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Abstract

The co-movement of stocks and of fundamentals changes across the business cycle. Empirical studies have shown that the correlation of stock returns is stronger in crisis. We show that the correlation of fundamentals is the highest during crisis using a large sample of quarterly firm revenues aggregated to industry data from 1969 to 2009. Fundamentals drive the expectation of market participants on stock and bond prices. Structural changes in correlation of fundamentals therefore have implications on diversification decisions in equity portfolio analysis and credit risk management. The higher correlation in times of crisis increases the downside risk and the bankruptcy probability of a portfolio. Both correlations between industries and the aggregate market and correlations between earnings confirm our findings.

JEL-Classification: C12, E32, G11, M49

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1 Introduction

In the stock market the co-movement of returns increases during crisis. Since fundamentals drive the expectation of market participants on stock prices, their behavior should be similar to the co-movement of stock returns. Numerous articles have examined the correlation structure of returns on stocks in different market environments, but surprisingly the correlation between fundamentals has not yet been investigated. The main contribution of this article is the disclosure of structural differences in the correlation between revenues through the phases of the business cycle. In particular, we reveal that the highest correlation is during crisis. The results provide an explanation for analysts of the correlation behavior of stock returns. The fundamental analysis of both equity and credit portfolio managers should take the different correlation levels of fundamentals into account in order to evaluate the potential benefits of portfolio diversification. When simulating assets in credit risk models, the correlation behavior of assets significantly influences the portfolio value. The higher correlation in times of crisis increases the downside risk and the bankruptcy probability of a portfolio, which is often neglected in the valuation of assets. Inaccurate correlation assumptions lead to mispricing of credit portfolios and have been one major reason for the current financial crisis. If all revenues tend to fall together as the economy plunges down, the value of diversification may be overstated by those not regarding the higher correlation in crisis.

Several articles address the question of correlation behavior in different market phases. Erb et al. (1994) find that cross-equity correlations in certain countries are influenced by the business cycle. In particular, they document higher correlations during recession. When business cycles of two countries are classified neither as recession nor as growth period, correlations are lower. Ang and Chen (2002) test asymmetries in conditional correlations between U.S. stocks and the aggregate U.S. market and provide evidence that correlations for downside moves are higher than for upside moves. Moreover, the correlation behavior between financial asset returns during stable and turbulent market periods has often been investigated. Longin and Solnik (1995) analyze data of monthly stock indices for industrial countries and conclude that the correlations between international financial markets increase in highly volatile periods. King and Wadhwani (1990), Ramchand and Susmel (1998) and Bernhart et al. (2009) also provide evidence of increasing correlations in volatile market periods. A number of further studies find significant differences in correlations among stock returns in bull and bear markets (e.g. Karolyi and Stulz (1996), Longin and Solnik (2001), Ang and Bekaert (2002), Campbell et al. (2002) and Poon et al. (2004).) Academic research has widely discussed correlation behavior of stock markets but there is a lack of evidence regarding correlation behavior of fundamentals.

Why do revenues have an important impact on stock markets? Kama (2009) states that revenues serve as an indicator of future firm performance and persistence. Revenues contain more sustainable information on firm performance than other fundamentals such as expenses. Ghosh et al. (2005) explain that expenses are also cut in response to financial distress and could be increased in anticipation of future profits. The change of revenues therefore provides more accurate information about future prospects than changes in expenses. Revenues differ in persistence from expenses and earnings. Ertimur et al. (2003) mention that revenues are more persistent than expenses because revenues are more homogeneous and are not as easily influenced by managers. As an indicator of the higher revenue persistence, they reveal higher autocorrelation for revenues than for expenses. The greater persistence of revenues is lost when it is aggregated with gains, losses and expenses into earnings. Swaminathan and Weintrop (1991) point out that revenues have information content that is incremental to earnings. The information content of earnings decreases through reporting incentives by the application of earnings management. To smooth earnings, managers hide changes in their firm's performance by using financial reporting opportunities. As a result, revenues are less influenceable through accounting discretion than earnings. Consequently, the revenues' co-movement with the business cycle should be stronger than the co-movement of other fundamentals with the business cycle. Revenues are a key driver in valuing firms, which is an explanation of why stock prices respond significantly to revenue information. Empirical evidence about the important role of revenues in stock markets is documented by Jegadeesh and Livnat (2006). Moreover, revenues are a fundamental indicator of future cash flows and Vuolteenaho (2002) shows that news concerning cash flows drive stock returns. In our study we first focus on revenues and as a robustness check we also present results for the correlations of earnings in the extension.

Our sample contains quarterly revenues of firms during the period of 1969 to 2009. We aggregate firm revenues into industry panels by SIC codes and Fama-French classification. To analyze correlation behavior the panels are conditioned on the business cycle by dividing them into sub panels: First, by using well known 2-phase business cycle indicators (National Bureau of Economic Research (NBER) turning points and the Chicago Fed National Activity Index (CFNAI)) we divide the panels into recession and expansion. In addition, we want to analyze whether there is an increase in correlation during boom. Therefore, by using 3-phase indicators (adjusted CFNAI and capacity utilization (CU)) we divide the panels into crisis, boom and the remaining phases of the business cycle, which we refer to as common phase.[1] We use Pearson's correlation coefficient as well as the robust Kendall's τ and test the hypotheses that average correlations[2] are significantly different from each other across the business cycle phases by applying permutation and bootstrap techniques. We provide empirical evidence that average correlations are higher during recession than during expansion. When dividing the cycle into three phases, average correlations are highest during crisis. The empirical results further indicate that the average correlations during boom are higher than during common phase. Additionally, we document estimations of unconditional correlations and compare them with the conditional correlations. To support our results, we also calculate the average correlations between each industry with the aggregate market.

In section 2 we explain the classification of revenues by industries and the partition of quar-

[1] Note that Markov regime switching models are not applied in the framework of our study.

[2] Note that for the sake of simplification, we use the term 'correlation' as a synonym for both correlation measures as it is often done in literature.

ters by business cycle indicators. Section 3 describes the research methodology by introducing the dependence measures, the data preparation of our sample, and our hypotheses. Section 4 presents the results of average correlations and of the hypotheses tests. While we concentrate on revenues in the following sections, we present the results for the correlations of earnings as an extension in section 5. The final section 6 concludes the article.

2 Schemes of Industry and Business Cycle Classification

In the progress of our study we aggregate the firm revenues into industry revenues and divide the sample into the respective business cycle phases. In this section we present industry classification schemes as well as business cycle indicators.

2.1 Industry Classification

We classify firms into industries since firm revenues can be distorted by M&A activities. After an acquisition, the firm taken over disappears from the sample and the revenues of the acquiring firm increase heavily, caused only by the acquisition itself. To deal with these M&A-effects, the firm revenues should be aggregated to industry revenues assuming that the M&A-effects tend to balance out within an industry class and across industries. Moreover, industry classification generates additional information for financial and economic analyses by dividing firms into homogeneous groups. In this section we discuss the common industry classification schemes in academic research.

The Standard Industrial Classification (SIC) codes have become the first algorithm for depicting industrial activities in the United States and are largely used in financial research.[3] Later on, the North American Industry Classification System (NAICS) was established by the U.S. Census Bureau to replace the SIC codes. Both SIC codes and NAICS are production and technology

[3] Starting from industry divisions (one-digit SIC codes) finer partitions are defined, namely major groups (two-digit SIC codes), industry groups (three-digit SIC codes) as well as industries (four-digit SIC codes). For further information about the SIC codes see http://www.osha.gov/oshstats/index.html.

oriented.[4] The Fama-French 48 (FF48) industry classification, introduced by Fama and French (1997), reorganizes firms by the four-digit SIC codes into 48 industry groups.[5] The intent of Fama and French is to form groups of industries according to their common risk characteristics. Similar to SIC codes, the FF48 industry classification has a great impact on academic research. Another approach to industry classification is the Global Industry Classifications Standard (GICS) system, which was jointly developed by Standard & Poor's and Morgan Stanley Capital International. The classification does not only consider operational aspects but it is also based on information about the perceptions of investors concerning the firm's core business. The GICS system is applied among financial practitioners, but contrary to FF48 industry classification it is not commonly used by academic researchers.

In our empirical study we classify the firms of the sample by SIC codes and FF48 industry classification. We prefer them for several reasons. First, both are widely used in academic research. Second, in our sample the data availability of SIC codes is greater than for NAICS and GICS. Finally, as Bhojraj et al. (2003) document in their broad comparison of industry classifications, the performances of SIC and NAICS are fairly similar in most financial applications.

2.2 Business Cycle Indicators

In order to analyze the correlation behavior of industry revenues in the business cycle, we divide the sample into different phases. Several business cycle indicators are considered in financial research. In our empirical study we apply two 2-phase indicators and two 3-phase indicators.

In times of recession, when markets fall jointly, we expect correlation to increase heavily. We separate the recession from the expansion by using the commonly known 2-phase indicators: NBER turning points and CFNAI.[6] The NBER turning points are defined by peaks and troughs

[4] Krishnan and Press (2003) compare the differences between SIC codes and NAICS.

[5] For the transformation of SIC codes into these industries see Appendix of Fama and French (1997). Detailed information about the FF48 industry classification is available at the website of Kenneth R. French, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french.

[6] A further often applied business cycle indicator is the Experimental Coincident Recession Index (XRIC) developed by Stock and Watson (1989). The advantage, that this index is a forecasting indicator, is irrelevant

in the business cycle that frame economic recession and expansion. A recession is described as a significant decline in economic activity spread across the economy, lasting more than a few months, generally indicated by the real GDP, real income, employment, industrial production, and trade.[7] The NBER reports turning points monthly where the vast majority of months are defined as expansions. The CFNAI is a monthly summary index constructed to measure overall economic activity and associated inflationary pressure. It corresponds to the index of economic activity by Stock and Watson (1999). The CFNAI is a weighted average of 85 monthly indicators of U.S. activity.[8] Beside the monthly index, the CFNAI is provided as a three-month moving average. As defined by the Chicago Fed, an increasing likelihood for a beginning recession is indicated by a value of the three-month moving average below -0.7 when it is following an expansion period. After a contraction period, a value above -0.7 indicates an increasing likelihood that a recession has ended and a value above +0.2 indicates a significant likelihood.[9] The CFNAI indicates more periods as a recession than the NBER turning points.

We also expect stronger joint behavior of revenues in times of boom. To consider it in our empirical analysis, we extend the 2-phase to a 3-phase partition. We separate crisis and boom from the remaining states of the economy. If a quarter is neither classified as crisis nor as boom, it remains in common phase.[10] Since there is no differentiation between the three phases through the widely used NBER and CFNAI, in particular boom is not separated, we use an adjusted Chicago Fed National Activity Index (CFNAI*) and the log growth of capacity utilization (CU).[11] To divide the sample into three phases, we adjust the thresholds and assume an upper threshold for the CFNAI* to distinguish between common phase and boom. As a second

in our context. Furthermore, the availability of XRIC data is limited to the end of 2003 which makes the XRIC inappropriate for our study.

[7]For more information, see http://www.nber.org/cycles.html.

[8]The historical and current data of the CFNAI are provided by the Chicago Fed on their website, http://www.chicagofed.org/webpages/research/data/cfnai/current_data.cfm.

[9]Evans et al. (2002) critically discuss these thresholds of the CFNAI.

[10]Note, when we use the 2-phase indicators, we refer to the phases as recession and expansion, when we use the 3-phase indicators, we refer to the phases as crisis, boom and common phase.

[11]McQueen and Roley (1993) also apply a similar 3-phase approach which is based on the trend of the industrial production index.

3-phase business cycle indicator we employ the CU. Capacity utilization is defined as a ratio of the actual level of output to a sustainable maximum level of output, or capacity. The Federal Reserve Board calculates the capacity utilization quarterly for the industrial sector of the U.S. economy.[12] The application and relevance of capacity utilization is discussed by Koenig (1996) and Morin and Stevens (2005) among others. Corrado and Mattey (1997) state that capacity utilization is a useful indicator of business cycle fluctuations. In order to apply the capacity utilization as a business cycle indicator it has to be independent of its level, otherwise a strong decrease at a high level could falsely indicate boom instead of crisis. We therefore use its quarterly log growth rates. The CU represents the different phases in the business cycle according to changes of capacity utilization. To differentiate between the three phases we again have to define a lower and an upper threshold. Further details about the partition of quarters in our study will be presented in the next section.

3 Research Methodology

In this section we explain how we measure the dependence with Pearson's correlation coefficient and Kendall's τ. Afterwards we describe our sample and prepare the data for our analysis. We estimate the correlation matrices and define our hypotheses.

3.1 Dependence Measures

We measure the correlation[13] of revenue growth rates with the well known Pearson's correlation coefficient. However, the right use of this coefficient depends on the assumptions made with respect to the data to be analyzed. An important assumption is that the distributions of both variables should be normal and that the scatter-plots should be linear and homoskedastic. In situations where the assumptions are violated, Pearson's correlation coefficient can become

[12] The seasonally adjusted, quarterly data of the capacity utilization total index are available on the website of the Federal Reserve Board, http://www.federalreserve.gov/datadownload/.

[13] Remember, we use "correlation" as a synonym for both Pearson's correlation coefficient and Kendall's τ.

inadequate to explain a given relationship. For example, it fails to show perfect dependence if the relationship between two variables is not linear. The Pearson's correlation coefficient is affected by the marginal distributions of time series and its estimates are sensitive to outliers. To reinforce our results, we employ Kendall's τ as a robust second measure. Kendall's τ is invariant under strictly increasing transformations. To define its conditional empirical version we regard a sample of n points (x_k, y_k), for $k = 1, \ldots, n$, of two random variables X and Y (e.g. the residuals of two industry revenue growth rates). Let S be a subsample of these points (e.g. the observations in one of the business cycle phases). If we consider all possible pairs $((x_k, y_k), (x_l, y_l))$ within S and either denote each of them as concordant if $(x_k - x_l)(y_k - y_l) > 0$ or as discordant if $(x_k - x_l)(y_k - y_l) < 0$, we can define the conditional empirical version of Kendall's τ as

$$\hat{\tau}(X, Y \,|S) = \frac{c - d}{c + d}, \tag{1}$$

where c denotes the number of concordant pairs and d the number of discordant pairs in the subsample S.[14]

3.2 Sample Description

Our sample contains quarterly firm revenues over a 40-year period from the first quarter in 1969 to the first quarter in 2009. We use the Standard & Poor's `COMPUSTAT` quarterly database to obtain information about revenues. In line with other studies we drop all financial institutes because of their different characteristics. Our sample contains 21,266 different firm identifiers and 923,234 observations of quarterly revenues. The revenues in the sample exhibit a mean of \$288.05 million and a standard deviation of \$1,696.71 million. As shown in table 1, the mean number of observed firms per quarter is 6,712 with a standard deviation of 1,976. The minimum number of firms is 2,001 in the first quarter of 1969 and the maximum number of firms is 9,355 in the first quarter of 1999.

[14]In practice there might arise cases in which $x_k = x_l$ or $y_k = y_l$. Therefore one should employ the adjusted version of Kendall's τ, where these cases are not accounted for in the numerator, but of course in the denominator. For more information see e.g. Lindskog (2000).

[Please insert table 1 here]

To deal with M&A-effects, firm revenues are aggregated to industry revenues and grouped by two different industry classifications.[15] First, in panel A we group the firms in SIC industry portfolios by their SIC code (1-digit). Second, in panel B we group the firms in Fama-French 48 (FF48) industry portfolios by their FF48 industry classification. We exclude revenues from the financial sector by dropping SIC codes 6000-6999 (finance, insurance and real estate) and FF44-FF47 (banking, insurance, real estate and trading). The remaining industries are indicated by the index i and j. Descriptive statistics about the number of firms which are grouped in an industry portfolio per quarter are presented in table 2.

[Please insert table 2 here]

3.3 Data Preparation

The log growth rates of industry revenues $r^A_{i,t}$ ($r^B_{j,t}$) for panel A (panel B) are computed by the current industry revenues $R^A_{i,t}$ ($R^B_{j,t}$) and previous industry revenues $R^A_{i,t-1}$ ($R^B_{j,t-1}$):

$$r^A_{i,t} = \log\left(\frac{R^A_{i,t}}{R^A_{i,t-1}}\right), \qquad r^B_{j,t} = \log\left(\frac{R^B_{j,t}}{R^B_{j,t-1}}\right). \tag{2}$$

Industry revenues can be biased by new stock listed firms and the delisting of firms through bankruptcy, for example. The sample consists of both active and inactive firms. We do not drop the inactive firms with incomplete times series. To circumvent the problem of incomplete time series we have to decide at each time point which firms are involved in the calculation of the industry growth rate. A firm is involved every time revenue data is provided for the two consecutive time points (t and $t-1$). Moreover, the log growth rates of revenues are demeaned by subtracting the respective time series mean from each growth rate.[16] After computing revenue growth for all industry portfolios, we obtain 160 quarters of demeaned growth rates.

[15] We aggregate by forming value-weighted industry portfolios to approximate total industry revenues.

[16] Note that Pearson's correlation coefficient and Kendall's τ are invariant under strictly increasing linear transformation.

To estimate correlations and to obtain time invariant results, the time series of growth rates have to be stationary. Therefore, the panels A and B are tested for the presence of a unit root by the augmented Dickey-Fuller test. The null hypothesis, that growth rates contain a unit root, can be rejected at a 1% significance-level for both panels.[17] Thus, we assume that the growth rates of both panels are generated by a stationary process.

Several studies reveal that computing correlations which are conditioned on low or high returns, or on low or high volatility, can cause a conditioning bias in the correlation estimates. For example, Forbes and Rigobon (2002) show that a bias occurs due to heteroskedasticity of financial return series. Boyer et al. (1999) state that a selection bias is induced by splitting the sample according to the observed or realized data alone. To circumvent these bias problems we clean the growth rates of revenues for autocorrelation and heteroskedasticity by using a filtration approach and apply exogenous indicators to classify the phases of business cycle.

As a first step, we analyze the distribution of the demeaned revenue growth rates to choose an appropriate filtration approach for our data.[18] The skewness and kurtosis indicate that most of the time series do not follow the Gaussian distribution. The skewness is negative for all time series in panel A and for most of those in panel B. In more than half of the cases the excess kurtosis is positive resulting from heavy tails in the distributions. To confirm these impressions, we perform Jarque-Bera tests and Omnibus tests for normality.[19] As expected, the null hypothesis of normality has to be rejected for most of the time series in panel A and for more than two-thirds of the time series in panel B at a 5% significance level. Due to the observed skewness, we choose to filter the growth rates with a semi parametric approach. We apply the GJR-model which models asymmetry in the GARCH process and is described by Glosten et al. (1993).

The demeaned growth rates of industry revenues are filtered with the following AR(1)-GJR(1,1)

[17] The test is introduced by Dickey and Fuller (1979). We provide the Dickey-Fuller test statistic with zero lags for panel A in table 9 in Appendix A. The test results for panel B are similar.

[18] In Appendix A, we present summary statistics of the growth rates for panel A and B in tables 10 and 11.

[19] The Jarque-Bera test is described by Jarque and Bera (1980) and the Omnibus test is proposed by Doornik and Hansen (2008). In Appendix A, we report the test results for panel A in table 12.

model assuming Gaussian residuals for all industry portfolios i in panel A and j in panel B. Note, to simplify we omit the indices i and j in the notation of the model.

$$r_t = a_0 + a_1 \cdot r_{t-1} + u_t \tag{3}$$

$$u_t = h_t \cdot z_t, \quad z_t \overset{iid}{\sim} N(0,1)$$

$$h_t = b_0 + b_1 \cdot u_{t-1}^2 + b_2 \cdot h_{t-1} + b_3 \cdot u_{t-1}^2 \cdot \delta_{t-1} \tag{4}$$

with

$$\delta_t = \begin{cases} 1, & \text{if } u_t < 0 \\ 0, & \text{if } u_t \geq 0. \end{cases}$$

For each time series of growth rates the Ljung-Box test for autocorrelation is applied.[20] If a time series of an industry portfolio passes the test, a constant-GJR(1,1) model with Gaussian residuals is estimated. If a time series does not pass the test, the AR(1)-GJR(1,1) model with Gaussian residuals is estimated.[21] After having cleaned the times series of growth rates for first order autocorrelation and heteroskedasticity, we obtain the residuals u_t resulting from the filtration.

In the next step, the residuals are assigned to the business cycle phases through the four indicators. On one hand through NBER-turning points and CFNAI into the two sub panels recession (R) and expansion (E), and on the other hand through CFNAI* and CU into the three sub panels crisis (C), common phase (O) and boom (B). Since the NBER reports turning points monthly, we have to transform them to a quarterly indicator as follows: If a turning point indicates the beginning of a recession in the first or second month of a quarter we classify the quarter as recession, otherwise we classify it as expansion and the following quarter as recession.

[20] The test is introduced by Ljung and Box (1978).

[21] The estimated parameter from the model for panel A are presented in table 13 in Appendix A. For the filtration we use the approach of Vogiatzoglou (2009).

If the turning point indicates the ending of a recession in the second or third month of a quarter we also classify this quarter as recession, otherwise it is classified as expansion. Applying the NBER turning points we obtain 28 quarters of recession and 132 quarters of expansion. For the second 2-phase indicator CFNAI, we use the index's three-month moving average of the last month in the current quarter.[22] It results in 42 quarters of recession and 118 quarters of expansion. We determine the crisis of the 3-phase CFNAI* by values of the CFNAI's three-month moving average below -0.7. To divide the sample into three phases, we assume an upper threshold to distinguish between common phase and boom. All values above 0.55 are assigned to boom and all quarters which are between the two thresholds are classified as common phase. The CFNAI* divides the sample in 25 quarters of crisis, 100 quarters of common phase and 35 quarters of boom. Considering the CU, we identify boom by defining the upper threshold as 0.008 and crisis by defining the lower threshold as -0.013. The values between these thresholds are specified as common phase. Thus, we obtain 25 quarters of crisis, 99 quarters of common phase and 36 quarters of boom. The 3-phase partition through CFNAI* and CU is shown in figure 1. It indicates that the quarters of crisis are mainly in line with the quarters of recession identified by NBER.

[Please insert figure 1 here]

As figure 1 shows, the partition into the three phases is not identical through CFNAI* and CU, but the number of quarters per phase is nearly equal. Moreover, the differences between correlations conditioned on the three phases are only slightly sensitive to a variety of the applied thresholds of the 3-phase business cycle indicators. Table 3 summarizes the four partitions.

[Please insert table 3 here]

After dividing both panel A and B, we estimate correlation matrices by using both Pearson's correlation coefficient and Kendall's τ. Furthermore, we estimate the unconditional (UC) correlation matrices for the undivided panels A and B. The correlations are calculated between the

[22] The three-month moving average represents the economic condition of all quarter's months. Therefore, it is superior to the quarter's last month.

obtained residuals u within each industry classification:[23]

$$\hat{\rho}_S = \widehat{Corr}(u_{\cdot_k}, u_{\cdot_l}\,|S) \qquad \text{or} \qquad \hat{\rho}_S = \hat{\tau}(u_{\cdot_k}, u_{\cdot_l}\,|S) \tag{5}$$

$$\hat{\rho}_{UC} = \widehat{Corr}(u_{\cdot_k}, u_{\cdot_l}) \qquad \text{or} \qquad \hat{\rho}_{UC} = \hat{\tau}(u_{\cdot_k}, u_{\cdot_l}) \tag{6}$$

where S is the state of the business cycle. It is either R and E for the 2-phase indicators or C, O and B for the 3-phase indicators. In the case of panel A, the residuals u_{i_k}, u_{i_l} result from the filtration of the growth rates r_i^A with industries $k, l = 0, \ldots, 5, 7, 8, 9$. In the case of panel B, u_{j_k}, u_{j_l} result from r_j^B with industries $k, l = 1, \ldots, 43, 48$. $\hat{\rho}$ indicates both the estimates of Pearson's correlation coefficient and Kendall's τ.

While stocks are traded daily, revenue data is only provided by firms quarterly. Additionally, quarterly data of revenues has only been sufficiently available for the last 40 years in the `COMPUSTAT` database. As already shown in table 3, the number of observed quarters is small in some sub panels. To evaluate the validity of the conditional correlations we bootstrap the correlation's standard error.[24] The number of bootstrap replications is 10,000. The bootstrap distributions are not skewed and are centered close to the correlation estimates of the original sub panels. Hence, they have only small biases. Since the bootstrap standard errors are not always small in relation to the individual correlations, a pairwise comparison of those between the sub panels is not meaningful.[25] Therefore, we consider the median $\widetilde{\hat{\rho}}$ of the entries in each correlation matrix instead of analyzing individual correlations. An advantage of applying the median is its statistical property. In contrast to the mean, the median is not sensitive to outliers. This is particularly important since some of the quarterly industry growth rates are only based on a few revenue observations. The resulting correlation estimates can be heavily biased which can lead to outliers. Market participants are also interested in the strength of the dependence regardless of whether it is positive or negative. Since some correlations are negative, we also

[23]Correlation matrices of SIC industry portfolios are presented in tables 14 to 16 in Appendix B.
[24]Bootstrap methods for standard errors are shown in Efron and Tibshirani (1986).
[25]Standard errors for SIC industry portfolios are reported in tables 17 to 19 in Appendix B.

estimate the absolute median correlations $\widetilde{|\hat{\rho}|}$. To illustrate a simple example, we consider correlations with high positive values, the same amount with high negative values and one correlation of zero. Although there is a high dependence in this example, the median correlation is zero which results in the wrong interpretation of independence. Nevertheless, the absolute median correlation is high and reveals the strong dependence.

3.4 Hypotheses

In this section we motivate our research hypotheses. The market expectations of fundamentals are revised in response to macroeconomic news. The efficient-market hypothesis asserts that market participants anticipate changes in fundamentals and adjust the stock prices accordingly. Vuolteenaho (2002) shows that stock returns are mainly driven by news regarding cash flows. In particular, Veronesi (1999) finds that during periods of high uncertainty the expectations of future cash flows react faster to macroeconomic news.[26] In times of recession, the quick reaction of market participants indicates a faster declining demand, e.g. the revenues plunge down jointly and the co-movement of revenues increases which indicates the increasing correlation between stock returns. Following this reasoning, we investigate the differences between average correlations of revenues in different business cycle phases. We suppose that average correlations are higher during recession than during expansion. When using the 2-phase indicators, our null hypothesis can be formalized as:

$$H_0^I : \widetilde{\hat{\rho}_R} - \widetilde{\hat{\rho}_E} \leq 0 \qquad \text{vs.} \qquad H_1^I : \widetilde{\hat{\rho}_R} - \widetilde{\hat{\rho}_E} > 0 \tag{7}$$

Besides the hypotheses of differences between the median correlations, we also test the differences between absolute median correlations:

$$H_0^{II} : \widetilde{|\hat{\rho}_R|} - \widetilde{|\hat{\rho}_E|} \leq 0 \qquad \text{vs.} \qquad H_1^{II} : \widetilde{|\hat{\rho}_R|} - \widetilde{|\hat{\rho}_E|} > 0 \tag{8}$$

[26] McQueen and Roley (1993) and Boyd et al. (2005) provide evidence for a relationship between stock prices and macroeconomic news conditioned on the business cycle.

The rejection of the null hypothesis would reinforce our assumptions. Moreover, increasing demand often effects all industries together in times of boom, and most revenues increase jointly. This results in higher average correlations during boom than during common phase. We assume the negative effect of decreasing demand during crisis is stronger than the positive effect of increasing demand in good times. We expect that average correlations are higher during crisis than during boom, and higher during boom than during common phase. When using the 3-phase indicators we test the following null hypotheses:

$$H_0^{III}: \widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_B} \leq 0 \qquad \text{vs.} \qquad H_1^{III}: \widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_B} > 0 \tag{9}$$

$$H_0^{IV}: \widetilde{\hat{\rho}_B} - \widetilde{\hat{\rho}_O} \leq 0 \qquad \text{vs.} \qquad H_1^{IV}: \widetilde{\hat{\rho}_B} - \widetilde{\hat{\rho}_O} > 0 \tag{10}$$

$$H_0^{V}: \widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_O} \leq 0 \qquad \text{vs.} \qquad H_1^{V}: \widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_O} > 0 \tag{11}$$

We also test the differences between absolute median correlations:

$$H_0^{VI}: \widetilde{|\hat{\rho}_C|} - \widetilde{|\hat{\rho}_B|} \leq 0 \qquad \text{vs.} \qquad H_1^{VI}: \widetilde{|\hat{\rho}_C|} - \widetilde{|\hat{\rho}_B|} > 0 \tag{12}$$

$$H_0^{VII}: \widetilde{|\hat{\rho}_B|} - \widetilde{|\hat{\rho}_O|} \leq 0 \qquad \text{vs.} \qquad H_1^{VII}: \widetilde{|\hat{\rho}_B|} - \widetilde{|\hat{\rho}_O|} > 0 \tag{13}$$

$$H_0^{VIII}: \widetilde{|\hat{\rho}_C|} - \widetilde{|\hat{\rho}_O|} \leq 0 \qquad \text{vs.} \qquad H_1^{VIII}: \widetilde{|\hat{\rho}_C|} - \widetilde{|\hat{\rho}_O|} > 0 \tag{14}$$

4 Empirical Results

We present the estimates of average correlation coefficients and discuss their differences in the business cycle. The results are examined with hypotheses tests by applying a permutation test and a bootstrap approach. As a further robustness check, we confirm the results with the estimates of the average correlation coefficients between industries and the aggregate market.

4.1 Average Correlation Coefficients

We report the estimation results of the median and absolute median of conditional correlation coefficients as well as the median differences and absolute median differences. Table 4 shows the results when we partition through the 2-phase business cycle indicators and the findings of unconditional correlations. Table 5 presents the results when we partition through the 3-phase indicators. All results are provided for Pearson's correlation coefficient and Kendall's τ. Note that Kendall's τ is always lower than Pearson's correlation coefficient.

[Please insert table 4 here]

The results in table 4 support the hypotheses H^{I} and H^{II}. As expected, all differences are positive, i.e. the median and absolute median correlations are always higher during recession than during expansion. These results are consistent for both correlation measures, both panels and both 2-phase indicators. Since the CFNAI classifies more quarters as a recession than the NBER turning points, the sub panel recession of CFNAI includes more quarters with relatively lower correlation. Therefore, it is not astonishing that the differences are smaller for CFNAI than for NBER. The unconditional average correlations are between the average correlations during recession and expansion, except the absolute median correlations in panel A.

[Please insert table 5 here]

The results in table 5 support the hypotheses H^{III} to H^{VIII}. Again, all differences are positive, i.e. the median and absolute median correlations are always the highest during crisis and always the lowest during common phase. The correlations during boom are lower than during crisis and higher than during common phase. The differences between crisis and common phase are larger than the differences between boom and common phase. These results are consistent for Pearson's correlation coefficient and Kendall's τ, for panel A and panel B as well as for CFNAI* and CU. The disparities in results between CFNAI* and CU are a result of differences of correlations in times of boom. Classified by panel B and conditioned on CFNAI*, the median correlations during boom and common phase are close in value. Nevertheless, we observe slightly higher median correlations during boom. The unconditional average correlations are between the average correlations during boom and common phase, except in panel B for CFNAI*. The results are only slightly sensitive to a variety of the thresholds of the two 3-phase business cycle indicators.

Finally, the differences of the median and absolute median correlations are higher for panel A than for panel B. We assert that the average correlations of panel A are also higher than those of panel B. A main objective of Fama and French (1997) is to form industry portfolios which are more likely to share common risk characteristics than SIC portfolios (see Bhojraj et al. (2003)). Through the finer level of disaggregation in panel B the groups are more homogeneous concerning their co-movement in revenue growth. Thus, the correlations increase within industries and decrease across industries compared to panel A.[27]

Although the level of correlations differs across industry classification and business cycle partition, our hypotheses are reinforced.[28] The findings reveal a structural break in correlation across the states of the economy. Correlations are higher during recession than during expansion. Even when dividing into three phases, we find the following descending order concerning the level of correlations: crisis, boom and common phase.

4.2 Hypotheses Tests

To investigate the statistical significance of the hypotheses we perform a permutation test and check the results with a bootstrap approach.

[27]Chan et al. (2007) examine the correlation of revenue growth within industries and outside industries grouped by GICS and FF48 Industry Classification.

[28]Moreover, we checked our results by using the mean instead of the median and find similar results. As a further robustness check, we compute the unfiltered correlations. Even these biased results largely confirm the previous results. As expected, the unfiltered correlations are higher than the filtered ones. Although the differences between average correlations are smaller, the order remains the same for panel B. However, the average correlations are higher during boom than during crisis for panel A. We do not present the results.

Permutation Test

In order to test the significance of the differences between two medians of correlations we use a permutation test.[29] Assuming that the null hypotheses of section 3.4 are true, e.g. H_0^I : $\widetilde{\hat{\rho}_R} - \widetilde{\hat{\rho}_E} \leq 0$, we estimate the sampling distribution of the test statistic and the p-value by resampling in a consistent manner with the null hypotheses. To apply resampling, we take the difference between the two medians of correlations as the test statistic. We put the sub panels, e.g. the observations for recession and expansion, together in one sample and choose permutation resamples from this data without replacement. That means we allocate each of the observed quarters to one of these two phases randomly. Now the quarters are regrouped into two sub panels which have the same sizes as the two original ones. We repeat the resampling 10,000 times and obtain a permutation distribution of the statistic of the resamples. The p-value of each permutation test is the proportion of the 10,000 resamples which exhibits a median difference at least as high as the original observed median difference.

[Please insert table 6 here]

As reported in table 6, the null hypothesis H_0^I concerning differences of median correlations between recession and expansion can be rejected for NBER in both panels for both correlation measures at a 5% significance level. It can be rejected for CFNAI in panel A for both correlation measures and in panel B for Pearson's correlation at a 10% level. For the differences of absolute median correlations between recession and expansion the null hypothesis H_0^{II} can be rejected at a 5% level in the case of NBER in panel B and at a 10% level for both 2-phase indicators in panel A measured with Kendall's τ.

The null hypothesis H_0^V concerning differences of median correlations between crisis and common phase can be rejected for both 3-phase indicators in both panels for both correlation measures at a 10% significance level. The rejection of this null hypothesis is even significant at a 5% level in the cases of CFNAI* in panel A and CU in panel B. For the differences of absolute median

[29]The permutation test is evolved from Fisher (1935), Pitman (1937) and Pitman (1938).

correlations between crisis and common phase the null hypothesis H_0^{VIII} can be rejected in most cases at a 10% level, and even at a 5% level in the case of CFNAI* in panel A measured with Kendall's τ. The p-values for this hypothesis, which are not lower than the 10% level, are only slightly above 10%. The null hypotheses H_0^{IV} and H_0^{VII} concerning differences of average correlations between boom and common phase cannot be rejected in most of the cases at a 10% level. For the differences between crisis and boom the null hypotheses H_0^{III} and H_0^{VI} cannot be rejected at any significance level, except for CFNAI* in panel A measured with Kendall's τ.

As already discussed, the availability of quarterly data is restricted. As a consequence to this the permutation test results show that the differences have limited statistical significance. Nevertheless, the large differences observed in median correlations between recession and expansion as well as crisis and common phase are confirmed by the permutation test.

Bootstrap Approach

To confirm the results of the permutation test with a bootstrap approach, we calculate bootstrap confidence intervals for the differences of median and absolute median correlations. The bootstrap percentile confidence intervals also provide information about the statistical significance of the differences. In contrast to permutation resamples which are drawn from sub panels without replacement, bootstrap samples are drawn separately from each sub panel with replacement. We therefore build resamples of the quarters with the same size as the original sub panels, e.g. we draw a resample of quarters with replacement from the sub panel recession and a separate resample from the sub panel expansion. We use 10,000 replications of the resampling process and compute for each combined resample the difference of median and absolute median correlations. The 10,000 differences shape a bootstrap distribution, which is approximately normally distributed. The bootstrap distributions have a small bias because they are centered close to the true values of the differences. The interval between the 2.5% and 97.5% percentiles of the bootstrap distribution is used as the 95% confidence interval. Beside the 95% interval we also present the 90% confidence interval for the differences of median and absolute median correlations in tables 20 to 22 in Appendix C. The confidence intervals give a wide range for the population of the differences of median and absolute median correlations between the phases. If a confidence interval fails to include the value of zero, the observed difference of average correlations is significant at the corresponding level.

In both panels and in the case of applying NBER, the 90% intervals for the differences between recession and expansion do not include zero. In some cases it is not included in the 95% intervals as well. The bootstrap results in the case of CFNAI are nearly similar for the 90% intervals, except in two cases. Thus, the differences between recession and expansion are statistically significant at the corresponding levels. In both panels and in the case of CFNAI*, the value of zero for the differences between crisis and common phase is not included in the 90% intervals and in most of the cases it is not even included in the 95% intervals. For CU in panel B, the value of zero for the differences between crisis and common phase is not included in the 95% confidence intervals, except in the case of differences between median correlations measured with Kendall's τ. These results are not confirmed for CU in panel A. Finally in panel B for CFNAI* and CU, the value of zero for the differences of absolute median correlations between boom and common phase is not included in the 95% intervals. Thus, the mentioned differences between crisis and common phase, as well as between boom and common phase, are statistically significant at the corresponding levels.

We assert differences of median and absolute median correlations between business cycle phases for growth rates of revenues across industries. The results of the significance tests indicate empirical evidence for the existence of structural changes in correlation across the phases of the business cycle.

4.3 Correlations Between the Industries and the Aggregate Market

As a further robustness check, we calculate the average correlations between the industries and the market as a whole. Therefore, we aggregate all industry revenues to value-weighted market revenues and compute the market's log growth rates. After filtering the market growth rates and dividing the panels A and B into the sub panels through the 2-phase and 3-phase business cycle indicators, we compute the correlations between the growth rates in revenues of each industry portfolio and the market portfolio.[30] We present the estimation results of median and absolute median of conditional correlation coefficients as well as for the median differences and absolute median differences in table 7.

[Please insert table 7 here]

The table shows that our previous results are robust. The differences between recession and expansion as well as the differences between crisis and common phase, and between crisis and boom are positive. These results are consistent for both correlation measures, both panels and all applied business cycle indicators.[31] Since the industry revenues are part of the aggregate market revenues, the average correlations are higher than those of the previous tables 4 and 5. However, the results for panel B also indicate that the average correlations in common phase can be higher than in boom.

5 Extension

In this section we present and analyze the results of the correlations between earnings in the different phases of the business cycle. Similar to the revenue methodology, we aggregate firm earnings of our sample to industry earnings by using the SIC codes and the FF48 industry classification. Since earnings are sometimes negative, we calculate arithmetic growth rates instead of log growth rates. These earnings growth rates are stationary and we also filter them for autocorrelation. Table 8 presents the estimates of the median and absolute median correlations as well as their differences between the business cycle phases.

[30] The correlations between the SIC industry portfolios and the aggregate market for the sub panels and the undivided panel are reported in table 23 in Appendix D.

[31] In panel A, the absolute median correlations are equal to the median correlations because nearly all correlations are positive.

[Please insert table 8 here]

As expected, the average correlations of earnings are lower than those of revenues. Earnings management reduces the dependence of earnings on the business cycle and therefore the strength of correlation between earnings across industries. In expansion and common phase the median correlations of earnings almost equals zero. However, we also observe structural differences in the correlation of earnings growth through the business cycle phases. The results of correlations between earnings largely confirm our previous findings of the following descending order of correlation levels: crisis, boom, common phase.

6 Conclusion

The intent of this article is to reveal the existence of structural changes in correlation behavior of fundamentals through the business cycle. Our empirical study shows that correlations are the highest during crisis which could explain the high correlation between stock returns in times of crisis. Our results indicate that the co-movement of fundamentals drives the co-movement of stock returns. Moreover, we find that correlations are also higher during boom than during the remaining phases of the business cycle which we refer to as common phase in our study. Our findings are consistent for both dependence measures and all applied business cycle indicators. We test the differences of average correlations through permutation and bootstrap approaches and find that the correlations during crisis are significantly different from the correlations during common phase. In our study we use industry revenues, since revenues serve as an indicator of firm performance and persistence. As robustness checks, we first confirm the results by calculating the average correlations between the industries and the aggregate market. Second, we investigate the correlations between earnings. Since earnings management smooths earnings, the average correlations of earnings are lower than the ones of revenues in the different business cycle phases. Nevertheless, the results concerning earnings largely reinforce our previous findings. Analysts should take our results as an explanation for the correlation behavior of stock returns into account. Researchers and practitioners should be aware of structural changes in correlation when valuing firms and deciding on diversification in portfolio analysis and risk management. One major reason for the current financial crisis have been inaccurate correlation assumptions which lead to mispricing of credit portfolios. In credit risk models, the correlation behavior of assets significantly influences the portfolio value. In particular, higher correlations of fundamentals in crisis increase the downside risk of portfolios. As a result the value of diversification is often overstated.

Appendix

A Data Statistics and Results of Preliminary Tests

Table 9: **Panel A: Stationary test of demeaned revenue growth rates**

Dickey-Fuller test for unit root			**Number of obs = 159**		
SIC Industry Portfolio i		Interpolated Dickey-Fuller: Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
0	$Z_1(t)$	-15.743	-3.490	-2.886	-2.576
1	$Z_2(t)$	-12.035	-3.490	-2.886	-2.576
2	$Z_3(t)$	-10.749	-3.490	-2.886	-2.576
3	$Z_4(t)$	-21.029	-3.490	-2.886	-2.576
4	$Z_5(t)$	-14.134	-3.490	-2.886	-2.576
5	$Z_6(t)$	-21.375	-3.490	-2.886	-2.576
7	$Z_7(t)$	-24.108	-3.490	-2.886	-2.576
8	$Z_8(t)$	-19.906	-3.490	-2.886	-2.576
9	$Z_9(t)$	-24.818	-3.490	-2.886	-2.576

The approximate p-values for all $Z_i(t)$ are almost zero with zero lags. Industries are classified by SIC portfolios i (panel A). The null hypothesis, that the demeaned growth rates contain a unit root, can be rejected at a 1% significance-level. For panel B, the null hypothesis can also be rejected at a 1%-significance level. For detailed information about panel B please contact the authors.

Table 10: **Panel A: Descriptive statistics of demeaned revenue growth rates**

i	**Quarter**	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**Skewness**	**Kurtosis**
0	160	0	0.175	-0.393	0.360	-0.223	2.358
1	160	0	0.072	-0.289	0.130	-0.773	4.330
2	160	0	0.056	-0.297	0.127	-1.338	7.851
3	160	0	0.067	-0.333	0.137	-0.842	5.626
4	160	0	0.052	-0.138	0.107	-0.549	2.822
5	160	0	0.097	-0.199	0.157	-0.530	2.309
7	160	0	0.084	-0.255	0.161	-0.650	3.426
8	160	0	0.043	-0.178	0.137	-0.075	4.975
9	160	0	0.130	-0.377	0.341	-0.508	3.177

Industries are classified by SIC portfolios i (panel A). The means exhibit a value of zero because the growth rates of revenues are demeaned.

Table 11: **Panel B: Descriptive statistics of demeaned revenue growth rates**

j	**Quarter**	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**Skewness**	**Kurtosis**
1	160	0	0.179	-0.394	0.381	-0.209	2.399
2	160	0	0.045	-0.119	0.104	-0.641	3.241
3	160	0	0.117	-0.232	0.299	0.531	2.646
4	160	0	0.116	-0.258	0.248	-0.208	2.317
5	160	0	0.131	-0.577	0.378	-1.390	7.444
6	160	0	0.195	-0.913	0.374	-1.221	5.823
7	160	0	0.067	-0.384	0.261	-0.788	10.044
8	160	0	0.089	-0.217	0.176	-0.551	2.419
9	160	0	0.060	-0.197	0.094	-0.791	2.747
10	160	0	0.085	-0.142	0.190	0.641	2.392
11	160	0	0.055	-0.363	0.312	-0.343	20.400
12	160	0	0.041	-0.120	0.086	-0.433	3.423
13	160	0	0.039	-0.133	0.131	-0.058	4.440
14	160	0	0.060	-0.165	0.162	0.063	3.012
15	160	0	0.058	-0.175	0.130	0.013	3.398
16	160	0	0.057	-0.202	0.146	-0.299	3.810
17	160	0	0.071	-0.176	0.146	0.152	2.783
18	160	0	0.093	-0.261	0.170	-0.707	2.727
19	160	0	0.080	-0.478	0.183	-1.650	11.203
20	160	0	0.066	-0.270	0.177	-0.397	4.105
21	160	0	0.052	-0.243	0.117	-0.705	4.815
22	160	0	0.118	-0.520	0.383	-0.977	5.992
23	160	0	0.110	-0.551	0.268	-0.854	5.608
24	160	0	0.094	-0.205	0.307	0.031	2.557
25	160	0	0.059	-0.165	0.255	0.495	4.866
26	160	0	0.141	-0.401	0.391	-0.196	3.239
27	160	0	0.088	-0.244	0.250	-0.047	3.262
28	160	0	0.170	-0.479	0.599	0.146	4.599
29	160	0	0.093	-0.314	0.347	0.398	5.233
30	160	0	0.092	-0.467	0.237	-1.141	7.240
31	160	0	0.121	-0.287	0.242	-0.702	2.414
32	160	0	0.048	-0.174	0.144	-0.844	5.054
33	160	0	0.049	-0.129	0.107	-0.075	2.424
34	160	0	0.104	-0.316	0.215	-0.572	3.506
35	160	0	0.076	-0.286	0.141	-0.852	4.132
36	160	0	0.085	-0.267	0.290	-0.128	3.282
37	160	0	0.062	-0.219	0.132	-0.383	3.431
38	160	0	0.039	-0.150	0.093	-0.528	4.230
39	160	0	0.081	-0.251	0.247	-0.293	2.996
40	160	0	0.046	-0.166	0.094	-0.532	3.435
41	160	0	0.046	-0.306	0.083	-2.292	14.888
42	160	0	0.124	-0.259	0.196	-0.555	2.379
43	160	0	0.059	-0.148	0.158	-0.042	2.783
48	160	0	0.108	-0.335	0.288	-0.529	3.123

Industries are classified by Fama-French industry portfolios j (panel B). The means exhibit a value of zero because the growth rates of revenues are demeaned.

Table 12: **Panel A: Normal distribution tests of revenue growth**

	Jarque-Bera test			Omnibus test		
i	χ^2	df	P-value	D-H	df	P-value
0	4.07	2	0.0935*	5.59	2	0.0612*
1	27.72	2	0.0012***	14.08	2	0.0009***
2	204.60	2	0.0010***	33.00	2	0.0000***
3	64.88	2	0.0010***	20.33	2	0.0000***
4	8.24	2	0.0233**	13.71	2	0.0011***
5	10.41	2	0.0141**	25.90	2	0.0000***
7	12.48	2	0.0093***	12.46	2	0.0020***
8	26.16	2	0.0014***	22.93	2	0.0000***
9	7.08	2	0.0317**	7.66	2	0.0217**

Industries are classified by SIC portfolios i (panel A). *, **, ***, indicate that the null hypothesis of normality for revenue growth can be rejected at a 10%, 5% and 1% significance level. The table reports that the null hypothesis can be rejected by Jarque-Bera test and Omnibus test for all portfoilios at a 5%-significance level, except for $i = 1$. For revenue growth in panel B the null hypothesis of normality can be rejected by both tests for more than two-third of the portfolios at a 5%-significance level. For detailed information about panel B please contact the authors.

Table 13: **Panel A: Estimated parameters from the AR(1)-GJR(1,1) model**

i	a_0	a_1	b_0	b_1	b_2	b_3	$\mathcal{LL}$
0	0.013	-0.294	0.001	0.399	0.740	-0.278	71.8106
1	-0.001	-0.108	0.003	0.565	0.154	-0.475	203.5729
2	0.004	-0.089	0.001	0.925	0.442	-0.734	253.6948
3	0.005	-0.682	0.001	0	0.459	0.519	245.5516
4	6.26e-05	-0.115	6.30e-05	0.165	0.907	-0.165	258.1060
5	0.001	-0.487	3.72e-06	0.063	0.961	-0.063	171.5596
7	0.003	-0.548	6.48e-05	0.151	0.910	-0.137	210.6744
8	-0.003	-0.291	2.02e-05	0.029	0.913	0.094	300.7045
9	0.004	-0.641	0.001	0.227	0.759	-0.095	142.6988

Industries are classified by SIC portfolios i (panel A). The estimated parameters correspond to equations (3) and (4). $\mathcal{LL}$ corresponds to the log-likelihood function value. For the detailed results from the AR(1)-GJR(1,1) model in panel B please contact the authors.

B Correlation Matrices and Standard Errors

Table 14: **Panel A: Correlation matrices conditioned on CFNAI***

CFNAI* crisis - Pearson's correlation (normal) and Kendall's τ (italics)

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	1	*-0.1067*	*-0.0600*	*0.0733*	*-0.1600*	*-0.3000*	*-0.1733*	*0.0600*	*-0.1267*
1	-0.2341	1	*0.6467*	*0.4067*	*0.2000*	*0.3133*	*0.4400*	*0.2600*	*0.3400*
2	-0.0752	0.7952	1	*0.4400*	*0.2733*	*0.3867*	*0.6067*	*0.2933*	*0.3867*
3	0.0827	0.5308	0.4594	1	*0.3267*	*0.4133*	*0.5000*	*0.2933*	*0.5067*
4	-0.2410	0.2747	0.3309	0.5142	1	*0.2867*	*0.3200*	*0.0333*	*0.1667*
5	-0.3823	0.5236	0.4077	0.5939	0.4219	1	*0.4867*	*0.3200*	*0.6400*
7	-0.3284	0.6044	0.6030	0.6045	0.5149	0.7240	1	*0.3400*	*0.3933*
8	0.0556	0.4192	0.3605	0.4230	0.0645	0.4697	0.4753	1	*0.3333*
9	-0.2087	0.4124	0.3415	0.5933	0.1144	0.7815	0.4838	0.4396	1

CFNAI* common phase - Pearson's correlation (normal) and Kendall's τ (italics)

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	1	*-0.1337*	*-0.0735*	*0.0024*	*-0.4210*	*-0.3172*	*-0.3426*	*0.0521*	*-0.2004*
1	-0.1810	1	*0.5737*	*0.1608*	*0.1341*	*0.2808*	*0.3281*	*0.1200*	*0.2594*
2	-0.0986	0.7907	1	*0.1782*	*0.1337*	*0.2505*	*0.2824*	*0.1293*	*0.1903*
3	-0.0347	0.2370	0.2382	1	*0.1135*	*0.0533*	*0.2339*	*0.1576*	*0.0974*
4	-0.6426	0.1855	0.1573	0.1372	1	*0.2182*	*0.2590*	*-0.0598*	*0.1410*
5	-0.4863	0.3837	0.3484	0.1804	0.3477	1	*0.6473*	*0.1604*	*0.4606*
7	-0.4674	0.4614	0.4537	0.4065	0.3655	0.8581	1	*0.1851*	*0.5168*
8	0.0982	0.1607	0.0871	0.1773	-0.1086	0.1868	0.2419	1	*0.2093*
9	-0.3139	0.3660	0.3150	0.1770	0.2217	0.5825	0.7095	0.2167	1

CFNAI* boom - Pearson's correlation (normal) and Kendall's τ (italics)

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	1	*0.0992*	*0.2101*	*0.0387*	*-0.2168*	*-0.0151*	*-0.0353*	*0.3008*	*-0.1866*
1	0.0687	1	*0.4924*	*0.2807*	*-0.1092*	*0.2874*	*0.3815*	*0.3613*	*0.3042*
2	0.2161	0.6757	1	*0.1899*	*0.0420*	*0.4521*	*0.4857*	*0.3916*	*0.3815*
3	0.0485	0.3652	0.3731	1	*-0.0017*	*0.0185*	*0.1059*	*0.0857*	*0.0017*
4	-0.4467	-0.1452	0.0220	-0.0533	1	*0.0723*	*0.1395*	*-0.2101*	*0.2303*
5	-0.0754	0.4338	0.6146	-0.0717	0.2251	1	*0.6370*	*0.2538*	*0.5597*
7	-0.0265	0.4694	0.6628	0.1712	0.3046	0.8442	1	*0.2202*	*0.5597*
8	0.3940	0.4450	0.5002	0.0334	-0.3780	0.4004	0.2925	1	*0.1832*
9	-0.2916	0.4389	0.5082	0.0021	0.3907	0.8172	0.7362	0.3038	1

Industries are classified by SIC portfolios i (panel A). The business cycle phases are partitioned in three phases through CFNAI*. Pearson's correlation coefficients are normal and Kendall's τ coefficients are in italics. For detailed information about panel B please contact the authors.

Table 15: **Panel A: Correlations conditioned on CU and unconditioned**

CU crisis - Pearson's correlation (normal) and Kendall's τ (italics)

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	1	*-0.1200*	*-0.1267*	*-0.0933*	*-0.2600*	*-0.2600*	*-0.2533*	*0.0333*	*-0.0800*
1	-0.2448	1	*0.6467*	*0.4267*	*0.1533*	*0.2467*	*0.4667*	*0.3133*	*0.2400*
2	-0.1363	0.7769	1	*0.4200*	*0.2800*	*0.3467*	*0.6333*	*0.3733*	*0.2733*
3	-0.0872	0.5327	0.4312	1	*0.2333*	*0.3800*	*0.4400*	*0.2867*	*0.3733*
4	-0.3042	0.2070	0.3168	0.4138	1	*0.2800*	*0.3400*	*0.1200*	*-0.0200*
5	-0.3009	0.4472	0.3402	0.5829	0.3792	1	*0.5000*	*0.4133*	*0.5133*
7	-0.4109	0.6273	0.6113	0.5842	0.4917	0.6994	1	*0.4200*	*0.2800*
8	0.0607	0.4310	0.3936	0.4509	0.1550	0.6198	0.5944	1	*0.4200*
9	-0.1440	0.3113	0.2122	0.4393	-0.0553	0.6387	0.3633	0.4974	1

CU common phase - Pearson's correlation (normal) and Kendall's τ (italics)

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	1	*-0.1239*	*-0.0423*	*0.0761*	*-0.3622*	*-0.3102*	*-0.2604*	*0.0802*	*-0.2088*
1	-0.1746	1	*0.5605*	*0.1561*	*0.1622*	*0.2966*	*0.3094*	*0.1354*	*0.2892*
2	-0.0925	0.7846	1	*0.1783*	*0.1482*	*0.3032*	*0.3119*	*0.1404*	*0.2505*
3	0.0593	0.2313	0.2480	1	*0.1231*	*0.0744*	*0.2430*	*0.1878*	*0.1404*
4	-0.5741	0.2064	0.1805	0.1326	1	*0.2496*	*0.2797*	*-0.0674*	*0.2142*
5	-0.4551	0.4194	0.4404	0.1756	0.3610	1	*0.6417*	*0.0917*	*0.4863*
7	-0.3602	0.4477	0.5015	0.3915	0.3734	0.8583	1	*0.1581*	*0.5230*
8	0.1277	0.1717	0.0934	0.2186	-0.1326	0.0891	0.1833	1	*0.1816*
9	-0.3329	0.4091	0.4074	0.2233	0.2930	0.6328	0.7230	0.1635	1

CU boom - Pearson's correlation (normal) and Kendall's τ (italics)

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	1	*0.0254*	*0.1270*	*-0.1524*	*-0.3746*	*-0.0413*	*-0.2254*	*0.2508*	*-0.2286*
1	-0.0338	1	*0.5619*	*0.2825*	*-0.0730*	*0.3556*	*0.4254*	*0.3238*	*0.3270*
2	0.1059	0.7965	1	*0.1619*	*0.0540*	*0.4000*	*0.4190*	*0.3746*	*0.3714*
3	-0.2529	0.4804	0.3111	1	*0.1175*	*0.1460*	*0.2921*	*0.1460*	*0.1683*
4	-0.6267	-0.0797	0.0382	0.1664	1	*0.0698*	*0.2032*	*-0.1778*	*0.1937*
5	-0.2491	0.4482	0.4462	0.2284	0.2865	1	*0.6254*	*0.4095*	*0.6032*
7	-0.3189	0.5233	0.4912	0.4243	0.3536	0.8829	1	*0.2889*	*0.6476*
8	0.3193	0.3973	0.4436	0.1595	-0.3260	0.4718	0.3680	1	*0.2603*
9	-0.3850	0.4094	0.3872	0.2166	0.3521	0.8670	0.8488	0.3463	1

Undivided panel - Pearson's correlation (normal) and Kendall's τ (italics)

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	1	*-0.0893*	*-0.0217*	*0.0368*	*-0.3110*	*-0.2336*	*-0.2258*	*0.0942*	*-0.1884*
1	-0.1446	1	*0.5714*	*0.2252*	*0.1116*	*0.3050*	*0.3629*	*0.1932*	*0.2852*
2	-0.0373	0.7868	1	*0.2651*	*0.1623*	*0.3258*	*0.3984*	*0.2002*	*0.2755*
3	0.0290	0.3763	0.3820	1	*0.1792*	*0.1409*	*0.2978*	*0.1533*	*0.1667*
4	-0.5084	0.1724	0.2003	0.2360	1	*0.2223*	*0.2701*	*-0.0719*	*0.1943*
5	-0.3564	0.4330	0.4296	0.2829	0.3516	1	*0.6214*	*0.2140*	*0.5321*
7	-0.3232	0.5195	0.5540	0.4910	0.4084	0.8257	1	*0.2388*	*0.5189*
8	0.1471	0.2564	0.2087	0.1884	-0.1352	0.2758	0.2899	1	*0.2344*
9	-0.2737	0.4021	0.3680	0.3011	0.2489	0.6753	0.6565	0.2725	1

Industries are classified by SIC portfolios i (panel A). The business cycle phases are partitioned in three phases through CU. Moreover, the correlations for the undivided panel are presented. Pearson's correlation coefficients are normal and Kendall's τ coefficients are in italics. For detailed information about panel B please contact the authors.

Table 16: **Panel A: Correlations conditioned on NBER and CFNAI**

NBER recession - Pearson's correlation (normal) and Kendall's τ (italics)

i	0	1	2	3	4	5	7	8	9
0	1	*-0.0952*	*-0.0794*	*-0.0106*	*-0.1693*	*-0.1270*	*-0.1376*	*0.0317*	*-0.0476*
1	-0.2034	1	*0.6667*	*0.4603*	*0.2593*	*0.3122*	*0.4921*	*0.3228*	*0.2963*
2	-0.1151	0.8304	1	*0.4233*	*0.3175*	*0.3175*	*0.5820*	*0.3280*	*0.3122*
3	0.0054	0.6058	0.5009	1	*0.3016*	*0.3228*	*0.4497*	*0.3651*	*0.3386*
4	-0.2668	0.3692	0.4116	0.5188	1	*0.1958*	*0.2698*	*0.0899*	*0.0317*
5	-0.2004	0.4923	0.3460	0.4428	0.2989	1	*0.5026*	*0.3862*	*0.6138*
7	-0.2714	0.6769	0.6329	0.5868	0.5040	0.6908	1	*0.4497*	*0.3704*
8	0.0242	0.4895	0.4128	0.5422	0.1654	0.5767	0.6198	1	*0.4127*
9	-0.1457	0.4163	0.3104	0.4869	0.0524	0.7456	0.4547	0.5410	1

NBER expansion - Pearson's correlation (normal) and Kendall's τ (italics)

i	0	1	2	3	4	5	7	8	9
0	1	*-0.0814*	*0.0062*	*0.0254*	*-0.3590*	*-0.2683*	*-0.2623*	*0.1127*	*-0.2140*
1	-0.1369	1	*0.5427*	*0.1760*	*0.0793*	*0.3014*	*0.3319*	*0.1661*	*0.2804*
2	-0.0210	0.7677	1	*0.2216*	*0.1240*	*0.3345*	*0.3498*	*0.1871*	*0.2658*
3	0.0021	0.2800	0.3251	1	*0.1358*	*0.1006*	*0.2639*	*0.1314*	*0.1397*
4	-0.5820	0.1153	0.1388	0.1539	1	*0.2186*	*0.2649*	*-0.1027*	*0.2087*
5	-0.4151	0.4107	0.4507	0.2152	0.3582	1	*0.6581*	*0.1758*	*0.5131*
7	-0.3664	0.4529	0.5164	0.4284	0.3819	0.8679	1	*0.1851*	*0.5524*
8	0.1806	0.1966	0.1549	0.1093	-0.1953	0.2120	0.2073	1	*0.1830*
9	-0.3271	0.3943	0.3884	0.2344	0.3060	0.6598	0.7390	0.1982	1

CFNAI recession - Pearson's correlation (normal) and Kendall's τ (italics)

i	0	1	2	3	4	5	7	8	9
0	1	*-0.1289*	*-0.0662*	*0.0128*	*-0.2218*	*-0.3124*	*-0.2195*	*0.0569*	*-0.1754*
1	-0.2011	1	*0.6167*	*0.3751*	*0.2102*	*0.3612*	*0.4588*	*0.1452*	*0.3635*
2	-0.0180	0.7823	1	*0.4100*	*0.2497*	*0.3589*	*0.5401*	*0.1754*	*0.3844*
3	0.0439	0.5403	0.4603	1	*0.3148*	*0.3217*	*0.4379*	*0.0918*	*0.3287*
4	-0.3636	0.3495	0.3352	0.4663	1	*0.3055*	*0.3798*	*-0.0221*	*0.2056*
5	-0.3569	0.4933	0.3529	0.4652	0.4117	1	*0.5168*	*0.3008*	*0.5842*
7	-0.3563	0.5719	0.5416	0.5597	0.5285	0.7211	1	*0.2729*	*0.4355*
8	0.0640	0.2396	0.2333	0.1632	-0.0007	0.4836	0.3550	1	*0.2753*
9	-0.2118	0.4328	0.3217	0.4700	0.1811	0.7441	0.4903	0.3572	1

CFNAI expansion - Pearson's correlation (normal) and Kendall's τ (italics)

i	0	1	2	3	4	5	7	8	9
0	1	*-0.0648*	*-0.0001*	*0.0198*	*-0.3643*	*-0.2183*	*-0.2398*	*0.1111*	*-0.1998*
1	-0.1273	1	*0.5477*	*0.1714*	*0.0665*	*0.2809*	*0.3336*	*0.2157*	*0.2583*
2	-0.0586	0.7827	1	*0.1989*	*0.1184*	*0.3154*	*0.3490*	*0.2050*	*0.2395*
3	-0.0038	0.2669	0.3019	1	*0.0868*	*0.0769*	*0.2276*	*0.1641*	*0.1001*
4	-0.5889	0.0817	0.1228	0.0902	1	*0.1772*	*0.2224*	*-0.1152*	*0.1714*
5	-0.3768	0.4010	0.4452	0.1701	0.3138	1	*0.6587*	*0.1722*	*0.5115*
7	-0.3477	0.4768	0.5375	0.3732	0.3344	0.8662	1	*0.2035*	*0.5382*
8	0.1737	0.2407	0.1689	0.1185	-0.2200	0.1887	0.2181	1	*0.2116*
9	-0.3210	0.3679	0.3712	0.1696	0.2545	0.6517	0.7289	0.2126	1

Industries are classified by SIC portfolios i (panel A). The business cycle phases are partitioned in two phases through NBER and CFNAI. Pearson's correlation coefficients are normal and Kendall's τ coefficients are in italics. For detailed information about panel B please contact the authors.

Table 17: **Panel A: Bootstrap standard errors of correlations for CFNAI***

CFNAI* crisis - bootstrap standard errors of correlations

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	0	*0.1283*	*0.1390*	*0.1482*	*0.1597*	*0.1443*	*0.1566*	*0.1655*	*0.1395*
1	0.1654	0	*0.0943*	*0.1324*	*0.1595*	*0.1202*	*0.1112*	*0.1265*	*0.1304*
2	0.1664	0.0779	0	*0.0994*	*0.1479*	*0.1263*	*0.0913*	*0.1159*	*0.1397*
3	0.2027	0.1667	0.1002	0	*0.1571*	*0.1204*	*0.1113*	*0.1485*	*0.1003*
4	0.2027	0.2048	0.1681	0.1510	0	*0.1572*	*0.1553*	*0.1683*	*0.1625*
5	0.1957	0.1305	0.1699	0.1337	0.1855	0	*0.1142*	*0.1670*	*0.0996*
7	0.1696	0.1016	0.1159	0.1070	0.1520	0.1073	0	*0.1430*	*0.1310*
8	0.1976	0.1497	0.1226	0.1810	0.2149	0.1868	0.1842	0	*0.1376*
9	0.1749	0.1711	0.2126	0.0900	0.2109	0.0716	0.1434	0.1470	0

CFNAI* common phase - bootstrap standard errors of correlations

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	0	*0.0616*	*0.0656*	*0.0646*	*0.0547*	*0.0505*	*0.0476*	*0.0618*	*0.0541*
1	0.0797	0	*0.0447*	*0.0667*	*0.0653*	*0.0628*	*0.0655*	*0.0742*	*0.0736*
2	0.0877	0.0387	0	*0.0686*	*0.0675*	*0.0713*	*0.0739*	*0.0716*	*0.0724*
3	0.0932	0.0928	0.0905	0	*0.0677*	*0.0695*	*0.0675*	*0.0665*	*0.0669*
4	0.0602	0.0866	0.0932	0.0945	0	*0.0698*	*0.0616*	*0.0656*	*0.0655*
5	0.0647	0.0695	0.0919	0.0999	0.0800	0	*0.0398*	*0.0735*	*0.0596*
7	0.0658	0.0795	0.0905	0.0843	0.0713	0.0260	0	*0.0701*	*0.0540*
8	0.0773	0.1264	0.1374	0.0883	0.0788	0.1091	0.1203	0	*0.0696*
9	0.0714	0.1026	0.1004	0.0926	0.0833	0.0845	0.0561	0.1177	0

CFNAI* boom - bootstrap standard errors of correlations

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	0	*0.1184*	*0.1104*	*0.1235*	*0.1199*	*0.1139*	*0.1144*	*0.1060*	*0.1128*
1	0.1589	0	*0.1082*	*0.1090*	*0.1420*	*0.1109*	*0.1294*	*0.0968*	*0.1136*
2	0.1413	0.0718	0	*0.0994*	*0.1487*	*0.0894*	*0.0868*	*0.0868*	*0.1189*
3	0.1577	0.1411	0.1675	0	*0.1244*	*0.0926*	*0.1057*	*0.1167*	*0.1167*
4	0.1005	0.1668	0.1491	0.1613	0	*0.1494*	*0.1358*	*0.1314*	*0.1331*
5	0.1510	0.1172	0.1414	0.1436	0.1333	0	*0.0674*	*0.1325*	*0.0780*
7	0.1554	0.1288	0.1617	0.1281	0.1210	0.0325	0	*0.1140*	*0.0780*
8	0.1257	0.0898	0.0803	0.1479	0.1305	0.1245	0.1036	0	*0.1166*
9	0.1397	0.1356	0.1838	0.1572	0.1309	0.0310	0.0410	0.1272	0

Industries are classified by SIC portfolios i (panel A). The business cycle phases are partitioned in three phases through CFNAI*. The number of bootstrap replications is set to 10,000. The bootstrap standard errors of Pearson's correlation coefficients are normal and those of Kendall's τ coefficients are italicized. For detailed information about panel B please contact the authors.

Table 18: **Panel A: Bootstrap standard errors (CU and unconditioned)**

CU crisis - bootstrap standard errors of correlations

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	0	*0.1433*	*0.1507*	*0.1626*	*0.1682*	*0.1576*	*0.1581*	*0.1597*	*0.1497*
1	0.1824	0	*0.1016*	*0.1411*	*0.1588*	*0.1386*	*0.1183*	*0.1321*	*0.1436*
2	0.1828	0.0828	0	*0.1106*	*0.1469*	*0.1375*	*0.1004*	*0.1000*	*0.1464*
3	0.2128	0.1882	0.1198	0	*0.1652*	*0.1439*	*0.1173*	*0.1372*	*0.1369*
4	0.2127	0.2136	0.1747	0.1826	0	*0.1646*	*0.1484*	*0.1556*	*0.1513*
5	0.2081	0.1484	0.1807	0.1410	0.1946	0	*0.1230*	*0.1438*	*0.1339*
7	0.1645	0.1044	0.1230	0.1172	0.1540	0.1098	0	*0.1054*	*0.1392*
8	0.2001	0.1533	0.1205	0.1661	0.2059	0.1328	0.1168	0	*0.1187*
9	0.1829	0.1699	0.2248	0.1413	0.1925	0.1389	0.1644	0.1299	0

CU common phase - bootstrap standard errors of correlations

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	0	*0.0608*	*0.0614*	*0.0652*	*0.0607*	*0.0518*	*0.0538*	*0.0626*	*0.0534*
1	0.0772	0	*0.0481*	*0.0637*	*0.0675*	*0.0635*	*0.0640*	*0.0790*	*0.0727*
2	0.0837	0.0417	0	*0.0669*	*0.0675*	*0.0672*	*0.0701*	*0.0757*	*0.0678*
3	0.0960	0.0897	0.0909	0	*0.0676*	*0.0666*	*0.0667*	*0.0643*	*0.0654*
4	0.0696	0.0872	0.0931	0.0964	0	*0.0692*	*0.0646*	*0.0676*	*0.0664*
5	0.0688	0.0690	0.0829	0.0963	0.0875	0	*0.0410*	*0.0757*	*0.0547*
7	0.0751	0.0789	0.0792	0.0822	0.0769	0.0268	0	*0.0752*	*0.0498*
8	0.0797	0.1371	0.1508	0.0908	0.0811	0.1124	0.1303	0	*0.0721*
9	0.0668	0.1024	0.0916	0.0917	0.0829	0.0683	0.0473	0.1287	0

CU boom - bootstrap standard errors of correlations

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	0	*0.1177*	*0.1180*	*0.1115*	*0.1178*	*0.1141*	*0.1165*	*0.1048*	*0.1131*
1	0.1612	0	*0.0925*	*0.1224*	*0.1249*	*0.0989*	*0.1202*	*0.0905*	*0.1067*
2	0.1421	0.0728	0	*0.1137*	*0.1323*	*0.1019*	*0.1158*	*0.0832*	*0.1189*
3	0.1586	0.1414	0.1675	0	*0.1071*	*0.1005*	*0.1128*	*0.1184*	*0.1232*
4	0.1004	0.1669	0.1509	0.1615	0	*0.1374*	*0.1013*	*0.1264*	*0.1201*
5	0.1531	0.1197	0.1429	0.1454	0.1341	0	*0.0695*	*0.1157*	*0.0606*
7	0.1570	0.1296	0.1649	0.1278	0.1192	0.0325	0	*0.0881*	*0.0698*
8	0.1257	0.0892	0.0806	0.1482	0.1314	0.1236	0.1029	0	*0.1126*
9	0.1401	0.1366	0.1842	0.1571	0.1296	0.0308	0.0408	0.1254	0

Undivided panel - bootstrap standard errors of correlations

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	0	*0.0500*	*0.0517*	*0.0523*	*0.0485*	*0.0455*	*0.0469*	*0.0497*	*0.0456*
1	0.0678	0	*0.0353*	*0.0541*	*0.0552*	*0.0478*	*0.0503*	*0.0557*	*0.0545*
2	0.0720	0.0303	0	*0.0487*	*0.0533*	*0.0496*	*0.0491*	*0.0523*	*0.0546*
3	0.0781	0.0773	0.0589	0	*0.0537*	*0.0539*	*0.0511*	*0.0535*	*0.0517*
4	0.0594	0.0770	0.0734	0.0793	0	*0.0576*	*0.0489*	*0.0541*	*0.0526*
5	0.0661	0.0550	0.0671	0.0767	0.0678	0	*0.0334*	*0.0561*	*0.0385*
7	0.0653	0.0567	0.0558	0.0623	0.0590	0.0288	0	*0.0521*	*0.0405*
8	0.0645	0.0901	0.0974	0.0793	0.0711	0.0854	0.0858	0	*0.0518*
9	0.0670	0.0767	0.0864	0.0706	0.0702	0.0480	0.0565	0.0834	0

Industries are classified by SIC portfolios i (panel A). The business cycle phases are partitioned in three phases through CU. The number of bootstrap replications is set to 10,000. Moreover, the bootstrap standard errors of correlations for the undivided panel are presented. The bootstrap standard errors of Pearson's correlation coefficients are normal and those of Kendall's τ coefficients are italicized.

Table 19: **Panel A: Bootstrap standard errors (NBER and CFNAI)**

NBER recession - bootstrap standard errors of correlations

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	0	*0.1301*	*0.1314*	*0.1493*	*0.1449*	*0.1496*	*0.1529*	*0.1463*	*0.1366*
1	0.1649	0	*0.0857*	*0.1277*	*0.1437*	*0.1256*	*0.1138*	*0.1252*	*0.1293*
2	0.1680	0.0619	0	*0.0901*	*0.1329*	*0.1274*	*0.0821*	*0.1149*	*0.1409*
3	0.2023	0.1467	0.0916	0	*0.1325*	*0.1328*	*0.1073*	*0.1312*	*0.1111*
4	0.1803	0.1817	0.1509	0.1327	0	*0.1537*	*0.1369*	*0.1364*	*0.1490*
5	0.1947	0.1351	0.1701	0.1519	0.1853	0	*0.1162*	*0.1295*	*0.0960*
7	0.1765	0.0958	0.0977	0.1060	0.1428	0.1098	0	*0.0997*	*0.1240*
8	0.1820	0.1401	0.1255	0.1449	0.1894	0.1262	0.1020	0	*0.1125*
9	0.1754	0.1653	0.2095	0.1029	0.1909	0.0656	0.1394	0.1123	0

NBER expansion - bootstrap standard errors of correlations

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	0	*0.0559*	*0.0557*	*0.0573*	*0.0506*	*0.0460*	*0.0457*	*0.0526*	*0.0478*
1	0.0733	0	*0.0415*	*0.0585*	*0.0603*	*0.0532*	*0.0565*	*0.0621*	*0.0602*
2	0.0755	0.0374	0	*0.0565*	*0.0600*	*0.0561*	*0.0596*	*0.0592*	*0.0605*
3	0.0840	0.0808	0.0728	0	*0.0600*	*0.0587*	*0.0561*	*0.0575*	*0.0547*
4	0.0573	0.0814	0.0820	0.0873	0	*0.0609*	*0.0540*	*0.0593*	*0.0565*
5	0.0645	0.0594	0.0731	0.0814	0.0718	0	*0.0327*	*0.0628*	*0.0436*
7	0.0685	0.0675	0.0724	0.0663	0.0641	0.0209	0	*0.0596*	*0.0399*
8	0.0655	0.1059	0.1175	0.0795	0.0714	0.0956	0.0978	0	*0.0586*
9	0.0645	0.0862	0.0848	0.0754	0.0689	0.0592	0.0403	0.0978	0

CFNAI recession - bootstrap standard errors of correlations

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	0	*0.0955*	*0.1084*	*0.1085*	*0.1088*	*0.1034*	*0.1117*	*0.1115*	*0.1060*
1	0.1211	0	*0.0721*	*0.0945*	*0.1054*	*0.0954*	*0.0851*	*0.0931*	*0.1022*
2	0.1314	0.0572	0	*0.0765*	*0.1091*	*0.1052*	*0.0749*	*0.0915*	*0.1122*
3	0.1557	0.1251	0.0735	0	*0.1216*	*0.1016*	*0.0950*	*0.1108*	*0.0933*
4	0.1442	0.1394	0.1231	0.1262	0	*0.1173*	*0.1064*	*0.1219*	*0.1156*
5	0.1465	0.1041	0.1489	0.1326	0.1444	0	*0.0869*	*0.1162*	*0.0813*
7	0.1278	0.0835	0.1019	0.1042	0.1102	0.0904	0	*0.0999*	*0.0988*
8	0.1389	0.1144	0.0904	0.1509	0.1596	0.1329	0.1406	0	*0.0984*
9	0.1382	0.1340	0.1868	0.0923	0.1608	0.0640	0.1240	0.1120	0

CFNAI expansion - bootstrap standard errors of correlations

i	**0**	**1**	**2**	**3**	**4**	**5**	**7**	**8**	**9**
0	0	*0.0615*	*0.0618*	*0.0589*	*0.0559*	*0.0535*	*0.0474*	*0.0595*	*0.0526*
1	0.0790	0	*0.0448*	*0.0642*	*0.0651*	*0.0571*	*0.0631*	*0.0661*	*0.0656*
2	0.0832	0.0380	0	*0.0592*	*0.0643*	*0.0582*	*0.0609*	*0.0650*	*0.0624*
3	0.0879	0.0884	0.0765	0	*0.0619*	*0.0591*	*0.0589*	*0.0611*	*0.0580*
4	0.0599	0.0872	0.0880	0.0926	0	*0.0662*	*0.0587*	*0.0607*	*0.0592*
5	0.0740	0.0653	0.0722	0.0852	0.0788	0	*0.0353*	*0.0680*	*0.0460*
7	0.0710	0.0748	0.0702	0.0724	0.0703	0.0230	0	*0.0642*	*0.0423*
8	0.0737	0.1187	0.1340	0.0877	0.0715	0.1023	0.1096	0	*0.0628*
9	0.0715	0.0939	0.0872	0.0805	0.0733	0.0637	0.0435	0.1087	0

Industries are classified by SIC portfolios i (panel A). The business cycle phases are partitioned in two phases through NBER and CFNAI. The number of bootstrap replications is set to 10,000. The bootstrap standard errors of Pearson's correlation coefficients are normal and those of Kendall's τ coefficients are italicized. For detailed information about panel B please contact the authors.

C Bootstrap confidence intervals

Table 20: **Bootstrap confidence intervals (NBER and CFNAI)**

Panel A	**Pearson's correlation coefficient**			
	NBER		**CFNAI**	
Differences	**90%**	**95%**	**90%**	**95%**
$\widetilde{\hat{\rho}_R} - \widetilde{\hat{\rho}_E} = 0$	[0.0353, 0.3497]	[0.0016, 0.3778]	[0.0076, 0.2831]	[-0.0161, 0.3089]
$\widetilde{\lvert\hat{\rho}_R\rvert} - \widetilde{\lvert\hat{\rho}_E\rvert} = 0$	[0.0008, 0.2795]	[-0.0286, 0.3065]	[-0.0119, 0.2294]	[-0.0345, 0.2533]

	Kendall's τ			
	NBER		**CFNAI**	
Differences	**90%**	**95%**	**90%**	**95%**
$\widetilde{\hat{\rho}_R} - \widetilde{\hat{\rho}_E} = 0$	[0.0014, 0.2528]	[-0.0247, 0.2738]	[0.0114, 0.2065]	[-0.0049, 0.2259]
$\widetilde{\lvert\hat{\rho}_R\rvert} - \widetilde{\lvert\hat{\rho}_E\rvert} = 0$	[0.0101, 0.2183]	[-0.0318, 0.2388]	[0.0131, 0.1877]	[-0.0028, 0.2065]

Panel B	**Pearson's correlation coefficient**			
	NBER		**CFNAI**	
Differences	**90%**	**95%**	**90%**	**95%**
$\widetilde{\hat{\rho}_R} - \widetilde{\hat{\rho}_E} = 0$	[0.0266, 0.2466]	[0.0052, 0.2656]	[0.0090, 0.1622]	[-0.0092, 0.1755]
$\widetilde{\lvert\hat{\rho}_R\rvert} - \widetilde{\lvert\hat{\rho}_E\rvert} = 0$	[0.0464, 0.2057]	[0.0351, 0.2233]	[0.0146, 0.1238]	[0.0060, 0.1342]

	Kendall's τ			
	NBER		**CFNAI**	
Differences	**90%**	**95%**	**90%**	**95%**
$\widetilde{\hat{\rho}_R} - \widetilde{\hat{\rho}_E} = 0$	[0.0096, 0.1899]	[-0.0054, 0.2077]	[-0.0045, 0.1096]	[-0.0156, 0.1217]
$\widetilde{\lvert\hat{\rho}_R\rvert} - \widetilde{\lvert\hat{\rho}_E\rvert} = 0$	[0.0336, 0.1607]	[0.0260, 0.1771]	[0.0068, 0.0863]	[0.0012, 0.0960]

The table presents the 90% and 95% confidence intervals for the differences of median and absolute median correlations between business cycle phases. If a confidence interval fails to include the value of zero, the observed difference of median and absolute median correlations is significant at the corresponding level. The number of replications is 10,000. The abbreviations denote R = recession and E = expansion, where $\hat{\rho}$ indicates either the estimates of Pearson's correlation coefficient or Kendall's τ. $\widetilde{\hat{\rho}} - \widetilde{\hat{\rho}}$ is the difference of two median correlations, whereas $\widetilde{\lvert\hat{\rho}\rvert} - \widetilde{\lvert\hat{\rho}\rvert}$ denotes the difference of two absolute medians. Industries are classified by SIC portfolios (panel A) and Fama-French portfolios (panel B). The business cycle phases are partitioned through the 2-phase indicators NBER and CFNAI.

Table 21: **Panel A: Bootstrap Confidence Intervals (CFNAI* and CU)**

	Pearson's correlation coefficient			
	CFNAI*		**CU**	
Differences	**90%**	**95%**	**90%**	**95%**
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_B} = 0$	[-0.0208, 0.2842]	[-0.0517, 0.3167]	[-0.1029, 0.2417]	[-0.1358, 0.2738]
$\widetilde{\hat{\rho}_B} - \widetilde{\hat{\rho}_O} = 0$	[-0.0523, 0.1887]	[-0.0773, 0.2077]	[-0.0418, 0.2209]	[-0.0727, 0.2420]
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_O} = 0$	[0.0420, 0.3573]	[0.0140, 0.3864]	[-0.0020, 0.3186]	[-0.0326, 0.3473]
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_B\rvert} = 0$	[-0.0397, 0.2313]	[-0.0658, 0.2571]	[-0.1095, 0.1994]	[-0.1356, 0.2277]
$\widetilde{\lvert\hat{\rho}_B\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert} = 0$	[-0.0343, 0.1639]	[-0.0529, 0.1817]	[-0.0313, 0.1871]	[-0.0517, 0.2091]
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert} = 0$	[0.0155, 0.3050]	[-0.0086, 0.3317]	[-0.0177, 0.2697]	[-0.0447, 0.2958]

	Kendall's τ			
	CFNAI*		**CU**	
Differences	**90%**	**95%**	**90%**	**95%**
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_B} = 0$	[-0.0069, 0.2442]	[-0.0305, 0.2685]	[-0.0726, 0.2034]	[-0.0994, 0.2311]
$\widetilde{\hat{\rho}_B} - \widetilde{\hat{\rho}_O} = 0$	[-0.0583, 0.1264]	[-0.0761, 0.1440]	[-0.0396, 0.1549]	[-0.0595, 0.1724]
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_O} = 0$	[0.0365, 0.2723]	[0.0134, 0.2945]	[-0.0018, 0.2483]	[-0.0262, 0.2724]
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_B\rvert} = 0$	[-0.0092, 0.2079]	[-0.0307, 0.2294]	[-0.0680, 0.1722]	[-0.0905, 0.1938]
$\widetilde{\lvert\hat{\rho}_B\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert} = 0$	[-0.0459, 0.1127]	[-0.0595, 0.1279]	[-0.0225, 0.1404]	[-0.0393, 0.1596]
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert} = 0$	[0.0222, 0.2423]	[0.0037, 0.2641]	[-0.0025, 0.2231]	[-0.0202, 0.2450]

The table presents the 90% and 95% confidence intervals for the differences of median and absolute median correlations between business cycle phases. If a confidence interval fails to include the value of zero, the observed difference of median and absolute median correlations is significant at the corresponding level. The number of replications is 10,000. The abbreviations denote C = crisis, O = common phase and B = boom, where $\hat{\rho}$ indicates either the estimates of Pearson's correlation coefficient or Kendall's τ. $\widetilde{\hat{\rho}} - \widetilde{\hat{\rho}}$ is the difference of two median correlations, whereas $\widetilde{\lvert\hat{\rho}\rvert} - \widetilde{\lvert\hat{\rho}\rvert}$ denotes the difference of two absolute medians. Industries are classified by SIC portfolios (panel A). The business cycle phases are partitioned through the 3-phase indicators CFNAI* and CU.

Table 22: **Panel B: Bootstrap confidence intervals (CFNAI* and CU)**

	Pearson's correlation coefficient			
	CFNAI*		**CU**	
Differences	**90%**	**95%**	**90%**	**95%**
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_B} = 0$	[-0.0053, 0.2170]	[-0.0305, 0.2340]	[-0.0830, 0.1539]	[-0.1084, 0.1766]
$\widetilde{\hat{\rho}_B} - \widetilde{\hat{\rho}_O} = 0$	[-0.0732, 0.0922]	[-0.0871, 0.1082]	[-0.0058, 0.1755]	[-0.0226, 0.1948]
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_O} = 0$	[0.0197, 0.2032]	[0.0004, 0.2189]	[0.0261, 0.2134]	[0.0035, 0.2302]
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_B\rvert} = 0$	[-0.0247, 0.1208]	[-0.0393, 0.1344]	[-0.0520, 0.1081]	[-0.0695, 0.1250]
$\widetilde{\lvert\hat{\rho}_B\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert} = 0$	[0.0084, 0.1027]	[0.0003, 0.1145]	[0.0168, 0.1334]	[0.0081, 0.1483]
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert} = 0$	[0.0368, 0.1666]	[0.0271, 0.1808]	[0.0376, 0.1696]	[0.0275, 0.1832]

	Kendall's τ			
	CFNAI*		**CU**	
Differences	**90%**	**95%**	**90%**	**95%**
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_B} = 0$	[-0.0101, 0.1620]	[-0.0262, 0.1779]	[-0.0645, 0.1193]	[-0.0811, 0.1370]
$\widetilde{\hat{\rho}_B} - \widetilde{\hat{\rho}_O} = 0$	[-0.0528, 0.0627]	[-0.0623, 0.0762]	[-0.0070, 0.1257]	[-0.0185, 0.1402]
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_O} = 0$	[0.0044, 0.1540]	[-0.0125, 0.1670]	[0.0108, 0.1620]	[-0.0050, 0.1769]
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_B\rvert} = 0$	[-0.0154, 0.0957]	[-0.0241, 0.1096]	[-0.0353, 0.0877]	[-0.0487, 0.1010]
$\widetilde{\lvert\hat{\rho}_B\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert} = 0$	[0.0071, 0.0706]	[0.0012, 0.0796]	[0.0148, 0.1010]	[0.0087, 0.1120]
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert} = 0$	[0.0260, 0.1296]	[0.0188, 0.1406]	[0.0323, 0.1366]	[0.0254, 0.1494]

The table presents the 90% and 95% confidence intervals for the differences of median and absolute median correlations between business cycle phases. If a confidence interval fails to include the value of zero, the observed difference of median and absolute median correlations is significant at the corresponding level. The number of replications is 10,000. The abbreviations denote C = crisis, O = common phase and B = boom, where $\hat{\rho}$ indicates either the estimates of Pearson's correlation coefficient or Kendall's τ. $\widetilde{\hat{\rho}} - \widetilde{\hat{\rho}}$ is the difference of two median correlations, whereas $\lvert\widetilde{\hat{\rho}}\rvert - \lvert\widetilde{\hat{\rho}}\rvert$ denotes the difference of two absolute medians. Industries are classified by Fama-French portfolios (panel B). The business cycle phases are partitioned through the 3-phase indicators CFNAI* and CU.

D Correlations Between the Industries and the Market

Table 23: **Panel A: Correlations between the industries and the aggregate market**

Pearson's Correlation

	NBER		**CFNAI**		**CFNAI****			**CU**			**Undivided**
i	$\hat{\rho}_R$	$\hat{\rho}_E$	$\hat{\rho}_R$	$\hat{\rho}_E$	$\hat{\rho}_C$	$\hat{\rho}_O$	$\hat{\rho}_B$	$\hat{\rho}_C$	$\hat{\rho}_O$	$\hat{\rho}_B$	$\hat{\rho}_{UC}$
0	-0.1526	-0.2892	-0.1428	-0.3162	-0.1311	-0.3843	-0.0773	-0.2250	-0.2961	-0.3289	-0.2330
1	0.8271	0.6658	0.7831	0.6794	0.7637	0.7077	0.6290	0.7697	0.7020	0.6591	0.7135
2	0.8247	0.7369	0.7826	0.7517	0.8092	0.7200	0.7924	0.8198	0.7446	0.6588	0.7636
3	0.7923	0.6155	0.7523	0.5783	0.7736	0.5787	0.4616	0.7580	0.5795	0.6070	0.6756
4	0.5869	0.4868	0.5650	0.4589	0.5562	0.4927	0.3916	0.5283	0.4962	0.4560	0.5049
5	0.6428	0.7694	0.7192	0.7457	0.7662	0.7021	0.7749	0.7205	0.7242	0.8296	0.7365
7	0.7815	0.8306	0.7696	0.8210	0.7841	0.7984	0.8344	0.7682	0.7983	0.8797	0.8215
8	0.6225	0.1641	0.3364	0.1763	0.4723	0.1863	0.3240	0.5540	0.1696	0.3681	0.2605
9	0.5838	0.6095	0.6294	0.5711	0.6691	0.5114	0.7344	0.5011	0.5800	0.7781	0.5994
$\widetilde{\hat{\rho}}$	**0.6428**	**0.6155**	**0.7192**	**0.5783**	**0.7637**	**0.5787**	**0.6290**	**0.7205**	**0.5800**	**0.6588**	**0.6756**

Kendall's τ

	NBER		**CFNAI**		**CFNAI****			**CU**			**Undivided**
i	$\hat{\rho}_R$	$\hat{\rho}_E$	$\hat{\rho}_R$	$\hat{\rho}_E$	$\hat{\rho}_C$	$\hat{\rho}_O$	$\hat{\rho}_B$	$\hat{\rho}_C$	$\hat{\rho}_O$	$\hat{\rho}_B$	$\hat{\rho}_{UC}$
0	*-0.1481*	*-0.1959*	*-0.1266*	*-0.2070*	*-0.1133*	*-0.2776*	*-0.0185*	*-0.1800*	*-0.2031*	*-0.2000*	*-0.1733*
1	*0.6508*	*0.4955*	*0.6121*	*0.4973*	*0.6333*	*0.5410*	*0.4723*	*0.6200*	*0.5234*	*0.5016*	*0.5233*
2	*0.6878*	*0.5734*	*0.6702*	*0.5677*	*0.6933*	*0.5648*	*0.6168*	*0.7067*	*0.5770*	*0.5333*	*0.5965*
3	*0.6508*	*0.4229*	*0.5912*	*0.3924*	*0.6400*	*0.3952*	*0.2975*	*0.6200*	*0.4092*	*0.3873*	*0.4594*
4	*0.4180*	*0.3363*	*0.4262*	*0.3136*	*0.4333*	*0.3354*	*0.2303*	*0.4133*	*0.3585*	*0.2794*	*0.3519*
5	*0.4603*	*0.5357*	*0.5308*	*0.5246*	*0.5733*	*0.4909*	*0.5731*	*0.5467*	*0.5110*	*0.5873*	*0.5208*
7	*0.6190*	*0.6116*	*0.6469*	*0.6109*	*0.6333*	*0.5745*	*0.6672*	*0.6467*	*0.5807*	*0.7143*	*0.6261*
8	*0.3968*	*0.1608*	*0.2451*	*0.1928*	*0.3467*	*0.1669*	*0.2235*	*0.4133*	*0.1692*	*0.2889*	*0.2121*
9	*0.4233*	*0.4388*	*0.4959*	*0.4197*	*0.5733*	*0.3604*	*0.5630*	*0.3933*	*0.4104*	*0.6095*	*0.4450*
$\widetilde{\hat{\rho}}$	**0.4603**	**0.4388**	**0.5308**	**0.4197**	**0.5733**	**0.3952**	**0.4723**	**0.5467**	**0.4104**	**0.5016**	**0.4594**

The table presents the correlations between industries and the market. Industries are classified by SIC portfolios i (panel A). The market revenues are calculated as the sum of all industry revenues. The business cycle phases are partitioned through the 2-phase indicators NBER and CFNAI and through the 3-phase indicators CFNAI* and CU. The abbreviations denote R = recession and E = expansion for the 2-phase indicators and C = crisis, O = common phase and B = boom for the 3-phase indicators. Moreover, the correlations for the undivided panel are presented. Pearson's correlation coefficients are normal and Kendall's τ coefficients are in italics. $\widetilde{\hat{\rho}}$ indicates either the median estimates of Pearson's correlation coefficient or Kendall's τ. For detailed information about panel B please contact the authors.

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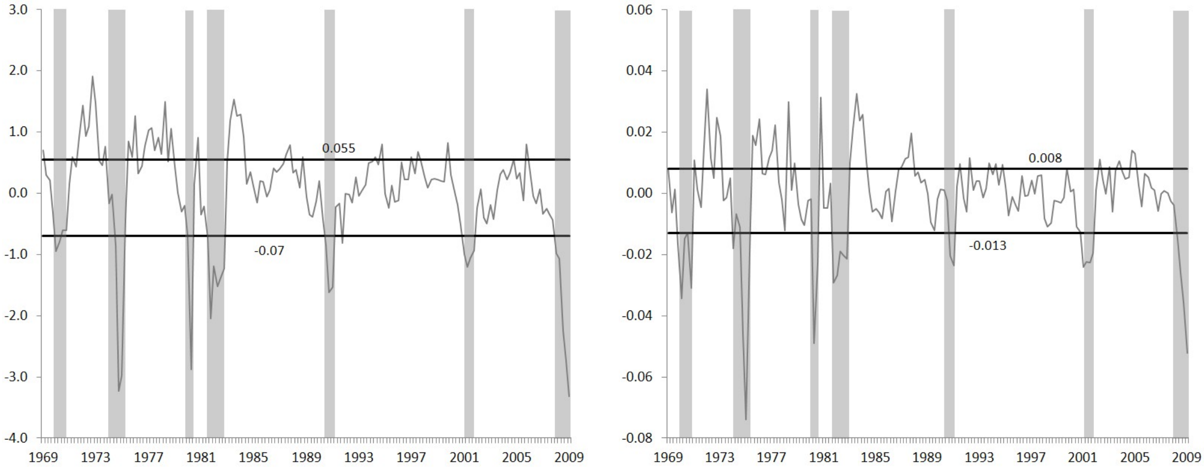
Figure 1: **3-phase business cycle indicators CFNAI* and CU (1969-2009)**



The left figure shows the three-month moving average CFNAI* and the right figure shows the log growth of capacity utilization (CU). Shaded areas indicate the NBER recessions between 1969 and 2009.

Table 1: **Number of firms per quarter**

Variable	Mean	Std. Dev.	Min.	Max.
Firms	6,712	1,976	2,001	9,355

The table reports descriptive statistics about the number of firms per quarter.

Table 2: **Number of firms per industry portfolio and per quarter**

Variable	Mean	Std. Dev.	Min.	Max.
Panel A: SIC	1,182	646	3	2,570
Panel B: FF48	314	300	3	1,602

The table reports descriptive statistics about the number of firms which are grouped in an industry portfolio per quarter.

Table 3: **Quarters of business cycle phases**

2-phase indicators				
State of	**NBER**		**CFNAI**	
the economy	**Freq.**	**Percent**	**Freq.**	**Percent**
Recession (R)	28	17.50	42	26.25
Expansion (E)	132	82.50	118	73.75
Total	160	100	160	100

3-phase indicators				
State of	**CFNAI***		**CU**	
the economy	**Freq.**	**Percent**	**Freq.**	**Percent**
Crisis (C)	25	15.63	25	15.63
Common phase (O)	100	62.50	99	61.88
Boom (B)	35	21.88	36	22.50
Total	160	100	160	100

The table reports the number of quarters assigned to two or three states of the economy. The business cycle phases are partitioned in recession (R) and expansion (E) through NBER and CFNAI and in crisis (C), common phase (O) and boom (B) through CFNAI* and CU.

Table 4: **Revenues - correlation averages and differences of the 2-phase indicators**

	Pearson's Correlation				**Kendall's τ**			
	Panel A: SIC		**Panel B: FF48**		**Panel A: SIC**		**Panel B: FF48**	
	NBER	**CFNAI**	**NBER**	**CFNAI**	**NBER**	**CFNAI**	**NBER**	**CFNAI**
$\widetilde{\hat{\rho}_R}$	0.4488	0.3561	0.3067	0.2466	0.3175	0.3031	0.2116	0.1591
$\widetilde{\hat{\rho}_E}$	0.2136	0.2153	0.1683	0.1612	0.1795	0.1747	0.1130	0.1092
$\widetilde{\hat{\rho}_{UC}}$	0.2712		0.2138		0.1997		0.1339	
$\widetilde{\lvert\hat{\rho}_R\rvert}$	0.4488	0.3604	0.3243	0.2717	0.3175	0.3089	0.2222	0.1719
$\widetilde{\lvert\hat{\rho}_E\rvert}$	0.3156	0.2844	0.2110	0.2117	0.2113	0.2043	0.1386	0.1424
$\widetilde{\lvert\hat{\rho}_{UC}\rvert}$	0.2758		0.2393		0.2025		0.1543	
$\widetilde{\hat{\rho}_R} - \widetilde{\hat{\rho}_E}$	0.2352	0.1408	0.1384	0.0854	0.1380	0.1284	0.0986	0.0499
$\widetilde{\lvert\hat{\rho}_R\rvert} - \widetilde{\lvert\hat{\rho}_E\rvert}$	0.1332	0.0760	0.1133	0.0601	0.1061	0.1047	0.0837	0.0295

According to equations (5) and (6), $\hat{\rho}$ indicates either the estimates of Pearson's correlation coefficient or Kendall's τ. The abbreviations denote R = recession, E = expansion and UC = unconditional. $\widetilde{\hat{\rho}}$ symbolizes the median of the correlation matrix, $\widetilde{|\hat{\rho}|}$ the absolute median, $\widetilde{\hat{\rho}} - \widetilde{\hat{\rho}}$ is the median difference, whereas $\widetilde{|\hat{\rho}|} - \widetilde{|\hat{\rho}|}$ denotes the difference between absolute medians. Industries are classified by SIC portfolios (panel A) and Fama-French portfolios (panel B). The business cycle phases are partitioned through the 2-phase indicators NBER and CFNAI.

Table 5: **Revenues - correlation averages and differences of the 3-phase indicators**

	Pearson's Correlation				**Kendall's τ**			
	Panel A: SIC		**Panel B: FF48**		**Panel A: SIC**		**Panel B: FF48**	
	CFNAI*	**CU**	**CFNAI***	**CU**	**CFNAI***	**CU**	**CFNAI***	**CU**
$\widetilde{\hat{\rho}_C}$	0.4225	0.4037	0.2738	0.2763	0.3200	0.2833	0.1867	0.1867
$\widetilde{\hat{\rho}_O}$	0.2018	0.2125	0.1643	0.1571	0.1590	0.1602	0.1077	0.1039
$\widetilde{\hat{\rho}_B}$	0.3042	0.3492	0.1685	0.2334	0.2000	0.2270	0.1143	0.1460
$\widetilde{\lvert\hat{\rho}_C\rvert}$	0.4225	0.4124	0.3078	0.2993	0.3200	0.2833	0.2033	0.2067
$\widetilde{\lvert\hat{\rho}_O\rvert}$	0.2400	0.2705	0.2138	0.2138	0.1877	0.1983	0.1408	0.1383
$\widetilde{\lvert\hat{\rho}_B\rvert}$	0.3692	0.3608	0.2523	0.2646	0.2134	0.2556	0.1664	0.1746
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_B}$	0.1182	0.0545	0.1053	0.0429	0.1200	0.0563	0.0724	0.0406
$\widetilde{\hat{\rho}_B} - \widetilde{\hat{\rho}_O}$	0.1025	0.1367	0.0042	0.0762	0.0410	0.0668	0.0066	0.0421
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_O}$	0.2207	0.1912	0.1095	0.1191	0.1610	0.1232	0.0790	0.0828
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_B\rvert}$	0.0533	0.0516	0.0556	0.0347	0.1066	0.0278	0.0369	0.0321
$\widetilde{\lvert\hat{\rho}_B\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert}$	0.1291	0.0903	0.0385	0.0507	0.0258	0.0572	0.0256	0.0363
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert}$	0.1824	0.1419	0.0940	0.0855	0.1323	0.0850	0.0625	0.0683

According to equation (5), $\hat{\rho}$ indicates either the estimates of Pearson's correlation coefficient or Kendall's τ. The abbreviations denote C = crisis, O = common phase and B = boom. $\widetilde{\hat{\rho}}$ symbolizes the median of the correlation matrix, $\widetilde{\lvert\hat{\rho}\rvert}$ the absolute median, $\widetilde{\hat{\rho}} - \widetilde{\hat{\rho}}$ is the median difference, whereas $\widetilde{\lvert\hat{\rho}\rvert} - \widetilde{\lvert\hat{\rho}\rvert}$ denotes the difference between absolute medians. Industries are classified by SIC portfolios (panel A) and Fama-French portfolios (panel B). The business cycle phases are partitioned through the 3-phase indicators CFNAI* and CU.

Table 6: **P-values of permutation test**

2-phase business cycle indicators

	Pearson's Correlation				**Kendall's τ**			
	Panel A: SIC		**Panel B: FF48**		**Panel A: SIC**		**Panel B: FF48**	
H_0	**NBER**	**CFNAI**	**NBER**	**CFNAI**	**NBER**	**CFNAI**	**NBER**	**CFNAI**
$\widetilde{\hat{\rho}_R} - \widetilde{\hat{\rho}_E} = 0$	0.0174**	0.0886*	0.0297**	0.0680*	0.0210**	0.0251**	0.0187**	0.1048
$\widetilde{\lvert\hat{\rho}_R\rvert} - \widetilde{\lvert\hat{\rho}_E\rvert} = 0$	0.1122	0.2357	0.0400**	0.1328	0.0545*	0.0347**	0.0207**	0.2321

3-phase business cycle indicators

	Pearson's Correlation				**Kendall's τ**			
	Panel A: SIC		**Panel B: FF48**		**Panel A: SIC**		**Panel B: FF48**	
H_0	**CFNAI***	**CU**	**CFNAI***	**CU**	**CFNAI***	**CU**	**CFNAI***	**CU**
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_B} \leq 0$	0.1696	0.3260	0.1195	0.3261	0.0855*	0.2453	0.1375	0.2779
$\widetilde{\hat{\rho}_B} - \widetilde{\hat{\rho}_O} \leq 0$	0.1940	0.1232	0.4858	0.0720*	0.2263	0.1444	0.4264	0.1369
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_O} \leq 0$	0.0307**	0.0676*	0.0620*	0.0486**	0.0157**	0.0561*	0.0523*	0.0451**
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_B\rvert} \leq 0$	0.3369	0.3399	0.2521	0.3614	0.0962*	0.3739	0.2707	0.3209
$\widetilde{\lvert\hat{\rho}_B\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert} \leq 0$	0.0619*	0.1468	0.3082	0.1803	0.3538	0.1734	0.3002	0.1576
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert} \leq 0$	0.0514*	0.1166	0.0767*	0.1047	0.0333**	0.1261	0.0872*	0.0673*

The null hypotheses H_0 are that the difference of two median correlations (two absolute median correlations) is less than or equal zero. The alternative hypotheses H_1 are that the difference is greater than zero, see equations (7) to (14). The number of replications is 10,000. The abbreviations denote R = recession and E = expansion for the 2-phase indicators and C = crisis, O = common phase and B = boom for the 3-phase indicators. Where $\hat{\rho}$ indicates either the estimates of Pearson's correlation coefficient or Kendall's τ. $\widetilde{\hat{\rho}} - \widetilde{\hat{\rho}}$ is the difference of two median correlations, whereas $\widetilde{|\hat{\rho}|} - \widetilde{|\hat{\rho}|}$ denotes the difference of two absolute medians. Industries are classified by SIC portfolios (panel A) and Fama-French portfolios (panel B). The business cycle phases are partitioned through the 2-phase indicators NBER and CFNAI and through the 3-phase indicators CFNAI* and CU. *, **, ***, indicate that H_0 can be rejected at a 10%, 5% and 1% significance level.

Table 7: **Revenues - correlations and differences between industries and the market**

2-phase business cycle indicators and unconditioned

	Pearson's Correlation				**Kendall's τ**			
	Panel A: SIC		**Panel B: FF48**		**Panel A: SIC**		**Panel B: FF48**	
	NBER	**CFNAI**	**NBER**	**CFNAI**	**NBER**	**CFNAI**	**NBER**	**CFNAI**
$\widetilde{\hat{\rho}_R}$	0.6428	0.7192	0.5162	0.4464	0.4603	0.5308	0.3598	0.2358
$\widetilde{\hat{\rho}_E}$	0.6155	0.5783	0.3364	0.3328	0.4388	0.4197	0.2247	0.2132
$\widetilde{\hat{\rho}_{UC}}$	0.6756		0.4088		0.4594		0.2361	
$\widetilde{\lvert\hat{\rho}_R\rvert}$	0.6428	0.7192	0.5162	0.4464	0.4603	0.5308	0.3598	0.2358
$\widetilde{\lvert\hat{\rho}_E\rvert}$	0.6155	0.5783	0.3548	0.3400	0.4388	0.4197	0.2247	0.2200
$\widetilde{\lvert\hat{\rho}_{UC}\rvert}$	0.6756		0.4088		0.4594		0.2361	
$\widetilde{\hat{\rho}_R} - \widetilde{\hat{\rho}_E}$	0.0273	0.1409	0.1799	0.1136	0.0215	0.1111	0.1351	0.0225
$\widetilde{\lvert\hat{\rho}_R\rvert} - \widetilde{\lvert\hat{\rho}_E\rvert}$	0.0273	0.1409	0.1614	0.1064	0.0215	0.1111	0.1351	0.0157

3-phase business cycle indicators

	Pearson's Correlation				**Kendall's τ**			
	Panel A: SIC		**Panel B: FF48**		**Panel A: SIC**		**Panel B: FF48**	
	CFNAI*	**CU**	**CFNAI***	**CU**	**CFNAI***	**CU**	**CFNAI***	**CU**
$\widetilde{\hat{\rho}_C}$	0.7637	0.7205	0.4934	0.5059	0.5733	0.5467	0.3233	0.3367
$\widetilde{\hat{\rho}_O}$	0.5787	0.5800	0.3515	0.3495	0.3952	0.4104	0.2135	0.2136
$\widetilde{\hat{\rho}_B}$	0.6290	0.6588	0.2896	0.3038	0.4723	0.5016	0.1882	0.2302
$\widetilde{\lvert\hat{\rho}_C\rvert}$	0.7637	0.7205	0.4934	0.5059	0.5733	0.5467	0.3233	0.3367
$\widetilde{\lvert\hat{\rho}_O\rvert}$	0.5787	0.5800	0.3799	0.3578	0.3952	0.4104	0.2465	0.2136
$\widetilde{\lvert\hat{\rho}_B\rvert}$	0.6290	0.6588	0.3068	0.3575	0.4723	0.5016	0.2235	0.2413
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_B}$	0.1347	0.0617	0.2038	0.2021	0.1011	0.0451	0.1351	0.1065
$\widetilde{\hat{\rho}_B} - \widetilde{\hat{\rho}_O}$	0.0502	0.0788	-0.0619	-0.0457	0.0771	0.0912	-0.0253	0.0166
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_O}$	0.1849	0.1406	0.1419	0.1564	0.1782	0.1362	0.1098	0.1231
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_B\rvert}$	0.1347	0.0617	0.1866	0.1484	0.1011	0.0451	0.0998	0.0954
$\widetilde{\lvert\hat{\rho}_B\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert}$	0.0502	0.0788	-0.0731	-0.0003	0.0771	0.0912	-0.0229	0.0277
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert}$	0.1849	0.1406	0.1134	0.1481	0.1782	0.1362	0.0769	0.1231

The table presents the correlation averages and differences between industry revenues and the market revenues. $\hat{\rho}$ indicates either the estimates of Pearson's correlation coefficient or Kendall's τ. $\widetilde{\hat{\rho}}$ symbolizes the median of the correlation between industries and the market, $\widetilde{\lvert\hat{\rho}\rvert}$ the absolute median, $\widetilde{\hat{\rho}} - \widetilde{\hat{\rho}}$ is the median difference, whereas $\widetilde{\lvert\hat{\rho}\rvert} - \widetilde{\lvert\hat{\rho}\rvert}$ denotes the difference between absolute medians. The abbreviations denote R = recession and E = expansion for the 2-phase indicators and C = crisis, O = common phase and B = boom for the 3-phase indicators. Moreover, the correlation averages for the undivided panel (UC = unconditional) are presented. Industries are classified by SIC portfolios (panel A) and Fama-French portfolios (panel B). The business cycle phases are partitioned through the 2-phase indicators NBER and CFNAI and through the 3-phase indicators CFNAI* and CU.

Table 8: **Earnings - correlation averages and differences**

2-phase business cycle indicators and unconditioned

	Pearson's Correlation				Kendall's τ			
	Panel A: SIC		Panel B: FF48		Panel A: SIC		Panel B: FF48	
	NBER	CFNAI	NBER	CFNAI	NBER	CFNAI	NBER	CFNAI
$\widetilde{\hat{\rho}_R}$	0.2011	0.0674	0.0320	0.0110	0.0556	0.0685	0.0582	0.0453
$\widetilde{\hat{\rho}_E}$	-0.0087	0.0146	0.0019	0.0032	0.0077	0.0098	0.0409	0.0475
$\widetilde{\hat{\rho}_{UC}}$	0.0203		0.0033		0.0197		0.0493	
$\widetilde{\lvert\hat{\rho}_R\rvert}$	0.2191	0.1039	0.1438	0.0833	0.1138	0.1138	0.1111	0.0918
$\widetilde{\lvert\hat{\rho}_E\rvert}$	0.0651	0.0791	0.0364	0.0421	0.0718	0.1086	0.0650	0.0723
$\widetilde{\lvert\hat{\rho}_{UC}\rvert}$	0.0647		0.0330		0.0712		0.0666	
$\widetilde{\hat{\rho}_R} - \widetilde{\hat{\rho}_E}$	0.2099	0.0528	0.0301	0.0077	0.0479	0.0587	0.0173	-0.0022
$\widetilde{\lvert\hat{\rho}_R\rvert} - \widetilde{\lvert\hat{\rho}_E\rvert}$	0.1539	0.0247	0.1074	0.0412	0.0419	0.0052	0.0461	0.0195

3-phase business cycle indicators

	Pearson's Correlation				Kendall's τ			
	Panel A: SIC		Panel B: FF48		Panel A: SIC		Panel B: FF48	
	CFNAI*	CU	CFNAI*	CU	CFNAI*	CU	CFNAI*	CU
$\widetilde{\hat{\rho}_C}$	0.1864	0.1740	0.0254	0.0326	0.0167	0.0600	0.0433	0.0667
$\widetilde{\hat{\rho}_O}$	-0.0083	-0.0324	-0.0005	0.0027	-0.0026	0.0031	0.0414	0.0414
$\widetilde{\hat{\rho}_B}$	0.0131	0.0722	0.0205	0.0178	0.0218	0.0349	0.0521	0.0524
$\widetilde{\lvert\hat{\rho}_C\rvert}$	0.2191	0.2235	0.1331	0.1338	0.1233	0.0900	0.1133	0.1133
$\widetilde{\lvert\hat{\rho}_O\rvert}$	0.0614	0.0930	0.0436	0.0513	0.0826	0.1064	0.0675	0.0717
$\widetilde{\lvert\hat{\rho}_B\rvert}$	0.1665	0.1402	0.1224	0.1005	0.1160	0.0952	0.1160	0.1048
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_B}$	0.1733	0.1017	0.0049	0.0148	-0.0052	0.0251	-0.0088	0.0143
$\widetilde{\hat{\rho}_B} - \widetilde{\hat{\rho}_O}$	0.0214	0.1047	0.0210	0.0151	0.0245	0.0318	0.0107	0.0109
$\widetilde{\hat{\rho}_C} - \widetilde{\hat{\rho}_O}$	0.1947	0.2064	0.0259	0.0300	0.0193	0.0569	0.0019	0.0252
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_B\rvert}$	0.0526	0.0833	0.0107	0.0333	0.0074	-0.0052	-0.0026	0.0086
$\widetilde{\lvert\hat{\rho}_B\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert}$	0.1051	0.0472	0.0788	0.0492	0.0333	-0.0111	0.0485	0.0330
$\widetilde{\lvert\hat{\rho}_C\rvert} - \widetilde{\lvert\hat{\rho}_O\rvert}$	0.1578	0.1305	0.0895	0.0825	0.0407	-0.0164	0.0459	0.0416

The table presents the correlation averages and differences between earnings growth across industries. $\hat{\rho}$ indicates either the estimates of Pearson's correlation coefficient or Kendall's τ. $\widetilde{\hat{\rho}}$ symbolizes the median of the correlation between industry earnings growth, $\lvert\widetilde{\hat{\rho}}\rvert$ the absolute median, $\widetilde{\hat{\rho}} - \widetilde{\hat{\rho}}$ is the median difference, whereas $\lvert\widetilde{\hat{\rho}}\rvert - \lvert\widetilde{\hat{\rho}}\rvert$ denotes the difference between absolute medians. The abbreviations denote R = recession and E = expansion for the 2-phase indicators and C = crisis, O = common phase and B = boom for the 3-phase indicators. Moreover, the correlation averages for the undivided panel (UC = unconditional) are presented. Industries are classified by SIC portfolios (panel A) and Fama-French portfolios (panel B). The business cycle phases are partitioned through the 2-phase indicators NBER and CFNAI and through the 3-phase indicators CFNAI* and CU.