UNIVERSITEIT GENT

FACULTEIT ECONOMIE
EN BEDRIJFSKUNDE

HOVENIERSBERG 24
B-9000 GENT
Tel. : 32 - (0)9 – 264.34.61
Fax. : 32 - (0)9 – 264.35.92

WORKING PAPER

Bank Risk Strategies and Cyclical Variation in Bank Stock Returns

Lieven Baele[1]

Rudi Vander Vennet[2]

Astrid Van Landschoot[3]

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[1] Department of Financial Economics, Ghent University. Email: Lieven.Baele@UGent.be.
[2] Department of Financial Economics, Ghent University. Email: Rudi.VanderVennet@UGent.be.
[3] National Bank of Belgium, Astrid.VanLandschoot@nbb.be.

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Abstract

This paper investigates whether the stock returns of banks with different risk profiles exhibit different risk factor sensitivities over the business cycle. More specifically, we investigate whether or not high levels of capital adequacy or functional diversification provide banks with a structural hedge against a deterioration in the prevailing credit market conditions. Based on recent imperfect capital market theories, we develop a number of theoretical arguments for the existence of asymmetries in systematic risk across various types of banks. We use a regime-switching model to test the theoretical hypotheses empirically on a sample of European listed banks. We find that bank stock returns are strongly asymmetric; both the sensitivity to shocks and the conditional volatility are higher during business cycle troughs. Better capitalized and functionally diversified banks are perceived by investors as being better protected against a deterioration in credit market conditions compared to their relatively less capitalized and more specialized competitors.

JEL: G12, G21, F34

Keywords: Bank Risk, Financial Conglomerates, Capital Adequacy, Regime-Switching Models

*Baele and Vander Vennet are at Ghent University. Van Landschoot is at the National Bank of Belgium. Please send comments to Rudi.VanderVennet@UGent.be. We thank Jan Annaert, Gurdip Bakshi, Geert Bekaert, Steven Ongena, Koen Schoors, and seminar participants at the Annual Meeting of the European Economic Association and the 2003 FDIC/JFSR Conference on Finance and Banking: New Perspectives for useful comments. Baele and Vander Vennet acknowledge financial support from the Belgian Program on Interuniversity Poles of Attraction, initiated by the Belgian Federal Office for scientific, technical and cultural affairs, contract UAP No. P 5/21.

1 Introduction

This paper investigates whether stock returns of European banks with a different risk profile exhibit different risk factor sensitivities over the business cycle. While it is widely accepted that banks act as delegated monitors and manage risk, an important question is to what extent bank stock returns are sensitive to business cycle fluctuations. Theories of imperfect capital markets (Bernanke and Gertler 1989; Kiyotaki and Moore 1997, for example) argue that asymmetric information and agency costs are typically high during business cycle troughs and low during booms. The banking sector is especially vulnerable to adverse selection and moral hazard, both caused by asymmetric information. A recession will directly increase the overall riskiness of the outstanding loans through a reduction in the total value of collateral and a lower success rate of financed projects. Indirectly, moral hazard may increase loan riskiness if the lower firm value caused by worsening economic conditions leads to excessive risk taking behavior of borrowers. Notice that also banks themselves will be more prone to gambling in an environment in which their franchise values are being eroded (see e.g. Hellmann et al. 2000). These theories predict that banking becomes more risky in business cycle troughs. Apart from being driven by cyclical variation, banking risk may also increase during periods of financial turmoil. The aim of this paper is to investigate these statements empirically using a large sample of listed European banks over a two-decade period. More specifically, we test (1) whether or not bank stocks are sensitive to changes in the overall credit market conditions, and (2) whether or not these sensitivities vary asymmetrically over the business cycle.

A second question we want to address is whether the relationship between bank stock returns and credit market conditions depends on the risk profile of the bank. In this respect, we focus on two features of modern banking: capital adequacy and functional diversification. First, banks are required to hold minimum levels of capital to cover unexpected losses incurred on their risky assets. However, banks may hold capital in excess of the regulatory minimum to signal their creditworthiness. The question is whether or not the stock market judges banks with excess capital coverage to be less sensitive to adverse economic and financial shocks. Second, banks have been allowed to broaden the scope of their activities beyond their traditional intermediation role of taking deposits and making loans. In Europe, the Second Banking Directive of 1989 allows banks to combine commercial banking, investment banking, asset management, financial advisory activities and even insurance underwriting. The question is whether or not the stock market judges these financial conglomerates to be less sensitive to adverse shocks because of their diversified risk profile. Therefore we investigate whether adequate capitalization or functional diversification (sometimes called universal banking) make banks less vulnerable to worsening credit market conditions. In addition, we test whether the asymmetry in business cycle sensitivity is different for banks with opposite risk profiles. Practically, we subdivide the sample of listed European banks in subsamples of relatively strongly versus relatively poorly capitalized banks, and functionally diversified versus specialized banks. Similar to Perez-Quiros and Timmermann (2000), we compare the sensitivities of the stock returns of these portfolios over two states using a bivariate factor model with regime switches in both the factor sensitivities and the conditional volatility. The regime-switching model detects strong asymmetries in the distribution of bank stock returns: both the sensitivity to shocks and the conditional volatility are higher during business cycle troughs for all types of banks. Better capitalized and functionally diversified banks are found to be better protected against a deterioration in credit market conditions compared to their relatively less capitalized and more specialized competitors.

A thorough understanding of this issue is of obvious importance for national and international bank supervisors and regulators. A deterioration of bank health may be transmitted to the real economy and may raise questions about the systemic stability of the financial system. Current efforts at the BIS level (commonly called Basel II) have the ambition to relate the capital position of banks more adequately to the overall riskiness of their operations. We investigate whether adequate capitalization is perceived by the stock market as a structural hedge against negative economic shocks. One of the pillars of the proposed new prudential strategy of Basel II is to introduce elements of market discipline in the supervisory process. Hence, it is important to determine whether bank stock prices are a potentially useful indicator of financial stress. The examination of the impact of functional diversification of banking institutions on their risk profile may provide useful information on the desirability of the gradual broadening of banking powers. In this respect, the European bank sector offers a broad scope for fertile research, since the Second Banking Directive (1989) has given banks a large degree of freedom to implement strategies of functional diversification. In the US, the 1999 Gramm-Leach-Bliley Act dismantled depression-era barriers between banks and other financial businesses, clearing the way for the creation of financial supermarkets. However, in contrast to the European case, only a limited number of cross-activity merger deals have been recorded in the US, largely ascribed to the unfavorable economic and financial market conditions. It remains an open question whether or not the longer-term equilibrium involves the coexistence of specialized and diversified financial services firms. Focusing on those European banks that made long-standing strategic choices in terms of the scope of their activities may provide useful information.

The remainder of the paper is organized as follows. Section 2 develops the theoretical justification for the existence of asymmetries in bank stock returns, both across the business cycle and across various bank risk profiles. Section 3 introduces the regime-switching methodology that allows us to incorporate and test these asymmetries in an empirical model. Section 4 describes the data and the construction of the bank portfolios. Section 5 presents and interprets the empirical results and section 6 concludes.

2 Theoretical Framework

The aim of this section is twofold. First, we want to provide a theoretical foundation for the hypothesis that bank stocks may depend asymmetrically on the business cycle. Second, we provide arguments for the claim that banks with a different risk profile may react differently to swings in the business cycle. More specifically, we develop hypotheses about the behavior of banks with a different degree of capital adequacy (strongly versus poorly capitalized banks), and functional specialization (diversified versus specialized banks).

2.1 Bank Stocks and Credit Market Conditions

In their role as financial intermediaries, banks are inherently exposed to changes in the overall economic conditions. From a theoretical point of view, banks are commonly characterized as delegated monitors, because they issue illiquid claims (loans) funded by short-term liquid deposits (Diamond 1984). In their lending business, banks are exposed to default risk, caused by problems of asymmetric information, both ex ante (adverse selection) and ex post (moral hazard). In their role as maturity transformers, banks are exposed to interest rate risk because the average duration of their assets exceeds that of their liabilities. However, these risks are themselves influenced or even determined by business cycle conditions. In the literature, various channels have been developed through which economic conditions may have an impact on bank risk. We use three channels to justify our hypotheses. First, there is an obvious association between the business cycle, the degree of asymmetric information, and bank default risk. Second, the economic environment may influence bank lending behavior and may alter the trade-offs between risk and franchise value. The third channel builds on the role of bank lending in the transmission of monetary policy. The state of the business cycle is , however, not the only potential source of banking risks. As a fourth determinant, we consider the uncertainty surrounding financial crises because, irrespective of their case-specific geographical occurrence, they may have an impact on the risk of the European banking system through economic linkages, lending exposures or a worldwide shift in risk aversion. Examples include the Asian and Russian crisis as well as the collapse of the Long Term Capital Market (LTCM) hedge fund. In what follows, we define credit market conditions as a combination of the state of the business cycle and the degree of uncertainty related to the effects of (remote) financial crises.

First, in economic downturns, it becomes more difficult for banks to assess the creditworthiness of corporate borrowers. Since adverse economic conditions have a negative impact on the cash flow of borrowers, banks may suffer losses because some of their outstanding loans default. At the same time, the assessment of new loan applicants becomes more subject to type I errors because the net present value of new corporate investment becomes more uncertain. In addition, the net worth of companies and the value of their collateralizable assets decreases. Bernanke and Gertler (1989) argue that information and agency costs are inversely related to the borrower's net worth and collateral. Since the value of collateral is likely to be procyclical, asymmetric information will be relatively high in business cycle downturns and relatively low in booms. This implies that bank intermediation becomes riskier during downturns through a reduction in the value of collateral attached to outstanding loans and an increase in the degree of asymmetric information. These effects should especially increase the risk of poorly capitalized banks, because they have a lower buffer for unanticipated losses, and of banks specialized in traditional bank intermediation, because their profits depend predominantly on the realized interest margin.

Second, a shift in the risk profile of banks over the business cycle can also be caused by changing incentives on the part of banks. Economic downturns may produce the conditions in which banks have incentives to lower their lending standards and, hence, increase their riskiness. Rajan (1994) argues that bank managers with short horizons will set credit policies that are driven by demand side conditions, which could amplify business cycle movements. Hellmann et al. (2000) show that banks have an incentive to gamble when their franchise value is harmed. Since this effect will be stronger in economic downturns, bank riskiness may behave asymmetrically. These risk incentives may cause lending cycles and associated swings in the riskiness of banks (Kiyotaki and Moore 1997; Asea and Blomberg 1998, for example). Repullo (2002) and Schoors and Vander Vennet (2003) show that a gambling equilibrium may exist when the degree of asymmetric information increases, which is typically associated with recessions. However, they also show that this risky behavior is less likely to occur when capital adequacy rules are binding. Hence, we expect that well capitalized banks will be less prone to excessive risk taking.

Third, there is evidence of a bank lending channel in most developed economies, although its importance vis-à-vis other monetary policy transmission channels remains disputed (see Angeloni et al. 2002). Faced with adverse credit market conditions, banks may elect to ration credit. This happened in a number of periods, both in the US and in Europe. Peek and Rosengren (1995) argue that the recession of 1990-1991 in New England was reinforced by the reluctance of banks to lend. Also in the most recent business cycle downturn (2001-02), banks have been accused of being excessively restrictive, both in the US and in Europe (The Economist 2002). However, banks will react differently to monetary policy actions, depending on their financial strength and their access to internally or externally generated liquidity. Kashyap and Stein (1995) conclude that small banks seem more prone than large banks to reduce their lending, with the effect greatest for small banks with relatively low liquidity buffers. On the other hand, well capitalized banks should find it relatively easy to access the interbank or the securities markets to raise funds in the face of a deposit shock. This implies that a restrictive monetary policy will have less impact on the loan supply of well capitalized banks. Empirically, Kishan and Opiela (2000) show that the impact of monetary policy actions is different for banks with different sizes and capital ratios in the US. Similar evidence is reported across the EMU banking systems in the 1990s (Altunbas et al. 2002). Hence, well capitalized banks are expected to be less sensitive to the effects of a restrictive monetary policy.

Fourth, the perceived riskiness of the European banking system may increase in times of financial turmoil. Often these events are not related to the performance of the local economy, but to stress in remote financial systems or individual institutions to which European banks are exposed. For instance, both the credit spread and volatility on bank bonds and stock returns increased considerably in the aftermath of the Asian and Russian financial crises and the collapse of the Long Term Capital Management (LTCM) hedge fund (see IMF 2003). The increased riskiness reflects uncertainty about exposure banks may have to these crisis regions, or more generally, about the effect the crises may have - through bank contagion - on the systemic stability of the financial system (see De Bandt and Hartmann 2000, for an overview).

This selective survey of arguments related to the relationship between the business cycle, financial crises, and bank behavior leads us to the hypothesis that bank riskiness is expected to reflect changes in credit market conditions, but potentially in an asymmetric fashion. The second hypothesis of this paper is that banks with different risk strategies will be affected in a structurally different way by economic swings. Banks know that shifts in credit market conditions, such as a deterioration of the creditworthiness of their borrowers, may be caused by reversals of the business cycle. Consequently, they will try to mitigate some of the associated risk, e.g. by hedging certain positions with credit or other types of derivatives. However, while the off balance sheet activities of commercial banks have increased substantially over the last decade, it is not clear if this trend has produced less risk (see BIS 2003). Hence, even a careful hedging strategy may not constitute an effective protection against unanticipated events (Peek and Rosengren 1997; Froot and Stein 1998; Chaudhry et al. 2000; Cebenoyan and Strahan 2004). We consider two possible avenues for banks to adjust their risk profile in a more structural way: functional diversification and high levels of capital adequacy.

2.2 Bank Risk Profile

A first option for banks is to diversify their income sources by engaging in different types of financial services. Many countries allow universal banking or the formation of financial conglomerates in which commercial banking, insurance and securities-related activities can be integrated, although different organizational models of universal banking coexist (Saunders and Walter 1994). Typically, banks have tried to lessen their dependence on interest income (from loans and securities) and have increased the proportion of non-interest income in total revenues. The economic rationale refers to standard portfolio theory. If the non-interest income sources are imperfectly correlated with the traditional revenues from intermediation, the bundled income stream will be more stable. ECB (2000) reports an inverse correlation between interest income and non-interest income in several EU bank markets, suggesting a high potential for diversification benefits. The general conclusion of merger studies among different financial services providers is that the combination of banking and other activities, especially insurance, may have a positive impact on the overall riskiness of the conglomerate (Kwan and Laderman 1999; Genetay and Molyneux 1998; Cybo-Ottone and Murgia 2000). DeLong (2001), however, finds higher abnormal returns for focusing rather than diversifying US bank mergers. For US banks, Stiroh (2002) finds that interest income and non-interest income have become more correlated in recent years. In contrast to merger studies and correlation analyses, our approach allows a direct assessment of the sensitivity differences to economic shocks for diversified versus specialized banks.

Based on a different argumentation, a number of studies have provided evidence that universal banks could be less risky than their specialized peers. The closer ties with corporate borrowers and repeated lending may give universal banks access to private information which may improve the effectiveness of their monitoring efforts. The biggest advantage of universal banks may be in the ex post monitoring of firms facing financial distress because they can build up renegotiation reputation (Chemmanur and Fulghieri 1994; Longhofer and Santos 2000). If universal banks are better able to deal with financial distress, their cash flows will be less affected by adverse economic conditions. Specialized banks, on the other hand, are expected to be more vulnerable to economic fluctuations. Based on a large sample of European banks, Vander Vennet (2002) finds that the market betas of universal and specialized banks do not differ significantly in periods of economic expansion. In times of economic contraction, however, the market beta of universal banks is significantly lower than that of specialized banks. This finding is consistent with the conjecture that universal banks are better monitors and, hence, are less sensitive to shifts in the business cycle. The results are broadly in line with those reported by Dewenter and Hess (1998) for portfolios of relationship versus transactional banks in eight countries. Hence, our prediction is that diversified (universal) banks exhibit less sensitivity to shifts in credit market conditions than their specialized competitors and that diversified banks are less vulnerable to adverse credit market conditions.

A second option for a bank to signal financial strength is to maintain a relatively high level of capital as a protection against possible losses. Banks in all European countries that are analyzed in this paper are required to maintain minimum capital levels as a proportion of their risky assets, calculated according to the current BIS standards. However, while the supervisory authorities impose a risk-based capital ratio of 8%, banks can signal their creditworthiness by holding levels of equity in excess of the required minimum. The excess capital serves as an additional buffer to cover unexpected future losses, thereby decreasing the risk of failure. In all standard models of banking, high capital levels are associated with a lower bankruptcy risk (see Freixas and Rochet 1999). Hence, the prediction is that banks with a relatively high degree of capital coverage should be better able to alleviate adverse changes in the business cycle and, consequently, will be judged by the financial markets to be less sensitive to shifts in credit market conditions. Next to this positive risk effect, well capitalized banks could also benefit from the potentially lower funding costs that this strategy may imply. This element of market discipline is expected to apply especially to the funds obtained in the professional and interbank markets, where competitive pricing based on perceived riskiness is standard practice. Berger (1995) documents a positive relationship between capital and earnings for US banks, a finding which he ascribes to the beneficial effect of capitalization on funding costs. Goldberg and Hudgins (2002) and Park and Peristiani (1998) show that uninsured deposits are exposed to market discipline. They find that riskier banks attract smaller amounts of uninsured deposits and pay higher interest rates on this type of funding than less risky competitors. For European banks, Sironi (2003) finds that investors in bank subordinated debt are sensitive to bank risk and that this effect has increased over the 1990s[1]. This beneficial effect on bank profits may strengthen the positive risk effect of higher capital levels and, hence, affect the valuation of the bank by the stock market.

From this overview it is clear that banks with different risk profiles (functionally diversified versus specialized, and relatively high versus relatively low capital ratio) should exhibit different sensitivities to changes in the credit market conditions. Since listed European banks have implemented different risk strategies, we can use their stock returns to assess the sensitivities to pervasive shifts in credit market conditions empirically by using a regime-switching methodology.

3 The empirical model

3.1 General Specification

We compare return distributions of portfolios of banks with opposing risk strategies, say 1 and 2. Let $r_{1,t}$ be the return on a portfolio of banks with strategy 1, and $r_{2,t}$ the return on a portfolio of

[1]A number of studies have examined whether the stock market is able to differentiate among financial institutions with different financial and risk profiles. The evidence suggests that the stock market reacts efficiently to information concerning individual banks and to changes in the regulatory environment (see Flannery (1998) for the US and Brewer III et al. (1999) for Japan). The findings support the idea that stock markets are able to assess the quality of the bank's assets.

banks with the opposite strategy 2. The returns $r_t = [r_{1,t}, r_{2,t}]'$ contain an expected component, $E_{t-1}[r_t]$, and an unexpected component, $\varepsilon_t = [\varepsilon_{1,t}, \varepsilon_{2,t}]'$. The return innovations deviate from zero partly because of news and partly because of noise in the market. Suppose that the information that becomes available to investors at time t is contained in $X_t \in R^n$, so that the time t information set is given by $\Omega_t = [X_t, X_{t-1}, ..., X_0]'$. We define news as innovations in the information set, or $\varepsilon_{x,t} = X_t - E[X_t|\Omega_{t-1}]$. Current returns are then described by the following system:

$$r_t = E\left[r_t|\Omega_{t-1}\right] + \varepsilon_t = E\left[r_t|\Omega_{t-1}\right] + \boldsymbol{\beta}'\left(S_t\right)\varepsilon_{x,t} + u_t,$$

where $\boldsymbol{\beta} = \left[\beta^1, \beta^2\right]'$ is a n by 2 matrix of parameters that depends on a latent regime variable S_t, and u_t represents noise in the market. The matrix of parameters $\boldsymbol{\beta}$ governs the relationship between return innovations and news. Several authors (see Flannery and Protopapadakis 2002) have successfully demonstrated the link between return innovations and a large set of macroeconomic and financial news factors. Most of these studies, however, do not allow the relationship between returns and news to change over time. Perez-Quiros and Timmermann (2000, 2001) argue, however, that the relationship between expected returns and information variables may depend on the state of the business cycle. They test their hypothesis on the Fama and French size-sorted decile portfolios, and find that asymmetries are especially strong for small firms. This confirms theoretical predictions that small firms are expecially vulnerable to tightening credit market conditions because of their lower levels of collateral. In the previous section, we argued that different types of banks are likely to react differently to changes in the prevailing credit market conditions. To test this hypothesis, we allow the return sensitivities of different types of banks to depend on business cycle news via a latent regime variable S_t. We suppose that S_t can take only two values, $S_t = 1$ or $S_t = 2$. This specification allows us to test whether the sensitivity of bank stock returns to economic news is governed by two states and whether these states correspond to recessions and expansions respectively. If these hypotheses would be confirmed, one can directly test whether banks with opposite strategies have different exposures to economic shocks in business cycle downturns and upturns.

Not only bank stock returns sensitivities are likely to be affected by business cycle fluctuations, but also their volatility. Campbell et al. (2001), among others, find stock return volatility to increase substantially in economic downturns. Conditional volatility is usually modelled in an ARCH or stochastic volatility framework. Recently, however, regime-switching volatility models have attracted considerable interest, for several reasons. First, as argued by e.g. Diebold (1986) and Lamoureux and Lastrapes (1990), the near integrated behavior of the conditional variance might be due to the presence of structural breaks, which are not accounted for by standard GARCH-models. This persistence is shown to disappear when regime-switching volatility models, pioneered by Hamilton and Susmel (1994), Cai (1994), and Gray (1996), are used. High volatility regimes are typically found to correspond with recession periods. Second, as discussed in Ang and Bekaert (2001), regime-switching volatility models do much better in modeling asymmetric correlations, i.e. the empirical regularity that correlations are larger when markets move downward than when they move upward, even compared to the fairly general GARCH models. Apart from distinguishing between regimes or by adding (G)ARCH terms, a number of studies have directly related conditional volatility to innovations in macroeconomic and financial variables. Glosten et al. (1993) found a positive link between conditional volatility and the level of the short rate, while Flannery and Protopapadakis (2002) find that a set of real and monetary variables significantly drive daily conditional US market volatility. In this paper, as in Perez-Quiros and Timmermann (2000), we take into account these findings by making the conditional variance-covariance matrix $\mathbf{H}_t$ dependent on the latent regime variable S_t and on a set of information variables y_{t-1},where y_{t-1} is a subset of Ω_{t-1}. More specifically, we extend the constant correlation model of Bollerslev (1990) to include regime switches:

$$u_t \sim N(0, \mathbf{H}(y_{t-1}, S_t)),$$

where

$$\mathbf{H}(y_{t-1}, S_t) = \begin{bmatrix} h^1(y_{t-1}, S_t) & 0 \\ 0 & h^2(y_{t-1}, S_t) \end{bmatrix} \begin{bmatrix} 1 & \rho(S_t) \\ \rho(S_t) & 1 \end{bmatrix} \begin{bmatrix} h^1(y_{t-1}, S_t) & 0 \\ 0 & h^2(y_{t-1}, S_t) \end{bmatrix},$$

where $\rho(S_t)$ is the regime-dependent correlation coefficient. The univariate conditional variance specifications for respectively bank type 1 and 2, $h^1$and h^2, are specified as follows:

$$\ln(h^z(y_{t-1}, S_t)) = \omega^z(S_t) + \Psi^z(S_t) y_{t-1},$$

where ω^z is an intercept, and Ψ^z is a $n \times 1$ vector of parameters, for $z = \{1, 2\}$.

As argued before, the sensitivity of return innovations and the variance-covariance matrix to news factors is conditional on a latent regime variable S_t. We limit the number of states to two, so S_t can take on two values: $S_t = 1$ or $S_t = 2$. This regime variable follows a two-state Markov chain with a time-varying transition probability matrix Π_t, defined as

$$\Pi_t = \begin{pmatrix} P_t & 1 - P_t \\ 1 - Q_t & Q_t \end{pmatrix}, \tag{1}$$

where the transition probabilities are given by

$$\begin{aligned} P_t &= \Pr(S_t = 1 | S_{t-1} = 1, \phi_{t-1}) = p(\phi_{t-1}) \\ Q_t &= \Pr(S_t = 2 | S_{t-1} = 2, \phi_{t-1}) = q(\phi_{t-1}). \end{aligned} \tag{2}$$

ϕ_{t-1} is a subset of information variables part of the information set Ω_{t-1} that influence the probability that there occurs a state switch between time $t-1$ and t. Because the states should more or less correspond with periods of booms and recessions, we let ϕ_{t-1} contain information about the state of the business cycle. We use a logistic function to guarantee that P_t and Q_t are between zero and one at any time:

$$P = \frac{\exp(\xi_p + \zeta_p' \phi_{t-1})}{1 + \exp(\xi_p + \zeta_p' \phi_{t-1})}$$

$$Q = \frac{\exp(\xi_q + \zeta_q' \phi_{t-1})}{1 + \exp(\xi_q + \zeta_q' \phi_{t-1})}.$$

The assumption that the return process of both bank series is driven by a single latent variable may look restrictive. However, the aim of this latent variable is to separate expansion from recession states, rather than discovering bank-specific states. Differences in exposure over the business cycle between banks will be determined by the bank-specific parameters within a state.

3.2 Testable Restrictions

The specification presented above allows for a large number of interesting tests. The first question we want to investigate is whether bank stock returns react significantly to our economic news variables.

Apart from the standard significance tests on the individual parameters, we also test whether the bank-specific betas are individually and jointly significant across regimes. More specifically, we test whether $\beta^1(S_t = 1) = \beta^1(S_t = 2) = 0$, whether $\beta^2(S_t = 1) = \beta^2(S_t = 2) = 0$, and whether they are jointly equal to zero. Similarly, the relevance of news for the conditional variance is investigated by testing, respectively, whether $\Psi^1(S_t = 1) = \Psi^1(S_t = 2) = 0$, $\Psi^2(S_t = 1) = \Psi^2(S_t = 2) = 0$, or both. Finally, we test whether the information variables contained in $\boldsymbol{\phi}_t$ significantly drive the transition probabilities P_t and Q_t by testing whether ζ_p and ζ_q are significantly different from zero.

A second question we want to answer is whether bank stock returns react asymmetrically over the regimes. In the mean equation, we reject symmetry for bank z when the null hypothesis $\beta^z(S_t = 1) = \beta^z(S_t = 2)$ does not hold. In a similar fashion, we investigate whether the asymmetry of the conditional volatility is stronger for a specific type of banks, both with respect to the intercept ω and the sensitivities Ψ.

Third, we are interested in whether different types of banks react differently to information. Suppose that state 1 and 2 broadly correspond to recession and expansion states, respectively. First of all, the reaction of bank stocks to news may only be statistically significant in one state, typically in the recession state. Therefore, the following hypotheses are tested: $\beta^1(S_t = 1) = \beta^2(S_t = 1)$, $\beta^1(S_t = 2) = \beta^2(S_t = 2)$, and both. To test whether the sensitivity of the conditional volatility to news differs significantly between banks across states, we test whether the hypothesis of $\Psi^1(S_t = 1) = \Psi^2(S_t = 1)$, $\Psi^1(S_t = 2) = \Psi^2(S_t = 2)$, or both, hold. Similarly, the hypothesis that bank 1 (2) reacts more asymmetrically to business cycle information than bank 2 (1) is investigated by testing the null that

$$\left|\beta^1(S_t = 1) - \beta^1(S_t = 2)\right| = \left|\beta^2(S_t = 1) - \beta^2(S_t = 2)\right|$$

against the alternative hypothesis that the sensitivity differential is largest for bank type 1 (2). Table 7 gives an overview of the various likelihood ratio tests calculated for this model.

4 Data Description

Our dataset includes a total number of 143 listed European banks and covers the period January 1985-June 2002.[2] This period encompasses markedly different states of the European business cycle and, hence, is particularly well suited to investigate the evolution of bank risk sensitivities over the business cycle. It contains the economic boom of the second half of the 1980s, the economic slowdown at the beginning of the 1990s, and the period of economic growth associated with the EMU-related convergence in the mid-1990s, interrupted by a number of financial crises (Mexican, Asian, and Russian crisis and the near-collapse of the Long Term Capital Management hedge fund). Finally, our sample also includes the period of global economic slowdown in the period 2000-2002 in which a lot of concerns were raised about the health of certain types of banks (see The Economist 1998, 2002). Since most of the listed banks in Europe are the largest in terms of asset size, they cover the vast majority of their national banking systems. Consequently, our results reflect pervasive risk effects across European banking. These large banking institutions are also of particular concern for national and European regulators and supervisors.

The dependent variables in this study are the excess returns of portfolios of banks with specific risk characteristics. For the 143 European banks, we download monthly stock returns (including dividends) from Datastream International. Returns are denominated in German marks before 1999, and in euro thereafter[3]. Next to the banks listed in June 2002, the sample includes 39 dead banks to alleviate the problem of survivorship bias.[4] We require that the banks display at least two years of return data in order to ensure that we estimate meaningful risk exposures.

4.1 Types of banks

To construct portfolios of banks with different risk profiles, all banks in the sample are ranked according to their degree of functional diversification and their capital adequacy level. Balance sheet and income statement data are retrieved from Bankscope, a bank database maintained by the London-based rating

[2] More specifically, the sample includes 7 Austrian, 7 Belgian, 4 Danish, 6 Dutch, 3 Finnish, 6 French, 11 German, 4 Greek, 3 Irish, 24 Italian, 4 Luxemburg, 6 Norwegian, 7 Portuguese, 20 Spanish, 6 Swedish, 8 Swiss and 17 UK banks.

[3] All returns are denominated in a common currency so that stock returns of banks within a particular portfolio but from different countries can be aggregated. We choose the German mark because it was considered by market participants as the anchor currency of the European Monetary System before the introduction of the euro in 1999. As a robustness test, we also constructed the various portfolios based on local returns. Summary statistics were found to be qualitatively similar to those based on deutschmark denominated returns.

[4] None of the banks included in the sample went bankrupt; all delisting are related to mergers. When a bank is fully acquired, the target bank is treated as a dead stock.

agency Fitch/IBCA on a yearly basis. This data is sufficiently comparable across countries for a number of reasons. First, bank accounting rules are relatively similar between the European countries under investigation. Second, all data is obtained from Fitch/IBCA's harmonized balance sheet and income statements. Finally, for the items needed to construct the relevant ratios, we check the data for internal consistency to guarantee that all ratios are calculated based on the same items and subitems.

In order to make a distinction between relatively strongly and poorly capitalized banks, we make a ranking of banks based on the ratio 'equity-to-total customer loans'[5]. To distinguish between functionally diversified and non-diversified banks, we make a ranking of banks based on the ratio 'non-interest income-to-total income'. Non-interest income includes commissions and fees, e.g. from insurance underwriting and distribution, investment banking activities, asset management, and proprietary financial market trading. The Second Banking Directive (1989) allows banks to engage freely in these types of financial service activities. While a number of European banks have adopted strategies that eventually led to the creation of financial conglomerates, others have remained more focused on traditional intermediation. For the 143 European banks in our sample, there are on average 7 years of balance sheet data available, with a minimum of two years. As a result, we are not able to make a yearly ranking of banks from 1985 until 2002. Instead, we concentrate on the average 'equity-to-total customer loans' and the 'non-interest income-to-total income' ratios for which data over the sample period is available. Banks with the 15% highest ratios of 'total equity-to-total customer loans' are considered to be relatively well capitalized, whereas the group with the 15% lowest ratios is considered to be relatively poorly capitalized.[6] Diversified (specialized) banks are those with the 15% highest (lowest) ratio of 'non-interest income to total income'. Although both ratios vary over time, we observe no shifts from being classified as a diversified to a specialized bank or from well to poorly capitalized, and vice versa in both cases. Therefore, we are confident that taking the average of both ratios does not bias the results. Moreover, this procedure ensures that the classification of the banks in different risk profiles reflects a deliberate long-term strategic choice.

Table 1 presents the summary statistics of the different portfolios of banks. For each portfolio, we

[5]Since loans are the most important category of risky assets, we prefer the capital-to-loan ratio to capture cross-sectional variation in capital adequacy levels. The loan-to-asset ratio would be a biased indicator, e.g. because banks in different countries hold different proportions of government debt. Notice that this indicator differs from the risk-weighted capital ratio imposed by the current BIS capital rules.

[6]The capital and non-interest income ratios used to subdivide the sample are calculated based on the consolidated bank statements. For each bank we calculate the average ratio over the sample period, from the earliest possible year available in Bankscope to 2001

present the average, the standard deviation, the minimum and the maximum of the ratios 'equity/total customer loans' and 'non-interest income/total income'. The summary statistics indicate that there is considerable cross-sectional variation between bank types for both ratios. In terms of capital adequacy, the ratio 'equity-to-customer loans' is 34.2% for the 15 percent strongest capitalized banks compared to 5.7% for the 15 percent poorest capitalized banks. The minimum level of the capital adequacy ratio in the subsample of strongly capitalized banks is larger than the maximum level in the poorly capitalized bank sample. This indicates that the capital adequacy position of the two bank subsamples differs considerably. A similar observation can be made for the diversified versus specialized banks. The ratio 'non-interest income/total income' is 5.4% for the 15 percent most specialized banks, compared to 31.7% for the 15 percent most diversified banks. Again, the minimum ratio in the 'diversified' sample is higher than the maximum in the 'specialized' sample, indicating that the two groups are structurally different. Although the results of the 30 percent subsamples are less pronounced compared to the 15 percent portfolios, the characteristics are similar. Therefore, in the remainder of this paper, we focus on the 15 percent subsamples. To investigate the potential overlap between the different portfolios, Table 2 presents the percentage of banks in each of the (15% percentile) portfolios that are also included in another portfolio of banks. The first part of Table 2 shows that 30% of the banks that are relatively poorly capitalized are also functionally specialized. For the relatively strongly capitalized banks, 22% are diversified, while 39% are specialized. In the group of specialized banks, there are more relatively poorly capitalized banks compared to relatively strongly capitalized banks. As a conclusion, this table indicates that there is some overlap between the different banking portfolios, but not to the extent that one is redundant with respect to the others. Finally, Table 3 shows that none of the portfolios is dominated by banks from one specific country. In all portfolios, banks of at least 10 countries are present. Overall, there is no evidence of a substantial country bias in any of the portfolios.

4.2 Bank Stock Returns

In Table 4, we investigate whether the differences in risk profile are reflected in the (excess) return characteristics. Specialized banks in Europe yield an average return and volatility that is higher compared to diversified banks (1.19 versus 0.97 and 6.28 versus 4.84). Both types of banks produce , however, similar Sharpe Ratios. The average return of the relatively poorly capitalized banks is considerably lower than for the relatively strongly capitalized banks, 0.89% versus 1.39%. The difference in return only partly compensates the difference in volatility. As a result, the Sharpe Ratio is higher for well capitalized banks (0.23 versus 0.18). The last three columns of Table 4 report the Jarque-Bera test for normality, an ARCH test (with four lags) for heteroskedasticity, and a Q test (also with four lags) for autocorrelation. The Jarque-Bera rejects normality for all portfolios, mainly because of high excess kurtosis. In addition, the Q and ARCH test indicate that most series exhibit (fourth order) autocorrelation and heteroskedasticity.

Table 5 reports average correlations between the returns on the different portfolios. All portfolios are strongly correlated with the returns on a portfolio of all banks in sample. This suggests that bank returns, independently of their risk profile, are to a large extent determined by common risk factors. Correlations are considerably lower though between functionally diversified and specialized banks (66%), and between relatively poorly and well capitalized banks (72%), suggesting that the choice of a particular strategy has an effect on the return-generating process of bank stock returns.

Finally, Table 6 reports year-by-year average returns and volatilities for the different bank portfolios. While both average returns and volatilities exhibit considerable variation over time, there is similarly strong evidence that the different bank types follow the same cycle. Banks returns are high and relatively stable during or in anticipation of prosperous times, but low and volatility during recession years (e.g. during the periods 1987, 1990-1993, and 2001-2002). The regime-switching model should be able to capture these dynamics.

4.3 Information Variables

Before estimating the model, we need to define the information variables in the information set Ω_{t-1}, and determine which instruments drive the factor innovations $\varepsilon_{x,t}$, the expected return μ_t, the conditional variance-covariance matrix $\mathbf{H}_t$, and the transition probabilities P_t and Q_t.

We relate excess bank stock returns to three instruments that are shown to have leading indicator properties for the business cycle, and hence for stock returns. The first variable is the short-term nominal Interest Rate (IR), represented by the change in the one-month euro (or ECU before the introduction of the euro in 1999) interest rate. A large number of papers have found the short rate to have predictive power for excess stock returns (Fama and Schwert 1977; Campbell (1987); Breen et al. 1989; Shiller and Beltratti 1992; Lee 1992, for example). Recently, Ang and Bekaert (2003) compared the predictive power of the short rate to those of dividend and earnings yield, and find that, once corrected for small sample problems, the short-term interest rate is the only robust predictor of stock returns. A similar result is found in Campbell and Yogo (2003). While these studies typically investigate the predictability of returns on the market portfolio, other studies have specifically looked at bank stock returns. In fact, banks may be especially prone to changes in the short-term interest rate because of a duration mismatch between their assets and liabilities structure. Among others, Flannery and James (1984b) and Aharony et al. (1986) find the expected negative relationship between bank returns and unexpected changes in the short-term interest rates.

We also include a measure for the overall liquidity of the economy, i.e. the growth in the Money Stock (M), here the money aggregate M1 for EMU plus UK. Fama (1981) argues that it is important to control for money supply when establishing the inflation - future real economic activity argument. Furthermore, Perez-Quiros and Timmermann (2001) find that the expected return of small firms reacts significantly positively to growth rates in the money base, especially during business cycle downturns. One explanation for this may be that the central bank expands the monetary base during recessions, and that small firms' risk and risk premium are highest in this state. Finally, there is some evidence that the increases in the economy's liquidity are partly explained by an increase in risk aversion, which gives rise to portfolio rebalancing from e.g. stocks and bonds to liquid assets like bank deposits.

A third information variable we consider is the Term Spread (TS), defined as the spread between the ten-year euro (ECU) benchmark bond rate and the 3-month euro (ECU) interest rate. This variable is consistently shown to be a leading indicator of real economic activity, and hence stock prices. Estrella and Hardouvelis (1991) and Estrella and Mishkin (1998) show that for the United States the yield spread significantly outperforms other financial and macroeconomic indicators in forecasting recessions. Bernard and Gerlach (1996), Estella and Mishkin (1997), and Ahrens (2002) present similar results for other countries. In addition, several papers (Campbell 1987; Fama and French 1989; Campbell and Yogo 2003, for example) have found a postive relation between the term structure and equity returns.

To extract the unexpected, or "news", component out of changes in these three instruments, we define $\mathbf{X}_t = [\Delta TS_t, \Delta IR_t, \Delta M_t]$, and estimate the following Vector-AutoRegressive (VAR) model of order n :

$$\mathbf{X}_t = \sum_{i=1}^{n} \mathbf{A}_i \mathbf{X}_{t-i} + \varepsilon_{x,t},$$

where n represents the number of autoregressive components. The $\mathbf{A}_i$'s are 3×3 matrices of parameters and $\varepsilon_{x,t}$ a 3×1 vector of time t innovations. The Schwartz information criterion as well as a likelihood ratio test indicate that a lag of one, $n = 1$, is sufficient.

To determine the expected return component $\mu_t = [\mu_{1t}, \mu_{2t}]'$, we estimate the following set of equations:

$$\begin{aligned} r_{1t} &= \mu_{1t} + \varepsilon_{1,t} = \alpha_0^1 + \alpha_1^1 \Delta TS_{t-1} + \alpha_2^1 \Delta IR_{t-1} + \alpha_3^1 \Delta M_{t-1} + \varepsilon_{1,t} \\ r_{2t} &= \mu_{2t} + \varepsilon_{2,t} = \alpha_0^2 + \alpha_1^2 \Delta TS_{t-1} + \alpha_2^2 \Delta IR_{t-1} + \alpha_3^2 \Delta M_{t-1} + \varepsilon_{2,t}. \end{aligned}$$

To keep the number of parameters in the regime-switching model manageable, we determine both the factor innovations and expected returns in a first step estimation.

The conditional variance-covariance matrix depends on a latent state variable S_t, which is supposed to separate recessions from booms, and on a set of information variables. Previous literature has documented a link between equity market volatility and the business cycle. Hamilton and Susmel (1994) estimate a regime-switching ARCH model for monthly US stock returns in which the probability of switching from a high to a low regime depends on the overall business cycle conditions. More specifically, the probability of staying in or switching to the high volatility state is higher during recessions. Glosten et al. (1993), Elyasiani and Mansur (1998), and Perez-Quiros and Timmermann (2000) find that lagged interest rates are important in modeling the conditional volatility of monthly stock returns. In this paper, we relate the conditional variance to a latent state variable S_t and the lagged change in the three month interest rate, IR_{t-1}.

Finally, we have to choose the relevant drivers of the transition probabilities. The states should roughly correspond to business cycle booms and troughs. As we have argued before, many studies have successfully used the term spread in predicting recessions. Consequently, we use this variable to model the transition between states:

$$P_t = \frac{\exp(\zeta_{1p}' + \zeta_{2p}' TS_{t-1})}{1 + \exp(\zeta_{1p}' + \zeta_{2p}' TS_{t-1})}$$

$$Q_t = \frac{\exp(\zeta'_{1q} + \zeta'_{2q} TS_{t-1})}{1 + \exp(\zeta'_{1q} + \zeta'_{2q} TS_{t-1})},$$

where TS_{t-1} is the one-month lagged value of the term spread.

5 Estimation and Empirical Results

We estimate the expected return μ_t and the factor innovations $\varepsilon_{x,t}$ as outlined in the previous section in a first step regression[7], and impose these estimates in the second step. The model is then given by

$$\begin{aligned}
\varepsilon_{1,t} &= r_{1,t} - \mu_{1,t} = \beta_0^1(S_t) + \beta_1^1(S_t)\,\varepsilon_{\Delta TS,t} + \beta_2^1(S_t)\,\varepsilon_{\Delta IR,t} + \beta_3^1(S_t)\,\varepsilon_{\Delta M,t} + u_{1,t} \\
\varepsilon_{2,t} &= r_{2,t} - \mu_{2,t} = \beta_0^2(S_t) + \beta_1^2(S_t)\,\varepsilon_{\Delta TS,t} + \beta_2^2(S_t)\,\varepsilon_{\Delta IR,t} + \beta_3^2(S_t)\,\varepsilon_{\Delta M,t} + u_{2,t},
\end{aligned}$$

while the conditional variance-covariance matrix is specified as follows

$$u_t = [u_{1,t}, u_{2,t}]' \sim N(0, \mathbf{H}(S_t, IR_{t-1})),$$

$$H(S_t, IR_{t-1}) = \begin{bmatrix} h^1(.)^2 & \rho(S_t)h^1(.)h^2(.) \\ \rho(S_t)h^1(.)h^2(.) & h^2(.)^2 \end{bmatrix},$$

and

$$\begin{aligned}
\ln(h^1(S_t, IR_{t-1})) &= \omega^1(S_t) + \Psi^1(S_t) IR_{t-1} \\
\ln(h^2(S_t, IR_{t-1})) &= \omega^2(S_t) + \Psi^2(S_t) IR_{t-1}.
\end{aligned}$$

Finally, the time-varying transition probabilities are specified as

$$\begin{aligned}
P_t &= \Pr(S_t = 1 | S_{t-1} = 1, TS_{t-1}) = \frac{\exp(\zeta_{1p} + \zeta_{2p} TS_{t-1})}{1 + \exp(\zeta_{1p} + \zeta_{2p} TS_{t-1})} \\
Q_t &= \Pr(S_t = 2 | S_{t-1} = 2, TS_{t-1}) = \frac{\exp(\zeta_{1q} + \zeta_{2q} TS_{t-1})}{1 + \exp(\zeta_{1q} + \zeta_{2q} TS_{t-1})}.
\end{aligned}$$

The parameters are estimated by maximum likelihood, assuming normally distributed errors. Given

[7] Detailed results about the first step estimation are not reported, but are available upon request.

the strongly nonlinear character of this model, the estimation procedure is started from 25 different starting values to avoid local maxima.

Before discussing the results, we conduct a number of specification tests on the standardized residuals. More specifically, we test for fourth-order autocorrelation in standardized and squared standardized residuals, as well as for skewness and excess kurtosis. Using a GMM procedure similar to Bekaert and Harvey (1997) and Baele (2003), we find that the standardized residuals do not exhibit any fourth-order autocorrelation or heteroskedasticity. The model does account for most but not all of the skewness and excess kurtosis. Interestingly, the test statistics for excess kurtosis greatly improve after allowing for different regimes.

Panel A and B of Table 8 present the estimated parameters and standard deviations of the mean equation. The dependent variables are unexpected excess portfolio returns of relatively poorly and relatively well capitalized banks (Panel A) and functionally specialized and diversified banks (Panel B). Panel A and B of Table 9 report the corresponding Likelihood Ratio (LR) tests[8]. Part 1 of each panel investigates whether (combinations of) parameters are significantly different from zero and whether the mean and the conditional variance of the two types of banks react differently to information. Part 2 of each panel tests for business cycle asymmetry and investigates whether this asymmetry is significantly different between banks. Figure 1 plots the filtered probability of being in state 1 for the different combinations of bank types. Figure 2 plots the conditional volatility series for the different types of banks. Figure 3 investigates to what extent shocks are different across bank types.

We first discuss the results of the transition probabilities. Then, we present the results of the mean equation followed by the variance equation.

5.1 Transition between States

The parameter estimates for the specification of the transition probabilities are given in the bottom part of Panels A and B in Table 8. The corresponding LR tests are presented in Table 9 (Part 1 of Panels A and B). Figure 1 plots the filtered probabilities of being in state one for each combination of bank types.

[8]An overview of the likelihood ratio tests is given in Table 7.

The parameter estimates are similar for the different bank combinations. Under the assumption that $\zeta_{2p} = \zeta_{2q} = 0$, the estimates for the intercept would imply a constant probability of staying in state 1 between 0.92 and 0.96, a level of persistence often found in monthly data.[9] However, we do find weak evidence for time variation in the transition probabilities. A LR test rejects the null hypothesis of no effect from the term structure on the transition probabilities at a 10% level both for relatively poorly and strongly capitalized banks and for functionally diversified and specialized banks. For all bank combinations, the probability of staying in state 1 is positively related to the term structure, and significantly negatively in state 2. Since the term structure typically becomes steeper in (anticipation of) expansions and flatter (or negative) in recessions, this suggests that state 1 and 2 can be characterized as economic expansion and recession states, respectively.

Figure 1 shows the classification of states is similar for the pairs of relatively poorly and strongly capitalized and specialized and diversified banks. This suggests that the transition probabilities are determined by common rather than bank-specific factors. For all bank portfolios in figure 1, the model switches from an expansion to a contraction state during the recession at the beginning of the 1990s, during the period of financial crises in 1997-1998, and during the global economic slowdown between 2000 and 2002. As shown in Table 6, the periods 1990-91 and 2001 are characterized by higher volatility and lower mean bank stock returns for all types of banks. In 1990-91, the average yearly return is close to zero, whereas the volatility is above the average over the sample period. In 2001, the average yearly return is negative, whereas the volatility is almost double the average of the volatility over the sample period (7.09% versus 3.95%). This suggests that regime 1 corresponds to a low volatility - high return state, while regime 2 is characterized by low returns and high volatility.

5.2 Mean Equation

Based on the estimation output for the mean equation, we first examine whether bank stock returns react significantly to our economic news variables, and whether they have the anticipated sign. A steepening of the yield curve is generally considered as an indication of an improved economic outlook, so one expects a positive relationship between bank stock returns and term spread innovations. This is confirmed by our empirical results (see Table 8), which show a positive and significant sign in all but one of the cases. According to the ex-ante expectations, we find a negative relationship

[9] We could not reject the null hypothesis that the intercepts in the specification for the transition probabilities are equal ($\zeta_{1p} = \zeta_{1q}$). Consequently, to save parameters, we assume that $\zeta_{1p} = \zeta_{1q} = \zeta_1$.

between innovations in the short rate and bank stock returns. Finally, as expected, we find a negative relationship between money growth innovations and bank stock returns, but it is only significant at a 10% level for poorly capitalized and specialized banks. A likelihood ratio test in Part 1 of Panel A of Table 9 indicates that innovations in the term spread, the short rate, and the monetary base jointly influence realized bank returns. However, this is to a large extent due to the high significance of the term spread sensitivities.

The second question is whether bank stock returns are more sensitive to economic news in business cycle downturns than in economic expansions. Except for diversified banks, the sensitivity to the term spread increases considerably in the recession state. More specifically, the sensitivity increases from 0.69 to 1.21 for the relatively poorly capitalized banks, from 0.77 to 0.84 for the relatively strongly capitalized banks, and from 0.84 to 1.22 for the specialized banks. Similarly, the sensitivity to the short-term interest rate becomes much more negative in the recession state for all bank types. The same observation holds for innovations in the money base. While the sensitivities to the short rate and money base are not significant for any of the bank types in the expansion state, they become highly significant in the recession state for the relatively poorly capitalized and specialized banks. The null hypothesis of a symmetric response to economic news is rejected at a 1 percent level for the relatively poorly capitalized banks and at a 5 percent level for the specialized banks (Part 2 of panel A and B of Table 9).

The third objective of this paper is to test whether adequate capitalization and functional diversification make banks less vulnerable to worsening credit market conditions. As can be seen from the bottom panel of Part 1 of Panel A of Table 9, there is no statistical difference between relatively poorly and strongly capitalized banks in the expansion state. In the recession state, however, the null hypothesis of equal sensitivities across states is rejected at a 10 percent level. This is mainly the result of asymmetry in the term spread and money base sensitivities. A related question is whether the asymmetry is stronger for relatively poorly than relatively well capitalized banks. The test statistics in the first two columns of Part 2 of Panel A of Table 9 reveal that relatively poorly capitalized banks react more asymmetrically to economic news than their relatively well capitalized peers. Similar observations can be made about the difference between specialized and diversified banks (Panel B of Table 9). First, sensitivities are only statistically different in the recession state. Second, sensitivities increase statistically more strongly over the cycle for specialized than for diversified banks. This evidence corroborates the hypothesis that well capitalized banks and diversified banks are less vulnerable to economic fluctuations and are perceived by the stock market to be less risky.

To further investigate how different types of banks react to changes in the prevailing credit market conditions, we compare the total shocks spillovers between different types of banks. The total shocks are calculated as follows:

$$\begin{aligned}
\Lambda_t^1 &= \tilde{\beta}_0^1 + \tilde{\beta}_1^1 \varepsilon_{\Delta TS,t} + \tilde{\beta}_2^1 \varepsilon_{\Delta IR,t} + \tilde{\beta}_3^1 \varepsilon_{\Delta M,t} \\
\Lambda_t^2 &= \tilde{\beta}_0^2 + \tilde{\beta}_1^2 \varepsilon_{\Delta TS,t} + \tilde{\beta}_2^2 \varepsilon_{\Delta IR,t} + \tilde{\beta}_3^2 \varepsilon_{\Delta M,t},
\end{aligned}$$

where Λ_t^1 and Λ_t^2 represent the total shocks for bank type 1 and 2 respectively, and $\tilde{\beta}$ the probability-weighted sensitivities. To answer the question whether banks with opposed risk strategies react differently to information over the business cycle, Figure 3 plots the total shock difference, calculated as Λ_t^2-Λ_t^1. Panel A of Figure 3 plots the difference in shocks between relatively poorly and strongly capitalized banks. While total shocks appear to be very similar during most of the expansion periods (difference close to zero), relatively poorly capitalized banks react much stronger to news in business cycle downturns. More specifically, relatively poorly capitalized banks perform worse compared to their better capitalized peers during the years 1986-87, 1990-91, and 2001, periods of low economic growth. The negative shock differences over the period 1997-2000, which is characterized by strong equity market appreciation and high volatility, are explained by the better performance of relatively well capitalized banks during this period. Shock differentials between functionally diversified and specialized banks are depicted in Panel B of Figure 3. The difference between both types of banks is mainly apparent during the period 1997-2002, during which specialized banks receive considerably larger shocks than diversified banks. This suggests that during these years investors perceived diversified banks as being better shielded against a worsening in the credit market conditions than specialized banks.

5.3 Variance Equation

The level of volatility across states, time, and bank portfolios, depends both on the time variation in the latent regime variable and on the actual estimates of the parameters in the conditional volatility specification. For all bank types, the intercepts are significant at the 1% level. In addition, there is clear evidence of volatility asymmetry. The intercept is considerably larger in the recession state in all specifications of the variance equation (see Table 8). As can be seen in Part 2 of Table 9, this asymmetry is not only economically important, but also statistically significant at a 1% level. Overall, the parameter estimates in the recession state imply a level of conditional volatility that is between 6 and 9 times higher than in the expansion state. In all specifications, the estimates for the conditional correlations are higher in the recession state than in the expansion state, even though the hypothesis of equal correlations cannot be rejected (see Part 1 of Panel A in Table 9). We find that, except for diversified banks, the conditional volatility of the return series is significantly (at a 10% level) related to lagged changes in the short rate. Moreover, in all specifications, interest rate sensitivities are considerably higher in the recession state (Table 8). However, only for the returns on specialized banks the hypothesis of equal sensitivities to lagged changes in the short rate can be rejected.

One of the advantages of the bivariate specification is that we can test whether banks with an opposite strategy react differently to information across states. In Part 1 of Panels A and B (Table 9), we test whether the parameter estimates are statistically different between bank types, both within a particular state, or jointly across states. The intercepts in the volatility specification for the relatively poorly and strongly capitalized banks are statistically different in the recession state, but not in the expansion state. However, we do not find that the sensitivities of conditional variance to lagged changes in the short rate differ between these two types of banks. Panel A of Figure 2 plots the estimated conditional variances. While both bank types exhibit a comparable level of volatility during the expansion state, relatively well capitalized banks show a higher volatility intercept and appear to have higher levels of risk during recessions. This suggests that banks with a higher capital buffer not necessarily have a lower level of residual risk (not explained by the information variables) relative to their relatively less capitalized peers. For the case of functional diversification, we do find evidence that diversification of revenue sources is effective in lowering overall risk (see Panel B of Table 9, Panel B of Figure 2). The volatility intercept is higher for specialized banks, both in the expansion and in the recession state. Moreover, since we can reject the null hypothesis of equal intercepts in both states, the difference appears to be economically, as well as statistically relevant. In addition, there is some evidence that the specialized banks are more sensitive to lagged changes in the short rate in the recession state.

6 Conclusion

In this paper, we investigate (1) whether bank stock returns react to economic news, proxied by innovations in the term spread, the short-term interest rate, and the money stock, (2) whether they do so in an asymmetric way, and (3) whether relatively poorly capitalized banks and specialized banks react stronger and more asymmetrically to economic news than their well capitalized and more diversified peers. We develop a bivariate regime-switching model to test these hypotheses empirically.

First, we find strong evidence that bank stock returns react to economic news, especially to innovations in the term spread. Positive (negative) term spread innovations have a significantly positive (negative) effect on bank stock returns. This suggests that bank stock returns react to predicted changes in the business cycle and that they can potentially be useful indicators for the evolution of bank riskiness over the cycle. Finding that the stock market appears to be able to convey information about the banks' health fits into the market discipline framework put forward in the Basel 2 proposals.

Second, our results provide strong evidence that the distribution of bank stock returns shifts significantly over the business cycle. First, the regime-switching model developed in this paper distinguishes between two states in the return-generating process of bank stock returns: a low volatility / high mean state (state 1), and a high volatility / low mean state (state 2) . The classification of states appears to be very similar across the various bank types, suggesting that bank stock returns are to a large extent driven by common factors. The high volatility / low mean state is observed around the 1987 stock market crisis, during the recession at the beginning of the 1990s, during the series of financial crises at the end of the 1990s, and in the period of global economic slowdown in the 2000-2002 period. The link between the business cycle and the classification of states is further confirmed by the estimation results for the transition probability specification: the probability of staying is positively related to the term spread in state 1 and negatively in state 2, suggesting that state 1 and 2 are expansion and recession states, respectively. We find that the sensitivities of bank stock returns to innovations in the short rate, term spread, and money base increase considerably in the recession state. Moreover, while the short rate and money base innovations appear unrelated to bank stock returns in the expansion state, a statistically significant relationship appears for relatively poorly capitalized banks and for specialized banks in the recession state. A joint test indicates that the level of asymmetry is statistically significant for the relatively poorly capitalized banks and for the specialized banks. Our results provide strong evidence for asymmetry in the conditional variance of all bank returns. The parameter estimates in the recession state imply a level of volatility that is between 6 and 9 times higher than in the expansion state. In addition, we find a significant relation between the conditional variance of relatively poorly capitalized banks and specialized banks and lagged changes in the short-term interest rate.

Third, our results indicate that relatively poorly capitalized banks and specialized banks are more vulnerable to worsening credit market conditions than banks with a higher capital base or banks with functionally diversified activities. While sensitivities are not economically and statistically different in the expansion state, the sensitivity of stock returns of relatively poorly capitalized and specialized banks increases much stronger in recessions, resulting in statistically different sensitivities in the recession state. Relatively poorly capitalized and specialized banks are harder hit during business cycle downturns than their better capitalized or functionally diversified peers. Maintaining relatively high capital levels and functional diversification are therefore identified as useful strategies for banks to decrease their overall risk profile. Furthermore, the results also indicate that the behavior of the conditional volatility differs across bank types. First, while relatively poorly and strongly capitalized banks have similar levels of volatility in the economic expansion state, the level of residual volatility in the recession state is higher for the better capitalized banks. In accordance with ex-ante expectations, we find evidence that functionally diversified banks have lower levels of volatility than specialized banks. This finding offers support to the claim that the formation of financial conglomerates may be beneficial for the stability of the banking system.

References

[1] Aharony, J., A. Saunders and I. Swary. (1986). "The Effects of a Shift in Monetary Policy Regime on the Profitability and Risk of Commercial Banks.", Journal of Monetary Economics 17, 363-506.

[2] Ahrens, R. (2002). "Predicting Recessions with Interest Rate Spreads: A Multicountry Regime-Switching Analysis.", Journal of International Money and Finance 21(4), 519-537.

[3] Altunbas, Y., O. Fazylov, and P. Molyneux. (2002). "Evidence on the Bank Lending Channel in Europe." Journal of Banking and Finance 26, 2093-2110.

[4] Ang, A., and G. Bekaert. (2001). "Stock Return Predictability: Is it There?" NBER Working Paper 8207, National Bureau of Economic Research.

[5] Angeloni, I., B. Mojon, A.K. Kashyap, and D. Terlizzese. (2002). "Monetary Transmission in the Euro Area: Where Do We Stand?" ECB Working Paper 114, European Central Bank.

[6] Asea, P.K. and B. Blomberg. (1998). "Lending Cycles." Journal of Econometrics 83 (1-2), 89-128.

[7] Baele, L. (2003). "Volatility Spillover Effects in European Equity Markets." Ghent University Working Paper.

[8] Bekaert, G. and C.R. Harvey. (1997). "Emerging Equity Market Volatility." Journal of Financial Economics 43(1), 29-77.

[9] Berger, A.N. (1995). "The Relationship between Capital and Earnings in Banking." Journal of Money, Credit and Banking 27(2), 432-456.

[10] Bernanke, B. S., and M. Gertler. (1989). "Agency Costs, Net Worth, and Business Fluctuations." American Economic Review 79(1), 14-31.

[11] Bernard, H. and S. Gerlach. (1996). "Does the Term Structure Predict Recessions? The International Evidence." BIS Working Paper 37, Bank for International Settlements.

[12] Bank of International Settlements (BIS). (2003). "The Financial Sector." BIS 73rd Annual Report., 98-119.

[13] Bollerslev, T. (1990). "Modelling the Coherence in Short-Run Nominal Exchange-Rates - A Multivariate Generalized ARCH Model." Review of Economics and Statistics 72(3), 498-505.

[14] Breen, W., R. Glosten, and R. Jagannathan. (1989). "Economic Significance of Predictable Variations in Stock Index Returns." Journal of Finance 44(5), 1177-1189.

[15] Brewer III, E., Genay, H., Hunter, W. C. and Kaufman, G. G. (1999). "Does the Japanese Stock Market Price Bank Risk? Evidence from Financial Firm Failures." Federal Reserve Bank of Chicago Working Paper 99-31.

[16] Cai, J. (1994). "A Markov Model of Switching-Regime ARCH." Journal of Business and Economic Statistics 12, 309-316.

[17] Campbell, J.Y. (1987). "Stock Returns and the Term Structure." Journal of Financial Economics 18(2), 373-399.

[18] Campbell J.Y., M. Lettau B.G. Malkiel, and Y.X. Xu. (2001). "Have individual stocks become more volatile? An empirical exploration of idiosyncratic risk." Journal of Finance 56(1), 1-43.

[19] Campbell, J.Y., and M. Yogo. (2003). "Efficient Tests of Stock Return Predictability." Working Paper.

[20] Cebenoyan, A.S., and P.E. Strahan. (2004). "Risk Management, Capital Structure, and Lending at Banks." Journal of Banking and Finance 28(1), 19-43.

[21] Chaudhry, M.K., R. Christie-David, T.W. Koch, and A.K. Reichert. (2000). "The Risk of Foreign Currency Contingent Claims at US Commercial Banks." Journal of Banking and Finance 24(9), 1399-1417.

[22] Chemmanur, T.J. and Fulghieri, P. (1994). "Reputation, Renegotiation, and the Choice between Bank Loans and Publicly Traded Debt." Review of Financial Studies 7, 475-506.

[23] Cybo-Ottone, A. and M. Murgia. (2000). "Mergers and Shareholder Wealth in European Banking." Journal of Banking and Finance 24(6), 831-859.

[24] De Bandt, O., and P. Hartmann. (2000). "Systemic Risk: a Survey." ECB Working Paper 35, European Central Bank.

[25] DeLong, G.L. (2001). "Stockholder Gains from Focusing versus Diversifying Bank Mergers." Journal of Financial Economics 59(2), 221-252.

[26] Dewenter, K.L. and A.C. Hess. (1998). "An International Comparison of Banks' Equity Returns." Journal of Money, Credit, and Banking 30(3), 472-492.

[27] Diamond, D. W. (1984). "Financial Intermediation and Delegated Monitoring." Review of Economic Studies 51(3), 393-414.

[28] Diebold, F.X. (1986). "Comment on Modelling the Persistence of Conditional Variance." Econometric Reviews 5, 51-56.

[29] Economist, The (2002), "Crisis? What crisis?", 16 May.

[30] Economist, The (1998), "The trials of megabanks", 29 October.

[31] Elyasiani, E., and I. Mansur. (1998). "Sensitivity of the Banking Stock Returns Distribution to Changes in the Volatility of Interest Rate: A GARCH-M Model." Journal of Banking and Finance 22 (5), 535-563.

[32] Estrella, A. and G. A. Hardouvelis. (1991). "The Term Structure as a Predictor of Real Economic Activity." Journal of Finance 46(2), 555-576.

[33] Estrella, A. and F.S. Mishkin. (1998). "Predicting US Recessions: Financial Variables as Leading Indicators." Review of Economics and Statistics 80(1), 45-61.

[34] European Central Bank. (2000). "EU Bank's Income Structure." August.

[35] Fama, E. F. (1981). "Stock Returns, Real Activity, Inflation, and Money." American Economic Review 71(4), 545-565.

[36] Fama, E. F., and K. French. (1989). "Business Conditions and Expected Returns on Stocks and Bonds." Journal of Financial Economics 25(1), 1089-1108.

[37] Fama, E.F., and G. W. Schwert. (1977). "Asset Returns and Inflation." Journal of Financial Economics 5(2), 115-146.

[38] Flannery, M.J. and C.M. James. (1984a). "The Effect of Interest-Rate Changes on the Common Stock Returns of Financial Institutions" Journal of Finance 39(4), 1141-1153.

[39] Flannery, M.J. and C.M. James. (1984b). "Evidence on the Effective Maturity of Bank Assets and Liabilities." Journal of Money, Credit and Banking 16(4), 435-445.

[40] Flannery, M. J. (1998). "Using Market Information in Prudential Bank Supervision: A Review of the US Empirical Evidence." Journal of Money, Credit, and Banking 30(3), 273-305.

[41] Flannery, M.J. and A.A. Protopapadakis. (2002). "Macroeconomic Factors *Do* Influence Aggregate Stock Returns." Review of Financial Studies 15(3), 751-782.

[42] Freixas, X. and J.-C. Rochet. (1999). Microeconomics of Banking. Cambridge, MA.: MIT Press.

[43] Froot, K.A. and J. C. Stein. (1998). "Risk Management, Capital Budgeting, and Capital Structure Policy for Financial Institutions: an Integrated Approach." Journal of Financial Economics 47(1), 55-82.

[44] Genetay, N. and P. Molyneux. (1998). "Bancassurance." Macmillan, London.

[45] Glosten, L.R., R. Jagannathan, and D. Runkle. (1993). "On the Relation between the Expected Value and the Volatility of the Nominal Excess Returns on Stocks." Journal of Finance 48(5), 1770-1801.

[46] Goldberg, L.G. and S.C. Hudgings. (2002). "Depositor Discipline and Changing Strategies for Regulating Thrift Institutions." Journal of Financial Economics 63(2), 263-74.

[47] Gray, S. (1996). "Modeling the Conditional Distribution of Interest Rates as a Regime Switching Process." Journal of Financial Economics 42(1), 27-62

[48] Hamilton, J.D., and R. Susmel. (1994). "Autoregressive Conditional Heteroskedasticity and Changes in Regime." Journal of Econometrics 64(1-2), 307-33.

[49] Hellmann, T.F., K. C. Murdock, and J. E. Stiglitz. (2000). Liberalization, Moral Hazard in Banking, and Prudential Regulation. Are Capital Requirements Enough?" American Economic Review 90(1), 147-165.

[50] International Monetary Fund (IMF). (2003). "Financial Asset Price Volatility: A Source of Instability?" In: Global Financial Stability Report. Market Developments and Issues, September.

[51] Kashyap, A.K., and J. Stein. (1995). "The Impact of Monetary Policy on Bank Balance Sheets." Carnegie-Rochester Conference Series on Public Policy 42, 151-195.

[52] Kishan, R.P. and T.P. Opiela. (2000). "Bank Size, Bank Capital, and the Bank Lending Channel." Journal of Money, Credit, and Banking 32(1), 121-141.

[53] Kiyotaki, N. and J. Moore. (1997). "Credit Cycles." Journal of Political Economy 105(2), 211-48.

[54] Kwan, S. and E. Laderman. (1999). "On the Portfolio Effects of Financial Convergence - A Review of the Literature." FRBSF Economic Review 99(2), 18-31.

[55] Lamoreux, C.G. and W.D. Lastrapes. (1990). "Persistence in Variance, Structural Change and the GARCH model." Journal of Business and Economic Statistics 8(2), 225-234.

[56] Lee, B. S. (1992). "Causal Relations among Stock Returns, Interest Rates, Real Activity, and Inflation." Journal of Finance 47 (4), 1591-1603.

[57] Longhofer, S.D. and J.A.C. Santos. (2000). "The Importance of Bank Seniority for Relationship Lending." Journal of Financial Intermediation 9(1), 57-89.

[58] Park, S., and S. Peristiani. (1998). "Market Discipline by Thrift Depositors." Journal of Money, Credit and Banking 30 (3), 347-64.

[59] Peek, J. and E.S. Rosengren. (1997). "Derivatives Activity at Troubled Banks." Journal of Financial Services Research 12 (2-3), 287-302.

[60] Peek, J. and E.S. Rosengren. (1995). "The Capital Crunch: Neither a Borrower nor a Lender Be." Journal of Money, Credit, and Banking 27(3), 625-638.

[61] Perez-Quiros, G., and A. Timmermann. (2001). "Business Cycle Asymmetries in Stock Returns: Evidence from Higher Order Moments and Conditional Densities." Journal of Econometrics 103(1-2), 259-306.

[62] Perez-Quiros, G., and A. Timmermann. (2000). "Firm Size and Cyclical Variations in Stock Returns." Journal of Finance 55(3), 1229-1262.

[63] Rajan, R.G. (1994). "Why Bank Credit Policies Fluctuate: a Theory and some Evidence." Quarterly Journal of Economics 109(2), 399-441.

[64] Repullo, R. (2002). "Capital requirements, market power and risk taking in banking, CEPR Discussion Paper 3721, Centre for Economic Policy Research.

[65] Saunders, A. and I. Walter. (1994). "Universal Banking in the U.S.?", Oxford University Press.

[66] Schoors, K. and R. Vander Vennet. (2003). "Rules versus Discipline: Capital Adequacy Rules, Monitoring Incentives, and Bank Behavior in Transition Economies." Ghent University Working Paper.

[67] Shiller, R. J., and A. E. Beltratti. (1992). "Stock Prices and Bond Yields: Can their Comovement be explained in terms of Present Value Models?" Journal of Monetary Economics 30(2), 25-46.

[68] Sironi, A. (2003). "Testing for Market Discipline in the European Banking Industry: Evidence from Subordinated Debt Issues." Journal of Money, Credit, and Banking 35(3), 443-472.

[69] Stiroh, K.J. (2002). "Diversification in banking. Is noninterest income the answer?" Federal Reserve Bank of New York Staff Report No. 154.

[70] Vander Vennet, Rudi. (2002). "Cost and Profit Efficiency of Financial Conglomerates and Universal Banks in Europe." Journal of Money, Credit and Banking 34(1), 254-282.

Table 1: Summary Statistics of Balance Sheet Variables for Portfolios of Banks

		Mean (%)	Stdev (%)	Min (%)	Max (%)
15% ratios (22 banks)					
Strongly Capitalized Banks	Eq/Loans	34.2	28.2	16.2	119.4
	NonInt/Rev	22.8	16.7	1.6	73.0
Poorly Capitalized Banks	Eq/Loans	5.7	1.1	2.2	6.8
	NonInt/Rev	13.3	7.6	0.4	32.5
Diversified Banks	Eq/Loans	10.6	4.7	5.9	27.4
	NonInt/Rev	31.7	9.4	23.0	53.6
Specialized Banks	Eq/Loans	11.5	11.3	2.2	53.1
	NonInt/Rev	5.4	3.5	0.4	10.0
30% ratios (43 banks)					
Strongly Capitalized Banks	Eq/Loans	24.9	22.8	13.0	119.4
	NonInt/Int	20.3	13.4	1.3	73.0
Poorly Capitalized Banks	Eq/Loans	6.4	1.2	2.2	7.9
	NonInt/Int	14.7	7.5	0.4	32.5
Diversified Banks	Eq/Loans	11.9	6.6	5.9	45.4
	NonInt/Int	27.0	8.5	20.5	53.6
Specialized Banks	Eq/Loans	10.4	8.7	2.2	53.1
	NonInt/Int	8.8	4.5	0.4	14.6

Note: A distinction is made between relatively poorly and strongly capitalized banks and between functionally specialized and diversified banks. The division between relatively strongly and poorly capitalized banks is based on the ratio "Total Equity to Customer Loans (Eq/Loans)". Similarly, specialized and diversified banks are separated by the ratio "Non-Interest Income over Total revenues (NonInt/Rev)". This table reports averages of both ratios for the lowest and highest 30% and 15% percentiles. The annual account data used to calculate these ratios is obtained from Bankscope.

Table 2: Percentage Overlap between Portfolios of Banks

	Specialized Banks	Diversified Banks
Poorly Capitalized Banks	30.4%	8.7%
Strongly Capitalized Banks	39.1%	21.7%
	Poorly Capitalized Banks	Strongly Capitalized Banks
Specialized Banks	34.8%	17.4%
Diversified Banks	8.7%	4.3%

Note: This table reports the proportion of banks classified in a particular risk type (relatively strongly/poorly capitalized, functionally diversified or specialized) that are also included in bank portfolios with other risk strategies.

Table 3: Geographical Representation of Banks in different portfolios

	Specialized	Diversified	Poorly Capitalized	Strongly Capitalized
Austria	4.3%	4.3%	4.3%	-
Belgium	4.3%	8.7%	8.7%	-
Denmark	4.3%	-	-	4.3%
Finland	-	8.7%	-	4.3%
France	-	8.7%	8.7%	4.3%
Germany	13.0%	4.3%	17.4%	4.3%
Greece	17.4%	-	4.3%	13.0%
Ireland	8.7%	-	-	-
Italy	17.4%	17.4%	17.4%	8.7%
Luxembourg	4.3%	-	-	13.0%
Netherlands	-	-	-	8.7%
Norway	8.7%	-	8.7%	-
Portugal	-	17.4%	-	8.7%
Spain	-	-	-	26.1%
Sweden	8.7%	4.3%	4.3%	-
Switzerland	-	8.7%	8.7%	4.3%
UK	8.7%	17.4%	17.4%	-

Note: This table reports the percentage each country represents in the portfolios of specialized, diversified, poorly and strongly capitalized banks.

Table 4: Summary Statistics of Portfolio Returns

	Mean (%)	Volatility (%)	Sharpe Ratio	Jarque-Bera	ARCH(4)	Q(4)-Test
All European Banks	0.98	4.54	0.22	91.7***	5.37	10.19**
15% indices						
Specialized Banks	1.19	6.28	0.19	38.9***	9.67**	9.31**
Diversified Banks	0.97	4.85	0.20	68.1***	3.24	6.88
Poorly Capitalized Banks	0.89	5.09	0.18	26.5***	14.71***	3.34
Strongly Capitalized Banks	1.39	5.99	0.23	140***	15.08***	25.62**

Note: This table reports summary statistics of portfolio excess returns, both for the total sample of European banks and for the different portfolios of banks. We calculated the mean, volatility (standard deviation), Sharpe Ratio, the Jarque-Bera test for normality, an ARCH(4) test for heteroskedasticity, and a Q(4) test for autocorrelation. All returns are on a monthly basis, in German marks. The mean and the volatility are presented in percentages. *** indicates that the parameter is significant at a 1% level, ** at a 5% level and * at a 10% level.

Table 5: Correlation Matrix of Portfolio Returns

	EU	Specialized	Diversified	Poorly Capitalized	Strongly Capitalized
EU	1.00				
Specialized Banks	0.81	1.00			
Diversified Banks	0.92	0.66	1.00		
Poorly Capitalized Banks	0.89	0.83	0.82	1.00	
Strongly Capitalized Banks	0.81	0.82	0.66	0.72	1.00

Note: EU represents returns on Datastream's European Bank Sector index.

Table 6: Average Monthly Return and Volatility per Year

Panel A: Average Monthly Return per Year (in %)

	EU	Specialized	Diversified	Poorly Capitalized	Strongly Capitalized
1985	3.47	3.56	3.73	3.45	3.28
1986	1.48	1.87	0.91	0.42	4.74
1987	-1.12	-1.42	-1.22	-1.37	-2.39
1988	1.26	1.04	1.26	0.90	1.37
1989	1.45	2.85	2.09	2.25	2.47
1990	-0.42	4.05	-1.67	0.58	2.37
1991	-0.56	-0.91	-0.23	-0.33	-0.71
1992	-1.21	-1.73	-0.52	-1.33	-0.72
1993	2.83	2.42	2.72	2.38	2.58
1994	-0.74	-0.51	-0.70	-0.60	-0.79
1995	0.44	-0.31	0.34	-0.35	0.31
1996	1.77	2.28	1.62	1.59	2.27
1997	4.12	4.21	4.57	4.35	4.92
1998	2.92	4.09	2.11	1.93	5.72
1999	1.40	1.21	2.17	2.31	0.84
2000	0.68	-1.13	0.90	-0.08	0.54
2001	-0.77	-1.19	-0.76	-0.02	-1.83
2002	-0.97	-1.14	-1.55	-1.48	-1.70

Note: Panel A and B of this table report, respectively, the average return (in percentage) and standard deviation (in percentage) of monthly stock returns on the different bank stock portfolios over the years in the sample period.

Panel B: Average Monthly Volatility per Year

	EU	Specialized	Diversifed	Poorly Capitalized	Strongly Capitalized
1985	2.76	4.18	3.18	2.95	3.76
1986	5.02	7.69	5.10	5.58	6.17
1987	5.55	7.18	4.89	5.12	8.37
1988	2.42	3.75	2.36	3.26	3.43
1989	3.16	4.16	4.27	3.70	2.97
1990	5.85	10.29	5.38	7.78	10.13
1991	4.86	7.81	4.90	5.52	6.40
1992	3.55	3.95	3.73	3.19	4.42
1993	3.28	3.52	3.34	3.60	3.10
1994	2.75	4.59	3.27	2.87	3.77
1995	3.18	3.90	2.92	3.39	3.37
1996	1.76	3.51	2.09	4.92	2.58
1997	4.47	7.76	5.53	5.62	6.32
1998	8.80	10.54	9.14	8.87	9.97
1999	2.04	3.86	3.13	3.09	3.59
2000	1.78	2.80	2.96	3.86	3.67
2001	6.90	8.00	7.47	6.79	7.76
2002	6.11	6.87	7.99	7.26	5.31

Table 7: Overview of the Different Likelihood Ratio Tests

Part 1: Zero and Equality Restrictions

Sensitivities, Zero constraints	JOINT	Type 1	Type 2
MEAN EQUATION			
All sensitivities = 0	$\beta^1(z) = \beta^2(z) = 0$	$\beta^1(z) = 0$	$\beta^2(z) = 0$
Term Spread	$\beta_1^1(z) = \beta_1^2(z) = 0$	$\beta_1^1(z) = 0$	$\beta_1^2(z) = 0$
Short Rate	$\beta_2^1(z) = \beta_2^2(z) = 0$	$\beta_2^1(z) = 0$	$\beta_2^2(z) = 0$
Money Base (M3)	$\beta_3^1(z) = \beta_3^2(z) = 0$	$\beta_3^1(z) = 0$	$\beta_3^2(z) = 0$
VARIANCE EQUATION			
Interest Rate (IR) Effect	$\Psi^1(z) = \Psi^2(z) = 0$	$\Psi^1(z) = 0$	$\Psi^2(z) = 0$
LEADING INDICATOR			
Term Spread	$\zeta_{2p} = \zeta_{2q} = 0$	$\zeta_{2p} = 0$	$\zeta_{2q} = 0$

Sensitivities, Equality Constraints	JOINT	STATE 1	STATE 2
MEAN EQUATION			
All Sensitivities Equal	$\beta^1(z) = \beta^2(z)$	$\beta^1(1) = \beta^2(1)$	$\beta^1(2) = \beta^2(2)$
Term Structure	$\beta_1^1(z) = \beta_1^2(z)$	$\beta_1^1(1) = \beta_1^2(1)$	$\beta_1^1(2) = \beta_1^2(2)$
Short Rate	$\beta_2^1(z) = \beta_2^2(z)$	$\beta_2^1(1) = \beta_2^2(1)$	$\beta_2^1(2) = \beta_2^2(2)$
Money Base (M3)	$\beta_3^1(z) = \beta_3^2(z)$	$\beta_3^1(1) = \beta_3^2(1)$	$\beta_3^1(2) = \beta_3^2(2)$
VARIANCE EQUATION			
Equal Intercepts, across states	$\omega^1(z) = \omega^2(z)$	$\omega^1(1) = \omega^2(1)$	$\omega^1(2) = \omega^2(2)$
Equal IR Sensitiv., across states	$\Psi^1(z) = \Psi^2(z)$	$\Psi^1(1) = \Psi^2(1)$	$\Psi^1(2) = \Psi^2(2)$
Joint	$\omega^1(z) = \omega^2(z)$ $\Psi^1(z) = \Psi^2(z)$	$\omega^1(1) = \omega^2(1)$ $\Psi^1(1) = \Psi^2(1)$	$\omega^1(2) = \omega^2(2)$ $\Psi^1(2) = \Psi^2(2)$
Equal Correlation	$\rho(1) = \rho(2)$		

Part 2: Test for Asymmetry

	Type 1 vs. Type 2	Type 1	Type 2
MEAN EQUATION			
Business Cycle Asymmetry	$\lvert\beta^1(2)-\beta^1(1)\rvert = \lvert\beta^2(2)-\beta^2(1)\rvert$	$\beta^1(2)=\beta^1(1)$	$\beta^2(2)=\beta^2(1)$
Intercept	$\lvert\beta_0^1(2)-\beta_0^1(1)\rvert = \lvert\beta_0^2(2)-\beta_0^2(1)\rvert$	$\beta_0^1(2)=\beta_0^1(1)$	$\beta_0^2(2)=\beta_0^2(1)$
Term Spread	$\lvert\beta_1^1(2)-\beta_1^1(1)\rvert = \lvert\beta_1^2(2)-\beta_1^2(1)\rvert$	$\beta_1^1(2)=\beta_1^1(1)$	$\beta_1^2(2)=\beta_1^2(1)$
Short Rate	$\lvert\beta_2^1(2)-\beta_2^1(1)\rvert = \lvert\beta_2^2(2)-\beta_2^2(1)\rvert$	$\beta_2^1(2)=\beta_2^1(1)$	$\beta_2^2(2)=\beta_2^2(1)$
Money Base (M3)	$\lvert\beta_3^1(2)-\beta_3^1(1)\rvert = \lvert\beta_3^2(2)-\beta_3^2(1)\rvert$	$\beta_3^1(2)=\beta_3^1(1)$	$\beta_3^2(2)=\beta_3^2(1)$
VARIANCE EQUATION			
Equal Intercepts	$\lvert\omega^1(2)-\omega^1(1)\rvert = \lvert\beta^2(2)-\beta^2(1)\rvert$	$\omega^1(2)=\omega^1(1)$	$\omega^2(2)=\omega^2(1)$
Equal IR Sensitiv.	$\lvert\boldsymbol{\Psi}^1(2)-\boldsymbol{\Psi}^1(1)\rvert = \lvert\boldsymbol{\Psi}^2(2)-\boldsymbol{\Psi}^2(1)\rvert$	$\boldsymbol{\Psi}^1(2)=\boldsymbol{\Psi}^1(1)$	$\boldsymbol{\Psi}^2(2)=\boldsymbol{\Psi}^2(1)$
Joint	$\lvert\omega^1(2)-\omega^1(1)\rvert = \lvert\beta^2(2)-\beta^2(1)\rvert$	$\omega^1(2)=\omega^1(1)$	$\omega^2(2)=\omega^2(1)$
	$\lvert\boldsymbol{\Psi}^1(2)-\boldsymbol{\Psi}^1(1)\rvert = \lvert\boldsymbol{\Psi}^2(2)-\boldsymbol{\Psi}^2(1)\rvert$	$\boldsymbol{\Psi}^1(2)=\boldsymbol{\Psi}^1(1)$	$\boldsymbol{\Psi}^2(2)=\boldsymbol{\Psi}^2(1)$

Table 8: Estimation Results for the regime-switching model

Panel A: Relatively Poorly versus Relatively Strongly Capitalized Banks

	LOW CAPITAL		HIGH CAPITAL	
	Estim.	*s.e.*	*Estim.*	*s.e.*
MEAN EQUATION				
Constant, state 1	0.002	0.003	-0.007**	0.003
Constant, state 2	-0.001	0.008	0.01	0.01
Term Spread, State 1	0.69***	0.18	0.77***	0.18
Term Spread, State 2	1.21**	0.50	0.84*	0.46
Short Rate, State 1	-1.47	5.52	-0.44	0.58
Short Rate, State 2	-14.91**	6.50	-18.93	15.19
Money Base, state 1	3.56	9.05	-0.06	8.82
Money Base, state 2	-16.70**	7.81	-3.54	6.07
VARIANCE EQUATION				
Constant, state 1	-7.04***	0.18	-7.12***	0.24
Constant, state 2	-5.49***	0.20	-4.98***	0.26
Short Rate, State 1	64.84*	36.01	54.87*	31.76
Short Rate, State 2	102.10*	55.73	88.25	72.55
Correlation, State 1	0.78***	0.12		
Correlation, State 2	0.83***	0.15		
TRANSITION PROBABILITY				
Intercept	2.84	0.45		
Term Spread, state 1	0.39	0.28		
Term Spread, state 2	-0.84**	0.32		

Note: Panel A presents the results of the regime-switching model for the 15% poorly versus 15% strongly capitalized European banks. The dependent variables are the unexpected excess returns for both types of banks. The parameter estimations (Estim.) and the standard deviations (s.e.) in both states of the mean equations are presented in the upper part of the table. The middle part gives the results of the variance equation and the correlation (ρ) in both states. The lower part of the table presents the results of the transition probability. ***, **,* indicate significance at a 1%, 5% and 10% level respectively.

Panel B: Specialized versus Diversified Banks

	SPECIALIZED		DIVERSIFIED	
	Estim.	*s.e.*	*Estim.*	*s.e.*
Mean Equation				
Constant, state 1	0.02*	0.01	-0.001	0.003
Constant, state 2	-0.02	0.03	-0.002	0.02
Term Spread, State 1	0.84**	0.35	0.91***	0.24
Term Spread, State 2	1.22*	0.70	-0.37	0.92
Short Rate, State 1	-3.65	5.98	-4.38	5.58
Short Rate, State 2	-6.13***	1.47	-15.85	14.42
Money Base, state 1	-1.32	1.78	1.06	0.93
Money Base, state 2	-5.67*	2.97	-0.79	1.20
Variance Equation				
Constant, state 1	-6.18***	0.28	-7.03***	0.27
Constant, state 2	-4.35***	0.37	-4.91***	0.56
Short Rate, State 1	12.90	59.53	8.77	38.45
Short Rate, State 2	195.16**	90.32	70.92	62.95
Correlation, State 1	0.68***	0.10		
Correlation, State 2	0.83**	0.32		
Transition Probability				
Intercept	2.43*	1.41		
Term Spread, state 1	0.01	0.76		
Term Spread, state 2	-1.01**	0.47		

Note: Panel C presents the results of the regime-switching model for the 15% most specialized and diversified European banks. The dependent variables are the unexpected excess returns for both types of banks. The parameter estimations (Estim.) and the standard deviations (s.e.) in both states of the mean equations are presented in the upper part of the table. The middle part gives the results of the variance equation and the correlation (ρ) in both states. The lower part of the table presents the results of the transition probability. ***, **,* indicate significance at a 1%, 5% and 10% level respectively.

Table 9: Likelihood Ratio Tests for European Banks

Panel A: Relatively Poorly versus Strongly Capitalized Banks

Part 1: Zero and Equality Restrictions

Sensitivities, Zero constraints	JOINT		POOR CAPITAL		STRONG CAPITAL	
	Estim.	Prob.	Estim.	Prob.	Estim.	Prob.
MEAN EQUATION						
All sensitivities = 0	36.78	[0.00]	28.79	[0.00]	19.35	[0.004]
Term Spread	26.95	[0.00]	22.99	[0.00]	14.49	[0.00]
Short Rate	3.09	[0.54]	2.99	[0.23]	1.39	[0.50]
Money Base (M3)	6.05	[0.20]	4.68	[0.10]	0.02	[0.99]
VARIANCE EQUATION						
Interest Rate Effect	8.93	[0.06]	7.31	[0.03]	5.49	[0.06]
LEADING INDICATOR						
Term Spread	5.67	[0.06]				

Sensitivities, Equality Constraints	JOINT		STATE 1		STATE 2	
	Estim.	Prob.	Estim.	Prob.	Estim.	Prob.
MEAN EQUATION						
All Sensitivities Equal	13.09	[0.04]	3.87	[0.28]	6.78	[0.08]
Term Spread	4.96	[0.08]	1.18	[0.28]	3.38	[0.07]
Short Rate	0.96	[0.62]	0.76	[0.39]	0.64	[0.42]
Money Base (M3)	3.11	[0.21]	0.17	[0.68]	2.91	[0.09]
VARIANCE EQUATION						
Equal Intercepts, across states	5.01	[0.08]	0.33	[0.56]	4.41	[0.04]
Equal IR Sensitiv., across states	1.19	[0.55]	0.04	[0.83]	0.63	[0.43]
Joint	6.96	[0.14]	0.77	[0.68]	4.82	[0.09]
Equal Correlation	0.58	[0.45]				

Part 2: Test for Asymmetry

	Low vs. High		Low Capital		High Capital	
	Estim.	Prob.	Estim.	Prob.	Estim.	Prob.
MEAN EQUATION						
Business Cycle Asymmetry	8.77	[0.07]	13.55	[0.01]	4.29	[0.37]
Intercept	0.18	[0.67]	0.11	[0.74]	1.66	[0.20]
Term Spread	2.90	[0.09]	6.75	[0.01]	1.62	[0.20]
Short Rate	0.78	[0.38]	3.18	[0.08]	0.90	[0.34]
Money Base (M3)	3.26	[0.07]	3.71	[0.05]	0.83	[0.36]
VARIANCE EQUATION						
Equal Intercepts	3.65	[0.06]	21.51	[0.00]	19.65	[0.00]
Equal IR Sensitiv.	0.58	[0.45]	0.60	[0.44]	0.61	[0.44]
Joint	3.66	[0.16]	22.31	[0.00]	20.98	[0.00]

Panel B: Functionally Specialized versus Diversified Banks

Part 1: Zero and Equality Restrictions

Sensitivities, Zero constraints	JOINT		SPECIALIZED		DIVERSIFIED	
	Estim.	Prob.	Estim.	Prob.	Estim.	Prob.
MEAN EQUATION						
All sensitivities = 0	45.39	[0.00]	15.38	[0.02]	14.98	[0.02]
Term Spread	15.81	[0.00]	10.64	[0.01]	12.31	[0.00]
Short Rate	4.99	[0.29]	1.25	[0.54]	2.56	0.28
Money Base (M3)	6.51	[0.16]	4.90	[0.09]	1.90	[0.39]
VARIANCE EQUATION						
Interest Rate Effect	4.04	[0.40]	5.51	[0.06]	0.49	[0.78]
LEADING INDICATOR						
Term Spread	5.15	[0.08]				

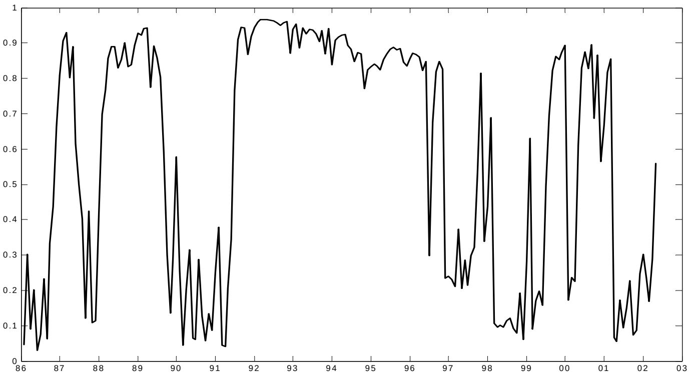
Sensitivities, Equality Constraints	JOINT		STATE 1		STATE 2	
	Estim.	Prob.	Estim.	Prob.	Estim.	Prob.
MEAN EQUATION						
All Sensitivities Equal	12.08	[0.06]				
Term Spread	4.17	[0.13]	0.96	[0.33]	2.81	[0.09]
Short Rate	1.81	[0.18]	0.09	[0.77]	1.72	[0.19]
Money Base (M3)	3.81	[0.15]	0.79	[0.38]	3.19	[0.07]
VARIANCE EQUATION						
Equal Intercepts, across states	6.09	[0.05]	2.92	[0.09]	3.88	[0.05]
Equal IR Sensitiv., across states	5.11	[0.08]	0.41	[0.52]	4.61	[0.03]
Joint						
Equal Correlation	1.09	[0.30]				

Part 2: Test for Asymmetry

	DIV. vs. SPEC.		SPECIALIZED		DIVERSIFIED	
	Estim.	Prob.	Estim.	Prob.	Estim.	Prob.
MEAN EQUATION						
Business Cycle Asymmetry	8.37	[0.08]	10.18	[0.04]	2.39	[0.67]
Intercept	3.30	[0.07]	7.49	[0.01]	0.79	[0.37]
Term Spread	0.50	[0.48]	0.30	[0.58]	2.06	[0.15]
Short Rate	5.60	[0.02]	3.59	[0.06]	3.90	[0.05]
Money Base (M3)	0.66	[0.42]	0.79	[0.37]	0.27	[0.60]
VARIANCE EQUATION						
Equal Intercepts	0.97	[0.33]	33.83	[0.00]	40.98	[0.00]
Equal IR Sensit.	1.69	[0.19]	3.53	[0.06]	0.48	[0.49]
Joint	2.89	[0.09]	34.53	[0.00]	6.28	[0.00]

Figure 1 : Probability of being in state 1

Relatively Strongly versus Poorly Capitalized Banks



Functionally Diversified versus Specialized Banks

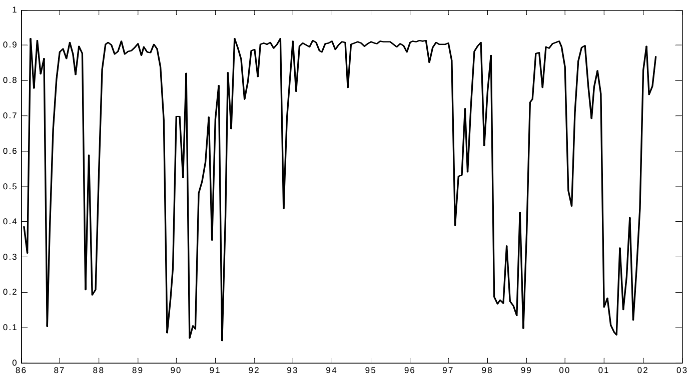
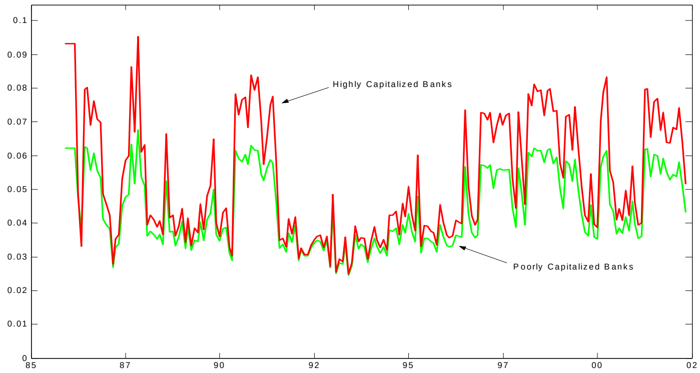


Figure 2 : Individual Conditional Standard Deviations

Relatively Strongly versus Poorly Capitalized Banks



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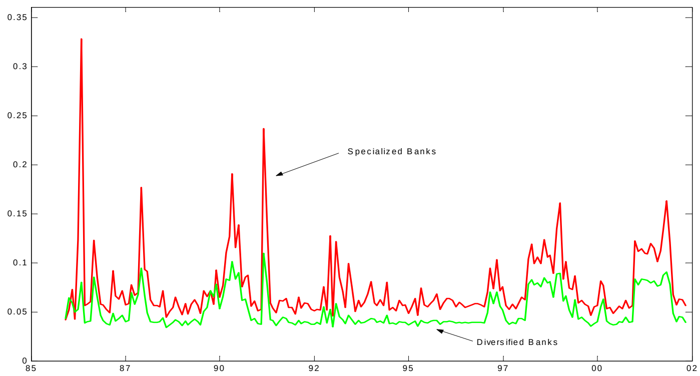
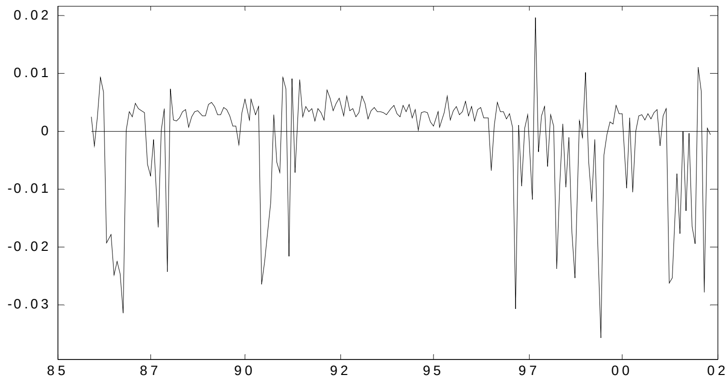
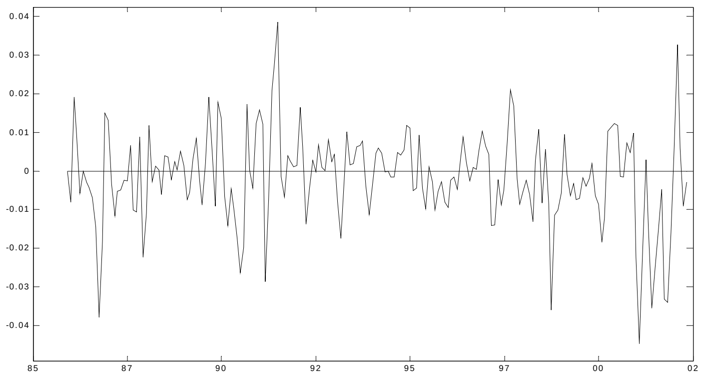


Figure 3 : Differences in Shocks

Shock Differential between Poorly and Strongly Capitalized Banks



Shock Differential between Specialized and Diversified Banks



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