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Essays on Industry Portfolios
and Macroeconomic News

*University of Tampere
Tampere 2000*

Essays on Industry Portfolios and Macroeconomic News

Acta Universitatis Tamperensis 735

ACADEMIC DISSERTATION

University of Tampere,
Department of Economics

Distribution



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Cover design by
Juha Siro

Printed dissertation
Acta Universitatis Tamperensis 735
ISBN 951-44-4776-X
ISSN 1455-1616

Electronic dissertation
Acta Electronica Universitatis Tamperensis 22
ISBN 951-44-4777-8
ISSN 1456-954X
<http://acta.uta.fi>

Tampereen yliopistopaino Oy Juvenes Print
Tampere 2000

Acknowledgments

This doctoral dissertation is a result of a four-year intensive research project. During different stages of this study, I have received help and assistance from many people. Now that the project has come to an end, it gives me a pleasant chance to thank all those people. Especially, I am indebted to my supervisor, Professor Jouko Ylä-Liedenpohja, for his valuable comments, suggestions and guidance. Moreover, the econometric expertise by Markku Rahiala, Hannu Kahra, Hannu Nurmi, and Kari Takala has been very beneficial when dealing with various methodological problems.

In addition, the discussions with the seminar participants both at the University of Tampere and in the workshops organized by the Finnish Postgraduate Programme in Economics have been very helpful. Within these workshops, the constructive comments and suggestions by Professors Tom Berglund, Vesa Kanninen, Eva Liljebloom as well as the visiting professors have been useful. I would also like to thank my official examiners, Professors Kenneth Högholm and Johan Knif, for their comments, which helped me to improve the final version of the dissertation.

Most of this study was carried out while participating in the Finnish Postgraduate Programme in Economics. This graduate school fellowship gave me an opportunity to concentrate on scientific research work in a full time. In addition, financial support from the Yrjö Jahansson Foundation, Osuuspankkiryhmän Tutkimussäätiö, and Säästöpankkien Tutkimussäätiö is gratefully acknowledged. I would also like to thank William Evjen and Virginia Mattila who helped me to improve the English language significantly.

Finally, I would like to express my deepest gratitude to those closest to me: my parents, Erkki and Marjatta, for their unconditional support in the course of my doctoral studies and, most of all, my dear wife, Sari, for her love and understanding. They have always believed in me and encouraged me to finish this project.

Vantaa, Pakkala, March 2000

Jari Järvinen

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Chapter 1

AN OVERVIEW OF THE DISSERTATION

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1. INTRODUCTION

In recent years, the effects of fundamental macroeconomic news on stock returns have received considerable attention in both the financial press and the research literature of financial economics. This doctoral dissertation concentrates on this issue by seeking answers to the following questions: What role does the macroeconomic news play in explaining the movements in stock prices? Do the responses of stock returns to news vary depending on business conditions or exchange rate regimes? Does positive and negative news or alternatively major and minor news cause different reaction to the stock market? Are stock returns predictable using past macroeconomic information?

Finding answers to these questions is important for both market practitioners and academic economists. Practitioners, like analysts and firms' financial managers, are possibly interested in using aggregate economic information in pricing assets in speculative markets or alternatively making decisions about future real investments. On the other hand, academics might be interested in these questions since answering them will help to identify some sources of systematic risk factors that should be priced on the stock market according to the standard economic theory.

The news approach is based on the efficient market hypothesis, which attributes movements in asset prices to new information that affects either the expected future cash flows or the expected discount rates at which those cash flows are capitalized, or both. According to Fama (1970), a stock market is efficient if current market prices fully and instantaneously reflect all available information¹. Another important aspect is that the expected or past information contains no new information, and therefore should have no effect on stock prices, since this information has already been incorporated into prevailing market prices. Hence, the implication of market efficiency is that if economic agents are careful users of available information, then stock price changes can only be due to news about, for example, macroeconomic fundamentals.^{2,3}

¹ Fama (1970) distinguished three types of market efficiency. A market is said to be weak form efficient if past prices are useless in predicting future prices. A market is semi-strong form efficient if all publicly available information like inflation rates, interest rates, or earnings have no predictive power. Finally, a market is strong form efficient if all information is reflected on prices, including the inside information. Afterwards, Fama (1991) partly redefines these efficiency definitions by using the following terms: tests for return predictability, event studies, and tests for private information, respectively.

² Nevertheless, it should be noted that the market efficiency per se is not testable due to the joint hypothesis problem (see Fama 1991); that is, rational expectations and some equilibrium model of expected stock returns must be tested jointly. Therefore, rejection of the efficient market hypothesis may be due to either because agents do not use all available public information efficiently or because the used equilibrium

Most prior studies (e.g., see Pearce & Roley 1985; Hardouvelis 1987; Wasserfallen 1989; Sadeghi 1992; Prag 1994; Ewing 1998; and Siklos & Anusiewicz 1998) show that stock returns primarily respond to monetary news while the responses to non-monetary news are weaker. Attempts to explain stock price changes by macroeconomic news have also been disappointing. A variety of authors including Roll (1988), Cutler, Poterba, and Summers (1989), and King, Sentana, and Wadhvani (1994) show that only one third of the stock returns can be attributed to the news about key fundamentals, at the most. On the Finnish stock market, the importance of economic news seems to be even lower compared to the large stock markets such as the U.S. (e.g., Lahti & Pylkkönen 1989; Viskari 1992; and Junttila, Larkomaa & Perttunen 1997 and references therein).

Moreover, one puzzling feature is that stock prices seem to be less affected by macroeconomic news than bond prices (McQueen & Roley 1993 and Jones, Lamont & Lumsdaine 1998). Furthermore, the responses of stocks to news about fundamentals are not constant over time, but vary depending on business conditions (McQueen & Roley 1993 and Löflund & Nummelin 1997) or the values of the news variables (Hafer 1986 and Orphanides 1992). Macroeconomic information is also processed differently on Mondays than other days of the week (Chang, Pinegar & Ravichandran 1998).

However, these aforementioned studies are almost exclusively concerned with the relationship between the aggregate stock market and macroeconomic news, while very little is known about the cross-sectional variation in this relation across various industry-sorted stocks (i.e., industry portfolios). As already noted in King (1966), although the aggregate economic information is generally bound to have a market-wide impact on stock returns, the magnitude of the impact need not be the same for all stocks. Hence, this dissertation provides an empirical investigation on the relationship between industry portfolios and fundamental macroeconomic news by employing the tools of modern econometric and time series analysis.

This study consists of four essays on industry portfolios and macroeconomic news. These essays are in logical order in such a way that in the first essay, a traditional approach is applied by testing what happens in the stock market after unanticipated changes in some of the key macroeconomic fundamentals. The next two essays extend the

asset-pricing model is wrong. Due to this joint hypothesis problem, care should be taken when considering the results acquired as evidence against the market efficiency.

³ Of course, in well-informed stock markets, news about firms' future profits, world economy, political stability, international military or other conflicts are also important, but this study concentrates only on the relation between stock returns and macroeconomic news.

conventional approach by allowing the stock market responses to economic news vary depending on business conditions or the qualitative nature of the news variable itself. In the last essay, the standard approach is further extended by testing what kind of short-run dynamic behavior economic shocks cause to the stock market and how quickly the stock market absorb these shocks.

The remainder of this overview section is organized as follows: In the following section, time series data and the research methods used in the analysis are briefly described. Next, the contributions of this dissertation are discussed, and in the final section, the main results of the four essays on industry portfolios and macroeconomic news are summarized.

2. DATA AND METHODOLOGY

The dissertation utilizes monthly data on the Helsinki Stock Exchange and the macroeconomic fundamentals in the Finnish economy over the period January 1987 to December 1996 (the sample period is somewhat shorter in the first two essays). Although the chosen sample period was an exceptional time in the history of the Finnish economy, it is also interesting from the researcher's perspective. During this sample period, several major institutional and policy regime changes in the economic and stock market environments took place⁴.

Seven industry portfolios are employed as test assets. Industry portfolios are formed based on their industry classification given by the Helsinki Stock Exchange. Industry stock returns are measured as the logarithmic difference in the HEX industry indices⁵

⁴ These major changes include, for example, changes in taxation, the deregulation of the Finnish financial markets, changes in exchange rate regime, and the removal of the restrictions of the foreign ownership of Finnish stocks. Naturally, these important events could have affected the estimation results, and hence one should be cautious to some extent when interpreting these results.

⁵ HEX price indices (see Hernesniemi 1990) across industries are calculated by the Helsinki Stock Exchange and they are pure price indices (i.e., without dividends). Of course, theoretically it would be preferable to use dividend-adjusted returns, but unfortunately, HEX yield indices are not available before 1991. However, when running the regressions with dividends included at the aggregate market level, the results did not change noticeably (as will be shown later). The dividend-inclusive returns were calculated using the WI-Index, 87 – 90, and HEX Yield Index, 91 – 96, (for further details about these indices, see Berglund, Wahlroos & Grandell 1983 and Hernesniemi 1990). The results were expected since during the sample period, the dividend yield, in general, has been low and the movements in price and yield indices were strongly correlated (correlation is 0.983). Naturally, the results might be somewhat different at the industry-level, but it can be argued that, at least during the chosen sample period, omitting dividends would not bias the results and price changes are good proxies for returns.

(end-of-month values) in real terms; that is, nominal stock price indexes are deflated by the consumer price index. Industry portfolios are as follows: (1) banks and finance; (2) insurance and investment; (3) other services; (4) metal and engineering; (5) forest industries; (6) multi-business industry; and (7) other industries. In order to compare the results in industry level to the overall market response, estimations with HEX general price index are also conducted. Hex price index series are obtained from the Helsinki Stock Exchange.

Descriptive statistics for industry stock returns and general price index are reported in Appendix 1. Over the sample period, summary statistics (see Panel A) show that across industries, multi-business industry gives the highest mean return while banks and finance sector has the highest standard deviation in returns. The calculated Ljung-Box Q -statistics (see Panel B) for 12 lags were also significant for five industries out of seven. Q -statistics provide an indication that first order dependencies are present in the stock return data. However, the evidence shows lack of higher order dependencies among industry portfolios. Q -statistics applied to squared returns suggest that only financial sectors include higher order dependencies.

Unconditional cross-correlation coefficients between different industry portfolios are also reported in Appendix 1 (see Panel C). Across industries, the highest correlation is between metal and engineering industry and other services, while the lowest correlation is between other industries and forest industry. Interestingly, the high cross correlation coefficient between all share price index and multi-business industry also reveals the Nokia's dominance on the Helsinki Stock Exchange. In the subsequent analysis, these industry portfolios can be further classified into three separate groups: domestic-oriented (other services and other industries), export-oriented (metal and engineering, forest industry, and multi-business industry), and financial sectors (banks and finance and insurance and investments).

Without a precise economic theory of the interaction between the stock market and the macroeconomy, the choice of fundamental economic variables that should be included in the analysis is somewhat arbitrary. Nevertheless, following Chen, Roll, and Ross (1986), the choice of variables is based on the assumption that economic fundamentals that influence the expected future dividends and discount rates, or variables that describe the changing investment opportunity set will influence stock prices. Macroeconomic fundamentals that describe both the real and the financial side of the Finnish economy

include the industrial production, the real money supply, the interest rates, the inflation rates (or the price level), and the real exchange rates⁶. These specific monetary and non-monetary variables describe both the real and the financial side of the Finnish economy, and they are selected since they are commonly presumed to have an impact on expected future dividends, discount rates, or both. Moreover, the market practitioners closely monitor these variables.

Graphs for the macroeconomic variables are plotted in Appendix 2. Based on the preliminary visual inspection, macroeconomic variables appear to be nonstationary. This conclusion is supported by the Augmented Dickey and Fuller (1979, 1981) and Phillips and Perron (1988) unit root tests⁷. According to these unit root tests (for various lags), variables are nonstationary with stationary differences; that is, they are I(1) variables. Therefore, first differencing is necessary to produce a stationary vector autoregression (VAR) model as is required by statistical theory. Hence, in the third and the fourth essay, the VAR models in first differences are estimated.

However, the VAR model in first differences is misspecified if cointegration is present among the variables included in the VAR model since it omits long-run information contained in the levels of the variables. Therefore, it is also necessary to test whether there can be found cointegration relationship(s) between the variables. Based on Johansen's (1988, 1991) Likelihood Ratio tests (again, for various lags), macroeconomic variables appear to be cointegrated with several cointegration vectors⁸. Therefore, the VAR model is estimated in its error correction form (essay one). Moreover, it is also permissible to fit the VAR in its level form (essay two) if the variables are cointegrated since the linear combination (i.e., news) of the non-stationary I(1) variables are stationary I(0) variables (see e.g., Jansson 1994, 26 and Apergis & Eleftheriou 1997).

From the methodological standpoint, the two-step strategy originally proposed by Barro (1977) to generate unanticipated values of the macroeconomic indicators is applied

⁶ The consumer price index and the industrial production series were obtained from Statistics Finland while the money supply, the short-term interest rates, and the real exchange rates series were obtained from the Bank of Finland.

⁷ Unit root and cointegration tests are not reported here, but may be obtained from the author upon request.

⁸ However, it should be noted that cointegration test results were sensitive to variable transformations and the chosen information set (i.e., how inflation is measured or are stock prices included in the information set used in the VAR model).

in the first three essays⁹. Nevertheless, it should be noted that the two-step procedure gives consistent parameter estimates and standard errors when only contemporaneous news variables are present in the second stage regressions (e.g., see Pagan 1984; Orphanides 1992; and Smith & McAleer 1993, 1994). Furthermore, in the first three essays, serial correlation and heteroscedasticity in residual terms over time is corrected by employing the Newey and West (1987) procedure, which gives consistent standard errors in the presence of serial correlation and heteroscedasticity.

However, in the fourth essay, a different research methodology must be used, since this two-step procedure suffers from methodological drawbacks because the effects of past news or shocks on the stock market are investigated. In order to avoid these potentially serious problems associated with generated regressors (see Pagan 1984), impulse response functions and variance decomposition measures within the VAR framework (due to Sims 1980 influential work) are applied. Impulse response functions and variance decomposition measures can be obtained from the moving average representation of the VAR model. These two measures can then be used to analyze the dynamic short-run responses on stock returns to macroeconomic shocks and their explanatory power over different time horizons.

3. THE CONTRIBUTION OF THE STUDY

The study extends previous work in several ways and the contribution can be summarized as follows: First, industry portfolio stock returns are used as dependent variables since there may be some distinct effects across industries. The use of more disaggregated data is especially important in the case of the Helsinki Stock Exchange, where Nokia Corporation (a large telecommunications firm) dominates the aggregate stock market. Industry level analysis can also provide further insight as to how different industries respond to news and whether these responses are significantly different from the stock market on average. Furthermore, the Finnish stock market is traditionally dominated by export-oriented, cyclical industries such as forest industries, but it would be interesting

⁹ The two-step strategy is as follows: first, estimate the news by the fitted residuals of the VAR model and second, estimate the responses of stock returns to news by regressing returns on the current and lagged news proxies.

also to study how non-cyclical industrial sectors like other services or financial sectors respond to economic news.

Second, the stability of the parameter estimates is investigated by dividing the sample period into two non-overlapping sub-samples in order to test whether the stock price responses are the same during different phases of exchange rate regimes. The responses of stock prices to fundamental economic news might be different depending on the chosen monetary policy regime (i.e., whether monetary authority has inflation rate targeting or exchange rate targeting)¹⁰. More importantly, if the sample period includes structural breaks, the whole sample results would then be misleading since it would show the neutralized effects of different market reactions over the whole sample.

Third, the stock market reactions to economic news during different stages of the business cycle are investigated. These responses could well be different depending on whether the economy is booming or in a recession (i.e., agents might require different risk premiums in up and down states or the degree of agents risk aversion might change over time). Therefore, the response coefficients are allowed to change over time with changing business conditions. Moreover, the chosen sample provides a good test laboratory for exploring this business cycle asymmetry since the sample includes the whole business cycle. The implication of this potential business cycle asymmetry is straightforward: if the same type of news is considered good in some states and bad in other states, the estimated news effects in previous studies will be biased towards zero. Hence, it is necessary to test this possible asymmetry to obtain unbiased estimates of the news effects on stock prices.

Fourth, the potential asymmetrical size and sign effects on industry portfolios are studied. In general, good news induces investors to adjust their estimates of the future cash flows upward or future discount rates downward, and causes increase in stock prices while bad news has the opposite effects. Therefore, the price reactions may depend on the “sign” of the news. Moreover, the market reactions to news may also vary depending on the “size” of the news. Major news with a greater “surprise” component may be considered as more informative and hence, cause greater swings in stocks compared to minor news with less information contents. If these asymmetrical reactions are real, it is possible to improve estimates of news effects on stocks by taking the sign and the size differences of the news items into account. In other words, if the news effects are

¹⁰ For example, market perceptions regarding the effects of news on the firms expected future cash flows might have been changed, which was obviously the case in September 1992 when the Finnish Mark (FIM) was allowed to float.

asymmetrical and these effects are not accounted for, then the models that have been used in previous studies are misspecified, and the news effects will be biased towards zero.

Fifth, whereas most other studies focus on testing whether stock returns are predictable by lagged returns, dividend yields, or various term-structure variables, the present dissertation investigates whether returns are predictable by using a broader information set about the macroeconomic indicators. Only short-run responses are considered since shocks, by definition, are random variables around zero and hence, will not influence stock returns over a long horizon. Impulse response functions and variance decomposition measures obtained from the moving average representation of the VAR model are used to test how efficient the Finnish stock market is in absorbing economic shocks in stock prices. In well-informed stock markets, the responses should be immediate; otherwise, there might be excess profit opportunities for rational investors.

Sixth, from a methodological viewpoint, this study extends existing literature by using different model specifications (i.e., VAR in levels, VAR in first differences, or vector error correction VEC models) and estimation procedures (i.e., OLS, ML, or recursive OLS) to generate news¹¹. Using different model specifications and estimation procedures gives the researcher an opportunity to evaluate how sensitive or alternatively robust the results acquired are. To the author's knowledge, a comparison with different estimation methods and model specifications on estimation results of this kind has not been presented in the existing literature.

Seventh, publication lags in economic statistics are considered, and the recent time series data available are used to update the findings of earlier studies. Accounting for publication lags is important, since otherwise the VAR model uses "too much" information and the residuals are imprecise estimates of the news components. Finally, since the previous studies have concentrated for the most part on large stock markets such as the United States, this study is performed to shed light on the workings of a small stock market like the Helsinki Stock Exchange. The Finnish environment provides an interesting opportunity to investigate this issue with a different data set.

¹¹ The advantage of the VEC model is that it captures both the short-run dynamics (market expectations) as well as the long-run equilibrium relations (revisions in expectations) at one pass. Moreover, news items were also produced by using the VAR estimated via recursive OLS, which allows market expectations to change over time when new information becomes available to economic agents.

4. SUMMARY OF THE MAIN RESULTS OF THE ESSAYS

In this section, a brief summary of the main results of the four essays on industry portfolios and macroeconomic news is given. In the first essay, *Industry Portfolios and Macroeconomic News: A Traditional Approach*, stock market reactions to economic news are investigated by using a traditional two-stage approach and the Finnish disaggregated monthly data for the period January 1987 to September 1996. Due to cointegration properties of the macroeconomic data, unanticipated changes in economic fundamentals are treated as residuals from a VEC model estimated with Johansen's (1988, 1991) ML estimation procedure. Furthermore, special emphasis is placed on testing whether the stock market reactions to news about the economy vary depending on the exchange rate regime.

The results support the efficient market view and suggest further that stock prices respond primarily to monetary news. Individual response coefficients suggest statistically significant responses to news about the industrial production, the real money supply, and the interest rates. A positive surprise (higher than expected) in real money supply or interest rates decreases stock returns while the similar surprise in industrial production leads to an increase in stock returns. Other news appears to have less significant effects on stock prices.

Macroeconomic news jointly explains from 2.4 to 15.5 (11.4) percent of the variance in stock returns across industries (aggregate market). The explanatory power of news about the economy appears to be somewhat higher than previously obtained from the Finnish data employing aggregate market index (e.g., see Lahti & Pylkkönen 1989 and Viskari 1992). Across industries, the explanatory power varies on both sides of the market suggesting distinct intrinsic characteristics. Interestingly, an exchange rate regime also seems to have an impact on the estimation results: for a fixed (floating) rate, a weaker than expected real exchange rate is bad (good) news for the stock market. In the whole sample period, the results do favor a common response, but across sub-periods, some industries respond significantly differently from the market, suggesting distinct industry-specific characteristics (e.g., the interest rate sensitivity of the financial stocks during the floating rates).

In the second essay, *Industry Portfolios, News, and Business Conditions: Evidence from the Finnish Stock Market*, the traditional approach is extended to a more realistic

direction by allowing the stock market reactions to economic news to vary over business conditions. Specifically, monthly stock price reactions across various industries to macroeconomic news (residuals from the VAR model estimated in the levels of the variables) conditional on the state of the economy are examined over the period January 1987 to June 1995. Business conditions are defined in high, medium, and low state depending on the industrial production relative to trend industrial production.

The results suggest that stock return responses to news are not constant, but vary depending on different stages of the business cycle. For example, industrial production, real money supply, and interest rate news may sometimes cause a positive reaction to stock returns and at other times a negative reaction. When the economy is already strong, higher than expected industrial production and real money supply decrease stock returns while in weak business conditions the responses are positive. For the interest rate news, the signs are reversed. Interestingly, it appears that the better the business conditions, the more returns decline after a positive shock in real money supply. Nevertheless, the reverse holds in the case of interest rate news (i.e., the weaker the business conditions, the more heavily stock returns decrease after unanticipated increase in interest rates).

The main result is that when the estimations are made conditional on the state of the economy, a stronger relationship between macroeconomic news and stock returns is evident and stock prices respond to a larger set of economic news. In general, the results are in line with those of McQueen and Roley (1993). Therefore, it can be concluded that the Finnish stock markets do not behave differently from their counterparts in the United States despite the use of empirical expectation proxies and one-month event windows instead of survey expectations and daily data.

The third essay *The Effects of Positive, Negative, Major and Minor Economic News on Industry Portfolios: Is there an Asymmetry in the Finnish Stock Market?* investigates whether the responses of stock returns across various industries to macroeconomic news (residuals from a VAR model fitted in first differences and estimated via recursive OLS) are constant and symmetrical over the interval from January 1987 to December 1996. News proxies are classified into positive, negative, major, and minor news items depending on the “sign” and the “size” of the news proxies.

The results suggest that the reaction of stock returns to macroeconomic news is neither constant nor symmetrical, but varies depending on the qualitative nature of the news. For example, news about industrial production, interest rates, inflation rates, and real

exchange rates may sometimes cause a positive reaction to stock returns and at other times a negative reaction. Interestingly, positive and major news jointly has a significant impact on stock returns across industries. It seems that stock returns respond only to positive news, while negative news is ignored. Furthermore, the sign effect relates to non-monetary news while the size effect relates to monetary news. Overall, these results suggest that when taking the sign and the size of the news into account, a stronger relationship between economic news and stock returns pertain.

In the fourth essay, *Industry Portfolios and Macroeconomic Shocks: An Impulse Response and Variance Decomposition Analysis*, the short-run dynamic responses of industry portfolio stock returns to fundamental macroeconomic shocks over the period January 1987 to December 1996 are investigated. Employing impulse response functions and variance decomposition measures, the results obtained suggest that the stock market responses, excluding the inflation rate, to economic shocks decay quickly, implying that the Helsinki Stock Exchange can absorb shocks quickly and efficiently. Quick responses imply complete dissemination of publicly available aggregate economic information on stock returns. However, inflation rate shocks are the most important source of variation among these pre-specified fundamental economic shocks, and have some predictive power four months ahead, although the predictability is not economically exploitable after accounting for trading costs.

Furthermore, shocks to key economic indicators do not explain the majority of movements in monthly stock returns: only 14.5 percent or less of the market on average can be explained within the first 12-month period. Shocks related to the financial side of the economy are the main determinants of the variability in stock returns in the short run. Furthermore, inflation rate shocks seem to be the most important source of stock return variation among the five pre-specified shocks considered. Across industries, the responses are mainly uniform, although some industry-specific variations in the magnitudes and relative importance of the shocks can be found (e.g., the interest rates sensitivity of the financial stocks).

Finally, although various different specifications of the VAR model and estimation procedures were used, the results did not change significantly. The parameter estimates and their signs remain practically the same, which supports the robustness of the findings. This conclusion holds true especially for the inflation rate news. The sign of the response coefficient remains mainly positive, although the inflation rates are measured in various

alternative ways (i.e., first differences, annual differences, or price levels). Moreover, the effects of news about industrial production on stock returns are the same although seasonally adjusted or raw data is used when generating news.

On the other hand, publication lags in economic statistics appear to have a significant effect on the estimation results. When running the regressions without considering publication lags, the signs of the response coefficients were opposite compared to the response coefficients with publication lags accounted (these results are reported in Järvinen 1997a, b). For example, a higher than expected real money supply had a statistically significant effect on three industries out of seven in addition to aggregate market. This finding is consistent with the evidence provided by Viskari (1992). Therefore, it can be argued that considering publication lags is necessary in order to obtain estimates that are consistent with the economic theory as well as the international evidence (e.g., Siklos & Anusiewicz 1998).

Overall, the results acquired are reassuring from the researcher's perspective when considering the parameter estimates and their statistical significance. Based on these point estimates, the results were robust irrespective of the news generating mechanism chosen. Still, the explanatory power of economic news is rather low (usually in the region of 2.2 - 11.5 percent at the aggregate market), and it appears to vary depending on the chosen expectation generating mechanism¹². Therefore, as also stated in Cutler et al. (1989), stock prices reflect for the most part something other than news about fundamentals. Furthermore, due to the exceptional sample period, conclusions concerning the strength of the true relationship between economic news and stock returns should not be made entirely based on the adjusted R^2 measures, but rather based on estimated elasticities.

What are the implications of these results? It can be concluded that macroeconomic news has statistically significant effects on stock returns. These significant responses imply that unanticipated changes in macroeconomic fundamentals are risks that are priced in the stock market thus providing support to the efficient market theory. Yet one should be careful when modeling this relationship since the responses are neither symmetrical nor constant over time, but vary depending on business conditions, the qualitative nature of the news variables, and the chosen monetary policy regime. Moreover, industry

¹² For example, at the aggregate market level, the highest (lowest) adjusted R^2 is obtained when using the VAR model in levels (recursive OLS) as a news generating process. This is expected since the VAR estimated in fixed parameters may overstate the importance of economic news since it utilizes information that is not available to economic agents at the time when they form their expectations concerning the future.

specific characteristics should also be considered since for some cases the reactions were different from the market on average.

For market practitioners these results might be useful when considering their portfolio strategies. For example, it might be a profitable strategy to invest in stock market after good news about the economy when business conditions are weak. Similarly, investing in financial stocks immediately after an unanticipated decrease in short-term interest rates within the first three months might be profitable. After this overview and introductory section, the four essays on industry portfolios and macroeconomic news are presented.

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APPENDIX 1. Summary statistics for the monthly stock returns, 1987:01 - 1996:12

Panel A: Descriptive statistics

Industry	Mean	S.D.	Skew.	Kurt.	Max.	Min.
Banks and finance	-0.983	10.436	0.685	4.865	38.173	-26.629
Insurance and investment	-0.038	9.715	0.185	6.352	38.931	-39.913
Other services	0.354	6.533	0.394	4.037	25.147	-15.035
Metal and engineering	0.603	7.632	0.506	3.624	24.929	-18.404
Forest industry	0.306	7.924	0.300	2.919	23.635	-19.147
Multi-business industry	1.265	8.550	-0.127	3.572	26.289	-26.253
Other industries	-0.458	7.161	-0.065	3.689	21.166	-22.293
HEX all share price index	0.459	8.550	-0.127	3.572	26.289	-26.252

Panel B: Autocorrelations

Industry	ρ_1	ρ_2	ρ_3	ρ_{12}	$Q(R_{it})$	$Q^2(R_{it})$
Banks and finance	0.126	-0.065	0.215*	0.015	30.65*	104.63*
Insurance and investment	0.159	-0.074	0.001	-0.149	24.62*	28.16*
Other services	0.229*	-0.012	0.271*	0.231*	36.83*	11.37
Metal and engineering	0.062	-0.214*	-0.008	0.208*	26.04*	14.65
Forest industry	0.110	-0.073	-0.038	0.079	15.93	6.60
Multi-business industry	0.218*	-0.058	0.119	0.089	31.92*	19.98
Other industries	0.075	-0.010	0.103	0.082	10.73	6.98
HEX all share price index	0.223*	-0.040	0.125	0.096	29.12*	9.46

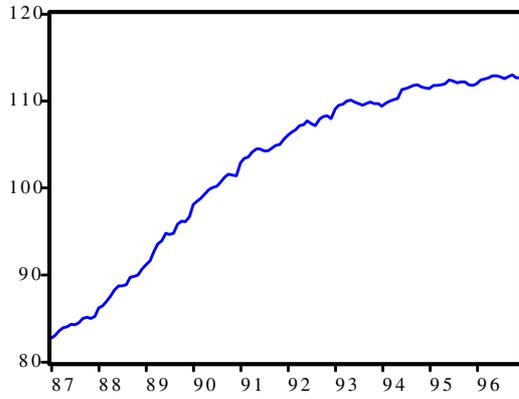
Panel C: Cross-correlations

Industry							
Banks and finance	1.000						
Insurance and investment	0.714	1.000					
Other services	0.609	0.647	1.000				
Metal and engineering	0.562	0.595	0.755	1.000			
Forest industry	0.526	0.537	0.672	0.752	1.000		
Multi-business industry	0.579	0.638	0.702	0.730	0.722	1.000	
Other industries	0.605	0.703	0.641	0.647	0.516	0.603	1.000
HEX all share price index	0.709	0.772	0.807	0.844	0.810	0.913	0.795

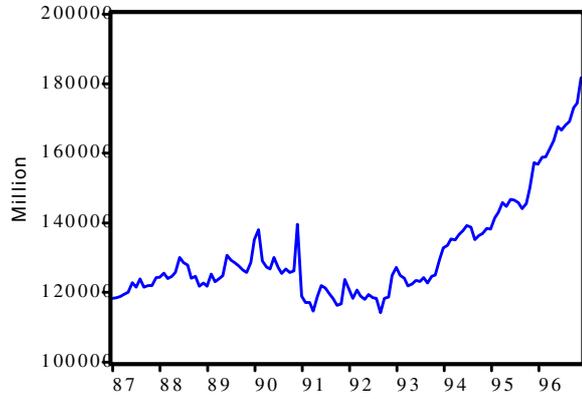
Note: Monthly returns in real terms are multiplied by 100. The sample size is 120 observations. Descriptive statistics for the returns are: average monthly returns (Mean), standard deviation (S.D.), skewness (Skew.), kurtosis (Kurt.), maximum (Max.), and minimum (Min.). Serial correlation coefficients (ρ_i) are reported with different lags, and Ljung-Box statistics are reported for both levels $Q(R_{it})$ and squared returns $Q^2(R_{it})$ for 12 lags. * Statistically significant at the 5 percent level.

APPENDIX 2. Graphs of the macroeconomic variables

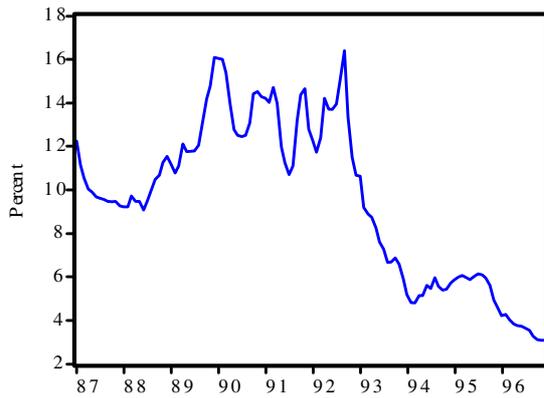
Consumer Price Index (1990 = 100)



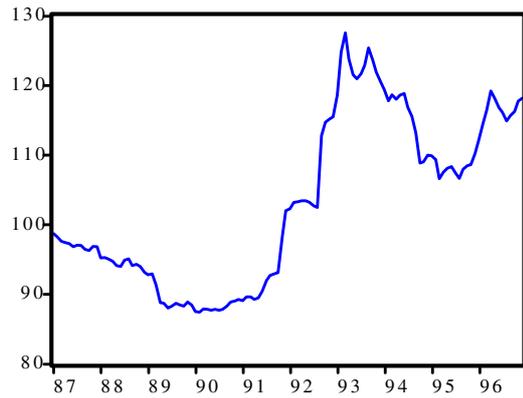
Real Money Supply (M1)



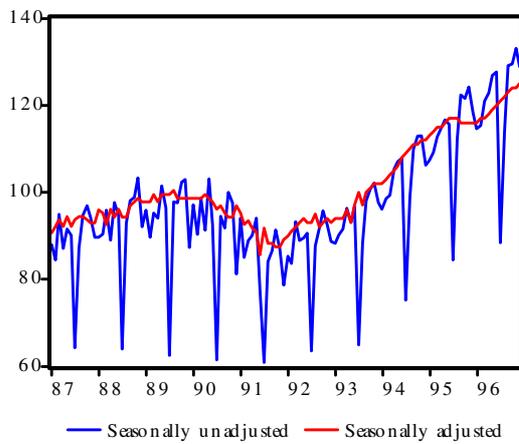
Three-Month Hilbor Rate



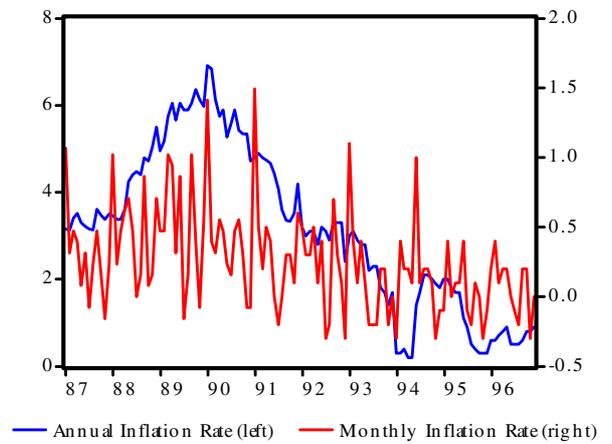
Real Exchange Rate (1982 = 100)



Industrial production (1990 = 100)



Inflation Rates



Chapter 2

INDUSTRY PORTFOLIOS AND MACROECONOMIC NEWS: A Traditional Approach*

ABSTRACT

This paper examines monthly stock market reactions to macroeconomic news (residuals from a VEC model) using Finnish disaggregated data for the period of January 1987 to September 1996. Responses during different exchange rate regimes are also studied. The results give support to the efficient market view and suggest further that stock returns respond primarily to news about industrial production, real money supply, and interest rates. For example, a positive surprise in real money supply and interest rates decreases stock returns while the similar surprise in industrial production leads to an increase in stock returns. Furthermore, an exchange rate regime also seems to have an impact on the results. For a fixed (floating) rates, a weaker than expected real exchange rates is bad (good) news for the stock market.

KEY WORDS: Industry portfolios, Macroeconomic news, VAR model, VEC model

* The helpful comments by Jouko Ylä-Liedenpohja and other seminar participants at the University of Tampere are gratefully acknowledged. Furthermore, I would like to thank an anonymous referee of the Finnish Journal of Business Economics for useful suggestions on earlier versions of the paper.

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1. INTRODUCTION

Financial theory attributes changes in asset prices to changes in fundamental values. An even stronger claim is based on the *Efficient Market Hypothesis*, which states that stock prices accurately reflect all publicly available information immediately and completely. Therefore, changes in stock prices can only be due to unanticipated changes or "news" about - for example, taxation or general macroeconomic conditions that plausibly affects fundamentals (i.e., expected future dividends or discount rates). If market participants are careful users of all available information, past or expected information should then have no effects since this information is already reflected in current market prices.

This paper concentrates on the relationship between macroeconomy and the stock market in Finland by asking the following question: What role does the macroeconomic news play in explaining the movements in stock prices? This question is important for both practitioners and academic economists. Practitioners are perhaps interested in using the information about macroeconomic fundamentals in pricing assets or alternatively making decisions about future real investments. On the other hand, academic economists may be interested in this question because answering it will help to identify some sources of systematic risks, and to consider whether these risks are priced (as they should) on the stock market.

There is a branch of econometric studies testing the relevance of macroeconomic news for stock price movements. The empirical evidence (e.g., see Pearce & Roley 1985; Hardouvelis 1987; Wasserfallen 1989; Aggarwal & Shirm 1992; Sadeghi 1992; McQueen & Roley 1993; Siklos & Anusiewicz 1998; and Ewing 1998) suggests that stock returns respond to news. However, these results show that news can explain only a small fraction of observed variations in equity returns (Roll 1988 and Cutler, Poterba & Summers 1989), even if some of the influences are significant at conventional levels. In the Finnish stock market data, the explanatory power of economic news seems to be even lower (see Junttila, Larkomaa & Perttunen 1997 and references therein). In general, these results indicate that stock returns primarily respond to monetary news while non-monetary news seems to have only weaker effects (Hardouvelis 1987). The empirical evidence also seems to be sample-specific and unstable over time (Orphanides 1992).

The purpose of this paper is to investigate whether macroeconomic news can explain a significant fraction of the stock returns for various industries in the Helsinki Stock

Exchange. The major contribution is to document empirical evidence of the cross-sectional relation between industry portfolios and macroeconomic news. Moreover, special emphasis is placed on investigating the responses during different exchange rate regimes. The two-stage ordinary least squares (OLS) estimation methodology used previously by Cutler et al. (1989), Lahti and Pylkkönen (1989), Orphanides (1992), and Viskari (1992), among others, is followed. The methodology is as follows: First, a vector autoregression (VAR) model is used to identify the unexpected components (i.e., residuals) of each macroeconomic indicator; and second, to consider these unanticipated news components in explaining the changes in industry stock returns.

This paper extends previous studies in several ways. First, industry portfolios are used as dependent variables since there may be distinct effects across industries. This is especially important in the Helsinki Stock Exchange, where Nokia Corporation (a large telecommunications firm) dominates the aggregate stock market. This could bias the results by masking some important dependencies. Industry level analysis can also provide further insight about how different industries respond to news and whether these responses are significantly different from the stock market on average (i.e., whether common response applies to all industries). Furthermore, the Finnish stock market is traditionally dominated by export-oriented, cyclical industries like forest industries, but it would be interesting to investigate how also non-cyclical industries such as other services respond to macroeconomic news.

Second, the stability of the parameter estimates is investigated by dividing the sample period into two non-overlapping sub-samples and testing whether the response coefficients in the pricing model are the same during different phases of exchange rate regimes. Third, publication lags in economic statistics are considered as well as the recent time series data available is used to update the findings of earlier studies. Finally, from a methodological point of view, using vector error correction (VEC) models to generate market expectations and thus news extends the existing literature. The advantage of the VEC model is that it captures both short-term dynamics (market expectations) as well as long-run equilibrium relations (revisions in market expectations) at one pass.

The results suggest that a systematic relationship between stock returns and macroeconomic news is evident, although the explanatory power of news seems to be rather low. Across industries, news jointly explains from 2.4 to 15.5 (11.4) percent of the variance in (market) returns, and mainly news about monetary policy affects stock returns

(i.e., real money supply and interest rates). In addition, during the fixed (floating) exchange rate regime, a weaker than expected real exchange rate is bad (good) news for the stock market. In the whole sample, the estimation results do favor a common response, but during sub-periods, some industries respond significantly differently from the market suggesting distinct intrinsic industry-specific characteristics.

The remainder of this paper is organized as follows: Section 2 outlines a simple theoretical model that relates stock prices to new information. In the following section, the data and statistical methods are described. Section 4 presents the empirical results, and in the last section, conclusions are drawn.

2. THEORETICAL FRAMEWORK

A common model that relates a stock price to news posits that stock price equals the present value of future dividends discounted by a risk-adjusted discount rate. Theoretically, stock prices are determined by ex ante variables (i.e., expected cash flows and expected discount rates at which those future cash flows are capitalized) that are not directly observable. Therefore, it is the impact of new information on agents' expectations that determine the ultimate response of stock prices to news. The rational valuation formula (see Cuthbertson 1996, 77 - 78) for stock price can be written as:

$$(1) \quad p_t = E\left[\sum_{i=1}^{\infty} \delta^i D_{t+i} \mid \Omega_t\right],$$

where p_t is the stock price at time t , $E[\bullet \mid \Omega_t]$ is mathematical expectation conditional on the market's period- t information set Ω_t , D_{t+i} is the dividend paid at time $t+i$, and $\delta = 1/(1+r)$ is the discount factor for cash flows that occur at time $t+i$, determined in the market based on information known at time t .

Since stocks are priced according to rational valuation formula (1), any useful new information that may well affect future discount rates or future dividends, or both, should be of interest. Expected dividends are a function of macroeconomic fundamentals (e.g., exchange rates or industrial production) that affect the future profits of the firms. Expected discount rate, instead, is a function of the risk-free rate (r). In addition, expected

discount rate also depends on risk premium, which, nevertheless, is assumed to be constant in this study.

3. DATA, MODELS, AND ESTIMATION METHODS

3.1. Macroeconomic and stock price data

The data set consists of 117 monthly observations from January 1987 to September 1996. Some of these observations are lost due to publication lags in economic statistics as well as lags in the VAR model. The specific variables are as follows:

Stock return data:

- 1) Stock returns (R_{it}) are expressed in differences in logs (end-of-month values) of the stock price indices measured by the HEX industry indices¹ deflated by the consumer price index. The industry portfolios are as follows: 1) banks and finance, 2) insurance and investment, 3) other services, 4) metal and engineering, 5) forest industries, 6) multi-business industry, and 7) other industries. In order to compare the industry-level results to the whole market, the aggregate stock market responses are estimated by using HEX all share price index, which serves as a proxy for the benchmark model. (Source: The Helsinki Stock Exchange).

Without a precise economic theory that explains the link between macroeconomy and the stock market, the decision about which fundamental economic variables are to be included in analysis is somewhat arbitrary. In reality, several factors may have impacts on stock prices. Therefore, some simplifying assumptions about investors' relevant

¹ See Hernesniemi (1990) for further details about the HEX price indices for various industries. Of course, it would be theoretically preferable to use dividend adjusted monthly stock returns, but these HEX yield indices (including dividends) are not available before 1991. Therefore, stock returns are calculated without dividends, which has practically no impact on the results at the aggregate stock market level as will be shown later (see footnote 11). Furthermore, the movements of price and yield indices in real terms are strongly correlated (correlation is 0.985) during the period September 1987 to September 1996. Therefore, the HEX price indices are good proxies for the HEX yield indices.

information set as a proxy for the true information set, which is unobservable, are required. However, since this paper deals with a small open economy, the following macroeconomic indicators are included to describe both real and financial conditions of the domestic economy:

- 2) Logarithm of the industrial production (ip) measured by the volume index of the industrial production. (Source: Statistics Finland).
- 3) The logarithm of the real money supply ($m1$) measured by the nominal narrow money supply (M1 monetary aggregate) deflated by the consumer price index. (Sources: the Bank of Finland and Statistics Finland).
- 4) The nominal short-term interest rate ($H3$) measured by the three-month Helibor rate. (Source: the Bank of Finland).
- 5) Logarithm of the inflation rate (π) measured by the annual difference of the consumer price index. (Source: Statistics Finland).
- 6) The logarithm of the real exchange rate (s). Real exchange rate ($s = ep^f/p^d$) is measured as a nominal trade-weighted exchange (e) rate deflated by the price levels ratio between foreign (p^f) and domestic (p^d) price levels, respectively. (Source: the Bank of Finland).

All time series are seasonally unadjusted. A real exchange rate is the relative price of the foreign good in terms of the domestic good. It determines the price competitive positions of the domestic firms compared to their foreign competitors. It is measured as the number of domestic currency needed to buy one unit of the foreign currency. Defined in this way, an increase (decrease) in real exchange rate denotes depreciation (appreciation); that is, improvement of price competitive position of the domestic economy.

3.2. A VAR model for describing market expectations

The theoretical background discussed in the last chapter implies that unanticipated changes in macroeconomic fundamentals are the relevant variables to be included in the empirical work. Therefore, the analyses conducted in this paper also require proxies for expected and unexpected values for fundamentals. One fundamental obstacle in testing

asset-pricing theories is our inability to measure “news” accurately. Studies conducted for the US data benefit from the vast amount of available data to overcome obvious measurement problems. Specifically, regularly published survey data can be taken to measure market expectations, so that direct measures of news can be constructed.

Such information does generally not exist in Finland (at least as wide information set as is considered in this paper). Therefore, a statistical procedure must be chosen to extract news from the observed time series. Previous studies have solved this problem by using time series models like ARIMA or VAR models as a proxy for investors’ expectations, and thus news-generating process. Some researchers (e.g., Graham 1996 and Martikainen & Yli-Olli 1991) prefer to use simply first difference of the variable as a proxy for news. This choice is based on the assumption that if macroeconomic variables are random walk processes, the first differences are equivalent to unexpected values, which are the unanticipated innovations in the economic variables (see Cheng 1995).

In this paper, unanticipated values were generated via the estimation of the VAR model². However, this statistical procedure may be problematic due to measurement problems concerning how exactly the different variables are measured, and how well news can be isolated from the expected changes. In order to avoid the errors-in-variables problem, it is assumed that investors respond to the measured rather than the true news, implying that the original estimating equation should be specified in measured rather than true news.

Furthermore, efficient market theory assumes that all lagged values of \mathbf{x}_t are known at the end of the period $t - 1$. Unfortunately, most macroeconomic time series are not available until subsequent periods due to publication lags in economic statistics. In addition, they may be subject to revisions for months or, even years after their initial release have occurred. Therefore, to account for publication lags, a two-month lag in the industrial production and a one-month lag in the real money supply, the consumer price index, and the real exchange rate is assumed^{3,4}.

² Pearce and Roley (1985) show that survey data is more efficient (i.e., smaller root mean-squared error) than time-series models in generating expectations. McQueen and Roley (1993) concluded that despite the use of empirical expectation proxies, the estimated news coefficients using VARs seem to be consistent with the survey data.

³ Lagged values are used to ensure that the data is publicly known at the beginning of the period over which the stock returns are measured. Ignoring publication lags creates potential problem in such a way that the information set implied by a typical VAR contains information that is not actually available to market participants. Therefore, if some of the variables on the right-hand side of the VAR model are not observable at time $t - 1$, the residuals will be improperly estimated.

It is common in financial literature to describe movements in some variables via lagged values (see Chen 1991). However, this approach restricts the information set to include only the values of that particular variable. In reality, the investors' information set is, of course, larger. Therefore, expectations are modeled as a function of the lagged values of the variable itself, and the lagged values of other relevant variables. To coincide with this structure, expectations are expected to follow a finite order VAR process

$$(2) \quad \mathbf{x}_t = \mathbf{A}_1 \mathbf{x}_{t-1} + \dots + \mathbf{A}_k \mathbf{x}_{t-k} + \Phi \mathbf{D}_t + \mathbf{e}_t,$$

where \mathbf{x}_t is a (5×1) vector of variables $\mathbf{x}_t = (ip_{t-2}, m1_{t-1}, H3_t, \pi_{t-1}, s_{t-1})'$, \mathbf{A} is a (5×5) matrix, and \mathbf{e}_t is a (5×1) vector of time t error terms $\mathbf{e}_t = (e_t^{ip}, e_t^{m1}, e_t^{H3}, e_t^{\pi}, e_t^s)'$ which are assumed to be independently and identically distributed with zero mean and positive definite covariance matrix Σ . Each equation also includes vector of deterministic terms \mathbf{D}_t that may contain constant, seasonal dummies, and possibly, some other intervention dummies to be specified later. The one-step-ahead forecast errors $\hat{\mathbf{e}}_t$ are treated as news, and used as explanatory variables for the stock return equations.

This VAR model relates the current value of each series to the lagged values of the series itself and to those of the others. Since the information set used in forecasting cannot be available at the time the forecast is made, only lagged values of the variables are permitted in the model. Estimations can be carried out equation-by-equation by using OLS, because all explanatory variables in every equation are the same. Finally, after fitting the VAR model to the data, it is important to check that the assumptions underlying the model are satisfied. Otherwise, the procedure derived may not be valid, and thus residuals would be improper estimates of news.

VAR estimation assumes that variables included in the system are stationary. The standard Phillips and Perron (1988) unit root tests are used to test for the order of integration of the different series. If variables are nonstationary then a sufficient amount of differences should be used to achieve a stationary VAR model. Nevertheless, it should be noted that mechanical differencing is not recommended, since it is possible that the levels of the variables are cointegrated. If cointegration is present, then a VAR-model in

⁴ Accounting for publication lags in real exchange rate is problematic. Nominal exchange rate is known contemporaneously, but price levels only with a one-month lag. Of course, nominal exchange rate could be used, but this may not be suitable because the FIM was fixed during the period 87 – 92. Therefore, instead of using nominal exchange rate, the real exchange rate with one-month lag is used.

differences would be misspecified because it omits the long-run information that is contained in levels of the variables (Hamilton 1994, 651 – 653).

Therefore, these possible cointegration relations between variables also need to be tested. The Johansen (1988, 1991) maximum likelihood technique is used to test for long-run cointegration. If cointegration is present, then the estimations should be conducted by using the VEC model

$$(3) \quad \Delta \mathbf{x}_t = \mathbf{\Pi} \mathbf{x}_{t-k} + \mathbf{\Gamma}_1 \Delta \mathbf{x}_{t-1} + \dots + \mathbf{\Gamma}_{k-1} \Delta \mathbf{x}_{t-k+1} + \mathbf{\Phi} \mathbf{D}_t + \mathbf{e}_t,$$

where $\mathbf{\Gamma}$ and $\mathbf{\Pi}$ matrices provide both the short-run dynamics and the long run information contained in the data, respectively. When $0 < \text{rank}(\mathbf{\Pi}) = r < 5$, matrix $\mathbf{\Pi}$ can be written as $\mathbf{\Pi} = \alpha \beta'$, where β can be interpreted as a $(5 \times r)$ matrix of cointegration vectors, and α as $(5 \times r)$ matrix of error correction parameters. Again, $\hat{\mathbf{e}}_t$ is a vector of estimated residuals to be considered as news. The economic interpretation of the VEC-model is as follows: the error correction term is considered as the “error” from the long-run equilibrium relation (i.e., revisions in market expectations) while the difference terms give the short-run dynamics (i.e., market expectations).

3.3. The empirical model for stock returns and macroeconomic news

To analyze the systematic relationship between macroeconomic news and stock returns, it is necessary to make a functional form assumption of the relationship between dependent and independent variables. The commonly used relationship is linear, and the constant-mean-return model used to test the effects of news on industry returns is as follows:

$$(4) \quad R_{it} = \alpha_i + \beta_{1i} \hat{e}_t^{ip} + \beta_{2i} \hat{e}_t^{m1} + \beta_{3i} \hat{e}_t^{H3} + \beta_{4i} \hat{e}_t^{\pi} + \beta_{5i} \hat{e}_t^s + u_{it}$$

where R_{it} ($i = 1, \dots, 7$) is the realized ex-post return of the industry i at month t , α_i is industry-specific constant, $\beta_{1i}, \dots, \beta_{5i}$ are the unknown regression coefficients (elasticities), which measure the impact of economic news on industry returns, and u_{it} is a stochastic disturbance term, which is assumed to be $u_{it} \sim \text{i.i.d.}(0, \sigma^2)$. The regression error term u_{it} describes all other news (e.g., industry-specific, world economy, etc.) plus noise that is

not directly related to pre-specified macroeconomic variables. Specifications similar to regression Equation (4) have been used in numerous studies (e.g., see Siklos & Anusiewicz 1998).

The coefficient of determination R^2C (adjusted for degrees of freedom) measures the fraction of the return variation that can be explained by news. However, the R^2C measure may be misleading because of the large macroeconomic fluctuation that occurred in the Finnish economy at the beginning of the 1990s. It makes identification of a linear relationship between macroeconomic changes and stock price changes easier and possibly overestimates the importance of news. In other words, given a true underlying constant linear relationship, the R^2C increases when there is a larger dispersion in the explanatory variables. Therefore, conclusions concerning the strength of the relationship between news and stock returns should not be made based on the R^2C -coefficients, but rather on the estimated industry-specific elasticities (β_i).

Another potential problem is the structural break(s) that may have occurred in the sample. The chosen period may not be homogenous, because there have occurred several major changes (e.g., in exchange rate regime or foreign ownership in Finnish companies) that might have had an impact on the stability of the estimated models. If the sample included structural breaks that represent changed market perceptions regarding the impact of news on stock market, the whole sample regression results would be misleading since they would show the neutralized effects of different market reactions over the whole sample. Therefore, structural stability of estimated models should be tested, and when necessary, separate models for different periods should be estimated.

One obvious candidate for structural break would be September 1992 when the Bank of Finland switched from a fixed to a floating exchange rate regime. Therefore, the sample is divided into two parts - pre-September 1992, representing the period of fixed rates; and post-September 1992, representing the period of floating rates. It is important to consider regime changes for at least two reasons. First, news may have different effects on firms' expected cash flows or expected discount rates, and thus on stock prices depending on chosen exchange rate regime. Second, ignoring structural breaks may mask the significant response coefficients.

3.4. Expected signs of the news coefficients and testable hypothesis

Many studies (e.g., see Lintner 1975, Fama & Schwert 1977, Fama 1981, 1982, Geske & Roll 1983, Chatrath, Ramchander & Song 1997 and Groenewold, O'Rourke & Thomas 1997) find a significant negative relationship between expected and unexpected inflation and stock returns. This is surprising since according to the Fisherian hypothesis, shares should provide a hedge against expected and unexpected inflation. One possible channel by which inflation news may have a negative impact on stock prices is that higher-than-expected inflation increases inflation expectations, which in turn leads to a monetary tightening. This implies higher short-term nominal interest rates, which reduces the present value of future cash flows, and thus current stock prices.

A negative relationship between higher-than-expected interest rates and stock returns is also expected (e.g., see Pearce & Roley 1985 and Thorbecke 1997). Higher-than-expected interest rates decrease firms' future profits through increased interest payments on debt and reduced aggregate demand. Unexpectedly high interest rates also increase the discount factors at which those future profits are capitalized. Therefore, higher interest rates are bad news for the stock market. Thus, when interest rates increase, the market values of equity prices decline. Furthermore, previous studies (e.g., see Hardouvelis 1987) find that stocks for financial companies (e.g., banks and finance and insurance and investments) are interest rate sensitive. This hypothesis is also tested here.

Depreciation in real exchange rate stimulates export of the domestic firms by making their products cheaper in foreign markets. However, if depreciation is higher than expected, monetary authority typically tries to reduce depreciation by increasing short-term interest rates⁵. Therefore, unanticipated depreciation is bad news for the stock market, in general. Furthermore, export-oriented industries (i.e., metal and engineering, forest industries, and multi-business industry) may even gain (if positive cash flow effect dominates negative discount rate effect) from unanticipated depreciation, since a cheaper FIM makes them more competitive on the foreign market. Hence, a positive association between real exchange rate news and stocks of export-oriented industries is expected.

However, stock price responses to unanticipated changes in real exchange rate may depend on monetary policy regime. During the fixed rates (exchange rate targeting),

⁵ This policy is known as "leaning against the wind" (see Solnik 1987). Because stock returns systematically decline as interest rates increase, then the monetary authority's policy of "leaning against the wind" will expose also domestic-oriented industries to unanticipated changes in real exchange rates.

central bank "leans against the wind" after higher than expected depreciation, trying to keep the exchange rate within some fixed, pre-specified interval. During the floating rates (inflation targeting), the same surprise does not necessarily lead to monetary tightening, if, for example, general macroeconomic conditions are weak, or inflation expectations are at low level. Both of these conditions held in the Finnish economy at the beginning of the 1990s. Therefore, it is assumed that during the fixed (floating) rates, higher-than-expected depreciation in real exchange rate is bad (good) news for the stock market.

Many recent studies (see Prag 1994 and Siklos & Anusiewicz 1998) have examined the impact of the money supply news on stock returns. The consensus finding is that unexpectedly high money growth is associated with lower stock prices. One interpretation of this result is that investors may believe that the monetary authority will respond to this piece of news by quickly moving to a more restrictive monetary policy due to increased inflation expectations. Alternatively, unexpectedly high money supply may signal increase in future expected real interest rates (Hardouvelis 1987). According to these explanations, higher-than-expected money supply is bad news for the stock market.

Finally, higher-than-expected economy activity may increase investors' expectations of future economic growth and expected future profits of the firms. Good news about real economy should make stocks even more attractive and hence cause an upward leap in share prices. Several studies (see Pearce & Roley 1985 and Sadeghi 1992) have shown that stock returns respond positively to higher-than-expected economic activity. Therefore, the likely impact of real activity surprises on stock prices is positive. Furthermore, it is expected that industrial industries are more sensitive to news about real economy than are other industry portfolios.

Summarizing the priors, stock returns across industries can be written as a function of news about macroeconomic indicators known at period t as follows:

$$(5) \quad R_{it} = f_i(\hat{e}_t^{ip}, \hat{e}_t^{m1}, \hat{e}_t^{H3}, \hat{e}_t^{\pi}, \hat{e}_t^s)$$

+ - - - -/+

where (+/-) denotes the expected sign of the response coefficient. These signs correspond to the stock return responses to a higher than expected values of the fundamentals.

The significance of individual response coefficients is examined by t -tests. Common response (i.e., statistical difference from the response of the overall market index) is also tested. In addition, the joint significance of monetary (\hat{e}_t^{m1} , \hat{e}_t^{H3} , and \hat{e}_t^{π}) and non-

monetary (\hat{e}_t^{ip} and \hat{e}_t^s) news is tested to explore whether monetary or non-monetary variables contain relevant information for the stock markets. Wald tests for coefficient restrictions are used for this purpose. Conventional significance levels of 1, 5, and 10 percent are used throughout the analysis. F -distribution is used because in small samples, it is more cautious in rejecting the null than the χ^2 -distribution (e.g., see Theil 1971, 402).

4. ESTIMATION RESULTS

4.1. Producing news via the estimation of the VAR model

In the first stage, news variables were generated via the estimation of the VAR^{6,7}. The lag length was chosen using Schwarz multivariate information criteria and Likelihood Ratio tests corrected for small samples suggested by Sims (1980). Information criteria suggest the optimal lag length of two. However, residual misspecification tests revealed that additional lag is required to capture the dynamics of the model. The LR-test statistic comparing the three-lag model to the two-lag model is highly significant at less than 1-percent level. After that, residual diagnostics give no hint of misspecification, except of non-normality at the 5 percent level. Therefore, the lag length of the VARs is chosen to be three in this study.

⁶ VAR estimation is based on i.i.d. errors. However, due to the nature of this application, error terms need not be homoscedastic or normally distributed. The only requirement for news is to be independent in time, since otherwise, they could not be treated as news. When taking a closer look at the residual diagnostics, serial correlation and non-normality are found, which are due to some outliers. Preliminary data analysis (not shown) reveals several outliers, which are modeled by using intervention dummies (see footnote 7). However, care should be taken when using intervention dummies, since relevant information may be lost from the stock market's viewpoint in the second stage estimations. Therefore, the VAR model is estimated with intervention dummies, but after estimating parameters, the dummies with their estimated coefficients are added back to the residual series. The advantage of this method is that it prevents outliers to disturb VAR estimation, and still includes this information in the second stage.

⁷ The following vector of intervention dummies is used: $\mathbf{D}_t = (D894, BS, D9101, D9102, D9107, D9108, D9112, DSPEC, D9210)'$. These dummies have been included since they all have clear economic interpretation, and because error term diagnostics show that residuals are better behaved with them rather than without them. The dummies are as follows: $D894$, $D9112$, and $D9210$ account for revaluation in March 1989, devaluation in November 1991, and floating decision in September 1992, respectively. BS accounts for a bank workers' strike (takes the value 1 in January 1990 and -1 in March 1990). $D9101$ and $D9102$ account for withholding tax, and the end of the special tax-free account. In addition, the harbor workers strike in June 1991 and devaluation speculation $DSPEC$ that takes the value 1 from April to November 1992, and zero otherwise are considered. Every equation in the VAR system also includes 11 seasonal dummies and a constant.

After defining a suitable lag order, time series properties (not shown) of the data are investigated. Phillips and Perron (1988) unit root tests suggest that all variables (including stock prices) are nonstationary with stationary differences (i.e., $\mathbf{x}_t \sim I(1)$ processes). In addition, Johansen's (1988, 1991) cointegration tests (with and without intervention dummies) for alternative lags suggest that there may be one or two independent cointegration vectors present in the data⁸. Therefore, the VAR(3) model with two cointegration vectors in VEC form is estimated, and its residuals are used as news proxies.

4.2. Whole sample results: stock market responses to news

Equation (4) is estimated separately for each industry by using OLS⁹ and the Newey and West (1987) estimator¹⁰ of the covariance matrix. These results are reported in Appendix 1. Several interesting results emerge from this appendix. First, news explains approximately 11.4 percent of the market return¹¹. Across industries, the explanatory power varies between 2.4 percent (metal and engineering) and 15.5 percent (insurance

⁸ Several recent studies present evidence in favor of cointegration relationships among macroeconomic variables such as those investigated in this paper (e.g., see Fung & Kasumovich 1998).

⁹ Initially, the estimations were conducted with seasonal dummies and a dummy for the October 1987 crash, but this seems to have only minor effects of the results. Therefore, to avoid efficiency losses, these dummies are not included in the subsequent estimations.

¹⁰ The reported results are based on i.i.d. residuals. Several diagnostic tests (not shown) for the estimated models were run, and were largely acceptable, despite some problems. Residuals are normally distributed for most of the cases measured by Jarque-Bera -statistics. However, serial correlation seems to be a problem, although Durbin-Watson test gives no hint of serial correlation. Ljung-Boxin Q -tests calculated at 28 lags show that autocorrelation is present in every equation at least at the 10 percent level. Furthermore, the ARCH(1) effect is clearly observed only in banks and finance. Finally, RESET(1) tests for general misspecification reject the null of correctly specified model at the 5 percent level only in insurance and investment.

¹¹ In order to check the potential bias that excluding dividends might cause; Equation (4) was re-estimated by using dividend adjusted monthly stock returns as a dependent variable. The dividends adjusted stock returns were calculated by combining the WI index (1987-1990) and the HEX yield index (1991-1996). For further details see Berglund, Wahlroos, and Grandell (1983) and Hernesniemi (1990). The estimation results were as follows:

$$R_t = 0.004 + 0.577 \hat{e}_t^{ip} - 0.679 \hat{e}_t^{m1} - 0.031 \hat{e}_t^{H3} + 1.271 \hat{e}_t^{\pi} + 0.147 \hat{e}_t^s \quad R^2C = 0.123 \quad DW = 1.841$$

(0.659) (2.913) (-2.574) (-2.394) (1.309) (0.338)

As can be seen from these results (t -statistics in parenthesis) compared to those in Appendix 1 without dividends, the parameter estimates are very close. Industrial production, real money supply, and interest rate news has statistically significant effect on stock returns. Therefore, it can be argued that stock returns calculated simply through capital gains or losses are a good proxy for the total stock return, which consists of capital gains and dividend yield.

and investment). As a group, the most news sensitive industries are financial sectors (banks and finance and insurance and investments). In total, these results imply that news accounts for only a small, but still non-zero portion of stock return variation.

Second, according to F -tests, news jointly appears to be important determinants of stock returns: news jointly has significant effect on stock returns (H_1) for five industries out of seven at the 1-percent level. Comparing the role-played by monetary and non-monetary news as a group, monetary news (H_2) are more important than non-monetary news (H_3) in affecting stock returns. Across industries, forest industries and multi-business industry respond also to non-monetary information for less than the 1- percent level.

Third, individual response coefficients suggest significant aggregate market responses to news about industrial production, real money supply, and interest rates. The other news appears to have less significant effects on stock returns. Most of the significant coefficients affect stock returns with their predicted signs. For example, industrial production news parameter estimates range from 0.36 to 0.93 across industries compared to the aggregate market reaction of magnitude 0.57. Higher-than-expected money supply and interest rates are bad news for the stock market: one percent (percentage) unexpected increases in real money supply (interest rate) decreases market by 0.69 (2.9) percent.

Across industries, significant responses for more than half of the cases were found with respect to news about industrial production, real money supply, and interest rates. Overall, these estimates were very similar to those of the market on average. In fact, industry portfolios do not respond significantly differently from the market. Despite the common response, there are still some industry-specific differences worth mentioning. First, primarily export-oriented cyclical industrial industries respond to industrial production news. Second, cyclical industries do not respond to interest rate news. Third, domestic-oriented industries (other services and other industries) as well as financial sectors seem to be more sensitive to the domestic money market conditions. Finally, financial sectors are the most sensitive among all industries to interest rate news: responses are over twice stronger than the market on average.

However, news about inflation and real exchange rate produce mixed results. Five industries out of seven produce a positive inflation coefficient, which is contrary to the prior expectations. The coefficient is even significant in multi-business industry. The positive responses seem not to depend on the way inflation is measured. If monthly

consumer price inflation or consumer price index in levels is used as a proxy for inflation, these results still hold (these results are reported in chapters 3 and 4). However, ignoring publication lags changed the inflation coefficient to negative. Furthermore, a higher-than-expected real exchange rate is bad news for most industries as expected, although these estimates failed to reach significance at conventional levels¹².

4.3. Sub-sample results: responses during different exchange rate regimes

As a preliminary step for detecting structural breaks, CUSUM tests and recursive residuals are used. Without exception, these tests show that at least one statistically significant break occurred in the Finnish stock market. This breakpoint is located at September 1992. The CHOW breakpoint (forecast) test confirmed that this break was significant in two (four) industries out of seven¹³. Therefore, the regression Equation (4) was re-estimated separately across various industries over these two different exchange rate regimes: 1987:07 - 1992:08 (fixed rates) and 1992:09 - 1996:09 (floating rates).

The sub-sample results are reported in Appendices 2 and 3. These results suggest that news jointly (H_1) has an effect on stock returns in both regimes. According to R^2C -measures, news account for about the same fraction of the market returns (some 6 – 7 percent) irrespective of the exchange rate regimes. Instead, across industries, the explanatory power of the regressions seems to depend on a sub-sample. Again, the signs of significant response coefficients match prior expectations for the most part. Yet, there are some differences in the magnitudes of the coefficients across industries and periods. For example, during the period 92 – 96, financial sectors (forest industry and multi-business industry) have their peak responses to interest rate (industrial production) news.

¹² However, this conclusion turns out to be premature since real exchange rate parameters change over time in several industries (e.g., banks and finance, multi-business industry, other industries, and general price index). One of the results of fitting the model, which assumes constant parameters when they are in fact variable, is low t -statistics (see footnote 13).

¹³ Initially, the estimations with a full set of slope and intercept dummies are experimented with in order to test whether any response coefficients were affected by the change in exchange rate regime. These results (not reported) indicate that the dummies for the interest rate (insurance and investment) and real exchange rate (all share price index, banks and finance, multi-business industry, and other industries) news turn out to be significant. Furthermore, average stock returns also have changed in other services and market index. Due to these significant dummies, it seems that stock market responses to interest rate and real exchange rate news depend on monetary policy regime.

Furthermore, banks and finance and multi-business industry show above average sensitivity to macroeconomic news during both monetary policy regimes.

During the period 92 – 96, stock returns seem to be more sensitive to non-monetary (H_3) news. Interest rate news turned out to be significant for financial sectors: an unexpected one-percentage increase in interest rate lowers these industries by 6.8 - 11.9 percent, which is 5 – 8 times more than the market on average. Other services also respond to interest rate news, but the response is smaller in magnitude. Furthermore, the real exchange rate now has a significant effect on banks and finance, multi-business industry, and market index: an unexpected one percent depreciation increases these industries by 1.0 – 1.5 percent. When testing for the common response, financial (insurance and other services) sectors differ from the average market response to interest rate (real exchange rate) news at the 10 percent level.

During the sub-period 87 – 92, there is no obvious pattern whether service or industrial industries are more sensitive to news. When looking at individual coefficients, stock returns now respond to a broader set of news. The coefficients of industrial production, real money supply, and interest rates are as expected. For example, an unexpected one percent increase in real money supply depresses stock returns for most of the industries by about 0.5 – 0.8 percent, while an unexpected one percent depreciation in real exchange rate lowers stock returns by 0.6 - 2.1 percent. The only exception is insurance and investment, whose negative response to industrial production news seems somewhat dubious. Again, financial sectors show the strongest reactions to interest rate news.

Some evidence that stock return responses to real exchange rate news depend on the exchange rate regime was also found. Response coefficients were negative for every industry during the fixed rates. However, this no longer holds during floating rates, and the signs turn out to be positive for five industries out of seven. Moreover, forest and multi-business industries respond positively to news about industrial production for both of the sub-periods, but during the period 92 – 96, the price responses are some 1.5 – 2 times stronger. Another interesting observation is that during the floating rates, real money supply news seems to have no significant impact on stock prices.

The most interesting part of these sub-sample results is the negative relation between stocks and real exchanges rate news, which is valid for every industry. These responses are actually statistically significant for more than half of the cases. For example, an unexpected 1 percent depreciation in real exchange rate is associated with a 1.4 (2.1)

percent increase (decrease) in banks and finance during the floating (fixed) exchange rate regime. This evidence indicates that stock market responses to real exchange rate news depend on exchange rate regime.

5. CONCLUSIONS

The purpose of this paper was to investigate to what extent macroeconomic news drives monthly stock returns across industries during the sample period January 1987 to September 1996. The main results are as follows. First, a systematic relationship between news and stock returns was found. Second, this relationship with respect to real exchange rate news is not constant, but varies depending on the time period considered: during the fixed rates, the responses were negative while during the floating rates, the reverse held. Third, stock returns respond primarily to monetary news, although during the floating rates, non-monetary news seems to be more important. Nevertheless, differences in measurement accuracy may explain why monetary news seems to be more important.

The switch in exchange rate regime meant that market perception regarding the monetary policy and the likely effects of the real exchange rate news on stock returns may have changed. Therefore, the results concerning real exchange rate news for the whole sample are misleading. In fact, unanticipated changes in real exchange rates are important determinants for stock market movements during the both sub-samples. The sub-sample results with respect to industrial production, real money supply, and interest rates are fundamentally the same as the whole sample estimations, although there are some variations in the magnitude of the responses across industries.

Consistent with Hardouvelis (1987), the financial sectors show the strongest reactions to interest rate news among all industries. During the floating rate regime, the responses were even significantly stronger than the market, apparently because monetary developments directly affect the cash flows of financial companies. Overall, these results suggest a common response across industries in the whole sample period, but during the sub-samples, the common response for some of the industries is rejected.

As also noted by Cutler et al. (1989), the use of estimated VAR residuals, as proxies for news, may be problematic for several reasons. First, if the VARs are misspecified, residuals do not accurately reflect the value of information to market participants. Second,

in reality, the appropriate information set is much richer than the one implied in this paper. If investors operate with an information set larger than that considered here, residuals might overstate the importance of news. Third, VAR does not capture news about future macroeconomic conditions, revealed in period t , but not directly reflected in that period's variables.

The estimation results suggest the difficulty of explaining as much as 11.4 percent of the market return, which is somewhat higher than previously obtained from the Finnish data employing aggregate stock market index (e.g., Lahti & Pylkkönen 1989 and Viskari 1992). Across industries, the explanatory power varies on both sides, suggesting distinct intrinsic characteristics. However, since the data covers a very short and exceptional period, care should be taken when comparisons with results from other periods are made exclusively based on explanatory power.

In addition, due to the exceptional sample period, expectation-generating mechanism may also have changed. This problem can be reduced by recursive estimation of VARs (see Siklos & Anusiewicz 1998). However, due to the small number of observations, this approach is not followed in the present study. Publication lags also seem to have important effects on the results. Ignoring publication lags produces inverse signs to all, but interest rates variables. This may explain the positive stock market response to higher than expected real money supply in the Finnish data reported by Viskari (1992). Nevertheless, despite using lagged values to account for lags in publication; there are still some timing issues associated with the real exchange rate news and the reflection of that piece of news on the stock market.

In this paper, several simplifying assumptions concerning the relationship between stock returns and news were made. For example, the assumption that there is a straightforward linear relationship between news and stock returns, although widely used, can be criticized. In reality, this relationship could be, of course, a complicated non-linear form. Moreover, from the efficiency viewpoint, the results acquired in this paper do not necessarily mean either efficiency or inefficiency, since our tests are not direct tests of market efficiency. Instead, these tests are joint tests of rational expectations and market efficiency (see Fama 1991).

Likewise, the fact that stock returns do not respond systematically to inflation news does not necessarily mean that inflation shocks are an unimportant determinant of stock returns. It might simply be that the VAR at a monthly frequency is an inferior way to

measure news. Monthly data involves much noise and other effects that may mask the impacts of news on stock returns. Therefore, an alternative way to measure news about macroeconomic indicators is to use survey data on expectations. So far, the problem is the lack of suitable data, but in the future, this would have the advantage of applying the higher frequency data.

Although news jointly seem to be an important determinant of stock returns, the fact that most of the variation in returns cannot be explained using economic information (e.g., see Cutler et al. 1989) remains. Therefore, the central question in interpreting this evidence is whether the unexplained return movements are due to omitted news about future cash flows and discount rates, or to other factors, that may not affect expectations of these variables.

Cutler et al. (1989) and Orphanides (1992) have documented the same magnitude of explanatory power for monthly aggregate returns despite using a broader information set. Hence, adding more fundamentals into the analysis does not seem to be a fruitful path for the future research. Instead, extending the traditional approach into a more realistic modeling strategy by allowing, for example, asymmetric responses could give us some further insight about how Finnish stock prices are priced with respect to macroeconomic news. Finally, non-economic news like elections or international military and other conflicts may also have an impact on equity market risk premium and thus on the pricing of the Finnish stocks.

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APPENDIX 1. Stock market reactions to macroeconomic news (1987:09 - 1996:09, $n = 117$)

$$R_{it} = \alpha_i + \beta_{1i}\hat{e}_t^{ip} + \beta_{2i}\hat{e}_t^{m1} + \beta_{3i}\hat{e}_t^{H3} + \beta_{4i}\hat{e}_t^{\pi} + \beta_{5i}\hat{e}_t^s + u_{it}$$

Industry	β_{1i}	β_{2i}	β_{3i}	β_{4i}	β_{5i}	R ² C	DW	H_1 :	H_2 :	H_3 :
Banks and finance	0.223 (0.880)	-0.436 (-1.382)	-0.066*** (-2.806)	1.919 (1.265)	0.359 (0.432)	0.128	2.085	4.320*** [0.001]	7.163*** [0.000]	0.470 [0.626]
Insurance and investment	0.278 (1.167)	-0.647** (-2.023)	-0.073*** (-2.728)	-0.239 (-0.188)	-0.170 (-0.225)	0.155	1.998	2.668** [0.026]	4.281*** [0.007]	0.706 [0.496]
Other services	0.392** (2.067)	-0.483* (-1.815)	-0.037*** (-3.324)	3.507 (0.552)	-0.400 (-1.140)	0.104	1.816	4.225*** [0.002]	6.662*** [0.000]	2.923* [0.058]
Metal and engineering	0.361* (1.838)	-0.610** (-2.057)	-0.016 (-1.240)	1.708 (1.345)	-0.144 (-0.315)	0.024	2.004	1.689 [0.144]	2.512* [0.063]	1.689 [0.189]
Forest industries	0.690*** (3.304)	-0.478 (-1.331)	-0.009 (-0.707)	2.516 (1.590)	0.287 (0.741)	0.060	1.825	3.762*** [0.004]	4.301*** [0.007]	6.139*** [0.003]
Multi-business industry	0.928*** (3.473)	-0.947*** (-2.713)	-0.026 (-1.519)	2.490** (2.041)	0.295 (0.574)	0.149	1.810	5.902*** [0.000]	9.474*** [0.000]	6.083*** [0.003]
Other industries	0.284 (1.116)	-0.515 (-1.609)	-0.039*** (-3.775)	-0.343 (-0.298)	-0.068 (-0.135)	0.082	2.092	3.929*** [0.004]	5.032*** [0.003]	0.626 [0.537]
HEX all share index	0.570*** (2.805)	-0.686** (-2.542)	-0.029** (-2.161)	1.208 (1.188)	0.166 (0.379)	0.114	1.812	4.161*** [0.002]	6.642*** [0.000]	4.035** [0.020]

Note: Independent variables are industrial production (ip^u), real money supply ($m1^u$), three-month helibor rate ($H3^u$), annual inflation rate (π^u), and real exchange rate (s^u). They are proxied by the VEC residuals. t – values (in parenthesis) and F – values [p -values in square brackets] are corrected for heteroscedasticity and autocorrelation by using the Newey-West (1987) procedure. Coefficients that are significantly differently from the market are shown in bold. R²C is the coefficient of determination adjusted for degrees of freedom. DW is Durbin – Watson statistic. H_1 is the null hypothesis that all slope coefficients are jointly zero; H_2 and H_3 are similar for monetary ($m1^u$, $H3^u$, and π^u) and non-monetary (ip^u and s^u) coefficients, respectively. *, **, and *** denote significance at the 10 %, 5 %, and 1 % level, respectively.

APPENDIX 2. Stock market reactions to macroeconomic news during fixed rates (1987:07 - 1992:08, $n = 62$)

$$R_{it} = \alpha_i + \beta_{1i}\hat{e}_t^{ip} + \beta_{2i}\hat{e}_t^{m1} + \beta_{3i}\hat{e}_t^{H3} + \beta_{4i}\hat{e}_t^{\pi} + \beta_{5i}\hat{e}_t^s + u_{it}$$

Industry	β_{1i}	β_{2i}	β_{3i}	β_{4i}	β_{5i}	R ² C	DW	H ₁ :	H ₂ :	H ₃ :
Banks and finance	0.085 (0.327)	-0.462 (-1.653)	-0.043* (-1.811)	0.743 (0.699)	-2.132 *** (-3.909)	0.167	1.333	11.340*** [0.000]	9.114*** [0.000]	10.448*** [0.626]
Insurance and investments	-0.169 (-0.616)	-0.494* (-1.700)	-0.035 (-1.217)	-1.310 (-1.064)	-1.661** (-2.126)	0.032	1.482	1.887 [0.111]	1.087 [0.362]	2.317 [0.108]
Other services	0.218 (1.014)	-0.564** (-2.124)	-0.026** (-2.166)	0.196 (0.185)	-0.615* (-1.892)	0.041	1.668	3.394** [0.010]	4.814*** [0.005]	3.065* [0.055]
Metal and engineering	0.353 (1.500)	-0.554** (-2.220)	-0.003 (-0.194)	2.662** (2.561)	-0.498 (-0.991)	0.065	1.719	3.601*** [0.007]	4.944*** [0.004]	1.819 [0.172]
Forest industries	0.453* (1.954)	-0.568 (-1.672)	-0.007 (-0.362)	1.457 (0.959)	-0.159 (-0.389)	0.000	1.522	1.807 [0.126]	2.221* [0.096]	2.103 [0.132]
Multi-business industry	0.622** (2.120)	-0.775** (-2.026)	-0.022 (-0.959)	2.712* (1.929)	-0.871 (-1.567)	0.080	1.683	5.819*** [0.000]	6.814*** [0.001]	3.856** [0.027]
Other industries	0.194 (0.695)	-0.430 (-1.151)	-0.036** (-2.382)	-0.439 (-0.313)	-1.374*** (-3.073)	0.105	2.063	3.257** [0.012]	2.077 [0.114]	5.144*** [0.009]
HEX all share index	0.371* (1.685)	-0.594** (-2.032)	-0.021 (-1.129)	1.205 (1.129)	-0.957** (-2.251)	0.062	1.587	4.235*** [0.002]	4.321*** [0.008]	4.719** [0.013]

Note: Independent variables are industrial production (ip^u), real money supply ($m1^u$), three-month helibor rate ($H3^u$), annual inflation rate (π^u), and real exchange rate (s^u). They are proxied by the VEC residuals. t – values (in parenthesis) and F – values [p -values in square brackets] are corrected for heteroscedasticity and autocorrelation by using the Newey-West (1987) procedure. Coefficients that are significantly differently from the market are shown in bold. R²C is the coefficient of determination adjusted by degrees of freedom. DW is Durbin – Watson statistic. H_1 is the null hypothesis that all slope coefficients are jointly zero; H_2 and H_3 are similar for monetary ($m1^u$, $H3^u$, and π^u) and non-monetary (ip^u and s^u) coefficients, respectively. *, **, and *** denote significance at the 10 %, 5 %, and 1 % level, respectively.

APPENDIX 3. Stock market reactions to macroeconomic news during floating rates (1992:09 - 1996:09, $n = 49$)

$$R_{it} = \alpha_i + \beta_{1i}\hat{e}_t^{ip} + \beta_{2i}\hat{e}_t^{m1} + \beta_{3i}\hat{e}_t^{H3} + \beta_{4i}\hat{e}_t^{\pi} + \beta_{5i}\hat{e}_t^s + u_{it}$$

Industry	β_{1i}	β_{2i}	β_{3i}	β_{4i}	β_{5i}	R ² C	DW	H ₁ :	H ₂ :	H ₃ :
Banks and finance	0.030 (0.051)	-0.679 (-0.685)	-0.068 ^{***} (-2.953)	1.976 (0.535)	1.396 [*] (1.867)	0.099	2.335	7.143 ^{***} [0.000]	4.345 ^{***} [0.009]	2.016 [0.146]
Insurance and investments	1.046 ^{**} (2.270)	-1.498 (-1.273)	-0.119 ^{***} (-5.747)	-1.659 (-0.479)	-0.524 (-0.767)	0.278	2.274	24.251 ^{***} [0.000]	19.131 ^{***} [0.000]	2.583 [*] [0.087]
Other services	0.454 (1.499)	0.206 (0.307)	-0.039 ^{**} (-2.253)	-0.010 (-0.004)	-0.363 (-0.642)	0.018	2.163	3.981 ^{***} [0.005]	1.919 [0.141]	1.267 [0.291]
Metal and engineering	0.190 (0.415)	-0.206 (-0.217)	-0.024 (-1.018)	-2.465 (-0.662)	0.112 (0.132)	0.000	2.208	1.827 [0.127]	0.652 [0.586]	0.147 [0.864]
Forest industries	0.849 [*] (1.759)	-0.117 (-0.124)	0.006 (0.252)	4.767 (1.613)	0.579 (0.816)	0.045	2.065	2.606 ^{**} [0.038]	1.604 [0.204]	3.288 ^{**} [0.047]
Multi-business industry	0.981 ^{***} (2.210)	-1.035 (-1.488)	0.009 (0.657)	0.7781 (0.301)	1.522 ^{***} (2.880)	0.163	1.946	5.528 ^{***} [0.001]	0.809 [0.495]	7.276 ^{***} [0.002]
Other industries	0.264 (0.488)	-0.835 (-0.900)	-0.023 (-1.107)	-1.659 (-0.660)	0.827 (1.077)	0.001	2.012	8.175 ^{***} [0.000]	0.990 [0.406]	1.145 [0.327]
HEX all share index	0.598 (1.423)	-0.731 (-0.949)	-0.014 (-1.103)	-0.414 (-0.158)	0.985 [*] (1.883)	0.066	1.946	7.299 ^{***} [0.000]	0.693 [0.561]	4.945 ^{**} [0.012]

Note: Independent variables are industrial production (ip^u), real money supply ($m1^u$), three-month helibor rate ($H3^u$), annual inflation rate (π^u), the real exchange rate (s^u). They are proxied by the VEC residuals. t – values (in parenthesis) and F – values [p -values in square brackets] are corrected for heteroscedasticity and autocorrelation by using the Newey-West (1987) procedure. Coefficients that are significantly different from the market are shown in bold. R²C is the coefficient of determination adjusted for degrees of freedom. DW is Durbin – Watson statistic. H_1 is the null hypothesis that all slope coefficients are jointly zero; H_2 and H_3 are similar for monetary ($m1^u$, $H3^u$, and π^u) and non-monetary (ip^u and s^u) coefficients, respectively. *, **, and *** denote significance at the 10 %, 5 %, and 1 % level, respectively.

Chapter 3

INDUSTRY PORTFOLIOS, ECONOMIC NEWS AND BUSINESS CONDITIONS:

Evidence from the Finnish Stock Market*

ABSTRACT

This paper compares monthly stock price reactions across industries to macroeconomic news (residuals from VAR models) conditional on the state of the economy over the period 1987:01 - 1995:06. Business conditions are defined relative to trend industrial production. The results suggest that stock return responses to news are not constant, but vary depending on business conditions. For example, industrial production, real money supply, and interest rate news may sometimes cause a positive reaction to stock prices and at other times a negative reaction. When the economy is strong, higher than expected industrial production and real money supply decrease stock prices while in weak conditions the responses are positive. For interest rate news, the signs are reversed. Furthermore, the results show that when the estimations are made conditional on the state of the economy, stock prices respond to a larger set of economic news. The results are in line with McQueen and Roley's (1993) study. Therefore, Finnish stock markets do not behave differently than their counterparts in the United States despite the use of empirical expectation proxies and monthly observations.

KEY WORDS: Industry portfolios; Macroeconomic news; VAR model; Business conditions

* Forthcoming in the Finnish Journal of Business Economics 2/2000. I thank Tom Berglund, Hannu Kahra, Eva Liljebloom, Markku Rahiala, Jouko Ylä-Liedenpohja, as well as seminar participants at the Capital Markets and Financial Economics (FPPE) and at the University of Tampere for their helpful comments and suggestions. Furthermore, the comments by an unknown referee of the Finnish Journal of Business Economics are gratefully acknowledged. All the remaining errors are entirely my responsibility.

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1. INTRODUCTION

In seeking to understand movements in the absolute level of aggregate stock markets, there are two dominant approaches in the financial literature. The first approach is based on an efficient market view, which is a direct application of rational expectations to financial markets. The efficient market hypothesis states that stock prices fully and instantaneously reflect all publicly available information, which implies that stock prices are expected to respond only to the external news. The second reference point is based on “fads”, “noise”, or “bubbles” approach in which asset prices reflect for the most part something other than news about fundamental values (e.g., see West 1988; LeRoy 1989; and Cochrane 1991). In this study, the efficient market approach is followed.

A strand of empirical studies has sought to test the relevance of macroeconomic news for the stock price movements. Voluminous evidence (e.g., Pearce & Roley 1985; Hardouvelis 1987; Wasserfallen 1989; Bailey 1990; Aggarwal & Schirm 1992; Sadeghi 1992; Ajayi & Mehdian 1995; and Siklos & Anusiewicz 1998) shows that stock prices respond to economic news as predicted by the efficient market theory. However, only a small fraction of observed variations in equity returns can be explained by news (see Roll 1988 and Cutler, Poterba, and Summers 1989). The overall conclusion appears to be that monetary news (e.g., money supply or interest rate) affects stock returns while non-monetary news (e.g., industrial production or unemployment rate) has weaker effects.

Each of these studies implicitly assumes that the investor’s reactions to economy-wide news is constant over different stages of the business cycle, although a more realistic model allows the investor’s responses to news to vary depending on business conditions¹. It might be a reasonable assumption that a higher than expected industrial production during the depression is good news for the stock market since it might be a sign of the end of the depression. On the other hand, if the economy is booming, a positive “surprise” in industrial production is likely to be bad news for the stock market since it might result in fears of an overheating economy. This might possibly induce policy makers to increase interest rates. The implication of this potential asymmetry is straightforward: if the same

¹ For example, Fama and French (1989) and Jensen, Mercer, and Johnson (1996) argue that expected stock returns may vary depending on business conditions and monetary environment. Moreover, risk premium could also be time varying depending on whether the economy is in up or down states. This would be consistent with the idea of whether the income or substitution effect dominates in different states (see e.g., Abel 1988 and Löflund & Nummelin 1997).

type of news is considered good in some states and bad in others states, the estimated news effects in previous studies will be biased towards zero.

Few studies have sought to test for the asymmetry with respect to the level of the economic activity. For example, McQueen and Roley (1993) show that when the estimations are made conditional on the different stages of the business cycle, a stronger announcement effect between stock returns and economic news is evident. They found that higher than expected industrial production is good news for the stock market during a low state of economic activity, but bad news during a high state of economic activity. Similar asymmetry (with signs reversed) holds true for unemployment rate news as well. Furthermore, this business-condition asymmetry is mainly related to cash flow effect rather than a discount rate effect.

Orphanides (1992) finds also asymmetric responses to economic news despite using a different methodology. His results confirm the conventional view (the so-called overheating hypothesis) that an unexpected increase in unemployment is bad news for the stock market during recessions, but good news when the economy is overheated. Furthermore, in the Finnish stock market data, Löflund and Nummelin (1997) tested for the potential asymmetry in the link between stock prices and industrial production during different business conditions. According to their results, forecasted industrial production growth seems to affect Finnish stock returns differently depending on the level of the current industrial production. Specifically, higher conditional production growth increases expected stock returns only when the economy is weak.

The previous studies are almost exclusively concerned with the relation between the aggregate market and economic news, and very little is known about the cross-sectional variation in this relation across industry-sorted stocks. Specifically, some industries may be less affected by economy-wide changes that occur during different stages of the business cycle, while others may be more affected. For instance, export-oriented industries may be more affected in the price competitive position of the domestic economy than the financial sectors. Therefore, it is interesting to explore whether the industry-specific responses to economic news in up and down states differ from the aggregate market.

The purpose of this paper is to investigate whether the stock price reactions to economic news are different depending on business conditions. Previous studies from all share price index to stock price indexes for various industries are extended. Industry level

data is especially important in the Helsinki Stock Exchange since the aggregate market index can give biased results due to the fact that Nokia Corporation (a large telecommunications firm) dominates it. Stock returns may vary across industries based on the sensitivity of the industry to general macroeconomic conditions. Furthermore, publication lags in economic statistics and the latest time series available are used.

The results show that a stronger relationship between economic news and stock returns is evident when the market reactions are allowed to vary with business conditions. It is found that stock prices show asymmetric responses to industrial production, real money supply, and interest rate news in up and down states. A higher than expected industrial production and a real money supply is bad news for the stock market in the high state, but good news in the low state. The reverse holds true with interest rate news. Overall, the results are parallel to McQueen and Roley's (1993) study, showing that the Finnish stock market does not behave differently than its counterpart in the US despite the use of empirical expectation proxies and monthly observations.

The remainder of this paper is organized as follows: Section 2 outlines the theoretical background. In the next section, data and methods are described. In section 4, empirical results are reported, and in the last section, conclusions are drawn.

2. THEORETICAL BACKGROUND

Efficiency in the stock market is based on the assumption that economic agents form their expectations rationally, and that stock prices reflect all publicly available information instantaneously; that is, stock prices reflect their fundamental values (see Summers 1986). In an efficient and well-informed stock markets (under Fama's 1970 semi-strong form definition), prices should already embed (or "discount") the expected part of any movement in fundamental, and only the news or unexpected changes should have an effect on stock returns.

A common theoretical model that relates stock prices to information posits that stock prices equal the present value of rationally forecasted future cash flows discounted by expected risk-adjusted interest rates. Following McQueen and Roley's (1993) notations, this model can be illustrated

$$(1) \quad p_t = E \left[\sum_{j=1}^{\infty} \frac{D_{t+j}}{(1 + {}_t r_{t+j})} \mid \Omega_t \right],$$

where p_t is the price of the stock at time t , E represents the mathematical expectations conditional on information set Ω_t available to market participants at time t , D_{t+j} is the dividend paid at time $t+j$ and ${}_t r_{t+j}$ is the time varying risk-adjusted discount rate for dividends that occur at time $t+j$, determined in the market based on information known at time t .

According to model (1), news affects stock prices both through an impact on expected future cash flows and an impact on required rates of return used to discount these futures cash flows to the present values. However, we need not to expect that news will affect future cash flows and discount rates in the same way during different stages of the business cycle. For example, when the economy is contracting, a higher than expected industrial production could result in a larger increase in cash flows than discount rates (i.e., the possibility of time varying risk premium). This causes stock prices to increase because, in this case, there is no need for monetary tightening since the economy is operating below capacity.

Similar reasoning applies also to other news (see subsection 3.4). Therefore, the ultimate impact of news on stock prices depends on whether the “cash flow effect” or the “discount rate effect” dominates over different stages of the business cycle. In other words, in this paper, the assumption of constant size and sign responses is relaxed, and the responses are allowed to vary depending on business conditions.

3. DATA, METHODS AND HYPOTHESES

3.1. Statistical procedure

The theoretical framework discussed in the last section implies that unexpected changes in fundamentals are the relevant explanatory variables to be included in the empirical work. News in this context is taken to mean any new information that is of relevance to the stock prices that were unexpected in the previous period. One major obstacle in this field is our inability to measure accurately investors’ expectations. Studies conducted for

the US data benefit from the rich menu of available survey data to overcome obvious measurement problems in fundamentals. Specifically, regularly published survey data can be taken to measure expectations, so that direct measures of the news can be constructed. Such information does generally not exist in Finland. Therefore, a statistical procedure must be chosen to separate news from expected changes in an observed time series.

The empirical analysis is carried out in three stages. First, as in Cutler et al. (1989), Lahti and Pykkönen (1989), Orphanides (1992), and Viskari (1992), among others, a vector autoregression (VAR) model is used to generate the unexpected component of each macroeconomic variable. Second, following McQueen and Roley (1993), different levels of economic activity are separated depending on the growth of industrial production relative to its mean. Finally, monthly stock returns across industries are regressed on residuals from VARs in order to test for the possible asymmetric stock market responses in the high and low states of economic activity.

However, this statistical procedure might be problematic due to measurement problems concerning exactly how the different variables are measured, and how well news can be identified from expected changes in these fundamental economic indicators. Nevertheless, in this study it is assumed that investors respond to the measured news rather than the true news, implying that the original estimating equation should be specified in measured rather than the true values of the news. This eliminates the potential errors-in-variables problem. Furthermore, Pearce and Roley (1985) argue that survey data is more efficient (smaller root-mean-square error) than time-series models in generating expectations. Despite this “inefficiency”, McQueen and Roley (1993) show that the estimated news coefficients using VARs are consistent with the survey data.

3.2. Stock return and macroeconomic data

The data set consists of 102 monthly observations during the period of January 1987 to June 1995. Stock returns in real terms are measured as follows:

- 1) The differences in logarithms of the stock price indices (end-of-month values) measured by the HEX industry stock price indices² deflated by the consumer price index. The HEX industry indices are as follows: (1) banks and finance, (2) insurance and investment, (3) other services, (4) metal and engineering, (5) forest industries, (6) multi-business industry, and (7) other industries. R_{it} denotes industry stock returns at time t . In order to compare the industry-level results to aggregate market, we also include the HEX all share price index in this analysis. Source: The Helsinki Stock Exchange.

Without a precise economic theory which explains the link between the economic fundamental's and industry stock returns, the decision about which variables are to be included in information set is somewhat arbitrary. Since this paper deals with a small open economy, the following representative set of macroeconomic indicators is included to describe both real and financial conditions of the Finnish economy. In addition, professional investors closely watch these key economic variables:³

- 2) The logarithm of seasonally adjusted industrial production (ip). Source: Statistics Finland.
- 3) The logarithm of the nominal money supply deflated by the consumer price index ($m1$). Sources: The Bank of Finland and Statistics Finland.
- 4) Nominal short term interest rate measured by the three-month helibor rate (H3). Source: The Bank of Finland.
- 5) The logarithm of the consumer price index (p). Source: Statistics Finland.
- 6) The logarithm of the real exchange rate calculated by the Bank of Finland (s). Source: The Bank of Finland.

² See Hernesniemi (1990) for details in HEX industry price indices (without dividends). Of course, a more appropriate means of measuring stock returns would have been to use Hex yield indices since these capture both capital gains and dividends, but these HEX yield indices are not available prior to 1991. Furthermore, as will be shown later (see footnote 11), the results were close to those including dividends. This is expected since for the early 1990s, the average dividend yield has been relatively low (i.e., some 1 – 2 percent). In addition, the movements of price and yield indices are strongly correlated (correlation is 0.986) over the period 1987:09 – 1995:06. Therefore, price indices are good proxies for yield indices for the chosen sample.

³ Since this paper deals with industry-level data, some industry-specific news should not be forgotten, but these issues shall be dealt at the future stages of this research.

Real exchange rate is a nominal trade-weighted exchange rate deflated by the foreign and domestic consumer prices. Real exchange rate is measured as the number of domestic currency needed to buy one unit of foreign currency at time t . Defined in this way; an increase (decrease) in real exchange rate denotes depreciation (appreciation).

3.3. The estimated models

To isolate the news component from expected changes of these five macroeconomic series, an unconstrained p dimensional VAR(p) system in levels is fitted to the data⁴

$$(2) \quad \mathbf{x}_t = A_1\mathbf{x}_{t-1} + A_2\mathbf{x}_{t-2} + \dots + A_p\mathbf{x}_{t-p} + \boldsymbol{\mu} + \mathbf{e}_t,$$

where A is a (5x5) matrix of coefficients, \mathbf{x}_t is a (5x1) column vector of macroeconomic variables $\mathbf{x}_t = (ip_{t-2}, m1_{t-1}, H3_t, p_{t-1}, s_{t-1})'$, $\boldsymbol{\mu}$ is (5 x 1) column vector of constants, \mathbf{e}_t is a (5x1) column vector of error terms $\mathbf{e}_t = (e_t^{ip}, e_t^{m1}, e_t^{H3}, e_t^p, e_t^s)'$ and $\mathbf{e}_t \sim \text{i.i.d}(0, \sigma^2)$. The lag length of VARs, based on sequential LM tests, was chosen to be six⁵ in this study.

Because of lags in the publication of economic statistics, the values for industrial production in period t were assumed to be the published values for month $t - 2$. In addition, the values for the consumer price index, the real money supply, and the real exchange rate in period t were assumed to be the published values for month $t - 1$. Therefore, the first eight observations of each series were lost because of lags in the VAR model (2) and delays in the publication of certain monthly series⁶. This VAR model

⁴ Before estimating the VAR model, it is important to difference the individual series the correct number of times to obtain stationary variables. According to Augmented Dickey and Fuller (ADF) tests, the null hypothesis of a unit root in first differences is rejected for all variables (not shown), and all series achieve stationary after differencing them once. The possibility of cointegration within the framework established by Johansen (1988) is also tested. Likelihood Ratio tests suggests that there may be as many as 2 – 4 cointegrating vectors presence in the data (not shown) at the 5 percent level. Therefore, the VAR in first differences would be misspecified since it removes the long-run information contained in the levels of the variables. Following Apergis and Eleftheriou (1997) the implication of the cointegration tests is that the VAR model is estimated in levels since the linear combinations of the non-stationary $I(1)$ variables are stationary $I(0)$ variables, which are suitable for the statistical analysis in the second stage regressions.

⁵ For shorter lag lengths, the residuals turned out to be serially correlated. This violates our assumption of news being white noise (i.e., news $\hat{\mathbf{e}}_t$ represents white noise if $E(\hat{\mathbf{e}}_t) = 0$ and $E(\hat{\mathbf{e}}_t \hat{\mathbf{e}}_{t-j}) = 0$ for $j \neq 0$). Furthermore, examination of the off-diagonal elements of the variance-covariance matrix of the residuals revealed them to be very close to zero (not shown). Only two cross-correlation coefficient out of ten turn out to be significant at the 5 percent level. Therefore, the multicollinearity is not a severe problem, either.

⁶ However, if the publication lags are ignored, then the residuals $\hat{\mathbf{e}}_t$ are improper estimates of news since the VAR model utilizes information that is not yet available to the market participants.

relates to the current value of each series to the lagged values of the series itself and to those of the other four series. The VAR model is estimated equation-by-equation by using ordinary least squares (OLS) method. The residuals $\hat{\mathbf{e}}_t$ from Equation (2) are treated as unexpected changes and used as independent variables in the second stage regressions.

The empirical analysis is carried out by first testing the impact of economic news on industry portfolios without conditioning on the state of the economy. To contrast results from the business condition model with those from the traditional model, a benchmark model is required. As a starting point, a simple linear regression model is used where news and possibly some later-defined exogenous variables are added. The benchmark model used to test the effects of news on industry stock returns without conditioning the state of the economy is as follows:

$$(3) \quad R_{it} = a_i + \hat{\mathbf{e}}_t \mathbf{b}_i + \mathbf{d}_i + u_{it},$$

where R_{it} , ($i = 1, \dots, 7$), is the real return of the industry i from month $t - 1$ to month t , a_i is the mean return for industry i , $\hat{\mathbf{e}}_t$ is a (1×5) vector of economic news calculated as the residuals from the VAR(6) model, \mathbf{b}_i is a (5×1) vector of unknown regression coefficients measuring the effects of news on industry stock returns, \mathbf{d}_i is a vector of dummy variables,⁷ and u_{it} are industry-specific error terms, which are assumed to be independently and identically distributed with zero mean and constant variance. This model specification is widely used in previous empirical studies (see e.g., Siklos & Anusiewicz 1998).

In order to test the main hypothesis that stock price responses to macroeconomic news vary over business conditions, some kind of classification of different levels of economic activity must be done. Following McQueen and Roley (1993), the level of seasonally adjusted monthly industrial production (1990 = 100) index relative to trend to define three discrete economic states is used. The classification of economic states is as follows: First, the logarithm of seasonally adjusted industrial production (ip) on a constant and a time trend from September 1987 to June 1995 is regressed

⁷ Vector of dummies consists of 11 monthly seasonal dummies, a time trend, and a "crash" dummy ($D87 = 1$ if $t = 1987:10$ and otherwise zero), which captures the impact of the October 1987 stock market crash. Furthermore, dummy vector includes an exchange rate dummy ($D92 = 1$ if $t = 1992:09 - 1995:06$ and otherwise zero) to account for the change in exchange rate regime from fixed to floating exchange rate. Finally, a dummy ($D929 = 1$ if $t = 1992:09$ and otherwise zero) is included to account for floating decision.

$$(4) \quad ip = constant + time\ trend + \eta.$$

Second, in order to create upper and lower bounds in economic activity, a constant from a time trend is added and subtracted⁸. The constant is chosen in such a way that about 25 percent of the actual values of the logarithm of industrial production are above and below the created upper and lower bounds, respectively. The classification of economic states is presented in Figure 1. The economic activity is denoted as “*HIGH*” and “*LOW*” when the logarithm of observed industrial production is above the upper bound and below the lower bound, respectively. The remaining 50 percent of observations between the upper and lower bounds represent the “*MEDIUM*” economic activity.

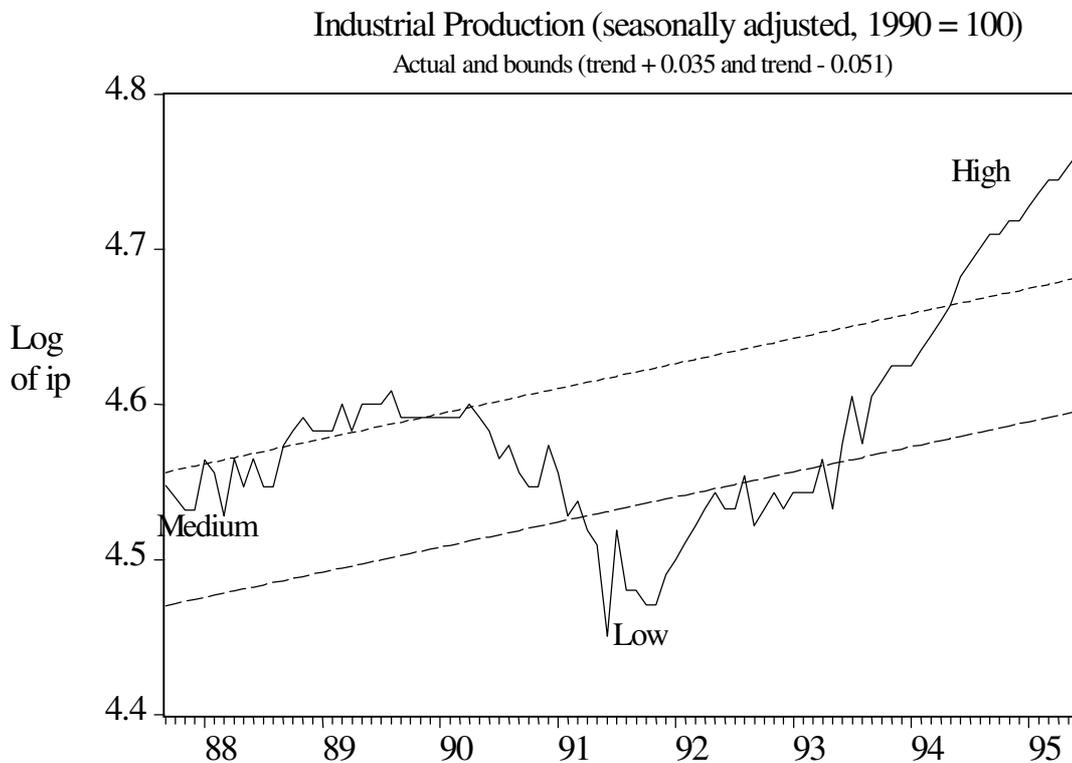


FIGURE 1. The Classification of Economic States

Equation (2) is unnecessarily restrictive since it assumes that the response of stock prices to news are constant (size and sign) and independent of business conditions. However, if

⁸ The bounds for the industrial production are not constructed symmetrically. Instead, the deviations from the trend industrial production are + 0.035 and - 0.051. This classification puts about 26 percent of the observations in the high state and about 25 percent in the low state.

the responses are different depending on the level of the economic activity, then accounting for these asymmetric responses should improve the estimates of news effects on stock returns. In order to test whether the industry portfolio responses to macroeconomic news vary across business conditions, the following linear model specification is used:

$$(5) \quad R_{it} = a_i + HIGH_t \cdot \hat{\mathbf{e}}_i \mathbf{b}_i^H + MEDIUM_t \cdot \hat{\mathbf{e}}_i \mathbf{b}_i^M + LOW_t \cdot \hat{\mathbf{e}}_i \mathbf{b}_i^L + \mathbf{d}_i + u_{it}$$

where $HIGH_t = 1$ if economic activity is in the high state at time t , and otherwise zero, $MEDIUM_t = 1$ if economic activity is in the medium state, and otherwise zero, and $LOW_t = 1$ if economic activity is in the low state, and otherwise zero. The other variables are defined as in the basic model (3).

3.4. Mapping from news to stock prices and statistical tests

Following the studies by Pearce and Roley (1985), McQueen and Roley (1993), and Amihud (1996), a negative relationship between the unexpected inflation and stock returns is expected. This is surprising since according to the Fisherian view, stock returns should provide a hedge against expected inflation. One channel by which inflation news may have a negative impact on stock prices occurs if investors believe that monetary authority reacts to unexpected inflation by monetary tightening. Given that inflation is negatively related to future economic activity, a higher (lower) than expected inflation may lead to decrease (increase) in stock prices (see e.g., Boudough, Richardson, and Whitelaw 1994). This negative relation applies to all economic states since the central bank is assumed to conduct monetary policy that aims for a low inflation in all states of the economic activity.

It is also expected to see a negative relationship between the interest rate news and stock returns (see e.g., Chen, Mohan, and Steiner 1999). Higher interest rates mean lower present value of equity prices. A higher interest rate *ceteris paribus* makes the rate of return on debt instruments relatively more attractive compared with stocks to the investors. In the low state, higher than expected interest rates is more bad news (i.e., negative) since at the same time, cash flows are also diminishing. However, in the high

state, the effect is smaller or even positive if investors consider that the monetary authority responds in time to economic prospects to avoid overheating economy in the future. McQueen and Roley (1993) find that in the high state, higher than expected Federal Reserve discount rate have a positive, although statistically insignificant, impact on stock returns.

Weaker than expected real exchange rate is positive news for the stock market since it improves the price competitiveness of domestic industries by making their products cheaper to foreigners (see Chow, Lee, and Solt 1997). This increases firms' profits and the value of their shares. However, in the high state, weaker than expected currency is negative news since the monetary authority may raise interest rates to avoid inflation due to the foreign commodity and product markets. Instead, in the low state, it is expected that this piece of news would be positive news since the probability that the central bank increase its tender rate is smaller. Namely, if the expected cash flow dominates the expected discount rate effect, the response coefficients might even change into positive.

Several studies (see e.g., Pearce & Roley 1985, Hardouvelis 1987, Prag 1994, and Siklos & Anusiewicz 1998) have examined the impact of the money stock news on security returns. The consensus findings are that unexpectedly high money growth is associated with higher interest rates and lower stock prices. One interpretation of this result is that investors may expect that the monetary authority will react to a higher than expected money growth by quickly moving to a more restrictive monetary policy. However, in the high state, it is expected that unexpectedly high money growth depress stock returns even more due to increase inflation expectations. In the low state, the liquidity effect dominates the expected real interest rate and the expected inflation hypotheses (detailed discussion can be found in, e.g., Cornell 1983). Therefore, the effect is smaller and if the liquidity effect is strong enough, the price response to money supply news could result in opposite sign⁹.

Finally, higher than expected real activity is good news for the stock market since it may increase investors' expectations of future growth and expected future profits of firms. Good news about the economy in the low state should make equity investments more attractive and thus increase share prices even more since it might be a sign of the

⁹ In the Finnish data, the empirical evidence is mixed, however. Lahti and Pylkkönen (1989) report a negative relationship between unexpected real money supply and stock prices while Viskari (1992) finds a positive relation between these variables. However, both of these studies ignore publication lags in economic statistics, which, in fact, have an effect on the results (see Järvinen 1997).

end of a depression. On the other hand, when the economy is in the high state, output surprises may cause investors to forecast more restrictive monetary policy in the future if such surprises are correlated with future inflation or money growth. Therefore, the likely impact of real activity surprises on stock prices at the high state is smaller or even negative. McQueen and Roley (1993) provide evidence for these asymmetric stock price responses to real activity news.

In order to summarize the mapping from news about the economy to industry portfolios, the expected signs concerning the stock price responses to news conditional on the state of the economy are presented in Table 1. Furthermore, due to possibly time varying risk premium, the response coefficients could be lower in some states and higher in other states depending on whether the cash flow or discount rate effect dominates.

TABLE 1. The Expected Signs of the Response Coefficients

Business conditions	News Variables				
	ip^u	$m1^u$	$H3^u$	p^u	s^u
High	<i>lower</i>	<i>higher</i>	<i>lower</i>	<i>higher</i>	<i>lower</i>
Medium	(+)	(-)	(-)	(-)	(+)
Low	<i>higher</i>	<i>lower</i>	<i>higher</i>	<i>lower</i>	<i>higher</i>

Notes: The news variables are industrial production (ip^u), real money supply ($m1^u$), three-month helibor rate ($H3^u$), consumer prices index (p^u), and real exchange rate (s^u). In the medium state, plus (+) and minus (-) signs denote positive and negative news for the stock returns, respectively. *Higher* and *lower* denote the magnitude of the response coefficients in up and down states compared to medium state.

Finally, the statistical significance of individual coefficients is examined by t -tests. The significance of various subsets of coefficients is also examined by using F -tests of coefficient restrictions. H_1 tests the hypothesis that news jointly has no impact on stock returns across industries. H_2 and H_3 test the significance of the news related to monetary policy and the other three news coefficients as a group, respectively.

Also tested was whether the news coefficients in the low and in the high state are the same. H_4 tests whether news jointly has a similar impact on industry portfolios both in the high and in the low state of the economy. Hypotheses from H_5 to H_9 test one by one

whether the response coefficients in the low state are significantly different from the same coefficients in the high state.

4. ESTIMATION RESULTS

4.1. The response of stock prices to economic news: unconditional results

First, Equation (3) is estimated separately for each industry and the HEX all share price index without considering any business conditions. Following Pagan (1984), OLS results in consistent parameter estimates and standard errors of the response coefficients only when contemporaneous residuals are present in the second stage estimations. Due to the usual serial correlation of stock returns, a systematic pattern in residuals is seen because if returns are serially correlated, then Equation (3) would exhibit serially correlated residuals.¹⁰ Furthermore, heteroscedasticity (see e.g., Schwert 1989) might also be present in residuals. These problems can be corrected via the Newey and West (1987) procedure to obtain correct standard errors and test statistics.

The estimation results of the Equation (3) are reported in Appendix 1. These results show that the data supports the efficient-market theory that stock returns respond to economic news¹¹. The data rejects the hypothesis (H_1) that news jointly has no impact on stock returns at less than at the 5 percent level on every industry, excluding insurance and investment and forest industries. Furthermore, the hypothesis (H_2) that news related to monetary policy (i.e., real money supply and interest rate) has no impact on stock returns

¹⁰ See Amihud and Mendelson (1989) for an analysis of serial correlation in stock index returns. In the Finnish data, for example, Vaihekoski (1999) reported serial correlation in monthly returns. In principle, there are two ways to deal with this problem: include lagged return(s) or use the Newey and West (1987) method. When taking a closer look at the serial correlation in returns, it turns out that the serial correlation diminished in the floating exchange rate period. This might be considered as an increased liquidity, which cause smaller problems with infrequent trading.

¹¹ To check the possible bias that excluding dividends would produce, the regression model (3) is estimated by using dividend adjusted monthly aggregate returns as a dependent variable (calculated by using the WI-index (87 – 90) and HEX yield-index (91 – 95)). For further details, see Berglund et al. (1983) and Hernesniemi (1990). The results are

$$R_t = 0.386 ip^u - 0.569 m1^u - 0.023 H3^u + 0.359 p^u + 0.633 s^u \quad R^2C = 0.086 \quad DW = 1.742$$

(1.229) (-1.568) (-2.108) (0.155) (1.562) (.) = t-values

The results (a constant and dummies are not reported) are close to those without dividends. Therefore, it can be argued that excluding dividends would not bias our results, at least in the chosen sample period.

is rejected at the 10 percent level in all industries, but forest industries and in the multi-business industry. On the other hand, the hypothesis (H_3) that the other news jointly has no impact on stock returns is rejected at the 10 percent level only in the multi-business industry and other industries¹².

The explanatory power (without dummies) of economic news is rather low: news explains only some 8 percent of the aggregate stock return variation¹³. This finding is in line with previous studies conducted on the Finnish stock market (see e.g., Lahti & Pylkkönen 1989 and Viskari 1992). Across industries, the explanatory power varies between zero to 16 percent. Most of the statistically significant response coefficients affect industry stock returns with their predicted signs. For example, an unexpected one-percentage point increase in interest rate lowers share prices for most industries by 2.9 - 6.1 percent, the financial sectors being the most interest rate sensitive.

A real exchange rate has significant impact on banks and finance, multi-business, and the all share price index. An unexpected one percent depreciation increases share prices for these stocks by 0.8 - 1.5 percent. Furthermore, higher than expected depreciation is negative news for domestic-oriented industries. In addition, an unexpected one percent increase in the real money supply decreases stock returns in the financial sectors by 0.7 percent. Higher than expected industrial production increases stock returns in the metal and engineering and other industries also by 0.7 percent. News about price levels appears to have less significant effect on stock returns, and the positive values of response coefficients are in contrast with prior expectations, although the large standard errors also permit a wide range of negative values¹⁴.

¹² This paper also tests whether the stock returns respond to past information. Adding news lagged by one month into the model (3) produced only a few significant coefficients for some industries (not reported). This might be a sign of inefficiency due to the slow dissemination of information. However, it also might be a consequence of the estimation problems or timing issues associated with the release of new information and the reflection of the information into the variables in question. Moreover, the coefficients for contemporaneous news coefficients remained practically unchanged in magnitude, although the t -values became systematically lower. It is also tested whether the lagged news jointly has significant impacts on stock returns (hypothesis H_1). This hypothesis can be rejected at the 1- percent level only in insurance and investment, while the hypothesis H_2 and H_3 cannot be rejected at conventional levels for any industries.

¹³ When referring to adjusted coefficient of determination, the R^2 -measures without the dummies are meant (denoted in brackets). This makes it possible to compare the results with the previous studies.

¹⁴ It should be noted that the results with respect to price level news were sensitive to the inclusion of $D929$ -dummy (September 1992). Without it, price level news has negative (insignificant) impact on stock returns.

4.2. *The response of stock prices to economic news: conditional results*

The results in Appendix 1 are based on the implicit assumption that the response of stock prices to economic news is symmetric irrespective of business conditions. In this subsection, this assumption is relaxed. It is important to investigate further how robust or sensitive the unconditional results are by considering the responses conditional on the level of economic activity^{15,16}. Again, the Newey and West (1987) estimator of the covariance matrix is employed to obtain correct standard errors and test statistics.

We begin with the summary of the signs of the response coefficients as well as their statistical significance (as reported in Appendix 2). From a quick glance of Appendix 2, the results support the hypothesis of asymmetric reaction depending on the business conditions. For example, at the aggregate market level, the asymmetry with respect to industrial production and real money supply is as severe as it results in opposite signs for the slope coefficients in up and down states. Across industries, similar sign reversals can also be found with the rest of the news, but overall, this business conditions asymmetry is mainly related to industrial production, real money supply, and interest rate news.

The detailed results from Equation (5) are reported in Appendix 3. In contrast to Appendix 1, there is now a stronger relationship between news and industry portfolios since the adjusted coefficients of determination are systematically higher than those in the unconditional model (3) ignoring potential business cycle asymmetries. For example, news jointly explains now about 11.5 percent of the aggregate market variation, and across industries, the R^2 C-measures vary from 2.9 to 13.6 percent. Furthermore, when the

¹⁵ The results are based on the assumption of i.i.d. residuals. According to diagnostic tests, residuals are not serially correlated in most industries, and the second-order ARCH effect is clearly observed only in banks and finance (these results are not reported here, but may be obtained from the author upon request). Still, although some minor residual problems are detected, the standard errors and test statistics across industries are based on the Newey and West (1987) procedure. Furthermore, residuals from almost every industry pass the Jarque-Bera normality-test. Specifically, only metal and engineering industry exhibits non-normal residuals. However, decomposition of the statistic into tests using separate measures of skewness and kurtosis shows that deviation from normality is due to asymmetric distribution, which is probably more serious than excess kurtosis (too many large residuals).

¹⁶ The structural stability of the models is also examined (not shown). CUSUM tests suggest that there has occurred at least one structural break, which is located in September 1992. CHOW tests confirmed that this break was significant at the 5 percent levels in every industry, except metal and engineering and forest industry. There are also some problems with the model misspecification with some industries. In total, while there are some signs of deviations from OLS-assumptions, the diagnostics are interpreted (after correction) as suggesting that our models across industries have statistical properties that are passable.

estimations are made conditional on the level of the economic activity, stock returns respond significantly to a larger set of economic news¹⁷.

When considering individual coefficients, good news about the economic activity in the high state is bad news for the stock market. When the economic activity is low; good news about the economy is also generally good news for the stock returns, although the response coefficients fail to reach any significance at conventional significance levels. Furthermore, a higher than expected real money supply in the high state is negative news for the stock returns, but it changes into positive news for most of the cases when the economic activity is low. In the medium state, a higher than expected real money supply causes stock prices for most industries to decrease by 0.4 - 1.2 percent and metal and engineering and multi-business industry respond to real money supply news more than the market.

An interesting result is the positive relationship between stock returns and higher than expected interest rates in the high states, although this relationship is not significant. Furthermore, the negative impact is even stronger when the state is low compared with results when the state is medium. In the low state, a higher than expected interest rate decreases shares prices across all industries but financial sectors at the 10 percent levels by 5.1 - 9.8 percent. Among all industries, financial sectors show the strongest reaction to interest rate news in the medium state.

The inflation news has a negative impact on stocks in the high and in the low state for most cases, although these estimates are not significant. In addition, inflation news decreases stock returns more in the low state than in the high state. For example, higher than expected inflation decreases stock returns for the multi-business industry by 10 percent in the high state as compared to the low state, where the same kind of news decreases stock returns twice as much. Overall, inflation news produces mixed results in the medium state. Real exchange rate news has a negative impact on share prices for about half of the cases when the state is low or high. Nevertheless, the same kind of news is good for the stock market in the medium state. None of the response coefficients reaches significance at conventional levels.

¹⁷ An interesting observation is that average returns in most industries increase when business conditions improve from low to normal. The same results hold also when business conditions become weaker from high to normal. However, when business conditions improve from normal to high, average returns decrease six industries out of seven. Therefore, it appears that the "best time" to buy equities is when the level of economic activity is revised up in a weak economy, or when the level of economic activity is revised down in an already strong economy. This finding is in line with the results by Löflund and Nummelin (1997).

Finally, the joint hypothesis of the business cycle asymmetry is tested. First, the hypothesis that all response coefficients in the high and in the low state are the same (H_4) can be rejected less than 10 percent levels only in other services and metal and engineering, among all industries. Second, when testing whether the individual coefficients in the high and low states are the same ($H_5 - H_9$), the null can be rejected at the 10 percent levels all but inflation and real exchange rate news for some industries¹⁸.

5. CONCLUSIONS

The purpose of this paper was to investigate whether the stock price reactions to fundamental macroeconomic news depend upon business conditions. It is found that the reactions are not constant, but vary with the state of the economy. In particular, higher than expected industrial production or real money supply when the economy is already strong results in lower stock prices, whereas the same surprise in a weak economy is associated with higher prices. For interest rate news, the signs are reversed. Overall, these results suggest that previous estimates obtained without any allowances for business cycle effects be biased towards zero partly for this reason, contributing to the insignificant responses estimated in earlier studies.

Without conditioning on the state of the economy, the statistically significant response coefficients affect stock returns mainly with their predicted signs. Consistent with the

¹⁸ This paper also investigates how sensitive or robust the reported results are by considering alternative ways to produce market expectations, news, and economic states. First, news is generated by using ARIMA-models, but the results were in line with the reported results, although the test statistics were systematically lower. News is also generated with residuals from the VAR in first differences and error correction form, which produces somewhat higher test statistics in the second stage of the regressions.

Second, several alternative lag structures in the VAR-model is tried, and it appears that the fewer lags are included in the VAR model the stronger the asymmetry especially with respect to industrial production (H_5). When considering alternative width of the bounds around the fitted trend used to define business conditions, the changes concern mainly industrial production news. These results suggest that the more observations are classified in normal state the stronger the data rejects the hypothesis (H_5).

Third, seasonally adjusted unemployment rate is used to classify economic states. The results support the hypothesis of asymmetric responses with respect to industrial production news in up and down states, although the evidence is now weaker. Furthermore, economic states were also classified by using the graph of the general stock market index (see e.g., Borio and McCauley, 1996, 94 – 95) into bull and bear markets. The effects of industrial production and real money supply news change signs in bull market, but in total, the results are difficult to summarize here.

Finally, the economic states were classified by using survey data on firms expectations of future business conditions. The results with this ex ante criteria produce similar results as classification with bull and bear market conditions. Therefore, future studies might focus on investigating the news effects using ex ante criteria instead of ex post classification scheme.

evidence of Pearce and Roley (1985), stock returns respond primarily to monetary news while responses to non-monetary news is weaker. Across industries, parallel to Hardouvelis (1987) among others, the financial sectors show the strongest reactions to interest rate news, apparently because monetary development directly affects the cash flows of financial companies. Moreover, stocks for domestic-oriented sectors respond to news about the domestic fundamentals stronger when compared to stocks for export-oriented sectors, whose prices might instead reflect global business conditions or changes in economic growth in export markets. Surprisingly, metal and engineering and forest industries show no response to the real exchange rate.

When the estimations are conducted conditional on the level of the economic activity, stock returns respond to a larger set of news, and a stronger relationship between news and stock price changes is evident. According to the results, several asymmetric response coefficients were found. The different response coefficients in up and down states could well be due to changes in risk premium in up and down states. For example, good news about the economic activity when the economy is booming is bad news for the stock market. On the other hand, when the economy is in a recession, good news about the economy is generally good news for the stock market. This implies that the cash flow (discount rate) effect is more likely to dominate in down (up) states.

Similarly, a higher than expected real money supply in the high state is negative news for the stocks while in the low state, the same piece of news is positive news for the stock market. The response of stock prices to real money supply news in low state is dissimilar to what the other researchers have found in US data. Therefore, it seems that in recessions the liquidity effect dominates the expected real interest rate and the expected inflation hypotheses (discussed in Cornell 1983). Moreover, when considering the magnitudes of the parameter estimates, stock prices fall most when the business conditions are normal indicating that market's expectations of inflation and fear of monetary tightening influence stocks stronger in the normal states than other states.

Another interesting observation is the positive (although statistically insignificant) relation between stock returns and higher than expected interest rate in the high states. This finding is parallel to McQueen and Roley's (1993) result in US data. Interestingly, the results show that the negative relationship between interest rate news and stock prices is stronger when the state is low. In other words, the weaker the business conditions the more stocks decrease after unanticipated increase in interest rates. This implies that as the

business conditions become stronger, agents might put more weight on improved future cash flows expectations than return requirements. Finally, the results support the common finding that financial companies are the most interest rate sensitive, but this conclusion is valid only in normal state.

As also noted in Cutler et al. (1989), the use of estimated VAR residuals, as proxies for news might be problematic for several reasons. First, if the VARs are misspecified, residuals do not accurately reflect the value of news to agents. If market participants operate with an information set larger than the one we have considered here, residuals may overstate the importance of news. Second, VAR does not capture new information about future macroeconomic conditions, revealed in period t but is not directly reflected in that period variable. According to Fama (1990), stock price changes may largely reflect changes in expectations about future movements in macroeconomic fundamentals, which may not always be reflected in news about their current values. Third, there are some timing issues associated with the release of new information about fundamentals and the reflection of the information into the variables in question.

Overall, the results presented in this paper suggest that monetary news have the main effect on stock prices. These results are parallel to McQueen and Roleys (1993) study and based on these results, Finnish stock markets do not behave differently than their counterparts in the US despite the use of empirical expectation proxies and monthly data. It appears that mainly domestic-oriented industries respond monetary news stronger than industrial industries. This might indicate that export-oriented industrial industries respond to news about the export market and international business conditions. Future research might focus on studying the response of export industries to global economic news for example, concerning monetary policy conducted by the Federal Reserve or to study the effects of unexpected changes in US future economic activities.

Another topic for the future research would be to use different econometric methodology. For example, the expectations generating process might be improved into a direction that is more realistic by using recursive least square estimation method when producing news. This statistical procedure allows economic agents to update their expectations continuously when new information becomes available. Furthermore, due to possible cointegration properties of macroeconomic data, vector error-correction (VEC) models could also be used as a description of news generating process. In such a

modeling strategy, both short-term expectations (differences) as well as revisions in expectations (error-correction term) could be modeled at one pass.

Finally, business conditions could be alternatively classified in up and down states by using Smooth Transition Regression (STR) models, or alternatively by using some ex ante measures (e.g. consumer confidence index) as a criterion for classification. This could give us valuable information about how stocks in the Helsinki Stock Exchange are priced with respect to macroeconomic information during different states.

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APPENDIX 1. The response of industry portfolios to macroeconomic news (1987:09 - 1995:06, $n = 94$)

Model (3): $R_{it} = a_i + \hat{\mathbf{e}}_i \mathbf{b}_i + \mathbf{d}_i + u_{it}$										
Industry portfolios	ip^u	$m1^u$	H3 ^u	p^u	s^u	R ² C	SEE / DW	$H_1: \mathbf{b}_i = 0$	$H_2: \mathbf{b}_i = 0$	$H_3: \mathbf{b}_i = 0$
Banks and finance	-0.223 (-0.446)	-0.723* (-1.948)	-0.042** (-2.324)	-1.551 (-0.534)	1.351* (1.729)	0.376 {0.151}	0.087 1.99	3.67*** [0.005]	4.35** [0.016]	1.29 [0.286]
Insurance and investments	0.478 (0.776)	-0.680* (-1.850)	-0.061** (-2.285)	-1.204 (-0.346)	0.194 (0.284)	0.344 {0.160}	0.082 1.99	1.82 [0.120]	3.61** [0.032]	0.36 [0.785]
Other services	0.538 (1.317)	-0.289 (-0.939)	-0.035*** (-3.368)	3.545 (1.520)	-0.359 (-0.741)	0.352 {0.070}	0.057 1.88	5.14*** [0.000]	6.28*** [0.003]	1.11 [0.350]
Metal and engineering	0.676* (1.677)	-0.701 (-1.373)	-0.029* (-1.687)	-0.154 (-0.053)	0.047 (0.077)	0.125 {0.007}	0.075 1.96	2.50** [0.038]	2.84* [0.065]	1.00 [0.398]
Forest industries	0.429 (0.995)	-0.406 (-0.800)	-0.014 (-0.882)	1.463 (0.459)	0.562 (0.767)	0.139 {0.000}	0.077 1.86	1.41 [0.232]	1.01 [0.368]	0.56 [0.643]
Multi-business industry	0.538 (1.150)	-0.863 (-1.458)	-0.019 (-0.983)	0.271 (0.082)	1.450*** (2.845)	0.346 {0.090}	0.076 1.73	5.01*** [0.001]	1.87 [0.162]	4.00** [0.011]
Other industries	0.763** (2.596)	-0.335 (-1.135)	-0.039*** (-3.079)	0.087 (0.034)	-0.064 (-0.134)	0.326 {0.090}	0.055 2.10	4.85*** [0.001]	4.74** [0.012]	2.38* [0.076]
HEX all share index	0.410 (1.217)	-0.635 (-1.606)	-0.023* (-1.722)	0.018 (0.007)	0.778* (1.780)	0.381 {0.082}	0.058 1.74	4.31*** [0.002]	2.99* [0.057]	2.00 [0.121]

Notes: News variables are the industrial production (ip^u), the real money supply ($m1^u$), the three-month helibor rate (H3^u), the consumer price index (p^u), the real exchange rate (s^u), and are proxied by the VAR(6) residuals. T-statistics are in a parenthesis, and are corrected for heteroscedasticity and autocorrelation by using the Newey-West (1987) procedure. R²C is the coefficient of determination adjusted for degrees of the freedom. Round brackets denote R²C measures estimated without dummies (i.e., $\mathbf{d}_i = 0$). H_1 is the null hypothesis that all news coefficients are jointly zero; H_2 is similar for $m1^u$ and H3^u; and H_3 is similar for the other three coefficients. Numbers in square brackets are p -values. *, ** and *** denotes significance at the 10 %, 5%, and 1% level, respectively.

APPENDIX 2. Summary of the signs of the response coefficients and their statistical significances

Industry		ip^u	$m1^u$	$H3^u$	p^u	s^u
Banks and finance	<i>H</i>	-	-**	+	-	+
	<i>M</i>	-	-	-	-	+
	<i>L</i>	-	-	-	-	+
Insurance and inv.	<i>H</i>	-	-	-	-	-
	<i>M</i>	+	-*	-	+	-
	<i>L</i>	-	-	-	-*	+
Other services	<i>H</i>	-***	-	+	+	-
	<i>M</i>	+*	-*	-*	+*	+
	<i>L</i>	+	+	-***	-	-
Metal and engin.	<i>H</i>	-*	-	+	-	-
	<i>M</i>	+	-***	-	+	+
	<i>L</i>	+	+**	-***	-*	-
Forest industries	<i>H</i>	-**	+	+	-	-
	<i>M</i>	+	-***	-	+	+
	<i>L</i>	+	+**	-*	-	-
Multi-business ind.	<i>H</i>	-	-	-	-*	+
	<i>M</i>	+	-***	-	+	+
	<i>L</i>	-	+	-**	-*	+
Other industries	<i>H</i>	+	-	-	-	+
	<i>M</i>	+*	-	-*	+	+
	<i>L</i>	+	-	-*	-	-
HEX all share index	<i>H</i>	-	-	-	-	+
	<i>M</i>	+	-***	-	+	+
	<i>L</i>	+	+	-**	-	+

Notes: News variables are: the industrial production (ip^u), the real money supply ($m1^u$), the three-month Helibor rate ($H3^u$), the price level (p^u), and the real exchange rate (s^u). *H*, *M* and *L* denote high, medium, and low state of economic activity, respectively. Plus and minus signs denote relationship between stock prices and macroeconomic news. *, **, *** denote significance at the 10 %, 5 % or 1 % level, respectively.

APPENDIX 3. The Response of industry portfolios to macroeconomic news during different states of the economy, (1987:09 - 1995:06)

Model (5): $R_{it} = a_i + HIGH_t \cdot \hat{\mathbf{e}}_t \mathbf{b}_i^H + MEDIUM_t \cdot \hat{\mathbf{e}}_t \mathbf{b}_i^M + LOW_t \cdot \hat{\mathbf{e}}_t \mathbf{b}_i^L + \mathbf{d}_i + u_{it}$

Industry		ip^u	$m1^u$	$H3^u$	p^u	s^u	R^2C	Null hypothesis	F -statistics [p -value]	
Banks and finance	<i>HIGH</i>	-0.371 (-0.306)	-0.174 (-0.106)	0.020 (0.336)	-4.324 (-0.693)	0.484 (0.360)	0.303 [0.091]	$H_4: \mathbf{b}^H = \mathbf{b}^L$ for all news $H_5: \mathbf{b}^H = \mathbf{b}^L$ for ip^u	0.58 0.08	[0.715] [0.784]
	<i>MEDIUM</i>	-0.080 (-0.092)	-0.888** (-2.118)	-0.051 (-1.631)	-1.815 (-0.389)	1.033 (0.566)		$H_6: \mathbf{b}^H = \mathbf{b}^L$ for $m1^u$ $H_7: \mathbf{b}^H = \mathbf{b}^L$ for $H3^u$	0.03 0.84	[0.868] [0.363]
	<i>LOW</i>	-0.883 (-0.700)	-0.498 (-0.535)	-0.056 (-1.103)	-4.681 (-0.288)	1.275 (0.670)		$H_8: \mathbf{b}^H = \mathbf{b}^L$ for p^u $H_9: \mathbf{b}^H = \mathbf{b}^L$ for s^u	0.00 0.11	[0.983] [0.738]
Insurance and investment	<i>HIGH</i>	-1.113 (-0.737)	-0.803 (-0.506)	-0.033 (-0.620)	-5.203 (-0.654)	-0.746 (-0.405)	0.276 [0.133]	$H_4: \mathbf{b}^H = \mathbf{b}^L$ for all news $H_5: \mathbf{b}^H = \mathbf{b}^L$ for ip^u	0.67 0.18	[0.646] [0.675]
	<i>MEDIUM</i>	0.849 (1.099)	-0.659* (-1.679)	-0.060 (-1.382)	0.562 (0.103)	-0.366 (-0.257)		$H_6: \mathbf{b}^H = \mathbf{b}^L$ for $m1^u$ $H_7: \mathbf{b}^H = \mathbf{b}^L$ for $H3^u$	0.01 0.08	[0.937] [0.779]
	<i>LOW</i>	-0.207 (-0.161)	-0.956 (-0.884)	-0.053 (-1.070)	-15.614* (-1.761)	1.745 (1.086)		$H_8: \mathbf{b}^H = \mathbf{b}^L$ for p^u $H_9: \mathbf{b}^H = \mathbf{b}^L$ for s^u	1.03 0.86	[0.315] [0.358]
Other services	<i>HIGH</i>	-2.118*** (-3.080)	-0.596 (-0.634)	0.030 (1.064)	1.681 (0.262)	-0.612 (-0.558)	0.368 [0.094]	$H_4: \mathbf{b}^H = \mathbf{b}^L$ for all news $H_5: \mathbf{b}^H = \mathbf{b}^L$ for ip^u	2.53** 6.84**	[0.038] [0.011]
	<i>MEDIUM</i>	1.133* (1.885)	-0.395* (-1.762)	-0.042* (-1.843)	7.030* (1.842)	0.428 (0.350)		$H_6: \mathbf{b}^H = \mathbf{b}^L$ for $m1^u$ $H_7: \mathbf{b}^H = \mathbf{b}^L$ for $H3^u$	0.58 8.79***	[0.449] [0.004]
	<i>LOW</i>	0.321 (0.621)	0.175 (0.324)	-0.071*** (-3.780)	-12.196 (-1.551)	-0.865 (-1.080)		$H_8: \mathbf{b}^H = \mathbf{b}^L$ for p^u $H_9: \mathbf{b}^H = \mathbf{b}^L$ for s^u	2.49 0.03	[0.119] [0.866]
HEX all share index	<i>HIGH</i>	-1.209 (-1.400)	-0.268 (-0.323)	-0.002 (-0.073)	-5.544 (-1.117)	0.249 (0.214)	0.387 [0.115]	$H_4: \mathbf{b}^H = \mathbf{b}^L$ for all news $H_5: \mathbf{b}^H = \mathbf{b}^L$ for ip^u	0.62 1.44	[0.688] [0.235]
	<i>MEDIUM</i>	0.740 (1.576)	-0.886*** (-3.365)	-0.026 (-1.054)	3.473 (0.993)	1.197 (1.125)		$H_6: \mathbf{b}^H = \mathbf{b}^L$ for $m1^u$ $H_7: \mathbf{b}^H = \mathbf{b}^L$ for $H3^u$	0.99 1.53	[0.325] [0.221]
	<i>LOW</i>	0.119 (0.183)	0.797 (0.933)	-0.051** (-2.281)	-14.161 (-1.522)	0.692 (0.667)		$H_8: \mathbf{b}^H = \mathbf{b}^L$ for p^u $H_9: \mathbf{b}^H = \mathbf{b}^L$ for s^u	0.78 0.07	[0.381] [0.790]

Notes: News variables are the industrial production (ip^u), the real money supply ($m1^u$), the three-month helibor rate ($H3^u$), the consumer price index (p^u), the real exchange rate (s^u), and are proxied by the VAR(6) residuals. T-statistics are in a parenthesis, and are corrected for heteroscedasticity and autocorrelation by using Newey-West (1987) procedure. R^2C is the coefficient of determination adjusted for degrees of the freedom. Round brackets denote R^2C measures estimated without dummies (i.e., $\mathbf{d}_i = 0$). H_4 is the null hypothesis that all news coefficients in the high and in the low states are the same; hypotheses from H_5 to H_9 are similar for individual news coefficients. Numbers in square brackets are p -values. *, ** and *** denote significance at the 10%, 5%, and 1% level, respectively.

APPENDIX 3. (...continued)

Model (5): $R_{it} = a_i + HIGH_t \cdot \hat{\mathbf{e}}_t \mathbf{b}^H_i + MEDIUM_t \cdot \hat{\mathbf{e}}_t \mathbf{b}^M_i + LOW_t \cdot \hat{\mathbf{e}}_t \mathbf{b}^L_i + \mathbf{d}_i + u_{it}$

Industry		ip^u	$m1^u$	$H3^u$	p^u	s^u	R^2C	Null hypothesis	F -statistics [p -value]	
Metal and engineering	<i>HIGH</i>	-1.619* (-1.877)	-0.236 (-0.222)	0.014 (0.445)	-2.776 (-0.578)	-1.232 (-0.835)	0.203 [0.097]	$H_4: \mathbf{b}^H = \mathbf{b}^L$ for all news $H_5: \mathbf{b}^H = \mathbf{b}^L$ for ip^u	2.27* 4.96**	[0.058] [0.029]
	<i>MEDIUM</i>	0.947 (1.561)	-1.213*** (-3.478)	-0.029 (-1.037)	3.421 (0.802)	1.350 (0.976)		$H_6: \mathbf{b}^H = \mathbf{b}^L$ for $m1^u$ $H_7: \mathbf{b}^H = \mathbf{b}^L$ for $H3^u$	2.93* 6.67**	[0.092] [0.012]
	<i>LOW</i>	1.090 (1.593)	2.279** (2.198)	-0.098*** (-3.802)	-16.107* (-1.671)	-1.321 (-0.552)		$H_8: \mathbf{b}^H = \mathbf{b}^L$ for p^u $H_9: \mathbf{b}^H = \mathbf{b}^L$ for s^u	1.86 0.00	[0.178] [0.965]
Forest industries	<i>HIGH</i>	-1.861** (-2.044)	0.896 (0.635)	0.008 (0.193)	-4.974 (-0.735)	-0.905 (-0.562)	0.158 [0.029]	$H_4: \mathbf{b}^H = \mathbf{b}^L$ for all news $H_5: \mathbf{b}^H = \mathbf{b}^L$ for ip^u	1.22* 4.72**	[0.311] [0.034]
	<i>MEDIUM</i>	0.621 (0.939)	-0.884*** (-2.862)	-0.021 (-1.022)	5.051 (1.175)	1.249 (0.849)		$H_6: \mathbf{b}^H = \mathbf{b}^L$ for $m1^u$ $H_7: \mathbf{b}^H = \mathbf{b}^L$ for $H3^u$	0.36 1.37	[0.549] [0.246]
	<i>LOW</i>	0.979 (1.038)	1.831** (2.129)	-0.051* (-1.709)	-8.109 (-0.450)	-0.067 (-0.051)		$H_8: \mathbf{b}^H = \mathbf{b}^L$ for p^u $H_9: \mathbf{b}^H = \mathbf{b}^L$ for s^u	0.03 0.14	[0.863] [0.712]
Multi-business industry	<i>HIGH</i>	-1.139 (-0.952)	-0.088 (-0.092)	-0.025 (-0.533)	-10.255* (-1.705)	1.350 (0.843)	0.378 [0.136]	$H_4: \mathbf{b}^H = \mathbf{b}^L$ for all news $H_5: \mathbf{b}^H = \mathbf{b}^L$ for ip^u	0.44 0.41	[0.821] [0.527]
	<i>MEDIUM</i>	1.047 (1.528)	-1.176*** (-3.199)	-0.018 (-0.493)	5.767 (1.358)	1.879 (1.491)		$H_6: \mathbf{b}^H = \mathbf{b}^L$ for $m1^u$ $H_7: \mathbf{b}^H = \mathbf{b}^L$ for $H3^u$	0.54 0.32	[0.465] [0.572]
	<i>LOW</i>	-1.254 (-0.314)	0.997 (0.789)	-0.055** (-2.081)	-22.032* (-1.962)	1.482 (1.250)		$H_8: \mathbf{b}^H = \mathbf{b}^L$ for p^u $H_9: \mathbf{b}^H = \mathbf{b}^L$ for s^u	0.99 0.00	[0.325] [0.949]
Other industries	<i>HIGH</i>	0.008 (0.001)	-0.567 (-0.488)	-0.034 (-1.045)	-0.368 (-0.110)	0.025 (0.029)	0.275 [0.073]	$H_4: \mathbf{b}^H = \mathbf{b}^L$ for all news $H_5: \mathbf{b}^H = \mathbf{b}^L$ for ip^u	0.28 0.16	[0.925] [0.686]
	<i>MEDIUM</i>	1.112* (1.960)	-0.288 (-0.827)	-0.040* (-1.584)	3.185 (0.846)	1.703 (1.629)		$H_6: \mathbf{b}^H = \mathbf{b}^L$ for $m1^u$ $H_7: \mathbf{b}^H = \mathbf{b}^L$ for $H3^u$	0.02 0.38	[0.878] [0.540]
	<i>LOW</i>	0.440 (0.722)	-0.355 (-0.432)	-0.060* (-1.953)	-7.405 (-1.120)	-1.007 (-0.904)		$H_8: \mathbf{b}^H = \mathbf{b}^L$ for p^u $H_9: \mathbf{b}^H = \mathbf{b}^L$ for s^u	0.81 0.57	[0.370] [0.454]

Notes: News variables are the industrial production (ip^u), the real money supply ($m1^u$), the three-month helibor rate ($H3^u$), the consumer price index (p^u), the real exchange rate (s^u), and are proxied by the VAR(6) residuals. T-statistics are in a parenthesis, and are corrected for heteroscedasticity and autocorrelation by using Newey-West (1987) procedure. R^2C is the coefficient of determination adjusted for degrees of the freedom. Round brackets denote R^2C measures estimated without dummies (i.e., $\mathbf{d}_i = 0$). H_4 is the null hypothesis that all news coefficients in the high and in the low states are the same; hypotheses from H_5 to H_9 are similar for individual news coefficients. Numbers in square brackets are p -values. *, ** and *** denote significance at the 10%, 5%, and 1% level, respectively.

Chapter 4

THE EFFECTS OF POSITIVE, NEGATIVE, MAJOR AND MINOR ECONOMIC NEWS ON INDUSTRY PORTFOLIOS*:

Is there an Asymmetry in the Finnish Stock Market?

ABSTRACT

This paper investigates whether the reactions of industry portfolio stock returns to macroeconomic news (residuals from a VAR model estimated via recursive least squares) are constant and symmetric over the period January 1987 to December 1996. News components are classified into positive and negative as well as major and minor news depending on the "sign" and the "size" of the news proxies, respectively. The results suggest that the reactions of stock returns to economic news are neither constant nor symmetric, but vary depending on the qualitative nature of the news. For example, news about industrial production, interest rates, inflation rates, and real exchange rates may sometimes cause a positive reaction in stock returns and at other times a negative reaction. Furthermore, positive and major news items jointly appear to have a significant impact on stock returns across industries. It appears that stock returns respond only to positive values of news, while negative values of news are ignored, and the sign (size) effects relate to non-monetary (monetary) news. Overall, the results suggest that when taking the sign and the size of the news into account, a stronger relationship between macroeconomic news and stock returns is evident.

KEY WORDS: Industry portfolios; Asymmetric reactions; Macroeconomic news; VAR model; Recursive least squares

* The helpful comments by Pekka Ahtiala and Jouko Ylä-Liedenpohja as well as the other seminar participants at the University of Tampere are greatly acknowledged. Furthermore, suggestions by an unknown referee of the Finnish Economic Papers are also gratefully acknowledged. All the remaining errors are solely on my responsibility.

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1. INTRODUCTION

Efficient market theory attributes the movements in asset prices to new information or “news” about, for example, taxation or macroeconomic conditions that plausibly affect fundamental asset values (i.e., either the expected cash flows or the expected discount rates at which these future cash flows are capitalized, or both). According to Fama (1970), the stock market is efficient if current market prices fully and instantaneously reflect all relevant information. Furthermore, if economic agents are careful users of all available information, then past information or anticipated changes in fundamentals should be useless in predicting future stock prices since this information is already incorporated into prevailing market prices. Therefore, stock price changes can only be due to new information.

In recent years, considerable amount of empirical research has been devoted to investigating the relationship between stock prices and macroeconomic news. These results (e.g., see Pearce & Roley 1985; Hardouvelis 1987; Wasserfallen 1989; Bailey 1990; Aggarwal & Schirm 1992; Sadeghi 1992; and Siklos & Anusiewicz 1998) suggest that news about the economy in general seems to have very little impact on the stock market. For instance, Roll (1988) and Cutler, Poterba, and Summers (1989) show that only a small fraction of observed equity returns could be explained by news. On the Finnish stock market, the importance of economic news seems to be even smaller compared to the large stock markets such as the US market (e.g., see Junttila, Larkomaa, and Perttunen 1997 and references therein). The overall conclusion appears to be that stock prices respond primarily to monetary information, although the results seem to be sample-specific as well as unstable over time.

Most of the existing literature implicitly assumes that the investors' reaction to economy-wide news is symmetric irrespective of whether the new information hitting the market is good or bad from the stock market viewpoint. For example, Siklos and Anusiewicz (1998) assume that a higher than expected money supply is bad news for the stock market, and will always causes a fall in stock prices. However, if for some reason the announced amount of money supply is lower than expected, it may be considered as good news since it decreases market participants' inflation expectations and the announcement effect may even turn out to be positive. In general, it can be taken that good news induces investors to revise their estimates of future cash flows upward or

future discount rates downward and causes increase in stock prices while bad news has the opposite effect on stock returns. Therefore, the stock market reactions may depend on the "sign" of the news.

Moreover, the stock market reactions to news about the economy may also vary depending on the "size" of the news component. Major news event with a greater "surprise" component may be considered as more informative, and therefore causes larger swings in stock prices compared to minor news event, which can be thought of as less informative and therefore, leads to only small movements in stock prices. If these potential asymmetric responses do occur, it is possible to improve estimates of news effects on stock returns by taking the sign and the size differences of the news into account. More importantly, if the news effects are asymmetric and these asymmetric effects are not accounted for, then the models that have been used in previous studies are misspecified, and the news coefficients will be biased towards zero.

A few studies have tested the potential asymmetric effects of economic news on the stock market. For example, Hafer (1986) finds that positive values of weekly money supply news lower stock prices, but the most interesting part is that the negative values of money supply news had no impact on stock returns. This asymmetry can be interpreted as evidence against market efficiency. Furthermore, Orphanides (1992) shows that the stock market responses to economic news vary systematically with the state of the economy. The results support the so-called "overheating hypothesis"; that is, an unanticipated increase in unemployment is bad news for the stock market during recessions, but good news when the economy is overheated. McQueen and Roley (1993) find similar asymmetric stock price reactions to economic news in such a way that a higher than expected industrial production is bad (good) news for the stock market in the high (low) state of the economic activity.

Engle and Ng (1993) detect asymmetry in stock return volatility, and they conclude that bad news (negative values of the unexpected returns) produces more volatility than good news (positive values of the unexpected returns) on the Japanese stock market. Jensen and Johnson (1995) find that stock returns following discount rate decreases are less volatile than stock returns following discount rate increases. Jensen, Johnson, and Bauman (1997) extend the analysis from aggregate stock market index into industry level and show that similar conclusions also hold for stock returns across different industry sectors.

In the Finnish stock market data, Löflund and Nummelin (1997) show that positive values of industrial production growth forecasts seem to affect stock prices differently depending on the level of current industrial production; that is, higher conditional production growth increases expected real stock returns only when the economy is weak. Furthermore, Gulley and Sultan (1998) find that negative values regarding the consumer confidence index have a greater effect on the Dow Jones Industrial Average than positive values. Koutmos (1999) concludes that good news (positive past returns) are more persistent in affecting a conditional mean than bad news (negative past returns) of an equal magnitude. All these results indicate that at least some kind of asymmetry is present in stock market reactions to different kinds of macroeconomic and other types of news.

The purpose of this paper is to investigate the potential asymmetric stock market reactions to news about the economy. This paper makes several contributions to the existing literature. First, it extends on previous studies from the all share price index to industry-sorted stocks to test whether the general market effects also occur uniformly across various industries. Analysis of the industry level data is especially important for the Helsinki Stock Exchange because the broad market index may lead to biased estimates due to the fact that Nokia Corporation (a large telecommunications firm) dominates it. Furthermore, there may be some distinct intrinsic characteristics across industries between, for example, cyclical industries and financial sectors, since responses may vary depending on the sensitivity of the industry to general macroeconomic conditions. Therefore, it is essential to analyze the relative response of different industries to the same piece of macroeconomic information.

Second, this study investigates the sensitivity of the estimation results by testing for the potential asymmetric effects of positive, negative, major, and minor economic news on industry stock returns. Third, from the methodological point of view, news items are generated by using the VAR model estimated via recursive ordinary least squares, which allows for market expectations to change over time when new information becomes available. Fourth, the publication lags in economic statistics are considered, and the latest time series data available is used throughout. Finally, since previous studies have concentrated for the most part on large stock markets such as the United States, this study was undertaken to shed more light on the workings of a small stock market like the Helsinki Stock Exchange.

This paper provides evidence in favor of asymmetric stock price reactions to news about the economy and suggests further that a stronger relationship between news and stock returns pertains when the reactions are allowed to vary depending on the sign or the size of the news. Stock returns show asymmetric responses to news about industrial production, interest rates and inflation. Interestingly, stock returns seem to respond systematically to positive and major news components, although the sign asymmetry is most likely related to non-monetary news. Furthermore, good news is associated with an increase in stock returns, while bad news is not associated with any significant changes in stock returns. This may imply that bad news is already incorporated into prevailing market prices and only good news has real effects on stock returns. Similar results also hold true for major and minor news, although the size effects are mainly associated with monetary news. These findings suggest that stock returns respond mainly to positive values of news, and that major news seems to be more informative than minor news.

The remainder of this paper is organized as follows: Section 2 describes the data and the research methodology. The following section reports the estimation results and in the last section, conclusions are drawn.

2. DATA AND METHODOLOGY

2.1. Stock price and macroeconomic data

The period under investigation consists of 120 monthly observations during the period of January 1987 to December 1996 (end-of-month values). Stock returns are calculated as the logarithmic difference in the HEX industry price indices (i.e., by first deflating the stock indices with the consumer price index and then calculating the time differences of the deflated stock prices)¹. The HEX industry indices are as follows: (1) banks and

¹ See Hernesniemi (1990) for details about the HEX indices. The price indices are value weighted and not adjusted for dividends. Of course, it would be theoretically more preferable to measure stock returns as a sum of capital gains and dividends, but, in practice, there are some problems with data availability since the HEX yield indices that include dividends are not available before 1991. Furthermore, Lo and MacKinlay (1988) argue that the inclusion of dividends would add little to the overall variability and time series structure of the stock price data given that dividends are generally reported only annually or semi-annually. Hence, following Groenewold and Kuay (1994), it is expected that adjustment for dividends would not affect the results. This is, in fact, quite realistic assumption on the Finnish stock market (see footnote 15).

finance, (2) insurance and investment, (3) other services, (4) metal and engineering, (5) forest industries, (6) multi-business industry, (7) and other industries. Industry i returns at time t are denoted R_{it} in this study. In order to compare the industry-level results to the aggregate market, the HEX all share price index (as a proxy for the aggregate market) is also included in analysis.

In the absence of a widely accepted economic theory of the interaction between the stock market and the macroeconomy as a whole, the choice of the aggregate economic indicators is to some extent arbitrary. Nevertheless, the choice of variables was based on the general hypothesis that stock returns are influenced by two classes of variables: real domestic activity and nominal domestic influences². Furthermore, since this paper deals with a small open economy, the foreign influences should also be considered. Therefore, the following set of macroeconomic indicators is assumed to influence either expected cash flows or the expected risk-adjusted discount rate or both (i.e., the two fundamental variables when stocks are priced by the expectation of the present value of future cash flows).

Variables that describe economic conditions of the Finnish economy are as follows: (1) industrial production [ip] and (2) real exchange rate [s]. Variables that describe financial conditions are as follows: (3) real money supply [$m1$], measured as M1 monetary aggregate deflated by the consumer price index, (4) nominal short-term interest rate, measured by three-month Helibor rate [H3], and (5) the consumer price index [p]³. All time series of the variables are seasonally unadjusted and transformed into logarithms (except for interest rate, which is in annual percentage). Of course, this selected information set does not exhaust all possibilities, but it does include those macroeconomic indicators which are generally considered the most important (see e.g., Cutler et al. 1989 and King, Sentana, and Wadhvani 1994).

² Since this paper deals with industry-level data, some industry-specific news should not be forgotten, but these issues will be dealt with at the future stages of this research.

³ The stock price data were obtained from the Helsinki Stock Exchange. Industrial production and consumer price data were obtained from Statistics Finland. Money supply, interest rate, and real exchange rate data were obtained from the Bank of Finland. Real exchange rate (calculated by the Bank of Finland) is nominal trade-weighted exchange rate deflated by consumer prices. Real exchange rate is measured as the quantity of domestic currency needed to buy one unit of foreign currency at time t . Defined in this way, an increase (decrease) in real exchange rate denotes a depreciation (appreciation) of the real exchange rate for constant inflation rate.

2.2. Theoretical bases of stock price responses to economic news

A common theoretical model that relates stock price to information posits that stock price equals present value of future cash flows discounted at expected risk-adjusted discount factor (see e.g., McQueen & Roley 1993 and Prag 1994). According to this present value formula, movements in stock prices are attributed to new information about the economy that affects either market expectations of future cash flows or future discount rates, or both⁴. Summarizing the mapping from news to stock prices, the expected signs of the response coefficients conditional on the sign and the size of the news are presented in Appendix 1.

Throughout this paper, it is assumed that major (minor) news with a greater (lesser) information content induces a stronger (weaker) effect on stock prices compared to the benchmark estimates. In addition, positive values of non-monetary (monetary) news are considered good (bad) news and negative values to be bad (good) news from the stock market point of view. Furthermore, it should be noted that if these potential asymmetries are strong enough, they might even cause sign reversals in response coefficients. Without allowing for any asymmetries, it is expected that the signs of the response coefficients are similar to those of positive values of the non-monetary news variables. Let us next consider the theoretical explanations for the expected signs of the response coefficients one by one, starting at non-monetary variables.

First, higher than expected real economic activity may increase investors' expectations of future growth prospects of the domestic economy and thus profits of the firms that produce an increase in stock prices. Following Pearce and Roley (1985) and Sadeghi (1992), a positive relationship between stock prices and higher than expected industrial production is expected in the benchmark case. Furthermore, positive values of news should make stock investments even more attractive and thus further increase in share prices. On the other hand, negative values of industrial production news may cause

⁴ However, it should be noted that the theoretical effects of news on stocks are often ambiguous. Unexpected changes may alter stock prices through two means: by influencing the level of expected future cash flows of the firm and by changing the rate employed in discounting these cash flows. For example, an upward revision of expected real activity raises expected cash flows, but at the same time, it raises the discount rates at which those cash flows are discounted. Therefore, the effect of this news on stock prices is ambiguous, depending on whether the cash flow or discount rate effects dominate (e.g., McQueen & Roley 1993), or as Löflund and Nummelin (1997) define whether income or substitution effect dominates.

investors to fear an economic slowdown, which decreases firms' future profits, and thus decreases stock prices.

Expected currency depreciation is usually good news for the stock market, since weaker currency increases cash flows for export-oriented industries. However, this interpretation is not necessarily valid if depreciation is higher than expected, since the monetary authority may raise interest rates to avoid inflation arising from the foreign commodity and product markets. Previous studies have shown that the relationship between stock returns and real exchange rate is positive (see Chow, Lee, and Solt 1997), and furthermore, that the more open the economy, the stronger this relationship is (see Friberg & Nydahl 1997). Following these studies, it is expected that the positive relationship will also persist in positive values of the real exchange rate news. However, negative values denote bad news since the “cash-flow effect” would be smaller than expected while positive values are treated as good news.

Several studies (e.g., Hardouvelis 1987; Prag 1994; and Siklos & Anusiewicz 1998) have examined the impact of the money supply news on stock returns. The consensus findings are that unexpectedly high money growth is associated with higher interest rates and lower stock prices. One interpretation of this result is that investors may expect that the monetary authority will react to higher than expected money growth by quickly moving to a more restrictive monetary policy by raising its tender rate, which has a direct impact on short-term interest rates. This negative relationship is expected to be valid in the benchmark case as well as for positive values of news about real money supply. On the other hand, negative values state that money stock growth is lower than expected and therefore, the impact should be smaller or it may even change to become positive.

One can also expect to see a negative relationship between interest rate news and stock prices (see Pearce & Roley 1985, Hafer 1986, and Jensen et al. 1997). Higher interest rates means higher discount rates at which those future cash flows are capitalized and thus bringing a lower present value of equity prices. Furthermore, higher interest rates reduce future economic activity and, consequently, future corporate cash flows. When interest rate news is decomposed into positive and negative values, positive values are expected to be bad news for the stock market, and therefore, stock prices should decrease. On the other hand, negative values in interest rate news are good news from the stock markets viewpoint because unanticipated change in interest rates is indeed smaller than expected.

Finally, following the studies by Fama (1981), Pearce and Roley (1985), and Amihud (1996), a negative relationship between unexpected inflation and stock returns is expected. This is rather surprising since, according to the Fisherian's view, stocks should provide an effective hedge against expected inflation since stocks are claims on real assets, the productivity of which should be independent of the inflation rate. One channel by which inflation news may have a negative impact on stocks exists if investors expect that the monetary authority might react to unexpected inflation by monetary policy tightening in the near future. This negative relationship is also expected to be valid for positive values. However, if news about inflation is lower than expected, then it might be interpreted as good news and the reaction could be smaller or it may even change to positive.

2.3. The estimated models and statistical tests

Efficient market theory predicts that only the unexpected changes (i.e., how it compares to market expectations) of any economic fundamentals should have an effect on stock prices. One major obstacle in this research field is that expectations are not observable. Therefore, it is also difficult to measure news directly (at least as a large information set as is considered here). The obvious question arising is, then, how to extract news from expected changes. Up to now, the existing economics literature has considered the following methods to solve this problem: univariate time series models like AR(I)MA (e.g., Sadeghi 1992), multivariate time series models such as VAR (e.g., Cutler et al. 1989), survey data (e.g., McQueen & Roley 1993), and differenced data (e.g., Cheng 1995). In this paper, the appropriate VARs are used to describe the expectation-generating mechanism⁵.

In order to extract news components from actual changes in macroeconomic indicators, we estimate the VAR system in the reduced form

⁵ However, this statistical procedure may be problematic due to measurement problems concerning how exactly the different variables are measured and how well news can be identified from the actual changes. For example, monetary news could be measured more accurately and therefore reach the market faster than non-monetary news. This may be one explanation for the previous results that primarily monetary news has the main effect on the stock market. Furthermore, in this study I assume that investors respond to the measured rather than the true news, implying that the original estimating equation should be specified in measured rather than the true news. This eliminates the classical errors-in-variables problem.

$$(1) \quad \mathbf{x}_t = \mathbf{c} + \mathbf{A}(L)\mathbf{x}_{t-1} + \Phi D_t + \mathbf{e}_t,$$

where $\mathbf{A}(L) = \mathbf{A}_1(L) + \mathbf{A}_2(L)^2 + \dots + \mathbf{A}_p(L)^p$, and \mathbf{x}_t is a (5×1) vector of the endogenous variables⁶ $\mathbf{x}_t = \Delta(ip_{t-2}, m1_{t-1}, H3_t, p_{t-1}, s_{t-1})'$, respectively. $\mathbf{A}(L)$ is a (5×5) matrix polynomial in the lag operator L , \mathbf{c} is a vector of constants, and \mathbf{e}_t is a (5×1) vector of error terms $\mathbf{e}_t = (e_t^{ip}, e_t^{m1}, e_t^{H3}, e_t^p, e_t^s)'$ with the following properties $E(\mathbf{e}_t) = 0$, $E(\mathbf{e}_t \mathbf{e}_t') = \Sigma$, $E(\mathbf{e}_t \mathbf{e}_s') = 0$ for $t \neq s$. This VAR model also includes seasonal dummies D_t . Hence, the estimated one-step-ahead forecast error terms $\hat{\mathbf{e}}_t$ are treated as an unexpected component of each macroeconomic variable⁷. The lag length of VARs, based on the Schwarz multivariate information criterion and residual diagnostics, was chosen to be two.

However, there are essentially two problems that need to be addressed here. First, proper timing is necessary for running a VAR. That is, because of lags in the publication of economic statistics, the values of the macroeconomic variables, for example, industrial production in period t was assumed to be the published values for month $t - 2$. A VAR forecast for January uses December's data, although the most recent data available on industrial production is from November. In addition, the consumer price index, real money supply, and real exchange rate in period t were assumed to be the published values for month $t - 1$. Due to publication lags, the first two observations of each series were lost. Ignoring delays in publication is problematic in such a way that a VAR uses "too much" information, which implies that the estimated residuals are improper estimates of news components.

Another important aspect to which the existing literature has not given sufficient attention, is not to provide agents with any more information than they could have had when interpreting news (see Cuthbertson et al. 1992, 155 - 190). In general, an unrestricted VAR is fitted into the whole sample period with fixed coefficients. Nevertheless, assuming that agents know the "true" model of an expectation-generating mechanism is a rather strong assumption (especially during exceptional times like that

⁶ I use first-differenced data, since according to ADF tests (not shown), the macroeconomic variables are non-stationary with stationary differences, (i.e., they are $I(1)$ variables). Industry stock returns, instead, are stationary $I(0)$ variables, and therefore, suitable for statistical analysis.

⁷ This VAR model relates the current value of each series to the lagged values of the series itself and to those of the other four series. Because each equation in (1) has the same independent variables, the VAR model could be estimated equation-by-equation using OLS, which is as efficient, as seemingly unrelated regression (SUR).

used in this paper)⁸. Using recursive least square estimation procedure, which allows expectations to change over time (see also Siklos & Anusiewicz 1998), can considerably mitigate this problem⁹.

As a starting point, we begin by testing for the effects of economic news on industry stock returns following the traditional approach ignoring potential asymmetries. In this way, the benchmark estimates can be obtained, which can then be compared to the estimates obtained from a more unrestricted model that accounts for asymmetries. The basic constant-mean-return model can be written as:

$$(2) \quad R_{it} = a_i + \hat{\mathbf{e}}_t \mathbf{b}_i + \mathbf{d}_i + u_{it},$$

where R_{it} is the real return of the industry i from month $t - 1$ to month t , a_i is a scalar (constant equilibrium return for industry i), $\hat{\mathbf{e}}_t$ is a (1×5) vector of news calculated as the residuals from a VAR(2) model estimated via recursive OLS, \mathbf{b}_i is a (5×1) vector of industry-specific regression coefficients measuring the effects of news on industry portfolios, \mathbf{d}_i is a vector of zero-one deterministic dummy variables including seasonal dummies and an exchange rate dummy to account for switch in the exchange rate regime from fixed to floating rates in September 1992, and u_{it} are industry-specific error terms (capturing the effects of all other news). Error terms are assumed to satisfy the usual OLS assumptions; that is, $u_{it} \sim \text{i.i.d.}(0, \sigma^2)$. This basic model has been widely used in previous empirical studies (e.g., see Kutty & Sabi 1994).

However, a crucial limitation of the model (2) is that it does not capture the potential asymmetric nature of the relationship between news and stock returns. It simply assumes that stock return responses to news are symmetric. Ignoring potential asymmetries produces a kind of "averaged effect", which might mask the true (and possibly

⁸ Fixed coefficients VAR use information that was not available at the time the forecasts were made since it uses all of the data set (so-called look-ahead-bias). It may be more realistic to assume that investors continually update their expectations about the parameters of the expectations generating model, as new information becomes available. This applies with greater reason after regime changes such as the switch in exchange rate regime in September 1992 from fixed rates to floating rates.

⁹ In recursive least squares, all the equations of a VAR model are estimated repeatedly, using ever-larger subsets of the sample data. For example, if there are k coefficients to be estimated in the β vector, then the first k observations are used to form the first estimate of β . Then, the next observation is added to the data set and all $(k + 1)$ observations are used to compute the second estimate of β . This process is repeated until all the n sample points have been used. This method produces $(n - k)$ estimates of the β vector. At each step, the last estimate of β can be used to predict the next value of the dependent variable. The one-step forecast error is defined to be the recursive residual (Lilien et al. 1995, 230 – 231).

significant) effects. If for some reason the stocks respond only to the bad news and show no reaction to good news, then the response coefficient, on average, will be biased towards zero, although news with a more realistic model might be important determinants in explaining price movements. Therefore, if the market reactions to news are different depending on the sign or the size of the news, then accounting for these asymmetries should improve the estimates of news effects on stock prices.

In order to extend the basic model (2) in a more realistic direction, news proxies are first decomposed into positive and negative values. Following Hafer (1986), Brooks et al. (1998), and Gulley and Sultan (1998), the classification is done as follows: if news is positive (i.e., $\hat{\epsilon}_t \geq 0$), it takes the value of $\hat{\epsilon}_t$, and otherwise zero. Similarly, if news is negative (i.e., $\hat{\epsilon}_t < 0$), it takes the value of $\hat{\epsilon}_t$, and otherwise zero. These positive and negative values are then treated as good and bad news depending on the economic interpretation of the variable in question. Due to the theoretical framework discussed previously in subsection 2.2, positive values in monetary (non-monetary) variables denote bad (good) news and negative values denote good (bad) news.

In order to capture the potential asymmetries depending on the sign of the news variables, the basic constant-mean-return model (2) can be reformulated as follows:

$$(3) \quad R_{it} = a_i + POSIT_t \cdot \hat{\epsilon}_t \mathbf{b}_i^{POS} + NEGAT_t \cdot \hat{\epsilon}_t \mathbf{b}_i^{NEG} + \mathbf{d}_i + u_{it},$$

where $POSIT_t = 1$ if news has positive values at time t , and otherwise zero, $NEGAT_t = 1$ if news has negative values, and otherwise zero. The coefficient \mathbf{b}_i^{POS} and \mathbf{b}_i^{NEG} with superscripts POS and NEG measure the effects of positive and negative values of news variables, respectively. For $\mathbf{b}_i^{POS} = \mathbf{b}_i^{NEG}$ Equation (3) reverts to the basic model (2). The other variables and coefficients are defined in Equation (2).

Finally, in order to accommodate potential asymmetries depending on the size of the news variable, major news is defined as those that are above the 86th cumulative percentile (positive values of news) and those that are below the 14th cumulative percentile (negative values of news). Furthermore, minor news is defined as those that are below the 86th cumulative percentile and those that are above the 14th cumulative percentile. This chosen interval classifies about 30 percent of the observations realized as

major news, and the remaining about 70 percent of the realized observations as minor news¹⁰. The constant-mean-return model capturing the size effect is as follows:

$$(4) \quad R_{it} = a_i + MAJOR_t \cdot \hat{\mathbf{e}}_t \mathbf{b}^{MAJ}_i + MINOR_t \cdot \hat{\mathbf{e}}_t \mathbf{b}^{MIN}_i + \mathbf{d}_i + u_{it},$$

where $MAJOR_t = 1$ if news has large values at time t , and zero otherwise, $MINOR_t = 1$ if news has small values, and zero otherwise. The coefficient \mathbf{b}^{MAJ}_i and \mathbf{b}^{MIN}_i with superscripts MAJ and MIN measure the effects of major and minor news items on stock prices, respectively. Again, for $\mathbf{b}^{MAJ}_i = \mathbf{b}^{MIN}_i$ Equation (4) reverts to Equation (2). The other variables and coefficients are as defined in the basic regression model (2).

The statistical significance of individual response coefficients is examined by t -tests¹¹. The joint significance is also tested as well as potential asymmetries of various subsets of response coefficients (i.e., monetary versus non-monetary). A range of null hypothesis of equality restrictions is tested against alternative hypotheses. For this purpose, Wald F -tests of coefficient restrictions are used. These null hypotheses and alternative hypotheses are given in Appendix 1. The first three null hypotheses relate to the basic regression Equation (2) and the remaining hypotheses relate to more unrestricted model (3) and (4); that is, models dealing with the potential sign and size asymmetries. We also test the equality of the response coefficients on the positive, negative as well as on major and minor news.

3. ESTIMATION RESULTS

3.1. *The impact of news on industry portfolios: benchmark estimates*

In order to obtain benchmark estimates, the basic model (2) is estimated separately for each industry and the HEX general price index by using the OLS estimation method^{12,13}.

¹⁰ The subsequent estimation results were insensitive to moderate changes in cumulative classification interval. For example, using 10th and 90th percent interval produced response coefficients that were very close to the coefficients reported in this paper.

¹¹ Two-tailed t -tests are used since the news effects are often theoretically ambiguous due to the aforementioned “cash flow” and the “discount rate” effects, which may work in opposite directions.

¹² Following Pagan (1984), OLS estimation results in consistent estimates and standard errors of the response coefficients, when only contemporaneous residuals are present in the second stage estimations.

These results are presented in Appendix 2. When looking first at the joint significance tests, it seems that stock returns respond to economic news in general (hypothesis H_1)¹⁴. Nevertheless, the explanatory power (without dummies) of news is rather low: news explains some 7 percent of the industry stock returns, at the most, and only about 2 percent of the aggregate return¹⁵. Based on the explanatory power, stock returns for the financial sectors seem to be the most sensitive to news about the economy. Furthermore, the evidence indicates that non-monetary news jointly (hypothesis H_2) seems to be more important in affecting stock returns than monetary news (hypothesis H_3).

Significant response coefficients affect stock returns mainly through their predicted signs. At the aggregate stock market level, stock returns respond to news about industrial production, real money supply, and real exchange rate. Across industries, these results seem to hold true for the most part, and the signs of the response coefficients largely match the prior expectations. However, the most notable exception is inflation rate news, whose parameter signs are in contrast to prior expectations, although it appears to have no statistically significant impact on stock returns¹⁶. This finding does not support the view

However, I expect to see a systematic pattern in an error term due to the usual serial correlation of index returns since if industry stock returns are serial correlated equation (2) - (4) would exhibit serial correlated residuals. Furthermore, heteroscedasticity (see e.g., Schwert 1989) might be present in residuals. These problems can be corrected via the Newey and West (1987) procedure, which produces correct standard errors, t -values, and F -statistics.

¹³ The estimation results are based on the assumption of i.i.d. residuals. I ran several diagnostic tests for the estimated models (not reported here). Although the Durbin-Watson DW statistic does not give any hint of first order autocorrelation, the residuals in most industries are serially correlated according to Ljung-Boxin $Q(28)$ tests. In addition, ARCH(1) effect is clearly observed only in banks and finance. Although the problems are not alarming, the estimation is based on the Newey and West (1987) procedure.

¹⁴ All H_i 's in the text, where $i = 1, \dots, 13$, refer to the hypothesis classifications given in Appendix 1.

¹⁵ In order to check the robustness of the results with respect including or excluding dividend, I estimated the model by using dividend adjusted monthly stock returns, calculated by using the WI-index (1987-1990) and HEX yield-index (1991-1996). For further details on these indices see Berglund, Wahlroos, and Grandell (1983) and Hernesniemi (1990). The estimation results (superscripts u denote news variables) were as follows:

$$R_t = -0.0486 + 0.308 ip^u - 0.685 m1^u - 0.003 H3^u + 1.902 p^u + 0.933 s^u \quad R^2C = 0.037 \quad DW = 1.733$$

$$(-1.783) \quad (1.956) \quad (-2.001) \quad (-0.262) \quad (0.821) \quad (2.474) \quad (.) = t\text{-values}$$

The results (the model also includes dummy variables, although not reported here) are surprisingly close to those without dividends. Furthermore, the movements in price and yield indices are strongly correlated (correlation is 0.99) during the sample April 1989 to December 1996. Therefore, it can be argued that stock returns calculated without dividends are good proxies for total returns including capital gains and dividends.

¹⁶ The effects of inflation news on stock prices seem to be sensitive to the inclusion or exclusion of seasonal dummies. I ran similar regressions without seasonal dummies, and the results show that inflation news has negative effect on stocks, although these responses are not statistically significant. However, seasonal dummies have no impact on the subsequent estimations with respect to the sign and the size effects of the news on stock returns (these results are not reported here, but may be obtained from the author upon request).

that a higher than expected inflation should negatively influence stock returns. Nevertheless, it should be noted that the positive inflation news coefficient is in line with the results of Caporale and Jung (1997).

In addition, there are some interesting industry-specific results worth mentioning. First, cyclical industries respond to non-monetary news suggesting that the cash flow effects dominate the discount rate effects. For example, an unexpected one-percent increase in industrial production increases stock returns for cyclical industries on average by 0.4 – 0.5 percent. Second, the signs of interest rate news for cyclical industries are positive, but statistically and quantitatively unimportant. Third, financial sectors seem to be interest rate sensitive industries, which may also explain the negative response coefficients (insignificant) to industrial production news (i.e., the discount rate effects dominate the cash flow effects). Finally, unexpected one percent increases in real money supply decreases stock returns for cyclical industries (excluding forest industries) by about 0.8 – 1.0 percent.

The estimation results that are reported in Appendix 2 assume that the reactions of the stock market to economic news are symmetric irrespective of the sign or the size of the news variables. In the next two subsections, this assumption is relaxed, and we investigate how sensitive or robust these benchmark estimates are by considering alternative specifications of the basic regression equation (2).

3.2. Asymmetric impact of news on industry portfolios: positive and negative news

Appendix 3 presents the estimation results conditional to the sign of the news. Compared to the benchmark model, several interesting results emerge. First, in contrast to Appendix 2, a stronger relationship between news and stock returns is evident after taking the "sign effect" into account; that is, stock returns respond significantly to a larger set of news, and the coefficients of determination (without dummies) are systematically higher across industries. Following the traditional approach as in Equation (2), the model can explain only some 2 percent of the variations in aggregate returns, but after allowing for asymmetric responses, the explanatory power now increases to over 11 percent. Across industries, these R^2C measures vary from 3.8 to 16.1 percent in contrast to zero to 7.3 for the benchmark case.

Second, when response coefficients are considered one by one, several asymmetric reactions can be found. These sign reversals are mainly related to industrial production, the interest rate, the monthly inflation rate, and the real exchange rate news. For example, responses to positive values of news about industrial production are positive and often statistically different from zero: stock returns for most industries increase by about 1.1 – 1.5 percent in response to a 1 percent unexpected increase in economic activity. Furthermore, the return differences (indicated by #) turn out to be statistically significant for less than half of the industries. On the other hand, negative values in industrial production fail to reach significance at conventional significance levels. This result is consistent with our prior expectations concerning positive and negative values of news and their potential asymmetrical effects on stock returns.

Stock return responses to real exchange rate news also show sign reversals, and asymmetries in the magnitude of the response coefficients can be detected: the tests for the difference in the response coefficients (indicated by #) turn out to be statistically significant for most industries. Furthermore, positive values of news about real exchange rate seem to have a stronger effect on stock returns than negative news does, and the reactions to positive values are statistically significant as well. In total, these results suggest that the stock market seems to respond only to good news about the non-monetary variables, while bad news seems to have no significant impact.

In the case of monetary news, real money supply news seems to be bad news for the stock market irrespective of the way the news is split into positive and negative values. Stock return reactions to interest rate news are again in line with the good news and bad news assumption. Cyclical industries seem to respond only to the negative values of the interest rate news: metal and engineering and multi-business industry stocks increase by some 4 – 5 percent due to the negative values of interest rate news. Interestingly, stock returns also respond now to inflation news when split this way, and the results show some sign reversals: six industries out of seven exhibit significant positive responses to negative values (good news) of inflation news, but not to positive values. Again, the results suggest that the stock market seems to mainly respond only to the good news part, while the bad news part is ignored.

Finally, when testing whether the coefficients for positive and negative values of news jointly are the same (hypothesis H_6), it is found that the null of symmetry could be rejected at the 10 percent levels for four industries out of seven in addition to the

aggregate market level. This “sign” asymmetry is most likely related to non-monetary news (hypothesis H_7). These results suggest asymmetry in favor of the positive values of news (hypothesis H_4) having a stronger effect on stock returns than negative values of news (hypothesis H_5) since joint F -ratios for the positive values are higher when compared to those for the negative values.

3.3. Asymmetric impact of news on industry portfolios: major and minor news

Appendix 4 reports the estimation results conditional on the size of the news. Again, accounting for the “size effects” improves the results. Stock returns respond significantly to a larger set of news and the explanatory power (without dummies) of news is systematically higher when compared to the benchmark case, although the size effect, in general, seems to be weaker than the sign effect. Recall that when following the traditional approach as in Equation (2), only some 2 percent of the variations in market returns can be explained by news. However, after allowing for asymmetric responses depending on the size of the news as in Equation (4), the explanatory power now increases to over 5 percent and across industries, the R^2C varies from 2.3 to 9.3 percent in contrast to zero to 7.3 with the benchmark model.

Interestingly, stock market responses to only industrial production and real money supply news are consistent with the prior expectation that the more major the news the profounder the effect it has on stock returns. Furthermore, cyclical industries show significant responses to major news about industrial production: an unexpected one percent increase in industrial production increases cyclic industries by about 0.4 – 0.5 percent. In addition, most industries respond to major news about real money supply: a higher than expected real money supply decreases stock returns for 0.6 – 1.2 percent. We also ran the tests of the equality of the coefficients on the large and small values of news (indicated by #). These results yield only weak evidence in favor of the size asymmetry with respect to interest rate and real exchange rate news.

The estimation with respect to interest rate and real exchange rate news produced partly counter-intuitive results. Namely, most industries seem only to respond to minor news about these variables, and minor news produces stronger effects on stock returns (the same conclusions also hold for the monthly inflation rate news). The significant

responses to interest rate news are mainly concentrated on domestic-oriented sectors (other services and other industries). Especially the insurance and investment sector again shows the strongest response: an unexpected one-percentage unit increase in interest rate news decreases insurance and investment stock returns about 15 percent, which is almost three times more than for the aggregate market returns. Finally, mostly cyclical industries respond to minor news about real exchange rate: minor news produces 4 – 5 percent increases in the forest industries and the multi-business industry.

When testing whether the major and the minor news have the same effect; that is, whether their coefficients in the pricing model are the same (hypothesis H_{11}), the null can be rejected at the 10 percent levels for only two industries out of seven. The results are not so clear as in the sign effects of the news, and the size asymmetry is most likely related to monetary news (hypothesis H_{13}). Furthermore, stock returns appear to respond only to the major news (hypothesis H_9) while minor news (hypothesis H_{10}) seems to have no impact on stock returns. Major news jointly produces significant stock market responses for six industries out of seven. These results suggest asymmetry in such a way that major news has a much stronger effect on stock returns compared to minor news since the F -ratios for the large values are higher than for the small values of news are¹⁷.

4. CONCLUSIONS

The purpose of this paper was to test whether the stock market reaction to macroeconomic news depends on the sign or the size of the news. The main results can be summarized as follows: first, stock return reaction to news is neither constant nor symmetric, but varies depending on the sign and the size of the news. Second, a stronger

¹⁷ Since the period under investigation is exceptional, stability of the models should also be checked. One obvious candidate for the structural break occurs in September 1992 (change in exchange rate regime). I ran CHOW and CUSUM tests for the estimated models, and the results suggest parameter instability at the 5 percent level in cyclical stocks, other services, and general price index. Therefore, the estimations were conducted separately for these two sub-periods. The sub-sample results (not reported here) were, in general, similar to those reported in this paper, and the conclusions are robust. In the fixed exchange rate regime, the only notable exception was that the positive values of real money supply news had significant impact on stocks, which is in line with the results provided by Hafer (1986). Furthermore, large values of real money supply news and interest rate news had significant impacts on stock returns. The interesting part is the positive sign of large interest rate news, which is contrary to prior expectations. In the floating exchange rate regime, the results were close to those reported here, although the reactions of financial stocks to large interest rate news were stronger and statistically significant.

relationship between news and stock returns is evident when these asymmetries are accounted for. Third, when splitting news into positive, negative, major, and minor values, mainly positive and major news jointly have significant effects on stock returns. Fourth, the sign (size) effects relate to non-monetary (monetary) news. These results are also valid for most industries, although some industry-specific differences in reactions can be found.

The evidence that large values of news have significant effects on stock returns is consistent with the prior expectation that the stock market regards major news as more informative. Furthermore, market reaction to mainly good news may be indicative of the fact that economic agents are more likely to revise their estimates of future returns upward than downward, or that good news is more informative than bad news. However, the fact that only positive values of news have significant effects on stock returns defies the definition of market efficiency. This occurs if agents expect with equal probability that, for example, the announced growth of industrial production will be above or below market expectations. If this is the case, then the optimal strategy for an agent is to invest in stock market before the announcement of industrial production figures, since good news about industrial production will increase stock returns while bad news will have no effect. If such asymmetry persists, the stock market cannot be efficient, which may be valuable information for agents depending on whether it is economically exploitable after accounting for transaction costs.

Without allowing for asymmetry, economic news affects stock returns mainly with their predicted signs, although the explanatory power of news seems to be somewhat less than previously obtained from Finnish data (see e.g., Lahti & Pylkkönen 1989 and Viskari 1992). Also, parallel to the findings of Hafer (1986), Hardouvelis (1987), and Jensen et al. (1997), the results suggest that among all industry portfolios, the financial sectors are relatively more sensitive to interest rate news than other industry sectors, apparently because monetary development directly affects the cash flows of financial companies. Furthermore, cyclical industries respond predictably to non-monetary news. Overall, these results show that stock returns respond primarily to non-monetary news while responses to monetary news are weaker. This finding is contrary to the evidence of Pearce and Roley (1985) and Hardouvelis (1987) who found that monetary information has the main effect on stock returns.

As also noted in Cutler et al. (1989), the use of estimated VAR residuals, as explanatory variables might be problematic for several reasons. First, if the VARs are misspecified, the estimated residuals do not accurately reflect the value of new information to market participants. Second, if investors operate with an information set larger than the one we have considered here, residuals may overstate the importance of news. Third, VAR does not capture new information about future macroeconomic conditions revealed in period t , but is not directly reflected in that period variable. According to Fama's (1990) results, stock price movements may largely reflect changes in expectations about future movements in economic fundamentals, which may not always be reflected in news about their current values. Finally, there are some timing issues associated with the release of new information and the reflection of that information on the variables in question.

Overall, the results refute the constant sign and size responses, and indicate further that previous estimates without any allowances for the asymmetric responses are biased towards zero partly for this reason. In fact, there may be a systematic relationship between news and stock returns, but the news data must be carefully separated into positive and negative, as well as major and minor, components. This implies that the stock market responses may not be arbitrary reactions to news, but instead, reactions that may reflect the differences of information content in different news. However, it should be noted that these results must be interpreted with the customary caution given that our sample period is exceptional. The chosen sample includes several major changes (e.g., institutional and monetary policy) that may have affected the results. One topic for future research would be to study whether the reported asymmetric reactions to good news and bad news are permanent or transitory.

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APPENDIX 1. Expected signs of the response coefficients and testable hypothesis

Panel A: Expected signs of the response coefficients					
News classification	Macroeconomic news				
	ip^u	$m1^u$	$H3^u$	p^u	s^u
$\hat{\mathbf{e}}_{it}$ (symmetric)	+	-	-	-	+
$\hat{\mathbf{e}}_t \geq 0$ (positive)	+ (>)	- (>)	- (>)	- (>)	+ (>)
$\hat{\mathbf{e}}_t < 0$ (negative)	\pm (<)	\pm (<)	\pm (<)	\pm (<)	\pm (<)
$\hat{\mathbf{e}}_t < 14^{\text{th}}$ or $\hat{\mathbf{e}}_t > 86^{\text{th}}$ (major)	+ (>)	- (>)	- (>)	- (>)	+ (>)
$14^{\text{th}} < \hat{\mathbf{e}}_t < 86^{\text{th}}$ (minor)	\pm (<)	\pm (<)	\pm (<)	\pm (<)	\pm (<)

Panel B: The testable hypothesis

The Null hypothesis	Coefficients	The Alternative hypothesis
$H_1: \mathbf{b}_i = 0$	for all news	$H_A: \mathbf{b}_i \neq 0$ at least for one news
$H_2: \mathbf{b}_i = 0$	for ip^u and s^u	$H_A: \mathbf{b}_i \neq 0$ at least for one news
$H_3: \mathbf{b}_i = 0$	for $m1^u$, $H3^u$, and p^u	$H_A: \mathbf{b}_i \neq 0$ at least for one news
$H_4: \mathbf{b}^{POS}_i = 0$	for all news	$H_A: \mathbf{b}^{POS}_i \neq 0$ at least for one news
$H_5: \mathbf{b}^{NEG}_i = 0$	for all news	$H_A: \mathbf{b}^{NEG}_i \neq 0$ at least for one news
$H_6: \mathbf{b}^{POS}_i = \mathbf{b}^{NEG}_i$	for all news	$H_A: \mathbf{b}^{POS}_i \neq \mathbf{b}^{NEG}_i$ at least for one news
$H_7: \mathbf{b}^{POS}_i = \mathbf{b}^{NEG}_i$	for ip^u and s^u	$H_A: \mathbf{b}^{POS}_i \neq \mathbf{b}^{NEG}_i$ at least for one news
$H_8: \mathbf{b}^{POS}_i = \mathbf{b}^{NEG}_i$	for $m1^u$, $H3^u$, and p^u	$H_A: \mathbf{b}^{POS}_i \neq \mathbf{b}^{NEG}_i$ at least for one news
$H_9: \mathbf{b}^{MAJ}_i = 0$	for all news	$H_A: \mathbf{b}^{MAJ}_i \neq 0$ at least for one news
$H_{10}: \mathbf{b}^{MIN}_i = 0$	for all news	$H_A: \mathbf{b}^{MIN}_i \neq 0$ at least for one news
$H_{11}: \mathbf{b}^{MAJ}_i = \mathbf{b}^{MIN}_i$	for all news	$H_A: \mathbf{b}^{MAJ}_i \neq \mathbf{b}^{MIN}_i$ at least for one news
$H_{12}: \mathbf{b}^{MAJ}_i = \mathbf{b}^{MIN}_i$	for ip^u and s^u	$H_A: \mathbf{b}^{MAJ}_i \neq \mathbf{b}^{MIN}_i$ at least for one news
$H_{13}: \mathbf{b}^{MAJ}_i = \mathbf{b}^{MIN}_i$	for $m1^u$, $H3^u$, and p^u	$H_A: \mathbf{b}^{MAJ}_i \neq \mathbf{b}^{MIN}_i$ at least for one news

Note: The variables are industrial production (ip^u), real money supply ($m1^u$), short-term interest rate ($H3^u$), consumer price index (p^u), and real exchange rate (s^u). Superscript u denotes news variable. The symbol \pm denotes that the effect is ambiguous depending on whether the "cash flow" or the "discount rate" effect dominates. The symbols > and < in parenthesis denote that the effect is expected to be stronger or weaker than in the symmetric (i.e., benchmark) case, respectively.

APPENDIX 2. The reaction of stock prices to macroeconomic news, 1989:04 - 1996:12 ($n = 93$)

Model (2): $R_{it} = a_i + \hat{\mathbf{e}}_i \mathbf{b}_i + \mathbf{d}_i + u_{it}$										
News on industry	ip^u	$m1^u$	$H3^u$	p^u	s^u	R^2C	DW	H_1 :	H_2 :	H_3 :
Banks and finance	-0.318 (-1.106)	-0.379 (-0.849)	-0.023 (-1.289)	0.879 (0.216)	1.399* (1.895)	0.175 {0.060}	1.840	2.031* [0.084]	2.393* [0.098]	1.099 [0.355]
Insurance and investment	-0.169 (-0.678)	-0.336 (-0.882)	-0.050** (-2.051)	1.722 (0.391)	0.258 (0.348)	0.145 {0.073}	1.922	1.357 [0.250]	0.236 [0.789]	2.061 [0.113]
Other services	0.278 (1.583)	-0.500 (-1.329)	-0.010 (-0.968)	1.568 (0.699)	0.286 (0.683)	0.312 {0.017}	1.781	2.754** [0.024]	1.881 [0.159]	1.998 [0.122]
Metal and engineering	0.433** (2.122)	-0.853* (-1.839)	0.008 (0.452)	2.679 (0.760)	0.566 (0.925)	0.147 {0.000}	1.938	1.939* [0.098]	2.974* [0.057]	1.429 [0.241]
Forest industries	0.533*** (2.802)	-0.593 (-1.328)	0.011 (0.806)	0.616 (0.215)	1.064** (2.459)	0.125 {0.042}	2.000	3.887*** [0.003]	5.318*** [0.007]	0.621 [0.603]
Multi-business industry	0.451* (1.916)	-1.053** (-2.293)	0.008 (0.512)	4.892 (1.578)	1.294** (2.445)	0.259 {0.027}	1.917	3.346*** [0.009]	5.369*** [0.007]	3.851** [0.013]
Other industries	0.155 (0.639)	-0.408 (-1.492)	-0.012* (-1.721)	2.735 (1.047)	0.520 (1.044)	0.093 {0.018}	1.845	3.708*** [0.005]	0.947 [0.392]	2.569* [0.061]
HEX all share index	0.302* (1.844)	-0.698* (-1.923)	-0.002 (-0.145)	2.843 (1.145)	1.017** (2.361)	0.234 {0.022}	1.735	3.436*** [0.008]	5.243*** [0.007]	2.542* [0.063]

Note: Independent variables are industrial production (ip^u), real money supply ($m1^u$), short-term interest rate ($H3^u$), consumer price index (p^u), and real exchange rate (s^u), and are proxied by VAR(2) residuals estimated via recursive least squares. Superscripts denote news variables. Standard errors, t – values (in parenthesis) and F – values [p -values in square brackets] are corrected for heteroscedasticity and autocorrelation by using the Newey-West (1987) procedure. R^2C is the coefficient of determination adjusted for degrees of freedom. Round brackets denote R^2C measures without dummies. DW is the Durbin – Watson statistic. H_1 is the null hypothesis that all slope coefficients are jointly zero; H_2 and H_3 are similar for non-monetary (ip^u and s^u) and monetary ($m1^u$, $H3^u$, and p^u) news. *, **, and *** denote significance at the 10 %, 5 %, and 1 % level, respectively.

APPENDIX 3. The reaction of stock prices to positive and negative news, 1989:04 - 1996:12 ($n = 93$)

Model (3): $R_{it} = a_i + POSIT_t \cdot \hat{\mathbf{e}}_i \mathbf{b}^{POS}_i + NEGAT_t \cdot \hat{\mathbf{e}}_i \mathbf{b}^{NEG}_i + \mathbf{d}_i + u_{it}$									
News on industry		ip^u	$m1^u$	$H3^u$	p^u	s^u	R^2C	Null hypothesis	F -statistics
Banks and finance	<i>POSIT</i>	0.534 (0.766)	-0.012 (-0.014)	-0.015 (-0.444)	-10.899 (-1.304)	2.268 (1.369)	0.176 {0.100}	$H_4: \mathbf{b}^{POS} = 0$ for all j $H_5: \mathbf{b}^{NEG} = 0$ for all j $H_6: \mathbf{b}^{POS} = \mathbf{b}^{NEG}$ for all j	0.889 1.122 0.965
	<i>NEGAT</i>	-0.839 (-1.202)	-0.852 (-1.312)	-0.015 (-0.381)	9.425 (1.132)	-0.185 (-0.093)		$H_7: \mathbf{b}^{POS} = \mathbf{b}^{NEG}$ for ip^u and s^u $H_8: \mathbf{b}^{POS} = \mathbf{b}^{NEG}$ for $m1^u$, $H3^u$, and p^u	0.801 1.216
Insurance and investment	<i>POSIT</i>	0.085 (0.138)	-0.525 (-0.670)	-0.039 (-0.874)	-6.265 (-0.647)	2.208 [#] (2.089)	0.158 {0.134}	$H_4: \mathbf{b}^{POS} = 0$ for all j $H_5: \mathbf{b}^{NEG} = 0$ for all j $H_6: \mathbf{b}^{POS} = \mathbf{b}^{NEG}$ for all j	0.679 1.514 1.159
	<i>NEGAT</i>	-0.206 (-0.334)	-0.168 (-0.319)	-0.027 (-0.829)	8.465 [*] (1.726)	-2.639 [*] (1.799)		$H_7: \mathbf{b}^{POS} = \mathbf{b}^{NEG}$ for ip^u and s^u $H_8: \mathbf{b}^{POS} = \mathbf{b}^{NEG}$ for $m1^u$, $H3^u$, and p^u	1.832 0.572
Other services	<i>POSIT</i>	1.153 ^{***#} (2.933)	-0.644 (-1.139)	-0.039 [#] (-1.882)	-3.145 (-0.627)	1.696 ^{***#} (2.242)	0.371 {0.123}	$H_4: \mathbf{b}^{POS} = 0$ for all j $H_5: \mathbf{b}^{NEG} = 0$ for all j $H_6: \mathbf{b}^{POS} = \mathbf{b}^{NEG}$ for all j	2.923 ^{**} 1.508 2.304 [*]
	<i>NEGAT</i>	-0.397 (-1.166)	-0.459 (-0.955)	0.024 (1.311)	6.222 ^{**} (2.016)	-0.801 (-0.922)		$H_7: \mathbf{b}^{POS} = \mathbf{b}^{NEG}$ for ip^u and s^u $H_8: \mathbf{b}^{POS} = \mathbf{b}^{NEG}$ for $m1^u$, $H3^u$, and p^u	3.485 ^{**} 2.916 ^{**}
HEX all share index	<i>POSIT</i>	0.904 ^{***} (2.754)	-0.888 (-1.558)	-0.014 (-0.453)	-3.133 (-0.573)	2.445 ^{***#} (2.535)	0.250 {0.112}	$H_4: \mathbf{b}^{POS} = 0$ for all j $H_5: \mathbf{b}^{NEG} = 0$ for all j $H_6: \mathbf{b}^{POS} = \mathbf{b}^{NEG}$ for all j	2.887 ^{**} 2.219 [*] 2.169 [*]
	<i>NEGAT</i>	-0.108 (-0.284)	-0.579 (-1.067)	0.025 (1.097)	8.204 ^{**} (2.125)	-0.535 (-0.525)		$H_7: \mathbf{b}^{POS} = \mathbf{b}^{NEG}$ for ip^u and s^u $H_8: \mathbf{b}^{POS} = \mathbf{b}^{NEG}$ for $m1^u$, $H3^u$, and p^u	2.135 1.003

Note: News variables are industrial production (ip^u), real money supply ($m1^u$), short-term interest rate ($H3^u$), consumer price index (p^u), and real exchange rate (s^u), and are proxied by VAR(2) residuals estimated recursively. \mathbf{d}_i is a vector of exogenous variables (seasonal dummies and a dummy for with in exchange rate regime). Standard errors, t -statistics (in parenthesis) and F -tests are corrected for heteroscedasticity and autocorrelation by using the Newey-West (1987) procedure. R^2C is the coefficient of determination adjusted for degrees of freedom. Round brackets denote R^2C measures estimated without dummies. H_4 and H_5 test whether positive and negative values are jointly zero, respectively. H_6 tests whether all slope coefficients in positive and negative values of news are the same; H_7 and H_8 are similar for non-monetary (ip^u and s^u) and monetary ($m1^u$, $H3^u$, and p^u) coefficients, respectively. *, **, and *** denote significance at the 10%, 5%, and 1% level. # denotes statistically different from the response of negative news values at the 10 percent level.

APPENDIX 3. (...continued)

$$\text{Model (3): } R_{it} = a_i + \text{POSIT}_t \cdot \hat{\mathbf{e}}_t \mathbf{b}_i^{\text{POS}} + \text{NEGAT}_t \cdot \hat{\mathbf{e}}_t \mathbf{b}_i^{\text{NEG}} + \mathbf{d}_i + u_{it}$$

News on industry		ip^u	$m1^u$	$H3^u$	p^u	s^u	R^2C	Null hypothesis	F -statistics
Metal and engineering	<i>POSIT</i>	1.304 ^{***#} (3.233)	-1.023 (-1.417)	-0.019 (-0.553)	-4.066 (-0.585)	2.519 ^{*#} (1.949)	0.185 {0.058}	$H_4: \mathbf{b}^{\text{POS}} = 0$ for all j $H_5: \mathbf{b}^{\text{NEG}} = 0$ for all j $H_6: \mathbf{b}^{\text{POS}} = \mathbf{b}^{\text{NEG}}$ for all j	3.104 ^{**} 1.426 1.833
	<i>NEGAT</i>	-1.178 (-0.430)	-0.772 (-0.999)	0.049 [*] (1.808)	9.006 [*] (1.672)	-1.295 (-1.092)		$H_7: \mathbf{b}^{\text{POS}} = \mathbf{b}^{\text{NEG}}$ for ip^u and s^u $H_8: \mathbf{b}^{\text{POS}} = \mathbf{b}^{\text{NEG}}$ for $m1^u$, $H3^u$, and p^u	3.003 [*] 1.719
Forest industries	<i>POSIT</i>	1.523 ^{***#} (3.933)	-0.436 (-0.732)	-0.014 (-0.488)	-8.628 [#] (-1.294)	2.018 [*] (1.988)	0.152 {0.087}	$H_4: \mathbf{b}^{\text{POS}} = 0$ for all j $H_5: \mathbf{b}^{\text{NEG}} = 0$ for all j $H_6: \mathbf{b}^{\text{POS}} = \mathbf{b}^{\text{NEG}}$ for all j	3.994 ^{***} 1.377 2.070 [*]
	<i>NEGAT</i>	-0.152 (-0.364)	-0.856 (-1.299)	0.038 (1.601)	7.869 [*] (1.702)	0.355 (0.263)		$H_7: \mathbf{b}^{\text{POS}} = \mathbf{b}^{\text{NEG}}$ for ip^u and s^u $H_8: \mathbf{b}^{\text{POS}} = \mathbf{b}^{\text{NEG}}$ for $m1^u$, $H3^u$, and p^u	2.988 [*] 1.920
Multi-business industry	<i>POSIT</i>	1.237 ^{***} (3.028)	-1.097 (-1.442)	-0.006 (-0.153)	0.701 (0.108)	3.451 ^{***#} (3.208)	0.295 {0.161}	$H_4: \mathbf{b}^{\text{POS}} = 0$ for all j $H_5: \mathbf{b}^{\text{NEG}} = 0$ for all j $H_6: \mathbf{b}^{\text{POS}} = \mathbf{b}^{\text{NEG}}$ for all j	4.817 ^{***} 3.090 ^{**} 2.634 ^{**}
	<i>NEGAT</i>	-0.118 (-0.225)	-1.097 (-1.526)	0.041 [*] (1.716)	9.443 [*] (1.808)	-1.284 (-1.148)		$H_7: \mathbf{b}^{\text{POS}} = \mathbf{b}^{\text{NEG}}$ for ip^u and s^u $H_8: \mathbf{b}^{\text{POS}} = \mathbf{b}^{\text{NEG}}$ for $m1^u$, $H3^u$, and p^u	3.329 ^{**} 0.804
Other industries	<i>POSIT</i>	0.238 (0.459)	-1.698 ^{***#} (-2.861)	-0.028 (-0.820)	-2.275 (-0.423)	1.468 (1.539)	0.109 {0.038}	$H_4: \mathbf{b}^{\text{POS}} = 0$ for all j $H_5: \mathbf{b}^{\text{NEG}} = 0$ for all j $H_6: \mathbf{b}^{\text{POS}} = \mathbf{b}^{\text{NEG}}$ for all j	2.990 ^{**} 1.324 2.468 ^{**}
	<i>NEGAT</i>	0.072 (0.161)	0.822 [*] (1.979)	0.011 (0.399)	7.887 [*] (1.859)	0.095 (0.085)		$H_7: \mathbf{b}^{\text{POS}} = \mathbf{b}^{\text{NEG}}$ for ip^u and s^u $H_8: \mathbf{b}^{\text{POS}} = \mathbf{b}^{\text{NEG}}$ for $m1^u$, $H3^u$, and p^u	0.346 3.686 ^{**}

Note: News variables are industrial production (ip^u), real money supply ($m1^u$), short-term interest rate ($H3^u$), consumer price index (p^u), and real exchange rate (s^u), and are proxied by VAR(2) residuals estimated recursively. \mathbf{d}_i is a vector of exogenous variables (seasonal dummies and a dummy for with in exchange rate regime). Standard errors, t -statistics (in parenthesis) and F -tests are corrected for heteroscedasticity and autocorrelation by using the Newey-West (1987) procedure. R^2C is the coefficient of determination adjusted for degrees of freedom. Round brackets denote R^2C measures estimated without dummies. H_4 and H_5 test whether positive and negative values are jointly zero, respectively. H_6 tests whether all slope coefficients in positive and negative values of news are the same; H_7 and H_8 are similar for non-monetary (ip^u and s^u) and monetary ($m1^u$, $H3^u$, and p^u) coefficients, respectively. *, **, and *** denote significance at the 10%, 5%, and 1% level. # denotes statistically different from the negative news values at the 10 percent level.

APPENDIX 4. The reaction of stock prices to major and minor news, 1989:04 - 1996:12 ($n = 93$)

Model (4): $R_{it} = a_i + MAJOR_t \cdot \hat{\mathbf{e}}_t \mathbf{b}^{MAJ}_i + MINOR_t \cdot \hat{\mathbf{e}}_t \mathbf{b}^{MIN}_i + \mathbf{d}_i + u_{it}$									
News on industry		ip^u	$m1^u$	$H3^u$	p^u	s^u	R^2C	Null hypothesis	F -tests
Banks and finance	<i>MAJOR</i>	-0.443 (-1.344)	-0.571 (-1.412)	-0.016 (-0.847)	-1.109 (-0.257)	1.541* (1.750)	0.143 {0.023}	$H_9: \mathbf{b}^{MAJ} = 0$ for all news $H_{10}: \mathbf{b}^{MIN} = 0$ for all news $H_{11}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for all news	2.321* 0.910 0.758
	<i>MINOR</i>	0.208 (0.328)	-0.421 (-0.197)	-0.081 (-1.582)	6.912 (0.798)	3.317 (1.141)		$H_{12}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for ip^u and s^u $H_{13}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for $m1^u$, $H3^u$, and p^u	0.517 0.975
Insurance and investment	<i>MAJOR</i>	-0.128 (-0.443)	-0.638** (-2.106)	-0.029# (-1.247)	-1.685 (-0.505)	0.669 (0.826)	0.157 {0.071}	$H_9: \mathbf{b}^{MAJ} = 0$ for all news $H_{10}: \mathbf{b}^{MIN} = 0$ for all news $H_{11}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for all news	1.460 1.552 1.215
	<i>MINOR</i>	-0.156 (-0.249)	-0.517 (-0.369)	-0.146** (-2.600)	10.393 (1.002)	0.792 (0.259)		$H_{12}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for ip^u and s^u $H_{13}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for $m1^u$, $H3^u$, and p^u	0.002 1.916
Other services	<i>MAJOR</i>	0.186 (0.914)	-0.757*** (-2.828)	-0.007# (-0.598)	0.749 (0.326)	0.216 (0.495)	0.345 {0.093}	$H_9: \mathbf{b}^{MAJ} = 0$ for all news $H_{10}: \mathbf{b}^{MIN} = 0$ for all news $H_{11}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for all news	2.943** 2.076* 1.886
	<i>MINOR</i>	0.265 (0.648)	0.391 (0.520)	-0.059*** (-2.375)	0.667 (0.127)	2.369* (1.722)		$H_{12}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for ip^u and s^u $H_{13}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for $m1^u$, $H3^u$, and p^u	1.356 2.706*
HEX all share index	<i>MAJOR</i>	0.328* (1.710)	-0.912*** (-3.286)	0.004# (0.312)	0.958 (0.439)	1.001*# (1.986)	0.241 {0.052}	$H_9: \mathbf{b}^{MAJ} = 0$ for all news $H_{10}: \mathbf{b}^{MIN} = 0$ for all news $H_{11}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for all news	4.767*** 2.309* 1.721
	<i>MINOR</i>	0.274 (0.631)	-0.377 (-0.434)	-0.052* (-1.969)	7.877 (1.283)	3.542** (2.458)		$H_{12}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for ip^u and s^u $H_{13}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for $m1^u$, $H3^u$, and p^u	1.513 2.325*

Note: News variables are industrial production (ip^u), real money supply ($m1^u$), short-term interest rate ($H3^u$), consumer price index (p^u), and real exchange rate (s^u), and are proxied by VAR(2) residuals estimated via recursive least squares. Standard errors, t -statistics (in parenthesis) and F -tests are corrected for heteroscedasticity and autocorrelation by using the Newey-West (1987) procedure. R^2C is the coefficient of determination adjusted for degrees of freedom. Round brackets denote R^2C without dummies. H_9 and H_{10} test whether major and minor values are jointly zero, respectively. H_{11} tests whether all slope coefficients in major and minor values of news are the same; H_{12} and H_{13} are similar for non-monetary (ip^u and s^u) and monetary ($m1^u$, $H3^u$, and p^u) coefficients, respectively. *, **, and *** denote significance at the 10%, 5%, and 1% level. # denotes statistically different from the response of minor news values at the 10 percent level.

APPENDIX 4. (...continued)

Model (4): $R_{it} = a_i + MAJOR_t \cdot \hat{\mathbf{e}}_t \mathbf{b}^{MAJ}_i + MINOR_t \cdot \hat{\mathbf{e}}_t \mathbf{b}^{MIN}_i + \mathbf{d}_i + u_{it}$									
News on industry		ip^u	$m1^u$	$H3^u$	p^u	s^u	R^2C	Null hypothesis	F -tests
Metal and engineering	<i>MAJOR</i>	0.464* (1.882)	-1.184*** (-3.410)	0.024# (1.312)	-0.525 (-0.147)	0.816 (1.151)	0.196 {0.044}	$H_9: \mathbf{b}^{MAJ} = 0$ for all news $H_{10}: \mathbf{b}^{MIN} = 0$ for all news $H_{11}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for all news	3.849*** 2.299* 2.320*
	<i>MINOR</i>	0.447 (0.713)	-0.493 (-0.579)	-0.079** (-2.333)	11.635 (1.478)	2.454 (1.472)		$H_{12}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for ip^u and s^u $H_{13}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for $m1^u$, $H3^u$, and p^u	0.449 3.651**
Forest industries	<i>MAJOR</i>	0.513** (2.456)	-0.807** (-2.187)	0.009 (0.624)	-0.491 (-0.183)	0.780# (1.406)	0.127 {0.064}	$H_9: \mathbf{b}^{MAJ} = 0$ for all news $H_{10}: \mathbf{b}^{MIN} = 0$ for all news $H_{11}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for all news	4.649*** 1.843 1.298
	<i>MINOR</i>	0.483 (0.974)	-0.056 (-0.057)	-0.031 (-0.884)	1.693 (0.217)	5.102*** (2.827)		$H_{12}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for ip^u and s^u $H_{13}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for $m1^u$, $H3^u$, and p^u	2.842* 0.631
Multi-business industry	<i>MAJOR</i>	0.466* (1.692)	-1.217*** (-3.164)	0.010 (0.553)	3.584 (1.192)	1.155* (1.713)	0.237 {0.033}	$H_9: \mathbf{b}^{MAJ} = 0$ for all news $H_{10}: \mathbf{b}^{MIN} = 0$ for all news $H_{11}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for all news	4.639*** 1.432 0.959
	<i>MINOR</i>	0.394 (0.657)	-0.936 (-0.951)	-0.033 (-1.005)	7.142 (0.861)	4.104** (2.316)		$H_{12}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for ip^u and s^u $H_{13}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for $m1^u$, $H3^u$, and p^u	1.315 0.573
Other industries	<i>MAJOR</i>	0.150 (0.523)	-0.636*** (-2.562)	-0.010 (-0.921)	0.641 (0.268)	0.619 (1.158)	0.096 {0.032}	$H_9: \mathbf{b}^{MAJ} = 0$ for all news $H_{10}: \mathbf{b}^{MIN} = 0$ for all news $H_{11}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for all news	3.114** 2.471** 2.039*
	<i>MINOR</i>	0.299 (0.807)	0.178 (0.159)	-0.067** (-1.961)	10.335* (1.692)	2.588 (1.298)		$H_{12}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for ip^u and s^u $H_{13}: \mathbf{b}^{MAJ} = \mathbf{b}^{MIN}$ for $m1^u$, $H3^u$, and p^u	0.668 3.170**

Note: News variables are industrial production (ip^u), real money supply ($m1^u$), short-term interest rate ($H3^u$), consumer price index (p^u), and real exchange rate (s^u), and are proxied by VAR(2) residuals estimated via recursive least squares. Standard errors, t -statistics (in parenthesis) and F -tests are corrected for heteroscedasticity and autocorrelation by using the Newey-West (1987) procedure. R^2C is the coefficient of determination adjusted for degrees of freedom. Round brackets denote R^2C without dummies. H_9 and H_{10} test whether major and minor values are jointly zero, respectively. H_{11} tests whether all slope coefficients in major and minor values of news are the same; H_{12} and H_{13} are similar for non-monetary (ip^u and s^u) and monetary ($m1^u$, $H3^u$, and p^u) coefficients, respectively. *, **, and *** denote significance at the 10%, 5%, and 1% level. # denotes statistically different from the response of minor news values at the 10 percent level.

Chapter 5

INDUSTRY PORTFOLIOS AND MACROECONOMIC SHOCKS:

An Impulse Response and Variance Decomposition Analysis*

ABSTRACT

Employing impulse response functions and variance decomposition measures, the short-run dynamic responses of Finnish industry level stock market data to macroeconomic shocks over the period January 1987 to December 1996 are investigated. The results acquired suggest that the stock market responses, excluding the inflation rate, to economic shocks decay quickly, implying that the Helsinki Stock Exchange can absorb shocks quickly and efficiently. Furthermore, shocks to key economic indicators do not explain the majority of the movements in monthly stock returns. Across industries, the responses are mainly uniform, although some industry-specific variations in the magnitudes and relative importance of the shocks can be found. (*JEL C1, G1*)

KEY WORDS: Return predictability; Industry portfolios; VAR model; Macroeconomic shocks; Impulse response functions; Variance decomposition

* I am grateful for comments by Tom Berglund, Xavier Freixas, Vesa Kanninen, Markku Rahiala, Kari Takala, Jouko Ylä-Liedenpohja, and the participants at seminar at the University of Tampere and workshop on Capital Markets and Financial Economics (FPPE) at the Swedish School of Business and Economics. Furthermore, the helpful comments by an unknown referee of the Finnish Economic Papers are gratefully acknowledged. All the remaining errors are exclusive my responsibility.

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1. INTRODUCTION

Analyzing stock market movements has been one of the major research topics in the recent literature of financial economics. One popular approach to explain stock price movements is based on the efficient market hypothesis (Fama 1970), which assumes that stock prices *fully* and *instantaneously* reflect all available information. Therefore, stock prices should only respond to new information. Furthermore, if prices adjust slowly to new information, stock returns are then predictable by using past information. In other words, slow dissemination of publicly available information indicates that agents may be able to earn excess profits based on any initial market response. However, return predictability implies market inefficiency only if the expected returns are constant due to the joint hypothesis problem (i.e., market efficiency must be tested jointly with some asset pricing model).

Several empirical studies have shown that stock returns are predictable. Some examples of this can be seen by price-earnings ratios (see e.g., Keim & Stambaugh 1986), term-structure of interest rates (see e.g., Campbell 1987), past returns (see e.g., Fama & French 1988a), and dividend yields (see e.g., Fama & French 1989). In addition, the predictability increases with the return interval (see e.g., Fama & French 1988b). However, the forecast power of macroeconomic news has been given less attention in the last few years^{1,2}. For example, Darrat (1988, 1990) and Wasserfallen (1989) provide evidence of incomplete dissemination of publicly available economic information by the monthly and the quarterly returns. Nevertheless, these studies are usually based on the two-step strategy originally proposed by Barro (1977). Although this procedure is easy to apply in practice, it suffers from methodological drawbacks (see Pagan 1984) that decrease the validity of the results.

In order to avoid these potentially severe problems associated with generated regressors, impulse response functions and variance decomposition measures are applied within the VAR framework (due to Sims 1980). For example, a similar procedure was also used by Ali and Hasan (1993) when investigating the short-run dynamic behavior of the monthly Canadian stock market data to a unit standard deviation random shock given

¹ Previous studies (see e.g., Hardouvelis 1987; Cutler, Poterba & Summers 1989; Orphanides 1992, and McQueen & Roley 1993) generally concentrated on immediate stock return responses to economic news.

² In the Finnish stock market, the explanatory power of economic news seem to be even lower (see e.g., Junttila, Larkomaa & Perttunen 1997 and references therein). See also Kallunki et al. 1997 and Knif and Löflund (1997) for a review of the empirical studies conducted at the Finnish data.

to various macroeconomic fundamentals. Based on the lack of statistical significance of impulse response coefficients, they concluded that Canadian stock market is efficient with respect to both fiscal and monetary policies³.

The purpose of this paper is to investigate whether monthly stock returns in the Helsinki Stock Exchange are predictable by using past aggregate economic information. More specifically, this paper concentrates on answering the following questions: What kind of short-run dynamic behavior macroeconomic shocks cause to the stock market? How quickly does the stock market absorb shocks in key economic fundamentals? How much these shocks can explain for the short-run stock return variation? We address these questions in order to test how efficient the market is in impounding macroeconomic information in stock prices. Furthermore, only short-run responses are considered since shocks, by definition, are random variables around zero and hence will not influence stock returns over a long horizon.

The distinction between this paper and other papers in this area involves the following points. First, whereas most other studies focus on testing whether stock returns are predictable by lagged returns, dividend yields, and various term-structure variables, this study investigates whether stock returns are predictable by using a broader information set about key macroeconomic indicators. Second, former research usually neglects the possible heterogeneous impacts of unexpected changes in fundamentals on individual industry sectors. Stock returns in different industries possess distinct intrinsic characteristics and therefore, their reactions may differ substantially from the response of aggregate stock market⁴. In the third point, the publication lags in economic statistics are taken into account and the latest data available is used.

The results indicate that most macroeconomic shocks have statistically significant immediate effects on the stock market. Furthermore, similar to Ali and Hasan's (1993) findings, the monthly stock returns adjust quickly to economic shocks within one month, thus implying the complete dissemination of publicly available economic information on

³ Recently, VAR methodology is frequently used in the fields of economics and finance. For instance, Pynnönen and Knif (1998) applied impulse response functions and concluded that virtually all shock impulses (with respect to both the Helsinki and the Stockholm Stock Exchanges) are absorbed in the Finnish stock markets within one month. On the contrary, Saltoglu (1998) applies multivariate cointegration framework between stock prices and dividends. His results show that once the system is shocked, the initial adjustment in stock prices takes about 3 – 4 years, and the main part of the shock dies out by the end of the eight-year. According to Saltoglu (1998), this can be interpreted with the existence of market efficiency.

⁴ Industry level data is especially important in the Helsinki stock exchange because general price index can give biased results due to the fact that Nokia Corporation (a large telecommunications firm) dominates it. To reduce this possible bias, we have disaggregated all share price index into seven separate sub-indexes.

the stock market. However, there are some significant responses within four months after the initial shock for some industries. For example, inflation rate shocks seem to have some forecast power on stock returns in the very short run. Overall, shocks related to the financial side of the economy seem to be more potent than the non-monetary shocks in affecting stock returns. Due to the stationary presentation of the VAR system, the effect of shocks about economic fundamentals on industry stock returns decays rapidly, and stock returns will quickly return to their pre-shock levels.

According to variance decomposition measures, fundamental economic shocks do not explain the majority of movements in Finnish stock returns: at the most, about 14.5 percent of the general stock market variability can be explained by economic shocks. Across industries, the responses are uniform, although some industry-specific variations in the magnitudes and the relative importance of the fundamental economic shocks can be found (e.g., interest-rate sensitivity of the financial sectors). The inflation rate shocks are the most successful variable in explaining stock returns. In general, monetary shocks appear to be a more important source of variation in stock prices than non-monetary shocks. These results are consistent with those of impulse response functions.

The rest of the paper is organized as follows: In the next section, a simple theoretical model based on efficient market theory is presented. After that, data and econometric methodology are discussed. The fourth section reports the empirical evidence, and the final section brings everything into conclusion.

2. THEORETICAL BASES

To test the impact of new economic information on the stock market, we assume that stock returns are a function of expected changes and unanticipated changes (i.e., shocks), as well as past unexpected changes in some pre-specified macroeconomic fundamentals. Assuming linear functional form, this model is presented as follows:

$$(1) \quad R_{it} = a_i + \mathbf{x}_t^e \mathbf{b}_i + \mathbf{x}_t^u \mathbf{c}_i + \sum_{p=1}^k \mathbf{x}_{t-p}^u \mathbf{d}_{ip} + u_{it},$$

where

R_{it}	= real stock return of the industry i from month $t - 1$ to month t
a_i	= scalar, that is, mean return (assumed to be constant) for industry i
\mathbf{x}_t^e	= $(1 \times n)$ vector of expected changes in the macroeconomic variable
\mathbf{x}_t^u	= $(1 \times n)$ vector of unexpected changes in the macroeconomic variable
\mathbf{x}_{t-p}^u	= $(1 \times n)$ vector of the economic news variable k months prior to month t
$\mathbf{b}_i, \mathbf{c}_i, \mathbf{d}_{ip}$	= $(n \times 1)$ vector of coefficients measuring the effects of shocks on returns
u_{it}	= industry-specific error terms with the OLS-assumptions $u_{it} \sim \text{i.i.d.}(0, \sigma^2)$.

Efficient market theory is based on the assumption that stock prices fully reflect all available information instantaneously. Therefore, if economic agents are careful users of available information, then expected changes should have no effect (i.e., $\mathbf{b}_i = 0$) on stock returns since this information is already incorporated into prevailing market prices. In addition, past information should also equal zero (i.e., $\mathbf{d}_{ip} = 0$) since otherwise stock returns only slowly adjust to new information. These two propositions lead to the idea that stock returns respond only to new information and the reaction is immediate (i.e., $\mathbf{c}_i \neq 0$). However, since we are interested in testing whether stock returns are predictable by using the past macroeconomic information, we also allow for past unexpected changes, and the model (1) becomes

$$(2) \quad R_{it} = a_i + \mathbf{x}_t^u \mathbf{c}_i + \sum_{p=1}^k \mathbf{x}_{t-p}^u \mathbf{d}_{ip} + u_{it}$$

where the symbols are as in Equation (1). Most previous studies use this specification (see e.g., Sadeghi 1992). The null hypothesis is $H_0: \mathbf{d}_{ip} = 0$, and the alternative hypothesis is $H_A: \mathbf{d}_{ip} \neq 0$. If the data rejects the null in favor of the alternative, new economic information is not fully incorporated into current market prices.

3. DATA AND ECONOMETRIC METHODOLOGY

3.1. Stock price and macroeconomic data

Our data set consists of monthly observations over the period January 1987 to December 1996. This sample period contains 120 observations, but some of these observations are lost because of lags in VAR as well as lags in the publication of economic statistics. This particular period is chosen due to data limitations⁵. Notice that while this period is interesting, it is also exceptional in the Finnish economy. During this period, several major changes in the economic as well as the stock market environment have taken place (e.g., the deregulation of financial markets, and the removal of restrictions of foreign ownership of Finnish stocks).

After defining the sample period, next thing to do is to choose a set of relevant variables to be included in the VAR system⁶. Included are five key macroeconomic indicators, which might reasonably be expected to affect future cash flows or discount rates. This representative set of variables describes both the real and financial side of the Finnish economy (see Lahti & Pylkkönen 1989). In addition, professional forecasters closely watch these variables. Since Finland is a small open economy, it is also important to consider any foreign influences (see Viskari 1992).

Variables related to the real side of the economy are industrial production (*ip*) and real exchange rate (*e*). Real exchange rate is defined as nominal trade-weighted exchange rate deflated by the consumer prices between foreign and domestic countries. Variables related to financial side of the economy are: real money supply (*m1*); that is, nominal money supply deflated by consumer price index; three-month nominal helibor rate (H3); and monthly consumer price inflation (π). All macroeconomic time series⁷ are seasonally unadjusted and measured in log levels, except the short-term interest rate, which is measured in annual percentage.

⁵ Hex indexes (see Hernesniemi 1990) and interest rate data are not available before 1987. In the beginning of the 1997, the Helsinki Stock Exchange changes its industry classification from seven to sixteen industries and therefore, these seven indices are not available since then.

⁶ Selecting variables is always problematic since there are variety of factors that influence the behavior of stock prices. Therefore, we have to use some kind of subset as a proxy for the true and complete information set, which is not observable by the market participants.

⁷ Industrial production and consumer price index are obtained from Statistics Finland while money supply, interest rate, and real exchange rate are obtained from the Bank of Finland.

Industrial production is an important indicator of the performance of the domestic economy. A real exchange rate is the relative price of the foreign goods in terms of the domestic goods and it determines the price competitiveness of the domestic firms compared to their foreign competitors⁸. As stock prices equal present value of expected cash flows discounted by risk-adjusted interest rates, it is expected that non-monetary shocks will increase cash flows and hence stocks (see Pearce & Roley 1985, Chow, Lee, & Solt 1997, and Friberg & Nydahl 1997). Notice that the stock price responses to non-monetary shocks need not be constant, but they may vary in magnitude and relative importance at different time horizons.

Remaining variables (denoted hereafter as monetary) relate to the financial side of the economy. Money supply and interest rate shocks are expected to capture the impact of monetary policy on stock prices (see Sellin 1998 for a survey of the literature). Several recent studies (see Thorbecke 1997) have shown that an increase in interest rates and a higher than expected money supply (see Siklos & Anusiewicz 1998) are expected to have a negative impact on stock prices. In addition, according to the Fisherian view, stocks should provide a hedge against expected inflation. Contrary to conventional wisdom, increasing evidence (see e.g., Graham 1996 and Groenewold et al. 1997) shows that stock returns are negatively related to expected and unexpected inflation as well as changes in expected inflation. Therefore, it is expected that inflation shocks will have a negative impact on stock returns. Again, the reactions to monetary shocks may vary in magnitude and relative importance at different time horizon.

Our target variables are monthly industry stock returns (end-of-month values) measured as the logarithmic difference in the HEX industry price indexes⁹. Stock returns are measured in real terms' (i.e., by first deflating the nominal stock price indices with consumer price index and then calculating the time differences of deflated stock prices

⁸ Real exchange rate is measured as the number of domestic currency needed to buy one unit of the foreign currency at time t . Defined in this way, an increase (decrease) in real exchange rate denotes depreciation (appreciation) of real exchange rate.

⁹ HEX price series are obtained from the Helsinki Stock Exchange. Due to limitations in industry-level data, HEX industry returns are measured without dividends since HEX yield-index (including dividends) are not available before 1991. Of course, theoretically it would be more preferable to measure returns as a sum of capital gains (or losses) and dividend yields, but due to lack of suitable data, we simply use price changes as a proxy for returns. To check the potential bias that may be due to excluding dividends, we conduct similar estimations by using dividend adjusted monthly aggregate stock returns, which are calculated by combining the WI-index (1987 - 1990) and HEX yield index (1991 - 1996). For further details about these indices see Berglund et al. (1983) and Hernesniemi (1990). The results were very similar since these two series are strongly correlated ($r = .983$) over the period of 1987:02 – 1996:12, which is due to exceptional sample period. Therefore, excluding dividends do not change the results.

series). Industry portfolios are as follows: 1) banks and finance, 2) insurance and investments, 3) other services, 4) metal and engineering, 5) forest industries, 6) multi-business industry, and 7) other industries. Industry stock returns or simply industry portfolios are denoted hereafter by R_{it} , where R_{it} = real stock return of the i^{th} industry during month t and $i = 1, \dots, 7$. In order to compare the industry level results to aggregate market response, we conduct similar estimations with HEX all share price index as a benchmark model.

Finally, due to lags in publication of economic statistics, the values of the industrial production in time t were assumed to be the published values for month $t - 2$. In addition, the values of the variables for real money supply and consumer price index in the period t were assumed to be the published values for month $t - 1$. The other time t variables are considered to be publicly known at time t and thus available to market participants. Accounting for publication lags, the problem of using the data that is not actually available to economic agents can be avoided.

3.2. Measuring shocks to macroeconomic fundamentals

Previous studies (see e.g., Darrat 1988, 1990 and Wasserfallen 1989) that have tested the impact of past economic information on stock returns have usually relied on the so-called two-step procedure¹⁰. Although this two-stage strategy gives consistent estimates of both current and lagged news coefficients (see Pagan 1984), the standard errors, in contrast, are unbiased only in contemporaneous news (see Orphanides 1992). Due to these statistical problems, it is more convenient to map the two-step procedure into an asymptotically equivalent VAR-based procedure by using impulse response functions and variance decomposition measures.

Consider that we can represent a set of variables using a vector \mathbf{x}_t of stochastic processes without any deterministic part

$$(3) \quad A(L)\mathbf{x}_t = \mathbf{e}_t,$$

¹⁰ That is, first, to estimate the news by the fitted residuals in the OLS regressions assuming that expectations can be described by some time series models and second, to estimate the lagged responses of stock returns to news by regressing returns on the current and lagged news.

where $A(L) = I - A_1L - \dots - A_pL^p$ is a finite ordered matrix polynomial in nonnegative powers of L with I denoting identity matrix, \mathbf{x}_t is a (6 x 1) vector of relevant variables listed above. A is a (6 x 6) coefficient matrix for the lagged values of \mathbf{x}_t and \mathbf{e}_t is a (6 x 1) normally distributed vector of white noise error terms that can be contemporaneously correlated. To put it more formally, $E(\mathbf{e}_t) = 0$ for all t and $E(\mathbf{e}_s\mathbf{e}_t') = \Sigma$, if $s = t$ and $E(\mathbf{e}_s\mathbf{e}_t') = 0$, if $s \neq t$, where the prime denotes transpose. We measure shocks with the disturbance terms in a VAR model (3). In a VAR analysis the only source of variation of \mathbf{x}_t variables are random shocks that in the reduced form are represented by the vector white noise \mathbf{e}_t . Since each equation in VAR model has the same explanatory variables, the coefficients can be estimated by using simple equation-by-equation OLS regressions.

Once the parameters in a VAR model have been estimated, the model can be expressed in its moving average representation in which one can trace out the responses of each variable to a shock to one of the variables in the system. Impulse response analysis is a descriptive device representing the dynamic behavior of the stock returns due to one standard deviation innovation or shock in each of the macroeconomic variables. Assuming that the multivariate invertibility condition is valid; that is, $B^{-1}(L) = A(L)$, the \mathbf{x}_t process has a dual vector moving average representation

$$(4) \quad \mathbf{x}_t = B(L)\mathbf{e}_t = \sum_{s=0}^{\infty} \Theta_s\mathbf{e}_{t-s},$$

where $B(L) = A^{-1}(L)$ and $B(L) = I + B_1L + B_2L^2 + \dots$ is a matrix polynomial which can be of infinite order. The matrix function $B(L)$ thus represents the mechanism through which the impulses \mathbf{e}_t are propagated into the system. The moving average representation can be interpreted as the vector impulse response function¹¹ since it expresses \mathbf{x}_t in terms of past and present innovation vectors $\mathbf{e}_t, \mathbf{e}_{t-1}, \dots$. The Θ_s : s are (6 x 6) matrices with $\Theta_0 = I$, where a single coefficient $\theta_{ij, s}$ (the ij^{th} element of the matrix Θ_s) gives the response of x_i to a unit shock in x_j at time s , holding all other innovations and at all dates constant.

Further analysis can be undertaken through the computation of variance decompositions that provide complementary information for a better understanding of the

¹¹ Hamilton (1994) provides a discussion of the mathematics of the impulse response functions and variance decompositions. However, it should be noted that the representation (4) is defined only for stationary series.

relations between industry portfolios and economic shocks. Variance decomposition compares the relative contribution played by different variables in causing such reactions. In other words, variance decompositions show the fraction (in percentage terms) of variance in the prediction for stock returns that is attributable to contemporaneous and past shocks in economic fundamentals.

However, if contemporaneous correlation between innovations \mathbf{e}_t are high, statistical inference based on impulse responses and variance decomposition could be misleading since the results are not unique to the different orderings of the variables¹². Therefore, the variance-covariance matrix of innovations needs to be orthogonalized to observe the distinct response pattern the VAR model may display. Unfortunately, there is no unique way to do this. One widely applied procedure is the so-called Choleski decomposition (see e.g., Doan 1989). If we define $\Sigma = PP'$, where P is a lower diagonal non-singular (6 x 6) matrix, then the new residuals $\mathbf{u}_t = P^{-1}\mathbf{e}_t$ are uncorrelated and hence the model (4) becomes

$$(5) \quad \mathbf{x}_t = \sum_{s=0}^{\infty} \Theta_s \mathbf{e}_{t-s} = \sum_{s=0}^{\infty} \Theta_s P P^{-1} \mathbf{e}_{t-s} = \sum_{s=0}^{\infty} \Psi_s \mathbf{u}_{t-s},$$

where $\Psi_s = \Theta_s P$ with $\Psi_0 = P$. Variance decomposition of the s steps ahead forecast error variance $\psi_{ij,s}^2$ and thus gives the proportion of the total forecast-error variance of x_i accounted for by shocks to x_j .

Finally, in order to analyze short run dynamic stock market responses to macroeconomic shocks, some kind of classification of different time horizon should be made. However, this is a substantive choice. In order to capture the short-run effects, the responses less or equal to one year to a one standard deviation shock in each macroeconomic fundamental are considered. Moreover, the short-run responses are divided further into the very short run responses that occur within the first three months period after the initial shock has occurred. Presented next is the empirical results – in

¹² The ambiguity in interpreting impulse response functions and variance decompositions arises from the fact that in reality the errors are never totally uncorrelated (i.e., they have a common component, which cannot be identified with any specific variable). A somewhat arbitrary method of dealing with this problem is to attribute all of the effect of any common component to the variable that comes first in the VAR system (see Lilien et al. 1994, 267). Hamilton (1994, 318 – 323) provides for a full technical discussion of these issues. However, it should be noted that this problem is probably not relevant here since returns are always placed last in the ordering.

terms of impulse response functions and variance decomposition – in the following section.

4. EMPIRICAL RESULTS

4.1. Preliminary data analysis

An important preliminary step in VAR estimation is to ascertain the time series properties of each of the variables of the model. The aim is to estimate a covariance-stationary VAR that requires all the variables in the system to be stationary. Some researchers (see e.g., Ali & Hasan 1993) prefer to avoid differencing and estimate unrestricted VARs in levels despite the obvious nonstationarity of the macroeconomic variables¹³. Augmented Dickey and Fuller (1979, 1981) for a variety of lags and Phillips and Perron (1988) tests suggest (not reported) that all variables, except industry stock return series and monthly inflation rate, appear to be nonstationary with stationary differences (i.e., $\mathbf{x}_t \sim I(1)$)¹⁴. Therefore, differencing is necessary to produce a stationary VAR. In contrast, stock returns and the inflation rate are stationary $I(0)$ variables, and hence suitable for statistical analysis.

Before any estimation can be performed, a suitable lag order of the unrestricted VAR must be determined. Given that there are only 118 monthly observations, the dimension of the VAR is somewhat restricted. The lag length selections were carried out industry-by-industry by using Schwarz' multivariate BIC information criterion. These results suggest a parsimonious specification for most of the VAR models across industries. Namely, tests suggested optimal lag length of one month. Using the modified likelihood-ratio statistic of Sims (1980) and sequential testing strategy suggest that the dynamics of the system are not completely captured by the low order VARs. When using lags less than four, several estimated residuals remain serial correlated, while five-lag specification

¹³ Hamilton (1994, 651 - 653) discusses estimating VARs in levels versus differences.

¹⁴ We also conduct the cointegration tests of Johansen (1988). It is necessary to run cointegration tests since non-stationary $m1$, $H3$, s , and $ip \sim I(1)$ -variables can form a linear combination, which is stationary, and hence error-correction models should be used (e.g., see Duy & Thoma 1998). LR -tests (corrected for small sample size as suggested by Cheung and Lai 1993) for various lags indicate that the non-stationary variables are not cointegrated at the 5 percent level. Therefore, we difference the non-stationary series once in order to obtain stationary VAR model.

appears to be appropriate to ensure satisfactory error diagnostics¹⁵. Therefore, all VARs were estimated using five lags of all variables, a constant, and 11 seasonal dummies.

First, the complete set of 118 datapoints is used in estimations with no attempt to eliminate rather obvious outliers (such as the October 1987 crash or September 1992 floating decision). Then the VAR specifications are explored further by examining the recursive residuals (not reported). Recursive residuals show some outliers, which are taken into account by using dummy variables to control for the possibility that influential observations will affect the results. Then the VAR system is re-estimated with the following seven "crash" dummies \mathbf{d}_t , where $\mathbf{d}_t = 1$ if $t = \{1987:10, 1989:04, 1991:01, 1991:02, 1991:12, 1992:09, 1992:10\}$ as well as "changes in growth" dummy $t = \{1992:09 - 1996:10\}$ and zero otherwise¹⁶.

However, it turns out that the results are not sensitive to the removal of outliers and these dummies have practically no effect on impulse response functions and variance decomposition. The clear advantage of these dummies is that the non-normality problems in several of the VAR equations disappear. A major drawback with these intervention dummies is that they decrease degrees of freedom, which (due to small sample size) might lead to inaccurate confidence bounds. Therefore, these dummies are excluded in the subsequent analysis despite the fact that they have clear economic interpretation.

Before interpreting the results, it is important to check whether the variance-covariance matrix of the innovations is diagonal. The VAR covariance matrix shows some statistically significant positive contemporaneous correlation, thus requiring a prior ordering of the variables¹⁷. Impulse response functions were calculated assuming the

¹⁵ We conduct typical residual misspecification tests. These tests (not reported) suggest that the residuals pass the test for being uncorrelated at the 5 percent level. To test for serial correlation we used the standard Ljung-Box Q -statistics against 28th order of serial correlation. The residuals are also homoscedastic for the most cases measured by White and ARCH(2) tests. However, normality seems to be a problem. Jarque-Bera tests indicate that the null hypothesis of normally distributed residuals can only be accepted in the inflation rate and stock returns. Non-normality is mainly due to excess kurtosis (i.e., large observations, which in probably not so serious as asymmetric distribution). Although there is non-normality left in the estimated residuals for some of the VAR equations, we have decided to let the lag order equal five assuming that VAR(5) captures the dynamics of the system properly.

¹⁶ The first departure occurred in October 1987 stock market crash. The next dummy accounts for the March 1989 revaluation. The next two dummies relates to money supply, and may be explained by the discontinuance of two-year special tax-free savings account and the new withholding tax on deposit accounts, respectively. The last two dummies relate to Finnish currency crisis: November 1991 devaluation and September 1992 floating decision. The last dummy capture the regime shifts in economic policy, and is associated with the floating exchange rate (inflation targeting) regime. The exact timing includes publication lags.

¹⁷ In general, the correlation coefficients between innovations were low. The maximum correlation is – 0.41 between real exchange rate and interest rate. In total, only 3 (6) coefficients out of 15 were significant at the 1 (5) percent level. We tried several orderings of the variables (returns were always placed last), and

ordering of $\{m1_{t-1}, H3_t, s_{t-1}, ip_{t-2}, \pi_{t-1}, r_{it}\}$ ¹⁸. Although not reported, several different orderings of the variables were used to examine the robustness of the results but, in general, they yielded quite similar results and did not change any qualitative aspects of the subsequent results.

4.2. Impulse response functions

Graphs of the impulse response coefficients of industry portfolios in period 1 – 12 to one standard error shock from each of the variables in the VAR system are shown in Appendix 1. The eight graphs compare the dynamic responses of industry stock returns to economic shocks. The vertical axis denotes the real stock returns, and the horizontal axis denotes time in months. Solid lines represent point estimates of the coefficients of impulse response functions while the dashes represent 95 percent confidence bounds. A response is considered statistically significant if confidence bounds are above or below the solid zero lines¹⁹. Initially, 288 impulse response functions (one for each variable and one for each shock) with the associated confidence bounds were calculated, but only those related to stock returns are reported²⁰.

A number of interesting results emerge from Appendix 1. The results from a benchmark six variable VAR that includes the HEX all share price index in addition to macroeconomic variables, the impulse response functions are generally sensible and consistent with prior expectations. In general, economic shocks are absorbed within the same month, except for those where the inflation rate and the responses in the following

these experiments produced somewhat different results. However, using different orderings of the variables cannot reverse the conclusions.

¹⁸ This ordering of the variables can be motivated as follows: higher than expected money supply increases inflation expectations that puts upward pressure on interest rates via the Fisher effect. Furthermore, higher interest rates decreases (appreciation of the real exchange rate) the price competitive position of the domestic economy. Appreciation decreases industrial production through weaker export demand. Finally, assuming Keynesian view of price rigidity, inflation responds to changes in economic activity with a lag. In any case, stock returns are located last in the ordering since they are our target variables.

¹⁹ Recall that if the impulse response functions turns out to be statistically significant (insignificant), then the stock market will be deemed inefficient (efficient) with respect to the variable in question. This implies incomplete (complete) dissemination of publicly available economic information on stock market.

²⁰ Standard errors were calculated from the asymptotic analytic formula (see Hamilton 1994, 339). Standard errors were also calculated for the sake of comparability by using the Monte Carlo simulation technique (500 replications), but the results did not change significantly.

month were practically zero²¹. The rapid decay of the impulse response functions indicates that the Helsinki Stock Exchange can absorb economic shocks quickly and efficiently.

Turning to the effects of shocks related to real side of the economy, the results reveal that a one-standard-deviation shock to real exchange rate and industrial production leads to a positive impact on stock returns within two months. However, none of these impulse response functions is significant. When considering the shocks related to financial side of the economy, it appears that the dynamic effects of real money supply and interest rate shocks produce immediate negative responses and insignificant responses on all other horizons.

In contrast to other monetary shocks, stock market responses to inflation rate shocks produces an interesting pattern: namely, stock returns initially rise, but after two to three months, it falls below their pre-shock levels. Although the inflation rate shocks in the very short run cause an increase in stock returns, the responses tend to diminish over time, and after three months, the effect of the inflation shock turns negative. Notice that the significant responses with respect to the inflation rate shock implies that stock returns do not fully reflect the available information about the inflation rate²². Given the dynamic response paths of the benchmark case to macroeconomic shocks, it is interesting to investigate further, whether there are any differences across various industries.

After a quick glance at these graphs, a major impression is that the responses across various industries are close to the benchmark model. There are some interesting variations in the magnitude of the shock effects across different industries. When looking first at the effects caused by economic shocks to the financial sectors (banks and finance; and insurance and investment), it can be seen that financial sectors are the most interest rate

²¹ Since forward-looking investors should quickly capitalize the implications of shocks for future cash flows and discount factors, it is interesting to investigate whether the immediate responses are statistically significant. Our results suggest that at the initial period, stock returns show significant responses mainly to monetary shocks (i.e., $m1$, $H3$ and π). Interest rate and real money supply shocks decrease while inflation rate and industrial production shocks increase returns. Across industries, domestic-oriented and financial sectors respond to interest rate shocks. In contrast, industrial industries respond to real money supply. Inflation rate shocks appear to be important almost every industries. Shocks related to the real exchange rate, on the other hand, seem to have no immediate effect on stock returns. We also find that financial sectors show stronger reaction to interest rate shocks than do the rest of the stock return series. These significant immediate responses support the efficient market theory.

²² The potential explanation for this result might be as follows: according to augmented Phillips curve $y_t = \bar{y} + \delta(\pi_t - \pi_t^e)$, when inflation (π_t) is higher (lower) than expected (π_t^e), aggregate output (y_t) will be above (below) the natural rate (\bar{y}). Thus, in the short run, positive inflation rate shock increases economic activity, but at the same time, it also increases inflation expectations, which puts upward pressure on interest rates via the Fisher effect. This might explain observed positive very short run responses, which changes into negative at longer time horizons.

sensitive among all industries. Within the first two months, the responses are statistically significant, which indicates that interest rate shocks forecast stock returns for financial sectors in the very short run. A shock to interest rate is followed by a sharp decline in financial sectors. It is important to notice that the fall is concentrated in these industries, which decrease more sharply in the very short run than other industry portfolios.

The dynamic short-run responses of domestic-oriented industries (other services and other industries) and export-oriented industries (metal and engineering, forest industries, and multi-business industries) to economic shocks are quite similar to the benchmark case with few differences worth mentioning. First, shocks to real exchange rates and real money supplies lead to a delayed increase in returns within two and three months, respectively. Second, interest rate shocks have no effect on cyclical industries. In general, the aggregate market is dominated by multi-business industry since the resulting impulse responses in general price index and multi-business industry are very similar.

Viewed overall, the results discussed thus far suggest that fundamental economic shocks have statistically significant immediate effects on the stock market as predicted by the efficient market theory. In contrast, the impulse responses in the short run were insignificant for the most part as measured by the confidence bounds around them, which implies complete dissemination of available macroeconomic information on stock market. The most notable exception is inflation rate shocks, which predict returns four months ahead. Having found that in some cases the dynamic responses of the variables predict significant short-run responses in stock returns, the following step is to establish whether these responses are large enough to explain significantly the fluctuation of stock returns.

4.3. Variance decompositions

In order to investigate the relative importance of macroeconomic shocks, Appendix 2 presents the percentage of the 1, 2, 3, 4, 9, and 12-month forecast-error variance of stock returns that is explained by shocks in economic fundamentals. Focusing first on the aggregate market, the results suggest that economic shocks at the most account for 14.5 percent or less of stock return variability at the 12-month period²³. In general, monetary

²³ We also estimate two-year variance decompositions, but the results were virtually the same: in the two-year time, the estimated percentages ranged from 5.1 percent (real exchange rate) to 15.9 percent (inflation rate). Overall, impulse response functions and variance decompositions were also calculated 4 years (48 months) ahead, but no significant responses were found at longer time horizons. This is expected

shocks appear to be more important than non-monetary shocks in explaining stock returns since monetary shocks explain relatively larger fraction of the forecast-error variance of returns compared to non-monetary shocks.

A closer look at the results reveal that only a small portion of the variance in the benchmark index within the first three months is explained by shocks to non-monetary variables. Among monetary shocks, inflation rate shocks seem to be the most important information to the stock market. Within one year, inflation rate shocks explain 14.5 percent of the variance in stock prices, whereas innovations to real money supply and interest rate explain only 6.1 and 6.3 percent, respectively. As the horizons increases from one to six to twelve months, the variability in stock returns accounted for by shocks to the inflation rate increases from 4.7 to 12 to 14.5 percent, suggesting additional explanatory power of inflation shocks. Though, it seems that the change in stock returns can be largely (62.3 percent) explained by the forecast-error variance of stock returns itself especially in the very short run (not reported).

Across industries, a large part of the forecast error variance of financial sectors can be explained by interest rate shocks. For example, about 24 percent of the variance in insurance and investments can be attributed to past innovations in short-term interest rates. On the other hand, the importance of inflation rate shocks to financial sectors seems to be weaker compared to other industry sectors. A similar result holds also for the real money supply and industrial production shocks. For instance, past innovations in real money supply have almost no effect on the variance of financial sectors. If the forecast horizon is longer than three months, less than four percent of the forecast-error variance in financial sectors is accounted for by shocks to real money supply and industrial production.

When looking at exporting industries (excluding other industries), real exchange rate shocks are important as expected since the price competitive position of domestic firms depend on the real exchange rate. Another interesting observation is that shocks to the inflation rate initially have a quite small impact on the forecast-error variance of cyclical industries, but rather quickly, these shocks become increasingly important. In the case of domestic-oriented industries, macroeconomic shocks account for about 15 percent of the

since the effect of a unit shock in economic variable dies away rapidly due to stationarity of the VAR system.

forecast error variance at the one-year horizon. In addition, interest rate shocks are also relatively important.

In sum, the variance decomposition analysis demonstrates that fundamental economic shocks do not explain the majority of movements in industry stock returns, at least during the chosen sample period. It appears that shocks related to the financial side of the economy are the main determinants of the variability in stock returns in the short run. Furthermore, the inflation rate shocks seem to be the most important source of stock return variations among these five pre-specified economic shocks considered. In general, these results are consistent with those of impulse response functions.

4.4. Some further results

In order to study the robustness of these results, it is necessary to conduct some additional estimation. First, the real exchange rate, real money supply, and stock returns are replaced with their nominal counterparts. The resulting impulse response functions are virtually identical to those reported here and hence are not reproduced. In addition, the publication lags are ignored and the current values of the macroeconomic variables were experimented on. This makes again little difference for the results reported earlier. The only notably exception is that the real money supply shock has a significantly positive immediate impact on stock returns. This finding is consistent with the evidence provided by Viskari (1992).

The evidence is somewhat sensitive concerning alternative lag structures, and it is difficult to summarize these effects explicitly. After estimating VARs in various lag lengths, longer lags change the results in such a way that non-monetary shocks have stronger impact on stock returns, while inflation rate shocks have a smaller impact. For shorter lags, industrial production shocks have a significant impact on returns within 8 – 12 months, while the other shocks are in line with those reported earlier. Also tested was whether the fact that Nokia changed its industry classification from a multi-business industry to other industries in July 1995 had any effect on the results. It was found that there were only minor differences in impulse response functions with these industries during this sub-period 1987:06 – 1995:06.

This chosen sample period is exceptional in the Finnish economy as well as the Helsinki Stock Exchange. During this period, several major events have occurred (e.g., deregulation of the financial markets) that could have affected the structural stability of the VAR models and thus the impulse response functions. Therefore, it is important to test the stability of the estimated models with the breakpoint in 1992:09 (i.e., switch in exchange rate regime from fixed to a flexible rate). Chow-tests indicate instability at the 10 percent level in the case of the financial sectors as well as the cyclical industries (excluding multi-business industry).

Due to instability, the models were re-estimated using data for the two non-overlapping periods of 1987:01 – 1992:08 and 1992:09 – 1996:12. Since these different exchange rate regimes contain only 63 and 52 observations after adjusting endpoints, VAR models were estimated with two lags of each of the variables, constant and seasonal dummies. During the first sub-period, the impulse responses show similar patterns when compared with the whole period. In general, real money supply and industrial production shocks have significant immediate impact on stock market. Moreover, inflation rate shocks seem to have a weaker negative impact on stock returns, and the very short run predictability via inflation rate shocks disappears. Across industries, financial sectors show no interest rate sensitivity.

During the floating exchange rate period, the resulting impulse responses are almost identical to those reported. Hence, the floating rate period dominates the whole sample results. Furthermore, interest rate shocks become more important in the latter sample for several industries when compared to the whole sample results. Specifically, in the very short run, there exist some significant response functions for some of the industries including cyclical stocks. Overall, our sub-sample results support the efficient market view about quick dissemination of publicly available economic information upon the stock market.

5. CONCLUDING REMARKS

The purpose of this paper is to investigate whether the industry stock returns at monthly levels are predictable by using past macroeconomic information. The main findings are as follows: First, fundamental economic shocks have significant immediate impact upon

stock returns. Second, impulse response functions, in general, were insignificant implying complete dissemination of publicly available information on stocks. Third, monetary shocks play leading roles in explaining the short-run movements in stock prices. Fourth, the inflation rate shocks are the most important source of variations among these shocks, and it has some predictive power within the first four months after the shock. Finally, shocks do not explain the majority of movements in Finnish stock returns.

Comparing results across industries, the main findings are quite robust to departing from the benchmark specification. The cross-industry responses are mainly uniform, although some interesting industry-specific variations in terms of magnitude and relative importance of the shocks can be found. For example, export-oriented industries are sensitive to real exchange rate shocks since the estimated percentages for those industries are higher than the estimated percentages that emerge from the benchmark model. In addition, consistent with the results in Hardouvelis (1987) and Prag (1994), after a positive shock to the interest rate, stock returns for financial sectors decrease more when compared to other sectors or the market.

With the results obtained in this paper, it can be concluded that economic shocks, in general, are rapidly transmitted to the stock market. These quick responses imply that the behavior of the Finnish stock markets is consistent with the efficient markets. Nevertheless, it appears that the information about the inflation rate is not fully incorporated in stock prices. Does the slow adjustment of returns to inflation shocks indicate profit opportunities for rational investors who base their trading strategies on the initial stock market response? Not necessarily, since after accounting for trading costs, the excess profits are close to zero. Consequently, it appears that the return predictability is not economically exploitable. In contrast, investing in stocks within the financial sectors immediately after an interest rate cut might produce excess profits for agents within two months.

Though one should be cautious in interpreting these results, they do yield support to the efficient market view. This conclusion is consistent with the evidence provided by Ali and Hasan (1993). However, it should be noted that the evidence presented in this paper does not necessarily mean market efficiency or inefficiency in any form since our methodology is not a direct test of market efficiency. As Fama (1991) noted, market efficiency per se is not testable since it must be tested jointly with some equilibrium model. Due to the joint-hypothesis problem, care should be taken when interpreting these

short-run dynamic responses as evidence for or against market efficiency. The predictability of stock returns may be due to for instance time varying expected returns (see Fama & French 1989).

From the methodological viewpoint, the chosen approach has a disadvantage, which can also be attributed to the general VAR methodology (see Cooley and LeRoy 1985). To be more specific, the estimates of impulse response function and variance decomposition may depend upon the way the shocks in the underlying VAR model are orthogonalized. Furthermore, the small sample size may decrease the validity of confidence bounds used in impulse response functions. Another problem that might be relevant for the present paper, is the exceptional sample period in which several major changes has occurred that may have an impact on the stability of the system and hence the results. Therefore, the forecast power of inflation rate shocks might also be due to sample-specific conditions.

One topic for the future research would be to include some global economic variables into analysis and explore the short-run dynamics of the stock price adjustment in the Finnish stock market to new information from international sources. This might be interesting due to international capital market integration and the liberalization of capital movements resulting national stock markets to respond to new economic information from international sources (e.g., US economy). This could give us some further insight about how the Helsinki Stock Exchange responds to global macroeconomic shocks.

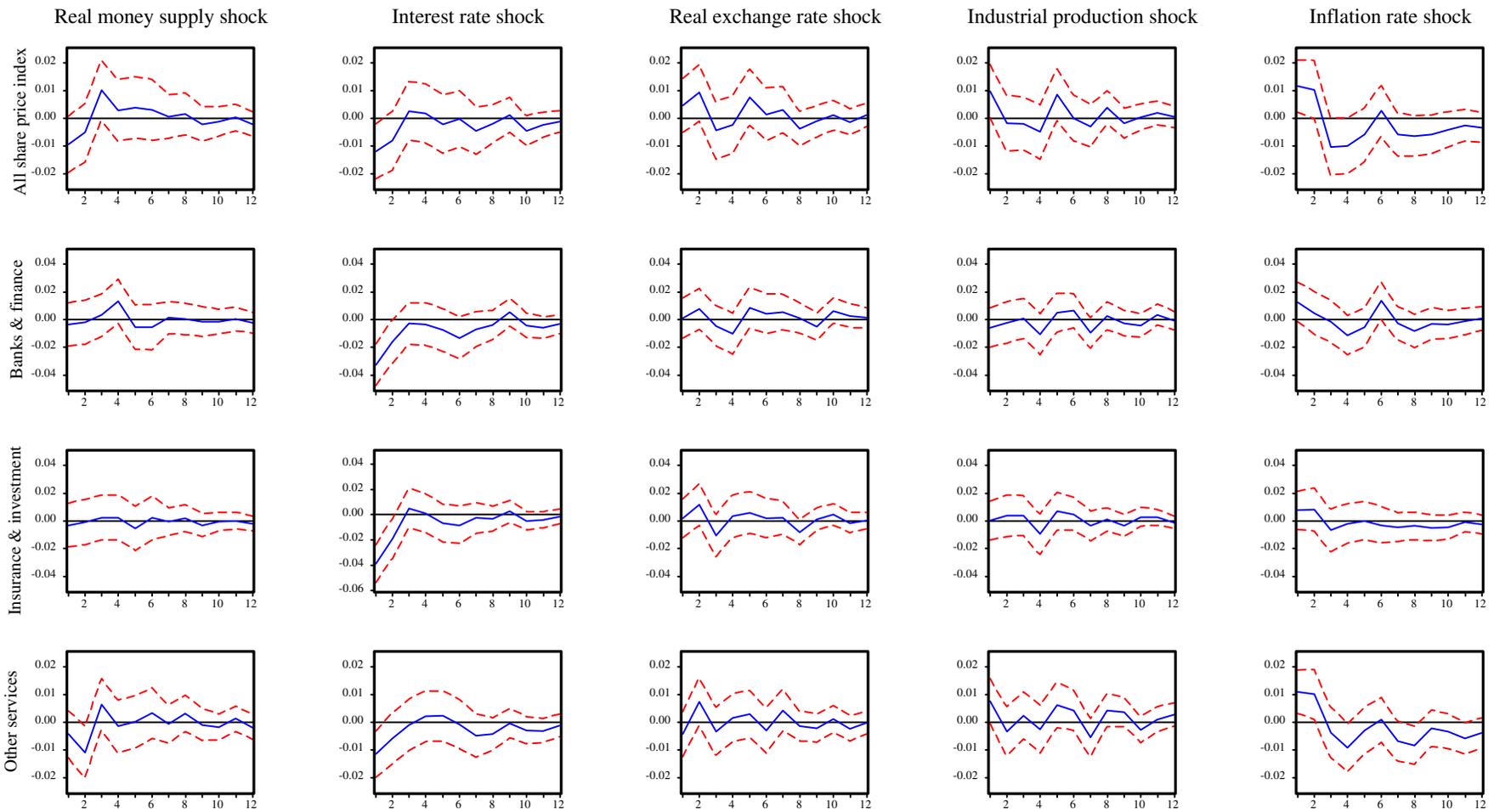
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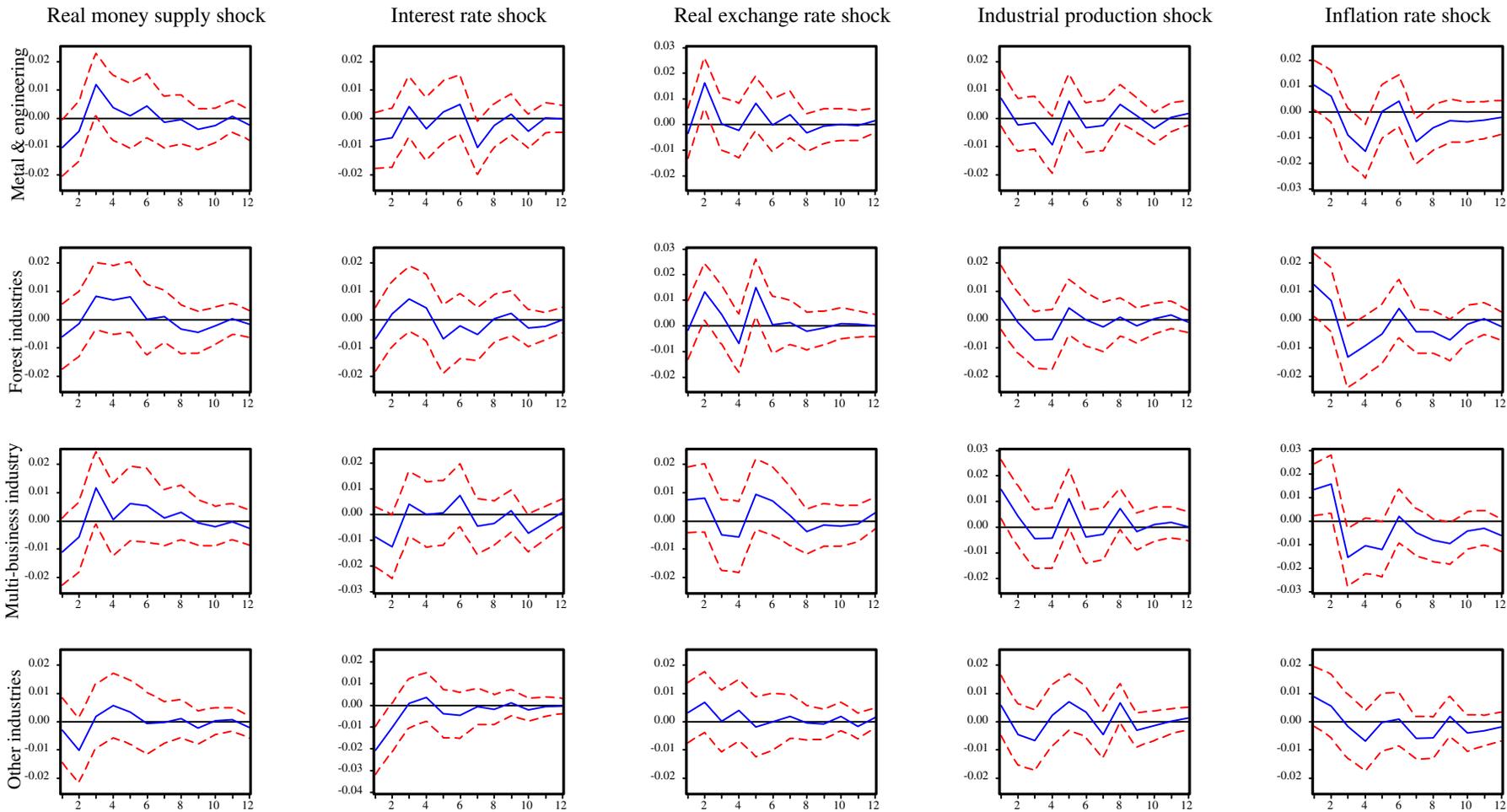
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APPENDIX 1. Response in industry portfolios to a one-standard-deviation shock to economic fundamentals with 95 percent confidence bounds



APPENDIX 1. (... continued)



APPENDIX 2. The percentage of the stock return variance that is explained by the macroeconomic shocks at different horizons

Relative variance in Industry Portfolios	Months- ahead	S. E.	Explained by innovations in				
			<i>m1</i>	H3	<i>s</i>	<i>ip</i>	π
HEX all share price index	1	0.054	3.015	4.915	0.771	3.319	4.684
	2	0.058	3.327	6.024	3.155	2.894	7.032
	3	0.061	5.858	5.797	3.447	2.795	9.403
	6	0.063	6.170	5.490	4.758	4.966	12.044
	9	0.065	6.031	5.809	5.092	5.342	14.026
	12	0.065	6.052	6.313	5.111	5.342	14.553
Banks and Finance	1	0.082	0.176	15.670	0.022	0.476	2.358
	2	0.086	0.212	17.917	0.849	0.503	2.498
	3	0.086	0.359	17.922	1.123	0.507	2.518
	6	0.094	2.878	17.609	3.128	2.452	5.931
	9	0.097	2.765	17.616	3.578	3.429	6.461
	12	0.098	2.794	17.817	4.039	3.702	6.493
Insurance and Investment	1	0.083	0.129	21.646	0.046	0.001	0.819
	2	0.088	0.124	24.428	1.853	0.179	1.614
	3	0.089	0.199	24.106	3.193	0.370	2.138
	6	0.092	0.686	23.888	3.586	2.240	2.146
	9	0.093	0.828	23.529	4.319	2.493	2.756
	12	0.094	0.864	23.447	4.687	2.637	3.034
Other services	1	0.045	0.929	6.548	0.875	2.878	5.788
	2	0.051	5.169	6.313	2.707	2.600	8.323
	3	0.052	6.537	6.156	3.007	2.726	8.616
	6	0.055	6.389	5.939	3.379	4.622	10.962
	9	0.057	6.201	6.760	3.865	6.168	13.685
	12	0.058	6.219	7.066	3.928	6.413	14.995

Note: We compute the percentage of the variance of the j ($j = 1, 2, 3, 6, 9, 12$) step ahead forecast error that is attributable to each macroeconomic shock. As j increases, this corresponds to the percentage of the variance of stock returns that is due to these shocks. S. E. is the forecast error of the variable for different forecast horizons due to variation in current and future values of the innovations. Economic shocks are industrial production (ip), real money supply ($m1$), three-month helibor rate (H3), monthly consumer price inflation rate (π), and real exchange rate (s).

APPENDIX 2. (...continued)

Relative variance in Industry Portfolios	Months- ahead	S. E.	Explained by innovations in				
			<i>m1</i>	H3	<i>s</i>	<i>ip</i>	π
Metal and engineering	1	0.054	3.795	2.136	0.402	1.713	3.739
	2	0.057	3.924	3.280	8.223	1.647	4.351
	3	0.061	7.315	3.369	7.328	1.534	6.073
	6	0.066	7.125	3.929	8.061	4.487	11.200
	9	0.069	6.871	6.071	7.886	4.785	14.068
	12	0.069	6.999	6.392	7.786	5.006	14.413
Forest industries	1	0.061	0.978	1.307	0.068	1.618	4.060
	2	0.063	0.973	1.319	4.510	1.545	4.966
	3	0.066	2.455	2.455	4.591	2.619	8.604
	6	0.071	4.263	3.495	9.216	3.572	9.837
	9	0.073	4.728	3.970	8.934	3.664	11.115
	12	0.073	4.832	4.211	8.887	3.705	11.184
Multi-business industry	1	0.063	2.961	1.966	1.399	5.497	4.472
	2	0.069	3.163	4.969	2.556	4.985	8.841
	3	0.072	5.513	4.857	2.822	4.936	12.716
	6	0.077	5.952	5.229	5.312	6.988	15.967
	9	0.079	5.790	5.481	5.325	7.592	17.689
	12	0.080	5.800	6.316	5.371	7.472	18.217
Other industries	1	0.060	0.254	11.718	0.287	0.917	2.154
	2	0.063	2.817	13.406	1.474	1.379	2.739
	3	0.064	2.822	13.064	1.435	2.434	2.729
	6	0.066	3.641	13.282	1.775	3.756	3.637
	9	0.067	3.637	12.908	1.809	5.221	5.043
	12	0.068	3.700	12.848	1.957	5.240	5.625

Note: We compute the percentage of the variance of the j ($j = 1, 2, 3, 6, 9, 12$) step ahead forecast error that is attributable to each macroeconomic shock. As j increases, this corresponds to the percentage of the variance of stock returns that is due to these shocks. S. E. is the forecast error of the variable for different forecast horizons due to variation in current and future values of the innovations. Economic shocks are industrial production (ip), real money supply ($m1$), three-month helibor rate (H3), monthly consumer price inflation rate (π), and real exchange rate (s).