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A FACTOR ANALYSIS APPROACH TO MEASURING EUROPEAN LOAN AND BOND MARKET INTEGRATION*

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Abstract

By using an existing and a new convergence measure, this paper assesses whether bank loan and bond interest rates are converging for the non-financial corporate sector across the euro area. Whilst we find evidence for complete bond market integration, the market for bank loans remains segmented, albeit to various degrees depending on the type and size of the loan. Factor analysis reveals that rates on large loans and small loans with long rate fixation periods have weakly converged in the sense that, up to a fixed effect, their evolution is driven by common factors only. In contrast, the price evolution of small loans with short rate fixation periods is still affected by country-specific dynamic factors. There are few signs that bank loan rates are becoming more uniform with time.

1. Introduction

One of the key objectives of the creation of a single market in Europe has been to level the playing field in the corporate sector in order to enhance competition and innovation. This is equally true with respect to finance. Despite the introduction of the euro and the liberalisation and harmonisation of the regulatory side of the financial services industry as a result of two banking directives and the Financial Services Action Plan (FSAP), retail banking remains, however, largely a national affair. Cross-border retail lending generally accounts for less than one percent of total lending (see Gropp and Kashyap, 2009). This de facto national segmentation justifies the use of national bank lending rates to assess whether or not the costs of corporate debt financing are converging across the euro area. This paper aims at precisely that.

Previous studies (see, among others, Adam et al., 2002, Baele et al., 2004, Kleimeier and Sander, 2006, and Vajanne, 2007) so far have found evidence for falling cross-country variance in loan rates (σ-convergence) but little or ambiguous evidence for stationarity of loan rate spreads to a benchmark (lack of β-convergence). On the one hand, σ-convergence suggests that the process of bank market integration is ongoing. On the other hand, the β-convergence results do not exclude the fact that loan rates may drift apart. For example, by estimating cointegration relationships Kleimeier and Sander (2006) find that all bi-lateral relationships between German rates and other national rates are unstable, showing absence of convergence.

We introduce an additional convergence measure to reassess whether retail bank market integration is absent, ongoing, or complete. Note that both the σ-convergence and β-convergence criteria capture long-term trends. There is also the question of whether rates move synchronously in their short-term fluctuations. Such correlation would be the result of national rates following common external factors, for example the European Central Bank (ECB) re-financing rate. In an integrated market national factors should not play a significant role, insofar as they are unrelated to country-specific risk or heterogeneity in demand for financial services.

This brings us to the concept of factor convergence. Factor analysis is applied to decompose the loan rates in a number of latent factors where each factor is multiplied by country-specific factor sensitivities, so-called ‘factor loadings’. Loan rates are said to exhibit (weak) factor convergence when all factor loadings are significant and all loadings associated with one common factor have the same sign. There are, then, no statistically significant country-specific dynamic factors. Factor convergence is complete when factor loadings are the same for all countries (= strong factor convergence). Factor convergence is absent when some factor loadings (of a significant factor) are insignificant or of different sign. Note that factor convergence captures the synchronisation of interest rate movements but ignores time-invariant differences in the absolute levels. The latent factors are found by maximum likelihood factor analysis following Jöreskog (1969). Strong factor convergence implies complete β-convergence, and vice versa, in the sense that one can find a benchmark rate for which all spreads are stationary and white noise. In contrast, weak factor convergence does not necessarily imply β-convergence, neither complete nor incomplete. Nor does incomplete β-convergence, i.e. when spreads are stationary but auto-correlated, imply weak factor convergence.

This study tests the law of one price in the corporate loan market from a lender's point of view. The threat of foreign entry and competition from alternative funding sources such as bond financing can be the driving factors enforcing this law. Gropp and Kashyap (2009) suggest analysing the convergence of bank profits rather than prices of financial products.[1] They argue that the absence of homogeneous loan pricing does not imply absence of retail banking integration due to differences in tax systems, borrowers' preferences, etc., meaning that the reason for price differences should not necessarily be sought on the supply side. This seems a valid point concerning part of the cross-country differences in loan rates.

In addition to differences in tax and legal systems, interest rate differences may stem from a variety of other factors. First, national bank loan portfolios may differ in their risk profile. Idiosyncratic risk is diversified but systematic (countrywide) risk may differ, especially when the share of small businesses in the loan portfolio is high. Second, differences in inflation expectations may affect nominal rates. This effect is likely to be increasing in the share of local bank investors, because real returns must take into account consumer price inflation in the investor's country of residence. International investors holding well-diversified portfolios are less affected by cross-country differences in both inflation and risk. Third, there can be heterogeneity in loan products

[1] This is not a solution for our case. Total bank profitability may not be informative about the corporate loan market since bank profitability is also driven by other business lines such as investment banking, residential mortgages, deposits and other financial services.

across countries due, for instance, to differences in collateral practices (see ECB, 2006). Fourth, there can be differences in deposit rates. This could lead to differences in loan rates even if the interest mark-up was the same.

Since the objective of this paper is to assess whether there is a level playing field in firm debt financing, and not to explain differences (as Affinito and Farabullini (2009) do), loan rates should not be adjusted for differences in competitive conditions (see Maudos and Guevara, 2004) or cost efficiency (see, among others, Casu et al., 2004; Schure et al., 2004) in banking. However, we adjust loan rates for differences in systematic risk (first factor) and inflation (second factor) to the extent that these variables can explain variation in loan rates across countries and over time. Unfortunately there is no obvious way of adjusting national loan rates for heterogeneity in loan products (third factor). Country fixed effects could capture at least part of such heterogeneity, but could also be attributed to many other factors, including those for which one should not adjust such as bank inefficiency. Hence, no adjustment is made for the third factor. Finally, in many cases differences in rates on Non-Financial Corporations' (NFCs) deposits (fourth factor) cannot account for differences in loan rates. In fact for some countries where loan rates are relatively high, deposit rates are relatively low. This means that mark-up differences can be even bigger than differences in loan rates. The cross-country relationship between deposit rates and loan rates is statistically insignificant, which made us decide to ignore deposit rates.

Thus, we suggest evaluating market integration against various measures of risk-adjusted price convergence. One approach is to test whether the median risk-adjusted interest rate level is the same across countries (*α-convergence*). The α-convergence measure captures time-invariant differences such as those caused by the tax and legal system. The σ-convergence and β-convergence measures capture some of the long-term aspects of the integration process while factor convergence also accounts for short-term movements. Although data limitations do not allow us to determine the precise reasons for possible incompleteness of bank market integration, the use of different convergence measures, in particular the factor convergence measure, could give some indication. For instance, if interest rates exhibit factor convergence but no α-convergence then explanations should rather be found in institutional differences than on the supply side.

We distinguish between small and large bank loans because small loans are dominated by small businesses which are more likely to suffer from monopolistic loan pricing than large scale enterprises (LSEs). In comparison to LSEs, small and medium-sized enterprises (SMEs) are often more information opaque. This makes the financing of SMEs especially challenging since asymmetric information may create adverse selection and moral hazard problems (see Akerlof, 1970). The sensitivity of firm growth to cashflow rises as firm size falls (see Carpenter and Petersen (2002) and Wagenvoort (2003) for evidence on firms in the USA and the European Union respectively), which may suggest that SMEs encounter finance constraints that prevent them from fully exploiting their growth potential. One way of reducing asymmetric information is to build long relationships with creditors. However, these bank-firm relationships can be exploited to extract monopoly rents from the firms.[2] For instance, Degryse and Van Cayseele (2000) find for small European businesses that interest rates on loans tend to increase with the duration of a bank-firm relationship.

For the purpose of benchmarking, we also apply the various convergence measures to the primary euro-denominated corporate bond market. A sample of 828 plain-vanilla fixed coupon bonds issued between January 1999 and October 2008 by NFCs in France, Germany, Italy, the Netherlands, and the United Kingdom is compiled from the Dealogic Bondware data set. The yield-to-maturity of these bonds is adjusted for differences in credit risk before applying the convergence measures. In accordance with the findings of Gabbi and Sironi (2005), our empirical results suggest that the expected secondary market liquidity is not a significant determinant of primary market bond yields when liquidity is measured by bond size. Hence, despite finding evidence for a negative relationship between transaction issuance costs and bond size, there is no need to adjust the bond yields for liquidity.

Our analysis indicates that the primary euro-denominated bond market can be considered fully integrated since the introduction of the euro. Bond yields move synchronously, i.e. exhibit strong factor convergence, and median yields are equal across countries. In contrast, our results show that the market for bank loans remains segmented albeit to various degrees depending on the type and size of the loan. Small loans with short rate fixation periods are least integrated, indicating that SMEs do not experience a level playing field in their debt financing costs.

[2] Boot (2000) provides a survey of relationship banking.

The plan of the paper is as follows. Section 2 formalises the different convergence measures and presents the adopted econometric approaches. Section 3 describes the data sets. The risk and inflation adjustment regressions are shown in Section 4 and Section 5 presents the convergence analysis. Section 6 concludes by summarizing the main findings.

2. Convergence measures and econometric approaches

Interest rate convergence can be viewed in different ways which together provide us with a more complete picture of the process. One approach is to test whether the median interest rate level is the same across countries (α *-convergence*). Another approach is to test whether differences between rates are becoming smaller over time (σ *-convergence*) and/or whether these differences are stationary (β *-convergence*), i.e. do not contain long-term trends. Finally, this paper introduces a new approach by testing for the irrelevance of country-specific dynamic factors in the short- and long-term evolution of interest rates (*factor convergence*).

2.1. α-convergence

Let $r_i = median(r_{1i},...,r_{Ti})$ where r_{ti} is the interest rate in period t $(t = 1,...,T)$ of country i $(i = 1,..., N)$. Then, differences in interest rate levels can be measured by:

$$\alpha_i = r_i - median(r_1,...,r_N), \quad i = 1,..., N \tag{1}$$

The non-parametric Kruskal-Wallis (1952) test of median equality is applied to infer the joint statistical significance of α_i $(i = 1,..., N)$. We speak of α *-convergence* when the median interest rates are equal across countries.

2.2. σ-convergence

Let $\sigma_t = \sqrt{\text{var}(r_{t1},...,r_{tN})}$. The trend in σ_t can be estimated by OLS of the regression model:

$$\sigma_t = a + bt + \varepsilon_t, \quad t = 1,...,T \ , \tag{2}$$

where t is a time trend, a is a constant and ε_t is an error term. We speak of σ-*convergence* when the estimate of parameter b on the time trend is significantly negative, which would suggest that the process of integration is ongoing.

2.3. β-convergence

Let $s_{ti} = r_{ti} - B_t$ where B_t is a benchmark rate in period *t*. The stationarity of the spreads s_{ti} can be tested by OLS estimation of the error correction model:

$$\Delta s_{ti} = \eta_i + \beta_i s_{t-1,i} + \sum_{j=1}^{L} \delta_j \Delta s_{t-j,i} + \varepsilon_{ti}, \quad t = 1,...,T \tag{3}$$

where η_i is a country-specific fixed effect, ε_{ti} is an error term, δ_j are parameters on the time-lagged change in spreads and β_i is the unit root parameter. In the setup of the Augmented Dickey-Fuller (ADF) test (see Dickey and Fuller, 1979), Equation (3) is estimated country by country. The spreads are stationary when β_i $(i = 1,..., N)$ are in the domain [-1, 0) while there is a unit root when at least one of the β_i is zero. Convergence is complete when β_i equal -1 for all countries. In this case interest rate deviations from the benchmark rate are white noise. We speak of β*-convergence* when all spreads are stationary. Sooner or later loan rates will then return to the benchmark rate up to the fixed country-specific effect. Complete β-convergence implies complete market integration. Under complete β-convergence, shocks to loan rates do not persist for more than one period.

A known weakness of the ADF test for single time series is its low power in small samples. Simulations have shown that the power of panel unit root tests can be considerably higher. We therefore apply recently developed panel unit root tests, i.e. the Hadri (2000) test, the Levin, Lin and Chu (2002) test and the Im, Pesaran and Shin (2003) test. These tests differ especially in the null (H_0) and alternative (H_1) hypotheses. In the case of the Hadri test all time series are stationary under H_0 while all series have unit roots under H_1. In contrast, in the case of the LLC and IPS tests all series have a unit root under H_0. The LLC test rejects H_0 only when all series are stationary whereas the IPS test rejects H_0 when at least one series is stationary.

2.4. Factor convergence

Incomplete β-convergence may be the result of short-term movements in interest rates due to country-specific dynamic factors. To test for the statistical significance of common and non-common factors we perform maximum likelihood factor analysis (see Jöreskog, 1969). That is, the interest rates are decomposed into:

$$r_{ti} = a_i + l_{1i}F_{1t} + l_{2i}F_{2t} + ... + l_{Ki}F_{Kt} + \varepsilon_{ti}, \quad i = 1,...,N; \;\; t = 1,...,T \tag{4}$$

where a_i is a country-specific constant, $F_1,...,F_K$ are K latent factors, $l_{1i},...,l_{Ki}$ are the associated country-specific factor loadings and ε_{ti} denotes white noise error. We use the EM algorithm (see, Rubin and Thayer 1982) to maximise the likelihood function. Confidence intervals are estimated by Efron's (1979) bootstrap. Factor *k* is considered statistically insignificant when the 99% confidence intervals of all loadings $l_{k1},...,l_{kN}$ include zero and considered statistically significant when the 99% confidence interval of at least one loading does not include zero. Factors can thus be country-specific while not being part of the errors. Loading l_{ki} on factor *k* associated with country i is considered statistically significantly different from loading l_{kj} associated with country *j* when at least one of the two loadings is outside the 99% confidence interval of the other loading.

Interest rates are said to exhibit (weak) *factor convergence* when all factor loadings are significant and all loadings associated with one factor have the same sign. There are then no statistically significant country-specific dynamic factors. However, interest rates may not respond with the same strength to the common factors. For example, when the ECB refinancing rate goes down, loan rates in all countries go down but by more in some countries than in others. Convergence is complete when factor loadings are the same for all countries, in which case there can be only one significant factor. We then speak of strong factor convergence. Under strong factor convergence interest rates move fully synchronously both in the short and long run in the sense that there are no systematic effects in bi-lateral interest rate differences up to a constant.

Definition 1 (weak factor convergence): *For all statistically significant factors* $k \in [1,...,K]$*, sign (*l_{ki}*) = sign (*l_{kj}*)* $\forall i, j \in [1,...,N]$ *and* $l_i \neq 0 \; \forall \; i \in [1,...,N]$.

Definition 2 (strong factor convergence): *For all statistically significant factors* $k \in [1,...,K]$, $l_{ki} \in \left[l_{kj}^{p}, l_{kj}^{1-p}\right]$ $\forall i, j \in [1,...,N]$ *and* $l_i \neq 0 \; \forall \; i \in [1,...,N]$, *where* $\left[l_{kj}^{p}, l_{kj}^{1-p}\right]$ *is the* $(1-2p)$ *percent confidence interval associated with the estimate of the loading* l_{kj}.

Table 1 provides an overview of the relationships between the various convergence measures. We first compare factor convergence with existing measures. Strong factor convergence implies complete β-convergence, and vice versa, in the sense that one can find a benchmark rate for which all spreads are stationary and white noise. In contrast, weak factor convergence does not necessarily imply β-convergence, neither complete nor incomplete. Indeed, loan rates may exhibit weak factor convergence but still drift apart due to differences in factor loadings. Nor does incomplete β-convergence, i.e. when spreads are stationary but auto-correlated, imply weak factor convergence. Stationary loan rates may still have persistent country specific components in short-term interest rate movements. Strong factor convergence further implies the absence of σ-convergence, for σ-convergence requires differences in factor loadings. When all factor loadings are equal then there is no σ-convergence. Going in the other direction, the absence of σ-convergence, however, is not a sufficient condition for either weak or strong factor convergence, again due to possible persistent country specific components in short-term interest rate movements. Factor convergence and α-convergence are unrelated in the sense that one can hold with or without the other.

Table 1 Relationships between convergence measures.

	α	σ	*Absence of* σ	*Incomplete* β	*Complete* β	*Weak Factor*	*Strong Factor*
α							
σ	⇎						
Absence of σ	⇎	⇎					
Incomplete β	⇎	⇎	⇎				
Complete β	⇎	⇎	⇒	⇒			
Weak Factor	⇎	⇎	⇎	⇎	⇐		
Strong Factor	⇎	⇎	⇒	⇒	⇔	⇒	

Notes: For convergence measures X and Y:

X ⇒ Y: X implies Y but Y does not necessarily imply X.

X ⇐ Y: Y implies X but X does not necessarily imply Y.

X ⇔ Y: X implies Y, and Y implies X.

X ⇎ Y: X does not necessarily imply Y, and Y does not necessarily imply X.

We next compare the existing measures only. Complete β-convergence implies the absence of σ-convergence because in that case interest rate deviations from the benchmark are white noise with constant variance for all rates.[3] This relationship does not hold in the other direction since the absence of σ-convergence does not necessarily

[3] Strictly speaking, one could observe σ-convergence while interest rates exhibit complete β-convergence if and only if the errors in Equation (3) are heteroskedastic. In this case, σ-convergence does not indicate that the trends in interest rates are converging but indicates that the deviations from the trends are falling in absolute value. This is not a common interpretation of σ-convergence.

imply that all interest rates are stationary. For example, some interest rates may converge to the benchmark rate which lowers the cross-sectional variance, while other rates may diverge from the benchmark which increases the cross-sectional variance. These effects on the cross-sectional variance may offset each other while some interest rates are non-stationary. Incomplete β -convergence is not a sufficient condition for the absence of σ -convergence since stationary interest rates may still converge. Indeed, a (non-linear) trend in the interest rate spread that dies out over time is stationary. σ -convergence is thus unrelated to incomplete β -convergence. There can be σ -convergence even when some of the interest rates are non-stationary. Finally, both β -convergence and σ -convergence are unrelated to α -convergence.

3. Data description

3.1. Bank loan interest rates

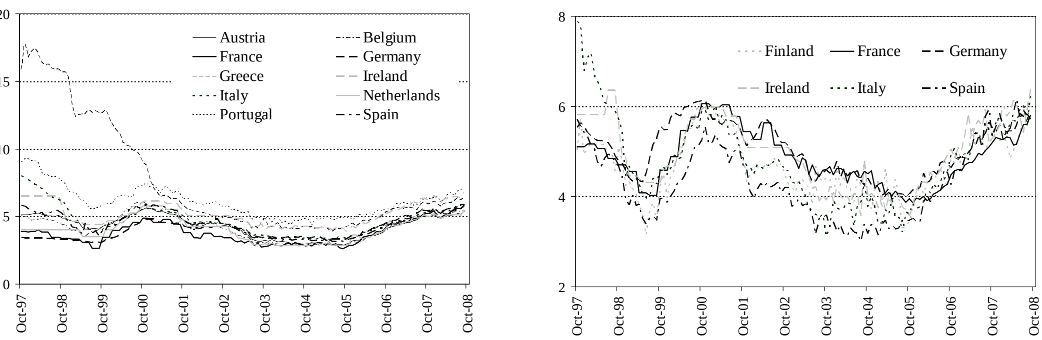
This paper analyses monthly interest rates on new business lending to Non-Financial Corporations (NFCs) in eleven euro area countries. New lending includes re-negotiated loans but excludes previously negotiated loans with automatic rate re-setting. Since January 2003 the ECB has reported harmonised interest rates of Monetary Financial Institutions (MFIs) in the euro area. To get more history, non-harmonised interest rates compiled by the National Central Banks (NCBs) are chain linked with the harmonised MFI interest rates compiled by the ECB. This allows us to construct (risk-adjusted) series that go back to October 1997. Appendix A contains a methodological note with the details of the variable construction.

Loan rates are separately reported for loans with an initial rate fixation period up to one year, hereafter called *short* loans (STL = Short-Term Loans and long-term loans with short rate fixation periods), and loans with rate fixations periods of more than one year, hereafter called *long* loans (LTL = Long-Term Loans with long rate fixation periods). Note that short loans include long-term variable rate loans but exclude overdrafts. Interest rates for different loan sizes are only available for the harmonized ECB statistics. *Small* loans do not exceed EUR 1 million. To some extent *large* loans (above EUR 1 million) are dominated by large firms with 250 employees or more. Short-Term and long-term variable rate Small Loans (STSL) and Short-Term and long-term variable rate Large Loans (STLL) are available for all eleven countries. Portuguese rates on Long-Term Small Loans with long rate fixation periods (LTSL) and Belgian, Greek and Portuguese rates on Long-Term Large Loans with long rate fixation periods (LTLL) are missing. Table 10 of Appendix C contains basic descriptive statistics of the bank loan interest rate series (before risk adjustment).

Figure 1a shows the evolution in short and long interest rates on NFC loans between October 1997 and September 2008. There is clear evidence of short and long interest rate convergence until the end of the year 2000. Convergence of loan rates during this period partly reflects the anchoring of inflation expectations at lower and more similar levels thanks to the single currency and the common monetary policy. However, even after correcting the series for differences in inflation (see next section), the ending of a period of strong interest rate convergence in some countries leads to structural breaks. Visual inspection of Figure 1a seems to indicate that, since 2001, interest rates have been moving almost in parallel, suggesting that convergence is nearly complete up to a constant difference in average rates. By applying the convergence measures discussed in the previous section over the period January 2001 – September 2008 this is tested formally in Section 5.

Fig. 1a. Developments in NFC loan rates (in %), non-harmonised series.

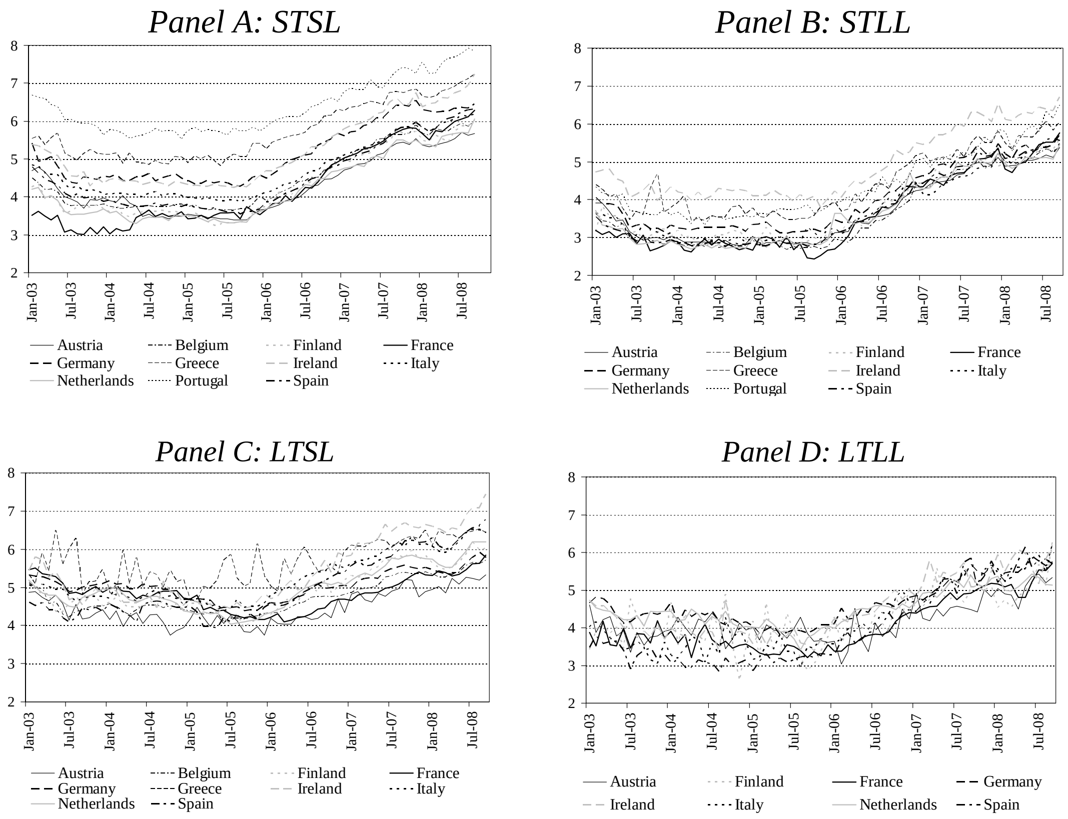
Panel A: STL *Panel B: LTL*



Source: National Central Banks and European Central Bank. See Appendix D for a glossary.

Figure 1b depicts the evolution in harmonized interest rates by rate fixation period and loan size. Two broad patterns can be detected by comparing loan sizes (Panel A with panel B and Panel C with Panel D): first, small loan rates are substantially higher than large loan rates. On average, small loan rates exceed large loan rates by about 75 basis points (b.p.) on both short and long loans. The empirical findings of both Dietsch (2003) and Wagenvoort (2003) suggest that from a portfolio credit risk viewpoint this may not be justified. A portfolio of loans to small firms is not necessarily riskier than a portfolio of loans to large firms, even when small firms individually are riskier than large firms. Second, the cross-country variance of small loan rates is higher than the variance of large loan rates. Rates on large loans are thus more uniform across the euro area than rates on small loans. Comparing rate fixation periods (Panel A with Panel C and Panel B with Panel D), we find that rate levels are generally lower, but that cross-country variances are higher on short than on long loans. Long-term rates with long rate fixation periods are thus more uniform than short rates.

Fig. 1b. Developments in NFC loan rates (in %), harmonised series.



Source: European Central Bank. See Appendix D for a glossary.

There is no single country that persistently has the lowest rate for any of the loan categories. Loan rates are generally higher in Germany, Greece, Ireland, Italy and Portugal than in Austria, Belgium, Finland, France, the Netherlands and Spain. Part of these cross-country differences in nominal loan rates can be explained by differences in macroeconomic risk and inflation. In Section 4 we adjust the loan rates for these conditions.

3.2. Primary bond yields

From the Dealogic Bondware data warehouse we construct a data set of primary market yields on euro-denominated bonds issued by NFCs between January 1999 and October 2008. After risk adjustment (see next section), quarterly averages of the yield to maturity are computed by nationality of the companies. Our sample of 828 plain-vanilla fixed coupon bonds has 0, 3, 9, 4, and 3 missing quarters for France, Germany, Italy, the Netherlands, and the United Kingdom respectively, out of a total of 40 quarters per country. We decided to restrict the number of countries to these five so that the share of missing quarters would not exceed 25 percent of observations per country. By enlarging this group with other euro area countries, the share of missing quarters in the country with the least frequent bond issuance would exceed that figure. Note that in four out of the five countries only 10 percent or less of the observations are missing. Missing values in the quarterly series are estimated by inter- and extrapolation of the neighbouring observations. Table 11 of Appendix C shows the main characteristics of the 828 bonds for which face values vary between EUR 20 million and EUR 20 billion.

4. Adjusting interest rates for risk

4.1. Adjusting bank loan rates for systematic risk and inflation

We measure systematic risk (R_{ti}) by the standard deviation of (year on year) GDP growth rates over the last twelve quarters as a negative relationship can be expected between the aggregate default rate on national loan portfolios and economic growth. Actual default rates are not publicly available. Actual inflation over the last twelve months is taken as a proxy for inflation expectations (I_{ti}).[4] In a first step the loan rates

[4] Both inflation and GDP growth data are from Eurostat. The frequency of the data is monthly and quarterly respectively.

(r_{ti}) are regressed on these two macroeconomic variables and a set of year dummies in a single equation:

$$r_{ti} = c + b_1 R_{ti} + b_2 I_{ti} + b_3 D_t + \varepsilon_{ti}, \quad i = 1,..., N, t = 1,..., T \tag{5}$$

where c is a constant, D_t is a matrix of year dummies, b_1 and b_2 are parameters, b_3 is a $(T-1)$-vector of parameters, and ε_{ti} is an error term. The loan rates are then adjusted as follows:

$$\tilde{r}_{ti} = r_{ti} - \tilde{b}_1 (R_{ti} - R_{tj}) - \tilde{b}_2 (I_{ti} - I_{tj}) \tag{6}$$

where $\tilde{r}_{ti}$ is the adjusted loan rate, $\tilde{b}_1$ and $\tilde{b}_2$ are OLS estimates of Equation (5) and country *j* is chosen as benchmark country.

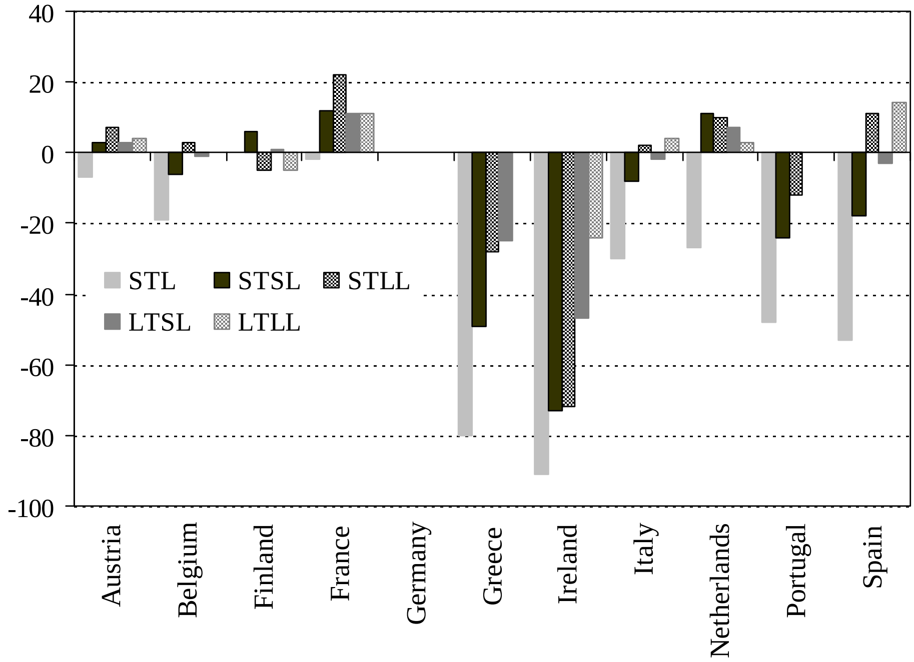
Table 2 OLS regression results used for the risk adjustment of bank loan rates.

	STL	LTL	STSL	STLL	LTSL	LTLL
	Oct. 1997 - Sept. 2008		Jan. 2003 - Sept. 2008			
Constant	3.99***	5.63***	4.67***	4.32***	5.02***	5.32***
Systematic risk	0.21***	0.06	0.45***	0.58***	0.33***	0.24***
Inflation	0.41***	0.01	0.30***	0.15***	0.15***	-0.04
N	10	6	11	11	10	8
T	132	132	69	69	69	69
Observations (NxT)	1320	792	759	759	690	552
Adjusted R^2	0.56	0.70	0.64	0.86	0.66	0.72

Notes: Parameters that are significantly different from zero at the 10%, 5% and 1% level are indicated with *, **, and *** respectively. The regressions include year dummies (not shown). In the case of LTL and LTLL, two additional variables are included: the systemic risk variable and the inflation variable both interacted with a dummy variable for Spain (not shown). See Appendix D for a glossary.

Table 2 contains the regression results. Both systematic risk and inflation affect loan rates significantly and positively except in the case of Long-term Large Loans with long rate fixation periods (LTLL) where the parameter on inflation is not significantly different from zero at the 10% level. Our model explains between 64% (STSL) and 86% (STLL) of the variation in harmonised loan rates.

Fig. 2. Average systematic risk and inflation adjustment of loan rates (in basis points).



Notes: See Appendix D for a glossary

Using Germany as a benchmark, average adjustments are relatively small (i.e. less than 25 basis points) for most countries (see Figure 2). Harmonized rates are negatively adjusted by more than 25 b.p. in the cases of Greece and Ireland only, bringing those high-rate countries closer to the other countries. Depending on loan category, French rates are positively adjusted between 11 b.p. and 22 b.p. This reduces the bi-lateral differences in loan rates between France and Germany. In the case of STL (non-harmonized) rates, the risk adjustment exceeds 25 b.p. for Greece (-80 b.p.), Ireland (-91 b.p.), Italy (-30 b.p.), Netherlands (-27 b.p.), Portugal (-48 b.p.) and Spain (-53 b.p.). No adjustment is made for the LTL category as neither risk nor inflation are statistically significant in Table 2.

The bank market integration analysis of the Section 5 is performed on the risk and inflation adjusted rates.

4.2. Adjusting bond yields for credit risk and liquidity

Let $Spread_i$ be the difference between the yield to maturity (y_i) of bond i and the corresponding swap rate with the same maturity, both at the bond issuance date. The unbalanced sample of 828 bonds is used to regress the bond spread on variables that capture expected secondary market liquidity and credit risk. The liquidity of bond i is measured by the natural logarithm of its face value (F_i). Credit risk is picked up by various variables including the bonds' credit rating at issue, time to maturity (M_i), and coupon (C_i). We expect higher credit risk on bonds with higher coupon and longer maturity.

Table 3 shows the OLS estimates of the following linear model:

$$Spread_i = c + b_1 A + b_2 BBB + b_3 BB + b_4 NR + b_5 M_i + b_6 C_i + b_7 F_i + b_8 D_t + \varepsilon_i, \quad i = 1, ..., N \quad (7)$$

where c is a constant, D_t is a matrix of year dummies, $b_1, ..., b_7$ are parameters, b_8 is a $(T-1)$-vector of parameters, *A* is a dummy variable for bonds rated A, *BBB* is a dummy variable for bonds rated BBB, *BB* is a dummy variable for bonds rated BB or lower, *NR* is a dummy variable for bonds without rating or bonds for which ratings are missing in Bondware, and ε_{ti} is an error term. Rating dummies are defined with respect to bonds rated AA and AAA. In accordance with the findings of Gabbi and Sironi (2005), we find that bond spreads rise significantly with lower credit ratings and higher coupons, and that bond size is not a significant determinant of bond spreads. However, in contrast with Gabbi and Sironi (2005) and with our expectations, bond spreads fall with higher maturity.[5] This effect is only significant when ratings and coupons are included in the regression and when bonds with maturities of longer than 10 years are included in the sample.

[5] The most important differences between our sample and model specification and those of Gabbi and Sironi (2005), hereafter abbreviated as GS, are as follows. First, our sample is restricted to bonds denominated in euros while the GS sample is restricted to Eurobonds but denominated in different currencies. We compute bond spreads to the corresponding swap rates while GS compute bond spreads to the corresponding Treasury bond rates. Finally, GS include a larger number of explanatory variables. Our more condensed model, however, is sufficiently developed to capture the key differences in credit risk.

Table 3 OLS regression results used for the risk adjustment of bond yields.

	Parameter	t-value
Constant	-2.89	-9.55
A	0.22	5.48
BBB	0.35	8.25
BB,B	0.92	7.72
No rating	0.48	7.85
Years to maturity	-0.03	-8.60
Coupon spread to swap	0.72	35.39
Natural log of face value	-0.02	-1.32
Observations	828	
Adjusted R^2	0.81	

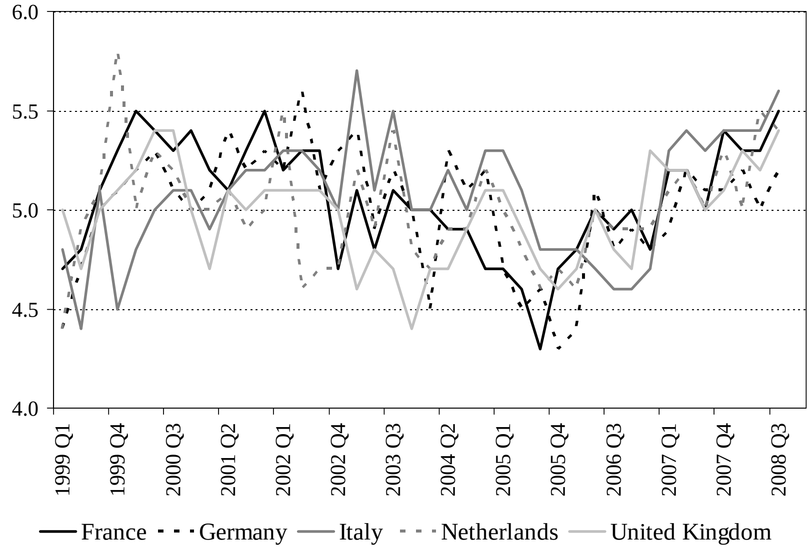
Notes: The regressions include year dummies (not shown). Dummy variables for ratings are defined with respect to the class of AA and AAA. Period: January 1999 – October 2008.

Using only the statistically significant variables in Table 3, the bond yields are adjusted for credit risk as follows:

$$\tilde{y}_i = y_i - \tilde{b}_1 A - \tilde{b}_2 BBB - \tilde{b}_3 BB - \tilde{b}_4 NR - \tilde{b}_5\left(M_i - \frac{1}{n}\sum_{i=1}^{n} M_i\right) - \tilde{b}_6\left(C_i - \frac{1}{n}\sum_{i=1}^{n} C_i\right) \quad (8)$$

where $\tilde{y}_i$ is the adjusted yield to maturity, and $\tilde{b}_1,...,\tilde{b}_6$ are OLS estimates of Equation (7). Figure 3 depicts the quarterly averages of the risk-adjusted bond yields that are used in the convergence analysis of the next section. As shown by the figure, there are no apparent systematic differences in risk-adjusted yields across countries, neither in the short-term nor in the long-term.

Fig. 3. Quarterly averages of risk-adjusted bond yields (in %).



5. Measuring financial market integration

In the following we apply the four convergence measures outlined in Section 2 to the balanced samples of monthly (risk and inflation adjusted) bank loan rates and quarterly (credit risk adjusted) bond yields.

5.1. α-convergence: are borrowing costs on average equal across countries?

To assess whether corporate borrowers in Europe pay on average the same interest rate, we compare the median level of interest rates across countries using the Kruskal-Wallis (KW) test. The KW test converges asymptotically to the chi-squared distribution with *N*-1 degrees of freedom where *N* denotes the number of interest rates. The critical percentiles associated with the one percent significance level are shown in the last row of Table 4.

Table 4 Differences in median risk-adjusted rates (α in basis points).

	Bonds	Bank loans					
		STL	LTL	STSL	STLL	LTSL	LTLL
	Jan. 99 - Oct. 08	*Jan. 2001 – Sept. 2008*		*Jan. 2003 – Sept. 2008*			
Austria		18		-6	0	-48	-1
Belgium		-7		4	-15	-32	
Finland			-6	-2	-3	-5	2
France	0	-57	6	-23	-28	9	-22
Germany	1	27	22	76	25	24	35
Greece		19		78	23	56	
Ireland		-1	28	0	31	-21	1
Italy	3	1	-8	19	-4	6	-13
Netherlands	-10	-58		-33	2	5	32
Portugal		91		160	31		
Spain		-44	-51	-20	-9	-31	-37
UK	-6						
countries (N)	5	10	6	11	11	10	8
T	40	93	93	69	69	69	69
Kruskal – Wallis	3.69	127.99	43.31	161.53	46.56	87.41	39.04
$\chi^2_{0.01}(N-1)$	13.28	21.67	15.09	23.21	23.21	21.67	18.48

Notes: The *Kruskal-Wallis* test of median equality converges asymptotically to the chi-squared distribution with *N-1* degrees of freedom. $\chi^2_{0.01}(N-1)$ denotes the chi-squared critical value at the 1% significance level. The null hypothesis of equal medians is rejected if the test statistic is greater or equal the critical value. See Appendix D for a glossary.

As is evident from Table 4, the corporate bond market exhibits α-convergence since differences between median bond yields are not statistically significant at commonly applied significance levels. In addition to interest expenses, NFCs also bear transaction costs on their bond financing. Appendix B mentions the main cost components of bond issuance and provides some basic descriptive statistics. In accordance with the results on interest expenses, transaction costs also are the same across countries when bond size is considered.

In sharp contrast, α-convergence has not been achieved in the bank loan market. The Kruskal-Wallis test rejects the equality of medians at the 1% significance level for all bank loan categories. Comparing bank loan rates since January 2003, thus focusing on the period since which the euro has been well established and national data have been harmonised, absolute differences in median levels of risk-adjusted bank loan rates are generally larger for small than for large loans, in particular for short loans. Short small (STSL) loans were about 100 b.p. more expensive for German than for French firms. The median German STSL rate was 76 b.p. above the median country (=Ireland) whereas the median French STSL rate was 23 b.p. below. Portuguese firms paid the most ($\alpha = 160$) whereas Dutch firms paid the least ($\alpha = -33$), leading to a difference of almost 200 b.p. between minimum and maximum levels. For short large (STLL) loans the differences are smaller but German STLL rates are still about 50 b.p. more expensive than those of France. Differences of a similar magnitude are observed for long large loans (LTLL).

Given that the average bank loan rate still varies considerably across the euro area, is there evidence that the differences in borrowing costs are diminishing over time and if so, how fast?

5.2. σ-convergence: are borrowing costs becoming more uniform over time?

Between January 1999 and October 2008 σ-convergence was absent in the bond market. The coefficient on the time trend in Equation (2) is not statistically significant at the 10 percent or lower significance level (see Table 5).

Turning to bank loans, Figure 4a shows the evolution of the cross-country standard deviation of loan rates. There is evidence of strong σ-convergence until December 2000 and weak σ-convergence thereafter. σ-convergence was significant at the 95% level for both short (STL) and long (LTL) loans between January 2001 and September 2008. The speed of convergence for this period averaged -2 and -3 b.p. per annum respectively (see Table 5). At such speed (say -3 b.p.) and σ-level (say 50 b.p.) at the end of 2000 it would have taken 25 more years before 95 percent of the loan rates would have had differences smaller than 25 basis points.[6]

Figure 4b depicts the evolution of σ by size category. The STSL σ-line is clearly above the lines of the other categories, suggesting that the short small loan segment is the least integrated. There are breaks in the series as from January 2008, for short rates in particular. As suggested by the graph, σ is increasing rapidly due to the financial crisis. Before the crisis, some series had a weak negative trend. We therefore run the σ-convergence regression also for the harmonized series separately for different periods: one covering the pre-crisis period up to and including December 2007, one covering the first nine months of 2008, and one for the whole period between January 2003 and September 2008.

In the five years before the crisis σ-convergence was significant at the 95% level in the case of short small and long large loans only. The speed of convergence for this period averaged -2 and -4 b.p. per annum respectively which correspond to the trends found for the aggregate STL and LTL series starting from 2001. Rather than becoming more uniform over time, during 2008 the standard deviation of loan rates actually increased rapidly in most cases. Both STSL and STLL σ-levels are now back to pre-2003 values. The modest σ-convergence in STSL rates registered for the period 2003-2007 has thus been entirely offset by recent developments. For the full period, σ-convergence is statistically insignificant for STSL rates. In contrast, in the case of LTLL σ-convergence is insignificant in 2008 but remains statistically significant for the full period.

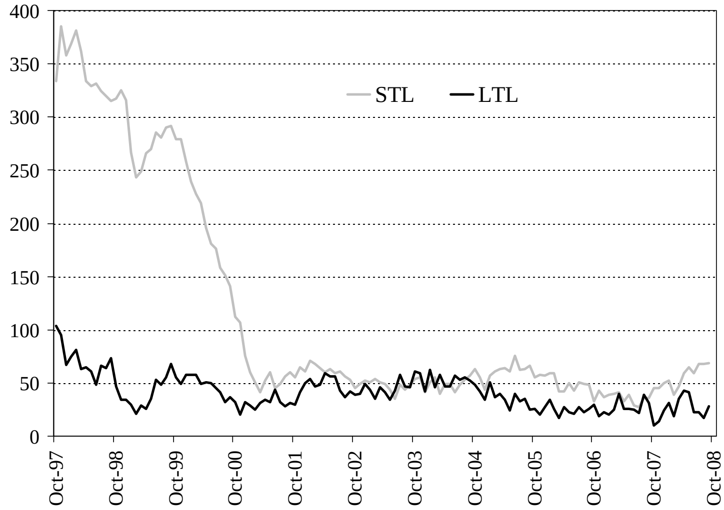
[6] Under the assumption that loan rates in period *t* follow a normal distribution, 95% of the rates have differences smaller than 100 b.p., which is reduced to 100-3*25=25 b.p. after 25 years.

Table 5 Annual speed of sigma convergence (in basis points).

	Bonds	Bank loans					
		STL	LTL	STSL	STLL	LTSL	LTLL
Jan. 99 - Oct. 08	0						
Oct. 97 - Dec. 00		-79	-12				
Jan. 01 - Sept. 08		-2	-3				
Oct. 97 - Sept. 08		-27	-3				
Jan. 03 - Dec. 07		-2	-7	-2	0	0	-4
Jan. 08 - Sept. 08		40	0	24	35	11	0
Jan. 03 - Sept. 08		0	-5	0	1	1	-3

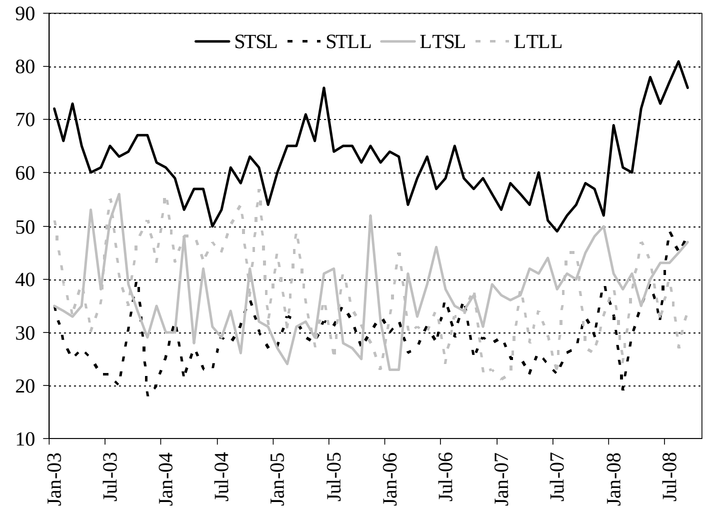
Notes: The annual speed is computed as *b*12* where *b* is the regression coefficient on the time trend of Equation (2). Insignificant coefficients at the 95% confidence level are set to zero. See Appendix D for a glossary.

Fig. 4a. Standard deviation of loan rates (σ in basis points), non-harmonised series.



Notes: See Appendix D for a glossary.

Fig. 4b. Standard deviation of loan rates (σ in basis points), harmonised series.



Notes: See Appendix D for a glossary.

In sum, there are few signs that bank loan rates continue to converge. Whether or not there are long-term trends in the rate differences is our next convergence criterion.

5.3. β-convergence: are differences between borrowing costs mean-reverting?

The β-convergence measure (see Equation 3) requires the choice of a benchmark rate. The empirical findings of Vajanne (2007) underline the difficulty of finding an appropriate benchmark. In her study for example, at the 10 percent significance level short small bank loans are stationary when the lowest loan rate is taken as the benchmark but have a unit root when a market-based swap rate is used. The lowest rate is not necessarily the best choice when the idiosyncratic component of this rate is relatively high.[7] Nor are market rates necessarily a good choice because bank loan rates may wander away from market rates without affecting cross-country differences in bank loan rates.

We choose the benchmark rate in period t to be the average interest rate of that period. The function of our benchmark rate is to minimize the measured differences between the interest rates rather than to set optimal levels to which interest rates are expected to converge.

For this benchmark choice the cross-country differences in risk-adjusted bond yields are stationary. Table 6a shows the p-values associated with the different panel unit root tests. Both the LLC and the IPS tests reject a unit root in the bond spreads whereas the Hadri test does not reject their stationarity at 10 percent or lower significance levels. There is thus clear evidence for β-convergence of the bond market.

Regarding bank loans, it turns out that our β-convergence results are sensitive to the type of test used. Both the LLC and the IPS tests reject the null hypothesis of a unit root in the loan spreads at commonly used significance levels for all loan categories. In sharp contrast the Hadri test rejects the stationarity of all series. Even if there was β-convergence, the speed of convergence is low as many β-estimates are close to zero (see Table 6b). The absolute value of the median β-estimate is higher for large than for small loans and higher for long than for short loans suggesting in line with the α-convergence

[7] Based on this argument, Dunne et al. (2007) for instance propose France as the benchmark for the euro-denominated sovereign bond market at most maturities although German bonds have the lowest yields.

results, that the market for large loans, long loans in particular, is more integrated than the market for small loans.

Table 6a Panel unit root test results for interest rate spreads (*p*-value).

	Bonds	Bank loans					
		STL	LTL	STSL	STLL	LTSL	LTLL
	Jan. 99 – Oct. 08	*Jan. 2001 – Sept. 2008*		*Jan. 2003 – Sept. 2008*			
Levin, Lin and Chu (2002)	0.000	0.001	0.004	0.001	0.000	0.000	0.000
Im, Pesaran and Shin (2003)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hadri (2000)	0.140	0.000	0.000	0.000	0.000	0.000	0.000
N	5	10	6	11	11	10	8
T	40	93	93	69	69	69	69
Observations	200	930	558	759	759	690	552

Notes: In the case of the Hadri test, all time series are stationary under H_0 while all series have unit roots under H_1. In contrast, in the case of the LLC and IPS tests all series have a unit root under H_0. The LLC test rejects H_0 only when all series are stationary whereas the IPS test rejects H_0 when at least one series is stationary. The number of time periods is approximate since the lag-length selection differs according to the test used. See Appendix D for a glossary.

Table 6b β-estimates of the Augmented Dickey-Fuller Equation (3).

	Bonds	Bank loans					
		STL	LTL	STSL	STLL	LTSL	LTLL
	Jan. 99 – Oct. 08	*Jan. 2001 – Sept. 2008*		*Jan. 2003 – Sept. 2008*			
Austria		-0.048 *		-0.081 *	-0.218	-0.382	-0.553
Belgium		-0.043 *		-0.103 *	-0.176 *	-0.243	
Finland			-0.525	-0.119 *	-0.046 *	-0.390	-0.898
France	-0.609	-0.224	-0.039 *	-0.038 *	-0.262	-0.091 *	-0.789
Germany	-0.848	-0.092 *	-0.126 *	-0.185	-0.116 *	-0.049 *	-0.251 *
Greece		-0.406		-0.600	-0.635	-0.818	
Ireland		-0.040 *	-0.625	-0.226	-0.118 *	-0.085 *	-0.669
Italy	-0.462	-0.316	-0.179 *	-0.318	-0.299	-0.127 *	-0.341
Netherlands	-1.021	-0.114 *		-0.159 *	-0.471	-0.189 *	-0.189 *
Portugal		-0.349		-0.109 *	-0.003 *		
Spain		-0.135 *	-0.071 *	-0.084 *	-0.170 *	-0.093 *	-0.089 *
UK	-0.758						
Median	-0.758	-0.124	-0.153	-0.119	-0.176	-0.158	-0.447
T	40	93	93	69	69	69	69

Notes: Cases for which the Augmented Dickey Fuller (ADF) test rejects the stationarity of the interest rate spread at the five percent or higher level are indicated with an asterisk. ADF tests were performed for each country separately, using the Schwarz information criterion for lag length selection. The number of time periods indicated in the table is therefore approximate. See Appendix D for a glossary.

Up to this point we have looked at convergence criteria that capture long-term differences and trends. Our next and last criterion measures short-term as well as long-term systematic differences in the evolution of loan rates.

5.4. Factor convergence: are borrowing costs moving synchronously?

The appealing feature of factor analysis is that factors do not have to be specified *ex ante* as they are estimated jointly with the factor loadings. We increase the number of latent factors until the last added factor is statistically insignificant for all countries at the 1% significance level. No more than two factors can explain all systematic variation in the bond yields and the bank loan rates. Our results for a model with two factors are shown in Appendix C. Table 12a of Appendix C shows the Maximum Likelihood estimates of the factor loadings for the bank loan rates; Table 12b and Table 12c show the corresponding 0.5^{th} and 99.5^{th} percentiles of the bootstrapped factor loadings respectively. Table 13 contains the factor analysis results for the bond yields.

In the case of the bond market, a single factor can account for all systematic variation in the risk-adjusted bond yields. Furthermore, each factor loading is in the 99 percent confidence interval of the other factor loadings. The bond market thus exhibits strong factor convergence. There is no systematic deviation of borrowing cost of companies in one European country in comparison to the borrowing cost of companies in other European countries.

In the case of bank loan rates, for some countries, but not all, two factors are statistically significant for the non-harmonized STL and LTL series, even when only observations since January 2001 are selected, i.e. after the structural break in σ-convergence. Factor convergence is thus here absent.

There is however evidence for weak factor convergence of bank loan rates for some of the harmonized series since January 2003. We find that a single factor can account for all systematic variation in the interest rates of loan categories STLL, LTSL and LTLL. In these cases factor loadings are all significant and have the same sign. Convergence here is weak and not strong since some of the factor loadings are outside the 99 percent confidence interval of the other loadings. In other words, although there are no country-specific dynamic factors that can explain the evolution in the respective series, the sensitivities to the common factor are different, leading to systematic differences in the evolution of borrowing costs across countries. In the case of short small loans (STSL) two factors are statistically significant. Figure 5 depicts the evolution of these factors. The first STSL factor is strikingly similar to the 6-month Euribor inter-bank rate. The unique factors that can explain the STLL, LTSL, and LTLL loan rates are almost identical to the first STSL factor. The factor loadings on the second STSL factor are, in some cases, statistically insignificant while in other cases they are significantly positive or negative. This means that STSL loan rates are driven by dynamic factors that are not common to all countries. Table 7 summarizes the factor convergence analysis results.

Fig. 5. Factors driving STSL rates and the Euribor rate (in %).

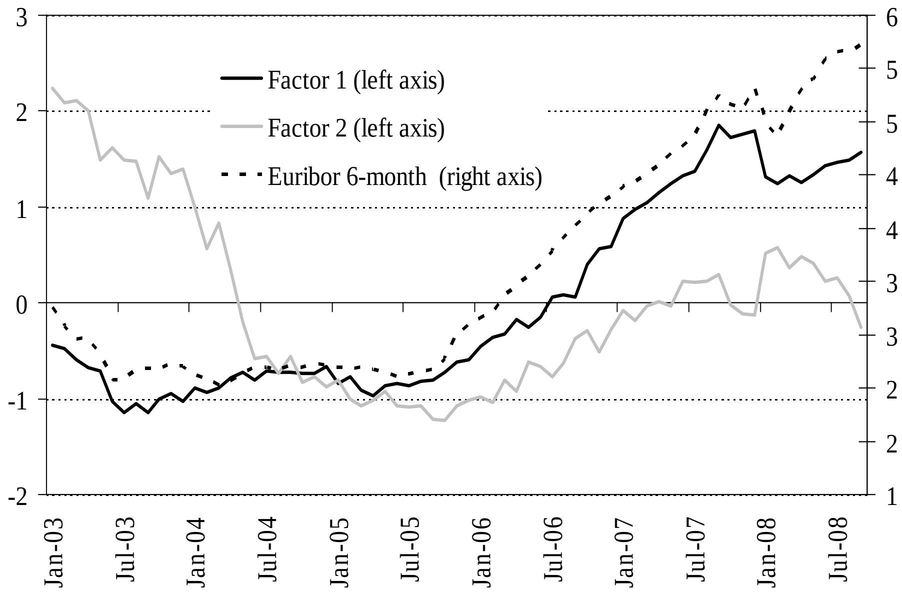


Table 7 Factor convergence results.

	Bonds	Bank loans					
		STL	LTL	STSL	STLL	LTSL	LTLL
	Jan. 99– Oct. 08	*Jan. 2001 – Sept. 2008*		*Jan. 2003 – Sept. 2008*			
Factor convergence	Strong	None	None	None	Weak	Weak	Weak
N	5	10	6	11	11	10	8
T	40	93	93	69	69	69	69
Observations (NxT)	200	930	558	759	759	690	552

Notes: See Appendix D for a glossary.

Why is the market for short small loans less integrated than the market for long small loans? Long-term loans presumably provide financing for investment whereas short-term loans usually provide working capital. The former loans are more often backed up by collateral than the latter. To the extent that loans with short rate fixation periods contain a larger share of working capital type of financing than loans with long rate fixation periods, short small loans are more susceptible to information problems and, therefore, possibly to distortions in loan pricing. There is no natural law stating that the STSL loan market is necessarily more heterogeneous across countries than the other loan markets.

The explanatory power of the factors is in most cases higher for the bank loan rates than for the bond yields. The adjusted R^2 showing the share of the variance in risk-adjusted rates (centred on their mean) that can be explained by the statistically significant factors is between 0.67 and 1.00 for the loans (see Table 12a) and between 0.42 and 0.70 for the bonds (see Table 13). There are two explanations for these differences. Firstly, national loan rates are based on a very large number of individual loan rates whereas some of the quarterly bond rates represent just one firm. Company specific components are thus more important for bonds than for loans. A second and related explanation is the fact that a bond yield on a particular day is likely to give an imprecise estimate of the average funding conditions during a quarter. Although this should not introduce systematic biases, measurement errors are expected to be larger for bonds than for loans.

6. Conclusion

The novelty of this study is the use it makes of factor analysis to compare NFC borrowing costs in the euro area. Our sample of 828 bond issues suggests that integration of the primary euro-denominated bond market is complete; there is evidence of α-convergence, β-convergence, strong factor convergence, and absence of σ-convergence. In contrast, the market for bank loans remains segmented albeit to various degrees depending on the type and size of the loan.

We find that rates on large bank loans and small bank loans with long rate fixation periods exhibit weak factor convergence in the sense that, up to a fixed effect, they are driven by common factors only. In contrast, the evolution of short small loan rates is still affected by country-specific dynamic factors. To the extent that loans with short rate fixation periods contain a larger share of working capital type of financing than loans with long rate fixation periods, short small loans are more susceptible to information problems and, therefore, possibly to distortions in loan pricing.

The factor convergence results resolve some of the ambiguity that follows from β-convergence results which are sensitive to the type of the panel unit root test used.

Notable differences remain in the average cost of bank loans across the euro area, in particular for small loans with short rate fixation periods where some differences are to the order of almost 200 basis points even after adjusting rates for macroeconomic conditions such as systematic risk and inflation. α-convergence is rejected for all loan categories.

There are few signs that bank loan rates are becoming more uniform with time. In 2008 the cross-country variance in loan rates increased as a result of the financial and economic crisis, bringing σ-levels on short loans back to pre-2003 values. There is some evidence of σ-convergence for long large loans albeit with rates converging at low speed.

To conclude, small businesses do not experience a level playing field in their debt financing costs, in particular with respect to the financing of working capital, and there are few signs of improvement. Additional policy efforts are therefore needed to make retail bank markets more competitive.

Appendix A. Methodological note on chain linking NCB and ECB interest rates

This study uses and extends the interest rate time series constructed by Van Leuvensteijn et al. (2008). Non-harmonised National Retail Interest Rates (NRIR) compiled by the National Central Banks are chain linked with more recent harmonised Monetary financial institution Interest Rate statistics (MIR) compiled by the ECB.[8] NRIR data predominantly feature interest rates on new business loans. For consistency, new business rates are therefore also chosen in the MIR data set. New business loans in the MIR data set include re-negotiated credits but exclude previously negotiated credits with automatic rate re-setting. There can still be some differences between NRIR and MIR data. For example, we exclude overdraft rates from our MIR series while they are included in most of the NRIR series. Secondly, most of the NRIR series are classified according to the remaining time to maturity of the loan while MIR series are classified according to the rate fixation period. A level shift is carried out for the NRIR rates to partly account for some of these differences. In a nutshell, chain linking NRIR to MIR rates consists of three consecutive steps: (i) Construct short and long corporate loan categories, (ii) Construct small and large loan categories, and (iii) Apply a level shift to the NRIR series.

(i) Construction of short and long corporate loan categories

MIR data categories need to be aggregated to make them comparable to NRIR data categories as the MIR data set offers a more detailed breakdown than does the NRIR data set. Loans with an initial rate fixation period of up to one year, including variable rate loans, are merged with the NRIR category of *short* loans with a maturity of up to one year. Loans with an initial rate fixation period of more than one year are merged with the NRIR category of *long* loans with a maturity of more than one year. The long MIR rate is a weighted average of the rate on loans with rate fixation periods over one year and up to five years and the rate on loans with rate fixation periods over five years based on their shares in the volume of new business lending. The euro area volumes are used to estimate the respective shares for countries for which rates are available but volumes are missing, i.e. Austria, Belgium, Finland, France, Ireland and Italy.

[8] See ECB (2002) and ECB (2003) for further information on the NRIR and MIR data sets respectively.

(ii) Construction of small and large loan categories

NRIR rates include interest on both *small* loans, which do not exceed EUR 1 million, and *large* loans above EUR 1 million. MIR rates on small and large loans are aggregated based on their respective shares in new business volume. In cases where loan volumes are not available we extract the small and large loan shares from the available aggregated interest rate in Van Leuvensteijn et al. (2008), using the following equation:

$$i^a = i^s s^s + i^l s^l \,, \qquad (9)$$

where i^a is the aggregate interest rate, i^s is the interest rate on small loans, i^l is the interest rate on large loans, s^s is the share of small loans, and s^l is the share of large loans in the volume of new lending. Since

$$s^s + s^l = 1 \qquad (10)$$

substituting and rearranging (9) gives

$$s^s = \frac{i^a - i^l}{i^s - i^l} \quad \text{and} \quad s^l = \frac{i^a - i^s}{i^l - i^s} \,. \qquad (11)$$

Averages of the shares in (11) are computed for the period from January 2003 until the end of the Van Leuvensteijn et al. series, i.e. December 2004. Those average shares are then used to extend the aggregate MIR series beyond 2004.

(iii) Application of a level shift

In cases where there is a methodological change between NRIR and MIR data, the NRIR rates are adjusted by a level shift based on the difference between the NRIR and MIR rates as of January 2003 for all countries except Portugal. In the latter case, the level shift is based on the difference between the December 2002 NRIR rate and the January 2003 MIR rate since Portuguese NRIR data end in 2002.

Table 8 shows the available bank loan rates after the risk-adjustment of Section 4 has been carried out. STL (Short-Term Loans and long-term loans with short rate fixation periods) and LTL (Long-Term Loans with long rate fixation periods) are chain-linked series that are available from October 1997. Harmonised MFI interest rates by size and rate fixation period, i.e. STSL (Short-Term Small Loans and long-term small loans with short rate fixation periods), STLL (Short-Term Large Loans and long-term large loans with short rate fixation periods), LTSL (Long-Term Small Loans with long rate fixation periods) and LTLL (Long-Term Large Loans with long rate fixation periods) are available only since January 2003. The frequency of all loan rate series is monthly.

Table 8 Availability of bank loan rates.

	STL	LTL	STSL	STLL	LTSL	LTLL
	Oct. 97 – Sept. 08		*Jan. 03 – Sept. 08*			
Austria	A	NA	A	A	A	A
Belgium	A	NA	A	A	A	NA
Finland	NA	A	A	A	A	A
France	A	A	A	A	A	A
Germany	A	A	A	A	A	A
Greece	A	NA	A	A	A	NA
Ireland	A	A	A	A	A	A
Italy	A	A	A	A	A	A
Netherlands	A	NA	A	A	A	A
Portugal	A	NA	A	A	NA	NA
Spain	A	A	A	A	A	A

Note: A = Available; NA = Not Available. See Appendix D for a glossary.

Appendix B. Transaction costs on bond financing

Bond transaction costs possibly consist of four components: the *management fee* (i.e. the cost of structuring the bond by the underwriter), the *selling concession* (i.e. the difference between the guaranteed price to the issuer and the offer price to the investors), *underpricing* (i.e. the difference between the offer price and the secondary market price) and *other expenses* (i.e. legal and administration costs). The management fee and selling concession make up the bulk of the total transaction cost. A recent study (see Melnik and Nissim, 2006) finds that, since EMU, underpricing has basically disappeared for most bonds.

Table 9 Transaction costs (in basis points) applied to the face value.

	Average	Median	Standard deviation	Maximum
France	52	35	54	200
Germany	52	34	57	275
Italy	67	40	54	200
Netherlands	73	35	70	275
United Kingdom	42	35	34	188

Notes: Period: January 1999 - October 2008. Source: Dealogic Bondware.

The sum of the management fee and selling concession, expressed in basis points, is shown by country in Table 9. The transaction costs for the median bond are basically the same across countries except for Italy where costs are about five basis points higher. This is possibly due to the smaller size of Italian bonds. The median Italian bond size of EUR 350 million is almost half the median bond size in the other four countries (see Appendix C, Table 11). Transaction costs are thus about the same across countries when bond size is considered.

Appendix C. Results

C.1. Descriptive statistics

Table 10 Bank loan rates (in %).

	AT	BE	FI	FR	DE	GR	IE	IT	NL	PT	ES
Short-Term or variable rate Loans (STL), Oct. 1997 – Sept. 2008											
Min.	2.9	2.9		2.6	3.1	3.9	3.9	3.3	2.8	4.4	3.2
Max.	5.6	6.1		5.9	5.8	17.8	6.8	8.0	5.8	9.2	5.9
Mean	4.3	4.2		3.8	4.0	7.5	5.2	4.7	4.1	6.1	4.5
Median	4.5	4.4		3.5	3.9	5.6	5.1	4.5	4.0	6.0	4.5
S.D.	0.8	0.9		0.8	0.7	4.1	0.9	1.1	0.9	1.1	0.9
Long-Term Loans (LTL), Oct. 1997 – Sept. 2008											
Min.			3.2	3.9	3.9		3.6	3.1			3.0
Max.			6.2	6.1	6.1		6.4	7.9			6.2
Mean			4.7	4.9	5.0		5.0	4.8			4.3
Median			4.6	4.8	5.1		5.0	4.7			4.2
S.D.			0.7	0.6	0.6		0.8	1.0			0.8
Short-Term or variable rate Small Loan (STSL), Jan. 2003 – Sept. 2008											
Min.	3.4	3.7	3.3	3.0	4.3	4.8	4.3	3.9	3.3	5.5	3.6
Max.	5.7	6.0	6.0	6.3	6.6	7.2	7.2	6.2	6.1	7.9	6.3
Mean	4.3	4.5	4.3	4.2	5.1	5.7	5.2	4.7	4.2	6.4	4.5
Median	4.0	4.1	4.0	3.7	4.8	5.5	4.9	4.4	3.9	6.1	4.1
S.D.	0.8	0.8	0.9	1.0	0.8	0.7	0.9	0.8	0.8	0.7	0.9
Short-Term or variable rate Large Loan (STLL), Jan. 2003 – Sept. 2008											
Min.	2.8	2.7	2.8	2.4	3.1	3.5	3.8	2.8	2.7	3.3	2.8
Max.	5.4	5.4	5.6	5.8	5.7	6.1	6.7	5.5	5.5	6.5	5.6
Mean	3.7	3.6	3.8	3.6	4.0	4.4	4.9	3.7	3.7	4.4	3.7
Median	3.4	3.3	3.4	3.1	3.6	4.1	4.5	3.5	3.4	4.1	3.2
S.D.	0.9	0.9	0.9	1.0	0.9	0.8	0.9	0.8	0.9	0.9	1.0
Long-Term Small Loan (LTSL), Jan. 2003 – Sept. 2008											
Min.	3.7	4.1	3.9	4.1	4.4	4.6	4.3	4.4	4.0		3.9
Max.	5.3	5.7	6.2	5.8	5.9	6.5	7.4	6.5	6.2		6.8
Mean	4.5	4.7	4.9	4.8	5.0	5.7	5.4	5.2	5.0		5.0
Median	4.3	4.6	4.7	4.9	5.0	5.7	5.1	5.0	4.9		4.6
S.D.	0.4	0.4	0.6	0.4	0.4	0.6	0.9	0.6	0.6		0.8
Long-Term Large Loan (LTLL), Jan. 2003 – Sept. 2008											
Min.	3.0		2.6	3.2	3.8		3.4	2.9	3.4		2.8
Max.	5.4		6.3	5.7	5.9		6.2	6.3	5.4		6.1
Mean	4.2		4.2	4.1	4.6		4.5	4.2	4.5		4.0
Median	4.1		4.2	3.8	4.5		4.3	3.9	4.4		3.6
S.D.	0.5		0.7	0.7	0.6		0.8	0.9	0.5		1.0

Source: National Central Banks and European Central Bank. Interest rates are not adjusted for risk. S.D. stands for standard deviation. See Appendix D for a glossary.

Table 11 Descriptive statistics of 828 bond issues (1999 – 2008).

	France	Germany	Italy	Netherlands	UK
			Yield to maturity (in %)		
Minimum	2.5	3.1	3.3	2.8	3.1
Maximum	8.9	12.4	8.7	10.8	7.3
Mean	5.1	5.3	6.0	5.2	5.2
Median	5.1	5.2	5.9	5.0	5.2
Standard deviation	1.0	1.3	1.0	1.3	0.9
			Years to maturity at issue		
Minimum	2.4	2.0	2.0	3.0	1.5
Maximum	30.0	30.0	50.0	30.0	40.0
Mean	8.8	8.2	7.4	7.5	7.0
Median	7.0	7.0	5.0	7.0	7.0
Standard deviation	5.0	4.2	6.5	3.7	4.0
			Coupon (in %)		
Minimum	3.0	3.0	3.4	3.3	3.0
Maximum	8.8	12.0	8.4	10.5	7.3
Mean	5.0	5.3	5.9	5.2	5.2
Median	5.0	5.1	6.0	5.0	5.1
Standard deviation	0.9	1.2	1.0	1.3	0.9
			Face value (in EUR million)		
Minimum	50	20	25	70	119
Maximum	20241	7311	6495	4970	3500
Mean	542	632	383	619	699
Median	500	600	350	750	650
Standard deviation	1754	1450	1228	679	685
			Number of rated bonds		
AAA, AA	97	35	9	15	14
A	84	67	23	44	63
BBB	101	46	48	17	50
BB,B	4	6	2	4	0
No rating	22	25	45	5	2
Total	308	179	127	85	129

Source: Dealogic Bondware. Bond yields are not adjusted for risk.

C.2. Factor analysis

Table 12a Estimated factor loadings for bank loans.

	a	l_1	l_2	Ad. R^2	a	l_1	l_2	Ad. R^2
	STL (Jan. 01 – Sept. 08)				*LTL (Jan. 01 – Sept. 08)*			
Austria	3.98*	0.81*	0.29*	0.98				
Belgium	3.84*	0.88*	0.31*	0.97				
Finland					4.65*	0.55*	-0.03	0.79
France	3.78*	1.06*	-0.08*	0.97	4.83*	0.52*	-0.32*	0.99
Germany	4.23*	0.69*	0.06	0.90	4.91*	0.53*	-0.15*	0.94
Greece	4.38*	0.92*	0.03	0.93				
Ireland	4.25*	0.92*	-0.40*	0.99	4.84*	0.74*	0.01	0.94
Italy	4.12*	0.90*	0.05*	0.97	4.54*	0.80*	0.08*	0.97
Netherlands	3.77*	0.96*	-0.29*	0.97				
Portugal	5.15*	0.88*	-0.06	0.89				
Spain	3.81*	0.98*	0.17*	0.98	4.27*	0.85*	0.23*	0.99
	STSL (Jan. 03 – Sept. 08)				*STLL (Jan. 03 – Sept. 08)*			
Austria	4.32*	0.83*	0.26*	0.90	3.75*	1.01*	0.14	0.98
Belgium	4.40*	0.93*	0.13*	0.97	3.64*	1.07*	0.16	0.99
Finland	4.38*	0.82*	-0.07*	0.96	3.73*	0.90*	-0.08	0.98
France	4.34*	1.24*	-0.17*	0.97	3.84*	1.18*	-0.01	0.98
Germany	5.14*	0.76*	0.13*	0.98	4.01*	0.85*	0.12	0.99
Greece	5.22*	0.96*	-0.04	0.98	4.11*	1.04*	0.03	0.96
Ireland	4.47*	1.01*	-0.18*	0.98	4.17*	0.96*	-0.23	0.98
Italy	4.61*	0.90*	-0.05*	0.99	3.77*	0.97*	-0.08	0.98
Netherlands	4.32*	1.04*	-0.01	0.98	3.78*	1.11*	-0.02	0.99
Portugal	6.13*	1.04*	-0.05	0.96	4.25*	1.23*	-0.07	0.96
Spain	4.34*	0.95*	0.17*	0.99	3.83*	1.07*	0.05	1.00
	LTSL (Jan. 03 – Sept. 08)				*LTLL (Jan. 03 – Sept. 08)*			
Austria	4.49*	0.45*	-0.11	0.80	4.20*	0.47*	0.06	0.67
Belgium	4.72*	0.51*	-0.08	0.96				
Finland	4.94*	0.53*	0.02	0.91	4.19*	0.59*	-0.41	1.00
France	4.95*	0.39*	-0.23	0.69	4.16*	0.71*	-0.01	0.92
Germany	5.05*	0.31*	-0.18	0.96	4.63*	0.55*	0.02	0.91
Greece	5.41*	0.56*	0.09	0.71				
Ireland	4.95*	0.88*	0.09	0.97	4.27*	0.73*	0.04	0.88
Italy	5.21*	0.72*	0.10	0.99	4.26*	0.90*	0.06	0.95
Netherlands	5.04*	0.68*	-0.07	0.97	4.54*	0.51*	0.00	0.90
Portugal								
Spain	4.95*	0.86*	0.03	0.98	4.14*	1.01*	0.11	0.98

Notes: Estimates that are significantly different from zero at the 1% level are indicated with an asterisk. a is a constant, l_1 and l_2 are the loadings on the first and second factors respectively. The adjusted R^2 shows the share of the variance in risk-adjusted bank loan rates (centred on their mean) that can be explained by the statistically significant factors. See Appendix D for a glossary.

Table 12b 0.5th percentile of bootstrapped factor loadings for bank loans.

	a	l_1	l_2	a	l_1	l_2
	STL (Jan. 01 – Sept. 08)			*LTL (Jan. 01 – Sept. 08)*		
Austria	3.75	0.70	0.24			
Belgium	3.59	0.75	0.24			
Finland				4.49	0.43	-0.12
France	3.5	0.91	-0.14	4.66	0.41	-0.35
Germany	4.03	0.58	-0.03	4.76	0.46	-0.20
Greece	4.13	0.79	-0.04			
Ireland	3.99	0.74	-0.45	4.64	0.64	-0.05
Italy	3.87	0.77	0.00	4.32	0.69	0.04
Netherlands	3.51	0.77	-0.35			
Portugal	4.91	0.73	-0.15			
Spain	3.54	0.86	0.12	4.03	0.71	0.17
	STSL (Jan. 03 – Sept. 08)			*STLL (Jan. 03 – Sept. 08)*		
Austria	4.05	0.68	0.16	3.45	0.86	-0.08
Belgium	4.12	0.76	0.06	3.32	0.9	-0.08
Finland	4.13	0.67	-0.13	3.46	0.75	-0.15
France	3.97	1.04	-0.21	3.49	1	-0.07
Germany	4.91	0.63	0.06	3.75	0.71	-0.12
Greece	4.93	0.81	-0.09	3.79	0.87	-0.09
Ireland	4.16	0.83	-0.23	3.87	0.79	-0.31
Italy	4.34	0.74	-0.08	3.48	0.82	-0.13
Netherlands	4.00	0.86	-0.05	3.44	0.94	-0.07
Portugal	5.82	0.85	-0.12	3.87	1.03	-0.18
Spain	4.05	0.77	0.12	3.51	0.9	0.00
	LTSL (Jan. 03 – Sept. 08)			*LTLL (Jan. 03 – Sept. 08)*		
Austria	4.34	0.35	-0.19	4.04	0.34	-0.35
Belgium	4.56	0.42	-0.14			
Finland	4.77	0.42	-0.05	3.97	0.43	-0.49
France	4.81	0.29	-0.29	3.94	0.57	-0.16
Germany	4.93	0.22	-0.22	4.45	0.44	-0.12
Greece	5.2	0.43	-0.42			
Ireland	4.68	0.73	-0.12	4.03	0.6	-0.21
Italy	4.99	0.6	-0.11	3.98	0.74	-0.11
Netherlands	4.83	0.55	-0.12	4.38	0.42	-0.07
Portugal						
Spain	4.69	0.71	-0.01	3.83	0.82	-0.01

Notes: a is a constant, l_1 and l_2 are the loadings on the first and second factors respectively. Estimates are based on 10000 draws. See Appendix D for a glossary.

Table 12c 99.5th percentile of bootstrapped factor loadings for bank loans.

	a	l_1	l_2	a	l_1	l_2
	STL (Jan. 01 – Sept. 08)			*LTL (Jan. 01 – Sept. 08)*		
Austria	4.21	0.90	0.33			
Belgium	4.10	0.99	0.38			
Finland				4.81	0.66	0.04
France	4.07	1.18	-0.03	4.99	0.61	-0.26
Germany	4.43	0.79	0.13	5.07	0.59	-0.09
Greece	4.64	1.02	0.12			
Ireland	4.53	1.07	-0.33	5.05	0.83	0.05
Italy	4.36	0.99	0.10	4.76	0.89	0.12
Netherlands	4.05	1.10	-0.22			
Portugal	5.40	1.02	0.02			
Spain	4.07	1.07	0.22	4.51	0.96	0.29
	STSL (Jan. 03 – Sept. 08)			*STLL (Jan.03 – Sept. 08)*		
Austria	4.59	0.94	0.32	4.07	1.12	0.19
Belgium	4.70	1.04	0.18	3.98	1.18	0.21
Finland	4.64	0.95	0.00	4.01	0.99	0.11
France	4.73	1.37	-0.11	4.22	1.30	0.06
Germany	5.38	0.85	0.18	4.28	0.95	0.16
Greece	5.53	1.07	0.01	4.44	1.16	0.14
Ireland	4.79	1.15	-0.10	4.48	1.10	0.30
Italy	4.89	1.01	-0.01	4.07	1.07	0.05
Netherlands	4.66	1.16	0.05	4.13	1.22	0.03
Portugal	6.46	1.17	0.04	4.64	1.37	0.06
Spain	4.64	1.05	0.21	4.17	1.18	0.09
	LTSL (Jan. 03 – Sept. 08)			*LTLL (Jan. 03 – Sept. 08)*		
Austria	4.65	0.53	0.12	4.39	0.59	0.32
Belgium	4.88	0.58	0.10			
Finland	5.11	0.62	0.14	4.40	0.76	0.13
France	5.10	0.47	0.24	4.40	0.82	0.13
Germany	5.16	0.38	0.20	4.81	0.65	0.13
Greece	5.62	0.67	0.32			
Ireland	5.23	1.00	0.17	4.51	0.83	0.28
Italy	5.44	0.80	0.15	4.56	1.02	0.17
Netherlands	5.26	0.77	0.13	4.71	0.59	0.06
Portugal						
Spain	5.23	0.96	0.10	4.46	1.14	0.20

Notes: a is a constant, l_1 and l_2 are the loadings on the first and second factors respectively. Estimates are based on 10000 draws. See Appendix D for a glossary.

Table 13 Factor loadings for bonds.

	France	Germany	Italy	Netherlands	UK
	Jan. 1999 – Oct. 2008				
	Estimated factor loadings				
a	5.05*	5.01*	5.07*	5.01*	4.98*
l_1	0.24*	0.24*	0.21*	0.21*	0.16*
l_2	0.08	0.02	-0.21	0.06	0.05
	0.5th percentile of bootstrapped factor loadings				
a	4.94	4.88	4.95	4.9	4.88
l_1	0.13	0.11	0.05	0.09	0.05
l_2	-0.15	-0.2	-0.29	-0.23	-0.17
	95.5th percentile of bootstrapped factor loadings				
a	5.16	5.12	5.19	5.12	5.08
l_1	0.33	0.34	0.32	0.32	0.24
l_2	0.16	0.17	0.28	0.24	0.24
Adjusted R^2	0.70	0.61	0.55	0.52	0.42

Note: Estimated factor loadings that are significantly different from zero at the 1% level are indicated with an asterisk. a is a constant, l_1 and l_2 are the loadings on the first and second factors respectively. Estimates are based on 10000 draws. The adjusted R^2 shows the share of the variance in risk-adjusted bond yields (centred on their mean) that can be explained by the statistically significant factors.

Appendix D. Glossary

STL = Short-Term Loans and long-term loans with short rate fixation periods.

LTL = Long-Term Loans with long rate fixation periods.

STSL = Short-Term Small Loans and long-term small loans with short rate fixation periods.

STLL = Short-Term Large Loans and long-term large loans with short rate fixation periods.

LTSL = Long-Term Small Loans with long rate fixation periods.

LTLL = Long-Term Large Loans with long rate fixation periods.

ECB = European Central Bank

MFIs = Monetary Financial Institutions

NCBs = National Central Banks

NFCs = Non-Financial Corporations

SMEs = Small and Medium-sized Enterprises

LSEs = Large Scale Enterprises

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