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Macroeconomic sources of foreign exchange risk in new EU members

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ABSTRACT

We address the issue of foreign exchange risk and its macroeconomic determinants in several new EU members. We derive the observable macroeconomic factors—consumption and inflation—using the stochastic discount factor (SDF) approach. The joint distribution of excess returns in the foreign exchange market and the factors are modeled using a multivariate GARCH-in-mean specification. Our findings show that both real and nominal factors play important roles in explaining the variability of the foreign exchange risk premium. Both types of factors should be included in monetary general equilibrium models employed to study excess returns. To contribute to the further stability of domestic currencies, the new EU members should strive to implement stabilization policies aimed at achieving nominal as well as real convergence with the core EU members.

1. Introduction

Research on explaining the currency risk premium using the uncovered interest rate parity condition is widespread and the literature has been growing since the earliest work of Hansen and Hodrick (1980) and Fama (1984). Engel (1996) provides a comprehensive survey of the literature and shows that most models are not able to account for the exchange rate anomaly known as "forward discount puzzle". Lustig et al. (2008) review the most recent additions to the literature and empirically show that risk premia in currency markets are large and time-varying. Arguably, time-variation in the currency risk premia is closely related to the fundamental factors driving the risk appetite of investors. However, most of the existing literature either focuses on the time-series properties of the risk premium without considering its relationship with the fundamental macroeconomic factors (e.g., Cheung, 1993), or derives an implausibly large impact of macroeconomic factors on the risk premium using data on developed economies (e.g., Kaminski and Peruga, 1990; Smith and Wickens, 2002a), in which many other aspects (e.g., carry-trading) make the identification of the impact of macroeconomic factors difficult.

In this paper we augment the discussion and fill a gap in the literature by sharpening a quantitative assessment of the critical real and nominal macroeconomic factors that drive the currency risk. These factors are grounded in the theoretical stochastic discount factor model. Our main contribution to the financial knowledge is in strengthening the to date limited evidence that both nominal and real factors play a role in explaining the foreign exchange risk premium. This finding is in accordance with theoretical models of currency pricing.

Our general contribution is that we derive our results in a multivariate framework which has been largely neglected in the literature. The main advantage of the semi-structural modeling approach employed in our study is that it provides a broader scope for an economic interpretation of factors driving the currency risk premium. The empirical implementation is based on a multivariate GARCH model with conditional covariances in the mean of the excess returns. This methodological framework allows us to impose a no-arbitrage condition on the estimations, a feature that is absent in the univariate models used in most previous studies.

Another contribution is more specific as we investigate the role of macroeconomic factors as systemic determinants of currency risk in the new member states of the European Union (EU). Since

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currency stability has been an important part of the macroeconomic policies in these countries on their way to becoming part of the EU and adopting of Euro, the impact of macroeconomic factors appears to play a crucial role in explaining currency risk premia in these countries. Therefore, the analysis of the impact of macroeconomic factors for the currency risk premium in new EU states, largely disregarded in the previous literature, can expand our understanding of the importance of the theoretically motivated macroeconomic fundamentals as foreign exchange risk premium drivers.

The empirical analysis is performed on four new EU member countries: the Czech Republic, Hungary, Poland, and Slovakia. After embarking on the uneasy path of economic transformation these countries in December 1991 signed so-called "European Agreements" with the European Union. Subsequently, they have striven to establish a workable framework for international trade and cooperation in order to facilitate the transition process and in March 1993 they established the Central European Free Trade Area. All four countries applied for EU membership in 1995–1996 and from 1998–1999 underwent a lengthy and thorough screening process towards their EU accession. On May 1, 2004 they joined the EU and, as such, are required to become part of the Economic and Monetary Union (EMU), or Eurozone, and adopt Euro at some point in time.[1] EU membership increases the pressure on new member countries to improve their institutions and maintain stable economic environments.

Kočenda and Valachy (2006) show that foreign exchange risk is pronounced in new EU member countries. The sources of the persistency in the foreign exchange risk premium in these countries are different due to underlying systemic differences among them, but there exists a common source of foreign exchange risk propagation, which is the questionable perspective of their macroeconomic policies (Kočenda et al., 2008). However, the question of to what extent nominal and real macroeconomic factors are significant in terms of explaining currency risk in new EU members has not been addressed in the earlier literature.

To briefly preview our main results, we find empirical support for the importance of both nominal and real macroeconomic factors as determinants of the currency risk premium. This finding is in line with the predictions of general equilibrium models and suggests that investors price currency risks based on both real and nominal factors. The relative impact of real factors is somewhat lower than the impact of nominal factors, supporting the idea that nominal vulnerability plays a larger role in pricing currency risk in the European Union relative to the real mismatches. From the policy recommendation perspective, this supports the notion that nominal integration with the EU in terms of preserving more stable inflationary prospects is essential for new EU countries in the aftermath of Euro adoption (Orlowski, 2005).

The remainder of the paper is organized as follows: in Section 2 we review the existing methodologies for studying foreign exchange risk and in Section 3 we introduce the stochastic discount factor (SDF) approach. Section 4 contains the econometric specification of the model and data description. In Section 5 we provide empirical results with a discussion, and also diagnostics and model specification tests. Conclusions are presented in Section 6.

2. Review of methodological approaches

Economists have been investigating the foreign exchange risk premium within a variety of empirical frameworks. The difficulty with modeling the foreign exchange risk premium is closely associated with a puzzling feature of international currency markets: the domestic currency tends to appreciate when domestic interest rates exceed foreign rates.[2] The mentioned deviations from the uncovered interest rate parity relationship are often interpreted as a risk premium from investing in a foreign currency by a rational and risk-averse investor. Apart from the negative correlation with the subsequent depreciation of the foreign currency, another well-documented property of these deviations includes extremely high volatility.

The first strand of empirical literature analyzing the foreign exchange risk premium implemented econometric models based on strong theoretical restrictions coming from two-country asset pricing models. Common problems encountered in these studies are incredible estimates of the deep structural parameters of the theoretical models (e.g., the coefficient of relative risk aversion) and the rejection of over-identifying restrictions suggested by the underlying theory. Overall, pricing theory to date was notably unsuccessful in producing a risk premium with the prerequisite properties outlined above (see Backus et al., 2001).

The second stream of literature pursued an alternative strategy by adopting a pure time-series approach. Unlike the theoretical models mentioned above, this approach imposes minimal structure on the data, for example via state space model as in Cheung (1993). A popular empirical methodology for studying the time-series properties of the foreign exchange risk premium is the "in-mean" extension of the ARCH framework due to Engle et al. (1987). While these studies were more successful in capturing empirical regularities observed in the excess return series, the lack of a theoretical framework makes it difficult to interpret the predictable components of the excess return as a measure of the risk premium (Engel, 1996).

Given the disadvantages associated with both approaches mentioned above, the current literature is moving towards a so-called semi-structural modeling approach (see Cuthbertson and Nitzsche, 2004 for a review). More recent studies resort to a stochastic discount factor (SDF) methodology, which allows putting some structure on the data sufficient for identifying a foreign exchange risk premium, but otherwise leaves the model largely unconstrained. In our investigation we follow the SDF approach in order to employ observable and theoretically-motivated factors to explain the variability of the foreign exchange risk. The details of our approach are given in the next section.

3. Theoretical background

3.1. Basic concepts

For the rest of the paper we will be using the following notation: R_t and R_t^* are nominal gross returns on risk free assets (government bonds) between time t and $t+1$ in the domestic and foreign country, respectively; S_t is the domestic price of the foreign currency unit at time t (an increase in S_t implies domestic currency depreciation). The excess return to a domestic investor at time $t+1$ from investing in a foreign financial instrument at time t is $ER_{t+1} = \frac{R_t^*}{R_t}\frac{S_{t+1}}{S_t}$, which can be expressed in logarithmic form as:

$$er_{t+1} = r_t^* - r_t + \Delta s_{t+1}, \quad (1)$$

where the lowercase letters denote the logarithmic values of the appropriate variables.

[1] Slovakia entered the Eurozone in 2009. With respect to an overal Euro dynamics Yang et al. (2008) show that martingale behavior cannot be rejected for Euro exchange rates with major currencies such as the Japanese yen, British pound, and US dollar.

[2] This phenomenon has been labeled as the "forward discount puzzle"; see Engel (1996) for a survey. Based on a large set of currencies, Murphy and Zhu (2008) provide empirical support that at least a portion of the forward bias is related to a small possibility of a large decline in spot exchange rates.