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GDP Growth and National Index Returns in Seven European Economies

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ABSTRACT

In this investigation a model is constructed in order to determine whether there exists a correlation between GDP growth in a given European nation and national stock index growth in that same European nation. The model investigates three potential cases: a correlation between GDP growth and national stock index growth in the same quarter, a correlation between GDP growth and national stock index growth in the following quarter and a correlation between GDP growth and national stock index growth in the two quarters later. This is done by inputting % GDP growth per quarter as the X-variable and national stock index log growth as the Y-variable. 7 countries were used in the model and the data points used spanned from Q1 of 2000 to Q4 of 2025. Panel Linear Regression Models were also constructed up to a 5 Quarter delay, including all nations in one model using dummy variables. In the single country models, the investigation finds that there exists no statistically significant correlation between the two variables, except in the panel models and this is likely down to the number of external variables which influence index returns separately from GDP growth and economic prosperity in a given nation. The panel models suggest a statistically significant correlation at a 2-3 quarter delay, but the weakness of this correlation indicates that it likely has little to no economic or practical importance.

INTRODUCTION

It is often argued that national stock indexes are a good indicator of whether or not a nation is thriving economically. While GDP growth often offers a delayed insight into economic growth, with values being altered, adjusted and revised for a significant period after their initial release, stock market growth reflects immediate changes in economic environment and investor sentiment, arguably giving a day to day representation of the economic situation in a nation and allowing for immediate policy and rate changes to be implemented based on immediate feedback, rather than delayed information (in the form of GDP).

Because of this, it is not unreasonable to suggest that it is likely for there to be a correlation between finalised and accurate GDP growth statistics and the relevant national index growth data looking back over the last 25 years in Europe. The expected result is that a correlation does exist between the two input variables used in the model. If a correlation does exist, it suggests that strong GDP growth will result in

national index growth, allowing investors to benefit from such a correlation and also further representing to foreign investors that GDP growth is a good representation of the economic state of a nation as a whole, giving them more confidence to directly invest in a nation with only GDP growth as an indicator of economic strength.

However, factors like inter-national trade and regulation could have an impact on this potential correlation and they will be considered in conjunction with the results of the investigation later in the paper.

The null hypothesis for this investigation is that no statistically significant correlation exists between GDP growth and national index returns, and the alternative hypothesis is that a statistically significant correlation does exist.

WHY MIGHT A CORRELATION BE EXPECTED?

The aim of this investigation is to determine whether a correlation exists between the two variables of GDP Growth and national index returns, where GDP growth in the x/independent variable in the investigation.

It is expected that a correlation exists for the following reasons:
Increased GDP growth typically indicates that consumer spending, average household income and business expansion/development have all also increased. This has two major effects on the stock market which are likely to lead to national index prices rising. The first is that the increases in these statistics are likely to simultaneously lead to an increase in corporate earnings and more corporations beating their earnings expectations, boosting prices on the stock market. This change (alongside the general boost in confidence in a nation GDP growth typically creates) will also inevitably raise investor confidence in corporations within a nation, meaning the access to corporate financing, foreign investment and a general improvement in morale and confidence within a corporation will also increase, raising share price.

Looking to a more long-term growth avenue, increasing GDP growth and a continuing stable economic environment within a nation leads to better political stability, lower unemployment (in most cases) and greater public investment into infrastructure, education and public services more generally. This creates a more suitable environment for strong economic and corporate growth and will allow corporations to maximise their earnings and share prices, also causing an increase in national index valuations.

Finally, positive GDP growth will more generally lead to a more confident and well-funded economic environment within a nation due to the growth in foreign investor confidence and general improvement in the morale of citizens in a nation due to the increase in disposable income and political stability which typically follows it. All of these factors with contribute to further strong economic and stock market growth, leading to an increase in national index valuations.

LITERATURE REVIEW

To preface this review, many of the investigations found/considered in the review examine the variables in reverse. This means their relevance to this investigation may be limited as the symmetricality of the models used is unknown, although their results still provide valuable insights into what may be expected to be found from this investigation.

Following an in-depth review of publicly available literature on this subject, limited directly comparable literature was identified that directly investigates a correlation of this sort, where GDP growth is taken as the independent variable and national index growth as the dependent variable in the linear regression model. Regardless, several papers discussing methodologically similar investigations, or in nations not considered in this investigation, were found and will now be considered and used to contextualise the results found above.

First, consider the papers that evaluate these variables in the reverse direction, using the national index growth (or in the case of the papers, more general stock market growth) as the independent variable and GDP growth as the dependent variable. In Nazir, Nawaz and Gilani's investigation into the *Relationship between economic growth and stock market development*[1], they are able to conclude economic growth in a given nation can be obtained by growing the stock markets of said country. While this conclusion does not directly influence or shed light on the conclusion reached in this investigation, it does suggest that there exists a correlation between stock growth and economic growth, which in this investigation was quantified using GDP growth, where stock market growth is the influencing variable. This contradicts the assumption made in this investigation, where GDP growth was assumed to be the deciding variable, and ultimately does align with the conclusion reached here that GDP movement in a nation has little impact on the stock market (i.e. national index) growth in that country.

Patatoukas' paper *Stock Market Returns and GDP News*[2] discusses something more directly comparable to the methodology employed. With GDP growth forecast surprises as the independent variable and stock returns as the dependent, we see this investigation mirrors the GDP growth and national index return variables used in this investigation much more closely. Patatoukas concludes that univariate association between the variables is 'indistinguishable from 0', mirroring closely the conclusion reached here that GDP growth and GDP-related factors have little connection to stock market (and by extension national index returns), supporting the findings of this investigation.

V. Vithalbhai also carried out an investigation very similar to this one in a different geographic location, investigating the *Impact of Gross Domestic Products (GDP) on Stock Market Movement in India*[3]. Using GDP as the independent variables and the stock market movement as the dependent variable, Vasani looked to determine whether there existed a correlation between the two variables in India. This particular

[1] (Sajid Nazir, Musarat Nawaz and Gilani, 2010)
[2] (Patatoukas, 2020)
[3] (Vasani, 2020)

study finds that there does in fact exist a correlation between GDP fluctuation and stock market movement, and this is likely due first to the fact that the investigation considers an entire stock market, rather than a national index, and that it is done in India rather than Europe, which is arguably a country still in its economic development phase when compared to countries considered in this analysis, which may also have contributed to a stronger correlation existing.

Fichtner and Joebges carried out a similar investigation into the 'relationship between stock indices and real economic activity' in their paper *Stock Market Returns and GDP Growth*[4]. They investigate the asymmetric effects of stock increases and decreases, among other factors listed in the paper, on GDP Growth. Given the broader range of factors they are able to simultaneously consider it is likely that some small correlation exists when compared to this investigation, but they too conclude that in the short-term correlations are insignificant, and a rather unstable correlation emerges in longer time periods (2-3 years), reflecting closely the conclusion that was reached in this investigation.

Ball and French's paper *Exploring what stock markets tell us about GDP in theory and practice*[5], which investigate the correlation between US GDP and the US Stock Market (using the S&P 500 as a representation of this, as was done in this investigation) by utilising a variety of modelling techniques, including regression models. They conclude that there does exist a weak correlation between the two variables in the case of the US, which, although is not directly analogous to the conclusion reached here, nevertheless suggests that this investigation may be correct in saying that a correlation does not exist in Europe as the weak correlation observed may be unique to the USA, a nation with a materially distinct economic environment when compared to the 7 countries considered in the European-focused model constructed in this investigation.

Olufisayo and Enisan[6] conducted a similar investigation, taking evidence/statistics from seven sub-saharan african nations which looked at the relationship between stock market development and economic growth in these nations. Overall, while the paper does use a slightly different analytical method to the one employed in this investigation, the researchers conclude that 'there is weak evidence of growth-led finance using market size as an indicator of stock market development'. This conclusion largely aligns with the one reached later in this paper, suggesting the conclusion reached is an adequate and supported one.

Alajekwu and Achugbu's paper 'The Role of Stock Market Development on Economic Growth in Nigeria: A Time Series Analysis'[7] also provides a valuable insight into an investigation similar to the one done in this paper. This particular paper investigated the relationship between 'stock market development indices and economic growth'. This investigation also ultimately resulted in a weak/negative correlation emerging in value traded ratios and market capitalization, which align closely with index prices, further

[4] (Fichtner and Joebges, 2024)
[5] (Ball and French, 2021)
[6] (Enisan and Olufisayo, 2009)
[7] (Alajekwu and Achugbu, 2012)

indicating that the conclusion reached in the investigation in this paper holds within further areas of investigation in other nations with differing economic environments.

DATA

All data for GDP growth was taken from the St Louis Federal Reserve Database (seasonally adjusted). All national index data was taken from Stooq.

Following the conversion of GDP Growth data to % growth and national index returns to log returns, both sets of data were tested for stationarity in order to ensure that a spurious regression is not found, which would indicate a correlation when one does not truly exist. Due to the limitations of the modelling software used a full Augmented Dickey-Fuller test was not available to be run, but it was approximated by running a second regression model which regressed the first difference of each series (Q(X) - Q(X-1)) on its lagged level (Q(X-1)). A Significance F of less than 0.05, paired with a negative X-variable coefficient, would indicate the data is stationary.

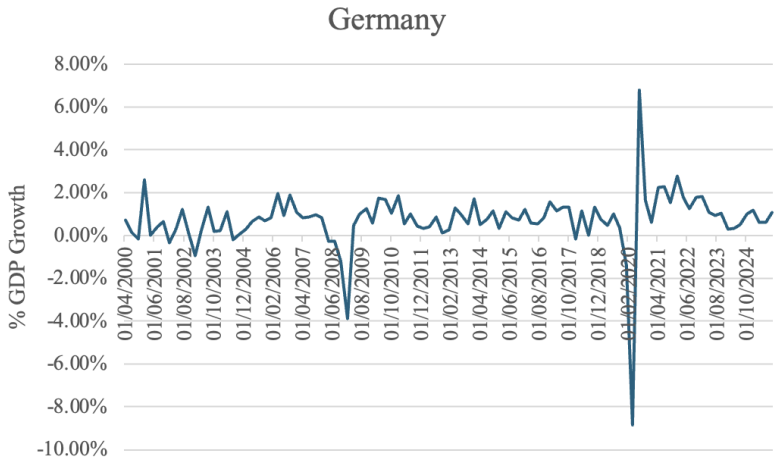
The following values were obtained for the Dickey-Fuller Test Approximation model, showing the series are in fact stationary by the parameters defined above:

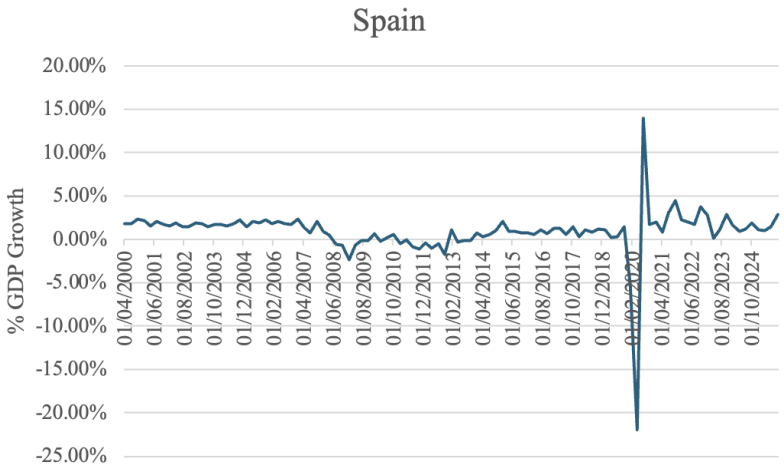
Country	Significance F	X-variable Coefficient
Germany % GDP Growth	0.0000000000000000093	-1.04
Spain % GDP Growth	0.000000000000000012	-1.08
France % GDP Growth	0.0000000000000000015	-1.11
Italy % GDP Growth	0.000000000000000021	-1.02
UK % GDP Growth	0.00000000000000000000069	-1.20
Finland % GDP Growth	0.0000000000000073	-0.90
Netherlands % GDP Growth	0.00000000000000016	-0.98
Germany (DAX) Log Return	0.0000000000000000090	-1.04
Spain (IBEX 35) Log Return	0.00000000000000077	-0.94
France (CAC 40) Log Return	0.000000000000000032	-1.01
Italy (FTSE MIB) Log Return	0.000000000000014	-0.89

UK (FTSE 250) Log Return	0.00000000000000040	-0.97
Finland (OMXH25) Log Return	0.000000000000000067	-1.00
Netherlands (AEX) Log Return	0.000000000000013	-0.89

Given the series are stationary, see below graphs of % GDP growth quarter on quarter and quarter on quarter national index log returns for each of the 7 countries considered. Note the UK was included in the analysis as, even though it is not an EU member state, it was a member for a large proportion of the data examined and it is still subject to a similar environment to the other EU member states examined. Also note the covid spike was not removed from the data as if GDP growth is to provide an accurate representation of index movement then the correlation would ideally hold even in periods of intense economic distress, such as during Covid-19.

Percent GDP Growth




Spain
% GDP Growth
20.00%
15.00%
10.00%
5.00%
0.00%
-5.00%
-10.00%
-15.00%
-20.00%
-25.00%
01/04/2000
01/06/2001
01/08/2002
01/10/2003
01/12/2004
01/02/2006
01/04/2007
01/06/2008
01/08/2009
01/10/2010
01/12/2011
01/02/2013
01/04/2014
01/06/2015
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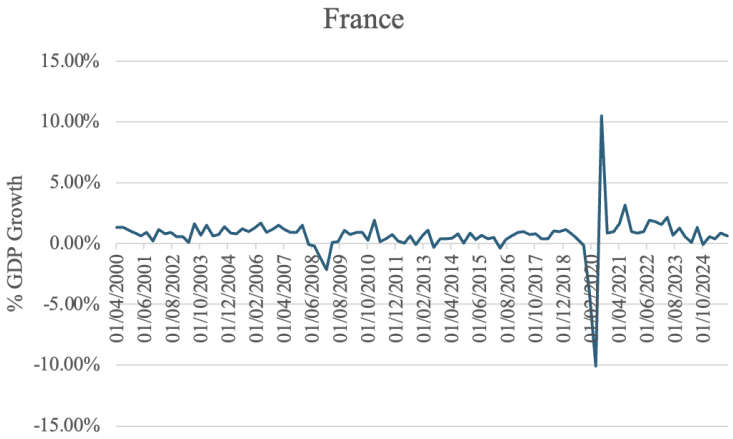
01/10/2024


France
% GDP Growth
15.00%
10.00%
5.00%
0.00%
-5.00%
-10.00%
-15.00%
01/04/2000
01/06/2001
01/08/2002
01/10/2003
01/12/2004
01/02/2006
01/04/2007
01/06/2008
01/08/2009
01/10/2010
01/12/2011
01/02/2013
01/04/2014
01/06/2015
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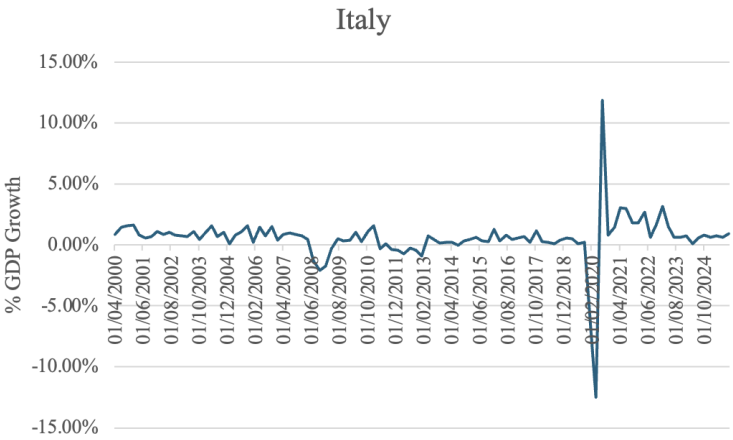
01/08/2023
01/10/2024


Italy
% GDP Growth
15.00%
10.00%
5.00%
0.00%
-5.00%
-10.00%
-15.00%
01/04/2000
01/06/2001
01/08/2002
01/10/2003
01/12/2004
01/02/2006
01/04/2007
01/06/2008
01/08/2009
01/10/2010
01/12/2011
01/02/2013
01/04/2014
01/06/2015
01/08/2016
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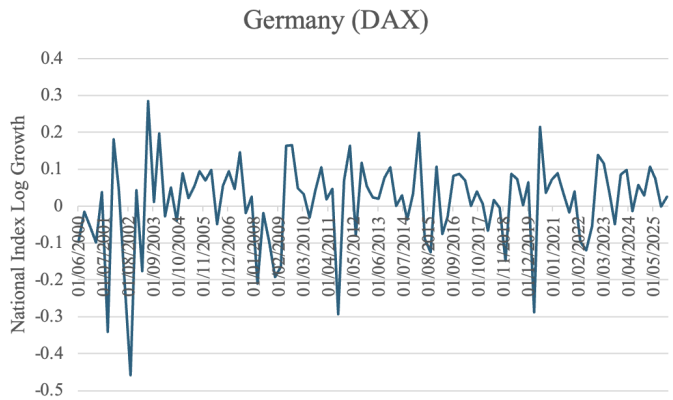
01/06/2022
01/08/2023
01/10/2024

Index Log Returns


Germany (DAX)
National Index Log Growth
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
01/06/2000
01/09/2003
01/10/2004
01/11/2005
01/12/2006
01/03/2010
01/04/2011
01/05/2012
01/06/2013
01/07/2014
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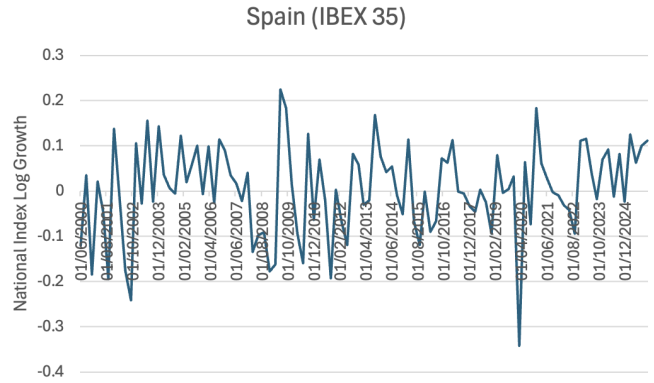
01/05/2025


Spain (IBEX 35)
National Index Log Growth
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
01/06/2000
01/12/2003
01/02/2005
01/04/2006
01/06/2007
01/10/2009
01/04/2013
01/06/2014
01/10/2016
01/12/2017
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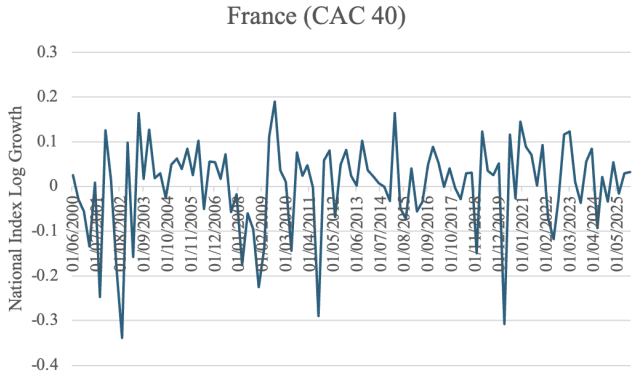
01/10/2023
01/12/2024


France (CAC 40)
National Index Log Growth
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
01/06/2000
01/09/2003
01/10/2004
01/11/2005
01/12/2006
01/03/2010
01/04/2011
01/05/2012
01/06/2013
01/07/2014
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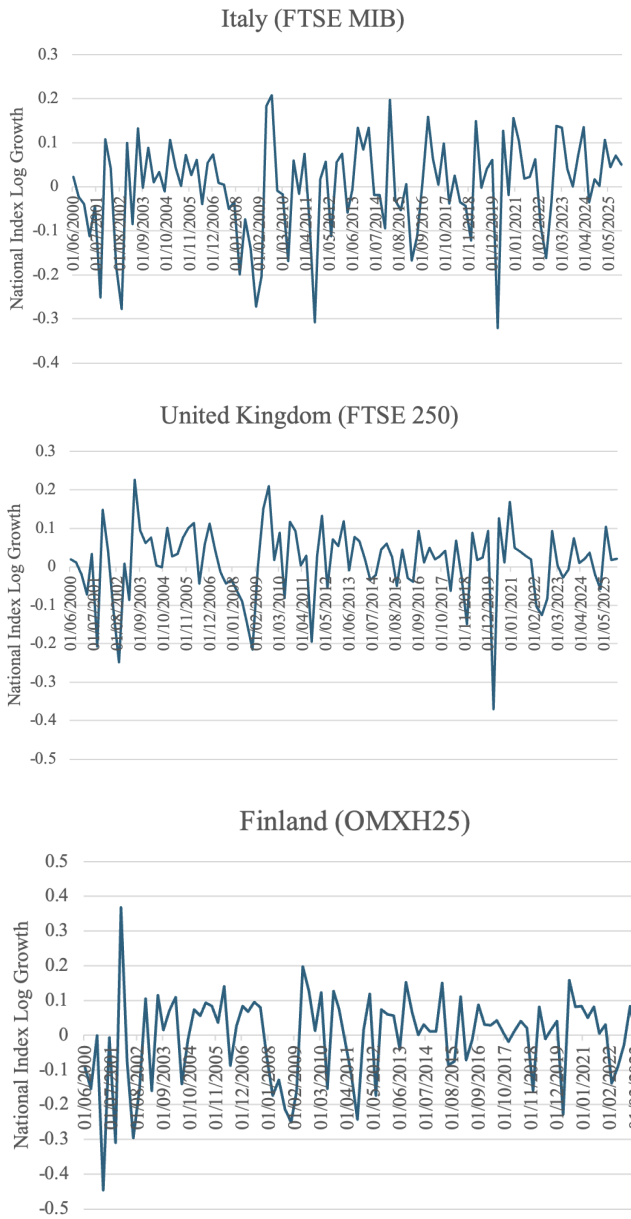
01/04/2024
01/05/2025



MODEL STRUCTURE

Once raw GDP data and national index closing prices were obtained, the data was processed to remove any factors such as currency or scale factor from data sources. This was done by converting GDP growth to a % change and calculating the Log Value of national index returns. From here, 3 regression models were run for each case.

The first was a time series regression, where the X-input was the GDP % growth in Quarter X and the Y-input was the Index Log Return also in Quarter X. The second was a forward looking regression with a one quarter delay, where a similar regression was run in which Index log returns in quarter X were used as the Y-input and the X-input was GDP % Growth in Quarter (X-1). The final regression was a 2 quarter delay forward looking model, where log returns in Quarter X were compared with % GDP growth in Quarter (X-2).[8]

The models above give a picture of whether a correlation exists for individual nations, which is useful to determine if certain countries behave in particularly different ways to others, and these results will be considered thoroughly in the results section. From here, in order to determine more broadly whether a correlation exists in general between GDP Growth and national index returns, 6 panel regression models were run in order to allow the question to be examined more broadly. Models were run in a similar fashion to above, with each model having a differing amount of lag between GDP growth and index return figures, spanning from a time series regression (GDP growth in Q(X) with index returns in Q(X)) to a 5 quarter delay model (GDP growth in Q(X-5) with index returns in Q(X)), with every model in between having a 1 quarter increase in comparison delay. The models were constructed with 6 dummy variables, with the Netherlands being arbitrarily assigned as the reference country in order to avoid the dummy variable trap. These models then returned an overall picture of whether a correlation exists in any case, and the results of this are discussed in detail below.

RESULTS

From the regression models above, the following results were obtained for each case.
Time Series Regression Model:

Country	Multiple R	R^2	Significance F	X-variable Coefficient
Germany	0.0152	0.0002	0.8785	-0.1268
Spain	0.0591	0.0035	0.5534	0.2036
France	0.0513	0.0026	0.6068	0.3089
Italy	0.0829	0.0069	0.4050	0.4482
United Kingdom	0.0153	0.0002	0.8777	-0.0655
Finland	0.0319	0.0010	0.7494	-0.2935
Netherlands	0.0925	0.0086	0.3527	-0.6534

[8] Note that all regression modelling was done in excel with the excel regression modelling software.

1 Quarter Delayed Regression Model:

Country	Multiple R	R^2	Significance F	X-variable Coefficient
Germany	0.0384	0.0015	0.7017	0.3180
Spain	0.1336	0.0178	0.1807	0.4579
France	0.1150	0.0132	0.2496	0.6924
Italy	0.0890	0.0079	0.3737	0.4811
United Kingdom	0.0256	0.0007	0.7987	0.1092
Finland	0.1776	0.0315	0.0741	-1.6323
Netherlands	0.0077	0.0001	0.9384	0.0547

2 Quarter Delayed Regression Model:

Country	Multiple R	R^2	Significance F	X-variable Coefficient
Germany	0.1157	0.0134	0.2492	-0.9587
Spain	0.0940	0.0088	0.3499	-0.3221
France	0.1044	0.0109	0.2986	-0.6283
Italy	0.0984	0.0097	0.3276	-0.5317
United Kingdom	0.1569	0.0246	0.1171	-0.6702
Finland	0.1395	0.0195	0.1641	-1.2721
Netherlands	0.1507	0.0227	0.1326	-1.0641

Panel Regression Models:

Delay	Multiple R	R^2	Significance F	% GDP	% GDP

				Growth Coefficient	Growth P-value
Time Series	0.0506	0.0026	0.9683	0.0762	0.7135
1 Quarter	0.0655	0.0043	0.8807	0.2392	0.2507
2 Quarter	0.1222	0.0149	0.1595	0.0096	0.0027
3 Quarter	0.1270	0.0161	0.1267	-0.6491	0.0019
4 Quarter	0.0827	0.0068	0.6947	0.0090	0.0642
5 Quarter	0.0416	0.0017	0.9913	0.0055	0.8614

DISCUSSION

The results are assessed first by considering each case individually.
In the time series regression, where GDP % growth in Q(x) was modelled against national index log returns in the same quarter, every calculated multiple R value for the regression is less than 0.1, and the R^2 values are accordingly small. This immediately leads us to the conclusion that there is likely no statistically significant relationship between the two input variables. The Significance F, or in other words the overall P-value for the model, is consistently significantly greater than 0.05, again leading to the conclusion that the model finds little to no statistical correlation between the two input variables. The fluctuating nature of the X-variable coefficients (not only in magnitude, but also concerning whether they exhibit as positive or negative correlation) further indicates that the two input variables hold no statistical significance to each-other.

In both the 1 quarter delayed regression model, where GDP % growth in Q(x) was modelled against national index log returns in Q(x+1), and 2 quarter delayed regression model (Q(x) vs Q(x+2)), similar results to those described above can be observed. Multiple R and R^2 values consistently indicate little to no statistically significant correlation existing, tending regularly towards 0 rather than 1 or -1, and Significance F values remain well above 0.1[9]. X-variable coefficients still vary widely and these results solidify the conclusion reached previously that the two input variables into the various regression models hold little to no statistical significance to one another.

[9] Finland in the 1 quarter regression model is the exception to this with a significance F value of 0.07, which is still too high to suggest a strong amount of statistical significance but is considerably lower than the corresponding values for other nations. However, given that 20 out of 21 cases considered do not display any form of statistically significant correlation, this value is likely a coincidence in Finland's case and does not skew the overall conclusion reached.

However, although a significant correlation does not emerge due to the time delays in % GDP growth and national index log returns, the results of the regression model do seem to improve as the delays are implemented. The average R^2 value increases from 0.0033 in the time series regression to 0.0157 in the 2 quarter delayed regression and the average Significance F value decreases from 0.63 in the first model to 0.23 in the 2 quarter delayed model. While these values do not suggest a statistical correlation of any reasonable form, they do suggest that the two input variables are becoming more correlated as the time delay increases. The panel regression models, which explore greater delays for correlation, shed light on this idea and also further illustrate the seeming lack of correlation between % GDP Growth and national index log returns.

As can be seen in the results section above, the Multiple R and R^2 values for the panel regression models are consistently close to 0, similar to the values seen in the individual country models discussed previously. The Significance F values are similarly disappointing, with most of the values being greater than 0.1. However, it is clear that the correlation improves as delay increases, up to a certain point. The Significance F and % GDP Growth P-value consistently decrease up to a 3 quarter lag (they then increase again after this point). The 2 and 3 quarter delay models return a statistically significant % GDP Growth P-value (well below 0.05), meaning that in those cases H0 could, in theory, be rejected. However, the R^2 values which accompany is of 0.0149 and 0.0161 indicate that, while the correlation may be statistically significant it is weak overall and very little of the variation in national index returns is explained by GDP movement, indicating that while a statistically significant correlation may exist it is likely of negligible economic and practical significance.

The lack of correlation found is likely due to the high-level of globalisation typically seen in companies that are included within indexes. Particularly in developed nations where international trade and cross-border operations are commonplace, the influence that the economic situation in other nations would likely have on the index returns would potentially counter-act any influence GDP has on the returns. Additionally, national indexes, particular smaller indexes such as the IBEX 35, are not always fully representative of a domestic economy. This means that fluctuations in GDP, which are often far more representative of the domestic economy, may not be fully transmitted into national index returns as the index structure is often not representative of the domestic economy, weighting some sectors more than others.

If this were found to be true and a lengthened delay did result in a stronger or statistically significant correlation being observed, it would likely arise either due to GDP and company earnings revisions following initial release, which often take 2-3 months to be priced into stock prices, and improved investor sentiment following consistently strong GDP growth, which again takes time to be priced into index movement.

CONCLUSION

The investigation finds that there does not exist any significant correlation between GDP growth and national index returns in the 7 countries considered in the model, even when national index returns are delayed to allow for GDP growth to take effect. Notably, the panel regression models with 2 and 3 quarter delay return % GDP Growth coefficient p-values below 0.05, meaning H0 is formally rejected, though the negligible R^2 values indicate that no meaningful practical relationship exists. However, the seeming improvement in correlation strength, regardless of the minimal improvement in R^2 values, seen in the improvement in the GDP Growth coefficient p-values (particularly in the panel regression models) suggests that a correlation may exist in some other fashion or different delay periods, and this would be an interesting avenue for future research. The model has various limitations as it is made up of a linear regression model, including a heightened sensitivity to outlier data points. While the Covid-19 caused fluctuations in GDP and index returns were included as correlation would be expected to exist even in times of economic crisis, this may have skewed the model's predictions and there is a possibility that a stronger correlation would be observed without the Covid-19 outlier data points.

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