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LIQUIDITY AND ISSUE COSTS IN THE EUROBOND MARKET: THE EFFECTS OF MARKET INTEGRATION

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Liquidity and Issue Costs in the Eurobond Market: The Effects of Market Integration*

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Abstract

We investigate and compare the issuance costs of Eurobonds before and after the completion of the Economic and Monetary Union (EMU) in 2002, and find that the introduction of the euro has significantly reduced the issue cost of euro-denominated bonds compared with bonds denominated in the legacy currencies. The reduction in issue cost was not due to a decrease in underwriter compensation, but rather to the elimination of underpricing (the difference between the market price after trading commences and the offering price). Underwriter fee has declined substantially after the EMU, but that decline was offset by an increase in the underwriter spread (the difference between the offering price and the guaranteed price to the issuer), leaving total underwriter compensation unchanged. The EMU is also associated with significant reductions in bond maturity and syndicate size, consistent with its expected effects on liquidity and issue costs in the Eurobond market.

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1. Introduction

For over 40 years the US dollar has been the leading currency used in international debt contracts. On January 1999, a new currency, the euro, was created with the aim of replacing the currencies of twelve European countries. Since January 2002, the euro is also used for daily transactions in the European Union. Although major European currencies such as the German Mark and French Franc have been used internationally in the past, neither currency approached the international use of the US dollar. With the creation of the euro, the dollar has a potential rival for the role of leading international currency. Extant research has examined the role of the euro in real trade and concluded that the euro is likely to become a major international currency and favorably impact real trade flows between European countries.¹ The implications of the new currency for debt markets, however, have not been fully explored.

As euro-denominated bonds substitute bonds denominated in the legacy currencies, the Eurobond market is becoming more liquid and offers lower transaction costs. In the past, debt issuers preferred US dollar-denominated bonds because of their high liquidity and low transaction cost, which increased investor demand. Thus, by improving liquidity and lowering transaction costs for euro-denominated bonds, the Economic and Monetary Union (EMU) in Europe has shifted market share towards debt denominated in euros. It has also expanded the investor base in euro-denominated bonds, eliminated currency risk, and reduced the effort and uncertainty associated with pricing and selling these bonds. All these effects are expected to reduce the issue costs of euro-denominated bonds compared with issues denominated in the legacy currencies.

¹ See, for example, Portes and Ray (1998), Rose and van Wincoop (2001), Frankel and Rose (2002) and Glick and Rose (2002).

In this study, we examine and compare the issue costs of Eurobonds before and after the completion of the EMU in 2002. In particular, we examine three components of issue costs: underwriter fee, underwriter spread (the difference between the offering price and the guaranteed price to the issuer), and underpricing (the difference between the market price after trading commences and the offering price). For the pre-EMU period, we analyze the issue costs of bonds denominated in the US Dollar (USD) and in three of the major currencies that were replaced by the euro: French Franc, Dutch Guilder and German Mark. For the post EMU period, we examine the issuance costs of euro and USD-denominated bonds.

We find that during the pre-EMU period, the issue costs of bonds denominated in the legacy currencies were larger than the issue costs of USD bonds, primarily due to differences in the extent of underpricing. USD bonds were issued in the primary market at prices close to their market values, while legacy currency bonds were issued at a discount. Total underwriter compensation was only slightly larger for the legacy currency bonds than for USD bonds, although the average values of the two components of underwriter compensation (fee and spread) were very different for the two groups. The average underwriter fee was almost twice as large for the legacy currency bonds compared with the USD bonds, but this difference was almost fully offset by an opposite difference in underwriter spread. Underwriters charged larger fees for legacy currency issues than for USD bonds, but guaranteed a considerably higher price than for similar USD issues. Consequently, the difference in total underwriter compensation between the legacy currency issues and USD-denominated bonds was small.

Our analysis of the post EMU period reveals that the differences between the USD and European currency bonds have largely disappeared. In particular, similar to

USD bonds, euro-denominated bonds are not underpriced and have similar characteristics to those of USD-denominated bonds. The only noticeable difference in the issue costs structure of euro and USD denominated bonds is that the underwriter fee is on average smaller for euro-denominated bonds while the spread is larger. This stands in sharp contrast to the pre-EMU structure, where the underwriter fees (spreads) of the legacy currency bonds were considerably larger (smaller) than those of USD bonds. The large reduction in the underwriter fees of euro-denominated issues compared with issues denominated in the legacy currencies has led prior research (e.g., Santos and Tsatsaronis (2003)) to conclude that the EMU resulted in a substantial reduction in issue costs. We reach the same conclusion, but attribute the reduction in issue cost to the elimination of underpricing rather than to a decrease in underwriter compensation.

The rest of the paper proceeds as follows. In the next section, we describe the institutional features of the Eurobond market and briefly survey some recent developments. In Section 3, we discuss potential implications of the EMU for the issue costs of Eurobonds. Section 4 defines the main variables of the analysis, and Section 5 provides descriptive statistics for the pre- and post EMU samples. In section 6 we present the results of regression analyses, and we conclude in Section 7.

2. The Eurobond Market

A Eurobond, or an international bond, is a debt instrument issued simultaneously to investors in a number of countries, outside the jurisdiction of any single country. Originally, the main borrowers in the Eurobond market were international agencies, sovereign governments of developed countries and major banks. After the mid-80's, high quality corporate borrowers also entered the market. In

the mid-90's, corporate borrowers became dominant. Most corporate eurobonds are issued by firms from the financial services sector. Other important corporate participants, on the supply side, are industrial conglomerates, utilities and firms from diverse sectors such as food, chemicals and communication equipments. According to Claes, De Ceuster and Polfliet (2002), the Eurobond market grew rapidly during the 1990's. For example, they report that 1,206 issues with total face value of 169.8 billion USD were sold in the primary market during 1990, compared with 3,716 issues totaling 857.3 billion USD nine years later.

Most of the bonds are issued by entities from highly developed countries such as the USA, UK, Netherlands, Japan, France and Germany, which together account for about 53% of the total nominal value of new issues. International agencies, such as the European Investment Bank and the International Bank for Reconstruction and Development, collectively issue around 9% of the total value. The remaining 38% are issued by firms and government units from other countries.²

In general, the credit quality of Eurobonds is very high, as most Eurobonds are rated in the AAA to A range. Only about 5% of the issues receive BBB ratings at the time of issue, and few issues are ranked BB or below. During the 1980's, bonds with initial maturity between five and ten years accounted for more than 50% of the total face value, while issues with maturities between one-to-five years (over ten years) constituted about 15% (35%). In the 1990's, the five-to-ten years category has declines to about 40%, and the one-to-five years category has increased to 30%. Eurobonds are

² The statistics in this section were extracted primarily from Claes, De Ceuster and Polfliet (2002), who provide a detailed analysis of the primary market for Eurobonds based on information about 33,024 publicly issued Eurobonds during the period 1980-2000.

primarily fixed coupon bonds (71%). The remaining bonds are floating rate notes (20%), zero coupon bonds (5%), or convertible bonds (4%).

Fixed coupon Eurobonds are purchased from the issuer by syndicates of investment banks that are formed specially for underwriting purposes on a case-by-case basis.³ The lead bank (the “arranger” or “book-runner”) draws up the agreement and collects a management fee, which is shared with other syndicate members.⁴ The members purchase the issue according to an agreed sharing formula at the underwritten price. At the issue date, they resell it to their customers at a potentially different price. The participation fees are usually allocated in similar proportions. The lead bank negotiates conditions with the borrower and prepares the necessary bond issue documentation, including a “term-sheet” or “information memorandum” about the issue that is circulated to potential syndicate participants.⁵

As noted by Melnik and Plaut (1996), Eurobonds markets are characterized by a “flat” syndicate structure. Usually there is one arranging (lead) bank. Occasionally, there are two or three co-arrangers for issues that are particularly large or complex. The other members are “regular” members or “managers.” Any bank may operate in

³ It should be noted that international bonds are often issued in combination with domestic issues. In such cases, the lead bank may head two syndicates, or there may be two or more lead underwriters in order to cover the two tranches. The National Association of Securities Dealers (NASD) requires a uniform pricing. That is, the offering price should be the same to all investors regardless of nationalities. Similarly, the international tranche (regardless of the country of origin of the issuer) cannot price discriminate between international investors.

⁴ According to Claes, De Ceuster and Polfliet (2002), 17% of all Eurobonds are placed by a single bank and the rest are taken up by syndicates. Over 90% of syndicated issues are coordinated by a single leading bank. For particularly large issues (often exceeding one billion USD), two or three banks may share the book-running duties.

⁵ The “term-sheet” contains a short description of the borrower and an outline of the issue (coupon, maturity, suggested yield, fees, etc.). It also contains summaries of relevant financial information, plans for the use of proceeds, and agreements to be signed.

some syndicates as an “arranger” (leader) and in others as a regular member. Since the mid 1990, the number of syndicate members who participate on a regular basis is about two hundreds, although this number has slightly declined in recent years.

The lead bank serves as an agent for both the client and the other syndicate members. It handles the clearing arrangements regarding the collection and distribution of the periodic interest payments and principal redemption. The arranging bank usually underwrites a significant amount of the issue. Other members of the syndicate receive the residual allocation. When the syndication terms are agreed, each member has an obligation to pay for his allotment. Each can then market his share of the issue either to “book registered” customers or to the market. Formally, all risks are assigned to syndicate members in proportion to their share of the issue. According to Melnik and Plaut (1996), riskier bond issues are dealt with by increasing the number of underwriters (each receives a smaller allocation in such a case). Syndicate members carry a standard underwriting risk. If they cannot sell the entire issue, they have to carry parts of it in their own books until the entire allocation is sold, possibly at lower prices. The credit risks associated with bond holdings are borne, of course, by the end investors that hold them in their portfolios.

The secondary market for Eurobonds operates through standard clearing systems that produce low costs transaction execution and product delivery. The underwriters, which are mostly international financial institutions, typically hold limited amounts of the bonds that they acquire. Most are placed with smaller banks and many non-bank investors, such as insurance companies, mutual funds, pension funds, corporations and wealthy individuals. For these investors, international bonds offer an alternative to domestic bonds and a substitute for bank certificates of deposit.

3. Expected Effects of the EMU on Bond Issue Costs

The EMU is expected to reduce the issue costs of European currency bonds for the following reasons.⁶ First, if the currency risk of the original constituent currencies was priced in the market (as argued by Dumas and Solnik (1995), Allayannis and Ihrig (2001) and De Santis and Gerard (1998)), then the elimination of this risk by the creation of a uniform currency should lead to a lower cost of capital. The EMU also improves risk-sharing opportunities, which may further contribute to the reduction in the cost of capital (Bekaert and Harvey (1995)).⁷ Indeed, using a multi-period APT model, Sentana (2002) finds that the European integration of the 1990's reduced the cost of capital for European firms. The reduction in the cost of capital is expected to lower the issue cost of Eurobonds, because both underpricing and underwriter compensation typically increase in the bonds' risk.⁸

Second, the adoption of the euro may have reduced the degree of "home bias," which influenced European investors before the integration. Home bias, or the preference of investors for financial assets with familiar characteristics, is an important factor influencing investment decisions (see Lewis (1999) for a review). In the context of the pre-EMU European financial markets, home bias was augmented by restrictive

⁶ Smith and Walter (2000) and Santillan, Bayle and Thygesen (2000) discuss the expected impact of the euro on the money and bond markets.

⁷ Investment bankers often cite the reduction in price variability in the secondary market as a reason for preferring global issues over domestic offers. Price variability is driven by systematic as well as unsystematic risk. Selling debt securities to foreign investors could make them less sensitive to domestic systematic risk. On the other hand, it may increase the issuer's exposure to foreign market shocks (e.g. large changes in foreign interest rates).

⁸ The uncertainty associated with the market value of bonds increases in their risk. High uncertainty implies greater effort in estimating the value of the bonds and higher underwriting risk, both leading to larger underwriter compensation. High uncertainty also implies greater probability of insufficient demand, which could induce underwriters to underprice the issue.

regulations. Before the creation of the EMU, most European pension funds were constrained by regulators to invest no more than 20% of their funds in foreign currency denominated assets. With the introduction of the euro, such restrictions were practically abolished. The reduction in the degree of home bias has expanded the investor base for European currency bonds, and is therefore expected to reduce underwriter compensation and underpricing.⁹

Third, the integration of financial markets in Europe is likely to attract non-European investors to the new euro-denominated assets. As the euro substitutes the legacy European currencies, European financial markets have become more liquid and offer lower transaction costs for investors. These trends have increased the demand for euro-denominated bonds and consequently reduced the effort and risk associated with selling these bonds.¹⁰ The reduction in effort and risk is expected to lead to lower underwriter compensation and underpricing.

Fourth, before the introduction of the euro, issuers in foreign markets had to select a syndicate with sales expertise in the currency of that country. Thus, underwriting syndicates often included local banks to enhance the marketability of bonds denominated in European currencies, which may have increased the issuance costs. The introduction of the euro reduced the reliance on local expertise and therefore may have reduced the issue cost of euro-denominated bonds.

⁹ According to Hartmann, Maddaloni and Manganelli (2003), the introduction of the euro has created a more homogeneous market and as a result expanded the demand for euro denominated bonds.

¹⁰ The importance of broad and liquid secondary market is discussed in Johnson (1994) and Kool (2000). According to McCauley (1997) and Hartman (1998), the preference of issuers for USD denominated bonds in the pre-EMU era was due to the lower transaction cost and greater liquidity of these instruments.

Fifth, by creating a uniform currency, the EMU allows issuers to consolidate issues that otherwise would have been denominated in different currencies. To the extent that economies of scale exist in the underwriting industry (Altinkilic and Hansen (2000)), this effect should lead to lower issue costs.

Consistent with these hypothesized effects, Santos and Tsatsaronis (2003) find that the introduction of the euro currency caused a significant reduction in bond underwriting fees. We examine two additional components of issue costs: underwriter spread (the difference between the offering price and the guaranteed price to the issuer), and underpricing (the difference between the market price and the offering price) and, as discussed below, find interesting interactions among the three cost components. We next discuss the measurement of cost components and issue characteristics.

4. Variables Measurement

In the process of issuing bonds, there are three prices that merit attention. First, the syndicate guarantees a given price to the issuer. This guaranteed price (P_G) represents the gross proceeds to the issuer (i.e., before deducting the fee). The second price, which is determined by the syndicate several days later, is the offering price (P_O). At this price the underwriters are usually able to sell the entire issue. The third price is the market price after trading commences (P_M). Using these three prices and the underwriter fee (FEE), we calculate the total issue cost and its components, as discussed below.¹¹

¹¹ The issuer has to bear some additional indirect costs such as accounting, legal and printing, which we do not consider due to data unavailability.

Measured relative to the market value of the bonds, the total cost to the issuer (i.e., the percentage of the bonds' value that the issuer loses) is

$$\begin{aligned} \text{COST} &= \frac{\text{FEE} + P_M - P_G}{P_M} = \frac{\text{FEE}}{P_M} + \frac{P_M - P_O}{P_M} + \frac{P_O - P_G}{P_M} \\ &= \text{RFEE} + \text{UNDERPR} + \text{SPREAD} . \end{aligned}$$

RFEE denotes the relative fee. UNDERPR represents the implicit cost associated with underpricing; that is, the loss to the underwriter (and indirectly to the issuer) that results when the underwriter sells the bonds below their market value. SPREAD reflects the difference between the offer price to the public and the amount the underwriter passes on to the issuer, and therefore represents an indirect payment to the underwriter. Unlike the fee, however, the spread may be negative. Total underwriter compensation (COMP) is

$$\text{COMP} = \frac{\text{FEE}}{P_M} + \frac{P_O - P_G}{P_M} = \text{RFEE} + \text{SPREAD} .$$

In addition to the price and fee information, we obtain data on the issue size (AMOUNT, measured as the total nominal face value and expressed in millions of USD), years to maturity (MATUR), the credit rating of the issue, and the number of syndicate members (UNDERWR).¹² Using the credit rating information, we construct a credit quality indicator (DQ), which takes value between one (lowest quality) and five (highest quality).¹³

¹² We obtained very similar results to those reported below when measuring AMOUNT, MATUR and UNDERWR in logarithm form.

¹³ The corporate bonds rating are by S&P and Moody's (in the few cases where the ratings were not identical, we follow Jewell and Livingston (1998) and average them). The top rank is assigned to AAA or Aaa (DQ = 5). The second group includes the group of AA+ and AA or Aa1 and Aa2 (DQ = 4). The third group includes the rating AA- and A+ or Aa3 and A1 (DQ = 3). The fourth rank includes the group of A and A- or A2 and A3 (DQ = 2). The final group covers the BBB range or the corresponding

5. Sample Characteristics and Descriptive Statistics

5.1 Before the EMU

We begin our investigation by comparing the issue costs of dollar denominated bonds with those of bonds denominated in three of the main legacy currencies that became part of the euro: German Marks (GM), French Francs (FF) and Dutch Guilders (DG). These currencies are the three most important constituents of the European Currency Union (by weight) other than the British Pound.¹⁴ Our sample covers the period from September 1996 to October 1997. This period preceded the market integration process mandated by the Maastricht Treaty, and it ends a year before the weights for the new currency were fixed in September 1998. During this period, a relative stability existed in the secondary market, as bond yields generally declined for all currencies.

In order to increase homogeneity and facilitate cross-currency comparisons, we focus on fixed-coupon bonds. We sample 316 issues, which represent approximately

Baa (DQ = 1). In a similar way we rank sovereign debt, most of which is issued by governments of stable western countries. Government of countries such as France, Germany, UK, USA and a handful of others routinely receive the highest rank by all rating firms. In our sample, the sovereign debt of such countries receives the top rank (DQ = 5). Debt issues of other countries are assigned rankings of 4, 3, and 2 depending on the relevant group. The ranking is based on the average score assigned by three rating organizations, which generally view “country risk” as being composed of three primary components: political risk, economic risk and financial risk. A lucid explanation of how sovereign risk ranking is constructed is contained in Erb, Harvey and Viscanta (1996). All the results reported in the next section are insensitive to the use of individual dummy variables for the different ratings instead of the multinomial DQ variable.

¹⁴ The designated weights of the European Currency Union basket were 31.9% for the German Mark, 20.3% for the French Franc, 12.5% for the British Pound, and 9.9% for the Dutch Guilder. Since the British Pound was not merged into the new currency, we do not analyze the cost of pound-denominated bonds.

20% of all the relevant issues during the sample period.¹⁵ The currency denominations of these bonds are: 201 USD, 68 DM, 23 FF, and 24 DG. All issues were internationally underwritten and placed by syndicates whose members are primarily large international financial institutions. **Table 1** presents summary statistics by currency denomination for the issue costs variables (total cost, underpricing, total underwriter compensation, underwriter fee, and underwriter spread) and issue characteristics (maturity, amount, number of underwriters, and credit rating). For each variable, we report the mean, median and standard deviation. For the DG, GM and FF bonds, we also report for each variable the t-statistic associated with the difference between the mean value of the variable for that currency and the value for the USD bonds ($t(\Delta)$).

The average issue costs of USD bonds are only about 0.32% of the bonds' market value. For the GM and FF bonds, the costs are 0.56% on average, significantly larger than for USD bonds. For the DG bonds, the issue costs are 0.42%, slightly (and insignificantly) larger than for USD bonds.¹⁶ The average issue costs across all the legacy currency bonds is 0.53%, which is about 66% larger than the average issue cost for USD bonds (t-statistic for the difference is 2.92). This difference between the issue costs of the legacy currency bonds and the USD bonds is due primarily to underpricing: The USD bonds were sold in the primary market at a price close to their

¹⁵ The data set was provided by a major investment bank out of the list of "participation offers."

¹⁶ These figures may be compared with domestic costs of large debt floatation. For example, Lee, Lochhead, Ritter and Zhao (1996) report that the cost of selling large issues of straight bonds is 0.64%. The larger scale and high credit quality in the international bond market may explain the smaller issue costs in our sample. Evidence on the effects of scale and credit rating on the issue costs is provided by many studies, including Livingston and Miller (2000), Smith and Walter (2000), Altinkilic and Hansen (2000), Cantor and Packer (1995) and Livingston, Pratt and Mann (1995).

market value (the mean value of UNDERPR is for USD bonds -0.02%), while the legacy currency bonds were sold at a statistically significant discount, which ranged from 0.11% (GM bonds) to 0.16% (DG bonds). The differences in total underwriter compensation (COMP) between the USD and legacy currency bonds are insignificant.

Interestingly, the average values of the components of total underwriter compensation for the USD and legacy currency bonds are very different. The mean fees for the legacy currency bonds are considerably larger than for the USD issues, while the spreads are smaller by a similar magnitude. Consequently, the differences in total underwriter compensation between the USD and legacy currency bonds are substantially smaller than the corresponding differences in underwriter fee. For both groups of bonds, however, the mean fee is large while the spread is negative (that is, the price guaranteed to the issuer is set above the expected market value). We return to this issue below.

The mean size of the USD denominated issues is 345 million dollars, which is larger than the mean size of GM (316 million) and DG bonds (244 millions), but is similar to the size of FF bonds (344 million). When considering all legacy currency bonds as one group, the difference in issue size relative to the USD bonds is insignificant (t-statistic of -1.23). USD issues have average maturity of less than five years, while the legacy currency bonds have average maturities ranging between seven and ten years. The differences in maturity relative to the USD bonds are all highly significant. In addition, for each of the three legacy currencies, the number of underwriters is larger than for the USD bonds. The difference in the number of underwriters relative to the USD bonds is insignificant for the DG and GM bonds, but is significant for the FF bonds as well as for the overall sample of legacy currency bonds (t-statistic of 2.11). The statistically significant differences in maturity and

number of underwriters between the USD and legacy currency bonds suggest that prior to the EMU it was indeed more difficult to issue European currency bonds than USD bonds. A larger number of underwriters was required to place legacy currency bonds compared with USD bonds, and issuers of legacy currency bonds preferred to sell long-term bonds to reduce the need to access the market frequently.

5.2 After the EMU

The post EMU sample includes 198 observations: 83 issues of USD denominated bonds, and 115 of euro denominated issues.¹⁷ **Table 2** provides descriptive statistics for the variables. Total issue costs of both USD and euro-denominated bonds are 0.43% on average. For the USD bonds, this figure represents an increase relative to the pre-EMU period, while for the European currency bonds it represents a decline. Unlike the legacy currency bonds in the pre-EMU period, the euro-denominated bonds are not underpriced, which is the primary reason for the decline in the issue costs of these bonds. Total underwriter compensation for the European currency bonds has not changed substantially; it was 0.40% prior to the EMU (average across all legacy currency bonds), and it is 0.38% after the EMU. For the USD bonds, total underwriter compensation has increased by an insignificant amount of 0.06% to 0.40%. Thus, in both periods, total underwriter compensation is similar for the USD and European currency bonds. The composition of compensation, however, is quite different. In the post EMU period, the underwriter fee for euro-

¹⁷ The sample centers on the first ten months of 2002. During 2002, there were 664 straight fixed rate dollar denominated issues with maturity for more than 2 years, and 642 similar issues denominated in euro. We sample 114 USD issues and 125 euro issues, representing 17.2% and 19.5% of the population, respectively. 31 USD denominated issues and 10 euro bonds were deleted due to missing costs, credit rating or syndicate data. The final sample includes 83 USD-denominated bonds and 115 euro-denominated bonds.

denominated bonds is substantially larger and the spread is smaller than for USD bonds, while the converse was true in the pre-EMU period.

Consistent with the evidence in Santos and Tsatsaronis (2003), we find that the introduction of the euro resulted in a considerable decline in underwriter fees for euro-denominated bonds. However, this decline was offset by a corresponding increase in the underwriter spread. In contrast to Santos and Tsatsaronis (2003), therefore, our results do not indicate that the EMU led to a sizeable decline in total underwriter compensation. Issue costs have indeed declined, but this was due to the elimination of underpricing rather than to a reduction in underwriter compensation. Evidently, the euro-denominated bond market is more efficient than the market for bonds denominated in the legacy currencies, and underwriters offer newly issued bonds at a price that is close to the expected market price.

Turning to the issue characteristics, we find that any differences in characteristics between the USD and euro-denominated bonds in the post EMU period are insignificant. In particular, the average issue size, maturity, credit quality and number of underwriters are all similar for the USD and euro-denominated bonds. In the pre-EMU period, the European currency bonds had substantially longer maturity and larger number of underwriters. Thus, the EMU appears to have mitigated the factors causing differences in the preferred characteristics of USD and European currency denominated issues. The changes in the characteristics of European currency bonds (shorter maturity, smaller number of underwriters) are consistent with the expected effects of the EMU (larger investor-base, higher liquidity, and lower issue cost).

6. Regression Analysis

The differences in issue costs between the USD and European currency bonds documented in the previous section could be due to differences in issue characteristics. To examine this possibility, we next conduct a regression analysis that allows us to control for differences in characteristics. **Table 3** presents the results of regressing the components of issue costs on a qualitative variable that indicates whether the issue is denominated in a European currency ($\text{NON\$} = 1$) or not ($\text{NON\$} = 0$) and three issue characteristics: time to maturity, amount, and credit quality. Panel A (Panel B) presents the results for the pre- (post) EMU period. The dependent variables are total issue cost (COST), underpricing (UNDERPR), total underwriter compensation (COMP), underwriter fee (RFEE), and underwriter spread (SPREAD). As discussed in more detail below, the regression results are generally consistent with the findings from the univariate analysis (in Section 5), indicating the differences in issue costs between the European and USD-denominated bonds can not be attributed to differences in issue characteristics.

For the pre-EMU period (Panel A), the total issue cost of legacy currency bonds was 0.168% larger than for USD bonds with similar characteristics, as measured by the coefficient on $\text{NON\$}$. Given that the mean issue costs of USD bonds in the pre-EMU period was 0.32%, the incremental cost associated with issuing bonds denominated in European currencies was clearly substantial. The results of the underpricing regression indicate that this issue cost differential is due primarily to underpricing. The coefficient on $\text{NON\$}$ in the underpricing regression is positive and significant, and its magnitude is only slightly smaller than in the total cost regression. The third regression indicates that total underwriter compensation (COMP) was insignificantly related to currency denomination. In contrast, the two compensation

components are strongly related to currency denominations. Compared with USD bonds, the fee for legacy currency bonds is considerably larger and the spread is smaller, even after controlling for issue characteristics. We return to this issue below.

The results for the post EMU period (Panel B) indicate that the issue costs of USD and euro-denominated bonds are generally similar, as the NON\$ indicator variable is insignificant in the total issue cost, underpricing, and total compensation regressions. The compensation component regressions, however, reveal that underwriter fee (spread) is smaller (larger) for euro-denominated issues compared with similar USD-denominated bonds. This result stands in sharp contrast to the pre-EMU period, when the fee for legacy currency bonds was substantially larger than for USD bonds and the spread was smaller.

Melnik and Nissim (2003) document a strong trade-off between the underwriter fee and spread in the issue cost structure of USD-denominated Eurobonds. They further show that this fee-spread structure is due to income tax minimization by issuers and to “strategic” behavior by underwriters.¹⁸ To examine whether this trade-off also holds for European currency bonds, we re-run the spread regression including underwriter fee as an additional explanatory variable. To the extent that underwrites or issuers have preferences for a particular form of underwriter compensation, the fee, which is determined before the spread, may help to predict the spread.

¹⁸ Borrowers may postpone tax payments by minimizing spreads and increasing fees. They may therefore offer to pay higher up-front fees (which are tax-deductible faster than the spread) in return for a significant reduction in spreads. Underwriters may agree with this structure because their tax obligations are not sensitive to the combination. In addition to the tax motivation of issuers, the trade-off between the fee and spread may be due to a two tier-pricing mechanism that underwriter use to separate borrowers according to their expected total amount of borrowing. Melnik and Nissim (2003) provide evidence consistent with both hypotheses.

Table 4 presents the regression results. In both periods, the coefficient on the fee is negative and highly significant, suggesting that underwriters set the fee and the guaranteed price (which determines the spread) strategically, so that one component compensates for the other. In the previous section, we have shown that during the pre-EMU period the average fee was large while the average spread was negative, but after the EMU the average spread was larger (less negative) both for the USD and euro-denominated bonds. The evidence in Table 4 suggests that while the trade-off between the fee and the spread is no longer reflected in the average values of these variables, in the cross-section (i.e., in terms of the correlation between the variables), it holds almost as strong as it did in the pre-EMU period.

We next re-run the regressions using all observations (from both periods) and including qualitative variables to capture the average effects of (1) the change in time period (POST), (2) denomination in legacy currency (PRENON\$), and (3) denomination in euro (POSTNON\$). The regression results are reported in **Table 5**. As shown, total issue costs are larger for bonds denominated in legacy currencies (PRENON\$), increase with maturity, decline with credit quality, and are insignificantly related to the time period (POST), issue denomination after the EMU (POSTNON\$) and issue amount.

The next two regressions confirm that the incremental issue cost associated with denomination in legacy currency is due to underpricing, and that total underwriter compensation is insignificantly related to issue denomination, both before and after the EMU. The fee and spread regressions reveal a substantial reduction in the average fees between the two subperiods (the coefficient on POST is negative and highly significant in the fee regression), which was offset by a similar increase in the spread. There was no significant change in total underwriter compensation between the two periods.

Bonds denominated in the legacy currencies had particularly large fees and small spreads, but the converse is true for euro-denominated bonds. All of these findings are consistent with the results of the previous analyses, demonstrating the robustness of the findings with respect to alternative test specifications.

To the extent that the market for the European currency bonds in the pre-EMU period was smaller and less liquid than the market for USD-denominated bonds, underwriters were likely to form larger syndicates when selling European currency bonds compared with USD-denominated bonds. In addition, if the arrival of the euro increased the liquidity of the European currency bonds and broaden their investment base, the number of underwriters per issue should decline. To examine these hypotheses, we regress the number of underwriters on the qualitative variables described above (POST, PRENON\$, and POSTNON\$), as well as the issue characteristics.

Table 6 presents the results. As expected, the number of underwriters is positively related to the issue amount and issue maturity (which is a proxy for interest rate risk), and negatively related to credit quality (high quality bonds are easier to sell). The coefficient on POST indicates that there was a large decline in the number of underwriters per issue for all currencies, and in particular for euro-denominated bonds (the difference between the coefficients on PRENON\$ and POSTNON\$ is positive and significant). The overall decline in the number of underwriters is consistent with the strong consolidation trend in this industry during the late 1990s and the beginning of the millennium.¹⁹ The incremental reduction in the number of underwriters for euro-

¹⁹ During the five-year period from 1997 to 2001 there were close to fifty major mergers in the industry. Some of the most visible mergers were Morgan Stanley with Dean Witter, Bankers Trust with Deutsche Bank, SBC Warburg with UBS, PaineWebber with UBS, Robertson Stephens with Bank of America, Bank of America

denominated bonds is consistent with the positive effects of the EMU on the market for euro-denominated bonds.

7. Summary and Conclusions

This study investigates and compares the issuance costs of Eurobonds denominated in USD and European currencies before and after the completion of the EMU in 2002. We find that the introduction of the euro has significantly reduced the issue cost of euro-denominated bonds compared with bonds denominated in the legacy currencies. The reduction in issue cost was not due to lower underwriter compensation, but rather to the elimination of underpricing. After the EMU, there was a substantial reduction in the underwriter fee of euro-denominated bonds and a similar increase in the underwriter spread. The net effect on underwriter compensation was insignificant. The strong trade-off between the fee and the spread, which has been documented for USD-denominated bonds in the pre-EMU period, existed for bonds denominated in the legacy currencies as well, and continues to exist after the EMU both for USD and euro-denominated bonds. However, the average spread is now substantially less negative and the average fee is smaller.

The EMU has also changed the characteristics of euro-denominated issues, particularly maturity and syndicate size. These changes are consistent with the expected effects of the EMU on the liquidity, investor base and transactions costs of euro-denominated bonds.

with NationsBank, BankBoston with Fleet Financial Group, Oppenheimer with CIBC Wood Gundy, Salomon with Smith Barney, Schroders with SSB Holdings, BZW with ABN-AMRO Holding, Donaldson Lufkin & Jenrette with CSFB, and JP Morgan with Chase Manhattan Corp.

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Table 1
Descriptive Statistics for the Pre-EMU Sample

	US Dollar, N = 201			Dutch Guilder, N = 24				German Mark, N = 68				French Frank, N = 23			
	Mean	Med	StD	Mean	Med	StD	t(Δ)	Mean	Med	StD	t(Δ)	Mean	Med	StD	t(Δ)
COST	0.32	0.29	0.57	0.42	0.41	0.59	0.79	0.56	0.36	0.71	2.53	0.56	0.57	0.48	2.23
UNDERPR	-0.02	0.01	0.34	0.16	0.19	0.39	2.16	0.11	-0.02	0.58	1.75	0.15	0.12	0.43	1.83
COMP	0.34	0.25	0.44	0.26	0.25	0.51	-0.74	0.44	0.33	0.50	1.47	0.41	0.35	0.29	1.03
RFEE	1.03	1.00	0.50	1.67	1.88	0.47	6.26	1.98	2.07	0.66	10.86	1.67	1.88	0.65	4.57
SPREAD	-0.69	-0.62	0.62	-1.41	-1.58	0.51	-6.38	-1.54	-1.75	0.70	-8.90	-1.26	-1.55	0.72	-3.65
MATUR	4.83	4.00	3.51	7.88	8.00	3.18	4.39	7.31	6.00	4.20	4.38	9.22	10.00	3.01	6.51
AMOUNT	345	250	306	244	168	166	-2.51	316	199	284	-0.71	344	291	178	-0.02
UNDERWR*	25.1	22.0	11.7	26.1	22.5	12.9	0.32	27.8	28.0	11.6	1.54	32.5	34.0	11.3	2.56
DQ	3.58	4.00	0.89	3.71	4.00	0.69	0.84	3.57	4.00	1.03	-0.07	3.61	4.00	0.84	0.16

Med is the median, StD is the standard deviation, and t(Δ) is the t-statistic associated with the difference in the mean value of the variable between the European currency bonds and the USD bonds. The issue costs are measured relative to the market value of the issue after trading commences, and are expressed in percentage points. COST is total issue costs. RFEE is the underwriter fee. SPREAD is the indirect component of the underwriter compensation, that is, the difference between the offering price and the price guaranteed to the issuer. COMP is the sum of RFEE and SPREAD. UNDERPR is underpricing, that is, the difference between the market price and the offering price by the underwriter. MATUR is the number of years to maturity on the issue date. AMOUNT is the amount issued in millions of U.S. dollars (for non-USD issues, amount is multiplied by the exchange rate on the date of issue). UNDERWR is the number of underwriters. DQ is a debt quality measure that receives values between 1 and 5, where 5 is the highest grade and 1 is the lowest grade.

* The number of observations for UNDERWR is 168, 18, 60 and 17, respectively.

Table 2
Descriptive Statistics for the Post EMU Sample

	U.S. Dollar (N = 83)			Euro (N = 115)			t(Δ)
	Mean	Med	StD	Mean	Med	StD	
COST	0.43	0.26	0.54	0.43	0.33	0.48	0.00
UNDERPR	0.03	-0.01	0.20	0.04	0.00	0.34	0.26
COMP	0.40	0.26	0.45	0.38	0.32	0.35	-0.34
RFEE	0.67	0.35	0.68	0.43	0.33	0.41	-2.86
SPREAD	-0.27	-0.01	0.61	-0.05	0.00	0.51	2.68
MATUR	6.00	5.00	2.54	6.37	5.00	3.65	0.84
AMOUNT	687	500	750	600	440	655	-0.85
UNDERWR	13.4	12.0	6.9	12.1	11.0	5.7	-1.48
DQ	3.52	4.00	1.16	3.40	3.00	0.93	-0.78

Med is the median, StD is the standard deviation, and $t(\Delta)$ is the t-statistic associated with the difference in the mean value of the variable between the European currency bonds and the USD bonds. The issue costs are measured relative to the market value of the issue after trading commences, and are expressed in percentage points. COST is total issue costs. RFEE is the underwriter fee. SPREAD is the indirect component of the underwriter compensation, that is, the difference between the offering price and the price guaranteed to the issuer. COMP is the sum of RFEE and SPREAD. UNDERPR is underpricing, that is, the difference between the market price and the offering price by the underwriter. MATUR is the number of years to maturity on the issue date. AMOUNT is the amount issued in millions of U.S. dollars (for non-USD issues, amount is multiplied by the exchange rate on the date of issue). UNDERWR is the number of underwriters. DQ is a debt quality measure that receives values between 1 and 5, where 5 is the highest grade and 1 is the lowest grade.

Table 3
Regressions Examining the Determinants of Issue Costs By Sub-periods

Panel A: Pre-EMU							
Dep. Var.	Intercept	NON\$	MATUR	AMOUNT	DQ	R ²	N
COST	0.545	0.168	0.017	0.160	-0.101	0.071	316
	3.811	2.067	1.367	1.339	-2.829		
UNDERPR	-0.059	0.139	0.005	0.086	-0.005	0.039	316
	-0.540	2.470	0.547	0.786	-0.185		
COMP	0.604	0.029	0.012	0.074	-0.096	0.054	316
	5.413	0.479	1.387	1.033	-3.417		
RFEE	1.964	0.822	0.003	-0.109	-0.254	0.459	316
	13.766	12.457	0.309	-0.839	-6.939		
SPREAD	-1.361	-0.794	0.009	0.183	0.158	0.302	316
	-8.122	-9.479	0.771	1.245	3.736		

Panel B: Post EMU							
Dep. Var.	Intercept	NON\$	MATUR	AMOUNT	DQ	R ²	N
COST	0.912	-0.022	0.002	-0.054	-0.130	0.089	198
	3.609	-0.311	0.164	-1.958	-2.581		
UNDERPR	-0.013	0.014	0.004	-0.020	0.007	0.005	198
	-0.166	0.374	0.537	-1.292	0.428		
COMP	0.924	-0.036	-0.002	-0.034	-0.138	0.147	198
	4.622	-0.662	-0.338	-1.516	-3.409		
RFEE	1.086	-0.253	-0.014	-0.118	-0.070	0.102	198
	5.188	-3.103	-1.622	-2.736	-1.517		
SPREAD	-0.162	0.217	0.012	0.084	-0.068	0.062	198
	-1.250	2.704	1.422	2.137	-2.018		

Heteroscedasticity consistent (White, 1980) t-statistics are reported below the coefficient estimates. The issue costs are measured relative to the market value of the issue after trading commences, and are expressed in percentage points. COST is total issue costs. RFEE is the underwriter fee. SPREAD is the indirect component of the underwriter compensation, that is, the difference between the offering price and the price guaranteed to the issuer. COMP is the sum of RFEE and SPREAD. UNDERPR is underpricing, that is, the difference between the market price and the offering price by the underwriter. NON\$ is a qualitative variable that equals one for issues denominated in a European currency (that is, a legacy currency for the pre-EMU period, or the euro for the post EMU period). MATUR is the number of years to maturity on the issue date. AMOUNT is the amount issued in billions of US dollars (for non-USD issues, amount is multiplied by the exchange rate on the date of issue). DQ is a debt quality measure that receives values between 1 and 5, where 5 is the highest grade and 1 is the lowest grade.

Table 4
Regressions Examining the Trade-off between Underwriter Fee and Spread
The Dependent Variable in Each Regression is the Underwriter Spread
(SPREAD)

Panel A: Pre-EMU								
Sample	Intercept	NON\$	MATUR	AMOUNT	DQ	RFEE	R ²	N
USD	0.094		0.039	-0.043	-0.012	-0.886	0.555	201
	0.608		5.808	-0.608	-0.374	-12.054		
legacy	0.765		-0.016	0.023	-0.130	-0.880	0.589	115
	2.717		-1.386	0.183	-2.433	-11.690		
Both	0.359	-0.074	0.011	0.088	-0.064	-0.875	0.656	316
	2.777	-0.944	1.347	1.199	-2.192	-16.804		

Panel A: Post EMU								
Sample	Intercept	NON\$	MATUR	AMOUNT	DQ	RFEE	R ²	N
USD	0.828		-0.002	0.026	-0.174	-0.737	0.684	83
	4.299		-0.139	0.759	-3.652	-6.636		
euro	0.602		0.003	-0.033	-0.069	-0.951	0.566	115
	5.014		0.388	-0.924	-2.277	-12.196		
Both	0.717	0.012	0.000	-0.011	-0.124	-0.809	0.620	198
	5.985	0.285	0.049	-0.510	-3.975	-8.971		

Heteroscedasticity consistent (White, 1980) t-statistics are reported below the coefficient estimates. The issue costs are measured relative to the market value of the issue after trading commences, and are expressed in percentage points. RFEE is the underwriter fee. SPREAD (the dependent variable) is the indirect component of the underwriter compensation, that is, the difference between the offering price and the price guaranteed to the issuer. NON\$ is a qualitative variable that equals one for issues denominated in a European currency (that is, a legacy currency for the pre-EMU period, or the euro for the post EMU period). MATUR is the number of years to maturity on the issue date. AMOUNT is the amount issued in billions of US dollars (for non-USD issues, amount is multiplied by the exchange rate on the date of issue). DQ is a debt quality measure that receives values between 1 and 5, where 5 is the highest grade and 1 is the lowest grade.

Table 5
Regressions Comparing Issue Costs Before and After the EMU

Dep. Var.	Intercept	POST	PRENON\$	POSTNON\$	MATUR	AMOUNT	DQ	RFEE	R ²	N
COST	0.656	0.086	0.163	-0.022	0.016	-0.012	-0.115		0.068	514
	5.167	1.219	2.208	-0.306	2.102	-0.402	-3.792			
UNDERPR	-0.054	0.039	0.131	0.014	0.007	0.003	-0.001		0.028	514
	-0.711	1.079	2.484	0.369	1.128	0.142	-0.046			
COMP	0.709	0.047	0.032	-0.036	0.010	-0.015	-0.114		0.076	514
	7.236	0.846	0.571	-0.658	1.609	-0.609	-4.751			
RFEE	1.704	-0.336	0.846	-0.264	-0.005	-0.071	-0.174		0.517	514
	15.202	-4.006	13.632	-3.187	-0.937	-1.805	-6.035			
SPREAD	-0.994	0.383	-0.814	0.228	0.015	0.055	0.060		0.418	514
	-8.663	4.575	-10.728	2.744	2.200	1.411	2.084			
SPREAD	0.465	0.095	-0.089	0.002	0.010	-0.005	-0.089	-0.857	0.735	514
	5.506	1.598	-1.268	0.036	1.818	-0.223	-4.364	-18.342		

Heteroscedasticity consistent (White, 1980) t-statistics are reported below the coefficient estimates. The issue costs are measured relative to the market value of the issue after trading commences, and are expressed in percentage points. COST is total issue costs. RFEE is the underwriter fee. SPREAD is the indirect component of the underwriter compensation, that is, the difference between the offering price and the price guaranteed to the issuer. COMP is the sum of RFEE and SPREAD. UNDERPR is underpricing, that is, the difference between the market price and the offering price by the underwriter. POST is a qualitative variable that equals one for issues from the post-EMU period. PRENON\$ is a qualitative variable that equals one for issues denominated in a legacy currency. POSTNON\$ is a qualitative variable that equals one for euro-denominated issues. MATUR is the number of years to maturity on the issue date. AMOUNT is the amount issued in billions of US dollars (for non-USD issues, amount is multiplied by the exchange rate on the date of issue). DQ is a debt quality measure that receives values between 1 and 5, where 5 is the highest grade and 1 is the lowest grade.

Table 6
Regressions Examining the Determinants of Syndicate Size

Sample	Intercept	POST	PRENON\$	POSTNON\$	MATUR	AMOUNT	DQ	R ²	N
Pre-EMU	18.015		4.095		0.145	22.674	-0.544	0.372	259
	8.538		2.917		0.705	6.320	-0.906		
Post EMU	9.443			-0.930	0.224	6.629	-0.549	0.538	198
	7.222			-1.511	2.226	7.914	-1.707		
Both Periods	21.850	-15.247	2.436	-0.801	0.485	9.479	-0.744	0.530	457
	14.356	-15.749	1.703	-1.178	3.269	7.070	-2.098		

The dependent variable is the number of underwriters (UNDERWR). Heteroscedasticity consistent (White, 1980) t-statistics are reported below the coefficient estimates. POST is a qualitative variable that equals one for issues from the post-EMU period. PRENON\$ is a qualitative variable that equals one for issues denominated in a legacy currency. POSTNON\$ is a qualitative variable that equals one for euro-denominated issues. MATUR is the number of years to maturity on the issue date. AMOUNT is the amount issued in billions of U.S. dollars (for non-USD issues, amount is multiplied by the exchange rate on the date of issue). DQ is a debt quality measure that receives values between 1 and 5, where 5 is the highest grade and 1 is the lowest grade.