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The volatility of exchange rates and the non-normality of stock returns

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ABSTRACT

In this study, we examine how exchange rate volatility in a particular country influences both the kurtosis and skewness of stock returns. In a variety of tests that hold constant the structure of the financial market, we show that exchange rate volatility is associated with greater kurtosis, and more negative skewness. We use the out-of-sample implementation of the Euro as an identification strategy in order to make stronger causal inferences. The implementation of the Euro created stability in exchange rates not only in the Euro Region but also in other parts of the world. We find some evidence that the adoption of the Euro decreased the level of kurtosis and increased the skewness of stock returns.

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1. Introduction

Traditional asset pricing models generally assume normality in the distributions of security returns. The lack of normality, however, has important and broad implications. Not only do non-normal return distributions adversely affect the accuracy of asset pricing models, but non-normality can also signal a higher likelihood of bubbles and subsequent market crashes. The literature is full of studies identifying non-normality in stock returns (see, for example, [Chen, Hong, & Stein, 2001](#); [Clark, 1973](#); [Damodaran, 1987](#); [Harvey & Siddique, 2000](#); [Richardson & Smith, 1993](#); [Tauchen & Pitts, 1983](#); [Xu, 2007](#)). [Xiong and Idzorek \(2011\)](#) contend that extreme returns on either side of the distribution occur at a rate that is 10 times greater than predicted by a normal distribution. In light of these findings, a growing body of research has begun to attempt to forecast the non-normality in return distributions. For example, [Chen et al. \(2001\)](#) find that, consistent with theoretical predictions in [Blanchard and Watson \(1982\)](#) and [Hong and Stein \(2003\)](#), positive past returns and trading volume increase the likelihood of observing negative skewness in stock returns. In a similar study, [Hutton, Marcus, and Tehranian \(2009\)](#) find that the level of opacity in a firm's financial reports affects both the likelihood of crashes as well as jumps in stock prices.

While our tests generally follow these lines of research, we deviate away from examining firm-specific characteristics when attempting to identify determinants of non-normal return distributions. Using a large sample of American Depository Receipts (ADRs), which are certificates traded on U.S. exchanges but reflect shares of foreign stock, we develop and test a new hypothesis that exchange rate volatility will affect both the kurtosis and skewness of stock returns. This hypothesis is based on the simple idea that instability in currency markets will have an unusually powerful effect on the level of uncertainty

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in an economy, which can affect the distribution of stock returns.¹ This increase in the level of uncertainty might sideline informed arbitrageurs, thus allowing security prices to move to more extreme levels. The theoretical framework for this possibility is spelled out nicely in [Abreu and Brunnermeier \(2002\)](#), who show that uncertainty about when peer arbitrageurs will exploit potential mispricing will lead to, what they denote as, synchronization risk. Their theory predicts that this type of synchronization risk will eventually delay arbitrage. [Blanchard and Watson \(1982\)](#) and [Chen et al. \(2001\)](#) suggest that, in the presence of delayed arbitrage, bubbles and crashes are more likely to occur, which will likely increase the kurtosis and decrease the skewness of stock returns. Through this mechanism, the uncertainty created by exchange rate volatility will likely explain the non-normality in the return distributions of ADRs.

The use of ADRs allows us to overcome two important issues. First, we must overcome the fact that within countries, skewness and kurtosis exhibit both cross-sectional and time-series variation (i.e. variation across securities and across time) while exchange rate volatility only varies across time. We could compare the skewness and kurtosis of securities across a broad sample of countries thus allowing for variation across exchange rates. However, the second issue we face is that non-normal return distributions might depend on the structure of financial markets in a particular country, and that structure could be endogenously determined by the instability of the currency market. Using ADRs allow us to overcome these issues by holding the structure of the market constant while testing for an association between exchange rate volatility and the non-normality of ADR return distributions.

After controlling for a number of ADR-specific and country-specific characteristics, our multivariate tests reveal a positive and robust relation between exchange rate volatility and kurtosis in ADR returns. Among the ADR-specific controls, we include liquidity measures, size measures, and, perhaps most importantly, ADR volatility. The country-specific controls include GDP per capita and unemployment rates. After holding these variables constant, we find that a one percent increase in exchange rate volatility is associated with an approximate 12% increase (relative to the mean) in kurtosis.

In a separate set of tests, we examine idiosyncratic kurtosis as a measure of robustness. Again, we find that a one percent increase in exchange rate volatility is associated with an increase in idiosyncratic kurtosis of about 0.67. The economic magnitude of these estimates is similar to the economic magnitude of our earlier results. These findings support our hypothesis that exchange rate volatility can help explain the level of excess kurtosis observed in stock returns ([Clark, 1973](#); [Damodaran, 1987](#); [Richardson & Smith, 1993](#); [Tauchen & Pitts, 1983](#); [Xiong & Idzorek, 2011](#)).

Next, we test whether exchange rate volatility in a particular country is likely to lead to more negative skewness in ADR returns. In multivariate tests that are similar to those used when examining kurtosis, we find that exchange rate volatility relates inversely with skewness in ADR returns. After holding ADR-specific and country-specific characteristics constant, our analysis shows that a one percent increase in exchange rate volatility is associated with a 43% reduction (relative to the mean) in negative skewness. These results support our hypothesis that exchange rate volatility can lead to return distributions that are more negatively skewed. We note that these tests are also robust when we examine idiosyncratic skewness. Admittedly, the economic magnitude of these robustness tests decreases, but we are still able to find a relationship between exchange rate volatility and skewness that is statistically significant and economically meaningful. For instance, our multivariate test show that a one percent increase in exchange rate volatility is associated with 39% decrease in negative skewness.

Finding a positive (negative) relation between exchange rate volatility and kurtosis (skewness) is not tantamount to finding that exchange rate volatility causes changes in the non-normality of return distributions. In fact, a broad stream of both theoretical and empirical research suggests that equity markets affect currency markets instead of the other way around ([Ajayi & Mougoue, 1996](#); [Gavin, 1989](#); [Smith, 1992](#); [Zapatero, 1995](#)). In the framework of our study, it is possible that greater kurtosis or more negative skewness directly influences the level of exchange rate volatility. To test for this possibility, we seek to find an appropriate identification strategy in order to make stronger causal inferences. On the last day of December in 1998, eight of our sample countries with ADRs adopted the Euro. This exogenous regime change in currency markets not only provided stability to the affected countries in the Euro Region, but it also provided stability to other countries that were directly or indirectly trade partners with the affected countries. We therefore use the implementation of the Euro as a natural experiment. Our hypothesis predicts that during the post-Euro period, kurtosis will decrease and skewness will increase. We recognize that this particular event, like most others, is not a perfect experiment. Because all of the ADR home countries in our sample may have been affected by the adoption of the Euro, it is difficult to identify a treatment sample and a control sample of securities. Therefore, the standard difference-in-difference approach will not be effective. Recognizing these limitations, we are left to only offer weak conclusions regarding causation from these tests. Results, however, show that ADR kurtosis generally decreases. In economic terms, kurtosis decreased more than 17% during the year after the Euro adoption when compared to the year before the Euro adoption. Similar results are found when we examine idiosyncratic kurtosis although we are careful to note that according to our non-parametric tests, the decrease in idiosyncratic kurtosis is not reliably different from zero. However, we do find that both total skewness and idiosyncratic skewness markedly increases during the post-Euro period. In economic terms, post-Euro skewness increased nearly 45% while post-Euro idiosyncratic skewness increased nearly 19%. Both of these increases are statistically significant. In general, we are able to offer similar conclusions when we examine the kurtosis and skewness of ADRs with home countries in the Euro Region. We are therefore

¹ Unstable currencies are likely to increase the uncertainty of investors. However, if the instability also affects the uncertainty that firms face in an unusual way, particularly those with exposure to the exchange rate volatility, then level of uncertainty in the market might be magnified.

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