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# A new perspective of equity market performance

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### ARTICLE INFO

### ABSTRACT

The traditional data envelopment analysis (DEA) models assess equity market performance using the risk and return factor values associated only with the assessed equity market. However, in DEA models, the risk and return factors may be valued differently for different equity markets. A measure that incorporates the risk and return factor values of other equity markets to assess the performance of a given equity market is cross-efficiency. The cross-efficiency of an equity market provides a global perspective of its performance. In this paper, each year from 2003 to 2011, we estimate the cross-efficiency of 40 equity markets in a multi-dimensional risk-adjusted return framework. Applying the multiple-correlation clustering algorithm to the estimated cross-efficiency scores we classify the equity markets so that each cluster comprises of the markets that have been ranked similarly by the other equity markets. We highlight that cross-efficiency scores and membership in clusters is useful information to investors when constructing international portfolios.

## 1. Introduction

Performance of financial products such as mutual funds is usually assessed under a risk-adjusted return framework. Two commonly used risk-adjusted return performance measures are, Sharpe ratio and Treynor ratio. These ratios measure risk-adjusted return with one measure of risk and one

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measure of return and therefore they may be classified as one-dimensional measures. Risk however is multidimensional. The risk positions that investors take may depend on their situation. Examples of risk positions that investors may take are shortfall risk, downside risk and total risk. One-dimensional approaches of performance assessment cannot account for the multidimensional nature of risk (Colson and Zeleny, 1979; Hurson and Zopounidis, 1995). Nevertheless, formulating a single comprehensive measure of risk that incorporates multiple risk factors is not easy. When there are several measures of risk and several measures of return, the risk metrics and the return metrics has to be aggregated separately to construct a composite measure of risk and a composite measure of return. One way of constructing a composite measure is to use a weighting scheme. Then the performance may be assessed in the ratio of a weighted sum of return to a weighted sum of risk. The non-parametric technique known as data envelopment analysis (DEA) computes such weights allowing each financial product being evaluated to show its performance in the best possible manner. Being a non-parametric technique, having the ability to accommodate multiple risk and return factors and assessing performance based on known levels of attainment rather than with reference to a benchmark makes DEA a powerful performance appraisal tool.

A large number of DEA applications are documented in the finance literature. For example, DEA has been used to assess the relative performance of mutual funds (Choi and Murthi, 2001), hedge funds (Gregoriou et al., 2005), banks (Vassiloglou and Giokas, 1990) and insurance companies (Cummins and Zi, 1998). Bainbridge and Galagedera (2009), Meric and Meric (2001) and Galagedera (2010) use DEA to assess equity market performance.

If return is the reward for bearing risk, we may consider return factors as output variables and risk factors as input variables of a process that compensates risk (inputs) with return (outputs). In the case of equity markets, the DEA methodology assesses performance by allowing each equity market to show its performance in a manner that is most favourable to that equity market. This is achieved by choosing the weights that gives the highest ratio of weighted sum of outputs to weighted sum of inputs. Each equity market may therefore choose different sets of weights.[1] Because of the freedom afforded to each equity market to choose its own weights, such an assessment of performance may be viewed as one of self-appraisal.[2]

An alternative is to assess the performance of all markets with a common set of weights. This means that the analyst will have to pre-specify a set of weights thereby introducing an element of subjectivity to the analysis. One way of circumventing this problem is to use the weights chosen by a given equity market to assess the performance of the other equity markets as well. The performance of a given equity market assessed with the weights of another equity market may be viewed as peer-appraised performance. In the DEA literature, peer-appraisal is referred to as cross-evaluation and the efficiency obtained through peer-appraisal is referred to as cross-efficiency (Sexton et al., 1986). We use peer-appraised efficiency and cross-efficiency interchangeably. Under peer-appraisal, the performance of a given equity market is assessed with the weights of each of the other equity markets in the sample. When this procedure is repeated for each equity market in the sample, all equity markets will have assessments based on a set of weights chosen by itself and by each of the other equity markets in the sample. Hence, we can obtain an average cross-efficiency score for each equity market indicating how the other equity markets in the sample may perceive its performance on average.[3] The average cross-efficiency score is simply the average peer-appraised performance score. Equity markets may be ranked based on the average peer-appraised performance score. Such rankings would be more

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[1] It is possible that one equity market assigns a lower weight to a particular risk factor and another equity market assigns a higher weight to the same risk factor.

[2] Another interpretation of this is that, under self-appraisal, the equity market being assessed assigns values to the return and risk factors to obtain the best possible (risk-adjusted return) performance score. Another equity market may value the same risk and return factors differently.

[3] Average cross-efficiency gives a broad overview of performance. The traditional measures such as the Sharpe ratio considers the returns associated with the equity market being assessed only and therefore such assessment is in line with the notion of self-appraisal.