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EURO AREA CORPORATE DEBT SECURITIES MARKET: FIRST EMPIRICAL EVIDENCE

BY GABE DE BONDT

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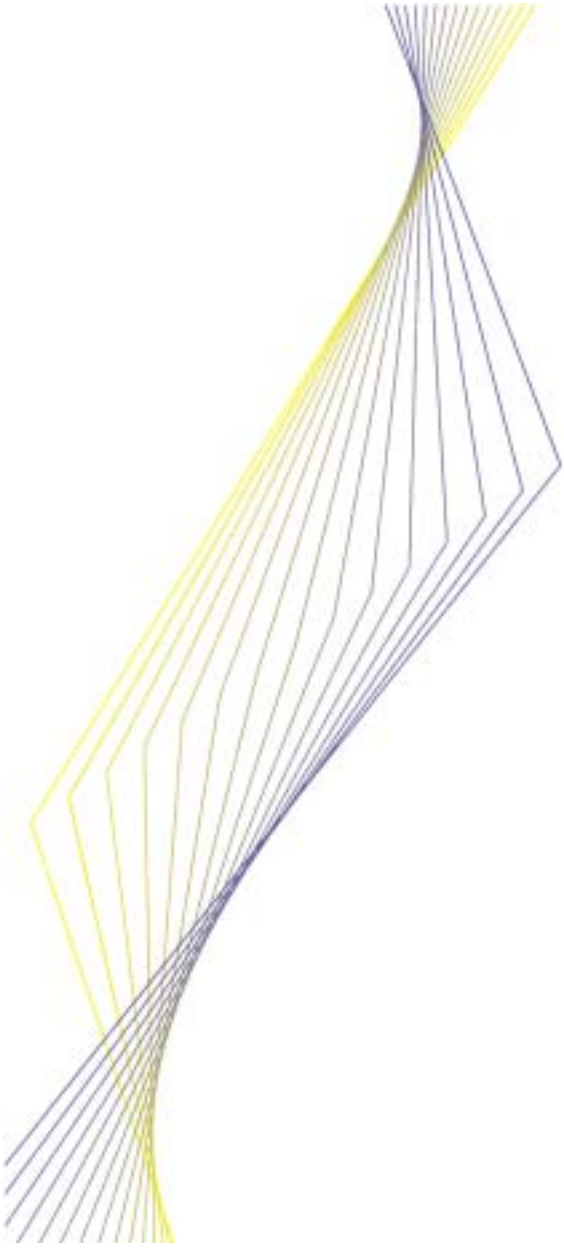

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BY GABE DE BONDT*

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Abstract

A striking development in the euro area financial markets since 1999 was the rapid growth of the corporate debt securities market. This paper offers a first empirical examination of this market since the introduction of the euro using macroeconomic data. It is shown that corporate debt issuance is positively correlated with mergers and acquisitions and with industrial production, taken as a proxy of investment expenditures or working capital. Substitution with other sources of finance is shown to be related to cost differentials. The timing and size of these explanatory factors of corporate debt securities issuance differ across maturity. The empirical findings also show that corporate bond spreads lag short-term interest rates and lead real economic activity. All this suggests that the euro area corporate bond market, though still young, is informative for monetary policy and may develop into a significant link in the euro area monetary policy transmission process.

Keywords: corporate debt securities issuance; corporate bond spreads; euro area

JEL classification: G32; E44

Non-technical summary

A striking development in the euro area financial markets since 1999 was the rapid growth of the corporate debt securities market. A well-developed corporate debt securities market is thought to encourage economic development, to be a potential information source of future real economic activity and of current credit conditions in the economy. This paper offers a first empirical examination of the euro area corporate debt securities market since the introduction of the euro using macroeconomic data. The focus is twofold by examining both quantities as well as prices. The main message is that since the single currency the euro area corporate debt securities market, though still young, is informative for monetary policy and may develop into a significant link in the euro area monetary policy transmission process.

The paper reviews three theoretical frameworks to model corporate debt securities issuance, since no single satisfactory comprehensive theory exists. The first approach is to model simultaneously all corporate financial liabilities in a portfolio modelling framework. The second framework models the supply of and demand for corporate debt securities simultaneously. The third modelling approach is the specification of a supply function of corporate debt securities and is followed in this study due to data limitations. Two main explanatory factors are considered in this framework, namely financing needs and substitution between debt securities and other sources of corporate finance.

The literature on the determinants and leading indicator properties of corporate bond spreads is also reviewed. A wide array of macroeconomic determinants of corporate bond spreads is examined in the literature and in this paper: business cycle conditions, the difference between government and corporate bond issuance, inflation, short-term interest rate, yield curve, bond and stock market volatility and stock prices. In turn, corporate bond spreads have potentially macroeconomic information content for real economic activity.

Three conclusions emerge from the empirical analysis which is based on a sample period starting in January 1999 and robust across different econometric specifications and methods.

The first conclusion is that since the single currency the debt securities market is tapped by non-financial corporations to fund mergers and acquisitions (M&A) and investment or working capital financing needs as reflected in industrial production. M&A reflect financing needs due to corporate restructuring, which in turn is, at least partially, triggered by the introduction of the euro. Conducting business in a common currency across the euro area may have widened the market perspective of euro area corporations from their domestic markets to an euro area perspective, thus encouraging corporations to reach a sufficient scale through M&A to operate on a euro area scale. It is found that M&A are notably reflected in short-term securities issuance activity in the same month and with a lag of one quarter and in long-term securities after three quarters. A one-to-one relation between corporate debt securities issuance and industrial production is found. For short-term debt securities the "income elasticity" is, however, found to be significantly larger than one.

Secondly, the estimations are supportive of substitution between debt securities and other sources of corporate finance through financing cost differentials and of direct, that is unrelated to price differentials, substitution between debt security financing and bank and internal financing. The spread between long

and short-term interest rates is a relevant factor for the mix between long and short-term debt securities. The direct substitution effects are found to be in particular strong for short-term debt securities issuance.

The third and final conclusion relates to the determinants and leading indicator properties of corporate bond spreads. Granger causality tests suggest that movements in corporate leverage, the gross issues of corporate vis-à-vis government bonds, the corporate debt-GDP ratio, stock prices, inflation and short-term interest rates precede those in corporate bond spreads. In turn, corporate bond spreads lead movements in industrial confidence and to a lesser extent growth in real GDP and industrial production. Regression results show that various macroeconomic factors, in line with the Granger causality results, explain corporate bond spread movements and that corporate bond spreads have predictive power for real output growth. These findings are supported by an impulse response analysis, that is corporate bond spreads adjust to changes in short-term interest rates and lead real GDP growth.

These empirical findings suggest that the broadening and deepening of the euro area corporate debt securities market since the single currency has opened up a viable alternative avenue of finance for corporations. This could have important implications for monetary policy since a broad, deep and liquid euro area corporate bond market may be tapped for finance when corporate profits are under pressure or when banks cut back on lending following a tightening of monetary policy. Other monetary policy implications are that changes in monetary policy seems to be reflected in the debt security financing costs of the corporate sector and that corporate bond spreads may be capturing the general degree of concern in the economy about credit risk.

1. Introduction

The relationship between financial structures and the real economy has been of interest to economists for long and has gained prominence in the research agenda over the last decade (King and Levine, 1993, Rajan and Zingales, 1998, Stulz, 2000, Wurgler, 2000, and Rosseau and Sylla, 2001). An important finding of this literature is that a causal link exists between financial development and economic growth. One of the predominant features of a well-developed financial system is the existence of a robust corporate debt securities market working alongside a sound banking system (Marqués, 2002). Furthermore, the development of a corporate debt securities market is closely linked, and often follows, the development of an equity market. As most of the costs of going public in bond and equity markets in terms of accounting requirements, legal and other fixed costs, are similar, the development of each of these markets encourages the development of the other. The link between the corporate debt securities market and economic growth notably operates through three channels.

First, a growing importance of debt security financing is beneficial to the stability of corporate financing. It should reduce volatility in the supply of overall credit to the private sector by providing an external source of finance in addition to conventional bank-based financing. This feature of multiple avenues of intermediation and corporate finance would be particularly useful, for instance in the event of credit rationing by the banking sector (Davis, 2001).

Secondly, debt security financing can encourage a swifter reallocation of funds from cash rich but economically declining corporate sectors to fast-growing sectors with urgent need of funds. Financing decisions are usually dependent on previous relationships as is the case with bank loans. Consequently, a well-developed financial sector in which there is a deep and liquid market for corporate bonds should facilitate both innovative new business and the transition of small firms into large enterprises (Rajan and Zingales, 1998).

Thirdly, debt security financing potentially improves corporate governance and the market for corporate control, as compared with bank-based financing. Decisions on the the provision and pricing of credit are no longer limited to a small number of bank loan officers granting loans at discrete points in time. On the contrary, the provision and pricing of credit takes place on a continuous basis by the interplay of market forces while the quality of credit is monitored continuously by a large number of economic agents. In turn, this creates a market-induced process in which investors and corporations have a collective interest in promoting greater accounting transparency, the development of respected rating agencies, as well as a more efficient market for corporate reorganisation and liquidation.

Developments in the corporate debt securities market are also of interest to monetary policy authorities. This interest arises from the link between this segment of the financial market and real economic activity, which is part of the monetary policy transmission process, and from the potential information source this market may play for future inflation and output and for current credit conditions in the economy (Davis and Fagan, 1997, Gertler and Lown, 1999, and Stock and Watson, 2001).

As regards the euro area corporate debt securities market, its development seems to be related to the introduction of the euro and various other factors. Debt securities amounted to almost 3% of total corporate liabilities in the euro area at the end of 1999, compared with around 10% in the United States and Japan (ECB, 2001d). However, at the end of 2001 debt securities amounted to 7% of total liabilities of euro area non-financial corporations (ECB, 2002). Underlying this was an average annual growth rate of the amount outstanding of euro-denominated debt securities issued by euro area non-financial corporations by around 20% in the first three years of the single currency.

The introduction of the euro represented a turning point for the euro area financial markets and functioned as a catalyst in the movement towards more integrated financial markets (ECB, 2000a, Santillán et al., 2000, and Galati and Tsatsaronis, 2001). The euro offered the opportunity to erode the national segmentation of financial markets by transforming national financial markets into a deep and liquid euro area-wide market. From a demand perspective, the possibilities to diversify risk across euro area government bond markets decreased further, while currency diversification-related opportunities to achieve higher rates of return for a given level of portfolio risk ceased to exist. Investors began to have an euro area-wide outlook and started investing in euro-denominated corporate debt securities, which offered an extra yield over government bonds. This extra yield was particularly appealing to investors, including pension funds, used to invest in fixed income government bonds which had traditionally offered a high nominal rate of return in many euro area countries. When non-financial corporations were trying to tap the debt securities market in the euro area, nationality-linked considerations started to give way to considerations concerning the sector and credit characteristics of the issuer. From a supply perspective, issuers started to have an euro area-wide perspective and benefited from easier access to the larger (institutional) investor base, in particular the ability to issue in size.

The increase in corporate bond issuance since the introduction of the euro is the result of the confluence of many factors, not all of them directly related to the catalysing influence of the single currency. One of the most important factors has been the ongoing process of corporate restructuring in the euro area, which has resulted in strong demand for M&A-related funds by non-financial corporations. For instance, telecommunications companies seeking to finance their UMTS licenses and growth in the wake of the privatisation of state-owned companies and the liberalisation of national markets.

Against this background, this study empirically analyses for the first time the euro area corporate debt securities since the introduction of the euro using macroeconomic data. The focus is on two interrelated issues with respect to the broadening and deepening of the euro area corporate debt securities market since the single currency, one relates to the quantities and the other to the prices observed in this market.

The first issue is whether the strong growth of the euro area corporate debt securities market can be explained by macroeconomic factors or remains unexplained and therefore could be attributed to the introduction of the euro. The empirical findings, based on a short sample starting in January 1999 but fairly robust across different econometric specifications and methods, suggest that the broadening and deepening of the corporate debt securities market in the euro area can be explained by macroeconomic factors and is not necessarily directly related to the one-off launch of the euro. It is found that corporate debt securities issuance is heavily used to finance M&A, reflecting corporate restructuring which in turn is, at least partially, triggered by the introduction of the euro. Corporate debt securities issuance also

reacts to business cycle conditions, reflecting investment or working capital financing needs. Another significant explanation of corporate debt securities issuance is the substitution between debt securities and other sources of corporate finance, both indirectly through financing cost differentials as well as directly by targeting an optimal mix between debt securities and other sources of corporate finance.

The second issue addresses whether price developments at the corporate debt securities market contain useful macroeconomic information content and whether corporate bond spreads are driven by macroeconomic factors. Again, a close examination of this issue provides insight into how broad and deep the corporate bond market in the euro area actually is. The empirical results are supportive of a broad and deep euro area corporate bond market that helps enhance the macroeconomic information content of the prices observed in this market. It is found that corporate bond spreads lead real output growth. This empirical relationship may be capturing the general degree of concern in the economy about credit risk. Furthermore, the different empirical methods show that corporate bond spreads adjust, among other factors, to changes in short-term interest rates. This suggests that monetary policy in the euro area plays an important role in the determination of the debt security financing costs in the corporate sector.

The outline of this paper is as follows. Section 2 provides a theoretical background by reviewing the literature on corporate debt securities from a macroeconomic perspective. The focus is on both the quantity and price of corporate debt securities. Section 3 deals with data issues and describes the key euro area data used in the empirical analysis of corporate debt securities issuance and corporate bond spreads in Section 4. Section 5 summarises the main conclusions of this study. Annex 1 provides a detailed description of the data and Annex 2 of the estimation results for the supply of corporate debt securities.

2. Theoretical background based on literature review

This section provides a theoretical background by reviewing the literature on corporate debt securities. It is by no means meant to be exhaustive, in particular studies using firm-level data are underexposed because of the macroeconomic point of view. Section 2.1 provides some general findings extracted from the corporate finance literature. Section 2.2 describes three theoretical frameworks to model corporate debt securities issuance taking account of the main findings of the corporate finance literature. Section 2.3 focuses on the (relative) price of debt securities by looking what the literature on corporate bond spreads tells us.

2.1 What does the corporate finance literature tell us?

According to the corporate finance literature, firms' capital structure is only relevant for real investment decisions if debt securities and other sources of corporate finance are imperfect substitutes. In other words, the irrelevance theorem of Modigliani and Miller (1958) is relaxed. Debt securities are one of the many financing sources in the toolbox of corporate finance, which comprises both internal and external finance. Besides debt securities, external financing sources are loans granted by financial intermediaries, trade credit and equity. Another dimension, neglected in this paper, is that firms face a choice between

domestic and international (offshore) financing. As regards the latter, euromarkets may play an important role (Davis and Mayer, 1991).

Broadly speaking, determinants of corporate finance are analysed using three methods.[1] First, survey studies conduct large or small-scale interview studies among non-financial corporations. Secondly, studies analyse the choice between issuing debt and equity or other aspects of firms' financing choice such as maturity, priority and debt placement structure. These cross-section studies analyse the relationship between certain firm-specific characteristics of a sample of individual firms and their capital structure. The third body of the corporate finance literature examines the relationship between the capital structure of firms and macroeconomic developments. Several elements from these types of studies are particularly of interest.

The static trade-off theory of capital structure contends that there is an optimal capital structure reflecting tax distortions and capital market imperfections. Traditionally an optimal debt-equity mix is modelled, but firms may also target an optimal mix between debt securities and other sources of corporate finance. Elements of interest from models based on the existence of asymmetric information are the pecking order in corporate finance and the signalling function of debt securities issuance. The pecking order theory contends that firms have a preference to internal finance, followed by low-risk debt and by equity in the last resort. Signalling models emphasise that a firm's choice to issue debt securities instead of demanding a bank loan may signal to outside investors the information of insiders, for instance a negative signal of a firm's probability of default. Agency models and models based on strategic interactions between firms and their competitors, customers and suppliers show that reputation, and strategic and corporate control considerations may also play a role in the determination of the capital structure.

2.2 How to model corporate debt securities issuance?

As yet there exists no satisfactory comprehensive theory of modelling corporate debt securities at the macro level. A key issue in modelling sources of corporate finance and thus debt securities is how many sources of corporate finance are simultaneously modelled. Broadly speaking, three different approaches of theoretically modelling corporate debt securities issuance are distinguished (see Table 1). First, a general equilibrium or portfolio balance framework models jointly the determination of all corporate liabilities by a simultaneous system of equations.[2] The second approach is a two-equation structural framework, which model jointly the supply of and demand for corporate debt securities. The third approach is one reduced form equation reflecting debt securities supply.

{Table 1}

[1] For an overview of the theory of capital structure see, among many others, De Haan (1997) and De Bondt (1998).

[2] Another a-theoretical way of modelling debt securities in a system of equations is within a VAR-type framework. Using flow of funds data of the United States, Christiano et al. (1996) show that after a contractionary monetary policy shock net funds raised by non-financial corporations rises for two to four quarters, after which it begins to decline. Virtually all of the response in liabilities reflect changes in the short-term liabilities of the corporate sector, concentrated in large firms.

2.2.1 General equilibrium and portfolio modelling

General equilibrium models are models with a strong theoretical foundation and are well equipped to simultaneously model all levels of corporate finance. Empirical application of this type of models requires, however, high-quality data and may result in implausible empirical results if some model assumptions are more restrictive than a priori expected (see Column 2 in Table 1). For instance, Benninga and Talmor (1988) develop a general equilibrium framework to analyse crowding out and in effects. Hughes and Nagurney (1992) design a network decomposition algorithm with the goal to estimate a data set that matches as close as possible the Federal Reserve Board flow of funds data. Their general equilibrium model captures the accounting identities which must hold and permits the estimation of sector holdings of both assets and liabilities as well as the amount outstanding of financial instruments, tangible assets and net worth.

Dynamic portfolio balance models in line with Brainard and Tobin (1968) have obtained a prominent place in the literature on the demand for financial asset holdings (investor perspective),[3] but have less commonly been applied to the supply of corporate financial liabilities (firm perspective). Choice-theoretic or portfolio models typically relate the supply of and/or demand for financial assets to relative prices (yields), among other variables. The own rate of return, i.e. the cost of debt securities, together with the cross rates of return, i.e. the costs of other sources of corporate finance, capture substitution effects. Accounting restrictions, such as aggregating to balance sheet total, also play an important role in portfolio models, just as in general equilibrium models. Notwithstanding the elegant theoretical structure of these models, the empirical results are generally not wholly satisfying. This may be due to statistical, specification and estimation problems such as multicollinearity of rate of returns, omitted explanatory variables, simplifying modelling assumptions, aggregation problems, a poor modelling of the error process and neglect of the simultaneity in the system.

One of originators of testing empirically the relevance of relative yields for the supply of debt securities is Friedman (1979 and 1985). One of Friedman's findings is that there is little ground for drawing any conclusion at all about even the sign of the substitutability of short-term debt and equity. In contrast, his findings indicate that long-term debt and equity are indeed substitutes although the estimates of the associated substitution elasticity are typically very small. Roley (1982) finds for the United States some degree of substitution between different maturities of government securities, corporate bonds, and equities. Johnson's (1988) empirical findings are consistent with imperfect substitutability between Canadian and American dollar-denominated corporate bonds.

[3] For instance, see De Bondt et al. (1997) for an application to several euro area countries of private sector's demand for financial assets, including M3, private sector holdings of government bonds, other domestic capital market investments and foreign assets.

2.2.2 Debt securities supply and demand in a two-equation structural framework

As far as known no study exists which models debt securities from a macroeconomic perspective in a solid two-equation framework. Friedman and Kuttner (1993) examine explicitly the supply of (issuer side) and demand for (investor side) commercial paper, but each equation is estimated separately. Following an eclectic approach based on the earlier mentioned theories several factors determine the supply of and demand for debt securities. Determinants of debt securities supply, DS^S, are i) the financing cost of debt securities, r_{DS}, ii) the cost of other financing sources, r_{OF}, iii) the total financing needs, TF, iv) other corporate financing sources, OF, to capture direct substitution effects and v) other supply factors, OS. Explanatory factors of debt securities demand, DS^D, are i) the yield on debt securities, r_{DS}, ii) the rate of return on other corporate financing sources, r_{OF}, iii) the yield on other financial assets, r_{OS}, and iv) other demand factors, OD. Against this background, the debt securities supply and demand functions read as follows. The expected signs are above the corresponding variables and of course supply equals demand.

$$(1) \quad DS^S = f\left(\overset{-}{r_{DS}}, \overset{+}{r_{OF}}, \overset{+}{TF}, \overset{-}{OF}, \overset{?}{OS}\right) \quad \text{supply function}$$

$$(2) \quad DS^D = g\left(\overset{+}{r_{DS}}, \overset{-}{r_{OF}}, \overset{-}{r_{OA}}, \overset{?}{OD}\right) \quad \text{demand function}$$

$$(3) \quad DS^S = DS^D$$

A difficulty in the joint estimation of a corporate debt securities supply and demand function is the well-known identification problem (see Column 3 in Table 1). The solution to the notoriously difficult identification problem is to have an adequate set of explanatory variables or instruments to identify supply and demand, that is supply factors which are completely independent of the demand for debt securities and vice versa.

2.2.3 Debt securities supply in a reduced form framework

A reduced form supply function of debt securities is formulated here along the line of commonly applied loan demand studies which ignore supply effects (Calza, Gartner and Sousa, 2001), i.e. assuming a perfectly elastic demand for debt securities at the prevailing own interest rate r_{DS}.[4] Assuming that the infinite elasticity assumption is correct, the reasons for this are given in Section 4.4.1, equation (2) and (3) in the two-equation modelling framework may be disregarded, resulting in a model specification which equals equation (1).

$$(1') \quad DS = f'\left(\overset{-}{r_{DS}}, \overset{+}{r_{OF}}, \overset{+}{TF}, \overset{-}{OF}, \overset{?}{OS}\right) \quad \text{supply function}$$

[4] There are, however, studies that model both the demand for and supply of credit (Kakes, 2000).

A potential difficulty of this partial equilibrium or reduced form supply function is the interpretation of the estimation results. Ambiguities on the sign of some explanatory factors may arise, because observable data reflect per se both supply and demand (see Column 4 in Table 1).

Recent studies estimating quasi-reduced form equations of corporate debt securities are Davis (2001) and Davis and Ioannidis (2002).

Davis (2001) explains the change in real corporate debt securities net issuance in the United States, Canada, the United Kingdom and Japan by financial demand and cost variables: real investment, the ratio between borrowing and investment, the investment-GDP ratio, the short-term interest rate, the credit spread, share prices, and the term spread. Only one explanatory factor, that is the financing-investment ratio, appears for all countries with the same sign. The main finding of this study is that corporate debt securities issuance compared with bank loans is more sensitive to cost elements and less sensitive to the business cycle. Consequently, an economy highly dependent on bank financing would show more cyclically volatile funding of firms than will be possible with debt securities markets alongside the banking system.

Davis and Ioannidis (2002) provide a similar empirical analysis based on quarterly flow-of-funds data for the United States over 1979-1999. This study focuses on whether debt securities and bank loans are substitutes (Bolton and Freixas, 2000) or complements (Holmstrom and Tirole, 1997). In contrast to Davis (2001), a positive relation is found between debt security financing and bank financing. Corporate debt securities issuance is significantly explained by bank loans, the difference between the Treasury bill rate and the prime rate (liquidity spread), the spread between the yield on 10-year BAA corporate and government bonds (credit quality spread), the stock market index return, and the cyclical fluctuations of corporate investment. For the latter a significant negative relationship with debt securities issuance is found, albeit a priori a positive one is expected.

2.3 What does the literature on corporate bond spreads tell us?

Not only debt securities issuance activity, but also the price of debt securities should be examined to improve the insights in the corporate debt securities market. The literature on the price of debt securities examines notably the determinants and leading indicator properties of corporate bond spreads, mostly defined as the spread between the yields on corporate and government bonds with comparable maturities. Albeit the focus is on corporate bond spreads, in principle the same ideas apply for commercial paper spreads.

2.3.1 Determinants of corporate bond spreads

Broadly speaking, corporate bond spreads can be broken down into three main components: i) market price of credit risk, ii) credit risk uncertainty premium, and iii) liquidity premium.[5] The first two

[5] Another component is a tax premium (Elton et al., 2001).

components depend on a number of factors. The market price of credit risk may increase when the economic outlook deteriorates but credit demand remains strong or when firms become more highly leveraged. The credit risk uncertainty premium may increase when the volatility of earnings increases. The liquidity premium is likely to fall with the development of corporate bond market. However, on occasions, for example under a "flight to quality", investors may still suddenly and abruptly reorient their portfolios towards the safest and most liquid securities.

Empirical studies reveal that determinants of corporate bond yield spreads are the business cycle, inflation, short-term interest rate, yield curve, interest rate volatility, equity market risk, the difference between treasury and corporate bond issuance and liquidity considerations, approximated by amounts outstanding (Dialynas and Edington, 1992, Athanassakos and Carayannopoulos, 2001, Elton et al., 2001, and Hattori et al., 2001). The option pricing theory literature is especially useful in showing the non-linear dependence of corporate bond spreads to these variables (Merton, 1974). In contrast, other authors argue that the corporate bond market is a segmented market driven by corporate bond specific supply or demand factors and not by macro-economic and financial variables as predicted by theory (Collin-Dufresne et al., 1999) or that aggregate United States high-yield spreads are driven by firm-specific events (Cooper et al., 2001).

2.3.2 Leading indicator properties of corporate bond spreads

Like other financial data, corporate bond spreads are determined in forward-looking markets and are available at a higher frequency than standard macroeconomic variables and are therefore potential useful indicators for future inflation and output growth. These features have generated a substantial literature assessing the information content of corporate bond spreads (Davis and Fagan, 1997, Stock and Watson, 2001, and Chan-Lau and Ivaschenko, 2001). Most studies examine investment-grade bonds. For instance, Chan-Lau and Ivaschenko (2001) argue that prices of investment-grade bonds reflect economic fundamentals better than the prices of below-investment-grade bonds. However, Gertler and Lown (1999) argue that high-yield spreads contain more useful information. They show that the high-yield spread has significant explanatory power for the United States business cycle since the middle of the 1980s and outperforms other financial leading indicators, including the paper-bill spread (Friedman and Kuttner, 1993a and 1993b, and Kashyap et al., 1993), term spread and federal funds rate. The information content of (high-yield) corporate bond spreads could be symptomatic of financial factors at work in the business cycle. This is also suggested by the fact that in periods where the terms of credit are tightened in the United States, as indicated by Senior Loan Officer Opinion Surveys, are associated with upward movements in the high-yield spread (Duca, 1999, and Gerter and Lown, 1999).

3. Data

Several corporate finance data limitations have to be tackled when euro area corporate debt securities are empirically modelled. Stock and flow figures of debt securities are available against nominal values at a

monthly frequency going backwards to January 1990 and reliable corporate bond yields go backwards to August 1998, but (secondary market) prices of short-term debt securities are not readily available. ECB (1999 and 2000b) provide more details on securities issues statistics and ECB (2001c) on developments in euro area corporate bond spreads in 2001. Furthermore, corporate bond spreads often do not measure accurately the "true" cost of debt securities, since a wide array of non-price terms and conditions may affect the cost of debt security financing. This type of measurement problem arises also for the cost of other source of corporate finance such as the bank lending rate (Fase, 1995).

As regards other corporate financing sources, flow-of-funds data for the euro area are available at a quarterly frequency since end-1997 (ECB, 2001b). In contrast, United States flow-of-funds data already start at the first quarter of 1945. Corporate financial liability data are available for the euro area as from 1995, but only with an annual frequency (ECB, 2001a and 2002b). Euro area equity data at market value are available at a monthly frequency, while loans to non-financial corporations are available at a quarterly frequency. For this reason, bank financing is in the empirical analysis approximated by MFI loans to non-financial corporations interpolated to a monthly frequency. Internal finance is approximated by corporate retained earnings, which in turn is defined as the earnings minus the dividends of corporations listed on stock markets. Annex 1 provides the detailed definitions of the variables and its sources.

Chart 1 plots the amount outstanding of long and short-term euro-denominated debt securities issued by euro area non-financial corporations. The chart illustrates that the corporate debts securities market has been growing relatively fast since the introduction of the euro, in particular for short maturities. Debt securities amounted in terms of total corporate liabilities to around 3% at the end of 1999, which is small compared with around 10% in the United States and Japan (ECB, 2001a), but 6.9% at the end of 2001 (ECB, 2002).

{Chart 1}

Chart 2 plots the cost of debt securities vis-à-vis the cost of internal finance, government debt securities, bank loans and equity, since the single currency. The cost of corporate debt securities is in this paper approximated by the yield on 7-10 year BBB-rated euro area corporate bonds. The cost of internal finance, government debt securities, bank loans, and equity are approximated by the interest rate on deposits with an agreed maturity of over two years, the yield on 7-10 year government bonds, the interest rate on loans to enterprises over two years, and the earning yield plus HICP, respectively. The lowest cost of corporate finance is obviously the internal cost of finance which is "free" of asymmetric information costs. The cost of debt securities is typically higher than the cost of bank finance and government bond yields, but lower than the cost of corporate equity capital. The latter is, however, not always the case during the period under review. Broadly speaking, the order in the financing costs matches with the pecking order theory which contends that firms have a preference to internal finance, followed by bank loans, debt securities and lastly equity.

{Chart 2}

For the empirical analysis in the next section two different relative financing cost variables have been constructed. The cost of debt securities vis-à-vis the cost of external finance and relative to the cost of external and internal sources of corporate finance. The cost of the other sources of corporate finance are weighted based on the financing structure of non-financial corporations in the euro area (ECB, 2001a). The applied weights for the cost of external finance are 50% for the cost of loans and 50% for the cost of equity. As regards the cost of internal and external finance, the weights are 50% for the cost of internal finance (total corporate financial liabilities minus loans and quoted equity), 25% for bank finance (loans) and 25% for equity finance (quoted equity).

4. Empirical analysis

In the empirical analysis corporate debt securities issuance refers to the annual growth rate of the amount outstanding of euro-denominated debt securities issued by euro area non-financial corporations. Since reliable corporate bond spreads are only readily available since August 1998 the effective sample period generally starts in January 1999 and ends in June 2001. The sample period is short but has the advantage of not including a structural break due to the introduction of the euro, because the beginning of the sample period matches with the start of Stage Three of EMU. However, it has the disadvantage of not covering several business cycles. For this reason the robustness of the findings is tested by an examination of different regression specifications and/or empirical methods.

4.1 Corporate debt securities issuance

The main finding of a regression analysis is that corporate debt securities issuance can well be explained by macroeconomic factors, suggesting a broad and deep corporate debt securities market since the single currency. In turn, the macroeconomic determinants of corporate debt securities issuance can to some extent be driven by the catalysing influence of the euro, for instance M&A-related financing needs due to corporate restructuring.

In sum, the regression results show that since the single currency the debt securities market is tapped by non-financial corporations to fund M&A and investment or working capital financing needs as reflected in industrial production. In addition, the estimations are supportive of substitution between debt securities and other sources of corporate finance through financing cost differentials and directly, that is unrelated to price differentials.

4.1.1 Empirical model of debt securities supply

This section presents a supply function of corporate debt securities issuance in the euro area following the modelling approach as described in Section 2.2.3 and as applied by Davis (2001) and Davis and Ioannidis (2002) for several industrialised countries and the United States, respectively. The choice for this

modelling approach is based on two motivations. First and foremost, adequate investor demand data are not available for the euro area. Secondly, disregarding demand effects seems to be warranted during the period under review. The fact that new corporate bond issues were generally oversubscribed in the first 2½ years of the single currency suggests that investors were in many cases willing to subscribe much more of the respective bond issues than was offered at the issuance price. This relates most likely to the fact that euro-denominated corporate bonds formed at that time a tiny small share in the total investment or bond portfolio of (global) investors. This means, from the modelling viewpoint, that the corporate bond issuance took place in a "seller's market" where it can be assumed that the supply side factors were dominant. Moreover, investors usually pursue a buy-and-hold-strategy for euro area corporate bonds. From an issuer perspective, it implies that in the first 2½ years of the euro non-financial corporations have been mainly quantity makers and price takers in the euro area corporate securities market. Consequently, the estimation of a supply function of corporate debt securities issuance can be attempted under the assumption of a fully supply-constrained market.

Corporate debt securities issuance is explained by three main factors.

The first explanatory factor considered is M&A activity, since it raises financing needs due to corporate restructuring (ECB, 2000a). This variable also substantially mitigates the interpretation problem of the reduced form framework, because M&A are expected to be unrelated to investor demand for corporate debt securities. In principle, an increase in M&A could lead to higher investor demand, as shareholders may receive cash following M&A and reinvest these funds in corporate bonds. These second-order effects are, however, expected to be of minor importance. The introduction of the euro may have acted as a catalyst for restructuring of the corporate sector within the euro area and for related (one-off) M&A financing needs. For instance, conducting business in a common currency across the euro area may have widened the market perspective of euro area corporations from their domestic markets to an euro area perspective, thus encouraging corporations to reach a sufficient scale through M&A to operate on a euro area scale. Another, not explicitly considered, specific factor has been an increased need of funds by telecommunication companies to finance UMTS licence auctions as took place especially during the course of 2000.

Secondly, the cost of debt securities vis-à-vis other sources of corporate finance may play a key role in the determination of corporate debt securities issuance. Two different relative financing cost variables are considered. One is the cost of debt securities vis-à-vis the cost of external finance, rec_{DS}, the other is relative to the cost of external and internal sources of corporate finance, rc_{DS}.

The third explanatory factors considered are an autoregressive term with a one-month lag and a moving average term with a lag order of eleven months. In economic terms the ar(1) and ma(11) terms reflect the dynamics of the corporate debt securities market. From a statistical perspective both terms are included due to omitted variables and measurement problems and overlapping observations, respectively.

The above results in model equation (4) and (5), where equation (5) is identical to equation (4), except that instead of the relative external cost of debt securities the cost of debt securities against the cost of both internal as well as external finance is considered.

(4) $\dot{DS} = h_1\left(\ln MA,\ rec_{DS}, ar(1), ma(11)\right)$

(5) $\dot{DS} = h_2\left(\ln MA,\ rc_{DS}, ar(1), ma(11)\right)$

With $\dot{X} = \frac{X - X_{-12}}{X_{-12}} \cdot 100$

In turn, model equation (5) is extended in three ways.

First, model equation (6) adds industrial production growth as an explanatory factor. On the one hand it is a proxy for internal finance, on the other for investment financing needs. Business cycles conditions capture the degree of internal finance and thus a negative relationship between industrial production growth and debt securities issuance is expected.[6] However, a positive relationship between industrial production growth and corporate debt securities issues is expected as industrial production reflects investment financing needs.[7] Another additional explanatory factor is the annual growth in the amount outstanding of Monetary Financial Institutions (MFI) loans to non-financial corporations. This term captures the substitution between debt securities and bank financing through non-price elements, the so-called direct substitution. For instance, this term captures any shift in firms' preference of debt securities vis-à-vis bank loans or the targeting by firms of an optimal mix between debt securities and MFI loans.

Secondly, to make a clearer distinction between internal finance and the investment financing needs as reflected in industrial production, corporate retained earnings are added as an explanatory factor in model equation 7. Retained earnings approximate internal financing and therefore capture the direct substitution between debt security financing and internal financing.[8] Industrial production is in this specification expected to reflect more accurately investment financing needs.

Finally, model equation (8) takes additionally into account substitution between long and short-term debt securities issuance through relative prices, approximated by the spread between long and short-term interest rates.

(6) $\dot{DS} = h_3\left(\ln MA,\ rc_{DS},\ \dot{INDPROD}, \dot{LOAN}, ar(1), ma(11)\right)$

(7) $\dot{DS} = h_4\left(\ln MA,\ rc_{DS},\ \dot{INDPROD}, \dot{LOAN}, \dot{REARN}, ar(1), ma(11)\right)$

(8) $\dot{DS}_{LT/ST} = h_5\left(\ln MA,\ rc_{DS}, \dot{INDPROD}, \dot{LOAN}, \dot{REARN}, spread, ar(1), ma(11)\right)$

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[6] For instance, Choe et al. (1993) examine the relation between equity issuance and the business cycle. They find that the proportion of external financing accounted for by equity relative to debt is substantially higher in expansionary phases of the business cycle.

[7] A graphical inspection between the contribution of gross fixed capital formation and inventory investment to GDP growth (interpolated to a monthly frequency) and the annual growth in industrial production shows a strong correlation between both series from 1992 till mid-1998. It is beyond the scope of this paper why this relation has become weaker since mid-1998.

[8] Given the construction of retained earnings as described in Annex 1, one could also argue that retained earnings of firms quoted on stock markets are closely and positively related to equity financing.

Model equation (9), based on the most general model equation (8), sheds light on the functional form of the estimated equations and the signs of the coefficients. All coefficients are defined as non-negative. The α parameters reflect financing needs, the β coefficients cost elements and the γ parameters direct substitution effects.

M&A is expected to have a positive impact on the annual growth rate in the amount outstanding of debt securities issued by non-financial corporations in the same month and up to 15 months lagged, since M&A can be immediately financed by debt securities or in a later stage. The latter is for instance the case if firms in first instance fund M&A by internal financing sources or by bridge financing through loans.

As regards the relative cost of debt securities, a distinction is made between a negative impact on debt securities issues in the same month and in the previous quarter, since a lag between the actual issuance date and the date at which the decision to issue debt is taken may be expected.

Industrial production growth is expected to be positively related to corporate debt securities issuance, at least when it captures investment financing needs. Both industrial production growth in the same month as well as one quarter lagged are included, because of the expected lag between the occurrence of the financing needs and the issue date. In case industrial production captures also internal financing need, as is the case in equation (6), the sign of the coefficient with respect to industrial production is less clear.

Direct substitution between debt securities and other sources of corporate finance is assumed to take place in the same month. A negative coefficient with respect to MFI loans and retained earnings is expected and reflects that debt securities and other sources of corporate finance are substitutes instead of complements. The underlying idea of the immediate impact is that firms target an optimal ratio between debt securities and other sources of corporate finance in the same month. This is along the modelling approach in portfolio balance models, which in a balance-sheet type of framework examine debt securities against other corporate financing sources in the same period and along the corporate finance literature which model an optimal mix between debt securities and other sources of finance.

Finally, for long and short-term debt securities issuance the term spread is added as a cost differential variable. This variable negatively relates to the annual growth in the amount outstanding of long-term debt securities and positively to the growth rate of short-term debt securities.

$$(9)\ \dot{DS}_{LT/ST} = \alpha_0 + \alpha_1 \ln MA + \alpha_2 \sum_{i=1}^{3} \ln MA_{-i} + \alpha_3 \sum_{i=4}^{6} \ln MA_{-i} + \alpha_4 \sum_{7}^{9} \ln MA_{-i} + \alpha_5 \sum_{i=10}^{12} \ln MA_{-i} + \alpha_6 \sum_{i=13}^{15} \ln MA_{-i} - \beta_1 rc_{DS} - \beta_2 \frac{1}{3} \sum_{i=1}^{3} rc_{DS_{-i}} + \alpha_7 \dot{INDPROD} + \alpha_8 \frac{1}{3} \sum_{i=1}^{3} \dot{INDPROD}_{-i} - \gamma_1 \dot{LOAN} - \gamma_2 \dot{REARN} - \beta_3 spread + \delta_1 ar(1) + \delta_2 ma(11) + \varepsilon$$

4.1.2 Empirical results

All maturities

The table in Annex 2 provides the detailed estimation results. As regards a statistical assessment of the regression results, the estimated coefficients, also those for the autoregressive and moving average terms,[9] are in many cases significantly different from zero. The model equations explain, adjusted for degrees of freedom, 94% to 99% of the variation in the annual growth of the amount outstanding of corporate debt securities since the Start of Stage Three of EMU. For long and short-term securities this figure varies between 95% and 98% and between 81% and 91% respectively. Broadly speaking, the residuals behave statistically correctly.

Turning to an economic assessment of the regression results, four main findings for all maturities can be extracted from the third column in Table 2, which summarises the estimation results.

First, the corporate debt securities market is used to finance M&A. On average, the semi-elasticity with respect to M&A activity varies between 0.5 and 2.8. This wide range of the impact of M&A relates to a different impact over time; it is the highest with a lag of three quarters. This suggests that M&A are initially more financed by other financing sources, for instance bridge financing through loans. A 1 percentage rise in M&A activity contributes, based on the sample mean, to the annual growth rate of the amount outstanding of corporate debt securities by on average between 1 to 7 percentage points.

The second finding is that substitution through the cost or price differential between debt securities and other sources of corporate finance significantly takes place. Corporate debt securities issuance is sensitive to the relative financing costs; a 100 basis point rise in the relative cost of debt securities results on average in a decrease in the annual growth of the amount outstanding of euro-denominated debt securities issued by non-financial corporations by 4 to 10 percentage points. This semi-elasticity is higher than the interest rate semi-elasticity typically found for the private sector's demand for loans. Calza et al. (2001) find for the private sector's loan demand in the euro area a semi-elasticity with respect to real market interest rates between 2.8 and 3.5 (1.0 to 0.4 for the real short-term interest rate and 1.8 to 3.1 for the real long-term interest rate). This comparison of semi-elasticities is, however, rather difficult because the latter is with respect to another absolute, instead of relative, financing cost variable and refers to loans to non-financial corporations as well as households.

Thirdly, corporate debt securities issuance reacts positively to industrial production growth in case internal financing is explicitly taken into account. Following a rise in industrial production growth by 1 percentage point, the annual growth rate of the amount outstanding of corporate debt securities increases by 0.5 percentage point immediately and by 1.3 percentage point after one quarter. The estimated "income elasticity" of 1.3 is not statistically different from 1 and is comparable with an income elasticity larger than one as typically found for loan demand studies. For loans to the private sector in the euro area an income elasticity is found to vary between 1.3 and 1.5 (Calza et al., 2001). The estimations show that industrial production is not only a proxy for investment financing needs but also for internal finance.

[9] Excluding both terms from the estimated equations do not, however, significantly change the size of the other coefficients.

When retained earnings as proxy for internal finance are not taken into account, the immediate impact of industrial production on securities issuance becomes negative and the effect after one quarter declines substantially.

The fourth and final main finding is that direct substitution between debt securities and bank and internal financing significantly takes place. A 1 percentage point increase in the annual growth rate of MFI loans to non-financial corporations and in corporate retained earnings results in a 1 and 0.3 percentage point lower annual growth rate of the amount outstanding of corporate debt securities, respectively. This suggests that the broadening and deepening of euro area corporate debt securities market has opened up a viable alternative avenue for finance for corporations, important in circumstances when it becomes difficult to obtain bank credit or where profits are under pressure.

The results for the euro area are broadly in line with the empirical findings for other countries. As found for the United States, Canada, the United Kingdom and Japan by Davis (2001), corporate debt securities issuance in the euro area reacts to cost elements and business cycle conditions. The euro area findings are also in line with the significant negative impact of the credit quality spread on corporate debt securities issuance and positive effects of the liquidity spread and the stock market return as found for the United States by Davis and Ioannidis (2002). In line with Davis (2001), but in contrast to Davis and Ioannidis (2002), it is found that corporate debt securities and bank loans in the euro area are substitutes. Consequently, a growing importance of debt security financing in the euro area leads to a smoothing of overall corporate finance.

{Table 2}

Long and short-term maturities

Turning to the regression results for long and short-term maturities (see Column 4 and 5 in Table 2), four striking differences between the determination of long and short-term debt securities issuance emerge.

First, there are substantial differences in the estimated semi-elasticities with respect to M&A for long-term debt securities compared with short-term. Broadly speaking, larger effects are found on the growth rate of short-term debt securities than for long-term securities due to the fact that the amount outstanding of short-term debt securities issued by non-financial corporations is much smaller than for long-term securities (see Chart 1). Moreover, there are differences in the timing of the impact of M&A. Short-term securities issuance activity is relatively sensitive to the immediate and one quarter lagged M&A, while long-term securities issuance reacts notably on M&A after two to four quarters.

The second difference is that long-term debt securities seems to be more sensitive to the relative cost of debt securities after one quarter and short-term securities issuance to the relative financing costs of the same month. Furthermore, substitution between long and short-term debt securities takes place through the differential in costs between long and short-term financing. A 100 basis point rise in the term spread reduces the annual growth in the amount outstanding of long-term corporate debt securities by around 2 percentage points and increases the short-term growth rate by the same magnitude.

Thirdly, long-term corporate debt securities issuance is significantly less sensitive to the business cycle or investment financing needs than short-term issuance. The estimated "income elasticities" for long-term debt securities are significantly less than one, while for short-term they are larger than one. In other words, short-term variation in corporate financing needs as reflected in industrial production is mostly absorbed by short-term debt securities issuance. This finding is in line with the theory about the debt maturity structure (De Bondt, 1998), assuming a positive relationship exists between the business cycle and the degree of agency and asymmetric information costs. The debt maturity theory contends that the degree of asymmetric information is more severe for short-term borrowing as compared with long term. Firms with large potential information asymmetries are thus likely to be forced to issue relatively more short-term debt because of the larger information costs associated with long-term debt. Disadvantages of rolling over short-term financing are, however, issue costs, interest rate risk and the risk that a solvent but illiquid borrower is unable to obtain refinancing.

The fourth and final difference is that direct substitution between debt security financing and bank and internal financing is found to be stronger for short-term debt securities than for long-term issues. The substitution between debt securities and MFI loans is found to be 0.2 for long-term debt securities and 1.2 for short-term. The substitution between long and short-term debt security financing and internal financing is estimated at 0.2 and 0.5, respectively. This finding is supportive of the general opinion that short-term corporate debt securities are issued more on an ad hoc basis compared with long-term issues.

4.2 Corporate bond spreads

This section examines both the determinants as well as the leading indicator properties of corporate bond spreads in the euro area along three different empirical methods: i) Granger causality tests, ii) regressions, and iii) impulse response functions based on vector autoregressions (VAR). The empirical findings suggest that the euro area corporate debt securities market has been broad and deep enough since January 1999 to contain useful macroeconomic information in the prices observed in this market compared to these in the government bond market. At the same time, corporate bond spreads can be explained, among other factors, by monetary policy-related factors.

In sum, Granger causality tests suggest that movements in corporate leverage, the gross issues of corporate vis-à-vis government bonds, the corporate debt-GDP ratio, stock prices, inflation and short-term interest rates precede those in corporate bond spreads. In turn, corporate bond spreads lead movements in industrial confidence and to a lesser extent growth in real GDP and industrial production. Regression results, examining simultaneously potential driving factors of corporate bond spreads, reveal that the relevant factors as found by the Granger causality analysis indeed explain corporate bond spread movements. Estimation results also show that corporate bond spreads have predictive power for real output growth. Finally, a VAR analysis is in line with these empirical findings. Impulse responses reveal that corporate bond spreads adjust to changes in short-term interest rates and lead real GDP growth.

4.2.1 Granger causality analysis

The Granger causality analysis shows that corporate debt and leverage, stock prices, and corporate debt securities issues vis-à-vis the general government Granger cause corporate bond spreads. The short-term interest rate and inflation also Granger predict corporate bond spreads. At the same time, movements in corporate bond spreads precede these in (the change in) industrial confidence and to a lesser extent real GDP and industrial production growth.

The Granger approach to the question of whether x causes y is to see how much of the current y can be explained by past values of y and then to see whether adding lagged values of x can improve the explanation (Granger, 1969). Variable y is said to be Granger-caused by x if x helps in the prediction of y, or equivalently the coefficients on the lagged x's are statistically significant. In other words, Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term. Two-way causation is frequently the case; x Granger causes y and y Granger causes x.

Table 3 shows the results of pairwise Granger causality tests.

As regards the Granger predictability from economic factors to corporate bond spreads, it is found that corporate leverage, approximated by the log ratio between the amounts outstanding of corporate debt (MFI loans to and debt securities issued by non-financial corporations) and retained corporate earnings, Granger causes corporate bond spreads. Stock prices, which can be viewed as a proxy for changes in corporate health, also have Granger predictability for corporate bond spreads. Demand and supply imbalances between corporate and government bonds, defined as the difference between the quarterly gross issues of corporate bonds vis-à-vis bonds issued by the general government, are found to Granger predict corporate bond spreads. A likely reason why monetary policy related variables, i.e. HICP inflation and short-term interest rate, are found to be related to corporate bond spreads is because during periods of high inflation and tight monetary policy investors may require higher risk premia from their investment in corporate bonds. This might be due to the macroeconomic uncertainty associated with high inflation but also because a tight monetary policy may lead to a future economic slowdown and therefore an increase in the risk of corporate default. Furthermore, rising short-term interest rates reduce corporate cash flows net of interest rate payments on floating-rate and short-term debt and, possibly, have other adverse effects on firms balance sheets.

Turning to the Granger predictability from corporate bond spreads to economic factors, the Granger causality analysis reveals that corporate bond spreads contain information on future (change in) industrial confidence and, to a lesser extent, the annual growth rate of real GDP and industrial production.

{Table 3}

4.2.2 Regression analysis

The regression analysis reveals that the corporate debt-GDP ratio, stock prices, and (real) short-term interest rates are among the key determinants of corporate bond spreads in the euro area. The estimation results also suggest that corporate bond spreads have predictive power for real economic activity. A widening of corporate bond spreads predicts a fall in real output growth up to 10 months in the future.

The potential determinants of corporate bond spreads, CBS, based on the Granger causality analysis are simultaneously taken into account by performing a regression analysis. The level of the corporate bond spread can well be explained by these potential determinants and the corporate bond spread of previous months. The OLS estimates with absolute Newey-West corrected t-values between parentheses read as follows.

$$CBS = -434.6 + 14.1\,rs - 17.7\,HICP + 37.6\,corporate\,leverage + 11.6\,corporate\,debt/GDP +$$

(1.54) (2.48) (1.83) (1.71) (3.37)

$$26.3\,relative\,corporate\,issues - 26.3\ln stock\,market + 0.37\,CBS_{-1}$$

(2.12) (1.28) (4.23)

$$Sample\ period: 1999.01 - 2001.06 \quad \bar{R}^2 = 0.93 \quad Q(4) = 6.1 \quad Q(12) = 14.3$$

One criticism of the estimated regression model is that it is only a level-specification and ignores the short-term dynamics (Δ-terms) and does not test explicitly the existence of any cointegration relationship. Hence, the same set of explanatory factors is considered within an error correction framework. The estimated error-correction model is estimated in one step and by using the two-step procedure proposed by Engle and Granger (1987). Coefficients with t-values below 1.0 are restricted to be 0. In the one-step procedure all Δ-terms seems to be statistically insignificant, while with the two-step estimation procedure the change in the short-term interest rate and the stock market return do play a significant role. Both estimated model equations indicate the existence of a cointegration relationship between the corporate bond spread and the (real) short-term interest rate, the corporate debt-GDP rate and stock prices. The two equations read as follows.

One step procedure

$$\Delta CBS = -434.6 - 0.63(CBS_{-1} - 22.6\,rs_{-1} + 28.3\,HICP_{-1} - 60.1\,corporate\,leverage_{-1} -$$

(1.54) (7.07) (2.71) (1.62) (1.62)

$$18.6\,corporate\ \ debt_{-1}/GDP_{-1} - 42.0\,relative\,corporate\,issues_{-1} + 42.1\ln stock\,market_{-1})$$

(2.79) (1.93) (1.43)

$$Sample\ period: 1999.01 - 2001.06 \quad \bar{R}^2 = 0.64 \quad Q(4) = 6.1 \quad Q(12) = 14.3$$

Two-step procedure

$$\Delta CBS = -0.43 + 23.8\Delta rs - 36.2\,\Delta \ln stock\ market - 0.86(CBS_{-1} - 30.0rs_{-1} + 11.7HICP_{-1} -$$
$$(0.17)\ (2.56)\qquad (1.42)\qquad\qquad (6.16)\qquad (3.14)\qquad (1.23)$$
$$11.8corporate\quad debt_{-1}/GDP_{-1} + 129.6\ln stock\ market_{-1} - 465.1)$$
$$(2.66)\qquad\qquad (4.15)\qquad\qquad (1.45)$$
$$Sample\ period: 1999.01 - 2001.06\quad \bar{R}^2 = 0.64\quad Q(4) = 8.2\quad Q(12) = 10.7$$

Table 4 shows the regression results of a model equation explaining the annual growth rate of output (real GDP and industrial production) by past movements in financial variables. The lag orders of the explanatory variables correspond with the lags of the highest correlation between output and the respective financial variable. The variables considered are corporate bond spreads, the term spread defined as the difference between the long and short-term interest rate, M1 growth and the short-term interest rate.[10] Table 4 clearly show that corporate bond spreads even have leading indicator properties when other financial variables are simultaneously taken into account. Corporate bond spreads, 8 to 10 months lagged, have significant predictive power for output growth. In addition, the term spread, M1 growth and the short-term interest significantly explain real GDP growth, while M1 growth is a significant explanatory factor for industrial production growth.

Broadly speaking, the finding of the predictive power of euro area corporate bond spreads to output is in line with the empirical finding for the United States (Gertler and Lown, 1999, Chan-Lau and Ivaschenkko, 2001, and Stock and Watson, 2001). For instance, Chan-Lau and Ivaschenko (2001) find that the yield spread between investment-grade bonds relative to Treasuries predicts changes in industrial production up to 12 months in the future. However, it is not fully clear whether and how exactly changes in corporate bond spreads cause economic activity. Therefore it is possible that the empirical relationship found between the euro area corporate bond spread and real GDP may be capturing the general degree of concern in the economy about credit risk.

{Table 4}

4.2.3 Impulse response analysis

The impulse response analysis shows that changes in the short-term interest rate are reflected in corporate bond spreads and that corporate bond spreads lead real economic activity in the euro area.

An impulse response analysis is performed based on bivariate VAR models. The lag order of the VAR models is set at two months, as low as possible given the wide range of optimal lag orders derived from the Akaike, Hannan-Quinn and Schwartz criteria and the residual properties. Over-parameterisation is

[10] The stock market index return has also been considered, but it has a low correlation with output growth during the period under review.

considered to be a larger problem than underestimation of the lag order given the short sample. The impulse response functions are based on the traditional Cholesky decomposition of the residual variance-covariance matrix (Hamilton, 1994). The impulse response functions presented are fairly insensitive to the ordering. The ordering of the variables corresponds to the order of presenting the variables in the charts.

Chart 3 plots the adjustment of corporate bond spreads to a one-standard deviation innovation to the three-month money market rate. Following a short-term interest rate shock, the corporate bond spread for BBB-rated euro area firms rises significantly after 2 months and reaches a peak after 6 months. An unexpected temporary rise in the short-term interest rate of around 25 basis points leads to an increase in corporate bond spreads of 10 basis points. These impulse response functions are qualitatively fairly similar to those presented in De Bondt (1999), which examines the external finance premium at the household mortgage market instead of at the corporate bond market, following a short-term interest rate shock.

{Chart 3}

Chart 4 plots the adjustment of the annual growth rate of real GDP in the euro area following a one-standard deviation innovation to the corporate bond spread. A temporary increase in the corporate bond spread by around 15 basis points results after 2 months in a decline in real GDP growth. This decline is significant different from zero after 5 months and peaks between 9 and 12 months at a decline by around 0.2 percentage points. Fairly similar results are obtained for the annual growth rate of industrial production; an unexpected temporary increase in corporate bond spreads by around 15 basis points results after 2 months to a significant decline in industrial production growth and peaks at a decline by 0.6 percentage points after 7 months. The same holds for industrial confidence; an unexpected rise in corporate bond spreads results in a significant decline of industrial confidence between 4 and 12 months and the maximum decline is reached after 9 months. However, it cannot be excluded that this tentative empirical finding captures more generally the credit conditions of the economy. United States studies show a strong positive relationship exists between corporate bond spreads and the credit conditions as reported by the Fed bank lending survey (Duca, 1999, and Gertler and Lown, 1999).

{Chart 4}

5. Concluding remarks

This paper offers the first empirical examiniation of quantities and prices observed in the euro area corporate debt securities market since the introduction of the euro using macroeconomic data. The main message is that since the single currency, the euro area corporate debt securities market, though still young, is informative for monetary policy and may develop into a significant link in the euro area monetary policy transmission process.

Three conclusions emerge from the empirical results, which are admittedly tentative given the short sample period but fairly robust across different econometric specifications and methods.

The first conclusion is that since the introduction of the euro the debt securities market is tapped by non-financial corporations to fund their M&A and investment or working capital financing needs as reflected in industrial production. M&A are notably reflected in short-term securities issuance activity in the same month and with a lag of one quarter and in long-term securities after three quarters. A one-to-one relation between corporate debt securities issuance and industrial production is found when the latter reflects investment expenditures or working capital. For short-term debt securities the "income elasticity" is, however, found to be significantly larger than one.

Secondly, regression results show that substitution between debt securities and other sources of corporate finance takes place, both indirectly through financing cost differentials as well as directly. It is found that the supply of debt securities by non-financial corporations is sensitive to the cost of debt securities vis-à-vis other sources of corporate finance and that the spread between long and short-term interest rates is relevant for the mix between long and short-term debt securities. The direct substitution effects suggest that corporations target an optimal mix between debt securities and internal and bank financing sources. These direct substitution effects are found to be in particular strong for short-term debt securities issuance.

The third and final empirical conclusion is that in particular the corporate debt-GDP ratio, stock prices, and (real) short-term interest rates are the driving factors in the determination of corporate bond spreads. In turn, corporate bond spreads have leading indicator properties for real economic activity. The empirical relationship found between corporate bond spreads and economic activity may be capturing the general degree of concern in the economy about credit risk.

The empirical findings emphasise that quantity and price developments in the euro area corporate debt securities market should be closely monitored by economists and policy makers. They also suggest that the broadening and deepening of the euro area corporate debt securities market since the single currency has opened up a viable alternative avenue of finance for corporations. This could have important implications for monetary policy since corporations may go to the debt market to raise finance when corporate profits are under pressure or when banks cut back on lending following a tightening of monetary policy. The results also show that monetary policy-related factors are among the main determinants of corporate bond spreads, suggesting that monetary policy might play an important role in the determination of the debt security financing costs of the corporate sector.

Issues that in particular warrant future research are the substitution between different sources of corporate finance at a macro level, how developments in the corporate bond market relate to other debt factors at work in the business cycle, and the possibility of asymmetries over the business cycle in explaining corporate debt securities issuance. Other promising avenues of research for the euro area are the high-yield bond segment of the corporate bond market, the Pfandbrief or mortgage bond market (Lichtenberger, 2001), and, as soon as a longer sample becomes available, the stability of the empirical relationships found in this paper.

ANNEX 1: DATA DESCRIPTION

Table A.1 Overview euro area data

Code	Description	Unit	Source
DS	Debt securities (all maturities, long and short term); amount outstanding of euro-denominated debt securities issued by euro area non-financial corporations	EUR billions, nominal values, end-of month	ECB
RGI	Gross issues of debt securities issued by non-financial corporations relative to issued by general government	EUR billions, nominal values, transactions during the month	ECB
cbr	Corporate bond rate; yield on BBB-rated euro area corporate 7 to 10-year bond	Percentages per annum, monthly average of daily observations	Bloomberg, Merrill Lynch, ECB calculations
cbs	Corporate bond spread; spread between BBB-rated euro area corporate bond yield and government bond yield for 7 to 10 years	Percentages per annum, monthly average of daily observations	Bloomberg, Merrill Lynch, ECB calculations
rs	Short-term interest rate; three-month EURIBOR	Percentages per annum, monthly average	Reuters and ECB
rl	Long-term interest rate; 10-year government bond yield	Percentages per annum, monthly average	Reuters and ECB
HICP	HICP inflation rate	Annual percentage changes, monthly average	Eurostat
p_{equity}	Stock market index	End-of-month	Datastream
per	Price-earning ratio	End-of-month	Datastream
$yield_{div}$	Dividend yield	End-of month	Datastream
coe	Cost of equity capital; inverted price earning ratio plus HICP	Percentages per annum, end-of month	Datastream, Eurostat, author's calculations
REARN	Retained earnings, approximated by p_{equity} / per – p_{equity} * $yield_{div}$/100	End-of-month	Datastream
bondvol	Implied bond market volatility	Percentages per annum, monthly average of daily observations	Bloomberg, author's calculations
eqvol	Implied stock market volatility	Percentages per annum, monthly average of daily observations	Bloomberg, author's calculations
indprod	Annual growth of industrial production	Annual percentage changes, using data adjusted for number of working days	Eurostat
indconf	Industrial confidence indicator	Percentage balances, seasonally adjusted data	EC Business Survey
lenut1y / lenov1y	Lending interest rate to enterprises up to 1 year / over 1 year	Percentages per annum, monthly averages	ECB
deput1y / depov2y	Deposit interest rate up to 1 year / over 2 year	Percentages per annum, monthly averages	ECB
rec_{ds}	Relative external cost of debt securities; 0.5*lenov1y + 0.5*coe, short-term debt securities 0.5*lenut1y + 0.5*coe	Percentages per annum, monthly averages	Various, author's calculations
rc_{ds}	Relative cost of debt securities; 0.5*depov2y + 0.25*lenov1y + 0.25*coe, short-term debt secirities 0.50*deput1y + 0.25*lenut1y+0.25*coe	Percentages per annum, monthly averages	Various, author's calculations
MA	M&A; cash payments of mergers and acquisitions inside and outside the euro area by euro area non-banks	EUR billions, monthly flows	Thomson SDC Platinum, ECB's calculations
LOAN	Outstanding MFI loans to non-financial corporations (all maturities, long term/over 1 year and short term/up to 1 year)	EUR billions, not seasonally adjusted, end of quarter (interpolated into monthly)	ECB, author's calculations
INV	Investment contribution to GDP growth; contribution of gross fixed capital formation and inventory investment to GDP growth	Annual percentage changes, (interpolated into monthly figures)	Eurostat, author's calculations
GDP / gdpr	Seasonally adjusted nominal GDP / real GDP	EUR billions, (interpolated into monthly figures)	Eurostat, ECB calculations
M1	M1, seasonally adjusted index of adjusted stocks	EUR billions	ECB

Table A.2 Regression results of the annual growth rate in the amount outstanding of euro-denominated debt securities issued by non-financial corporations

Variable		All maturities				Long term					Short term				
		Eq. (4)	Eq. (5)	Eq. (6)	Eq. (7)	Eq. (4)	Eq. (5)	Eq. (6)	Eq. (7)	Eq.(8)	Eq. (4)	Eq. (5)	Eq. (6)	Eq. (7)	Eq. (8)
Constant	$\alpha 0$	-35.2**	-32.6**	-42.7**	-23.3**	-30.7**	-32.0**	-38.2**	-19.1**	-21.3**	-69.7*	-63.5*	-69.5**	-30.3*	-40.0**
		(10.3)	(5.28)	(8.34)	(4.24)	(16.5)	(6.21)	(9.61)	(3.38)	(3.58)	(2.76)	(2.33)	(7.32)	(2.70)	(4.07)
LnMA	$\alpha 1$	0.90**	0.90**	0.34	-0.17	0.59**	0.56*	0.41	0.13	0.20	4.00*	3.79*	3.99**	3.30*	3.26*
		(3.21)	(2.93)	(0.73)	(0.40)	(2.95)	(2.25)	(1.28)	(0.33)	(0.39)	(2.55)	(2.23)	(3.15)	(2.76)	(2.64)
Σ lnMA$_{-1}$	$\alpha 2$	1.15**	1.16*	1.41**	1.35**	0.68**	0.63*	0.69**	0.77**	0.79*	4.19**	4.11*	4.95**	3.59**	4.65**
		(4.37)	(2.76)	(6.78)	(3.84)	(4.77)	(2.60)	(5.84)	(3.45)	(2.29)	(2.95)	(2.76)	(7.17)	(8.30)	(10.3)
Σ lnMA$_{-4}$	$\alpha 3$	1.64**	1.69**	3.01**	2.07**	1.30**	1.47**	2.33**	1.37**	1.34**	3.03**	2.98**	4.79**	2.72**	3.06**
		(9.41)	(4.71)	(10.7)	(6.70)	(9.67)	(4.83)	(9.57)	(4.93)	(5.06)	(3.59)	(3.47)	(6.43)	(4.76)	(5.17)
Σ lnMA$_{-7}$	$\alpha 4$	2.19**	2.63**	3.64**	2.81**	2.09**	2.85**	3.17**	1.86**	2.01**	3.42**	3.52**	4.37**	2.61**	2.79**
		(11.6)	(8.90)	(8.93)	(6.30)	(10.5)	(8.39)	(8.36)	(3.21)	(4.08)	(3.68)	(3.75)	(9.10)	(4.27)	(5.32)
Σ lnMA$_{-10}$	$\alpha 5$	1.27**	1.74**	3.22**	2.27**	1.24**	1.99**	2.73**	1.15**	1.42**	1.19*	1.21	2.35**	0.72	1.08*
		(12.7)	(8.53)	(8.58)	(8.01)	(17.3)	(9.94)	(8.86)	(2.24)	(3.70)	(2.04)	(1.99)	(3.39)	(1.20)	(2.51)
Σ lnMA$_{-13}$	$\alpha 6$	0.55**	0.81**	1.65**	1.03**	0.54**	1.00**	1.40**	0.71**	0.66*					
		(4.42)	(4.40)	(6.43)	(3.98)	(4.47)	(6.25)	(9.24)	(3.48)	(2.63)					
rec_{DS} / rc_{DS}	$\beta 1$	-1.63	-1.97	-4.43**	-6.48	-1.39*	-2.54*	-3.36	-2.86	-0.89	-2.66	-3.37	-8.37*	-2.01	-10.8
		(1.98)	(1.47)	(4.63)	(1.76)	(2.32)	(2.67)	(1.59)	(1.20)	(0.25)	(0.66)	(0.74)	(2.61)	(0.68)	(1.74)
$1/3\Sigma$ rec_{DS-1} / $1/3\Sigma$ rc_{DS-1}	$\beta 2$	-4.19**	-7.99*	-13.9**	-13.2**	-4.63**	-9.40**	-9.49**	-8.77**	-5.31	0.65	0.12	-3.09	-9.14	-4.47
		(3.62)	(2.36)	(4.11)	(4.75)	(7.79)	(4.13)	(4.31)	(5.19)	(1.16)	(0.17)	(0.03)	(0.63)	(1.96)	(1.60)
AR(1)	$\delta 1$	0.32*	0.51**	0.20	-0.36	0.34*	0.56**	0.32*	0.17	-0.37	0.06	0.08	-0.32	-0.33	-0.42
		(2.19)	(4.52)	(1.63)	(1.08)	(2.48)	(6.84)	(2.04)	(1.96)	(1.08)	(0.19)	(0.23)	(1.74)	(1.56)	(1.59)
MA(11)	$\delta 2$	-0.89**	-0.89**	-0.89**	0.89**	-0.89**	-0.89**	-0.89*	0.89**	-0.89**	-0.89**	-0.89**	-0.89**	-0.89**	-0.89**
		(3644)	(3602)	(2178)	(3476)	(3163)	(3895)	(2976)	(3552)	(3311)	(11.9)	(11.8)	(5657)	(5012)	(5895)
INDPROD	$\alpha 7$			-0.27*	0.47*			-0.12	0.27	0.16			-0.99	0.32	0.58
				(2.43)	(2.18)			(0.65)	(1.51)	(1.08)			(1.33)	(0.55)	(1.13)
$1/3\Sigma$ INDPROD$_{-1}$	$\alpha 8$			0.51	1.34**			0.19	0.62**	0.28			1.82	3.43**	3.81**
				(1.79)	(6.52)			(0.73)	(3.78)	(0.90)			(1.62)	(3.97)	(4.29)
LOAN	$\gamma 1$			-1.44**	-0.67*			-1.06*	0.59	-0.08			-1.68**	-0.90*	-0.99**
				(3.85)	(2.84)			(2.31)	(1.11)	(0.16)			(3.16)	(2.26)	(3.61)
REARN	$\gamma 2$				-0.30**				-0.28**	-0.19*				-0.43**	-0.54**
					(6.36)				(4.50)	(2.79)				(6.52)	(6.53)
Term spread	$\beta 3$									-2.02					2.27
										(1.90)					(0.81)
R^2 (adjusted)		0.95	0.94	0.95	0.99	0.96	0.95	0.95	0.98	0.98	0.81	0.81	0.87	0.87	0.91
Q(4)		5.8	2.5	1.5	8.5	1.7	0.6	3.6	1.5	4.4	6.0	5.5	7.3	10.2*	5.9
Q(12)		14.9	9.5	12.8	25.2*	13.5	9.9	22.8*	10.8	7.2	20.7	19.5	25.2*	15.8	10.4

*Explanatory notes: sample period 1999.01-2001.06;OLS estimation; heteroscedasticity and autocorrelation-corrected absolute t-values between parentheses; ** and * denote significance at the 1% and 5% level, respectively; variable codes and equations (4) to (8) are defined as introduced in Annex 1 and Section 4.1, respectively.*

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Chart 1 Amounts outstanding of euro-denominated debt securities issued by euro area non-financial corporations

(EUR billions)

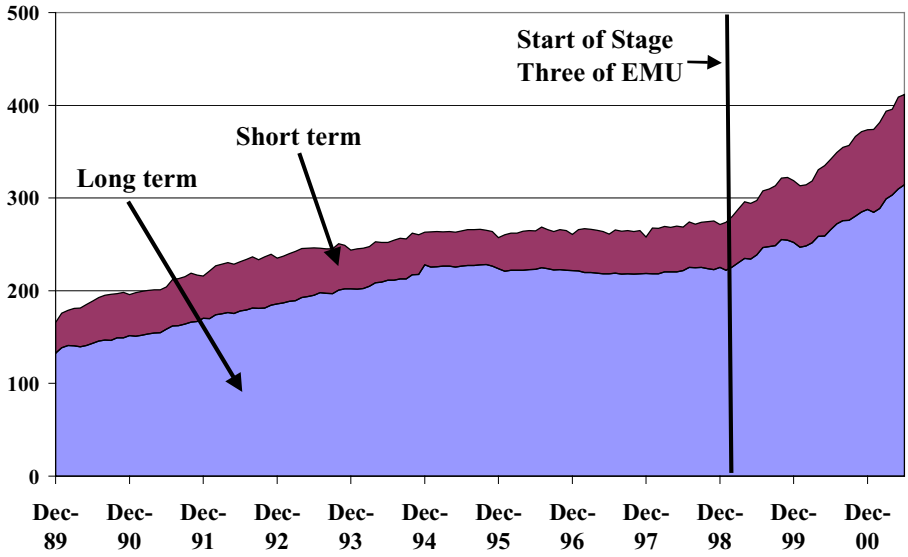

Chart 2 Cost of corporate debt securities vis-à-vis other sources of corporate finance

(basis points)

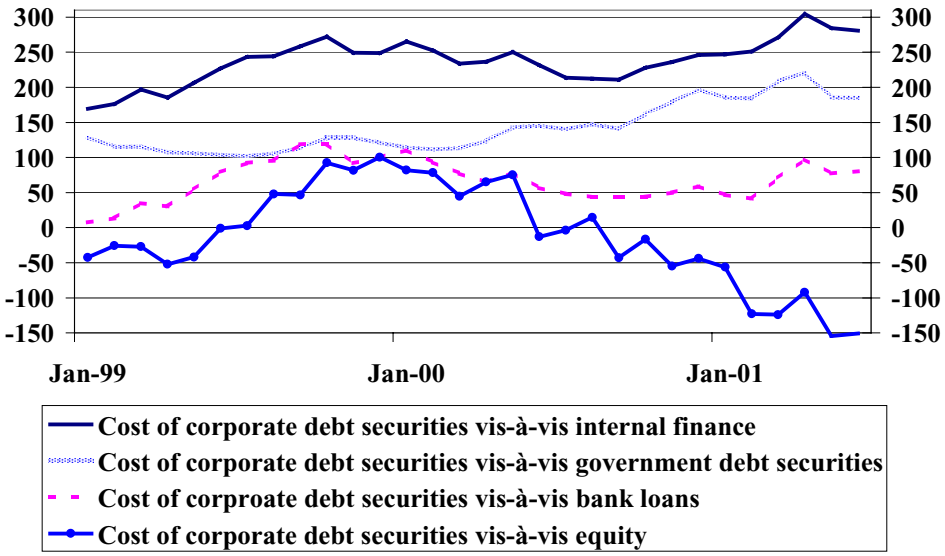

Chart 3 Adjustment of corporate bond spread to a short-term interest rate shock

(percentages per annum)

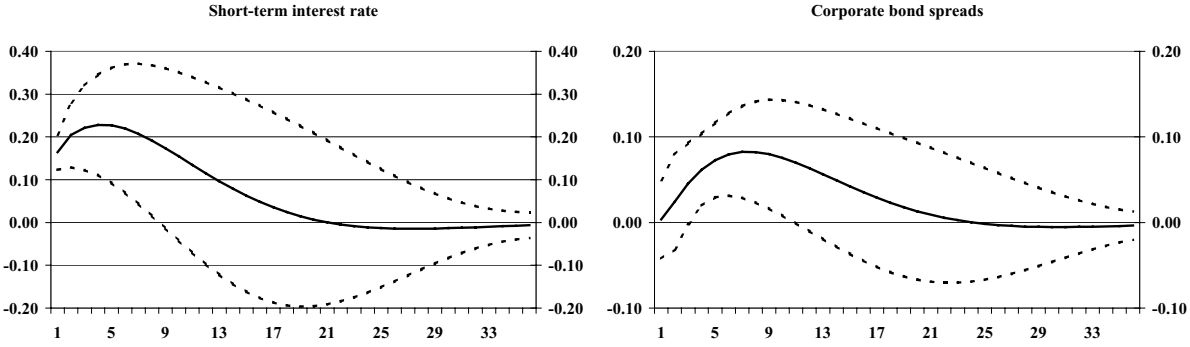

Chart 4 Adjustment of real GDP growth to a corporate bond spread shock

(percentages per annum; annual percentage changes)

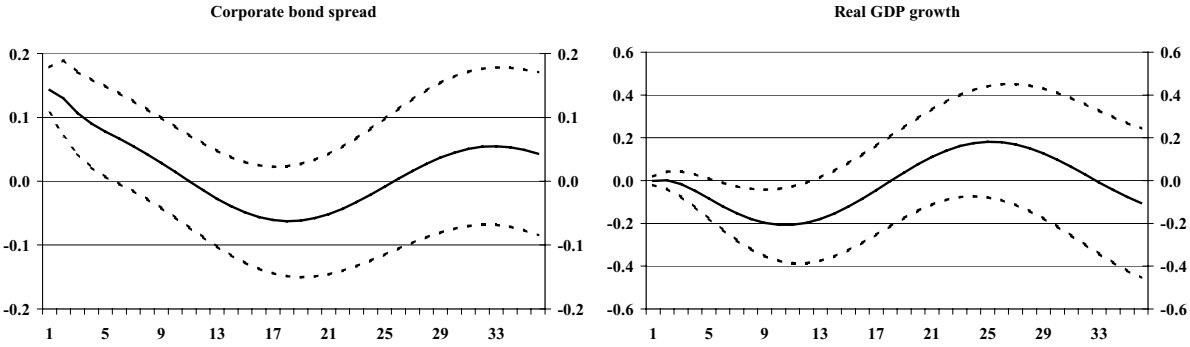

Table 1 Overview on approaches to model corporate debt securities issuance

Corporate finance level	All corporate financial liabilities	Debt securities	Debt securities
Theoretical framework	General equilibrium and portfolio model	Supply and demand function	Partial equilibrium and reduced form model
Modelling framework	System of equations	Two equations: supply and demand	Single equation
Merits	Theoretical foundation	Supply and demand effects	Easy and flexible model
Costs	Complexity, implausible empirical results	Identification problem	Interpretation problem
Data require-ments	High	Modest to high	Modest
	High-quality and consistent data required	Valid instruments required to identify supply and demand	No specific data requirements

Table 2 Overview of (semi-)elasticities with respect to corporate debt securities issuance

Variable	Impact	All maturities	Long term	Short term
M&A [1)]	Immediate	0.49	0.38	3.67
M&A [1)]	One quarter lagged	1.27	0.71	4.30
M&A [1)]	Two quarters lagged	2.10	1.56	3.32
M&A [1)]	Three quarters lagged	2.82	2.40	3.34
M&A [1)]	Four quarters lagged	2.13	1.71	1.31
M&A [1)]	Five quarters lagged	1.01	0.86	-
Relative financing cost [1)]	Immediate	-3.63	-2.21	-5.44
Relative financing cost [1)]	One quarter lagged	-9.82	-7.52	-3.19
Industrial production growth [2)]	Immediate	-0.27 / 0.47	-0.12 / 0.22	-0.99 / 0.45
Industrial production growth [2)]	One quarter lagged	0.51 / 1.34	0.19 / 0.45	1.82 / 3.62
Loan growth [3)]	Immediate	-1.06	-0.18	-1.19
Retained earnings growth [4)]	Immediate	-0.30	-0.24	-0.49
Term spread [5)]	Immediate	-	-2.02	2.27

Explanatory notes: [1)] average of estimated coefficients of equations (4) to (8); [2)] estimated coefficient of equation (6) / average of estimated coefficients of equations (7) and (8); [3)] average of estimated coefficients of equations (6) to (8); [4)] average of estimated coefficients of equations (7) and (8); [5)] estimated coefficient of equation (8).

Table 3 Granger causality analysis of corporate bond spreads

(F-statistic)

	x Granger causes bond spread		Bond spread Granger causes x	
	Lag of 2 months	Lag of 4 months	Lag of 2 months	Lag of 4 months
Real GDP growth	1.56	0.88	3.91*	2.21
Industrial production growth	1.97	1.53	2.28	2.07
Industrial confidence	4.48*	1.62	9.72**	3.90*
Δ industrial confidence	0.65	0.64	8.74**	6.41**
Corporate leverage	4.02*	4.11*	2.31	1.42
Corporate debt / GDP	5.55**	3.54*	0.80	2.55
Relative corporate issues	3.42*	3.76*	0.86	1.15
Short-term interest rate	4.66*	3.01*	1.78	1.08
HICP Inflation	3.78*	4.48**	2.46	1.54
Term spread	0.90	0.35	0.94	0.33
Bond market volatility	3.76*	1.98	0.91	1.52
Stock market volatility	0.44	2.23	0.03	0.09
Stock market index	4.00*	3.54*	1.52	1.11
Stock market return	4.12*	2.84*	1.09	0.82

*Explanatory notes: sample period 1999.01–2001.06; ** and * denote that the hypothesis that variable x does not Granger cause variable y has to be rejected at the 1% and 5% significance level, respectively.*

Table 4 Predictive power of corporate bond spreads for annual growth of output

	Real GDP growth		Industrial production growth	
	Model (1)	Model (2)	Model (1)	Model (2)
Corporate bond spreads	-0.58**	-0.46**	-2.85**	-3.84**
[Lag 8 and 10 months]	(2.60)	(3.03)	(3.04)	(4.17)
Term spread	0.18*	0.28*	-1.66	0.12
[Lag 6 and 7 months]	(2.21)	(2.21)	(1.91)	(0.16)
M1 growth	0.05*	0.08**	0.63**	0.84**
[Lag 10 and 10 months]	(2.04)	(7.07)	(4.95)	(3.84)
Short-term interest rate	-0.63**	-0.35*	-2.57**	0.37
[Lag 12 and 12 months]	(4.73)	(2.16)	(4.19)	(0.68)
Constant	5.17**	3.62**	12.1**	-1.28
	(5.77)	(4.60)	(3.03)	(0.46)
MA(11)	0.89**	-0.89**	-0.89**	-0.89**
	(7245)	(5668)	(4703)	(3422)
R^2 (adjusted)	0.98	0.97	0.83	0.79
Q(4)	6.71	8.45*	5.46	4.99
Q(12)	6.77	25.01**	9.20	9.37

*Explanatory notes: sample period 1999.04–2001.06 for model (1) and 1999.06–2001.06 for model (2); OLS estimation; ** and * denote significance at the 1% and 5% level, respectively; absolute Newey-West corrected t-values between parentheses; the lags of the explanatory factors of model (1) and (2) are in italics between square brackets; MA(11) term included due to overlapping observations.*

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