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What determines the yen swap spread?

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ABSTRACT

We investigate if Japanese yen denominated interest rate swap spreads price risks in addition to liquidity and default risk. These additional risks include: the time-varying correlation between interest rates of different types and maturities; business cycle risk; and market skewness risk. Our analysis, over a number of different maturities and sample periods, supports the existence of an additional risk premium. We also show that the time-varying correlation between short term market interest rates (e.g., TIBOR) and the longer term Government bond yield (e.g., Gensaki) is of particular importance. Japanese yen swap spreads are shown to contain both pro-cyclical and counter-cyclical elements of business cycle risk, positive risk premia for skewness risk and variable risk premia for correlation risk (between fixed and floating interest rates).

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1. Introduction

In recent years, a rich empirical literature has unfolded that investigates the drivers of credit spreads on corporate bonds and various derivative instruments such as interest rate swaps (IRS), which are the most important instrument traded[2]. Of concern in the pricing of interest rate swaps (henceforth simply "swaps" since this instrument is the exclusive focus of this paper) is the spread, being the difference between the swap yield and a riskless rate, typically a Treasury or Government bond of similar maturity. The aim of this study is to clarify the risks that drive swap spreads. The results presented, provide clear evidence that swap spreads contain significant components of other types of risks once default and liquidity risks are controlled. These include both pro-cyclical and counter-cyclical elements of business cycle risk, positive risk premia for skewness risk and variable risk premia for correlation risk (between the fixed and floating interest rates).

Prior work, including Kobor, Shi, and Zelenko (2005) amongst others, show that the spread expresses the relative price of risk and compensates for both default and liquidity risk (e.g., Cooper & Mello, 1991; Duffie & Huang, 1996; Duffie & Singleton, 1997). However, in contrast to these studies, Feldhütter and Lando (2008) find that the default risk factor and the swap factor have relatively little impact on the swap spread. This suggests the presence of other risks driving the pricing relationship. A cursory look at recent studies in the asset pricing literature suggests that business cycle risk, skewness risk, and correlation risk between the fixed and floating interest rates, should be relevant for better understanding of swap pricing (e.g., Adrian & Rosenberg, 2008; Buraschi, Porchia, & Trojani, 2010; Driessen, Maenhout, & Vilkov, 2009).

In this paper our attention is directed to the Japanese financial markets whose unique institutional characteristics encourage investigation of additional pricing determinates in yen denominated swaps[3] in

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[2] The size of the swap market relative to other derivatives highlights the importance of better understanding swap dynamics and pricing, with the most recent data from the Bank for International Settlements (BIS, 2014) showing interest rate swaps account for more than 60.9% of the US$692 trillion of outstandings in over-the-counter derivatives (OTC) markets as of June 2014.

[3] Many empirical findings in IRS markets are mixed and many puzzles remain. For example, during the period of the Global Financial Crisis (GFC) the 30-year US swap rate fell below that of the equivalent maturity U.S. Treasury bond, a phenomenon now termed the "swap spread puzzle".

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addition to their role as the third most important market after the US dollar and the euro[4]. As will be discussed in more detail in the next section, this study also employs the unique statistical technique of Adrian and Rosenberg (2008) to estimate the business cycle risk and skewness risk from the stock market return index.

Japan's decade-long zero interest rate policy is known to have both distorted the yield curve and the term structure of corporate bond yields as well as swap spreads (e.g. Ito, 2007 and Ito, 2008). The flattening of the yen term structure and the subsequent policy actions by monetary authorities to reduce interest rate volatility has therefore reduced the interest rate risk associated with the Japanese business cycle. In addition, these monetary actions can create liquidity distortions in the Government bond term structure, which affect the correlation risk associated with changes in floating rate (short term) and fixed rate (long term) interest rates. Given that swaps have similar features to bonds, Afonso and Strauch (2007) and Asgharian and Karlsson (2008) show that swap spreads vary positively with stock market volatility and hence, the swap spread can contain a systematic risk premium. In a similar sense, correlation risk is also a systematic risk as the co-variation between fixed and floating rates can introduce a risk that should be priced in the swap. Ignoring the dynamics of the correlation structure between underlying interest rates can also lead to serious errors in the pricing model and hedging decisions.

Covrig, Low, and Melvin (2004) and Batten and Covrig (2004) show that skewness risk is present in the short end of the Japanese yield curve, due to pricing distortions associated with the difference between TIBOR and LIBOR interest rates (the Tokyo Interbank Offer Rate and the London Interbank Offer Rate respectively) for unsecured deposits. Thus, determining whether skewness risk is also priced into yen swap spreads is especially important for those market participants who use TIBOR, or LIBOR, based futures contracts to arbitrage, or hedge, the floating rate side of yen interest rate swaps.

It is also worthy of mention that Japan's unique bank based financial system puts special emphasis on local swap markets: most financial market participants (major, regional and trust banks) trade and use swaps for managing the interest rate risk associated with their balance sheet. Also, income from these transactions has historically provided a significant share of other bank income[5]. The important role that swaps play in the Japanese financial system is also evident by the decision to be the first country to implement the Pittsburgh G20 Summit of 2009 agreement, which required that all standardized over-the-counter derivative (OTC) contracts be traded on exchanges or electronic trading platforms. Though there has been significant focus on efforts in Europe and the U.S., Japan also became the first country to pass laws requiring central clearing of OTC derivatives by amending the Financial Instruments and Exchange Act in May 2010.

The results of this study are both theoretically and empirically appealing as we find clear evidence that swap spreads contain significant components of these three risks once default and liquidity risks are controlled. The analysis covers various maturities of swap spread data from Japan, and shows that swap spreads contain both pro-cyclical and counter-cyclical elements of business cycle risk, positive risk premia for skewness risk and variable risk premia for correlation risk (between the fixed and floating interest rates). The empirical results are also robust to sub-sample analysis. This suggests that if pricing models do not incorporate these risks then the models would be seriously biased.

Overall, the benefits from understanding the influence of the above three risk factors are enormous and if ignored may instil instability in the pricing and hedging of swap positions. However, if market participants better understand the factors affecting credit risk in swaps, they should be able to better manage these risks, while dealers and market makers can include the appropriate risk premia in their pricing, while policy makers can take appropriate measures to reduce (but not entirely remove) these risks.

The rest of this paper is structured as follows: Section 2 describes the relevant literature and develops key hypotheses; Section 3 describes the data; and Section 4 explains the methodology used. The empirical results for the full sample are presented and discussed in Section 5, while those of the sub-sample are presented in Section 6. Section 7 concludes.

2. Literature review and hypothesis development

In existing theoretical and empirical studies, the swap spread, is typically modelled as a risk premium to compensate for assuming both default risk and liquidity risk (e.g., Cooper and Mello (1991); Duffie and Huang (1996); Duffie and Singleton (1997) and Liu, Longstaff, and Mandell (2006)). To some extent market risk (volatility) is also used as a determinant of the swap spread (e.g. Sultan (2006); Afonso and Strauch (2007) and Asgharian and Karlsson (2008)). However, the empirical findings from these many studies are not consistent. For example, Wall and Pringle (1989), Litzenberger (1992), Minton (1997), Gupta and Subrahmanyam (2000) and Grinblatt (2001) find little support for default risk, while liquidity risk seems to be more important. These studies argue that the default risk of a swap is minimal and is easily mitigated (Litzenberger, 1992).

This section reviews the literature related to the other risks that can affect swap prices: business cycle risk, skewness risk and correlation risk in financial markets. These three risks are also characterised as systematic risk. For instance, in a study of the bond market, Elton, Gruber, Agrawal, and Mann (2001) argue that when corporate bond returns move systematically with other assets, such as equity returns, then expected bond returns would require a risk premium to compensate for the non-diversifiability of that risk. There are two reasons why systematic risk exists in bond markets. First, if the expected default loss covaries with equity prices, that is, the default risk goes up (down) with the fall (rise) in stock prices, then it introduces systematic risk. Second, the reward for risk offered by financial markets is time-varying. If these changes simultaneously affect both bond and stock markets, then these changes introduce a systematic influence (Elton et al., 2001).

Given that swaps have similar features to bonds, Afonso and Strauch (2007) and Asgharian and Karlsson (2008) show that swap spreads vary positively with stock market volatility and hence, the swap spread can contain a systematic risk premium. In a similar sense, correlation risk is also a systematic risk as the co-variation between fixed and floating rates can introduce a risk that should be priced in the swap. These risks are discussed further below with their relevance to swap markets. Following this discussion, relevant hypotheses are developed.

2.1. Business cycle risk in swaps

If asset returns incorporate business cycle risk, expected returns should incorporate rewards for accepting that risk (Adrian and Rosenberg (2008) and Lettau, Ludvigson, and Wachter (2008)). Related to business cycle risk in swaps, Litzenberger (1992) argues that risk allocation between swap counterparties co-varies with the business cycle. Using this argument, Lang, Litzenberger, and Liu (1998) control for the business cycle (proxied by the unemployment rate) in explaining the determinants of swap spreads. They conclude that swap spreads follow the business cycle. A number of other studies, including those of Ito (2007) and Azad, Fang, and Wickramanayake (2011), also note that the swap market is affected by business cycle risk. However, none of these studies has specifically explored whether business cycle risk is a priced risk factor that can explain a substantial proportion of the swap spread.

The pro-cyclical assumption, as in Lang et al. (1998), implies that business cycle risk should increase the swap spread, since it increases the probability of default-which in turn increases the credit risk of the counterparties. Thus, business cycle risk contributes significantly to

[4] Yen denominated interest rate swaps comprise 9.3% or US$51.71 trillion in outstandings as of June 2014 (BIS, 2014).

[5] For example, see "Japanese banks and their swaps: Free lunch, for now" The Economist, August 15, 2012.

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