



Credit migration and covered interest rate parity

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Abstract

This paper examines the joint determination of deviations in long-term covered interest rate parity and differences in the credit spread of bonds of similar risk but different currency denomination. These two pricing anomalies are highly aligned in both the time series and the cross-section of currencies. The sum of these two pricing deviations—the corporate basis—represents the currency-hedged borrowing cost difference between currency regions and explains up to a third of the variation in the aggregate corporate debt issuance flow. I show that arbitrage aimed at exploiting one type of security anomaly can give rise to the other.

Introduction

Deviations from covered interest rate parity (CIP) have been persistently large since the global financial crisis (GFC) and have attracted the attention of a number of recent papers.¹ While the anomaly is significant in size given the liquidity and volume of the foreign exchange rate (FX) market, research linking this pricing anomaly to the quantity of arbitrage capital and the behaviors of firms and households has been limited. This paper examines the spillover of pricing anomalies between the FX funding market and the corporate credit market as well as the impact on corporate debt issuance flow across currency regions. Using a data set covering \$23 trillion of corporate bonds, I find that variations in the relative FX-hedged borrowing costs predict firms decision on the currency denomination of their debt. FX-hedged debt issuance flow, in turn, exerts price pressure on long-term cash CIP deviations and credit spread differentials, bundling together the two anomalies. I show, in this novel setting, that security anomaly in one market can arise as an equilibrium outcome of arbitrageur actions intended to correct anomaly in another market.

I relate my findings in three parts. First, I show large and persistent differences in the aggregated credit spreads of corporate bonds denominated in different currencies over their respective risk-free rates.

These pricing differences cannot be explained by fundamentals or quanto adjustment that captures the covariance between exchange rate movement and credit default risk. Instead, the pricing difference suggests that the credit market is segmented along currency lines. Relating to previous studies that find local supply and demand shocks as important determinants of credit spreads,² this paper is the first, to my knowledge, to show a currency denomination pricing anomaly for the aggregate corporate bond market. To measure this pricing anomaly in the aggregate, I construct a residualized credit spread for each currency that controls for bond and borrower characteristics using a large panel of bond prices.

Second, I show that residualized credit spread differentials align in direction and size with deviations from long-term covered interest rate parity in the cash market such that the overall borrowing costs with FX-hedging are largely equilibrated across currencies. CIP is a textbook no-arbitrage condition asserting that the interest rate differential between two currencies in the cash market should equal the differential between the forward and spot exchange rates. Although the CIP condition held tightly before 2008, persistent deviations appeared in the aftermath of the financial crisis. This anomaly is large given the size of the FX swap and forward market, which has an average daily turnover of \$3.1 trillion and an outstanding notional of \$58 trillion.³

Fig. 1 shows the time series of residualized credit spread differential and long-term CIP deviation between EUR and USD. Both of these deviations were close to zero before the GFC. Since 2008, however, these spreads have been large, even outside of crises. The residualized credit spread difference between EUR- and USD-denominated bonds had reached over 70 basis points in 2016, which is equivalent to \$25 billion, or 84% of net (12% of gross) annual issuance in the EUR corporate bond market. Periods in which the residualized credit spread is lower in EUR relative to USD (more negative dashed blue line) coincide with larger CIP violations in the direction of more expense to swap EUR to USD in the cash market (more positive red solid line). The two pricing disconnects share similar magnitudes and are highly correlated (-75%). This comovement of pricing anomalies also appears in other developed country currencies (Japanese yen, JPY; UK sterling, GBP; Swiss franc, CHF; Canadian dollar, CAD; and Australian dollar, AUD).

Third, I show that debt issuance flow responds to and equilibrates the overall difference in FX-hedged borrowing cost. I refer to this FX-hedged corporate borrowing cost differential as the corporate basis, which is the sum of the CIP deviation and residualized credit spread differential. Fig. 2 shows that the corporate basis covaries with the aggregate debt issuance flow between the U.S. and the euro area for large global issuers. When the corporate basis is positive, the overall FX-hedged borrowing cost is cheaper in USD (red line), firms issue more in USD (blue bars) and vice versa. In equilibrium, the corporate basis is kept small by large cross-currency issuance flow. A one standard deviation change in the corporate basis induces around a 4% shift in bilateral issuance flow (as a fraction of total issuance).

I develop a model of market segmentation to show that the reduction of either the credit spread differential or the CIP deviation necessitates arbitrageurs to engage in distorting the other. When markets are segmented, the price of risk in one market may be disconnected from those in other markets. Specialization of risk-taking contributes to market segmentation, as it has been studied in other contexts.⁴ The two pricing anomalies studied in this paper reflect distinct market segmentations along two dimensions—the credit market is segmented by the denomination currencies, and the CIP violation is a disconnect between the spot and forward exchange rates. The arbitrageur is risk-averse and thus desires to isolate the arbitrage spread while avoiding other risks. However, each of the two deviations serves as a short-sale constraint on the other. To take advantage of the credit spread differential, the arbitrageur needs to hedge FX risk through trading forwards or swaps. To arbitrage the cash CIP

deviation, she needs to borrow and lend in different currencies using assets with the same fundamental risks.

Global debt issuers and investors are natural cross-market arbitrageurs, as their activities straddle the credit and FX markets. I focus on issuers for three main reasons. First, firms issue a substantial amount of cross-currency debt with FX hedge. A textual analysis of 10K filings of S&P 500 firms indicates that around 40% of the firms have issued FX-hedged foreign debt in recent years (Section 6.1 presents this analysis). Second, firms make borrowing currency choice to cater to investors that have a strong home-currency bias. Related to this finding, Maggiori et al. (2019) show that investors have home-currency bias to such an extent that each country holds the bulk of all foreign debt securities denominated in their home currency regardless of the nationality of the issuer. Third, firms are natural cross-market arbitrageurs that can overcome limits of arbitrage problems, as shown in previous studies under other settings.⁵ Going beyond debt issuers, Liao and Zhang (2020) more broadly study currency hedging that links external imbalance at the country level to CIP deviations and spot exchange rate movements.

What might be drivers of the two deviations in the first place? Local credit market shocks could emanate from quantitative easing (such as European Central Bank (ECB) corporate bond purchase), liability-driven investments (e.g., pension fund benchmark changes),⁶ and credit sentiments.⁷ FX hedging demand shocks unrelated to debt could arise from bank funding shocks,⁸ regulatory changes,⁹ and structured products. The model presented in this paper highlights that shocks to either the credit market or the FX-hedging market are transmitted from one to the other through currency-hedged debt flows.

Additional empirical analyses support the model predictions. First, a counterintuitive implication of the model, which also appears in the data, is that the corporate basis is small even when deviations in both CIP and credit are large individually. Second, cross-currency issuance flow covaries with the corporate basis in predictable directions at the aggregate and the firm level. Third, large cross-currency debt issuances have a direct price impact on CIP deviations. Fourth, exogenous increases in total bond issuance, instrumented by the rollover of maturing debt, serve as increases in arbitrage capital that align the two deviations closer and reduce the corporate basis.

Violations of the law of one price (LOOP) have been found in various corners of the financial market. The typical explanation involves limits of arbitrage arguments that follow from the seminal work of Shleifer and Vishny (1997). Many important papers have contributed to the understanding of LOOP violation and arbitrage constraints: Kyle and Xiong (2001), Gromb, Vayanos, 2002, Gromb, Vayanos, 2018, Brunnermeier and Pedersen (2009), Gârleanu and Pedersen (2011), and He and Krishnamurthy (2013). The act of arbitrage can also endogenously determine the equilibrium risk of financial assets and transform alphas into betas (Cho, 2019). This paper contributes to the study of arbitrage by showing that LOOP violations in one market can arise as an equilibrium outcome of arbitrageur actions intended to correct violations in another market.

This study relates to papers on international portfolio holdings, borrowings, and exchange rates. The findings of credit market segmentation and issuers reaching across currency boundaries to cater to investor demand echo the results of investor home-currency bias (Maggiori et al., 2019; Burger et al., 2018). The influence of debt issuance flows on the CIP deviation resonates with the theory of exchange rate determination that emphasizes capital flow in imperfect financial markets (Gabaix and Maggiori, 2015). Other works have examined local versus foreign currency borrowing by firms in different contexts, often without currency hedging (Bruno, Shin, 2014, Bruno, Shin, 2017, Gozzi, Levine, Peria, Schmukler, 2015, Hale, Jones, Spiegel). My result on corporate issuance flow being sensitive to the

corporate basis at the aggregate level also expands upon the message by McBrady and Schill (2007), who find an opportunistic motive for foreign currency borrowing by sovereign government and agency issuers.

The CIP condition at the short and long maturities has been empirically validated in several early papers.¹⁰ A set of papers also examined short-term CIP violations during the financial crisis.¹¹ The general conclusion from earlier work is that any CIP violations were short-lived before and during the financial crisis. My finding of FX-hedged corporate bond pricing differences parallels studies that examine sovereign bond pricing differences in currencies of different denominations.¹² The result that the corporate basis is relatively small in comparison to CIP deviation based on interbank funding rates accords with the findings of Rime et al. (2017) that CIP holds well for most potential arbitrageurs when applying their marginal funding rates.

More closely related to this paper are Du et al., 2018, Ivashina, Scharfstein, Stein, 2015, Sushko, Borio, Mccauley, Mcguire. Ivashina et al. (2015) examine USD funding and lending behaviors of European banks during the eurozone sovereign crisis and explore how the shrinkage of wholesale USD funding compelled banks to swap their EUR funding into USD, which in turn generated CIP violations and affected lending.¹³ Du et al. (2018b) study persistent deviations from CIP in recent periods and propose an explanation relating to bank regulatory costs that lead to large quarter-end spikes in deviations. Sushko et al. (2016) examine the role of hedging demands and costly balance sheets in the determination of CIP violations. Relative to these papers, this study contributes in explaining the joint determination of both long-term CIP violations and credit spread disconnect in different denomination currencies — the two deviations need to be considered jointly in formulating an explanation for the equilibrium prices and debt capital flows.

This paper also contributes to the understanding of the US Treasury basis or “convenience yield” over other sovereign yields examined in recent studies.¹⁴ Using bonds from the same issuer but denominated in multiple currencies, this paper disentangles the currency effect from the entity effect in comparing currency-hedged yield differentials. The analysis suggests that most of the US government borrowing cost advantage relative to other developed countries is attributed to the specialness of the US dollar rather than the specialness of US Treasuries. The borrowing cost advantage in the dollar relative to other currencies is the largest for bonds that are high-grade and short-maturity, characteristics that resemble safeness.

Section snippets

Credit spread, CIP deviation, and corporate basis

To facilitate discussions, I define the corporate basis in relation to the credit spread differential and the CIP deviation based on the risk-free rates. Let y_t^ϵ and $y_t^\$$ be risky bond yields in the respective currencies and f_t and s_t be the forward and spot (log) exchange rate quoted in dollar per euro. For simplicity, we work with short-term interest rates and suppress terms indicating maturity. Corporate basis Ψ_t is the FX-hedged bond yield difference between bonds denominated in the EUR and...

Residualized credit spread differentials

This section develops a measure of the aggregated credit spread differential for bonds denominated in different currencies. The ideal experiment is to find pairs of identical bonds (same issuer, maturity, etc.) that differ only in currency denomination.¹⁵...

Corporate bases

To understand the overall currency-hedged yield difference between similar bonds denominated in different currencies, I examine the combined measure of the residualized credit spread differential $\kappa_{c,t}$ and the risk-free CIP deviation $x_{c,t}$. As defined earlier in Eq. (2), this combined measure is the corporate basis, $\Psi_{c,t} \equiv \kappa_{c,t} + x_{c,t}$. The corporate basis measures the incentives for firms to borrow and investors to invest in one currency relative to another. These decisions ultimately aggregate into...

A model of aligned deviations in credit and FX markets

The frictionless benchmark presented in Section 3.4 shows that in the absence of quanto risk, the same debt obligations in different currencies should have the same credit spread. The existence of a nonzero residualized credit spread differential κ suggests that markets are incomplete. The empirical evidence also motivates a theory that links κ to CIP deviation x .

In this section, I present a model that explains the high degree of alignment between k and x , as well as their relation to...

Tests of model predictions on issuance flow

In this section, I provide further validation of the theoretical framework using data on bond issuance. I first discuss reasons to focus on debt issuance. I then present evidence on the interactions among issuance flows, credit spreads, and CIP deviations that support the model....

Conclusion

This paper documents the joint determination of cash CIP deviations and credit spread differentials for bonds of similar risk but different denomination currency. I show that these two pricing anomalies have been substantial and persistent since the financial crisis. The two anomalies are highly aligned in magnitude and direction in both the time series and the cross-section of currencies. The sum of the two pricing deviations — the corporate basis — is the relative FX-hedged borrowing cost...

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