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An empirical evaluation of estimation error reduction strategies applied to international diversification☆

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ABSTRACT

This paper evaluates the international diversification performance of estimation error reduction strategies from the perspective of individual investors in 34 countries. These strategies can provide significantly lower levels of volatility versus the naively diversified domestic and international equity benchmarks. Both the global market capitalization weighted portfolio and the optimization strategies fail to achieve significant return-to-risk gains beyond the domestic market portfolio for investors in at least 31 countries. The results suggest that the potential economic gains available from international diversification reported in previous literature may be overstating the time-varying benefits that can be realized out of sample.

1. Introduction

The assumption of risk sharing in the international capital asset pricing model (e.g., Sercu, 1980; Solnik, 1974a) and the efficient portfolio optimization (Markowitz, 1952) envisaged by modern portfolio theory imply that investors will benefit from international diversification. However, investors exhibit a bias for local investments,[1] despite the potential benefits from optimization reported in the literature (e.g., De Roon et al., 2001; Driessen and Laeven, 2007; Li et al., 2003). This may be in part because the time-varying return distribution of assets reduces the effectiveness of mean-variance optimization out of sample (e.g., DeMiguel et al., 2009b; Jorion, 1985). Estimation error reduction strategies recently presented in the literature are reported to improve the efficiency of out-of-sample optimized portfolios consisting of stocks in a single market (e.g., Behr et al., 2013; DeMiguel et al., 2009a; Ledoit and Wolf, 2003, 2004a,b; Levy and Levy, 2014a). And while Jacobs et al. (2014) finds that estimation error reduction strategies do not provide European investors with significant diversification benefits versus naive international allocation strategies, the effectiveness of these strategies versus an investor's domestic market portfolio is not reported. In this paper I extend the literature regarding the benefits from international diversification available to investors in different countries by investigating the following questions: Are investors certain to achieve positive

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[1] This bias is identified in the early literature investigating the potential benefits from international diversification (e.g., Levy and Sarnat, 1970; Solnik, 1974b,c). French and Poterba (1991) highlight the extent of this bias across countries. Investors are increasing the size of foreign asset positions over time, but the home bias persists (e.g., Stulz, 2005; Tesar and Werner, 1995).

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diversification benefits from naive international diversification? Do optimization strategies prone to estimation error capture international diversification benefits out of sample? Can estimation error reduction strategies presented in the literature achieve significant improvements to portfolio efficiency beyond naively diversified benchmarks?

Early literature reports weak correlations between national markets and concludes investors can achieve diversification benefits from investing internationally (Grubel, 1968; Lessard, 1973; Levy and Sarnat, 1970). Studies measuring the potential benefits of international diversification from in-sample optimized portfolios using constant correlations over long investment horizons report that there are significant gains to portfolio efficiency available from using short sales (e.g., De Roon et al., 2001; Driessen and Laeven, 2007; Li et al., 2003). While restrictions on short sales are shown to largely reduce these benefits for U.S. investors (De Roon et al., 2001; Li et al., 2003), they can remain significant for investors in developing countries with high country risk (Driessen and Laeven, 2007). Chiou (2008) reports that constraints on positive market allocations further reduce, but do not eliminate, the potential benefits from international diversification for U.S. investors. McDowell (2017) extends these results and finds U.S. investors do not achieve significant positive return-to-risk (RR) improvements versus the domestic U.S. market during the 1988–2014 investment period from either naive international diversification or portfolios optimized with relaxed constraints on overseas market allocations and no short sales.

Correlations between markets have oscillated over the 20th century (Goetzmann et al., 2007; Quinn and Voth, 2008), with correlations peaking at the end of the 19th century, the Great Depression and the late 20th century. Because of changing market correlations, diversification benefits are time-varying in nature (You and Daigler, 2010). Levy and Levy (2014b) propose that strengthening correlations between markets magnify international trade frictions such as the asymmetric information costs and the higher variance in returns that result from currency risk. Because of this, they posit that the documented equity home bias amongst investors across countries (e.g., French and Poterba, 1991; Stulz, 2005; Tesar and Werner, 1995) will persist.

Early literature identifies the weak ex-ante performance of classical mean-variance optimization used in international diversification with historical estimates (Jorion, 1985). Return estimation error is large and results in poor out-of-sample optimization performance relative to the naive investment strategy of buying a market capitalization weighted (1/M) or an equally weighted (1/N) portfolio (DeMiguel et al., 2009b; Jorion, 1985). Jorion (1985) proposes the use of minimum-variance portfolio (MVP) optimization to remove return error from the optimization process. And Jagannathan and Ma (2003) shows that imposing weight constraints in the optimization solution, or the use of a shrunk covariance matrix, can reduce estimation error and improve the efficiency of out-of-sample optimized portfolio performance. Recent strategies designed to reduce estimation error through sample covariance matrix shrinkage (Ledoit and Wolf, 2003, 2004a,b) or constraints on the allocation weights in the optimization solution (Behr et al., 2013; DeMiguel et al., 2009a; Levy and Levy, 2014a) are reported to provide moderate ex-ante performance improvements compared to naive portfolios of U.S. equities.

The literature measuring the performance of estimation error reduction strategies has largely focused on analysing the results of optimization using stocks in a single market. Jacobs et al. (2014) considers the effectiveness of optimization strategies compared to naive international diversification from the perspective of European investors diversifying amongst the four regional equity indices of North America, Europe, Asia and emerging markets. Mean-variance optimization models, as well as the DeMiguel et al. (2009a) and Ledoit and Wolf (2004a) estimation error reduction strategies, are reported to provide insignificant economic improvements versus naive allocation strategies consisting of only regional equity indices, or regional equity indices, European bonds and world commodities. Jacobs et al. (2014) does not compare the results versus the local market portfolio or report whether the use of individual market indices can improve the effectiveness of the covariance shrinkage and allocation constraint strategies.

By addressing a gap in the literature regarding the cross-country benefits available to investors from naive diversification and optimization using estimation error reduction strategies, this paper contributes to the literature in several ways. First, this study presents the results of a modified Levy and Levy (2014a) strategy applied to the optimization of international equity portfolios and compares the significance of the results against other shrinkage and constraint strategies, which Levy and Levy (2014a) does not do. Also, this paper proposes the use of the cross-validation technique presented in DeMiguel et al. (2009a) to determine the alpha constraint used in the Levy and Levy (2014a) strategy. This contributes to Levy and Levy (2014a) by providing a method with which alpha is dynamically set using the data.

Next, this paper reports the optimization results using 34 market indices rather than the 4 naive regional indices in Jacobs et al. (2014). Using individual markets may improve the effectiveness of the estimation error reduction strategies as the information these models are designed to retain, and subsequently use in creating diversification benefits, may be lost with the use of naive regional portfolios. This paper also reports on the results of optimization using 4 naive regional indices in order to analyse the effectiveness of the optimization strategies as the number of assets is decreased.

Lastly, this paper extends Jacobs et al. (2014) to report the optimization results for investors in 34 countries, and compares portfolio performance to both the naive domestic market benchmark and the global 1/M benchmark. Both naive international diversification and the estimation error reduction strategies achieve significantly lower levels of volatility versus the naively diversified domestic benchmark in at least 27 countries. However, the global 1/M benchmark and the optimization strategies fail to provide significant return-to-risk gains beyond the naive domestic market portfolio for investors in at least 31 countries. The results suggest that the potential economic benefits from international diversification presented in previous literature (e.g., De Roon et al., 2001; Driessen and Laeven, 2007; Jacobs et al., 2014; Li et al., 2003) may be overstating the time-varying benefits of diversification that investors can expect to achieve out of sample.

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