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Foreign currency-denominated borrowing in the absence of operating incentives☆

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Abstract

It is well known that corporations issue foreign currency-denominated debt to hedge foreign currency cash flows with offsetting interest payments. We test an alternative "opportunistic" motive for foreign currency-denominated borrowing. We do so by constructing a comprehensive sample of foreign currency-denominated bonds issued by sovereign government and agency issuers with no foreign currency cash flows or foreign operations. We find strong and consistent evidence that the borrowers in our sample consider cross-currency differences in covered and uncovered interest yields in choosing the currency in which to denominate their international debt. We estimate the average gains to opportunistic covered yield borrowing to be 4 to 18 basis points. Interestingly, we also find that the average bond offering in our sample precedes a large and beneficial depreciation of the issue currency over the course of the following year. These results support what has been a frequent conjecture in the foreign debt market.

JEL classifications: G14; G32; F36

Keywords: Foreign currency debt; Interest rate parity; Capital structure policy

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1. Introduction

Foreign currency-denominated borrowing is increasingly common in global financial markets. The financial literature explains such behavior largely in operational terms: firms issue debt in foreign currencies to hedge their foreign currency cash flows or to fund their foreign operations (see, for example, Allayannis, Brown, and Klapper, 2003; Kedia and Mozumdar, 2003; Geczy, Minton, and Schrand, 1997; Graham and Harvey, 2001). Curiously, however, foreign currency borrowing is not the exclusive domain of entities with foreign currency exposure. Foreign currency borrowing by the US mortgage company, Fannie Mae, provides a case in point. Fannie Mae is the largest provider of mortgage funds in the United States. Although operated since 1968 as a private company, Fannie Mae is regulated by the US Office of Federal Housing Enterprise Oversight to operate exclusively in the buying and selling of US housing mortgages. By fiat, Fannie Mae maintains no foreign currency operating exposure. Even so, since 1995 it has offered 27 bond issues in seven major foreign currencies. In fact, Fannie Mae claims that it actively "monitors a number of currencies around the world in order to identify funding opportunities. Fannie Mae has the ability to issue foreign currency debt securities . . . in almost all tradable currencies and when market dynamics provide the company with an opportunity to do so" (Fannie Mae, 2004, p. 2).

Because Fannie Mae has no foreign currency cash flows or foreign operations, its foreign currency borrowing cannot readily be explained by the type of operating incentives that have dominated previous analyses in the literature. Instead, Fannie Mae's foreign currency borrowing appears "opportunistic" in nature. Graham and Harvey (2001) find considerable anecdotal evidence for this type of opportunistic borrowing behavior. Forty-four percent of the firms in their survey cite lower foreign interest rates as either an "important" or "very important" motivation for issuing foreign currency-denominated debt. In this paper, we examine this proposition empirically by constructing a comprehensive sample of foreign currency-denominated bonds issued by sovereign governments and agencies. Each of the issuers in our sample, like Fannie Mae, has no foreign currency-denominated cash flows or foreign operations. Because operating incentives cannot explain their foreign currency borrowing, we investigate whether or not the issuers in our sample attempt to exploit lower foreign currency borrowing costs when issuing foreign currency-denominated debt. To do so we relate the share of bonds they collectively issue in each currency to observable proxies for cross-currency borrowing cost discrepancies.

The traditional assumption of interest rate parity rules out this type of opportunistic issuance. Uncovered interest parity asserts that home currency interest premiums are exactly offset by expected rates of (home currency) depreciation. Covered interest parity asserts that local and foreign interest costs are the same once the cost of hedging foreign currency exposure is taken into account. Firms have ample reason to be skeptical, however, that uncovered interest rate parity holds. Empirically, researchers find that violations of uncovered interest parity are the rule, not the exception (see, for example, Froot and Thaler, 1990). The well-known forward discount bias maintains that differences in nominal interest yields are not offset by subsequent exchange rate movements. In fact, relatively low interest currencies systematically depreciate over time. This empirical pattern suggests that managers can reduce their expected borrowing costs by borrowing in low interest currencies and leaving currency exposures unhedged.

Because unhedged positions create currency risk exposure, however, risk-averse bond issuers may prefer to compare hedged or covered interest yields across currencies. Numerous studies document evidence in favor of covered interest parity at relatively short horizons. For short-term eurocurrency interest rates, Frenkel and Levich (1975, 1977) demonstrate that deviations from covered interest parity are typically smaller than the transaction costs associated with a round-trip arbitrage strategy that entails short-term borrowing in one currency, depositing the proceeds in another, and hedging the proceeds with a forward contract. Because these transaction costs are typically confined to bid-ask spreads of only a few basis points, covered interest parity holds to a close approximation.

At longer maturities, however, the transaction costs of round-trip arbitrage strategies are potentially much larger. Instead of simply borrowing in one eurocurrency and depositing the proceeds in another, prospective round-trip arbitrageurs would have to short-sell a bond denominated in one currency and purchase an equivalent bond denominated in another. Similarly, they would have to hedge their currency risk with an appropriate combination of long-term currency swaps instead of a simple foreign exchange forward. The costs and limitations of such a strategy would likely transcend simple transaction costs such as bid-ask spreads. Among the many limitations of this type of round-trip arbitrage strategy would be little to no access to the proceeds of the initial short-sale, exposure to asymmetric credit risk on the part of the bond shorted and the one purchased, and the need to collateralize adverse changes in the value of the currency swap even if it is ultimately held until maturity. Perhaps unsurprisingly, existing studies of long-term covered interest parity using a variety of bond yields and currency swap rates document deviations from parity that are much larger and more persistent than those observed for short-term interest rates (see, for example, Fletcher and Taylor, 1996, or McBrady, 2003). Overall, however, the previous literature on long-term covered interest parity does not address whether or not these deviations represent profitable arbitrage opportunities. Indirectly, we investigate this issue by examining potential opportunistic bond issuance by our sample of sovereign and agency borrowers. If deviations from covered interest parity exist, bond issuers should be able to exploit them through one-way arbitrage strategies that entail foreign currency borrowing packaged together with currency swaps to hedge unwanted currency risk. (See Popper, 1993, or McBrady, 2003, for a more detailed description of how currency swaps are used to hedge foreign currency-denominated bonds and the related parity conditions.)

A typical currency swap exchanges fixed-rate cash flows in one currency for floating-rate cash flows in US dollars. By packaging a fixed-rate foreign currency bond with a currency swap, an issuer transforms its foreign currency interest payments into floating rate payments made in US dollars. The rate paid over and above US dollar LIBOR (London Interbank Offered Rate) is given by the spread between the foreign currency bond yield and the foreign fixed-for-floating currency swap rate (i.e., the foreign covered interest yield). A subsequent currency swap can then be used to further transform these US dollar interest payments into fixed-rate payments in any desired third currency, with the final all-in-swapped yield determined by the original spread. As long as spreads between bond yields and currency swap rates differ across currencies, bond issuers can in principle lower their all-in-swapped borrowing costs by issuing bonds wherever the spreads (i.e., the covered interest yields) are the lowest. Because currency swaps require foreign currency and US dollar principal to be exchanged at maturity, at the original exchange rate, this reduction in borrowing costs is achieved without incurring currency risk. Recent market practice also requires out-of-the-money positions to be collateralized, so counterparty default risk for currency swaps is arguably negligible. Duffie and Huang (1996) and He (2001) provide a broader discussion of the risk of swaps. Overall, currency swaps transform foreign currency bond issuers into one-way arbitrageurs by enabling them to synthesize cheaper fixed-rate funding in one currency from bonds that are issued in another.

While the limited empirical evidence in favor of uncovered interest parity and (long-term) covered-interest parity provides some justification for opportunistic foreign currency bond issuance, it is largely immaterial to our study. We do not provide new evidence on interest rate parity, per se. Instead, we examine whether or not bond issuer behavior is consistent with the underlying belief that interest rate parity holds. In this way, our work is similar to previous studies that examine other dimensions of the debt issuance decision. Friedman (1979) and Baker, Greenwood, and Wurgler (2003), for example, investigate the choice between short-term and long-term debt. Similarly, Faulkender (2005) and Chernenko and Faulkender (2006) consider the choice between fixed and floating-rate debt issuance. Chaplinsky and Ramchand (2004) examine the registration decision of international borrowers with respect to public debt versus Rule 144A debt. Consistent with these studies, our focus lies squarely on firm behavior, not the implied failure of the relevant expectations hypothesis.

Existing evidence of opportunistic cross-currency choice in international bond markets is largely anecdotal. Johnson (1988) finds that the mix of Canadian dollar and US dollar denominated bonds is correlated with differences in nominal interest rates in the two currencies and proxies for expected depreciation. For a sample of East Asian firms, Allayannis, Brown, and Klapper (2003) find that firms are more likely to issue foreign currency debt when local short-term yields are relatively high. Henderson, Jegadeesh, and Weisbach (2006) investigate foreign debt issues into the US (i.e., Yankee) and UK (i.e., Bulldog) bond markets for a sample of G-7 issuers. They find that firms issue a relatively larger amount of debt in the Yankee (Bulldog) market when ten year US (UK) interest rates are low and when the difference between local and US (UK) interest rates is high. All these studies implicitly assume a simple binary choice for firms between issuing bonds in their home currency and issuing them in a single foreign currency. They also assume firms attempt to exploit differences only in uncovered interest yields.

We offer a richer analysis across several dimensions. First, we consider a cleaner and more comprehensive test by examining the foreign currency borrowing of entities with operating cash flows denominated exclusively in their home currency. This sample includes foreign currency-denominated bonds issued by both national and regional governments, as well as domestic development agencies from a total of 31 countries over the 1991–2003 period. Sample entities that are frequent issuers include the Italian government, the state of New South Wales, and development organizations such as Bank Nederlandse Gemeenten, Fannie Mae, and the Japan Highway Public Corporation. Second, we explicitly account for an issuer's ability to choose among a wide variety of currencies instead of examining only specific market pairs. We consider bonds issued in each of the six currencies that occur most frequently in our sample: the British pound, German mark, French franc, Japanese yen, Swiss franc, and US dollar. We omit the euro, despite being widely used after 1999, because of its transitional nature over the sample period. Third, we investigate whether firms alter their issuance behavior in response to differences in covered as well as uncovered interest yields. Finally, we offer a rough quantification of the economic magnitude of the gains that the issuers in our sample appear to realize.

We find substantial variation in the share of international bonds issued in each currency over time. Particular currencies appear to move in and out of favor among our sample of bond issuers over the sample period. Overall, we find strong and consistent evidence that firms attempt to exploit differences in both covered and uncovered interest yields in choosing the currency in which to denominate their debt. The share of foreign currency-denominated bonds issued in a given currency increases when its covered interest yields are relatively low. For the full sample of issues, we estimate the gains to this type of opportunistic borrowing to be 4–18 basis points, even after currency risk is hedged with currency swaps. To our knowledge, this is the first study to show this type of opportunistic borrowing based on differences in covered interest yields. With regard to uncovered interest yields, we also find evidence that currency shares increase when nominal bond yields are relatively low, confirming the results of previous analyses. We also observe that the sovereign and agency issuers systematically increase the share of bonds that they offer in a given currency following periods of relative appreciation, consistent with an underlying belief that exchange rates are mean-reverting over time. Perhaps surprisingly, we find that this belief appears subsequently validated in the data. The average bond offering in our sample precedes a 149 basis point depreciation in the issue currency in the year following the issuance. Further time-series tests find some evidence for effective covered interest yield timing as well. On average, covered interest yield savings reach their peak in event time just before our bond offerings. This suggests either that our sample of issuers successfully anticipates the subsequent decline or that their borrowing itself tends to eliminate the covered interest savings over time. Our findings are robust across broad subsets of our sample. All issuers in our sample appear equally likely to attempt to exploit cross-currency differences in borrowing costs, regardless of whether they are frequent or infrequent bond issuers, or they are from large or small countries. Similarly, we find that national and regional governments appear just as opportunistic in their foreign currency borrowing as the agencies and other types of organizations in our sample. Overall, these results support what has been a frequent conjecture in the literature and contribute considerably to an understanding of what motivates firms to issue foreign currency debt. In a companion study, McBrady and Schill (2007) identify consistent opportunistic borrowing behavior among corporate borrowers as well.

The rest of the paper is structured as follows. Section 2 presents a simple one-period model of a firm's choice of issue currency in the international bond market. Section 3 describes the data on relative bond issuance and covered and uncovered interest yields. Section 4 presents empirical tests and results, and it estimates the aggregate gain to opportunistic issuance for all issues in our sample. Finally, Section 5 offers concluding remarks.

2. A simple model of the currency denomination decision

Consider a firm with k^* percent of its cash flow in a foreign currency that needs to borrow funds worth a single unit of domestic currency at time $t = 0$ and must repay both principal and interest at time $t = 1$. At $t = 0$, the firm must choose B, the fraction of its borrowing denominated in the foreign currency. In making its denomination decision, the firm chooses among the three standard alternatives presented in textbook treatments of interest rate parity. To enable costs to be compared across alternatives (and without loss of generality), each is expressed in terms of the domestic currency.

Alternative 1. Uncovered domestic currency borrowing at cost of $(1+R)$.

Alternative 2. Uncovered foreign currency borrowing at (expected) cost of

$$E(S_1/S_0)(1+R^*).$$

Alternative 3. Covered foreign currency borrowing at cost of $(F_0/S_0)(1+R^*)$.

In the expressions above, R^* is the foreign interest rate; S_t is the time t exchange rate, expressed in units of domestic currency per foreign currency (i.e., as a direct quote); and F_0 is the $t=0$ forward rate for purchasing foreign currency at $t=1$.

2.1. Base case: interest rate parity

In frictionless markets, interest rate parity maintains that the cost of each alternative is identical, so

$$1+R = E(S_1/S_0)(1+R^*) = (F_0/S_0)(1+R^*). \tag{1}$$

In this case, expected borrowing costs are the same regardless of the firm's choice of B; opportunistic financing has no role to play in a firm's currency denomination decision. For the risk-neutral firm, the choice of currency is irrelevant. Currency denomination decisions are made randomly. If the firm is averse to currency risk, it is likely to simply set B equal to k^* so that its liabilities are denominated in the same currency as its operating cash flows. The value of hedging operating cash flows in this manner is discussed by Allayannis and Weston (2001). Because our sample of bond issuers has no foreign currency cash flows, k^* is equal to zero in the empirical analyses below. Even so, we retain k^* in the model so its predictions can be extended to a broader set of firms.

By taking logs and rearranging the first equality in Eq. (1), we arrive at the standard expression of uncovered interest parity (UIP):

$$r = r^* + E_0(s_1 - s_0), \tag{2}$$

where lowercase letters are continuously compounded uppercase yields and $(s_1 - s_0)$ is the continuously compounded rate of foreign currency appreciation. Eq. (2) is intuitive: it implies that the domestic interest rate is simply the foreign interest rate plus any expected foreign currency appreciation.[1] Countless researchers use Eq. (2) as the basis for empirical tests of UIP. Surprisingly, regressions that span virtually all major currencies and historical time periods find that low interest currencies do not appreciate enough to offset interest differentials. In fact, low interest currencies tend more frequently to depreciate than appreciate. This failure of UIP is often referred to as the forward premium puzzle or forward discount bias. Despite some recent evidence presented by Chinn and Meredith (2004) in favor of UIP at long horizons, the forward premium puzzle remains one of the most enduring mysteries in international finance.

By taking logs and rearranging the second equality in Eq. (1), we arrive at an analogous expression for covered interest parity (CIP):

$$r = r^* + (f_0 - s_0), \tag{3}$$

[1]For simplicity, Eq. (2) omits a Jensen's inequality term that results from taking logs across the expectations operator. This omission is immaterial to the discussion that follows.

where once again lowercase letters are continuously compounded uppercase yields. In this case, however, expected foreign currency appreciation is replaced by (f_0-s_0), the (continuously compounded) forward premium. This premium represents the additional price, over and above the current exchange rate, that is paid to purchase foreign currency in the forward market. Eq. (3), like Eq. (2), is invariably assumed to hold in theory. For short maturities, this is typically the case. Covered interest arbitrage is nearly costless, and currency dealers use Eq. (3) to calculate forward rates directly from interbank interest differentials.[2] At short maturities, interbank interest differentials and corporate borrowing cost differentials are virtually identical. At the longer maturities relevant for hedging the currency risk of bonds, however, this simple relationship breaks down. As described below, firms use currency swaps, not forward contracts, to hedge foreign currency-denominated bond issues. As a result, forward premiums are replaced by differences in currency swap rates. The latter, in turn, demonstrate no clear relationship with underlying corporate bond yields.

If the firm believes either the UIP or CIP condition does not hold, it can reduce its borrowing costs by adjusting its fraction of foreign currency borrowing to exploit the discrepancy. Deviations of B from k^* that coincide with apparent departures from interest rate parity thus provide evidence of firms behaving as if either UIP or CIP does not hold.

2.2. Uncovered currency bargains

The empirical failure of UIP has a straightforward implication for the firm's currency denomination decision. It implies that firms that borrow relatively low interest currencies and leave currency risk unhedged can systematically lower their expected borrowing costs. They make lower interest payments and repay principal in less valuable currency in the future. In other words, empirical evidence for the failure of UIP indicates that there are uncovered currency bargains that firms can attempt to exploit.

In the context of our model, firms that believe UIP does not hold expect to achieve borrowing cost savings on uncovered foreign currency borrowing that are equal to

$$\varepsilon^U \equiv \left(r - r^*\right) - \mathrm{E}(s_1 - s_0). \tag{4}$$

To illustrate the potential bargains that Eq. (4) identifies, assume the foreign interest rate, r^*, is lower than the domestic currency rate, r. Eq. (4) states that when the domestic interest premium is greater than expected foreign currency appreciation, the firm achieves lower expected borrowing costs through uncovered foreign currency borrowing. Intuitively, the loss it expects (if any) through foreign currency appreciation is less than the immediate gain from the lower foreign currency interest payments it makes. If the domestic interest premium is less than expected appreciation, ε^U becomes negative. In this case, uncovered domestic currency borrowing results in lower expected borrowing costs instead.

In Eq. (4), ε^U, is only an expected cost savings, since the future foreign currency exchange rate is unknown. For a risk-neutral firm, expected cost savings provide sufficient incentive to alter its borrowing behavior. For a risk-averse firm, the sensitivity to UIP deviations may be dampened, but one would still expect that B is increasing in ε^U. To keep

[2]As Clinton (1988) describes, dealers use interbank interest rates instead of risk-free interest rates. At short maturities, however, interbank and risk-free interest premiums are virtually identical.

our model simple, we assume that the following linear relationship exists between the firm's fraction of foreign currency borrowing and its expected borrowing costs:

$$B = k^* + \beta^U \varepsilon^U. \tag{5}$$

Absent any expected savings from uncovered foreign currency borrowing, $B = k^*$. In response to positive ε^U, expected foreign borrowing cost savings cause the firm to increase B by an amount given by $\beta^U \varepsilon^U$. When ε^U is negative, it decreases B by this amount instead. β^U is thus a slope term that relates a firm's percentage cost savings to a unit change in foreign borrowing share. In other words, it can be interpreted as the firm's partial elasticity of foreign currency borrowing demand.

2.3. Covered currency bargains

At short maturities, currency dealers ensure that CIP holds by setting forward rates in reference to underlying interbank interest rates. Likewise, in arranging short-term lines of credit, corporations typically borrow at the same spread over LIBOR in most major currencies. This ensures that the opportunity to exploit short-term covered currency bargains is limited. At longer horizons, however, the situation is different. As Popper (1993) demonstrates, firms use currency swaps to hedge the currency risk associated with foreign currency bonds. As a result, the forward discount in Eq. (3) must be replaced by the difference in continuously compounded currency swap yields:

$$r = r^* + \left(c - c^*\right), \tag{6}$$

where c and c^* are the domestic and foreign currency swap yields, respectively.

Covered currency bargains exist if the spread between bond yields and swap rates differ across currencies. Thus, in a manner analogous to Eq. (4), the firm can achieve borrowing cost savings on covered foreign currency borrowing that are equal to

$$\varepsilon^C \equiv (r - c) + \left(r^* - c^*\right). \tag{7}$$

Eq. (7) again is fairly intuitive. Covered foreign currency borrowing provides savings for the firm whenever the spread between foreign currency bond yields and swap rates exceed the analogous spread for the domestic currency. If the foreign currency spread, $(r^* - c^*)$, is less than corresponding domestic currency spread, $(r-c)$, the firm lowers its (fixed) borrowing costs in domestic currency by ε^C by swapping foreign currency bond payments into domestic currency instead of issuing in domestic currency directly. Once again, because it receives sufficient foreign currency to repay its principal at maturity, it achieves these savings without incurring currency risk.[3]

McBrady (2003) shows that average spreads between bond yields and currency swap rates differ considerably across a broad sample of currencies. As an example of this difference, Fig. 1 plots the spread between 5-year triple-A rated eurobond yields and currency swap rates for the British pound, Japanese yen, and US dollar. As evident in the figure, the three series differ considerably. In the early 1990s, pound-denominated triple-A

[3]As with all over-the-counter derivatives, however, the firm does incur some degree of counterparty credit risk. Even so, swap counterparties are typically major international banks. Swap contracts themselves also contain a number of features to render them virtually default risk-free. For a description of the risks associated with swap contracts, see He (2001) or Duffie and Huang (1996).

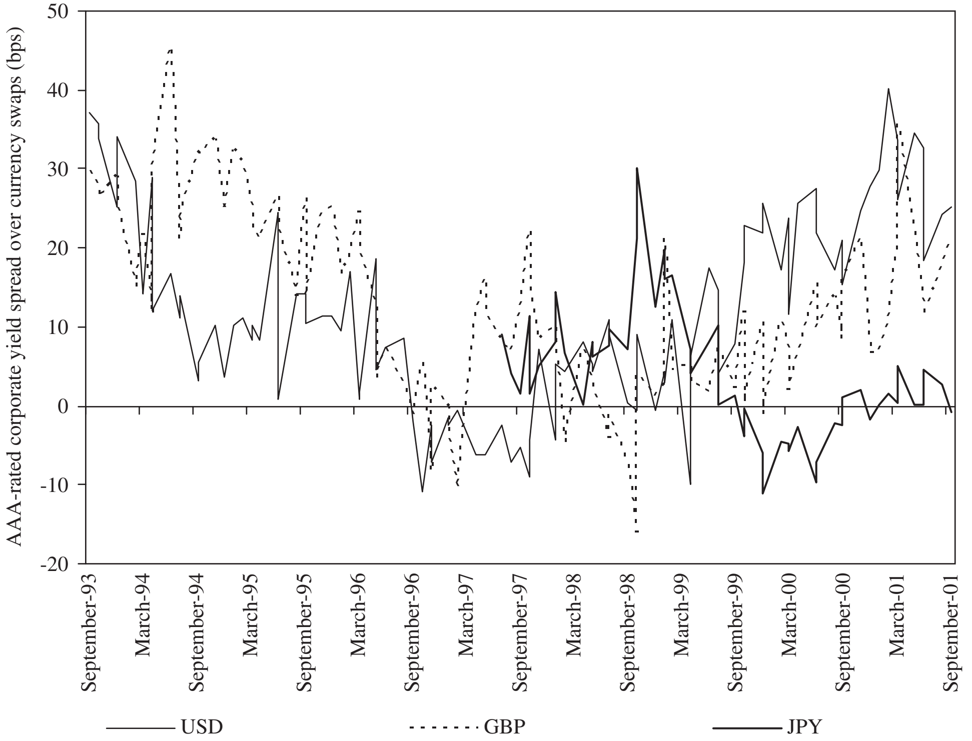

Fig. 1. This figure plots currency swap spreads ($r_i - c_i$) for 5-year AAA-rated eurobond yields and 5-year fixed-for-floating currency swap rates for the US dollar (USD), British pound (GBP), and Japanese yen (JPY). The AAA-rated eurobond bond yields are fair-market yield indices derived from yield curves constructed daily from a sample of the most liquid bonds in each category by Bloomberg research staff. The data are widely used as pricing benchmarks. The 5-year fixed-for-floating currency swap rates are constructed from separate interest rate swap rates and currency basis swap rates. For the USD, only the interest rate swap rate is used because the currency basis is already in US dollars. Each rate is reported by Bloomberg as a composite quote representing the average of a large number of dealers' separate bid and ask quotes, disregarding the highest ask and lowest bid. Fair-market yield indices and interest rate swap rates are generally available throughout the 1990s. Currency basis swap data are available for the British pound in September 1993 and Japanese yen in September 1997.

spreads are considerably higher than US dollar spreads. As a result, a triple-A rated British issuer could issue bonds in US dollars, swap them into pounds, and pay lower interest rates in pounds than if they issued pound-denominated bonds directly. Implicitly, this assumes that the British issuer can issue bonds at the US triple-A rate. In 2000 and 2001, this trend reverses itself. By the end of the sample period, the lowest-cost method of borrowing in either US dollars or British pounds is by issuing yen-denominated bonds and hedging them with currency swaps. As evident in the figure, differences in spreads of 10–20 basis points are fairly common providing what appear to be modest but meaningful covered currency bargains for opportunistic firms to exploit.

Because the firm achieves cost savings ε^C without incurring currency risk, the same borrowing behavior should be observed for risk-neutral and risk-averse firms. Maintaining the same simple linear structure introduced above, we assume the firm sets its fraction of foreign currency borrowing as

$$B_0 = k^* + \beta^C \varepsilon^C, \tag{8}$$

where, once again, β^C can be interpreted as the firm's partial elasticity of borrowing demand. If firms seek to exploit covered currency bargains, we expect them to adjust their fraction of foreign currency borrowing in response to observed differences in spreads between bond yields and currency swap rates.

3. Data

In this section, we discuss the estimation of foreign currency-denominated borrowing share and the uncovered and covered borrowing cost savings.

3.1. Currency share, B

The empirical analyses that follow focus primarily upon the currency share, or the fraction of foreign currency-denominated bonds issued in each of our sample currencies. One of the challenges in empirically modeling the currency share, as evident in Eq. (5) and (8), is the estimation of each bond issuer's foreign currency operating exposure, k^*. Without adequate measures of k^*, however, it is difficult or impossible to rule out hedging-based motivations for any foreign currency-denominated bond issues that are observed. This fundamental weakness limits virtually all previous analyses of opportunistic bond issuance in the literature. To overcome it, we restrict our sample to include only those borrowers for whom we have a priori reason to conclude that $k^* = 0$. We do so by constructing a comprehensive sample of sovereign governments and agencies that issue bonds in foreign currencies. These issuers (including sovereign entities such as the Italian government and the state of New South Wales, and development agencies such as Bank Nederlandse Gemeenten, Fannie Mae, and the Japan Highway Public Corporation) maintain no foreign currency operating cash flows that could motivate hedging-based foreign currency borrowing.[4] We focus exclusively on the foreign currency-denominated bonds that they issue, discarding from the sample any bond issues denominated in their local currency. We obtain our data on international bond offerings from the Thomson Financial Securities Data Company (SDC) Platinum Global New Issues data set over the period from 1991 to 2003. According to market terminology, these bonds include foreign bonds (bonds denominated in the home currency of the market into which they are issued) and eurobonds (bonds issued by nonresident firms in nonlocal currencies). The sample includes all nonconvertible, fixed-coupon, investment-grade bonds denominated in a foreign currency by public sector entities [Primary Standard Industrial Classification (SIC) code in the 9000s or 6111]. Again, our choice of public sector entities, by construction, restricts the sample to only those borrowers with exclusively domestic operating cash flows. To ensure a sample that is free of foreign currency cash flows, we review the SDC

[4]It is conceivable that these entites maintain some economic exposure to foreigh currency risk. For example, the Japan Highway Public Corporation might collect tolls (in yen) that fall when the yen is strong (and foreign currencies are weak). In that a strong yen motivates domestic residents to travel overseas and not vacation and use roads at home, and the strong yen similarly deters foreign visitors who would travel in Japan and use roads. We expect that this effect is relatively small but we accommodate some controls for such effects in Section 4.3.

sample by hand for verification. Because some emerging market economies use the US dollar as a quasi-domestic currency, we eliminate such transactions from our sample. To be specific, bond issues in US dollars from the following countries are eliminated: Argentina, Bolivia, Brazil, Columbia, Costa Rica, El Salvador, Hong Kong, Indonesia, Israel, Mexico, Panama, Peru, Philippines, South Korea, and Uruguay. Each of these countries pegged its currency to the US dollar during some portion of the sample period.

Table 1 reports the aggregate offering statistics for bonds issued in the 20 currencies most frequently observed in our sample. Although borrowers issue bonds in a wide variety of currencies, issuance appears concentrated in seven major currencies over the sample period. These currencies [the US dollar (USD), the euro/ECU, the Japanese yen (JPY), the German mark (DEM), the Swiss franc (CHF), the British pound (GBP), and the French franc (FRF)] comprise 94% of all foreign currency-denominated bond offerings in the initial set. Because we are looking for equilibrium choice behavior, we omit offerings in euros/ECU as this is a transitional currency over our sample period. As widely reported in the financial press, euro-denominated bond issuance soared following the onset of monetary union. In 1999, for example, euro-denominated bond issuance exceeded the maximum level previously observed for the ECU and each precursor currency combined. Most observers attributed this surge in issuance to one-time portfolio rebalancing effects on the part of investors or to European issuers' desire to replace previous local currency debt with new issues denominated in euros. This type of opportunistic issuance, while

Table 1
Foreign currency bond offerings by issuance currency for all countries. The table summarizes the currency share from the Thomson Financial Global New Issues data set over the period 1991–2003 for all non convertible, non-domestic currency bond offerings of entities in standard industrial classification codes 6111 and 9 from all countries. The table reports the total principal amount offered (expressed in billions of current US dollars). The 20 currencies with the greatest amount of total principal offered by these entities in non domestic currency debt over the sample period are listed in descending order.

Issuance currency	Number of offerings	Total principal amount (billions of dollars)
US dollar (USD)	957	433.6
Euro/ECU	238	150.6
Japanese yen (JPY)	583	149.7
German mark (DEM)	214	95.3
Swiss franc (CHF)	309	49.8
UK pound (GBP)	162	44.2
French franc (FRF)	66	34.4
Dutch guilder	29	12.2
Australian dollar	80	11.6
Canadian dollar	78	11.0
Italian lire	44	7.6
Luxemburg franc	45	3.1
South African rand	19	2.8
New Zealand dollar	30	2.6
Spanish peseta	29	2.1
Swedish krona	19	1.6
Norwegian krone	22	1.5
Hong Kong dollar	45	1.3
Austrian schilling	14	1.2
Danish krone	15	1.2

interesting, is unlikely to be related to cross-currency borrowing cost discrepancies. As a result, we restrict our sample to those offerings that are denominated in the six most common currencies denoted above. We also exclude from the sample firms from those countries in which all resident firms as a whole are not observed to issue bonds in at least three sample currencies. This excludes all issuers from some smaller developing countries that lack access to international bond markets and that are often forced to borrow in either US dollars or local currency. We apply this filter at the country-level, not the firm-level. In other words, we either include all firms from a given country or none of them. The revised sample includes 2,080 offerings from 111 entities and 31 countries with an aggregate current US dollar-based total principal of $0.8 trillion.

Table 2 reports a number of summary statistics for the revised sample of bond issues. Panel A disaggregates the data according to issue currency and bond issuer nationality. As evident in the table, the borrowers in our sample collectively choose from a broad menu of currencies when issuing foreign currency-denominated debt. Issuers from Canada and Italy offer the largest volume of foreign currency-denominated debt, contributing 14% and 13% of the sample, respectively. The US dollar is the dominant currency in the sample (48%), followed by the Japanese yen (19%), the German mark (11%), the French franc (9%), the Swiss franc (7%), and the British pound (6%). There are some interesting preferences among countries for particular currencies. Entities from some countries choose

Table 2
Summary statistics of foreign-currency bond offering sample. The table shows the distribution of home country, bond currency, and maturity for the 1991–2003 sample of foreign currency-denominated bond offerings. The table reports the total principal amount offered in billions of current US dollars (Panel A), the currency share by year (Panel B), and the median bond maturity (Panel C). In Panel B, currency share is defined as the fraction of dollars raised in a particular currency divided by the total bond capital raised in all six sample currencies (the number of issuance currencies drops to five beyond 1998). USD = US dollar; GBP = UK pound; JPY = Japanese yen; DEM = German mark; CHF = Swiss franc; FRF = French franc.

Panel A. Total principal amount by country of origin

Country of origin	USD	GBP	JPY	DEM	CHF	FRF	Total
Argentina	0.00	0.48	5.84	7.48	0.54	0.18	14.52
Australia	1.40	0.52	12.93	0.00	0.10	0.00	14.95
Austria	25.46	2.65	7.44	9.89	16.92	3.10	65.46
Belgium	5.40	0.00	2.11	3.77	0.93	1.55	13.76
Brazil	0.00	0.41	4.56	1.33	0.00	0.17	6.47
Canada	79.21	3.00	10.77	5.71	3.37	4.79	106.85
China	6.60	0.00	1.57	0.29	0.00	0.00	8.46
Columbia	0.00	0.16	0.90	0.10	0.00	0.00	1.16
Croatia	0.30	0.00	1.26	0.17	0.00	0.00	1.73
Denmark	9.95	1.11	2.60	4.46	2.08	1.23	21.43
Finland	10.08	3.40	4.68	5.31	2.35	4.16	29.98
France	7.38	1.59	0.80	3.09	1.50	0.00	14.36
Germany	23.80	1.51	5.74	0.00	3.03	0.66	34.74
Greece	2.24	0.00	6.73	1.34	0.75	0.00	11.06
Hungary	2.15	1.04	6.60	4.12	0.49	0.17	14.57
Iceland	0.53	0.15	0.21	0.11	0.07	0.00	1.07
Ireland	1.30	0.00	1.49	1.11	0.79	0.00	4.69
Italy	62.44	3.43	22.41	4.78	7.31	0.86	101.23
Japan	13.30	1.14	0.00	1.77	1.79	0.95	18.95

Table 2 (*continued*)

Panel A. Total principal amount by country of origin

Country of origin	USD	GBP	JPY	DEM	CHF	FRF	Total
Mexico	0.00	1.59	6.05	3.29	0.00	0.00	10.93
Netherlands	32.51	8.62	3.67	4.14	4.79	1.70	55.43
New Zealand	1.72	0.51	0.25	0.00	0.07	0.00	2.55
Norway	2.00	0.00	1.18	1.57	0.00	0.56	5.31
Poland	3.05	0.62	0.66	0.16	0.32	0.00	4.81
Portugal	2.22	0.00	2.10	2.05	0.00	3.13	9.50
Slovak Republic	0.31	0.00	0.27	0.47	0.00	0.00	1.05
South Africa	5.10	0.15	1.17	0.57	0.00	0.00	6.99
Spain	18.62	1.01	6.33	6.41	0.98	6.47	39.82
Sweden	16.96	3.53	15.63	4.95	1.64	4.19	46.90
Turkey	19.20	0.19	8.32	6.39	0.00	0.00	34.10
United States	0.00	6.78	1.39	2.22	0.00	0.30	10.69
Total	363.72	43.59	146.66	87.05	49.82	68.27	713.52
Fraction of total	0.48	0.06	0.19	0.11	0.07	0.09	

Panel B. Currency share of total principal amount by year of offering (percent)

Year	USD	GBP	YEN	DEM	CHF	FRF
1991	52	4	18	8	10	7
1992	46	6	17	17	7	7
1993	37	6	17	26	7	7
1994	30	2	47	9	4	8
1995	23	1	49	17	7	3
1996	27	3	31	24	5	11
1997	37	9	22	18	4	10
1998	42	13	3	23	12	6
1999	74	11	5		9	
2000	54	9	31		6	
2001	79	6	13		2	
2002	86	2	3		9	
2003	85	3	3		10	

Panel C. Median debt maturity by year of offering

Year	USD	GBP	YEN	DEM	CHF	FRF
1991	10.0	10.0	10.0	6.0	10.0	10.0
1992	7.0	6.0	6.0	10.0	9.0	5.0
1993	10.0	7.0	6.0	7.0	7.0	8.0
1994	5.0	10.0	5.0	5.0	5.0	7.0
1995	6.0	10.0	10.0	5.0	6.0	10.0
1996	4.0	6.0	5.5	5.0	6.0	11.0
1997	5.0	3.0	7.0	6.5	6.0	10.0
1998	5.0	6.0	3.0	7.0	7.0	11.0
1999	5.0	9.0	4.0		6.0	
2000	3.5	5.0	3.5		5.5	
2001	5.0	18.0	5.0		6.5	
2002	5.0	6.0	4.5		5.0	
2003	6.0	4.0	6.5		5.0	

not to issue any foreign-currency-denominated debt (e.g., Switzerland and the United Kingdom). Australian entities appear to prefer yen-based obligations. This may be because of some geographic familiarity preference for those currencies (see Sarkissian and Schill, 2004).[5] To facilitate appreciation for the composition of the sample of issuers, Appendix A reports issuance statistics for the most active entities in our sample. National governments are the dominant borrowers.

Panel B of Table 2 reports the fraction of total foreign currency-denominated bonds that are issued in each sample currency from 1991 to 2003. These currency shares, B, exhibit strong time variation over the sample period. For example, 49% of all foreign currency offerings in 1995 are in Japanese yen, whereas only 3% are in yen in 1998. Over the same two years, the share in British pound rises from 1% in 1995 to 13% in 1998. Panel C provides median bond maturity statistics by year of issuance and currency. Median maturities appear to be fairly uniform across currencies varying from 5 years to 10 years. Debt offerings in DEM and FRF stop at the end of 1998 because of the introduction of the euro. The anticipation of the euro launch could have depressed longer-term bond issuance in German marks and French francs toward the end of their respective sample periods. However, we see no evidence of a substantial decline in offering volume (Panel B) or maturity (Panel C) in the late 1990s.

3.2. Uncovered currency bargains, ε^U

Eq. (4) defines the uncovered foreign borrowing cost savings ε^U as the difference of two terms: the domestic interest premium $(r-r^*)$ and the expected foreign currency appreciation rate, $E_0(s_1-s_0)$. In principle, the domestic interest premium should reflect the difference in domestic and foreign long-term bond yields applicable for each of the issuers in our sample. Because our sample includes sovereign governments as well as agencies of various credit quality, we could construct a series of credit quality-specific interest premium proxies from composite eurobond yield indices. Because there could be differences in default risk pricing across currencies, however, this would leave open the possibility that agency borrowers choose their currency of issue to exploit differences in default risk pricing across markets. Instead, we construct domestic interest premium proxies from underlying long-term government benchmark yields in each market. In a sense, this rules out opportunistic bond issuance based on differences in default risk pricing across markets and focuses exclusively on more fundamental trends in the underlying risk-free and currency swap interest rate series. Kim and Stulz (1988) and Miller and Puthenpurackal (2002) investigate the effects of cross-market total borrowing costs on

[5]As suggested by an anonymous referee, issuers' preferences for some currencies might also result from established relationships with a given set of underwriters. If underwriters can most easily place bond issues in their own home currencies, then foreign issuers may appear to prefer certain currencies when in reality they simply prefer to work with certain underwriters. To investigate this possibility, we examine underwriter selection among the 98 Australian nondomestic currency offerings in our sample. We observe common consistency between the issue currency nationality and the nationality of the underwriter. For the Australian bonds we find that the currency and underwriter are from the same country in 72% of the offerings. This is particularly true for the most dominant nondomestic currency, the yen, which maintains underwriter-currency nationality consistency with 89% of the offerings. In so far as established underwriter relationships, instead of opportunistic attempts to lower borrowing costs, explain some of the foreign currency-denominated bond issuance in our sample, we would expect it to weaken the empirical results presented below.

bond market choice. We obtain 5-year benchmark yields from Datastream for all currencies in the sample. The choice of 5-year rates is arbitrary but roughly matches the shorter end of the respective bond maturity (see Table 2, Panel C). We choose to match the shorter maturities due to the fact that expected bond prepayments tend to shorten the expected maturity of the security.

Unlike the simple two currency model presented above, our empirical analyses allow for firms to choose among all six sample currencies. To accommodate this multi-currency setting, we replace domestic interest rate r with the contemporaneous average yield of all other currencies in the sample. Specifically, we specify our nominal interest savings proxy in the following manner:

$$\hat{\varepsilon}_{it}^{U_1} = \bar{r}_t - r_{it}, \tag{9}$$

where $\bar{r}_t$ is the average continuously compounded 5-year benchmark government bond yield observed across all sample currencies at the beginning of the quarter t.[6] Similarly, r_{it} is the continuously compounded 5-year benchmark government bond yield observed for currency i at the beginning of the quarter t. By measuring nominal interest savings for currency i against the contemporaneous average yield observed for all sample currencies, we explicitly account for managers' ability to choose their issue currencies from a relatively broad opportunity set. As in the simple two-currency model of Section 2, our multi-currency specification implies that positive values for $\hat{\varepsilon}_{it}^{U_1}$ correspond to attractive borrowing opportunities in currency i (i.e. that currency i is a bargain with respect to the other currencies).

To complete our estimate of ε^U, we must also estimate $E_0(s_1-s_0)$, the expected foreign currency appreciation rate for the particular currency of interest. For simplicity, we assume that bond issuers form their expectations of future appreciation rates based on past movements in exchange rates. To avoid imposing too much structure on their expectations-formation process, we include the appreciation rates observed over the previous four quarters as the relevant past information. Our goal here is simply to investigate whether or not issuers appear to use currently available information on past exchange rate movements in making their denomination decisions. While feasible, adopting a more satisfying approach to modeling expected appreciation rates would be beyond the scope of the present inquiry.

As above, we accommodate the multi-currency setting by subtracting our expected appreciation proxy for currency i from the analogous cross-currency average:

$$\hat{\varepsilon}_{i,t-\tau}^{U_2} = (\bar{s}_{t-\tau+1} - \bar{s}_{t-\tau}) - \left(s_{i,t-\tau+1} - s_{i,t-\tau}\right), \tag{10}$$

where s_{it} is the log exchange rate measured at the beginning of quarter t, and τ indexes quarterly lags from one to four. All exchange rates are expressed as euros per unit of foreign currency and are obtained from Datastream. In Eq. (10), we subtract currency i's appreciation rate from the contemporaneous cross-currency average. Accordingly, positive values for $\hat{\varepsilon}_{it}^{U_2}$ indicate that currency i has appreciated less than the cross-currency average over the relevant periods. In other words, it has proven to be a depreciation bargain

[6]Technically, we take the simple average of the continuously-compounded yields for all currencies in the sample. In so doing, we use a measure that is equivalent to the geometric average of the gross simple yields. Results are unaffected if arithmetic averages are used instead. The same approach is also used for the covered yield measures discussed later in the article.

relative to the other currencies in the sample. We assume, but cannot be sure, that past rates of depreciation are correlated with managers' expectations of future exchange rate movements. Positive values for our depreciation rate proxies indicate attractive borrowing opportunities if firms believe that past trends will continue and relatively unattractive borrowing opportunities if they expect them to be reversed.

In our panel regressions below, nominal yield bargains and expected depreciation bargains enter as separate terms. Intuitively, we suspect firms could evaluate differences in nominal interest rates and expected depreciation rates differently in making their currency denomination decisions. Econometrically, including the terms separately is also advantageous because the magnitude and variance of past depreciation rates are orders of magnitude larger than corresponding figures for nominal interest bargains.

3.3. Covered currency bargains, ε^C

Eq. (7) defines the foreign currency covered borrowing cost savings, ε^C, as the difference in spreads between long-term bond yields and currency swap rates in the domestic and foreign currency, respectively. We estimate each of these quantities separately for the six foreign currencies in our sample. To accommodate the multi-currency framework of our empirical tests, we again replace the domestic currency with the contemporaneous cross-currency average for all currencies in the sample.

The resulting specification is similar to the uncovered specifications presented above:

$$\varepsilon_{it}^C = (\bar{r}_t - \bar{c}_t) - (r_{it} - c_{it}), \tag{11}$$

where, once again, r_i is currency i's continuously-compounded 5-year benchmark bond yield and c_i is its 5-year fixed for floating continuously compounded swap rate. The $(\bar{r}_t - \bar{c}_t)$ term is the contemporaneous average spread between bond yields and currency swap rates for all currencies in the sample.

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. This implies $c_i = r_i^s - b_i$, where r_i^s is the local currency interest rate swap rate and b_i is the local currency basis swap rate.

We obtain interest rate swap rates for all currencies throughout the sample period from Datastream. Unfortunately, Bloomberg reports fixed-for-floating currency swap rates for only a few of the currencies in our sample. Likewise, Bloomberg reports currency basis swap rates only from the mid-1990s onward. As a result, fixed-for-floating currency swap rates cannot be constructed for most currencies during a large portion of our sample period. Given this data limitation, we use interest rate swap rates instead of fixed-for-floating currency swap rates for all currencies throughout the sample period. As a result, we substitute the spread between local bond yields and interest rate swap rates, $\left(r_i - r_i^s\right)$, for the spread between bond yields and fixed-for-floating currency swap rates, $(r_i - c_i)$, in constructing our right-hand-side variables.

Fortunately, the evolution of the currency swap markets toward a combination of plain vanilla swap instruments allows us to evaluate the quality of this proxy. Qualitatively, we find that, where data for both interest rate swaps and fixed-for-floating currency swaps are available, the two are observed to be virtually identical. For the German mark, for example, the difference between the 5-year fixed-for-floating currency swap rate, c_j, and the 5-year interest rate swap rate, r_i^s, averages less than 5 basis points throughout the 1995–1999 period. This is consistent with the observed magnitude of currency basis swap rates, b_i, for other currencies in our sample. For all currencies other than the yen, basis swap rates do not exceed ± 10 basis points. On the other hand, the difference between 10-year benchmark yields and swap rates is often 100 basis points or more.

From a more conceptual point of view, the true spread we wish to measure, $(r_i - c_i)$, is simply equal to our proxy spread, $\left(r_i - r_i^s\right)$, minus the currency basis swap rate. More formally, $\left(r_i - c_i\right) = \left(r_i - r_i^s\right) - b_i$, so our proxy for the spread between local bond yields and fixed-for-floating currency swap rates is limited by the usual errors in variables problem in which b_i, the currency basis swap rate, is the measurement error. Because we observe b_i's for all currencies in the latter portion of the sample, it is possible to analyze their correlation with proxy variables $\left(r_i - r_i^s\right)$ and thus to determine the sign of the bias that results. In most cases, we find correlations that are insignificantly different from zero. In some cases, notably for the UK and Japan, the two series are positively correlated. This implies that our proxy variable overstates the true spread between corporate bond yields and currency swap rates. Because this spread drives covered currency bargains, we bias our tests against finding evidence that firms increase relative issuance in response to covered currency bargains. For the remaining currencies in the sample, measurement error, b_i, is uncorrelated with $\left(r_i - r_i^s\right)$. In that case, simple attenuation bias has the same overall effect. Because the variance of b_i is more than an order of magnitude smaller than the variance of $\left(r_i - r_i^s\right)$, however, the resulting attenuation bias should be small.

4. Empirical tests and results

The empirical tests that follow seek primarily to determine whether the sovereign and agency borrowers choose to issue foreign currency-denominated bonds in such a way that is consistent with opportunistically reducing foreign currency borrowing costs.

4.1. Descriptive results

As an initial test, we adopt a simple sorting procedure to examine the relationship between currency share and our borrowing cost savings proxies. Specifically, we use the proxies identified in Eqs. (9)–(11) to sort the data for each currency into three categories: the highest-cost quarters, the medium-cost quarters, and the lowest-cost quarters. We then compare the average currency shares observed for each of these three subsamples of the data. For each measure of borrowing cost savings, we identify the lowest-cost quarters as the eight quarters in which the relevant proxy takes its highest value. The highest-cost quarters are those in which it takes its lowest value, and the medium-cost quarters include all remaining observations. For the expected appreciation rate proxies, this identification of highest-cost and lowest-cost quarters is somewhat arbitrary. Consistent with Eq. (10), we identify the highest-cost quarters to be those in which the relevant currency has appreciated the most during the previous four quarters. Implicitly, this assumes that the bond issuers in our sample expect past exchange rate trends to continue. If they expect exchange rates to revert to long-term means instead, periods following substantial currency appreciation would be the lowest-cost quarters. Appendix B provides plots of the individual currency share and borrowing yields for the six sample currencies.

As Panel B of Table 2 demonstrates, currency shares, B, vary considerably in both average size and variability across the six currencies in our sample. Prior to 1999, for example, the average share of bonds denominated in US dollars was 37%, while the average share denominated in British pounds was less than 6%. As a result, an increase of 1 percentage point in the British pound share reflects a considerable shift, while a comparable 1 percentage point increase in the US dollar share is relatively insignificant. To address this heterogeneity across currencies, we transform each of our quarterly raw currency shares, B_{it}, into an abnormal share, B^{*}_{it}, in the following manner. First, we regress each raw currency share on an intercept term and a post-euro indicator variable that equals one for all observations after January 1999 and zero otherwise. We then define the abnormal currency share to be the regression residual divided by the predicted value. The resulting abnormal currency shares admit a simple interpretation. Each expresses the observed currency share as a percentage increase (or decrease) over its average value throughout the relevant pre- or post-euro subsample of the data.

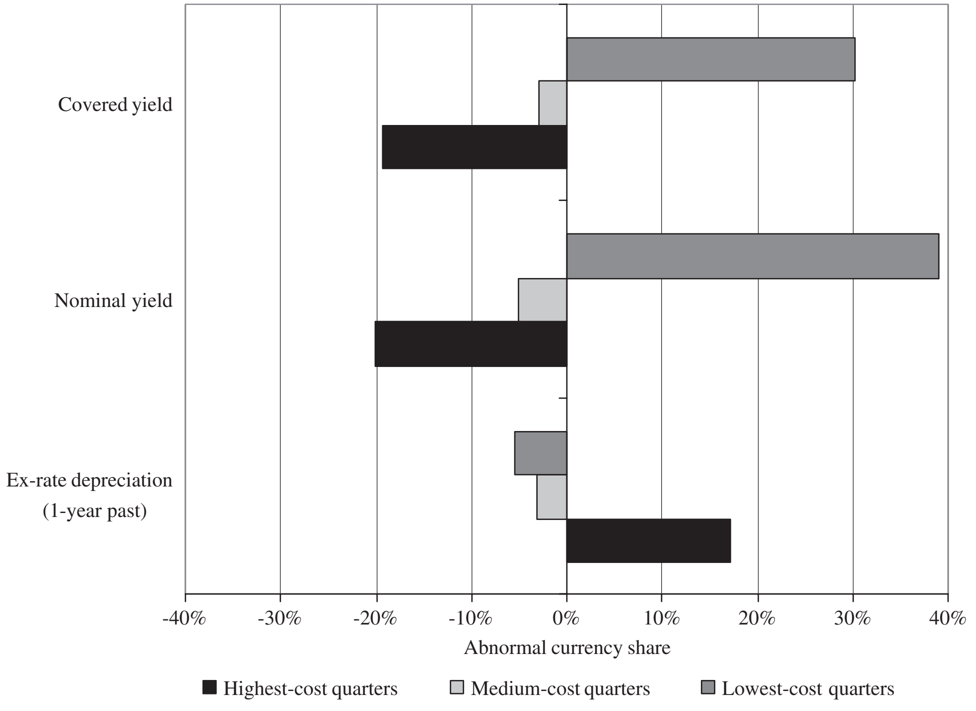

Fig. 2. The sample period is independently sorted into the eight most costly quarters and eight least costly quarters based on relative covered yields, nominal yields, and past 1-year exchange rate depreciation. The figure plots the mean abnormal currency share by classification of quarter. The abnormal currency share is based on the residuals from a regression of a quarterly series of the percentage of total principal amount of foreign currency bonds in a particular currency regressed on an intercept term and a euro introduction indicator variable which equals one for all quarters beyond January 1999 and equals zero otherwise. The abnormal currency share variable is equal to the residual from the regression divided by the predicted value.

Fig. 2 plots the mean abnormal currency shares observed for the highest-cost, medium-cost, and lowest-cost quarters in the sample. The figure suggests that abnormal currency shares are strongly correlated with our proxies for covered and uncovered borrowing cost savings. The eight quarters in which currencies appear to be the least costly (on either a covered or uncovered basis) are associated with currency shares that are approximately 30% higher than average. The eight quarters in which currencies are relatively the most expensive are associated with currency shares that are nearly 20% lower. For 1-year past currency appreciation rates, highest-cost quarters appear to be associated with relatively higher currency shares. In other words, currency shares appear to increase following periods of relative currency appreciation. This finding is consistent with the belief on the part of the bond issuers in our sample that exchange rates revert to long-term means over time. If so, they would expect currencies to depreciate following periods of relative appreciation.

Overall, this simple univariate analysis provides encouraging results. The bond issuers in our sample (none of whom has foreign currency operating cash flows) appear to pick the currencies in which to denominate their foreign currency bonds in an attempt to exploit apparent failures of covered and uncovered interest parity.

4.2. Multivariate results

Building upon the suggestive evidence provided by our univariate tests, we perform a series of fixed-effects panel regressions of currency share on our various metrics of cross-currency borrowing cost differences. As in the simple univariate tests, we accommodate the sizable differences in average issuance shares across currencies and time in our sample by including abnormal share, B^*_{it}, as the dependent variable in each of our regressions. This transformation implies that bond issuers respond to covered currency bargains of a given magnitude by increasing each currency's share of international bond issuance by the same fraction of its average share. Economically, we can thus interpret our estimates of coefficients, β^U and β^C, as true elasticities rather than partial elasticities as described in the model above. Throughout all of our regression specifications, we use beginning of quarter bond yields and swap rates to minimize endogeneity concerns. So, for example, ε^C_{it} represents the beginning of quarter covered currency bargain measured in basis points.

Eq. (8) motivates the specification on our first test as a regression of the abnormal currency share, B^*_{it}, on our estimate of the covered yield gains, ε^C. Because our sample excludes firms with foreign currency operating cash flow, k^* is not relevant for our purposes. In our regression we accommodate cross-currency differences in share with a currency fixed effects specification. If foreign-currency bond issuance by entities in our sample responds to covered yield opportunities, our coefficient estimate of elasticity, β^C, should be positive.

The panel regression framework imposes significant departures from the Gauss-Markov conditions on error term, η_{it}. Because the issuance shares for all currencies sum to one during each of our quarterly sample periods, the error term η_{it} is contemporaneously negatively correlated across currencies. It is also likely to be heteroskedastically distributed both within and across currencies. Finally, there is some (weak) evidence that currency-specific residuals are serially correlated up to one quarter. Letting η_i be the stacked vector of η_{it} 's for currency i, the heteroskedasticity and serial correlation imply that $\Sigma_{ii} \equiv \mathrm{E}\left(\eta_i \eta_i'\right)$ is a band diagonal matrix with three non-zero bands along the principal diagonal. The contemporaneous correlation across currencies i and j implies that $\Sigma_{ij} \equiv \mathrm{E}\left(\eta_i \eta_j'\right)$ has the same band diagonal structure. For the panel regression as a whole, then, the error variance-covariance matrix can be represented as

$$\Omega \equiv \begin{bmatrix} \Sigma_{11} & \cdots & \Sigma_{1J} \\ \vdots & \ddots & \vdots \\ \Sigma_{J1} & \cdots & \Sigma_{JJ} \end{bmatrix}, \tag{12}$$

where J is the total number of currencies in our sample.

One approach to handling these departures from the Gauss–Markov conditions is to model them explicitly and estimate the panel regression with feasible generalized least squares (FGLS). With this approach, however, the consistency of the resulting FGLS coefficient estimators is sensitive to the particular parameterization chosen. Instead, we opt for a more robust approach. We use ordinary least squares (OLS) to obtain unbiased estimates of all model parameters and residuals. We then use these residuals to construct an unbiased estimator of Ω in the manner suggested by Newey and West, extending the standard Newey and West estimator to account for contemporaneous correlation across currency panels. As a result, all our reported t-statistics have the standard normal limiting distributions. These t-statistics, along with coefficient estimates, are reported in Table 3. Consistent with the univariate results, we find that bond denomination responds strongly to bargains in covered yields. On average, issuance shares increase by 0.75% in response to 1 basis point increases in covered yield savings. In other words, a 10 basis point borrowing cost saving, a saving that is large but not infeasible given the data we observe, corresponds to an increase in currency share of an economically significant 7.5%.[7]

Our next regression specifications investigate whether or not firms alter the currency share of their new issues in response to uncovered currency bargains. The regression is a simple multi-currency extension of Eq. (5) and follows the same general structure as the covered yield regression model. In the first specification we regress abnormal currency share on the difference in nominal yields and fixed effects dummies. If firms increase issuance shares in response to nominal yield bargains, the coefficient estimate for partial elasticity on the difference in yields should be positive. The results for Regression 2 confirm that prediction. Overall, abnormal currency shares increase by 0.24% for each 1 basis point increase in nominal yield differentials. While smaller in magnitude than the corresponding estimate for covered yield bargains, the coefficient remains both economically and statistically significant. We suspect its smaller magnitude reflects currency risk-aversion on the part of the issuers in our sample. Overall, our findings are consistent with Johnson (1988), Allayannis, Brown, and Klapper (2003), and Henderson, Jegadeesh, and Weisbach (2006), all of whom argue that firms increase foreign currency bond issuance in response to nominal yield differentials. We observe that the coefficient for uncovered bargains is substantially lower than the coefficient on covered bargains. We suspect that this is the result of agent risk aversion.

[7]While economically significant, this increase in currency share is perhaps smaller than it initially seems. Consider the Japanese yen. Overall, yen-denominated bonds account for roughly 20% of the issues observed in our sample. A 7% increase in currency share for the yen thus corresponds to an increase in share from 20% to 21.4%.

Table 3
Regression results of abnormal foreign currency bond offering share. The table provides estimates of Eqs. (5) and (8). The dependent variable is the abnormal share of total non convertible, non domestic currency bond offerings of entities in standard industrial classification codes 6111 and 9 denominated in a particular currency. Abnormal share is measured in percentage points (multiplied by one hundred). The specification of the right-hand-side variables are as follows. The difference in covered yields is the relative log-basis point savings in the covered yield for the respective currency. The difference in nominal yields is the relative log-basis point savings in nominal benchmark yield for the respective currency. The exchange rate depreciation is the relative depreciation rate in the exchange rate spot rates (quoted as currency i/euro) in log basis points. The variables COVSALE and NOMSALE are indicator variables equal to one if the currency has the lowest covered cost or nominal cost, respectively, among the six currencies for that quarter. These variables are interacted with the respective currency yield measures. All regressors are measured at the beginning of the quarter. In addition to the right-hand-side variables noted in the table, the regression includes fixed-effect dummy variables for the sample currencies. The sample period is from 1991 to 2003, except for DEM (German mark) and FRF (French franc) that terminate at the end of 1998. Newey and West T-statistics are in parentheses. The regressions have 356 currency-quarter observations. ***, **, and * denote one-tail significance at the 1%, 5% and 10% level, respectively.

Dependent variables	(1)	(2)	(3)	(4)	(5)
Covered yield gains, ε^{C}	0.7529**		0.6642**	0.6286***	0.0082**
	(2.02)		(1.85)	(1.80)	(1.84)
Nominal yield gains, ε^{U_1}		0.2390***	0.3119***	0.2951***	0.0018***
		(3.06)	(4.06)	(3.75)	(2.92)
Exchange rate depreciation, t-1			−0.0240**		
			(−1.70)		
Exchange rate depreciation, t-2			−0.0362***		
			(−2.35)		
Exchange rate depreciation, t-3			−0.0180		
			(−1.08)		
Exchange rate depreciation, t-4			−0.0114		
			(−0.97)		
Exchange rate depreciation, t-1,t-4				−0.021***	−0.0001*
				(−2.46)	(−1.44)
COVSALE $*$ ε^{C}					−0.0048
					(−1.05)
NOMSALE $*$ ε^{U_1}					0.0032***
					(2.37)
NOMSALE $*$ exchange rate dep, t-1,t-4					−0.0002*
					(−1.55)

As discussed in Section 3.2, however, uncovered currency bargains are decomposed into nominal interest rate bargains and expected depreciation bargains. To add proxies for exchange rate expectations we use our measures of past exchange rate returns. In Regression 3 we add the quarterly exchange rate returns for the past four quarters. If agents use past exchange trends to forecast future movements, the coefficient on the exchange rate returns should be positive. If agents expect future depreciation following periods of appreciation as suggested by our univariate findings, the coefficient on the exchange rate returns should be negative. Our regression results suggest that the relationship is negative. All four coefficient estimates are negative and the coefficients on the one quarter and two quarter lags are significantly so. In this specification, we also add the covered yield difference variable. The covered and uncovered yield coefficients remain positive and significant. To test the joint effect across all four quarters we estimate a specification that compounds the four quarterly returns into a single annual past exchange rate return. The results (Regression 4) suggest that all three measures of borrowing costs matter. Relative currency appreciation of 1 basis point over the previous year corresponds to currency issuance shares that are roughly 2 basis points larger than average.

Our final specification is identical to Regression 4 except that we add interactive variables that are equal to one if the currency maintains the lowest covered cost (COVSALE) or lowest nominal cost (NOMSALE) among the six sample currencies. The dummy variable measures whether that currency is in effect "on sale." The Swiss franc and Japanese yen alternate maintaining the NOMSALE distinction over the sample period. We interact COVSALE with the covered yield gain variable and interact NOMSALE with both the nominal yield gain and the past depreciation variables. We find that both the coefficients on the NOMSALE are significant. The currency that is the cheapest across the sample currencies achieves a significant increase in currency share with respect to both the sensitivity to nominal rates and past exchange rate appreciation.

4.3. Robustness checks

One concern is whether the bond issuance in our sample is motivated by indirect exposure to foreign currency risk. For example, the mechanism that generates revenue for governments and agencies faces some indirect exposure to changes in exchange rates. These governments or agencies could use foreign currency-denominated debt to hedge such exposure. To gauge the importance of such exposure, we perform a test of the correlation between exchange rate returns and stock returns for firms in our sample. Only three firms among our sample are publicly traded. They are the three US agencies Fannie Mae, Freddie Mac, and Sallie Mae. We estimate the correlation coefficients for the monthly exchange rate returns for the sample foreign currencies and the monthly gross stock returns for the three US agencies. The coefficients vary from −0.052 to 0.047. None of the coefficients are statistically different from zero at the conventional levels with the smallest p-value being 0.48.

As an additional test we rerun each of the main regressions reported in Table 3 along with two regressors intended to capture the overall exposure of our bond issuers to the exchange rate risk of each currency in our sample. More specifically, we include the respective home country's relative real gross domestic product (GDP) growth and its relative growth rate of imports in each currency-specific regression in the panel. The underlying motivation to include GDP and import growth rates is straightforward. For example, we might suspect that the aggregate exposure of Japanese government entities to US dollar risk would increase as the US economy grows and particularly as US imports grow relative to the world economy. After including these additional control variables, we find that all coefficients for both GDP growth and import growth are not significant at the conventional levels. We also observe no material change in the other test coefficients with the revised specification. We conclude that hedging exchange rate risk exposure does not play a primary role in explaining the main findings of the paper.

To verify the generalizablilty of our overall findings we also conduct a series of subsample tests. We first check whether our results are dominated by issuers from large economies. To do this we compute separate currency share figures for issuers from the largest five countries in the sample—France, Germany, Japan, UK, and the US (i.e. the "G5")—and for issuers from all other countries. We then regress these two currency share series on the respective covered and uncovered currency yield variables and the two yield variables interacted with an indictor variable for G5 issuers, D(G5). In that way the coefficient on the interaction term captures the incremental sensitivity for G5 issuers. The specific specification for this test is

$$B_{it}^{*s} = \delta_i + \beta^C \varepsilon_{it}^C + \beta_s^C D_{it}(\mathrm{G5})\varepsilon_{it}^C + \beta^U \varepsilon_{it}^U + \beta_s^U D_{it}(\mathrm{G5})\varepsilon_{it}^U + \eta_{it}, \quad (13)$$

where B_{it}^{*s} is the subsample specific currency share and D_{it}(G5) is equal to one if B_{it}^{*s} is a currency share measured for G5 issuers and zero otherwise. The results are reported in Table 4. We find no evidence that G5 issuers are any more sensitive than non-G5 issuers as the coefficients on the interactive terms are not different from zero.

We construct a similar test to identify whether the results are driven by a few heavy issuing entities. To do this, we construct a separate series for those issuers that are above the 80th percentile for issuance volume from each home market. Again we find no difference in currency bargain sensitivity among the heavy issuers.

Finally, we examine how the sensitivity changes across entity type. We sort sample issuers into three main types: national governments, regional governments, and domestic development agencies. We split the sample by these three categories and rerun similar tests. We again find little difference in sensitivity across the three types of issuers. The sensitivity to interest rate bargains appears to be fairly general across a wide spectrum of issuer subsamples.

4.4. Magnitude of economic gains to opportunistic borrowing

We now turn to measurement of the economic gains associated with bargain motivated currency denomination decisions. We begin by comparing the borrowing rates that result from a naïve strategy of evenly distributing all bond issues over time with the borrowing rates that result from the actual pattern of bond issues we observe. We estimate the actual mean borrowing costs by weighting the quarterly interest rate and exchange rate depreciation observations by the respective quarterly bond offering currency share. In this way we generate an estimate of the effective relative borrowing gains for bond issuers over the sample period. Panel A of Table 5 reports the weighted averages over the six sample currencies. We observe that the weighted mean covered yield relative to the contemporaneous sample mean varies from −7.3 basis points for the German mark to 15.3 basis points for the US dollar. The average value for all currencies is 5.1 basis points. This suggests that, on average, firms choose currencies with a contemporaneous 5.1 basis point advantage over other available currencies. We report the standard deviation for the weighted borrowing rate in parentheses.

To clarify whether the reported mean values result from the particular distribution of bond offerings or simply the nature of the yield series, we compare the weighted mean with the relative borrowing costs associated with a naïve evenly distributed denomination choice policy. As the benchmark we calculate the mean interest rate and currency depreciation rates over the sample period. In so doing, we can compare the borrowing

Table 4
Regression results across subsamples. The table provides estimates of Eq. (12). The dependent variable is the abnormal share of total nonconvertible, nondomestic currency bond offerings of entities in standard industrial classification codes 6111 and 9 denominated in a particular currency for a particular category of firm. Abnormal share is measured in percentage points (multiplied by one hundred). The specification of the right-hand-side variables are as follows. The categories are firms from G5 countries (G5), issuers with sample issuance volume above the 80th percentile for their home country (Heavy), government issuers for non-national governments (Local), and issuers for national or regional development organizations (Agency). The difference in covered yields is the relative log-basis point savings in the covered yield for the respective currency. The difference in nominal yields is the relative log-basis point savings in nominal benchmark yield for the respective currency. All regressors are measured at the beginning of the quarter. In addition to the right-hand-side variables noted in the table, the regression includes fixed-effect dummy variables for the sample currencies. Indicator variables are created that equal one if the currency share is from a particular category of firm. These indicator variables are interacted with the respective currency yield measures as specified by the row header. The sample period is from 1991 to 2003, except for DEM (German mark) and FRF (French franc) that terminate at the end of 1998. Newey and West *T*-statistics are in parentheses. *** ,**, and * denote one-tail significance at the 1%, 5% and 10% level, respectively.

Dependent variables	(1)	(2)	(3)
Covered yield gains, ε^C	0.6402**	0.9067**	0.4349
	(1.73)	(1.71)	(1.08)
$\varepsilon^C * D$(G5)	0.7308		
	(1.27)		
$\varepsilon^C * D$(Heavy)		−0.2142	
		(−0.35)	
$\varepsilon^C * D$(Local)			−0.1970
			(−0.32)
$\varepsilon^C * D$(Agency)			−0.0897
			(−0.12)
Nominal yield gains, ε^{U_1}	0.1513**	0.1663**	0.2013***
	(1.73)	(2.11)	(2.45)
$\varepsilon^{U_1} * D$(G5)	−0.0084		
	(−0.12)		
$\varepsilon^{U_1} * D$(Heavy)		0.0108	
		(0.16)	
$\varepsilon^{U_1} * D$(Local)			0.0727
			(1.04)
$\varepsilon^{U_1} * D$(Agency)			−0.0165
			(−0.20)

rates that were achieved by the chosen currency choice policy with what would have been achieved with a naïve evenly distributed currency policy. The difference in borrowing costs is reported in brackets. We find that the difference between the realized covered borrowing rate and the naïve borrowing rate is positive for all of the currencies and varies from 1.1 basis points (DEM) to 7.2 basis points (JPY). The overall difference is 4.1 basis points. The patterns in differences in covered yields is again consistent with a tendency to denominate corporate bonds in currencies that offer covered yield bargains. While 4.1 basis points might seem a relatively small gain, we emphasize that it is the aggregate gain for all issues

Table 5

Summary statistics of benchmark yields and exchange rate depreciation. The table shows summary statistics for the relative covered and uncovered interest rates of government benchmark yield series and 1-year exchange rate depreciation rate series in six sample currencies. [US dollar (USD), UK pound (GBP), Japanese yen (JPY), German mark (DEM), Swiss franc (CHF), and French franc (FRF)]. All series are adjusted by the contemporaneous cross section mean value. All yield and exchange rate data are obtained from Datastream for the sample period 1991–2003 when available and are quoted in basis points. In Panel A, the dollar offering weighted relative mean gain is reported with the dollar offering weighted standard deviation rate in parentheses. The difference between the weighted relative mean rate and the simple relative mean weight is reported in brackets. This difference represents the realized gain achieved over the naïve equal-weighted currency selection. The difference between the simple mean rate for the eight highest currency share quarters and the simple mean rate for the eight lowest currency share quarters are reported in Panel B. ** and * denote one-tail significance that the mean rate of the high share quarters is greater than that of the low share quarters at the 1% and 5% percent level, respectively.

Borrowing cost variables	USD	GBP	JPY	DEM	CHF	FRF	All currencies
Panel A. Bond volume weighted rates for all quarters							
Relative covered yields							
Realized relative yield	15.3	10.4	−4.2	−7.3	9.9	−6.8	5.1
Standard deviation of realized relative yield	(11.8)	(4.4)	(9.4)	(6.0)	(6.0)	(2.9)	(8.9)
Realized relative yield less naïve yield	[4.3]	[5.8]	[7.2]	[1.1]	[2.7]	[2.1]	[4.1]
Relative nominal yields							
Realized relative yield	−81.2	−183.3	257.0	−46.3	107.0	−74.4	−2.8
Standard deviation of realized relative yield	(66.9)	(10.2)	(25.0)	(10.0)	(15.1)	(13.1)	(38.1)
Realized relative yield less naïve yield	[−4.1]	[2.5]	[16.5]	[−0.5]	[1.5]	[13.8]	[2.5]
Relative exchange rate depreciation (1-year subsequent)							
Realized relative dep.	199.0	88.5	288.8	162.9	19.8	151.4	189.3
Standard deviation of realized relative dep.	(519.1)	(135.9)	(378.7)	(165.6)	(126.6)	(107.7)	(351.7)
Realized relative dep. less naïve dep.	[120.1]	[53.7]	[387.9]	[55.5]	[69.4]	[61.5]	[148.5]
Panel B. Difference in sample time-series mean: high-volume quarter less low-volume quarters							
Difference in relative covered yields	22.46**	19.94**	28.83**	12.32	19.32	10.11*	18.44**
Difference in relative nominal yields	−0.65	16.67	57.83*	5.18	38.76	54.16*	32.33
Difference in relative exchange rate depreciation (1-year subsequent)	1203.46**	116.22	1316.90**	184.49	523.73**	317.05*	607.75**

in our sample. Table 2 reports $714 billion of foreign currency bond market issuance over our 12-year sample. If the bonds in our sample have an average maturity of eight years, an average of $476 billion are outstanding in each year of our sample. An annual 4.1 basis point savings on this principal amount represents a non-negligible $195 million in annual borrowing cost savings.

For the nominal yields, the overall borrowing patterns suggest a mean aggregate difference in nominal yields over the naive distribution of a more modest 2.5 basis points. The pattern for nominal yields is also not as consistent as covered yields. Two of the six currencies generate negative borrowing differences (USD and DEM). Because the borrowers are not achieving much financing cost gain from the difference in nominal yields, we question whether gains are made with effective timing of subsequent exchange rates. To measure the gains to uncovered borrowing positions, we measure the mean relative depreciation of the selected currencies over the first year of the obligation. The results suggest that the entities in our sample appear to effectively anticipate subsequent currency depreciation. Bonds of all six currencies are associated with positive weighted mean values for relative exchange rate depreciation, as well as consistently positive values relative to the naive currency choice. The mean magnitudes are also large. We find that overall, our sample entities reduce their borrowing costs by 149 basis points over the first year through realized currency depreciation relative to the naive borrowing policy. The risk exposure in taking an uncovered position, however, is readily apparent in the standard deviations in borrowing costs. The standard deviation for 1-year ahead rates vary from 108 basis points for the French franc to 519 basis points for the US dollar. Because the actual maturities are generally larger than one year, we expect that the true exchange rate risk is much larger. Firms taking an uncovered position are exposed to considerable swings in exchange rates. The uncovered borrowing strategy thus becomes one of "picking up nickels in front of steamrollers" because the mean gains in nominal borrowing gains are swamped by the risk exposure.[8]

Recognizing that there could be frictions in pursuing opportunistic currency denomination of obligations, we reformulate the prior exercise with a comparison of currency conditions for the eight quarters with the greatest currency share with those of the eight quarters with the lowest currency share for each sample currency. In Panel B we report the difference in the mean yield and exchange rate depreciation statistics between the eight quarters with the greatest currency share and the eight quarters with the lowest share. The mean gain to covered borrowing cost between high and low volume quarters is a statistically significant 18.4 basis points. Sizable differences in covered yields are found for many currencies. Differences between covered yields observed in high currency share quarters and those observed in quarters with low currency share are also consistently positive across all sample currencies at 22 (USD), 20 (GBP), 29 (JPY), 12 (DEM), 19 (CHF), and 10 (FRF) basis points. The positive differences are statistically significant for four of the six currencies. The magnitude of these apparent borrowing cost savings provide some evidence that the gains to opportunistically exploiting borrowing opportunities are economically modest but arguably within the bounds of a well-functioning market. Round-trip arbitrageurs would incur substantially greater transaction costs than required of entities that must borrow anyway to fund asset needs (see Deardorff, 1979). Moreover, the extended time requirement is likely to provide an additional deterrent to round-trip

[8]An alternative way of framing the naive policy for currency denomination is to consider a policy of borrowing only in the domestic currency. To examine whether foreign currency borrowing is better than a domestic-only policy, we examine the bond issuance from six countries: US, Japan, Germany, France, Italy, and Canada. The UK and Switzerland are not included because there are no non-domestic currency-denominated bonds from those countries in our data set. Italy and Canada are included because entities from these countries are the most active in foreign currency borrowing (see Table 2). For each of the relative borrowing cost series used in Table 5 we compute the simple average of the series in the home currency. Although the results are not reported, we find, for example, that the yen maintains an average lower uncovered borrowing yield of 295 basis points relative to the other sample currencies, whereas the lire maintains an average higher uncovered borrowing yield of 334 basis points relative to the other sample currencies. We then compute the difference between the weighted average yield realized by the country borrowing across the sample currencies and the simple average domestic yield. The results suggest that in most cases the realized borrowing costs are lower than the those that would have been achieved if restricted to the domestic currency. Notable examples include the two most active countries for foreign currency borrowing: Italy and Canada. A restrictive domestic-only policy would have cost Italian borrowers 81 basis points in covered yield, 396 basis points in uncovered yield, and 62 basis points in currency depreciation in the following year. For Canadian borrowers, the respective figures are 15 basis points in covered yield, 23 basis points in uncovered yield, and 103 basis points in currency depreciation.

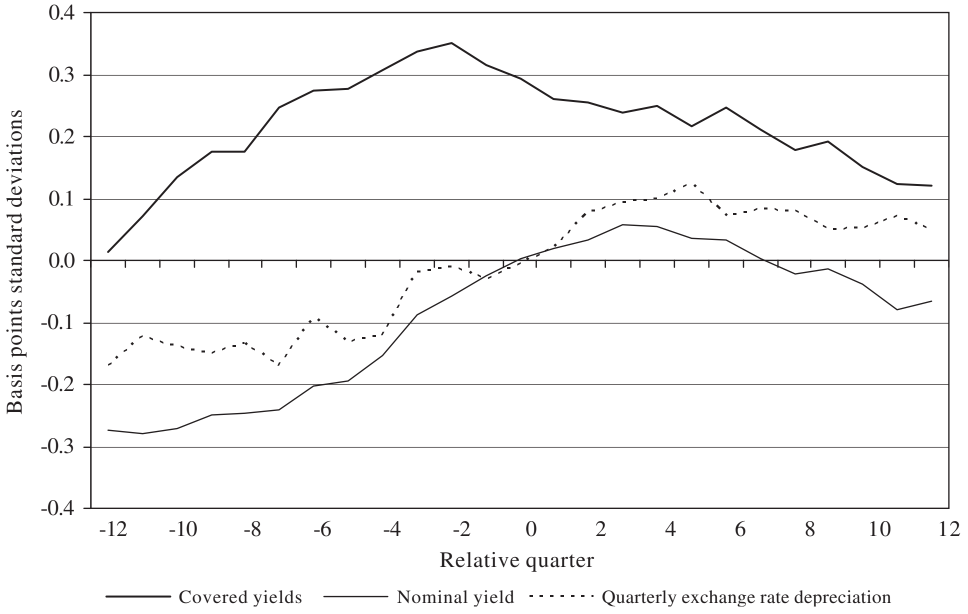

Fig. 3. This figure plots the mean abnormal borrowing cost variables in event time, where quarter = 0 is the quarter of the bond offering. The borrowing cost variables are measured at the beginning of the quarter (exchange rate depreciation is measured over the previous quarter). The borrowing cost measures are transformed by first subtracting contemporaneous cross-currency mean and then standardizing each currency series by subtracting the currency time-series mean and dividing by the currency time-series standard deviation. The values reported are the number of currency standard deviations away from the currency mean rate.

arbitrage. For the nominal yields, high share quarters are associated with nominal yield gains in five of the currencies, with values as large as 58 basis points (JPY) and 54 basis points (FRF). We estimate the overall difference in nominal yields at an insignificant 32 basis points. The subsequent 1-year exchange rate depreciation is consistently greater for high share periods for all currencies. The overall difference in borrowing costs between high volume and low volume periods is extraordinary at 608 basis points. The majority of the exchange rate timing gain is achieved from variation in the most important currencies, the USD and JPY. The mean difference in subsequent exchange rate depreciation is 1,203 basis points for the US dollar and 1,317 basis points for the yen. Clearly, in retrospect the sample borrowers in these currencies appear to have effectively borrowed in these currencies prior to depreciations and avoid these currencies prior to appreciations.

As a final exercise, we examine the time-series characteristics of the interest rate and exchange rate depreciation series in event time. To do this in a meaningful manner, we standardize the relative yield and quarterly depreciation series by subtracting the currency time-series mean and dividing by the currency sample standard deviation. In this way we produce a series that measures the unit deviations from the sample mean. Weighting each standardized series by the lagged, contemporaneous, and leading currency share, we report the three weighted average series in event time. Our primary interest in this test is the identification of event-time patterns that might suggest some aspect of timing or feedback effects in currency parity conditions.

We report our results in Fig. 3. We find that covered yields become increasingly attractive prior to the average bond offering, peaking two to three quarters prior to the bond offering. The attractiveness of the covered yield declines in the quarters following the offering. The peaking of covered yield bargains near the time of the bond offering is consistent with both firm timing ability as well as a notion that borrowing demand eventually eliminates the covered borrowing gains. For nominal yields we find that yields of the chosen currency become increasingly attractive over the two years prior to and the year following the bond offering. Borrowers thus appear to be responding to interest rate movements in favor of the issue currency. But the nominal borrowing gains are thus less than they might have been had the borrower waited an additional year. Finally, we find that the issue currency experiences periods of appreciation prior to the offering and then depreciation after the offering, consistent with the earlier results. If the borrowers in our sample attempt to time exchange rate movements, their foreign currency-denominated bond issues certainly appear to be placed at highly opportune times.

5. Conclusion

We examine the foreign currency-denominated bond issuance of a comprehensive sample of sovereign government and agency borrowers from 1991 to 2003. To do so, we construct a number of relative borrowing cost proxies and use these proxies to explain observed patterns in the currency composition of the bond issues we observe. Overall, we find compelling evidence that the bond issuers in our sample, each of which has no foreign currency-denominated cash flows or foreign operations, opportunistically issue foreign currency-denominated debt in an attempt to lower their borrowing costs. Collectively, they issue a greater share of bonds in those currencies with relatively low nominal interest rates, as well as in those with rates that remain low even after accounting for the cost of hedging foreign currency exposure. We also find evidence that the borrowers in our sample issue a larger share of bonds in currencies that subsequently depreciate, consistent with an attempt to time future exchange rate movements.

In designing our analysis, we set out to answer a simple question about firm behavior. We sought to determine whether or not borrowers issue foreign currency-denominated bonds in an attempt to lower their borrowing costs. The results presented above provide strong evidence that they do. However, they also raise an important question about the nature of international bond market integration. It is often supposed that covered interest parity holds, not only at short horizons but at long horizons as well. Our results suggest that internationally active bond issuers are able to exploit deviations from long-term covered interest parity by issuing bonds in currencies whose bond yields remain low even after hedging currency risk with currency swaps. In conducting this one-way arbitrage, they also appear to drive international bond yields and currency swap rates toward parity. If so, then large scale issuers of international bonds could be the arbitrageurs who effectively link global bond markets. As suggested by Richard Levich, if 5-year USD debt for Coca-Cola is 5.0% and a synthetic version composed of a 5-year yen bond and currency swap costs 4.75%, Coca-Cola will most likely pick the synthetic. It will do so, however, only if it is thirsty for funds. Otherwise Coca-Cola will pass up the opportunity and the 25 basis point arbitrage opportunity could remain unexploited. So, if round-trip arbitrage is prohibitively costly, one-way arbitrage by international bond issuers could result in relatively slow elimination of deviations from covered interest parity. More careful analysis of this proposition, and of the limits of more conventional covered interest arbitrage strategies, seems a fertile area for future research.

Appendix A

Sample entities with large borrowings in foreign currencies (Table A1).

Table A1
the table shows the distribution of entities with largest issuance amount for the 1991–2003 sample of foreign currency-denominated bond offerings.

Entity (home country)	Number of offerings	Total principal amount (billions of dollars)
Italy	83	99.7
Bank Nederlandse Gemeenten (Netherlands)	226	55.4
Sweden	118	45.8
Province of Ontario (Canada)	72	35.5
Turkey	72	33.6
Austria	86	31.3
Landwirtschaftliche Rentenbank (Germany)	138	29.1
Finland	49	28.3
OKB (Austria)	91	25.4
Spain	22	24.9
Canada	41	20.3
Denmark	72	19.7
Province of Quebec (Canada)	54	18.4
Argentina	40	14.1
Belgium	30	13.8
Magyar Nemzeti Bank (Hungary)	47	12.4
Columbia	36	11.7
CADES (France)	30	11.6
Mexico	20	10.9
Instituto de Credito Oficial (Spain)	25	10.8
Greece	24	10.3
Province of British Columbia (Canada)	38	10.1
Portugal	18	9.5
China	18	8.5
Japan Finance Corp Mncpl Entpr (Japan)	34	7.3
South Africa	15	7.0
Fannie Mae (US)	16	6.5
Brazil	11	6.5
Norway	7	5.3
New South Wales Treasury (Australia)	33	5.2
Japan Highway Public Corp (Japan)	12	5.1
Province of Manitoba (Canada)	20	5.0
Poland	11	4.8
Ireland	27	4.7
Asfinag (Austria)	26	4.3
Vienna (Austria)	25	3.7
Landeskreditbank Baden (Germany)	17	3.4
Province of Alberta (Canada)	9	3.0
Uruguay	17	3.0
Treasury Corp of Victoria (Australia)	14	2.7
Canada Mortgage and Housing (Canada)	6	2.6

Appendix B. Abnormal currency share and relative nominal and covered yield spreads

The abnormal currency share is based on the residuals from a regression of a quaterly series of the percentage of total principal amount of foreign currency bonds in a particular currency regressed on an intercept term and a euro introduction indicator variable that equals one for all quarters beyond January 1999 and equals zero otherwise. The abnormal currency share variable is equal to the residual from the regression divided by the predicted value. The nominal and covered yields are equal to the cross-section average yield less the yield (in log basis points) for the respective currency (see Figs. B1–B6).

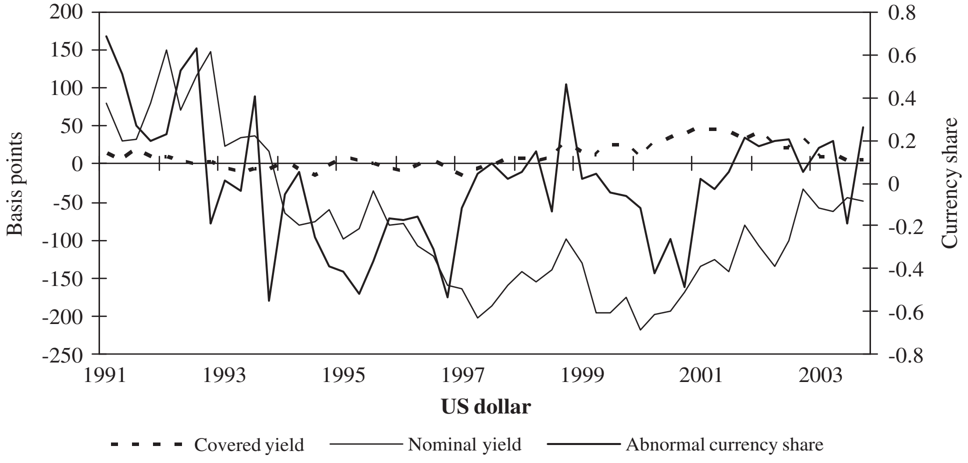

Fig. B1. Panel A

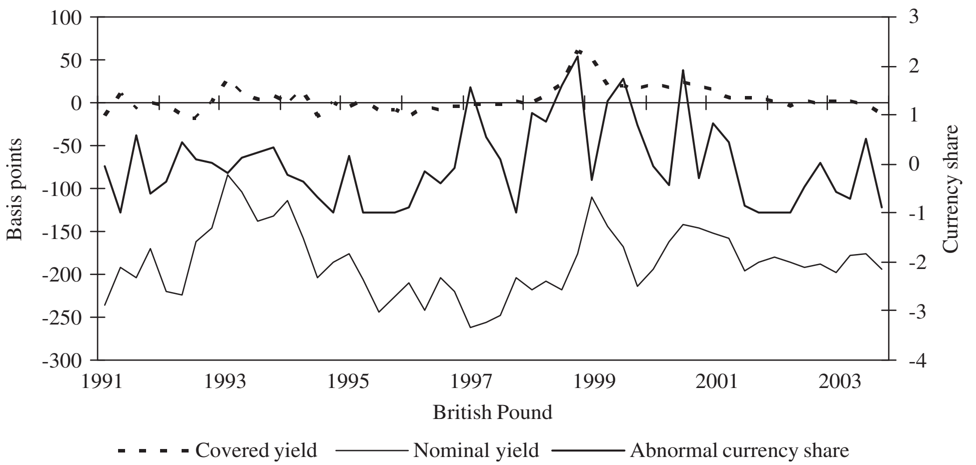

Fig. B2. Panel B

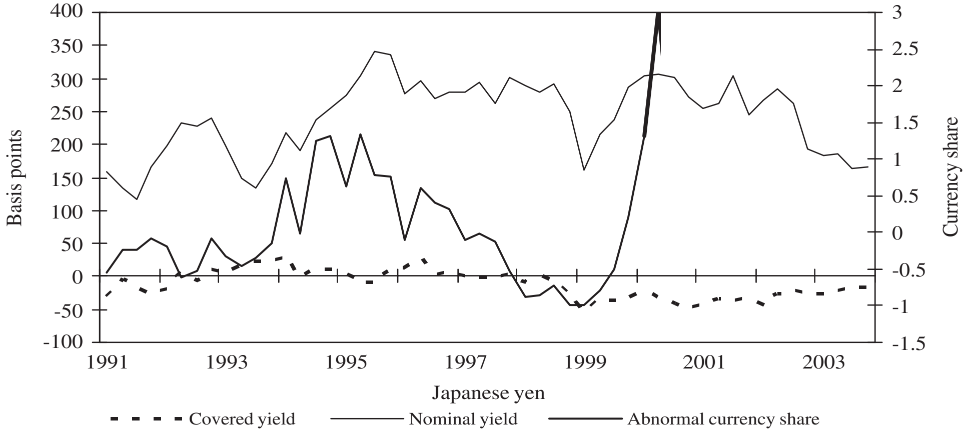

Fig. B3. Panel C

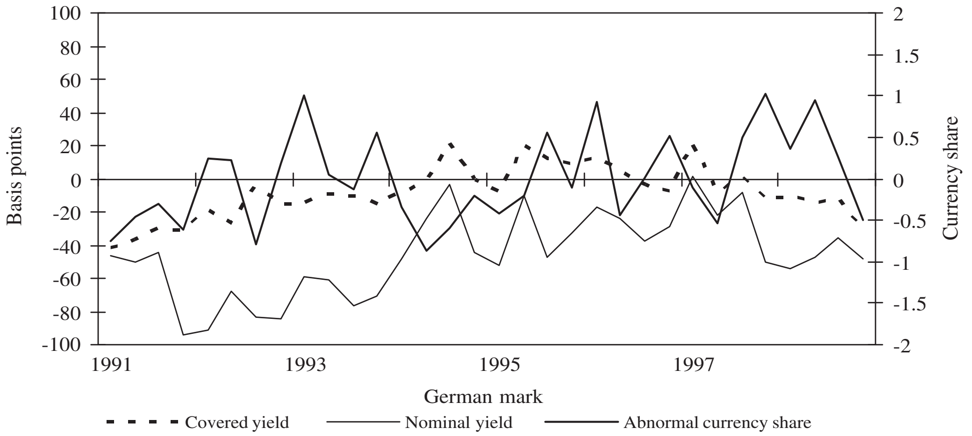

Fig. B4. Panel D

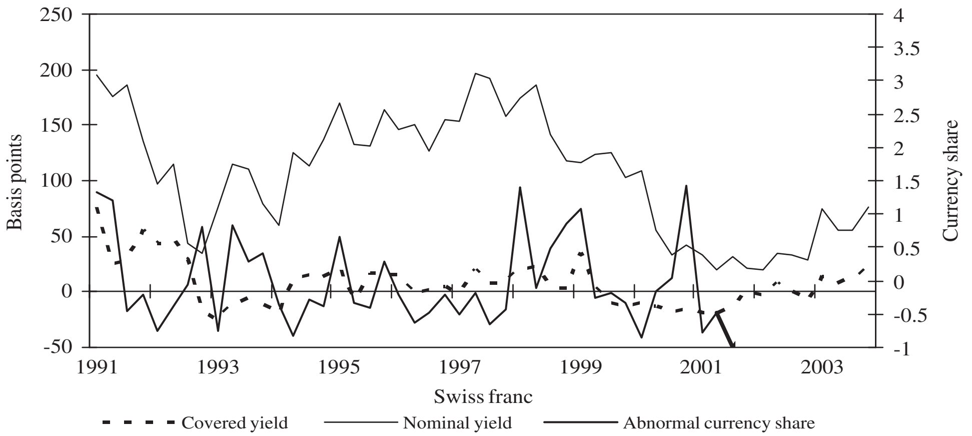

Fig. B5. Panel E

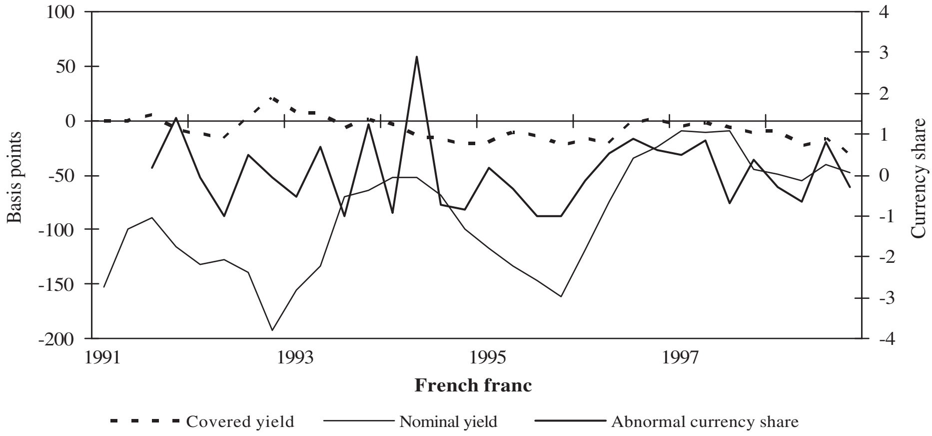

Fig. B6. Panel F

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