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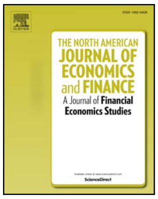

# Optimal combination of currency strategies

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## ABSTRACT

This paper handles the portfolio problem of combining optimally different currency strategies in the presence of return predictability. After transaction costs, our in-sample and out-of-sample empirical results confirm the relevance of considering state variables like FX volatility and the CRB industrial return or yield curve related variables to accurately time the currency carry trade and the dollar carry trade. An optimal combination of currency strategies and the use of risk management of the optimal portfolios also allows the investor to increase their Sharpe ratio and certainty equivalent, compared to an optimal portfolio of traditional assets.

## 1. Introduction

The search for investment opportunities that could represent an improvement of risk-return trade-offs offered by a classical mean-variance optimal portfolio consisting of traditional assets (e.g. stocks, bonds, and treasury bills) has led to the study of increasingly complex strategies including style-based investments and alternative vehicles of investment.

Since the seminal work of Markowitz (1952), an extensive body of theoretical and empirical literature has focused on the search for assets and investment strategies that could expand the mean-variance frontier achieved by traditional assets such as stocks and bonds. To accomplish this goal of expanding the traditional mean-variance frontier, the new assets under consideration should expect excess returns, volatilities, and correlations depending on underlying risk factors distinct from those determining the stock and bond excess returns. Within the universe of equities, Brandt, Santa Clara, and Valkanov (2009) estimate the optimal allocation weights for US equities, exploiting size, value and momentum anomalies to find that the optimal allocation to US equities overweighs small firms, value firms and past winners, and underweight large firms, growth firms and past losers. Outside the equity market, investors also care about the effects of including commodities, volatility-related assets, or hedge funds in their portfolios. This is due to the possible ability of increasing their welfare as a result of their ability to hedge inflation and to the low or even negative correlation of their returns with the risk factors affecting traditional assets (e.g. Jensen, Johnson, & Mercer, 2000; Chen, Chun, & Ho, 2011; Daskalaki & Skiadopoulos, 2011; Olmo & Sanso, 2012)

In this paper, we focus on the capacity of investing in foreign exchange markets to offer an improvement in terms of the welfare attained by the investor in the presence of currency return predictability. The difficulty in finding a model that could predict the exchange rates better than a random walk (Meese & Rogoff, 1983) interestingly motivates different currency strategies to deliver excess returns that are at least partly predictable, as was the case with currency carry trades (Fama, 1984). It is worth outlining that the traditional factor models used to explain stock and bond market returns fail to explain the returns on carry trade strategies (Burnside, 2012), and other currency strategies. This failure of standard asset pricing models has generated the need to find specific risk factors for pricing currency returns, like the HML factor, FX volatility, yield curve predictors, etc. (see Ang & Chen, 2010; Lustig, Roussanov, & Verdelhan, 2011; Menkhoff, Sarno, Schmeling, & Schrimpf, 2012a). In this context, we consider three currency

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strategies available to the investor: 1) the currency carry trade strategy that consists of a long position in the three highest-yield currencies and a short position in the three lowest-yield currencies from a basket of currencies of the group of G10 countries; 2) the dollar carry trade strategy proposed by Lustig, Roussanov, and Verdelhan (2014) that consists of going long (short) in a basket of foreign currencies from the G10 countries, and short (long) in the dollar whenever the average foreign short-term interest rate is above (below) the U.S. interest rate; and 3) the currency or FX momentum strategy that goes long in the currencies with high past excess returns (winners) and short in currencies with low past excess returns (losers). In all the cases, we consider the existence of transaction costs that have a clear impact on the profitability of the optimised strategies.

To accomplish our objective, we first develop simple investment strategies with the potential to improve the performance of the passive currency strategies that go long in the currency strategies in-sample and out-of-sample. This is achieved by considering state variables that are likely to be related to the predictability of the currency strategies' return distribution. To estimate the set of optimal weights, we build on the recent literature proposing optimal parametric portfolio allocations (e.g. Brandt, 1999; Ait-Sahalia & Brandt, 2001; Brandt et al., 2009) to construct optimal portfolios with weights that are functions of the related state variables.

Secondly, we estimate the optimal combination of the optimised currency strategies. Intuitively a combination of optimal strategies can increase the potential for diversification offered by each strategy individually, and hence could increase the investors' expected utility. In our setting, we consider that the currency carry trade strategy, the dollar carry trade, and the FX momentum strategy depend on different state variables where their relationship with the optimal portfolio is likely to be subject to change. Each strategy can be considered as an estimate of the investor's ultimate objective (his/her expected utility), and we search for their optimal combination.

To obtain the optimal combination of the optimised currency strategies, we define a loss function that depends on the investor's expected utility (e.g. Tu & Zhou, 2011) and estimate the parameters that define the optimal combinations by using the Generalised Method of Moments (GMM) (Elliot & Timmermann, 2004). This approach stems from the forecast combination literature that shows the benefits of combining different predictions of the same object, or in our context, the investor expected utility. The forecast combinations can be attractive due to: 1) the presence of diversification gains, especially when the overlap in the information sets used to produce the underlying forecasts is not excessively high (Clemen, 1987); 2) the existence of different degrees of adaptability of the individual forecasts to the occurrence of structural breaks (Aiolfi & Timmermann, 2006); and 3) the risk estimation linked to model misspecification that arises due to non-stationarities in the underlying data generating process (Stock & Watson, 2004).

Finally, we investigate the portfolio implications in terms of the investor welfare of including the optimal combination of optimised currency strategies in a portfolio of traditional assets composed of stocks, bonds, and the risk free rate. As risk factors that price traditional assets and currency strategies are different, it is sensible to think that currency strategies could be beneficial for diversified investors.

Therefore, our paper is related to recent literature that pursues study of optimal currency strategies and their relevance in the investor portfolio. Kroencke, Schindler, and Schrimpf (2014) finds that foreign exchange investment styles (like the currency carry trade, the FX momentum, and the FX value) provide significant improvements to traditional portfolios of U.S. and international stocks and bonds in the statistical and economic sense. Although they do not take into account currency predictability, they report an increase in the Sharpe ratio due to the consideration of currency strategies, which is robust in terms of the inclusion of transaction costs. Barroso and Santa Clara (2015a) use different technical and fundamental variables that are common across currencies to form optimal currency portfolios. They find that including currencies in a portfolio composed of stock and bonds allows investors to increase their welfare in terms of the certainty equivalent and Sharpe ratio. Laborda, Laborda, and Olmo (2014) consider the currency carry trade strategy before transaction costs as an asset class and show that a reduced set of systematic factors, such as the monetary policy, a financial index of commodity returns, and funding conditions, is sufficient to achieve optimal portfolios that outperform the stock market and the naïve currency carry trade portfolio.

In contrast to this recent literature, we consider the optimal combination of several foreign exchange investment styles incorporating the sources of return predictability that are heterogeneous for each currency strategy. Our statistical and economic analysis of the investment performance of the optimised strategies out-of-sample confirms that the optimised currency strategies outperform the corresponding passive or long currency strategies separately after transaction costs. The only exception is the FX momentum strategy, which is almost indistinguishable from the long strategy due to the lack of risk factors driving performance after considering transaction costs. Thus, the consideration of the relevant state variables allows the investor to accurately time the currency strategies, and avoid the crash risk inherent in these strategies (Brunnermeier, Nagel, & Pedersen, 2009; Menkhoff et al., 2012b; Bakshi & Panayotov, 2013). The optimised currency carry trade delivers a higher out-of-sample Sharpe ratio than the dollar carry trade (1.58 vs. 0.83) with positive skewness, but also higher kurtosis. The out-of-sample certainty equivalent of the optimised currency carry trade and the dollar carry trade vs. the passive strategy are approximately 8% higher per year, giving support to the economic significance of the results. Moreover, the optimal combination of the optimised currency strategies allows the investor to increase her welfare attaining the highest out-of-sample certainty equivalent return, reaching almost 15%. Thus, the investor is also better off when considering an optimal combination of different optimised currency strategies out-of-sample.

We also provide evidence of the positive impact of including currency strategies in a portfolio of stocks, bonds, and the risk free rate. The optimal portfolio that considers the optimised currency strategies allows investor welfare to increase significantly as the out-of-sample certainty equivalent is 4% higher and the Sharpe ratio almost 90 points higher, assuming a volatility similar to the optimised portfolio of stock and bond volatility. The optimal portfolio also reduces fat tails and provides positive skewness. These results are striking because they already consider the transaction costs.

The remainder of the paper is structured as follows. Section 2 outlines the theoretical background considered in this paper, the investor's optimal asset allocation problem, the econometric estimation of the weights defining the optimal portfolio, and how to

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