

# Safety-first and extreme value bilateral U.S.–Mexican portfolio optimization around the peso crisis and NAFTA in 1994

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## Abstract

High volatility can motivate safety-first portfolio optimization in emerging markets. Mexico is a case in point, as the December 1994 Mexico peso crisis followed the high positive expectations from the ratification of NAFTA earlier that year. This study examines safety-first and extreme value optimization for bilateral U.S.–Mexican portfolios in U.S. dollar (USD) and Mexican peso (MXN) around the crisis, and compares these to Markowitz mean–variance optimization. It finds that these approaches result in substantial differences for the optimal investment weights in Mexico, with these generally higher under safety-first pre-1994 and lower post-1994 than under mean–variance optimization, whether in MXN or USD. Safety-first objectives do not inhibit investment weights that are higher than the minimum variance optimization weights for Mexico in the non-crises pre-1994 period. But following the 1994 financial crisis, safety-first optimization requires more of an exit from Mexico than even minimum variance optimization.

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## 1. Introduction

Safety-first has greater relevance in the high volatility environment in emerging markets, with the December 1994 peso crisis in Mexico providing a good case study. Positive expectations were high following the ratification of NAFTA on January 1, 1994, making North America the largest trading block in the world. But shortly after, Mexico endured one of its worst economic crises. The peso crisis that followed highlight the attendant risks that accompany investing in emerging markets like Mexico, even in the midst of positive expectations, regardless of whether investors are domestic (Mexican) or foreign (U.S.). Similar crises and risks have appeared elsewhere, including Asia in 1997 and Russia in 1998. In these, risk managers must worry that portfolios may suffer from “extreme” events, even if they lie outside the range of available observations. The safety-first criteria of Roy (1952) operationalized with use of extreme value theory as applied by Arzac and Bawa (1977) and Jansen, Koedijk, and de Vries (2000), and most recently, Haque, Hassan, and Varela (2004), is useful in these cases.

Extreme value theory (EVT) provides a firm theoretical foundation for statistical models describing extreme events, and offers risk managers a seemingly objective tool to examine portfolio behavior under extreme circumstances. The analysis is undertaken by trying to “fit” the tail of the returns’ distribution of a portfolio, because the tails of a continuous statistical distribution generalize to a Pareto distribution as one examines further into the distribution’s extremes. The use of EVT lies principally in the manner in which it can quantify estimates of the probability of extreme events, and the way portfolios behave under such occurrences. It is applicable to fat tailed and asymmetric distributions, making it advantageous over models that assume symmetry (such as  $t$ , normal, ARCH and most GARCH-like distributions), because most financial returns are asymmetric.

The present study applies safety-first using EVT to portfolios of Mexican and U.S. equities from both Mexico and U.S. points of view during the period surrounded by the Mexican peso crisis in 1994, and by default NAFTA. It examines how these portfolios differ from Markowitz mean–variance portfolios, and draws lessons in the application of safety-first during such crisis in emerging markets. The study is divided into the following sections. Section 2 presents the literature review and Section 3 the sample and data. Section 4 discusses exceedence values and extreme value theory and Section 5 the safety-first methodology. Section 6 presents the empirical findings and Section 7 concludes the study.

## 2. Literature review

Periodic financial crisis in emerging markets generate volatility owing to currency, liquidity, regulatory and interest rate risks, among others. Edwards (1995) reports that Mexico was forced to devalue its peso in December 1994, leading to increased exchange rate volatility, macroeconomic and financial sector crisis, and a bail out. Kaminsky and Reinhart (1996) found that in about half of 20 countries examined, including Mexico, banking crisis preceded balance-of-payments crisis. Masson and Agenor (1996) suggest that the peso devaluation significantly weakened Mexico’s financial sector by increasing the cost of debt servicing, while Gruben and Welsh (1996) report that Mexican banks experienced a run by dollar-denominated bank depositors. Wilson, Saunders, and Caprio (2000) find little evidence that investors anticipated the peso devaluation. Mathur, Gleason, Dibooglu, and Singh (2002) find that the effects of the Peso crisis spilled over into the Chilean economy, supporting the contagion hypothesis.

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