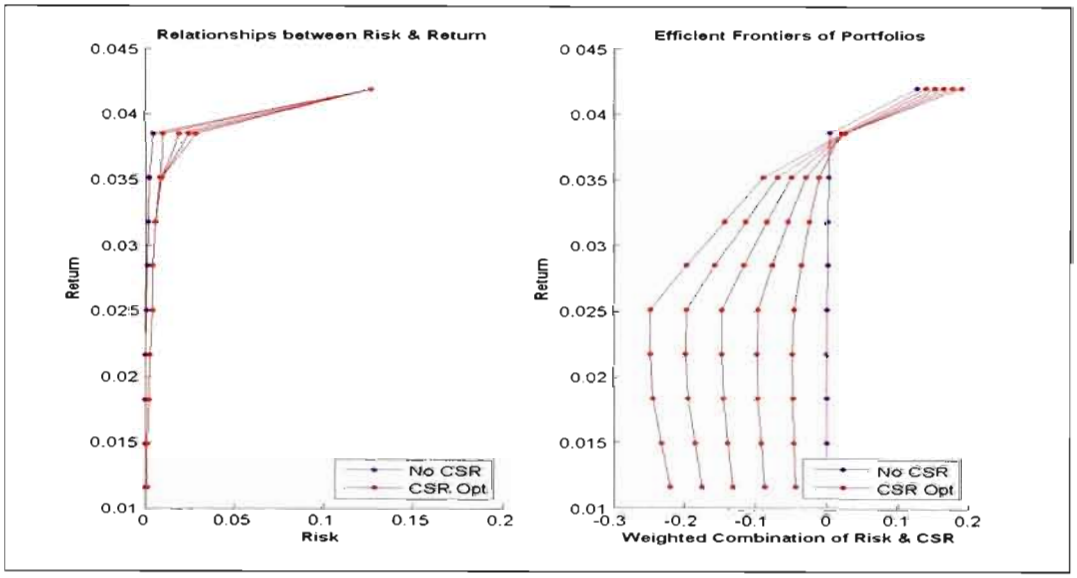

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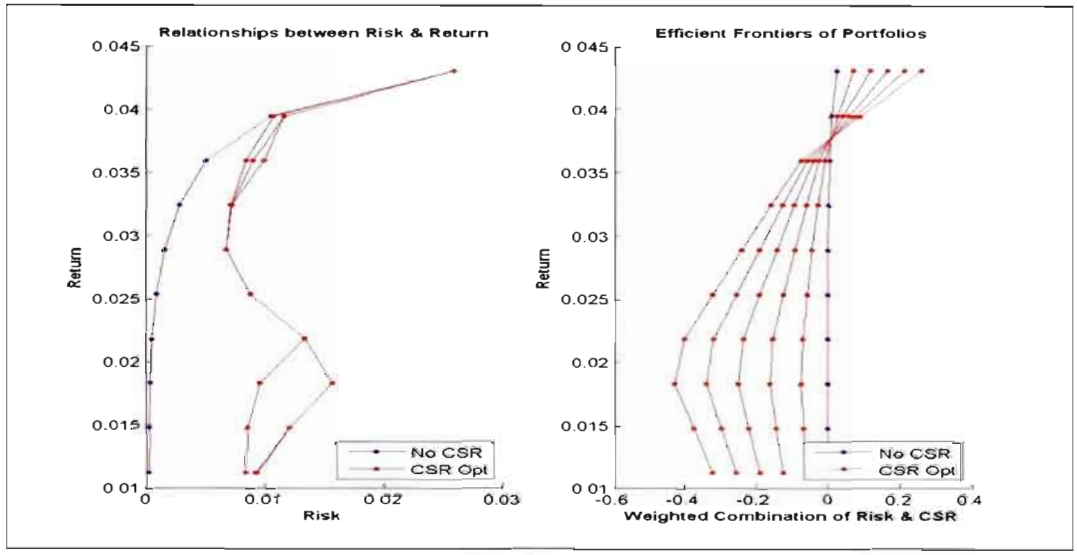

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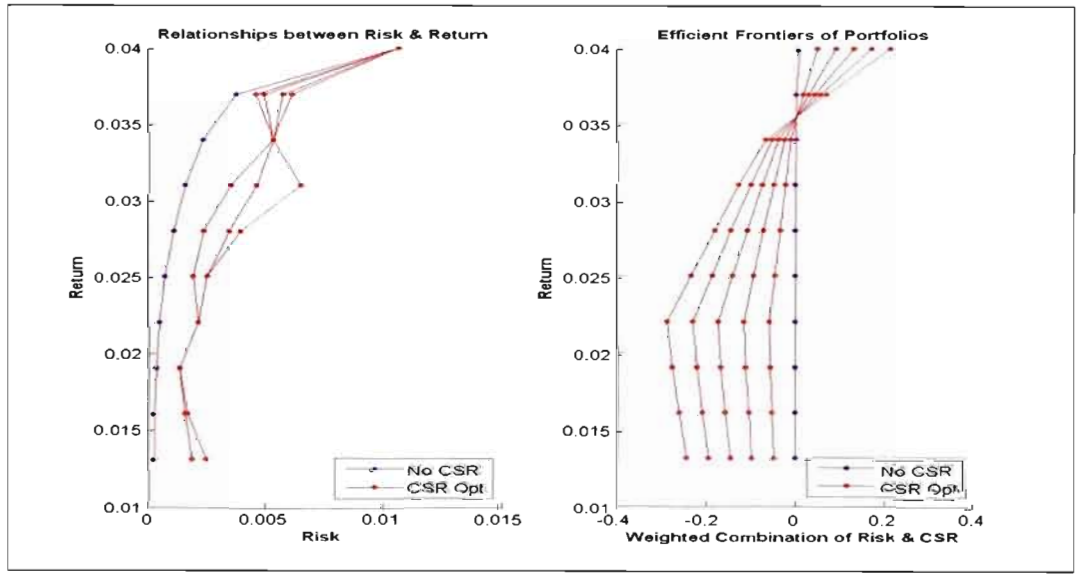

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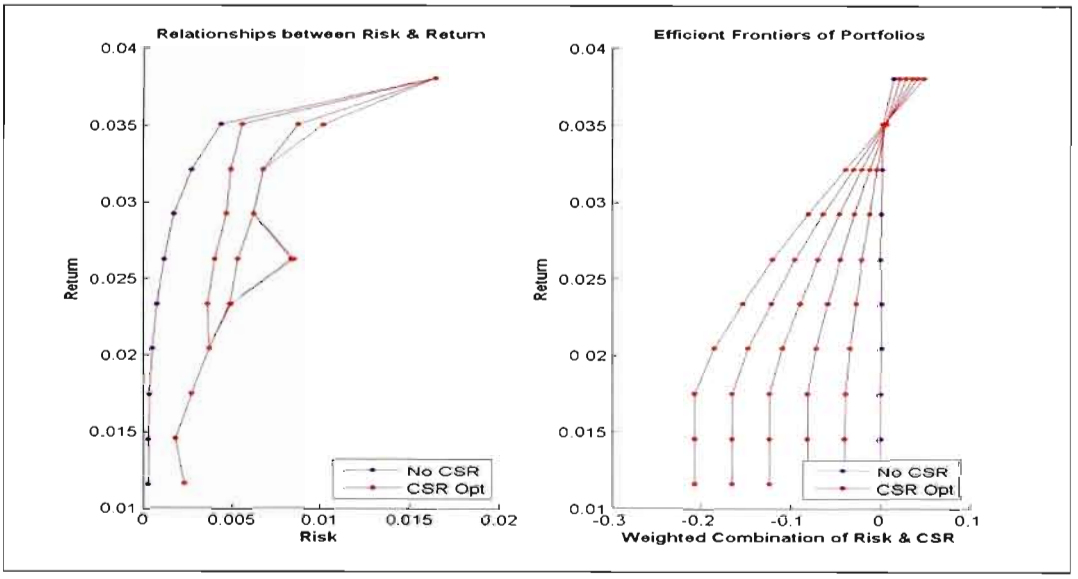

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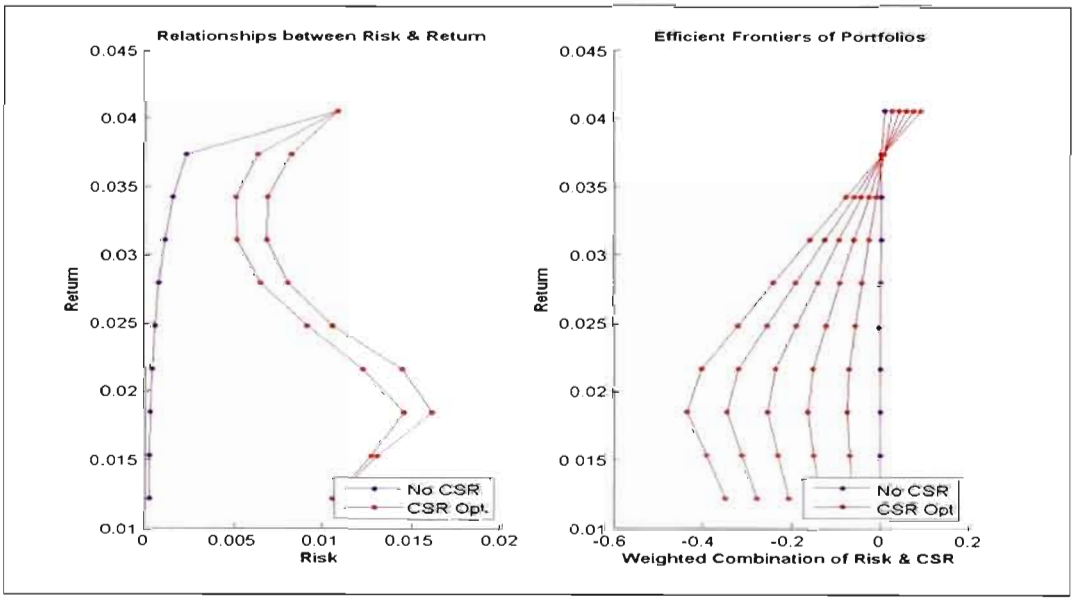

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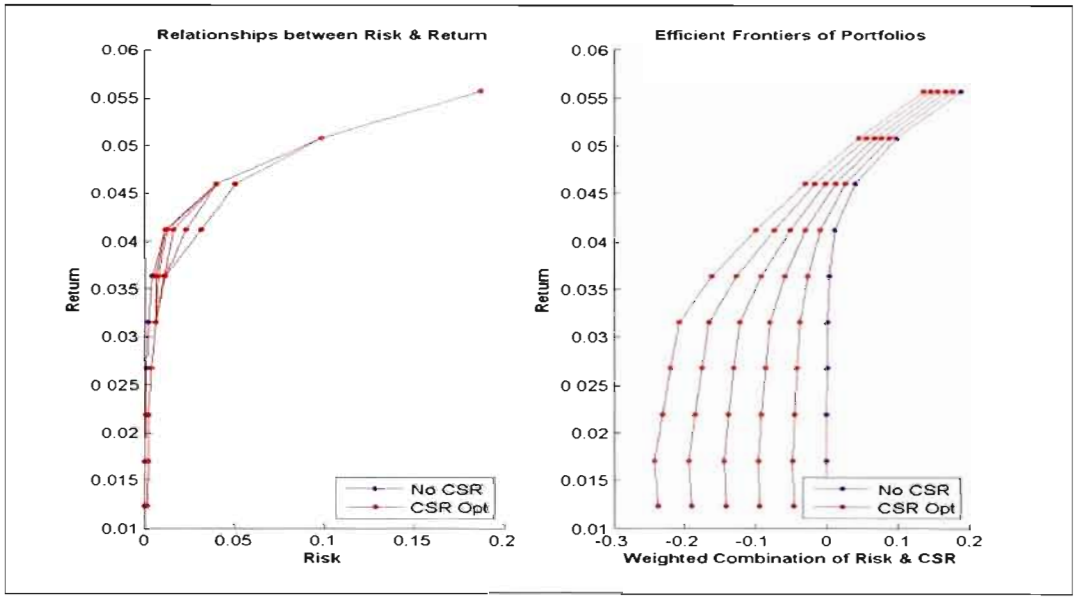

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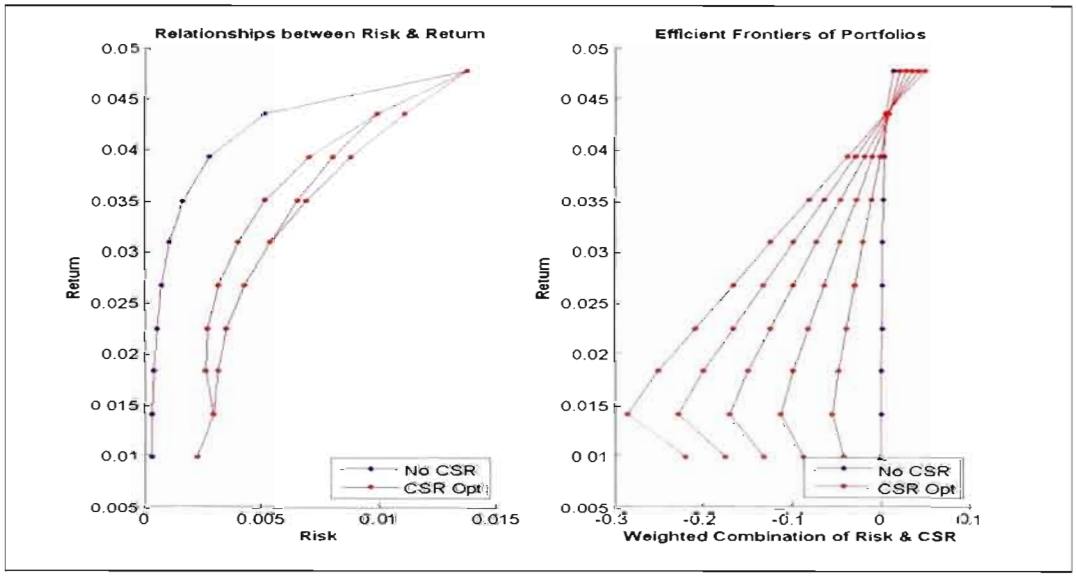

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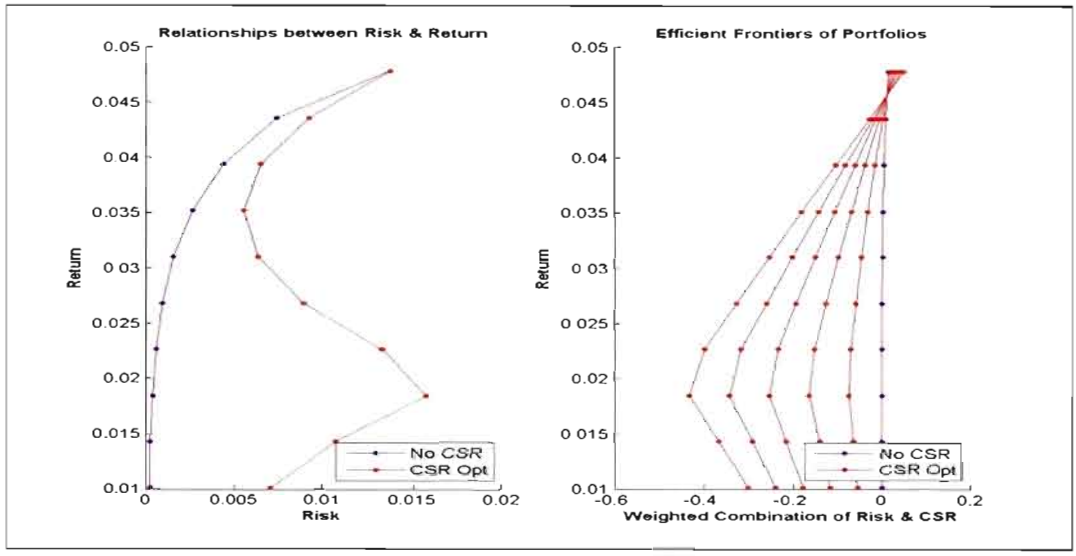

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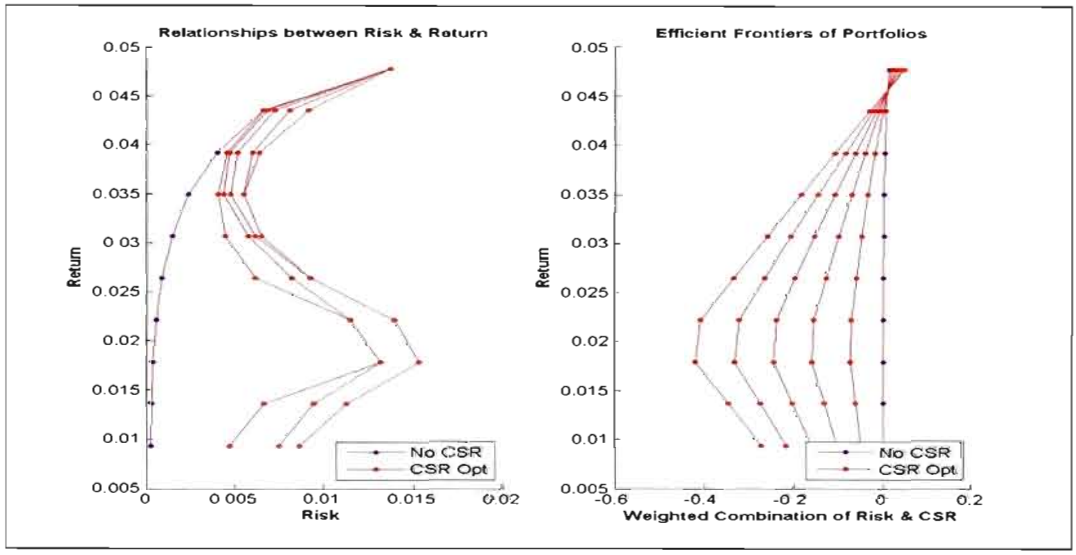

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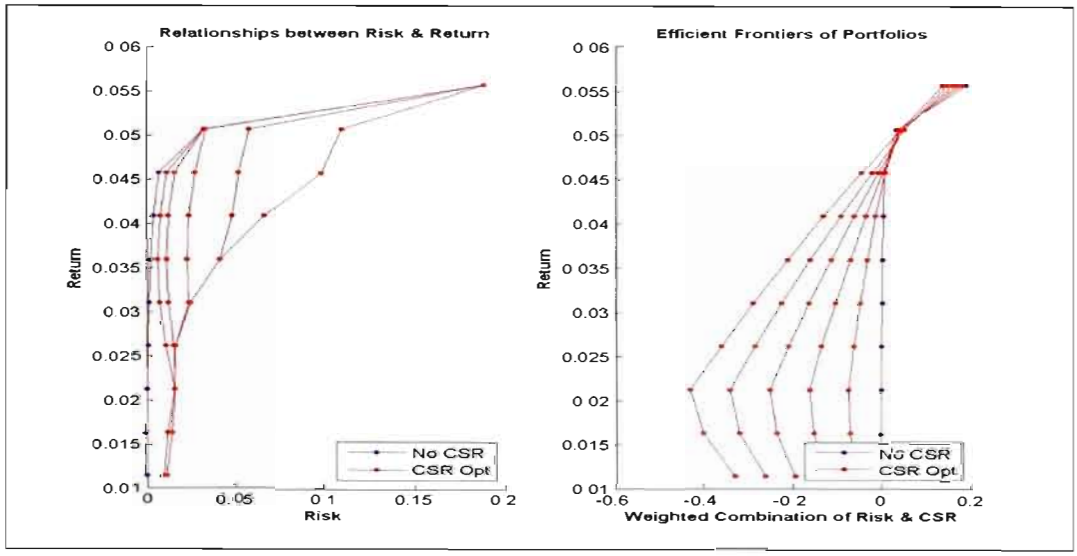

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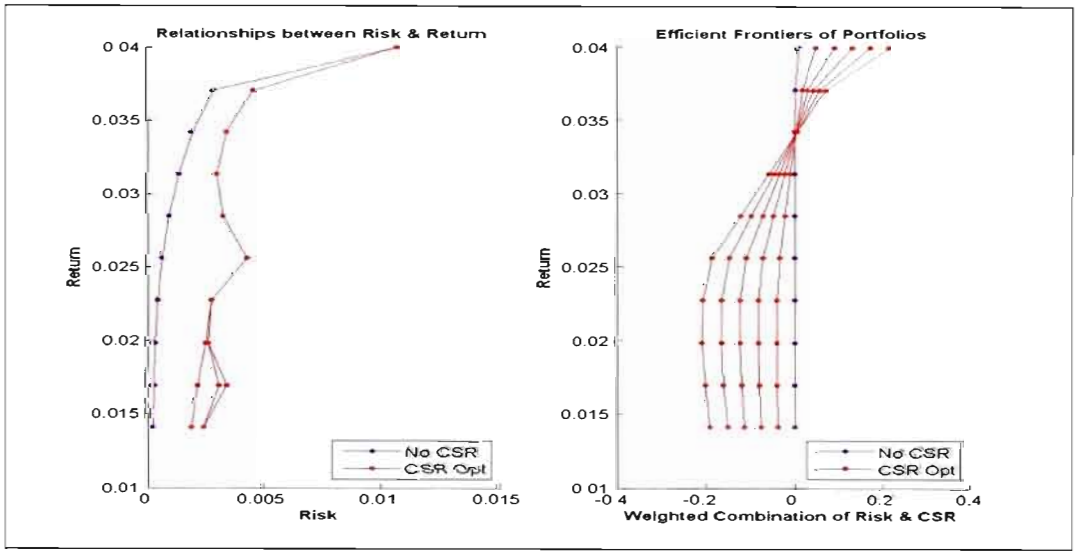

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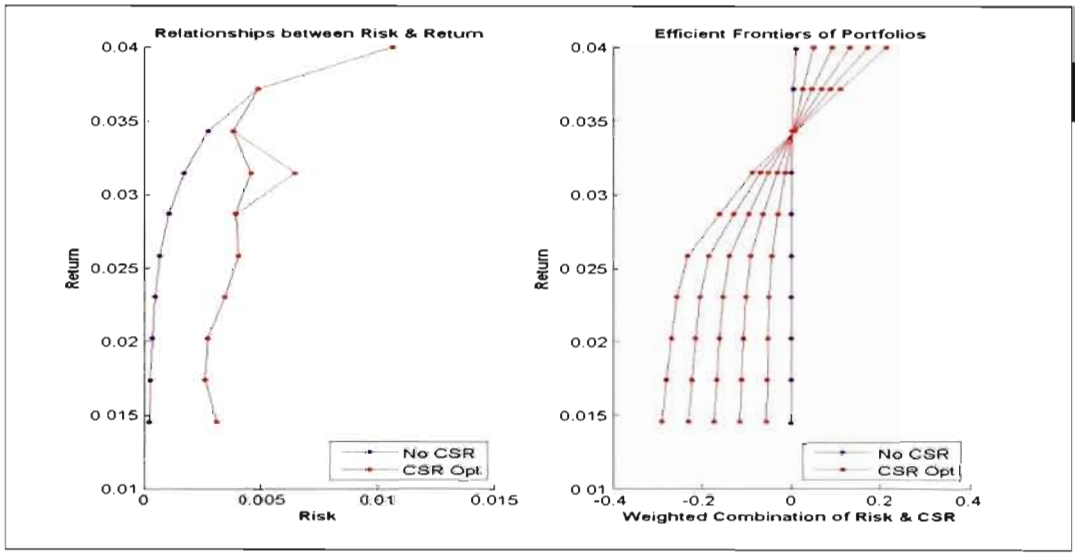

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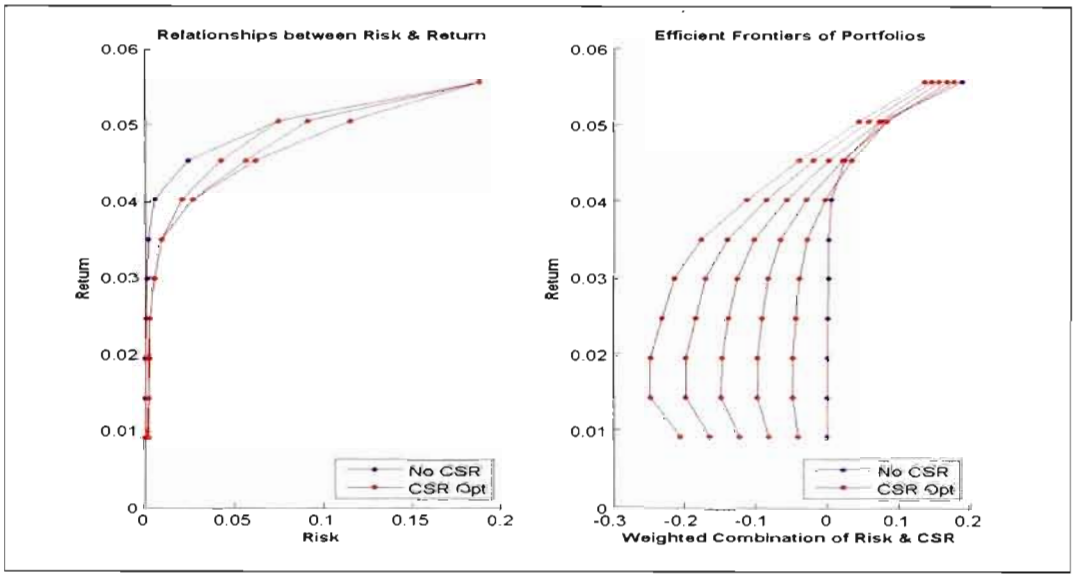

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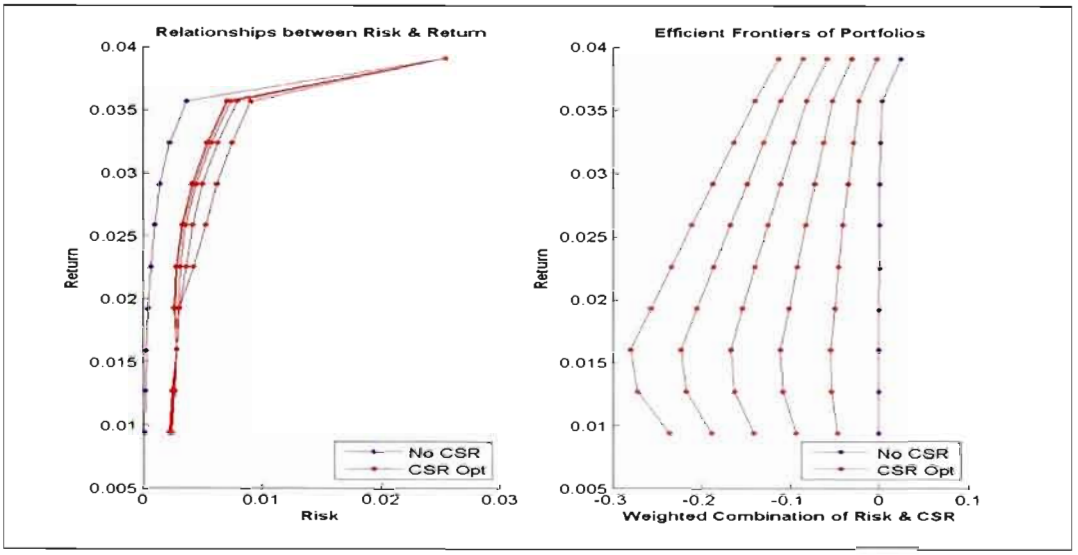

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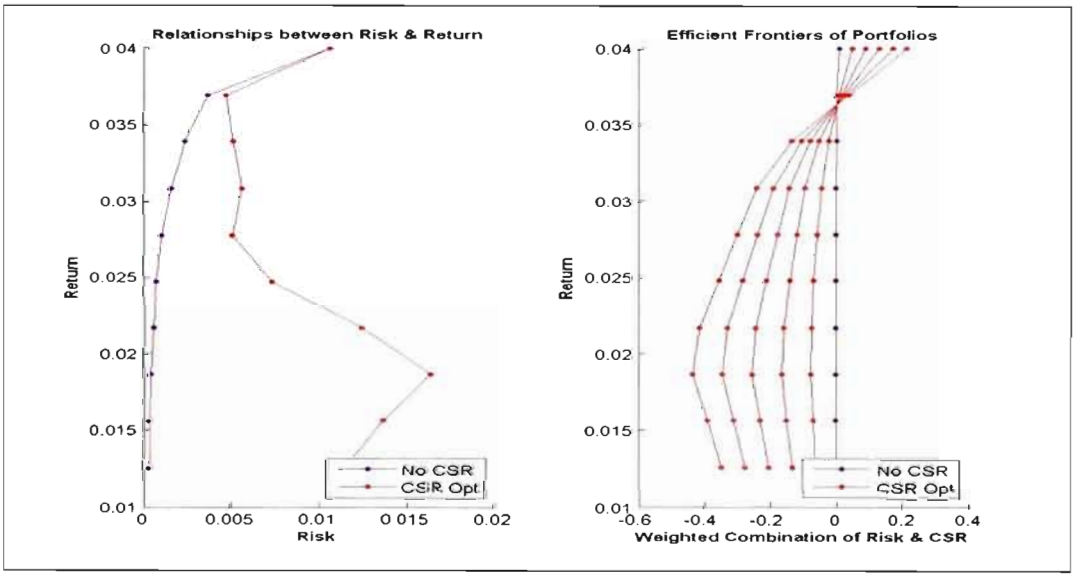

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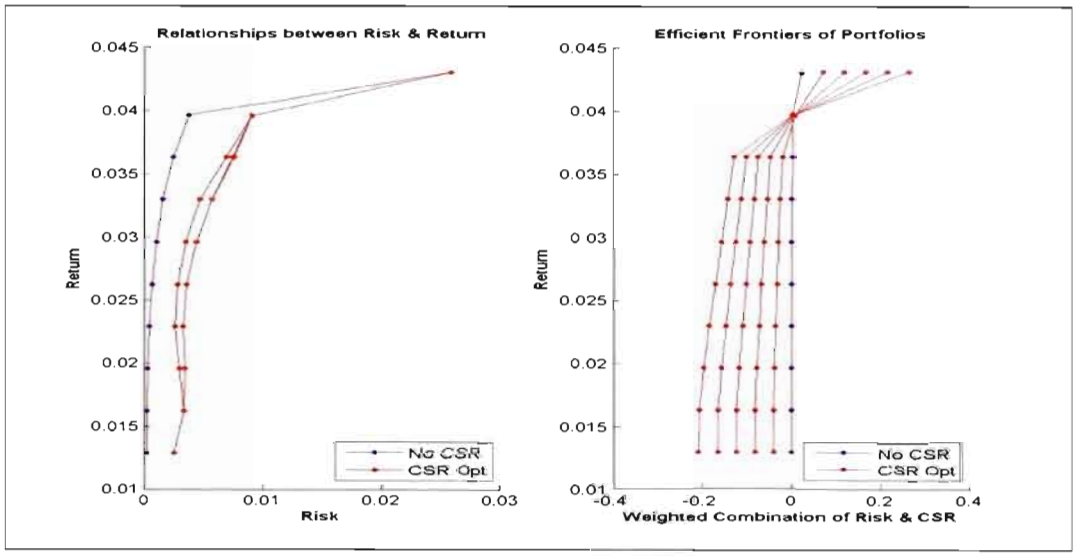

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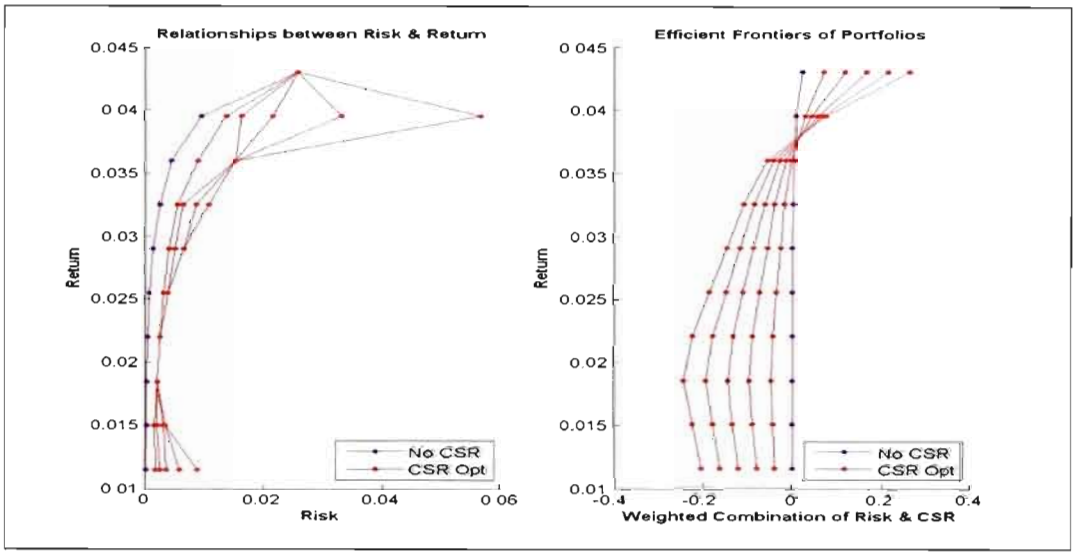

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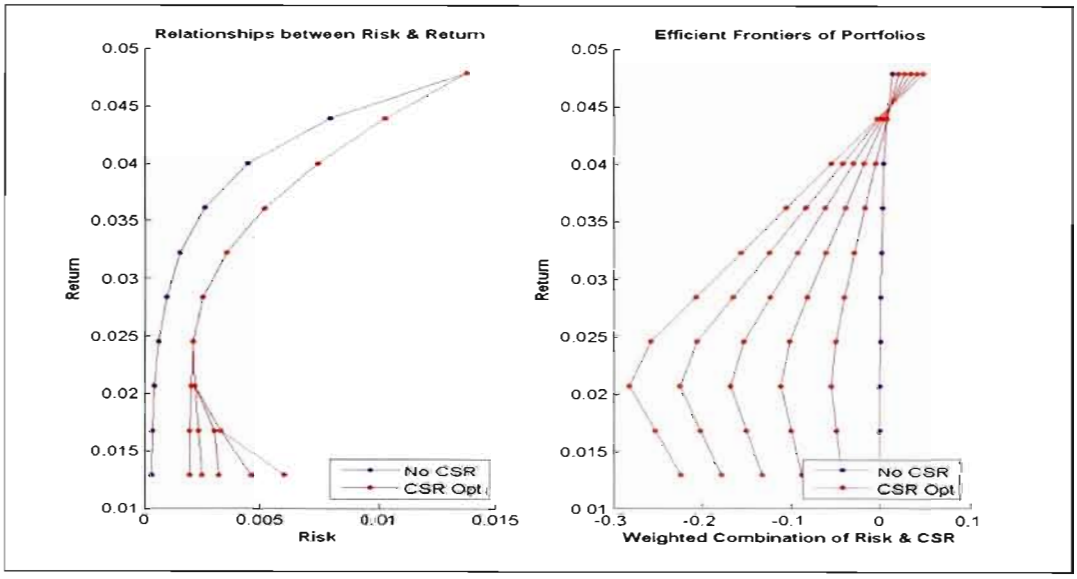

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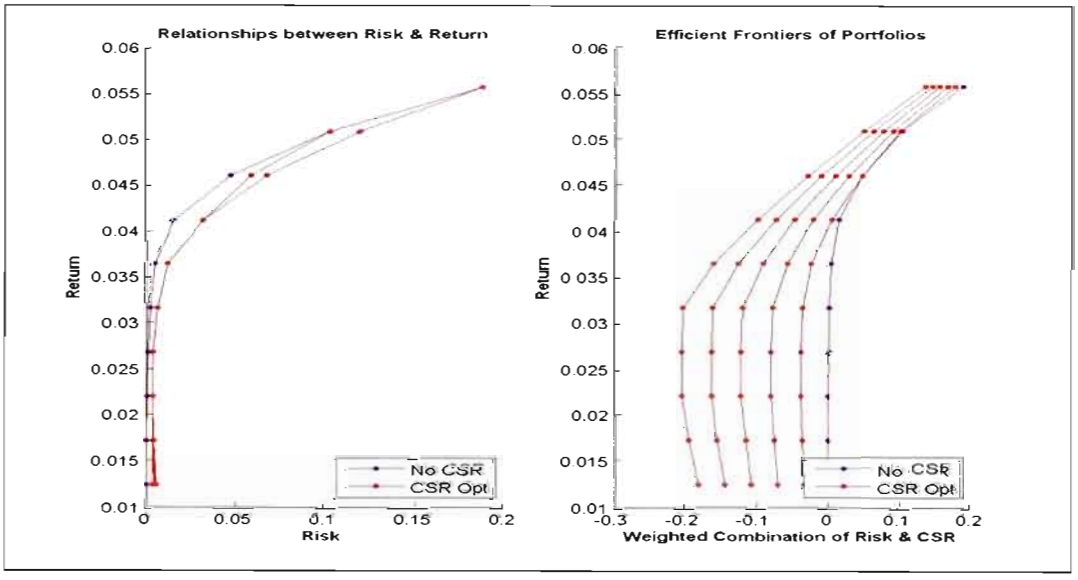

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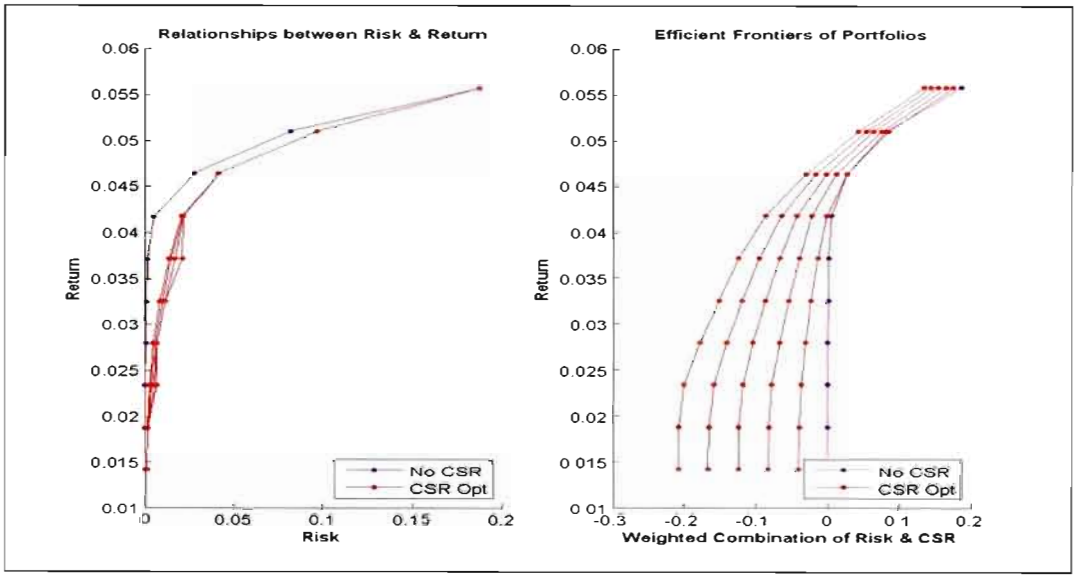

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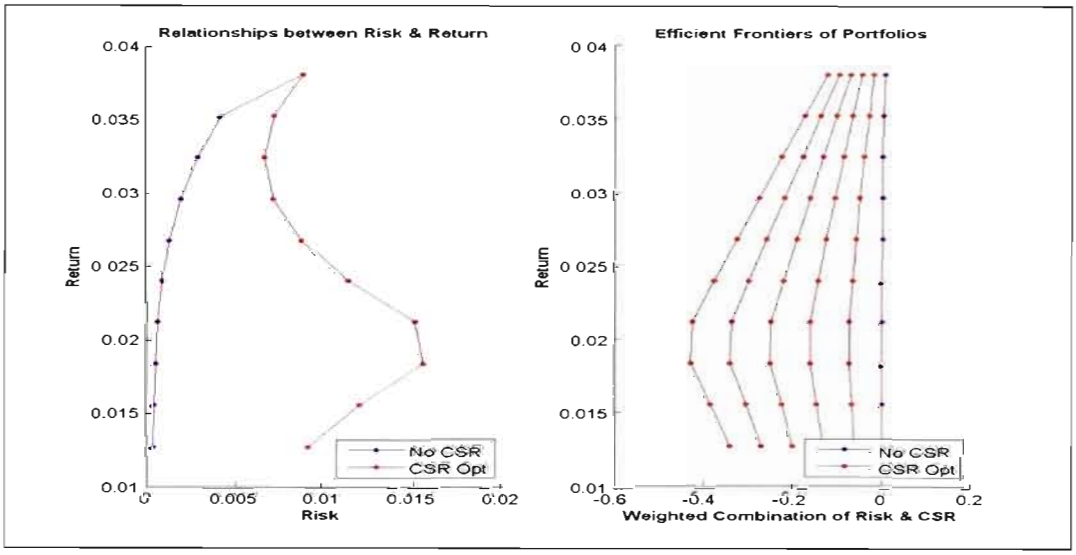

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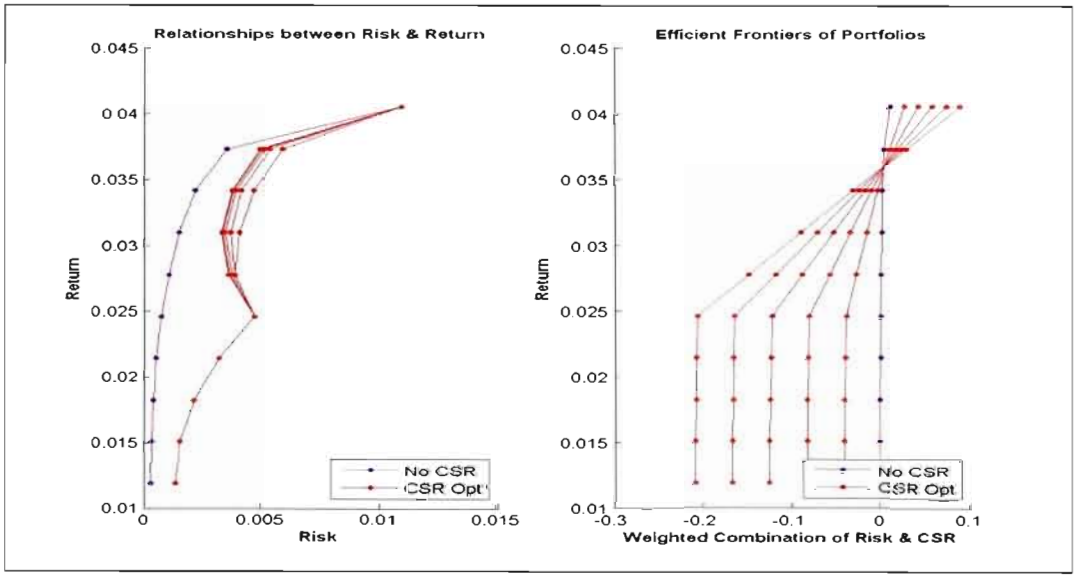

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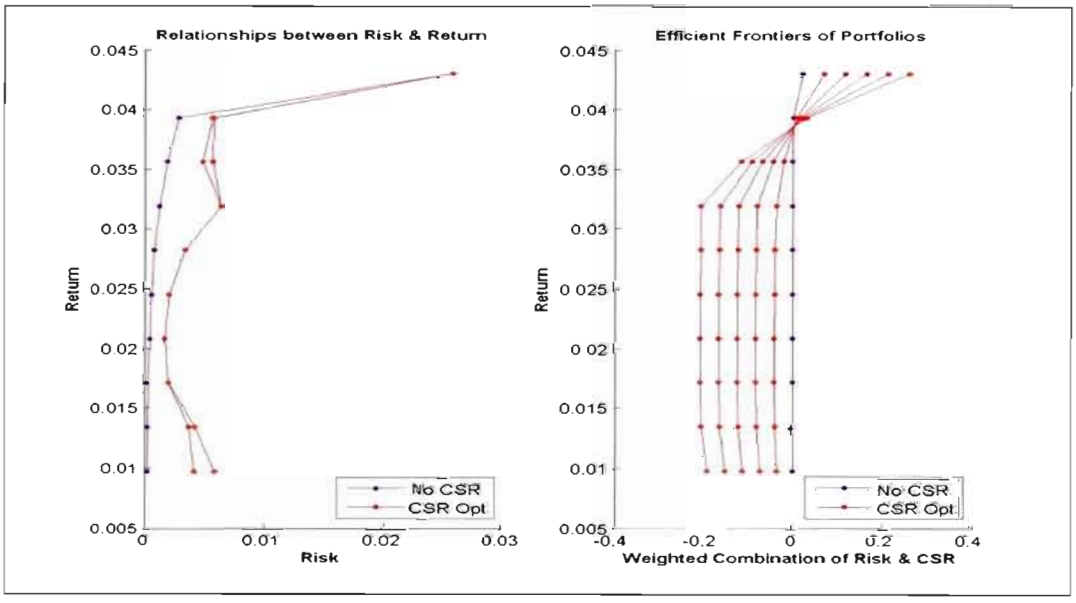

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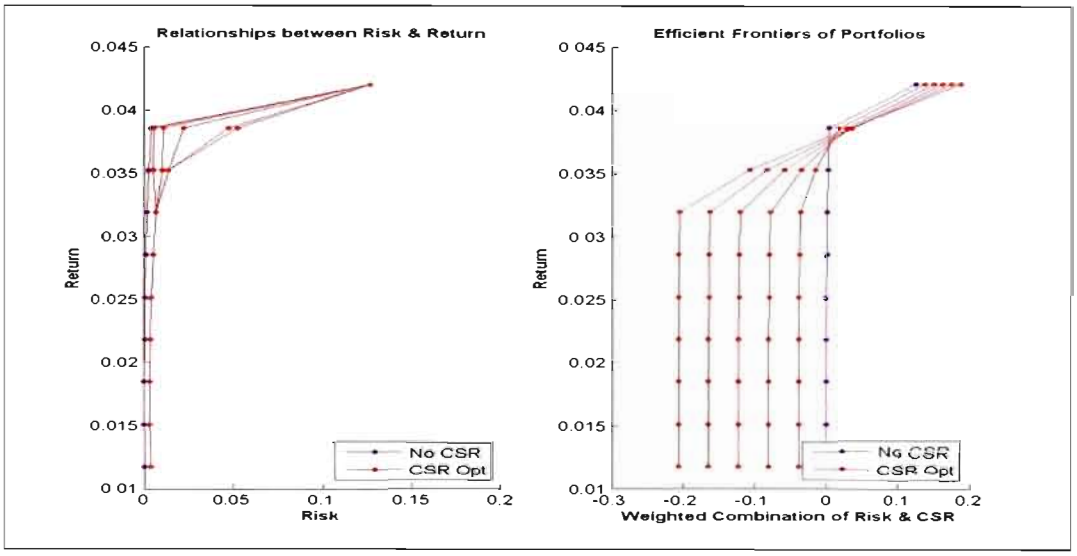

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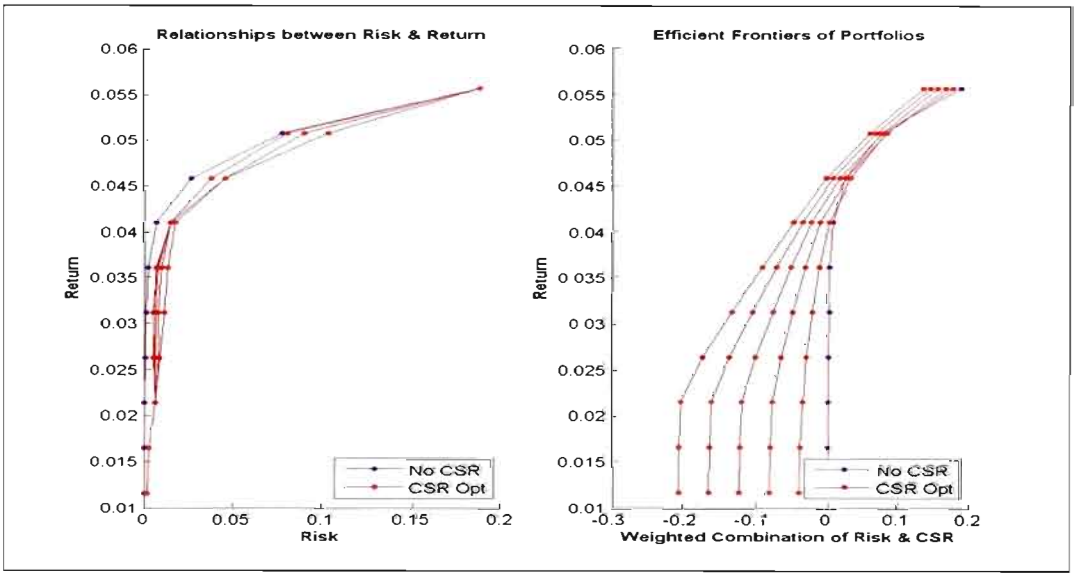

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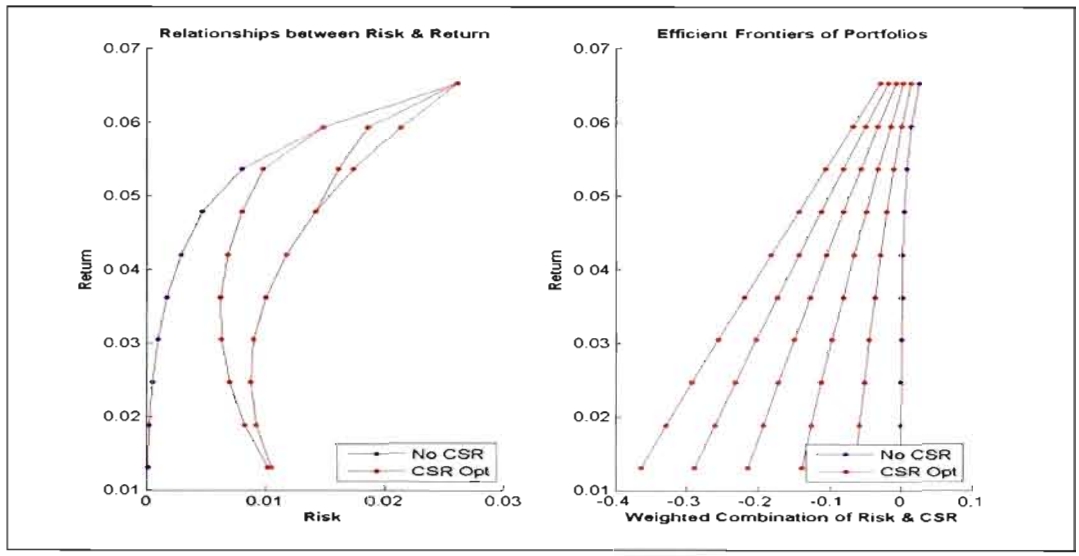

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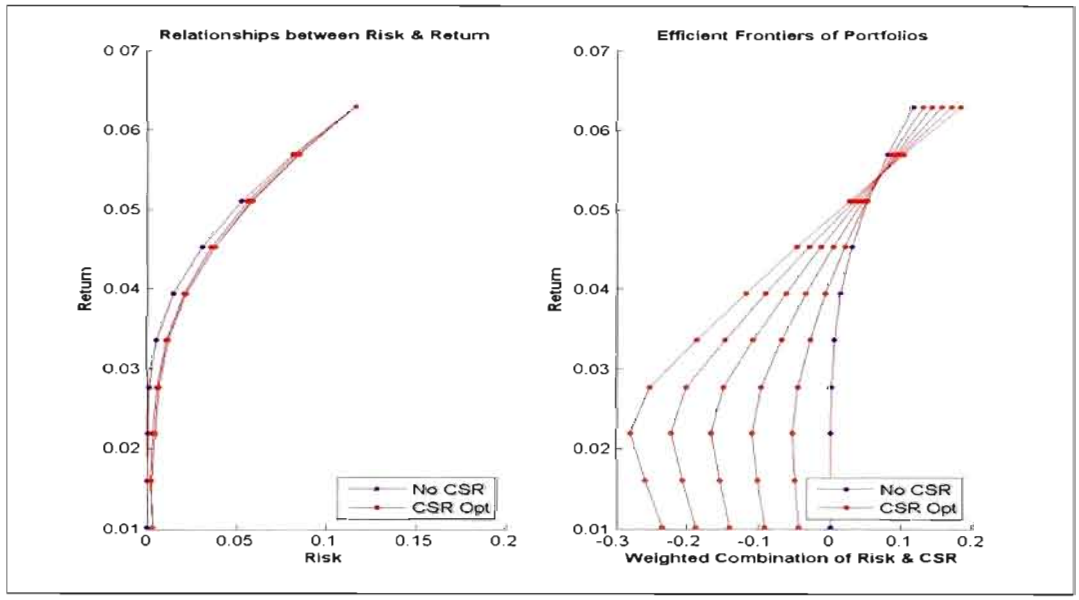

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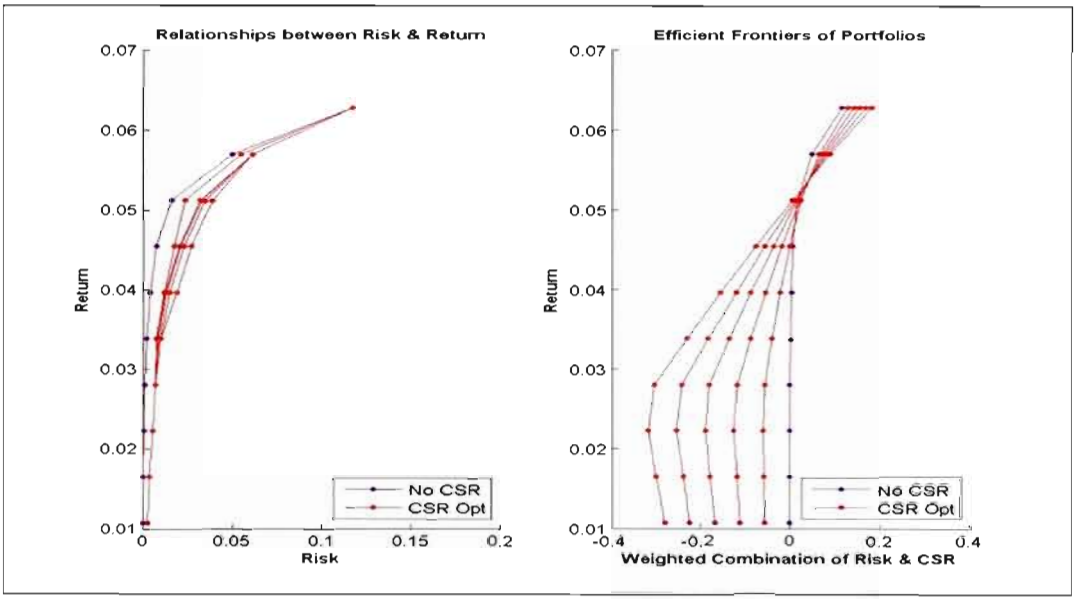

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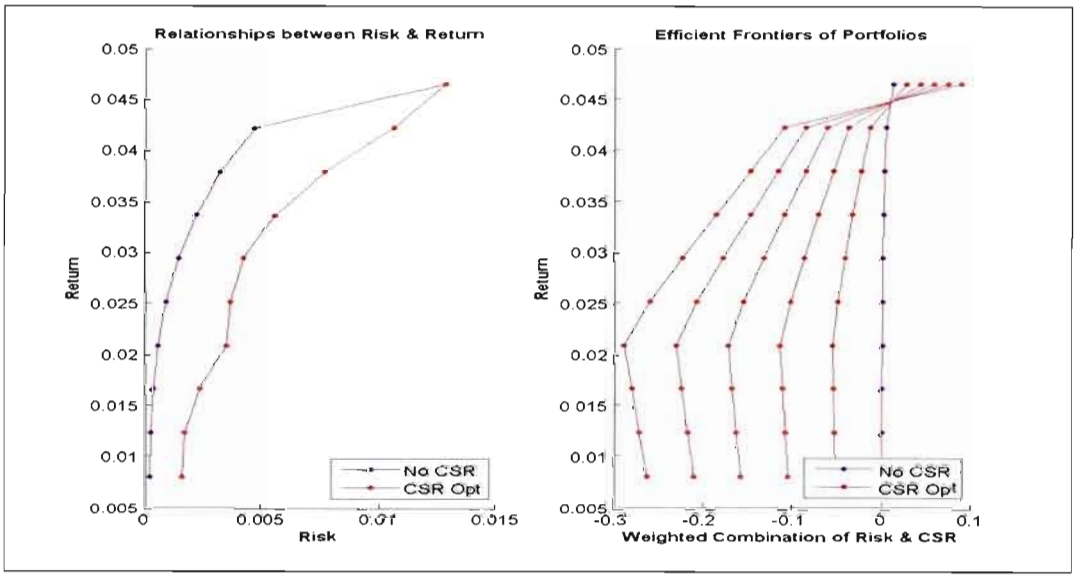

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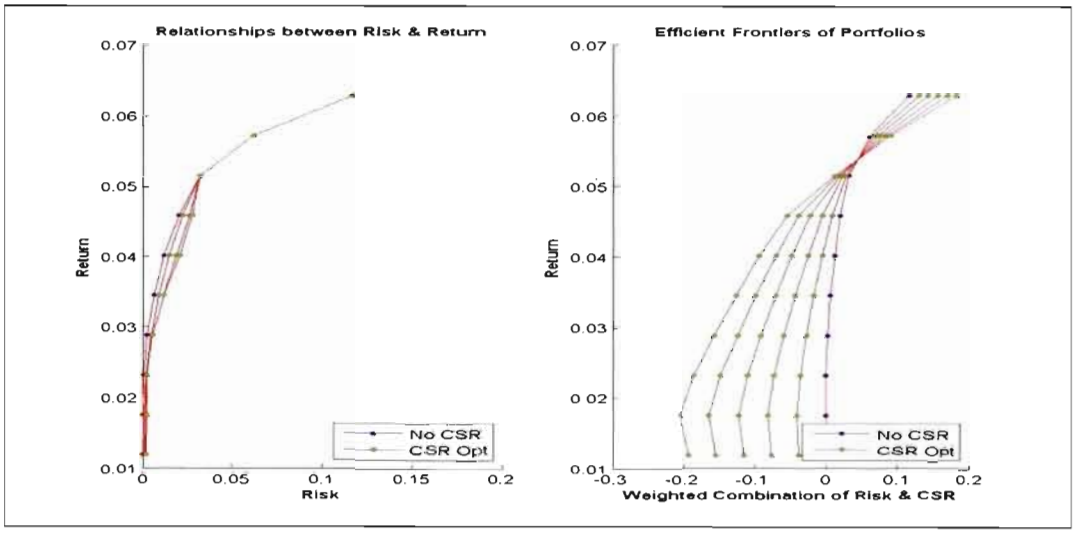

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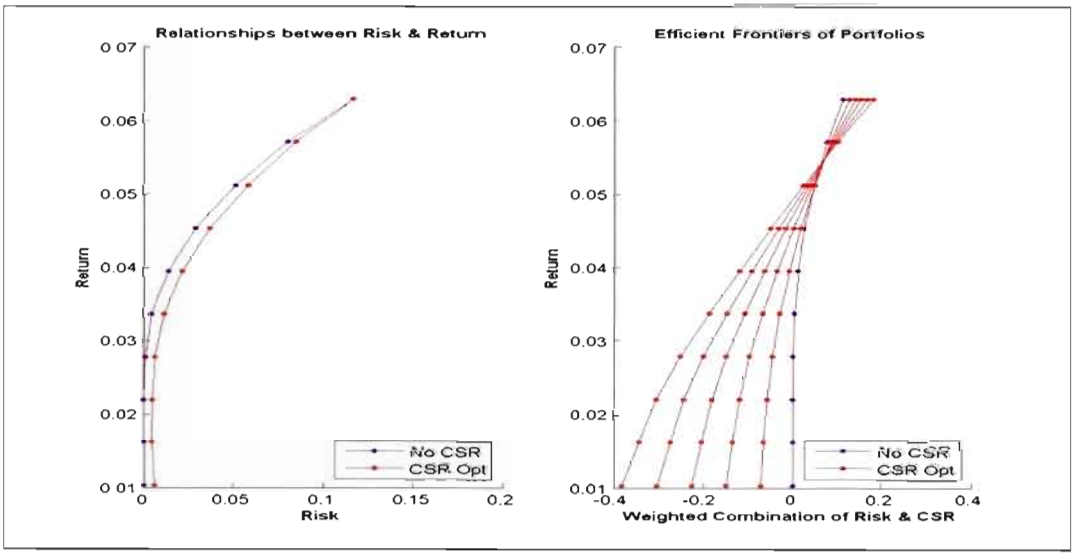

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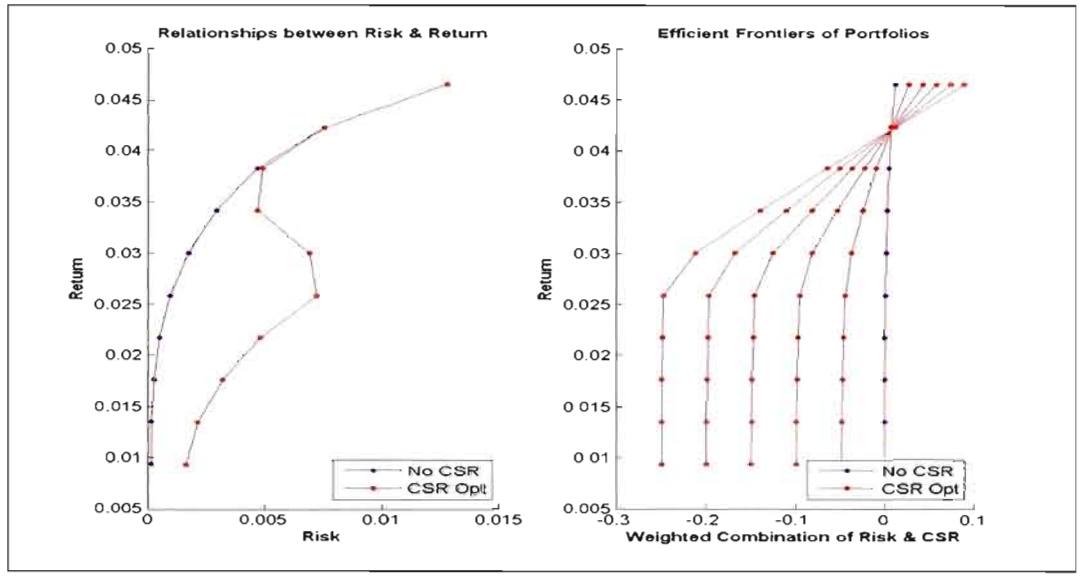

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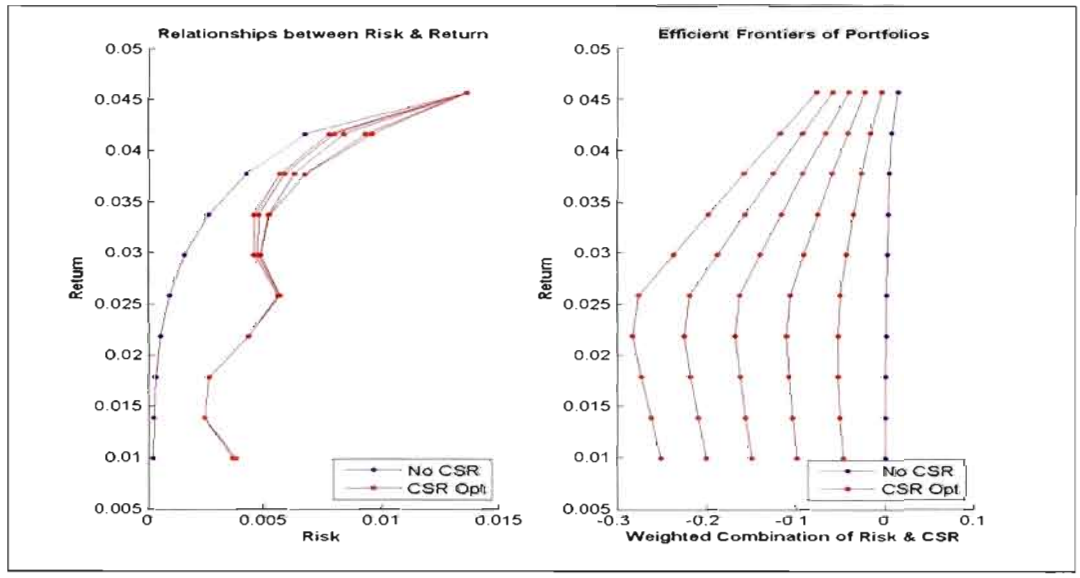

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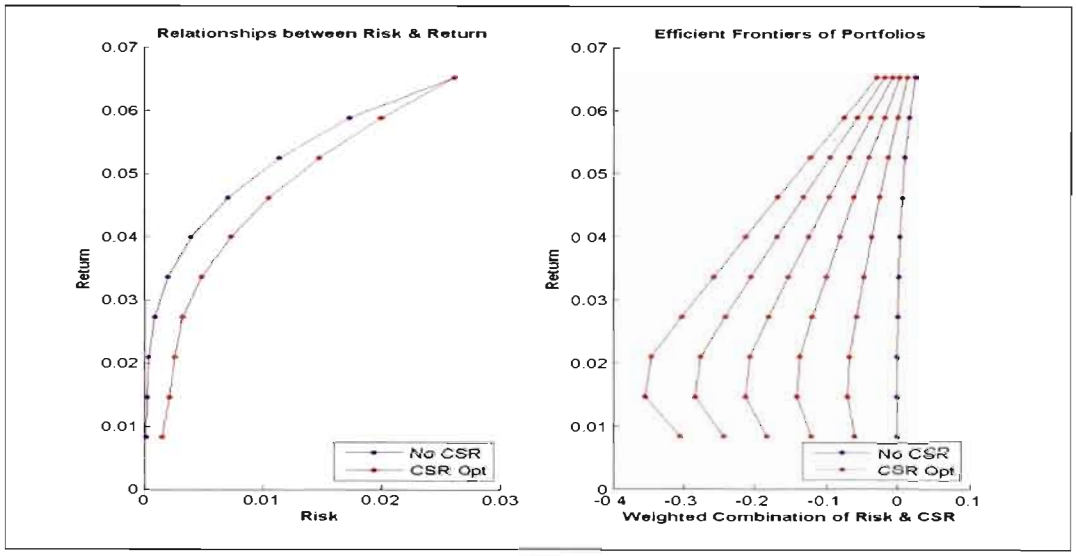

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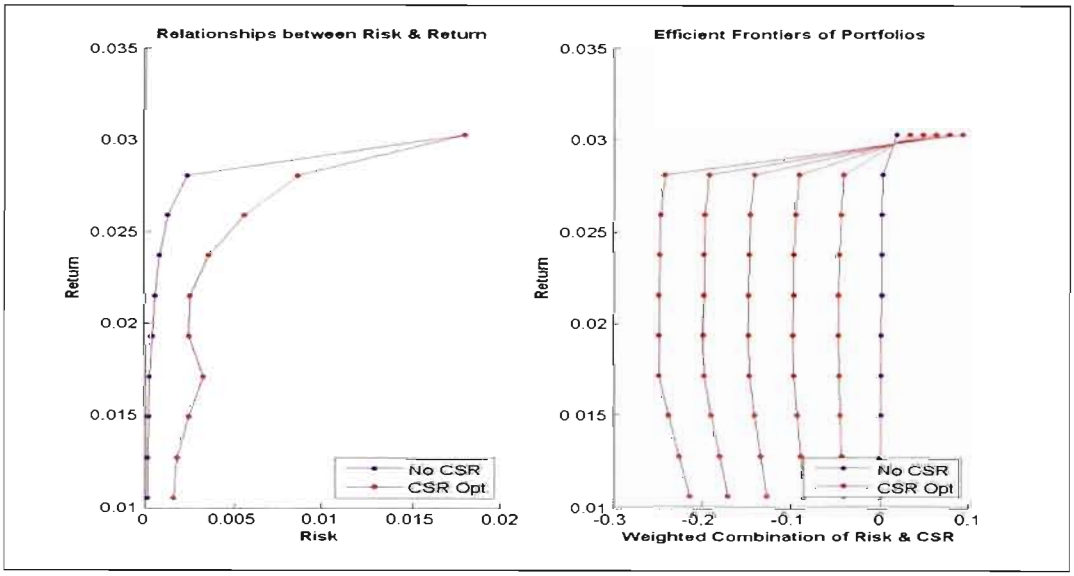

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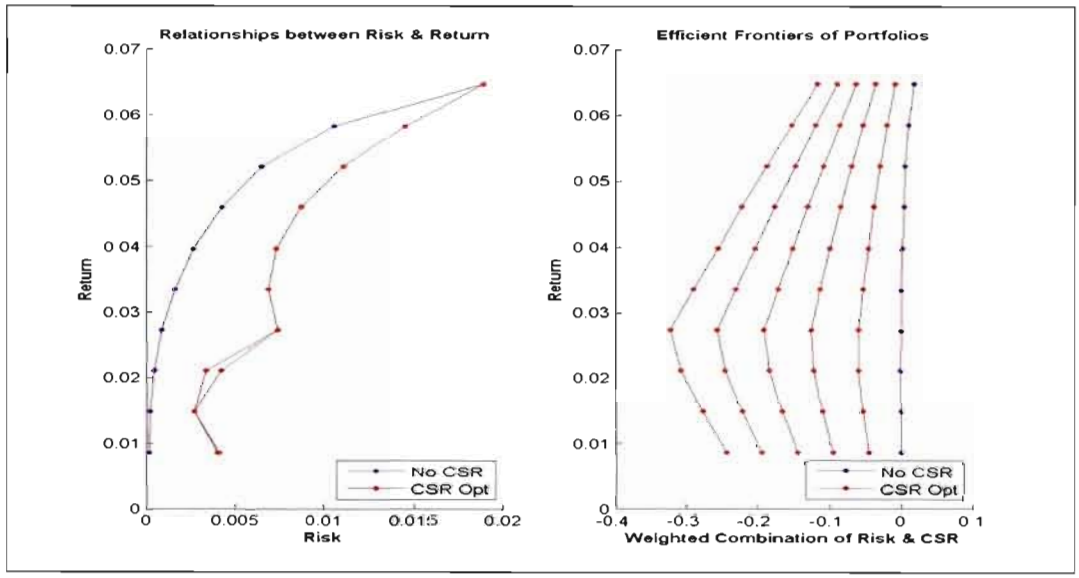

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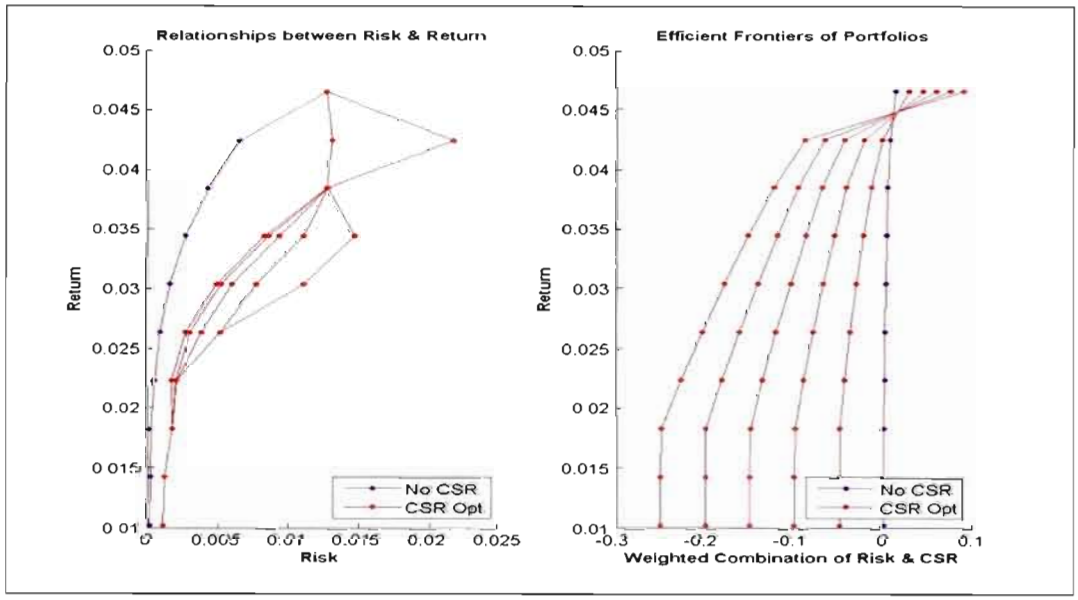

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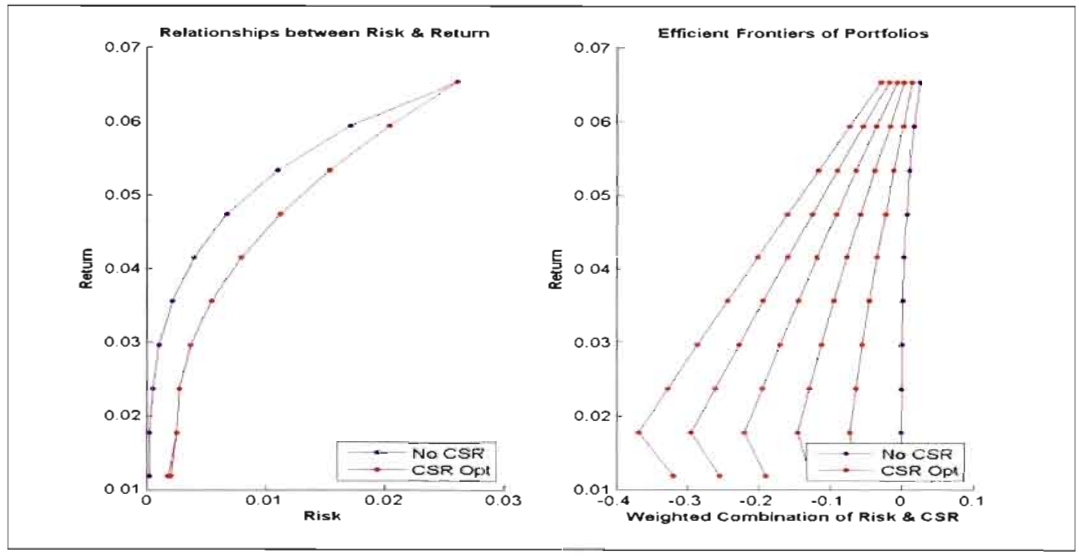

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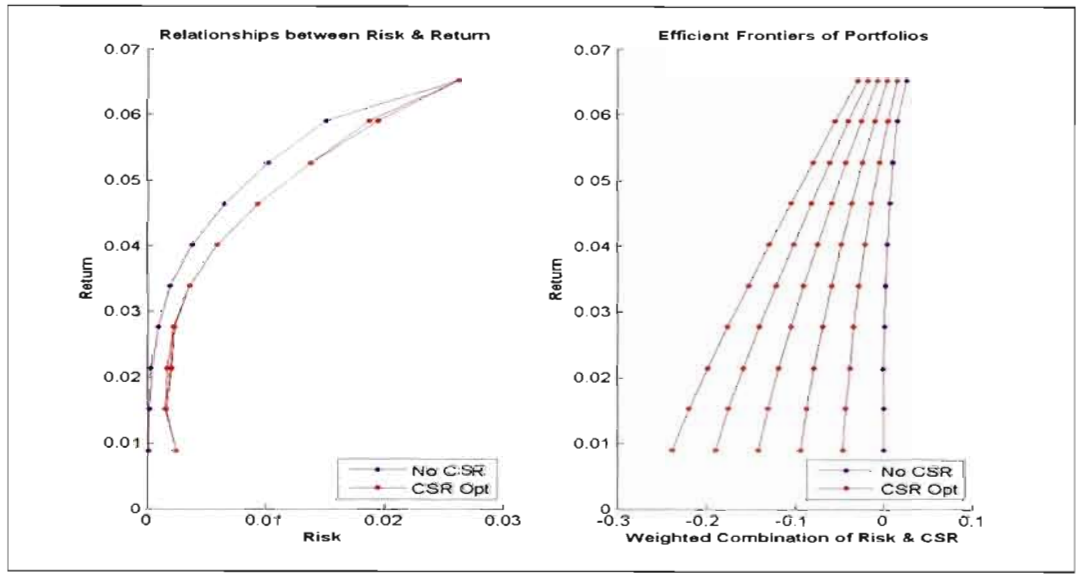

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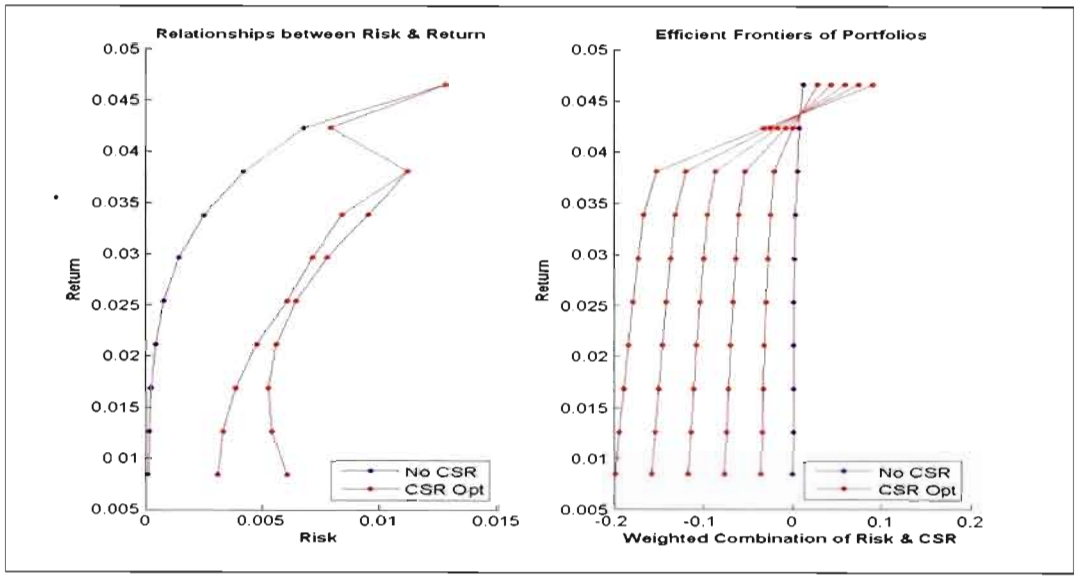

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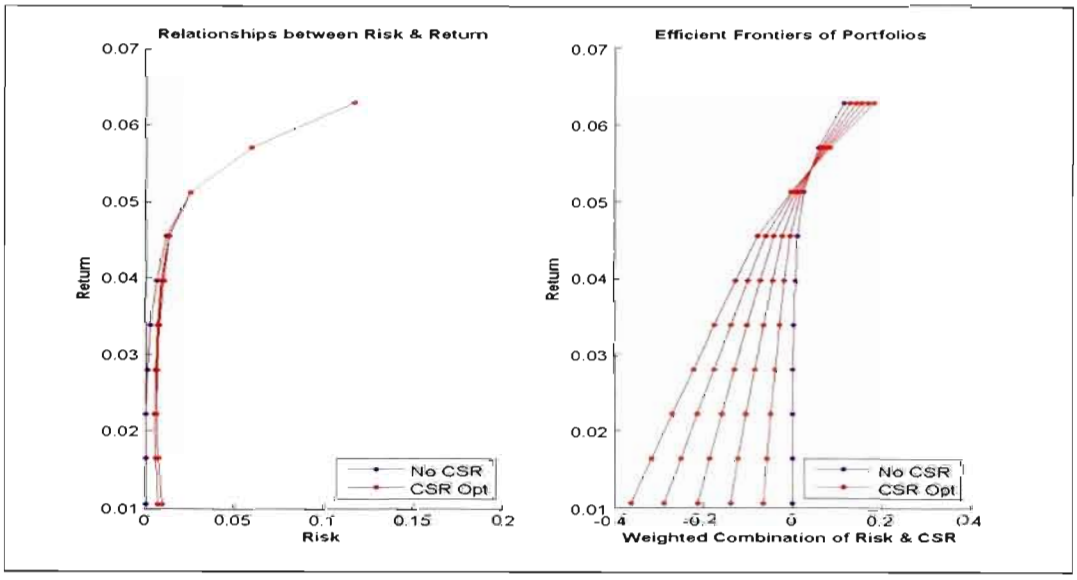

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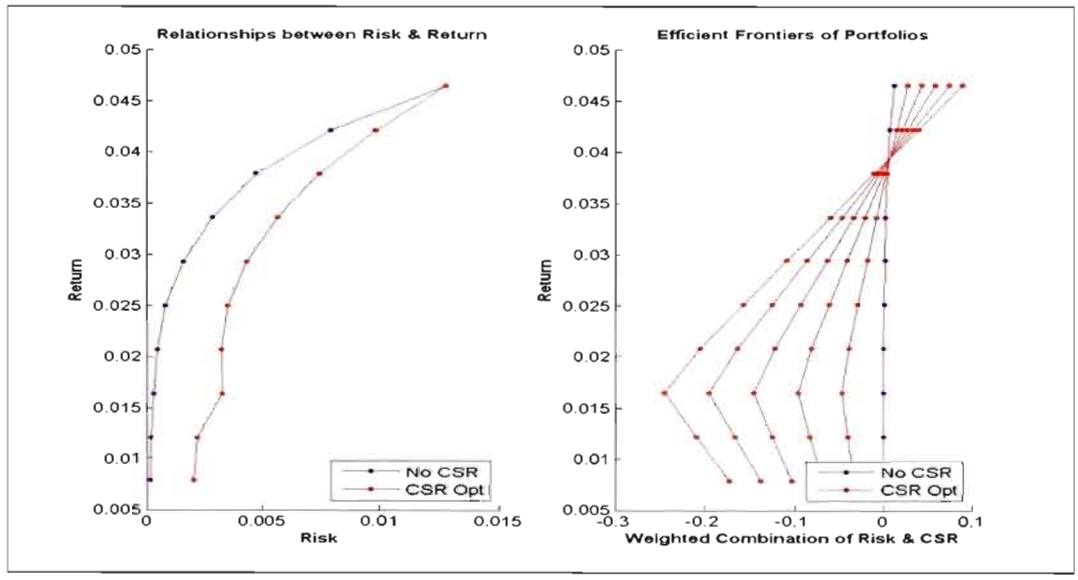

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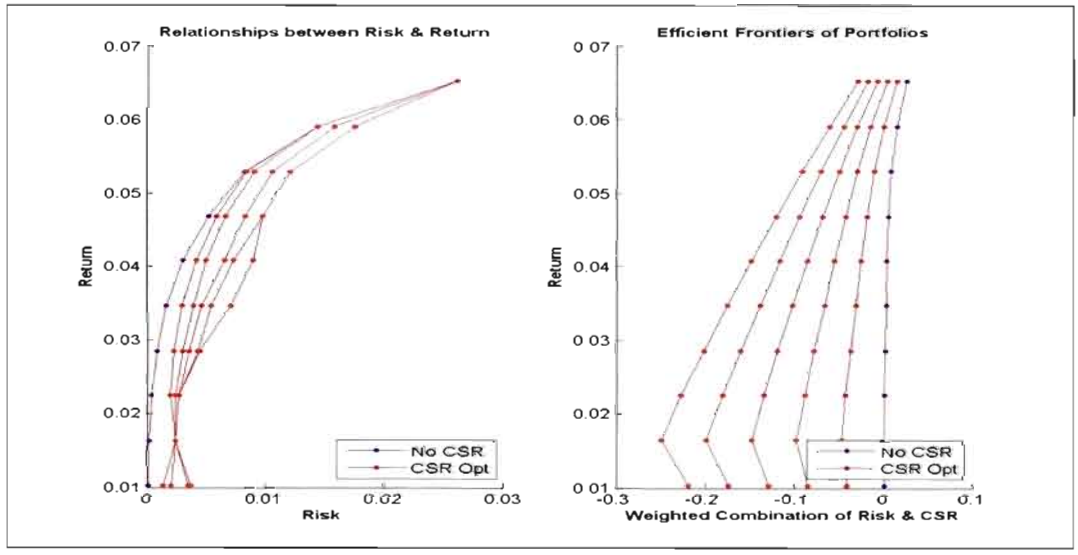

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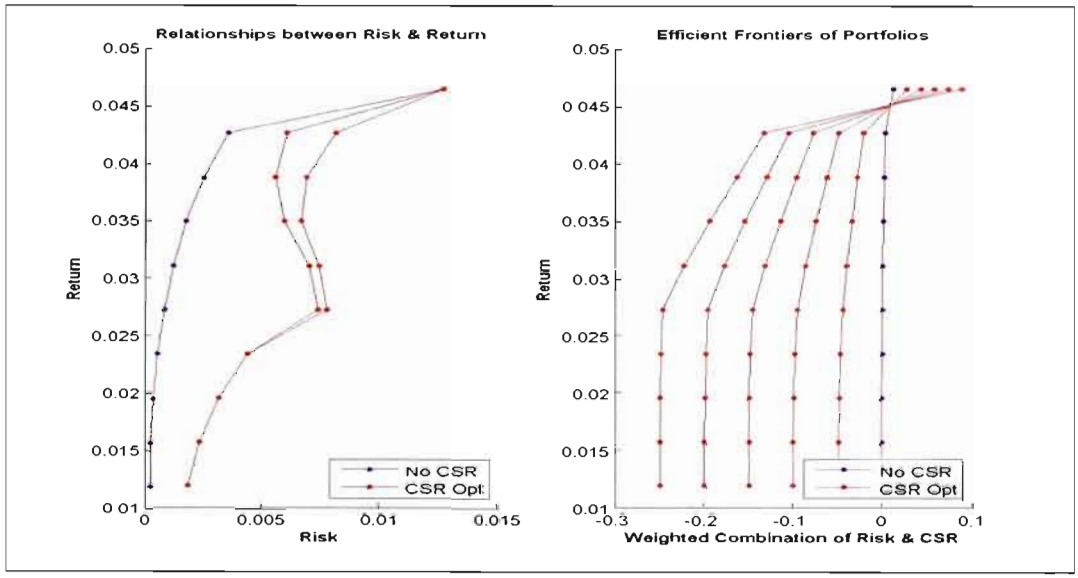

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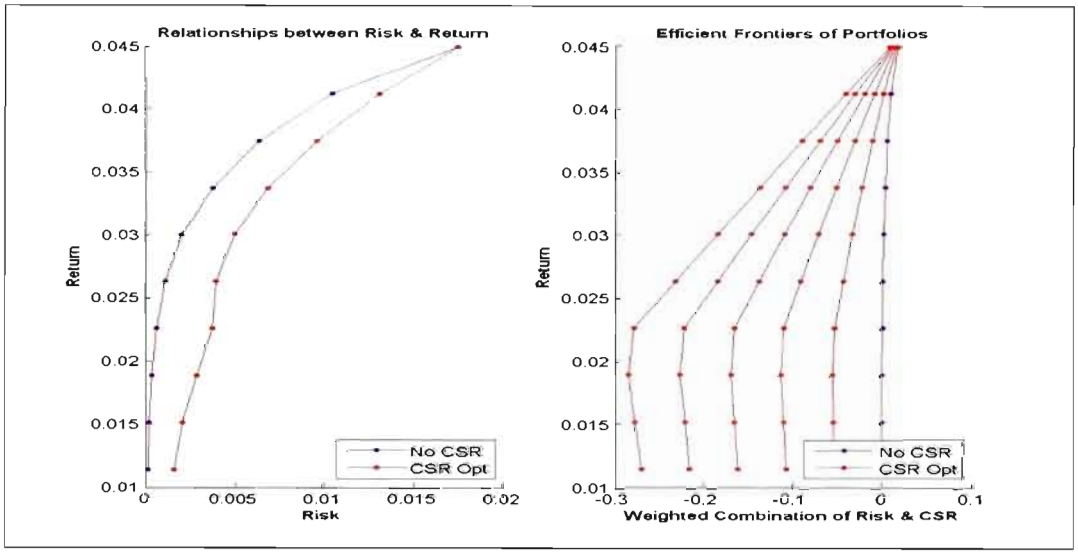

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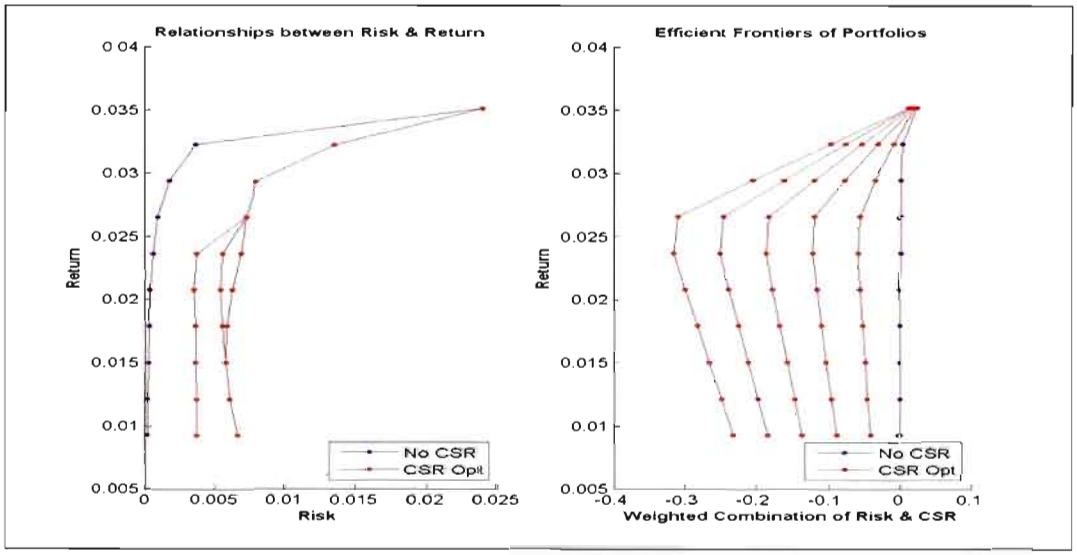

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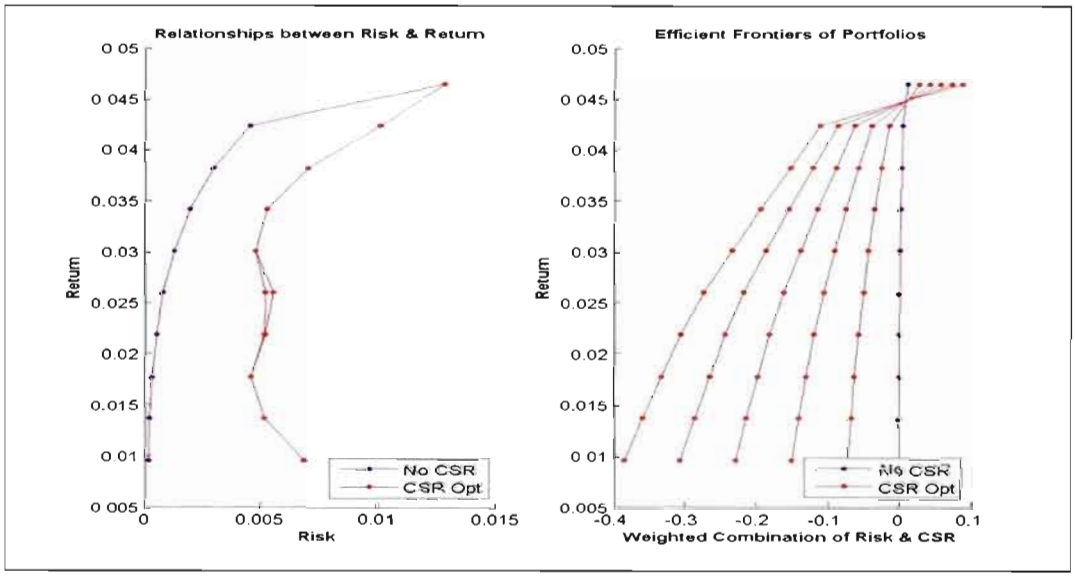

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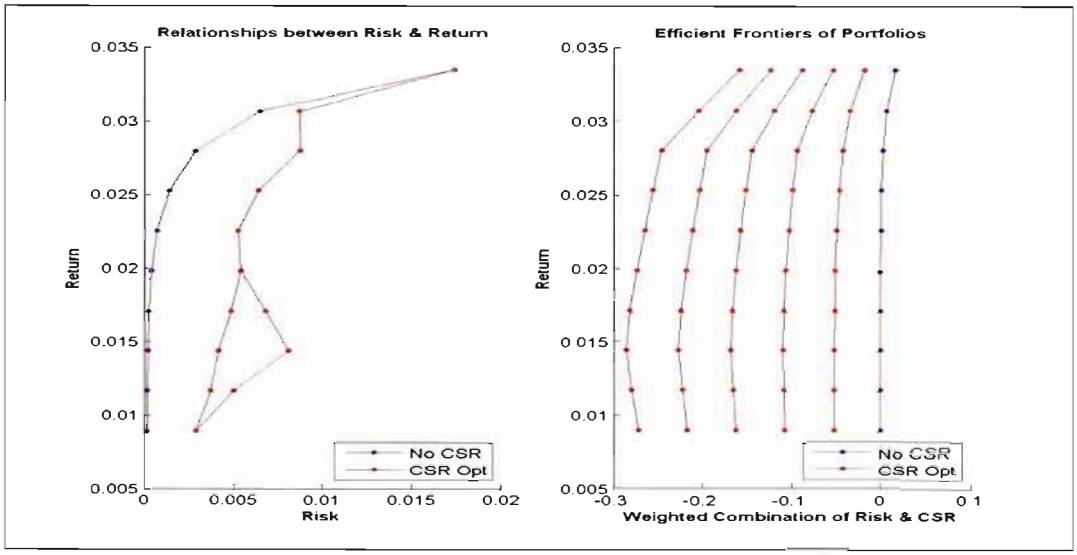

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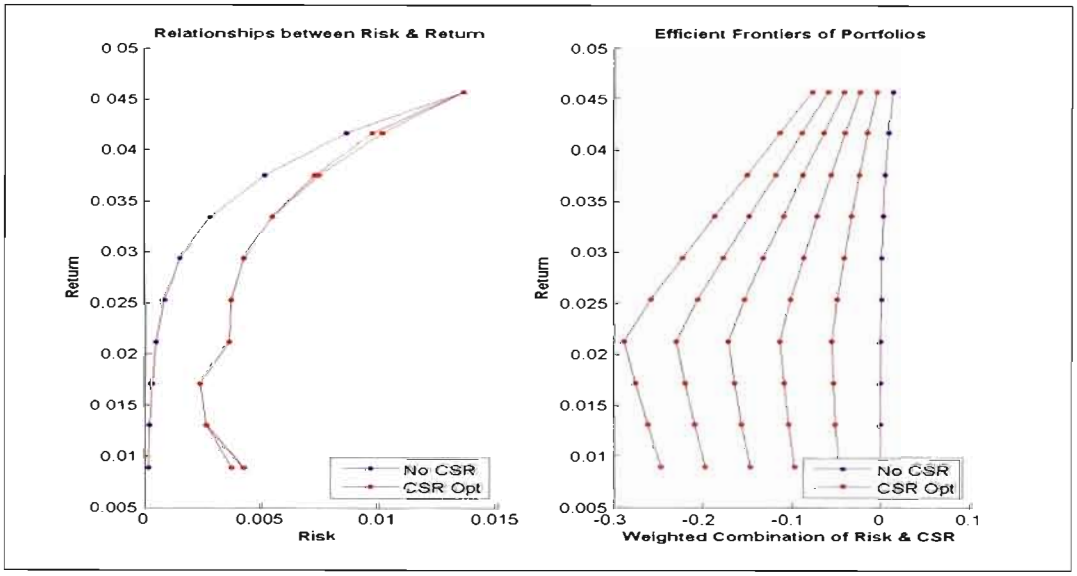

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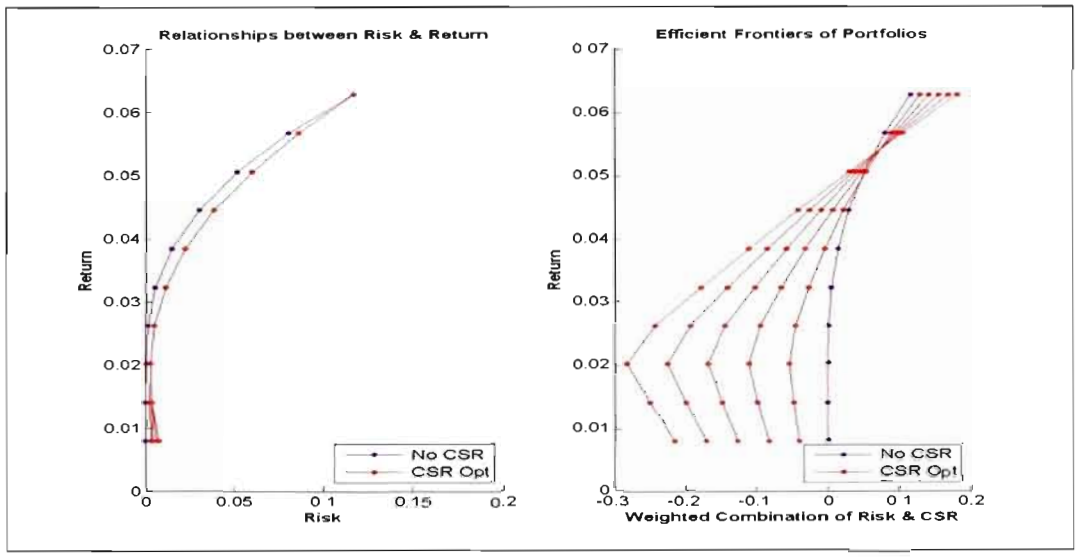

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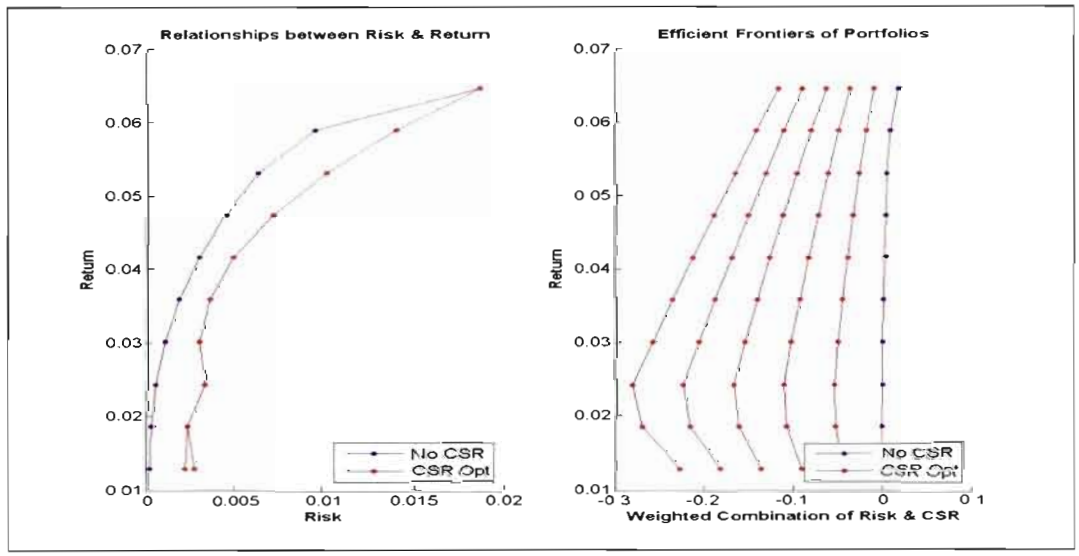

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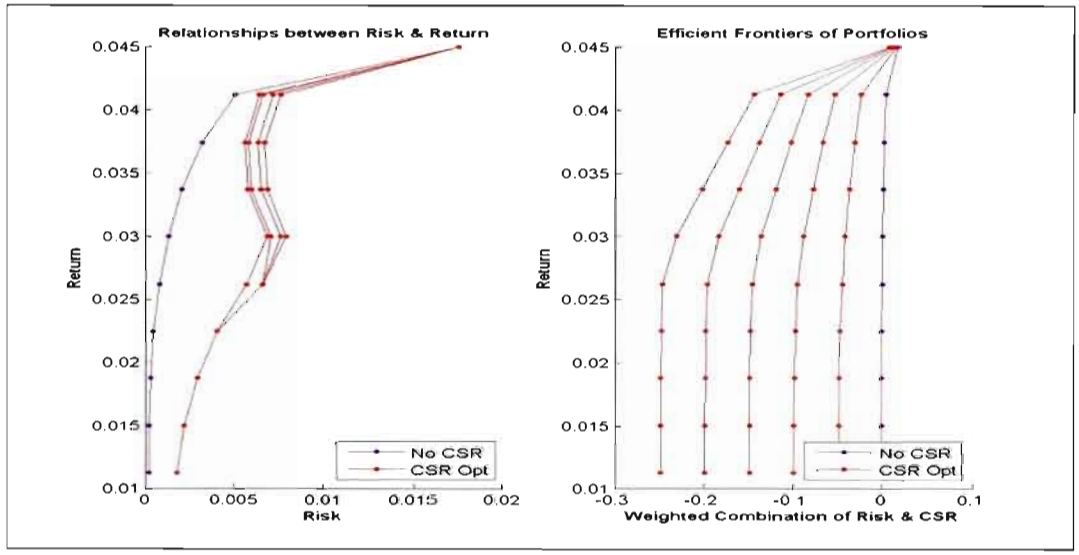

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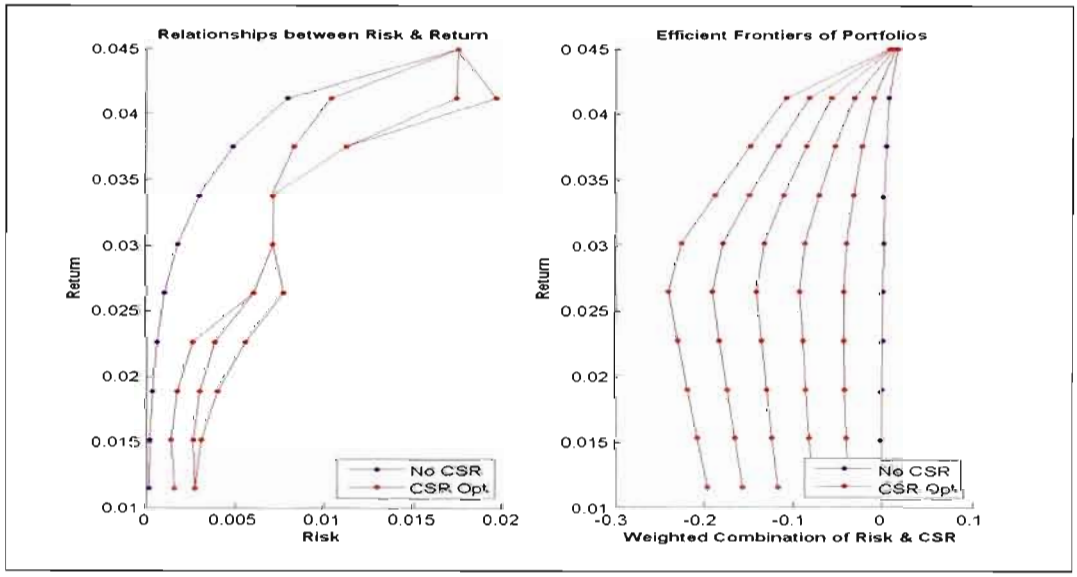

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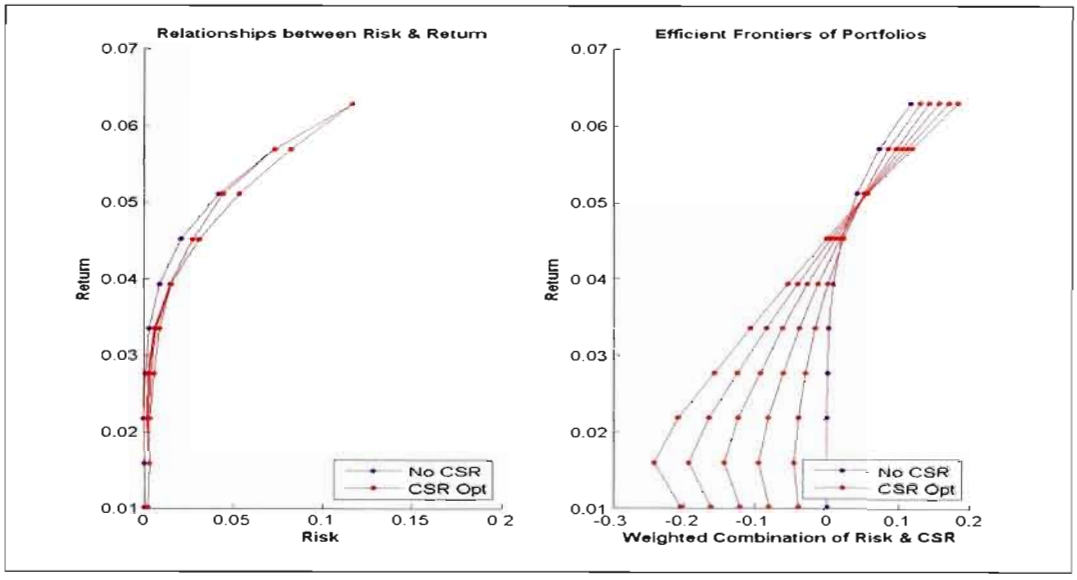

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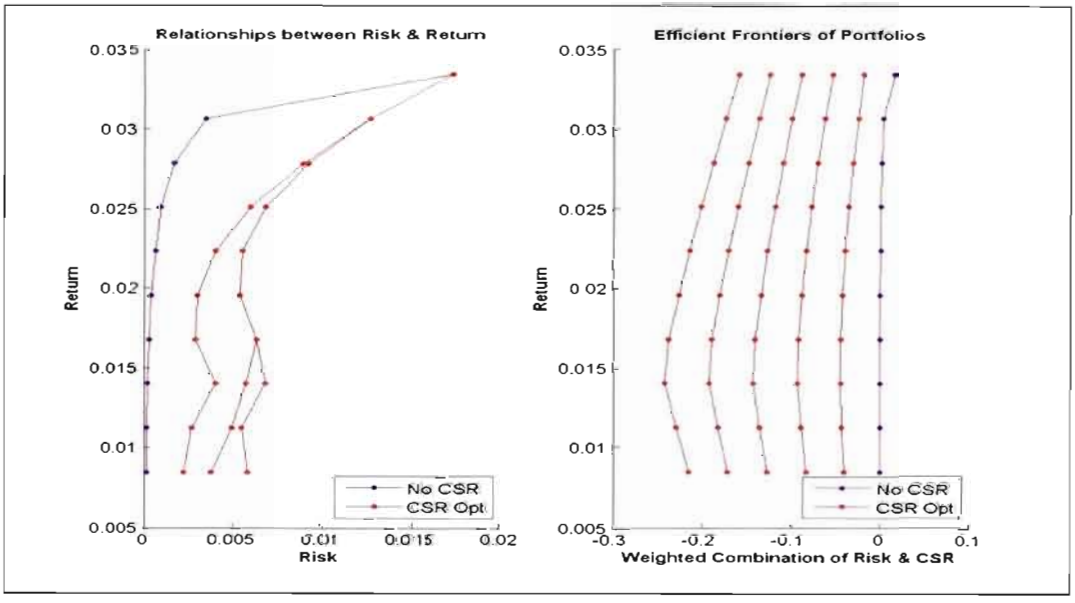

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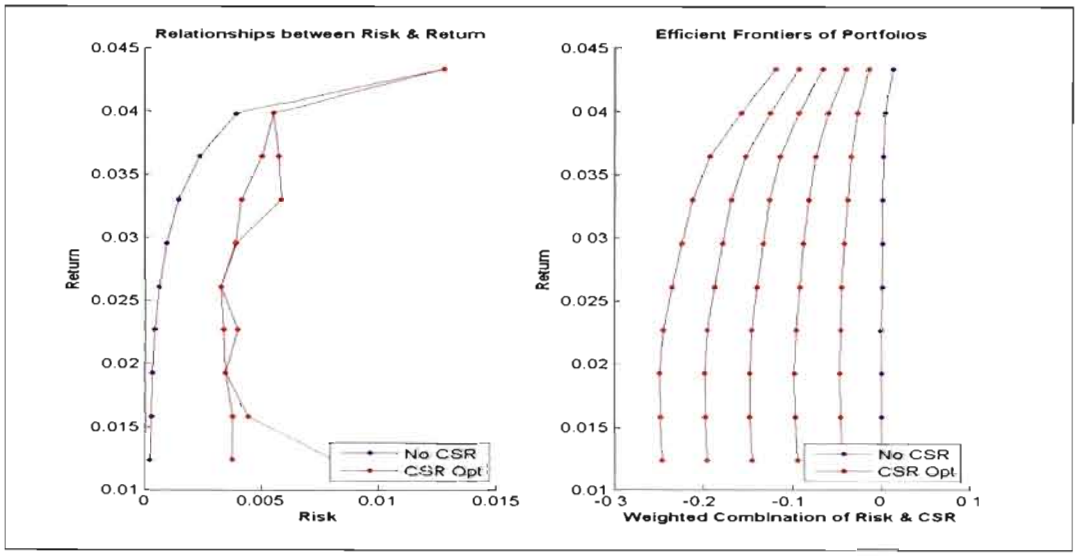

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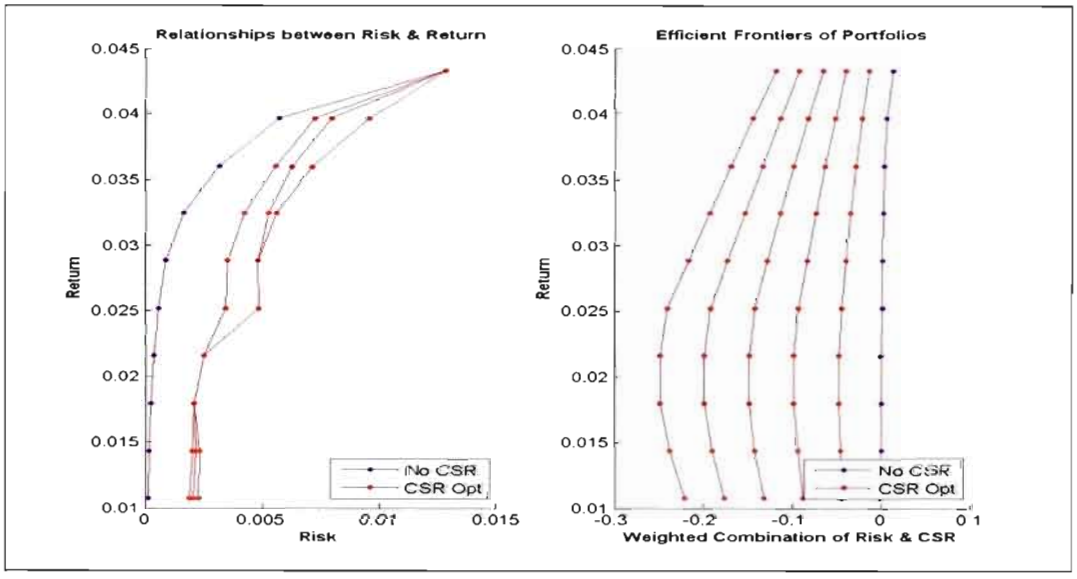

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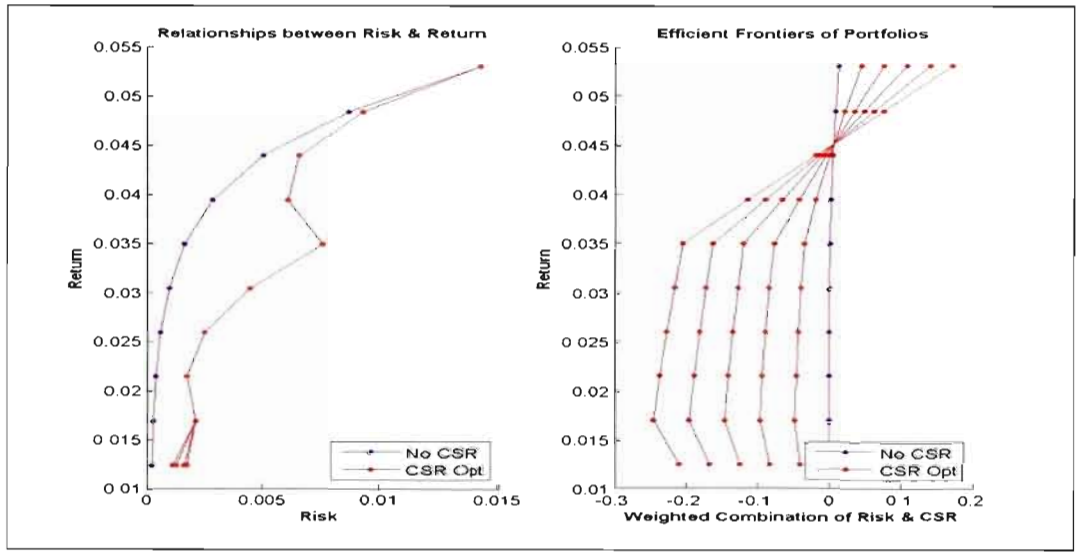

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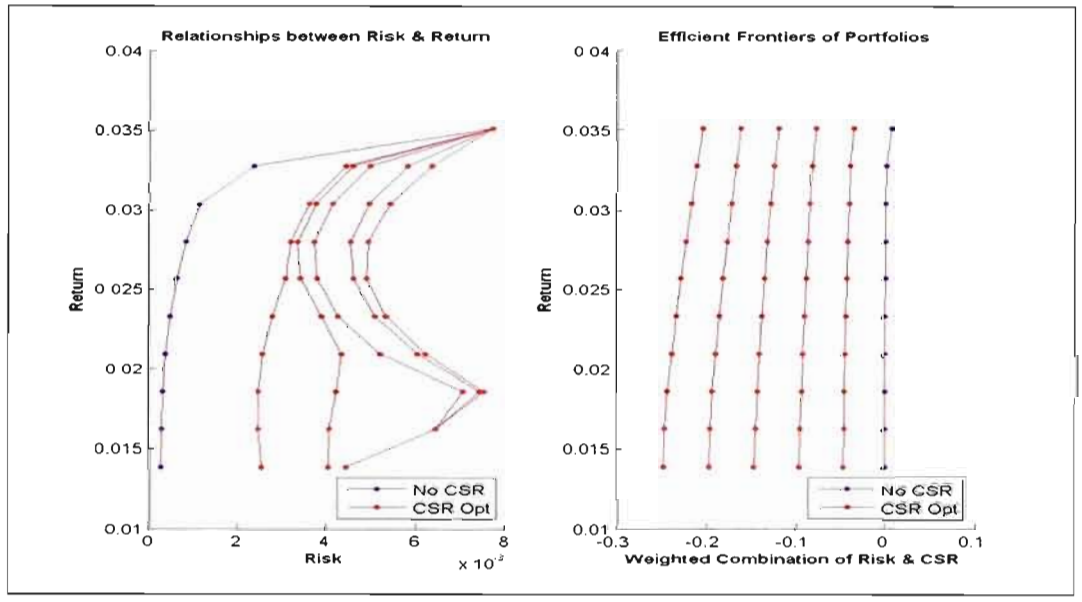

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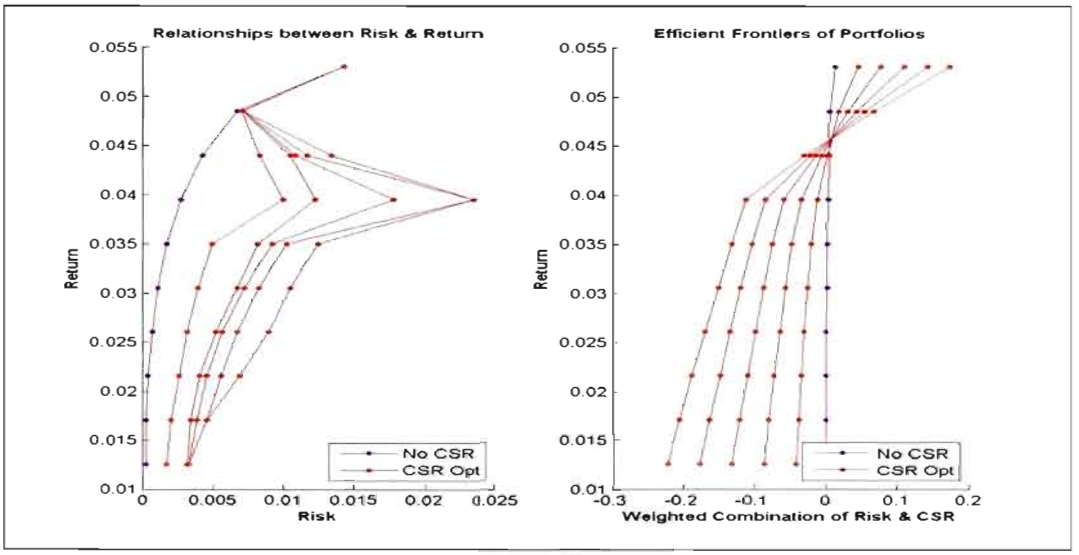

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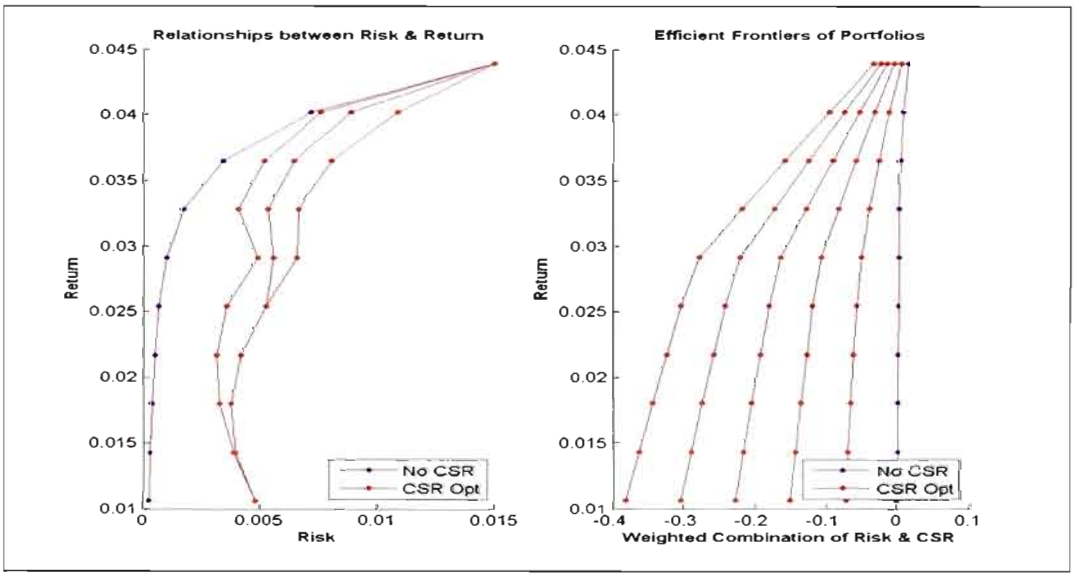

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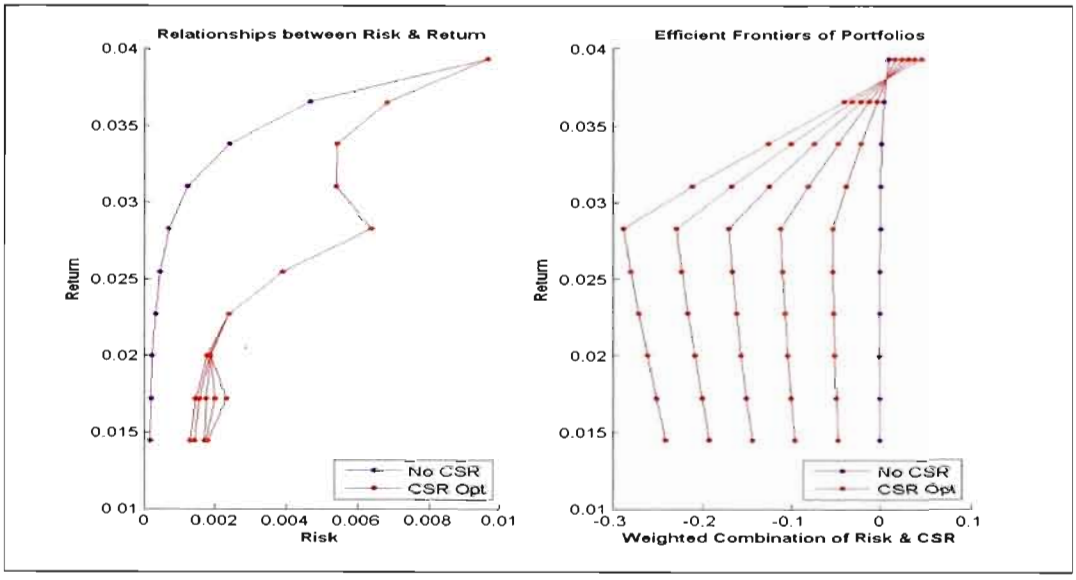

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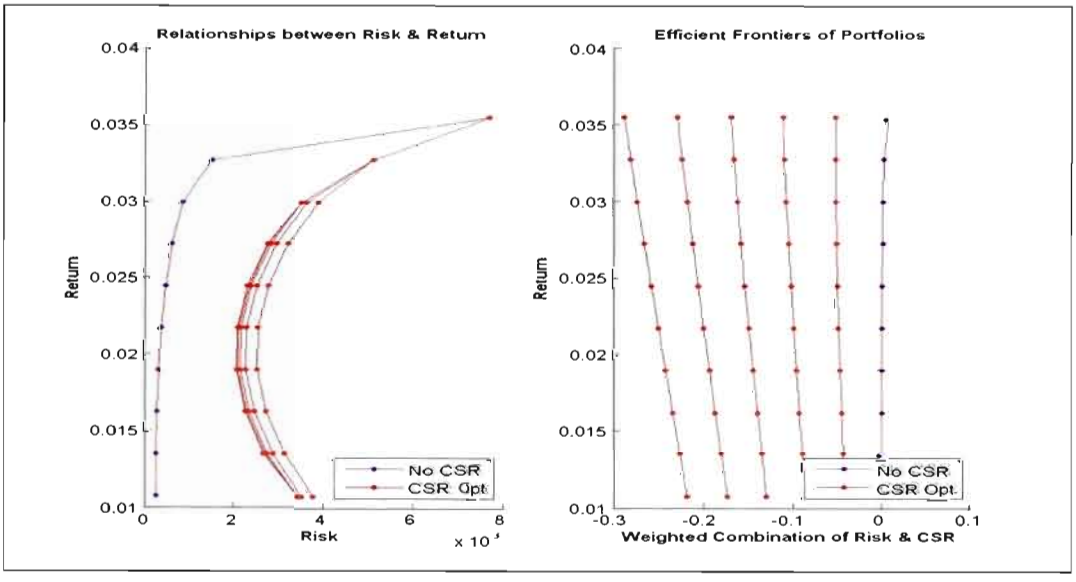

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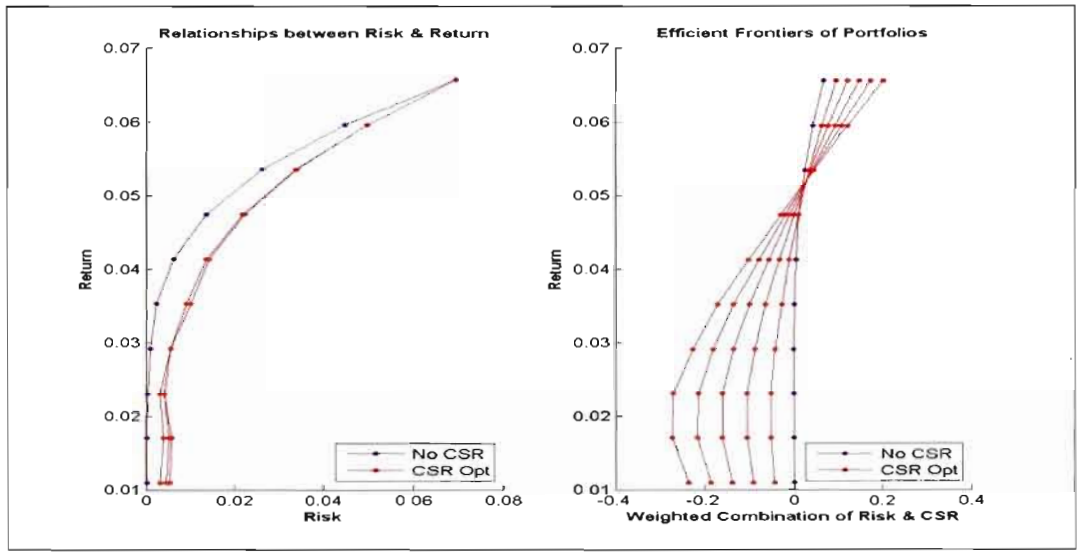

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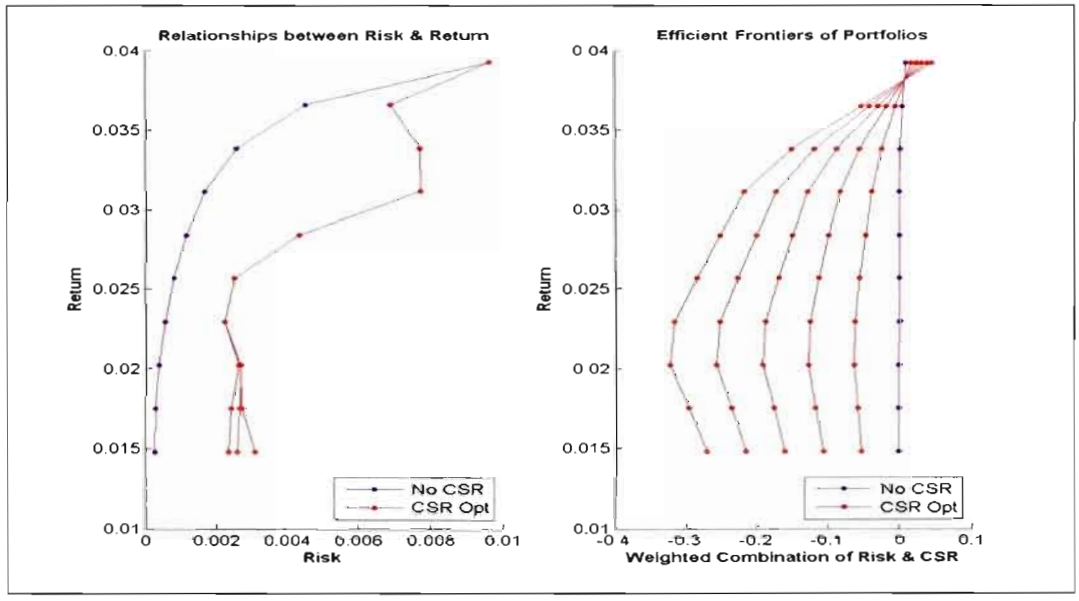

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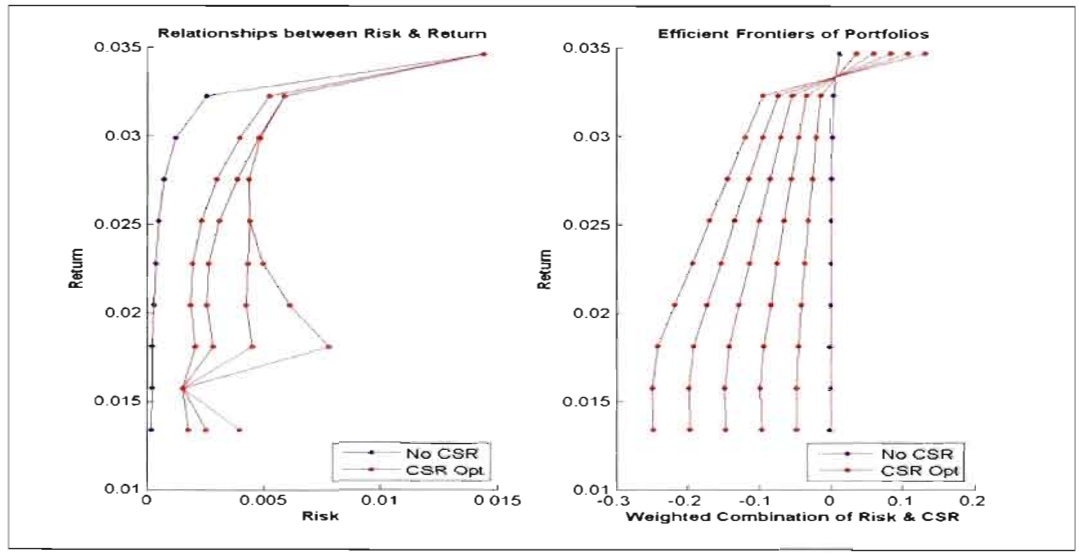

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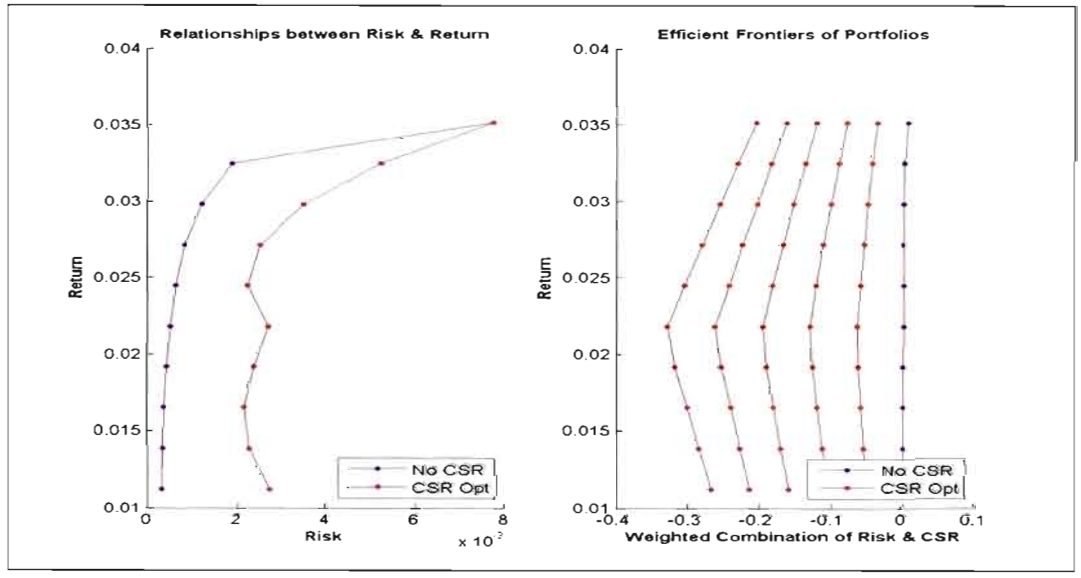

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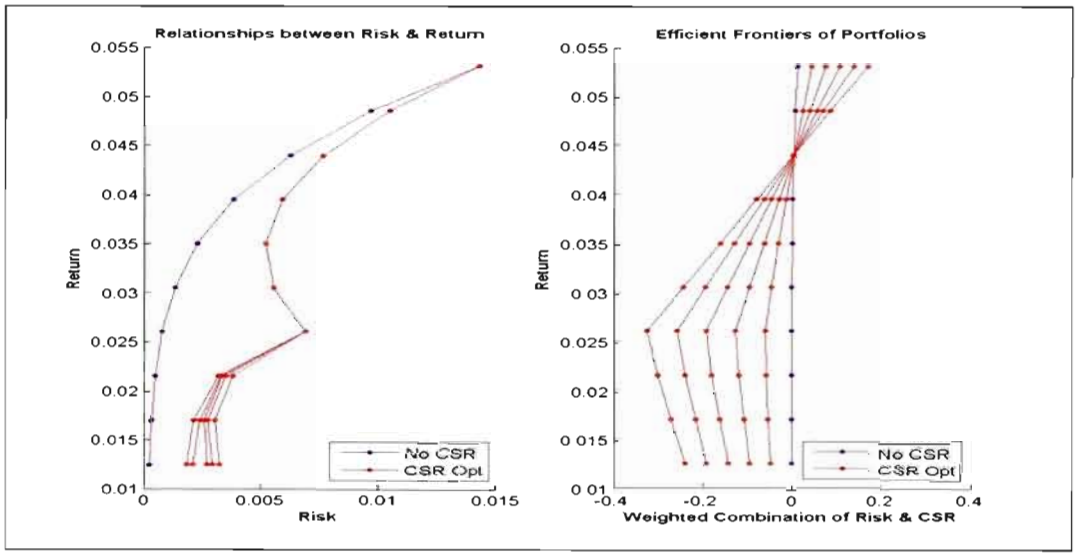

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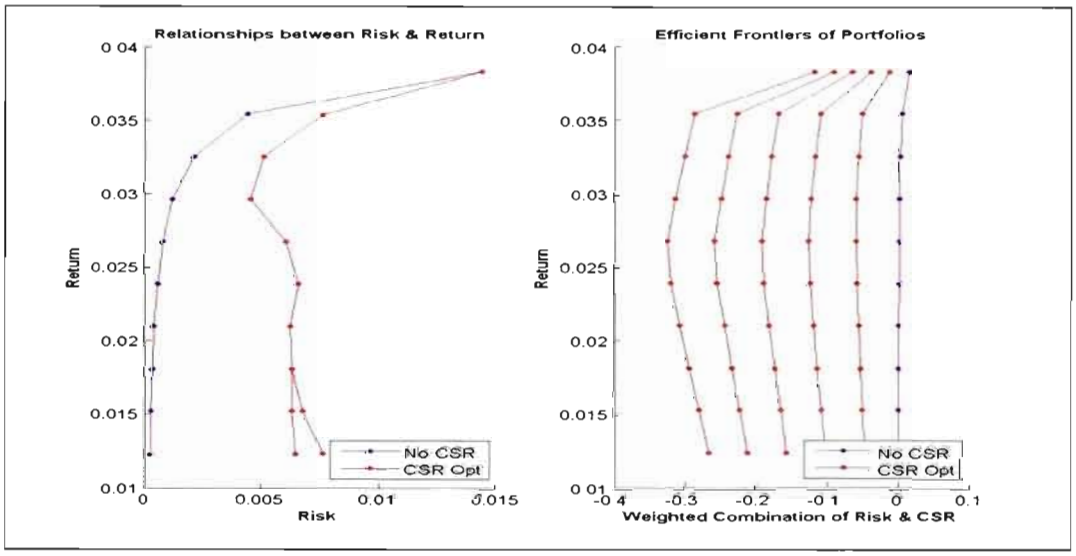

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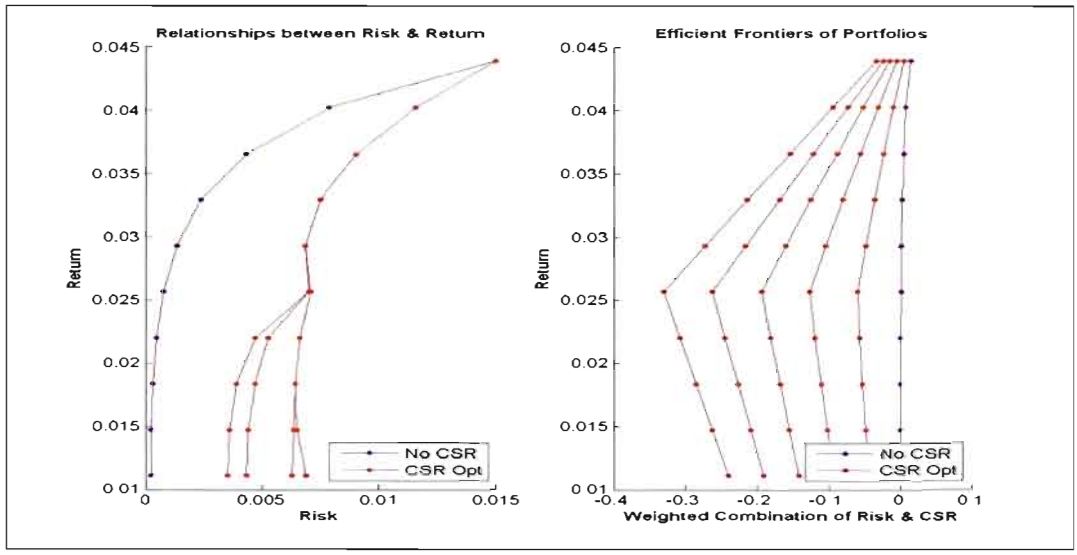

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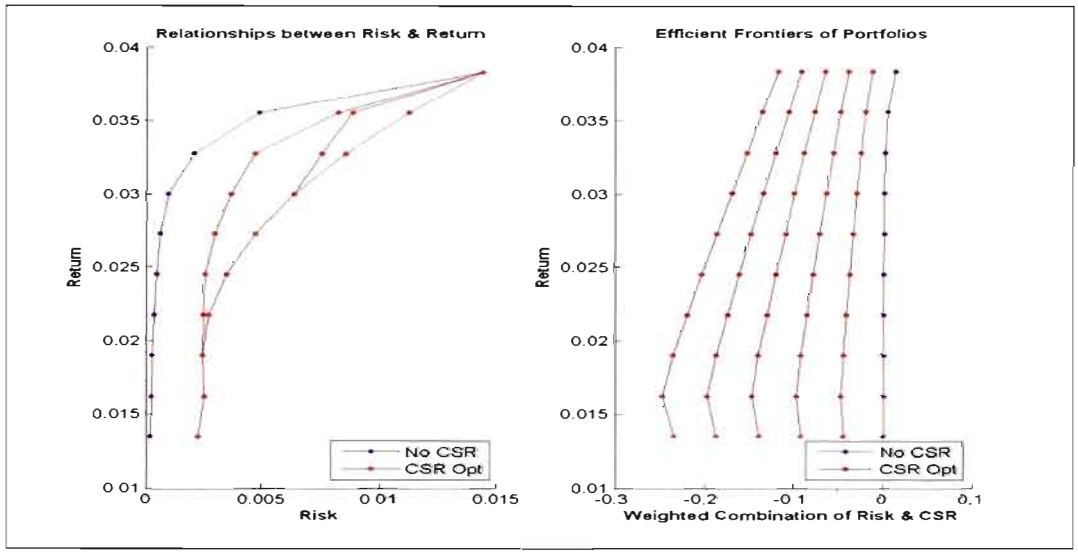

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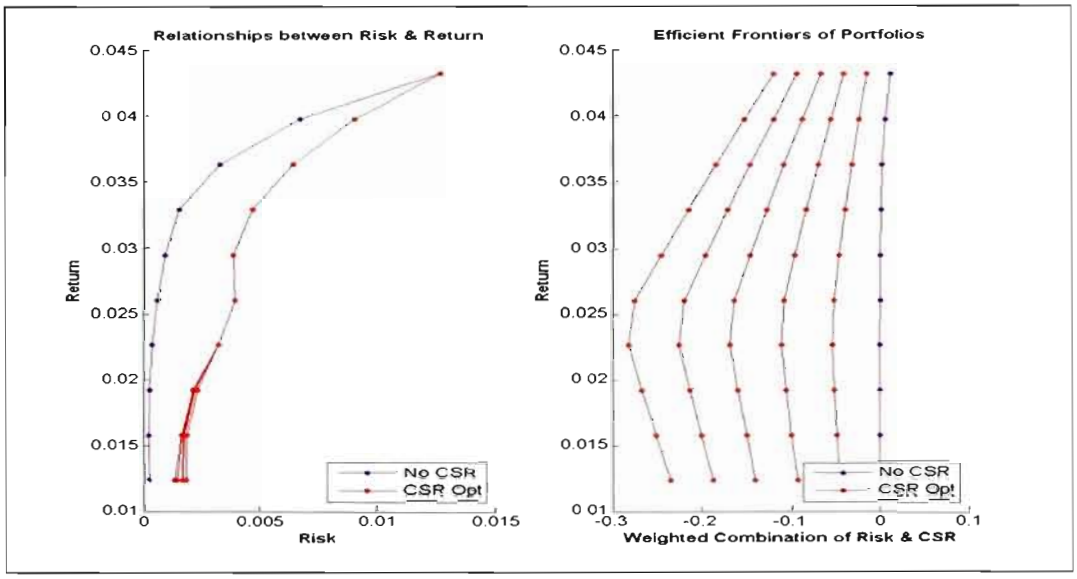

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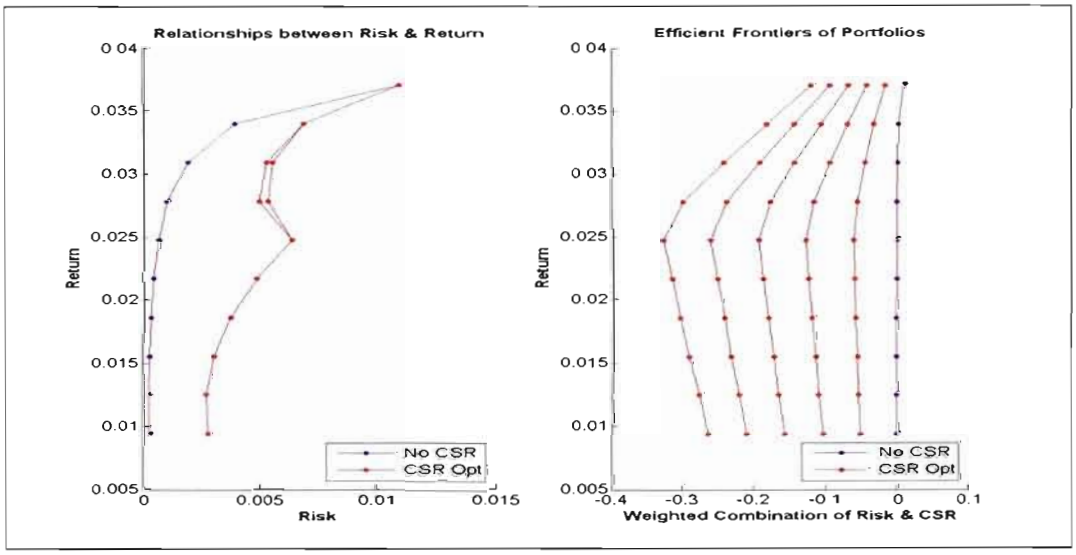

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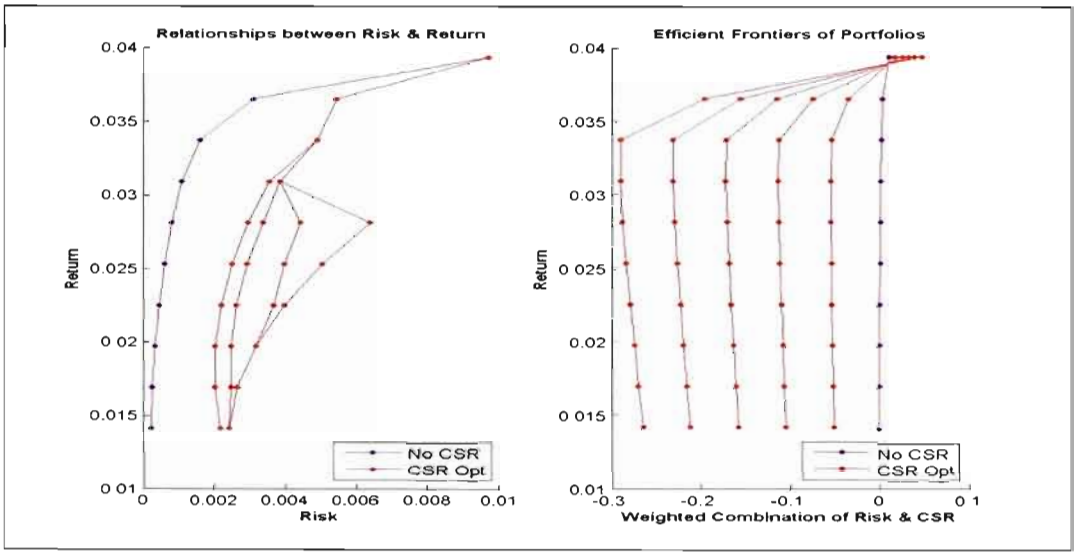

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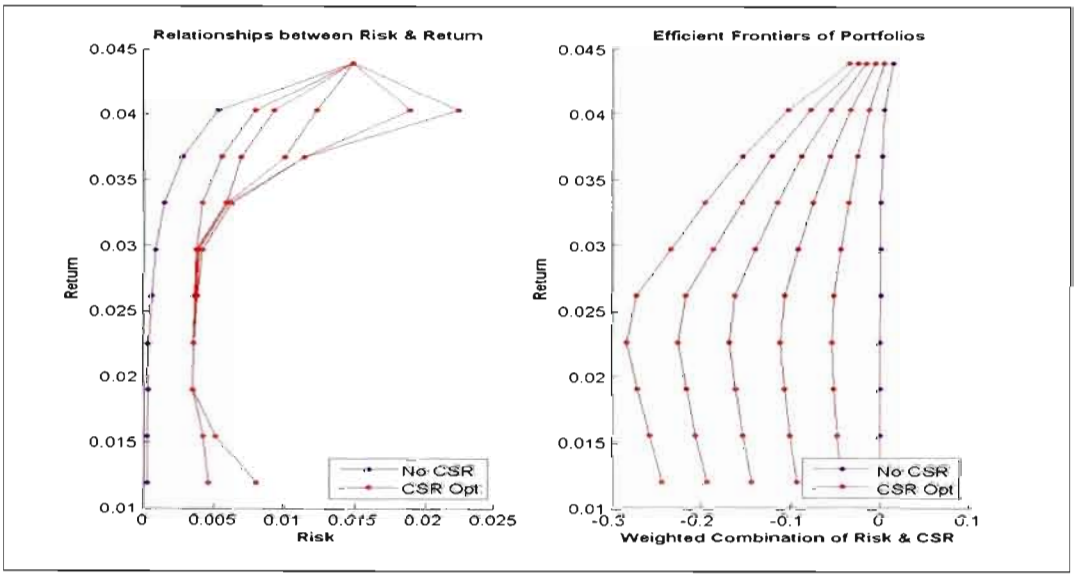

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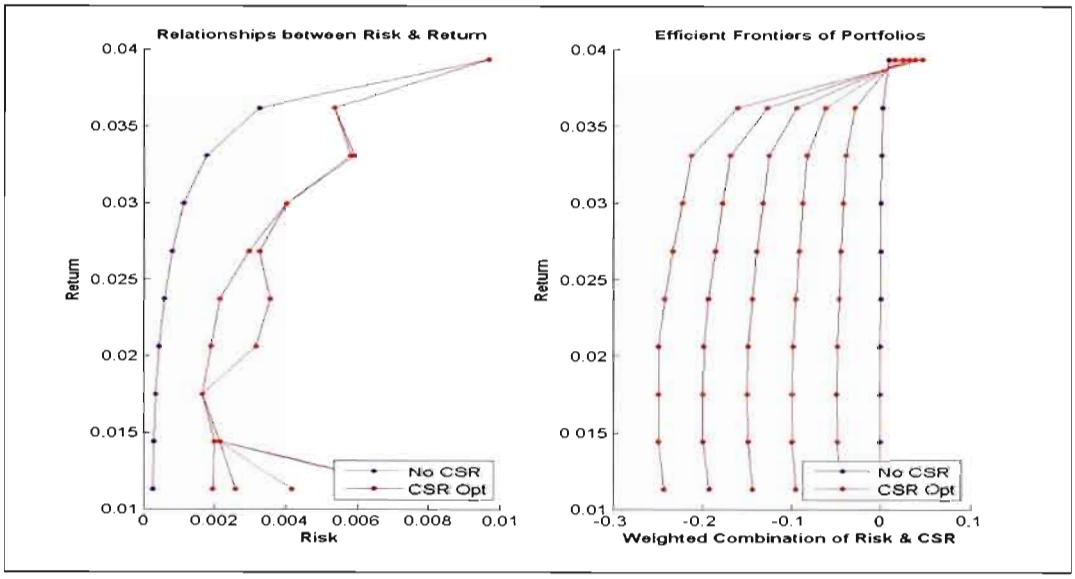

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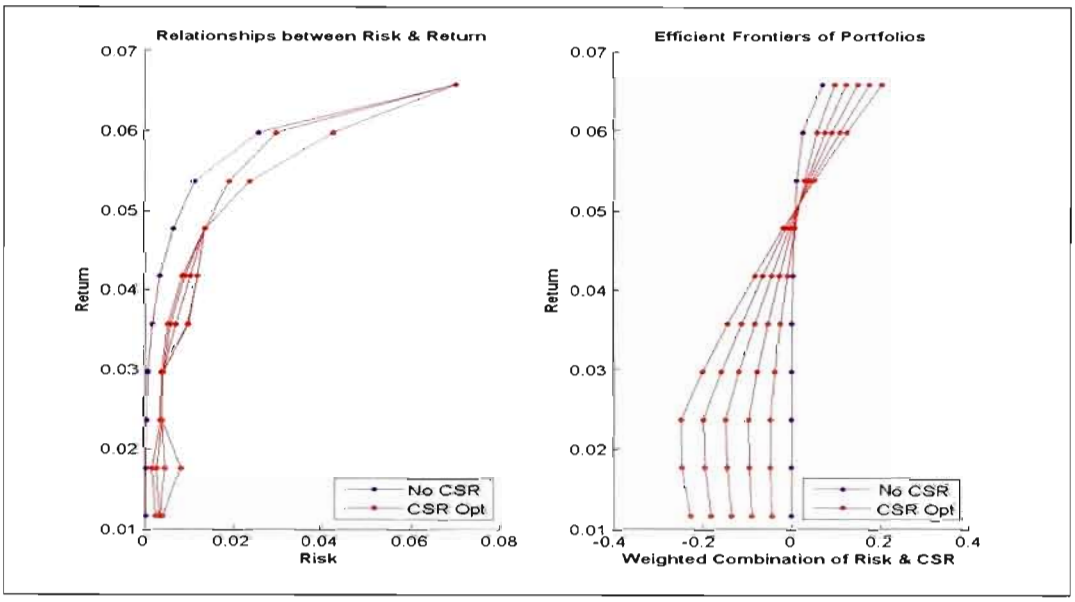

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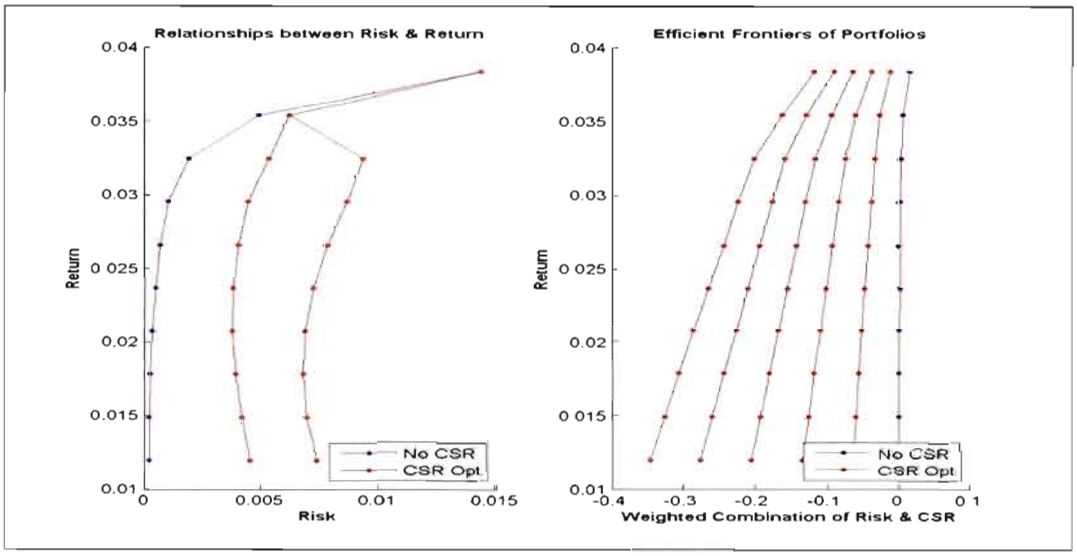

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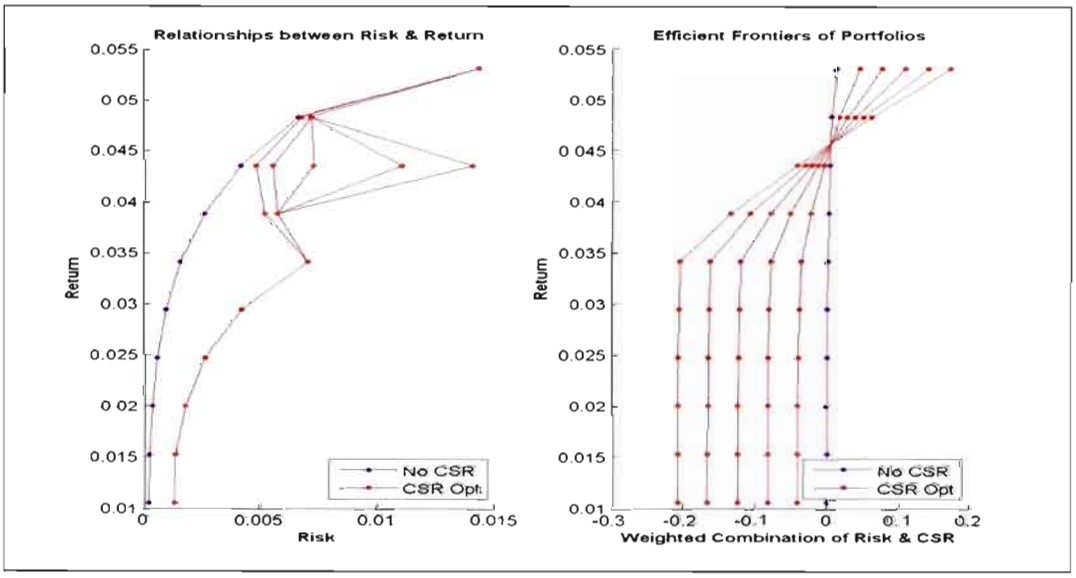

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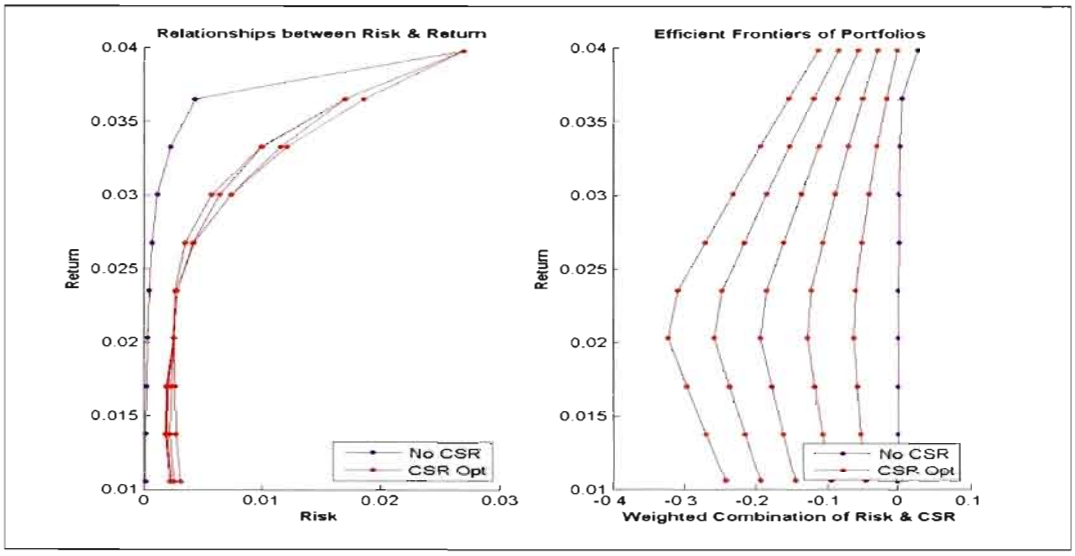

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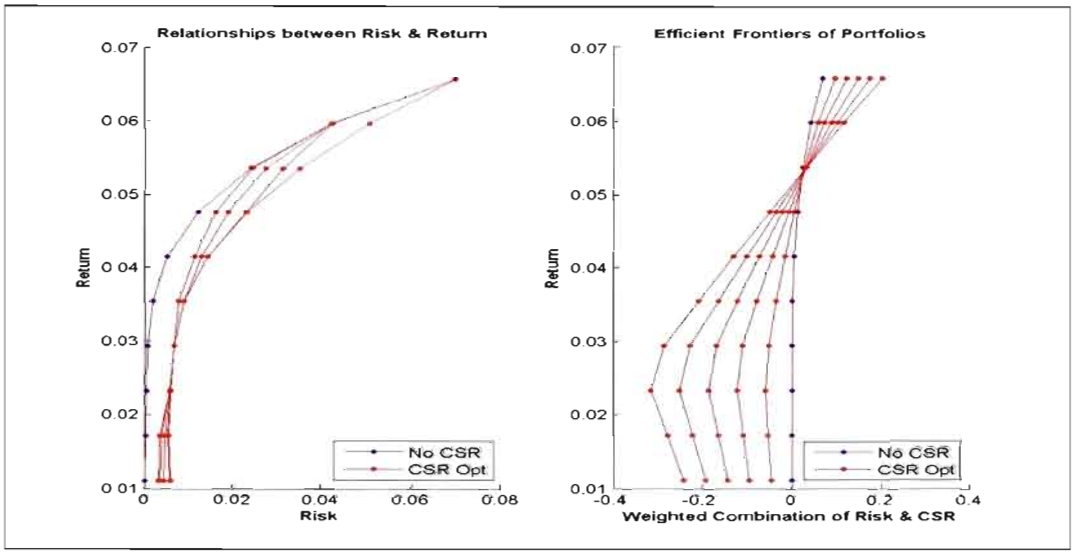

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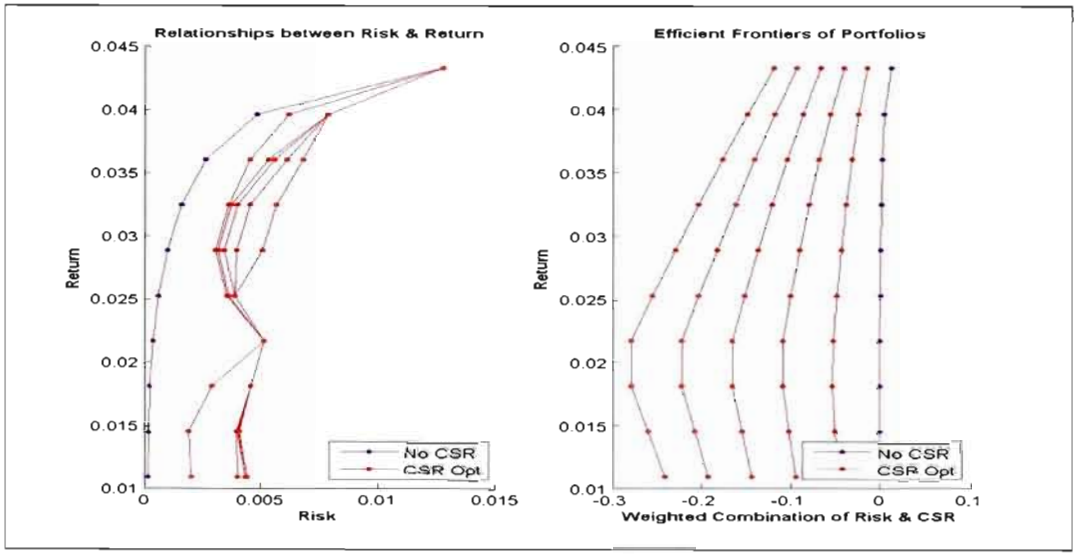

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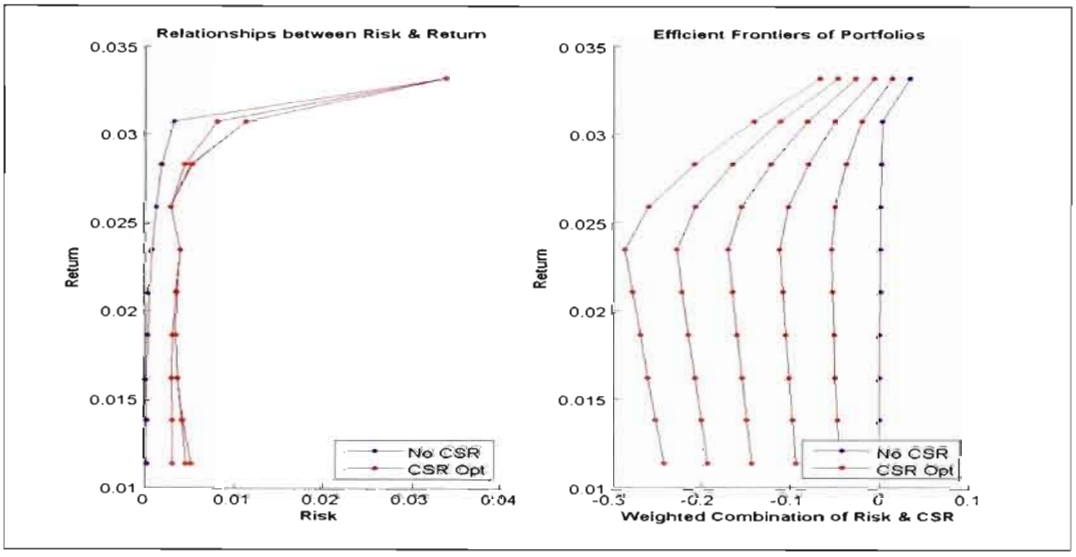

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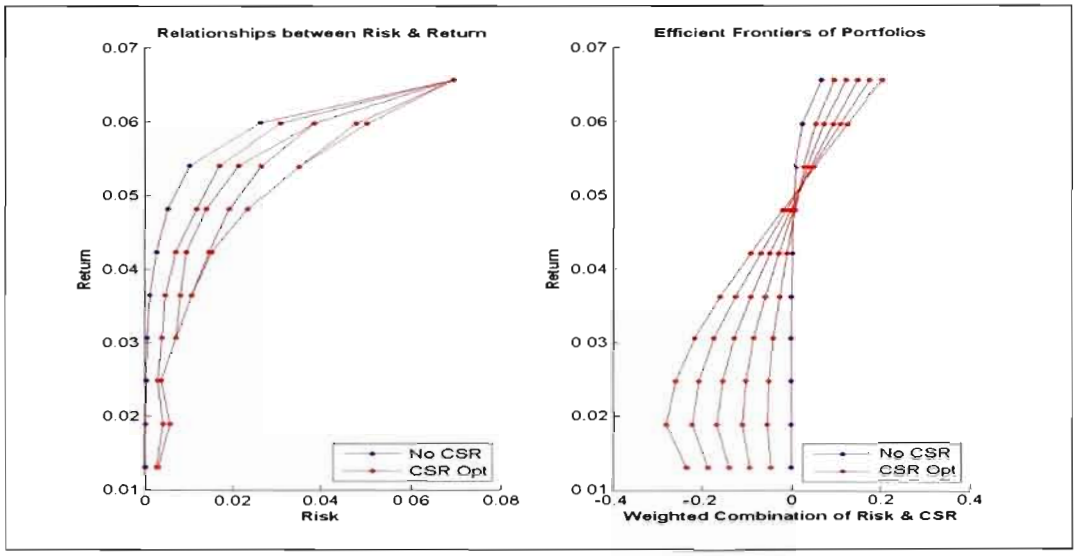

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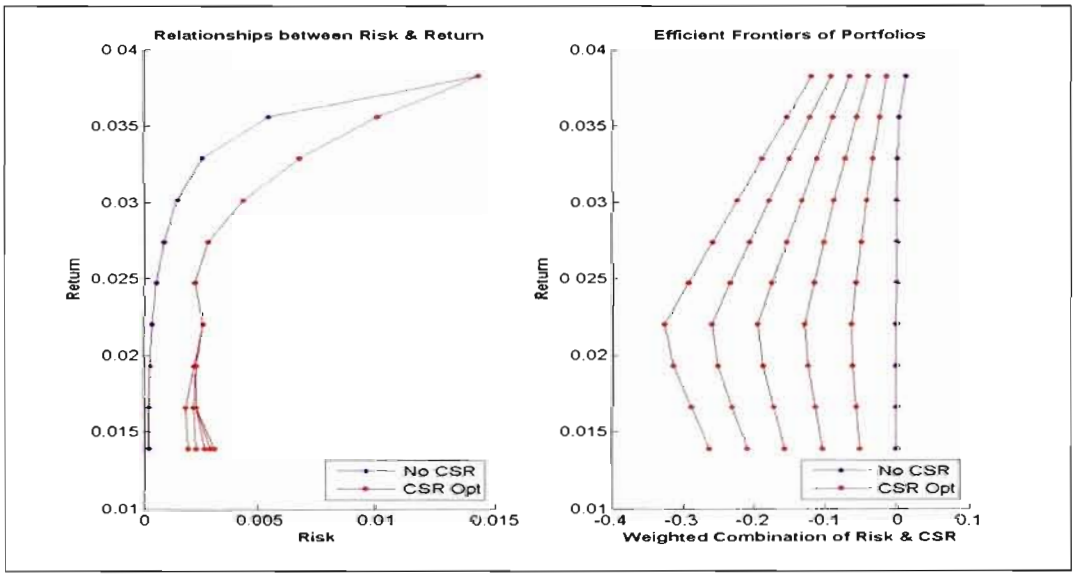

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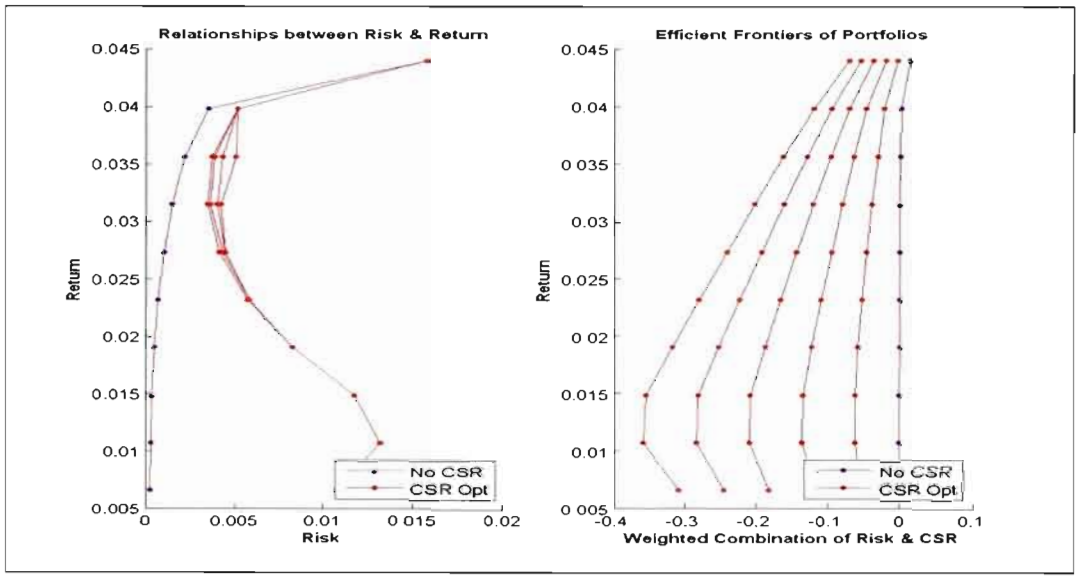

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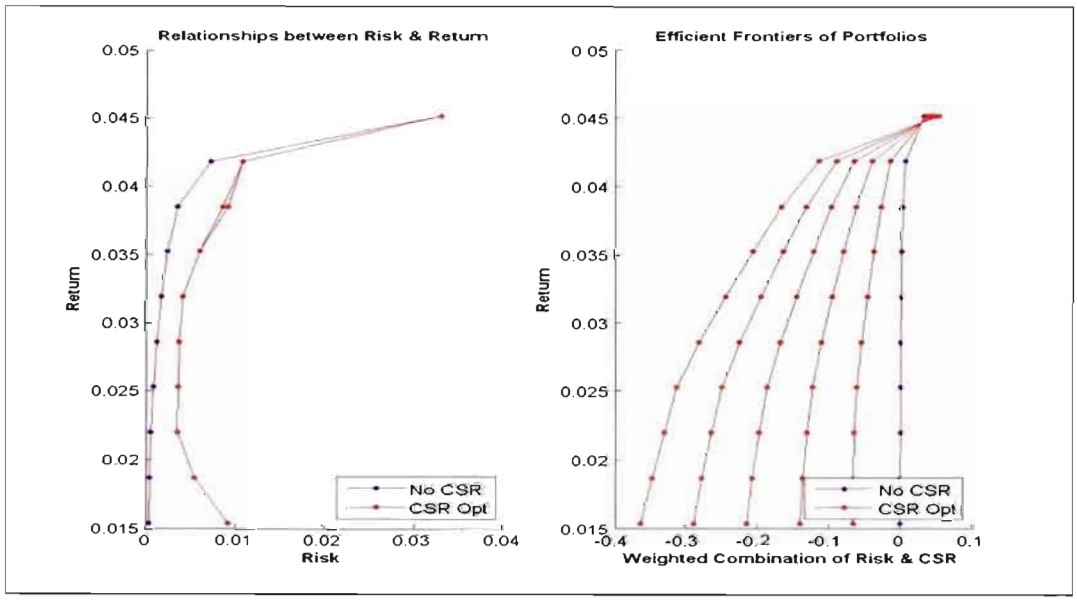

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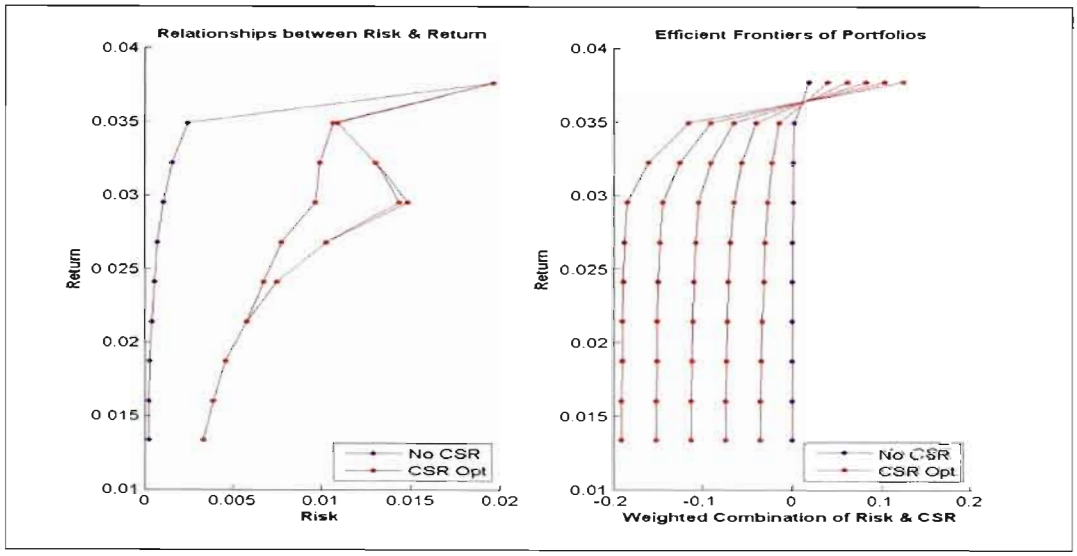

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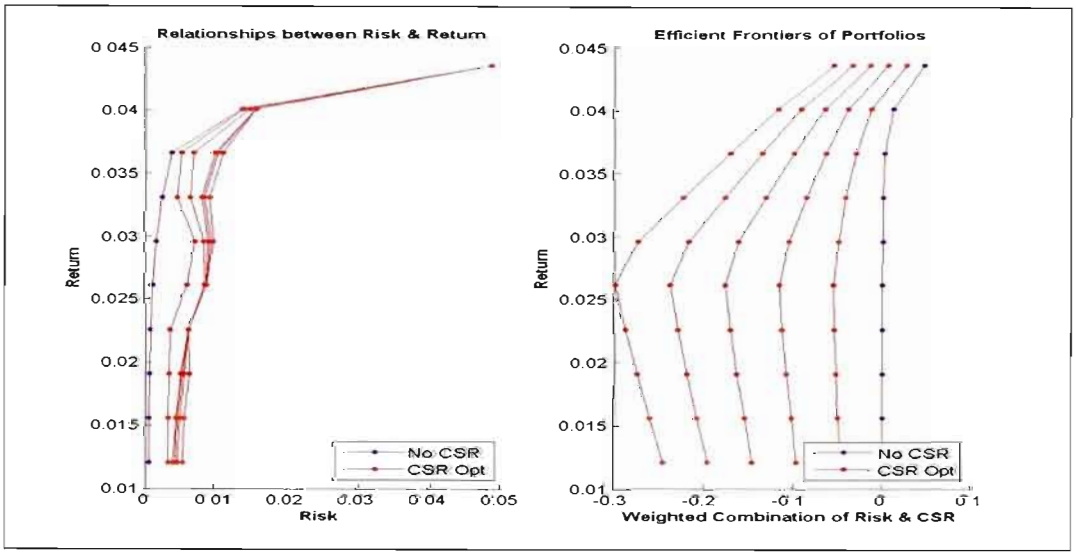

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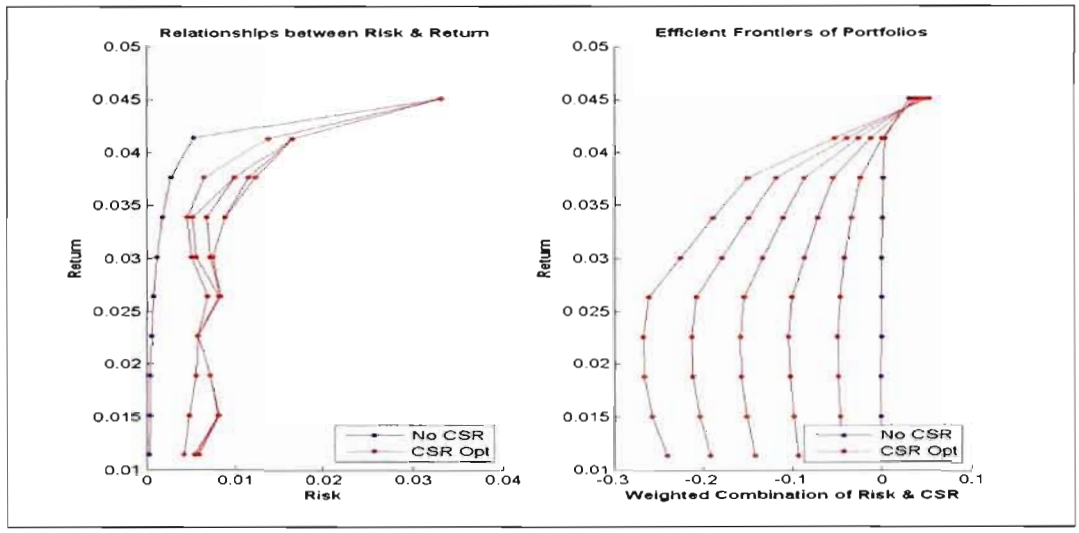

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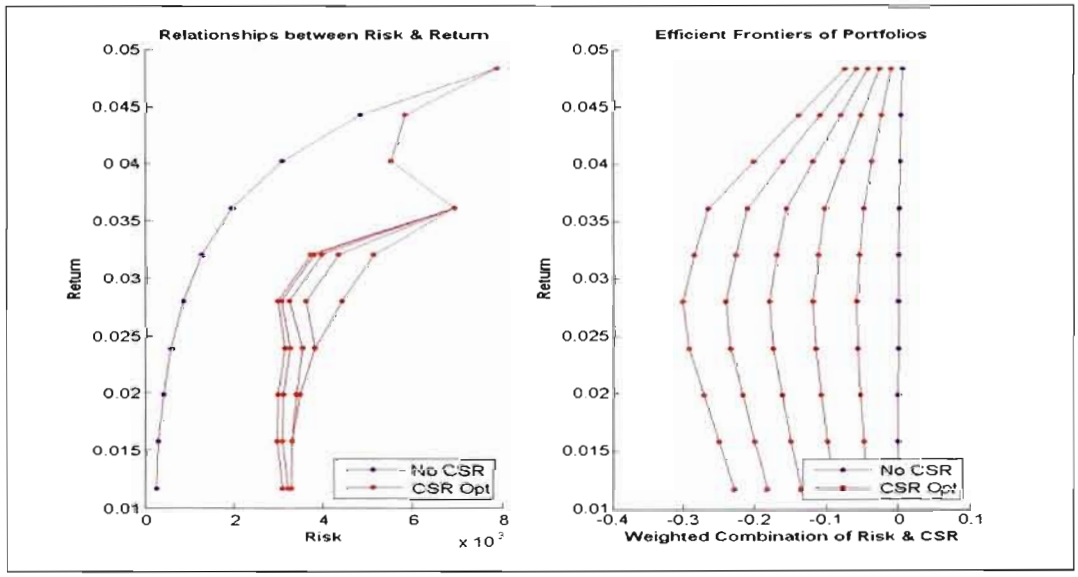

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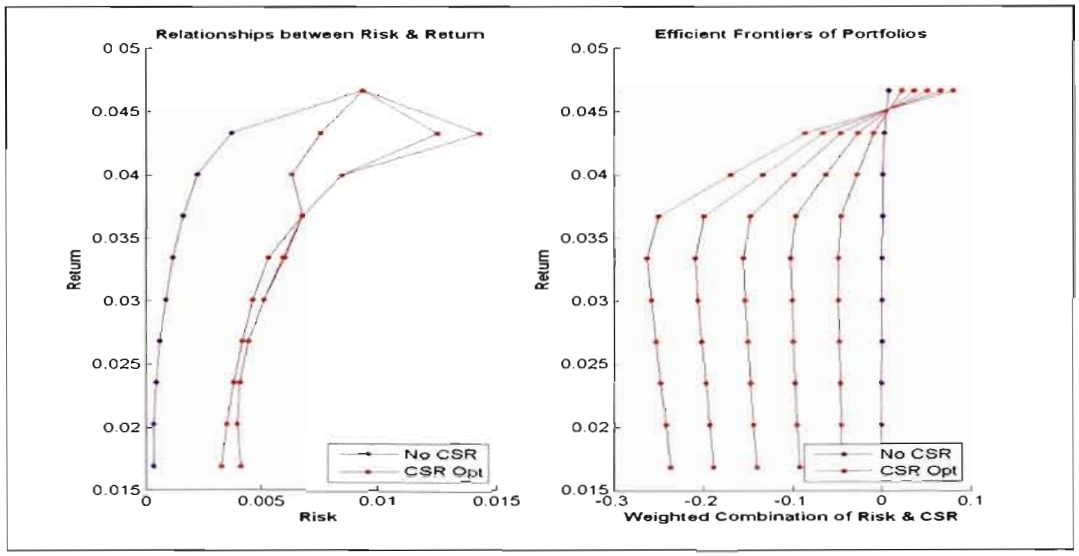

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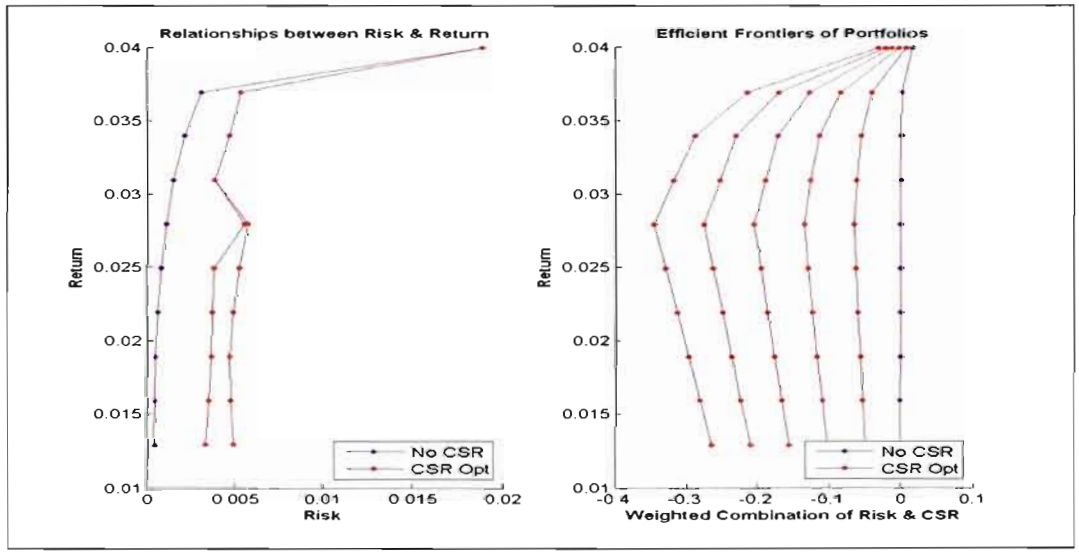

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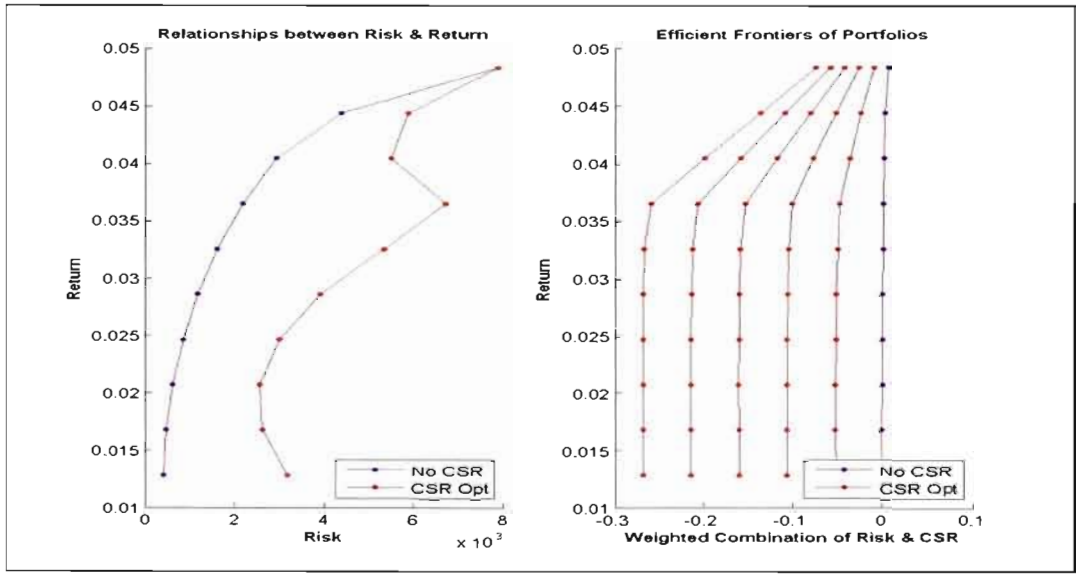

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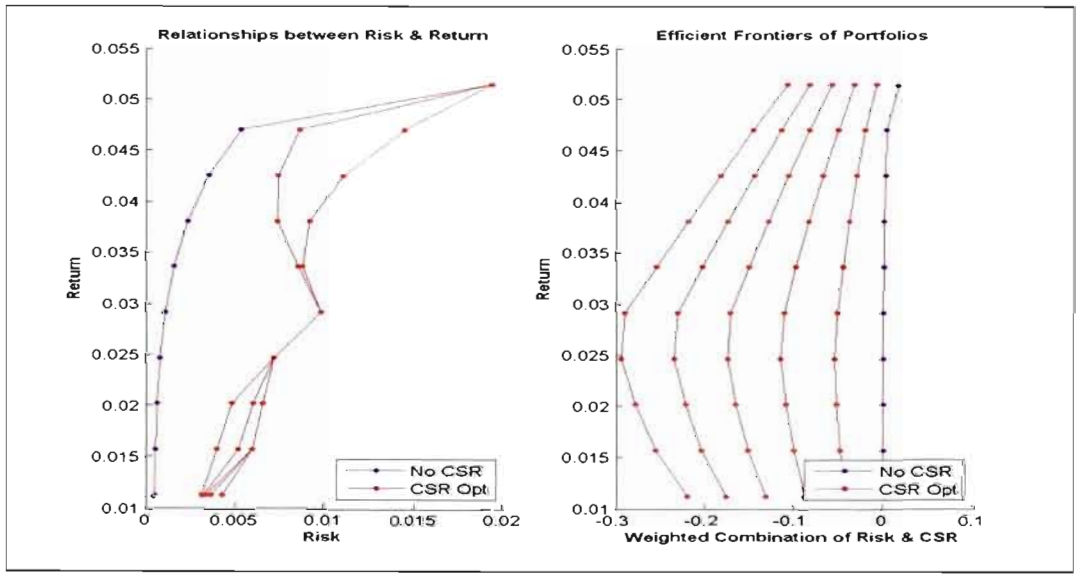

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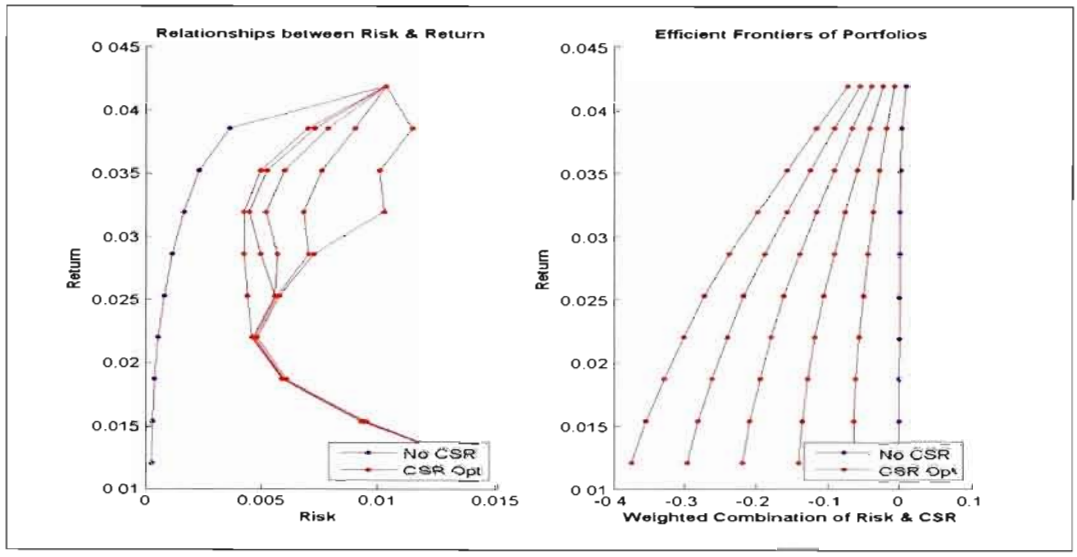

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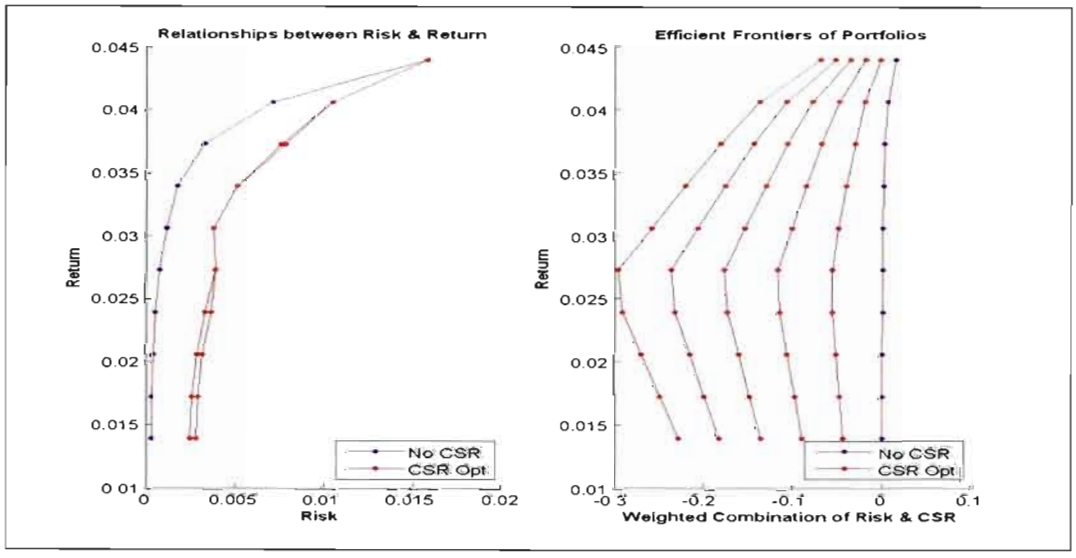

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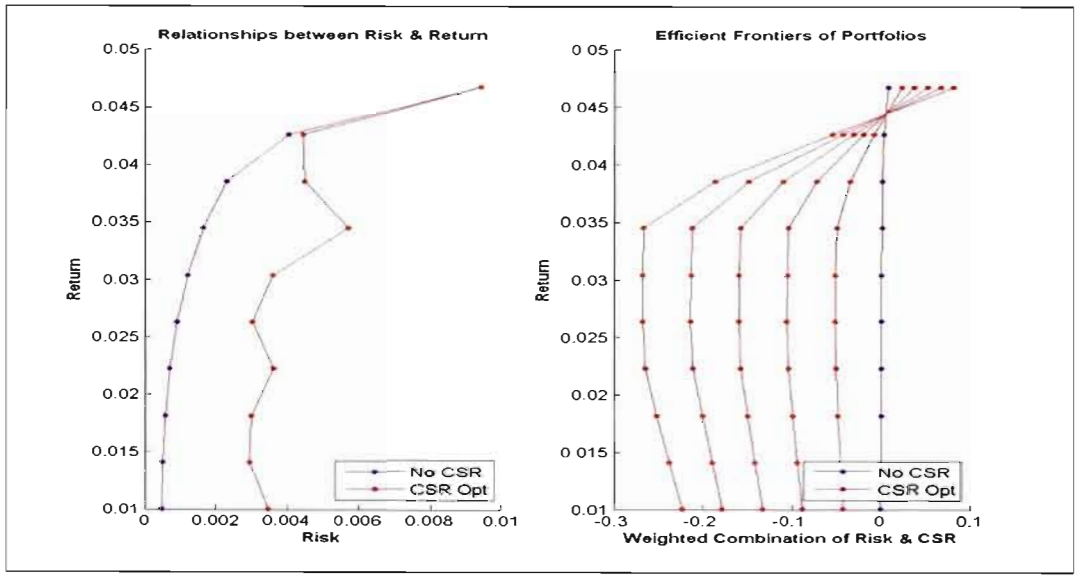

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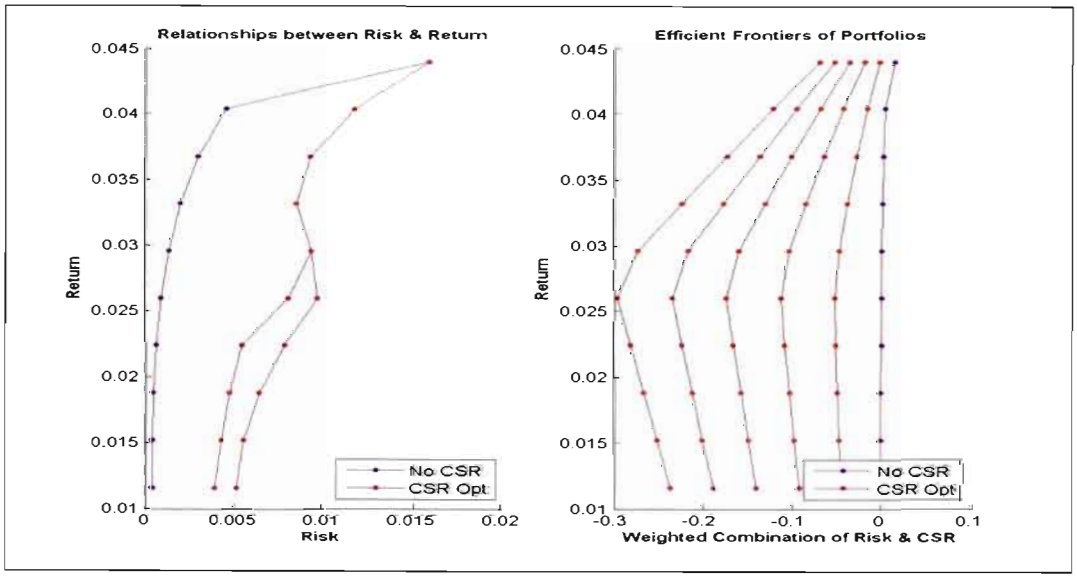

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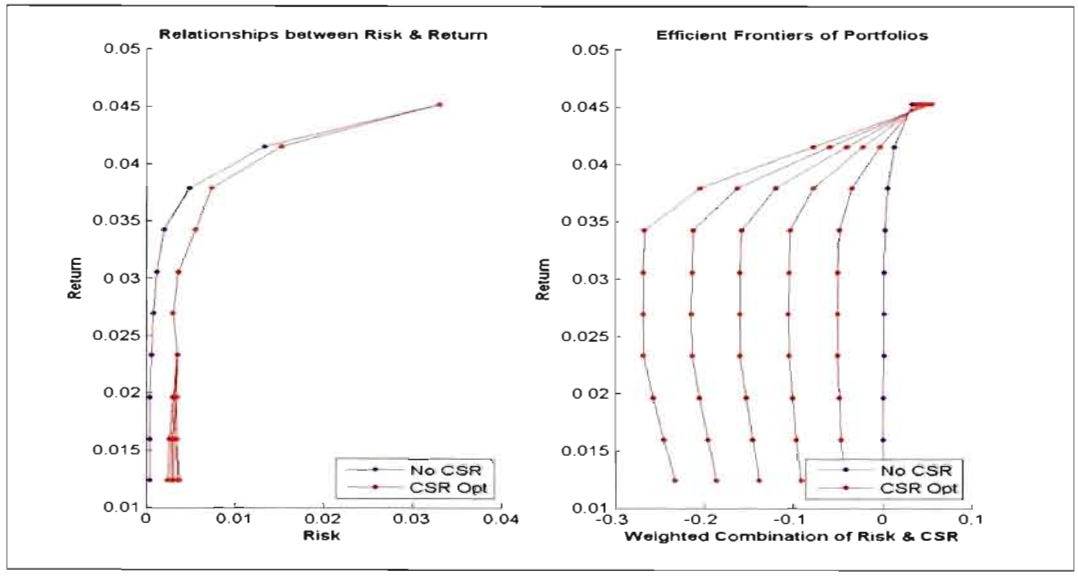

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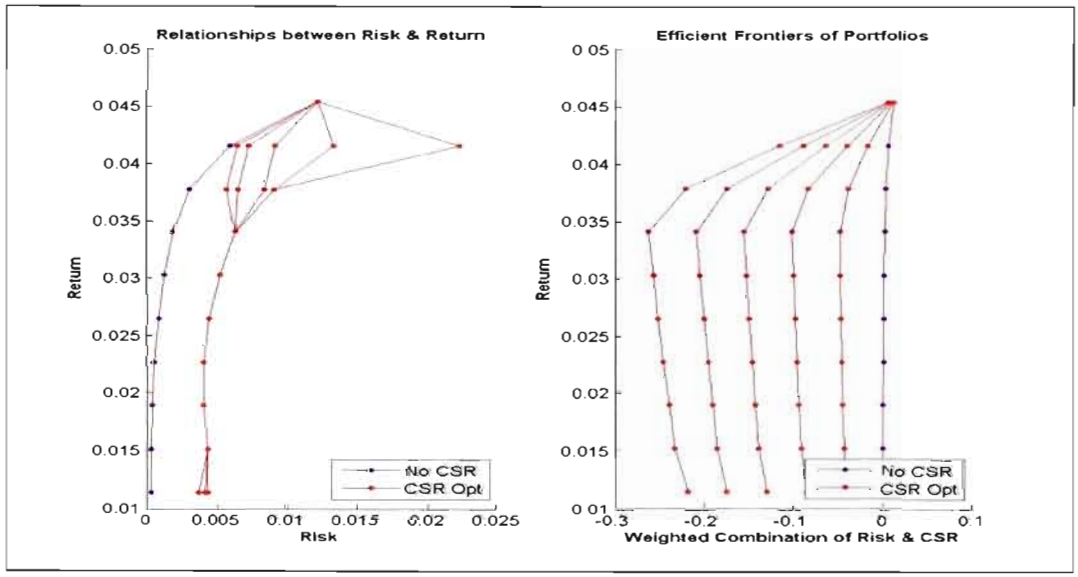

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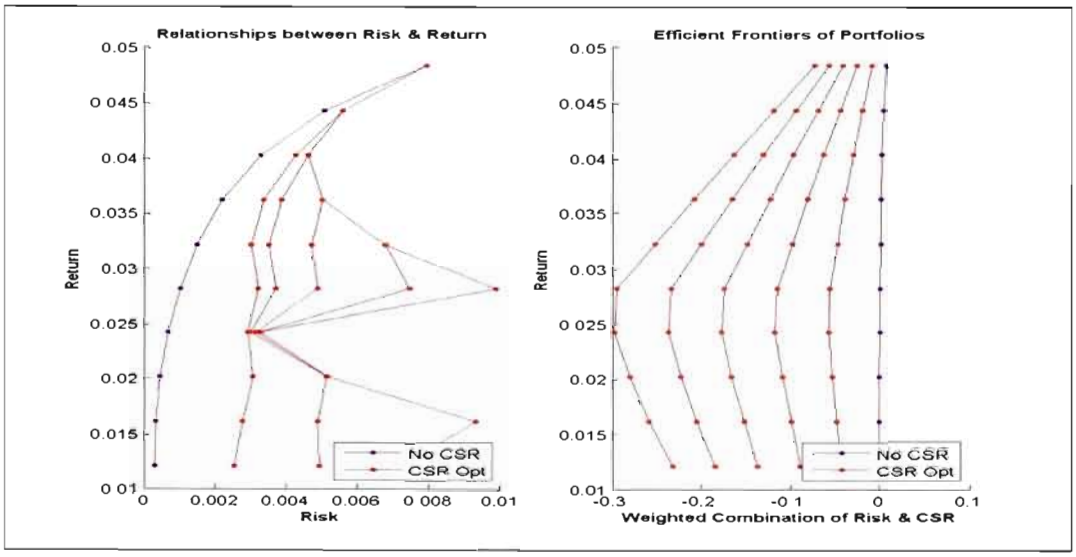

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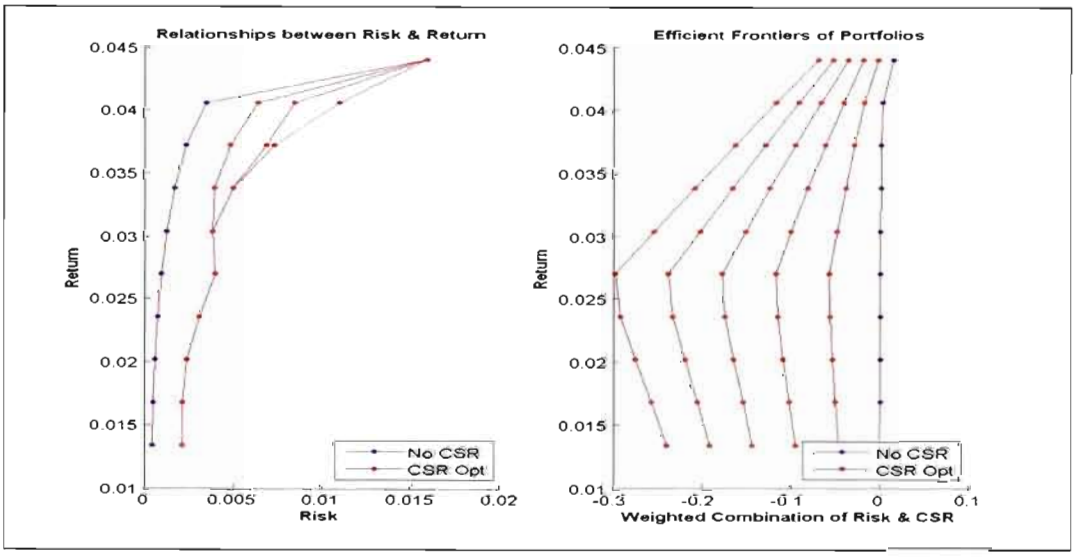

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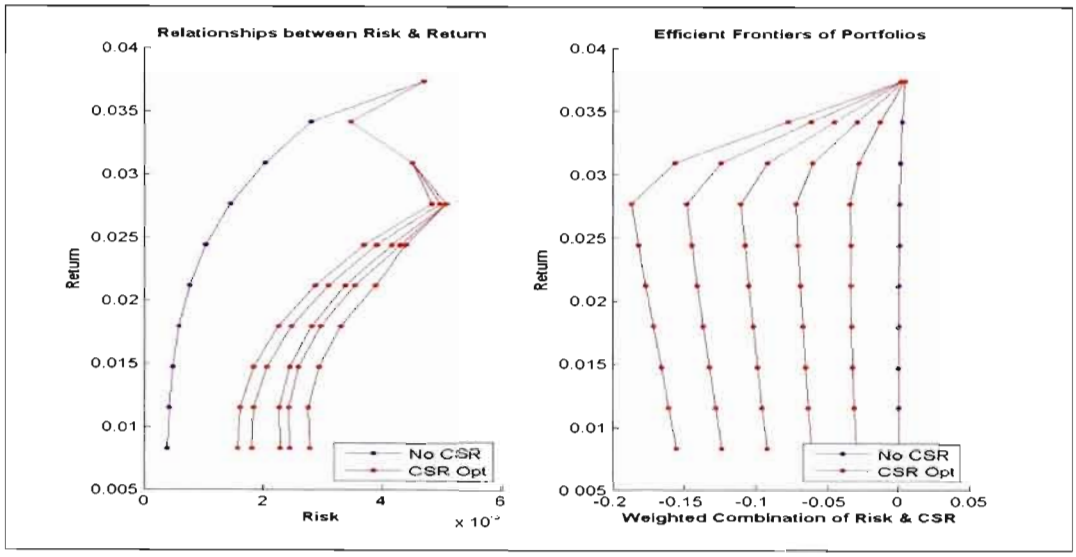

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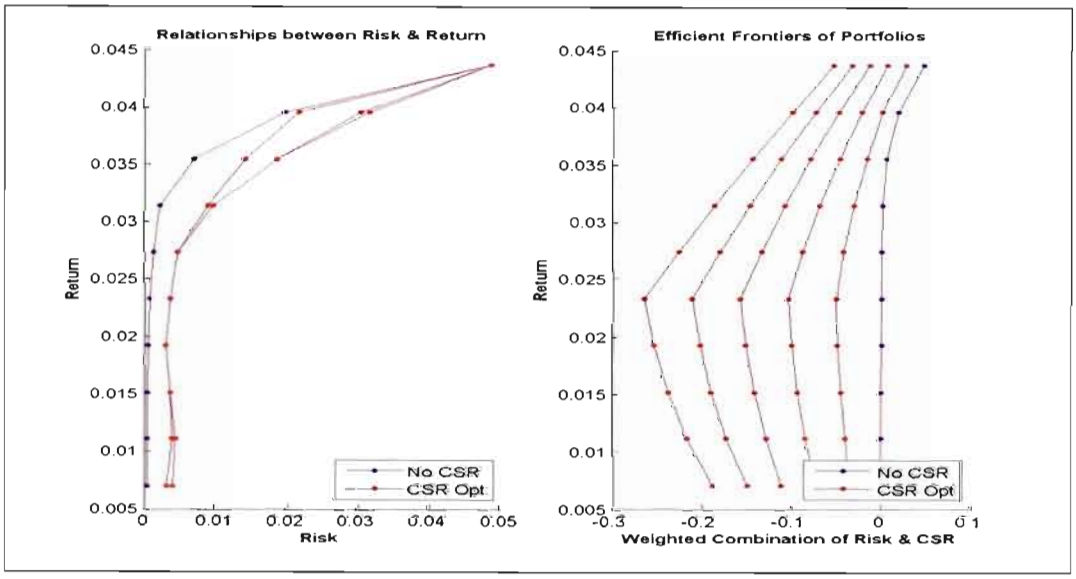

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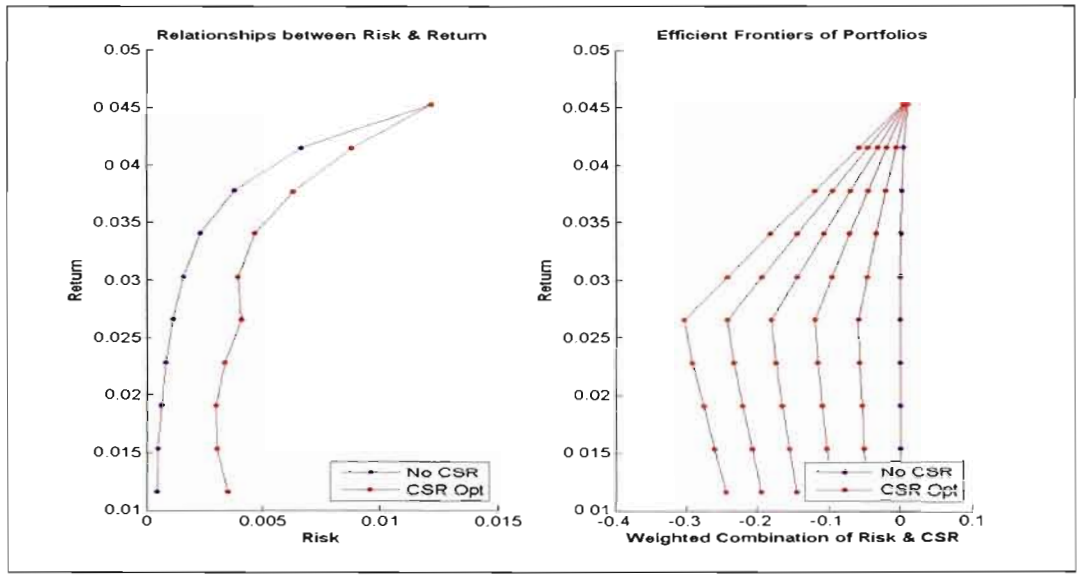

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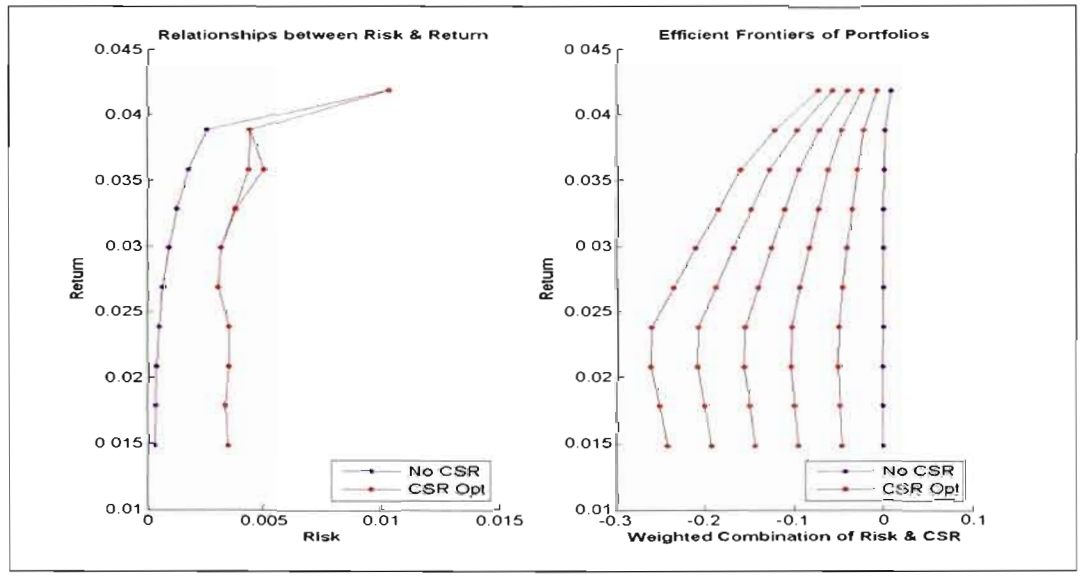

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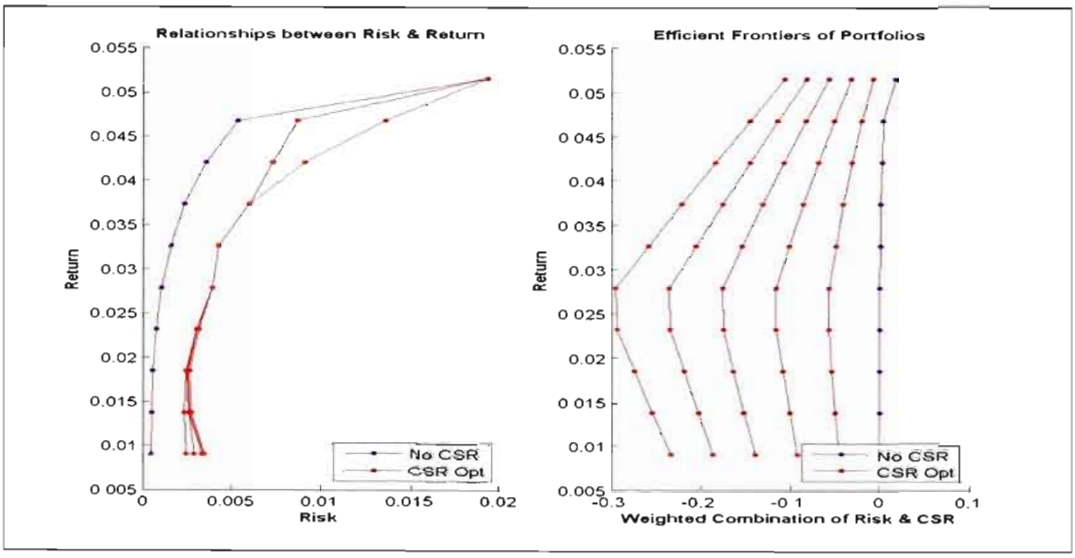

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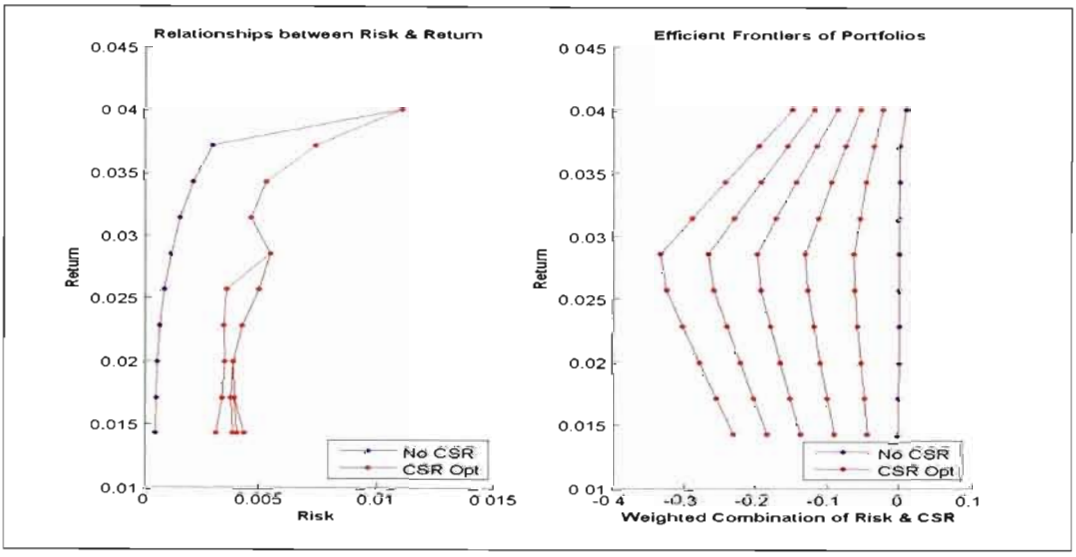

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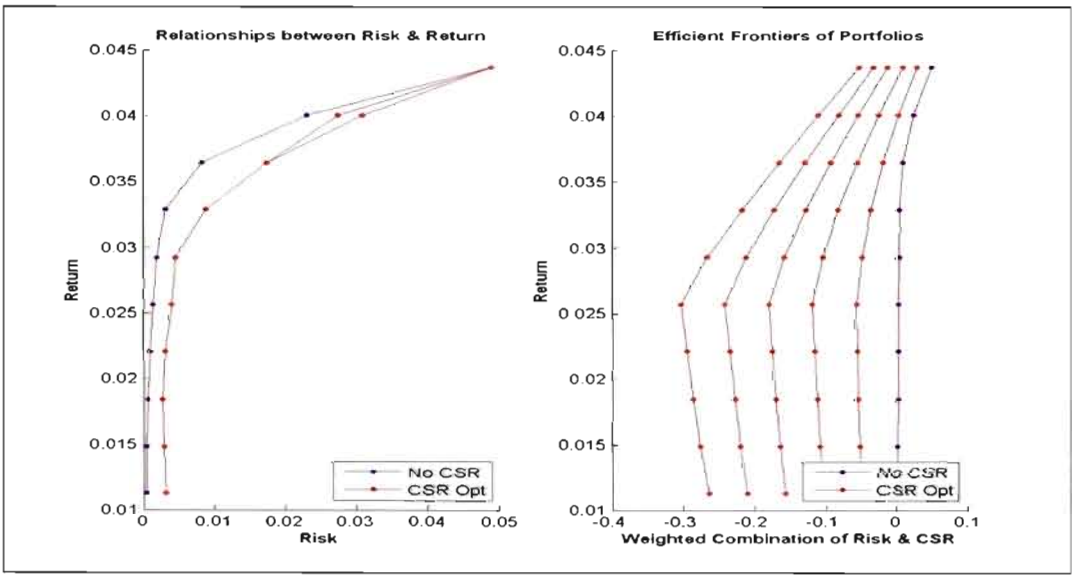

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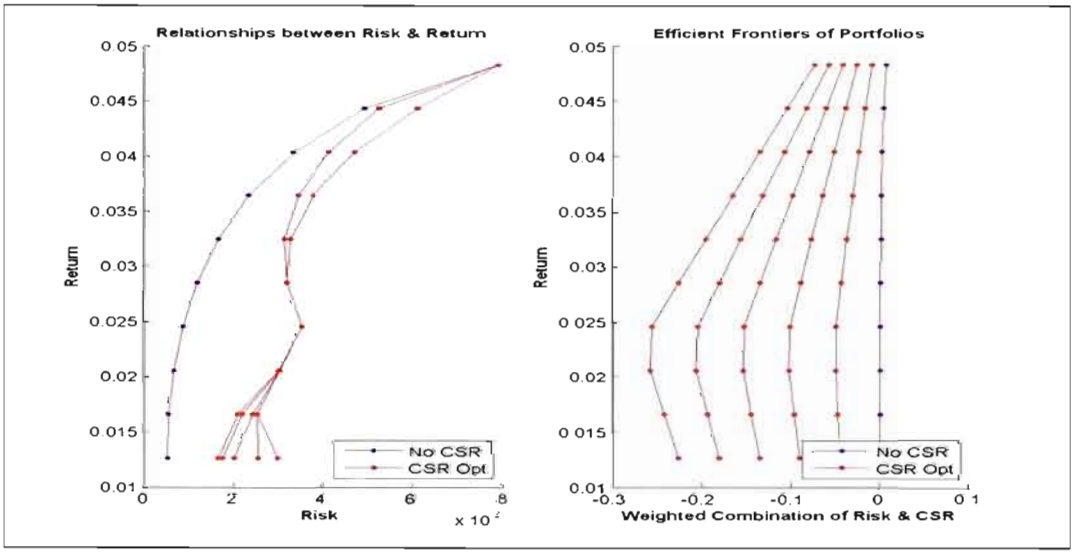

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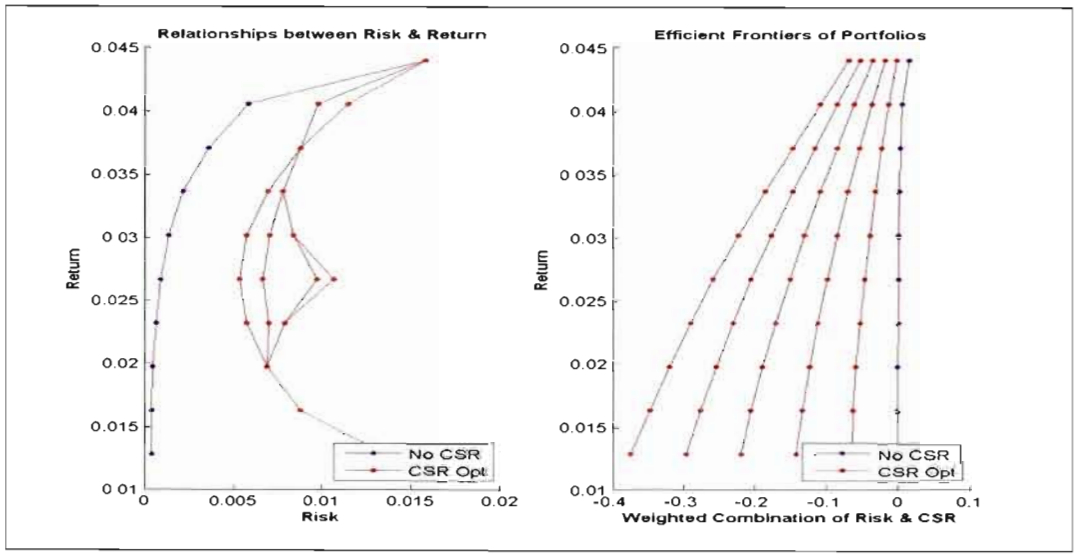

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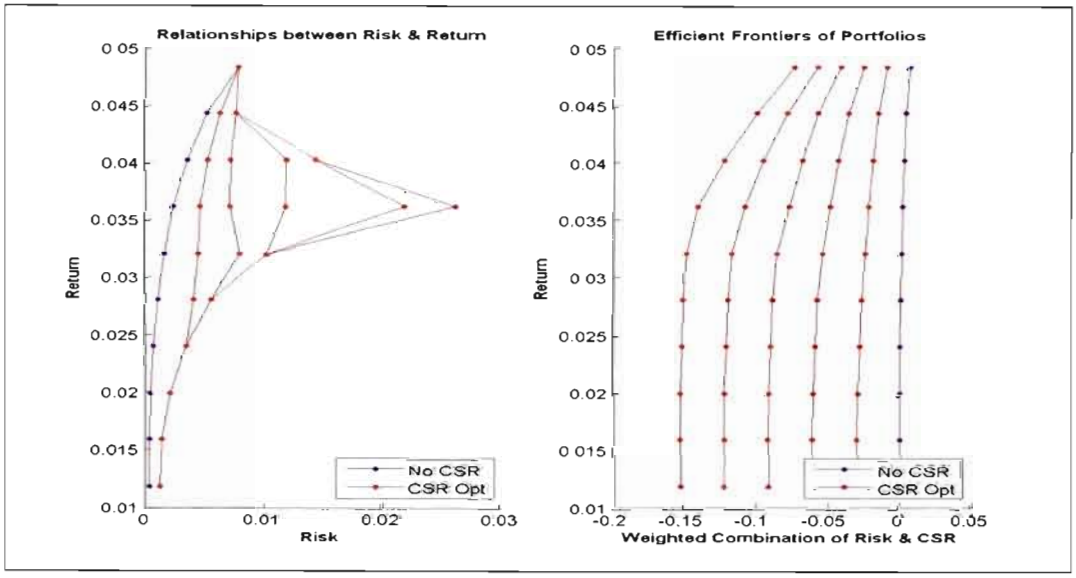

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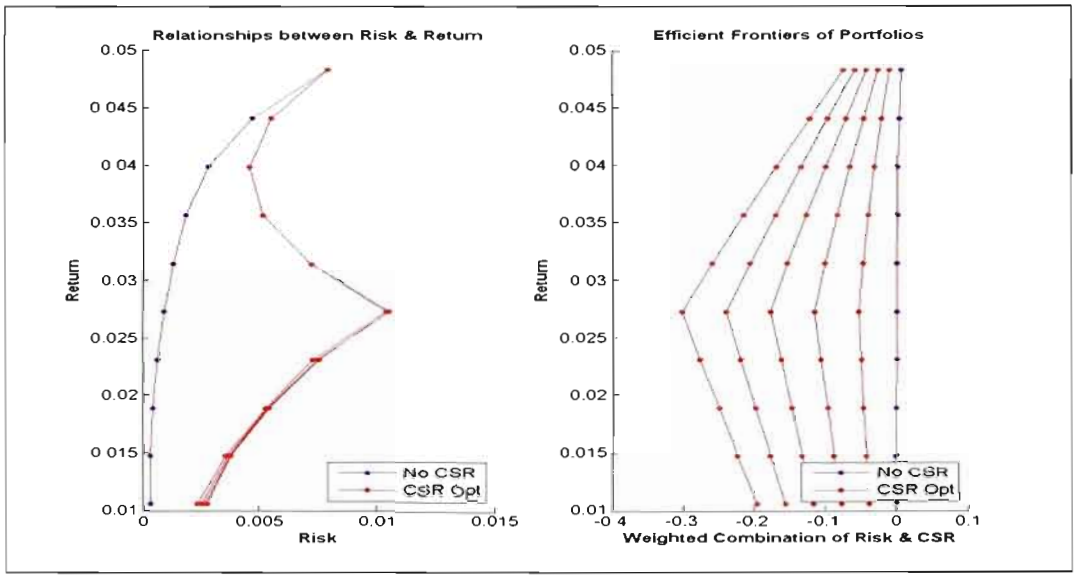

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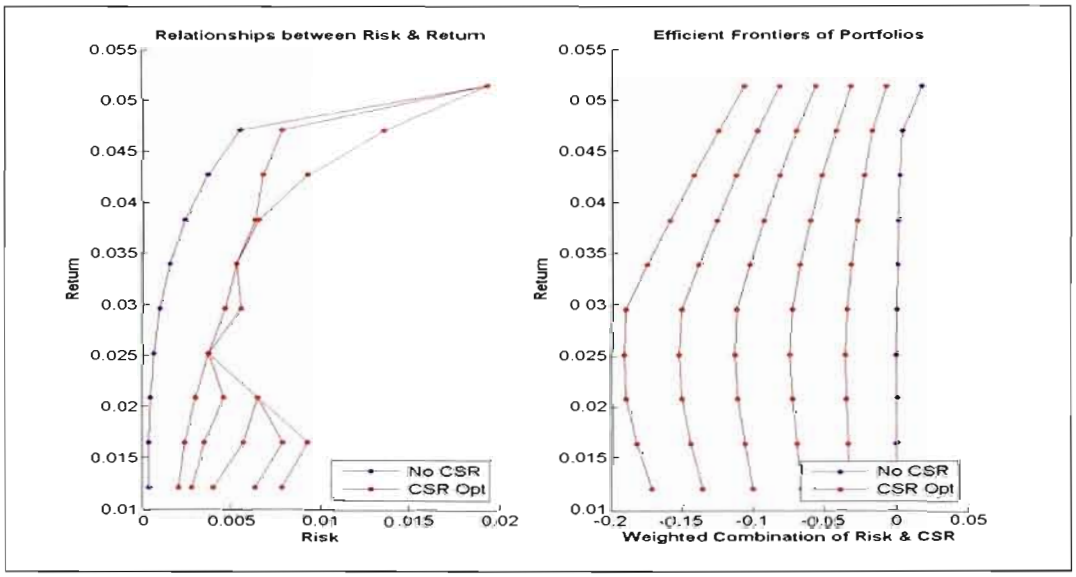

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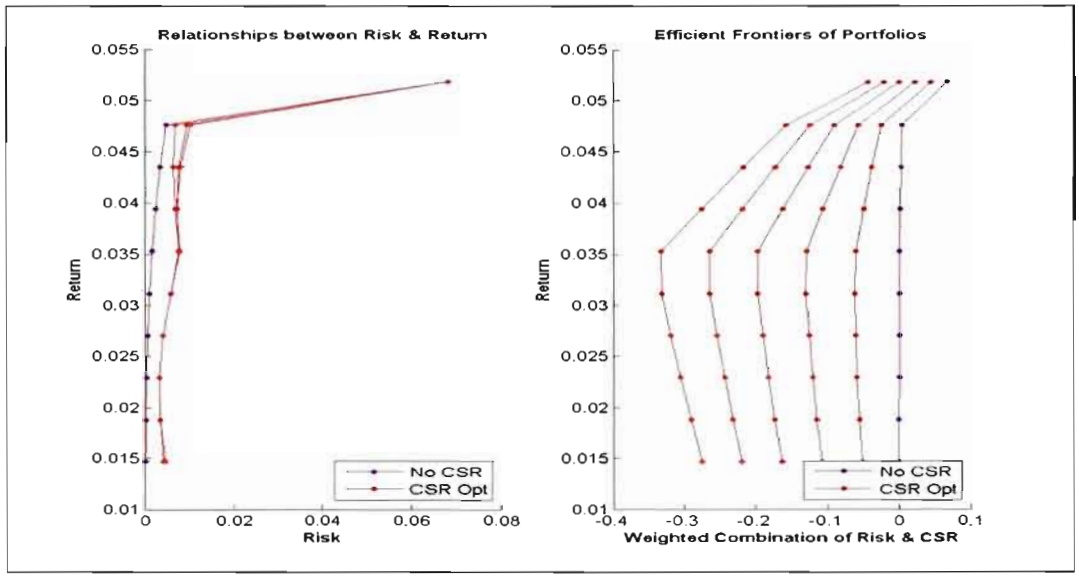

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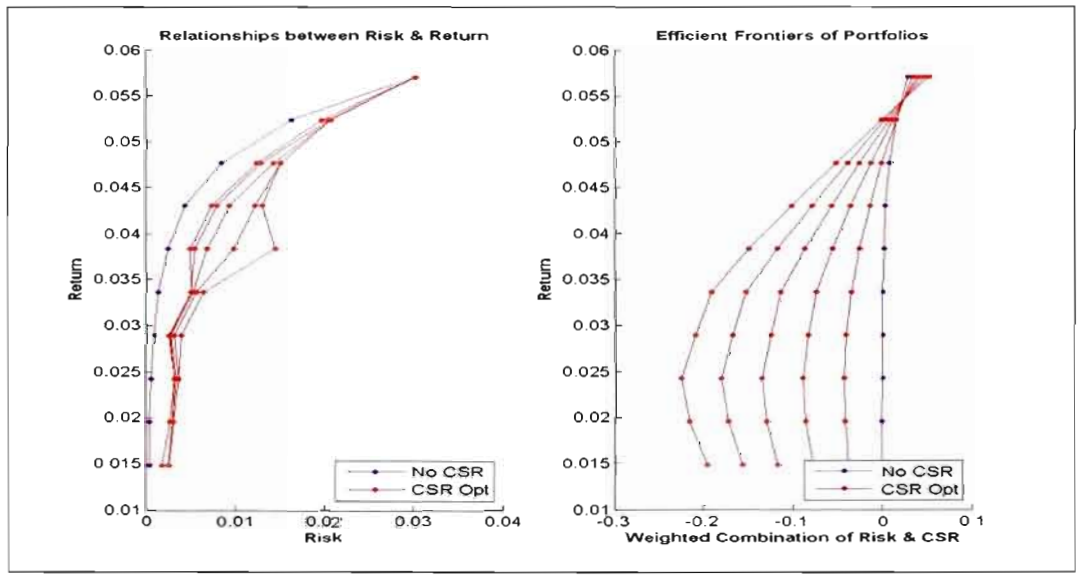

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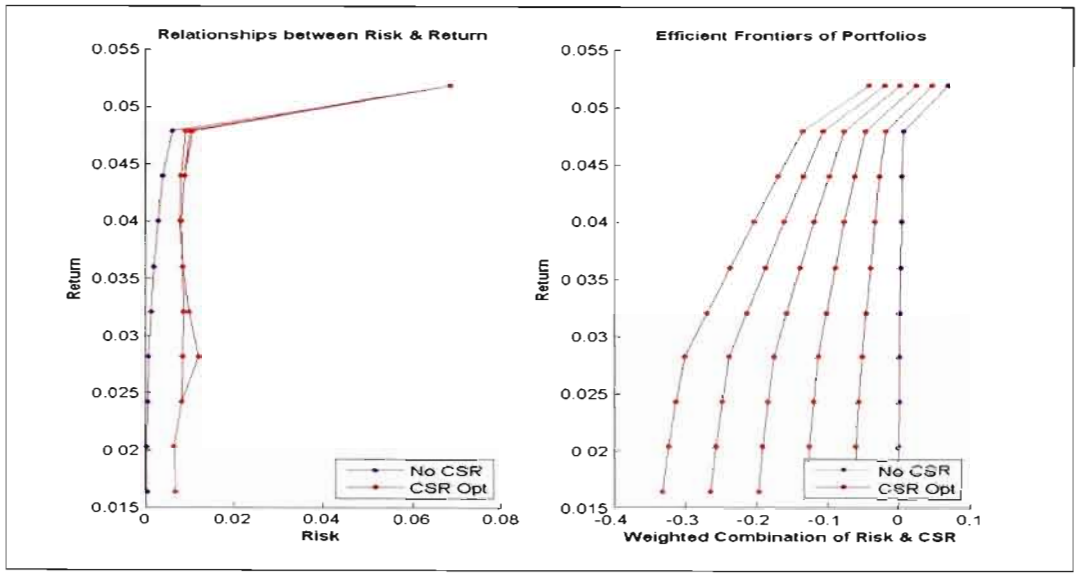

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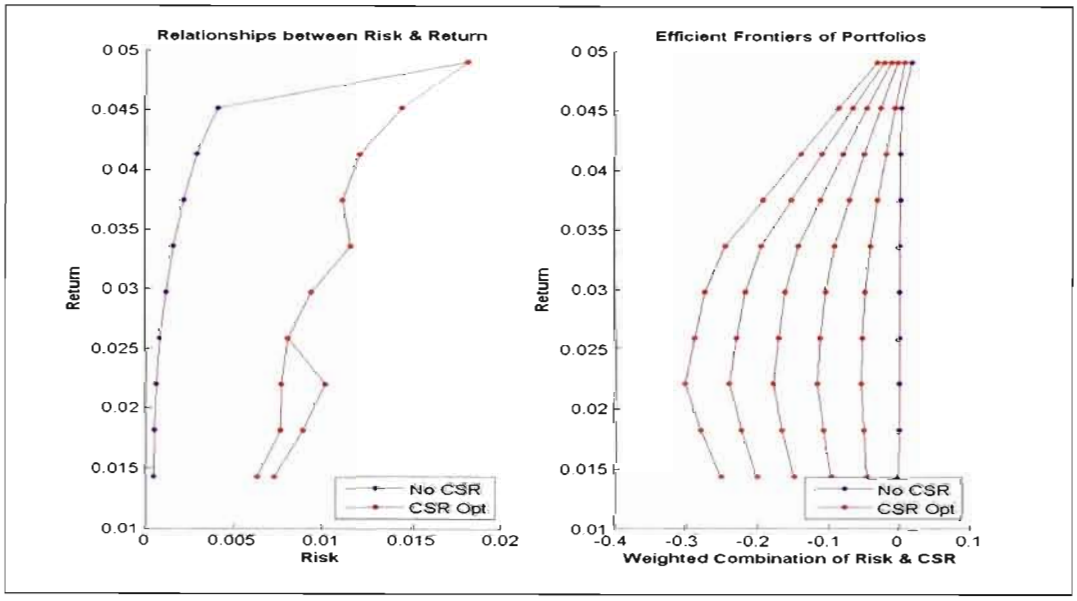

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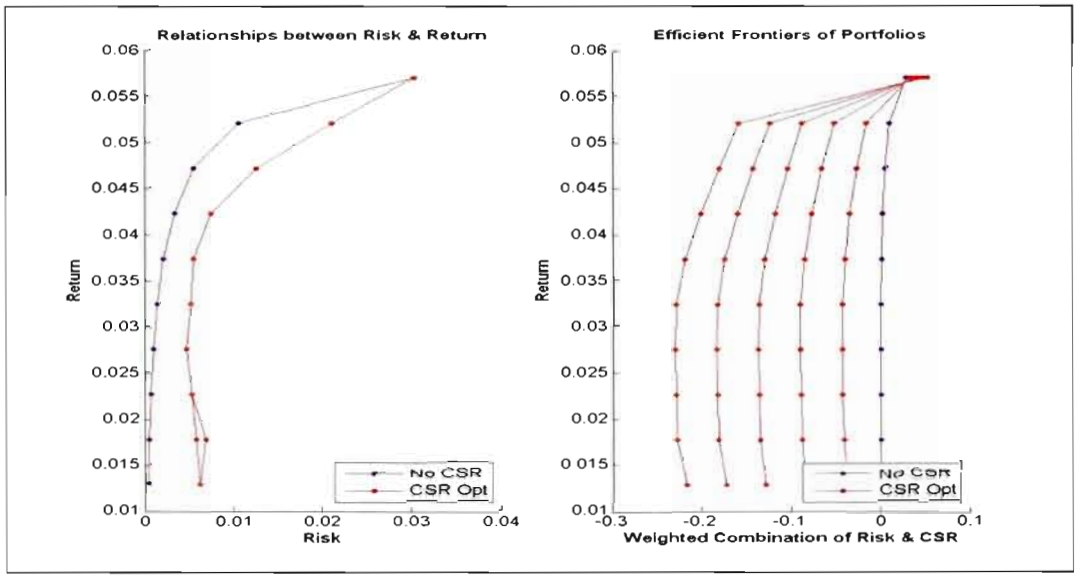

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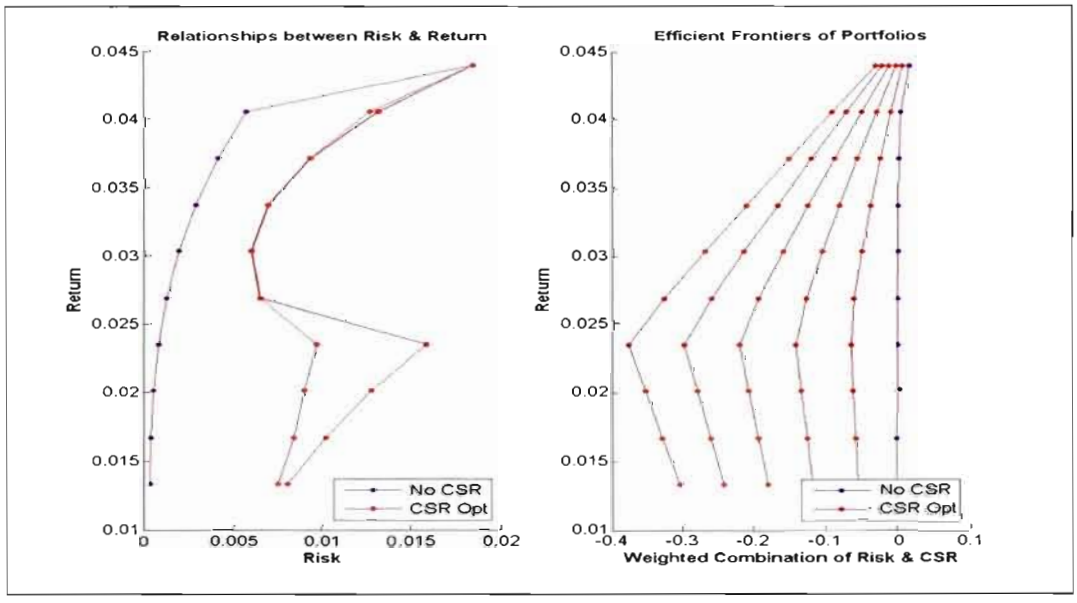

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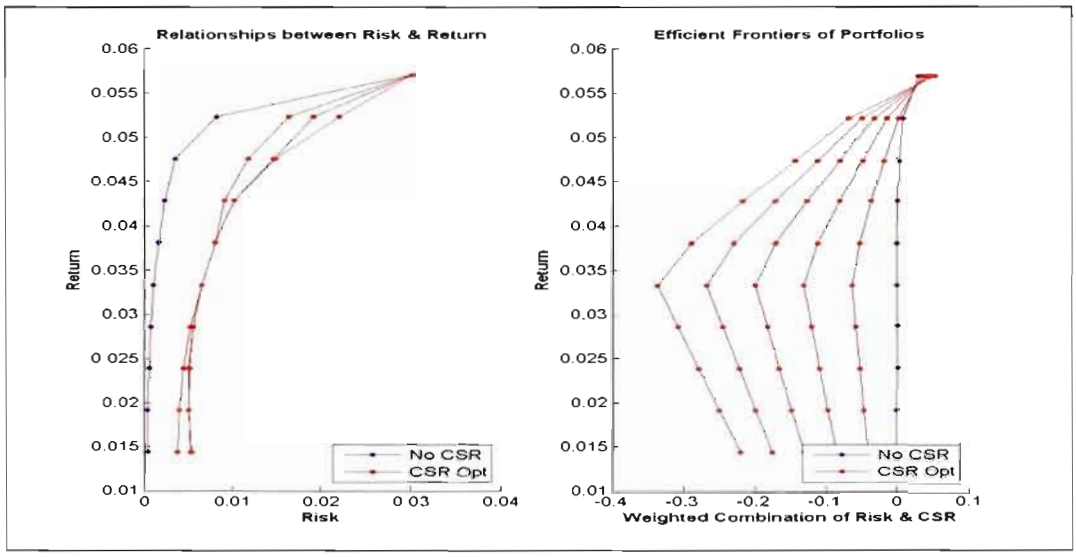

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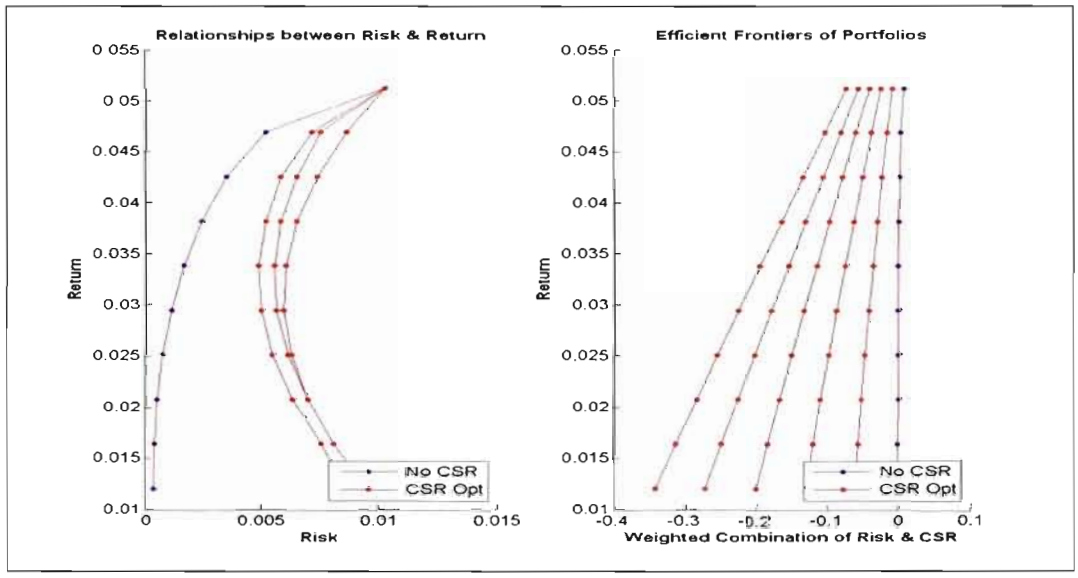

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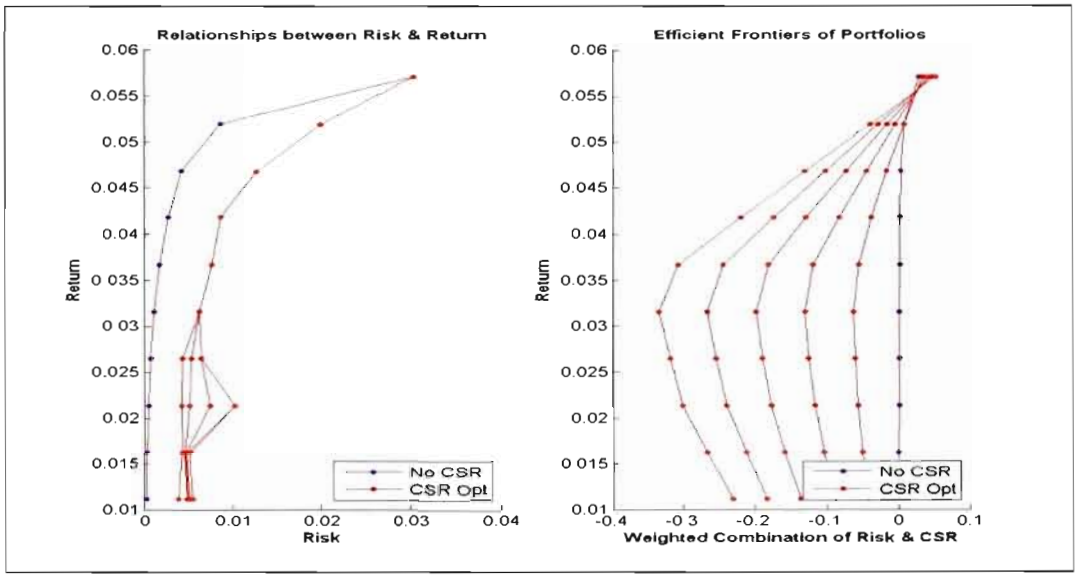

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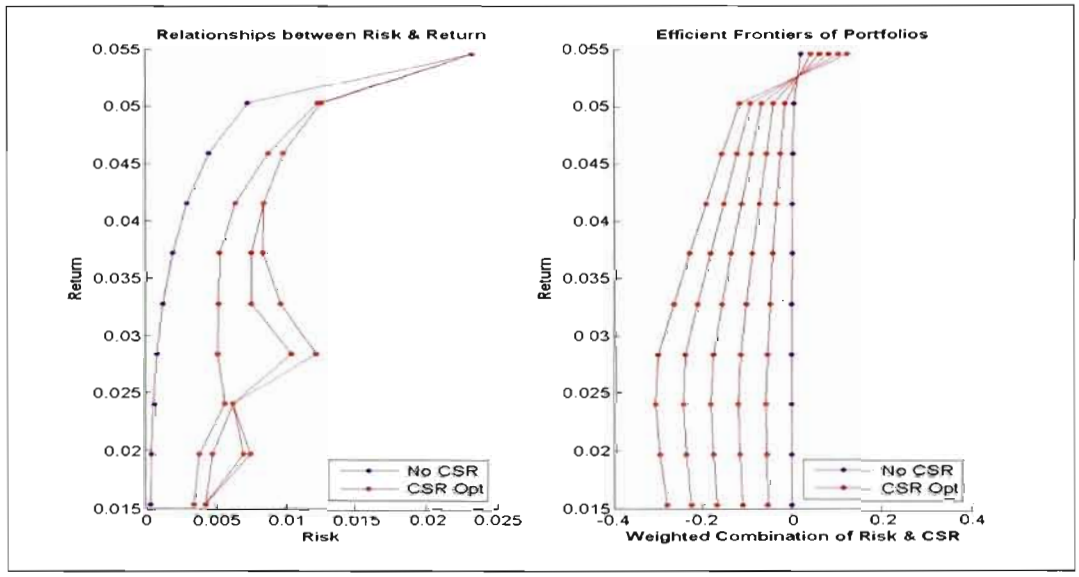

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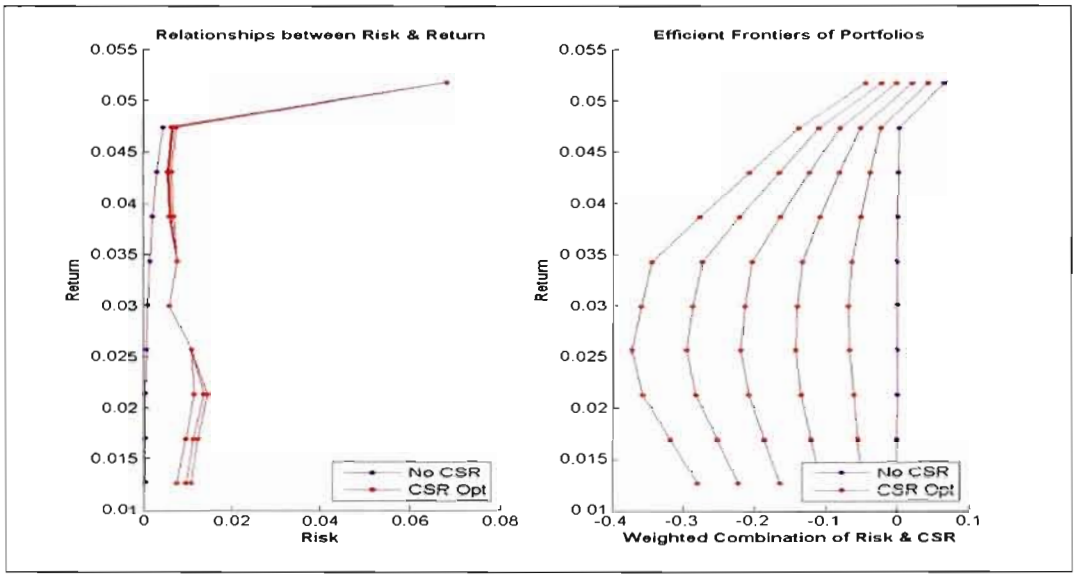

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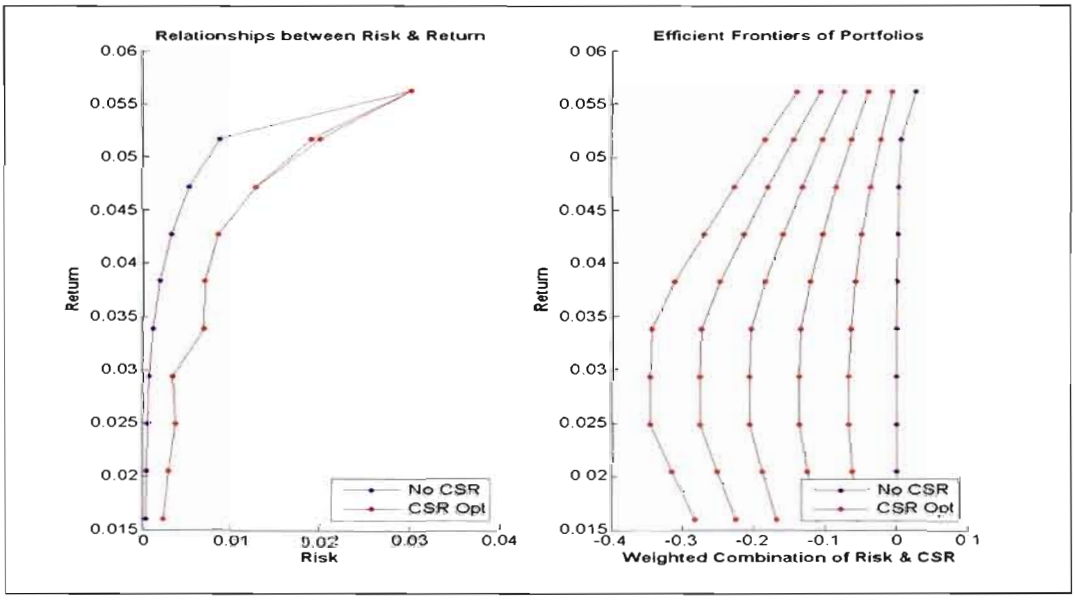

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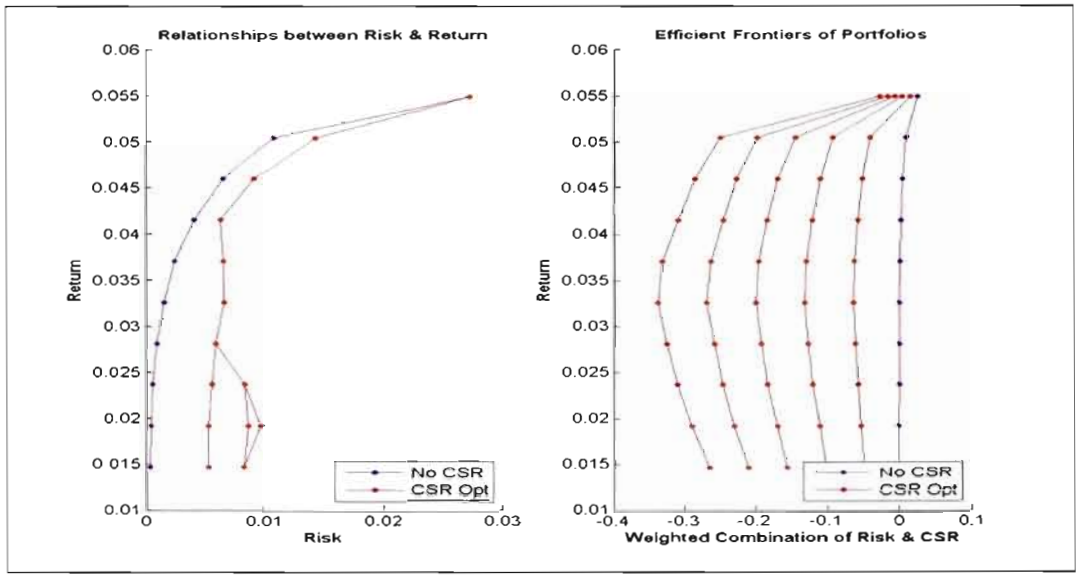

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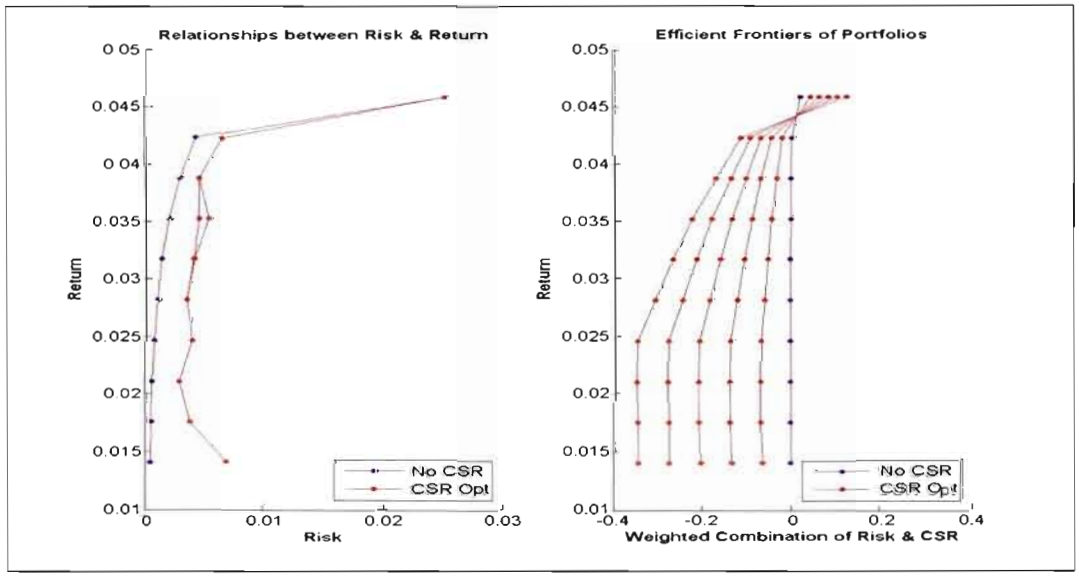

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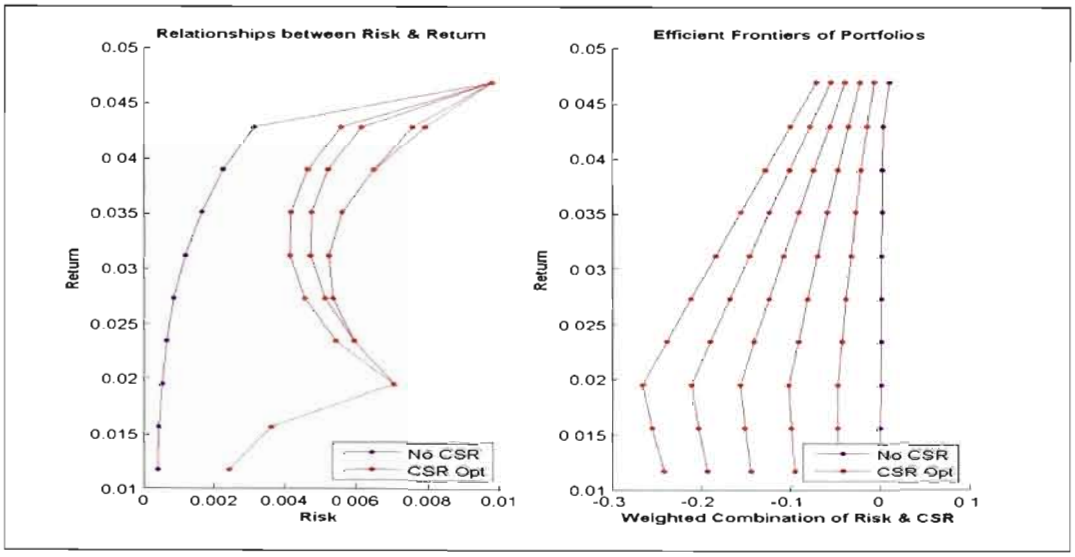

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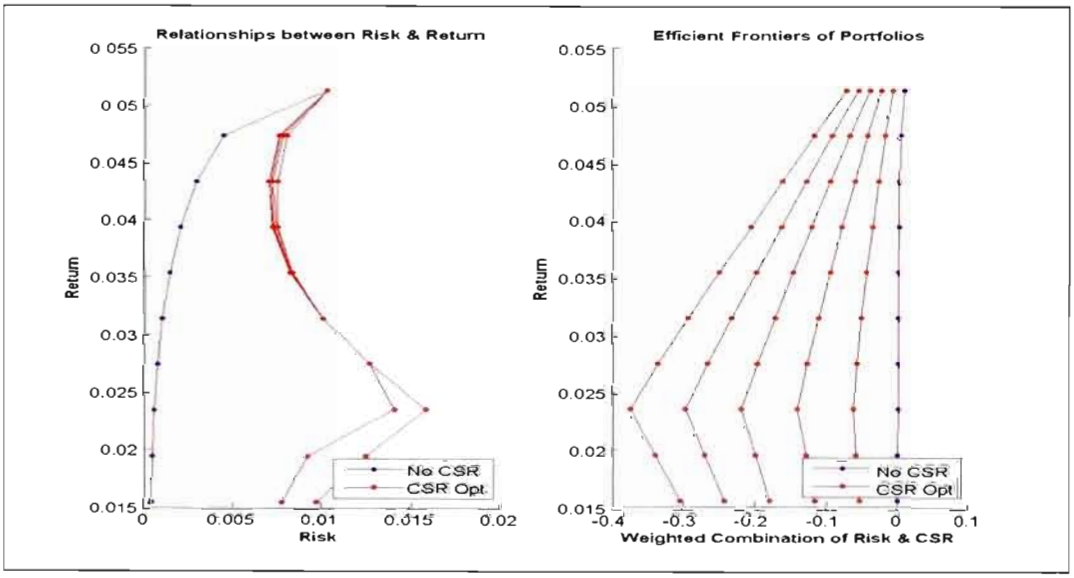

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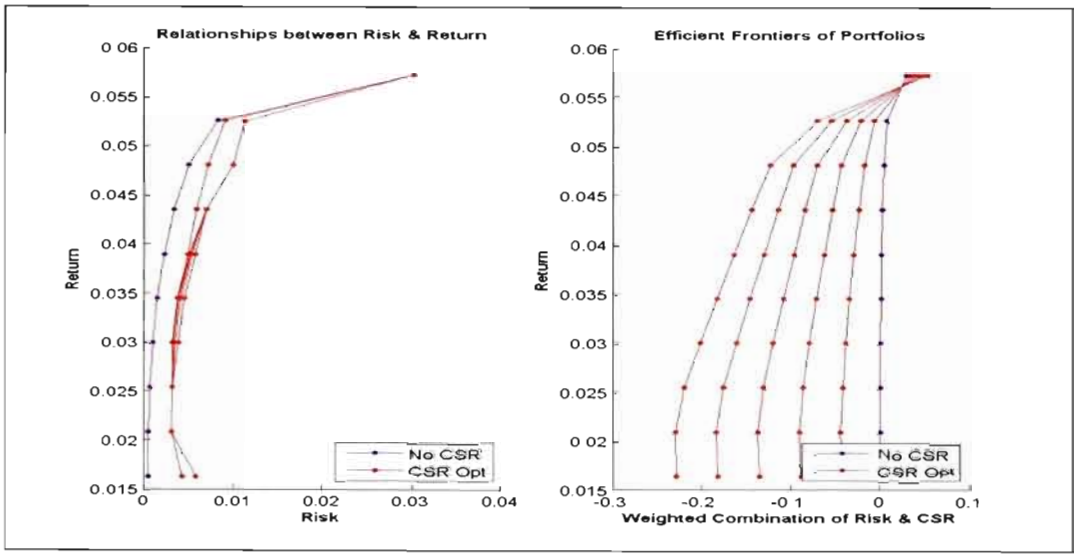

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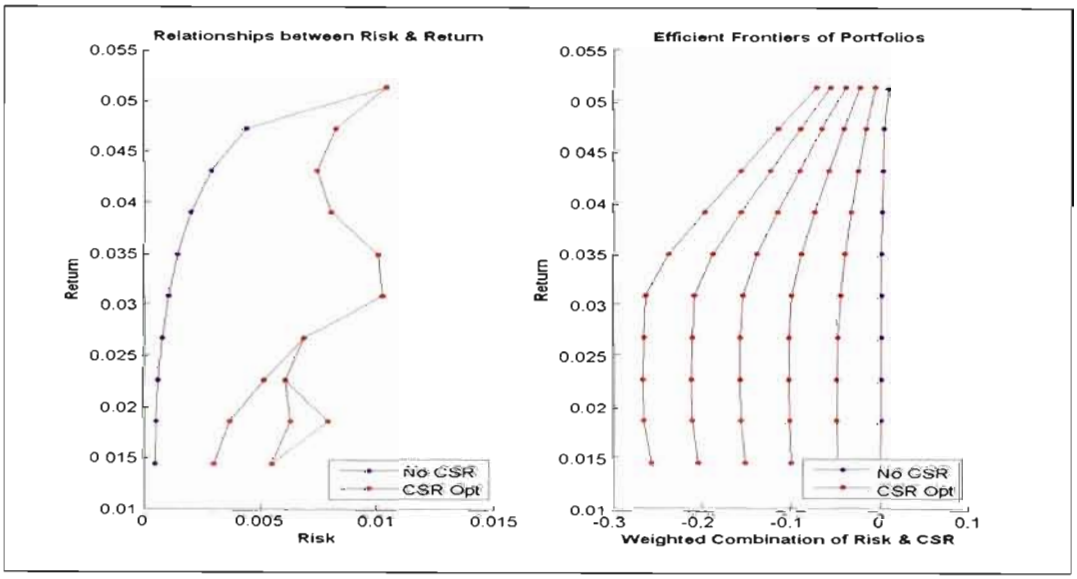

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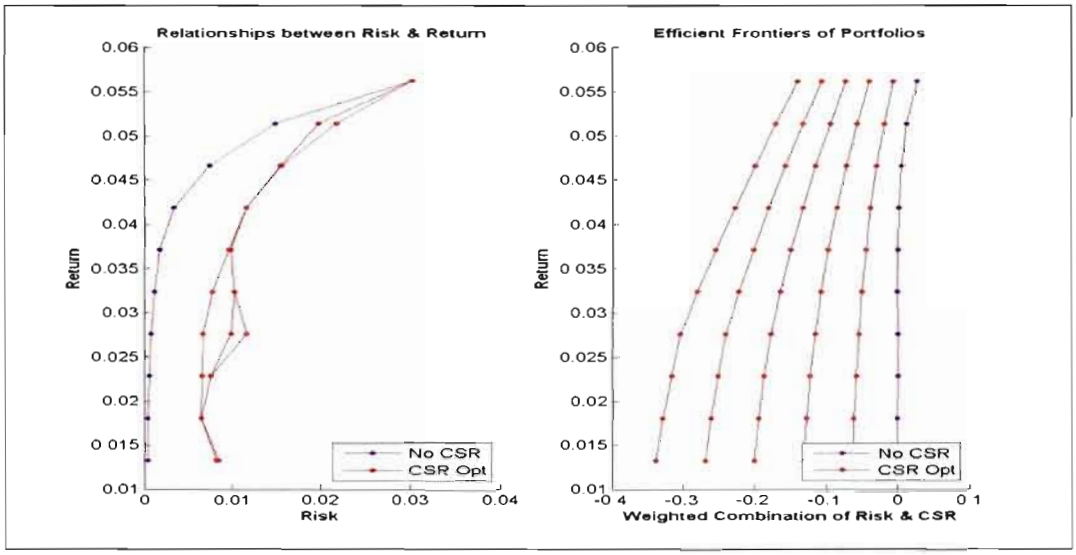

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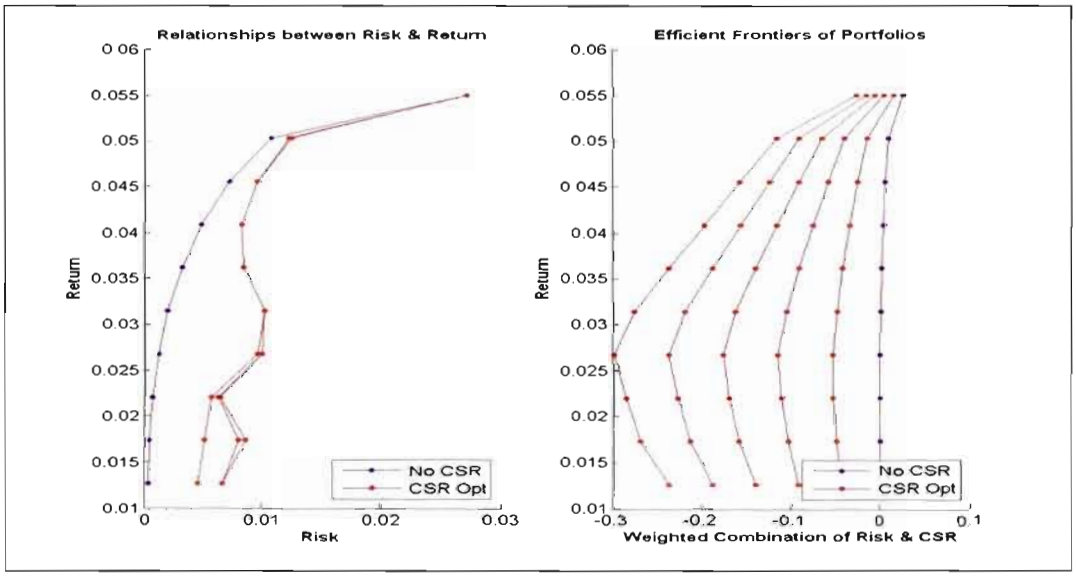

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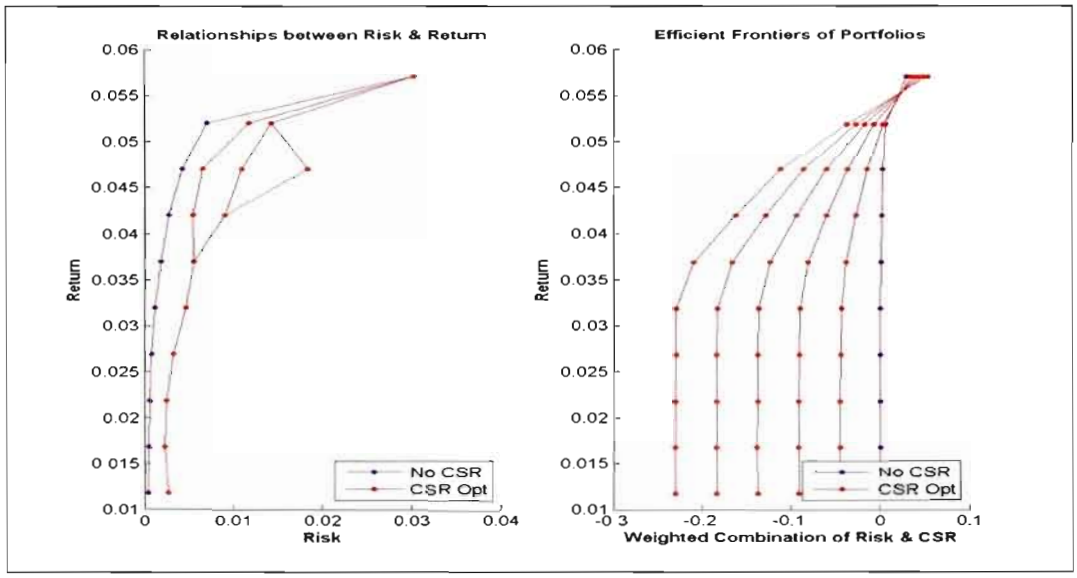

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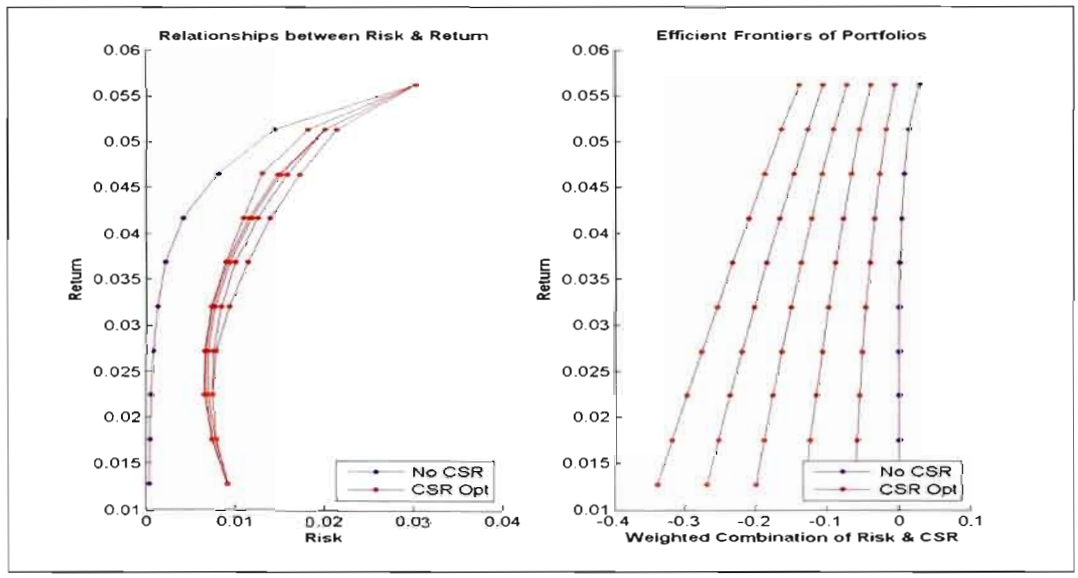

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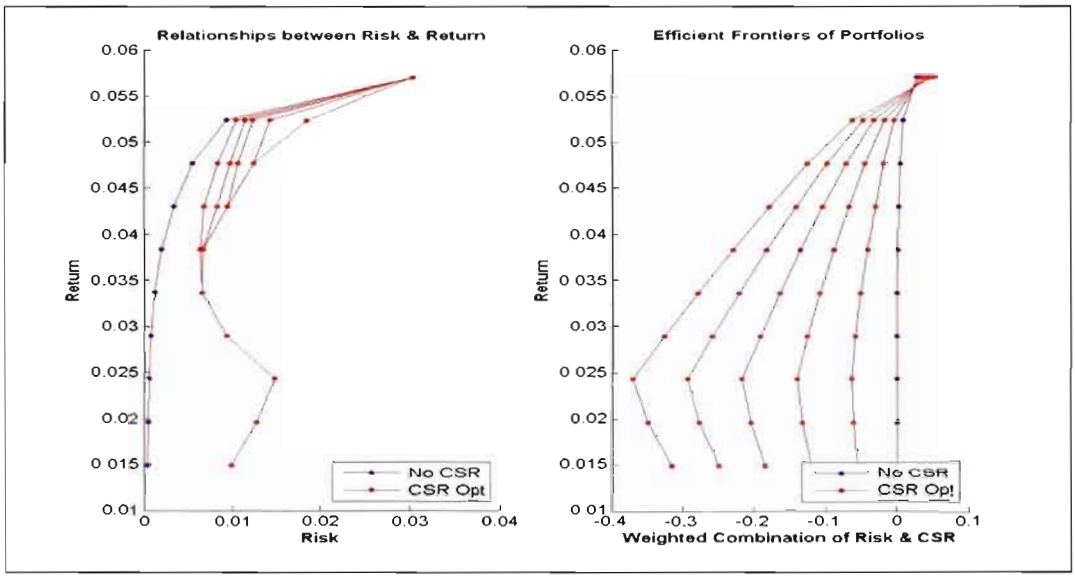

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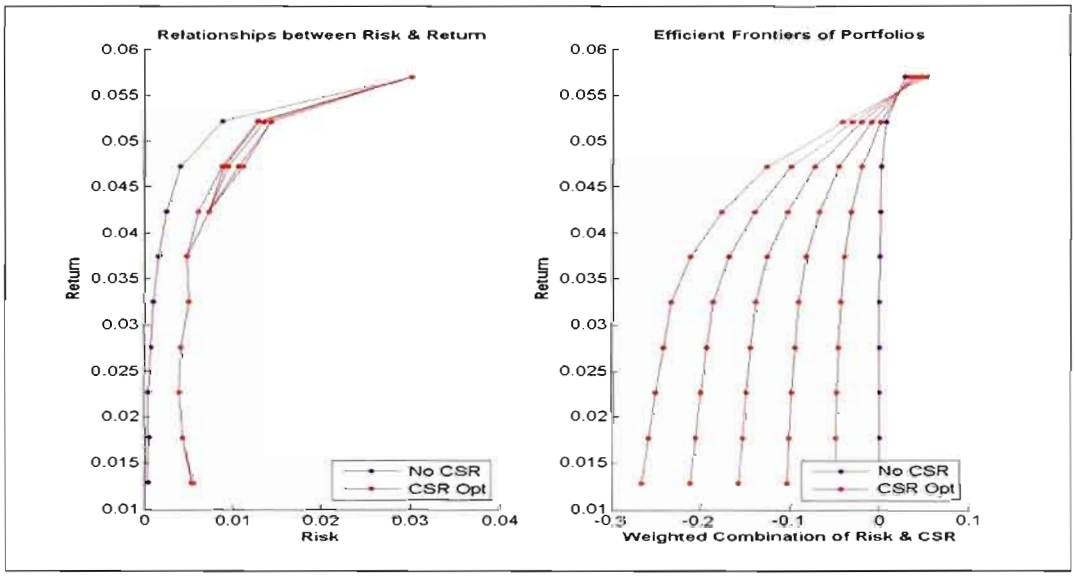

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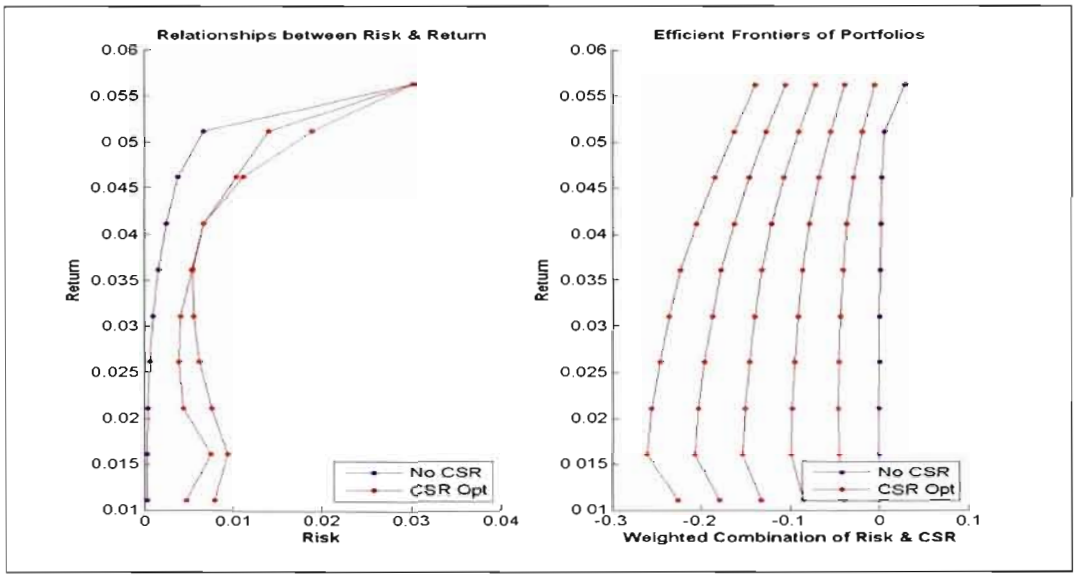

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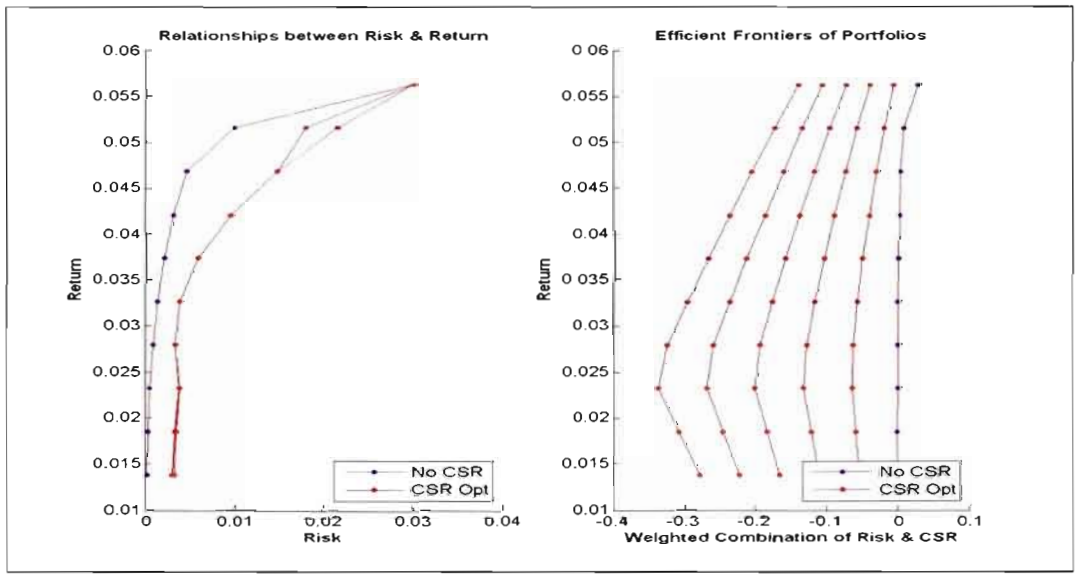

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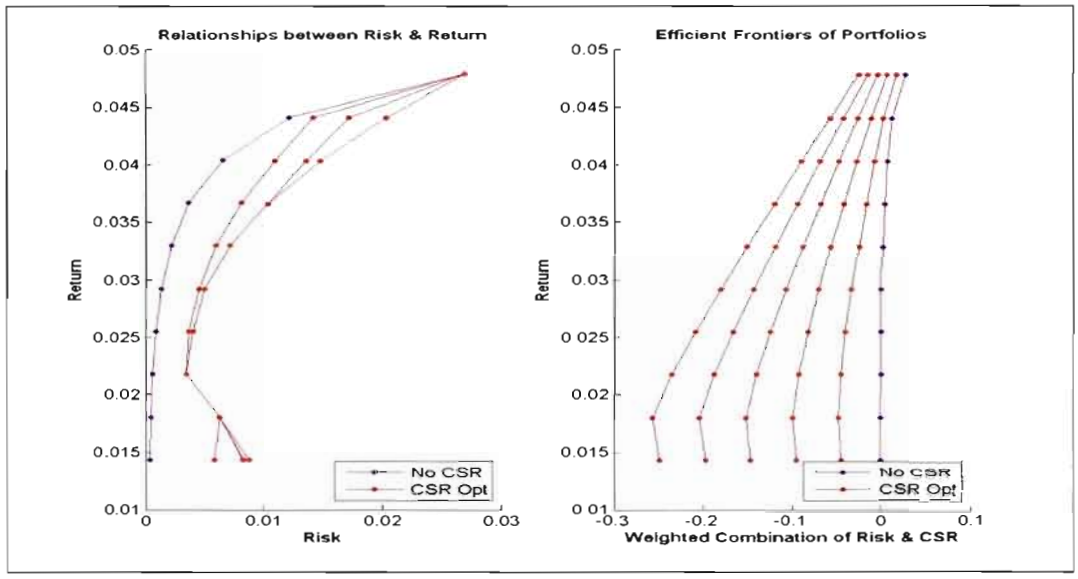

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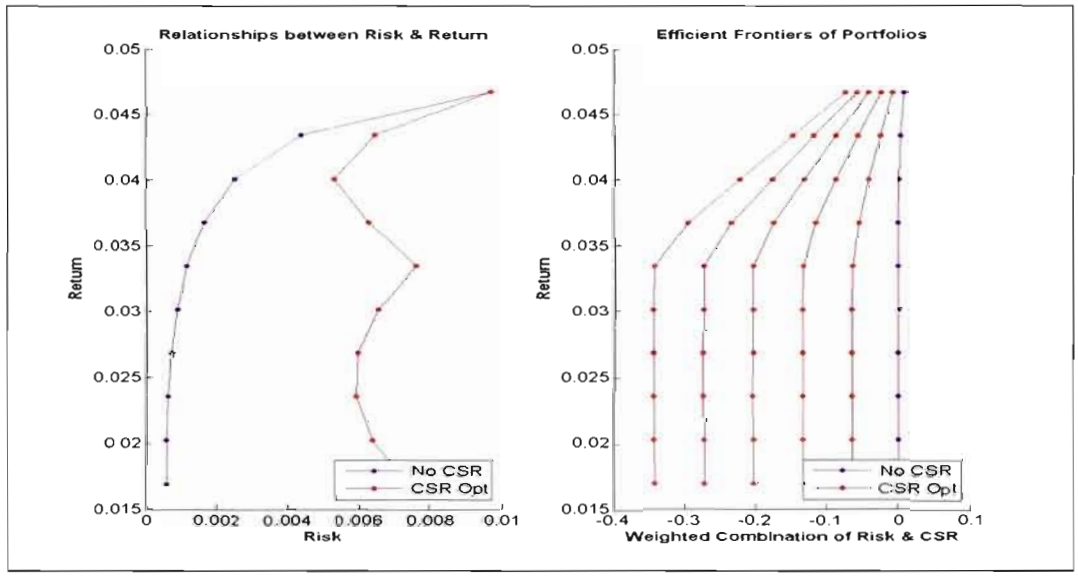

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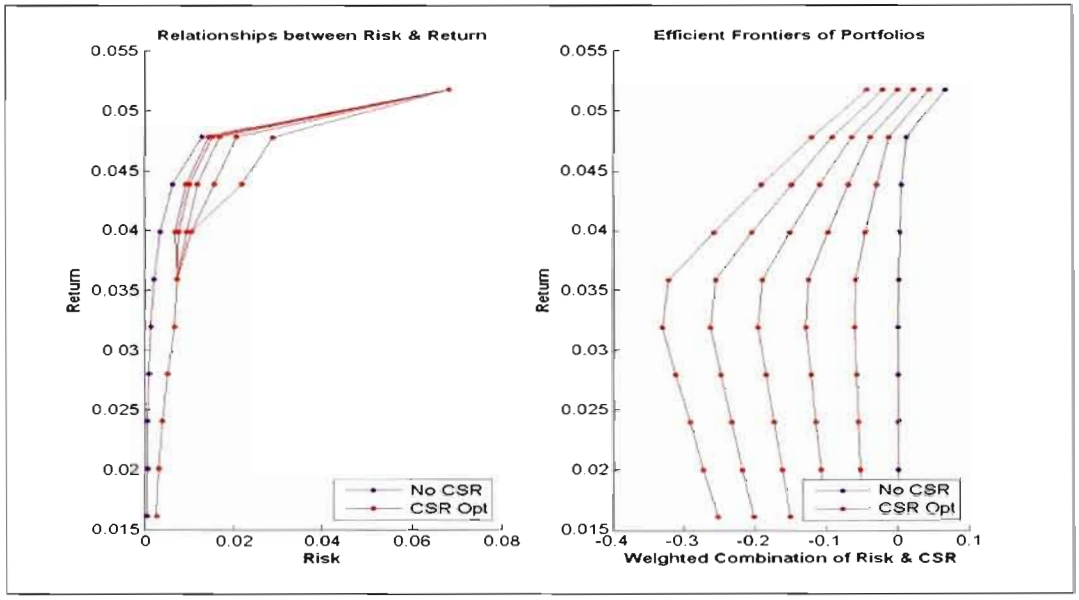

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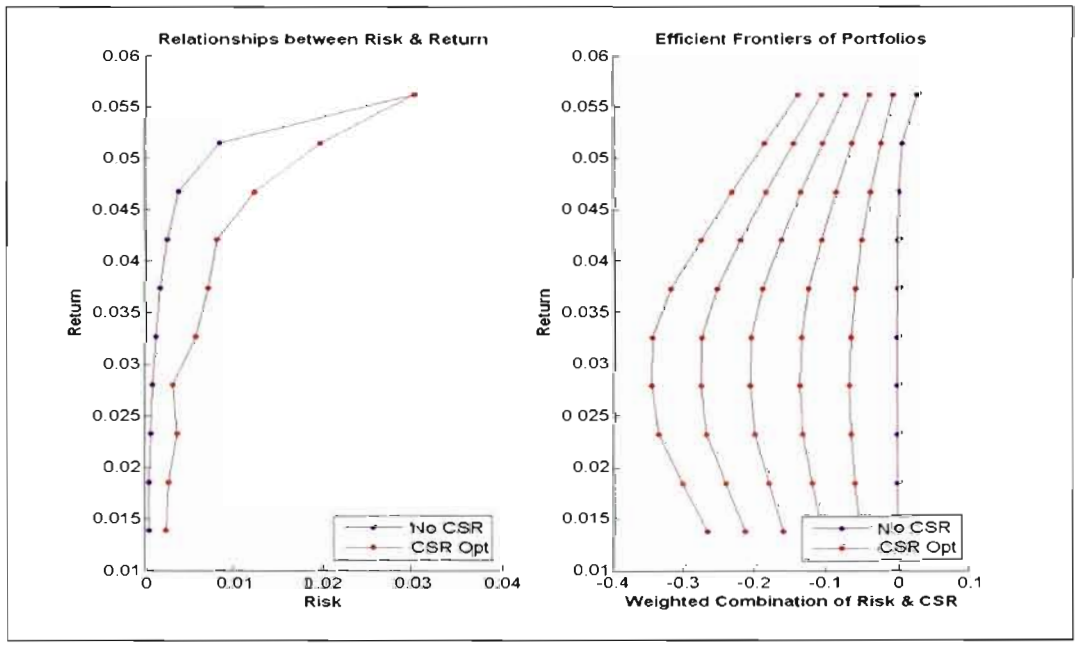

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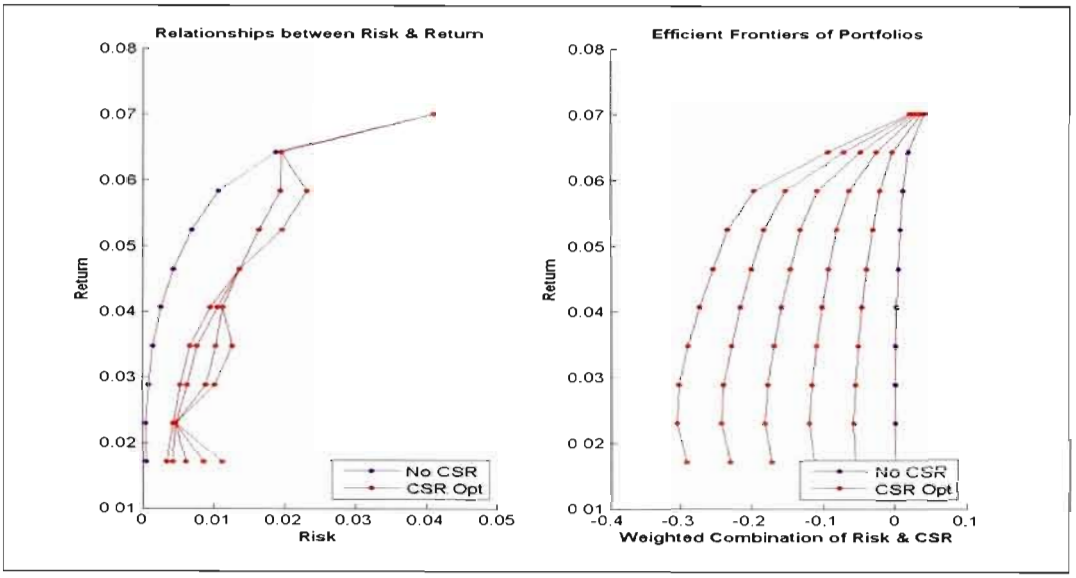

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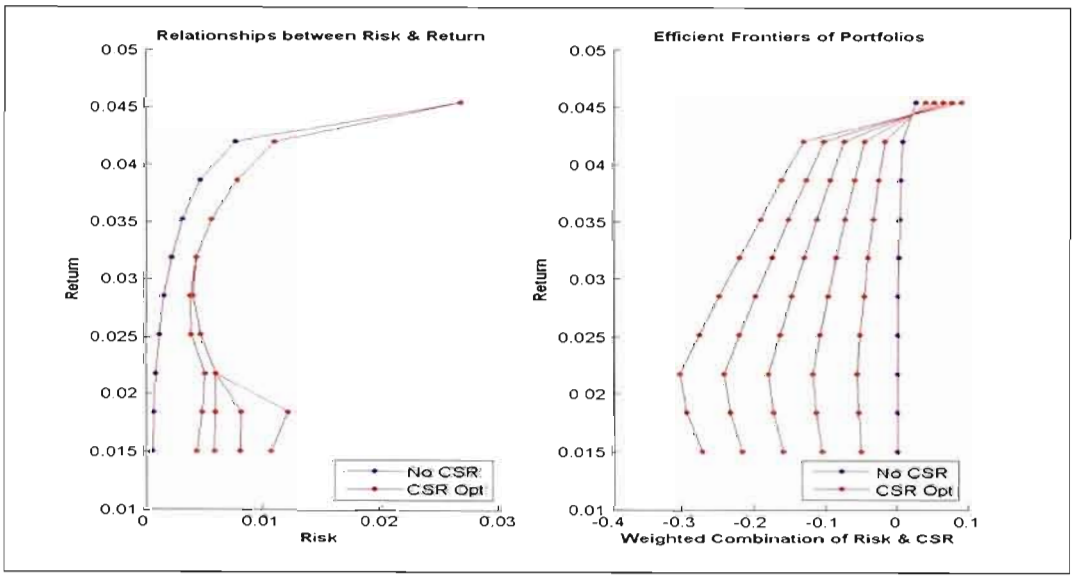

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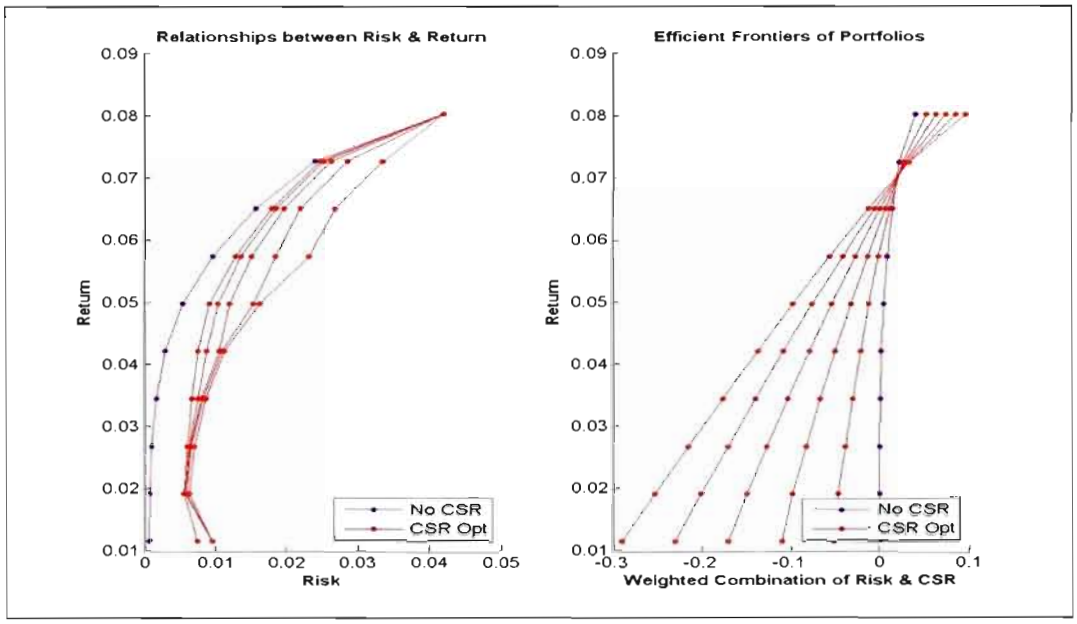

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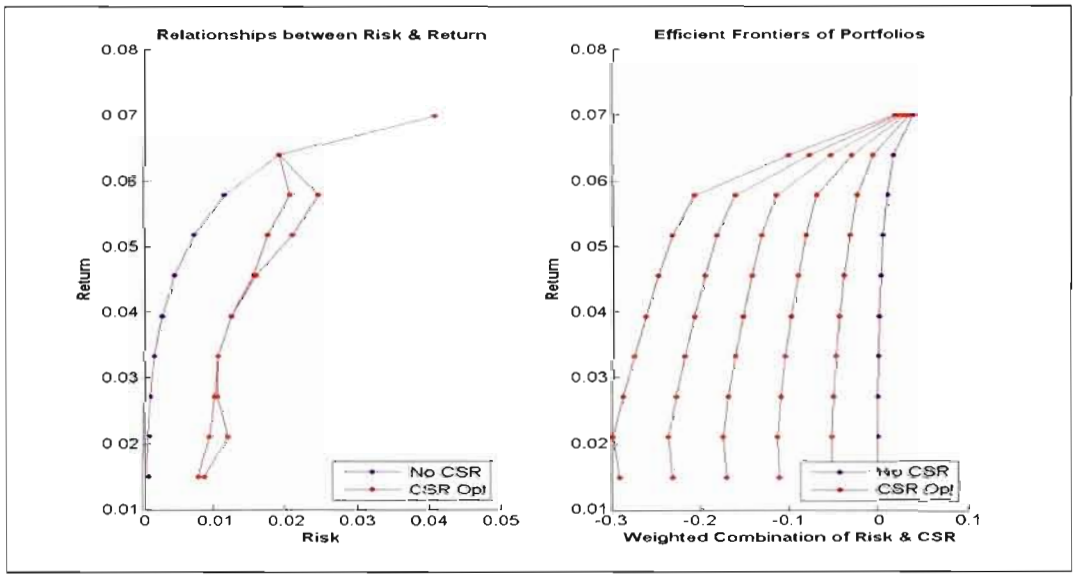

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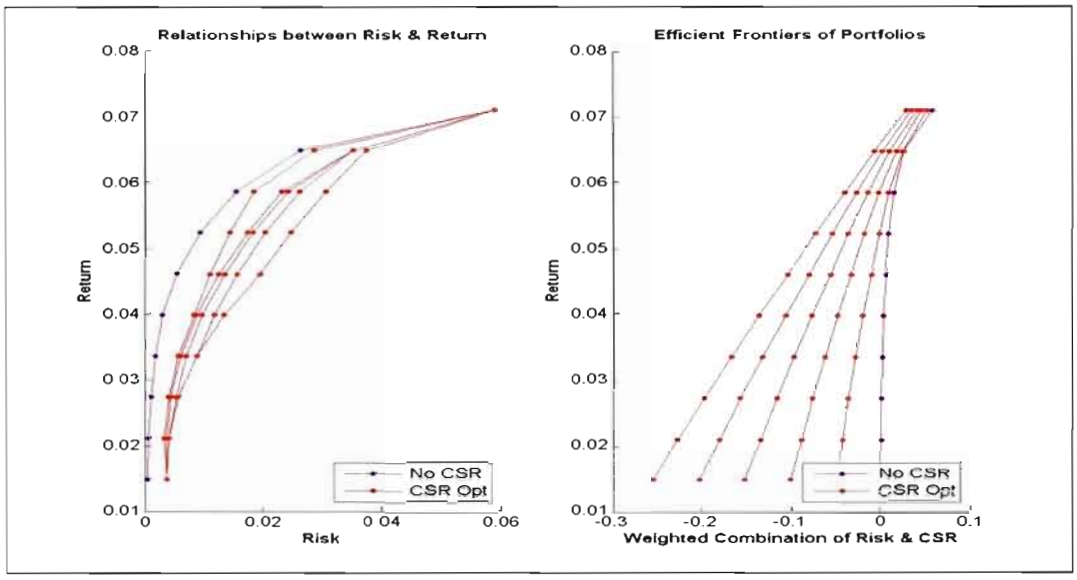

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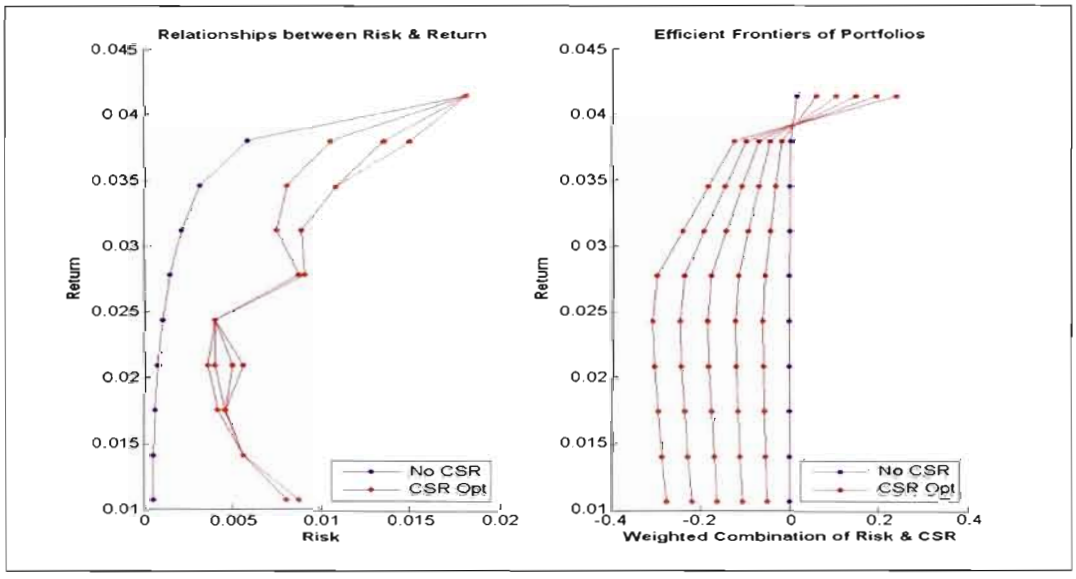

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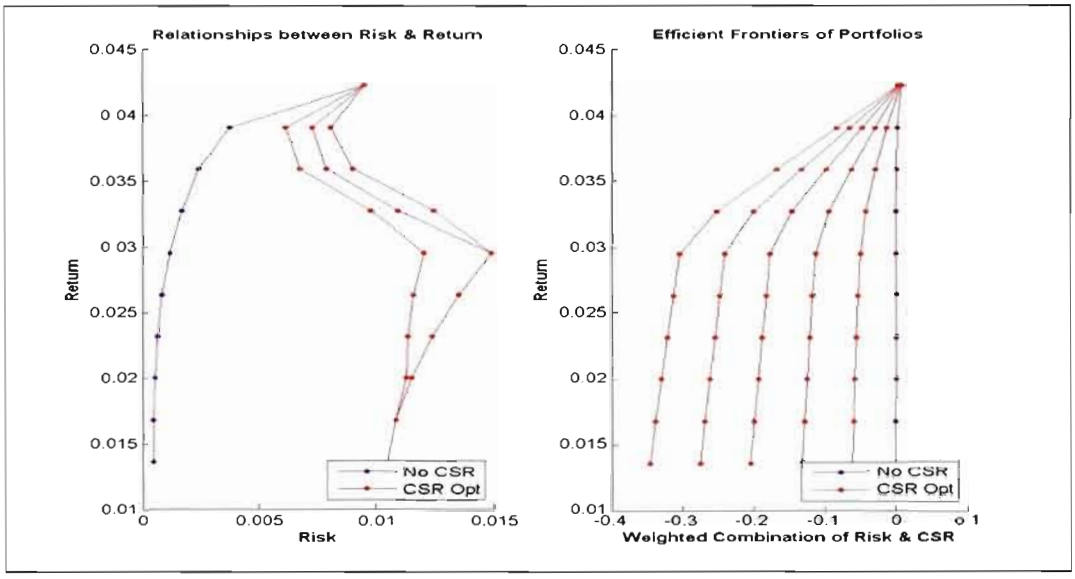

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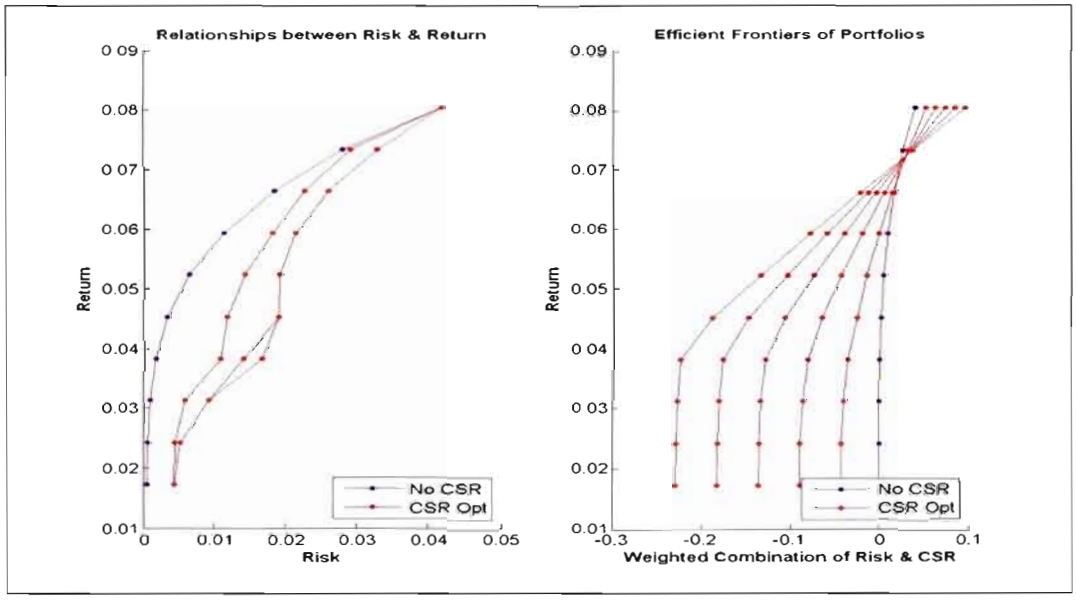

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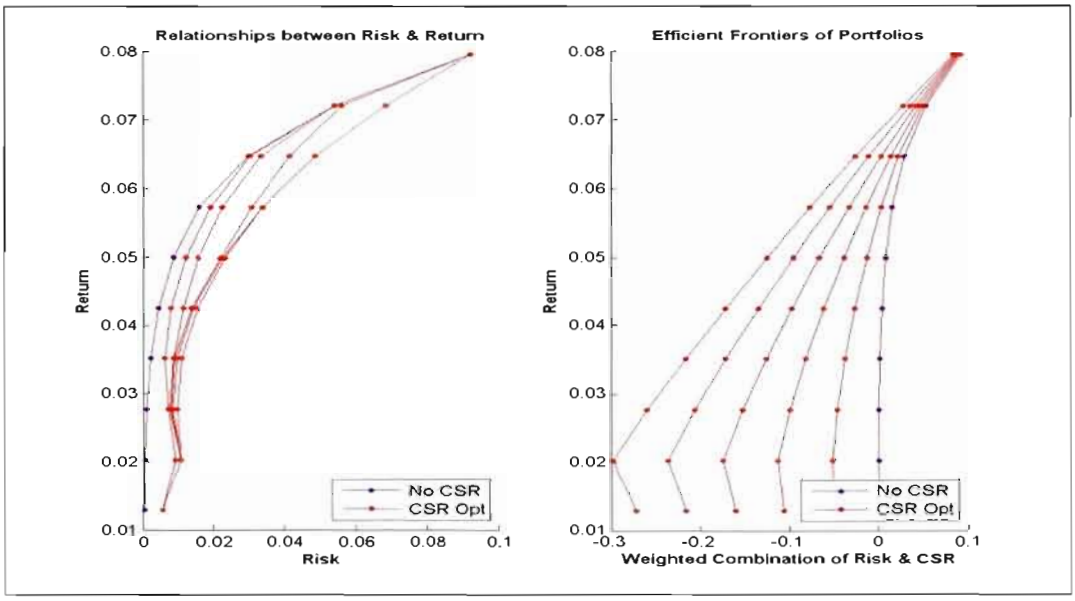

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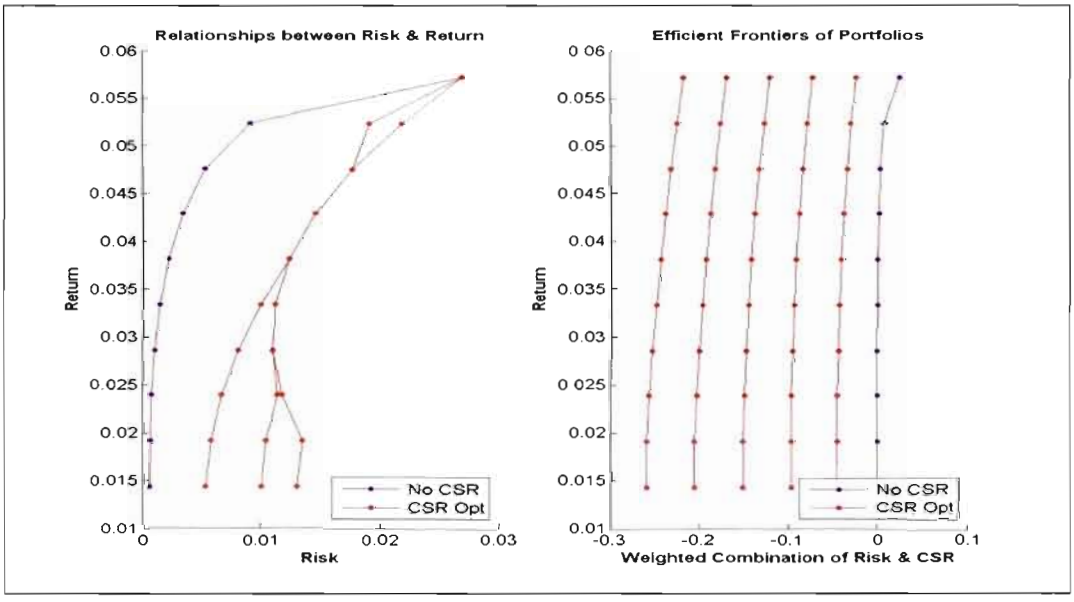

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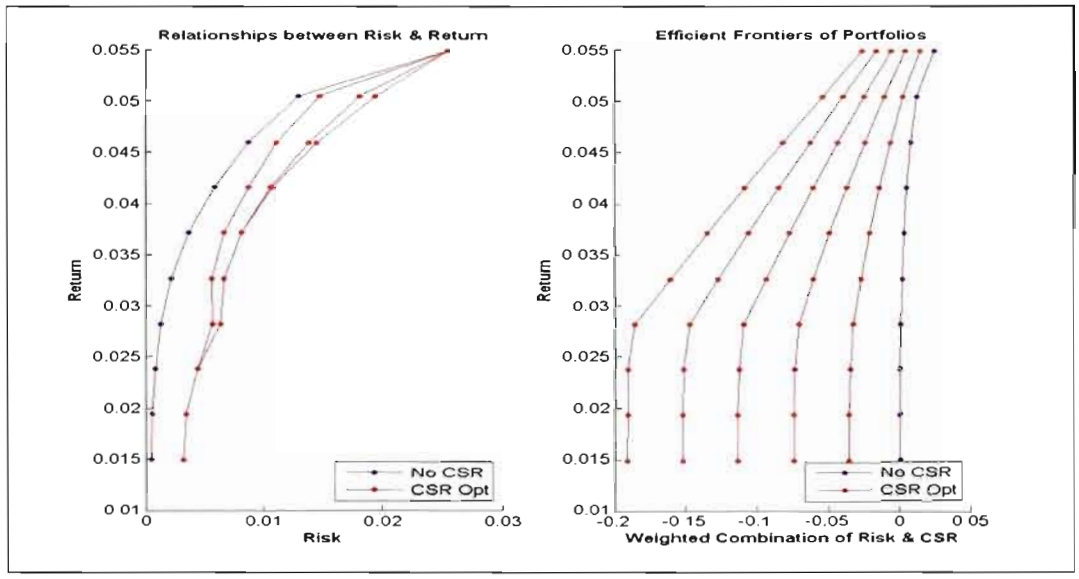

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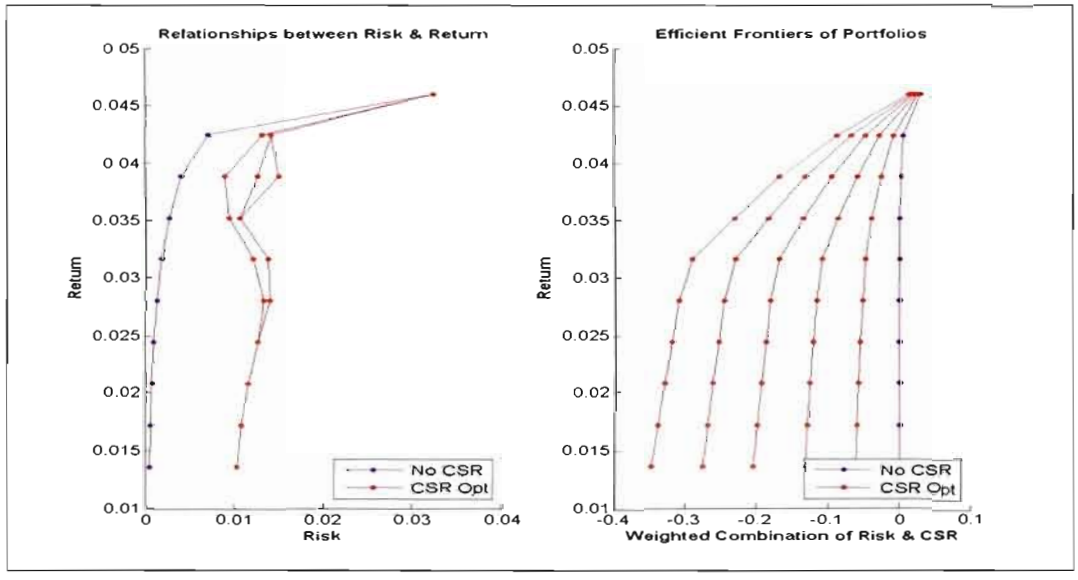

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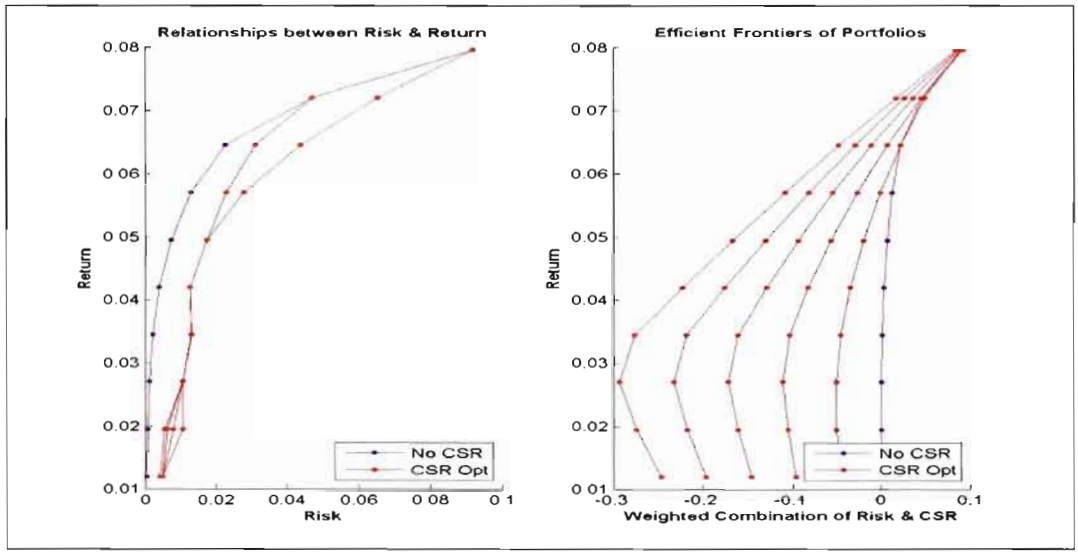

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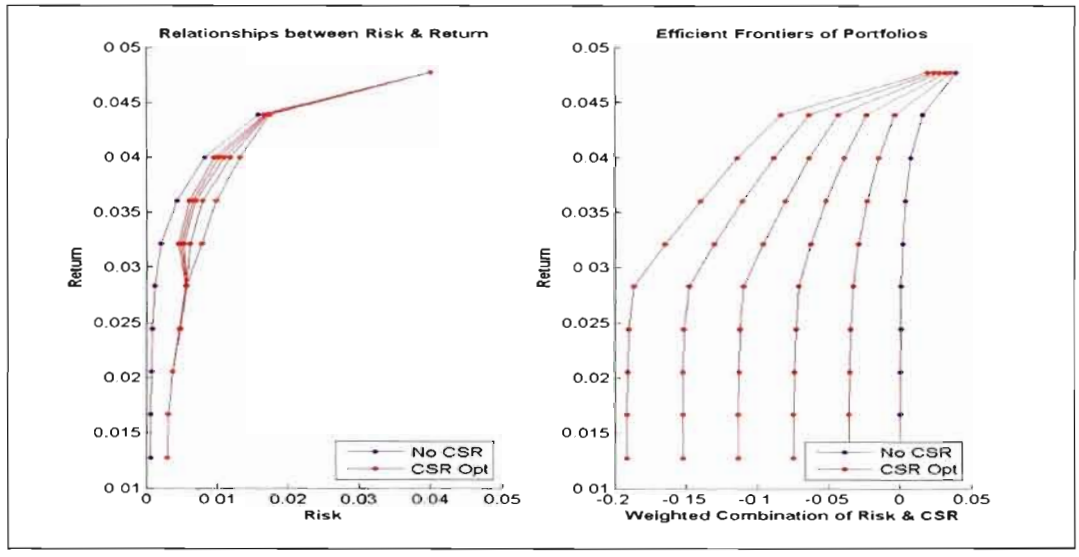

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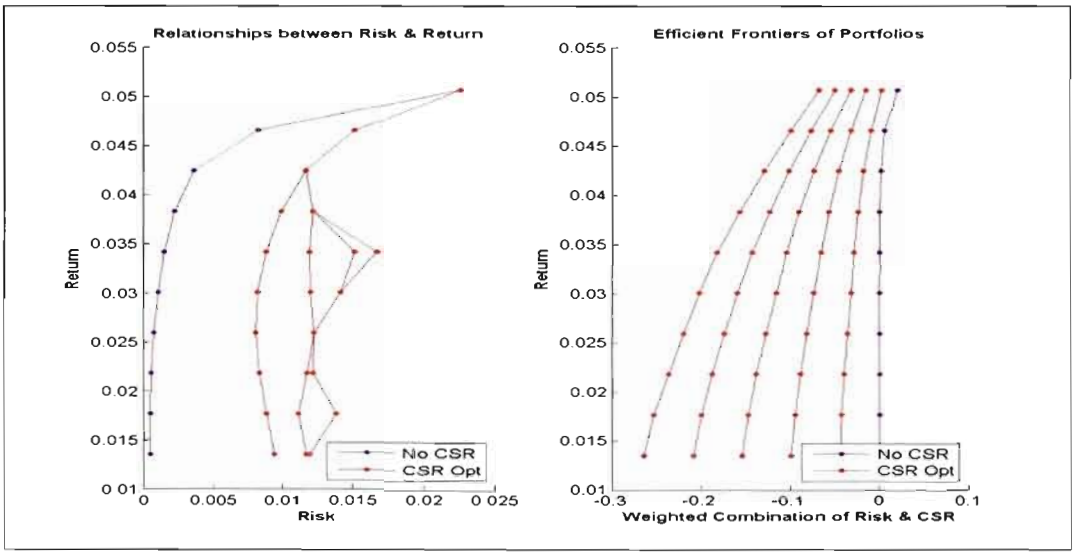

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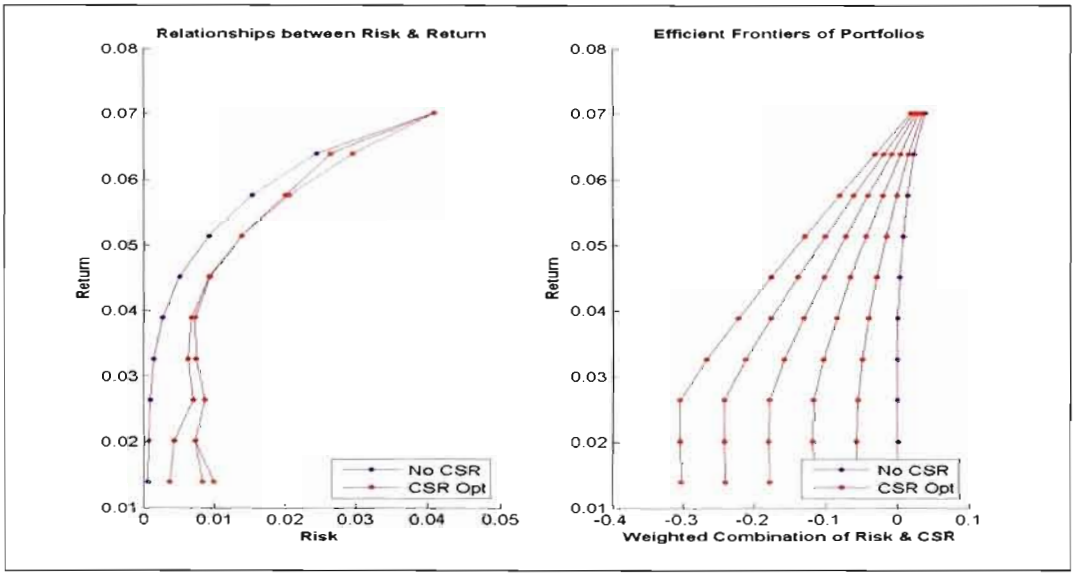

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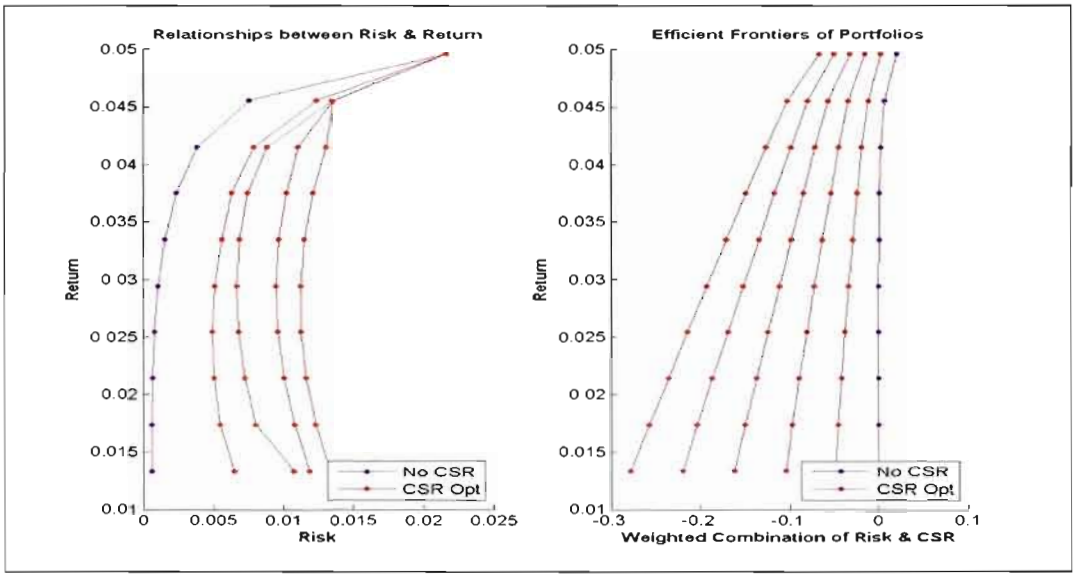

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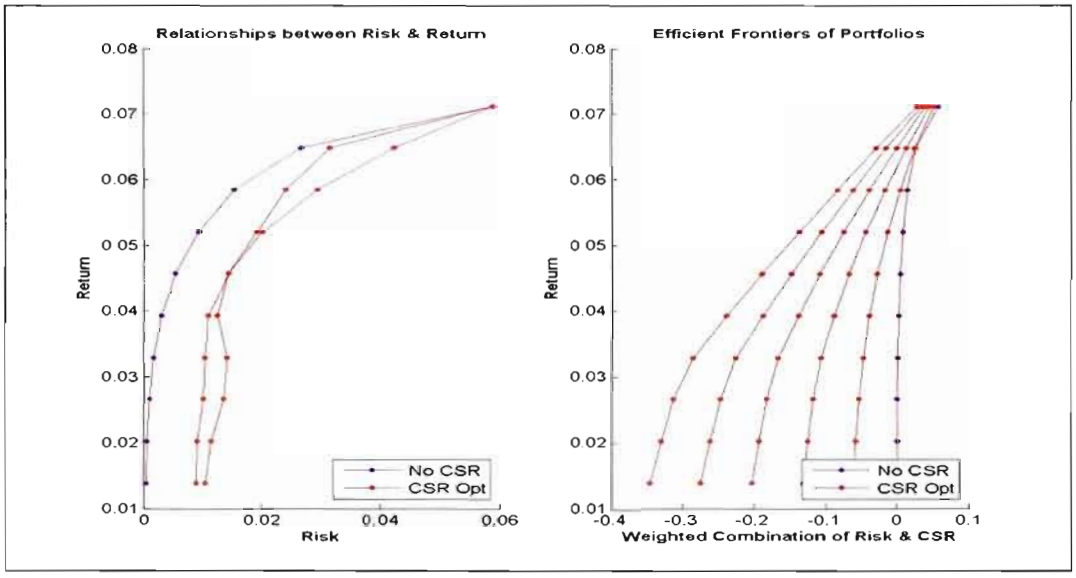

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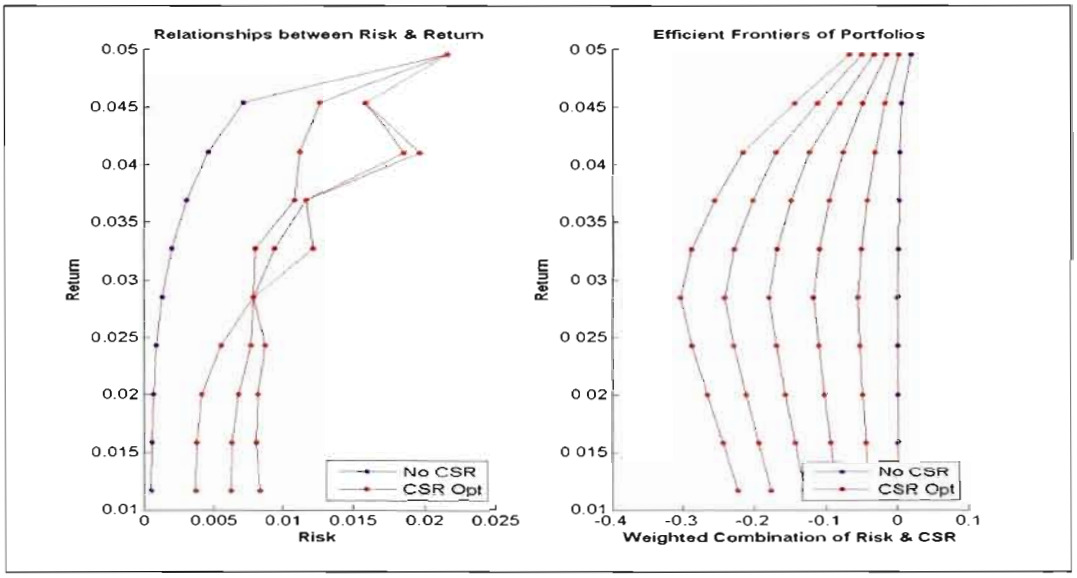

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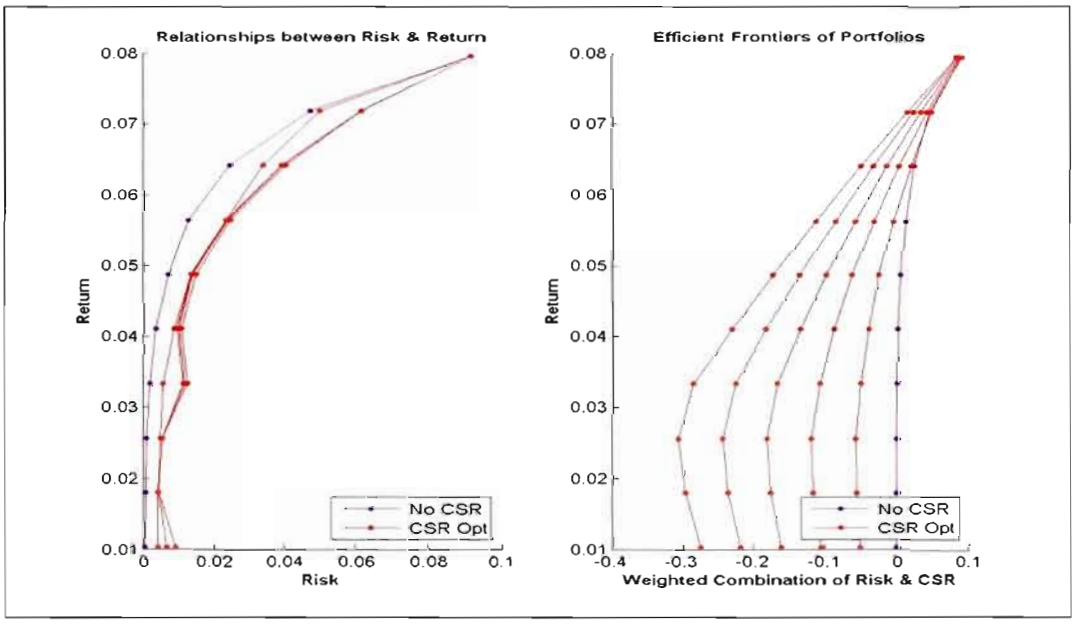

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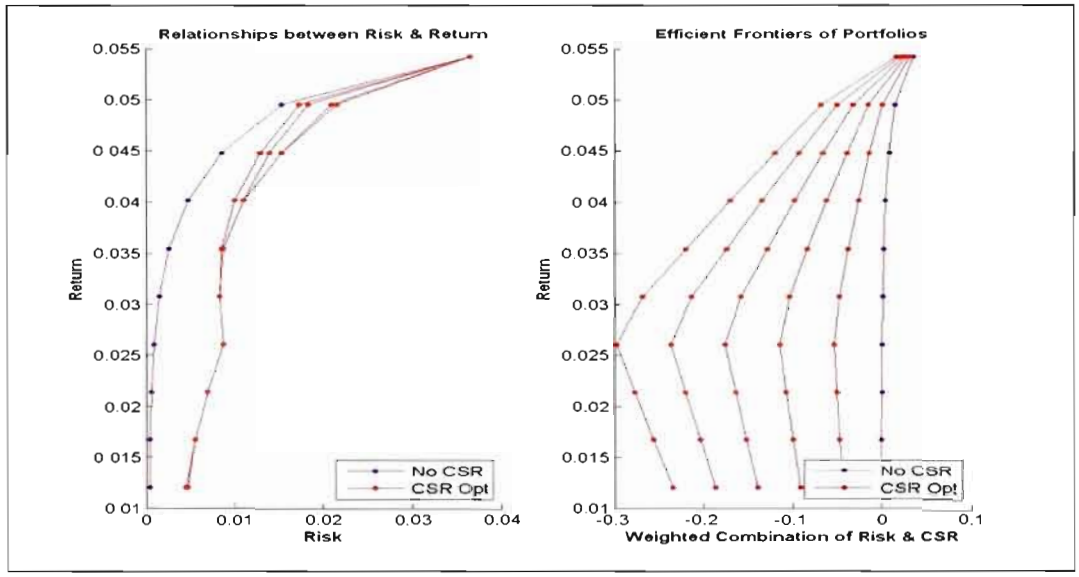

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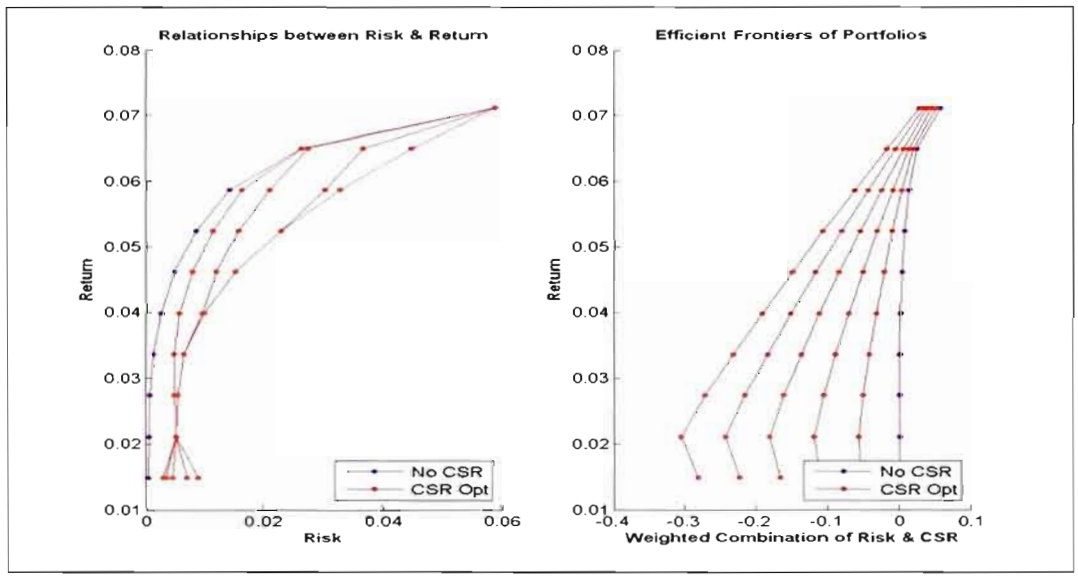

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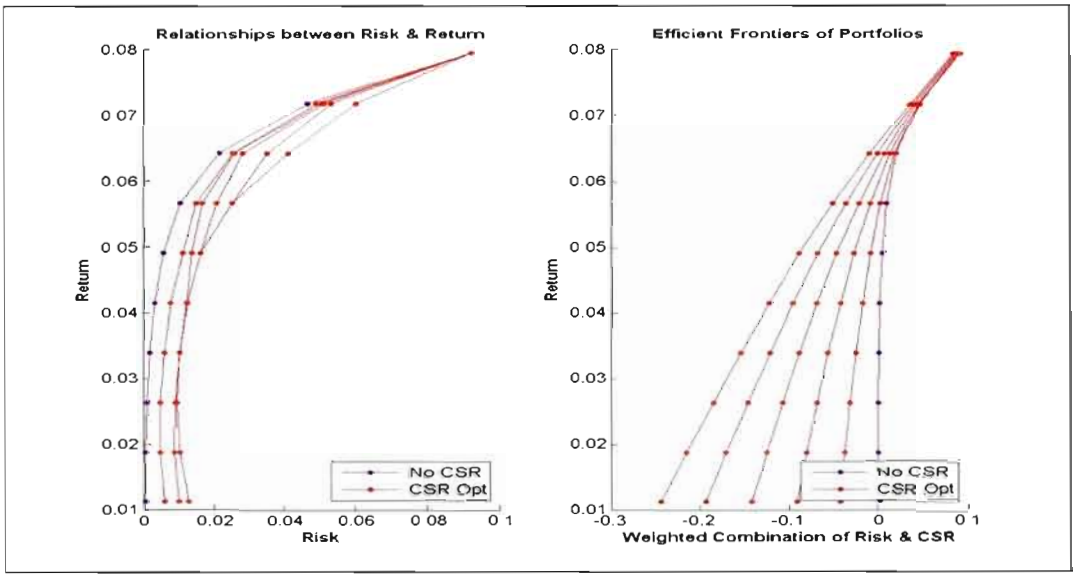

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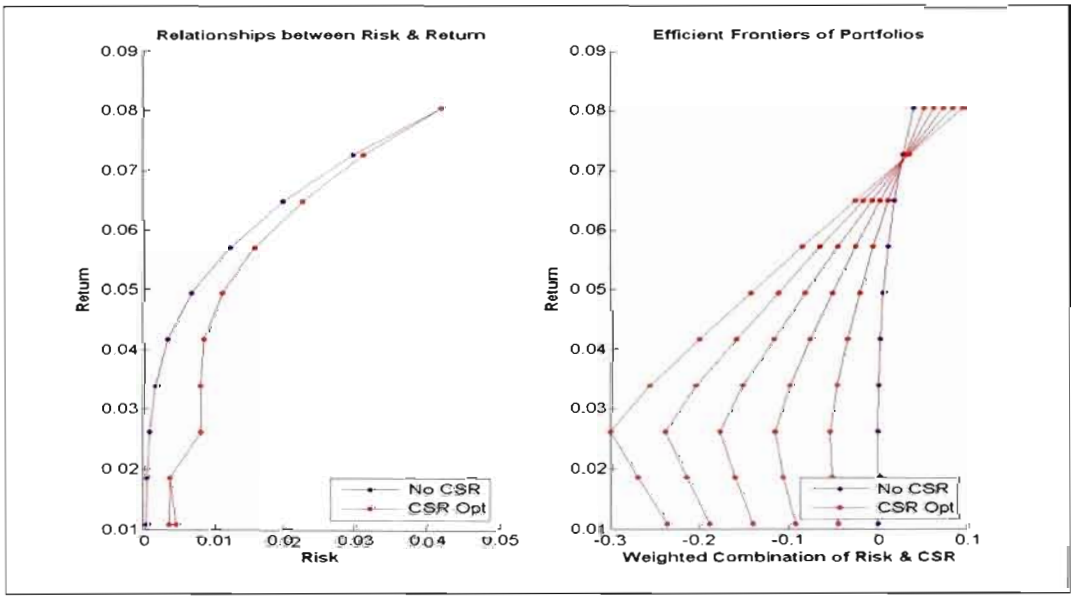

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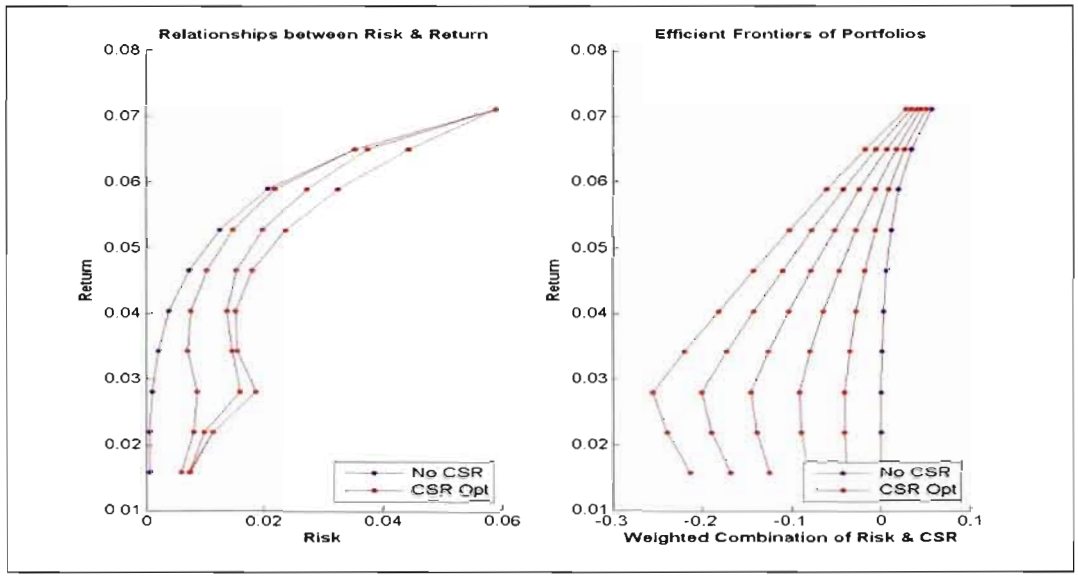

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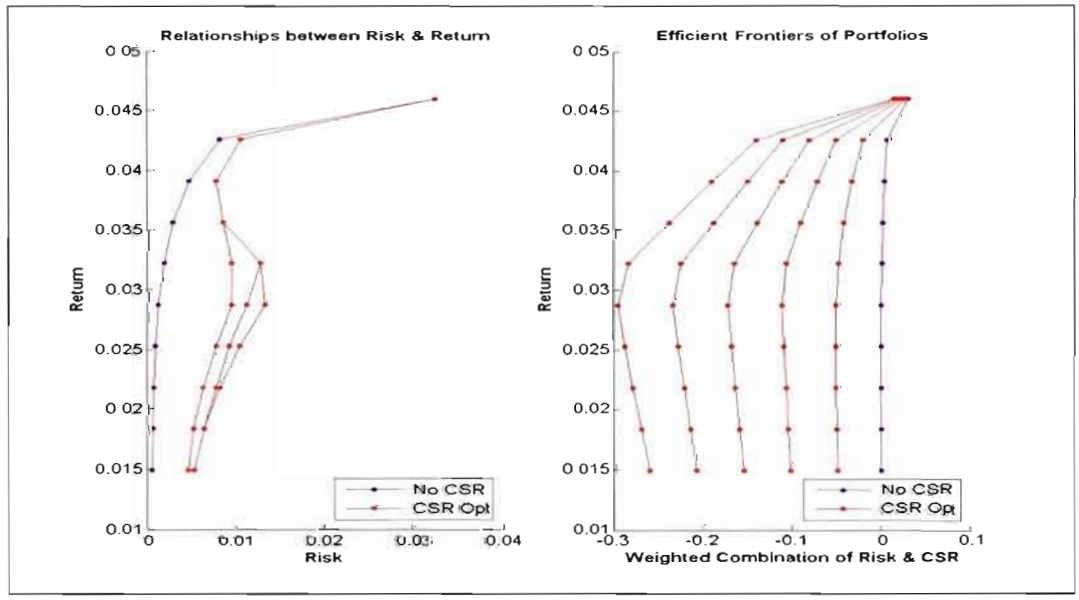

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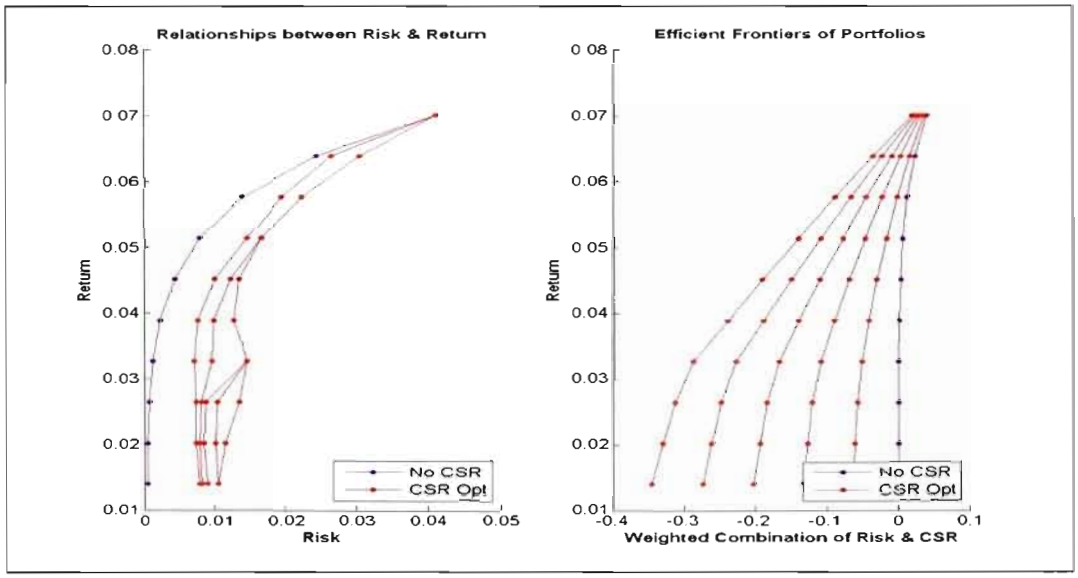

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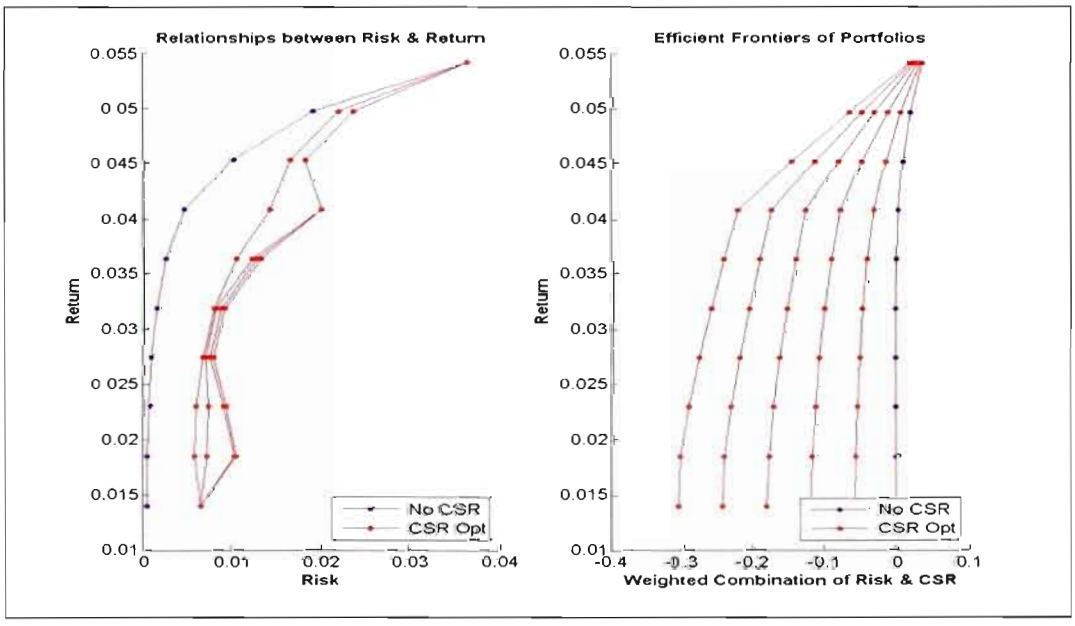

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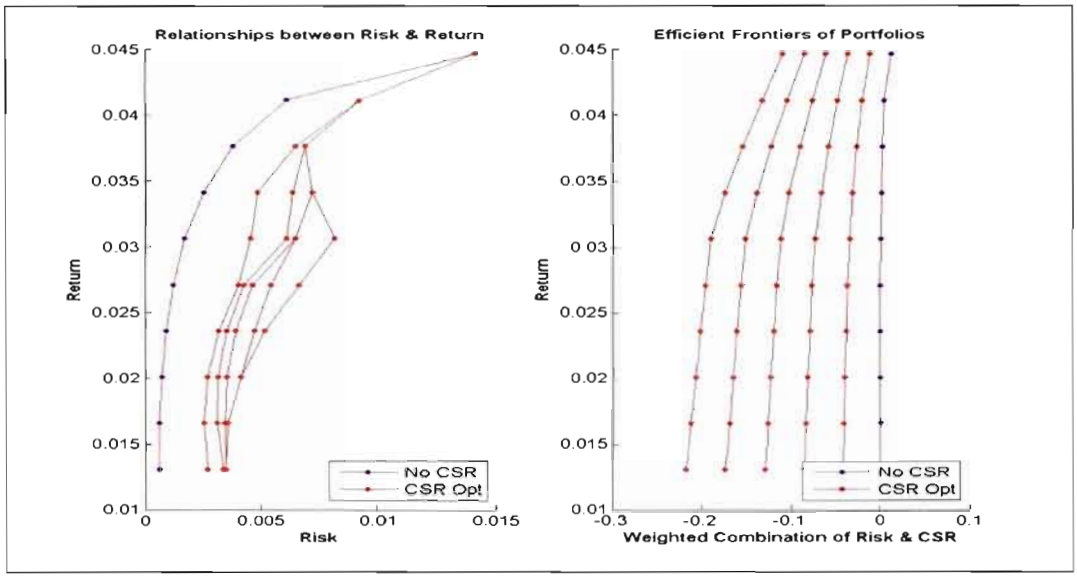

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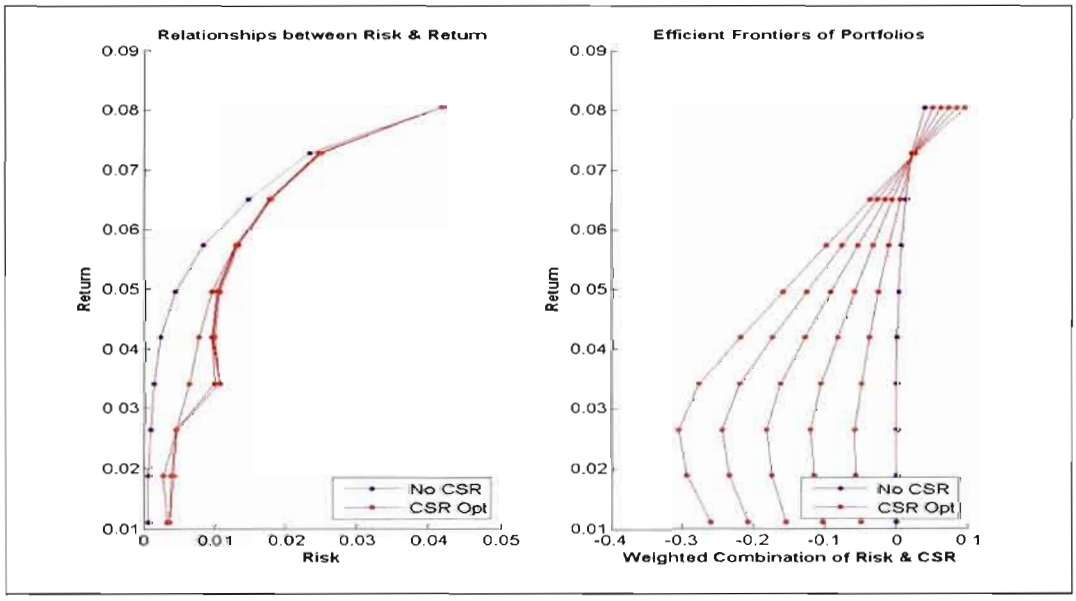

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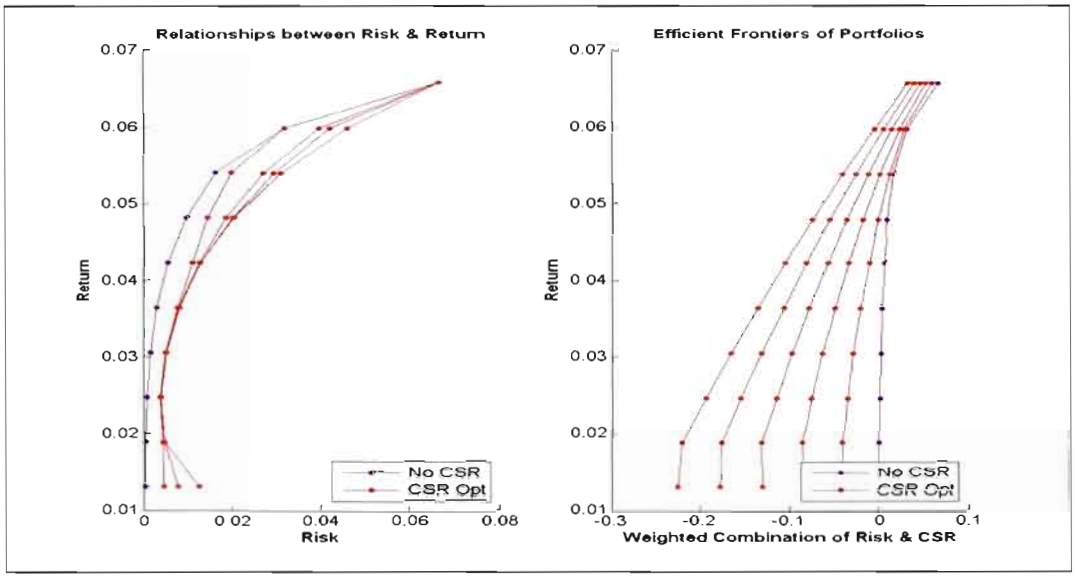

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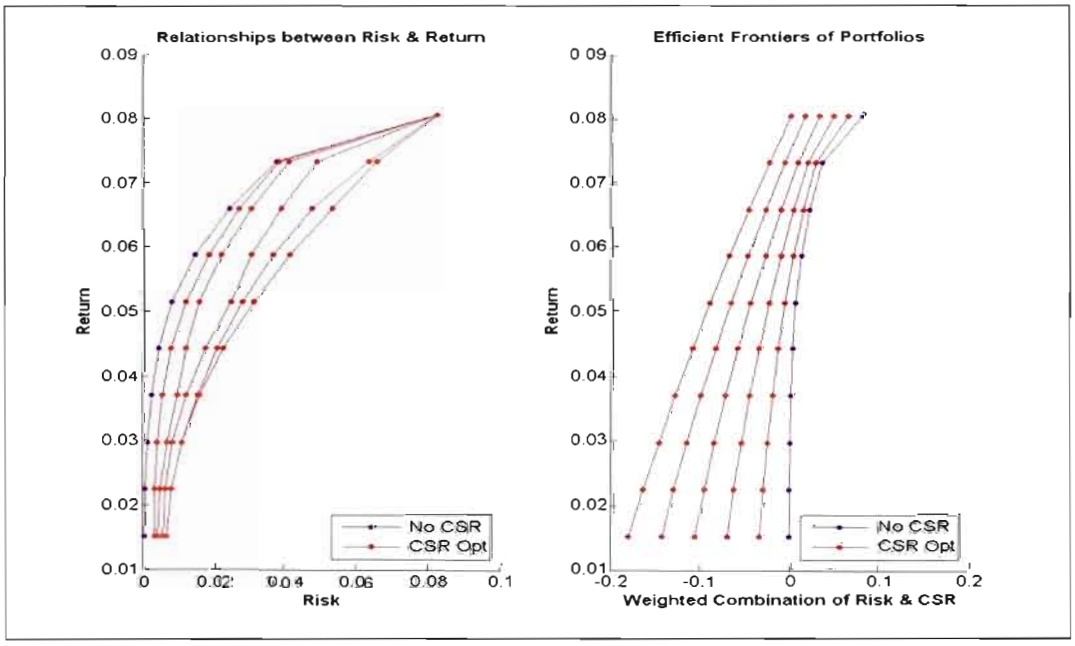

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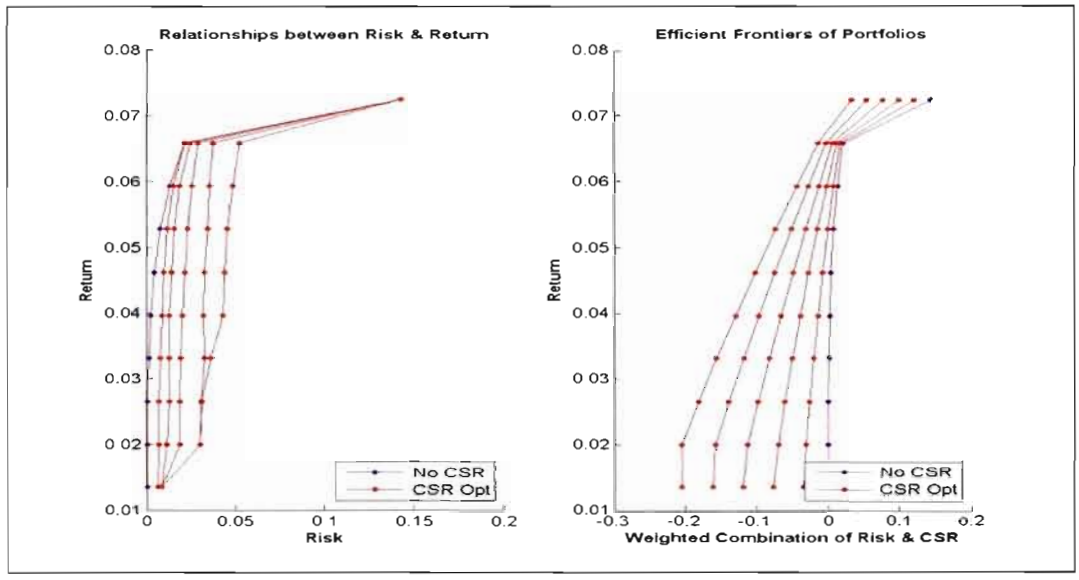

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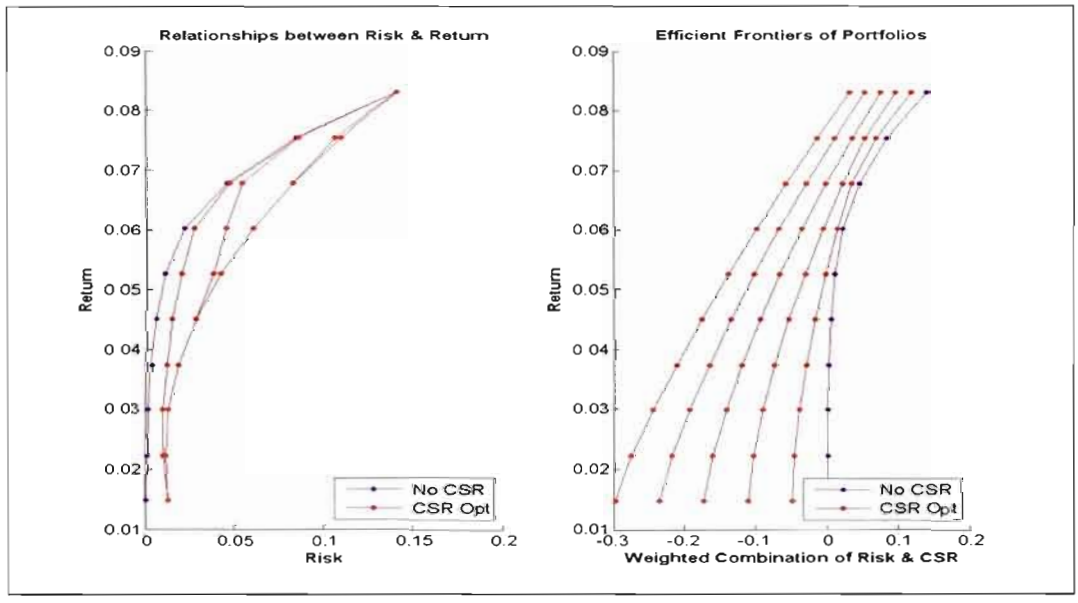

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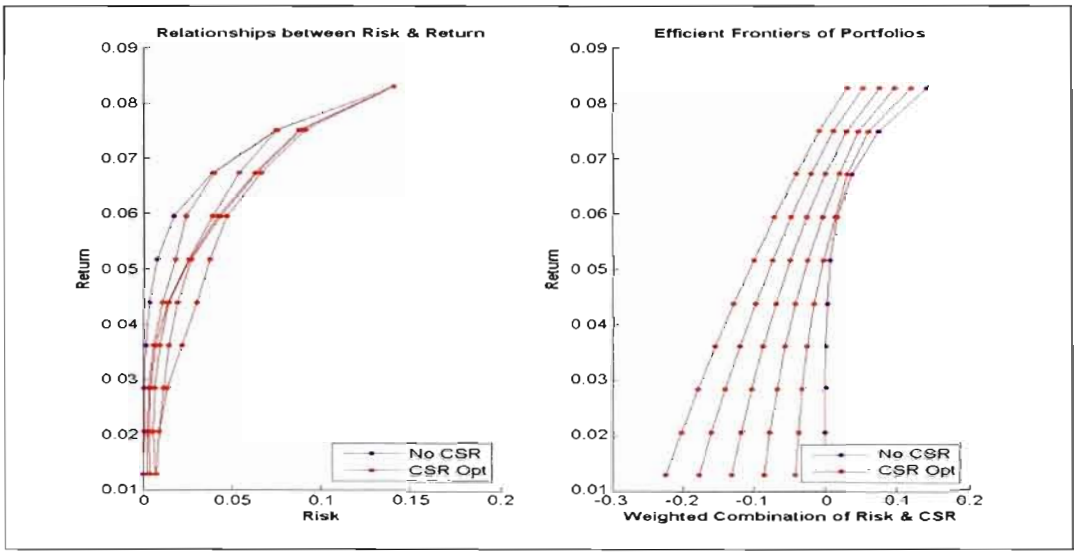

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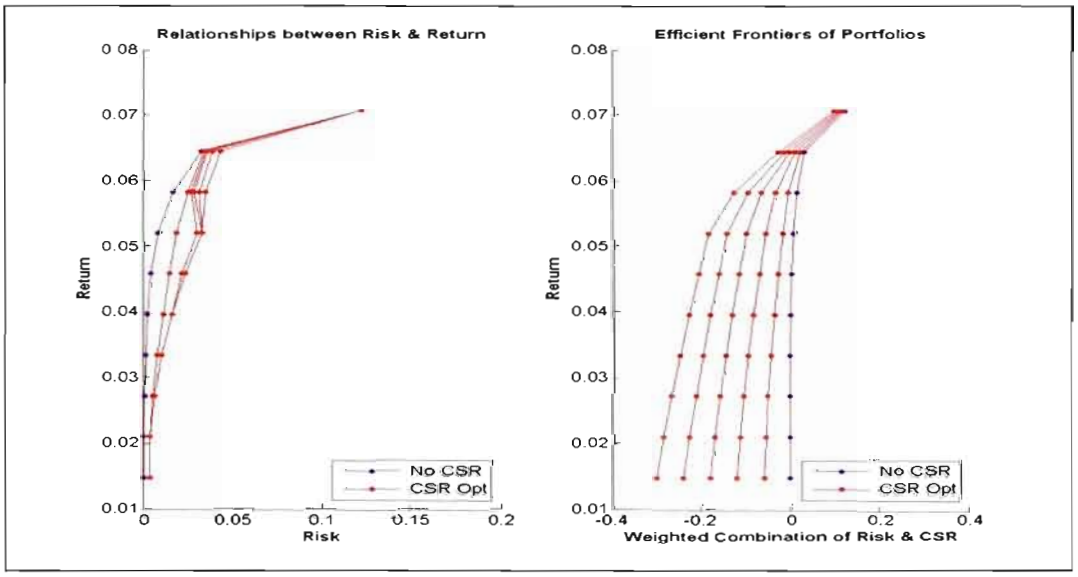

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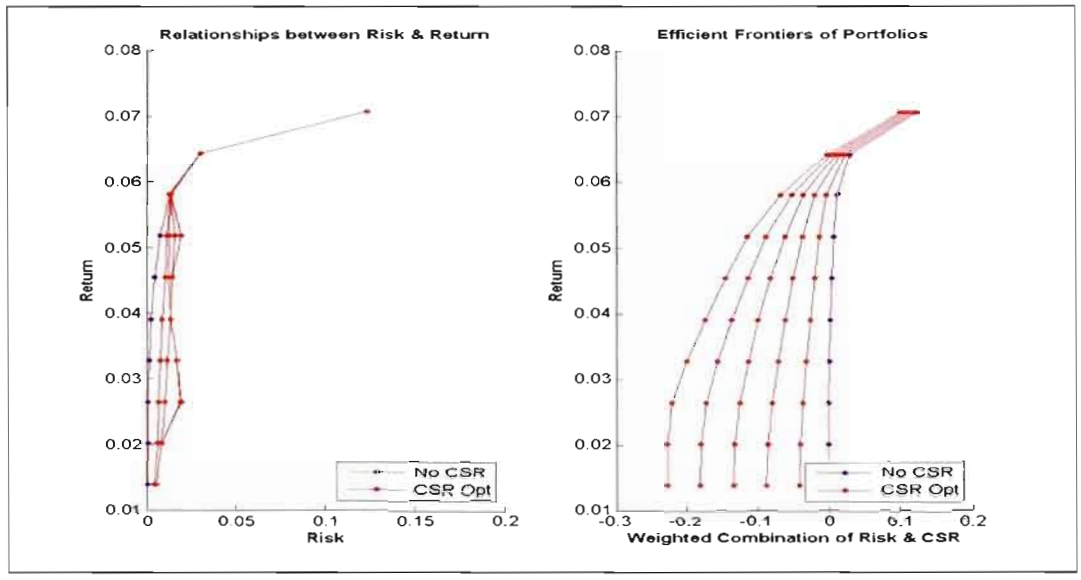

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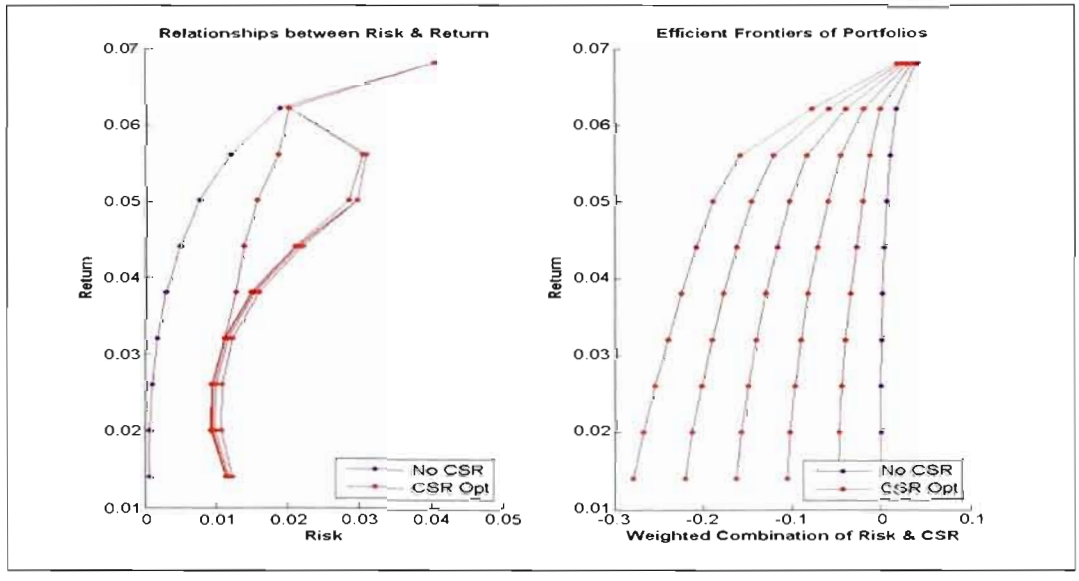

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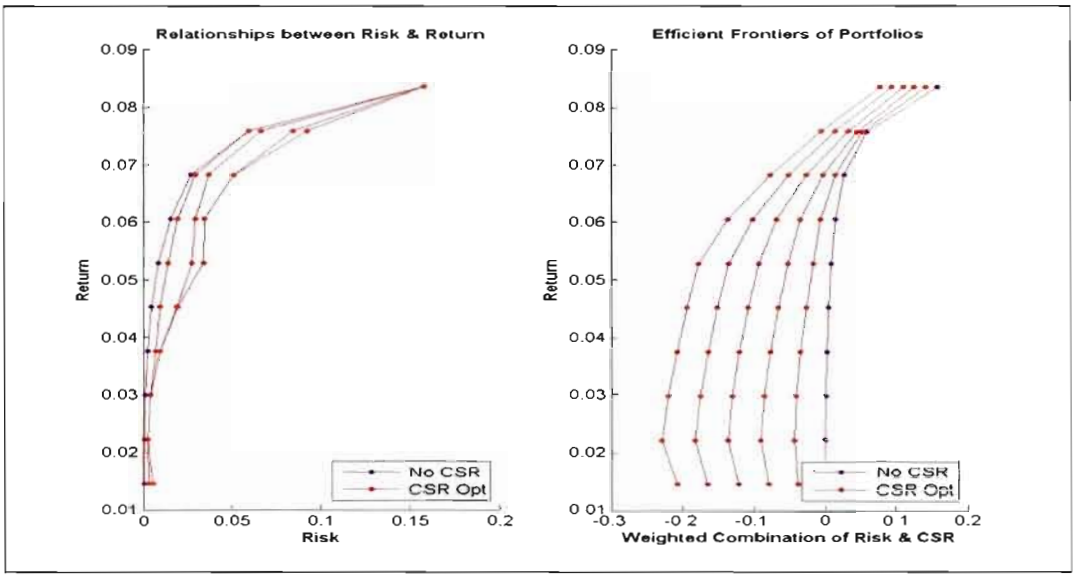

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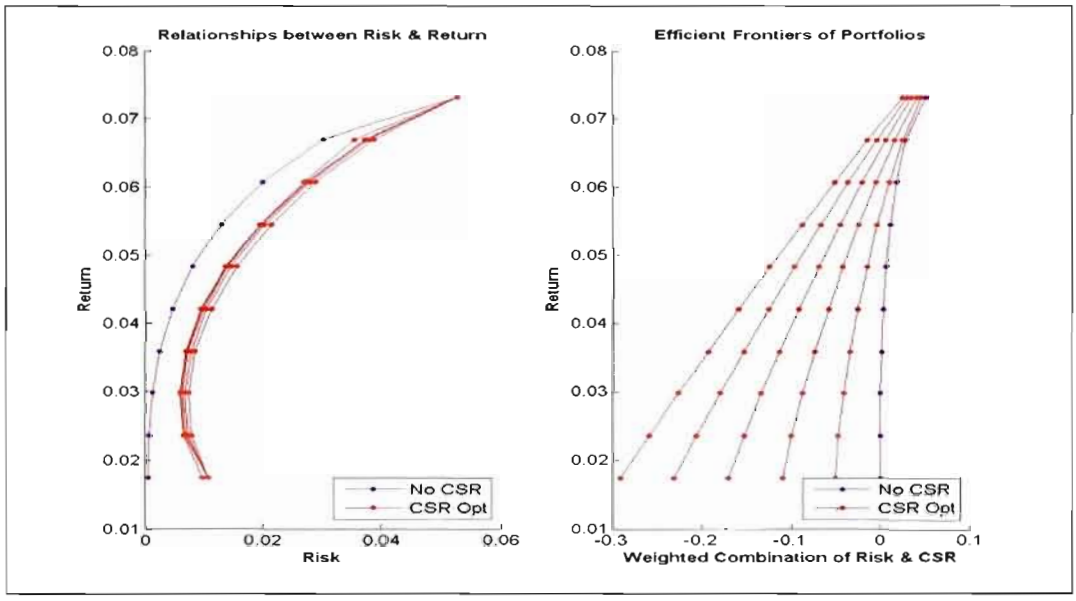

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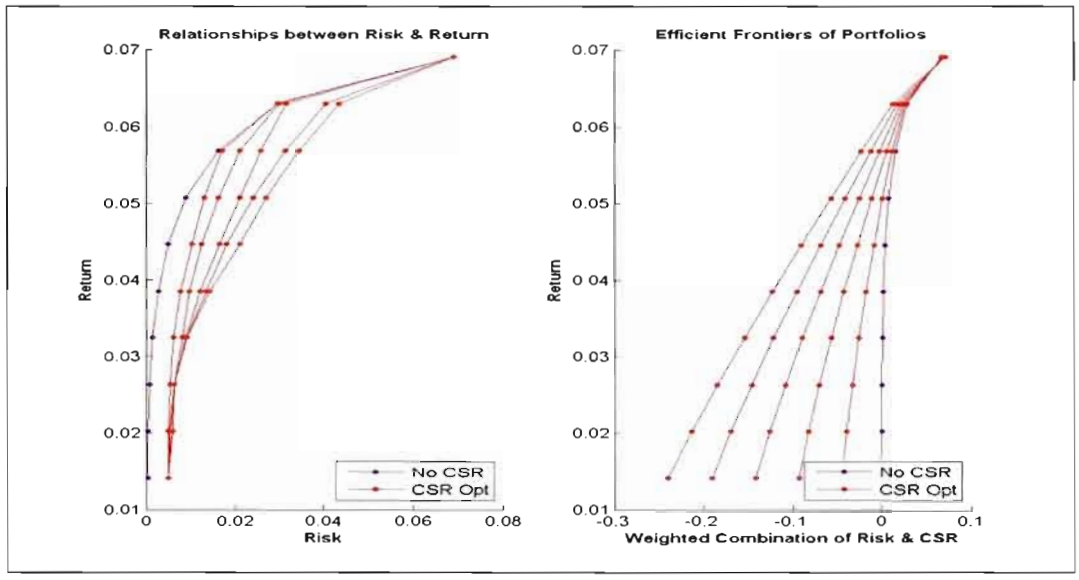

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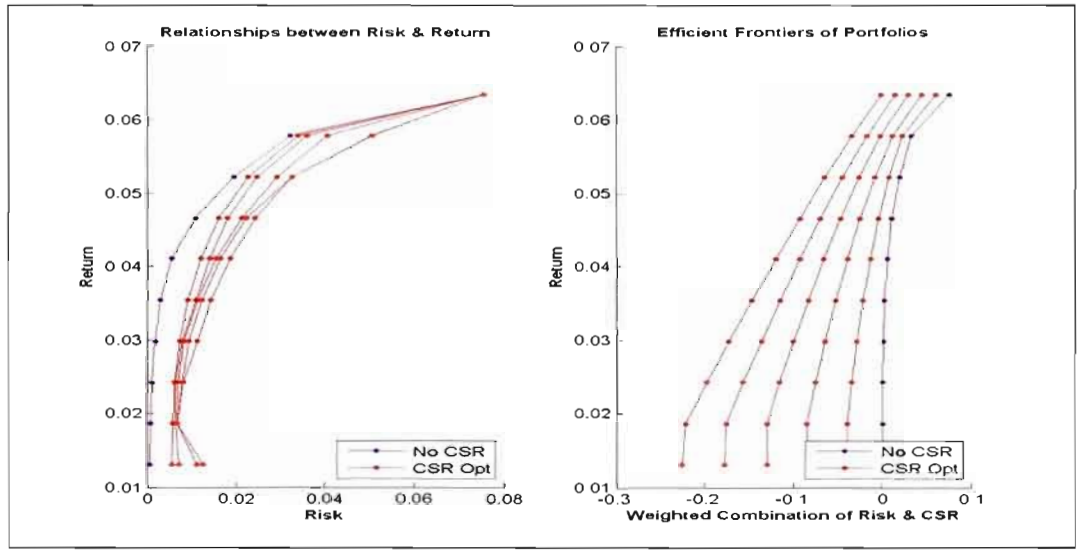

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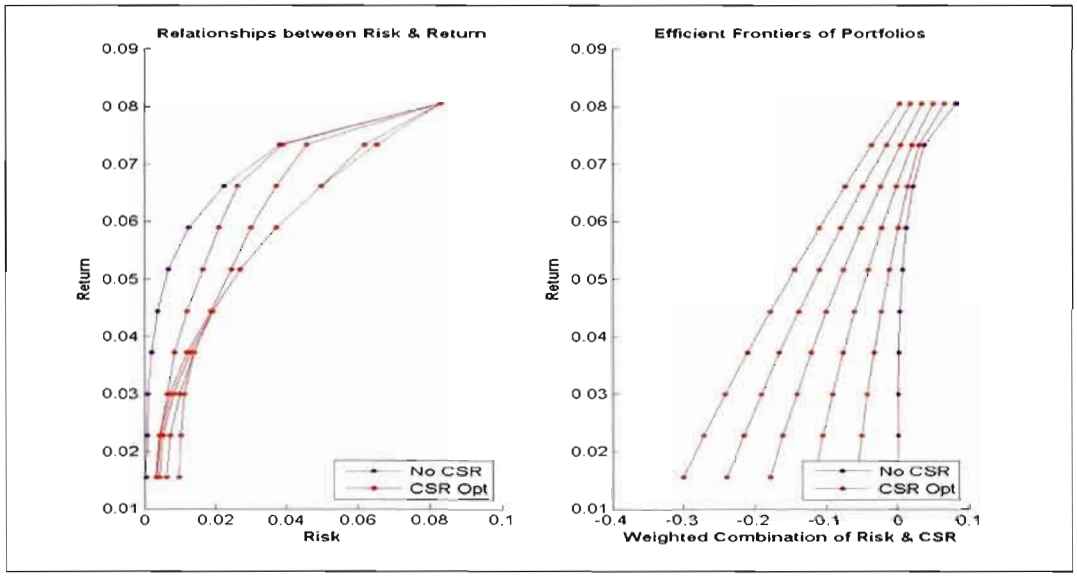

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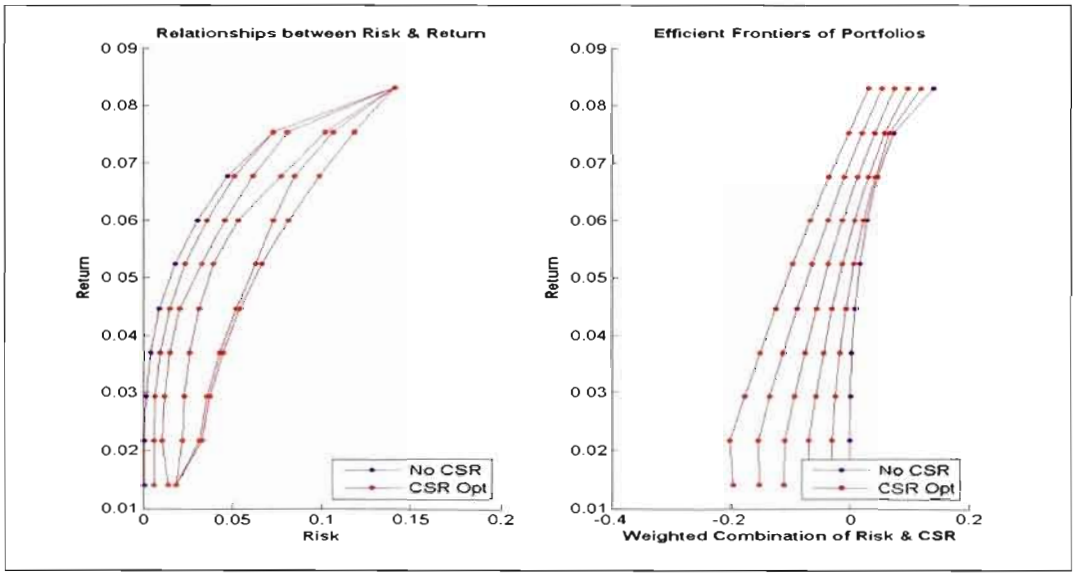

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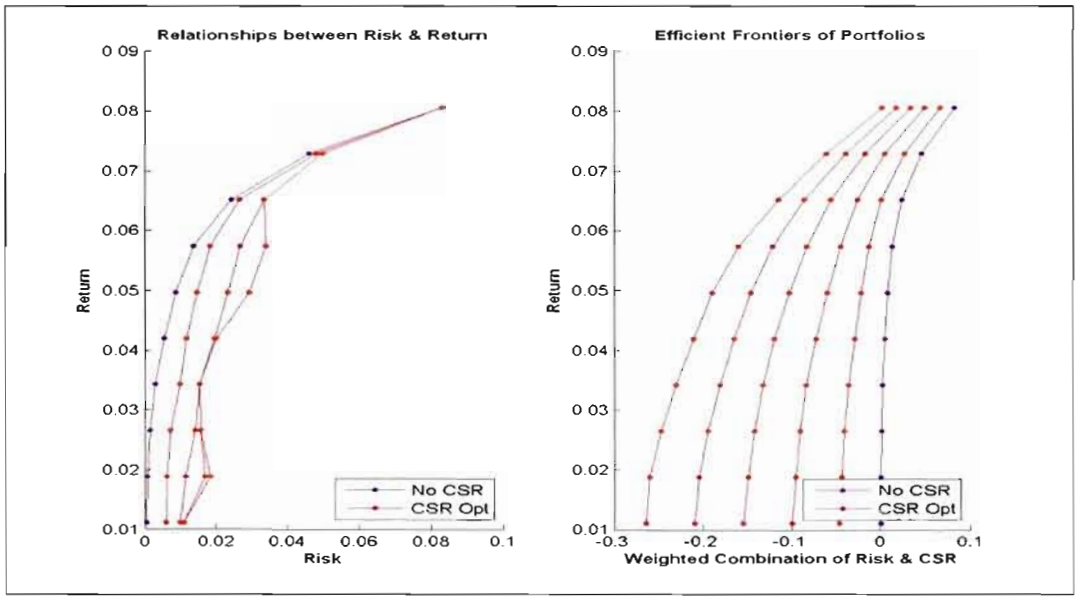

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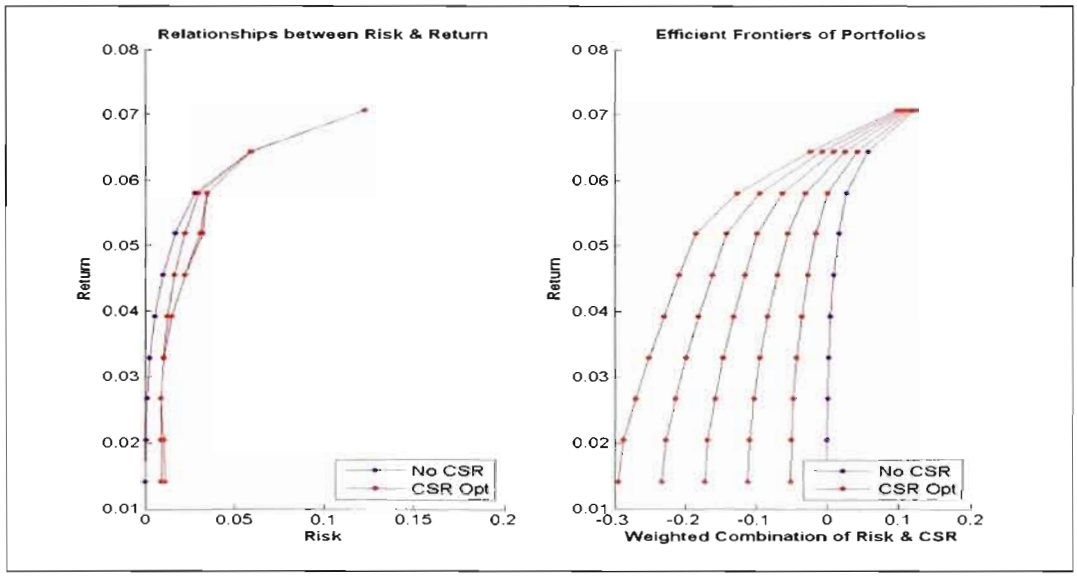

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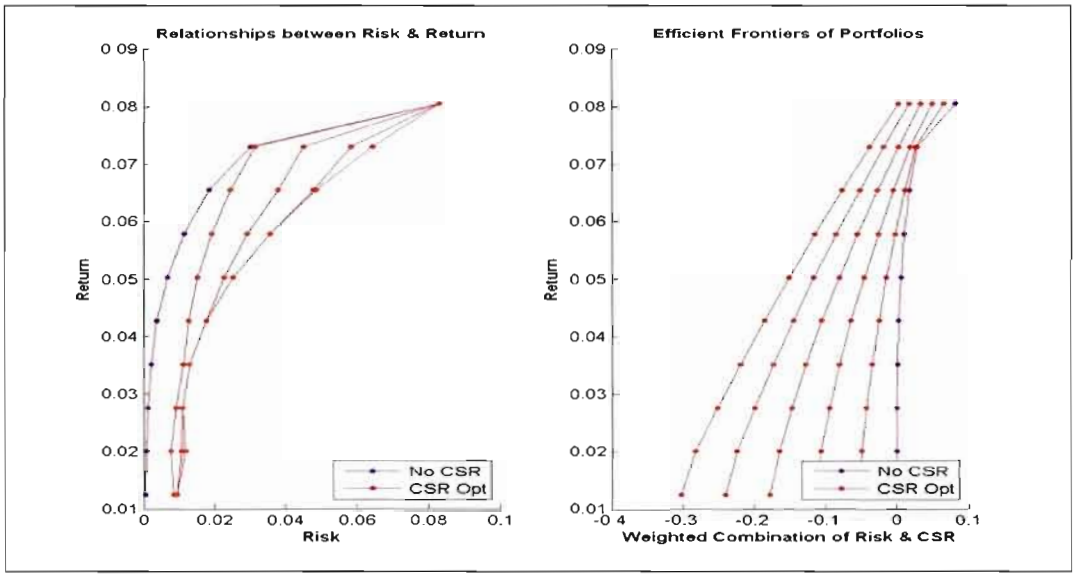

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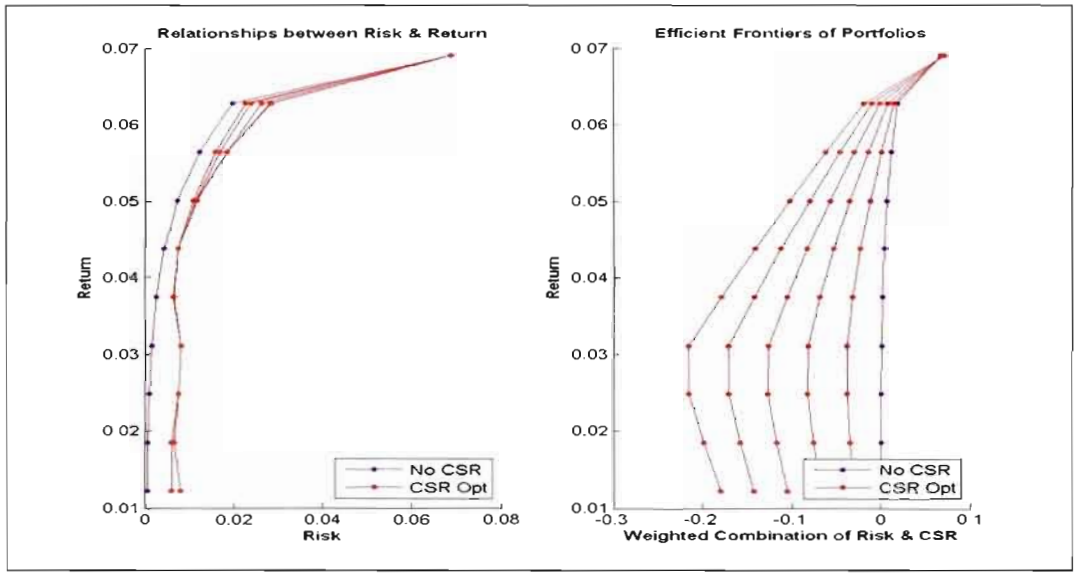

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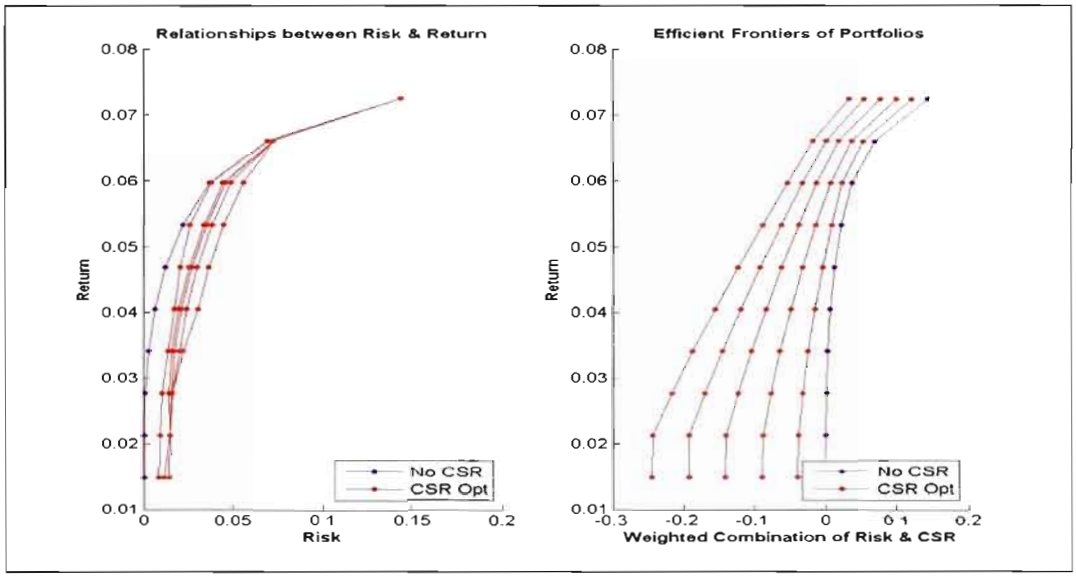

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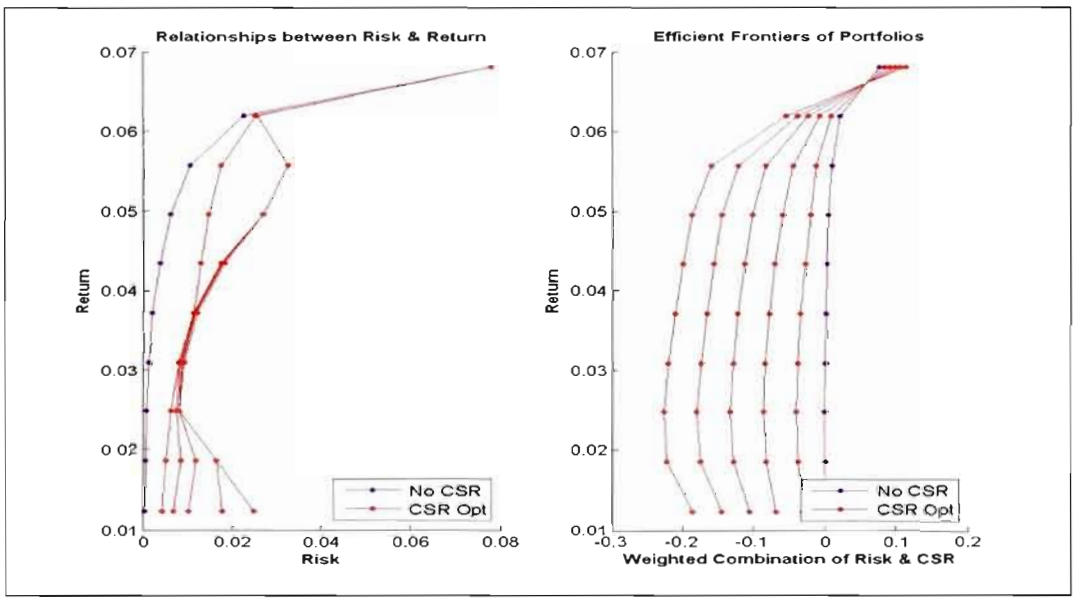

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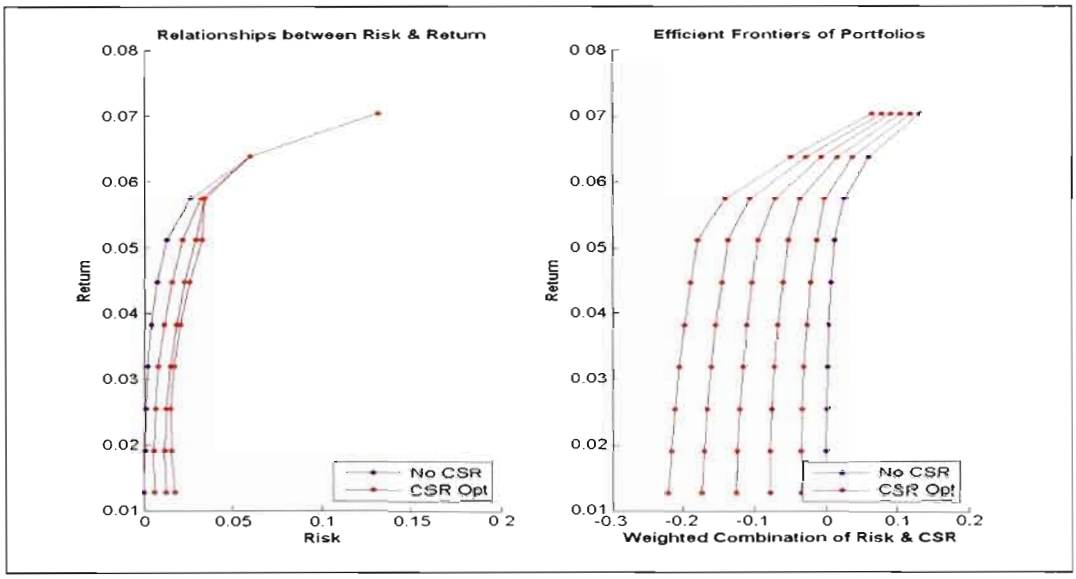

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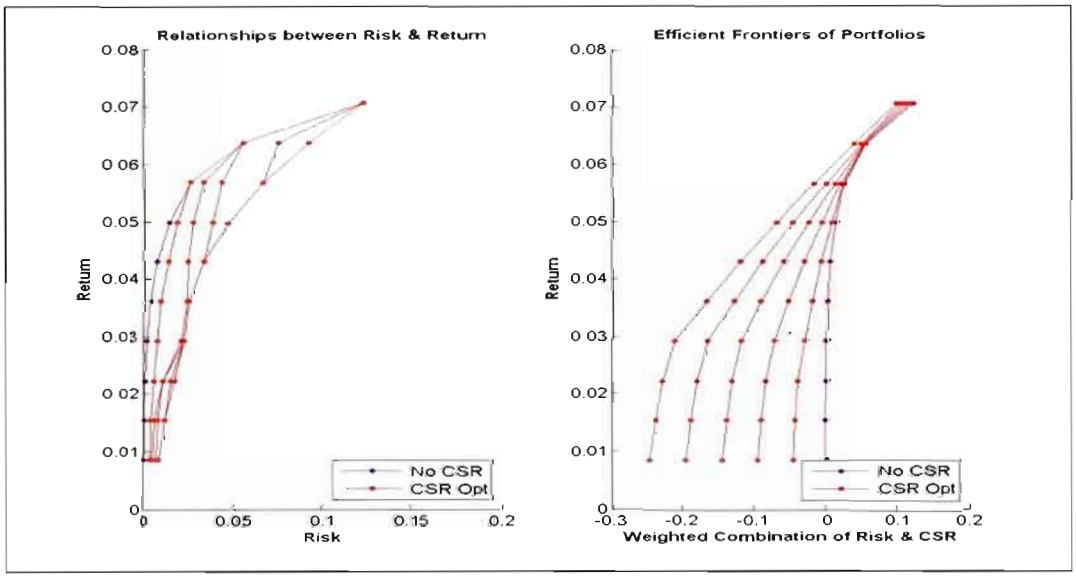

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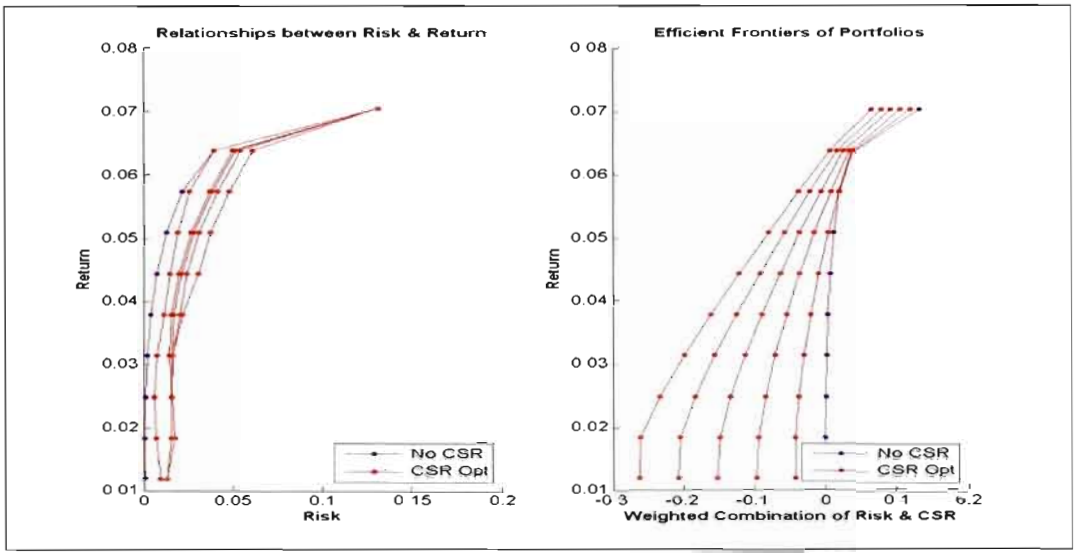

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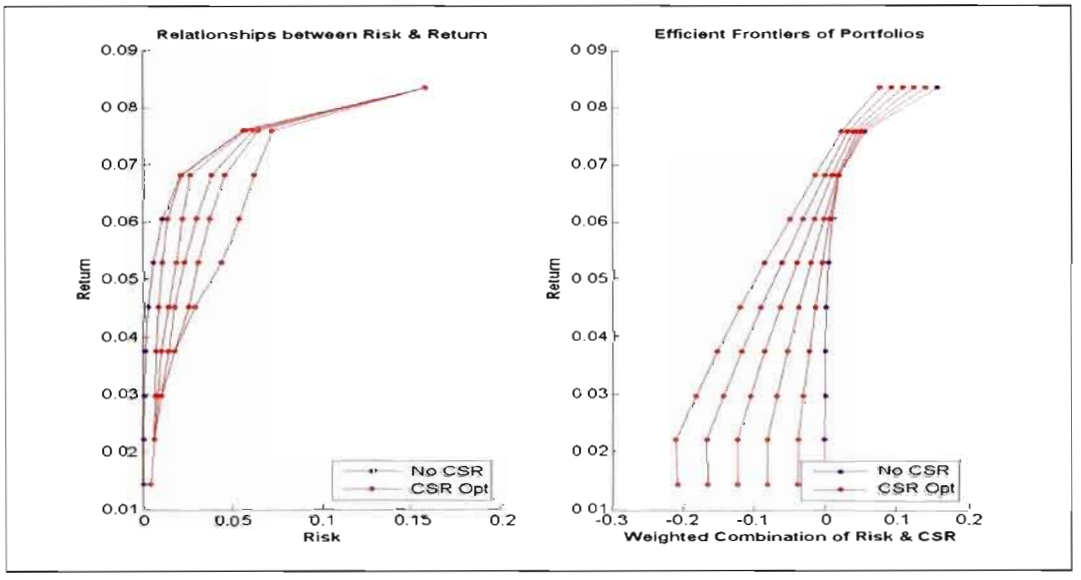

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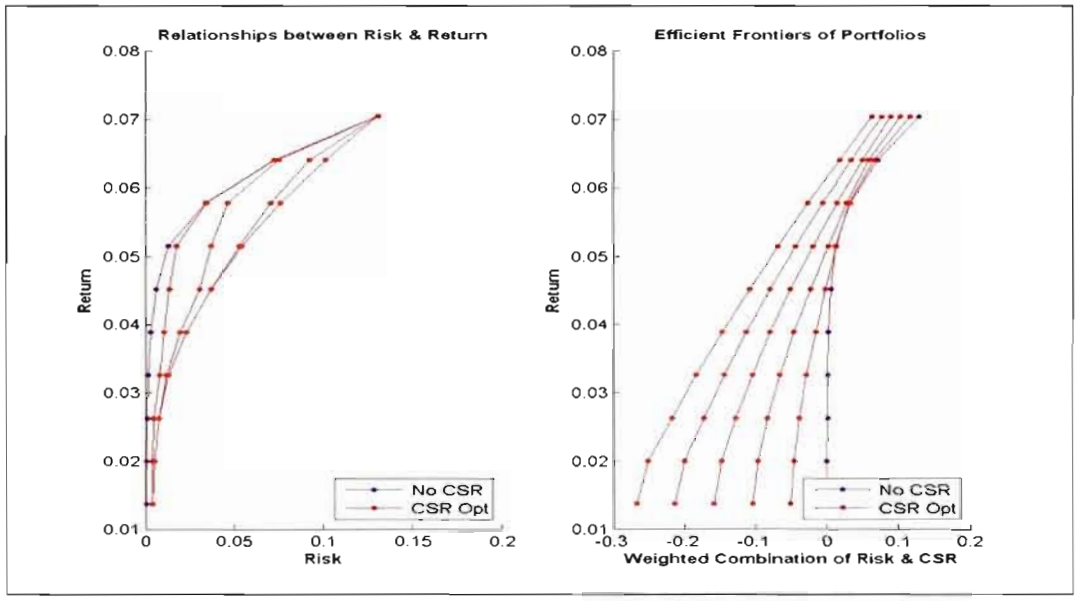

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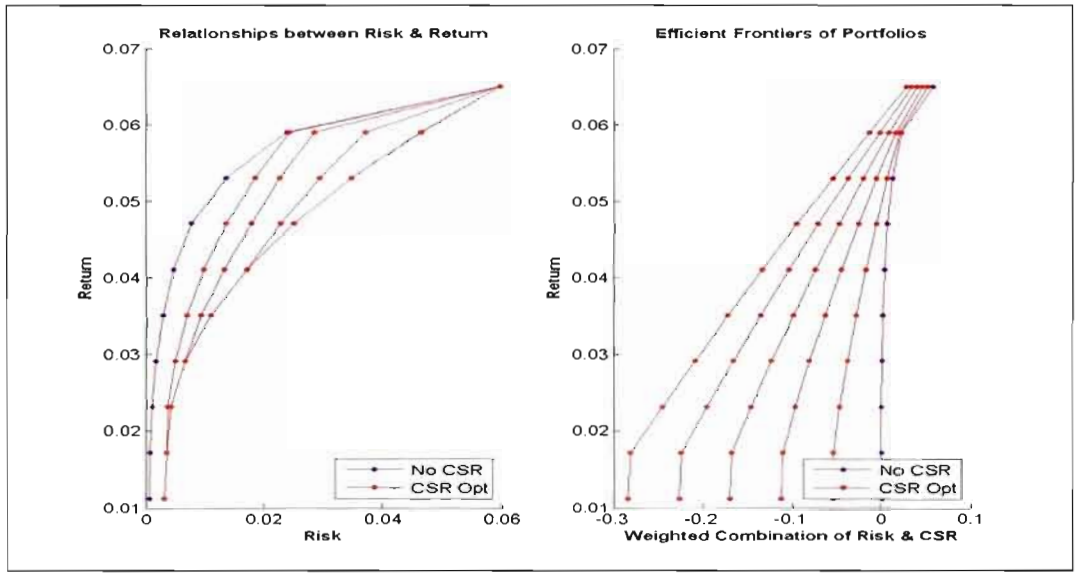

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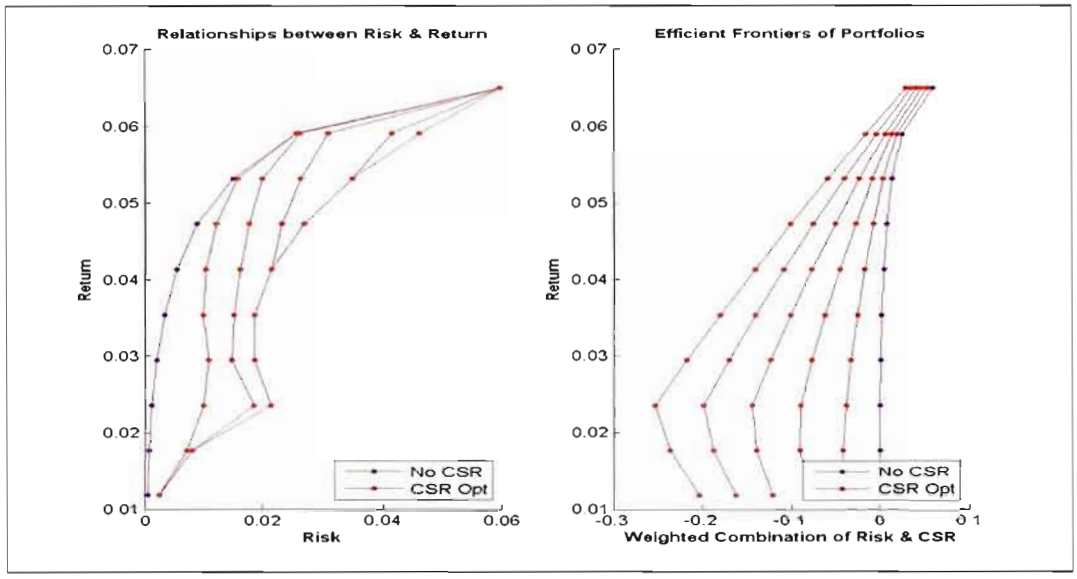

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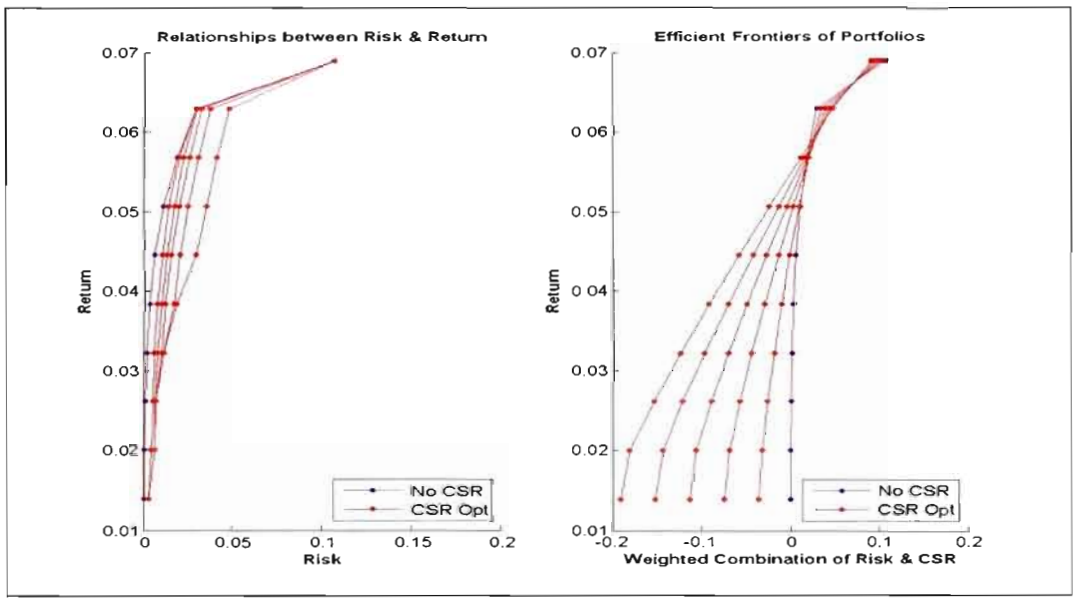

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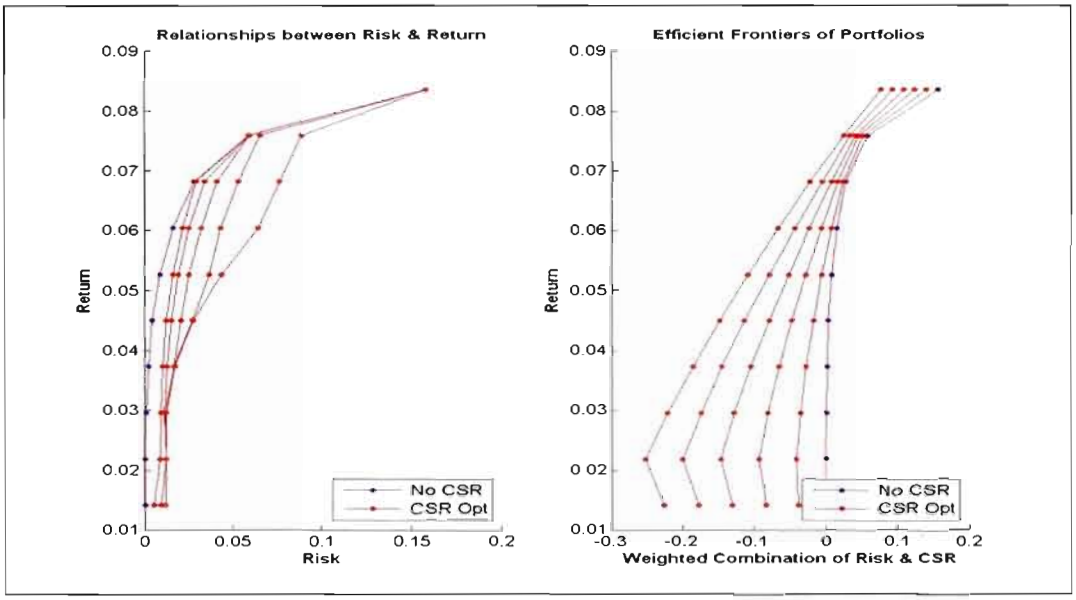

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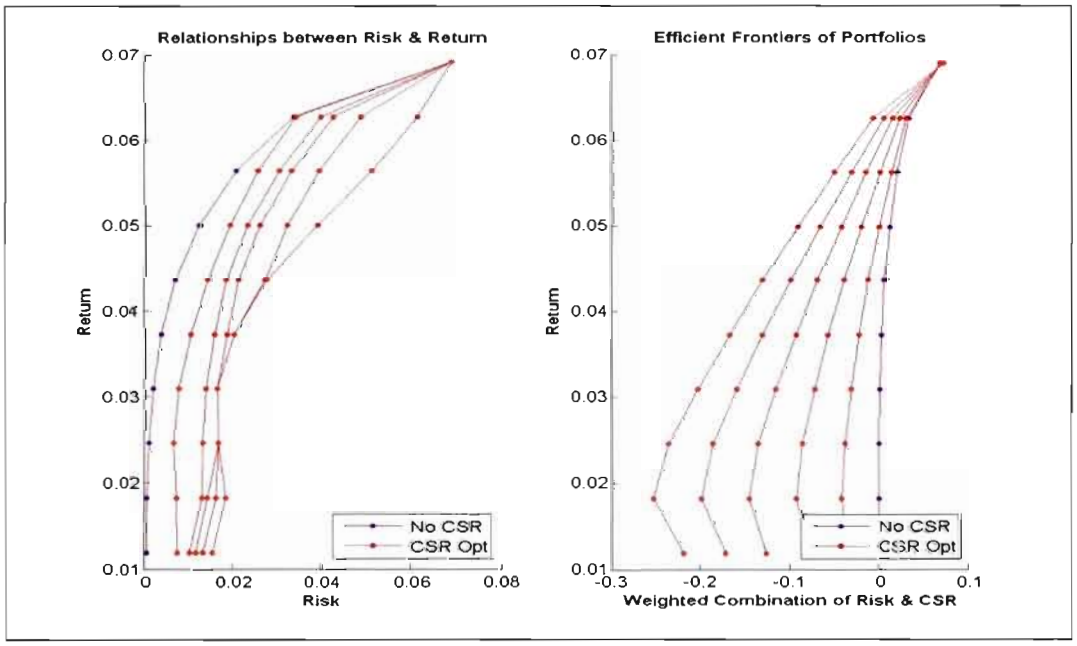

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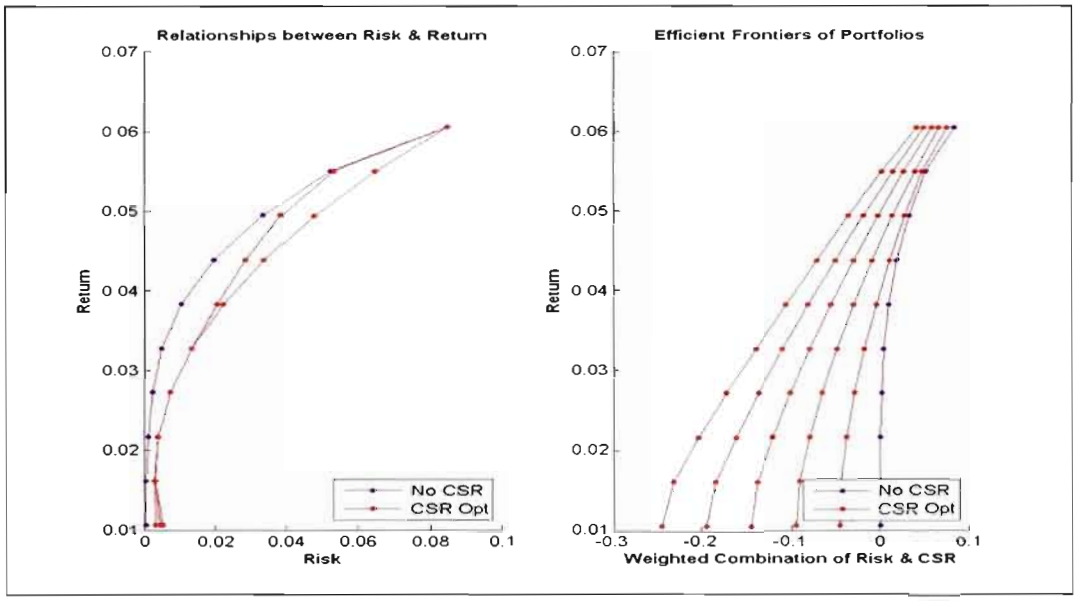

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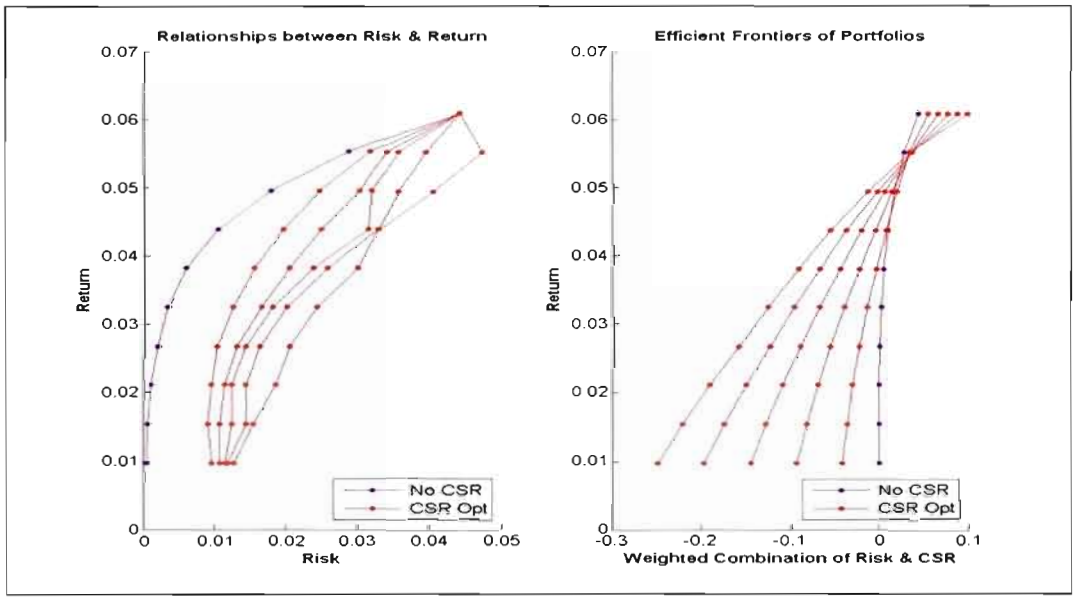

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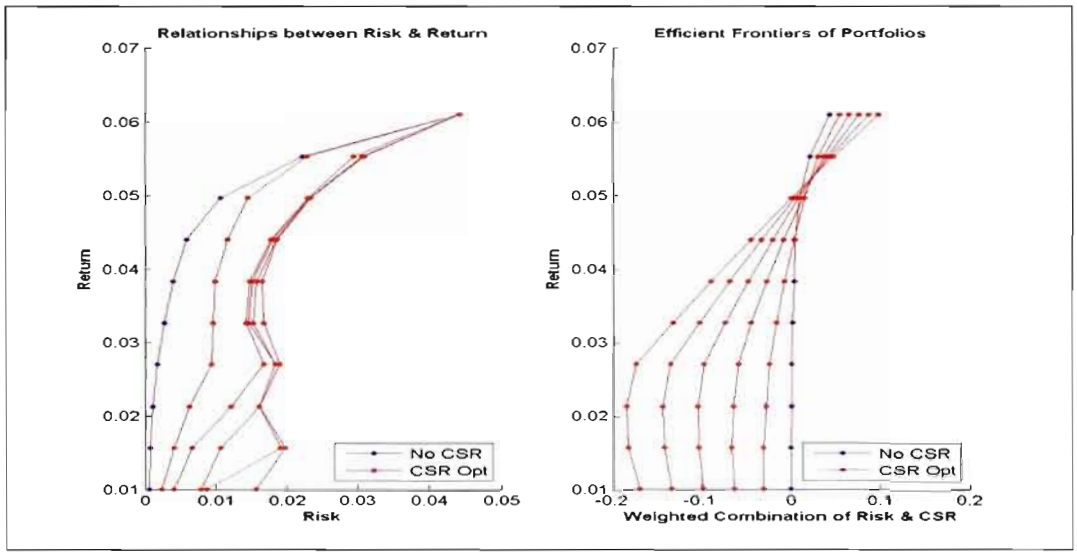

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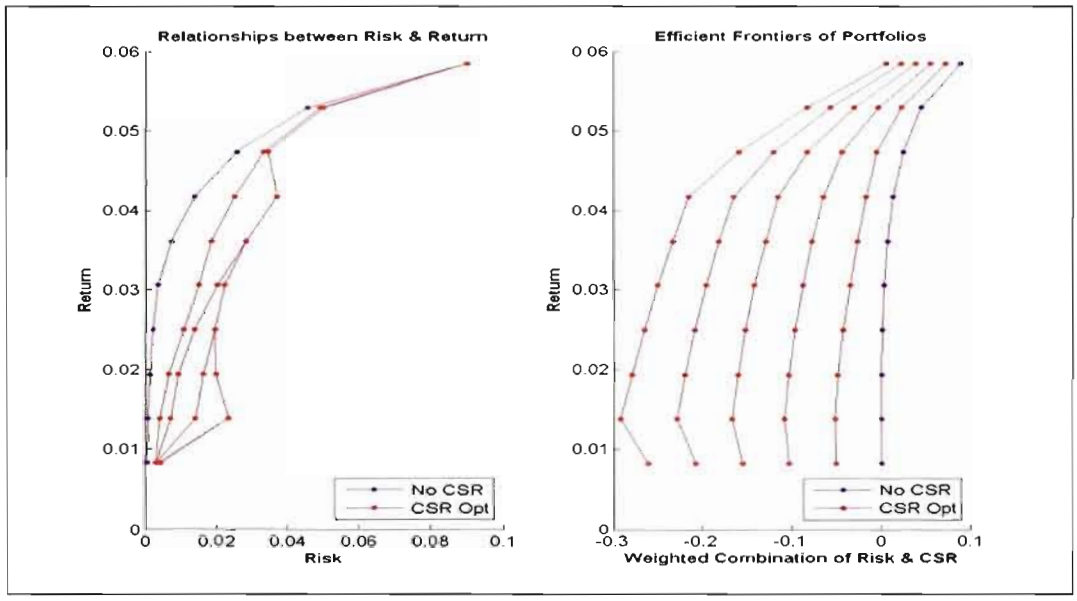

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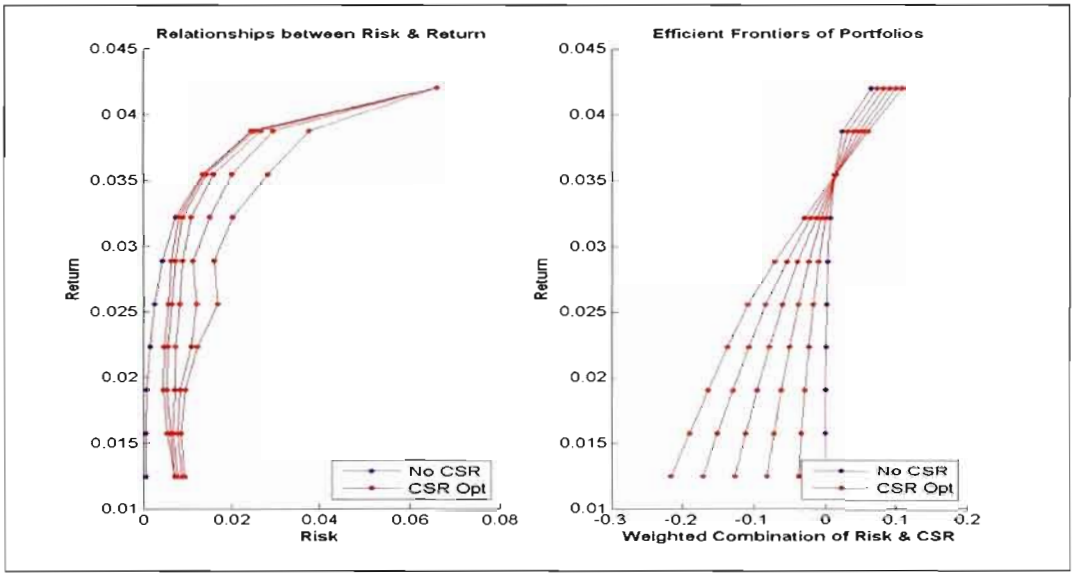

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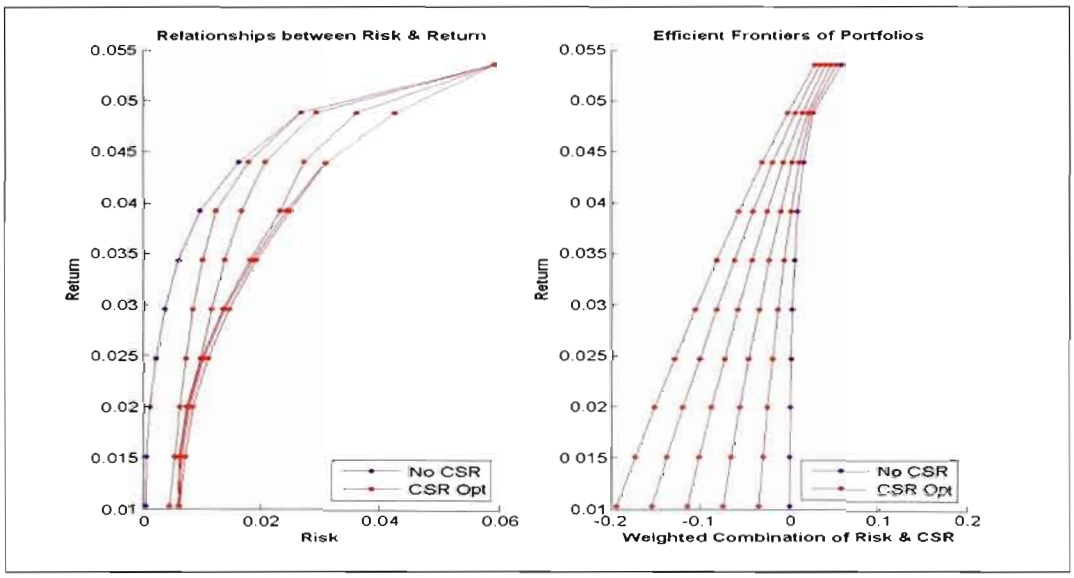

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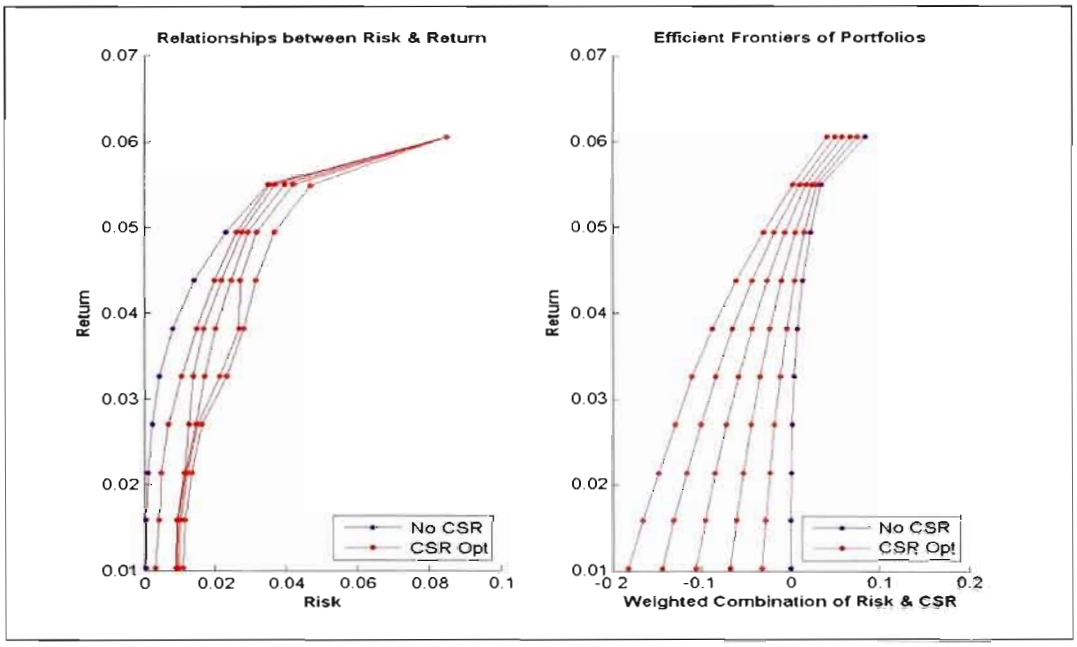

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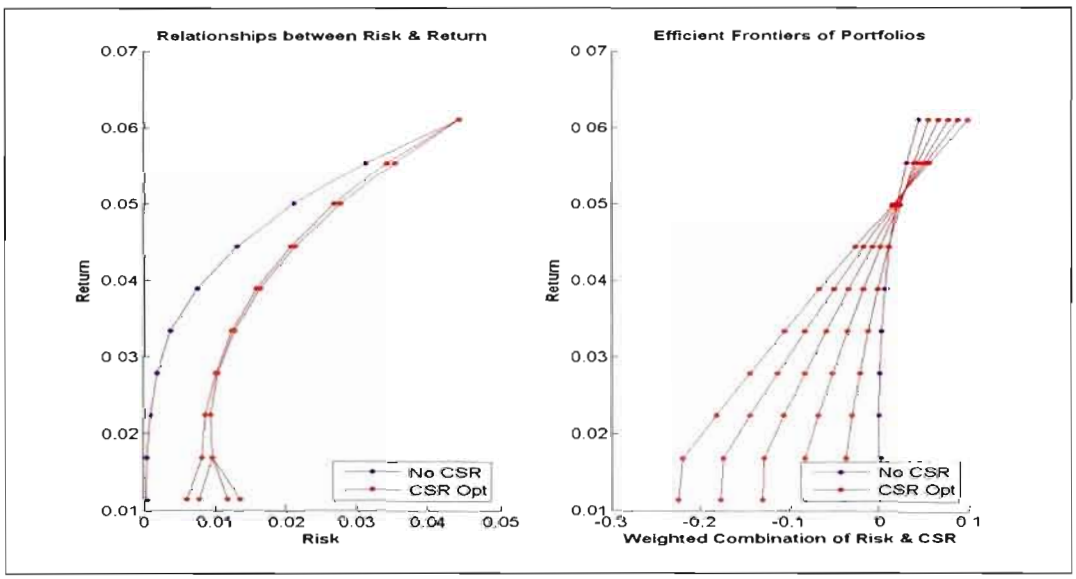

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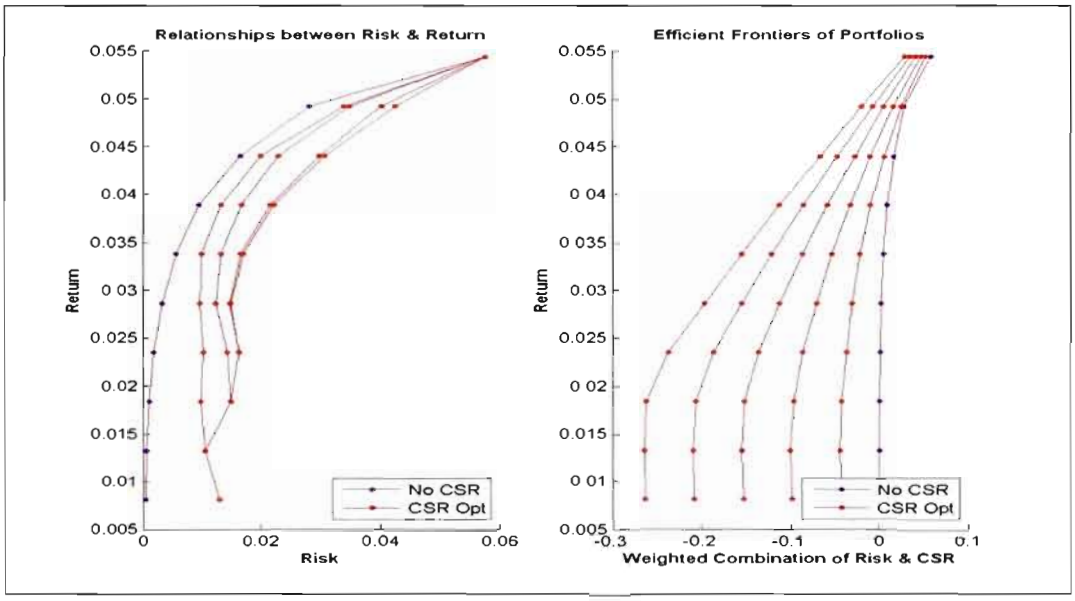

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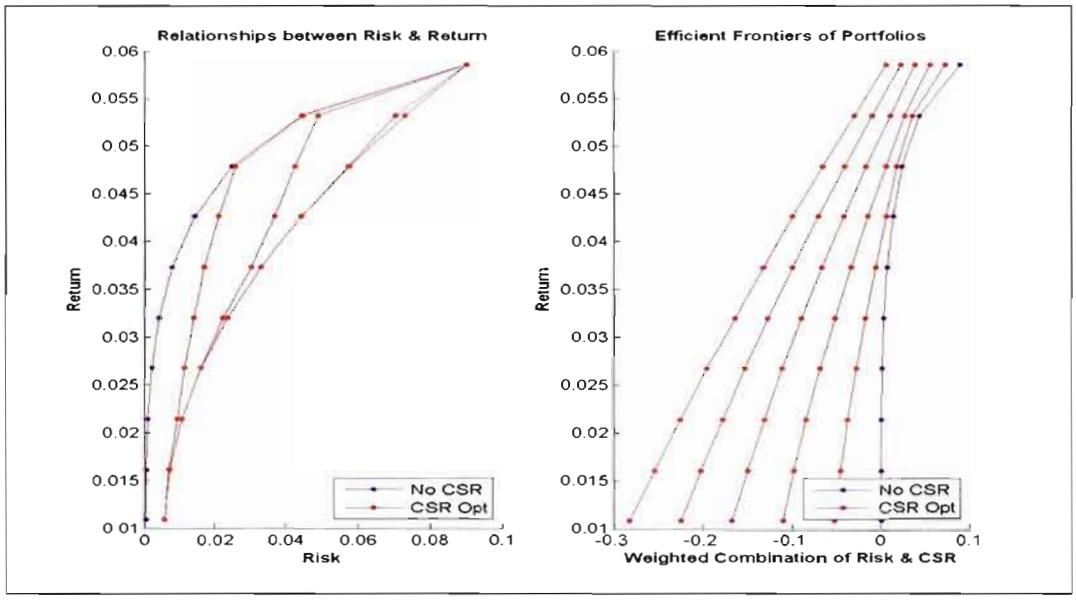

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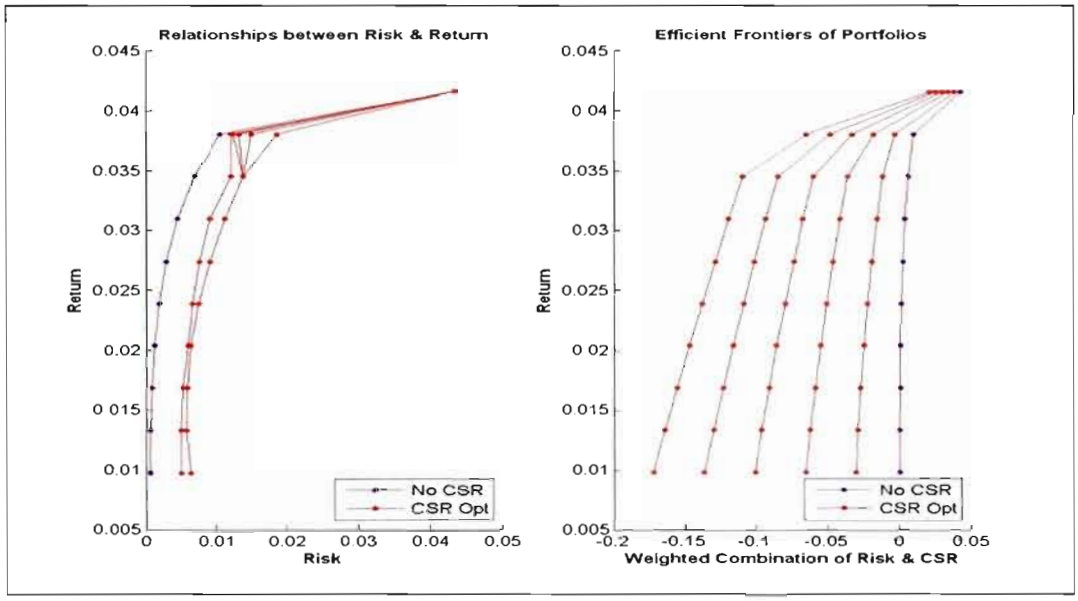

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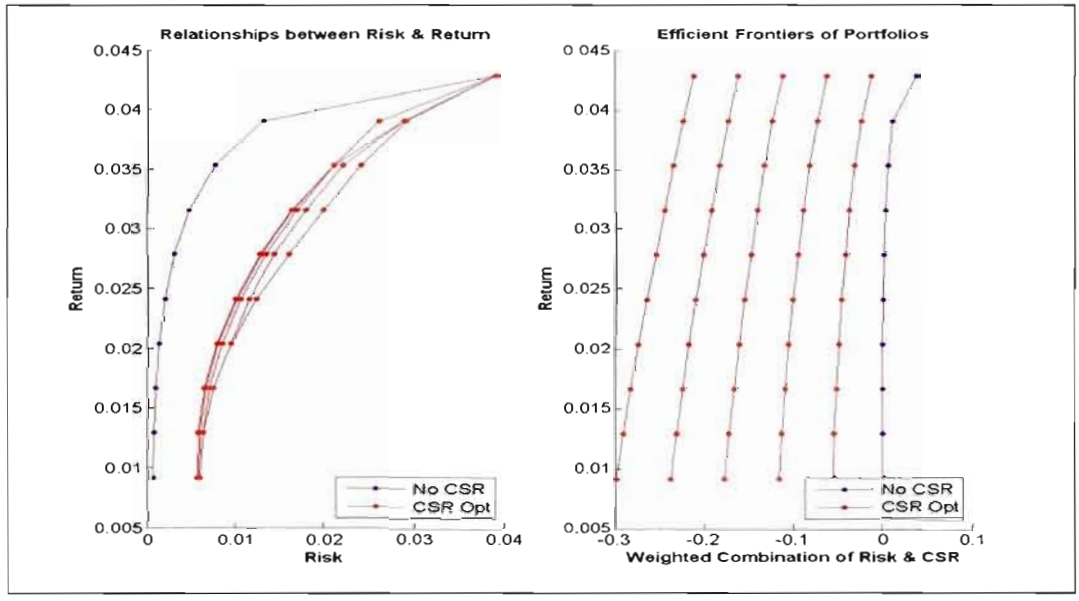

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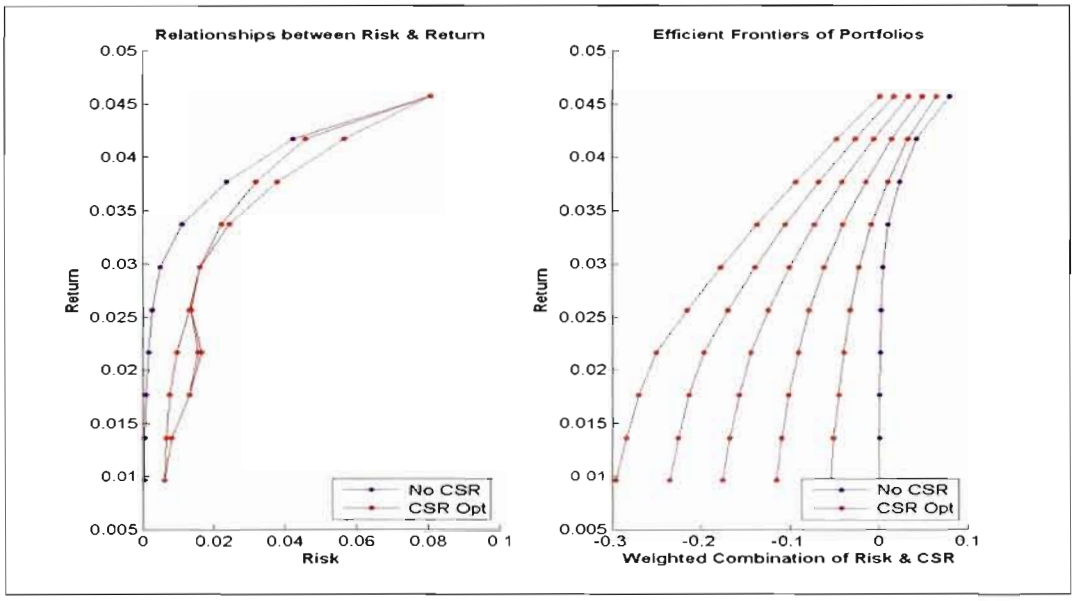

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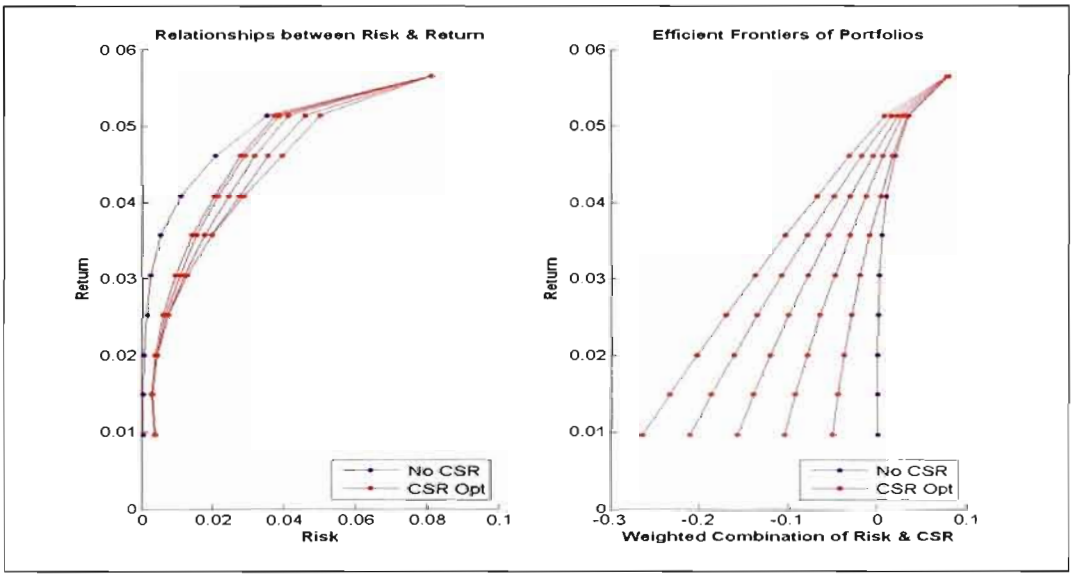

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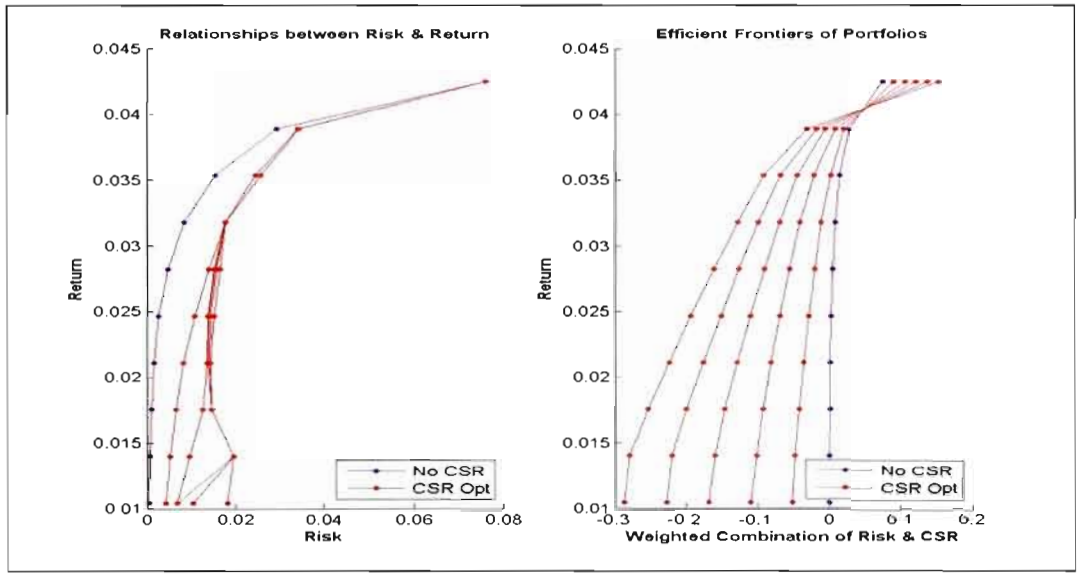

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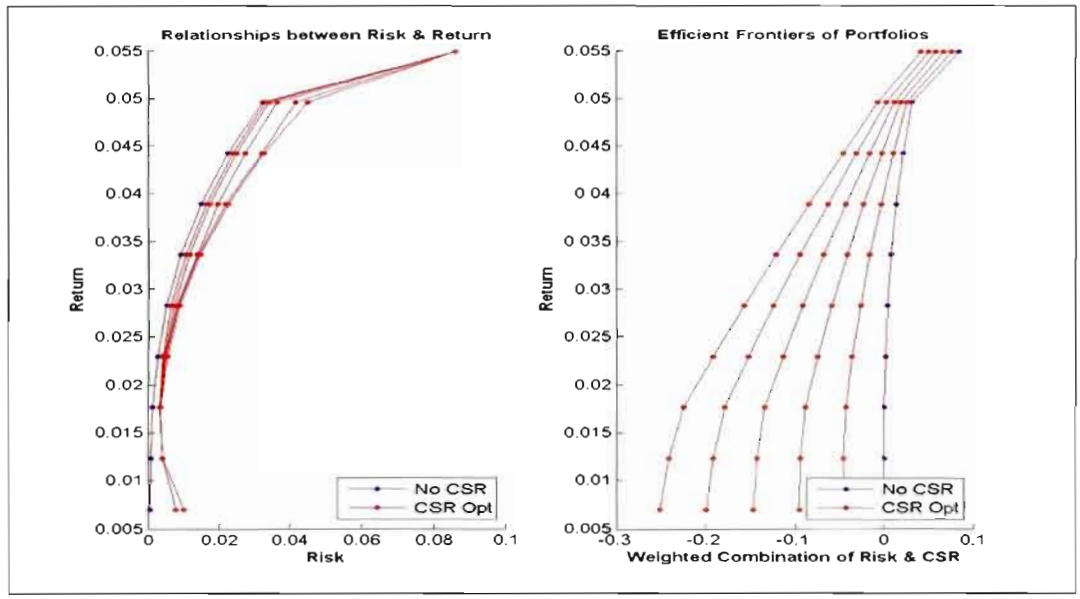

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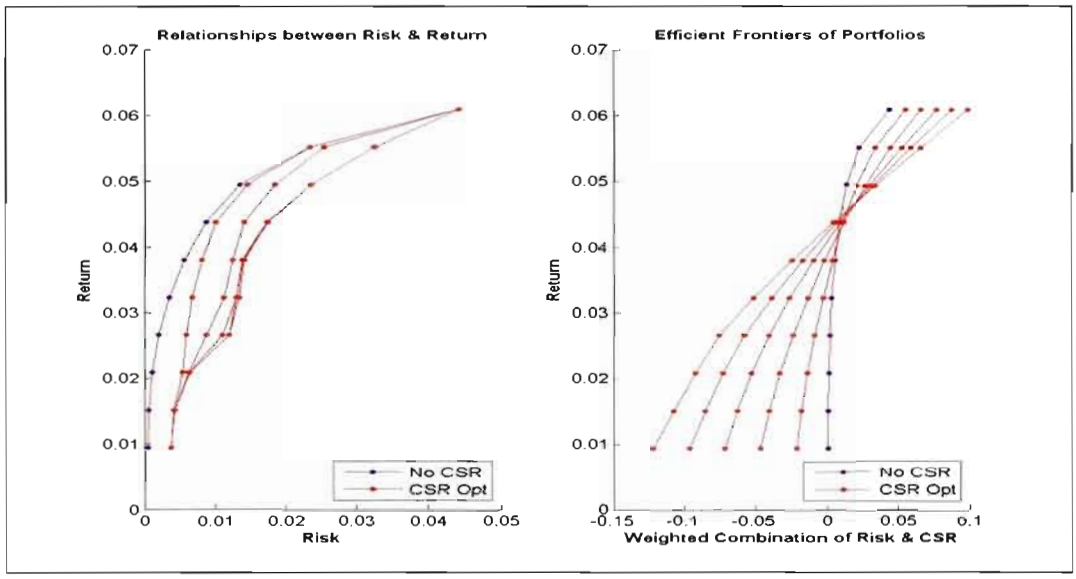

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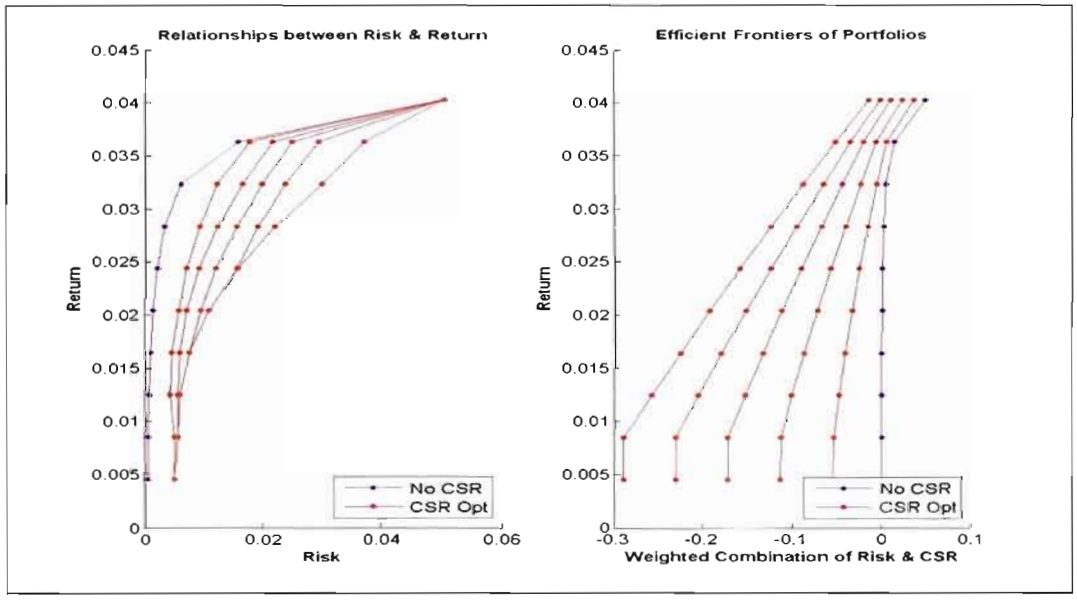

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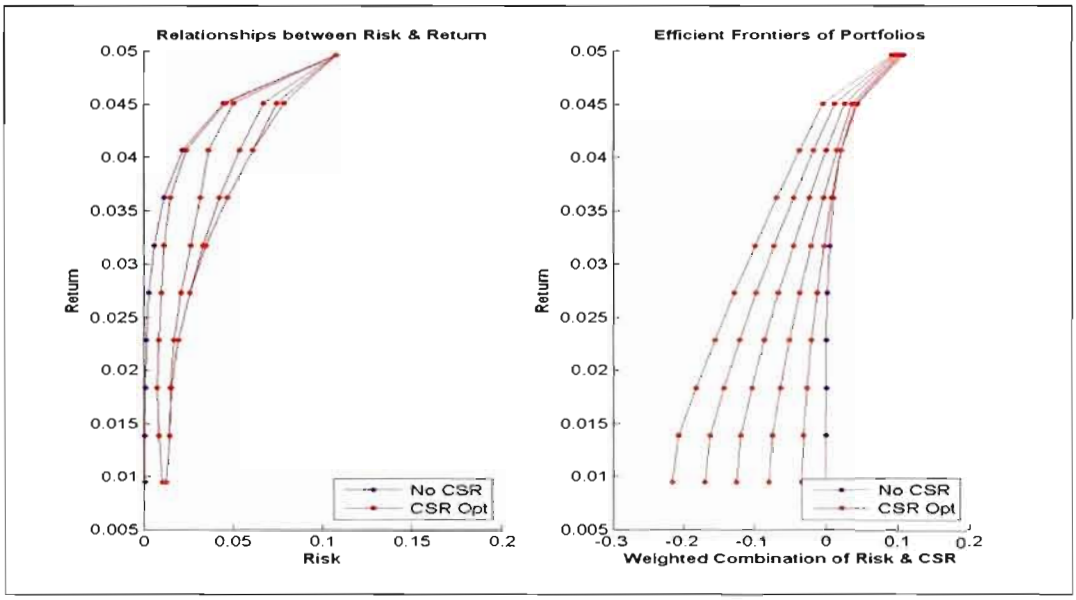

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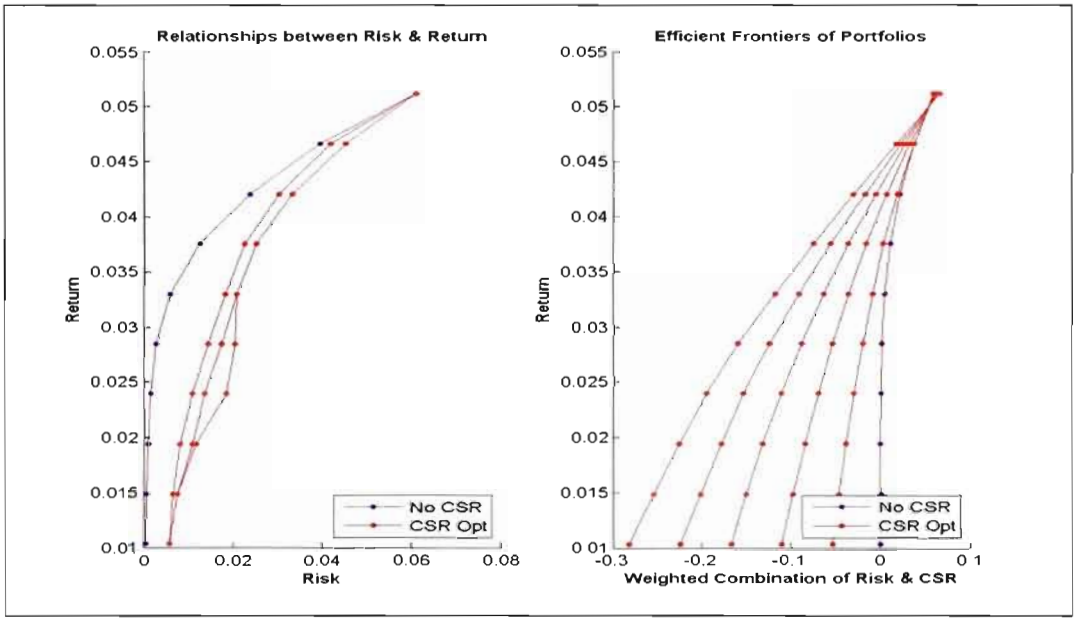

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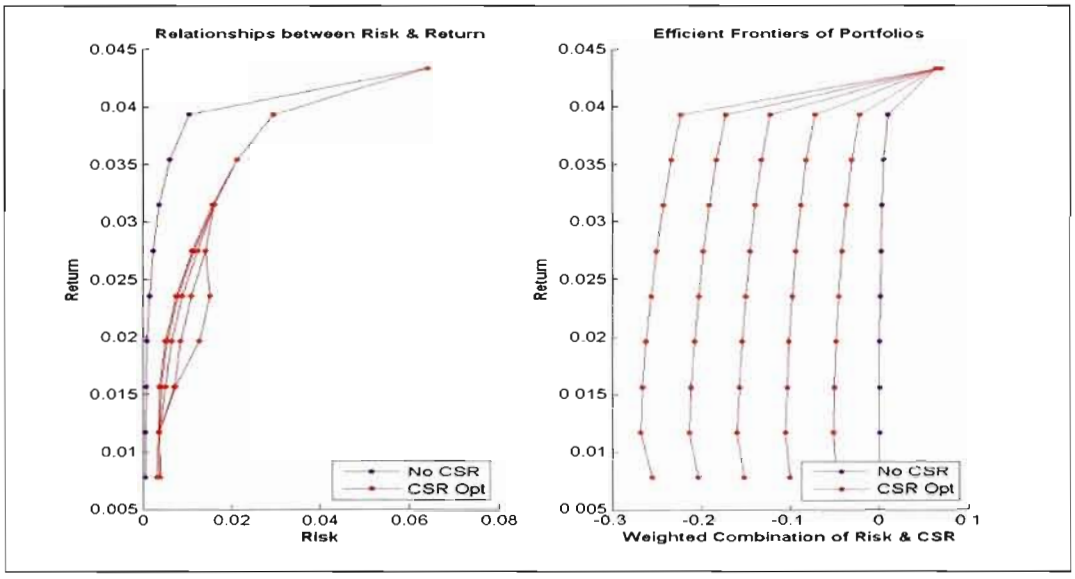

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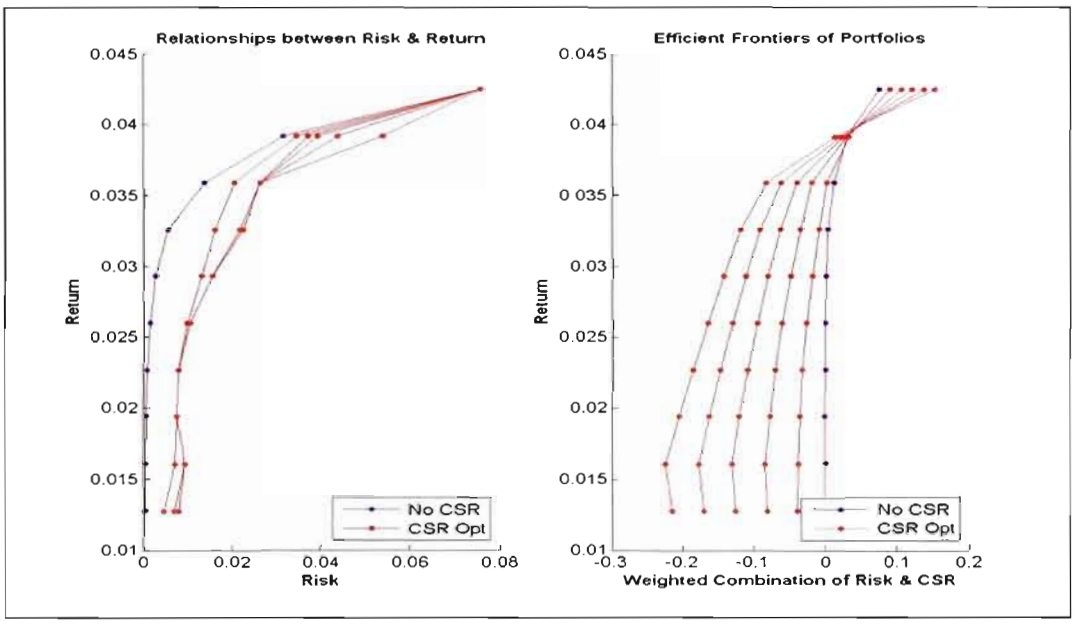

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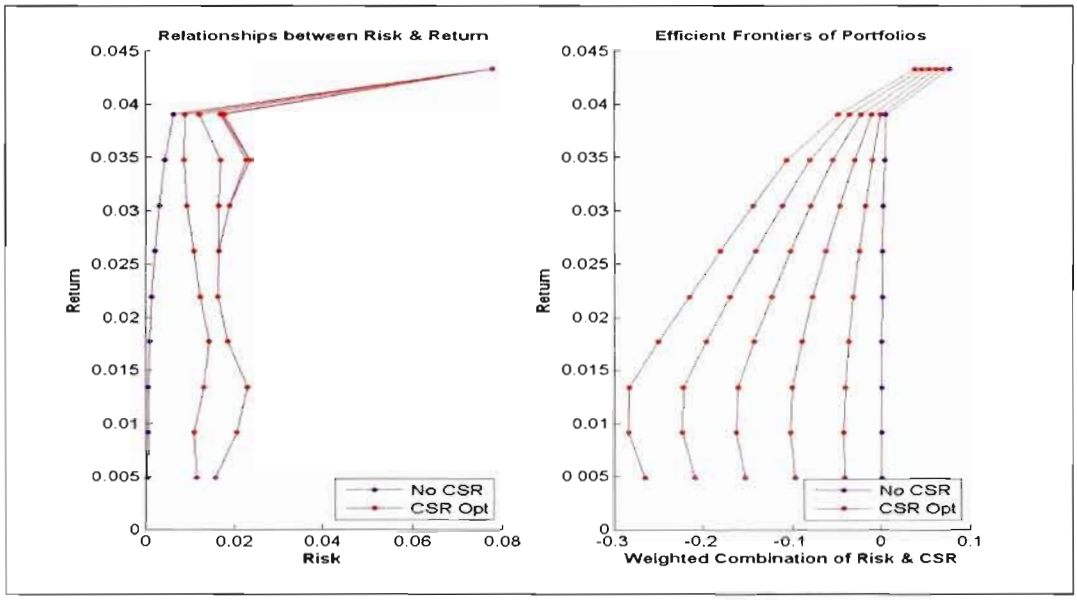

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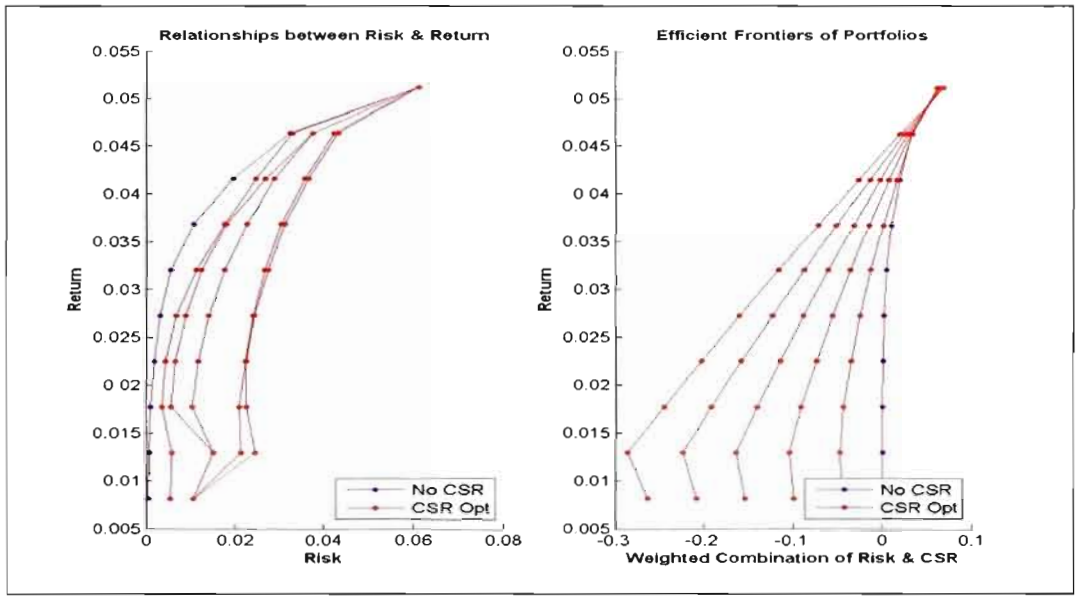

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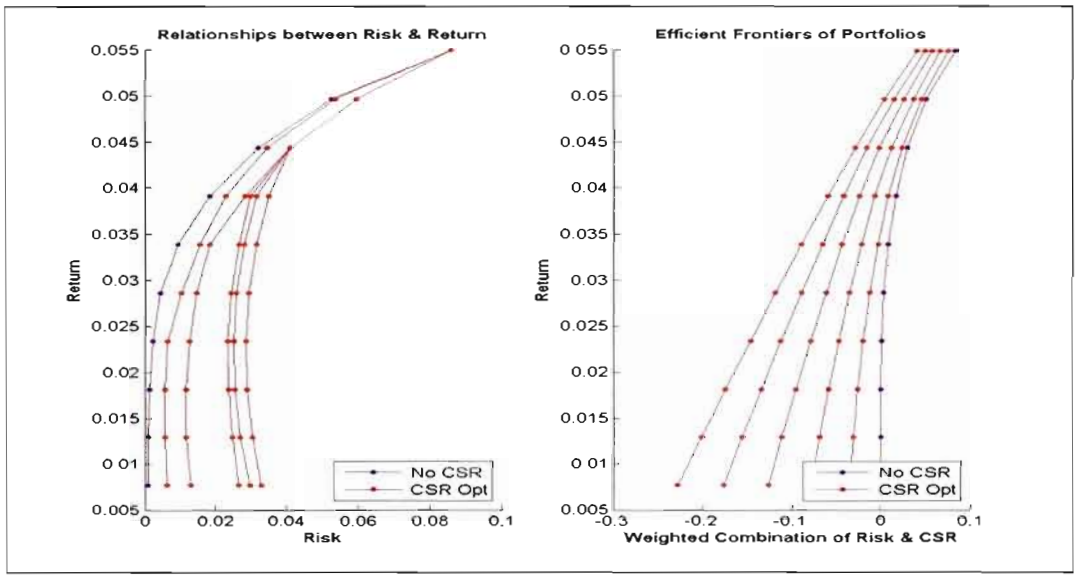

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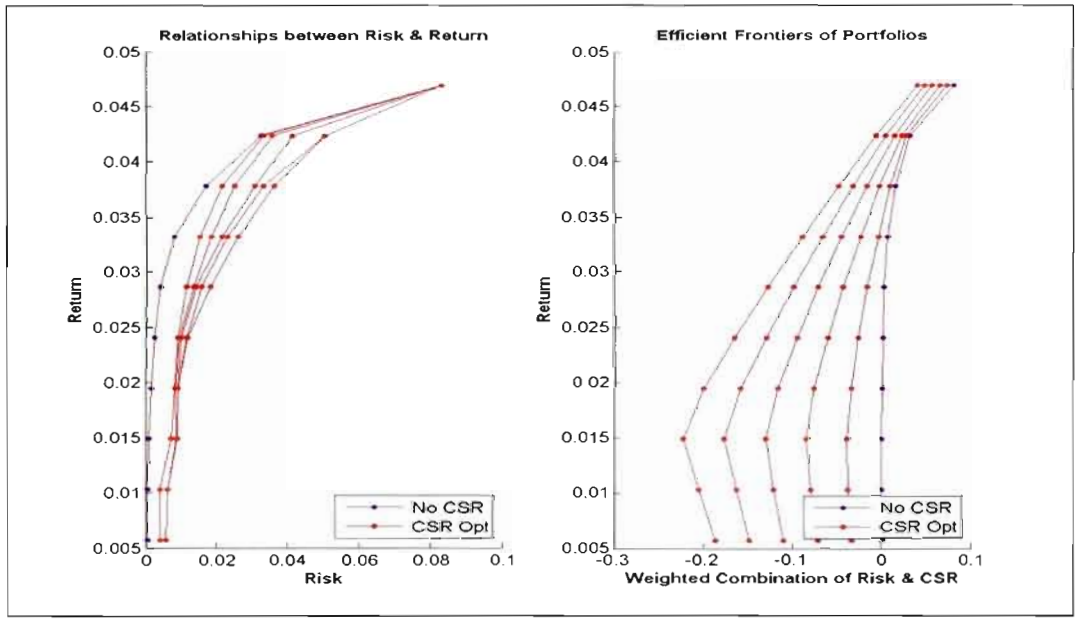

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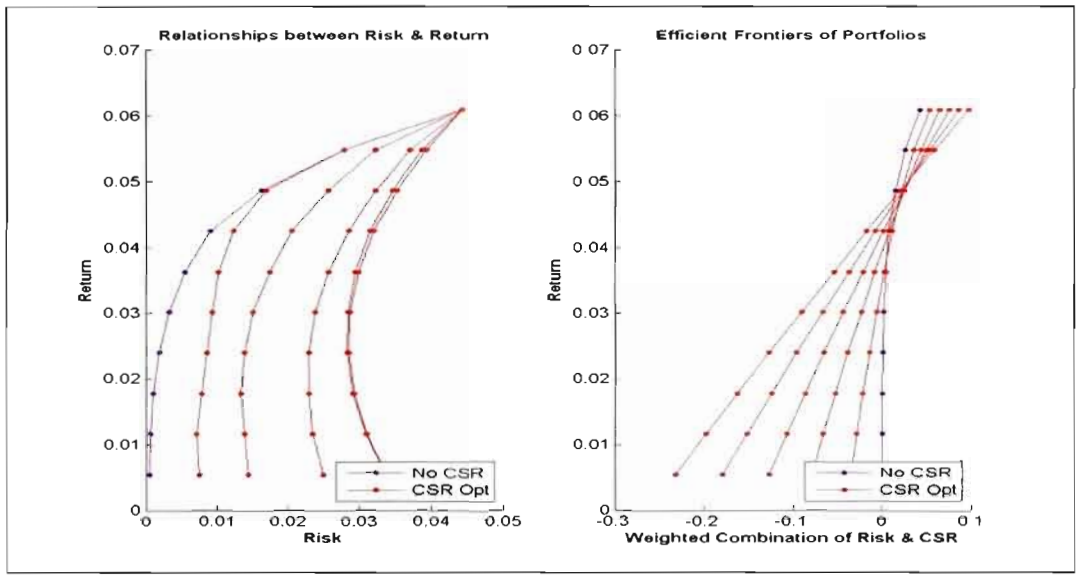

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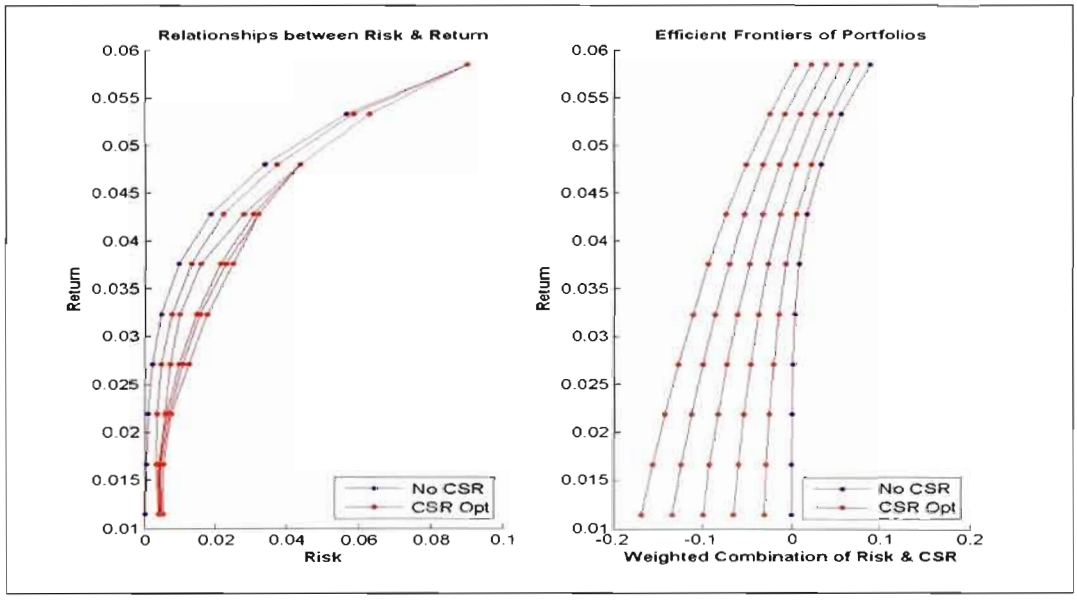

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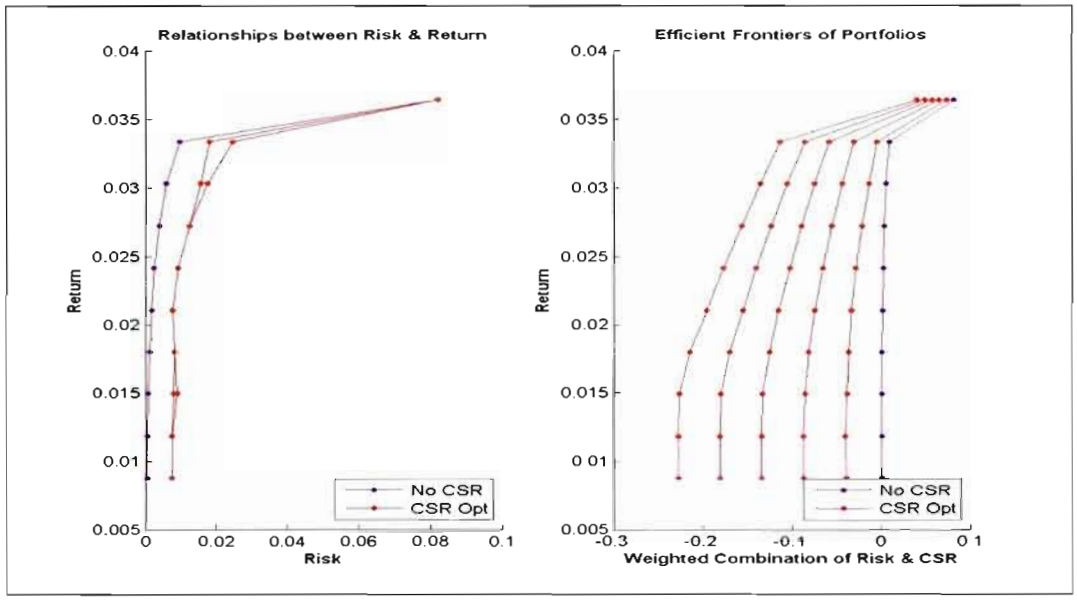

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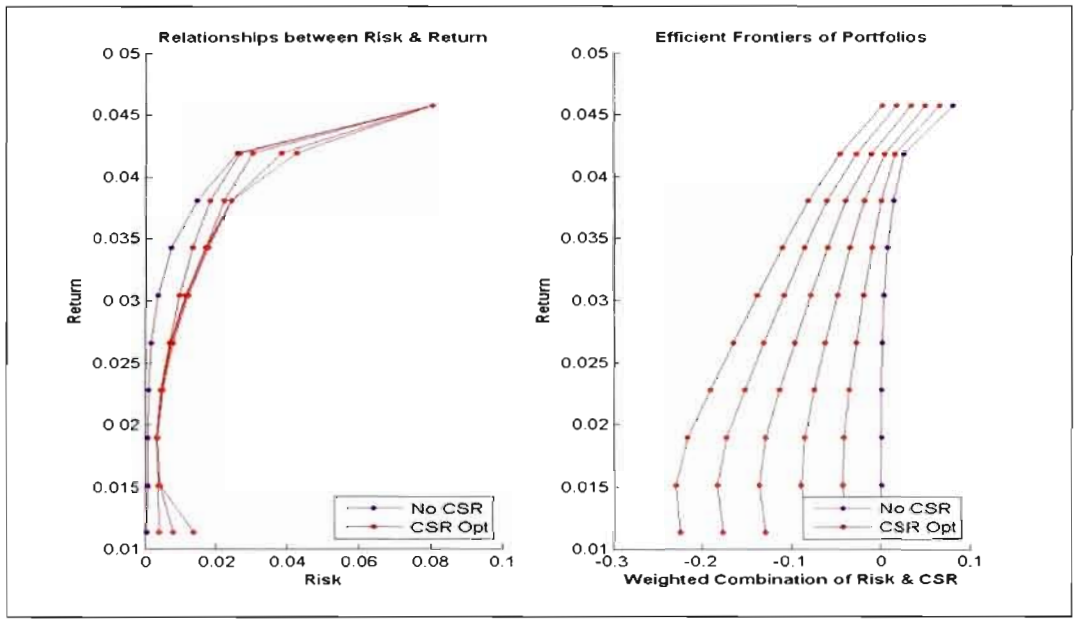

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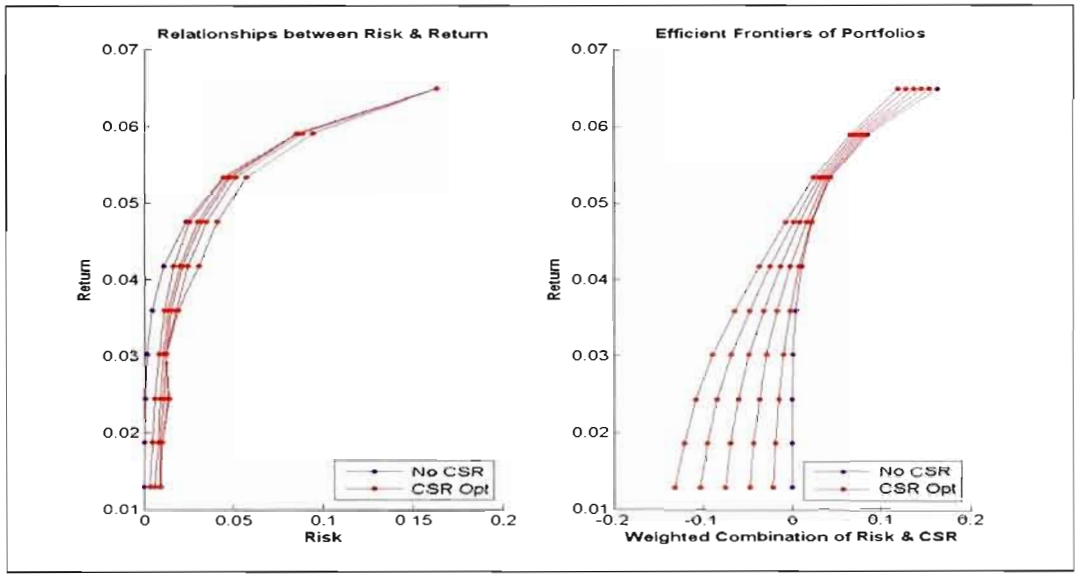

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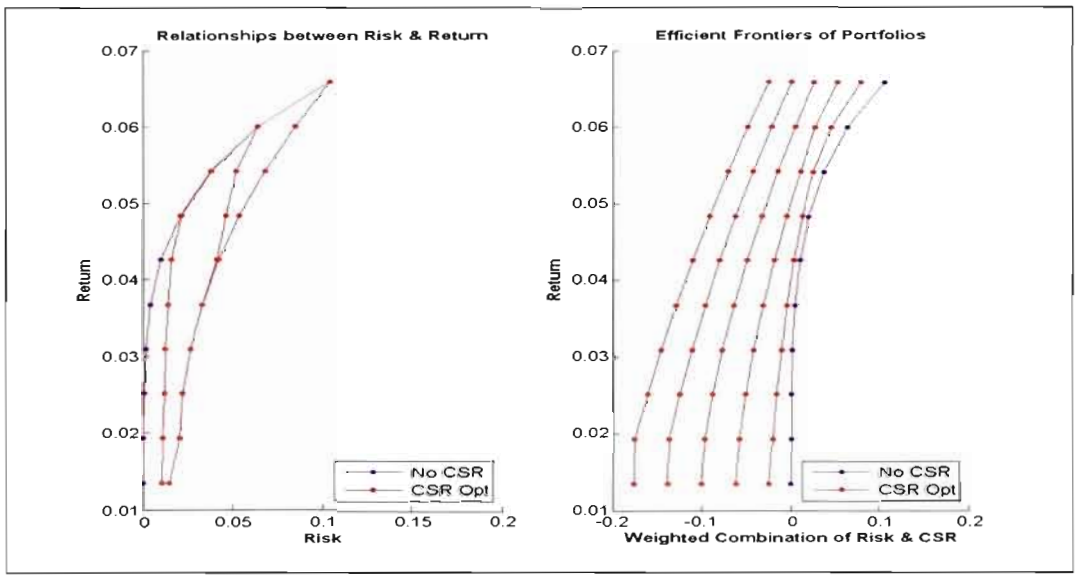

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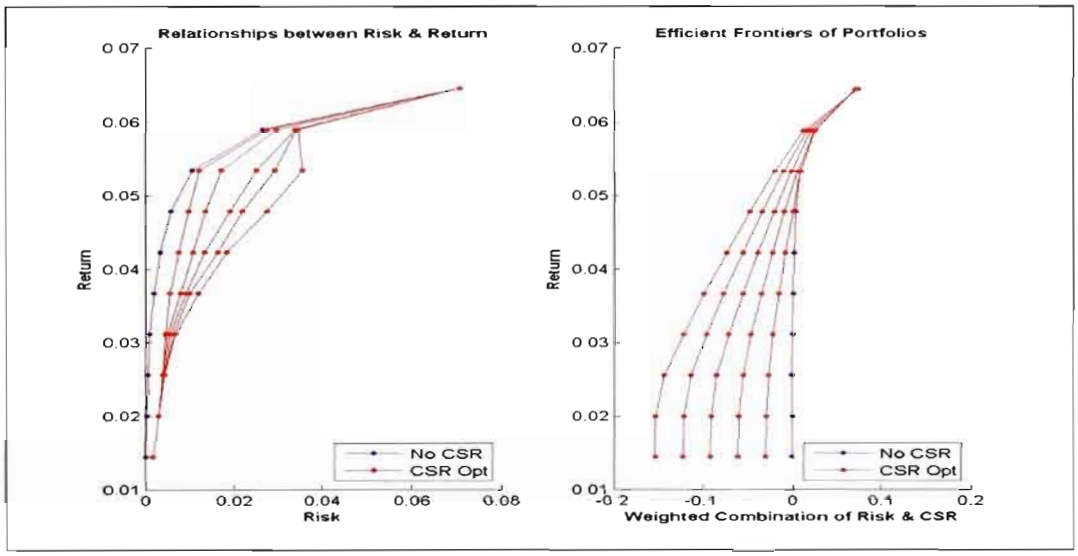

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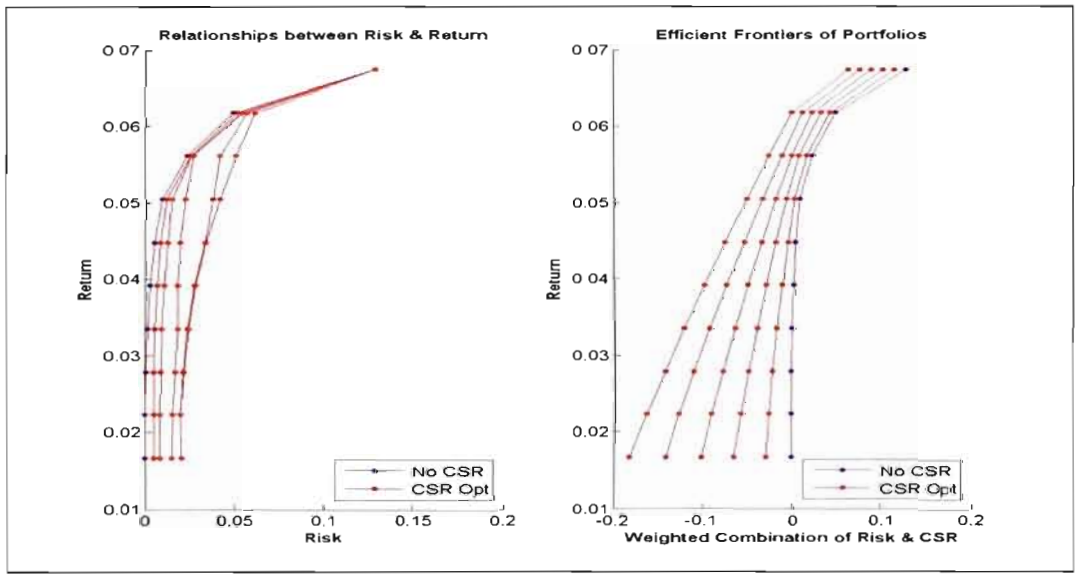

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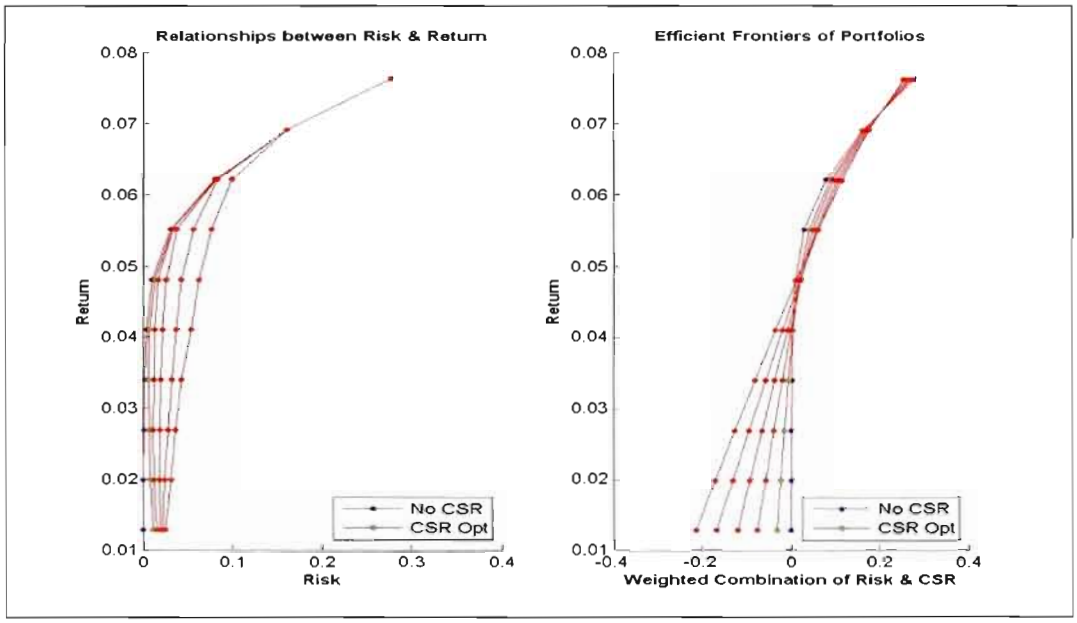

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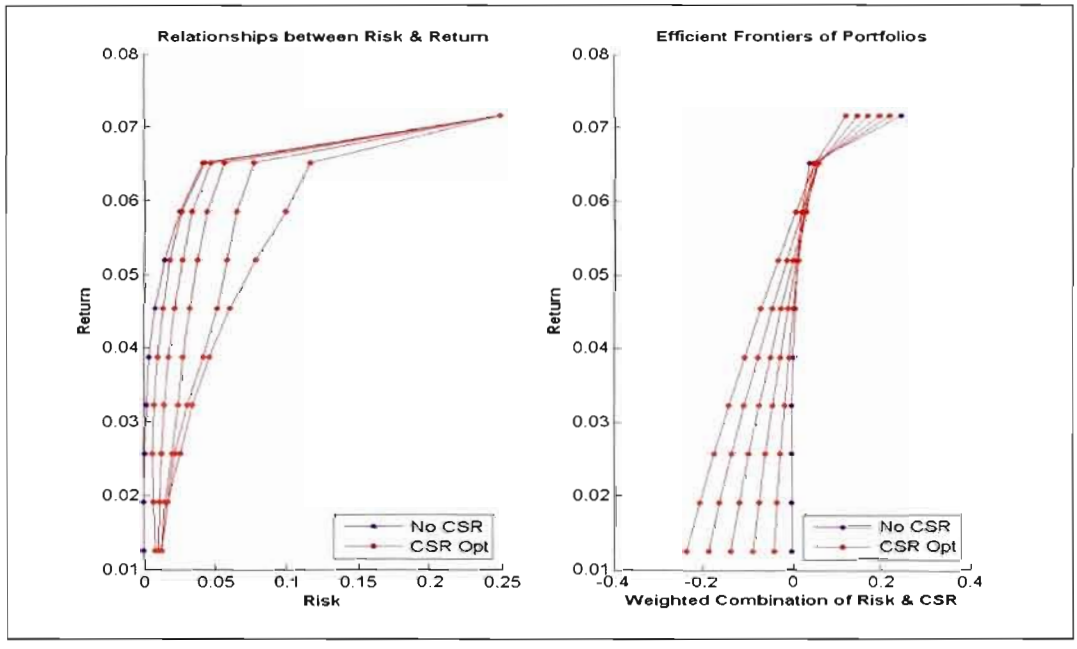

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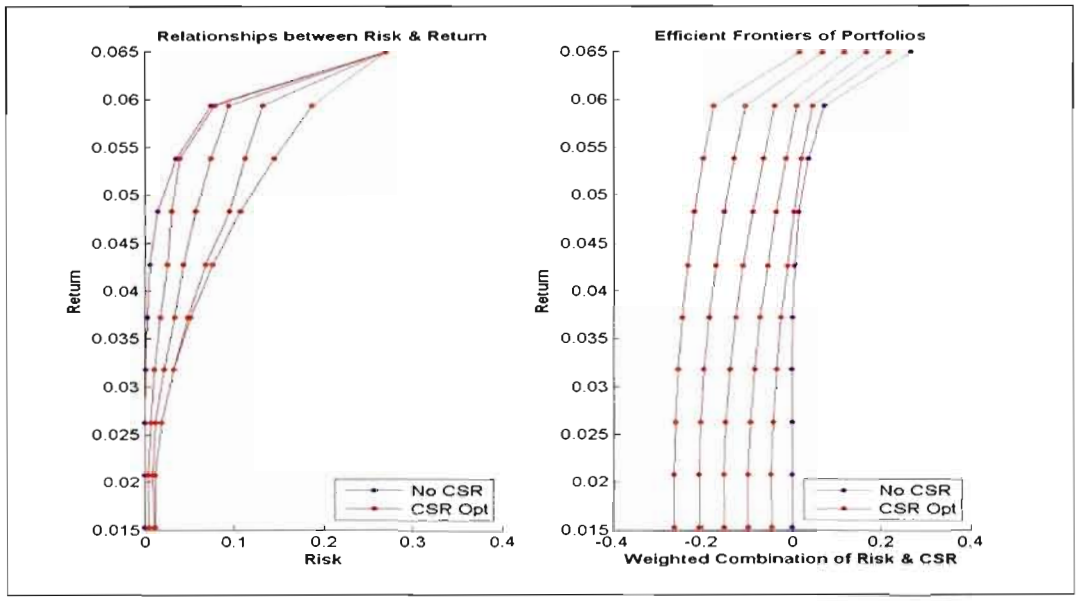

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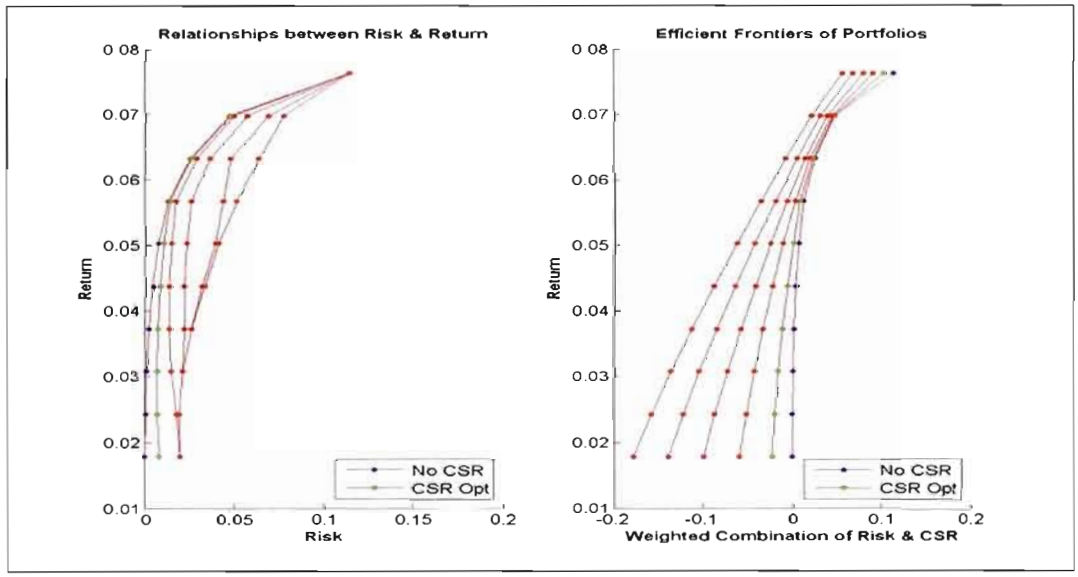

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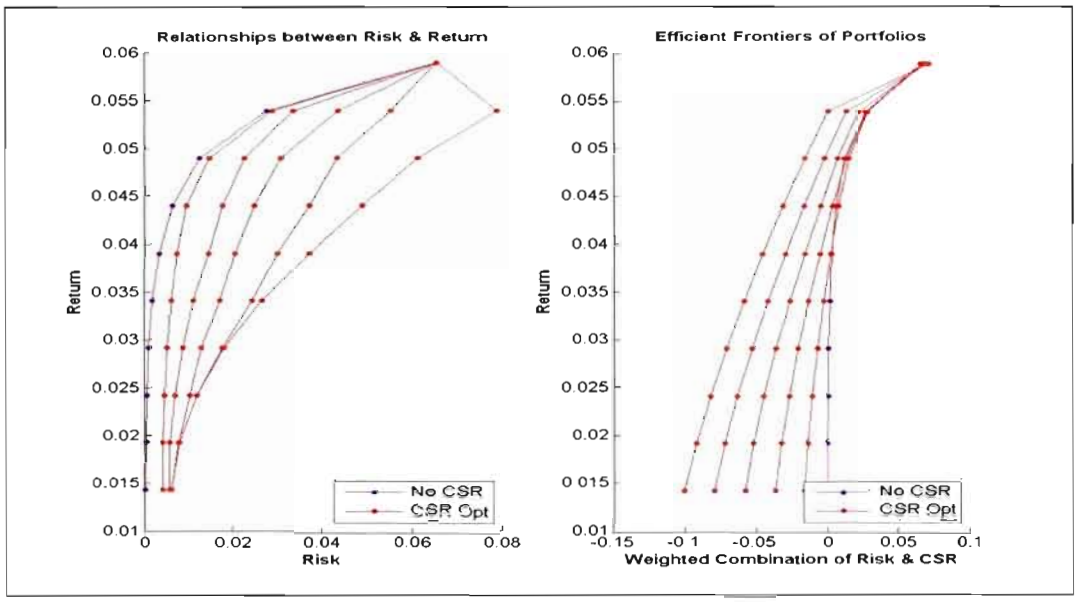

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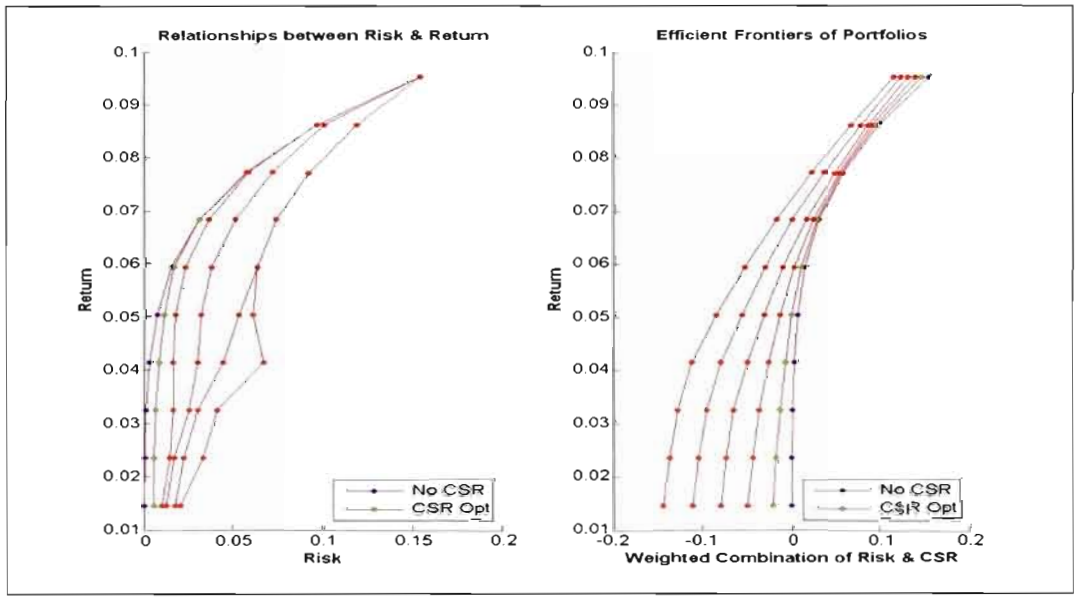

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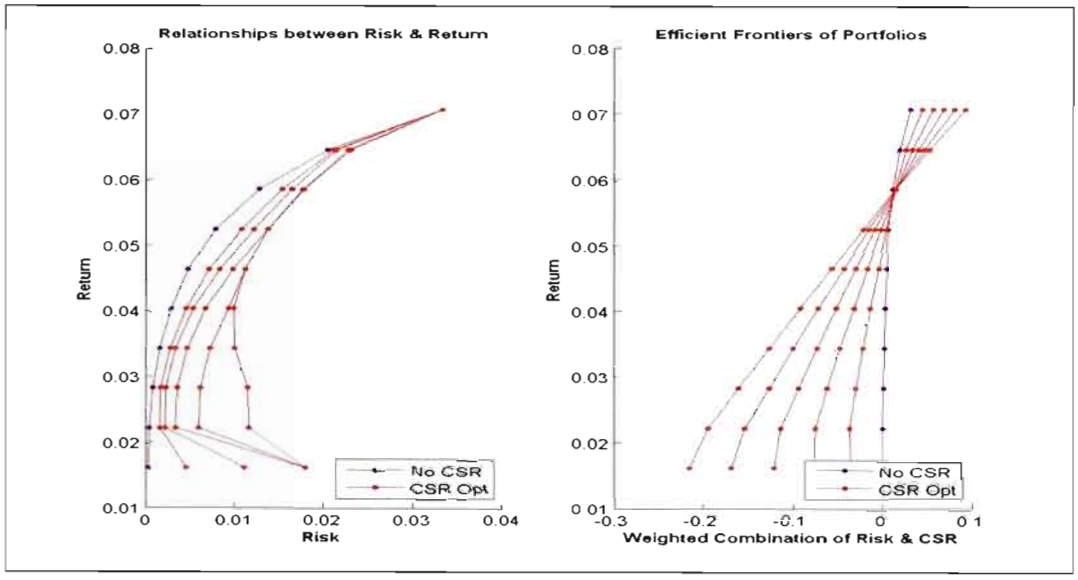

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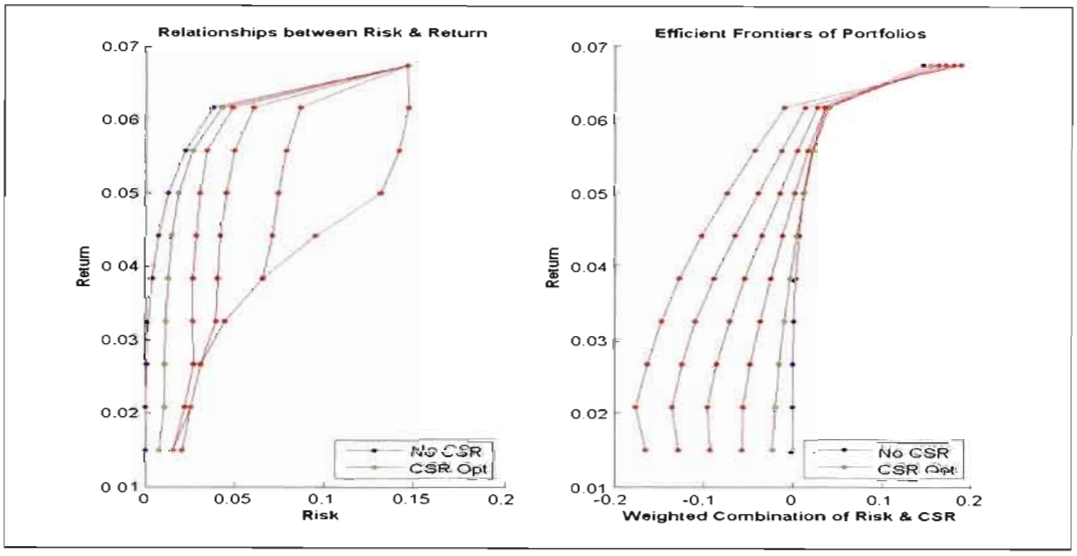

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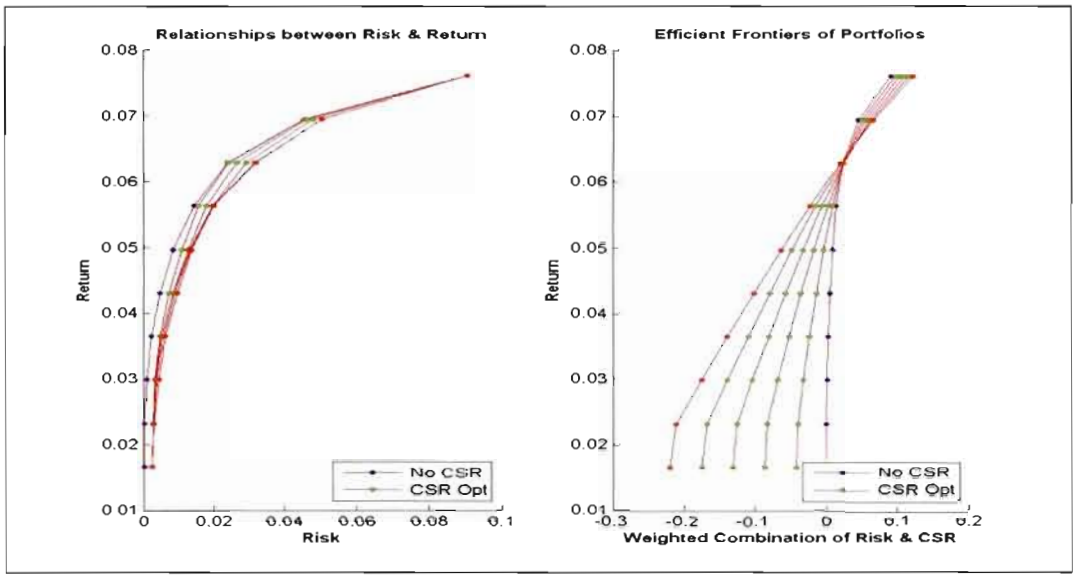

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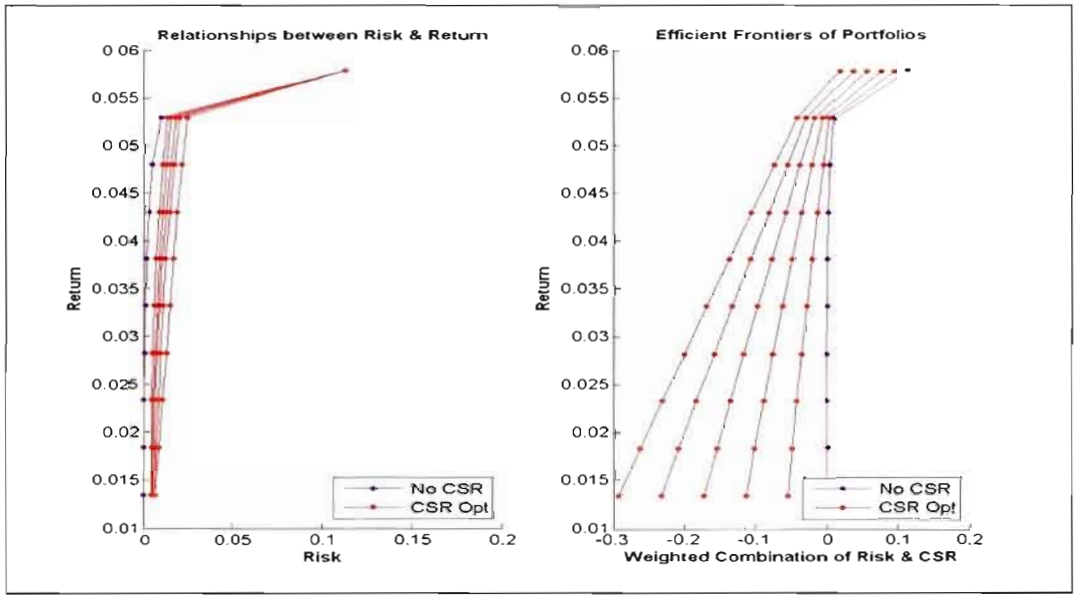

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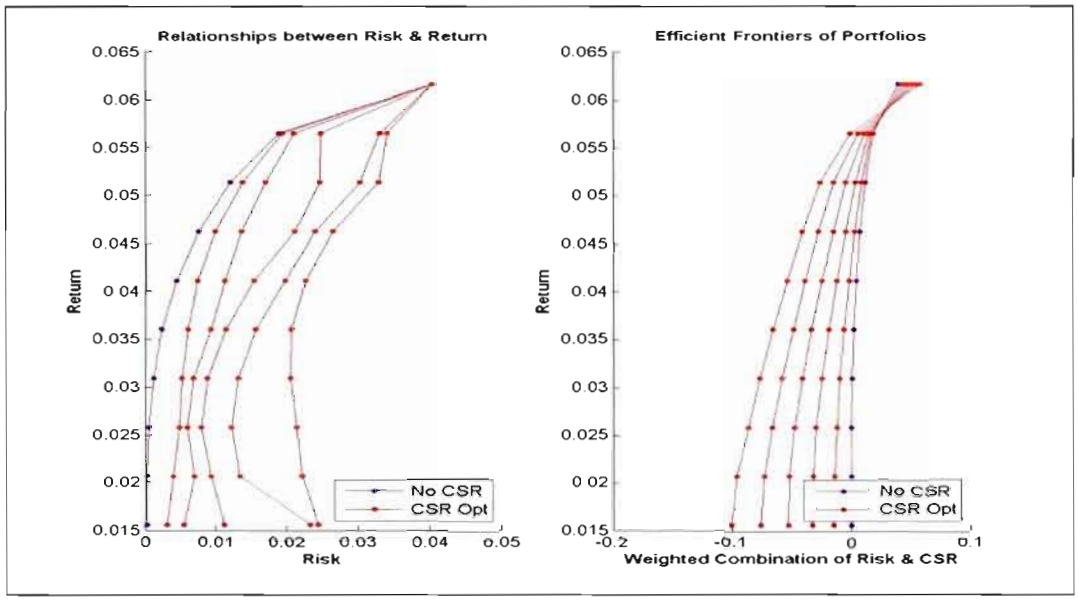

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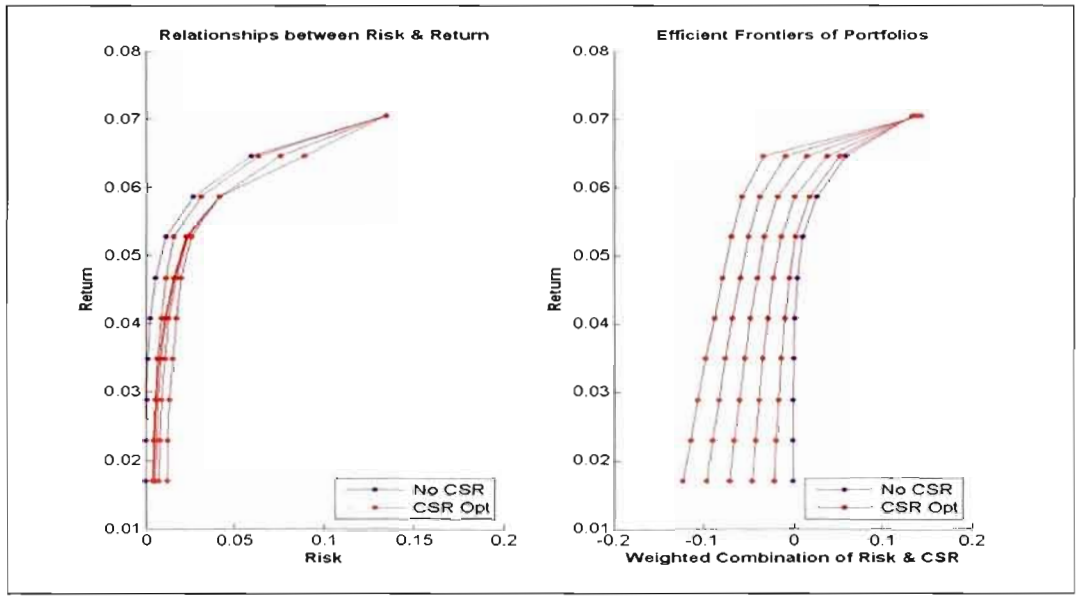

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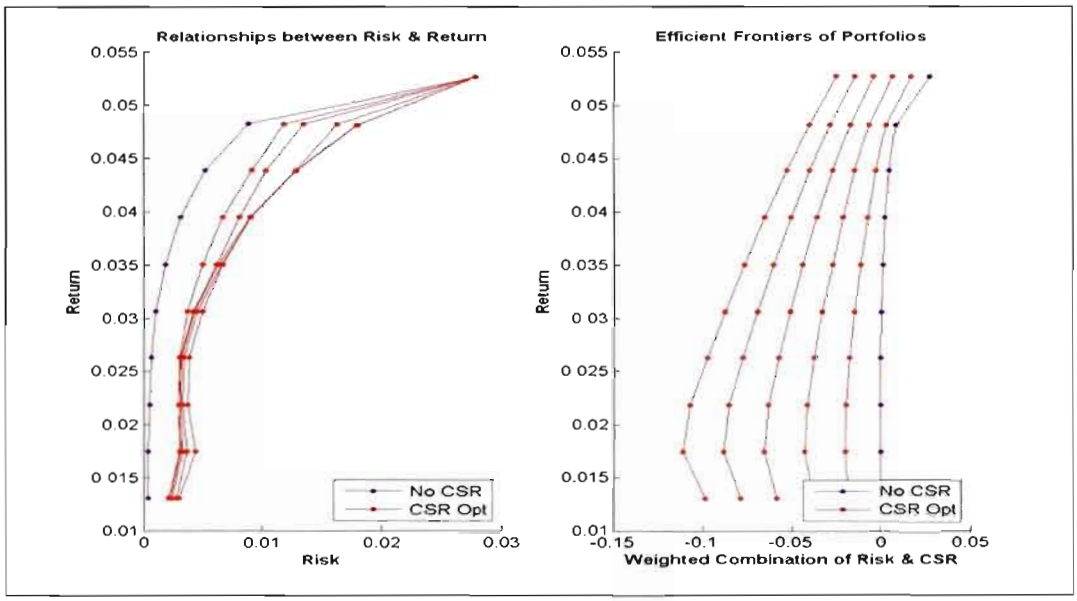

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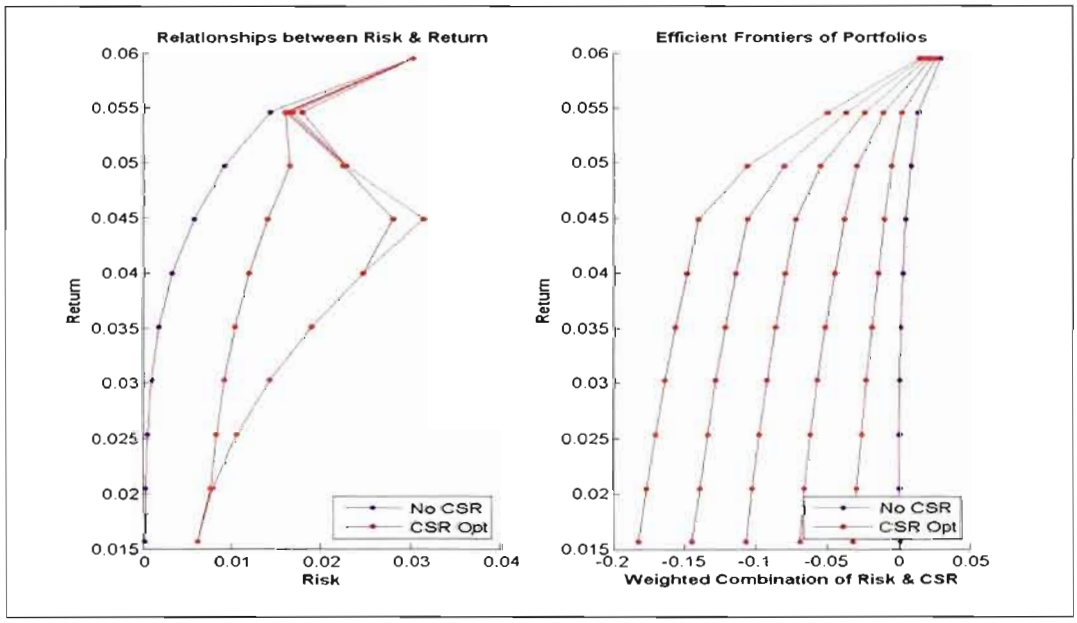

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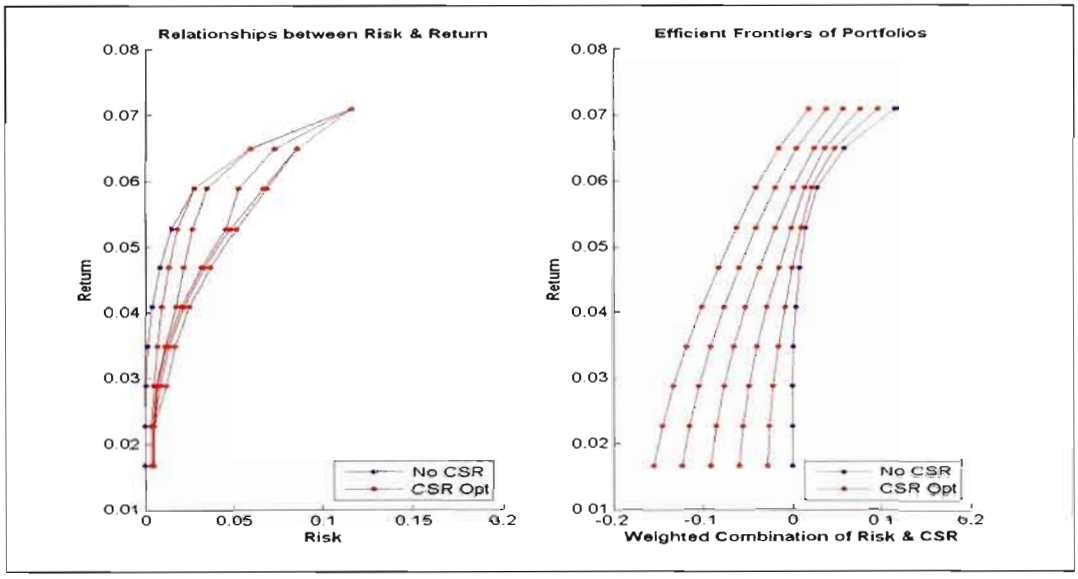

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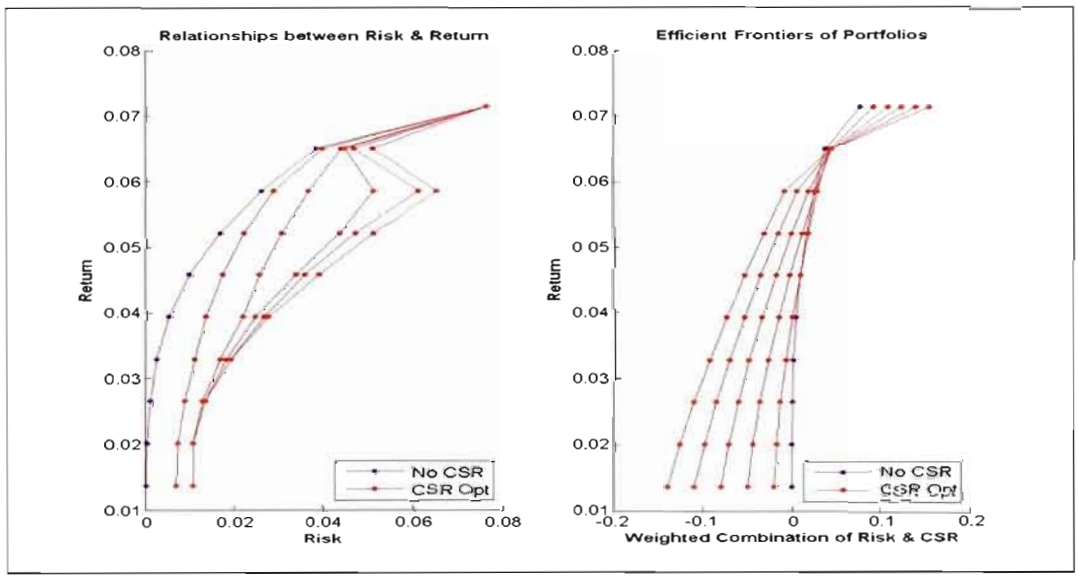

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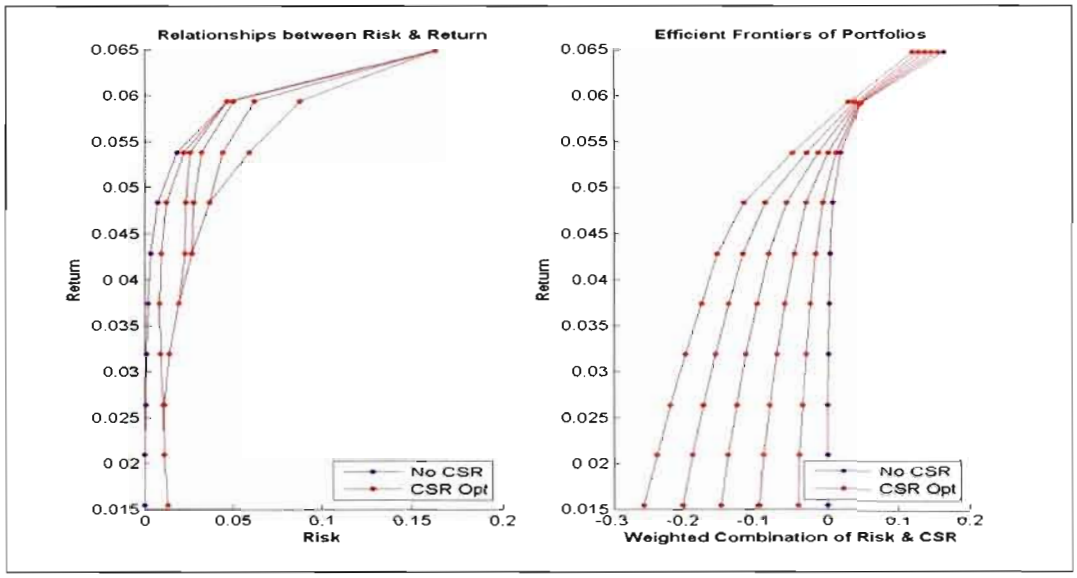

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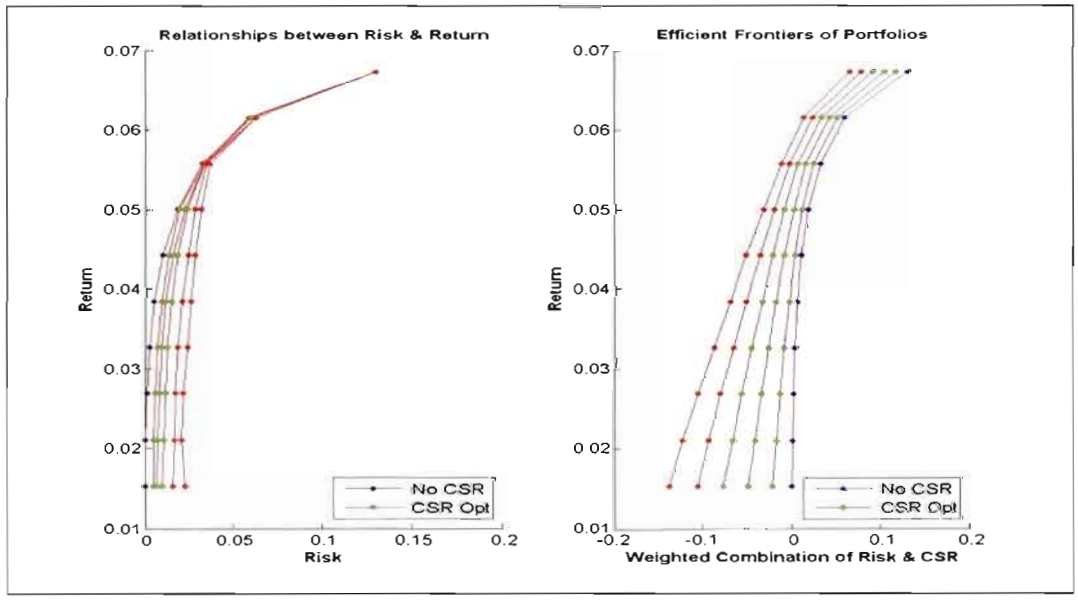

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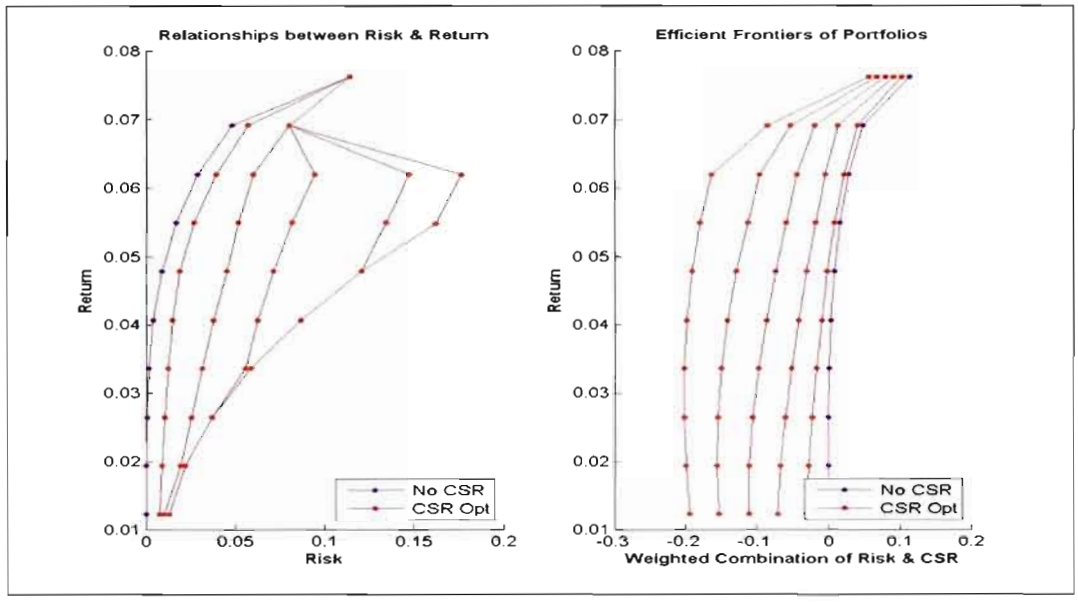

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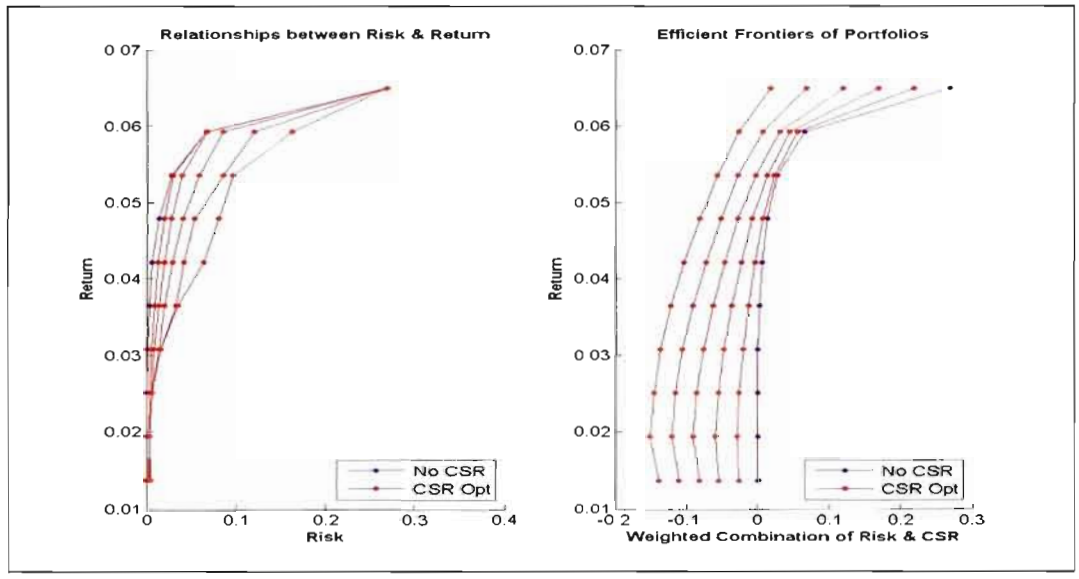

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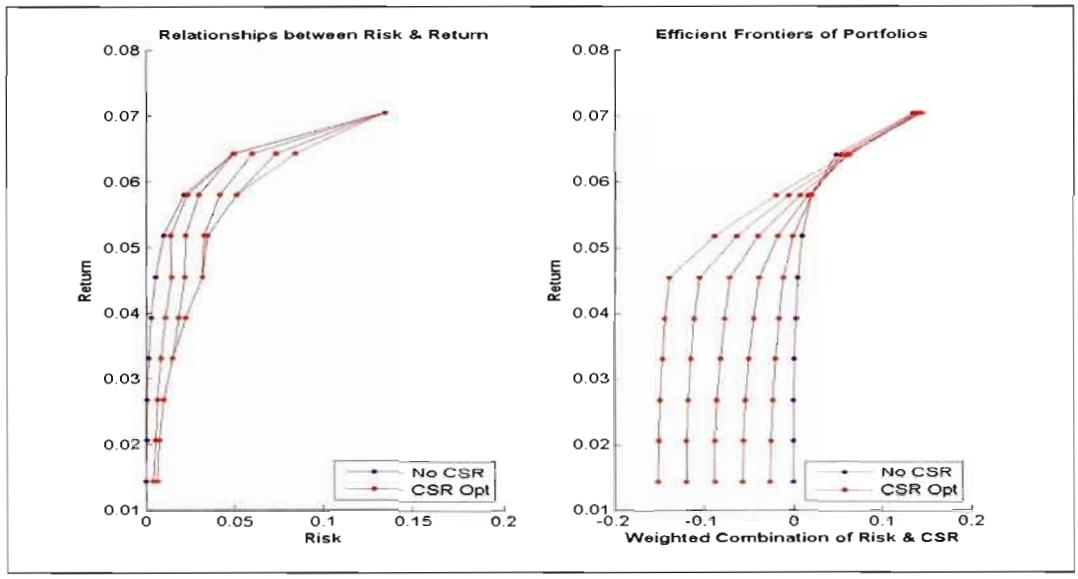

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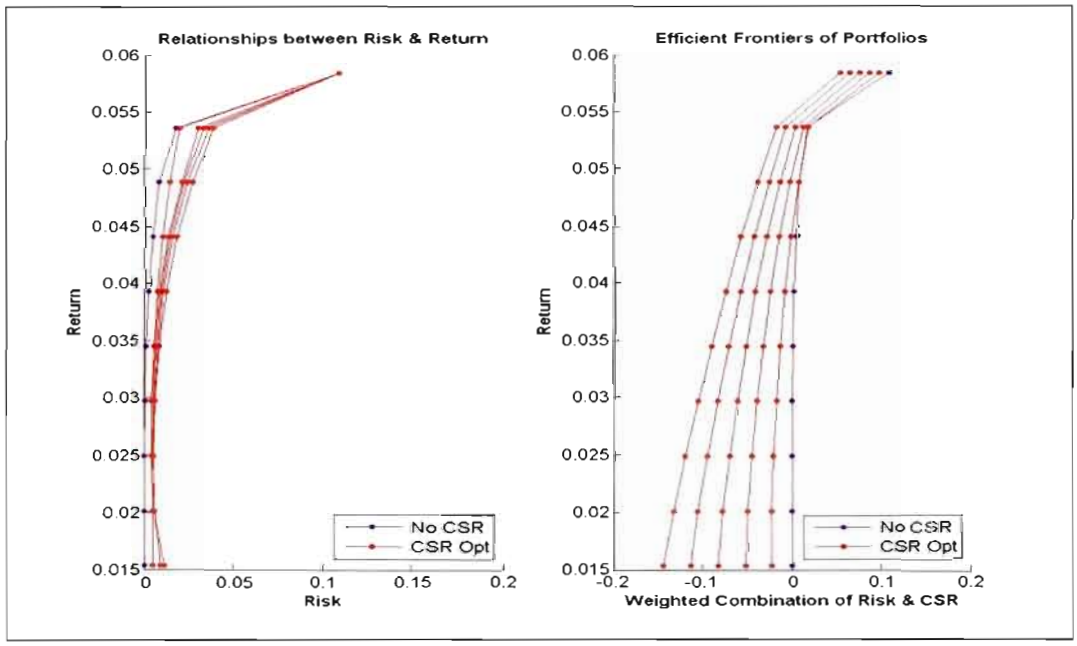

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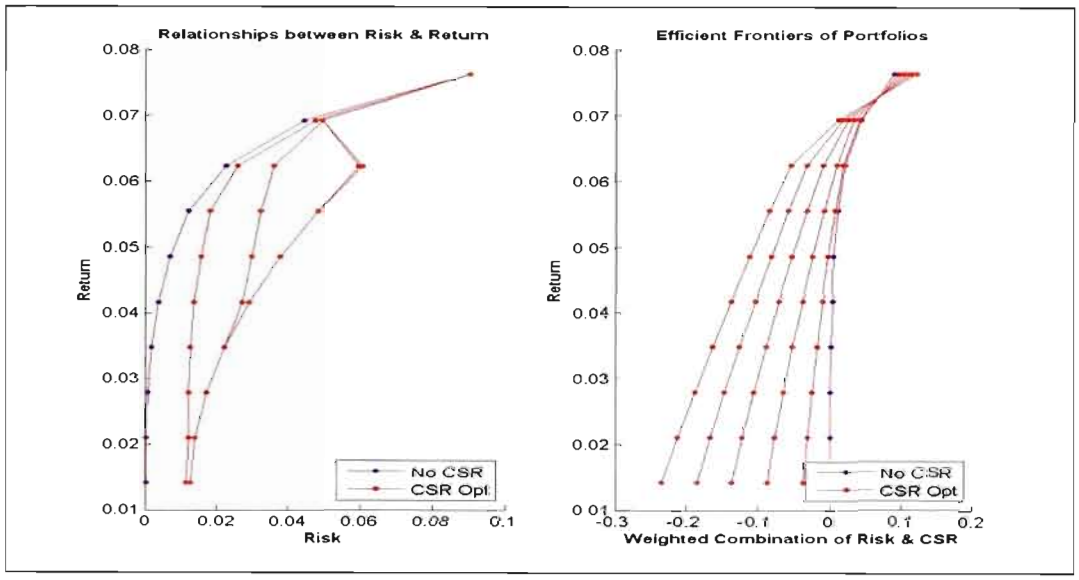

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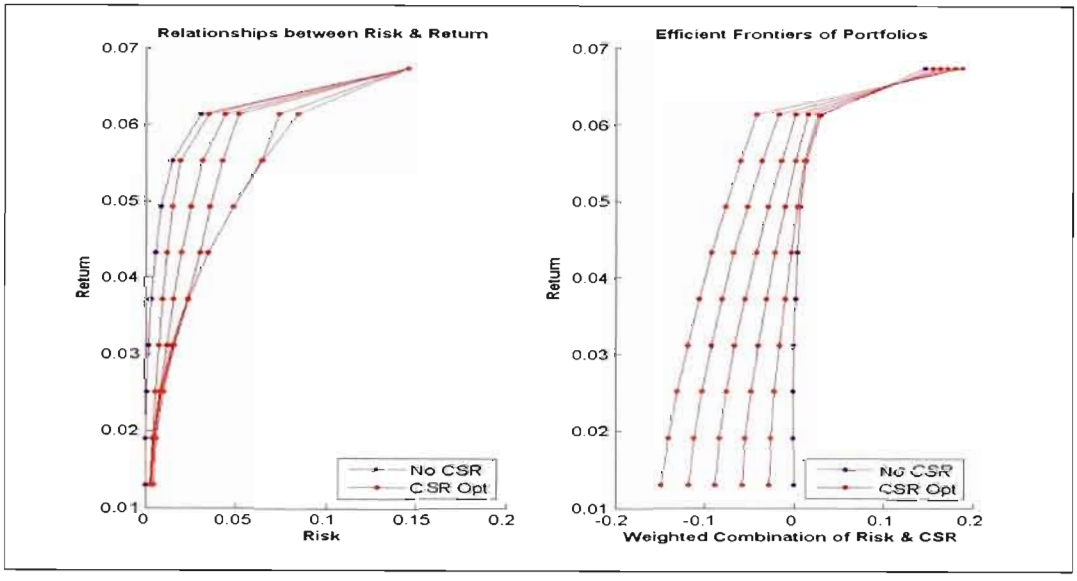

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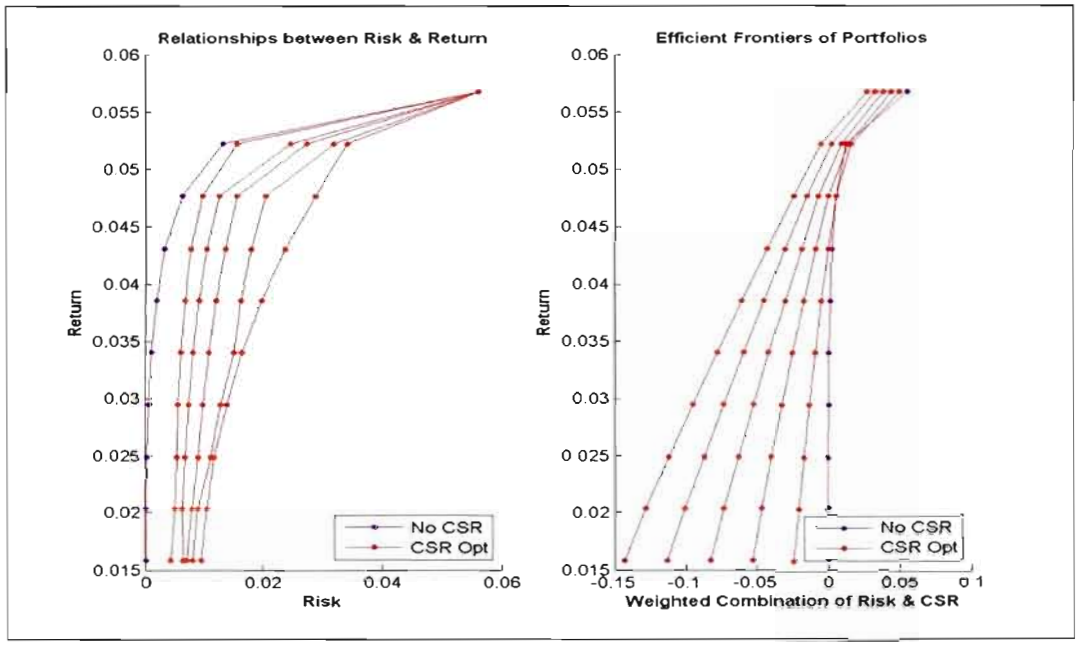

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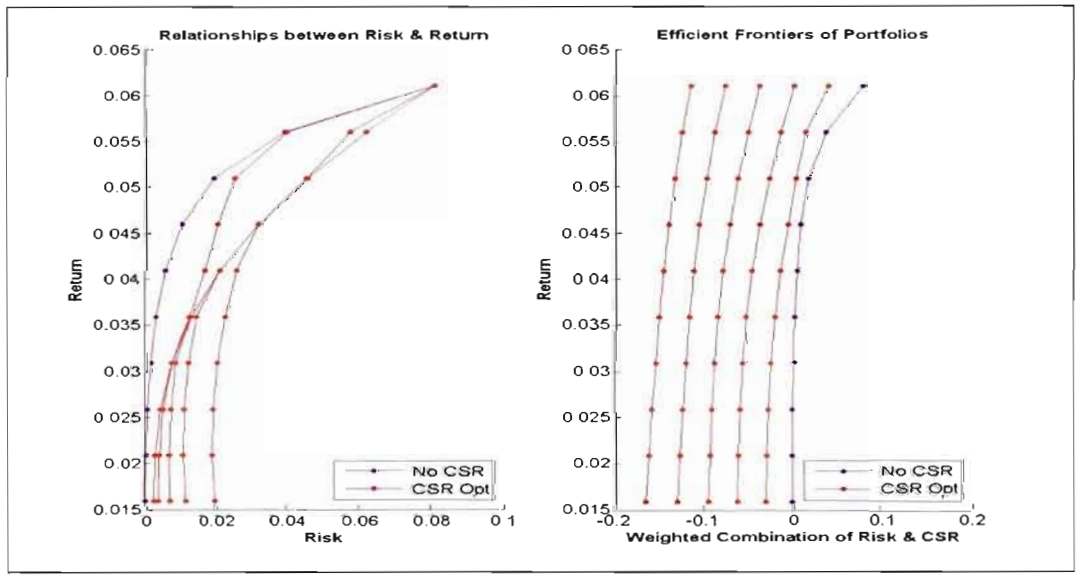

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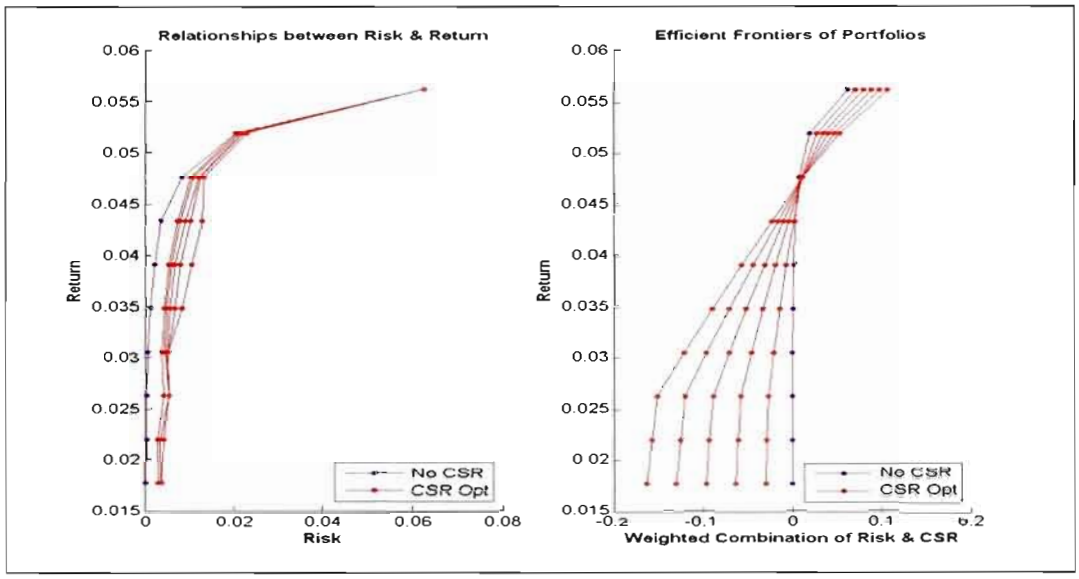

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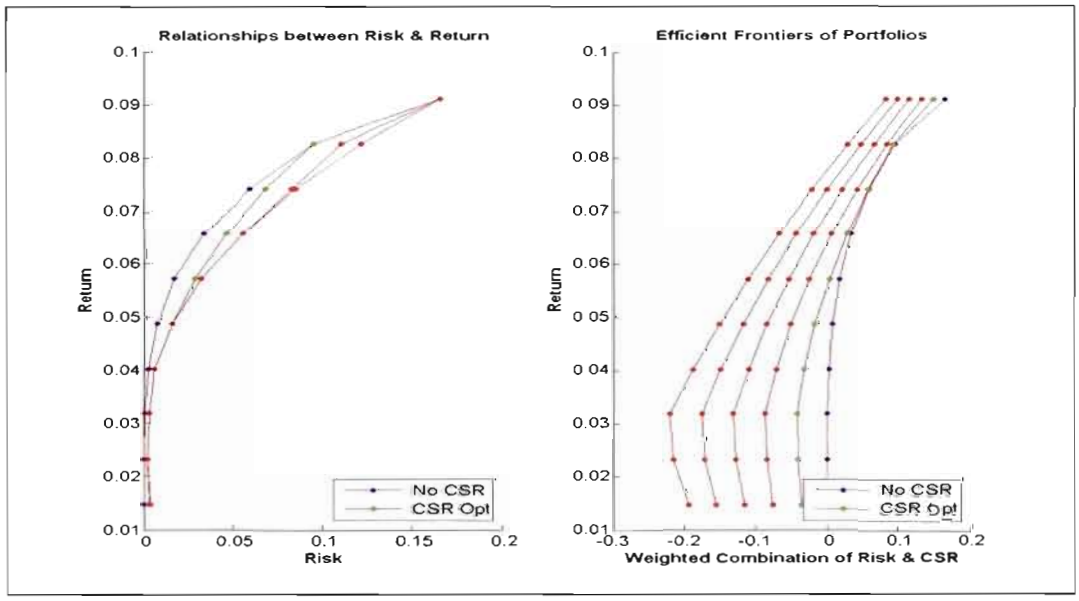

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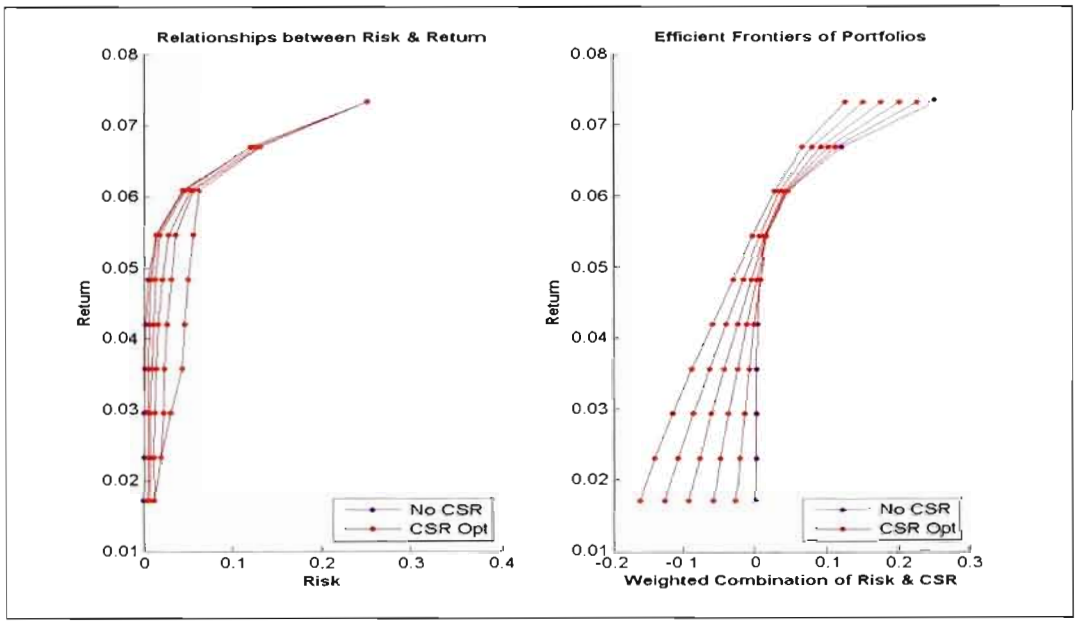

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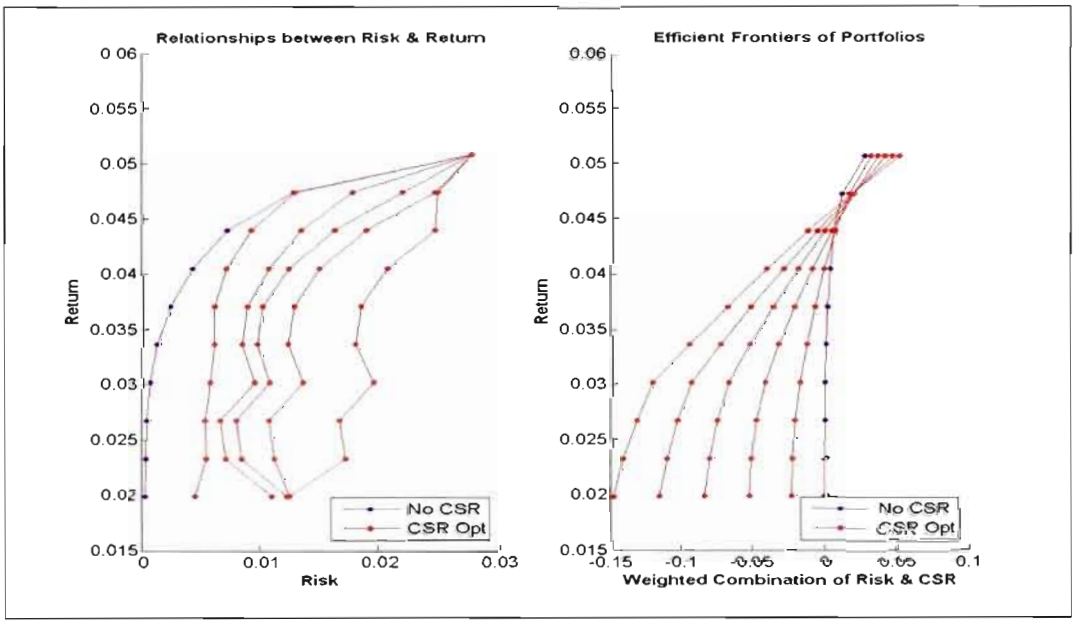

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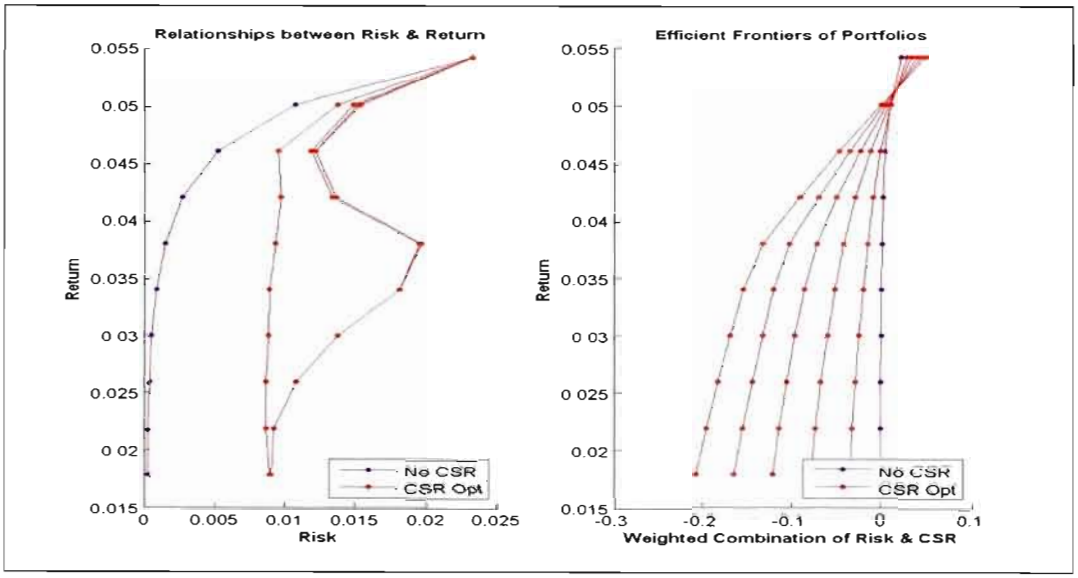

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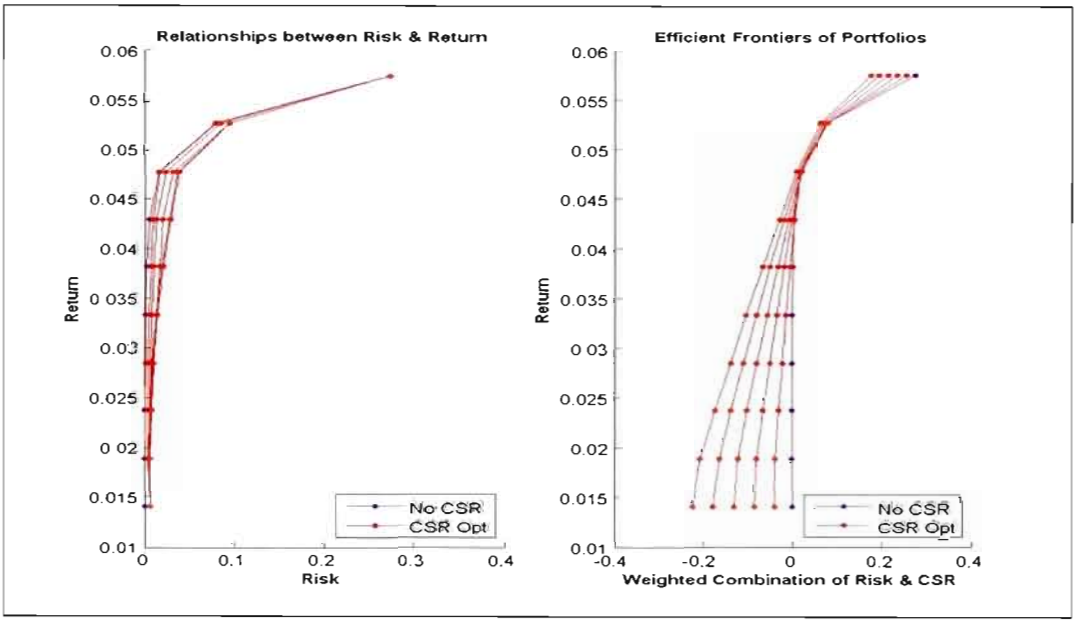

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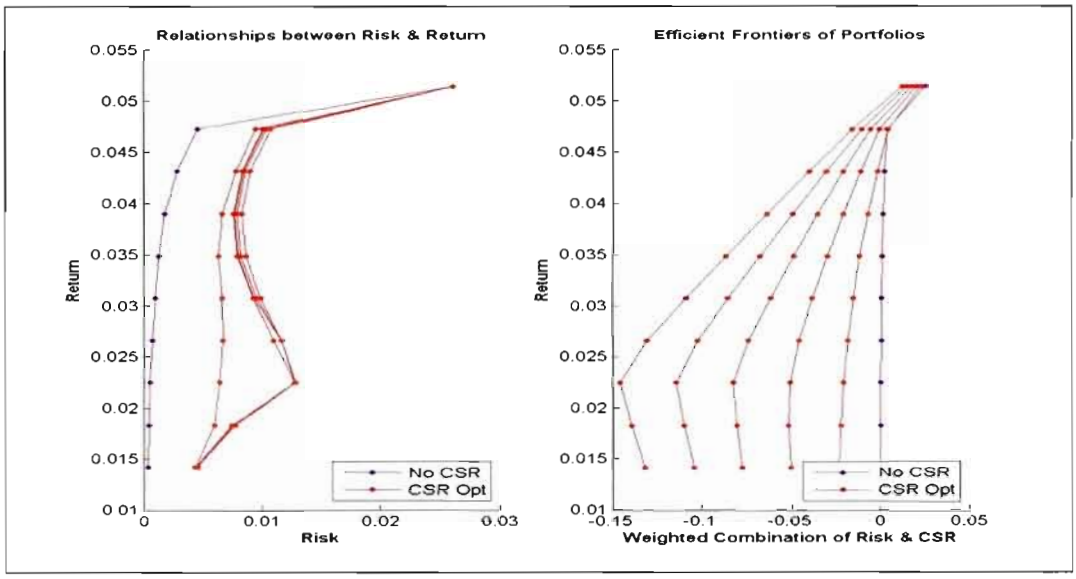

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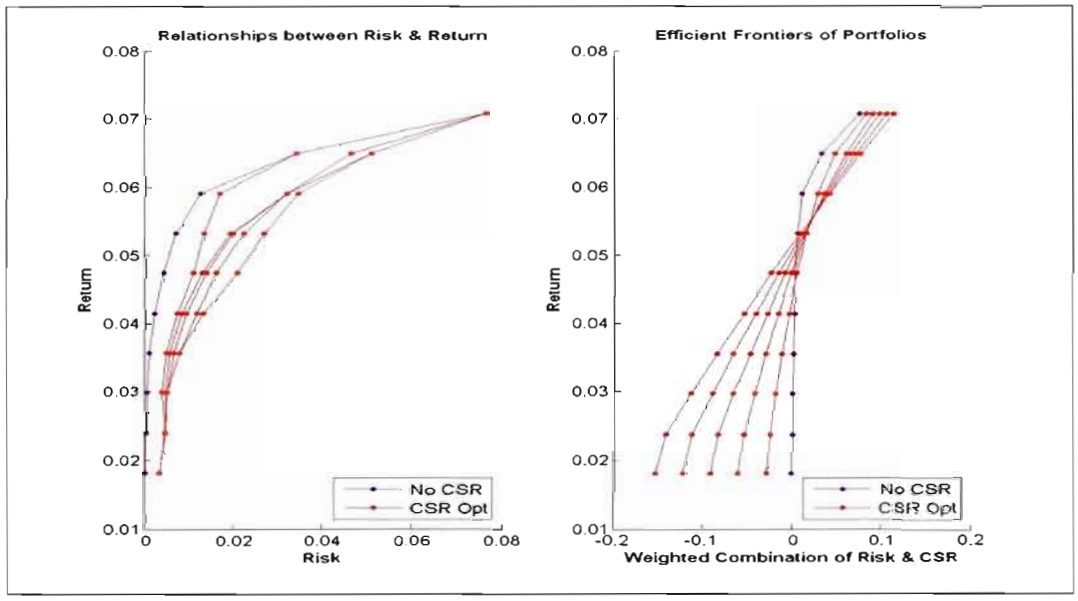

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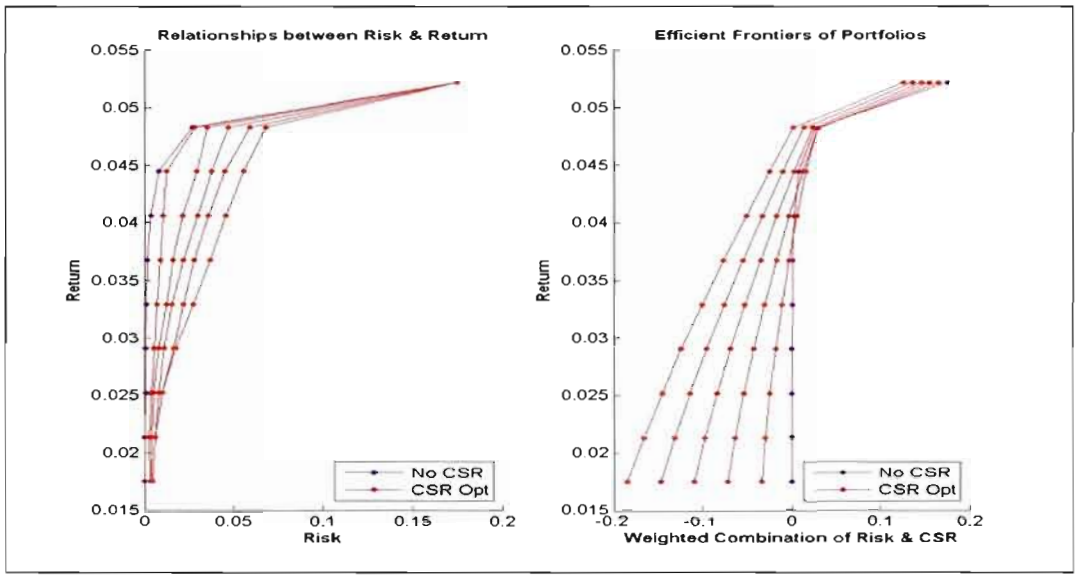

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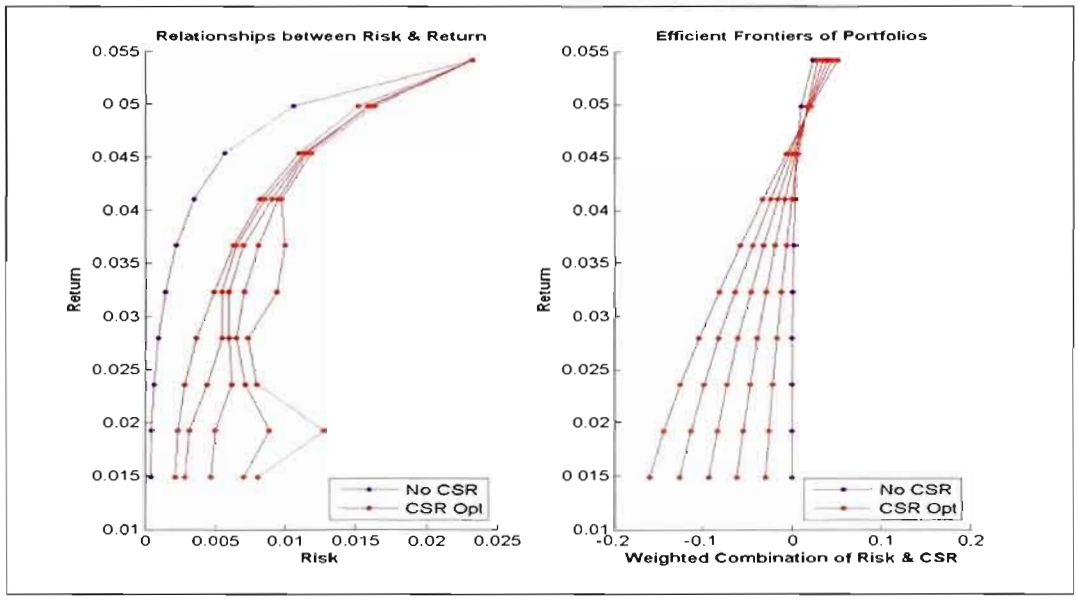

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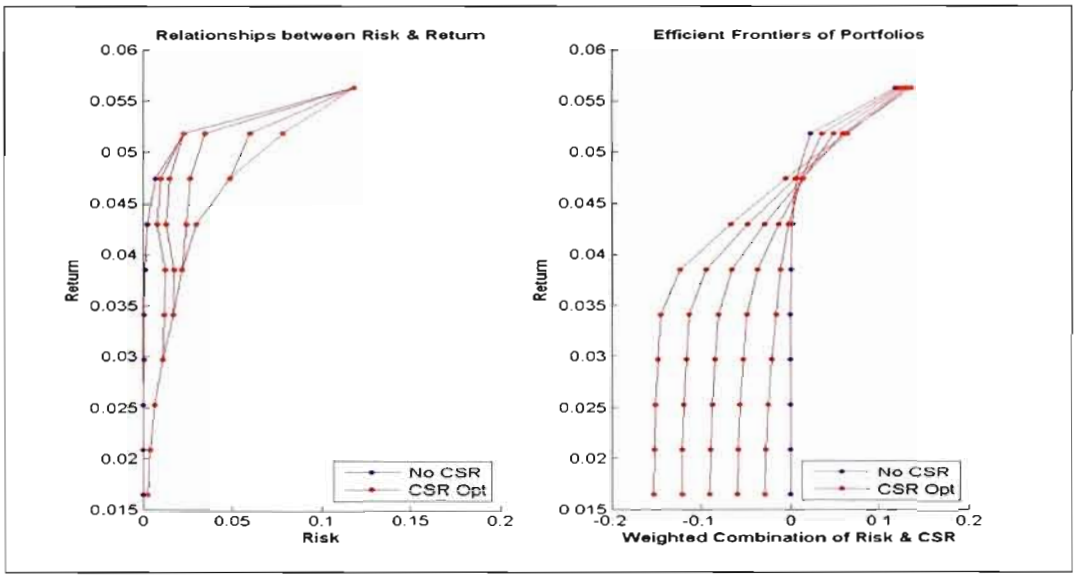

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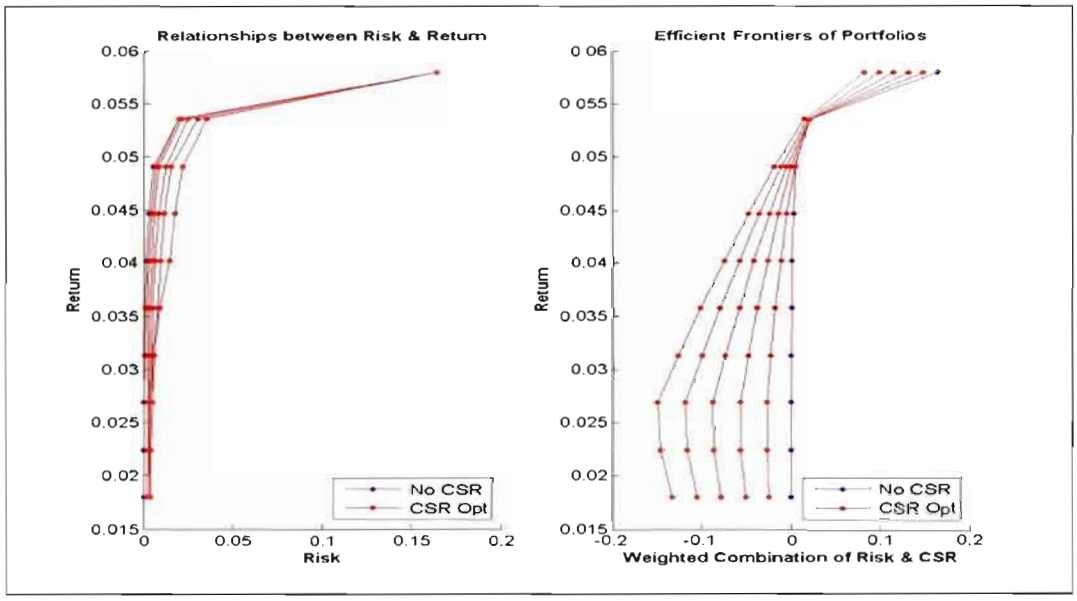

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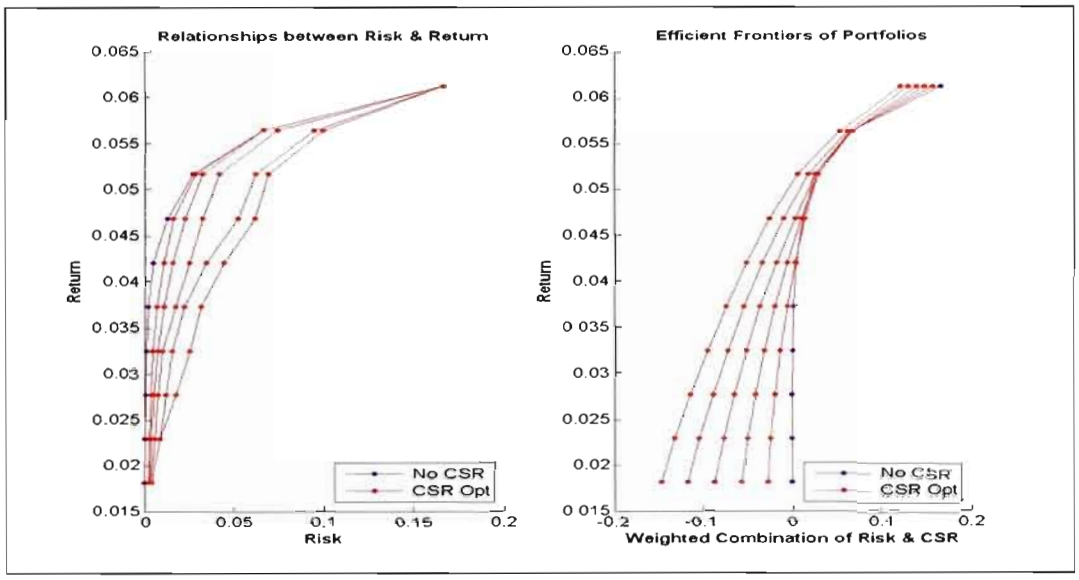

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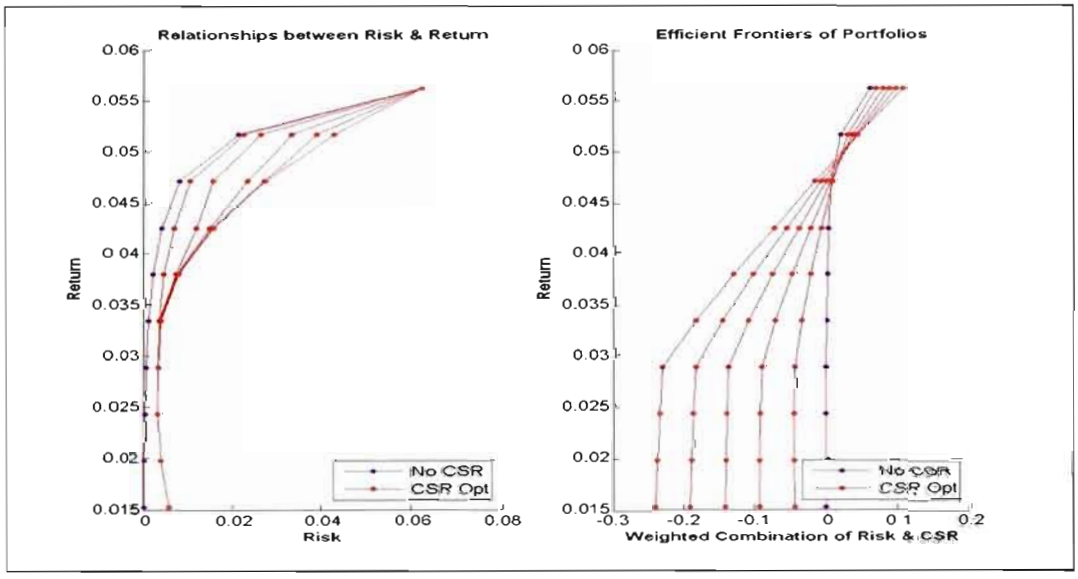

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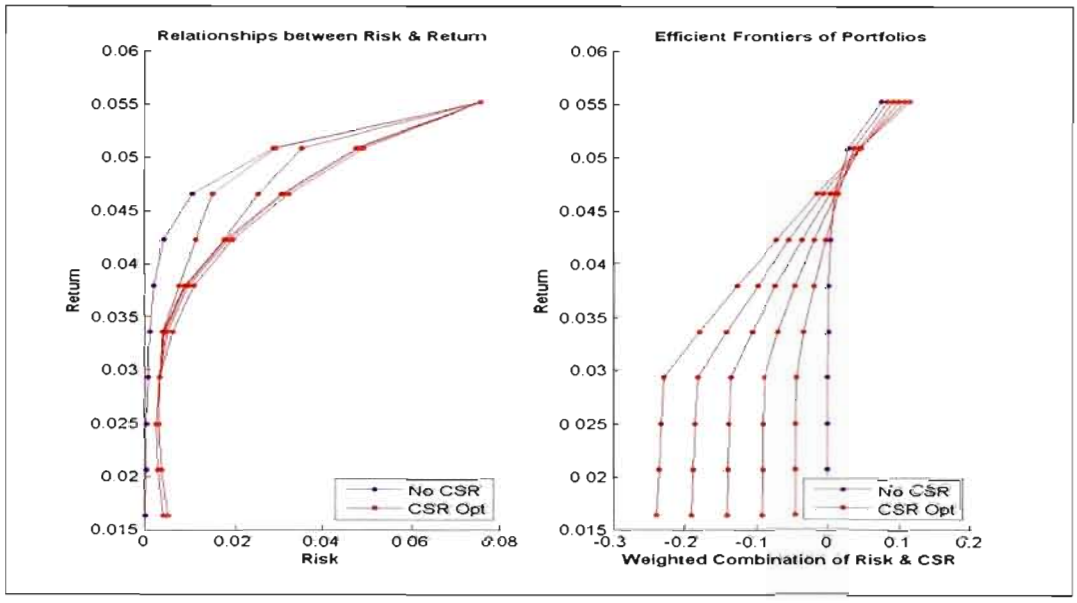

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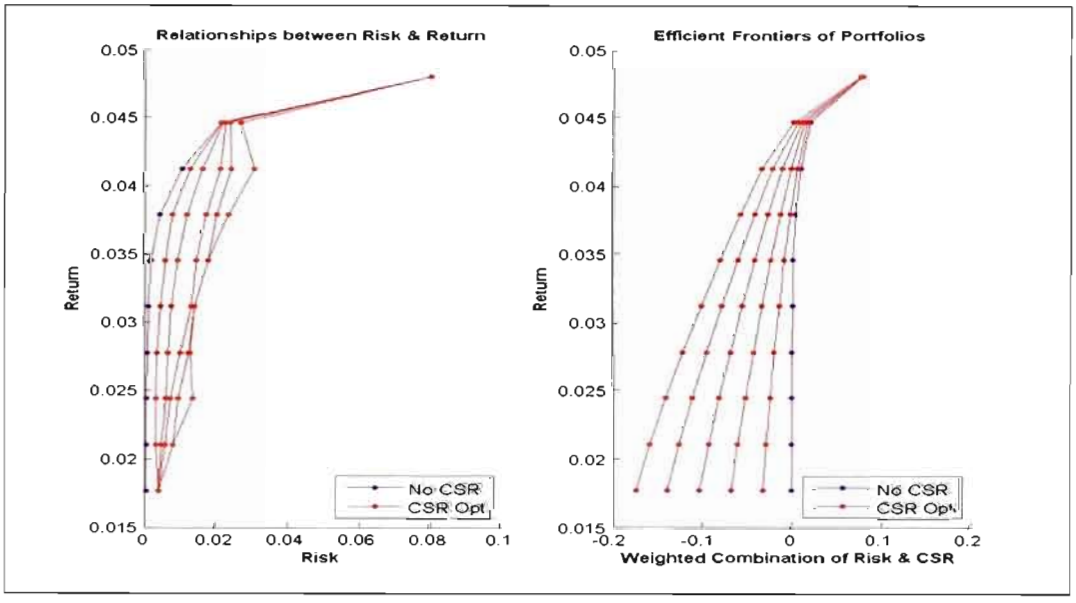

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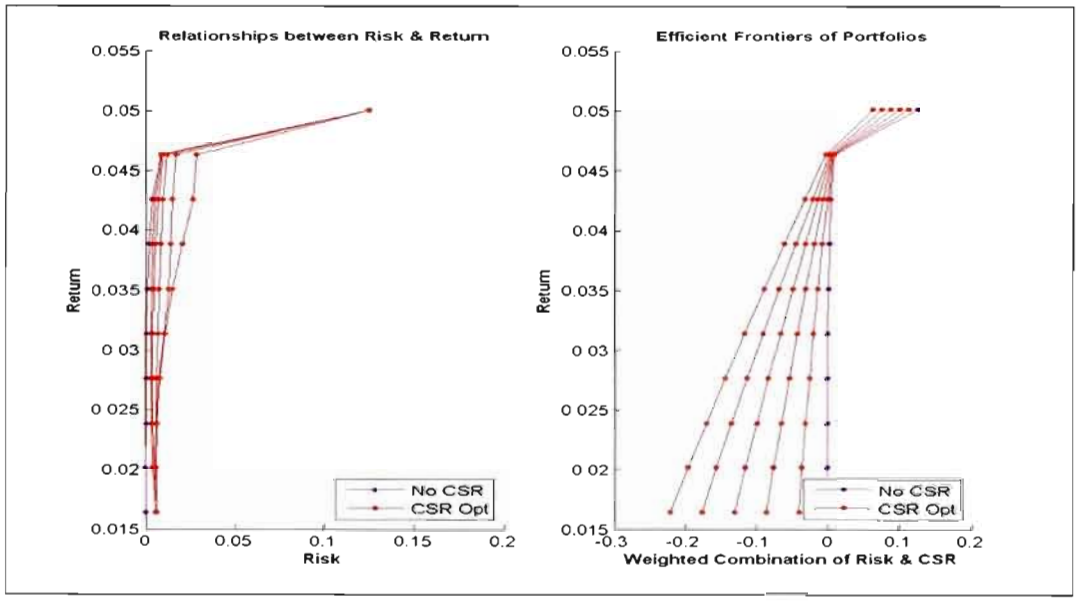

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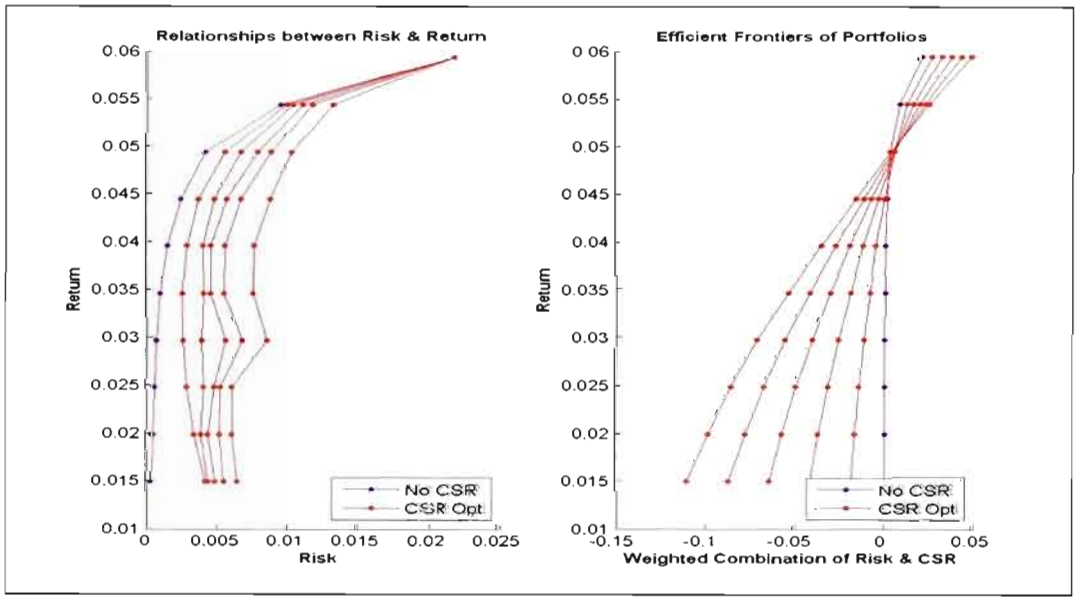

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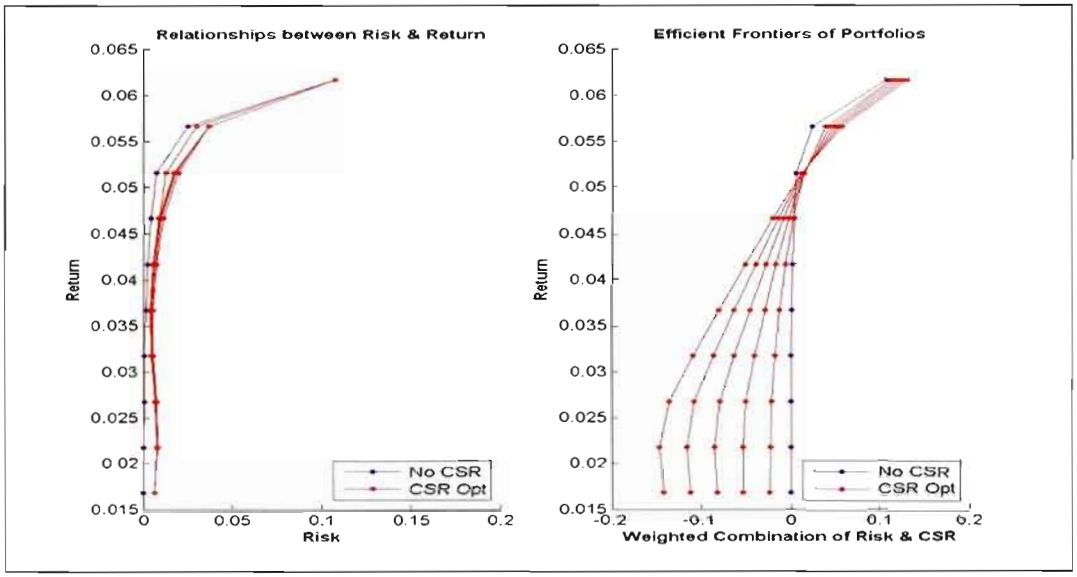

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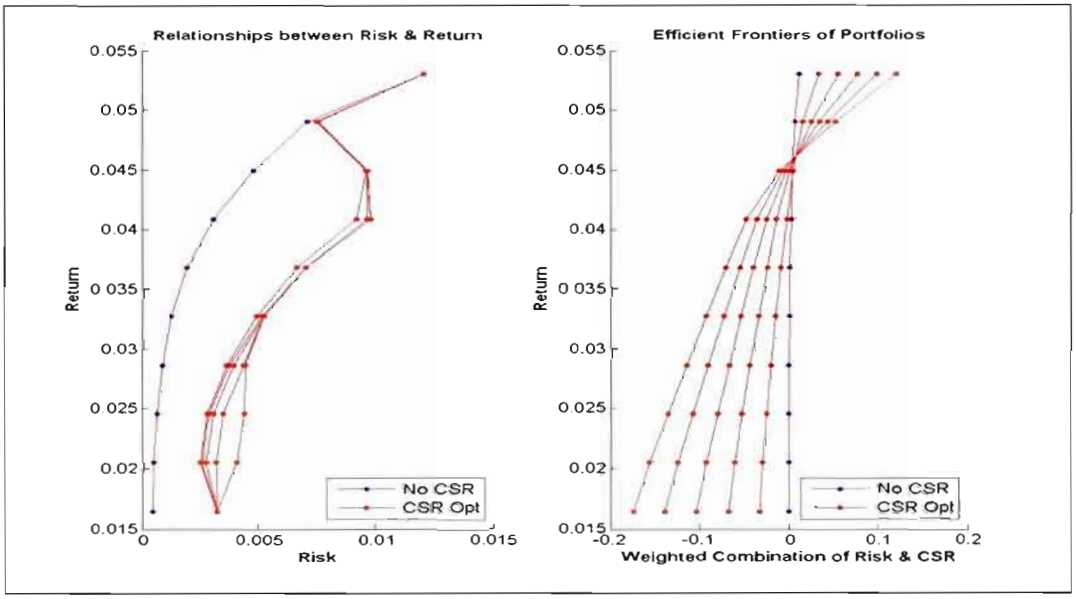

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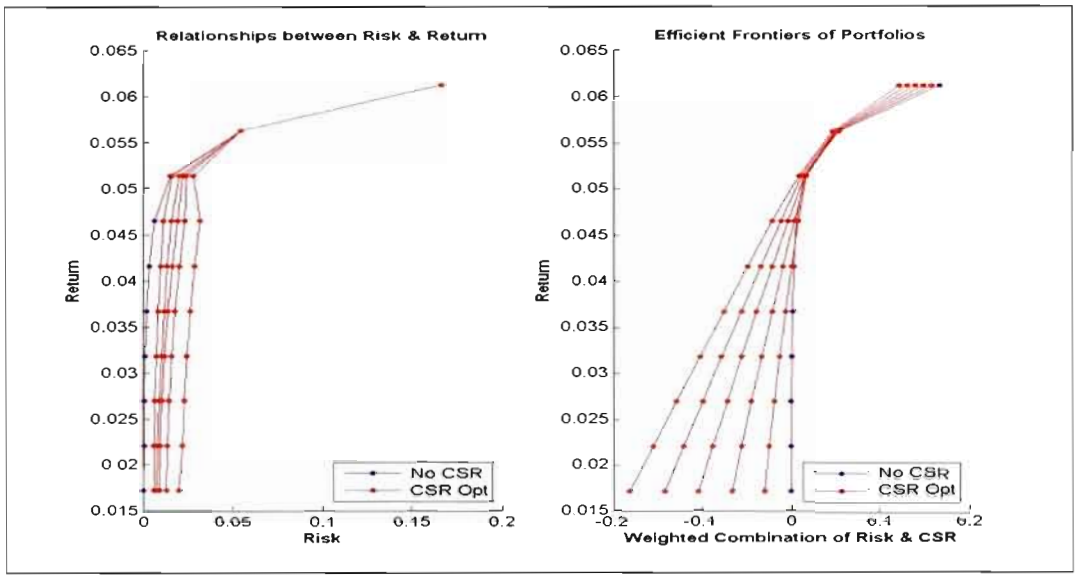

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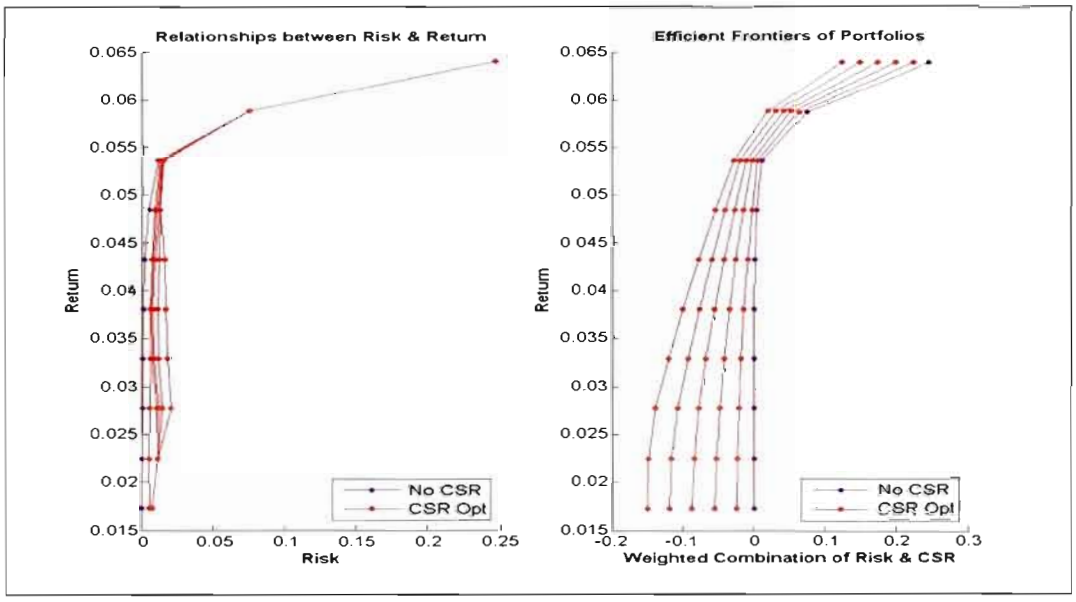

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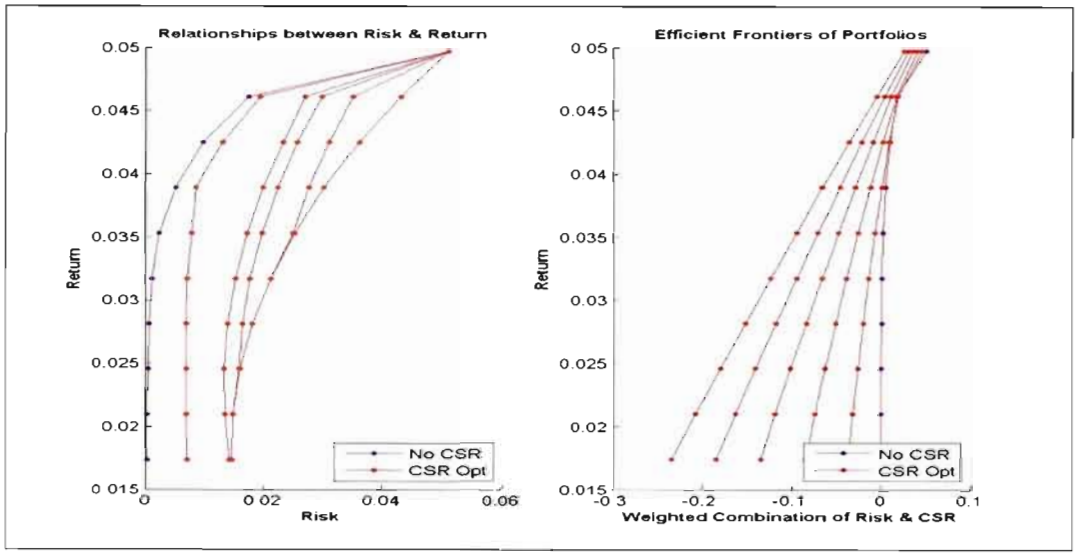

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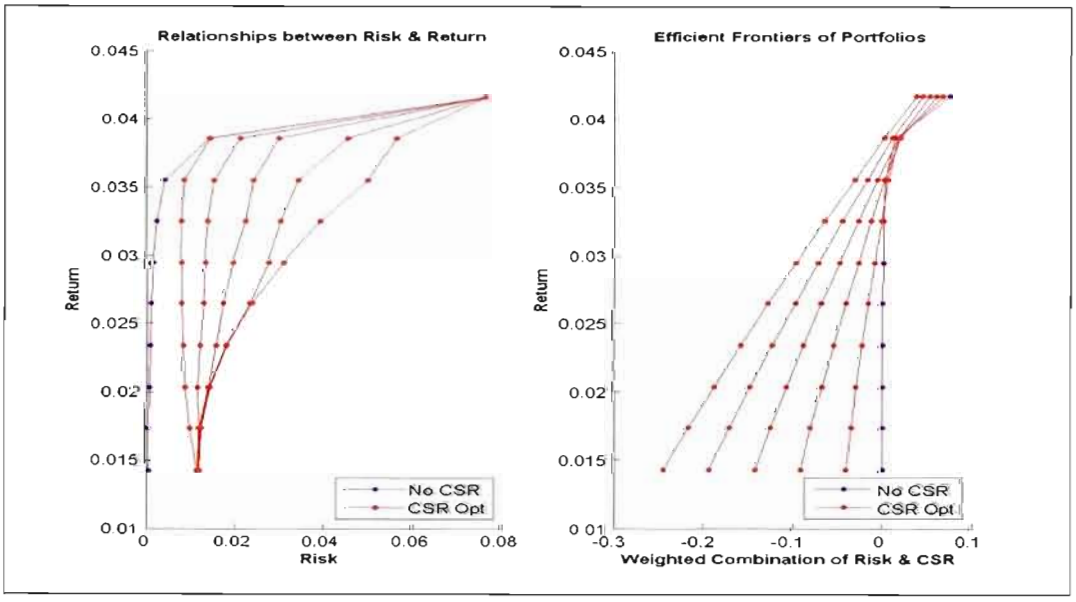

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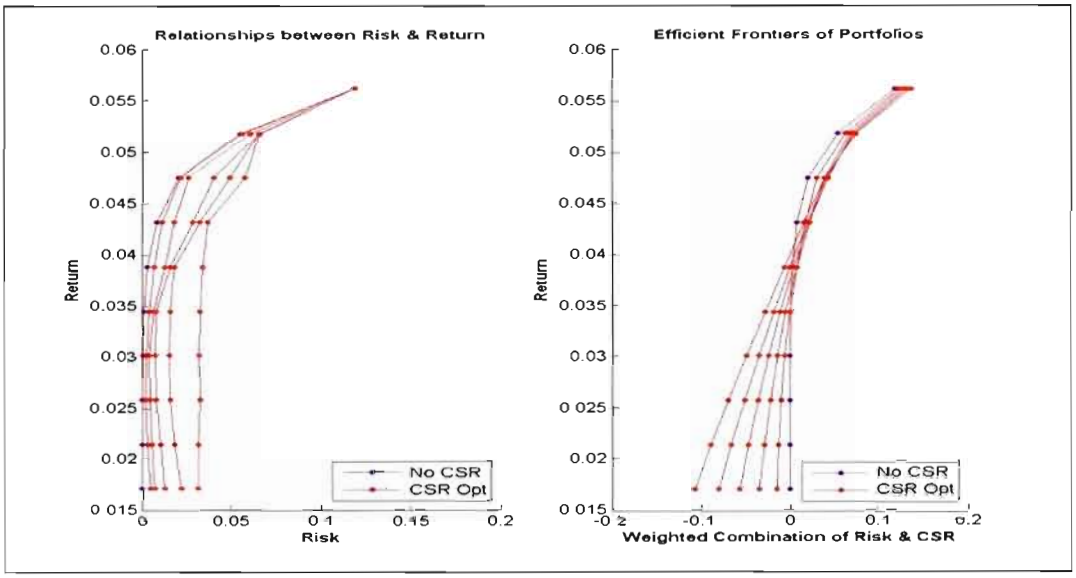

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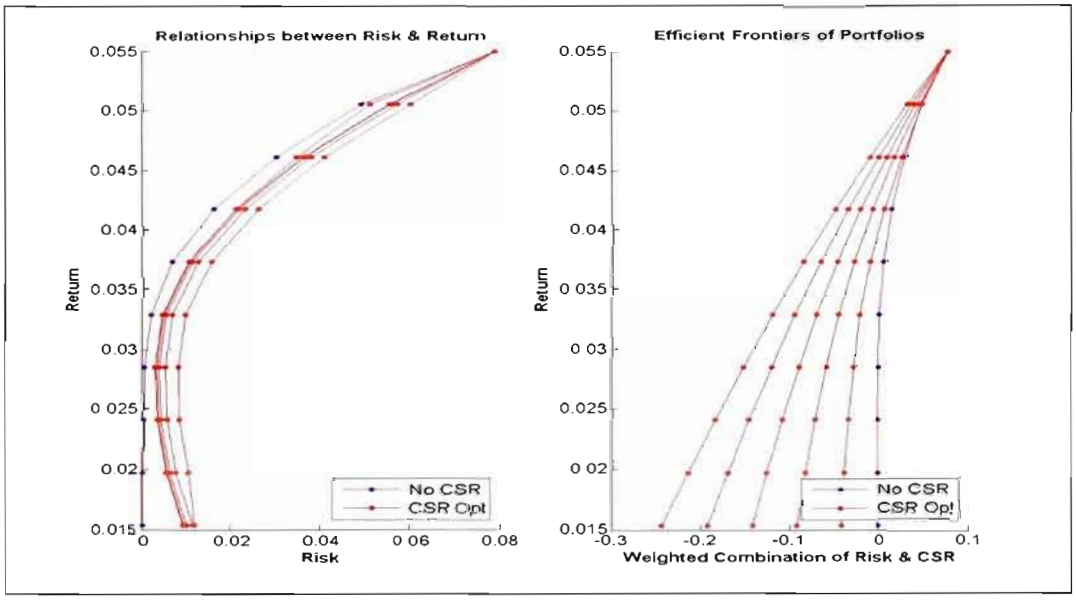

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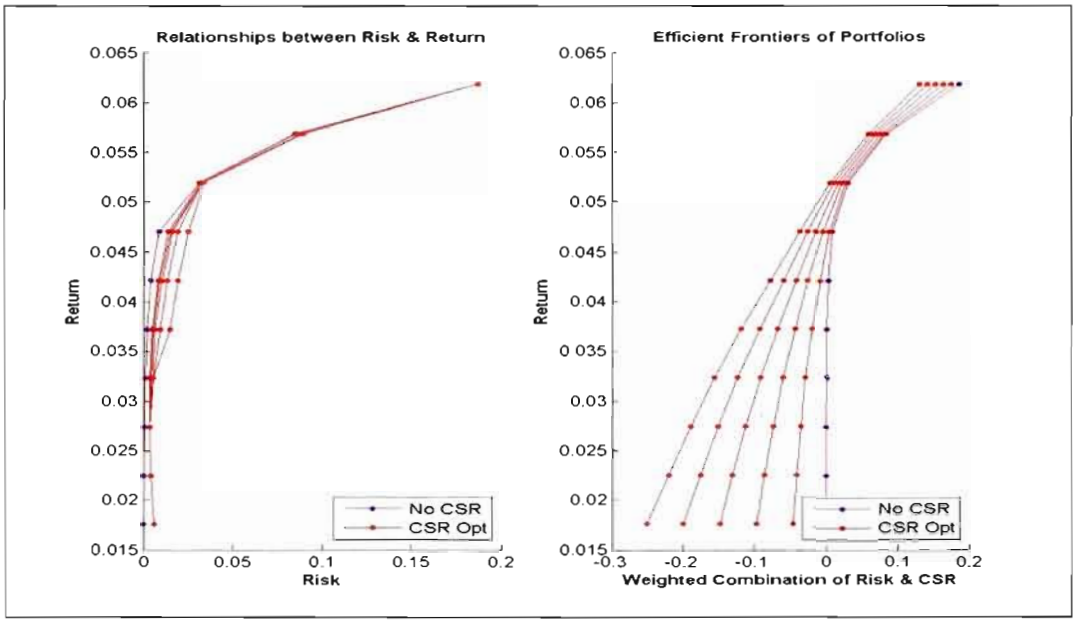

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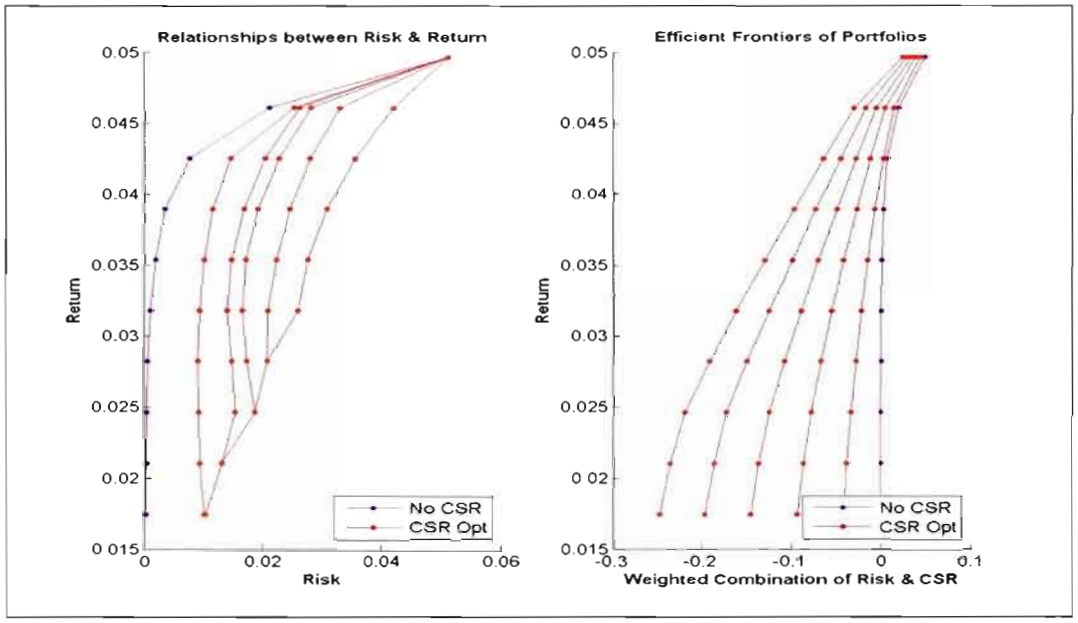

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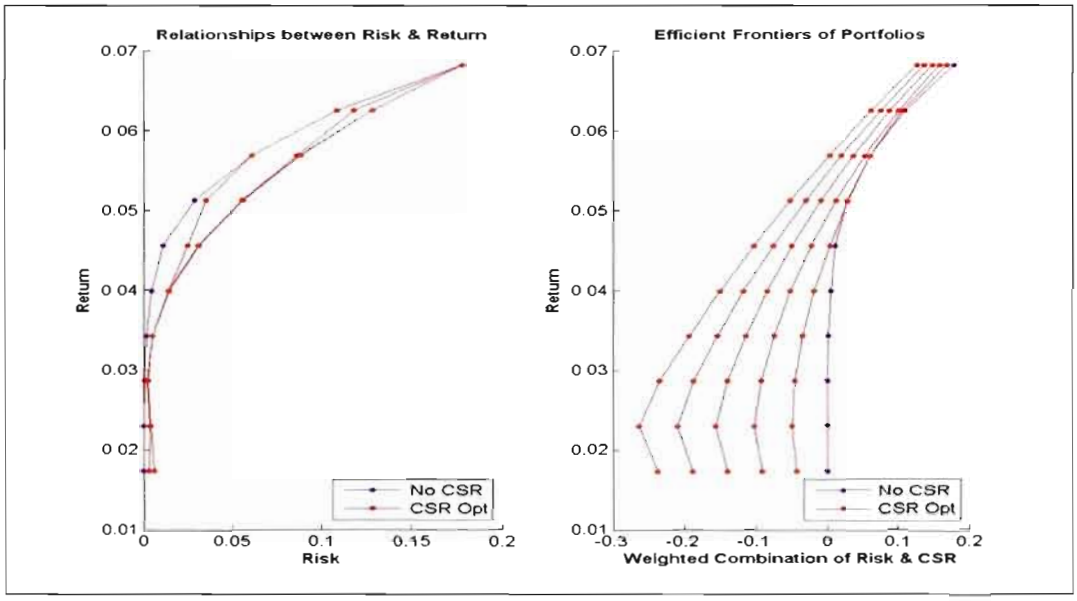

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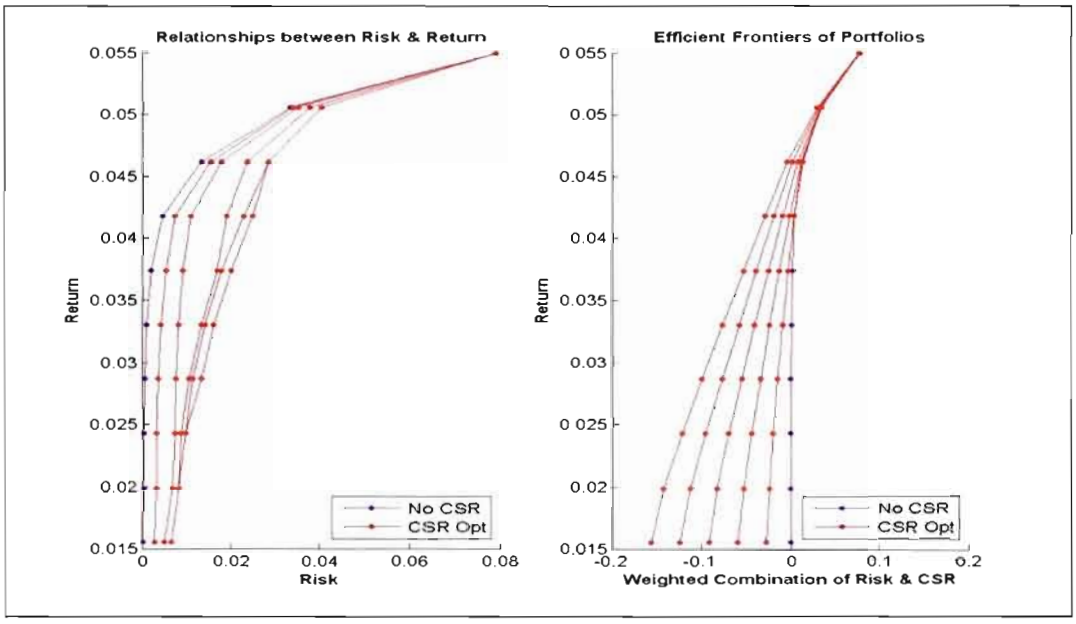

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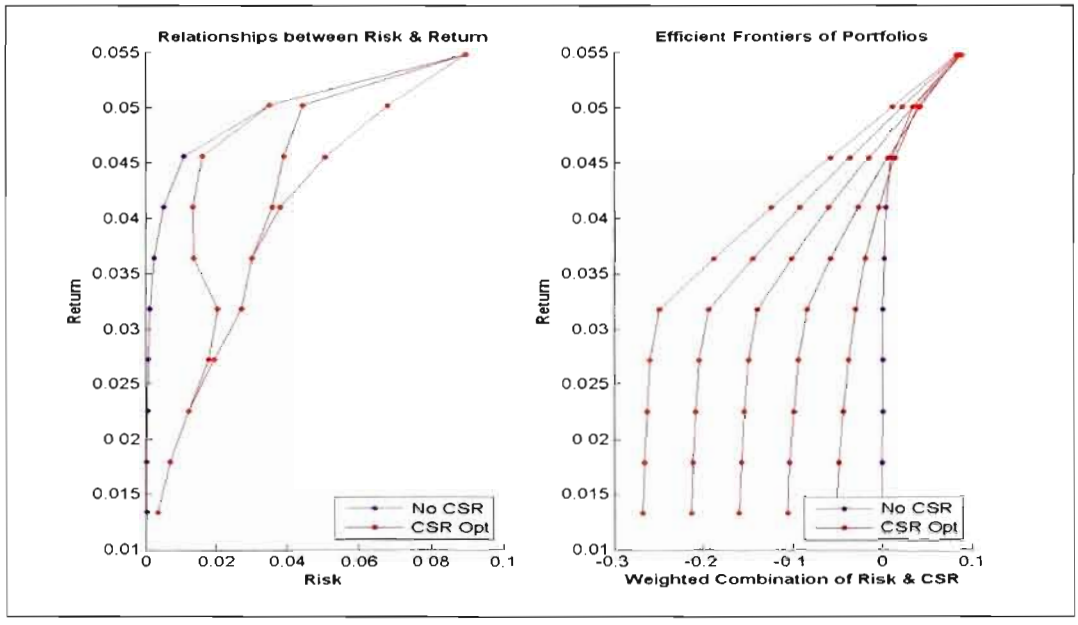

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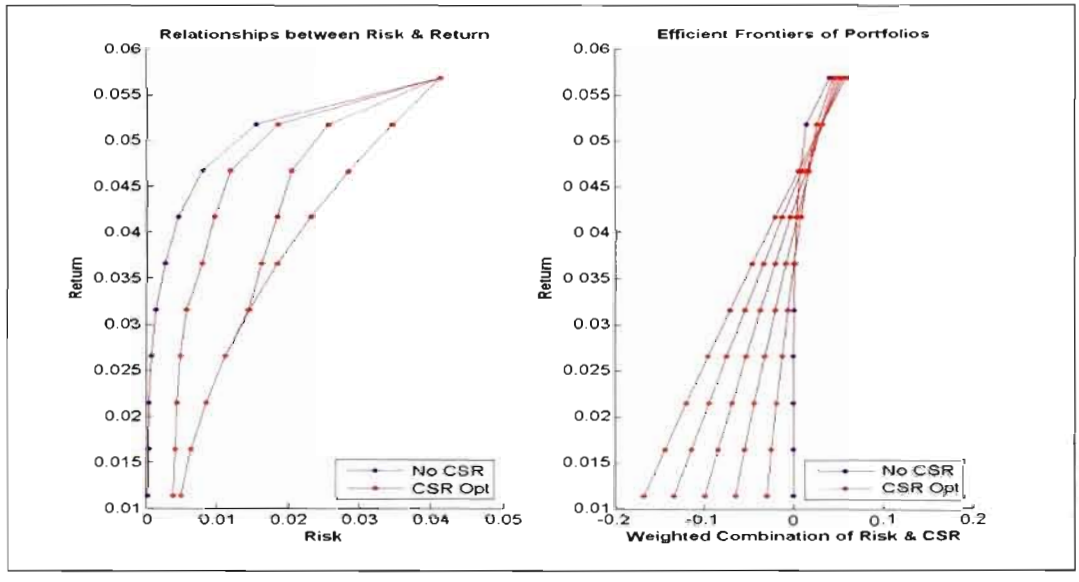

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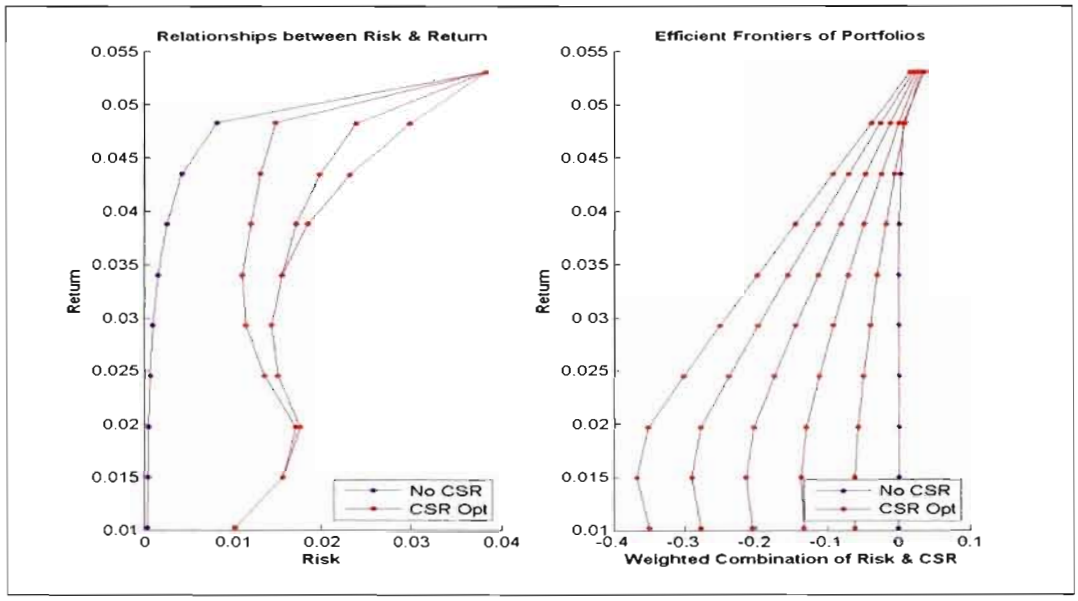

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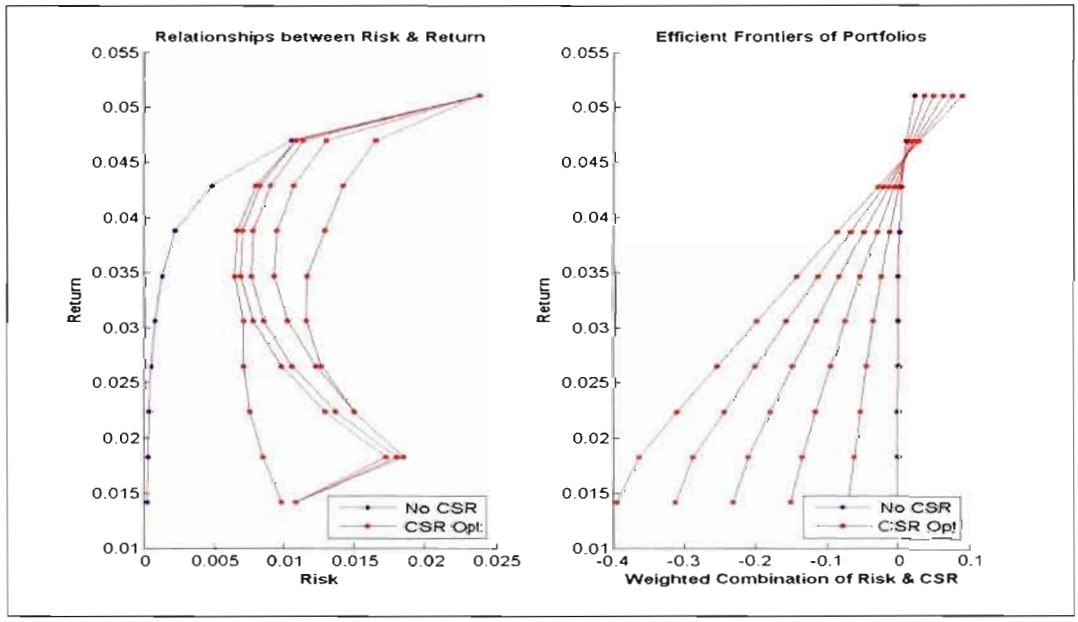

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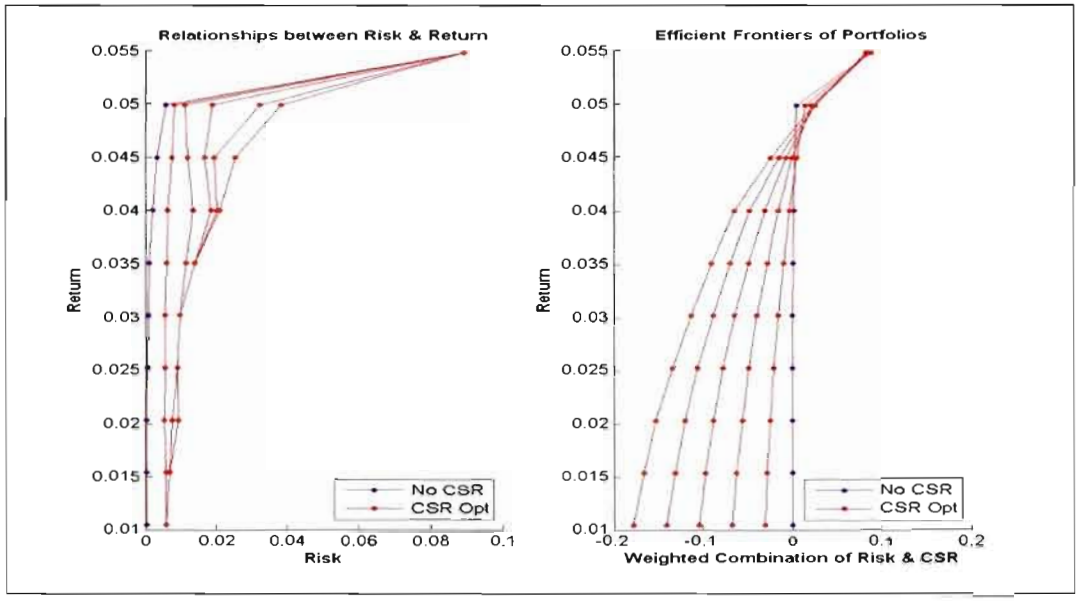

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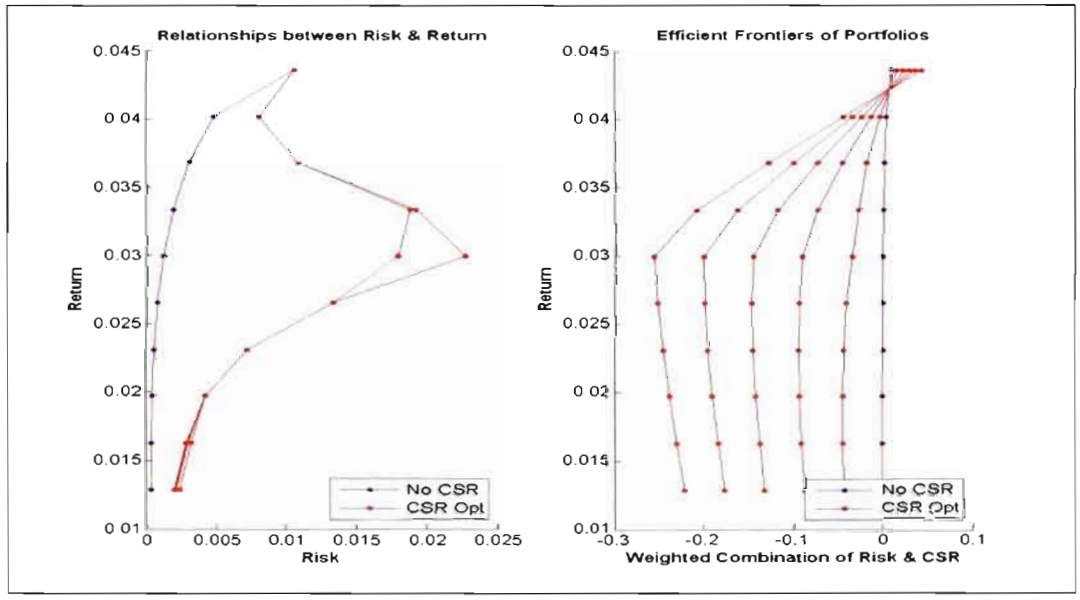

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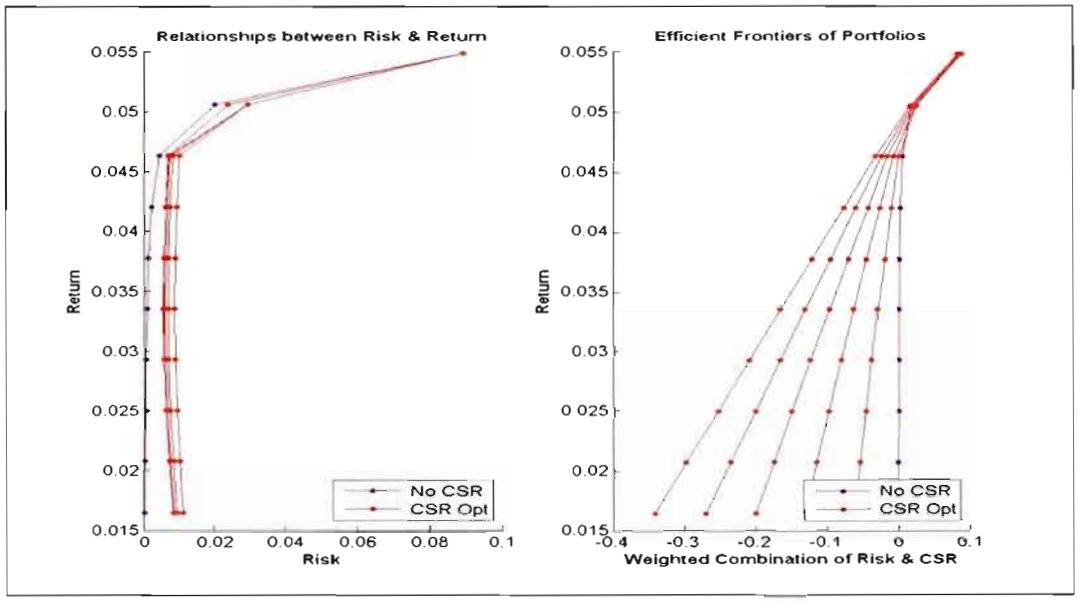

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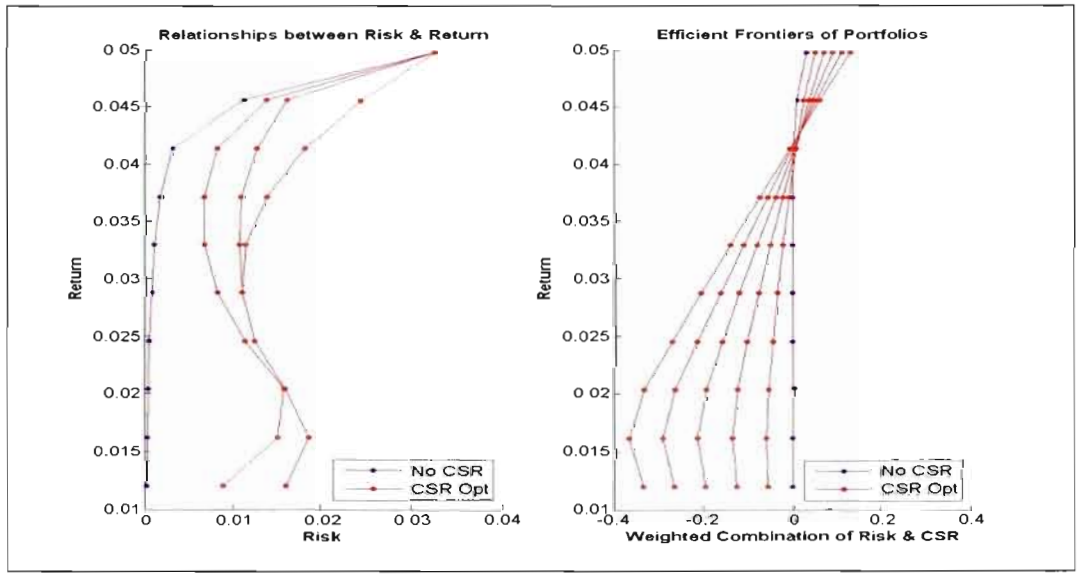

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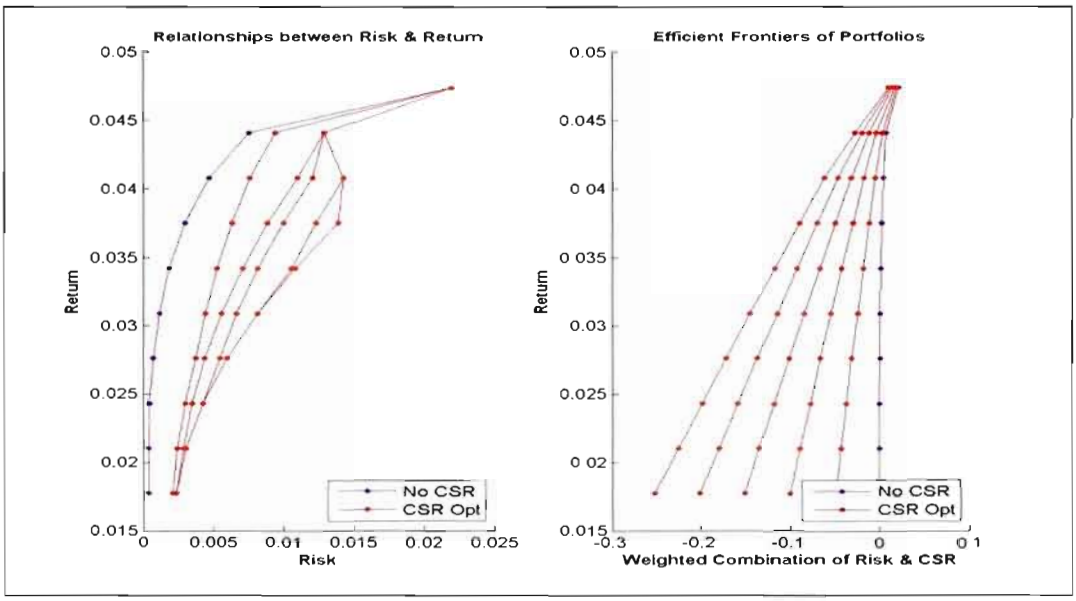

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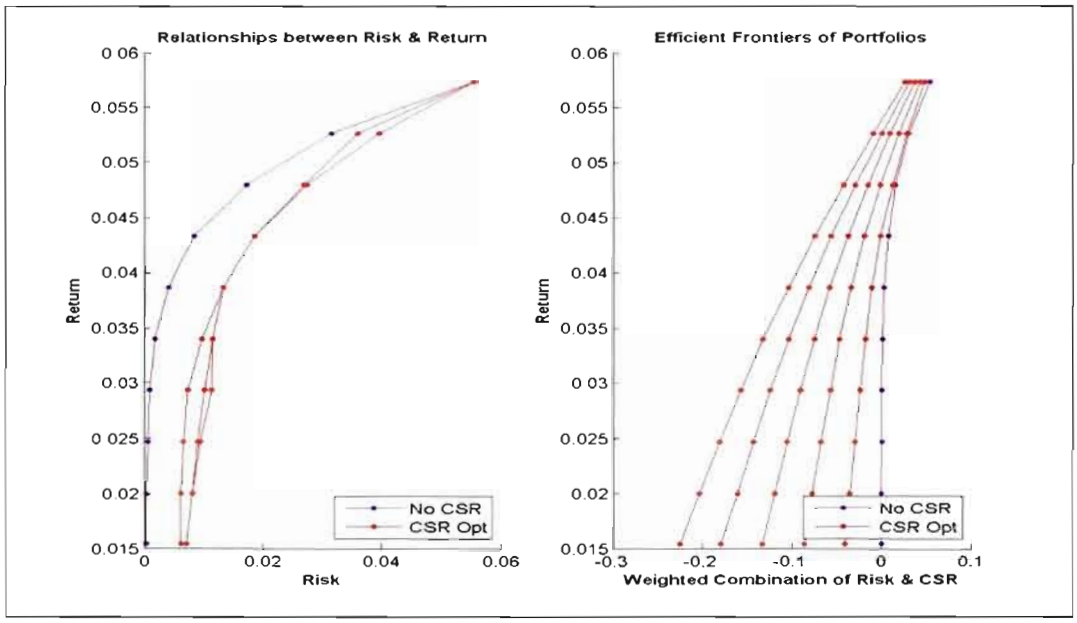

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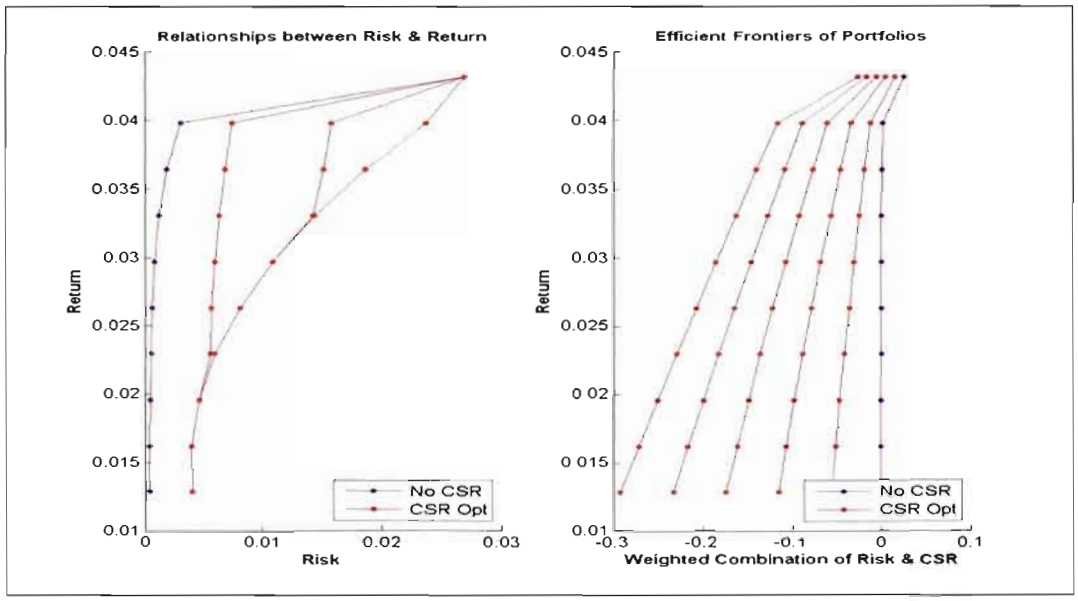

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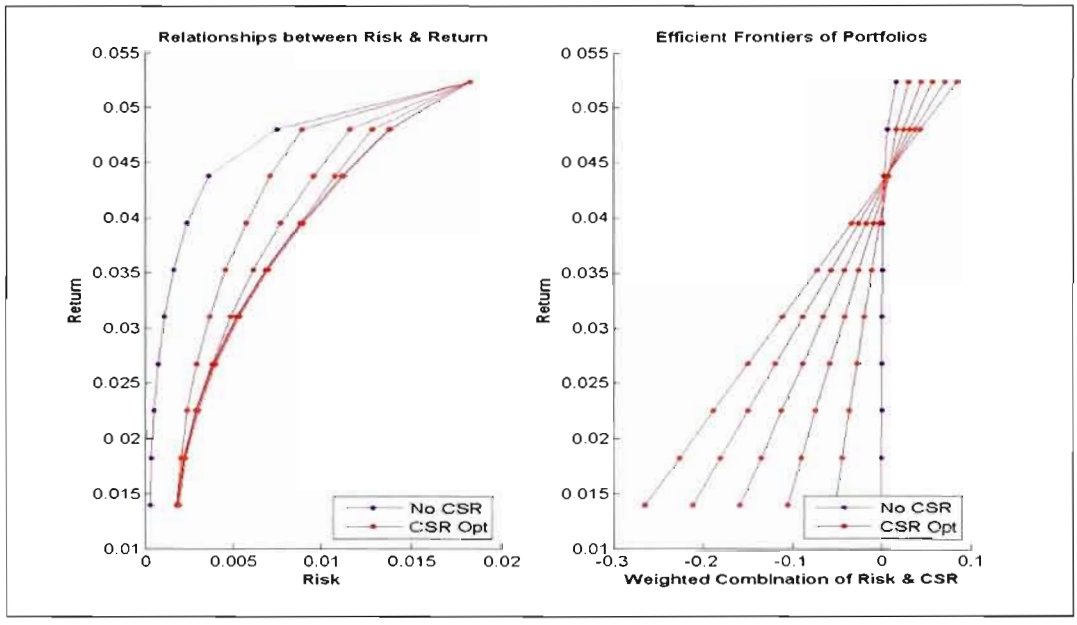

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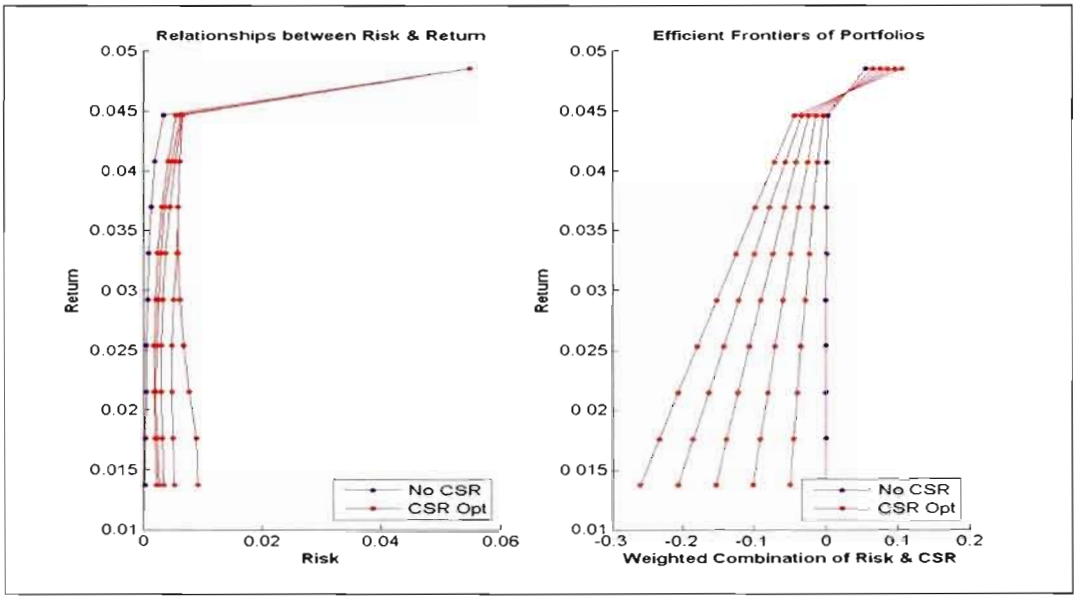

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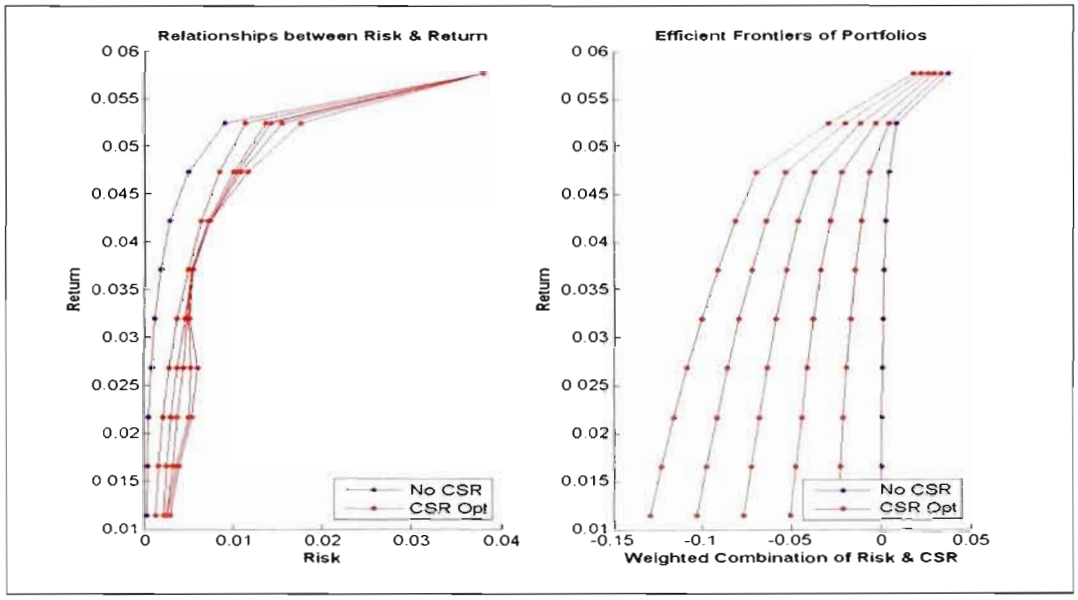

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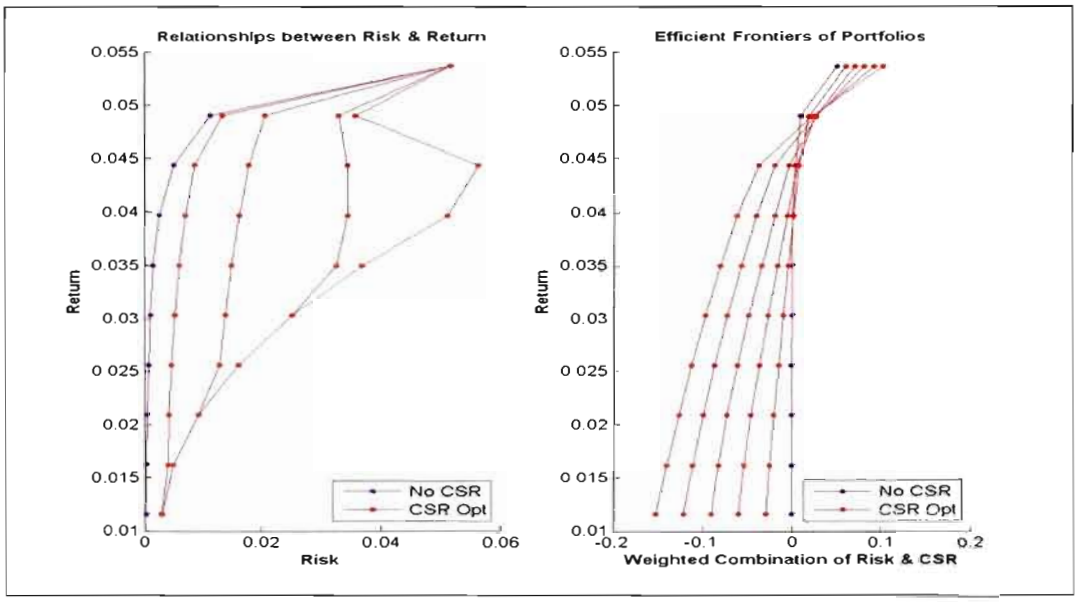

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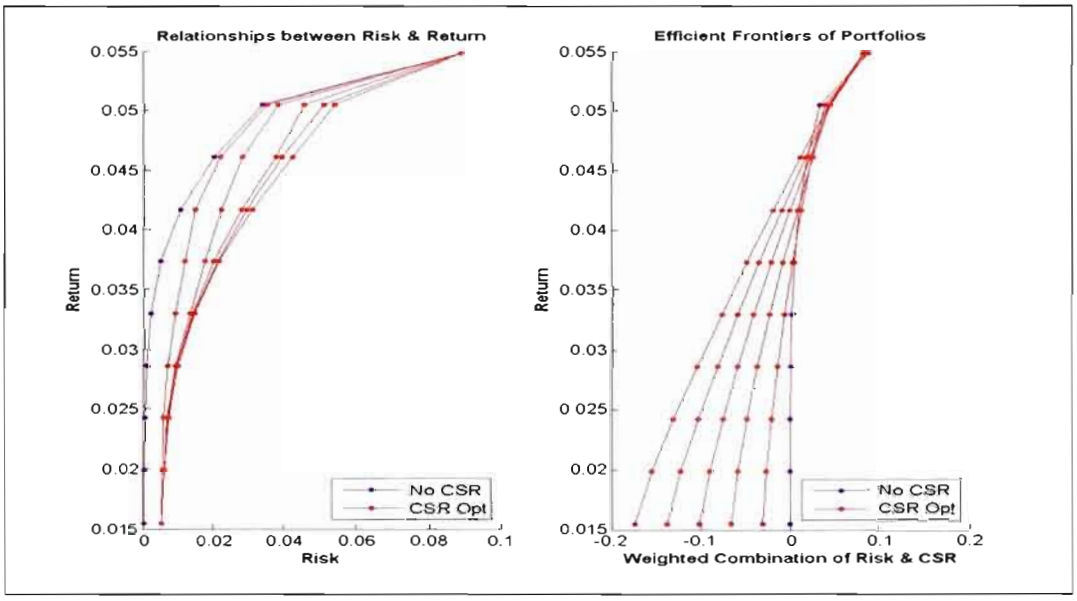

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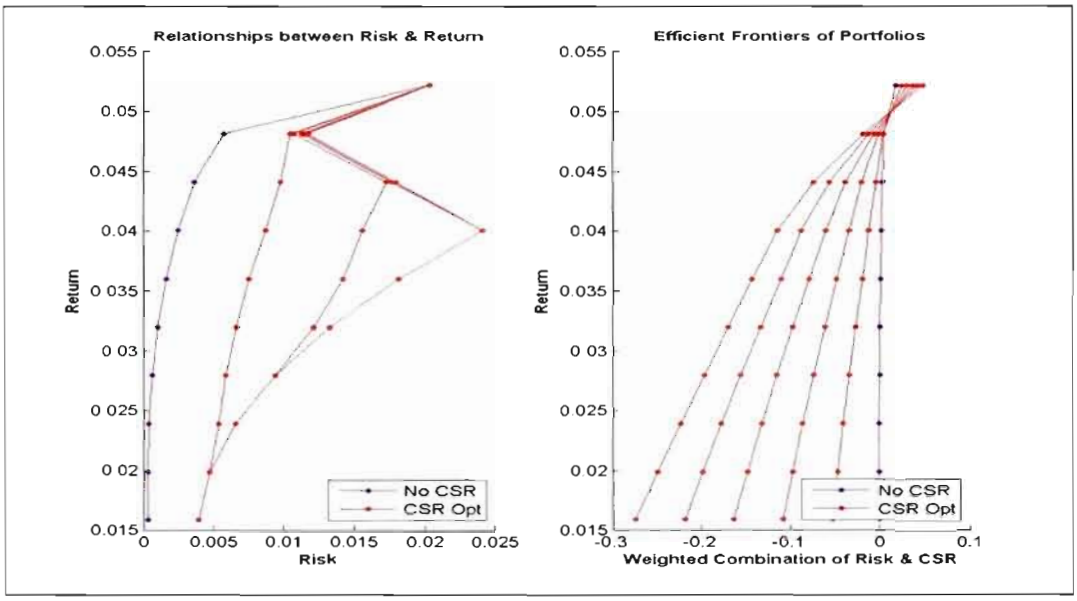

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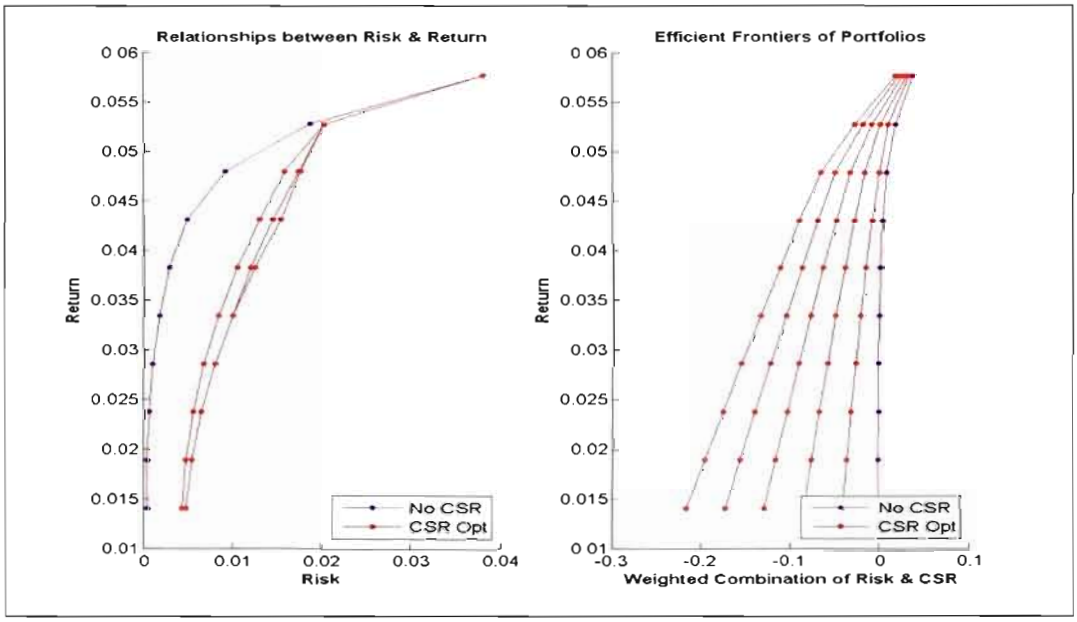

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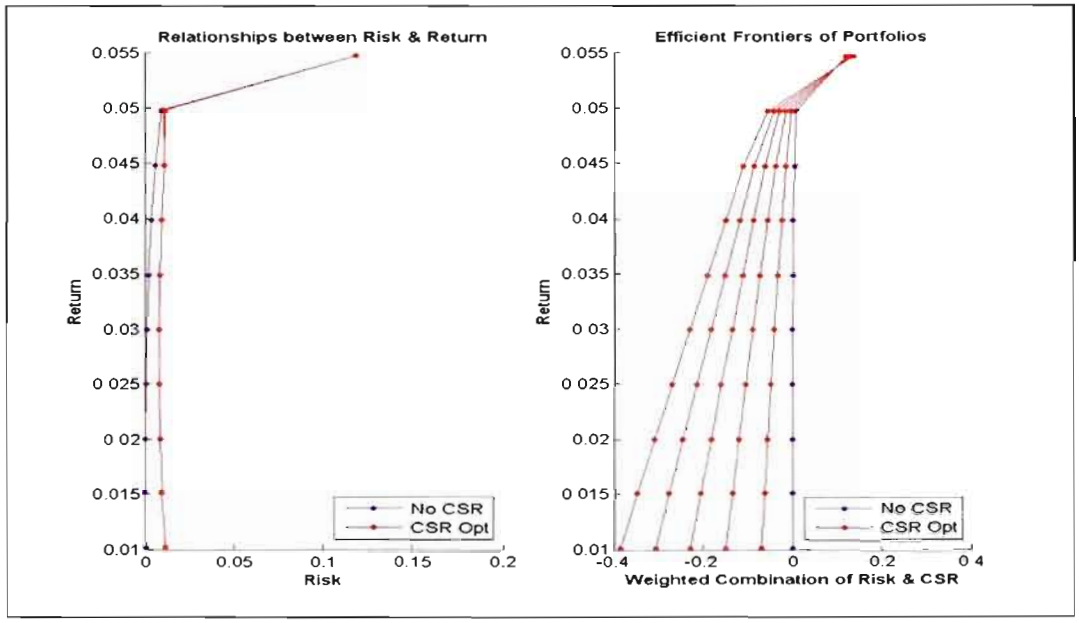

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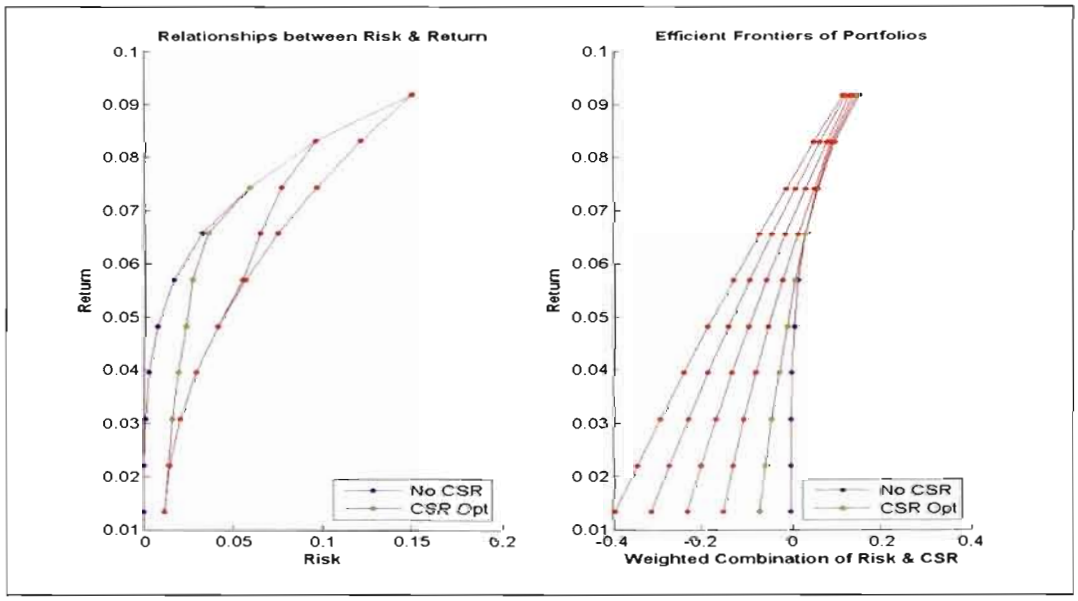

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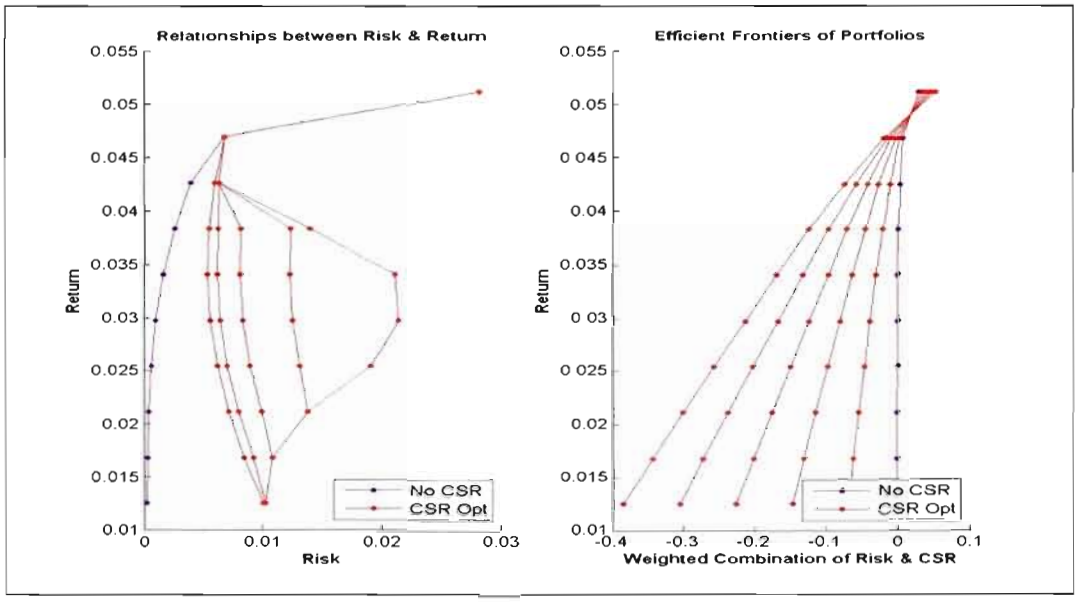

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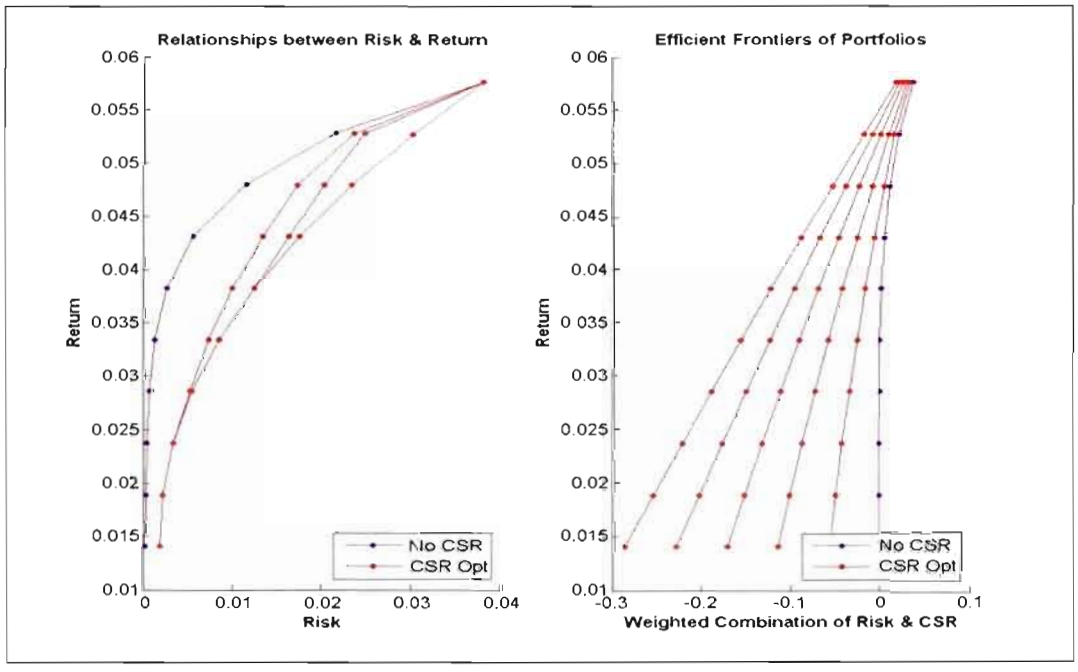

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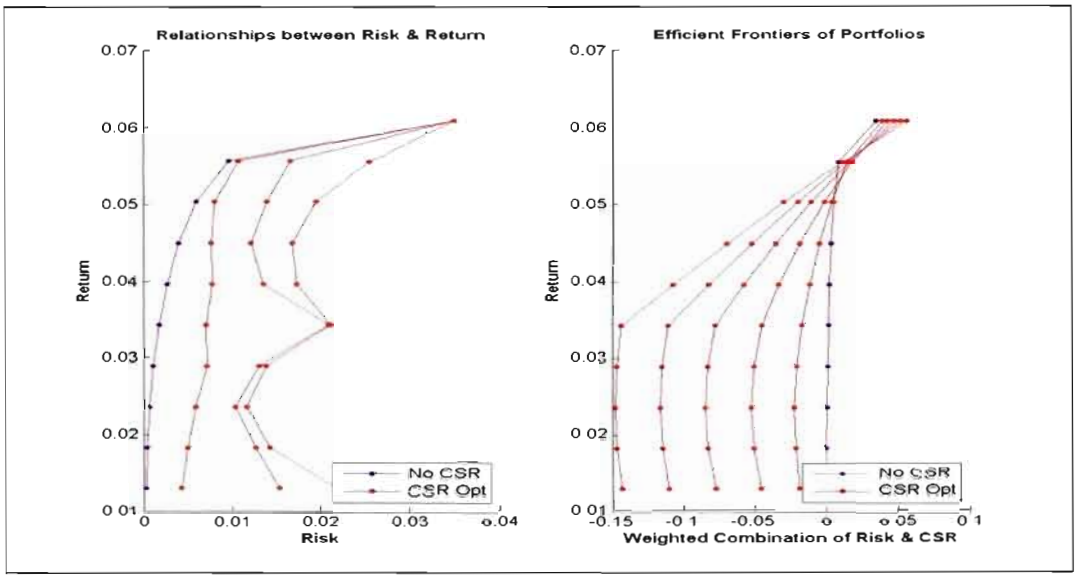

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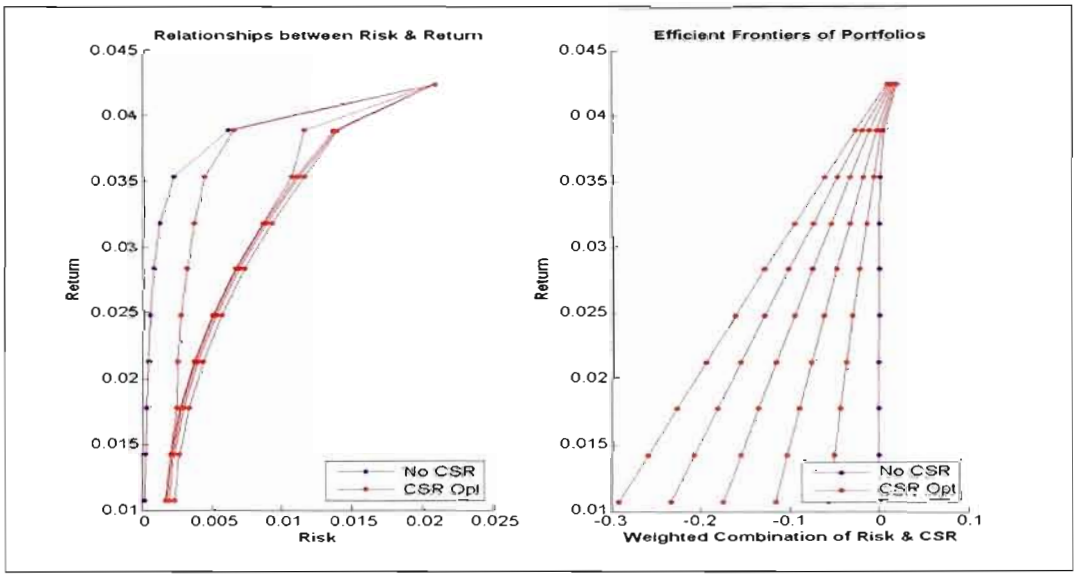

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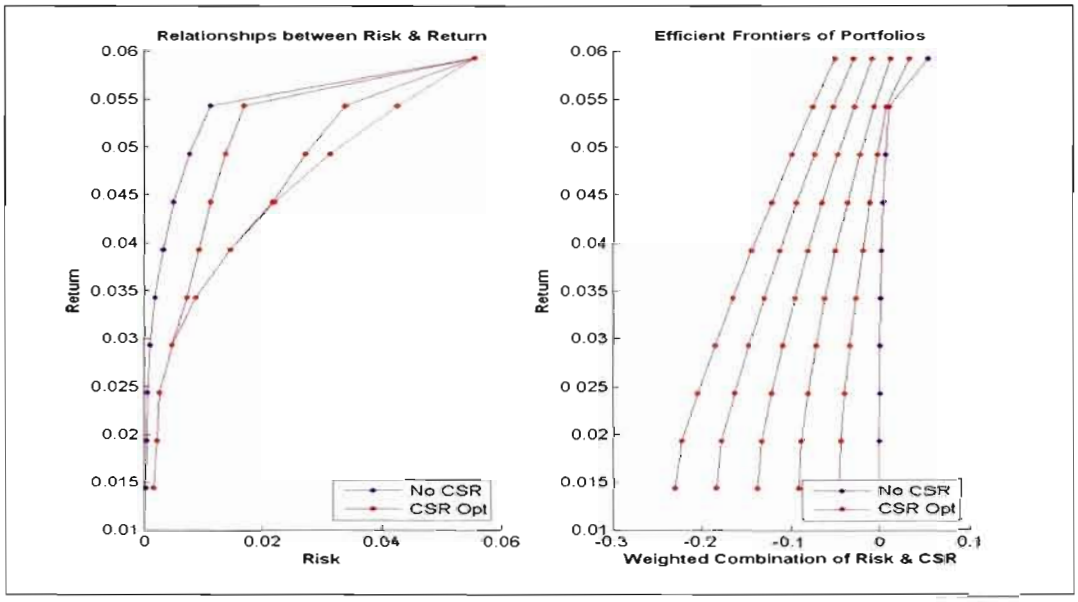

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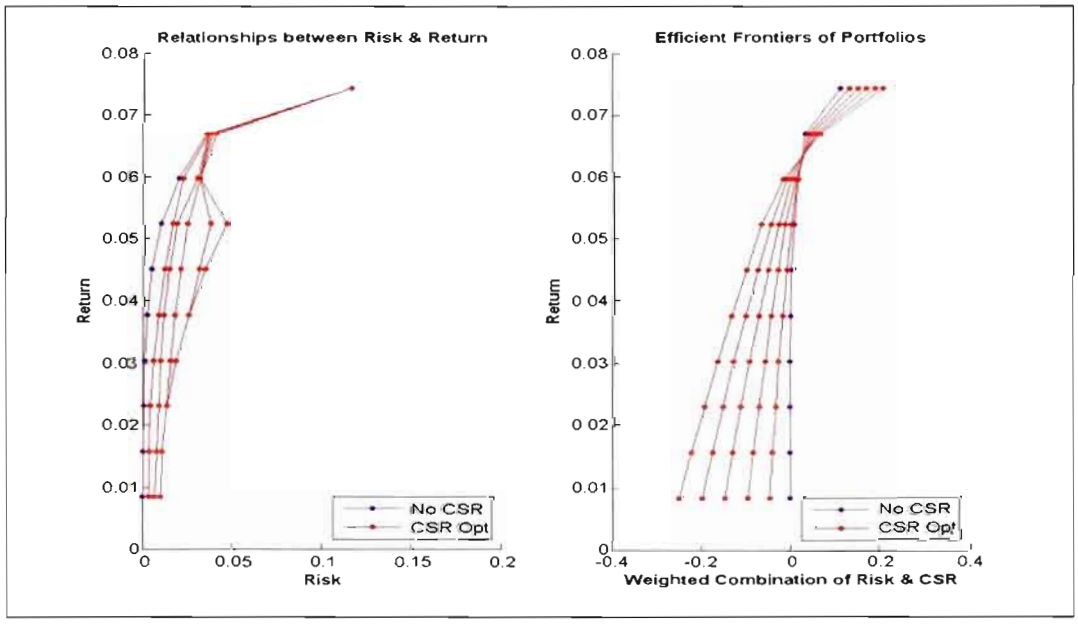

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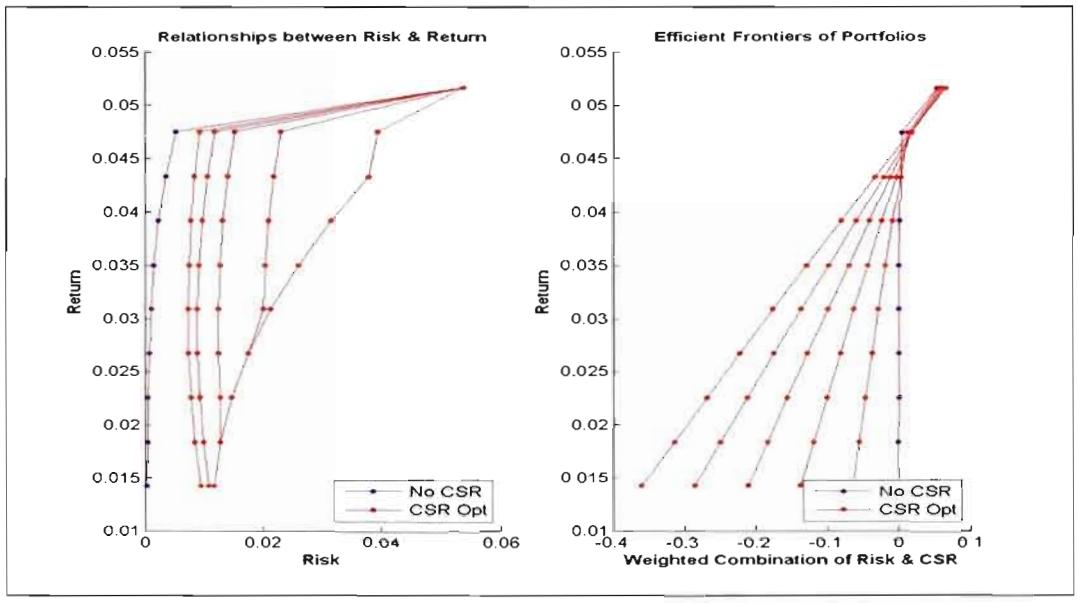

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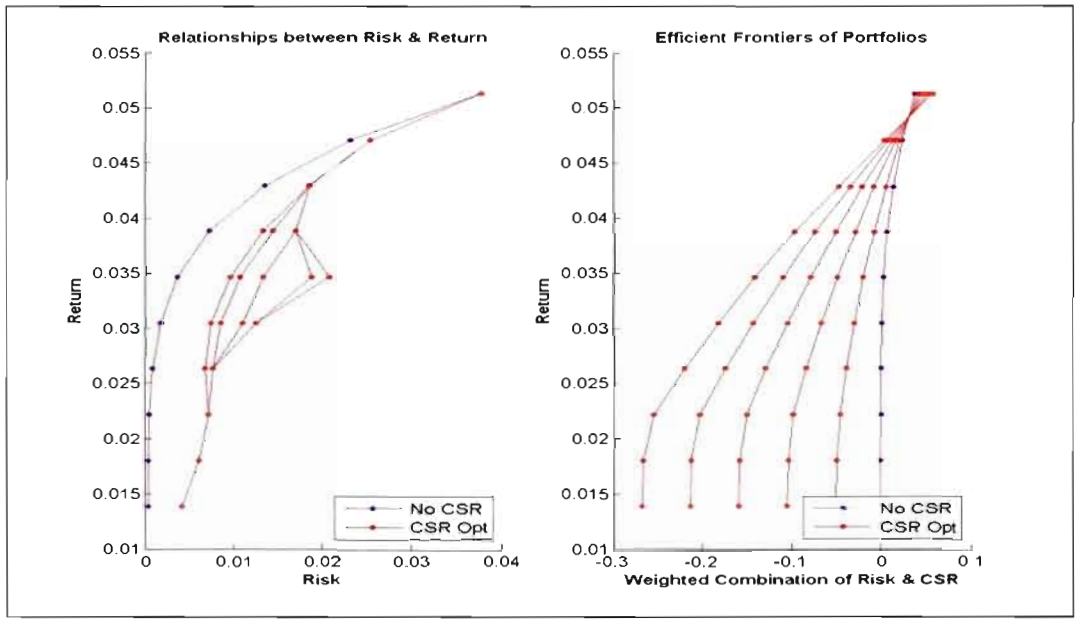

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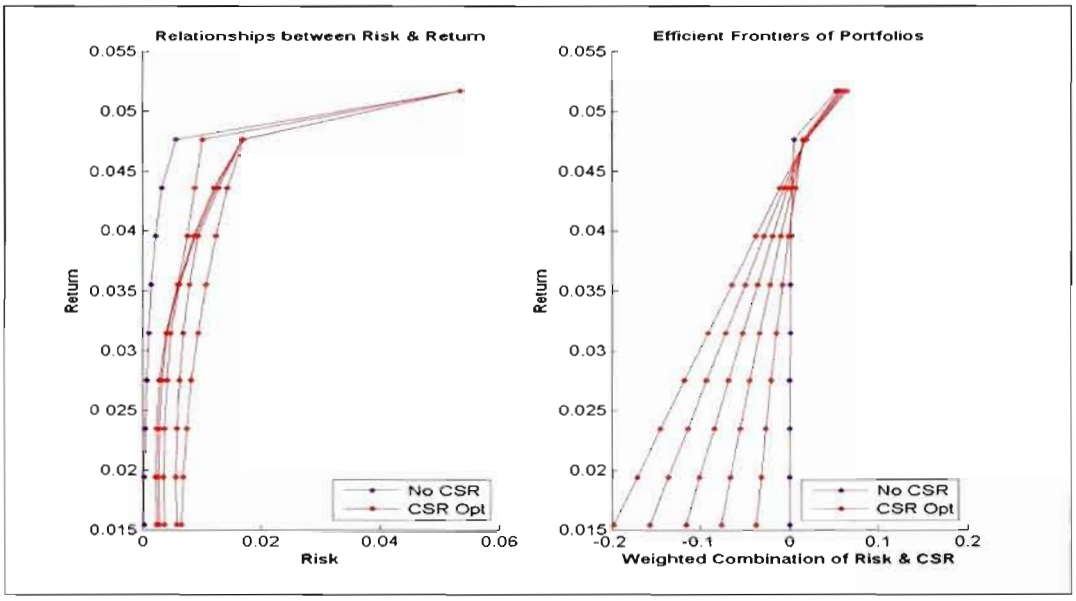

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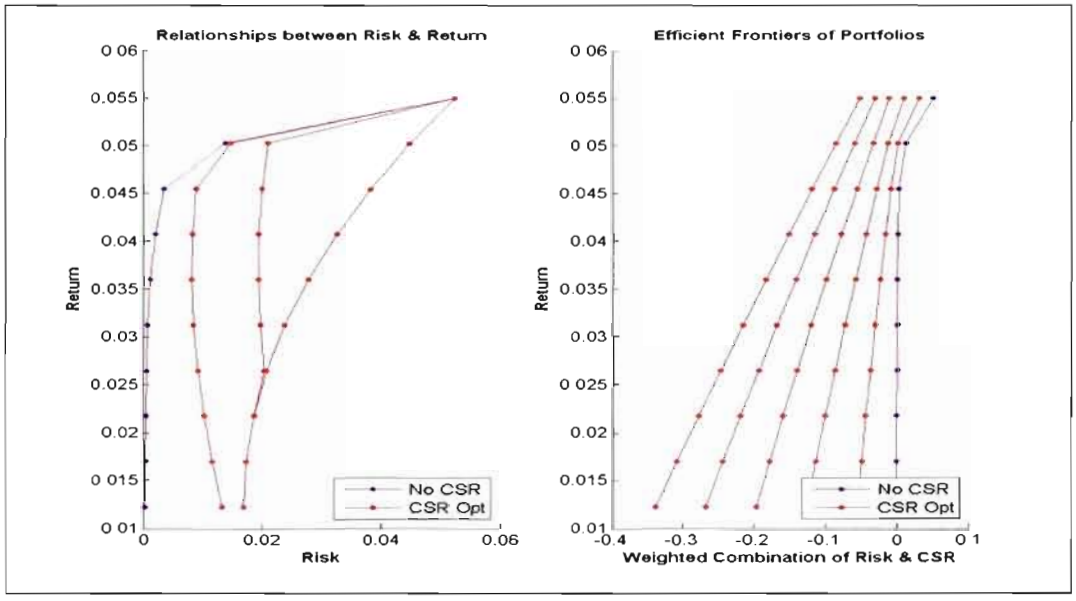

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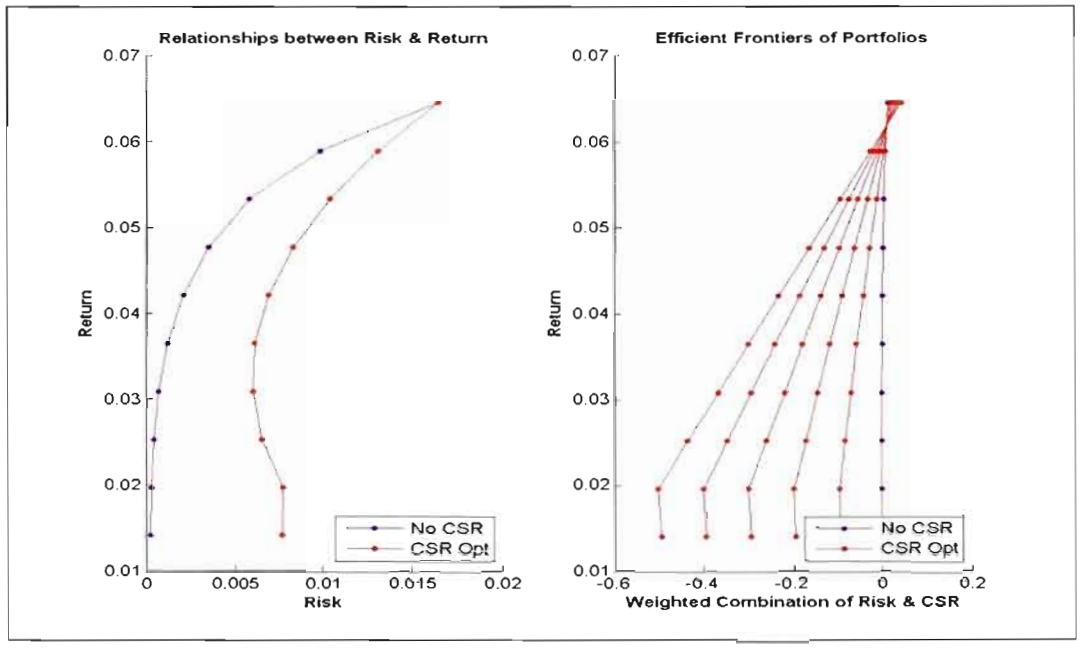

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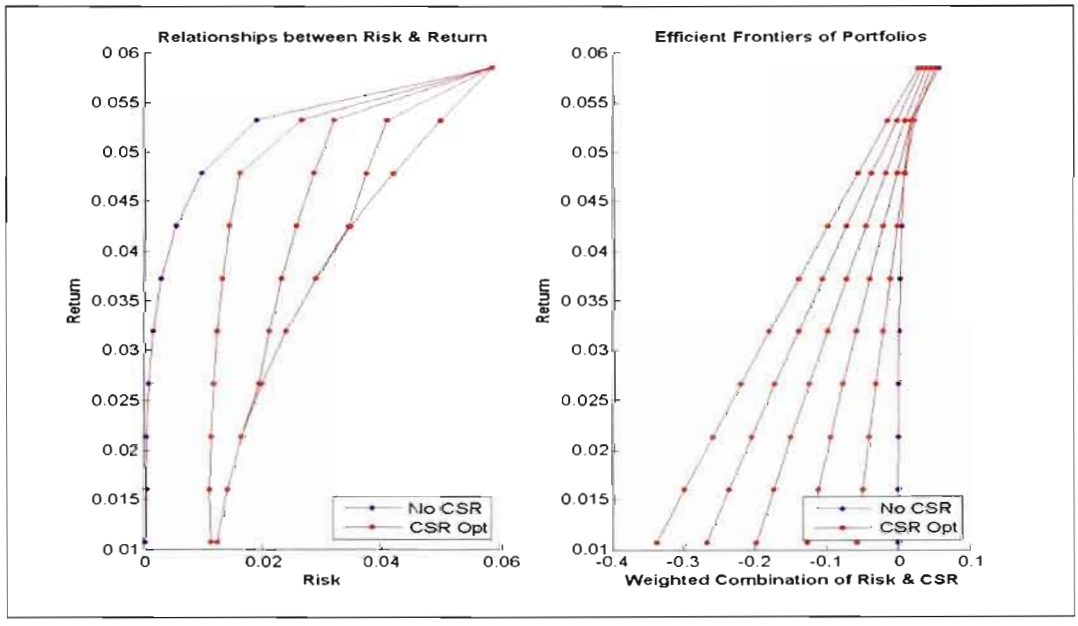

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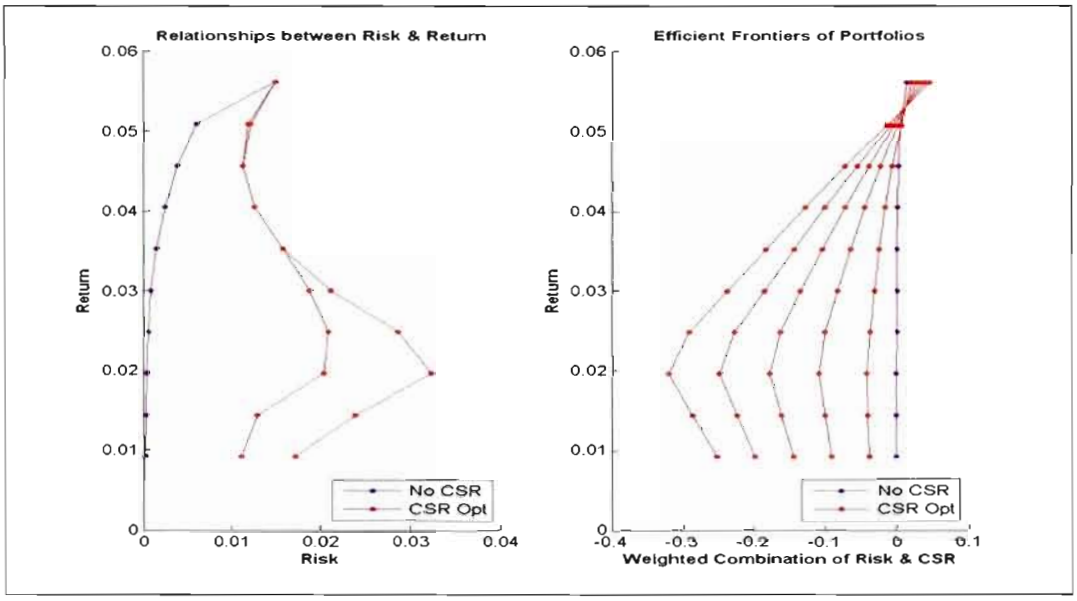

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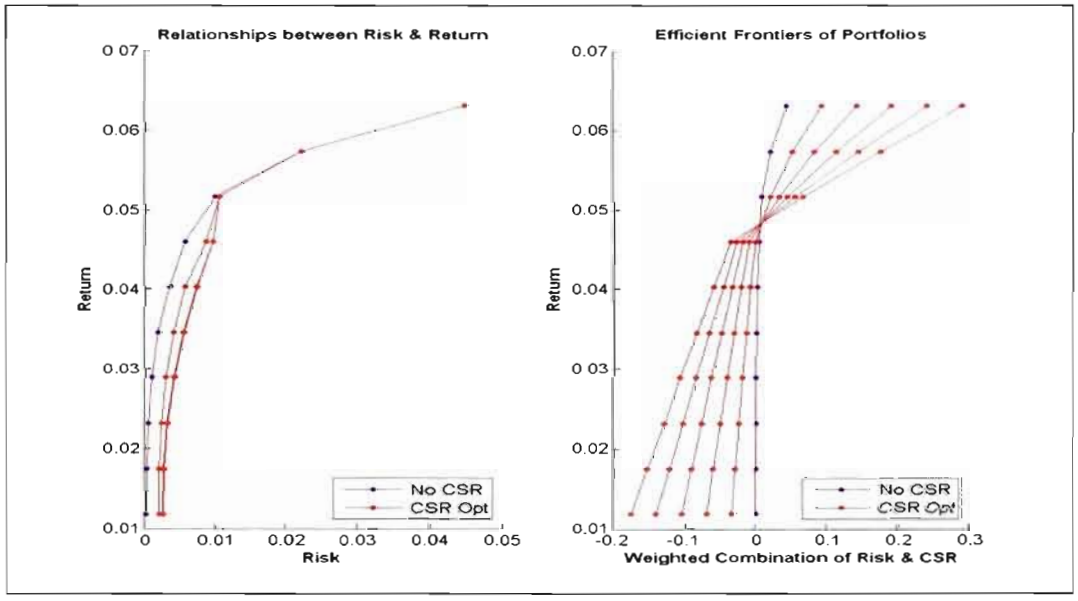

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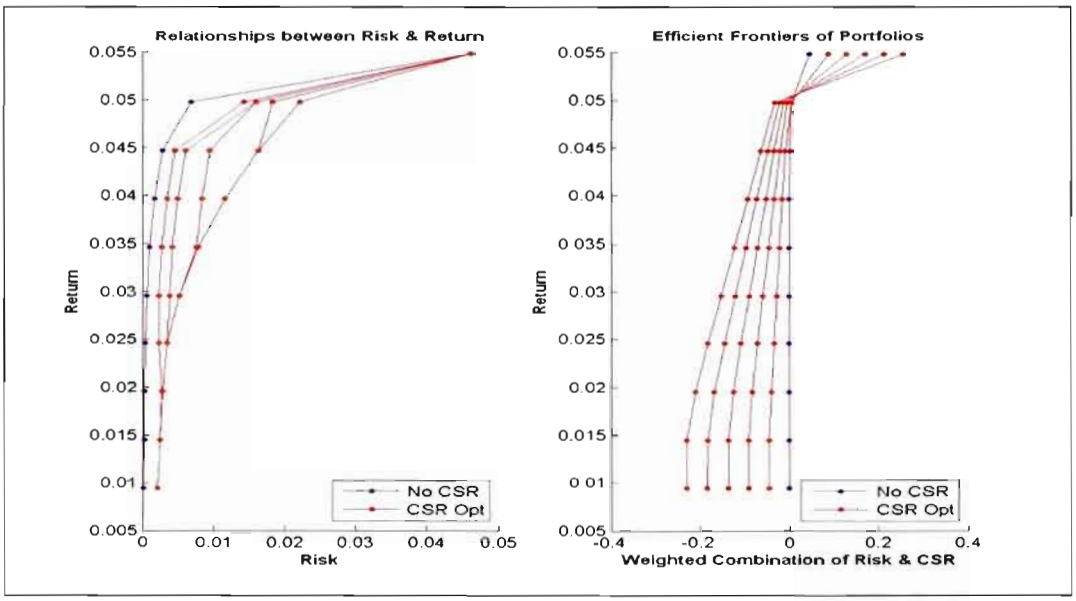

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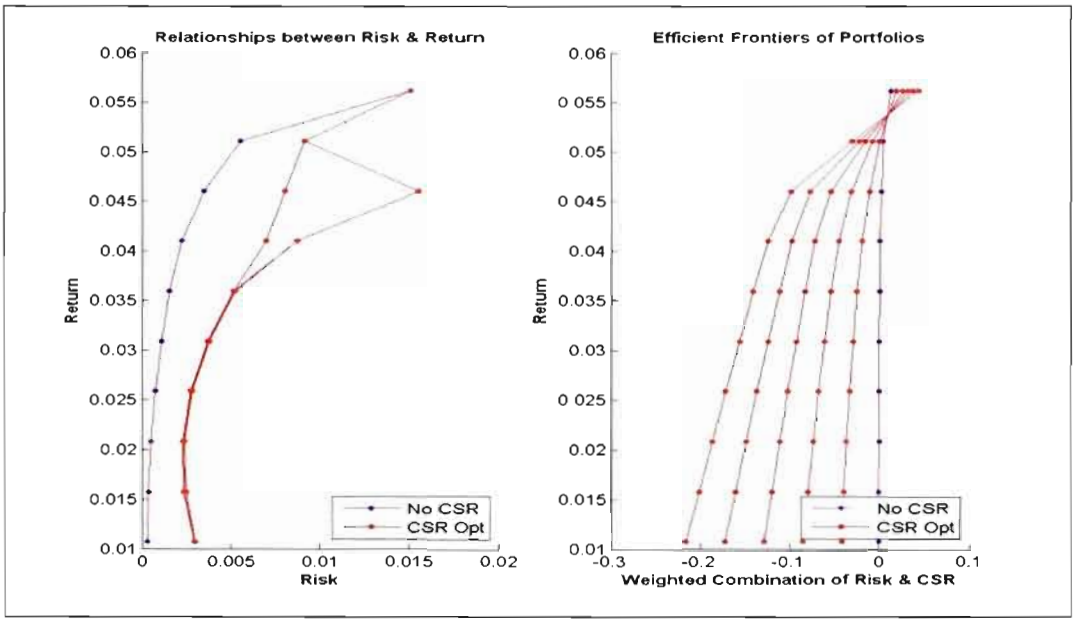

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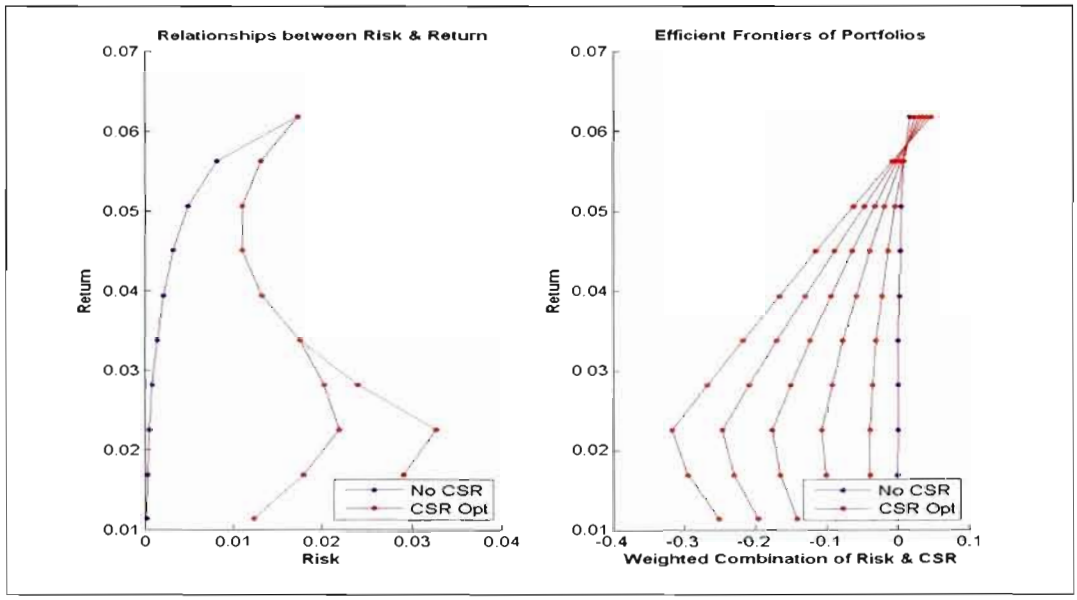

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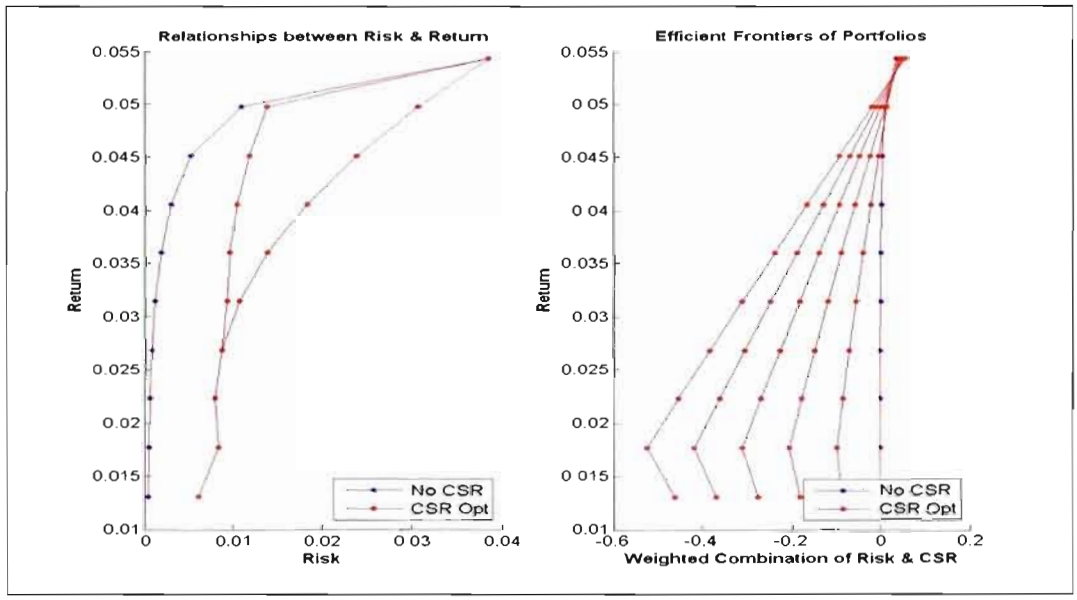

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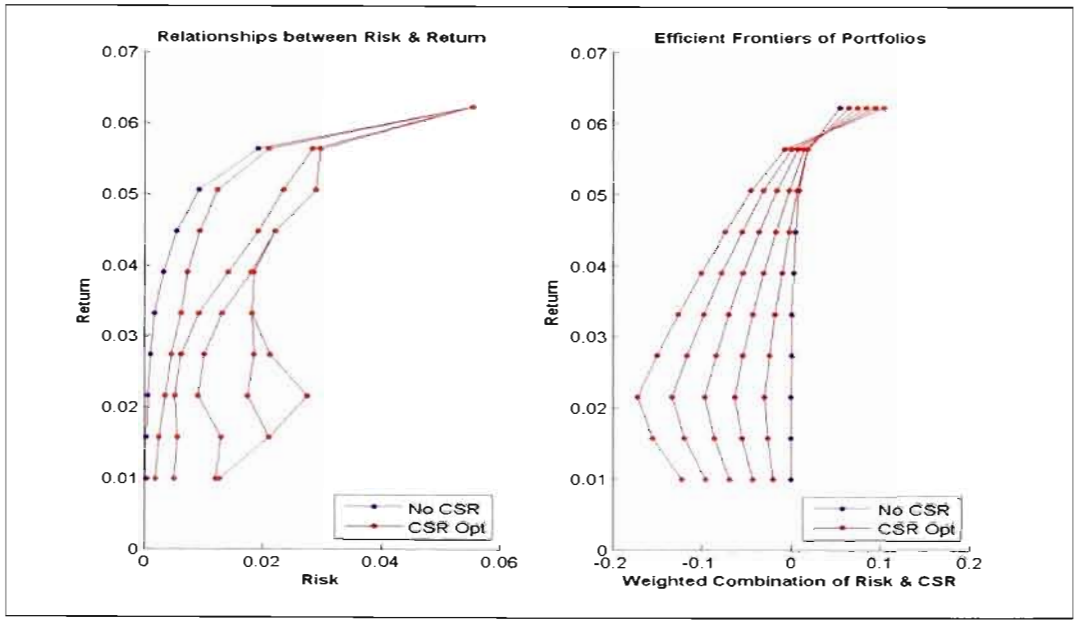

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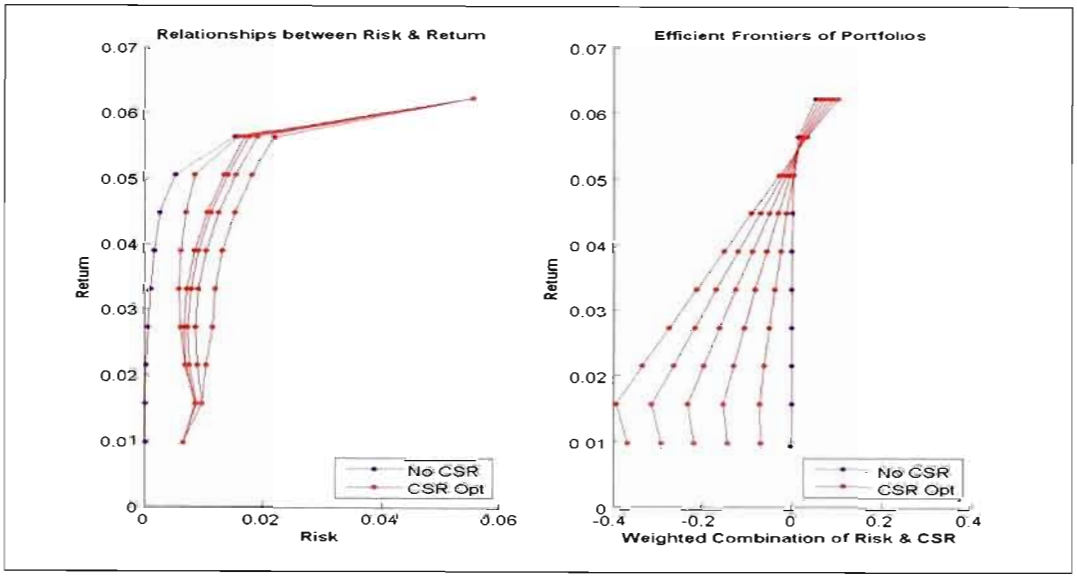

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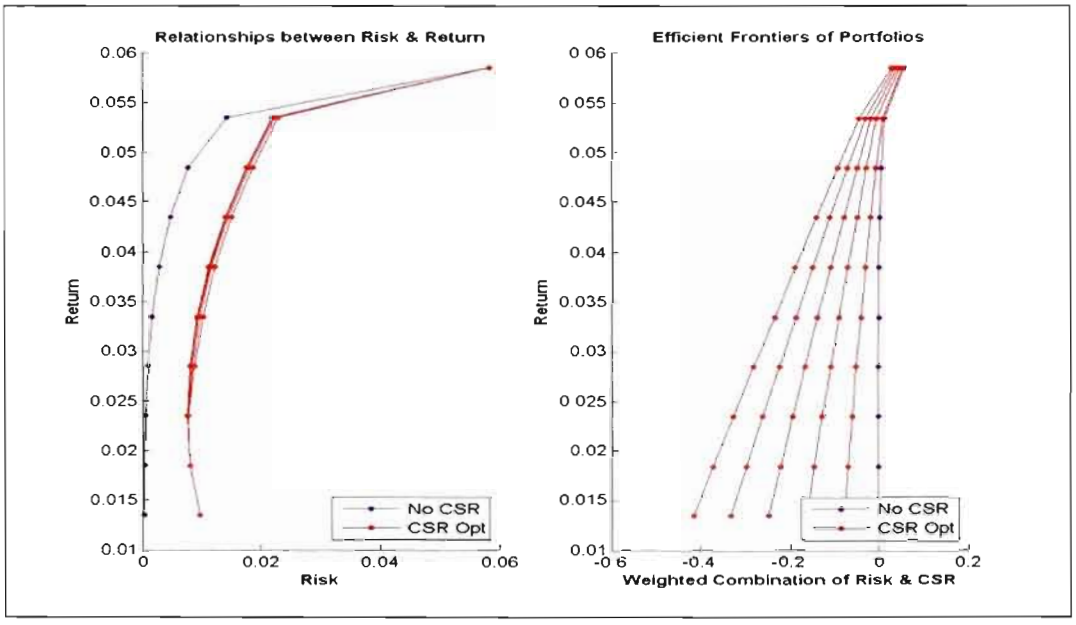

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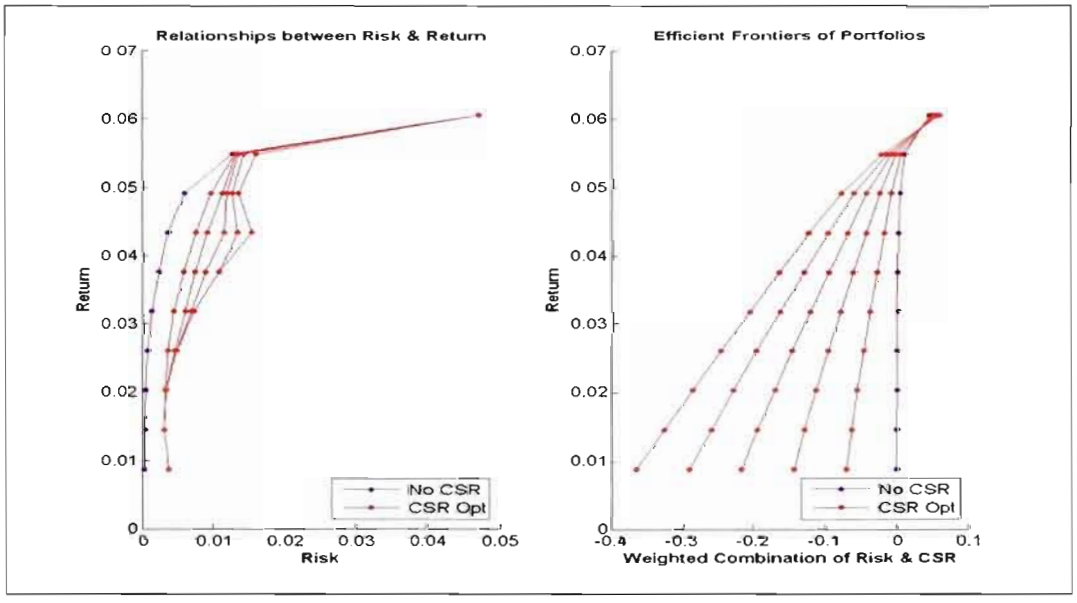

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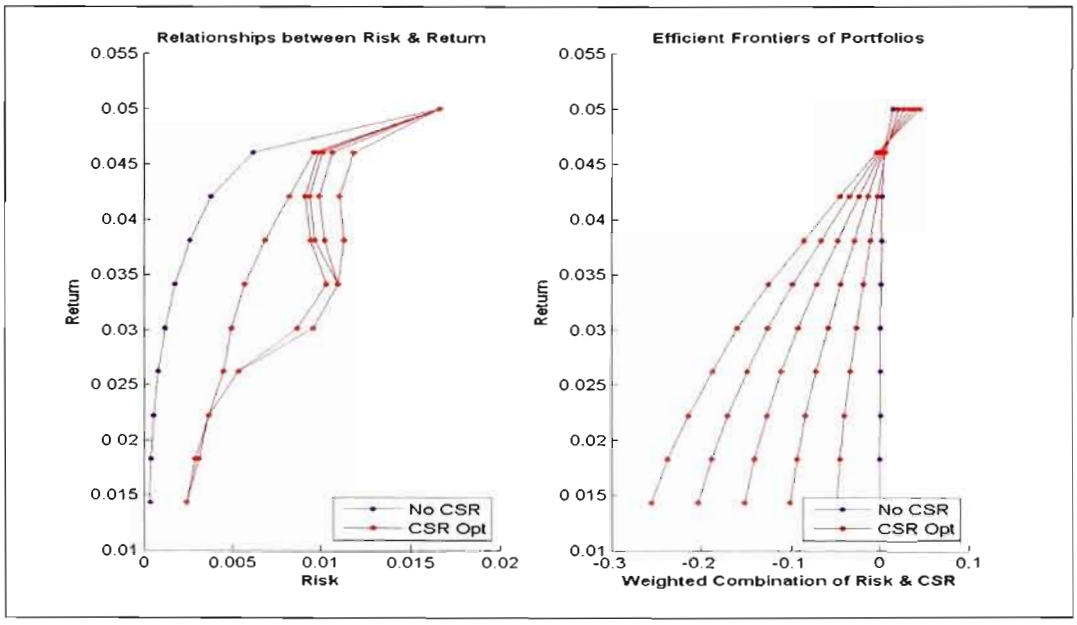

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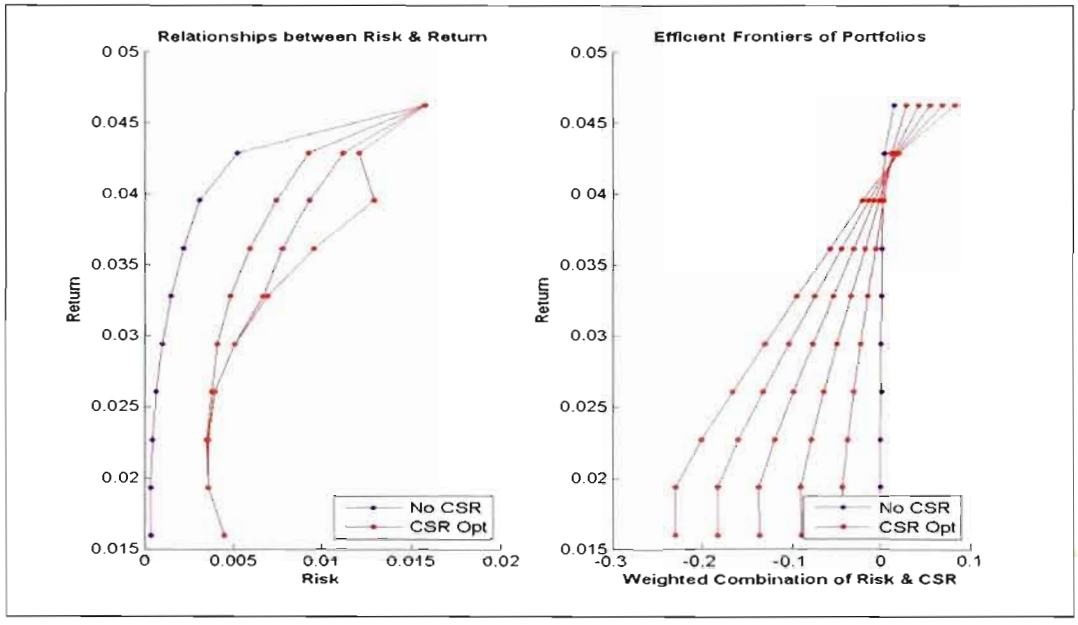

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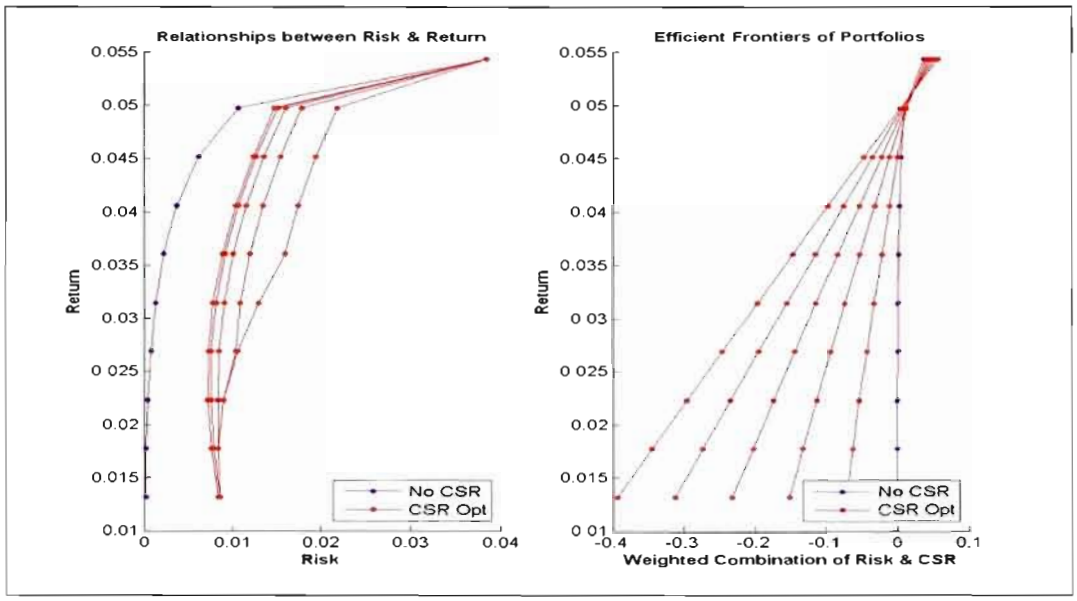

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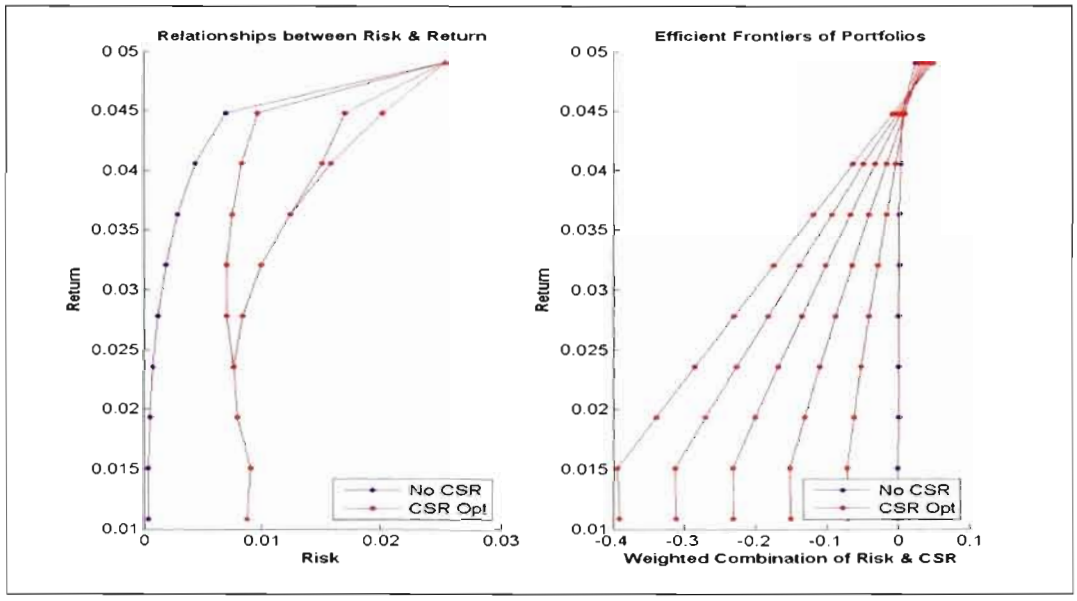

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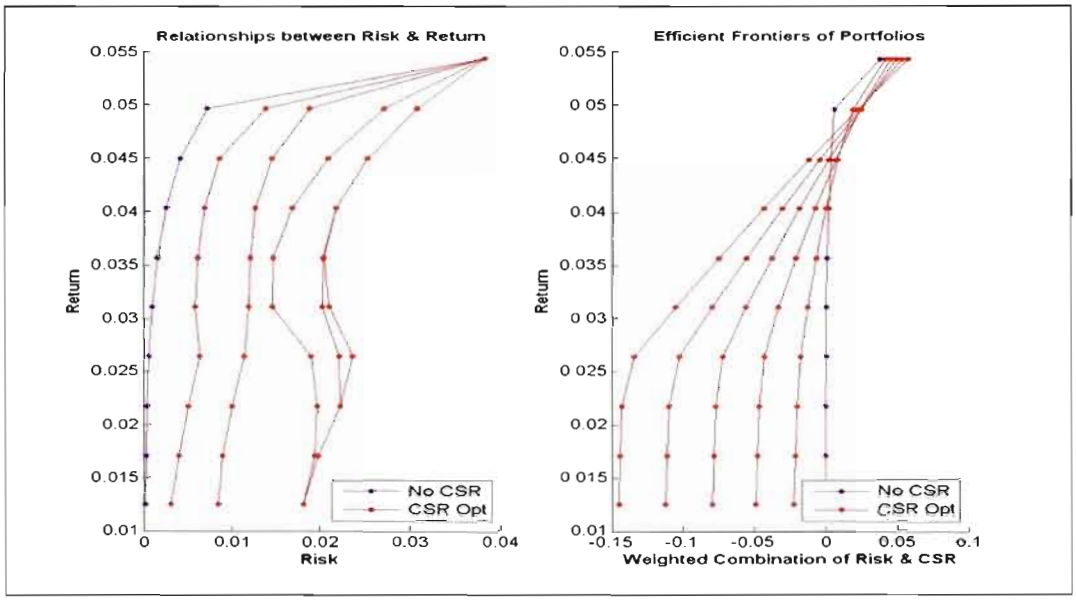

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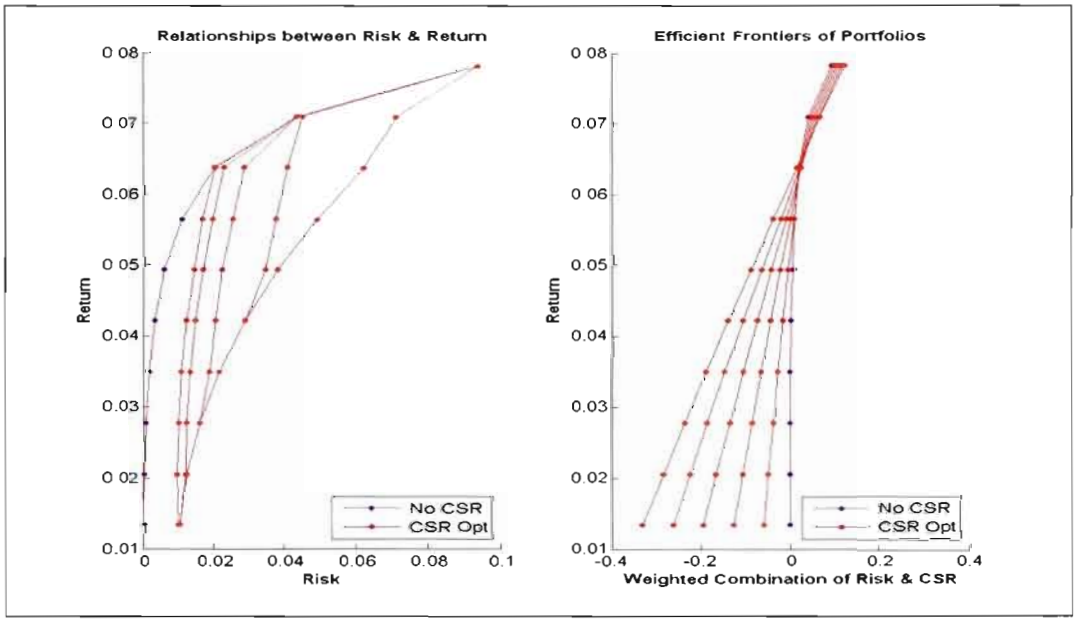

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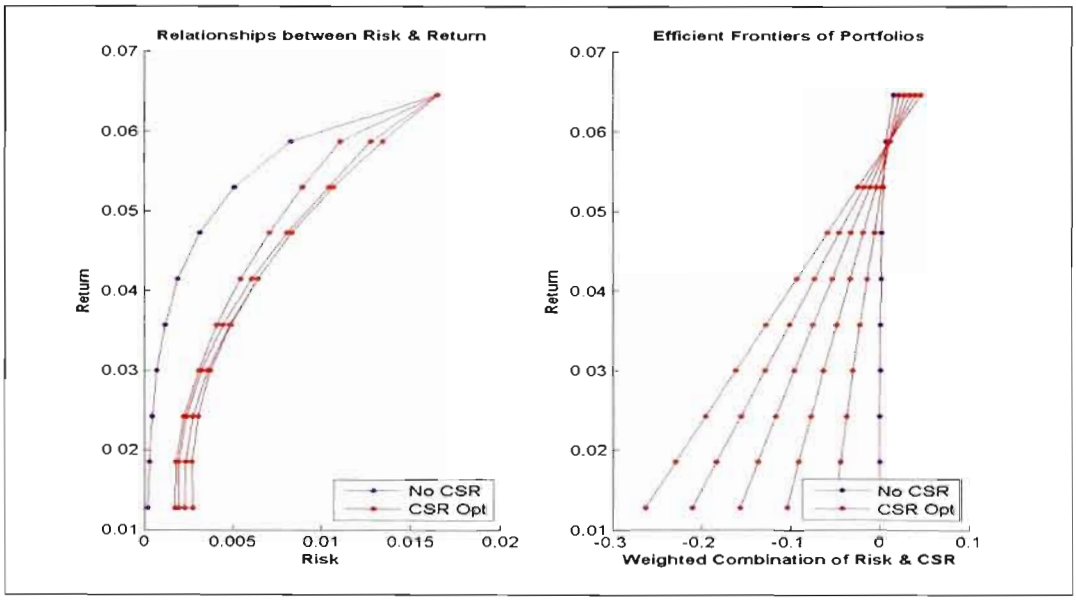

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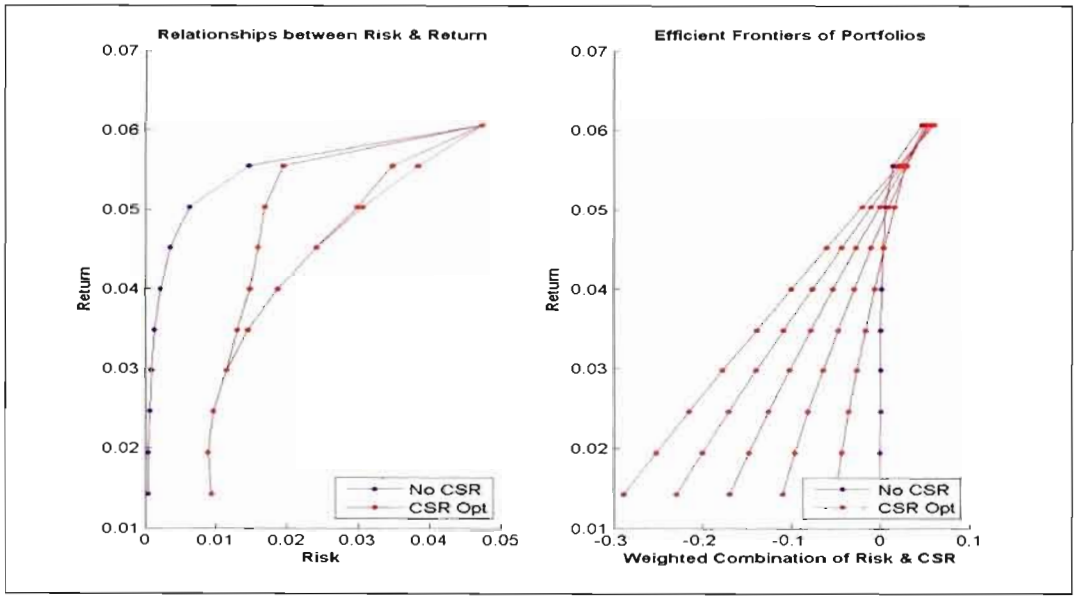

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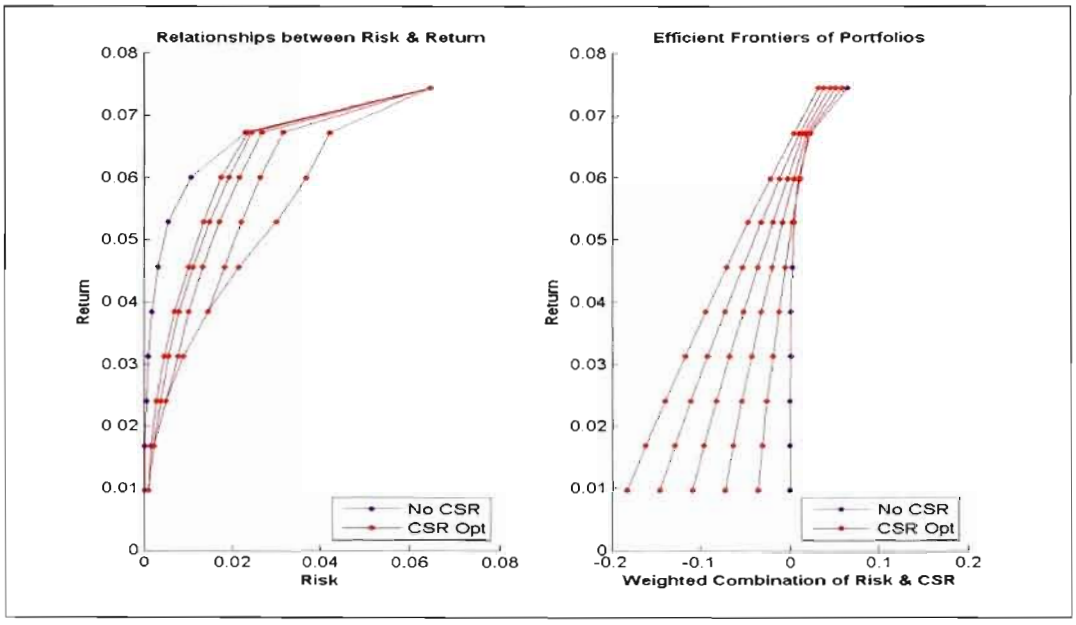

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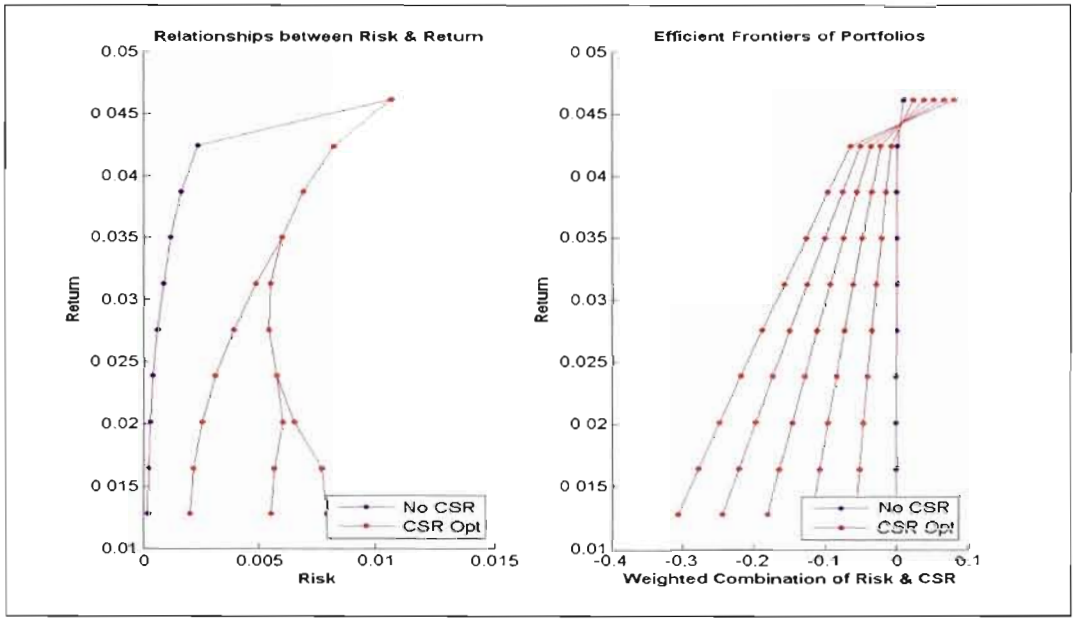

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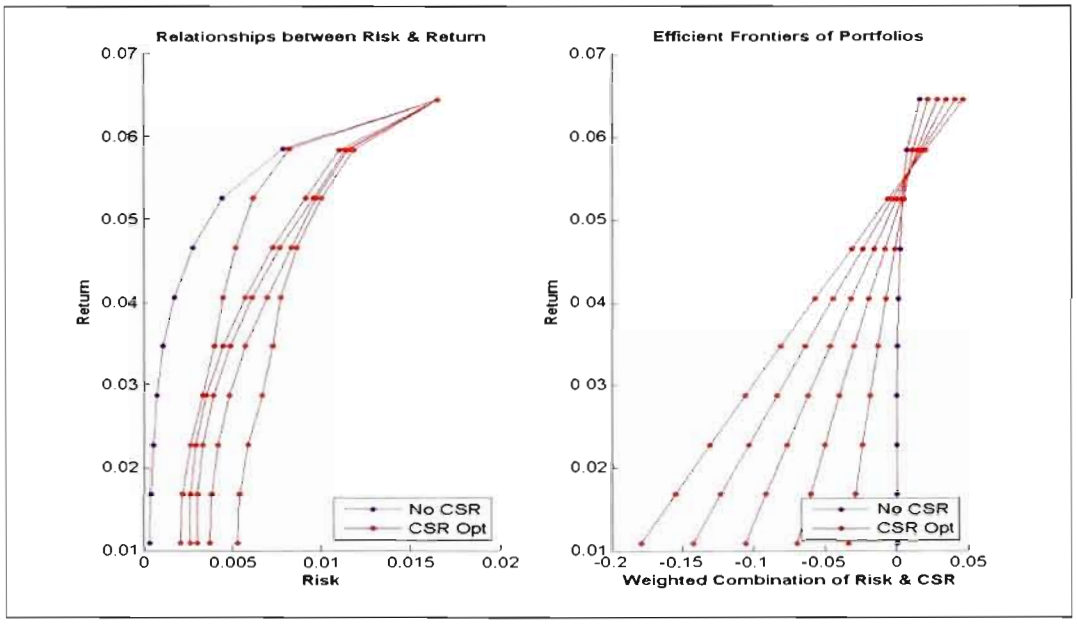

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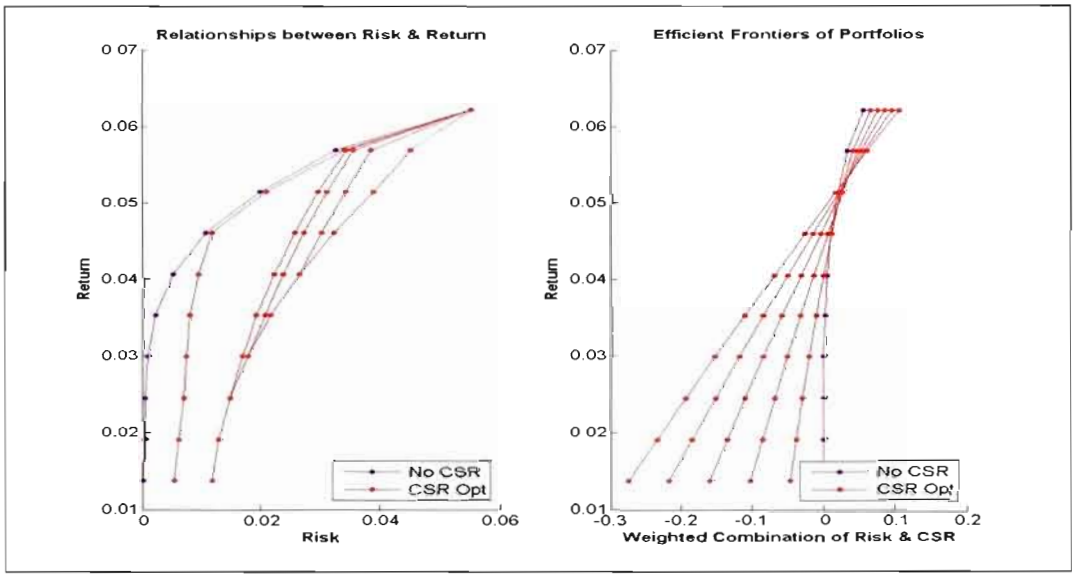

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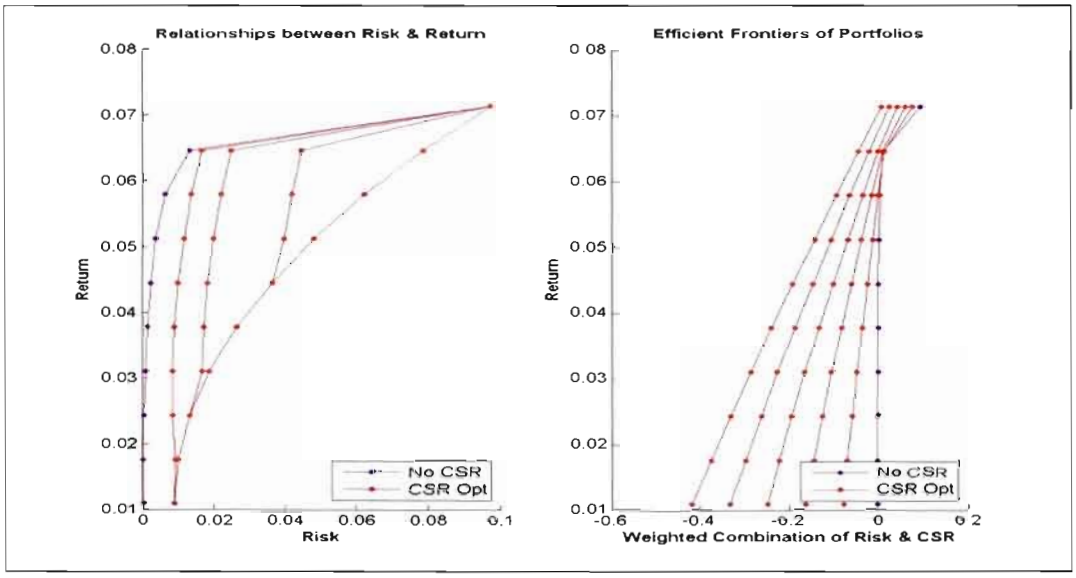

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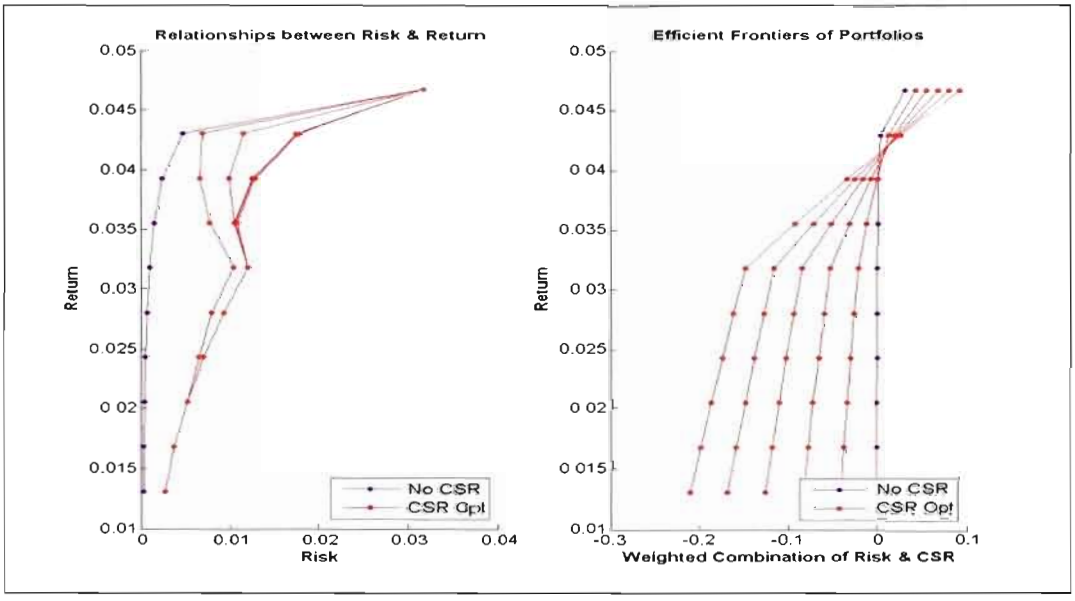

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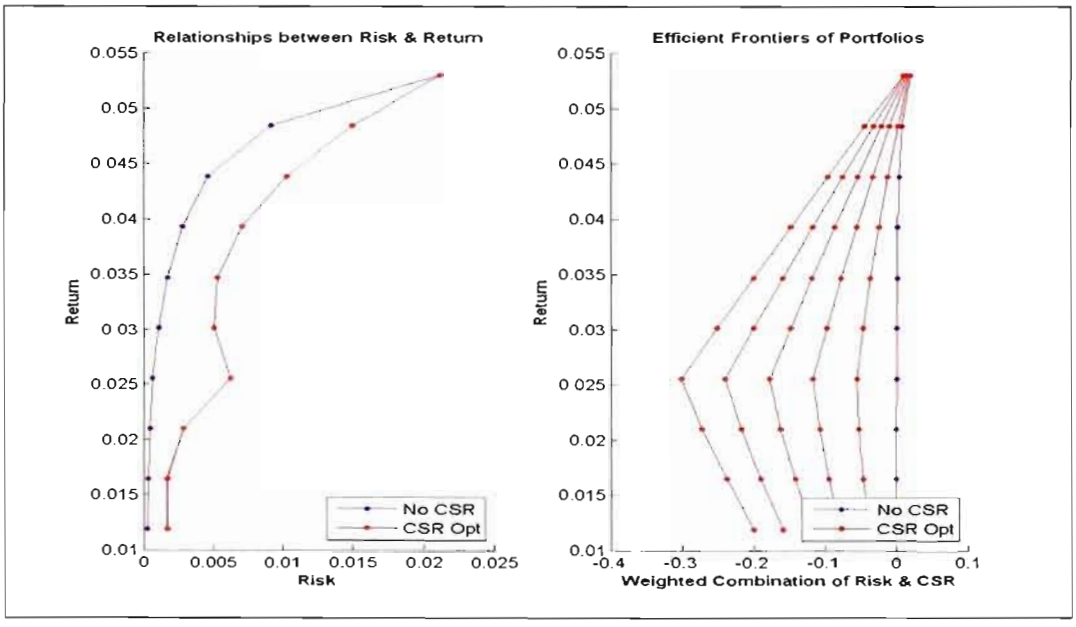

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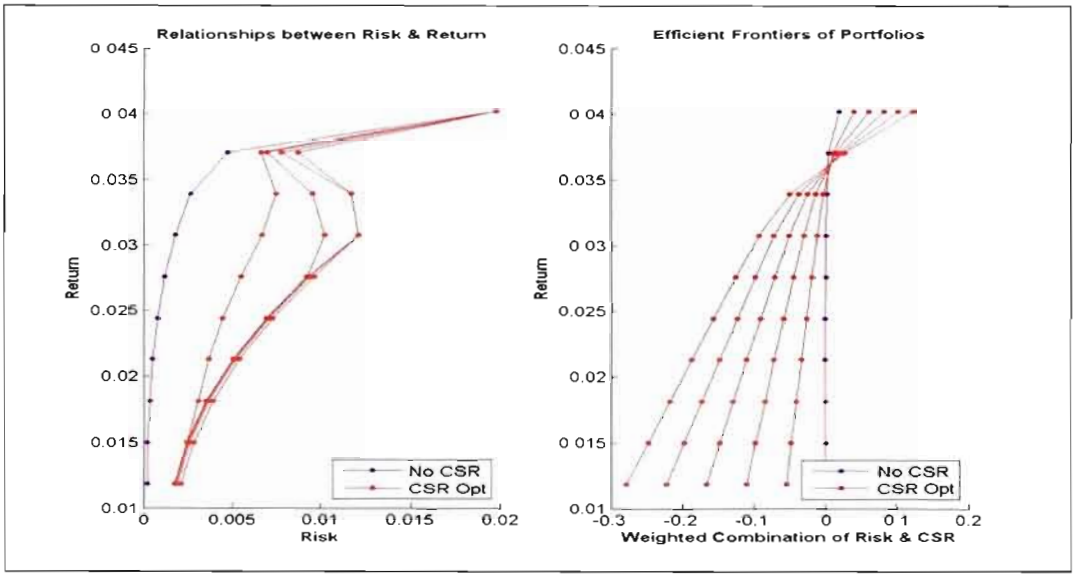

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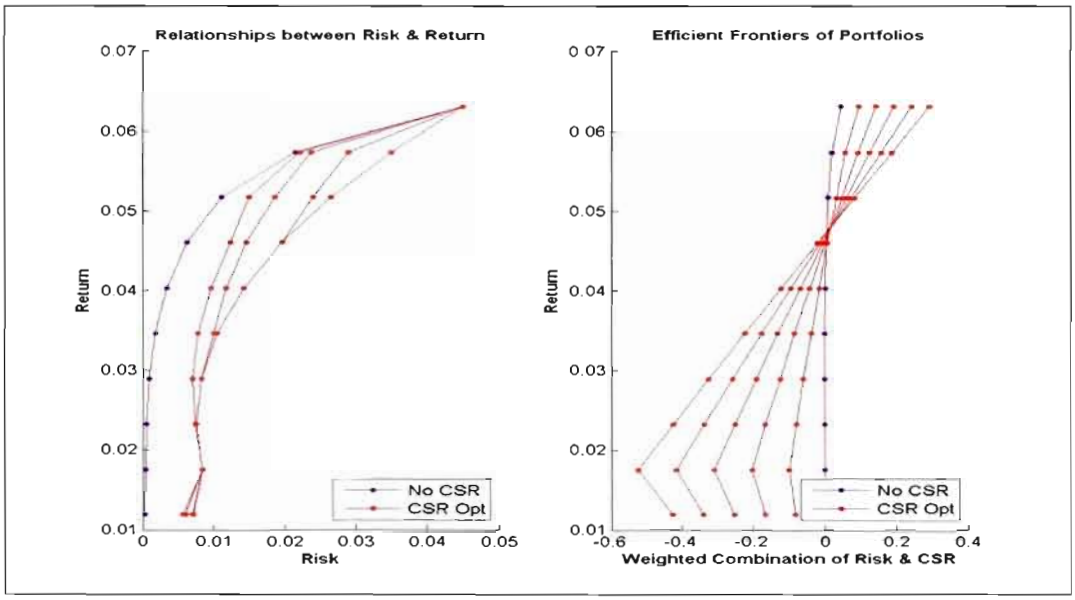

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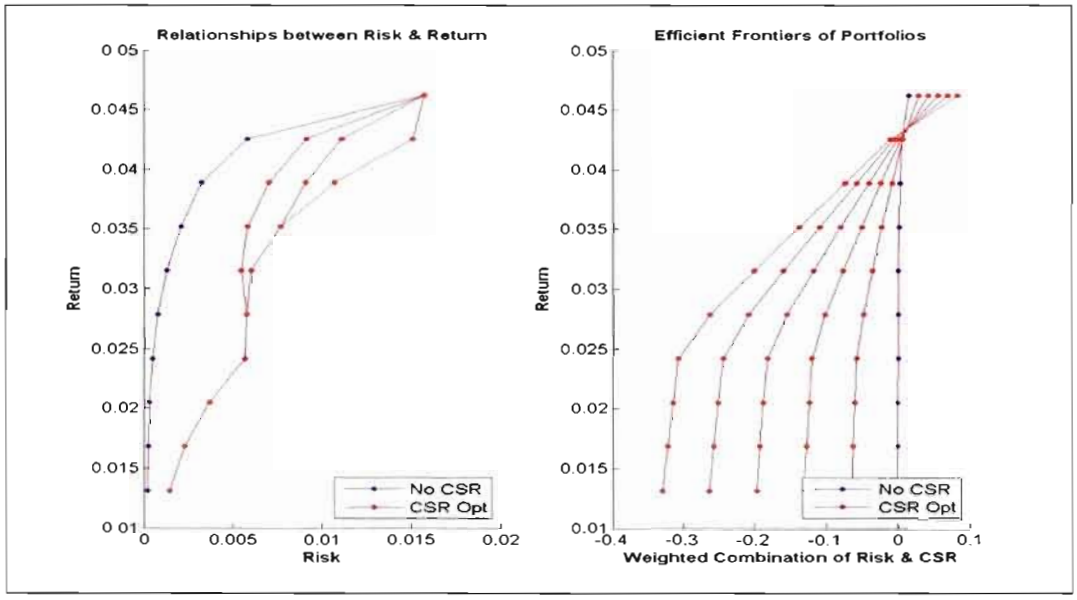

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