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Foreign exchange risk and the term-structure of industry costs of equity

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ABSTRACT

This paper makes two contributions to the literature. First, we build on the methodology of Ang and Liu (2004) to model the cost of capital term-structure for firms subject to foreign exchange (FX) risk. We emphasize the role of time-varying parameters such as FX risk and factor loadings. Second, we estimate the term-structure for 39 U.S. industries. We find that: 1) FX exposure changes the position and shape of the term-structures; 2) The average FX risk premium is 2.29% for cash flows with short-term maturity, but declines as maturity increases; 3) The pricing error from ignoring the term-structure is smaller than the error resulting from the omission of the FX risk component.

1. Introduction and motivation

The term-structure of interest rates represents the yearly interest rate on zero coupon bonds. Given the size of the market for risk-free securities, the term-structure is potentially observable at any point in time. The same cannot be said for the term-structure applicable to risky cash flows. There is no market for “zero-coupon equity” shares; also there is no market for single corporate cash flows exposed to foreign exchange (FX) risk. Hence, we must rely on theoretical asset pricing models, such as

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the international CAPM (ICAPM), to estimate the required cost of capital. The goal of this paper is to develop a term-structure model – with an emphasis on time-varying parameters, such as FX risk and market risk loadings, and then apply the model to estimate the costs of capital for 39 U.S. industries.

The theory to justify the inclusion of FX risk as a component of valuation is quite extensive (e.g., Adler and Dumas, 1983; Sercu, 1980; Solnik, 1974; Stulz, 1981). However, the empirical evidence is ambiguous. Several studies document surprisingly weak results on the economic significance of an FX risk premium at the industry level (Allayannis and Ihrig, 2001; Bodnar and Gentry, 1993; Choi and Prasad, 1995; Griffin and Stulz, 2001; Jorion, 1991). In contrast, recent work by several authors, often employing alternative research methodologies (including but not limited to conditional asset pricing models, panel-based approaches, stock return decompositions, and focused industry subsamples), show that FX exposure is an important risk factor at the industry level (Bredin and Hyde, 2011; Chaieb and Mazzotta, 2013; Francis et al., 2008; Williamson, 2001).[2]

Another strand of the literature is concerned with practical issues related to single-period unconditional cost of capital estimation. A number of studies, including Dolde et al. (2012), Koedijk et al. (2002), Koedijk and Van Dijk (2004), and Mishra and O'Brien (2001), ask whether the choice of pricing model results in meaningful differences in cost of equity estimates.[3] In view of the large uncertainties related to the size of the market risk premium (Fama and French, 1997) these studies conclude that, from an economic point of view, unconditional cost of capital estimates are not sensitive to model choice. However, Engle (1982) shows that conditional estimates can differ dramatically from unconditional estimates; moreover, De Santis and Gerard (1998), and Francis et al. (2008) emphasize that FX risk and market risk should be modeled as time-varying parameters. Discounting cash flows with time-varying expected returns requires conditional term structure costs of capital estimates.

In the last several years a number of papers have explored the term-structure issue. Brennan (1997) suggests the use of a single-period CAPM where the riskless rate and the market portfolio return are modeled as autoregressive processes, but systematic risk is assumed to be constant. A more general framework, proposed by Ang and Liu (2004), relies on a conditional CAPM with time-varying riskless rate, beta, and market risk premium. Empirical estimates of the term-structure appear to have many familiar shapes, including rising, falling, and hump-shaped features. Alternatively, Lettau and Wachter (2007) use an approach based on a stochastic discount factor to compare the term-structure of expected returns for growth and value firms. Giaccotto et al. (2011) rely on the CAPM to study the cost of capital term-structure for a sample of firms in the pharmaceutical industry. van Binsbergen et al. (2012) use option contracts to extract prices of dividend strips; using S&P 500 index options, they find an inverted yield curve for short-term dividend strips (cash flows with 1–3 years maturity).

In this paper we study the term-structure of costs of capital using a conditional asset pricing methodology. The two key contributions of our paper are: first, we elaborate the model of Ang and Liu (2004) to include a time-varying FX risk premium in addition to a time-varying FX exposure coefficient. And second, we estimate industry cost of equity term-structures and show that either omitting the FX risk factor or using constant discount rates can lead to substantial pricing errors.

For our empirical analysis, we estimate cost of equity term-structures for 39 U.S. industries with and without an FX risk component. The theoretical foundation for these estimates comes from a single-factor global CAPM (GCAPM) to model conditional expected returns without currency risk, and a two-factor international CAPM (ICAPM) that includes the global market portfolio and a currency risk factor.[4] We find that, on average, the industry FX risk premium is around 2.29% (or roughly 36% of total industry cost of equity) for expected cash flows with maturities between 1 and 3 years. The FX risk

[2] Several studies using conditional asset pricing models find that FX risk is priced at the aggregate market level (Carrieri et al., 2006; De Santis and Gerard, 1998; Dumas and Solnik, 1995).

[3] Typically the authors compare the use of (i) the classical local CAPM, (ii) a single-factor global CAPM – where in place of the domestic market portfolio one uses a global market index fund, (iii) a multi-factor international CAPM where the factors are returns of a global market portfolio and one or multiple trade-weighted currency baskets.

[4] Typically the FX risk component can be added in one of two ways. Some studies include the currency returns of several bilateral FX rates. Arguably more popular is the method of using returns of one or several trade-weighted currency baskets. In this study, the second factor in the two-factor international CAPM is the inflation-adjusted return of the Major Trading Partner Currency index (MCI).