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Do Firms Believe in Interest Rate Parity?*

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Abstract. Using a broad sample of international corporate bond offerings, we provide evidence that corporate borrowers make opportunistic currency choices, in that they denominate the currency of their bonds in a manner that is inconsistent with a belief in either covered or uncovered interest rate parity. Using firm-level tests, we identify a number of characteristics of firms that engage in opportunistic behavior. We observe that large issuers located in developed markets with investment-grade ratings and low cash flow characterize those firms that are responsive to covered borrowing rate differences across currencies. Corporate responsiveness to uncovered borrowing rate differences appears more general. We observe that although the gains firms achieve through opportunistic currency denomination are economically significant, the yield differential tends to systematically decline after issuance. This finding suggests that opportunistic issuance by corporations may be a primary mechanism for driving covered interest yields toward parity.

JEL Classification: G14, G15, G32

1. Introduction

Interest rate parity is a bedrock assumption of international finance. It asserts that debt yields are equivalent across currencies when considering expected movements in exchange rate spot rates (uncovered parity) or prevailing forward exchange rates (covered parity). Given its importance to international finance, the academic literature on interest rate parity is justifiably vast. Nevertheless, although there is a rich understanding of the behavior of interest and exchange rates, there is surprisingly little understanding of how market participants respond to cross-currency variation in interest rates. In survey data, Graham and Harvey (2001); Servaes and

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Tufano (2006), and Geczy et al. (2007) all document that firms claim to respond opportunistically to cross-currency variation in borrowing rates.[1] In this paper, we examine currency denomination decisions for a sample of firms issuing debt in international bond markets and test whether firm behavior is consistent with the survey evidence. In effect, this paper tests whether the borrowing behavior of firms is consistent with a belief in the parity of covered and uncovered interest rates.

Shortly after the breakdown of the Bretton Woods system of fixed exchange rates, Frenkel and Levich (1975, 1977) established much of the theoretical and empirical support for covered interest parity in the short-term currency markets. In that context, covered interest arbitrage strategies are simple and relatively costless. Essentially they amount to lending in high interest currencies and borrowing in low interest currencies, exchanging the proceeds from the loan in the spot market, and selling the proceeds of the investment (plus interest) in the forward market. As a result of the limited risk and transaction costs over short-term horizons, covered interest parity holds to a first approximation in normal market conditions.

Covered interest parity for short-term interest rates, however, does not guarantee covered interest parity for longer-term bond yields. With larger arbitrage costs, the covered yields across currencies at which firms can issue long-term bonds may not be identical (Clinton, 1988 and McBrady, 2003).[2] The standard assumption is that the magnitude of the deviation from interest rate parity should be bounded by the cost of executing and holding the round-trip arbitrage position. Deardorff (1979) argues that monitoring differences in covered interest yields and effectively enforcing long-term covered interest parity may be left to bond issuers conducting "one-way

[1] Graham and Harvey (2001) find that 44 percent of the firms in their survey cite lower borrowing costs as an important reason for issuing foreign currency obligations. Servaes and Tufano (2006) observe that "relative interest rates," "relative credit spreads," and "expected exchange rate movements" are among the most common reasons that firms cite in their study for issuing debt in a foreign currency. Geczy et al. (2007) find that 42 percent of the firms in their survey at least sometimes take positions in response to a market view on exchange rate or interest rate movements.

[2] In practice, firms hedge long-term foreign currency denominated debt with a collection of swap contracts. The first contract is a foreign currency interest rate swap contract where the borrower promises to exchange fixed rate interest payments in the foreign currency for floating rate interest payments in the foreign currency. The second contract is a basis swap contract where the borrower promises to exchange floating interest payments in the foreign currency for floating interest payments in the domestic currency. The last contract is an interest rate swap contract in the domestic currency where the borrower promises to exchange floating interest payments in the domestic currency for fixed interest payments in the domestic currency. The aggregate effect of the collection of three swap contracts is to transform fixed rate interest payments in the foreign currency to fixed rate interest payments in the domestic currency for a particular maturity that matches that of the original debt contract. In effect the collection of swap contracts mimics the effect of a series of forward exchange rate contracts at maturities that match the swap contract terms. For a further discussion of how bond issuers use currency swaps to hedge foreign-currency bond issuance, see Fletcher and Taylor (1996) or McBrady and Schill (2007).

arbitrage" as they opportunistically denominate borrowing in low yield currencies. Since firms with borrowing needs must make one side of the roundtrip arbitrage transaction anyway, they may face lower marginal costs to executing the other side of the arbitrage transaction than other market participants that must incur both sides of the arbitrage transaction. In this paper, we observe corporate borrowing behavior that is consistent with Deardorff's "one-way arbitrage" proposition. We find that firms systematically issue bonds denominated in currencies when covered yields are systematically low and that the yield discrepancy subsequently disappears. This finding suggests that opportunistic issuance by firms may be a primary mechanism for driving covered interest yields toward parity.

For uncovered interest yields, the empirical evidence for short-horizon exchange rate behavior is overwhelmingly inconsistent with interest rate parity. In fact, the failure of short-horizon uncovered interest parity, the so-called "forward premium puzzle," is one of the most well documented phenomena in international finance.[3] At longer horizons, relevant to corporate bond issuance, the evidence of interest rate parity is more mixed. Chinn and Meredith (2004), for example, present evidence consistent with interest rate parity for 5 and 10-year yields. We investigate whether firms systematically denominate bonds in currencies with relatively low nominal yields and/or in those currencies that tend to depreciate. Once again, we find strong support in the data that firms tend to choose low yield currencies when denominating bonds and that those differences in yields tend to subsequently disappear.

Overall, our analysis seeks to add to the large literature on interest rate parity and the more recent literature on opportunistic debt issuance. With regard to interest rate parity, the paper is most closely related to the early work by Frenkel and Levich (1975, 1977) and extensions of this work by Deardorff (1979) and Callier (1981). With regard to opportunistic debt issuance, the paper builds on studies of debt issuance in a cross-currency context (Johnson, 1988; Keloharju and Niskanen, 2001; Allayannis et al., 2003; Henderson et al., 2006) that are largely anecdotal and based on two currency comparisons using simple nominal interest rates. Despite being rather cursory, this literature largely rejects the acceptance of interest rate parity by corporations. In contrast, the evidence provided by Brown et al. (2009) is less supportive of opportunism across borrowing currencies, but their study is focused squarely on a large sample of small firms. None of these papers examine responses to variation in deviations in covered interest parity.[4]

[3] Early evidence of the forward premium puzzle is found by Bilson (1981); Longworth (1981); Meese and Rogoff (1983), and Chinn and Frankel (1994). Reviews of the uncovered interest parity literature are covered by Froot and Thaler (1990) and MacDonald and Taylor (1992).

[4] Our work also augments previous work on opportunism across various other dimensions of firms' debt issuance decision. Friedman (1979) and Baker et al. (2003), for example, examine the choice between short-term and long-term debt. Faulkender (2005) examines the choice between fixed-rate and floating-rate debt. Schramade et al. (2006) examine the optimal frequency by which corporations

McBrady and Schill (2007) do test for covered and uncovered opportunistic currency choice across a menu of currencies, as we do, but they use a sample of government and government agency borrowers rather than corporate borrowers. We believe that testing opportunistic behavior with a corporate sample is interesting for a number of reasons. First, government and corporate debt yields are known to move in a unique manner in some contexts. Durbin and Ng (2005) discuss examples such as Samsung Electronics where the corporation maintains lower borrowing yields than the sovereign government. Hund and Lesmond (2009) show the effect of significant liquidity differences between government and corporate debt securities. Greenwood et al. (2009) describe the unique and complimentary role of corporate and government borrowers in interest rate equilibrium. Second, the social welfare objectives of governments are very different than the profit motivation of corporations. Unlike government borrowers, we expect that corporations maintain clearer incentives to minimize the cost of capital by reducing borrowing costs. Third, governments are likely to maintain a different information set with respect to cross-country borrowing rates and foreign currency movements than the information set of corporations. The Italian government (the largest entity in the McBrady and Schill paper) is likely to have access to different information on international interest rates and currency movements than the information available to Fiat or Olivetti (two Italian borrowers represented in our sample). Moreover, governments are also likely to borrow on a much larger scale compared to corporations and thus face different economics. Lastly, government bonds are benchmark bonds and thus are likely to face a very different demand structure than corporate bonds.[5] The existing literature fails to provide much evidence on the important question of whether firms borrow opportunistically over covered and uncovered cross-currency yields. The distinctions between government and corporate borrowing combined with the foundational importance of interest rate parity to international finance motivate a large-scale test of opportunistic cross-currency debt issuance for corporations.

This paper offers such a large-scale test of opportunistic behavior across borrowing currencies for corporations. Our sample includes foreign currency-denominated bonds issued by firms from 22 countries in each of four major currencies over the 1993 to 2005 time period. We consider both aggregate tests (following McBrady

return to the debt markets. Chaplinsky and Ramchand (2004) examine the choice between public debt and Rule 144A debt. Barry et al. (2008) look at corporate debt offerings with respect to the time series of yield levels. Kim and Stulz (1988) and Miller and Puthenpurackal (2002) consider opportunism across bond markets. Like these papers, our work also emphasizes the role of opportunism in defining the characteristics of corporate debt contracts. But more importantly we add to this literature by emphasizing the role of corporate issuer in moving prices toward parity. However, we note that the tendency to seek opportunistic issuance is unlikely to be uniform across firms. Beber and Fabbri (2008), for example, investigate the effect of manager incentives and reputation in their willingness to speculate on corporate foreign currency exposure.

[5] We acknowledge the referee for articulating several of these points.

and Schill, 2007) and firm-level tests. In our firm-level tests we employ a conditional logit regression set up that increases the power of the inferences we are able to draw. The setup allows us to examine a number of novel cross-sectional relationships to identify characteristics of firms that engage in opportunistic debt issuance. The approach in this paper is to use borrowing cost measures that more accurately depict the yield alternatives facing borrowers. For nominal yields we use cross-currency differences in AA corporate bond yields. For covered yields we use cross-currency differences in the spread between corporate bond yields and rate to swap into a floating rate in a common currency. To estimate the prevailing currency swap rate we sum the prevailing interest rate swap rate with the currency basis swap rate. Since we observe that borrowing demand is correlated with the basis swap rate, this procedure is an important refinement over the approach of McBrady and Schill (2007). Finally, we examine both the economic gains that firms achieve through their opportunistic issuance and the extent to which they appear to influence subsequent yields and exchange rates.

Overall, we observe that bond currency denomination within our sample is not consistent with firm belief in interest rate parity, rather it is consistent with what firms say they do in the survey evidence in Graham and Harvey (2001); Servaes and Tufano (2006), and Geczy et al. (2007). The tendency to be opportunistic with prevailing uncovered yields appears to be general across the sample, although small, regulated firms with non-investment grade debt appear to be less sensitive. The responsiveness to covered yields, however, is isolated to firms from developed markets that are large, have low cash flow, and investment-grade bond ratings. These cross-sectional results seem reasonable. For example, emerging market and non-investment grade issuers are markedly less likely than other firms to pick currencies based on relatively low covered interest yields. In the former case, this follows from the absence of currency swaps for emerging market currencies. Unable to swap bond payments into their home currency, emerging market firms have little incentive to potentially swap their issue currency into any other. For non-investment grade firms, on the other hand, additional market frictions explain their relative inability to exploit lower covered interest yields. Currency swap counterparties (AA-rated international banks) assess credit charges for swaps entered into with less credit-worthy counterparties. These charges can be 15 to 20 basis points, effectively eliminating the potential gains available to higher credit-quality issuers. The tendency for low cash flow firms for foreign currency borrowing with hedged exchange rate risk is consistent with the intuition of Stulz (1990) and Geczy et al. (1997).

We estimate the economic gains to such behavior by comparing the average borrowing costs that are realized through firm denomination decisions with a "naïve" alternative currency denomination rule. For the full sample of issuers and time periods, the differences appear relatively modest at 1 basis point (bp) gain

over the naïve cost for the covered yields, 7 to 10 bps for the nominal yields, and 36 to 52 bps for the one-year currency depreciation. The full sample results are likely to be downwardly biased due to the noise of currency denomination decisions that are motivated by cash flow hedging considerations. To focus more specifically on opportunistic-based currency choice, we isolate those bonds issued during idiosyncratic surges in demand for borrowing in a particular currency. During such periods of relatively high issuance, firms achieve covered interest savings of 3 to 4 basis points. These gains are also somewhat larger for firms that tend to be more responsive to differences in borrowing rates. These modest gains may be sufficient to motivate a corporate treasurer to alter the denomination of a corporate borrowing need, yet consistent with well-functioning markets.[6] Following with the predictions of Deardorff (1979), we suspect that the gains are too small to be attractive to round-trip arbitrage firms after taking into account the associated transaction costs and long-horizon holding costs, though sufficiently attractive to one-way arbitrageurs such as corporate borrowers. Much larger gains are observed with regard to nominal yields and subsequent exchange rate depreciation. Firms achieve nominal interest savings of 63 to 80 basis points over borrowing in other currencies by issuing bonds in relatively low interest currencies during high-issuance months. Over the subsequent year, firms also benefit systematically by issuing bonds in currencies that tend to depreciate 175 to 202 basis points more than the other currencies in the sample. While these gains are impressive in magnitude, it is important to note that they do not come without risk. Given the volatility of exchange rates, large gains provide necessary compensation for the retention of currency risk.[7]

Lastly, we observe that cross-currency covered yields, uncovered yields, and exchange rate variation all tends to systematically dissipate following corporate

[6] We suspect that underwriters play a role in the decision. Consider a scenario where a corporate bond underwriter counsels firm management on an existing bond offer deal that the firm can save a few basis points in borrowing cost by denominating the bond in a particular currency and then swapping out the exchange rate risk. Such a scenario may be how such opportunities are revealed.

[7] Despite the paucity of existing academic evidence, such interest rate and exchange rate gaming has long been a conjecture of corporate lending. A 1979 *Business Week* article provides a case in point. "After going heavily into Swiss franc debt in the 1960s, the multinationals saw the franc shoot up by 130% against the dollar between 1970 and 1978. A $100 million loan made in 1969 had turned into a $230 million liability nightmare nine years later. That sort of thing cost dozens of corporate treasurers their jobs. But if the Swiss franc now stabilizes against the dollar—as many foreign exchange analysts are predicting—not going into Swiss franc debt could also mean the loss of millions of dollars in unnecessary extra costs for loans. Behind this career-making or career-breaking dilemma, of course, is the yawning interest rate differential that has opened up between U.S. dollar and Swiss franc borrowing. Imperial Chemical Industries Ltd. (ICI) . . . is currently borrowing 230 million Swiss francs in Zurich for 15 years at 3.5% interest. In the U.S., ICI would probably have to pay closer to 10% for the same 15-year money—650 basis points more to borrow in U.S. dollars . . . but to take advantage of this enormous rate differential, the dollar must be stable against the Swiss franc" (Business Week, 1979).

bond issuance in that currency. Such evidence suggests that firms, rather than more traditional long/short arbitrageurs, may effectively enforce interest rate parity at longer-term horizons. A complementary way to think of this is that firms provide a "gap-filling" role in the words of Greenwood et al. (2009), in that they maintain a greater capacity to absorb supply shocks than do arbitrageurs.

The rest of the paper is structured as follows. Section 2 describes the bond sample and our measures of borrowing cost. Section 3 presents the empirical tests. Finally, Section 4 offers concluding remarks.

2. Data

2.1 INTERNATIONAL CORPORATE BOND OFFERINGS

We construct a sample of international corporate bond offerings from the Thomson Financial SDC Platinum Global New Issues dataset over the period from 1993 to 2005. This data source is used in constructing bond underwriting league tables such that it is believed to be a fairly comprehensive record of bond offerings. We obtain all non-convertible, fixed-coupon corporate bonds placed in foreign markets or denominated in a foreign currency. The designation of international bonds is accomplished by selecting bonds in the SDC dataset with the variable "Market area" equal to "Euro" or "International." Bonds offered in the issuers' local currency are excluded from the sample. Issues from entities originating tax havens such as Bermuda, and Cayman Islands are also eliminated as we are not able to accurately identify the home country currency for these firms. Public sector bond offerings (Primary SIC code 6111 or in the 9000s), financial institutions (SIC Code 6000s), and trusts (SIC code 619A or B) are eliminated. The resulting dataset includes 5697 offerings with an aggregate current U.S. dollar-based total principal of $1.5 trillion.

Since we are looking for equilibrium choice behavior, we omit offerings in euros (including ECU) and euroland currencies (German marks, French francs, etc.) as these are transitional currencies over our sample period. Our concern is that over the transition period many euro-denominated debt offerings are simply "rebalancing transactions" of retiring old currency debt to replace with new currency debt.[8] In order to improve the power of our empirical tests, we restrict our sample to those offerings that are denominated in the four most common currencies, the U.S.

[8] The total number of bond offerings over the sample period for selected "euroland" currencies not included in the sample are 1467 for the euro, 205 for the German mark, 85 for the French franc, and 54 for the Italian lire.

dollar (USD), British pound (GBP), Japanese yen (JPY), and Swiss franc (CHF).[9] To ensure that firms maintain a legitimate choice across the sample currencies, we eliminate offerings from those home countries in which we find bonds denominated in less than three of the four sample currencies.[10] The revised sample includes 2567 offerings with an aggregate current U.S. dollar-based total principal of $544 billion.

Table I summarizes the currency denomination distribution across the ultimate country of origin of the corporate borrower. Panel A provides the distribution of number and U.S. dollar-based value of offerings by country and currency. We observe that firms from such countries as France and Germany tend to make use of the broad menu of currency choices in their denomination decision. We find that firms from other countries are less broad in their choice of menu currencies. South Korean borrowers, for example, tend to have a disproportionately large number of JPY denominated issues, consistent with expected operating cash flow hedging considerations in neighboring Japan. Borrowers from countries such as Brazil, Belgium, and Singapore are not represented in our sample, for example, as they fail to collectively pass our sample breadth screens. On a per offering basis, the sample bond offerings are on average largest from Hong Kong ($559 million per offering) and smallest from Austria ($57 million per offering).

In Panel B of Table I we report the distribution of international debt by country type, industry, bond rating, firm size, export orientation, cash flow, and size of offering. G5 firms are defined as those from France, Germany, Japan, United States, and United Kingdom. Emerging market firms are defined as those from China, Hong Kong, South Africa, and South Korea. Across industry, we use the utility industry to define regulated firms (SIC code within the 4000s). Bond rating and size of offering are as reported by SDC. The accounting variables are obtained for the year before the issue, and are from Worldscope for non-US firms and Compustat for firms domiciled in the US. Size is defined as total reported assets, foreign sales percentage is total sales from abroad as a percentage of total sales, cash flow is total operating profit plus depreciation and amortization divided by total assets.

[9] There is substantial drop off in frequency of bond offerings outside of this group of four currencies. We find, however, that the findings in this paper are insensitive to including the next two most common currencies, the Australian dollar and the Canadian dollar.

[10] The total size of the sample denominated in the four sample currencies is 3027. If we require at least 2 currencies for offerings from a country to be included the sample drops to 2624. If we require at least 3 currencies for offerings from a country to be included the sample drops to the final sample used in the paper of 2567. Almost all of the observations lost due to the currency representation cutoff are offerings in USD. These lost offerings come mostly from the following countries: Brazil (117), Mexico (89), Argentina (57), Russia (38), and Chile (24). Because the omitted observations tend to be quite small, the cutoff choice maintains negligible effect on a proceeds-weighted basis. The conclusions in the paper are robust to including the larger sample without the representativeness screen.

Table I Summary of international corporate bond offering sample

The table shows the distribution of home country, and borrower characteristics for the 1993 to 2005 sample of international corporate bond offerings in U.S. dollars (USD), British pounds (GBP), Japanese yen (JPY), and Swiss francs (CHF). Panel A reports the total principal amount offered in billions of current U.S. dollars and the total number of bond offerings in parentheses for each of the sample currencies by country of origin. The country of origin denotes the ultimate domicile nation of the issuer as defined by SDC. NA indicates the cells of domestic currency offerings which are excluded from our sample. Panel B reports the distribution of borrower characteristics in billions of current U.S. dollars. G5 firms are defined as those from France, Germany, Japan, United States, and United Kingdom. Emerging market firms are defined as those from China, Hong Kong, South Africa, and South Korea. Across industry, we define utilities as regulated firms (SIC code within the 4000s). The bond rating is that reported by SDC. The accounting variables are obtained for the year before the issue, and are from Worldscope for non-US firms and from Compustat for firms domiciled in the US. Size is defined as total reported assets, foreign sales percentage is total sales from abroad as a percentage of total sales, cash flow is total operating profit plus depreciation and amortization divided by total assets.

	Sample currencies									
	USD		GBP		JPY		CHF		Total	
	$Amt	(N)	$Amt	(N)	$Amt	(N)	$Amt	(N)	$Amt	(N)
Panel A. Total bond offerings by country of origin										
Australia	12.7	(49)	0.0	(0)	0.4	(5)	0.1	(1)	13.2	(55)
Austria	0.2	(1)	0.1	(1)	0.1	(6)	0.7	(13)	1.2	(21)
Canada	65.9	(240)	1.5	(6)	0.0	(0)	0.2	(1)	67.7	(247)
China	0.4	(2)	0.0	(0)	0.1	(1)	0.1	(1)	0.7	(4)
Denmark	1.0	(7)	0.8	(3)	0.9	(14)	0.3	(4)	3.0	(28)
Finland	1.1	(4)	0.4	(1)	0.2	(3)	0.0	(0)	1.6	(8)
France	10.8	(45)	10.5	(32)	6.3	(48)	5.9	(34)	33.4	(159)
Germany	19.0	(106)	13.0	(37)	11.0	(65)	3.8	(38)	46.7	(246)
Hong Kong	11.7	(20)	0.5	(1)	0.0	(0)	0.0	(1)	12.3	(22)
Italy	10.7	(21)	4.0	(7)	0.9	(7)	0.0	(0)	15.6	(35)
Japan	64.9	(305)	6.1	(23)	NA	(NA)	23.5	(330)	94.5	(658)
Netherlands	14.0	(41)	2.3	(6)	2.0	(4)	0.2	(1)	18.5	(52)
New Zealand	2.9	(17)	0.9	(4)	0.2	(1)	0.1	(1)	4.1	(23)
Norway	5.5	(21)	0.6	(3)	0.2	(6)	1.0	(9)	7.3	(39)
Portugal	0.2	(1)	0.3	(1)	0.0	(1)	0.0	(0)	0.5	(3)
South Africa	1.0	(3)	0.4	(2)	0.0	(0)	0.0	(1)	1.4	(6)
South Korea	9.3	(40)	0.0	(0)	3.6	(22)	0.0	(1)	12.9	(63)
Spain	5.8	(18)	0.6	(1)	0.9	(6)	0.2	(2)	7.6	(27)
Sweden	3.7	(16)	0.6	(2)	1.6	(12)	0.6	(8)	6.6	(38)
Switzerland	14.0	(46)	1.1	(4)	1.4	(2)	NA	(NA)	16.5	(52)
U. Kingdom	63.1	(189)	NA	(NA)	8.1	(64)	2.1	(14)	73.4	(267)
United States	NA	(NA)	49.0	(181)	36.8	(200)	19.7	(133)	105.5	(514)
Total	318.0	(1192)	92.7	(315)	74.8	(467)	58.7	(593)	544.3	(2567)
Share	.584	(.464)	.170	(.123)	.137	(.182)	.108	(.231)		

Table I (Continued)

	Sample currencies				
	USD	GBP	JPY	CHF	TOTAL
Panel B. Total principal amount by sub sample					
Country type					
G5	157.8	78.6	62.2	55.0	353.6
Other developed	137.9	13.3	8.9	3.5	163.4
Emerging markets	22.4	0.9	3.7	0.2	27.2
Industry					
Regulated (Utilities)	90.6	29.0	14.3	6.7	140.6
Other industries	227.4	63.7	60.5	52.0	403.7
Bond rating					
AAA	45.6	31.9	10.8	21.4	109.7
AA	29.3	13.9	14.1	11.8	69.1
A	64.2	18.3	31.1	6.5	120.1
BBB	82.9	15.7	5.9	0.2	104.7
Non investment grade	48.6	3.3	0.1	0.0	52.0
Non-rated	47.5	9.5	12.8	18.9	88.7
Firm assets					
$0 to $10b	106.3	8.0	4.0	13.9	106.3
$10 to $20b	39.7	9.0	8.6	3.6	39.7
$20 to $30b	27.2	8.1	9.5	1.9	27.2
> $30b	109.6	61.9	49.7	32.1	109.6
Foreign sales percentage					
0% to 25%	73.3	8.9	14.3	15.2	73.3
25% to 50%	48.7	24.0	13.5	12.3	48.7
50% to 75%	70.2	14.6	14.5	8.4	70.2
> 75%	52.9	30.2	24.3	12.4	52.9
Cash flow					
< 5%	20.5	2.0	0.3	2.2	20.5
5% to 10%	63.0	45.4	24.5	25.6	63.0
10% to 15%	79.1	20.6	12.7	10.1	79.1
>15%	95.6	17.3	33.5	9.8	95.6
Size of offering					
$0 to $100m	8.8	3.5	13.3	16.6	42.2
$100 to $250m	69.8	23.2	15.8	28.3	137.1
$250 to $500m	117.4	36.0	24.8	10.6	188.7
$500 to $1000m	79.0	21.9	14.3	3.2	118.5
>$1000m	43.0	8.2	6.6	0.0	57.9

We observe that utilities and firms from G5 countries represent an important segment of our sample. Moreover, the offerings are evenly distributed across large firms (>$30b in assets) and small firms (<$10b). Our sample pulls mostly from high cash flow (>10% cash flow) and export-oriented firms with more than 25% of their revenue generated abroad. Bonds are typically investment grade and issued in amounts between $0.1 and $1 billion. However, small offerings with higher ratings are much more common for bonds denominated in CHF.

Table II International corporate bond offerings by year

The table shows the distribution of share of international corporate bond offering activity by currency over the sample period from 1993 to 2005. Annual share is determined based on the total principal amount offered in billions of current U.S. dollars for each calendar year.

	Share				
Offering year	USD	GBP	JPY	CHF	Total principal
1993	72.4%	4.6%	2.9%	20.0%	42.9
1994	64.0%	6.4%	10.9%	18.7%	26.6
1995	72.3%	3.0%	5.0%	19.7%	29.2
1996	58.8%	5.4%	18.4%	17.5%	40.0
1997	70.4%	11.5%	8.5%	9.6%	38.7
1998	72.1%	15.3%	2.5%	10.1%	40.3
1999	59.9%	16.8%	14.4%	8.9%	40.5
2000	31.5%	17.0%	47.2%	4.3%	60.0
2001	47.6%	29.7%	14.4%	8.4%	39.6
2002	46.0%	36.8%	7.1%	10.1%	39.5
2003	67.7%	19.5%	6.4%	6.4%	53.7
2004	57.6%	25.2%	11.3%	5.9%	54.0
2005	54.3%	20.6%	13.7%	11.5%	38.8

In Table II we report the share of annual total foreign currency bonds (converted to USD) for each of the four sample currencies. We observe that bond offerings in CHF were particularly common in the early 1990s. Bond offerings in USD were particularly uncommon in the early 2000s during which time bond offerings in GBP and JPY were particularly common. The time variation in share can be large: JPY share moves from 3% in 1998 to 47% in 2000, and then 7% in 2002. Overall the data suggest that currency denomination demand is not static. Our objective is to test whether the increases in preferences of particular currencies correspond to periods when the various components of the costs of borrowing in a particular currency appeared relatively low.

2.2 BORROWING COST MEASURES

Interest rate parity asserts that ex-ante borrowing costs are similar across currencies such that borrowers have no incentive to seek borrowing cost advantages by selecting a low yield currency. To test this assertion we examine three proxies for borrowing cost rates: the nominal corporate borrowing yield, the related currency exchange rate movements, and the covered corporate borrowing yield that eliminates exchange rate risk. If firms believe in uncovered parity, we suspect that bond currency denomination is uncorrelated with cross-sectional variation in prevailing uncovered yields (the rate at which the firm can borrow in a particular foreign currency plus the percentage expected changes in exchange rates). If firms believe

in covered parity, we suspect that bond currency denomination is uncorrelated with cross-sectional variation in prevailing covered yields (the rate at which the firm can borrow in a particular foreign currency after hedging the exchange rate risk).

We obtain interest rate and exchange rate data on a monthly basis to generate a panel of prevailing borrowing cost measures across the four sample currencies. To estimate the corporate borrowing cost we use the 5-year Bloomberg Fair Market Yield indices for AA-rated Eurobonds in each sample currency. We choose the 5-year yield because the median bond maturity for our bond sample is 5 years. While Bloomberg Fair Market Yield indices do not represent the specific yield at which each of our corporate borrowers could issue a bond, they are designed to serve as pricing benchmarks and are widely consulted by fixed-income investment bankers. To maximize their applicability as pricing benchmarks in each respective market, the yield indices themselves are calculated from term structures constructed from a large sample of the most liquid bonds in each category (i.e. AA-rated euroyen bonds, for example).

To measure covered yields, we obtain five-year interest-rate swap rates for all currencies from Datastream and USD basis swap yields from Bloomberg. In the latter half of the 1990s, fixed-for-floating currency swaps evolved away from single instruments and toward two separate "plain vanilla" swaps: a simple interest rate swap packaged together with a foreign currency "basis" swap. The interest rate swap transforms fixed-rate cash flows in a given currency into LIBOR-based cash flows in the same currency. The currency basis swap then exchanges foreign LIBOR-based cash flows for US dollar LIBOR-based cash flows. To capture the dual effect, the covered spread is defined as the AA-rated eurobond yield less the total swap yield defined as the interest rate swap yield plus the basis swap yield for the respective currency.[11] This approach provides a more accurate estimate of the prevailing differences in covered yields across currency than that of McBrady and Schill (2007) who simply use the difference between government benchmark yields

[11] There are some limitations on the availability of the full panel of data over the sample period. For the AA-rated Eurobond yield data, the CHF series starts in July 1993. For the basis swap data, the JPY, GBP, and CHF series start in June 1997, January 1997, and July 1998, respectively. Because our empirical tests require a balanced panel we impute the values for the nominal yield and the covered yield. Over the sample period for all currencies other than the yen, basis swap rates do not exceed +/− 10 basis points. We assume the missing basis swap yield to be the mean rate for those sample months with available data. Because the sample mean rate for JPY during LTCM crisis (August 1998 to August 1999) was extraordinarily low and thus unrepresentative, we exclude the rate for this period in calculating the mean to be used for the missing values. For the AA-rated Eurobond yield we use the sample currency mean credit premium over government benchmark yields and then apply that premium to the missing observations based on the prevailing benchmark yields by currency. For the benchmark yields, we use the 5-year government benchmark yield for each currency from Datastream.

and the interest rate swap rate. We observe that not only is the currency basis swap rate time-varying but that it is correlated with borrowing behavior.

To proxy for foreign currency exchange rate movements, we follow McBrady and Schill (2007) and use one-year prior realizations of the exchange rate from Datastream for each currency relative to the euro.

For consistency, all yield values are log transformed and expressed in basis points. In constructing these proxies, our purpose is to isolate abnormal borrowing opportunities. Since we know that corporations also use foreign currency borrowing to hedge operating cash flow exposure (Allayannis et al., 2003; Kedia and Mozumdar, 2003; and Geczy et al., 1997), we can improve the power of our tests by removing any systematic hedging effects in the yields. We use two variables to purge our borrowing cost proxies from such systematic changes in cash flow in a particular currency: real GDP growth and nominal import growth. The GDP growth is measured as the log growth in real GDP in basis points for the currency's home country and import growth is measured as the log growth in nominal imports in basis points for the currency's home country. We use these two variables because we suspect that firms may collectively have more incentive to hedge cash flows in a particular currency if the respective economy for that currency receives a shock to overall economic growth in that economy or to growth in imports to that economy. The variables are meant to capture any systematic effects of variation in cash flow exposure in the currency on prevailing borrowing yields. To purge our borrowing cost proxies of any cash flow effects, we regress each borrowing cost measure on the contemporaneous estimate of GDP growth and import growth for the respective currency. Since GDP growth and import growth are only reported on a quarterly basis, all three months within a particular quarter are assumed to maintain the same quarterly growth rate. We allow the coefficient estimates to vary by currency. We construct an adjusted borrowing cost measure by adding the residuals of the regression to the pre-adjusted sample mean of the measure. In this way the measure maintains the same mean and fundamental time-series structure while becoming independent of the cash flow effects.[12]

We plot the borrowing cost series in Figure 1: covered yield (Figure 1a), nominal yield (Figure 1b), and exchange rate movements (Figure 1c). Figure 1d plots the basis swap rate, a component of the covered yield, showing with a flat line the imputed values in the early part of the sample period. Consistent with

[12] In these regressions, the cross-currency mean coefficient for the covered yield variable is −0.14 and −0.66 for GDP growth and import growth with mean *t*-statistics of −1.82 and −0.69, respectively. The cross-currency mean coefficient for the nominal yield variable is 0.12 and 0.14 for GDP growth and import growth with mean *t*-statistics of 0.07 and 0.41, respectively. The cross-currency mean coefficient for the exchange rate movement is 1.18 and −0.22 for GDP growth and import growth with mean *t*-statistics of 0.39 and −1.06, respectively. We conduct our tests with and without this adjustment and find that the conclusions are not sensitive to the adjustment.

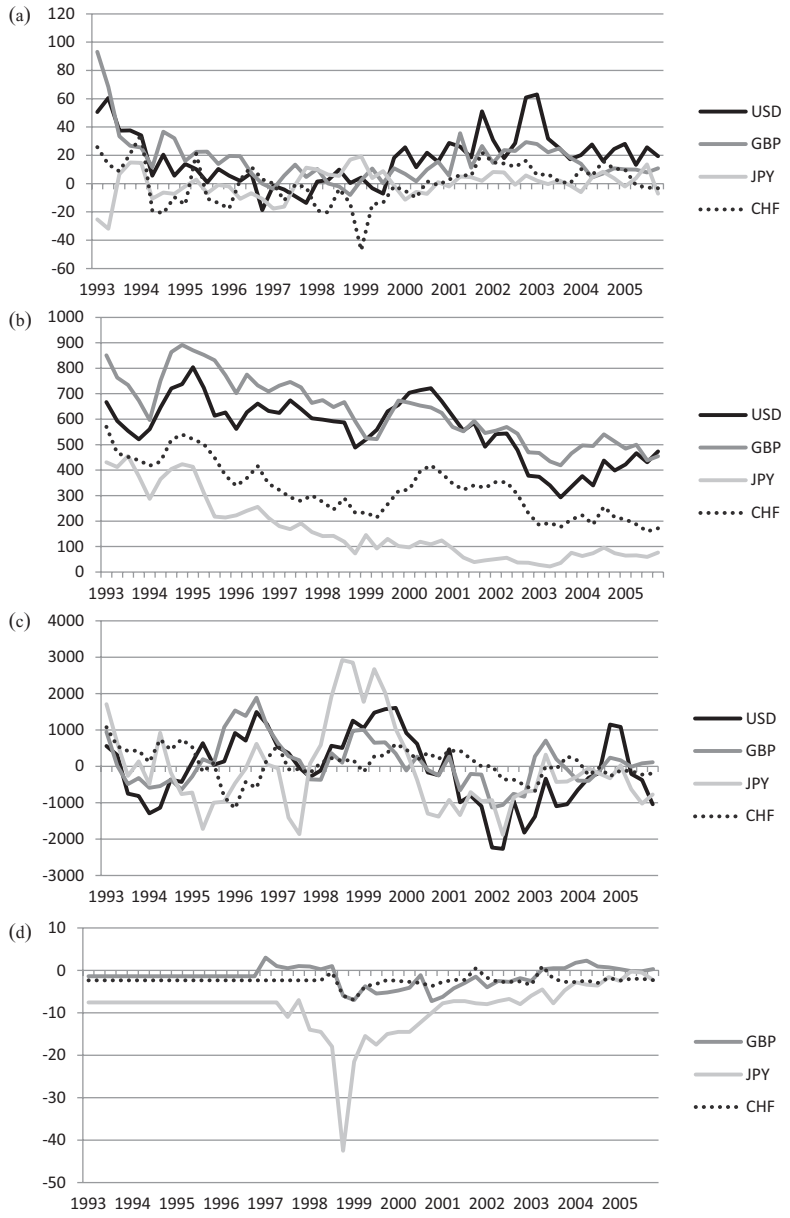

Figure 1. Borrowing cost variables over sample period
This figure plots the monthly borrowing cost measures over the 1993 to 2005 sample period. The units are log basis points. The various panels include the covered yields (Panel A), nominal yields (Panel B), and exchange rate appreciation (Panel C). Panel D plots a component of the covered yield, the basis swap rate. Due to lack of reported rates over the full time series, the imputed values are plotted as flat lines for a portion of Panel D.

Table III Summary statistics of borrowing cost measures

The table reports the means and correlation coefficients across the panel of currencies for the borrowing cost variables. All values are in log basis points. The sample period is from 1993 to 2005. The covered yield is the log-basis point difference in the 5-year AA-rated average yield from Bloomberg and the 5-year swap yield from Datastream plus the average basis swap yield from Bloomberg for the respective currency. The nominal yield is the log-basis point 5-year AA-rated average yield from Bloomberg for the respective currency. The exchange rate appreciation is the one-year past appreciation rate in the exchange rate spot rates (quoted as currency i/euro) in log basis points. All borrowing cost measures are measured at the beginning of the month. For each series, there are 624 currency months.

	Covered yield	Nominal yield	Exchange rate appreciation
Sample time-series means by currency			
USD	18.67	560.22	25.27
GBP	16.27	627.64	57.18
JPY	2.61	161.12	130.99
CHF	1.57	322.14	119.94
Sample autocorrelation coefficient			
1st order	0.815	0.992	0.927
Sample cross-correlation coefficients			
Covered yield	1.000	0.357	−0.191
Nominal yield		1.000	0.148
Exchange rate appreciation			1.000

Clinton (1988) and McBrady (2003), we also find cross-sectional variation in covered yields across sample currencies. This cross-currency difference in covered yields is due to not only variation in the credit spread between corporate bond yields and interest rate swap rates, but also due to variation in currency basis swap rates as shown in Figure 1d. Table III provides descriptive statistics of the borrowing cost variables over the sample period. Over the sample period, we observe some variation across the mean covered yields with the JPY and CHF spread over swaps at near zero while the USD and GBP range from 16 to 19 basis points on average. The nominal yield on the JPY debt is relatively low (161 bps) while that of the GBP (628 bps) is high. Over the sample period we observe that the JPY experienced the greatest annual appreciation (131 bps), while the USD appreciated the least against the euro (25 bps). We observe strong serial correlation in the series and some cross-correlation, with the correlation coefficient between covered yield and nominal yield series at 0.36.

3. Empirical Tests and Results

As a first look at the correlation between corporate bond currency denomination and prevailing cross-currency yields, we report the results of a simple time-series test used by McBrady and Schill (2007). In this test we regress the monthly share

Table IV Time-series test of monthly currency share on borrowing cost measures

The table reports the coefficients of a regression of the monthly time-series currency share across the four sample currencies on the three borrowing cost proxy variables defined in Table III (covered yields, nominal yields and one-year past exchange rate appreciation). The sample period is from 1993 to 2005. All borrowing cost measures are measured at the beginning of the month, and adjusted by subtracting a weighted average of the currency costs for that month. The weights are the proportion of the amount issued in each of the four currencies (bottom row of Table I panel A). Fixed effects coefficients for each of the sample currencies are also estimated in the regression (not reported). For each series, there are 624 currency months. T-statistics are reported in parentheses. The symbols *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	(1)	(2)	(3)
Covered yield	−0.00135**		−0.00112**
	(2.57)		(2.32)
Nominal yield		−0.00076***	−0.00076***
		(−5.04)	(5.03)
Exchange rate appreciation		0.00004***	0.00004***
		(4.06)	(3.60)
R-squared	0.50	0.52	0.53

issued in each currency on the respective adjusted borrowing cost variables and currency fixed effects. The test results are reported in Table IV. In all cases the coefficients are significantly different from zero, suggesting that the currency denomination is sensitive to the prevailing borrowing rates. For the covered yields and nominal yields, the negative coefficients suggest that high denomination share in a particular currency is associated with abnormally low yields in that currency relative to the other three currencies. For the variable on past exchange rate appreciation, the positive coefficients suggest that high share in a particular currency is associated with abnormally high past appreciation in that currency relative to the other three currencies. If managers are being opportunistic, a positive coefficient on exchange rate appreciation is consistent with managers responding to expectations that exchange rates are mean reverting such that subsequent debt repayments are made in a depreciating currency. These results for corporate borrowers corroborate the findings of McBrady and Schill (2007).[13] Overall, the results provide preliminary evidence that a certain population of corporate borrowers make opportunistic currency choices, in that they denominate the currency of their bonds in a manner that is inconsistent with interest rate parity.

[13] McBrady and Schill (2007) aggregate borrowing decisions by quarter and evaluate borrowing costs at the beginning of the respective quarter. To further refine their analysis, we report borrowing costs on a monthly basis. Since the borrowing cost variables are measured at the beginning of the month, they may or may not represent the appropriate lead time experienced for borrowers to make their choice of currency denomination. We rerun our tests using lag lengths between one and three months. We find that the correlations reported throughout this paper are somewhat strongest at a lag length of two months. However, we maintain the zero-lag specification throughout the reported tests.

3.1 TESTING A MODEL OF CURRENCY CHOICE

By examining only the aggregate currency share, the time-series test reported in Table IV ignores a substantial amount of available data. We improve upon the McBrady and Schill model by employing a model of firm-level currency choice.

We hypothesize that the probability of issuing debt denominated in one of the four sample currencies is a function of the relative prevailing borrowing costs in each currency. To model the firm's currency denomination decision, we use a multinomial response model where the firm chooses to denominate the bond across the four currencies based on the prevailing yields on borrowing. To be specific, we use the McFadden (1974) conditional logit model. This model allows us to collectively investigate how currency choice is affected by multiple currency attributes, such as the cost of borrowing in the different currencies. In our case, the bond issuer faces four currency choices, each with four potentially different costs.

In subsequent tests we use a mixed specification that uses features of both the conditional logit model and the related multinomial logit model. Both models allow for discrete choice across multiple alternatives. However, the conditional specification models that choice based on the characteristics of the alternatives, whereas the multinominal specification models the choice based on the characteristics of the decision maker. In the context of our analysis, the characteristics of the choice alternatives are the relative prevailing borrowing costs across currencies, while the characteristics of the decision maker are the characteristics of the firm.

We model currency choice as a function of nominal yields, exchange rate appreciation, covered yields, and indicator variables which capture the bond offering preferences for each currency. More formally, this choice is modeled as in Equation 1.

$$Prob(Y_i = j) = \frac{e^{\beta' x_{i,j}} e^{\alpha' w_j}}{\sum_{j=1}^{J} e^{\beta' x_{i,j}} e^{\alpha' w_j}} \tag{1}$$

where the probability of issue i being denominated in currency j is a function $of\, x_{i,j}$, which is a vector containing the currency cost attributes for issue i and choice j, and β is a vector containing the respective coefficients. The probability is also a function of w_j, which contains a set of indicators for the currency being equal to j and α is a vector containing the respective coefficients. To avoid multicollinearity we omit the indicator for the USD, and thus, the dummy variable coefficients represent the probability of issuing in the given currency with respect to the USD.[14]

[14] In estimating our conditional logit model, we must effectively expand our dataset of firm borrowing decisions by the number of sample currencies. The dependent variable is modeled as a binary variable for each sample currency. Because we have four sample currencies, each observation in our sample is repeated four times with the binary dependent variable referring to the binary decision to denominate the bond in each of the sample currencies in turn.

We provide the coefficient estimates of this model in Table V. For each specification we present two weighting methods. The first specification weights each observation equally (EW). The second specification weights each observation by the principal of the bond offering in USD (VW), thereby weighting larger issues more heavily. If large issues are more sensitive to interest rate bargains, then we would expect coefficients on borrowing cost variables to be larger. The coefficients on the currency dummies, α, which simply capture the same sample composition reported in Table I, are not reported. The null hypothesis is that if prevailing interest rates across currencies do not influence the currency denomination of firm borrowing, as implied by interest rate parity, the coefficients on the borrowing cost measures, β, should be zero.

Regressions 1 and 2 provide the estimates for the EW and VW specifications for the covered yields. In both specifications the coefficient on the covered yield series is significant and negative. The result indicates that declines in covered yields are associated with increases in the probability of corporate bond issuance in that currency. Since the covered yield series is computed as the sum of both the credit premium over interest rate swap yields and the currency basis swap rate, we rerun the regression with just the basis swap rate to see if the basis swap rate plays a role. The basis swap rate is the rate at which one can contract to exchange a floating rate in one currency for a floating rate in another currency. Industry wisdom is that the time-series variation in the currency basis swap rate plays a role in currency-based borrowing opportunities. In Regressions 3 and 4 we substitute the currency basis swap rate for the covered yield series used in Regressions 1 and 2. Since the currency basis swap rates are unavailable for our sample currencies until the late 1990s, we adjust the sample period in these tests to exclude all bond offerings prior to 1999. The test results find that the declines in the basis swap rate for a particular currency increases the probability that a corporate bond will be denominated in that currency. The finding supports the notion that the currency basis swap rate plays a role in the covered yield findings.

Regressions 5 and 6 provide the estimates for the EW and VW specifications for the uncovered yields and exchange rate appreciations over the one year prior. Regressions 7 and 8 contain regression specifications with all borrowing cost variables together. We observe a striking pattern in the coefficient estimates. For all the borrowing cost proxies, the coefficients on the yields are significantly different from zero. The negative coefficients on covered and nominal yields suggest that the probability of a firm choosing a particular currency increases as borrowing cost measures decline. The positive coefficient on exchange rate appreciation indicates that the probability of a firm choosing a particular currency increases as the currency appreciates, which is consistent with manager belief that currencies are mean reverting. The regression results reject the null hypothesis that bond issuers are indifferent to the relative value of prevailing covered and uncovered

Table V Conditional logit regressions of bond currency denomination

Conditional logit regressions of currency choice on currency attributes (covered yields, nominal yields and one-year past exchange-rate appreciation) and currency dummies, where USD is the omitted dummy. Panel A tabulates regression coefficients, and Panel B tabulates elasticities. The sample period is from 1993 to 2005. All borrowing cost measures are defined in Table III and measured at the beginning of the month. The observations in the regressions are either equal weighted (EW) or value weighted (VW) where value is defined as the total principal in USD of the bond. The coefficients on the currency dummies are not reported, and statistical inference is based on robust standard errors. T-statistics are reported in parentheses. Elasticities are based on coefficients from regression (5) and represent the change in the probability of issuing in a certain currency if its cost increases by 100 basis points, while keeping the other variables constant at their means. The actual currency shares are from the bottom row of Table I, Panel A. We also report the model estimated currency shares. The number of observations is 2567. The symbols *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	(1) EW	(2) VW	(3) EW	(4) VW	(5) EW	(6) VW	(7) EW	(8) VW
Panel A. Regression coefficients								
Covered yield	−0.0065***	−0.0098***					−0.0067***	−0.0082***
	(−4.02)	(−4.25)					(−3.78)	(−3.21)
Currency swap			−0.0003***	−0.0006***				
			(−2.78)	(−4.50)				
Nominal yield					−0.0029***	−0.0048***	−0.0030***	−0.0048***
					(−7.46)	(−8.08)	(−7.67)	(−8.20)
Ex-rate app.					0.00015***	0.00031***	0.00012***	0.00028***
					(4.64)	(6.12)	(3.69)	(5.48)
Pseudo-Rsqr	0.091	0.189	0.078	0.158	0.099	0.209	0.100	0.211
	USD	GBP	JPY	CHF				
Panel B. Price elasticities of demand								
Covered yield	−16.74	−7.24	−10.01	−11.95				
Nominal yield	−7.34	−3.18	−4.39	−5.24				
Ex-rate app.	0.31	0.13	0.19	0.22				
Actual currency shares	46.44	12.27	18.19	23.10				
Estimated currency shares	46.38	12.36	17.71	23.54				

yields when denominating international bonds. Such findings are rather supportive of opportunistic behavior on the part of firms and fully consistent with the results in Table IV.

The conditional logit regressions, unlike OLS regressions, are non-linear, and thus the coefficients do not have economic interpretation. For that reason we report in Panel B of Table V marginal effects for regression 5 (reported in Panel A). Specifically, we compute the change in the probability of issuing in a specific currency resulting from a 100 basis point increase in the cost of issuing in that same currency (see Green (1997, p. 918) for details of these calculations). We find that a 100 basis point increase in the USD covered yield from its mean (while keeping all other variables at their means), reduces the probability of denominating debt in USD by 17 percentage points, (i.e., it reduces its probability from approximately 46% to 29%). By the same token, a 100 basis point increase in the USD nominal yield, reduces the probability of denominating debt in USD by 7 percentage points. Thus, our results are not only statistically significant, they are also economically significant.

The remaining marginal effects are substantially smaller, but the probabilities of denominating debt in these other currencies are also substantially smaller resulting sometimes in larger proportional effects. For example, for the GBP, the least popular currency in terms of number of issues (it is actually the second most popular if currency share is measured in dollars), a 100 basis point increase in its nominal yield reduces the probability of denominating debt in the GBP by three percentage points from 12% to 9% (a proportionally large decline in probability of 25% (3% / 12%)). Overall, the effect of cross-sectional variation in borrowing yield appear to influence both statistically and economically the likelihood of currency denomination of international bonds.

We recognize the importance of eliminating the possibility that the regressions are simply picking up the effects of cash flow hedging by firms exposed to exchange rate risk. We attempt to control for such systematic effects by purging the borrowing cost series for time-series variation in relative trade and economic growth. It is possible that our procedure for purging the borrowing cost series for systematic foreign exchange cash flow hedging effects does not completely remove such effects. Ideally we would like to be able to control for the cash flow positions by each firm in each of the four sample currencies. Such data is not available for our sample firms. Some firms report geographic segment revenue at an aggregated level, but that is also insufficient for our purposes. Faulkender (2005) models firm interest rate sensitivity by regressing 6-month LIBOR on quarterly cash flows (scaled by assets) and uses the regression coefficients to quantify the firm's interest rate exposure. We expect that an exchange rate version of this variable would be an attractive control variable for firm exchange rate sensitivity, as firms with sensitivity to a particular exchange rate may be more likely to hedge the sensitivity by issuing debt

in that currency. We follow this procedure by estimating exchange rate sensitivity to quarterly revenue and operating profit data. We select these line items because they are above the line items in the income statement that are affected by exchange rate hedging. If we looked at the exchange rate sensitivity of firm net income or stock returns we would be unable to distinguish between those firms that have low sensitivity and those firms that have hedged away their exchange rate exposure (Jorion, 1990).

To estimate the exchange rate sensitivity, we regress the quarterly revenue and operating profit (Data items 2 and 21 in the quarterly Compustat file) scaled by total assets on the quarterly exchange rate appreciation relative to the euro for each sample currency in a rolling fashion over the past five years. Unfortunately, we do not have data on financial statements on a quarterly basis for nearly 70% of the firms in our dataset. We expect that estimates based on annual performance would be too imprecise to be of much statistical value. Despite the sample limitation, we proceed with our analysis using the roughly 30 percent of the firms in the dataset for which we do have data on quarterly results based on an equity listing in the United States. This subset of firms is comprised of firms from United States (65%), Canada (15%), United Kingdom (5%), Japan (3%), and other countries (12%). The sensitivity coefficients are Winsorized at the 10th and 90th percentiles following Faulkender. These coefficients measure whether the firm sales or operating profits are historically sensitive to the exchange rate of any of the respective sample currencies.

We begin our test by re-estimating Regressions 7 and 8 from Table V (not tabulated in the tables) with the smaller sample. We observe that the coefficients on the nominal yield are always statistically significant, but the coefficients on the exchange rate appreciation and covered yields are significant only some of the time. With this regression as the baseline, we subsequently add the exchange rate sensitivity measures. The operating cash flow sensitivity measure generates positive and significant coefficients for both non-weighted and value-weighted specifications, suggesting that firms with a long position in the sample currency (positive sensitivity) are statistically more likely to issue debt in that currency (consistent with a hedging motive).

The coefficient on the sales sensitivity measure however is negative and marginally significant (p-value 0.074) for the non-weighted specification, and insignificant for the value-weighted specification. Our results suggest that firms with strong sales exposure to a certain currency are also likely to hedge this risk by having operating cost exposure to that same currency, it is the firms with operating cash flow sensitivity that need to hedge currency risk by issuing debt in that same currency. Most importantly, despite including these sensitivity coefficients in our currency choice regressions, the addition of these variables maintains virtually no effect on the borrowing cost coefficients. Based on the two approaches we use to

control for exchange rate hedging motives, we conclude that the correlation between currency denomination and borrowing costs is not explained by hedging cash flow sensitivity.

3.2 THE EFFECT OF FIRM CHARACTERISTICS

Although we observe opportunistic borrowing behavior for our aggregate corporate sample, we question whether the sensitivity to covered and uncovered yields is uniform across the population of international borrowers. For example, we suspect that smaller borrowers, borrowers from emerging market economies, and those with low bond ratings may not display the same opportunistic sensitivity. Smaller borrowers may be less willing to behave opportunistically due to economies of scale. For most emerging market countries, a swap contract market did not exist in the domestic currency over this sample period. Without the ability to swap back into the domestic currency, we suspect that firms from emerging market economies are likely to be less sensitive to covered yield variations. For firms with non-investment-grade bond ratings we suspect that they are also likely to be less sensitive to covered yields since swap contracts with such firms will be executed at substantially greater costs. Such credit costs may very well be great enough to eliminate the gains from reductions in covered yields.

Cash flow, regulation and export orientation are also likely to affect firms' opportunistic sensitivity. Stulz (1990) and Geczy et al. (1997) argue that hedging risk such as exchange rate risk is more likely to occur for firms with lower cash flow and greater underinvestment cost. Thus, we suspect that low cash flow firms are more (less) likely to respond to variations in covered (uncovered) yields. Firms within regulated industries may not maintain the financing flexibility to respond to borrowing opportunities, and thus we expect regulated firms to be less responsive to variations in covered or uncovered yields. Finally, firms with little exposure to exports are less likely to issue currency for hedging purposes, and thus we expect their sensitivity to covered and uncovered variation in yields to be easier to measure.

To examine the cross-sectional relationships in currency denomination borrowing sensitivities, we construct indicator variables based on the following firm characteristics: size, bond rating, home country development, profitability, industry, and domestic orientation of revenue. The variables are defined as follows. D(Large) indicates that the firm's assets are above the annual median value for the sample. The global median value for total assets is $26 billion. D(Rating<BBB) indicates that the firm maintains a non-investment grade rating. D(Home=Emerge) indicates that the issue originates from a firm ultimately headquartered in an emerging market. D(Low cash flow) indicates that the firm's return on assets are below the annual 25^{th} percentile value for the sample. The global 25^{th} percentile value for ROA is 8%. D(Regulated) indicates that the SIC code is within 4000s (utilities).

D(Domestic) indicates that the foreign proportion of the firm's sales is below the annual 25th percentile value for the sample. The global 25th percentile value for foreign sales percentage is 17%. The (Domestic) indicator is meant to proxy for firms, like the sample of firms in McBrady and Schill (2007), that maintain little exposure to foreign currency operating cash flows. Correlation statistics for these variables are reported in Table VI. We observe that the strongest cross variable correlation is maintained by D(Domestic) and D(Regulated) with 0.37 and D(Domestic) and D(Large) with −0.30.

To test for the effect of these firm characteristics on their sensitivity to interest rate bargains, we include along with choice attributes (the borrowing cost measures), interactions of the choice attributes with these firm characteristics. As in the model discussed above we also include currency dummies that capture the overall currency proportions. In conditional logit models, characteristics are never added by themselves, as they would in more common models. This is because the characteristics are not a function of currency j and the term would drop out. Equation (2) contains the mathematical expression of the model for this specification.

$$Prob(Y_i = j) = \frac{e^{\beta'(x_{i,j} + ch_i * x_{i,j})} e^{\alpha' w_j}}{\sum_{j=1}^{J} e^{\beta'(x_{i,j} + ch_i * x_{i,j})} e^{\alpha' w_j}} \tag{2}$$

We report the regression results in Table VII. For presentation purposes currency dummies are not reported, as the coefficients on these variables effectively represent the sample distribution characteristics captured in Table I Panel A (the likelihood that a bond is denominated in any particular currency).

Our first observation is that the coefficient on covered yield is no longer significant. It appears that opportunistic borrowing behavior with respect to covered yields is isolated among those firms that share characteristics captured by our indicator variable interactions. Looking at the coefficients on the interaction variables we observe that firms with sensitivity to covered yields tend to be large, investment-grade rated, with low cash flow, from non regulated industries, with domestic-currency oriented revenue, and from developed countries. It is important to note that the explanatory power of the revenue orientation and the industry effect disappears once the uncovered yield variables are added as regressors (Regressions 5 and 6). These correlation values are consistent with an expectation that covered yield opportunities are more costly for small firms from emerging markets or non-investment grade bond ratings. The finding that low cash flow firms tend to more aggressively respond to covered yields is consistent with the hedging intuition of Stulz (1990) and Geczy et al. (1997).

For the uncovered yield proxies, both the nominal yield and exchange rate appreciation variables remain significantly correlated with bond currency choice when we include the interaction variables. The sensitivity to nominal yields is enhanced

Table VI Correlation coefficients of borrower characteristics

The table shows correlation coefficients for sample firm characteristics. D(Large) is an indicator variable for the total reported assets being above the annual median for the sample. D(Rating<BBB) is an indicator variable for the bond rating being below BBB. D(Home=Emerge) is an indicator variable for the bond issuer originating ultimately from an emerging market. D(Low cash flow) is an indicator variable for the ROA being below the yearly 25th percentile of ROA for the sample. ROA is defined as the total operating profit plus depreciation and amortization (EBITDA) divided by the total assets at the end of the previous year. D(Regulated) is an indicator variable for the industry SIC code being within the 4000s (utilities). D(Domestic) is an indicator variable for the firm foreign sales percentage being below the annual 25th percentile for the sample. Foreign sales percentage is obtained for the issuing firm at the end of the previous year. Accounting variables are from Worldscope and Compustat. The remaining characteristics are obtained from SDC. The number of observations is 2567.

	D(Large)	D(Rating<BBB)	D(Home=Emerge)	D(Low cash flow)	D(Regulated)	D(Domestic)
D(Large)	1.0000					
D(Rating<BBB)	−0.2108	1.0000				
D(Home=Emerge)	−0.1016	0.1331	1.0000			
D(Low cash flow)	0.0438	0.0845	−0.0059	1.0000		
D(Regulated)	−0.0815	0.1138	0.0468	−0.0227	1.0000	
D(Domestic)	−0.2956	0.1113	0.0994	0.0218	0.3688	1.0000

Table VII Conditional logit regression with issuer characteristic interactions

Conditional logit regressions of currency choice on currency attributes (covered yields, nominal yields and one-year past exchange-rate appreciation, all measured at the beginning of the month), interactions of currency attributes with firm characteristics, and currency dummies (where USD is the omitted dummy). The sample period is from 1993 to 2005. The currency attributes are defined in Table III and firm characteristics in Table VI. The observations in the regressions are either equal weighted (EW) or value weighted (VW) where value is defined as the total principal amount in USD of the bond. The coefficients on the currency dummies are not reported. Statistical inference is based on robust standard errors. The number of currency-bond choice observations is 7604. The symbols *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

	EW (1)	VW (2)	EW (3)	VW (4)	EW (5)	VW (6)
Covered yield (CY)	−0.0040	0.0036			−0.0051	0.0031
CY*D(Large)	−0.0078**	−0.0200***			−0.0038	−0.0160***
CY*D(Rating<BBB)	0.0725***	0.0793***			0.0290*	0.0449**
CY*D(Home=Emerge)	0.0494***	0.0684***			0.0630***	0.0756***
CY*D(Low cash flow)	−0.0111***	−0.0141***			−0.0174***	−0.0221***
CY*D(Regulated)	0.0189***	0.0171***			0.0076	0.0039
CY*D(Domestic)	−0.0201***	−0.0177***			0.0004	−0.0079
Nominal yield (NY)			−0.0031***	−0.0048***	−0.0035***	−0.0055***
NY*D(Large)			−0.0010***	−0.0020***	−0.0008**	−0.0015***
NY*D(Rating<BBB)			0.0069***	0.0060***	0.0058***	0.0045***
NY*D(Home=Emerge)			0.0009	−0.0002	−0.0014	−0.0029*
NY*D(Low cash flow)			−0.0001	0.0000	0.0006	0.0009
NY*D(Regulated)			0.0022***	0.0024***	0.0020***	0.0025***
NY*D(Domestic)			−0.0015***	−0.0018***	−0.0015***	−0.0021***
Ex. rate app. (ER)			0.0002***	0.0003***	0.0002**	0.0003***
ER*D(Large)			−0.0001	−0.0001	−0.0001	−0.0001
ER*D(Rating<BBB)			−0.0011***	−0.0016***	−0.0008**	−0.0012***
ER*D(Home=Emerge)			−0.0005	−0.0014***	−0.0002	−0.0009*
ER*D(Low cash flow)			0.0001	0.0003***	−0.0001	0.0001
ER*D(Regulated)			0.0001	0.0001	0.0002	0.0001
ER*D(Domestic)			0.0003	0.0002	0.0003***	0.0003*

for large firms with investment–grade ratings from non-regulated industries, and domestic oriented cash flows. Again, we consider the orientation of the revenue variable to be an additional control variable for the hedging of operating cash flows. One might expect that the denomination decision of those firms with more foreign-based revenue (the opposite of domestic orientation) to be motivated by hedging, and not by yield bargain opportunities. Thus it appears reasonable that nominal yields (exchange rate appreciation) are negatively (positively) correlated with D(Domestic). We also observe weak negative correlation with interaction of nominal yields with D(Emerge). This suggests that emerging market firms are more active in gaming nominal yields.[15] However, the sensitivity to exchange rate

[15] There is some anecdotal evidence that emerging market firms are more active in uncovered nominal yield bets. Regaldo and Lyons (2008) made the following report in conjunction with the

appreciation appears to be lower for firms from emerging markets and those with lower bond ratings.

3.3 ECONOMIC GAINS TO FOREIGN CURRENCY BORROWING

To estimate the economic gains associated with opportunistic corporate bond issuance decisions we begin by computing the mean realized borrowing cost estimates for the sample weighted equally across bond offerings. The realized covered yield estimate (not tabulated) is 11 bps and the realized nominal yield estimate is 449 bps. For the exchange rate series we adjust the variable from being defined as the past one-year appreciation rate to the forward one-year appreciation rate. The realized exchange rate appreciation estimate is −5 bps.

To compute the mean gain across bond offerings, we must compare the reported realized costs to those of some naive benchmark. We follow the approach of McBrady and Schill (2007). As a reference for the equal-weighted figure we construct a benchmark that assumes that firms naively denominate their debt proportionally to the total number of issues in each of the four currencies (bottom row of Table I, Panel A), namely 46% USD, 12% GBP, 18% JPY, and 23% CHF. Such naive weights generate mean equal-weighted borrowing cost estimates of 12 bps for the covered yield, 456 bps for the nominal yield, 31 bps for the exchange rate appreciation.

We follow the same procedure using the principal value weights to generate a benchmark for value-weighted borrowing costs. Subtracting the realized values from the respective naive values for the month provides an estimate of the mean gain over the naive cost attributed to the firm's choice of variation in the currency mix over the sample period. If firms choose to opportunistically issue in particular currencies over the sample period when the currencies are relatively less costly, the difference between the naïve value and the realized value will be positive.

The difference between the naïve borrowing costs and the realized borrowing costs are reported in Table VIII. For the full sample of bonds, the realized gain over the naïve cost on an equal-weighted basis is 0.7 bps, 7.0 bps, and 36 bps for the covered yield, nominal yield, and the one–year exchange rate effect, respectively. On a value-weighted basis, the realized gain over the naïve cost is slightly higher at 0.9 bps, 9.7 bps, and 52 bps for the covered yield, nominal yield, and the one–year exchange rate effect, respectively. It appears that firms do better on larger offerings than smaller ones. But, all of these values are statistically significantly different from zero at conventional levels.

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rapid exchange rate movements in late 2008, "throughout Latin America, companies are telling investors they have lost millions, in some cases billions, of dollars due to foreign-exchange gambles that, in some cases, had little to do with their core businesses. Losses from bad-currency bets are ricocheting through the world's major developing economies, including India and Korea."

Table VIII Abnormal borrowing cost gains

The table reports mean estimates of the difference between two naive denomination rules weighted by number (EW) and USD amount of offerings (VW), and the realized mean borrowing costs based on our proxy variables. The sample period is from 1993 to 2005. The gain is defined as the difference between the naïve borrowing cost and the realized borrowing cost. We present results for equal-weighted estimates when the naïve benchmark is the equal-weighted cost, and value-weighted estimates when the naïve benchmark is the value-weighted cost. The reported values capture the borrowing gains achieved by deviating from the respective generic borrowing strategy. Heavy issue volume months indicates that the month in which the offering was made was one of the 15 busiest months in the sample period for that currency, where business of the month is defined by the share of total sample bond offerings denominated in the particular currency. Home=Emerging market are those bonds in which the issuer originating ultimately from an emerging market as reported by SDC. Bond Rating<BBB are those bonds in which the bond rating is below BBB as reported by SDC. Regulated are those bonds in which the industry SIC code reported by SDC is within the 4000s (utilities). Large firms are those with total reported assets being above the annual median for the sample. Low cash flow denotes firms for which the ROA is below the annual 25th percentile of ROA for the sample. ROA is defined as the total operating profit plus depreciation and amortization (EBITDA) divided by the total assets at the end of the previous year. Foreign sales percentage is obtained for the issuing firm at the end of the previous year. Acounting variables are from Worldscope and Compustat. Robust *t*-statistics are reported in brackets. The symbols *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

		Naïve borrowing cost less realized borrowing cost					
		Covered yield		Nominal yield		Ex. rate app.	
Sample specification	N	VW	EW	VW	EW	VW	EW
Total sample	2,567	0.91***	0.74***	9.68***	7.02*	52.42***	36.12***
		[4.14]	[3.05]	[2.78]	[1.94]	[5.34]	[3.11]
Heavy issue volume months	457	4.47***	2.57***	79.55***	63.25***	174.80***	201.84***
		[7.92]	[4.59]	[7.09]	[5.76]	[7.17]	[8.09]
Bond Rating < BBB	192	−4.72***	−6.16***	−74.66***	−124.41***	−2.47	−18.14
		[−11.30]	[−11.38]	[−26.25]	[−31.98]	[−0.12]	[−0.61]
Home=Emerging market	95	−4.33***	−3.93***	−5.07	−9.34	152.51***	136.05**
		[−4.84]	[−3.80]	[−0.35]	[−0.49]	[3.76]	[2.50]
Home≠EM & Rating> = BBB	2,302	1.75***	1.43***	18.91***	17.44***	51.24***	35.35***
		[7.38]	[5.55]	[4.92]	[4.51]	[4.75]	[2.82]
Large firms	1,110	2.88***	1.82***	42.37***	26.75***	74.13***	34.84**
		[8.18]	[4.70]	[7.22]	[4.56]	[4.54]	[2.02]
Low cash flow	525	1.98***	2.38***	5.81	7.99	21.05	10.86
		[3.86]	[4.46]	[0.78]	[1.02]	[0.97]	[0.41]
Regulated	449	−0.62	−1.13*	−18.07**	−30.86***	52.85***	21.32
		[−1.17]	[−1.87]	[−2.18]	[−3.40]	[2.60]	[0.84]

The full sample results are likely to be downwardly biased due to the noise of currency denomination decision in the sample that are motivated by cash flow hedging considerations. To focus more specifically on opportunistic-based currency choice, we isolate those bonds issued during idiosyncratic surges in demand for borrowing in a particular currency. We identify the 15 months with the largest share of issuance in a particular currency over the sample period for each of the four sample currencies as heavy issuance months. To be specific, the heavy issue months are identified for each currency based on the share of total amount issued that is denominated in the particular currency for that month. During demand surges, the equal-weighted and value-weighted estimated gains are 3 to 4 basis points for the covered yield gains, 63 to 80 basis points for the nominal rate gains, and 175 to 202 basis points for the exchange rate gains.

From our earlier analyses we know that not all firms take equal advantage of variations in borrowing rates. To tease out the effects, we estimate the gains over a naïve benchmark for various sub-samples. As expected, we find the gains to be somewhat larger for firms that tend to be more responsive to differences in borrowing rates and vice versa. The covered yield gains for firms with non-investment grade bonds is 4 to 6 bps less, while that of firms from emerging markets is also 4 bps less than the naïve benchmark. Firms that are both from developed markets and investment grade rated generated covered yields that were 1 to 2 bps above the naïve benchmark. Large firms and low cash flow firms maintained covered rates that were both about 2 bps better than the benchmark. Regulated utility issuers maintained covered yields that are no better than the benchmark. Similar findings are documented for the nominal yields and exchange rate effects. Large firms systematically achieve better borrowing gains on the order of 27 to 42 bps for the nominal yield and 35 to74 bps for the exchange rate movements over the subsequent 12 months. Developed market and investment-grade rated firms achieved 17 to 19 bps better in nominal yield and 35 to 51 bps better for the exchange rate movement.

Even with the cross-sectional effects, the gains reported in Table VIII are still modest. We suspect that the gains are likely large enough to motivate a firm that already needs the debt capital to prefer currencies that provide slight savings but not be large enough to motivate a round-trip arbitrageur to take and hold a two-way position for five years.

3.4 BORROWING COST GAINS IN EVENT TIME

Lastly, we investigate the time-series variation of the borrowing cost gains measured in event time. We plot the mean abnormal borrowing cost gains in event time where Month 0 is the month of the bond offering. We measure the cost savings across each sample currency from 12 monthly lags through 12 monthly leads relative to

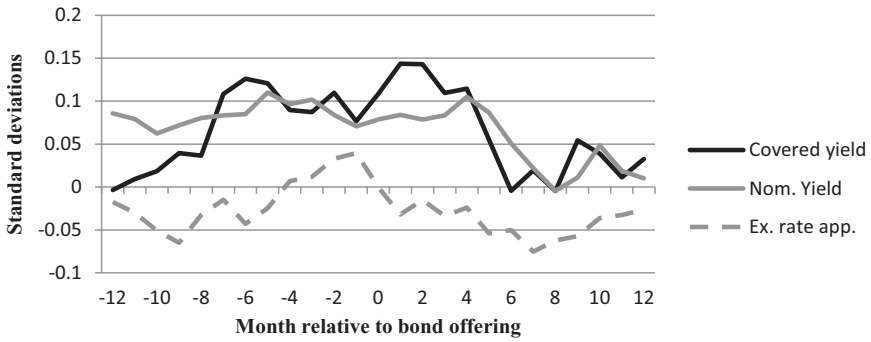

Figure 2. Abnormal borrowing gains in event time
This figure plots the mean abnormal borrowing cost gains in event time where Month 0 is the month of the bond offering. Observations are value weighted by the principal of the bond offering in USD. All series are standardized by subtracting the sample currency mean and dividing by the sample currency standard deviation. The exchange rate variable measures the standardized amount of exchange rate gain achieved by offering the bond in month 0. This is measured by calculating the relative amount of exchange rate appreciation before the bond offering and the relative amount of exchange rate depreciation after the bond offering. Specifically this amount is measured as the exchange rate for month 0 less the exchange rate at each of the event window months.

the month of the offer. We plot for each event month the value-weighted mean, weighted by the principal of the bond offering. For the exchange rate we alter the series somewhat so as to capture the abnormal appreciation of the currency prior to Month 0 and the abnormal depreciation of the currency subsequent to Month 0. Specifically this amount is measured as the exchange rate for Month 0 less the exchange rate at each of the event window months. If the yen to euro exchange rate moved from 100 at Month −12 to 80 at Month 0 to 100 at Month +12, the yen had appreciated prior to the offering and depreciated subsequent to the offering. Such currency movements reduce the euro-based borrowing cost to the issuing firm by its choice to issue at Month 0. Based on this example, the revised exchange rate series for the yen would be negative at Month −12, zero at Month 0 and negative at Month +12. The humped-shaped pattern of the plot correctly indicates that the bond was issued at the peak of the exchange rate movement.

In the plots, all of the three borrowing series are standardized by subtracting the sample currency mean and dividing by the standard deviation such that the currencies are treated equally. The plot is provided in Figure 2. For all three series, we observe that the borrowing gains tend to systematically decline in the months following the offering month. For the covered and nominal yields, the differences decline rapidly at three to four months after issuance. For the exchange rate difference the decline is even more rapid. The findings are similar to those of McBrady and Schill (2007) for government and agency bond issuance and Pasquariello et al. (2006) for ADRs and exchange rates.

The time-series evidence is consistent with the notion that firm currency-denomination decisions represent one-way arbitrage opportunities for these firms. Since the firm must borrow anyway, choosing a particular currency provides a way to lower the cost of capital on an "as needed" basis while not incurring the round-trip costs associated with classic interest-rate arbitrage. It may be that corporations are, in fact, the marginal market participant that moves yields toward parity.

4. Conclusions

The evidence in this paper is inconsistent with a model of firm borrowing behavior where currency choice is independent of the magnitude of foreign currency borrowing rates. For the first large broad sample of international, foreign-currency corporate bonds, we find evidence that managers may choose across a menu of potential currencies to identify borrowing bargains based on differences in uncovered or covered interest yields. The systematic currency denomination decisions of corporate bond issuers are inconsistent with the belief that covered and uncovered interest parity holds at long horizons.

Our results appear reasonable in the cross section as those firms with the incentives or less barriers to opportunism tend to be those firms with more sensitivity to prevailing covered and uncovered rates. Using a unique firm-level test approach, we find that the tendency for corporations to be opportunistic with prevailing uncovered yields appears to be general across the sample, although small, regulated firms with non-investment grade debt appear to be less sensitive. The responsiveness to covered yields, however, is isolated to firms from developed markets that are large, have low cash flow, and investment-grade bond ratings. We reconcile these cross-sectional results with reasonable explanations for such differences.

Overall, the gains that firms achieve are economically significant but consistent with well-functioning markets. We find that bond yields and exchange rates systematically move toward parity following periods of relatively high issuance. This result highlights the interesting notion that international corporate bond issuers, in fact, may effectively be the marginal traders who enforce interest rate parity at long horizons. We anticipate future tests of this hypothesis.

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