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BANK-LEVEL EVIDENCE USING THE DYNAMIC DIVIDEND-DISCOUNT MODEL

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In 2006 all ECB publications feature a motif taken from the €5 banknote.

1 The views expressed in this article are the authors' only and do not necessarily reflect those of the European Central Bank or the European System of Central banks. We thank Chiara Osbat and the members of the ESCB Banking Supervision Committee for helpful comments. All remaining errors are ours.

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Abstract

We combine the dynamic dividend-discount model with an accounting-based vector autoregression framework that allows for a decomposition of EU banks' stock returns to cash-flow and expected return news components. The main findings are that while the bulk of the variability of EU banks' stock returns is due to cash flow shocks, the expected return shocks are relatively more important for larger than for smaller banks. Moroever, variables used in the literature as cash-flow proxies explain a higher share of the cash-flow component of the total excess returns for smaller than for larger EU banks. This suggests that large banks could be more prone to market wide news and events - that in the literature are associated with the expected return news component - as opposed to the bank-specific news, typically assumed to be incorporated in the cash-flow component.

Key words: Bank stock return predictability, return decomposition, panel VAR estimation, cash flow news.

JEL classification: C33, G12, G21

Non-technical summary

The market prices of bank securities, such as equities, provide important information for market participants, for central banks with financial stability responsibilities, and for bank supervisors, from at least five different perspectives. First, a bank's equity price may effectively summarise all the public information available from the bank, including potential risks, in one number. Second, when working under the efficient-market hypothesis, banks' securities prices at any point in time have a forward looking component in that they incorporate expectations of both positive and negative future earnings prospects. Third, the banks' share price information is available at much higher frequency compared with accounting information. Fourth, as financial disturbances in one bank have the capacity to spread through various channels and this may be reflected in stock markets, it is important to know to what extent the variability in individual banks' stock prices are driven by common versus bank specific components. Finally, as part of the implementation of the Basel II rules and regulations, one of the pillars of the accord introduces market discipline to the supervisory and oversight process, thus accentuating the role of market information in the prudential monitoring process.

The main contribution of this paper is to provide a better understanding of the factors that may drive the unexpected variability in banks' equity prices by incorporating financial accounting data in an econometric model of bank stock returns. To this end, the empirical method developed by Campbell and Shiller (1988) and Campbell (1991) that is applied in the analysis below explicitly distinguishes between changes in rational expectations of future dividends and changes in rational expectations of future returns. The literature frequently calls the former "news about future dividends", or "cash-flow news", and the latter "news about future returns", or "expected return news." We will investigate the behaviour of EU banks' unexpected stock returns by separating them into components that are influenced by these two types of news.

Our analysis also contributes to assessing market efficiency in a way that it investigates how the markets price in information about banks and how this process may differ across different types of banks. To that end, we apply a large panel of 53 EU banks using a stationary vector autoregressive (VAR) system that allows us to focus on such firm-level effects. A further contribution to the literature is provided by the fact that we also want to analyse whether large banks' stock prices could be affected by different factors than small banks' stock prices. This could have important implications from the point of view of financial stability analysis in so far as the relative importance of stock market volatility as an indicator either for bank-specific distress or an indicator for market-wide disturbances may be different for different sizes of institutions. We also consider the potential effect of leverage on stock returns as this has previously been found to positively affect bank stock returns (see Cooper, Jackson, and Patterson (2003)).

In line with earlier work based on US firm-level stock market data, our results confirm that EU banks' stock returns exhibit a short-term momentum effect while the return gains tend to be reversed in the long-term. The main findings of our study are, however, that using bank-level data, news on cash-flow fundamentals tends to dominate news on expected returns as a driver for stock returns variability for these EU banks. Campbell (1991) and Vuolteenaho (2002) have interpreted the two returns news components so that the cash-flow, or dividend, component is more likely to reflect the firm-specific, or idiosyncratic, news. The expected return news component, in turn, is more likely to reflect the systematic, or macroeconomic, news. Indeed, in an accounting-based model, the cash-flow news can be shown to equal the expected changes in the bank's return on equity, while the expected return news can be shown to equal the expected changes in the bank's excess log stock return and in the common discount rate. Moreover, since unexpected changes in a banks' stock return are, by definition, associated with simultaneous offsetting movement in future expected returns, expected return news have a *transitory* impact on value. Cash-flow shocks instead have *permanent* effects on value as they do not result in a change in future expected returns.

We also find that the size of the cash-flow news component relative to the expected return news component is substantially stronger for small banks than for large banks. A possible reason behind this finding is that larger EU banks are more diversified across business lines and geographical regions which could make them more sensitive to market wide developments. On the other hand, smaller banks typically have exposures to more local projects. In addition, we find that firm-level earnings variables that have often been used to proxy cash-flow information in single-equation regressions with total returns as the left-hand side variable (see for example Collins, Kothari, Shanken, and Sloan (1994)) are indeed typically associated with the cash-flow news component of the total returns. However, the earnings measures are simultaneously also associated with the negative of the expected return news component, which reduces the explanatory power of these variables in the total return regressions. The association of the earnings variables with the cash-flow news is, interestingly, also more significant for small rather than for large EU banks. All in all, these result suggests that, among other things, smaller banks could be less prone to systemic shocks, the results of which are transmitted through the stock market.

1 Introduction

The market prices of bank securities, such as equities, provide important information for market participants, for central banks with financial stability responsibilities, and for bank supervisors, from at least five different perspectives. First, a bank's equity price may effectively summarise all the public information available from the bank, including potential risks, in one number. Second, when working under the efficient-market hypothesis, banks' securities prices at any point in time have a forward looking component in that they incorporate expectations of both positive and negative future earnings prospects. Third, the banks' share price information is available at much higher frequency compared with accounting information. Fourth, as financial disturbances in one bank have the capacity to spread through various channels and this may be reflected in stock markets, it is important to know to what extent the variability in individual banks' stock prices are driven by common versus bank specific components. Finally, as part of the implementation of the Basel II rules and regulations, one of the pillars of the accord introduces market discipline to the supervisory and oversight process, thus accentuating the role of market information in the prudential monitoring process.

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The paper proceeds as follws. Section 2 discusses the relevant literature. Section 3 provides an overview of the data. Section 4 first introduces the theory model for the stock return decomposition and then illustrates the emirical implementation using a vector autoregression (VAR) framework. Section 5 presents the estimation results. Section 6 concludes.

2 Potential Determinants of Bank Level Stock Returns

There is a growing literature that directly investigates the value of equity and bond market indicators for predicting distress in financial institutions. Curry, Elmer, and Fissel (2001) provide an analysis based on US institutions. For EU banks, Gropp, Vesala, and Vulpes (2006) find some indications that equity price developments and subordinated debt spreads help to predict banking distress as defined by rating agency downgrades. Vennet, de Jonghe, and Baele (2004) assess the effect of business cycle variables on bank stocks and conclude that returns can differ across countries and types of banks and that better capitalised banks produce higher stock returns during downturns. However, all these studies say little about how the bank-specific financial information actually gets incorporated in the stock returns.

The dividend-discount model of equity pricing states that a firm's stock returns can be high either if its future earnings growth (the "fundamental", often measured by dividends) is high, its expected returns are low, or in case of any combination of these two efects. This workhorse model for analysing equity market developments has lent itself to a substantial research on determinants of firm's stock prices.

The literature based on the dividend-discount model can be divided roughly into two main avenues. The first line of research is based on the static version of the model and tries to relate bank stock returns to contemporaneous bank risk or some other bank-specific characteristics. This work on empirical predictability of stock returns has produced several important and widely quoted results. Among these, the most prominent findings are that small firms' average stock returns tend to outperform large firms' returns (size effect, see Banz (1981)), that past longer-term losers tend to outperform past longer-term winners (long-term reversal, see Bondt and Thaler (1985)), and that past short-term winners tend to outperform past short-term losers (momentum, see Jegadeesh and Titman (2001)). Other findings include the fact that firms with past high profitability have generally had higher than average stock returns (Haugen and Baker (1996)), and that firms with higher leverage tend to have outperformed firms with lower leverage (Bhandari (1988)). Similar results for European markets have been presented by Rouwenhorst (1998).

However, the contemporaneous analysis cannot tell whether a bank's stock return reacts to news either because market participants' expectations of future dividends change or because their expectation of future returns change. The second research tradition, broadly based on the seminal work by Campbell and Shiller (1988), tries address this issue by explaining the empirical predictability of stock returns in a dynamic context and then to split the returns into its components. To this end, the present value formulation of the dividend-discount model where expected returns are assumed to remain constant has had to be augmented by a log-linear approximation that is tractable even when expected returns vary through time. This method enables an analysis of the relative importance of the cash-flow and expected return components as drivers of aggregate stock returns. Using market index level stock returns data, Campbell (1991) found that expected return news accounts for about 50 to 60% of variability in unexpected stock index returns. By contrast, cash-flow news only explains about one third of the variance of unexpected returns.

Until recently, however, the dynamic models have provided little evidence of what determines stock returns at the firm level. The ability to categorize the news to firm-specific and market-wide components can, however, tell us whether individual firms are more sensitive to common, or systemic, shocks relative to shocks that are specific to their own cash-flow fundamentals. Vuolteenaho (2002) and Cohen, Gompers, and Vuolteenaho (2002) apply firm-level data using the return de-composition technique and arrive at two important results. The first is that while expected return news tend to drive stock indices, variability in firm-level stock returns is mostly associated with shocks to cash-flow news. The second finding is that the dependence of firm-level returns tends to vary by size of the firm, with large firms being relatively more sensitive to firm-specific cash-flow news.

There are some reasons why banks' stock returns could be expected to behave differently than non-financial firms' stock returns. Indeed, the stock return literature sometimes excludes financial firms because "banks are different". Banks differ from most non-financial firms in two main respects. First, the majority of banks' assets are long-term financial claims - such as loans - on households and firms. Banks finance these assets by selling their own debt and equity as well as receiving a majority of their funds in the form of short-term deposits. The main difference between banks and non-financial firms in this case is that banks tend to be more highly leveraged. Second, because banks tend to hold their liquid deposits against relatively illiquid loans, and since they are highly leveraged, banks are vulnerable to runs. Since there is a high social cost of bank failures, the banking industry is highly regulated. For example, the EU regulatory instruments include minimum deposit insurance and minimum capital requirements to reduce the risk of bank failure. These regulatory instruments combined with various restrictions on entry to the banking industry at national level may increase the ability of firms in the industry to earn rents. For these reasons, banks' stock returns could behave differently than non-financial firms' stock retruns.

Empirical work using individual bank data needs to consider these factors. Given that the European regulatory framework for financial institutions, including deposit insurance, is harmonised at the EU level, and the Basel accord for capital requirements is rather widely applied, it is unlikely that regulatory factors can account for systematic differences in returns.[1] This leaves size and leverage as relevant variables to consider in our analysis. Cooper, Jackson, and Patterson (2003), using different methodologies and a cross-section of US banks, found that information about earnings, leverage, and non-interest in-

[1]For more on the introduction of deposit insurance in the EU level see Gropp and Vesala (2004).

come can predict a cross-section of future bank stock returns. Brewer, Jackson, and Moser (1996) use another approach based on cross-section time-series estimation. They investigate the relationship between stock return volatility, asset mix, and derivative activity for US Savings and Loans (S&L) institutions. Among other results, they find a positive relationship between leverage and the volatility of stock returns for S&L institutions. This may suggest a more complicated relationship between their measure of leverage and returns. Finally, there is some evidence that bank stock returns may vary with the business cycle. Baele, Vennet, and Landschoot (2005) use European data and find evidence of cyclical variation in bank stock returns and that banks that are better capitalised (higher equity to loan ratio) and more diversified have higher returns than poorly capitalised less diversified banks.

3 Data

Bank-level analysis requires the use of an accounting-based present-value model. Our model, to be introduced in the next section, consists of a system of four equations. The variables to be considered are log excess stock returns, log excess return on equity (RoE), log leverage and log book-to-market ratio. Vuolteenaho (2002) listst three assumptions that are necessary to replace dividends by RoE in the return decomposition framework. First, RoE, book equity and market equity need to be strictly positive. Second, the difference between log RoE and log book equity and the difference between log book equity and log market equity have to be stationary. Third, the clean-surplus identity is assumed to be satisfied, i.e. book equity in the current year equals book equity in the last year plus earnings less dividends. We avoid modelling corporate dividend policy by excluding any dividend-based variables from the model due to the lack of time-series stability of banks' dividend policy variables.

The banks that are selected for this study are listed EU banks that show a consistent time series of annual data from 1991 to 2004 for all variables that are used in the estimation. The data set consists of accounting and market information for a pooled time series of 53 EU banks. In total, this amounts to 753 bank year observations. The accounting data such as return on equity, book value of equity, book debt variables, as well as the equity price series and the earnings per share series, are taken from Datastream. A total of 7 observations were missing (2 for RoE, 2 for book equity and 3 for book debt). These missing observations were linearly interpolated. The risk free short-term interest rate is the 1-month bid rate in the euro currency market taken from the BIS database.

Various transformations are made to the data. The equity prices and the risk free rate are continuously compounded.[2] The excess stock return is constructed

[2] The data for the UK, Sweden and Denmark were converted to euros using the relevant market exchange rate. Data for the UK were also converted to euro units as they are quoted on Datastream in GBP pence. The compounding for UK data was done on a April to April rather than calendar year basis in order to coincide with the UK fiscal year which runs from April to April.

as the difference between the two series. Due to the panel estimation technique in our empirical application, the excess return series is then cross-sectionally demeaned and normalised by dividing by its standard deviation. In a last step the series is annualised. The excess RoE variable is created by subtracting the compounded risk free rate from the logged RoE. Leverage is defined as book equity divided by book equity plus book debt. The annual book-to-market ratio is defined as the ratio of book value of equity to market value of equity. The market value of equity is calculated by multiplying the monthly equity price with the monthly amount of shares outstanding; the series is annualized afterwards, to allow for consistency with the annual accounting-based variables. The earnings growth variables used as cash-flow proxies in the last part of our empirical analysis are computed as the log of earnings per share divided by its lagged value ($\log(\text{EPS}_t/\text{EPS}_{t-1})$).

4 EU Banks' Stock Return Decomposition

Our model builds on Campbell and Shiller (1988) and Campbell (1991) who introduced the return decomposition based on the log-linear dynamic approximation of the dividend-discount model. Vuolteenaho (2002) extends the Campbell-Shiller framework by incorporating accounting-based variables. In what follows, we apply that version of the dynamic dividend-discount model.

We assume first that the price of a stock, measured by the log book-to-market ratio θ, can be expressed as a function of the excess log stock return, r_t, the return on equity (RoE), e_t,the discount rate, ρ, the risk-free interest rate, f_t, and the approximation error, κ, that results from the Taylor-series expansion:

$$(1) \qquad \theta_{t-1} = \kappa_{t-1} + \sum_{j=0}^{\infty} \rho^j r_{t+j} - \sum_{j=0}^{\infty} \rho^j (e_{t+j} - f_{t+j})$$

In the spirit of the original Campbell-Shiller model, the book-to-market ratio can be low if future cash flows (RoE) are high and/or if future excess stock returns are low. Equation (1) allows the decompositon of the unexpected stock return into an expected retrun component and cash-flow component. Taking the change in expectations of (1) from *t-1* to *t* and rearranging yields

$$(2) \qquad r_t - E_{t-1} r_t = \triangle E_t \sum_{j=0}^{\infty} \rho^j (e_{t+j} - f_{t+j}) - \triangle E_t \sum_{j=0}^{\infty} \rho^j r_{t+j} + \kappa,$$

where $\triangle E_t$ denotes the change in expectations form *t-1* to *t.* The two return components can now be re-defined as cash flow news (N_{cf}) and expected-return news (N_r). We can then write

$$(3) \qquad \text{N}_{cf,t} \equiv \triangle E_t \sum_{j=0}^{\infty} \rho^j (e_{t+j} - f_{t+j}) + \kappa, \qquad N_{r,t} \equiv \triangle E_t \sum_{j=0}^{\infty} \rho^j r_{t+j}.$$

Since r_t-$E_{t-1}r_t$ = $N_{cf,t}$-$N_{r,t},$ the unexpected excess stock return can be high if either expected future excess stock returns decrease and/or expected future excess RoE increase. The unexpected return variance can be similarly decomposed into three components using equations (2) and (3):

$$(4) \qquad var(r_t - E_{t-1}r_t) = var(N_{r,t}) + var(N_{cf,t}) - 2cov(N_{r,t}, N_{cf,t})$$

The variance decomposition in equation (4) can be used to assess empirically the relative importance of expected return and cash flow news as drivers of banks' stock returns. To this end, we need to specify a vector-autoregression framework.

5 Empirical Implementation Using Vector Autoregression Approach

Taken to the empirical level, the stock return regression has to be augmented with other regression equations describing the evolution through time of the forecasting variables. The resulting vector autoregressive (VAR) system, in combination with the log-linear asset pricing framework, can be used to calculate the impact that an innovation in the expected return will have on the stock price, holding expected future cash-flow variables constant. This impact is the "expected returns news" component of the unexpected stock return. The "cash-flow news" is obtained as a residual.

We refer to the theory model above for details on the rationale of the decomposition and concentrate here on its representation in the VAR. In principle, the decomposition is the same, irrespective of whether a single-bank VAR or the pooled-panel VAR is to be estimated, provided that the panel VAR imposes homogeneity restrictions on the coefficients of interest. Here we discuss the pooled-panel VAR setting.

Let z_{it} be a $k-$dimensional vector of variables for each bank, the first of which is excess returns on the stock of bank i. A "panel VAR" is then estimated in companion form:

$$(5) \qquad z_{it+1} = \Gamma z_{it} + u_{it+1},$$

where u_{it} is serially uncorrelated, with mean 0 and variance Σ. There are no restrictions on contemporaneous correlation in Σ. Given a selection vector e_1 of appropriate dimensions, the forecast of excess stock returns is then

$$(6) \qquad h_{it+1+j} = e_1 \Gamma^{j+1} z_{it},$$

where j is the forecast horizon. Then:

$$(7) \qquad \begin{aligned} E_t\left[h_{it+1+j}\right] &= e_1{}' \Gamma^{j+1} z_{it} \\ E_{t+1}\left[h_{it+1+j}\right] &= e_1{}' \Gamma^{j} z_{it+1} \end{aligned}$$

and

(8) $$E_{t+1}\left[h_{it+1+j}\right]-E_t\left[h_{it+1+j}\right]=e_1{}'\Gamma^j z_{it+1}-e_1'\left(\Gamma^j\Gamma\right)z_{it}=e_1'\Gamma^j u_{it+1}.$$

The discounted sum of forecast revisions of returns, assuming a discount factor equal to one, is then given by

(9) $$(E_{t+1}-E_t)\sum_{j=1}^{\infty}\left[h_{it+1+j}\right]=e_1'\sum_{j=1}^{\infty}\Gamma^j u_{it+1}.$$

If the eigenvalues of the companion matrix Γ are inside the unit circle, then the (discounted) sum of revisions in forecast returns is given by:

(10) $$\begin{aligned}N_{r,t} &= (E_{t+1}-E_t)\sum_{j=1}^{\infty}\left[h_{it+1+j}\right]\\ &= e_1'\Gamma(I-\Gamma)^{-1}u_{it+1}=\lambda' u_{it+1},\end{aligned}$$

where $\lambda=e_1'\Gamma\left(I-\Gamma\right)^{-1}$.

As shown above in equations 2 and 3, the unexpected return can be decomposed as the difference between cash-flow news ($N_{cf,t}$) and expected return news ($N_{r,t}$). In terms of the VAR parameterisation we then get:

(11) $$e_1'u_{it}=N_{cf,t}-N_{r,t}.$$

The cash-flow news component can be written simply as:

(12) $$\begin{aligned}N_{cf,t} &= e'_1 u_{it} + N_{r,t}\\ &= e_1'(I+\Gamma(I-\Gamma)^{-1})u_{it}.\end{aligned}$$

To construct impulse response functions, we define the innovation in cumulative expected future stock return changes $k>1$ periods forward as:

(13) $$e_1'\Phi\left(k\right)u_{it}=e_1'\left(\Gamma-\Gamma^{k+1}\right)\left(I-\Gamma\right)^{-1}u_{it},$$

and the total impulse response as the shock itself plus the cumulative sum above:

(14) $$\begin{aligned}e_1'\Psi\left(k\right)u_{it} &= e_1'\left(I+\Phi\left(k\right)\right)u_{it}\\ &= e_1'\left(I+\left(\Gamma-\Gamma^{k+1}\right)\left(I-\Gamma\right)^{-1}\right)u_{it}.\end{aligned}$$

Looking back at the return decomposition, we see that the infinite-horizon total impulse response is equal to the cash-flow news, while the infinite-horizon innovation in cumulative expected changes equals the expected return news.

For empirical purposes, we calculate the impulse response of returns to an unexpected return, u_{1t}, by setting the return shock (somewhat arbitrarily) to be equal to 50 basis points while the other elements of the error vector are set equal to their conditional value given that $u_{1t} = 0.50$. To calculate the impulse response of returns to a 50 basis points cash-flow shock the normalised sum of squared errors from the VAR is minimised, subject to the constraint that $e_1' \left(I + \Gamma (I - \Gamma)^{-1} \right) u_{it} = 0.50$. Impulse responses of the other variables included in the VAR to shocks in expected return news and cash-flow news can be derived similarly, using different selection vectors.

6 Results from the VAR analysis

Based on the sample of EU banks described above the results from the VAR analysis appear to be in line with several seminal studies of determinants of firm level stock returns as reported above.

The coefficient estimates are reported in Table 1. The significant estimates reveal that expected stock returns are high when past returns and past leverage are high. Banks' expected profitability is high when past profitability is high and past book-to-market ratio is low. Expected leverage tends to be mainly driven by its past value, while expected book-to-market ratio is high when past excess returns and past profitability are low and past book-to-market ratio is high.

[Table 1 here]

These results would suggest that investors in EU bank stocks tend to be trend-followers in the short-run as bank stock returns show persistence. Moreover, the result that higher past leverage tends to be associated with higher returns is interesting in the case of banks, as banks are highly leveraged firms with the degree of leverage restricted by regulatory capital ratios.

6.1 Impulse Responses

The finding that EU banks' expected returns are high when past stock return is high is also confirmed by the impulse response function showing the response of cumulative returns to a 50 basis points return shock (see Figure 1 where the dotted lines represent Jackknife standard erros). The returns continue to rise for roughly three years after the shock, showing considerable momentum effect. However, after that the returns first level off and then slowly decline, confirming that EU banks' stock prices demonstrate some long run mean reversion.

[Figure 1 here]

The second impulse response function plots the reaction of EU banks' stock returns to a 50 basis points cash-flow shock (see Figure 2). If expected returns were constant, like in the static dividend-discount model, the shock would result in exactly 50% increase in realised returns. Instead, the analysis based on the dynamic dividend-discount model reveals that the initial response is only 44%, increasing only gradually towards 50%. This suggests that investors initially under-react to news, and that it could typically take the market up to several years to fully incorporate the positive fundamental shock into the stock prices. This is in line with the findings from US stock markets by Vuolteenaho (2002).

[Figure 2 here]

6.2 Variance Decomposition

The main focus of our analysis is, however, on the relative importance of cash flow, or firm-specific, versus expected return, or macro-level, news. The variance decomposition resulting from the VAR model reveals that the cash-flow news component is the main driving force of EU banks' stock returns. Indeed, the coefficient of the bank-specific cash-flow news component is more than ten times larger than the coefficient of the expected return news component (see Table 2). Moreover, there is a relatively strong positive covariance between the two return news components. Previous literature has shown that this positive interrelation between the two return components in fact is the factor driving the observed under-reaction by markets to the positive fundamental news. This is because part of the impact of cash flow shocks to returns is offset by the instantaneous opposite movement in the expected return component as prescribed by the underlying theoretical model.

[Table 2 here]

It is possible that the results of the variance decomposition could differ depending on bank size. The second and third columns of Table 2 confirm that this indeed is the case for EU banks, although the outcome is somewhat different than what has been reported for non-financial firms. While both large and small banks are more substantially affected by the cash flow news component, the ratio of cash-flow to expected return news is two times higher for small banks than for large banks. This suggests that the idiosyncratic, or bank-specific, component could actually be relatively more important for small banks.

Why might the bank-specific component be relatively more dominant for small rather than large listed EU banks? It could be that due to the more widespread activities of large banks both across borders and across business lines the market-wide information becomes more relevant for large banks, while bank-specific information could still be perceived relatively more valuable for smaller banks that are more specialised both geographically and regarding their business models. Small banks are also more often characterised by an ownership structure whereby the investors' portfolios are less diversified. In such cases, news that is more typically associated with bank-specific fundamentals could have a more profound impact on the banks' stock returns via investor reactions. Moreover, the typically less frequent disclosure of financial results by small banks could increase the relative role of published bank-specific information for the determination of their stock prices. Finally, at times banks' stock returns also tend to be affected by perceptions of future takeover activity, which is typically a bank specific factor. In so far as M&A activity among EU banks has tended to be more, albeit by no means exclusively, concentrated among the smaller banks, it could also explain the relative sensitivity of these types of banks' stock returns to firm-specific news.

It may also be the case that the size split is picking up differences in leverage between big and small banks to the extent that size is positively correlated with leverage. To check for this effect, we split the sample by the leverage into banks that are more or less leveraged than the median value for the sample. The variance decomposition results for this split are reported in table 3.

[Table 3 here]

The results suggest that behaviour of both sub-samples (high/low leverage split) is broadly similar compared to the overall (no-split) sample. Cash flow news remains the most important component for both high and low leverage banks. Expected return news appears to be marginally less important for high leverage banks compared to low leverage banks.

7 Can cash-flow proxies explain EU banks' stock returns?

The decomposition of EU banks' stock returns to cash-flow and expected return news yields several interesting results. However, from an analyst's perspective, cash flows must be measured using some observable variables that do not depend on a complex estimation of an approximated return generation process. The question then arises to what extent such "cash-flow proxies" actually can explain the excess returns and whether the return decomposition procedure could shed some light on that issue.

In this section we revisit some of the results from earlier studies that are based on the static version of the dividend-discount model. We recall that the static model treats the expected returns as constant, and therefore does not allow for a decomposition of the total returns to time varying news on cash flows and future expected retruns. Based on the static approach, Fama (1990), Kothari and Shanken (1992) and Liew (1995) regress aggregate stock returns on various cash-flow proxies. The relatively strong relationships that are unearthed in these regressions encourages the authors to argue that cash-flow news are an important source of observed return variation. In contrast, authors using models based on accounting literature, such as Beaver, Lambert, and Morse (1980), Easton and Harris (1991) and Collins, Kothari, Shanken, and Sloan (1994), find that earnings variables typically explain only a small fraction of stock return variability. These studies typically conclude that the low explanatory power stems from lack of timeliness or noisiness of the earnings data.

However, as recently suggested by Hecht and Vuolteenaho (2006), the dynamic dividend-discount model allows for an investigation of whether the explanatory power of cash-flow proxies actually arises from the correlation of these proxies with one-period expected returns, cash-flow news, or expected return news. More specifically, if expected return variation is responsible for the high explanatory power of the aggregate regressions, this should not be interpreted as evidence of cash-flow news driving the returns. Similarly, if expected return news is highly variable and positively correlated with cash-flow news, the low explanatory power in regressions of firm-level returns on earnings do not necessarily imply that earnings are a noisy measure of the cash-flow generating ability of the firm. Even in the case where earnings are a clear signal of cash flow news, expected return effects can blur the earnings-returns relation.

Following Hecht and Vuolteenaho (2006), we use the bank level stock retrun de-composition framework above to split the regression of total excess stock returns on cash flow proxies into three separate regressions, each corresponding to one component of return. We thus arrive at equations for total excess return and its three aprroximate components:

$$(15) \qquad \begin{aligned} r_t &= X_t(\eta_T)\beta + \varepsilon_t \\ E_{t-1}r_t &= X_t(\eta_T)\beta_{Er} + \varepsilon_{Er,t} \\ N_{cf,t} &= X_t(\eta_T)\beta_{N_{cf}} + \varepsilon_{N_{cf},t} \\ N_{r,t} &= X_t(\eta_T)\beta_{-N_r} + \varepsilon_{-N_r,t} \end{aligned}$$

The regressions using the full sample are then repeated for the two size groups of banks. The regressions as specified in equation 15 explain returns with cash-flow proxies $X_t(\eta_T)$, where η_T denotes the information set at the end of the world allowing for the possibility that some of the variables may not be known at the end of the return period. In particular, relative to r_t, X_t can contain contemporaneous and future relationships.

To illustrate the difference that return decomposition can make compared to the regressions based on the static dividend-discount model, we concentrate on a specification by Collins, Kothari, Shanken, and Sloan (1994) who regressed the total returns on contemporaneous and leads of future log earnings growth rate, defined as $\log(\text{EPS}_t/\text{EPS}_{t-1})$. Using the full sample of EU banks, we find that the regression of total excess returns on these explanatory variables yields an R^2 of over 9% (see Table 4). However, when we regress the estimated cash-flow news on the same earnings variables, we get a somewhat higher R^2 of 12% (Table 6). The lower explanatory power for the total excess return varibale is due to the fact that although the log earnings growth variables do track a part of the cash flow news, they also track the negative of excpected return news with R^2 of 5% (see Table 7) and the level of expected returns with an R^2 of 3.5% (see Table 5) Overall, the association of the earnings variables with both cash-flow and expected return news partially cancel each other, leaving the aggregate-return specification with a lower explanatory power. These results are very much in line with those obtained by Hecht and Vuolteenaho (2006) for a large sample of US non-financial firms, both qualitatively and quantitatively in terms of the sizes of R^2s.

[Tables 4-7 here]

How do these results vary with the size of banks? The remaining columns of Tables 4-7 illustrate the above regressions performed on the two subsamples of large and small listed EU banks. It turns out that for small banks, the earnings variables are capable of explaining up to 14% of the cash-flow news (Table 6 last column). However, the fact that the earnings variables also explain 8% of the negative of the expected return news implies that the R^2 from the equation with total excess returns as left-hand side variable is lower than the R^2 from the cash-flow regression. For large banks, we get the opposite result as the earnings variables we use as cash-flow proxies show practically no relationship with either the level of or the news on expected returns. Expected return components do therefore not blur the relationship between cash-flow proxies and cash-flow news in the total excess return regression. Consequently, for large banks, the explanatory power of the earnings variables is higher for the total excess returns than for the cash-flow news component.

The main contribution of this excercise is to confirm that the success or failure of cash-flow proxy variables, such as contemporaneous and future log earnings growth, can be quite strongly dependent on the association of these variables with the various components of the banks' excess stock returns. Moreover, the relationships between the various return components and the cash-flow proxies also vary with the size of the bank, as the ability of the log earnings growth variables to track cash-flow news is stronger for small banks than for large banks. We have therefore arrived at a conclusion that not only are cash-flow news relatively more important in explaining smaller EU banks' total excess stock returns, but variables that are typically used to proxy such cash flows seem also to be relatively more strongly associated with the actual cash-flow news component in the case of smaller rather than larger EU banks.

8 Conclusions

This paper combined the dynamic dividend-discount model with an accounting-based bank-level vector autoregression framework to analyse the driving forces of EU banks' stock returns. It was found that while in the short term expected returns are mainly driven by the momentum of past returns and past leverage, over longer term returns show some mean reversion to shocks. At the same time, the positive covariance between the return news components shows that the market tends to initially underreact to positive news on bank-specific fundamentals and only gradually incorporate such information into the prices. Such cash-flow news is, however, found to be the main driving force of bank level stock returns. Finally, we found that the cash-flow news component is relatively more important for small banks than for large banks, and that for smaller banks variables typically used as cash-flow proxies are better able to track the cash-flow news component of total excess returns. Several explanations can be identified to account for these results, with the key implication that movements in large banks' stock prices are likely to be more prone to market-wide shocks that are realised through the stock market.

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Table 1: VAR Coefficients 1991-2004

	Log excess Stock return (r_t)	Log excess ROE (e_t)	Log Leverage (lev_t)	Log Book to Market (θ)
Equation	1	2	3	4
$\tilde{r}_{t-1}$	0.06	0.01	-0.10	-0.14
	(0.09)	(0.83)	(0.91)	(0.00)
e_{t-1}	-0.03	0.57	0.02	-0.10
	(0.39)	(0.00)	(0.72)	(0.00)
lev_{t-1}	0.02	0.02	0.91	0.00
	(0.08)	(0.12)	(0.00)	(0.85)
θ_{t-1}	0.00	-0.04	0.03	0.89
	(0.77)	(0.02)	(0.18)	(0.00)

Note: T-probabilities in parentheses.

Table 2: Variance Decomposition

Variable	All Banks	Large Banks	Small Banks
r_t	1.23	1.18	1.26
	(0.08)	(0.10)	(0.14)
$N_{r,t}$	0.12	0.30	0.15
	(0.02)	(0.05)	(0.03)
$N_{cf,t}$	1.45	1.60	1.63
	(0.10)	(0.14)	(0.17)
$Cov.N_{r,t}, N_{cf,t}$	0.34	0.72	0.52
	(0.05)	(0.12)	(0.07)

Note: Jacknife standard errors in parentheses.

Table 3: Variance decomposition: leverage split

Variable	High leverage	Low leverage
r_t	1.01	0.96
	(0.13)	(0.09)
$N_{r,t}$	0.11	0.18
	(0.02)	(0.04)
$N_{cf,t}$	1.24	1.26
	(0.16)	(0.12)
$Cov.N_{r,t}, N_{cf,t}$	0.34	0.48
	(0.05)	(0.10)

Note: Jacknife standard errors in parentheses.

Table 4: Dependent variable: excess stock returns

Variable	All Banks	Large Banks	Small Banks
Constant	0.117	0.06	0.14
	(0.04)	(0.06)	(0.06)
LGEPS	0.87	0.97	0.84
	(0.10)	(0.15)	(0.14)
LGEPS_{t+1}	0.09	0.18	0.05
	(0.10)	(0.16)	(0.14)
LGEPS_{t+2}	0.16	0.20	0.19
	(0.10)	(0.15)	(0.14)
R^2(%)	9.3	10.3	9.2

Note: Standard errors in parentheses.

Table 5: Dependent variable: one-period expected returns

Variable	All Banks	Large Banks	Small Banks
Constant	0.22	0.18	0.24
	(0.01)	(0.02)	(0.01)
LGEPS	0.02	-0.00	0.02
	(0.02)	(0.04)	(0.02)
$LGEPS_{t+1}$	-0.08	0.02	-0.09
	(0.02)	(0.04)	(0.02)
$LGEPS_{t+2}$	0.03	0.11	0.04
	(0.02)	(0.04)	(0.02)
R^2(%)	3.4	1.5	5.1

Note: Standard errors in parentheses.

Table 6: Dependent variable: cash-flow news

Variable	All Banks	Large Banks	Small Banks
Constant	0.04	-0.07	-0.03
	(0.04)	(0.07)	(0.06)
LGEPS	-0.39	-0.15	-0.46
	(0.11)	(0.17)	(0.15)
$LGEPS_{t+1}$	0.94	0.86	0.91
	(0.11)	(0.17)	(0.15)
$LGEPS_{t+2}$	-0.11	-0.01	-0.23
	(0.11)	(0.17)	(0.15)
R^2(%)	11.6	6.8	13.7

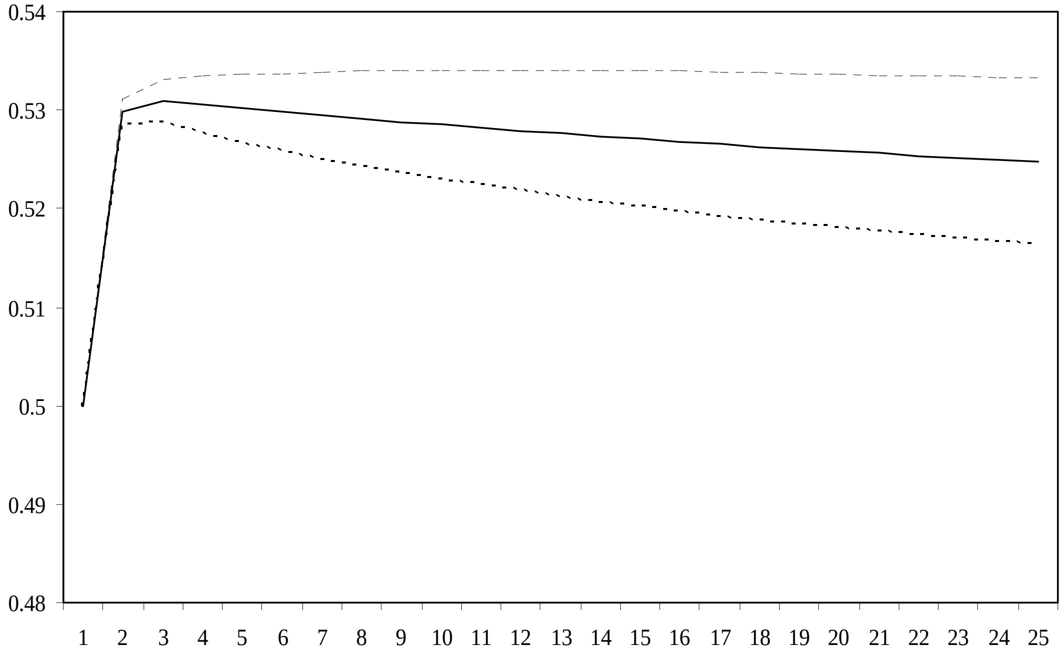
Note: Standard errors in parentheses.

Table 7: Dependent variable:negative of expected return news

Variable	All Banks	Large Banks	Small Banks
Constant	0.01	0.01	0.01
	(0.01)	(0.03)	(0.01)
LGEPS	-0.05	-0.03	-0.01
	(0.02)	(0.06)	(0.03)
$LGEPS_{t+1}$	0.04	-0.06	0.04
	(0.02)	(0.06)	(0.03)
$LGEPS_{t+2}$	-0.12	-0.05	-0.18
	(0.05)	(0.06)	(0.03)
R^2(%)	4.8	0.0	8.1

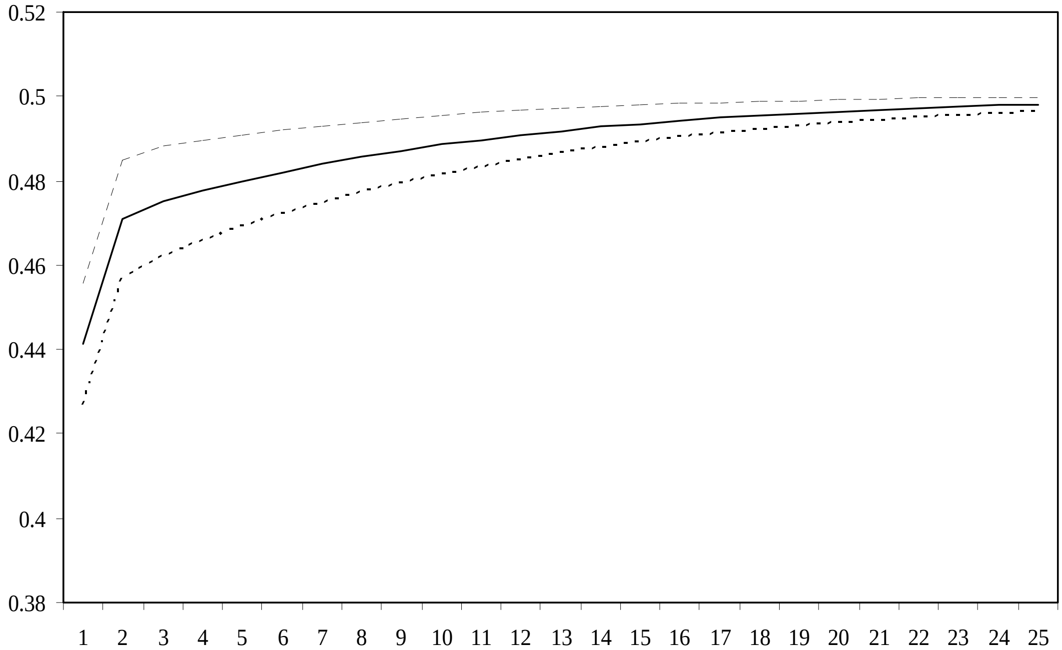
Note: Standard errors in parentheses.

Figure 1: Shock to expected return (50 basis points)



Note: The dotted lines show confidence bands representing Jackknife standard errors.

Figure 2: Shock to cash-flows (50 basis points)



Note: The dotted lines show confidence bands representing Jackknife standard errors.

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