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The relationship between business confidence surveys and stock market performance

1. INTRODUCTION

It's 8:30 am on any New York trading desk, the morning the National Association of Purchasing Managers (NAPM) releases their Purchasing Managers' Index. The air is tense while financial players mentally review the strategies they will follow depending on whether the latest index figure is above, below or in line with expectations. The report is the first indicator of real economic activity, released on the first business day of every month, well before reports on retail sales, industrial production and certainly GDP. The release, when it comes, does not often fail to move the markets.

The influence of business confidence surveys, such as the NAPM, is certainly felt on its release date on a trading floor, but to what extent do these surveys have a sustained influence on the market? Many countries, including South Africa and Russia, have recently created monthly purchasing manager surveys modelled on the NAPM survey in an effort to create additional information for their markets. However, little research has been done to analyse the influence of these surveys on stock markets. Where does the influence stop? Does information in the release of business confidence surveys actually have some causal effect on the performance of the stock market? Is it simply that business surveys are good leading indicators of the economy? Or do these surveys simply provide more information for the market, and hence more volatility?

This study is restricted to attempting to answer only one question - do business confidence surveys have predictive power for stock market performance? In the first section, this question is placed within the context of what the current literature already tells us about the relationship between business confidence surveys and economic activity as well as the relationship between macroeconomic variables in more general terms and stock market performance. In section 2, the methodology to determine precedence of stock market performance over business confidence surveys or vice versa is discussed. By establishing precedence, it is hoped to establish some evidence of causality or influence. The details of the data are introduced in section 3. The results are then presented in three separate parts of section 4 and concluded in section 5.

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2. LITERATURE REVIEW

From an academic standpoint, there is little research on business confidence surveys and their relationship with economic cycles and the stock market. What is written specifically about the surveys suggests that there is evidence that business conditions surveys like the NAPM help explain movements in economic activity, but it is questionable whether such surveys are leading indicators of economic conditions. Harris (1991) showed that contemporaneous correlations of components of the NAPM were mildly correlated with U.S. GDP growth. He went on, however, to test the NAPM's strength as a leading indicator by testing the predictive power of 1) turning points in the index and 2) crossing over a "threshold" level. He found that neither signal reliably predicted business cycle turning points.

In South Africa, Kershoff studied the relationship between economic cycles and the quarterly Business Confidence Index, measured by the South African Bureau of Economic Research at the University of Stellenbosch. Using simple correlation figures, he found the BCI has "proven itself historically both as a useful indicator of economic growth and as a very good leading indicator of the business cycle in South Africa" (Kershoff, 2000, p.5).

Although no literature specifically addresses the relationship of business confidence surveys and stock market performance, the more general role that macroeconomic variables have to play in stock market performance has been extensively reseached. Using U.S. data, Fama and Schwert (1977), Fama (1981), Geske and Roll (1983) and Kaul (1987) established that there is a significant negative correlation between inflation and stock returns. Chen, Ross and Ross (1986) and James, Koreisha and Partch (1985) used the arbitrage pricing theory (APT) framework to come up with the same results.

Subsequent to these initial findings, further analysis expanded the debate to other macroeconomic variables. The relationship between real interest rates and stock returns is unclear. Chen et al. (1986) concluded that stocks have a negative risk premium with respect to changes in real interest rates; while Lee (1992) found that real interest rates explain stock returns insignificantly. Lee (1992) included interest rates as a separate variable in the model, and found that interests rates play a large role in the determination of inflation, rather than stock returns. Nonetheless, Balduzzi (1995) used covariance analysis to measure the strength of the correlations between inflation and stock returns and concluded that

the rate of interest accounts for a significant proportion of the negative correlation between stock returns and inflation.

In non-US markets, studies have mostly been based on the APT framework as per Chen et al. (1986). The results have been mixed. Martinez and Rubio (1989) tested the Spanish market and found no significant pricing relationship between stock returns and macroeconomic variables. Poon and Taylor (1991) found the same results for the UK. In Norway, Gjerde and Sættem (1999) used the same methodology and found that real interest rate changes affect both stock returns and inflation, and the stock market responds accurately to oil price changes. They also found a delayed response to changes in domestic real activity, contrary to the findings of research in other markets.

The literature on this topic within emerging markets is scarce. Van Rensburg (1999) continued the debate on APT factor pricing, by testing data for the political transition period from 1965-1995 in South Africa. He found that equity returns lead real activity indicators. He also found the relationship between market returns and changes in interest rates consistently negative. Balance of payment and monetary variables, such as the current account balance, the level of gold and foreign exchange reserves and the money market shortage had significant relationships with stock market returns. Cornelius (1991) investigated the relationship between money supply and stock returns by using Granger Causality tests and co-integration tests for the six largest emerging markets at the time. He found that for two markets a causal relationship does exist and came to the conclusion that in those two markets there are informational inefficiencies.

In this study, one macroeconomic variable, business confidence surveys, is tested for several countries. The literature suggests some evidence that real activity variables do not precede market performance, but it is not conclusive. Business confidence surveys like the NAPM are a direct reading of business sentiment "on the ground" and are generally among the first real activity variables to be released in the monthly stream of data. As such, market participants treat them with great importance. It stands to reason then that if any real activity variable were to have predictive power over market performance, it would surely be the NAPM or its counterparts in other countries.

3. METHODOLOGY

Granger Causality is used as a first step to establishing whether business confidence surveys anticipate market returns. If the causality runs from stock returns to business confidence surveys or if there is no causal effect, there is still a possibility that an unexpected result could influence market returns, though the actual figures do not. Therefore, as a second step, unexpected results or "surprises" are then be estimated and tested for causality against actual market returns.

Before using Granger Causality tests, all variables are tested for stationarity using the Augmented Dickey-Fuller (1979,1981) test. Stationarity means that both the joint probability distribution and the conditional probability distribution are invariant with respect to time (Pindyck and Rubinfeld 1998). Estimating series that are not stationary would lead to spurious results in the following tests. The Dickey-Fuller test first uses ordinary least squares (OLS) to test the following equation on each series Y_t:

$$Y_t = \alpha + \beta t + \rho Y_{t-1} + \varepsilon_t \quad \ldots (1)$$

where a constant term (α) is included to depict a random walk with drift. A time trend (t) is also included to test for trend stationarity. An altered F test is compared against critical values created by Dickey and Fuller to test whether the restrictions (β=0, ρ=1) hold. The resulting test statistic should be higher than the critical values to test if the restrictions are to be rejected.

An additional alternation to the basic model is made to test the series. An Augmented Dickey-Fuller (ADF) test is used to allow for serial correlation in the error term (ε_t). Equation (1) is expanded by to include lagged changes in Y_t on the right hand side of the equation. By including this condition, the most restrictive form for stationarity is tested:

$$Y_t = \alpha + \beta t + \rho Y_{t-1} + \sum_{j=1}^{p} \lambda_j \Delta Y_{t-j} + \varepsilon_t \quad \ldots (2)$$

where $\Delta Y_t = Y_t - Y_{t-1}$. The series is tested with up to 10 lags (p) and the Akaike Information Criterion (AIC) is used to determine which lags to eliminate. The AIC assesses the size of the squared residuals of an equation while adding right hand size variables. The lag structure is determined by adding lags up to the point where the AIC reaches its minimum value. The ADF statistics of the final specification are then compared to critical values to accept or reject the null hypothesis of a unit root, i.e. the null hypothesis that the series is non-stationary.

In the next test, the Granger (Granger 1969 and Sims 1972) approach is used to test whether business confidence surveys predict market performance or vice versa. The approach is based not on the common concept of causation but on the idea that if X causes Y then changes in X should precede changes in Y. To claim that X causes Y, two conditions must be met. First, X should help predict Y and second, Y should not help to predict X. Two equations help establish whether these conditions hold. To test the null

hypothesis that X does not cause Y, values of Y are regressed against lagged values of Y and lagged values of X:

$$Y = \sum_{i=1}^{m} \alpha_i Y_{t-i} + \sum_{i=1}^{m} \beta_i X_{t-i} + \varepsilon_t \quad \ldots (3)$$

and then Y is regressed against only lagged values of Y:

$$Y = \sum_{i=1}^{m} \alpha_i Y_{t-i} + \varepsilon_t \quad \ldots (4)$$

A simple F test determines whether the lagged values of X contributed significantly to the explanatory power of the first equation. If they do, the null hypothesis is rejected and the conclusion is that X does cause Y. Then the null hypothesis that Y does not cause X is tested in the same way. A test that runs simultaneously the two variables on opposite sides of the equation is used which gives results for the null hypothesis in both situations (Pindyck and Rubinfeld, 1998).

In all our Granger Causality tests, six lags are used for monthly data and four lags for quarterly data. This was a result of running a series of tests using a greater number of lags in the monthly case and less lags in the quarterly case, and determining that there was little difference in the results.

In the third step of the analysis, the issue of unexpected announcements is addressed. If it is found that there is no causal relationship or that Granger Causality tests tend to favour the precedence of market performance over economic activity indicators, the business survey data should be further tested to be sure that all the information available in the data release is captured. In the first Granger Causality test, only actual results are tested, i.e. do actual results of business surveys precede market performance or vice versa? It may be that actual results do not influence market performance, but unexpected results do.

Anecdotal evidence suggests that when markets anticipate a data release, the results are measured against expectations in the market, and it is the difference between the expected and actual result that drives the response in the market, rather than the actual result by itself. The best way to test this hypothesis would be to use consensus data as a proxy for market expectations and re-run Granger Causality tests with an actual-versus-expected variable. However, the countries in our data sample do not have long enough series of consensus expectations, if any recorded consensus data at all. Therefore, the expected factor in the business confidence surveys is estimated by using stock market performance to create a fitted series of business confidence surveys. The residuals from that estimation reveal the difference between market expectations and the actual result, i.e. the "surprise" from each data release. The "surprise" series is then tested to determine if there is some causal relationship with market performance overlooked by tests using the actual series.

To estimate a best fit for the business confidence series a vector autoregression (VAR) is used. In a VAR, all variables are specified as being endogenous. An unrestricted VAR with n variables and K lags would be depicted by:

$$Y = \alpha_i + \sum_{i=1}^{n} \sum_{k=1}^{K} \beta_{ik} Y_{it-k} + \varepsilon_t \quad \ldots (5)$$

The maximum number of lags should be included to capture the full dynamics of the relationship, but the longer the lags, the greater number of parameters must be estimated and hence the degrees of freedom decline. The Akaike Information criterion is used to help determine the most appropriate number of lags. Again, six lags is appropriate for the monthly series and four lags for the quarterly series.

Having established the best fit for the VAR, the residuals resulting from the equation are used in a second round of Granger Causality tests with the "surprise" residuals and stock market performance.

4. DATA

4.1 Stock market indices

For each market, the monthly or quarterly percent change of the benchmark equity index is used as a measure of stock market performance. In most of the sample, with the exception of Japan, market capitalization weighted indices are used. For the U.S., the S&P 500 Index, which is made up of 500 representative companies of the leading industries, is used. For Germany, the DAX index of 30 blue chip German companies is used. In South Africa, the All Share Index, a broad index of all ordinary shares listed on the Johannesburg Stock Exchange, is used. In Japan, the Nikkei 225 Index of the 225 most actively traded issues on the Tokyo Stock Exchange, is used. It is calculated using the Dow formula, which is, roughly, an unweighted average of stock prices.

4.2 Business confidence indices

The business confidence indices for each country are based on a survey of executives in the leading enterprises of the country. In the U.S., the executives are specifically purchasing managers. In some cases, such as the U.S. and South Africa, the data specified are for the manufacturing sector. In others, such as Japan, all enterprises are covered in the index. The specific details of each business confidence survey are listed in Table 1.

Table 1: Details of the business confidence surveys

	Report	Data begins	Index compilation	Index composition	Frequency	Release time	Survey details
U.S.	National Association of Purchasing Managers Report on Business Purchasing Managers' Index	Jan. 1948	Diffusion Index – based on percent of positive responses plus ½ of those responding the same	Composite index of New Orders, Production, Supplier Deliveries, Inventories and Employment	Monthly	First business day of month after survey month	Questions asked of purchasing executives in more than 300 companies
Germany	Ifo Business Climate Index	Jan. 1969	Diffusion Index – based on percent answering "good" less percent answering "poor" Then converted to an index based to 1991	Geometric mean of Current Situation appraisals and Expected Situation appraisals	Monthly	Approx. mid-month after survey	Surveys of approx. 7000 companies, weighted according to industry importance
Japan	Tankan All Enterprises Survey	Feb. 1974	Diffusion Index – based on percent answering "favorable" less percent answering "unfavorable"	Aggregated from total	Quarterly	At the beginning of each quarter following the survey quarter	12 questions of roughly 9 000 private enterprises
South Africa	Bureau of Economic Research Business Confidence Index	Mar. 1975	Diffusion index – percentage gross respondents that rated prevailing conditions as satisfactory rather than unsatisfactory	Unweighted mean of five sectors	Quarterly	-	Approx. 2 000 responses One key question: "Do you find prevailing business conditions satisfactory or unsatisfactory?"

Note that these surveys are considered useful in financial markets because of the timeliness of their release. In most cases, it is the first economic activity variable to be released for a given period. However, for the purposes of this study, it is the survey's impact on the market when the data are released that is being assessed, not when the data are collected. For that reason, the business confidence survey data are lagged by one period to reflect the timing of the release against the appropriate period of market performance.

4.3 A note on diffusion indices

Most business confidence surveys are reported as diffusion indices, which are said to have the properties of leading indicators because they show the prevailing direction of change and the scope of change. The diffusion indices covered in this study are calculated in a number of different ways. Nearly all are based on surveys with three responses, "good", "same" or "bad", or similar. In the U.S., the diffusion index is calculated by taking the number of positive responses plus half the number of "same" responses. In Germany, the Ifo diffusion index is calculated by taking the number of responses of "good" and subtracting the number of "bad" responses. The balances resulting are then re-calculated as an index based to 1991. The Tankan survey follows the same methodology as the Ifo but does not present the final data indexed to a base year. Because this method produces a series that can fluctuate between negative and positive numbers, it presents an extremely volatile series when taking percent changes. The South African BER survey bases its Business Confidence Index on one question with two answers. The question is, "Do you find prevailing business conditions satisfactory or unsatisfactory?" The Business Confidence Index is calculated by taking the gross percentage of respondents that rated prevailing business conditions as satisfactory. The different methods of calculations undoubtedly contribute to the result of the following tests for each country.

Because of the nature of diffusion indices, it is difficult to determine if the tests should be conducted on percent changes of the series or the levels. Both expressions are tested to see if they give different results.

5. RESULTS

5.1 Results: Tests for stationarity

The results of the Augmented Dickey-Fuller tests in Table 2 show, as expected, that while levels of stock market indices are not stationary, the levels of the indices of business confidence survey are stationary. Stock market indices tend to grow steadily with time while diffusion indices, such as this sample of business confidence surveys, are less likely to continue to either increase or decrease persistently over periods of time. It therefore makes sense that the levels of all the business confidence surveys are found to be stationary at least at the 5% level.

When testing percent changes of both market performance and business confidence indices, either quarter-over-quarter or month-over-month, all series were found to be stationary at least at the 1% level. In the following tests, both the levels and the percent changes of business confidence indices for all four countries were tested against the percent changes of market indices.

Table 2: Results of unit roots test – ADF Statistics and acceptance/rejection of the null hypothesis of unit root

		Levels				Percent Changes (M/M or Q/Q			
		ADF Statistic	Critical value#	Lags	Conclusion	ADF Statistic	Critical value#	Lags	Conclusion
Monthly data									
U.S.	NAPM PMI	-7,19**	-3,98	10	Reject	-8,13**	-3,98	7	Reject
	S&P500	2,63	-3,13	4	Accept	-9,46**	-3,98	4	Reject
Germany	Ifo	-4,42**	-3,99	6	Reject	-6,88**	-3,99	4	Reject
	Dax	0,29	-3,13	9	Accept	-5,80**	-3,99	9	Reject
Quarterly data									
Japan	Tankan	-3,68*	-3,45	4	Reject	-4,14**	-4,05	4	Reject
	Nikkei 225	-1,23	-3,15	4	Accept	-4,82**	-4,05	4	Reject

5.2 Results: Granger causality

Table 3 shows the results of the Granger Causality tests. In all countries, the null hypothesis that business confidence surveys, either the levels or the percent changes, do not Granger Cause market performance is accepted. In all countries, it is found that the null hypothesis that market performance does NOT Granger-Cause business confidence surveys diffusion levels must be rejected at least at the 5% confidence level. In most countries, with the exception of Japan, the same is true for the percent changes of the business confidence surveys. In the case of Japan, the null hypothesis that the market performance does NOT Granger-Cause percent changes in business confidence surveys can only be rejected at the 17% confidence level—a rejection but at a less than significant level.

Table 3: Granger causality tests of stock market performance and business confidence surveys F-statistics and acceptance/rejection of null hypothesis

		Business confidence levels All business confidence data are expressed in diffusion index levels		Business confidence percent changes All business confidence data are expressed in monthly or quarterly percent changes	
	Period	Null hypothesis: Business confidence surveys do NOT Granger-cause market performance	Null hypothesis: Market performance do NOT Granger-cause business confidence surveys	Null hypothesis: Business confidence surveys do NOT Granger-cause market performance	Null hypothesis: Market performance do NOT Granger-cause business confidence surveys
Monthly data:6 lags					
U.S.	Feb 54-Jan 01	1,73 (Accept)	7,63** (Reject)	0,49 (Accept)	9,75** (Reject)
Germany	Feb 70-Dec 00	0,82 (Accept)	3,38** (Reject)	0,37 (Accept)	4,03** (Reject)
Quarterly data: 4 lags					
Japan	Q2 74 -Q4 00	0,69 (Accept)	2,71* (Reject)	0,43 (Accept)	1,66 (Accept)#
South Africa	Q2 75 - Q2 00	0,56 (Accept)	3,14* (Reject)	0,50 (Accept)	2,69** (Reject)

Note: * and ** denote significance at the 5% and 1% levels, respectively
#The null hypothesis is rejected at the 17% level.

5.3 Results: VARs

Since it was found that there was a greater chance of market performance preceding business confidence surveys, unexpected results in business confidence surveys were investigated. Having found that stock market performance was a good predictor of business confidence, it was used in a VAR to predict business confidence. The residuals of the equation, therefore, represent data points where the stock market failed to predict business confidence, i.e. where the business confidence result was a surprise to the market. Table 4a contains the results of the VARs using the levels of the diffusion indices of the business confidence surveys. Table 4b shows the results of the VARs with the percent changes of the business confidence surveys. Note that the relationship with market performance is far more significant for the levels of the business confidence surveys, rather than the percent changes.

The residuals of the VARs are then termed as "surprise" variables. All "surprise" series are all found to be stationary at the 1% level as noted in Table 5.

Table 4a: Vector autoregression result
Business confidence data are expressed in diffusion index levels

	Dependent Variable	Sample Period	Lag Length	Mean of dependent variable	Std error of regression	R^2	Adjusted R^2
Monthly data							
U.S.	NAPM PMI	Sept 54 - Jan 01	6	53,39	2,43	0,89	0,89
Germany	IFO	Sept 70 - Dec 00	6	93,21	1,24	0,97	0,97
Quarterly data							
Japan	Tankan	Q3 75 - Q4 00	4	-7,18	4,50	0,96	0,96
South Africa	BER BCI	Q3 76 - 00 Q2	4	39,75	7,95	0,88	0,87

Table 4: Vector autoregression results
Business confidence data are expressed in monthly or quarterly percent changes

	Dependent variable	Sample period	Lag length	Mean of dependent variable	Std error of regression	R^2	Adjusted R^2
Monthly data							
U.S.	NAPM PMI	Sept 54 - Jan 01	6	0,11	4,95	0,15	0,13
Germany	IFO	Sept 70 - Dec 00	6	0,00	1,38	0,22	0,19
Quarterly data							
Japan	Tankan	Q4 75 - Q4 00	4	-13,69	139,53	0,12	0,05
South Africa	BER BCI	Q3 76 - 00 Q2	4	4,18	28,09	0,16	0,08

Table 5: Results of unit roots tests on unexpected results of business confidence survey[1]
ADF statistics and acceptance/rejection of the null hypothesis of unit root

		Levels				Percent Changes (M/M or Q/Q)			
		ADF Statistic	Critical Value#	Lags	Conclusion	ADF Statistic	Critical Value#	Lags	Conclusion
Monthly data									
U.S.	NAPM PMI	-8,90**	-3,98	6	Reject	-9,06**	-3,98	6	Reject
Germany	Ifo	-7,22**	-3,99	6	Reject	-7,22**	-3,99	6	Reject
Quarterly data									
Japan	Tankan	-5,21**	-4,06	4	Reject	-4,53**	-4,06	4	Reject
South Africa	BER BCI	-4,10**	-4,06	4	Reject	-3,52*	-3,46	4	Reject

Note: * and ** denote significance at the 5% and 1% levels, respectively
#MacKinnon critical values for rejection of a null hypothesis of a unit root
[1] As measured by the residuals of VAR with stock market performance

5.4 Results: Granger Causality tests between equity market returns and "surprise" variables

The results of the Granger Causality tests between the "surprise" variables, or unexpected results of business confidence surveys, are in Table 6. For all countries, the results suggest that even when the result of the business confidence survey is unexpected, there is no evidence that there is a causal effect on stock market performance. Likewise, there is no causal effect in the opposite direction. The results do not change if the "surprise" was calculated from the level of the business confidence survey or the percent change.

Table 6: Granger causality tests of stock market performance and unexpected results of business confidence surveys[#]
F-statistics and acceptance/rejection of null hypothesis

		Business confidence levels All business confidence data are expressed In diffusion index levels		Business confidence percent changes All business confidence data are expressed in monthly or quarterly percent changes	
Period		Null hypothesis: Unexpected business confidence surveys do NOT Granger-cause market performance	Null hypothesis: Market performance do NOT Granger-cause unexpected business confidence surveys	Null hypothesis: Unexpected business confidence surveys do NOT Granger-cause market performance	Null hypothesis: Market performance do NOT Granger-cause unexpected business confidence surveys
Monthly data; 6 lags					
U.S.	Feb 54-Jan 01	0,78 (Accept)	0,01 (Accept)	0,48 (Accept)	0,00 (Accept)
Germany	Feb 70-Dec 00	0,48 (Accept)	0,02 (Accept)	0,61 (Accept)	0,02 (Accept)
Quarterly data: 4 lags					
Japan	Q2 74 -Q4 00	0,42 (Accept)	0,05 (Accept)	0,37 (Accept)	0,00 (Accept)
South Africa	Q2 75 - Q2 00	0,42 (Accept)	0,03 (Accept)	0,36 (Accept)	0,02 (Accept)

Note: * and ** denote significance at the 10% and 5% levels, respectively
[#]As measured by the residuals of VAR with stock market performance

6. CONCLUSIONS

This study confirms the findings of other studies in the literature on the relationship between macroeconomic variables and stock market performance. Business confidence surveys are not a predictor of stock market performance, but rather stock market performance is a predictor of business confidence surveys. When the unexpected results of a business confidence survey are estimated, there is no causal relationship in either direction between the unexpected business confidence survey and the stock market performance. Following Cornelius (1991), this suggests that the four markets tested are informationally efficient in terms of the underlying economic fundamentals that business confidence surveys represent.

Although this study suggests that business confidence surveys do not have predictive power over stock market performance, the surveys may add valuable contributions in other ways, particularly to frontier and emerging markets. This analysis may be the starting point for future studies involving real activity surveys, particularly as emerging market countries developed longer running series of business survey data. South Africa recently began compiling a monthly purchasing managers' survey modelled on the U.S. NAPM and has gathered over twelve months of monthly data by the time of this study. Russia has started a similar series. A deeper history of data may lead to further research into informational efficiency in emerging markets as well as investigations into what broader benefits lie in introducing new and varied economic indicators.

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