



# Time-varying exchange rate exposure and exchange rate risk pricing in the Canadian Equity Market



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## ABSTRACT

This paper aims to extend the existing literature on foreign exchange rate risk pricing. Unlike the existing studies on Canada, we use six alternative bilateral and one multilateral exchange rate proxies. Furthermore, using both a two-factor and a three-factor capital asset pricing model (CAPM), we test for the presence of a long-run relationship among exchange rate risk pricing, herding behavior, term structure and the interest rate. The estimated results based on both the ordinary least squares (OLS) and generalized least squares (GLS) estimation techniques confirm that exchange rate risk in the Canadian equity market is priced and that the pricing of this risk is time-varying. This result holds for all seven exchange rate proxies. Our empirical analysis also suggests the presence of a long-run relationship among exchange rate risk pricing, herding behavior, term structure and the interest rate. This relationship is found to be insensitive to variations in the world market return.

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## 1. Introduction

Irrespective of whether or not a firm is involved in international business, foreign exchange rate fluctuations can affect its value. Investors who are not compensated for exchange rate risk expect a higher return and hedging becomes highly desirable. Since the work of [Jorion \(1991\)](#), a number of studies have attempted to test for the presence of exchange rate risk pricing in stock markets around the globe. However, the evidence provided by the exiting literature is mixed. This has led to substantial research in this area.

Using an international version of the Capital Asset Pricing Model (CAPM), [Jorion \(1991\)](#) found that there was a link between the value of the US dollar and stock returns but exchange rate risk was not priced in the US stock market. Using a two factor asset pricing model, [Loudon \(1993a\)](#) reached the same conclusion for Australia where equity market

returns were sensitive to exchange rate movements but exchange rate risk was not priced. [Doukas et al. \(1999\)](#) considered the case of Japan and concluded that exchange rate risk was priced in the Japanese equity market. The distinguishing feature of this study is time varying nature of the exchange rate risk premium. Using a conditional version of International CAPM (ICAPM) involving time varying risk, [De Santis and Gérard \(1998\)](#) found that foreign exchange rate risk was not priced in the US equity market. [Dumas and Solnik \(1995\)](#) conducted a multi-country study where both the conditional and unconditional versions of asset pricing models were considered and risk premiums were allowed to fluctuate over time. They found some evidence in support of exchange rate risk pricing. Dumas and Solnik concluded that ICAPM out performs the national version. Recent studies such as [Saleem and Vaihekoski \(2008\)](#) consider the case of Russia whereas [Kodongo and Ojah \(2011\)](#) consider the case of some African countries.

The empirical studies in the area of exchange rate risk pricing can be divided into two groups. Group 1 includes studies that use unconditional multi-factor pricing models (e.g., [Apergis et al., 2011](#); [Carrieri and Majerbi, 2006](#); [Chen et al., 1986](#); [Choi et al., 1998](#); [Di Iorio and Faff, 2002](#); [Jorion, 1991](#); and [Loudon, 1993b](#)). These studies assume that

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exchange rate risk premium is constant over time. Even within this group, the empirical evidence is mixed. The second group includes studies that use conditional multi-factor asset pricing models. These studies assume that exchange rate risk premium varies over time. Generally speaking, studies in this group report evidence in favor of exchange rate risk pricing in some Asia-Pacific equity markets, such as Japan, Taiwan, and Australia (e.g., Brown and Otsuki, 1993; Chiang, 1991; Dumas and Solnik, 1995; Tai, 2003). In addition, empirical studies that consider the European equity markets found that exchange rate risk was priced in Finland, France, Eurozone and in Russia (e.g., Antell and Vaihekoski, 2007, 2012; Apergis et al., 2011; Korajczyk and Viallet, 1992; Saleem and Vaihekoski, 2008). Some multi-country studies (such as Bae et al., 2008; Groen and Balakrishnan, 2006; Guo et al., 2008) found evidence in favor of exchange rate risk pricing. However, generally speaking, the evidence provided by the existing studies is mixed and hence the literature in this area is continuously growing.

While the issue of exchange rate risk pricing has been examined in the context of a number of countries, few studies have considered the case of the Canadian equity market. Recent studies on Canada include the work of Samson (2013) and Al-Shboul and Anwar (2014b). This paper aims to extend the existing literature in a number of ways. First, we utilize both multilateral and bilateral exchange rate factors. Specifically we use the Canadian exchange rate trade-weighted index (TWI) and the value of Canadian dollar against several foreign currencies – the US dollar (USD), Euro (EUR), Japanese Yen (JPY), British Pound (GBP), Chinese Yuan (CNY) and Mexican Peso (MXN) are used as proxies for exchange rates.<sup>2</sup> Second, we examine the pricing of exchange rate risk phenomenon by means of a two-factor as well as a three-factor capital asset pricing model, which is an improvement over the existing Canadian studies. Third, we explore the issue of exchange rate risk pricing and the possibility of time-varying risk pricing by means of the Generalized Least Squares (GLS). Fourth, we conduct a full sample cointegration analysis to test for the presence of a stochastic trend among exchange rate risk pricing, herding behavior, term structure and the interest rate.

The need for testing for the presence of a long-run relationship also arises from the fact that recent studies, such as Pastor and Stambaugh (2012), argue that stock investors may encounter more volatile stock prices over long horizons compared to short horizons. This follows from the fact that, in real life, values of population parameters are unknown and the estimated parameters can lead to imperfectly predictions of the conditional expected returns. This imperfect prediction of expected returns may be attributed to the fact that stock returns generally tend to exhibit mean reverting behavior in the long-run. In addition, as a result of the persistence in the expected returns, the variances of stock returns in long-run may surpass short-horizon variances (Berentsen et al., 2009). Finally, uncertainty in current returns resulting from the use of predicted parameters can contribute to an increase in variances over longer horizons.

The choice of herding behavior, terms structure and the interest rate allows a wider analysis of the effects of both equity market (herding) and debt market instruments (interest rate and terms structure) on exchange rate risk pricing. While these three variables may be viewed as important determinants of the exchange rate risk pricing, focusing only on these variables is a limitation of our work. In real life, a number of fundamental factors also affect the price of exchange rate risk. Bailliu and King (2005, P. 8) suggest that macroeconomics factors can be unsuccessful in explaining the exchange rate risk exposure. The paucity of studies investigating the relationship between herd behavior of stock investors and exchange rate risk is one of the main motivations for our investigation of this issue. Recent studies, such as Russell (2012), suggest that the relationship between herding and exchange rate risk pricing has not been extensively examined in the existing literature. Kurz and Motolese (2001) argue that equity investors believe that the

herd behavior would influence the price of currency risk. They further argue that as investors are different in their levels of herding, they may also price exchange rate risk differently (Kurz and Motolese, 2001). Changes in interest rates and their term structure not only affect investor behavior but also the Canadian economy and hence it is useful to focus on the impact of these variables on exchange rate risk pricing. Changes in the dollar values are often driven by non-fundamental or speculative factors. Monetary policy, by neutralizing the impact of these factors, can be used to stabilize the economy. Finally, because of the unavailability of data and to limit the length of our study, we focus on only three variables.

Based on weekly data on the largest 58 Canadian listed firms over the period 2003–2010, our empirical analysis indicates the presence of a time varying exchange rate risk exposure. In addition, we find evidence of exchange rate risk pricing in the Canadian equity market in terms of all foreign exchange rate proxies. This suggests that equity returns in Canada include a premium for fluctuations in exchange rates. Using all exchange rate proxies, we found exchange rate risk pricing in the Canadian equity market to be time-varying. Furthermore, using Johansen's approach to cointegration, we found that a long-run relationship exists among exchange rate risk pricing, herding behavior, term structure and the interest rate. This result holds when the exchange rate risk pricing is measured using both a two-factor and a three-factor capital asset pricing model. It can therefore be argued that the long-run relationship among exchange rate risk pricing, herding behavior, term structure and the interest rate in Canada is insensitive to the inclusion of a proxy for the world market return in the model.

The rest of this paper is structured as follows. Section 2 contains a brief review of the related literature. Methodology is presented in Section 3. The empirical results are presented and discussed in Section 4. Section 5 concludes the paper.

## 2. Review of the related literature

The issue of exchange rate risk pricing arises from the fact that the assumption of purchasing power parity (PPP) does not always hold in real life and hence equity investors from different countries are exposed to greater uncertainty. This situation arises due to the uncertainty associated with future exchange rate changes that can affect the expected returns on stocks. Exchange rate changes are yet another source of systematic risk that cannot be diversified away (see Bodnar et al., 1995 & 1996; Nance et al., 1993). As a result, capital market investors require additional return in the form of a risk premium. An exchange rate risk premium term is included in empirical models containing the return on an asset with an exchange rate risk factor. The inclusion of an exchange rate risk factor to the classical CAPM model allows one to investigate the issue of exchange rate risk pricing.<sup>3</sup>

The general issue of exchange rate risk pricing has been the subject of a large number of empirical studies. Most of these studies examine the issue of exchange rate risk pricing in developed countries. Early studies used the unconditional asset pricing model and the issue of time varying risk pricing was not investigated. For instance, using a multi-factor model, Chen et al. (1986) found that exchange rate risk was not priced in the U.S. stock market. Using both a two-factor and a multi-factor model, Jorion (1991) failed to find evidence of statistically significant exchange risk pricing in the U.S. stock market. Using data over the period of January 1975 to December 1984, Hamao (1988) found no evidence of exchange rate risk pricing in the Japanese equity market. In addition, after taking into account several Japanese macroeconomic factors, Hamao found that there was no difference in the overall performance of CAPM and Arbitrage Pricing Theory (APT) based

<sup>2</sup> The US, the UK, Euro zone, Mexico, China, and Japan are Canada's major trading partners.

<sup>3</sup> While this paper focuses on the issue of exchange rate risk pricing, a good analysis of pricing in other contexts can be found in Jindra and Walking (2004), Eberhart (2005), Bartram (2007), Heng and Chan (2008), Daniels et al. (2009), Colla et al. (2012), Lel (2012), and Zhang (2012).

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