Issah & Antwi, *Cogent Economics & Finance* (2017), 5: 1405581
https://doi.org/10.1080/23322039.2017.1405581

cogent economics & finance

FINANCIAL ECONOMICS | RESEARCH ARTICLE

Role of macroeconomic variables on firms' performance: Evidence from the UK

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Received: 16 August 2017
Accepted: 10 November 2017
First Published: 16 November 2017

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Reviewing editor:
David McMillan, University of Stirling, UK

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Abstract: The purpose of this study is to investigate the role of macroeconomic conditions and predict the base performance of a firm as represented by Return on Asset (ROA) and macroeconomic variables. The predictor variables used in the construction of the models were selected using PCA. For the full sample and the industry-specific sample of data, the regression model evaluated the significance of macroeconomic factors based on t-statistics and the R^2 test. The results of the study are promising. The full sample and five out of six industry variable models incorporating lead–lag relationships have an R^2 between 0.79 and 0.95. For the full sample, the results of this study indicate that macroeconomic conditions should be incorporated when predicting firms' performance. For the industry-specific models, the empirical results present a mixed picture of the effect of macroeconomic factors and the lagged ROA on firm performance and the same conclusion for full sample cannot be reached easily when looking at the industry specific results. The results of this paper provide a compelling argument that firm performance is a function of the prior year ROA, and macro-economic variables and that macroeconomic variables and prior year ROA can have impact on future firm performance measure by ROA.

ABOUT THE AUTHOR

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The study's major contribution is the introduction of a simple framework to identify and exploit linkages between firm performance and potential macroeconomic drivers of that performance.

PUBLIC INTEREST STATEMENT

The purpose of our study is to investigate whether macroeconomic information directly influences firms' performance as represented by Return on Asset (ROA). The study employs 59 macroeconomic data selected from various theories, previous studies and evaluated the significance of macroeconomic factors for full Sample across industries.

The results of the study are promising. For the full sample, the results indicate that macroeconomic conditions should be incorporated when predicting firms' performance. For the industry-specific models, the empirical results present a mixed picture of the effect of macroeconomic factors and the lagged ROA on firm performance and the same conclusion for full sample cannot be reached easily when looking at the industry specific results.

To the extent that macro-economic variables are influenced by government policy, this research shows the connection between that policy and firm performance. The results provide a compelling argument that firm performance is a function of the prior year ROA, and macro-economic variables and they can have impact on future firm performance measure by ROA.

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Subjects: Economics; Finance; Business, Management and Accounting

Keywords: return on asset; firm performance; multiple regression; principal component analysis; macroeconomic variables

1. Introduction

In economic and business cycles, we experience Period of expansion, contraction, and recession. After the recession, the expansion starts again. Economists and Finance professionals around the globe have developed models and theories to at least understand and reduce the effect of the economic and business cycle across time; nevertheless, they have not been successful in eliminating the cycle and ultimately stop recent economies falling into crisis episodes, as suggested by the recent crises in Latin America, East Asia, Russia, and the global financial crisis in 2007.

Both Micro and Macro-economic factors affect the performance of a business; it is imperative that businesses are aware of these factors in order to reduce the impact of these on future cash flows and profitability. Microeconomics factors such as demand and factors of production are controllable and the effect of which can easily be anticipated and controlled, however, macroeconomic variables such as the unemployment rates, and corporation tax rate are beyond the control of an organization, therefore, the need for businesses to predict the heterogeneous effect of these macroeconomic variables on future corporate performances (Broadstock, Shu, & Xu, 2011).

Considerable degree of studies have look at the relationship between firm performance and macroeconomic variables (Ali, Klein, & Rosenfeld, 1992; Barakat, Elgazzar, & Hanafy, 2016; Broadstock et al., 2011; Caird & Emanuel, 1981; Clare & Thomas, 1994; Ibrahim & Aziz, 2003; Kandir, 2008; McNamara & Duncan, 1995; Stock & Watson, 2008), however, majority of the studies did not look at the effect of macroeconomic variables on specific industries and also most of these studies use stock returns instead of absolute accounting variables to measure performance.

In the light of the above evidence, there are some significant questions about: whether there are linkages between firm performance and potential macroeconomic drivers of that performance and whether the prediction of the future earnings (firm performance) could be concentrated on absolute values rather than financial statement variables that predict change in the direction of future earnings.

Thus, these questions have motivated the researchers and empirical research is conducted to predict the fundamental performance of a firm as measured by the rate of return on assets (ROA). The ROA of a firm is a function of a fundamental business-performance level and government economic policy (measured by macro-economic indicators). The study's major contribution is the introduction of a simple framework to identify and exploit linkages between firm performance and potential macroeconomic drivers of that performance for UK listed companies. The research presents a model relating ROA to prior year ROA and to the level of activity in the economy.

This study contributes to the existing literature in three ways. First, the study narrows the gap between the intuition and the current empirical research, especially in the UK. Secondly, this study shows that full-sample analysis commonly used in the literature may generate non-robust conclusions, therefore, the need to consider industry-specific analyses. Thirdly, the methodology of PCA gives the advantage to examine the impact of most available macroeconomic information instead of specific information from several pre-selected macroeconomic variables which is widely adopted in the current literature.

The study examined the linkages and causal relation between macroeconomic variables and firm performance by investigating the impact of macroeconomic factors on firm performance. Accordingly, this study constructed a model that will accurately predict the effect of macroeconomic factors on firm performance.

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2. Literature review

Ratio analysis has been a tool used in the interpretation and evaluation of financial statements for investment decision-making and measuring business performance since the late 1800's, (Lev, 1974) cited in Molinero, Bishop, and Turner (2005). Most accounting ratio-related studies focuses on the ability of financial statement related ratios to predict corporate failure (Agarwal & Taffler, 2008; Altman, 1968; Altman, Haldeman, & Narayanan, 1977; Beaver, 1966; Bunyaminu & Issah, 2012; Ohlson, 1980; Wang & Campbel, 2010).

The exception to earlier failure research work was an attempt to reconcile accounting return on assets to internal rate of return by Solomon (1966), Vatter (1966), and Livingstone and Salamon (1970) and an attempt to advance reconcile the rate of return on equity with traditional concepts of value (Brief & Lawson, 1992; Penman, 1991). A common characteristic of the majority of previous research is that it does not explicitly incorporate information external to the firm itself. While it is possible that disaggregating earnings into components will identify, in a reduced form, links to such external drivers of firm profitability, they are not explicit with respect to these external drivers (Li, Richardson, & Tuna, 2012).

Another recent study by Broadstock et al. (2011) re-examined the role of macroeconomic information when forecasting firms' earnings using Fama-MacBeth regression but with an important extension in which over 140 macroeconomic variables. Their evidence is mixed. For the full sample, it is evidenced that macroeconomic conditions can impact on firm level future earnings and should be incorporated when predicting firms' future earnings, and particularly in the early sample period, macroeconomic factors therefore enhance the predictive accuracy of the model. However, when using conventional inference techniques for the Fama-MacBeth method it is however shown that the significance of macroeconomic variables does not persist for the industry specific models and does not always impact firm specific earnings forecast, but only has impacts during certain periods.

Researchers such as Brown and Ball (1967); McNamara and Duncan (1995); Boyd, Hu, and Jagannathan (2005); Stock and Watson (2008); Broadstock et al. (2011); and Barakat et al. (2016) suggested that the macroeconomic environment has a strong impact on firms' financial positions, however, McNamara and Duncan (1995) criticized the above studies and argue that they concentrated on identifying those financial statement variables that were able to predict a change in the direction of future earnings instead of prediction of the absolute value of future earnings.

2.1. Conceptual framework

The financial performance is often measured using financial ratios such as Return on Asset (ROA), Return on Equity (ROE), Earnings before Interest (EBIT) or Sales growth. The advantage of these measurements is their general availability, however, creative accounting, manipulations of figures and choices of accounting methods makes comparison of the financial performance of companies difficult (Chenhall & Langfield-Smith, 2007).

Commonly used performance measure such as ROA or EBIT are susceptible to financial engineering, especially through debt leverage, which can obscure the fundamentals of a business. ROA on the other hand is less vulnerable to the kind of short-term creativity or manipulation that can occur on income statements since many assets involve long-term asset decisions that are more difficult to alter with in the short term.

In this study, we argue for rate of return on assets as the best for the purposes of predicting future profitability. Figure 1 present our model for firms profit performance.

ROA may not reflect the true earning power of the assets but it is the most effective, broadly available and widely used as a measure of firm performance (Benner & Veloso, 2008; McNamara & Duncan, 1995).

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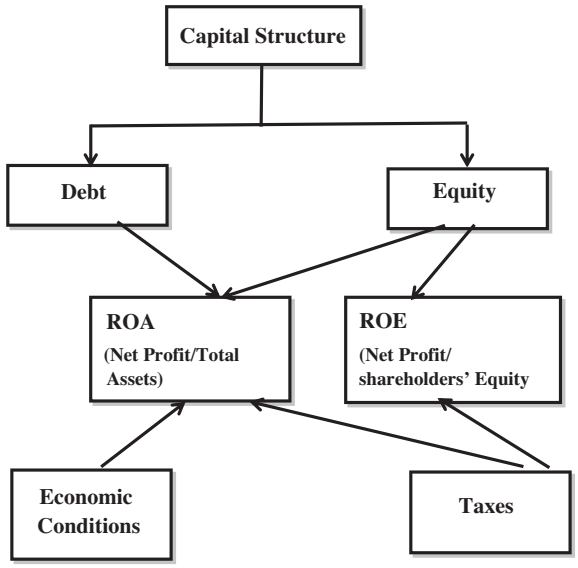

Figure 1. Profit performance model.

Source: (Constructed by authors, 2017).

ROA captures the fundamentals of business performance and operating capability in a holistic way, leakages of earnings through both payments to capital, and the final return to equity holders. We assume that, profits that are available to shareholders are a fixed function of the firm's total asset base. Where, an organization is working at full capacity and effectively utilizing other factors of production, then, ROA will measure its surplus operational capacity. The model also assumes that this base surplus operating capacity will be modified by the general level of economic activity.

The government general management (or mismanagement) of the economy affect demand for the firms goods and services in anyone particular year which in turn determine the obtained level of ROA. Management ability to manage the firm's factors of production in anyone particular year will result in individual firm differences. These differences should be captured in the ROA estimation to the extent that they are relatively consistent over time.

For the purpose of this study, ROA is used as a measure of firm performance which is determined by its asset base and the costs of its other factors of production. ROA measures the earnings before interest, tax, and extraordinary items, divided by net tangible assets (shareholder equity plus liabilities).

The fundamental hypothesis that guides the empirical research is that ROA, as a measure of base operating performance of a firm, is correlated with changes in the level of economic activity. The general form of the relationship adopted from McNamara and Duncan (1995) is:

$$ROA_t = f(ROA_{(t-1)}, Econ)$$

where: ROA = Rate of Return on Assets; *Econ* = Level of Economic Activity

3. Research design and methodologies

3.1. Data-set

The data-set consist of 116 listed companies in the UK and the sample covers UK firms over the period 2002 to 2014 excluding financial firms, and regulated utilities due to their high volatility ratios as a result of heavily reliance on the economy and the analysis of their ratios is slightly different as a result of the nature of their expenses. Each sample firm had at least 5 years financial data prior to failure; this is consistent with previous studies (Broadstock et al., 2011; Hou & van Dijk, 2010). All

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Table 1. Industry sector category

Categories	Sectors
1	Primary sector, chemicals, non-metallic products, textiles
2	Machinery, equipment, furniture, recycling, construction
3	Wholesale & retail trade
4	Hotels, restaurants, Real estate activities, telecommunications
5	Education, Health, Computing, IT Services
6	Other Services

firms included in the sample must have no missing values for the accounting variables to be included in the regression. The study excludes firms with turnover less than £3 million to avoid extreme value caused by scaling. Table 1 above shows the industry classification used in this study.

3.2. Selection of predictor variables

The macroeconomic variables chosen for this research were taken from data compiled by Stock and Watson (2008) and the measures of economic activity according the *Leading and Coincident Indicators, Supply or Cost-Push Theories, Monetary Economics,* and *Savings-Investment* theories. These theories provided an initial data-set of 59 variables. The main definition of each of the 59 macroeconomic variables is presented in Appendix A.

It is worth mentioning that 10 variables (X4, X7, X21, X23, X24, X26, X43, X51, X53, and X56) were transformed by applying the natural logarithms, while others are expressed in percentages. The purpose was to bring all values to a similar scale. The only variable for which the log transformation was not possible because of the presence of some negative values was X52.

3.3. Models and methodologies

The study applied two main models, namely; Principal Component Analysis (PCA) and Multiple Regression.

3.3.1. Principal component analysis

The macroeconomic variables used in this study and those by the various macro economic theories are indeed correlated. Therefore, the purpose of PCA stage of the analysis is to determine factors that can convey the essential information in a larger set of variables (McNamara & Duncan, 1995) and to at least reduce multicollinearity problems which make it difficult to make any statistical inferences. PCA also compresses data by reducing the number of dimensions and keeps only those characteristics of the data sets that contribute most to its variance without losing much of information (Abassi & Taffler, 1982; Andreica, Andreica, & Andreica, 2009).

The study applied PCA using Statistical Package Science for Social (SPSS) software to reduce the dimensionality of the initial financial data space in order to allow visual description of the total sample of the predictor variables and also, to avoid reliance on an arbitrarily selected number of prespecified variables to capture macroeconomic factors. The factors found in this stage of the analysis as the result of a varimax rotation enhances the orthogonality of the variables.

3.3.2. Multiple regression model

The second stage applies the statistical technique of a multiple regression using SPSS to establish the linear relationship between the dependent variables (ROA) and the independent variables (the key economic variables), and the lagged ROA. Multiple Regressions is a statistical technique that uses several independent variables to predict the outcome of a dependent variable. The aim of multiple linear regressions is to find a mathematical relationship between the explanatory and response variables. The model creates a relationship in the form of a straight line (linear) that best approximates all the individual data points. This study uses the following regression equation:

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$$Y_t = \beta_0 + \beta_1 Y_{t-i} + \beta_2 X_t \ldots\ldots\ldots\ldots + \beta n X_{nt} + \varepsilon_t$$

where, Y = is the value of the dependent variable; β_{0-n} = are the coefficients; Y_{t-1} = is the lagged dependent variable; X = are the independent variables; ε_t = is the residual error of the regression; t = is the total number of observations in the data-set

The regression equation above follows an autoregressive process with a one period lag (i.e. an AR1 process) because the lagged dependent variable included as an explanatory variable. Therefore, the model estimated included a one period lag of ROA as one of the independent variables.

The coefficients β is estimated using Ordinary Least square (OLS), however, because the regression equation above include a lagged independent variable, OLS might not give a linear unbiased estimator, this research therefore follows that hypothesis testing will be approximately valid. This is consistent with the method applied by Cooper and Schindler (2003) and Ahmed (2006). The study also explored the properties of both standardized and unstandardized regression coefficient. The unstandardized coefficient measures the average change in the dependent variable associated with 1 unit change of the independent variable, holding other independent variables constant. Standardized coefficient (also known as beta) measures the contribution of each independent variable on the dependent variable.

The model's degree of goodness of fit was estimated and evaluated using multiple coefficients denoted by R^2 (R^2) and the adjusted R^2. R^2 (R^2) is the square of this measure of correlation and indicates the proportion of the variance in the dependent variable that is explained by the independent variables in the model. However, the disadvantage of R^2 is that, it tends to over-estimate the success of the model in some cases when applied to the real world, so an Adjusted R Square value which takes into account the number of variables in the model and the number of observations is used (Ahmed, 2006).

It is also worth mentioning that, the F test was also estimated to test the hypothesis and also test the significance of R, which is the same as testing the significance of the regression model as a whole (R^2). If prob (F) < 0.05, then the model is considered significantly better than would be expected by chance and it is rejected null hypothesis of no linear relationship of Y to the independents.

The research questions and hypotheses clearly support this model. In this study, multiple Regression analysis and a correlation research design are selected using the "simultaneous" or Enter Method. Unlike the stepwise method, which enable the independent variables to be entered based upon their contribution to the model. The Enter method specifies the set of independent variables that make up the model. The reason for selecting this method is because The PCA analysis in previous section will establish the variables that are significant in entering the model.

4. Results of the analysis

This study used PCA and multiple regression models to predict the relationship between firm performance and macroeconomic variables of UK's public listed companies. The study also determined which macroeconomic variables have significant predictive ability in predicting the relationship. The analysis of the results was structured in three main parts; namely, descriptive statistics, PCA analysis and the regression analysis.

4.1. Descriptive statistics

A descriptive statistics of the 59 variables in Appendix B show the univariate analysis to identify variables that have the highest ability to be included in Regression and PCA models. The results show that all variables with a mean difference are significant at the 1% level for all variables with exception of **ULCMANAPNMEI (X14**-Benchmarked Unit Labor Costs–Manufacturing**)** and **CASHBLGBA (X55**-Cash surplus/deficit (% of GDP)**)** with p values **0.014 and 0.29**, respectively. Thus, X14 and X55 were excluded in the PCA analysis.

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4.2. Principal component analysis

We re-examine the macroeconomic variables since the correlation matrix indicated different strong correlations between the independent variables and also to check on the seriousness of the multicollinearity problem in the data by looking at the PCA. It is worth mentioning that, all variables were included in the analysis with the exception of X14 and X55, as it observed not significant from t-test observation.

Accordingly, all variables were selected for the PCA analysis. According to the Kaiser criterion, which selects only eigenvalues greater than 1, the PCA result of the selected set of variables, is presented in Table 2.

The results in Table 2 below show that there are 5 eigenvalues greater than 1, being presented in the table in a descending order: $\lambda 1 = 35.439$, $\lambda 2 = 12.795$, $\lambda 3 = 2.772$, $\lambda 4 = 2.610$ and $\lambda 5 = 1.041$. The first principal component contributes 62% of the total gain of recovered information, followed by a 22% contribution of the second component, with another 5% more of the third and fourth components and finally 2% more of the fifth component, leading to a total of 96% of the variability of the initial space. This shows that there are only these five components that have a greater contribution than the initial 57 variables included in the analysis. As a result, five principal components were retained in this analysis, with a total loss of only 4% of the initial information.

We interpret the five retained principal components determined using rotated component matrix. One common problem in PCA is that unrotated factor matrix often provides inconclusive interpretations (Andreica, 2009). To solve this problem, the rotated component matrix is computed, using the Varimax procedure, and the result of which is presented in Table 3.

The first principal component is powerfully correlated to Real GDP (X21-GDPR), providing information on real economic activity. The second component is correlated with Adjusted Unemployment Rate (X8-URNAA) and the third component is highly correlated with Output in Manufacturing X32 (OTPT), both also providing information on real economic activity. The fourth component is correlated with Benchmarked Unit Labour Costs - Total (X11-ULCTOTAPNMEI); providing information on inflation or price variables. The fifth component is highly correlated with Exchange Rates (Value of Foreign Currency Relative to US Dollar) (X58-FXUS). This provides information monetary or financial conditions. Therefore, the significant predictor variables to be included in the regression equation are **X8, X11, X21, X32, and X58.**

Table 2. Total variance explained

Component	Initial Eigen values			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	35.439	62.174	62.174	35.439	62.174	62.174	31.202	54.741	54.741
2	12.795	22.448	84.622	12.795	22.448	84.622	8.220	14.421	69.162
3	2.772	4.864	89.485	2.772	4.864	89.485	7.962	13.969	83.131
4	2.610	4.578	94.063	2.610	4.578	94.063	4.664	8.182	91.313
5	1.041	1.827	95.890	1.041	1.827	95.890	2.609	4.578	95.890
6	0.835	1.465	97.356						
7	0.724	1.270	98.626						

Note: Extraction method: Principal component analysis.

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Table 3. Rotated component matrix[a]

	Component				
	1	2	3	4	5
GDPR	0.981				
URNAA		0.851			
OTPT			0.845		
ULCTOTAPNMEI				0.893	
FXUS					0.563

Notes: Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser Normalization.
[a]Rotation converged in 10 iterations.

Table 4. Correlation coefficients

		ROA	Lagged ROA	URNAA	ULCTOTAPNMEI	GDPR	OTPT	FXUS
Pearson correlation	ROA	1.000	0.547	0.433	−0.223	0.344	−0.123	0.544
	Lagged ROA		1.000	0.058	−0.355	0.297	−0.132	0.182
	URNAA			1.000	0.413	0.118	−0.776	−0.310
	ULCTO-TAPNMEI				1.000	−0.105	−0.528	−0.322
	GDPR					1.000	−0.174	0.575
	OTPT						1.000	0.416
	FXUS						.	1.000

4.3. Construction and testing of prediction models

The study first observed the strength of the relationship between the predictor variables by looking at the coefficient of correlation. The results of the correlation analysis of this study are shown in Table 4.

Table 4 presents the correlation matrix among the variables. It is shown that the correlations among the variables are uniformly low and insignificant at level $p < 0.05$ with the exception of a strong correlation between Adjusted **Unemployment Rate (X8 -URNAA)** and **Output in Manufacturing (X32-OTPT)**, OTPT is therefore excluded from the regression analysis.The correlation coefficients would probably support the non-existence of multicollinearity problem between these variables in our regression analysis.

4.3.1. The full sample regression

A multiple regression model is designed to test the effect of macroeconomic factors and the lagged ROA on the firm performance measured by ROA. The regression model takes the following equation:

$$ROA_t = \beta_0 + \beta_1 ROA_{t-i} + \beta_2 GDPR_t + \beta_3 ULCTAPNMEIT_t + \beta_1 FXUS_t + \varepsilon_t$$

The results for the estimation of the regression Model for the full sample are reported in Tables 5 and 6.

The model's R^2 a value of 0.95 is shown in Table 5 below; this indicates considerable aggregate explanatory power for the estimated model. It is also found that adjusted R^2 explain 92% variations

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Table 5. Model summary[b]

Model	*R*	R^2	Adjusted R^2	Std. error of the estimate	Durbin-Watson
1	0.976[a]	0.953	0.919	1.25526	2.117

[a]Predictors: (Constant), FXUS, Lagged ROA, URNAA, ULCTOTAPNMEI, GDPR.

[b]Dependent variable: ROA.

Table 6. *F–Test*

ANOVA[a]

Model		Sum of squares	*df*	Mean square	*F*	Sig.
1	Regression	222.094	5	44.419	28.190	0.000[b]
	Residual	11.030	7	1.576		
	Total	233.123	12			

[a]Dependent variable: ROA.

[b]Predictors: (Constant), FXUS, Lagged ROA, URNAA, ULCTOTAPNMEI, GDPR.

in the dependent variables. This model shows higher adjusted R^2. Table 6 shows that the model provides significant explanatory power ($F = 28.19$, $p < 0.000$).

The analysis for the variables entered in Table 7 led to the following regression equation:

$$\text{ROA} = 218.513 + 0.389 \times \text{Lagged ROA} + 3.553 \times \text{URNAA} - 19.059 \times \text{GDPR} + 0.345 \times \text{FXUS}$$

The results of the regression presented in Table 7, shows that among the five variables, four of these variables—**Lagged ROA, URNAA, GDPR,** and **FXUS** are found to be significant based on the p-value of less than 0.05, which indicates that these variables are significant in contributing to the model and in predicting the relationship between firm performance (ROA) and macroeconomic variables and prior year ROA. GDP in real terms shows a negative relationship with the ROA. When the GDPR has been increased by 1 unit, holding other variable constant, ROA has been decreased by 0.40 units.

4.3.2. Industry-specific sample regression

The results for the estimation of Models for industry 1–6, respectively, are reported in Table 8.

All Models provide significant explanatory power Industry with the exception of industry 2. Industry 1 indicated ($F = 16.31$, $p < 0.001$), Industry 2 ($F = 1.58$, $p < 0.280$), Industry 3 ($F = 6.68$, $p < 0.014$), Industry 4 ($F = 5.75$, $p < 0.020$), Industry 5 ($F = 11.54$, $p < 0.003$) and Industry 6 ($F = 5.272$, $p < 0.025$).

Table 7. Classification results

Coefficients[a]

Model	Unstandardized coefficients		Standardized coefficients	*t*	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity statistics	
	B	Std. error	*β*			Lower bound	Upper bound	Zero-order	Partial	Part	Tolerance	VIF
(Constant)	218.513	72.628		3.009	0.020	46.775	390.25					
Lagged ROA	0.389	0.092	0.397	4.243	0.004	0.172	0.606	0.547	0.849	0.349	0.772	1.295
URNAA	3.553	0.445	0.804	7.981	0.000	2.500	4.605	0.433	0.949	0.656	0.665	1.503
ULCTO-TAPNMEI	−0.671	0.406	−0.166	−1.653	0.142	−1.630	0.289	−0.223	−0.530	−0.136	0.668	1.498
GDPR	−19.059	5.259	−0.403	−3.624	0.008	−31.493	−6.624	0.344	−0.808	−0.298	0.546	1.832
FXUS	0.345	0.044	0.899	7.827	0.000	0.241	0.449	0.544	0.947	0.643	0.512	1.953

[a]Dependent variable: ROA.

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Table 8. Model summary and coefficients

Industry	*R*	R^2	Adjusted R^2	*F*	Sig.
1	0.960	0.921	0.865	16.312	0.01
2	0.729	0.531	0.196	1.583	0.280
3	0.909	0.827	0.703	6.675	0.014
4	0.897	0.805	0.665	5.764	0.20
5	0.944	0.892	0.814	11.537	0.003
6	0.889	0.790	0.640	5.272	0.025

The R^2 values of 0.92 and the adjusted R^2 of 87% which explains variations in the dependent variables for Model Industry 1, indicate considerable aggregate explanatory power for the estimated models. The same can be said for Industry 3 ($R^2 = 0.83$, Adjusted $R^2 = 70\%$), Industry 4 ($R^2 = 0.81$, Adjusted $R^2 = 67\%$), Industry 5 ($R^2 = 0.89$, Adjusted $R^2 = 81\%$), and Industry 6 ($R^2 = 0.79$, Adjusted $R^2 = 64\%$). However, it is worth noticing that both R^2 and the adjusted R^2 for Industry 2 are not significant and does not depict any considerable explanatory variable.

The coefficients and the p Values of each variable entered into the equation and for each industry are presented in Table 9.

Table 9 depicts that three independent variables in Model Industry 1 are significant at the five per cent level or better, namely; Lagged **ROA, URNAA, and GDPR** (significant at $p < 0.05$) . This indicates that these variables are a good predictor of corporate performance.

Table 9 illustrates that none of the dependent variables were found to be statistically significantly related with ROA for Industry 2. This can be explained by the fact that, the model did not provide significant explanatory power ($F = 1.58$, $p < 0.280$).

Table 9 below illustrates that three of the dependent variables **Lagged ROA ($p < 0.05$), GDPR ($p < 0.05$) and FXUS ($P < 0.05$)** were found to be statistically significantly related with ROA for Industry 3. Here other variables are not significantly related with ROA. Here GDPR shows a negative relationship with the ROA. When the Real Gross Domestic Product increases by 1 unit, holding other variables constant, Return on Asset decreased by 0.48 units edit.

Table 9 shows that two predictor variables in Model Industry 4 are significant at $p < 0.05$. Namely; **Lagged ROA and FXUS**. This indicates that these variables are good predictors in contributing to the model

Table 9. Classification results

	Industry 1		Industry 2		Industry 3		Industry 4		Industry 5		Industry 6	
	B	Sig.	*B*	Sig.	*B*	Sig.	*B*	Sig.	*B*	Sig.	*B*	Sig.
(Constant)	−439.013	0.007	438.230	0.272	654.666	0.007	103.123	0.856	670.629	0.007	31.648	0.907
Lagged ROA	0.479	0.004	0.562	0.074	0.531	0.014	0.581	0.005	0.132	0.442	0.492	0.017
URNAA	2.075	0.030	0.897	0.736	0.009	0.994	7.922	0.052	7.019	0.001	5.525	0.011
ULCTO-TAPNMEI	−0.396	0.653	0.793	0.743	−0.466	0.641	−1.827	0.540	−1.913	0.108	−0.081	0.955
GDPR	28.720	0.012	−30.936	0.285	−47.804	0.007	−17.858	0.668	−53.034	0.004	−6.662	0.734
FXUS	0.060	0.435	0.048	0.843	0.431	0.006	0.992	0.022	0.560	0.002	0.248	0.171

Note: B = Unstandardized coefficients.
Sig = *p*-value at 5.0%.

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Table 9 depicts that three of the predictor variables **URNAA ($p < 0.05$), GDPR ($p < 0.05$) and FXUS** ($p < 0.05$) were found to be statistically significantly related with ROA for Industry 5. GDP shows a negative relationship with the ROA. When the GDP in real terms increased by 1 unit, holding other variable constant, ROA decreased by 0.53 units.

The results of the regression presented in Table 9, shows that among the five variables, only two of these variables—**Lagged ROA and URNAA,** are found to be significant based on the p-value of less than 0.05 for Industry 6, which indicates that these variables are significant in contributing to the model and in predicting the relationship between firm performance (ROA) and macroeconomic variables and Prior year ROA.

The empirical results present a mixed picture of the effect of macroeconomic factors on firm performance. For the full sample, it is shown with a combination of coefficients test, R^2 tests and other test that macroeconomic conditions are important on average across the full history of the data. However, the same conclusion cannot be easily reached when looking at the industry specific results. However, it is possible to observe that macroeconomic conditions have been seen to impact each of the sectors in different ways with the exception of Industry Sector 2 (Machinery, equipment, furniture, recycling, and construction).

The hypothesis for significant relationship between macroeconomic variables lagged ROA and ROA. The R^2 values of 0.95 for the full sample and average R^2 of 0.85 for the industries (excluding Industry 2); indicate considerable aggregate explanatory power for the estimated models. By previous research standards, this is a good result and significantly better than the result obtained from McNamara and Duncan (1995), their findings reported 0.65 and 0.70 for their models.

The hypothesis for significant predictor variables that impact on ROA. The coefficients of the macroeconomic variables, relate to the real economic activity factor, monetary factor, and inflation/price factor. For the full sample, unemployment rate, and Real GDP which measures economic activity are found to be significant and negative for GDP and positive for Unemployment Rate. The positive coefficient implies that as economic activity increases, the future earnings of a firm will increase and the reverse for the negative Real GDP coefficient. The findings of Gjerde and Sættem (1999) show a positive linkage between stock returns and real economic activities such as unemployment rates. A recent study by Flannery and Protopapadakis (2002) found that real GDP do not appear to be related with stock returns.

Prior year ROA was also found to be significant and positive, which implies that a prior year ROA increases, the future ROA will increase. This is consistent with the findings of McNamara and Duncan (1995). In terms of the other macroeconomic variables, Exchange Rates changes which measure the financial condition is significant and positively related ROA. While, Kandir (2008) observed a positive relationship between exchange rate and stock prices, Ibrahim and Aziz (2003) documented a negative one. The reason behind the finding of Ibrahim and Aziz (2003) could be attributed to the fact the study was conducted in Malaysia, a country that rely heavily on international trade, hence the negative effect of exchange rate on international trade of the countries.

The hypothesis for significant most important variables in determining the effect on industry-specific firm performance. Putting together, the results of this section and the previous parts of this paper provide a compelling argument that macroeconomic variables and prior year ROA can have impact on future firm performance measure by ROA. For the industry specific models the results are more mixed as can be seen from Table 10. It is seen that there are no significant variable for the industry 2 (Machinery, equipment, furniture, recycling, construction). Looking at the macroeconomic factors first, Adjusted Unemployment Rate (X8-URNAA) is significant for Primary Sector (Industry 1), Education, Health, Computing, IT Services (Industry 5) and Other Services (Industry 6). Real GDP (X21-GDPR) is significant for Primary Sector (Industry 1), Wholesale & retail trade (Industry 3) and Education, Health, Computing, IT Services (Industry 5). Exchange Rates (Value of Foreign Currency

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Table 10. Summarize prediction results

Sample	Significant variables
Full sample	Lagged ROA,URNAA, GDPR and FXUS
Industry-specific	
Industry 1	Lagged ROA, URNAA and GDPR
Industry 2	None
Industry 3	Lagged ROA, GDPR and FXUS
Industry 4	Lagged ROA and FXUS
Industry 5	URNAA, GDPR and FXUS
Industry 6	Lagged ROA and URNAA

Relative to US Dollar) (X58-FXUS) is significant to Wholesale & retail trade (Industry 3) Hotels, restaurants, Real estate (Industry 4) and Education, Health, Computing, IT Services (Industry 5) . The other variables Benchmarked Unit Labour Costs–Total (X11 -ULCTOTAPNMEI) is not considered to be important factors for all industries. The lagged ROA is significant for all industries except Industry 2 and 5.

5. Conclusions

5.1. Conclusions

The purpose of this study is to investigate the role of macroeconomic conditions and predict the base performance of a firm as represented by Return on Asset (ROA) and macroeconomic variables. Corresponding to current literature, this study specifically investigates whether macroeconomic information directly influences firms' performance when controlling for the role of firm-specific prior year ROA. A multiple regression model is designed to test the relationships between the ROA and five macroeconomic factors and Lagged ROA. In the regression models, ROA is used as dependent variables, while the macroeconomic variables and lagged ROA are used as independent variables.

For the full sample of data, the regression model evaluated the significance of macroeconomic factors based on *t*-statistics and the R^2-test. The study further explores the issue of interest by looking at key individual regression window to avoid any potential loss of information. The research conducted the same analysis across all industries to establish whether macroeconomic information imposes different impact for different industries. The research finally attempt to identify and discuss the significant predictor variables and their implications for future studies. Since our study analyzed two Samples of data (full sample and the industry-specific sample), the conclusions are reached separately.

The results of the study are promising. The full sample and five out of six industry variable models incorporating lead–lag relationships have an R^2 between 0.79 and 0.95. For the full sample, the results of this study indicate that macroeconomic conditions should be incorporated when predicting firms' performance; macroeconomic factors therefore enhance the predictive accuracy of the model. The coefficients of the significant macroeconomic variables relate to the real economic activity factor measured by Unemployment rate, and Real GDP and monetary factor which is measured by Exchange Rates changes. Prior year ROA was also found to be significant, which implies that a prior year ROA increases, the future ROA will increase.

For the industry-specific models, the empirical results present a mixed picture of the effect of macroeconomic factors and the lagged ROA on firm performance and the same conclusion for full sample cannot be reached easily when looking at the industry specific results. However, it is possible to observe that macroeconomic conditions have been seen to impact each of the sectors in different ways with the exception of Industry Sector 2 (Machinery, equipment, furniture, recycling, and construction). For the industry specific models the results are mixed as can be seen from Table 10.

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To the extent that macro-economic variables are influenced by government policy, this research shows the connection between that policy and firm performance. The results of this paper provide a compelling argument that firm performance is a function of the prior year ROA, and macro-economic variables and that macroeconomic variables and prior year ROA can have impact on future firm performance measure by ROA.

The results are indeed consistent with the theory and also contribute to current literature by narrowing the gap between the intuition and the empirical research on the role of macroeconomic conditions on firm performance. It also highlights the need to further consider industry-specific analyses in the literature. Future research involving the predicting of any accounting variable, must consider the impact o f macro-economic as well as firm-specific micro data.

The results of this study can assist managers, company auditors, lenders, and regulatory bodies to identify businesses that will be affected by macroeconomic changes to firm performance, continue monitoring and improving company's future performance. The limitation however of these prediction model and all previous firm performance prediction studies is that, they are not based on any economic theory in choosing those financial ratios such as ROA. Nonetheless, the conclusions are relatively encouraging.

5.2. Implications for further study

While this study's adoption of a PCA to reduce the number of variables to prevent over-fitting of data in the total sample, has been effective, Variance Inflation Factor (VIF) could be used in future research. This study also adopted Enter Method for the multiple regressions; future research should consider adopting stepwise method.

Since our analysis is confined to a linear framework, some results may be sensitive to nonlinearities. Future research should look at a nonlinear framework especially given the importance of research question. Although this research looks at a rich set of macroeconomic variables, the macroeconomic variable set employed is not exhaustive. Some other macroeconomic variables would provide more information about the firm performance–economic activity relationship. Further study would also consider other firm performance measure such Return on Equity, Earnings per Share and Liquidity ratios in order to obtain a better insight about the return generation process. Overall, this paper is expected to be useful for both potential investors and finance and business literature.

Funding
The authors received no direct funding for this research.

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Citation information
Cite this article as: Role of macroeconomic variables on firms' performance: Evidence from the UK, Mohammed Issah & Samuel Antwi, *Cogent Economics & Finance* (2017), 5: 1405581.

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Appendix

Appendix A. Macroeconomic variables and their definitions

Code	Variables	Definition	Measurement units
X1	INTGSTB	Interest Rates, Government Securities, Treasury Bills	Percent per Annum
X2	INTGSB	Interest Rates, Government Securities, Government Bonds	Percent per Annum
X3	INTDSR	Interest Rates, Discount Rate	Percent per Annum
X4	WFPMNA	Working-age Population for Men	Thousands of Persons
X5	POPL	Population	Millions of Persons
X6	URYNAA	Adjusted Unemployment Rate for Youth	PERCENT
X7	URTOTADSMEI	Unemployment Level: Survey-Based (All Persons)	Thousands of Persons
X8	URNAA	Adjusted Unemployment Rate	PERCENT
X9	URHARMADSMEI	Harmonized Unemployment Rate: All Persons	PERCENT
X10	ULCTTCAPNMEI	Benchmarked Unit Labor Costs–Trade, Transport and Communication	Percentage change
X11	ULCTOTAPNMEI	Benchmarked Unit Labor Costs–Total	Percentage change
X12	ULCMSAPNMEI	Benchmarked Unit Labor Costs–Market Services	Percentage change
X13	ULCMN	Unit Labor Costs in Manufacturing, National Currency Basis,	Index 2002 = 100
X14	ULCMANAPNMEI	Benchmarked Unit Labor Costs–Manufacturing	Percentage change
X15	ULCINDAPNMEI	Benchmarked Unit Labor Costs–Industry	Percentage change
X16	ULCFBSAPNMEI	Benchmarked Unit Labor Costs–Financial and Business Services	Percentage change
X17	ULCCONAPNMEI	Benchmarked Unit Labor Costs–Construction	Percentage change
X18	ULCBXAAPNMEI	Benchmarked Unit Labor Costs–Business Sector (Excluding Agriculture)	Percentage change
X19	TLHRS	Total hours in manufacturing	Index 2002 = 100
X20	TLCMF	Total labor compensation in manufacturing	Index 2002 = 100
X21	GDPR	Real GDP	Millions of 2010 US Dollars
X22	GDPH	Real GDP per Hour Worked	2010 US Dollars
X23	GDPE	Real GDP per Employed Person	2011 US Dollars
X24	GDPC	Real GDP per Capita	2012 US Dollars
X25	GDPRAPSMEI	Constant Price Gross Domestic Product	Percent Change from Year Ago
X26	GDPNADSMEI	Current Price Gross Domestic Product	Billions of British Pounds
X27	GDPDEFAISMEI	GDP Implicit Price Deflator	Index 2005 = 100
X28	PROMANAISMEI	Production in Total Manufacturing	Index 2005 = 100
X29	PROINDAISMEI	Production of Total Industry	Index 2005 = 100
X30	PROCONAISMEI	Production of Total Construction	Index 2005 = 100
X31	LFPRNA	Labor Force Participation Rate	Percent
X32	OTPT	Output in Manufacturing	Percent
X33	IMPORTADSMEI	Imports of Goods and Services	Billions of British Pounds
X34	EXPORTADSMEI	Exports of Goods and Services	Billions of British Pounds
X35	GFCEADSMEI	Government Final Consumption Expenditure	Billions of British Pounds
X36	PFCEADSMEI	Private Final Consumption Expenditure	Billions of British Pounds
X37	PESANA	Percent of Employment in Services	Percent
X38	PEMANA	Percent of Employment in Agriculture	Percent
X39	PEFANA	Percent of Employment in Manufacturing	Percent
X40	PEDANA	Percent of Employment in Industry	Percent
X41	EPP	Employment as Percentage of Population	PERCENT
X42	EMPTOTQPSMEI	Employment	Millions of Persons

(Continued)

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Appendix A. (*Continued*)

Code	Variables	Definition	Measurement units
X43	AHWEP	Average Annual Hours Worked per Employed Person	HOURS
X44	CPIALLAINMEI	Consumer Price Index: All Items	Index 2005 = 100
X45	PPDMAINMEI	Domestic Producer Prices Index: Manufacturing	Index 2005 = 100
X46	CPISXHAINMEI	Consumer Price Index: Services Less Housing	Index 2005 = 100
X47	CPIFODAINMEI	Consumer Price Index: Food	Index 2005 = 100
X48	CPIENGAINMEI	Consumer Price Index: Energy	Index 2005 = 100
X49	CPICORAINMEI	Consumer Price Index: All Items Excluding Food and Energy	Index 2005 = 100
X50	CINSADSMEI	Change in Stocks	Billions of British Pounds
X51	FAEEFNGBA	Financial Account (Excl. Exceptional Financing and Use of Fund Resources), Net	DOLLARS
X52	CUAEEFGBA	Current Account (Excludes Exceptional Financing), Net	DOLLARS
X53	CANEEFGBA	Capital Account, Net (Excludes Exceptional Financing)	DOLLARS
X54	DEBTTLGBA	Central government debt, total (% of GDP)	Percent of GDP
X55	CASHBLGBA	Cash surplus/deficit (% of GDP)	Percent of GDP
X56	TRESEGGBM	Total Reserves excluding Gold	DOLLARS
X57	GFCFADSMEI	Gross Fixed Capital Formation	Billions of British Pounds
X58	FXUS	Exchange Rates (Value of Foreign Currency Relative to US Dollar)	Index 2002 = 100
X59	SARTAISMEI	Total Retail Trade	Index 2005 = 100

Appendix B. Descriptive statistics

One-sample test

	Test value = 0		
	t	*Df*	Sig. (2-tailed)
INTGSTB	8.210	12	0.000
INTGSB	28.864	12	0.000
INTDSR	8.219	12	0.000
WFPMNA	1055.392	12	0.000
POPL	177.004	12	0.000
URYNAA	19.577	12	0.000
URTOTADSMEI	152.546	12	0.000
URNAA	20.847	12	0.000
URHARMADSMEI	20.694	12	0.000
ULCTTCAPNMEI	3.870	12	0.002
ULCTOTAPNMEI	9.459	12	0.000
ULCMSAPNMEI	5.977	12	0.000
ULCMN	105.129	12	0.000
ULCMANAPNMEI	**2.871**	**12**	**0.014**
ULCINDAPNMEI	3.439	12	0.005
ULCFBSAPNMEI	5.013	12	0.000
ULCCONAPNMEI	5.013	12	0.000
ULCBXAAPNMEI	6.554	12	0.000
TLHRS	20.662	12	0.000
TLCMF	159.717	12	0.000

(Continued)

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Appendix B. (*Continued*)

	Test value = 0		
	t	*Df*	Sig. (2-tailed)
GDPR	561.736	12	0.000
GDPH	48.386	12	0.000
GDPE	637.139	12	0.000
GDPC	497.832	12	0.000
GDPRAPSMEI	3.538	12	0.004
GDPNADSMEI	143.492	12	0.000
GDPDEFAISMEI	40.828	12	0.000
PROMANAISMEI	103.948	12	0.000
PROINDAISMEI	84.642	12	0.000
PROCONAISMEI	48.662	12	0.000
LFPRNA	662.888	12	0.000
OTPT	104.298	12	0.000
IMPORTADSMEI	16.312	12	0.000
EXPORTADSMEI	16.515	12	0.000
GFCEADSMEI	14.497	12	0.000
PFCEADSMEI	22.057	12	0.000
PESANA	145.002	12	0.000
PEMANA	29.826	12	0.000
PEFANA	20.463	12	0.000
PEDANA	40.136	12	0.000
EPP	250.828	12	0.000
EMPTOTQPSMEI	120.404	12	0.000
AHWEP	1907.345	12	0.000
CPIALLAINMEI	47.877	12	0.000
PPDMAINMEI	35.642	12	0.000
CPISXHAINMEI	24.496	12	0.000
CPIFODAINMEI	31.595	12	0.000
CPIENGAINMEI	14.094	12	0.000
CPICORAINMEI	67.477	12	0.000
CINSADSMEI	3.125	12	0.009
FAEEFNGBA	212.974	12	0.000
CUAEEFGBA	−7.376	12	0.000
CANEEFGBA	121.588	12	0.000
DEBTTLGBA	14.372	12	0.000
CASHBLGBA	−2.473	12	0.029
TRESEGGBM	419.383	12	0.000
GFCFADSMEI	23.362	12	0.000
FXUS	35.058	12	0.000
SARTAISMEI	27.581	12	0.000

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