National GDP Growth and Changes of Stock Market Indices

Evidence from France, Germany, Great Britain and Japan

Daniel Limberg
Lukas Mueller

11 Mai 2016

Abstract

Using data from Germany, Japan, Great Britain and France we provide an analysis of the effect of national GDP Growth on changes of national stock market indices. Controling for various covariates we find that for Great Britain and France GDP growth has statistically significant effects on the FTSE100 and the CAC40.

Contents

1 Introduction

In this paper, we investigate an odd relation: GDP growth and national equity prices; that is national stock indices. The intuitive assumption that one has automatically is fairly straight forward: The better the economy performs, the higher expectations of market participants, investments and trust in the future. In turn, we should - naturally - obtain an increase the level of national stock market indices. However, the more interesting question is beyond this intuitive assumption:
Focusing on four OECD countries (Germany, France, Great Britain and Japan) we investigate on the question whether there are different levels of statistical significance for the effect of GDP growth on equity prices. Note that we do not compare the size of the effects (i.e. coefficients) since we investigate on different dependent variables. Rather, we compare the statistical significance across the four countries of interest. For equity prices, we take the four major national stock market indices of the countries as our dependent variable: The CAC40 (France), DAX (Germany), FTSE100 (Great Britain) and the NIKKEI (Japan). We control for a row of other, lagged explanatory determinants - not only from within the national economy (e.g. unemployment rate) but also external, more global factors (e.g. oil prices). We elaborate on the specific covariates below. For our analysis we focus on the time period between the second quarter of 1999 (where ECB interest rates became relevant) and fourth quarter of 2015.

The rest of this paper is structured as follows:

2 Literature Review

We would like to provide a two-step literature review. In the first part we summarize general findings of the field regarding national indices: What are determinants that ought to be influential on the level of National Indices? In the second, more narrow step, we focus on the relationsship between GDP growth and national indices: Did previous studies find a relationship after all? Were causal assumptions confirmed?

2.1 National Indices

Dimson et al. provide a solid and helpful introduction to the subject[1] with a focus on world's stock markets and the question of returns (Dimson, Marsh, and Staunton 2009). The field provides a tremendous amount of research on the question what influences stock markets in general and national indices in specific. Work includes research on herding effects in advanced (Chiang and Zheng 2010), Chinese (Tan et al. 2008) or Japanese stock markets (Chang and Dong 2006).
Other scholars aim to predict the direction of indices via neural networks - as an attempt to go beyond traditional (non-)linear models. Examples of this stream of research include the work of Guresen et al. (Guresen, Kayakutlu, and Daim 2011) or a study of the Istanbul stock exchange index (Kara, Boyacioglu, and Baykan 2011). Other authors investigate the effect of the media (Tetlock 2007) or even the weather on stock markets (Symeonidis, Daskalakis, and Markellos 2010, Kang et al. (2010), Yoon and Kang (2009), Goetzmann and Zhu (2005), Cao and Wei (2005)).
Contagion and spill-over effects are also of interest for the field. Boyer et al. provide empirical evidence that stock market crises are spread globally through asset holdings of international investors. The more open (i.e. accessible) the stock markets, the higher the co-movements, they find (Boyer, Kumagai, and Yuan 2006). Kenourgios et al. conclude very similar. (Kenourgios, Samitas, and Paltalidis 2011). Furthermore, the field moved on to insights from behavioral economics. Bollen et al. provide an interesting piece of work and find correlations between what they call the *twitter mood* and the Dow Jones Industrial Average over time (Bollen, Mao, and Zeng 2011). The work of Zhang et al. (Zhang, Fuehres, and Gloor 2011) and Si et al. (Si et al. 2013) follow a similar approach and find identical results.

[1] The work of Dimson et al. was regularly updated. The 2009 edition is the most recent version available

2.2 GDP Development and National Indices

The field provides various studies focusing on the relationship between GDP growth (or macroeconomic determinants of GDP growth) and stock markets in general. For example, Claessens et al. "study how local stock market development and internationalization listing, trading, and capital raising in international exchanges are related to economic fundamentals" (Claessens, Klingebiel, and Schmukler 2006). Duca states that there is a clear co-movement between stock market prices and GDP in developed economies. Assuming causal effects he finds that "the level of economic activity in a country can potentially depend on the stock market amongst other variables" (Duca 2007). On the other hand, Ritter finds that cross-country correlation of real stock returns and per capita GDP growth over 1900-2002 is negative. This is mainly traced back to the fact that increases in capital and labor inputs (i.e. two main determinants of GDP growth) in new corporations (i.e. representing innovation) do not necessarily imply higher dividends (Ritter 2005).

For 42 emerging markets Yartey examines the effect of institutional and macroeconomic determinants on stock market developments (Yartey 2008). Similar studies focus on these determinants for a wide range of countries. These include OECD countries like Belgium (Van Nieuwerburgh, Buelens, and Cuyvers 2006), France (Sraer and Thesmar 2007), Germany (Antonios 2010) or New Zealand from 1990 to 2003 (Diebold and Yilmaz 2008). And developing markets such as Malaysia (Rahman, Sidek, and Tafri 2009) or BRICS-countries like India (Singh 2010, Agrawalla and Tuteja (2007)) and South Africa (Hsing 2011) in general.

3 Research Question and Hypothesis

Do changes in GDP growth lead to changes in the country's national stock market index?

- H_0: There are statistically significant effects of GDP growth on the growth rates of a country's stock market index.
- H_1: There are no statistically significant effects of GDP growth on the growth rates of a country's stock market index.

4 Data and Variables of Interest

In the following we introduce our variables of interest and briefly summarize how they fit our purpose. All variables were collected (or aggregated from our side) on a quarterly basis.

Variables	Number	Origin of Data	Time Range
Dependent Variables	4	Yahoo Finance	Quarter 2 1999 - Q4 2015
Covariates	6	ECB, OECD	Q2 1999 - Q4 2015

4.1 Dependent Variables

We use data from Yahoo Finance to derive four dependent variables. We are interested in equity prices in the form of national stock market indices for four OECD countries: France, Germany, Great Britain and Japan. The indices measure the combined stock values of companies and/or equities in a country which are top performing according to given benchmarks. We measure the dependent variables as the change of the the average closing value from the previous quarter. In other words, we are not interested in the *level* but rather in the *variation* of the indices over time.

Dependent Variables	Official Title	Scope
CAC40 (France)	Cotation AssistÃ© en Continu 40	40 highest Market Caps
DAX (Germany)	Deutscher Aktienindex	30 major Companies
FTSE100 (Great Britain)	Fin. Times Stock Exchange 100 Index	100 Companies
NIKKEI (Japan)	NIKKEI 225	225 Equities

4.2 Covariates

In the following we control for various covariates. We use a lag of one quarter and another lag of two quarters for all covariates. If not indicated differently, the default for the covariates is a lag of one quarter. For the control variables we differentiate between country-specific and general covariates that apply to all countries. Starting with country-specific covariates (i.e. variables that are unique to France, Germany, Great Britain and France), we use OECD data to derive the three following covariates. Among them is our key independent variable: GDP growth. We also use private consumption and the inflation rate (measured through the CPI) within the countries as additional control variables.

Country-specific Covariates	Measured
GDP growth	% change to previous rate
Consumer price index (CPI)	% change to previous rate
Private consumption	in % of GDP

From the ECB database we use the deposit facility (i.e. interest rate for banks[2] making overnight deposits with the Eurosystem). Quite noticeable is the fact that, since June 2014, the rate is negative. That is, quite counter-intuitive, banks are penalized when making deposits.
Again using OECD data, we also take the quarterly GDP growth rate of the USA as a proxy for the general development of the world economy. The economy of the USA has a profound impact on other national business cycles, and national recessions in the US have sever repercussions across the globe. This was demonstrated again after 2007 when the US subprime mortgage crisis turned into a global recession. Moreover, the West Texas Intermediate (WTI) price changes are taken as an indicator of global economic health and a crucial determinant of economic growth.

Covariates	Measured
ECB deposit facility	% change to previous rate
GDP growth USA	% change to previous rate
WTI	% change to previous rate

At the early stage of research for this paper other covariates were taken into account: the ECB's interest rate on the main refinancing operations (MRO), the unemployment rate for the four countries of interest and the brent crude oil price. However, a first variance inflation factor (vif) test after prelimenary regressions suggested to ignore the mentioned variables.

5 Descriptive Statistics

Before going into our analysis, we now turn to a brief description of our available and cleaned data. **Figure 1** below presents a first overview of the four dependent variables: The % change of the average

[2]We rakishly use the term "banks" for this paper. While "Financial Institutions" would be more appropriate to apply, we dare to continue with "banks" for reasons of simplicity.

closing value of the indices to the previous quarter. The graphs range from the first quarter in 1999 to the last quarter in 2015. Not surprising given the financial crisis, the CAC40, DAX, FTSE100 and NIKKEI share the remarkable downturn in the end of 2008 and in early 2009.

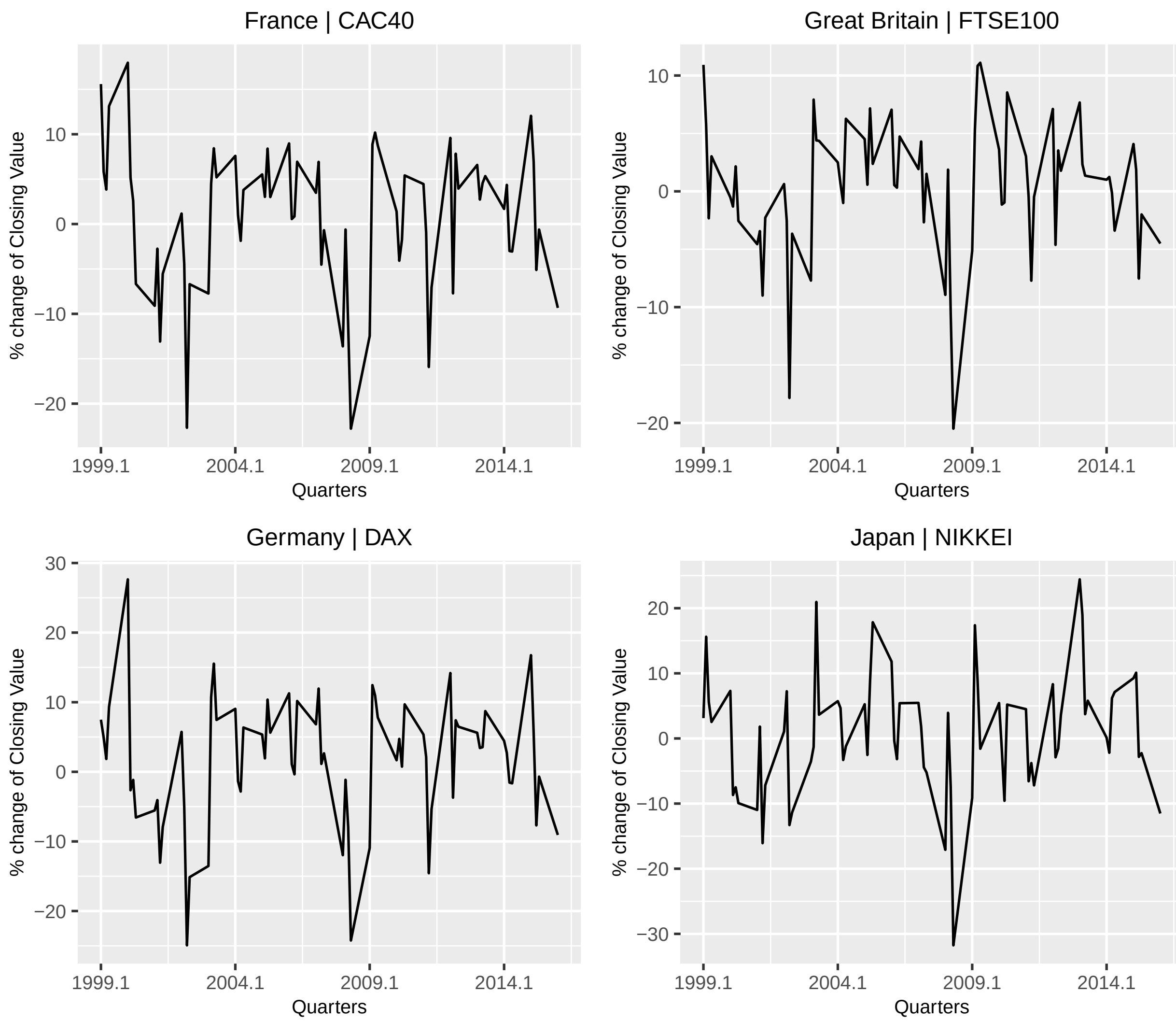


Figure 1: Dependent Variables (Change of National Stock Indices) over time

Another interesting overview is given with **Figure 2** which summarizes the developments of our key independent variables over the same time (i.e. Q2 1999 until Q4 2015). Our country-specific, key independent variables measure GDP growth (i.e. change to previous quarter) for the country in question. Note that below we also plot the graph for the USA: An external factor we assume to be influential on all four national stock indices. Compared to the dependent variables, the key independent variables show a relatively more congruent development. Remarkable is the major, well visible downturn during and in the aftermath of financial crisis in all five graphs.

Figure 3 summarizes the main characteristics for the depent and key indepent variables.

L.DEU.prvconsm 0.176021006763785 L.WTI.dollar.change 1.6 L.Brent.dollar.change 1.85 L.ECB.MRO.change NA

In the next step, **Figure 4** summarizes the frequency distributions of the dependent variables. For now, we assume the variables to be normally distributed. In following research to this assignment we will consider

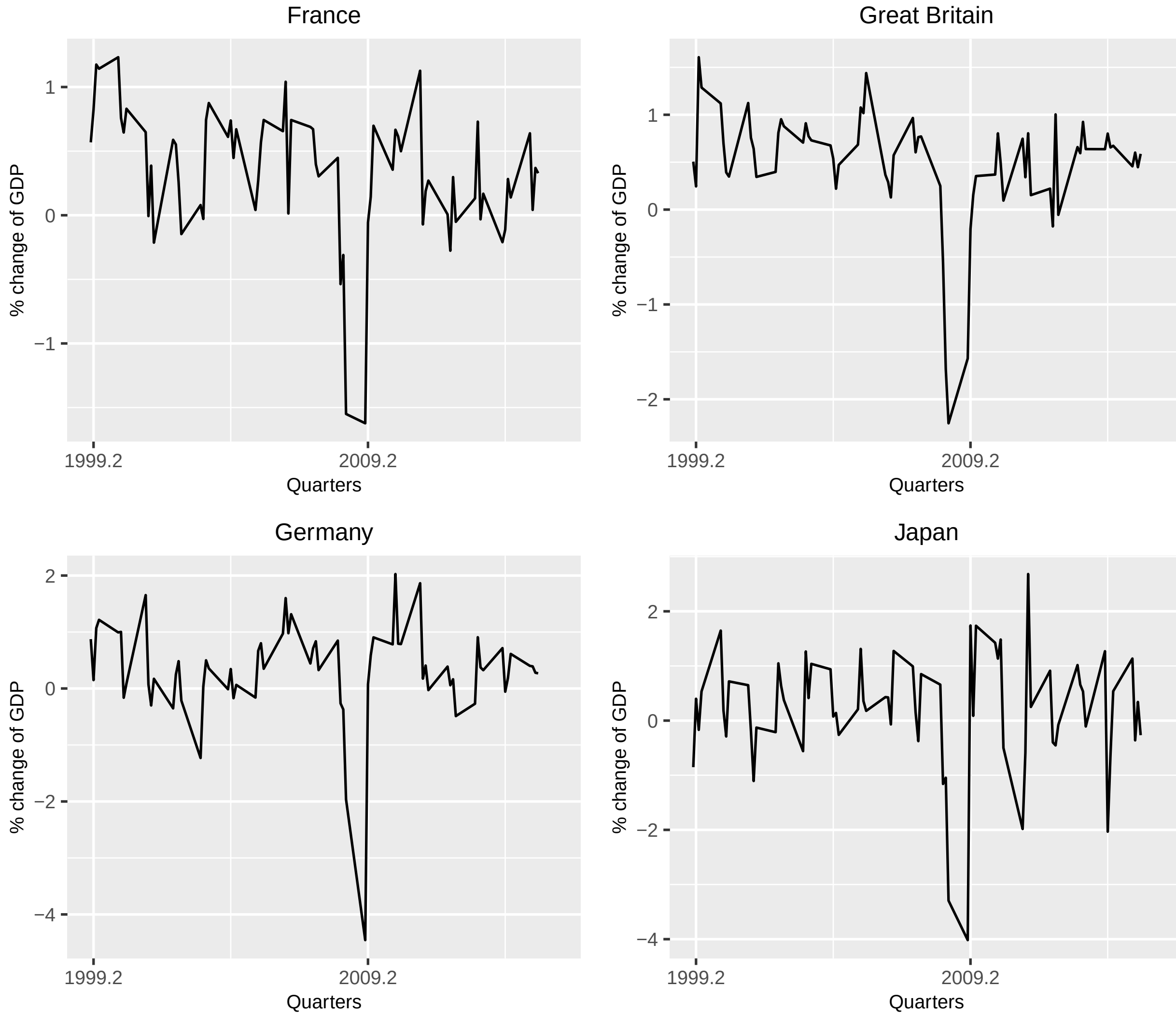


Figure 2: Key Independent Variables (Quarterly GDP growth to previous quarter)

Table 5: Descriptive statistics

Statistic	N	Mean	St. Dev.	Min	Max
CAC40 Average Closing	69	0.6	8.2	−22.8	18.0
DAX Average Closing	69	1.5	9.3	−24.9	27.6
FTSE.Close.change	69	0.3	5.9	−20.5	11.1
NIK.Close.change	69	0.7	9.5	−31.8	24.4
L.FRA.GDP	69	0.3	0.5	−1.6	1.2
L.DEU.GDP	69	0.3	0.9	−4.5	2.0
L.GBR.GDP	69	0.5	0.6	−2.3	1.6
L.JPN.GDP	69	0.2	1.1	−4.0	2.7

log-transformation for the variables.

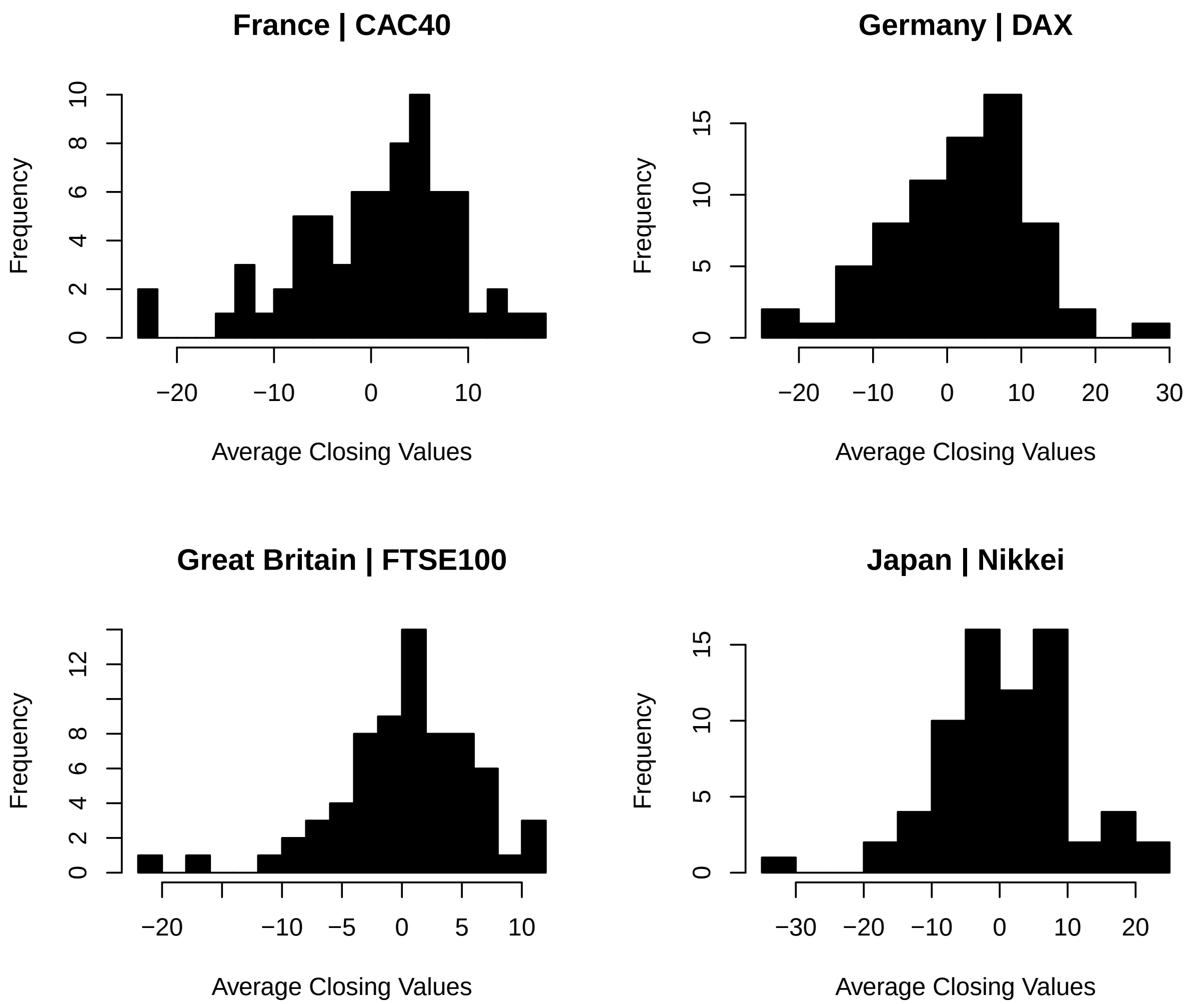


Figure 3: Distribution of Dependent Variables: Average Closing Values

Finally, we obtain the joint distributions between our dependent and key independent variables in **Figure 5**. Remarkable are the trends for a high GDP growth (i.e. over 2%) in the case of Germany and Japan. Here, the intuitive relation between higher GDP growth and a higher level of the index is violated.

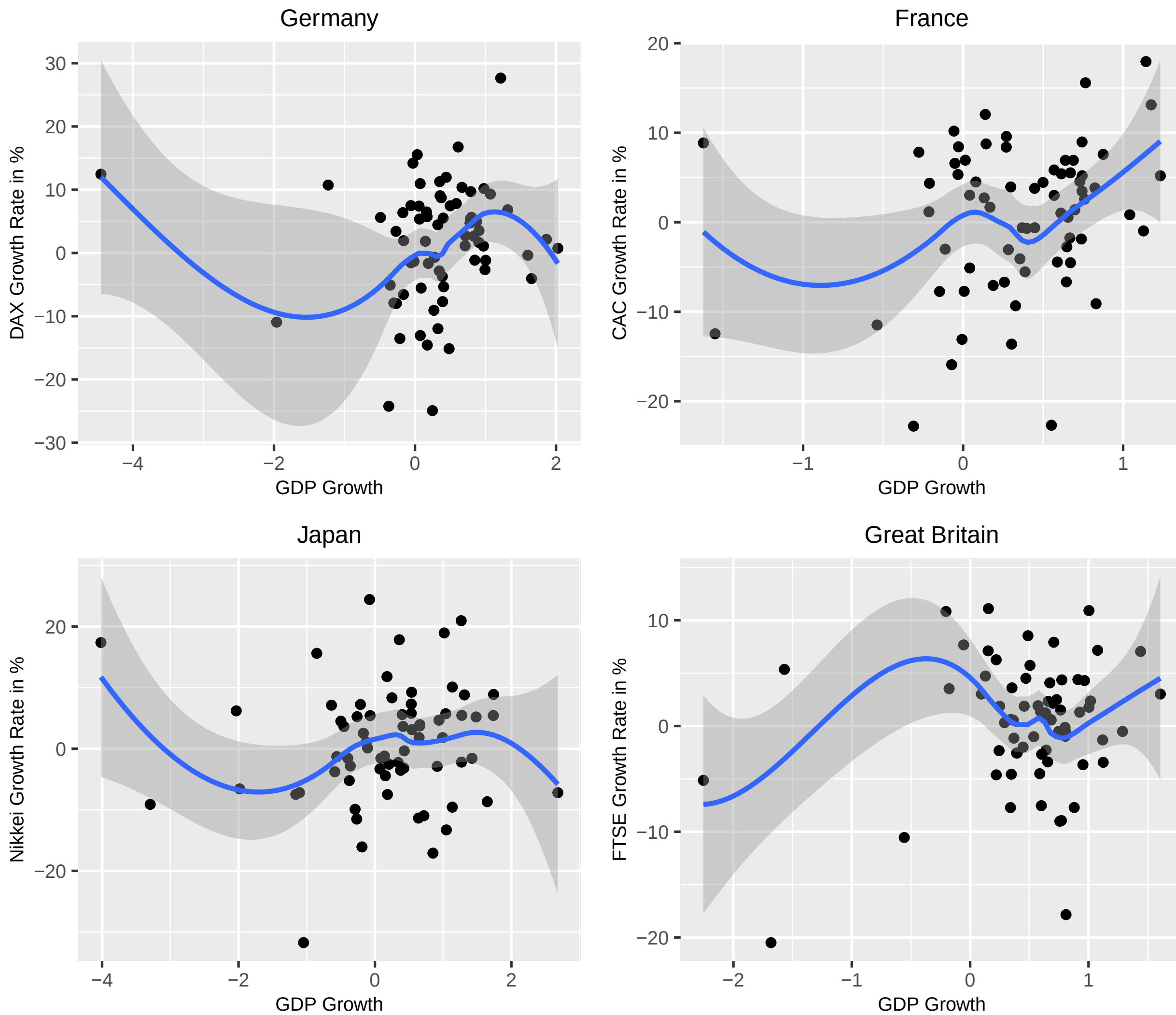


Figure 4: Joint Distributions of DVs and Key IVs

6 Analysis and Discussion of Results

For the analysis section we provide our comprehensive model below. However, before going into the most promising model that we found during our research, we would like to offer a very basic model as a starting point of the analysis. We only regress the change of the four national stock indices on the lagged quaterly GDP growth of the respective country.

Table 6: Basic Model

	Dependent variable:			
	CAC40	DAX	FTSE100	Nikkei
	(1)	(2)	(3)	(4)
France GDP growth	3.921**			
	(1.886)			
Germany GDP growth		0.810		
		(1.312)		
Great Britain GDP growth			1.800	
			(1.128)	
Japan GDP growth				0.516
				(1.075)
Constant	−0.721	1.251	−0.569	0.621
	(1.162)	(1.204)	(0.893)	(1.174)
Observations	69	69	69	69
R^2	0.061	0.006	0.037	0.003
Adjusted R^2	0.047	−0.009	0.022	−0.011
Residual Std. Error (df = 67)	8.029	9.376	5.824	9.601
F Statistic (df = 1; 67)	4.322**	0.381	2.545	0.230
Note:		*p<0.1; **p<0.05; ***p<0.01		

The basic model shows only for France a statistically significant relationship between change in quaterly GDP growth and change in the stock market indice CAC 40. All other coefficients are statisitcally insignificant but show the same positive sign. This result forshadows the significance of the coefficients for lagged quaterly GDP growth in the extended model. The coefficient for France will not change its level of significance when controlling for inflation, private consumption, the Europen Central Bank's deposit facility rate, the change in World Texas Intermediate prices, quaterly US GDP growth, and year factors. The coefficients for Germany, Great Britain, and Japan, however, become weakly statistically significant (at the 10 percent level). This might suggest a certian degree of robustness. It should be kept in mind that the stock indices measure the stock performances of a few selected companies. Thus, the four coefficients should be compared with caution. Looking at a variation of the final model[3] we see the statistical significance of the coefficients for lagged quaterly GDP growth unchanged. Only the coefficient for France increases its statistial significance to the 1 percent level.

Looking at **Table 7** we see that the effect of GDP growth of the previous quarter on national stock indices growth of the current quarter is only statistically significant in the case of France. It is weakly significant (at the 10 percent level) for Germany and Japan. Significance levels for Great Britain do not allow to tell whether the effect is different from zero. The effect of GDP growth becomes insignificant for all countries when lagged by two time periods (i.e. quarters). The effect is always positive which suggests that a healthy growing economy correlates with a growing stock market. That the effect of GDP growth becomes insignificant (standard errors increase relative to the coefficient) when lagged by two periods suggests that the channel of influence between the real and the financial economy is rather immediate.

[3] Appenidx: Table 8

Table 7: Final model

	Dependent variable:			
	CAC40	DAX	FTSE100	NIKKEI
	(1)	(2)	(3)	(4)
France GDP growth	8.020** (3.169)			
France GDP growth (two q. lag)	2.417 (3.468)			
France inflation	−9.222*** (2.823)			
France inflation (two q. lag)	−5.454* (2.945)			
France pr. consumption	−3.528 (2.856)			
France pr. consumption (two q. lag)	1.320 (2.972)			
Germany GDP growth		3.717* (2.011)		
Germany GDP growth (two q. lag)		0.447 (1.815)		
Germany inflation		−9.295* (4.771)		
Germany inflation (two q. lag)		−1.893 (4.869)		
Germany pr. consumption		−2.408 (2.412)		
Germany pr. consumption (two q. lag)		−0.632 (2.441)		
Great Britain GDP growth			1.823 (1.754)	
Great Britain GDP growth (two quarter lag)			2.609 (2.013)	
Great Britain inflation			−3.054 (2.029)	
Great Britain inflation (two q. lag)			−0.892 (1.901)	
Great Britain pr. consumption			0.115 (1.389)	
Great Britain pr. consumption (two q. lag)			1.245 (1.397)	
Japan GDP growth				3.731* (2.073)
Japan GDP growth (two q. lag)				1.722 (2.004)
Japan inflation				−7.805** (3.765)
Japan inflation (two q. lag)				−5.631 (3.487)
Japan pr. consumption				−3.576 (2.220)
Japan pr. consumption (two q. lag)				−2.336 (2.212)
ECB deposit facility	−9.098 (6.730)	−8.455 (9.966)	−1.803 (5.240)	−12.814 (8.457)
ECB deposit facility (two q. lag)	−14.694** (6.058)	−24.691*** (7.188)	−10.549** (4.146)	−13.956* (7.981)
WTI	−0.022 (0.115)	−0.150 (0.159)	−0.044 (0.080)	−0.219 (0.131)
WTI (two q. lag)	−0.014 (0.115)	−0.266 (0.174)	0.019 (0.094)	−0.096 (0.147)
USA GDP growth	0.599 (2.167)	1.909 (2.972)	−0.839 (1.890)	2.837 (3.035)
USA GDP growth (two q. lag)	−2.490 (2.410)	0.047 (2.796)	−1.898 (1.758)	−1.714 (3.005)
1999	−9.307 (6.948)	−14.344 (8.983)	−9.009 (5.399)	−13.689 (8.413)
2000	0.382 (4.418)	2.095 (6.190)	−5.125 (3.710)	−11.873* (6.412)
2001	−15.214*** (4.588)	−15.825** (6.197)	−12.402*** (3.725)	−19.575*** (6.176)
2002	−19.321*** (5.115)	−29.100*** (7.668)	−16.179*** (4.101)	−21.937*** (6.815)
2003	−9.268 (6.208)	−16.551* (8.730)	−9.567** (4.720)	−18.036** (8.487)
2004	−4.949 (5.057)	−6.920 (6.652)	−3.572 (3.773)	−10.338 (6.148)
2005	−0.604 (4.574)	−4.214 (6.412)	−1.539 (3.681)	−3.261 (5.925)
2007	−4.311 (4.067)	1.516 (5.667)	−1.874 (3.343)	−7.470 (5.412)
2008	−10.908** (5.290)	−11.066 (6.896)	−10.915** (4.306)	−13.184* (7.007)
2009	−11.522 (7.340)	−19.095* (10.171)	1.274 (6.520)	−18.577* (9.547)
2010	−8.717* (4.576)	−10.626 (6.631)	−0.665 (3.923)	−16.717** (6.632)
2011	−10.678** (4.704)	−9.067 (5.685)	−2.689 (3.892)	−8.912 (5.498)
2012	−1.848 (5.482)	−4.789 (6.570)	−1.809 (3.997)	−10.146 (6.585)
2013	−6.149 (5.095)	−5.463 (6.073)	−2.734 (3.595)	3.357 (6.484)
2014	−9.055 (5.538)	−13.345* (6.709)	−7.509* (3.751)	−0.542 (7.731)
2015	−9.579* (5.121)	−16.603** (6.636)	−9.127** (4.030)	−12.054* (7.113)
Constant	11.669** (4.994)	13.821** (6.226)	5.860 (4.033)	10.567* (5.249)
Observations	66	66	66	66
R^2	0.730	0.637	0.653	0.656
Adjusted R^2	0.526	0.363	0.391	0.395
Residual Std. Error (df = 37)	5.566	7.516	4.531	7.359
F Statistic (df = 28; 37)	3.572***	2.322***	2.491***	2.516***
Note:				*p<0.1; **p<0.05; ***p<0.01

The effect of inflation measured as the change of the consumer price index lagged by one period is negative and statistical significant for France and Japan. Results suggests that increasing inflation decreases performances of the respective stock market indices in these countries. This negative effect is weakly significant for Germany. Significant levels decrease for all countries when looking at the effect lagged by two periods. The effect however stays weakly significant for France which also showed the highest significance for the effect lagged by one quarter. These results suggest that the inflation does have a negative effect on stock market indices. It is not clear how the channel of influence works since theory would suggest that at a higher inflation rate consumers rather invest than safe.

Coefficients for both variables and both lags quarterly GDP and change of inflation (i.e. consumer price index) for Great Britain are statistically insignificant. First, this result can be interpreted as the real sector not being a significant determinant of the financial performance of the stock of the companies included in the FTSE100. One explanation would be that in the Anglo-Saxon economic model, the financial system is a capital market based system as opposed to a system which relies more on financial intermediaries on the continent. Thus, it is much more flexible and volatile independently of the real sector. Second, the statistically insignificant, negative coefficient of changes in consumer prices does indicate that people do not decrease savings and increase investments. This can be explained by the different set up of the financial sector in Great Britain as compared to the other countries. Such a financial sector might follow different underlying dynamics. Since banks are not so important people have a different propensity to save. Put differently,investments into stocks take place anyway regardless of the inflation rate. It should be noted, however, that in Germany and Japan this effect is only significant at the 10 percent level and thus, general conclusions are difficult to draw from these results.

Looking at the quarterly change of the European Central Bank's deposit facility the variable yield negative, statistically significant results for France, Germany, and Great Britain when lagged by two periods. For Japan the coefficient is only statistically significant at the 10 percent level. In simple terms, the negative effect suggests that when the deposit facility interest increases, banks' revenues increase when storing their money overnight at the ECB. This implies that a high interest rate incentives the banks to keep money off markets. The negative effect suggests that increasing volumes of money held at banks does hurt the stock market: Less liquidity dampens investments. It seems straightforward that this effect is only weakly significant for Japan since Japanese banks are not directly affected by changes of the deposit facility. Moreover, the statistical insignificance of the effect when lagged by one period can be explained by the outside lag of the political decision making process to have an effect on the economy. The effects of a change in the central bank's monetary policy on an individual may not become visible before a certain time has passed.

All other coefficients for all other variables are not statistically significantly different from zero. The effect for changes in private consumption is negative for France Germany and Japan. For France, however, the effect becomes positive when lagged by two periods. The effect is positive for Great Britain. This could suggests again a difference in the propensity to safe and consume respectively. The variables to measure the world economy as quarterly US GDP growth and the change in WTI oil prices have also no statistically significant effect which is surprising since the US economy is traditionally viewed as a strong factor determining global economic health. Compared to the baseline year of 2006, all year factors display a negative sign and are predominantly statistically insignificant. 2006 was the peak performing year financially and economically. One year later, in 2007, the financial crisis started in the USA with the breakdown of Lehman Brothers in September and continued to spill over to Europe in 2008/2009 culminating in the European sovereign debt crisis. Thus, comparing the othery ears with 2006, all years would perform worse and thus, have a negative impact on the stock indices performances.

7 Limitations and Future Research

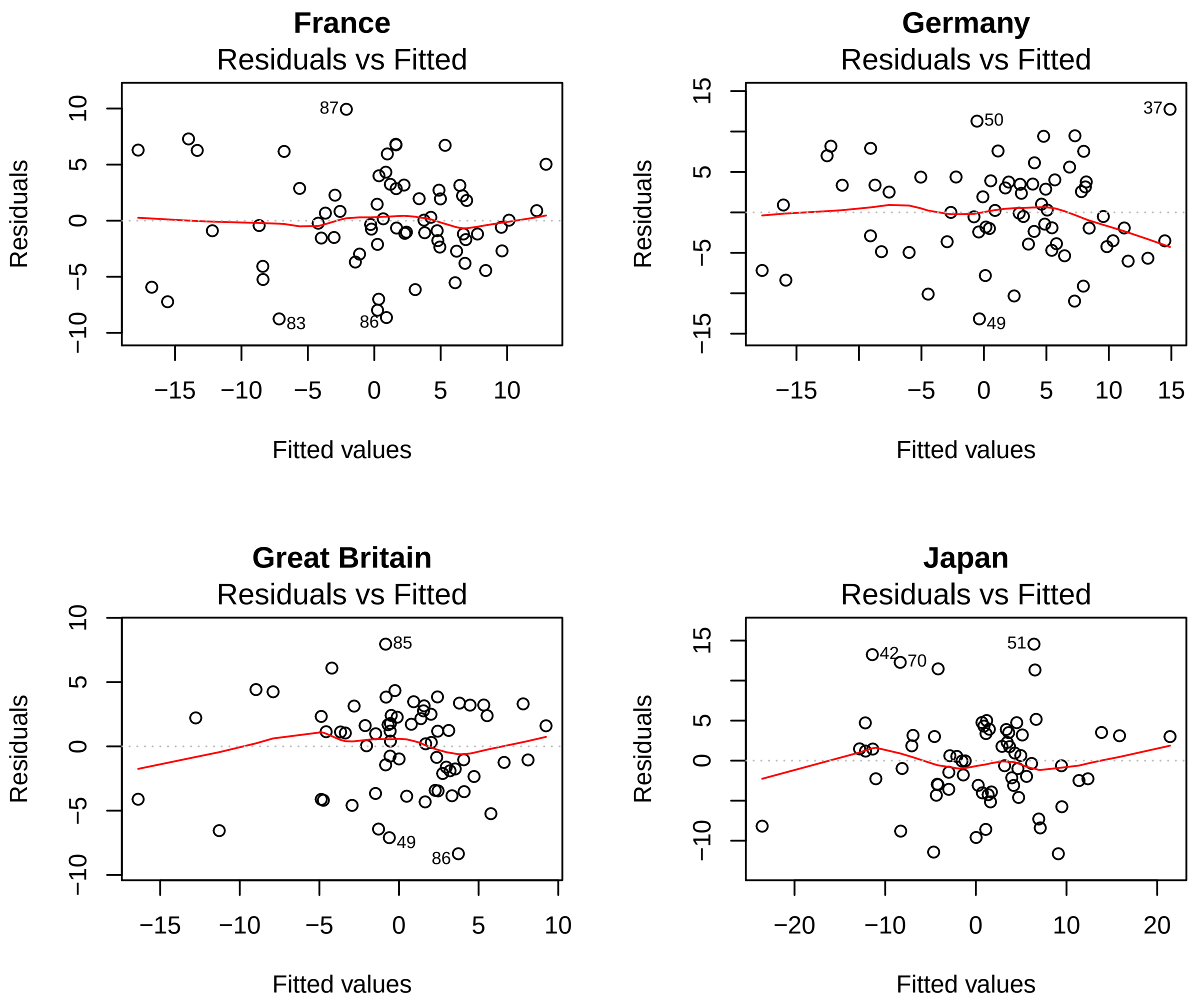
The analysis is subject to certain limitations.[4] First, it should be noted that one has to take results with caution: if GDP of an economy and stock market performance of its best firms and equities are intertwined then the regression measures a reverse causality. The analysis tries to mitigate this endogeneity problem by introducing two lags for GDP growth and each other variable. However, if the reverse causality is too strong and both variables would effectively measure the same concepts then the lag is the only variance in the regression. Second, a Breusch-Pagan test suggests that the analysis suffers from heteroscedasticity. We cannot accept the null and thus, have to assume that the variance of the residuals is dependent on the values of the changes in stock indices which renders coefficients inconsistent. Third, the analysis employs a Breusch-Godfrey test to look for serial autocorrelation. The test does indicate that we can accept the null and thus, can assume no serial autocorrelation is present in the data. Consequently, we assume that the standard errors are not underestimated. In summary, with biased coefficients we cannot conclude about the magnitude of the effect on the outcome variable, but we can conclude about its statistical significance since standard errors are efficient. Fourth, the external validity of the results must be seen with utmost caution. we have only looked at four national stock indices which are all composed differently and measure stock performances in industrial nations in the OECD. In summary, results should only be taken as indicative and not as final conclusive evidence.

Future Research could further invest into interactions: Is the true effect of GDP growth on changes of national stock market indices dependent on a second covariate?

[4]Diagnostics results can be found in the Appendix

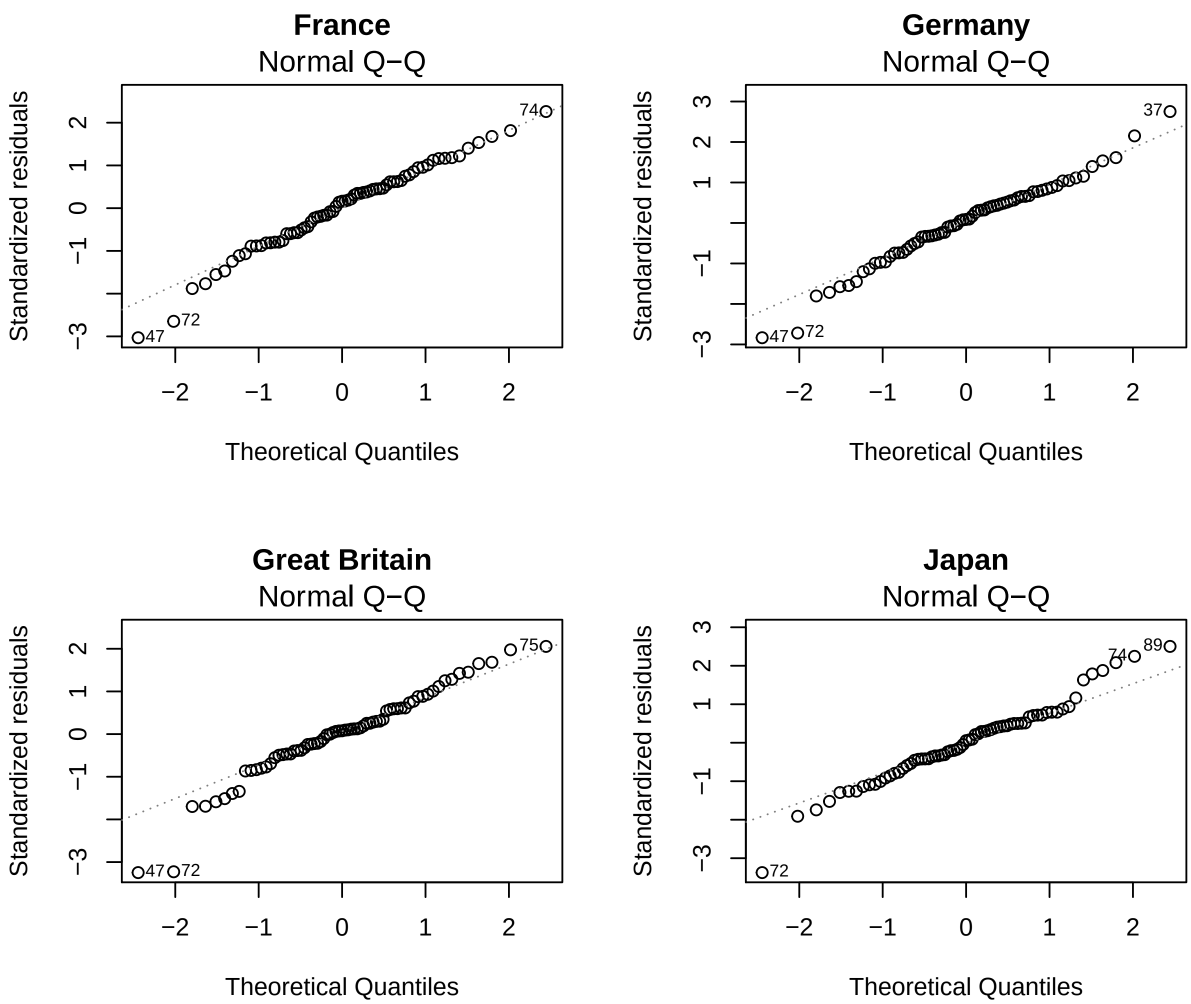
8 Appendix

8.1 Heteroscedasticity Diagnose



Looking at the four graphs we see that the basic models suffer to a certain degree from heteroskedasticity. This stems from outliers which bias the results in the graphs. We conclude that the overall degree of hetereoskedasticity is acceptable since the general relationship seems to be random.

8.2 Diagnose of non-normality of Errors



The graphs give and idea of the distribution of the error term in the regression. Ideally, the error terms should be normally distributed, and not show a right or left skew. In these graphs, however, we show a cummulative distribution function. That means that we want small residuals in the lower quantiles of the distriution and large residuals in the upper quantiles of the distribution of the error term. Put differently, we would expect a crosswise line from the lower left bottom to the upper right corner. All four lines sugest such a crosswise pattern indicating the degree of normality of error terms.

8.3 Variance Inflation Factor Test

Table 8: Variance Inflation Factor

	FRA	DEU	GRB	JPN
GDP growth	5.80	3.62	3.95	6.22
GDP growth (two q. lag)	6.96	2.97	5.20	5.89
inflation	2.96	2.79	3.84	4.43
inflation (two q. lag)	3.11	2.92	3.40	4.03

	FRA	DEU	GRB	JPN
pr. consumption	3.50	2.29	3.22	5.59
pr. consumption (two q. lag)	3.79	2.39	3.43	5.55
ECB deposit facility	5.13	6.17	4.69	4.63
ECB deposit facility (two q. lag)	4.16	3.21	2.94	4.13
WTI	3.56	3.71	2.58	2.64
WTI (two q. lag)	3.49	4.35	3.53	3.24
USA GDP growth	4.12	4.25	4.73	4.62
USA GDP growth (two q. lag)	5.11	3.77	4.11	4.55
1999	3.02	2.77	2.75	2.53
2000	2.37	2.55	2.52	2.85
2001	2.55	2.55	2.54	2.65
2002	3.17	3.91	3.08	3.22
2003	4.67	5.07	4.08	5.00
2004	3.10	2.94	2.61	2.62
2005	2.54	2.73	2.48	2.44
2007	2.01	2.14	2.05	2.03
2008	3.39	3.16	3.39	3.41
2009	6.53	6.88	7.78	6.32
2010	2.54	2.92	2.82	3.05
2011	2.68	2.15	2.77	2.10
2012	3.64	2.87	2.92	3.01
2013	3.15	2.45	2.37	2.92
2014	3.72	2.99	2.57	4.15
2015	3.18	2.93	2.97	3.51

```
## Warning in rm(a, FRA, DEU, GBR, JPN): Objekt 'GBR' nicht gefunden
```

8.4 Breusch-Pagan Test

`Breusch-Pagan test`

data: M13 BP = 36.3541, df = 28, p-value = 0.1338

`Breusch-Pagan test`

data: M14 BP = 27.9204, df = 28, p-value = 0.4687

`Breusch-Pagan test`

data: M15 BP = 23.9006, df = 28, p-value = 0.6868

`Breusch-Pagan test`

data: M16 BP = 37.3411, df = 28, p-value = 0.1115

8.5 Breusch-Godfrey Test

```
Breusch-Godfrey test for serial correlation of order up to 2
```

data: M13 LM test = 22.7414, df = 2, p-value = 1.153e-05

```
Breusch-Godfrey test for serial correlation of order up to 2
```

data: M14 LM test = 24.1847, df = 2, p-value = 5.602e-06

```
Breusch-Godfrey test for serial correlation of order up to 2
```

data: M15 LM test = 15.5284, df = 2, p-value = 0.0004247

```
Breusch-Godfrey test for serial correlation of order up to 2
```

data: M16 LM test = 17.964, df = 2, p-value = 0.0001257

8.6 Model Variation

Table 9: Variation of Final Model

	Dependent variable:			
	CAC	DAX	FTSE	Nikkei
	(1)	(2)	(3)	(4)
France GDP growth	9.544***			
	(3.396)			
France GDP growth (two q. lag)	0.636			
	(2.830)			
France inflation	−7.124**			
	(2.716)			
France pr. consumption	−3.266			
	(2.944)			
Germany GDP growth		2.013		
		(1.988)		
Germany GDP growth (two q. lag)		−1.750		
		(1.881)		
Germany inflation		−6.130		
		(5.049)		
Germany pr. consumption		−2.344		
		(2.184)		
Great Britain GDP growth			2.169	
			(1.719)	
GDP Great Britain GDP growth (two q. lag)			3.164	
			(1.986)	
Great Britain inflation			−3.347**	
			(1.494)	
Great Britain pr. consumption			−0.085	
			(1.345)	
Japan GDP growth				3.118*
				(1.830)
Japan GDP growth (two q. lag)				−0.443
				(1.220)
Japan inflation				−9.521***
				(3.068)
Japan pr. consumption				−3.169
				(2.086)
ECB deposit facility	−11.930*	−10.899	−2.441	−12.868
	(6.937)	(9.323)	(4.989)	(8.471)
WTI	0.013	−0.039	0.005	−0.037
	(0.113)	(0.169)	(0.080)	(0.123)
USA GDP growth	2.186	3.764	0.638	4.169
	(2.319)	(3.126)	(1.825)	(2.817)
USA GDP growth (two q. lag)	−3.064	−1.116	−1.742	−3.563
	(2.391)	(2.995)	(1.675)	(2.716)
1999	−4.044	−6.401	−2.723	−3.842
	(6.064)	(8.254)	(4.732)	(7.638)
2000	0.043	0.196	−6.059	−10.695*
	(4.756)	(6.636)	(3.631)	(6.007)
2001	−14.363***	−14.736**	−9.989**	−17.334***
	(4.912)	(6.706)	(3.754)	(6.242)
2002	−14.758***	−21.727***	−11.162***	−16.065**
	(5.061)	(7.233)	(3.864)	(6.347)
2003	−5.080	−8.825	−4.533	−10.172
	(6.173)	(8.393)	(4.475)	(7.491)
2004	−4.452	−5.684	−1.918	−6.562
	(5.163)	(7.201)	(3.883)	(6.317)
2005	0.604	−3.378	−0.165	−1.192
	(5.096)	(6.894)	(3.759)	(6.152)
2007	−4.966	0.027	−2.799	−7.362
	(4.532)	(6.173)	(3.460)	(5.658)
2008	−11.674**	−14.177**	−8.514**	−13.756**
	(5.379)	(6.738)	(4.055)	(6.243)
2009	−1.398	−8.082	8.131	−11.841
	(7.327)	(10.223)	(5.591)	(8.174)
2010	−7.448	−5.683	0.272	−12.317*
	(4.866)	(6.586)	(3.786)	(6.489)
2011	−10.250**	−7.703	−2.234	−8.329
	(4.729)	(6.183)	(3.617)	(5.660)
2012	−1.602	−2.922	−0.165	−7.602
	(5.743)	(7.189)	(3.998)	(6.585)
2013	−2.163	−2.426	−0.353	6.893
	(4.977)	(6.508)	(3.534)	(6.005)
2014	−5.723	−9.770	−5.440	0.515
	(5.688)	(6.902)	(3.792)	(6.431)
2015	−4.069	−6.750	−6.045	−5.081
	(5.187)	(6.879)	(3.909)	(6.307)
Constant	6.749	9.734*	3.076	7.856*
	(4.364)	(5.639)	(3.073)	(4.638)
Observations	67	67	67	67
R^2	0.611	0.475	0.576	0.578
Adjusted R^2	0.389	0.175	0.334	0.336
Residual Std. Error (df = 42)	6.292	8.496	4.737	7.793
F Statistic (df = 24; 42)	2.749***	1.583*	2.377***	2.394***
Note:				*p<0.1; **p<0.05; ***p<0.01

Bibliography

Agrawalla, Raman K, and SK Tuteja. 2007. "Causality Between Stock Market Development and Economic Growth: A Case Study of India." *Journal of Management Research* 7 (3). South Asia Publications: 158.

Antonios, Adamopoulos. 2010. "Stock Market and Economic Growth: An Empirical Analysis for Germany." *Business and Economics Journal* 2010. HATASO Enterprises, LLC: 1–12.

Bollen, Johan, Huina Mao, and Xiaojun Zeng. 2011. "Twitter Mood Predicts the Stock Market." *Journal of Computational Science* 2 (1). Elsevier: 1–8.

Boyer, Brian H, Tomomi Kumagai, and Kathy Yuan. 2006. "How Do Crises Spread? Evidence from Accessible and Inaccessible Stock Indices." *The Journal of Finance* 61 (2). Wiley Online Library: 957–1003.

Cao, Melanie, and Jason Wei. 2005. "Stock Market Returns: A Note on Temperature Anomaly." *Journal of Banking & Finance* 29 (6). Elsevier: 1559–73.

Chang, Eric C, and Sen Dong. 2006. "Idiosyncratic Volatility, Fundamentals, and Institutional Herding: Evidence from the Japanese Stock Market." *Pacific-Basin Finance Journal* 14 (2). Elsevier: 135–54.

Chiang, Thomas C, and Dazhi Zheng. 2010. "An Empirical Analysis of Herd Behavior in Global Stock Markets." *Journal of Banking & Finance* 34 (8). Elsevier: 1911–21.

Claessens, Stijn, Daniela Klingebiel, and Sergio L Schmukler. 2006. "Stock Market Development and Internationalization: Do Economic Fundamentals Spur Both Similarly?" *Journal of Empirical Finance* 13 (3). Elsevier: 316–50.

Diebold, Francis X, and Kamil Yilmaz. 2008. *Macroeconomic Volatility and Stock Market Volatility, Worldwide.* National Bureau of Economic Research.

Dimson, Elroy, Paul Marsh, and Mike Staunton. 2009. *Triumph of the Optimists: 101 Years of Global Investment Returns.* Princeton University Press.

Duca, Gevit. 2007. "The Relationship Between the Stock Market and the Economy: Experience from International Financial Markets." *Bank of Valletta Review* 36 (3): 1–12.

Goetzmann, William N, and Ning Zhu. 2005. "Rain or Shine: Where Is the Weather Effect?" *European Financial Management* 11 (5). Wiley Online Library: 559–78.

Guresen, Erkam, Gulgun Kayakutlu, and Tugrul U Daim. 2011. "Using Artificial Neural Network Models in Stock Market Index Prediction." *Expert Systems with Applications* 38 (8). Elsevier: 10389–97.

Hsing, Yu. 2011. "The Stock Market and Macroeconomic Variables in a BRICS Country and Policy Implications." *International Journal of Economics and Financial Issues* 1 (1). Econjournals: 12.

Kang, Sang Hoon, Zhuhua Jiang, Yeonjeong Lee, and Seong-Min Yoon. 2010. "Weather Effects on the Returns and Volatility of the Shanghai Stock Market." *Physica A: Statistical Mechanics and Its Applications* 389 (1). Elsevier: 91–99.

Kara, Yakup, Melek Acar Boyacioglu, and Ömer Kaan Baykan. 2011. "Predicting Direction of Stock Price Index Movement Using Artificial Neural Networks and Support Vector Machines: The Sample of the Istanbul Stock Exchange." *Expert Systems with Applications* 38 (5). Elsevier: 5311–19.

Kenourgios, Dimitris, Aristeidis Samitas, and Nikos Paltalidis. 2011. "Financial Crises and Stock Market Contagion in a Multivariate Time-Varying Asymmetric Framework." *Journal of International Financial Markets, Institutions and Money* 21 (1). Elsevier: 92–106.

Rahman, Aisyah Abdul, Noor Zahirah Mohd Sidek, and Fauziah Hanim Tafri. 2009. "Macroeconomic Determinants of Malaysian Stock Market." *African Journal of Business Management* 3 (3). Academic Journals: 95.

Ritter, Jay R. 2005. *Economic Growth and Equity Returns.* 5. *Pacific-Basin Finance Journal.* Vol. 13. Elsevier.

Si, Jianfeng, Arjun Mukherjee, Bing Liu, Qing Li, Huayi Li, and Xiaotie Deng. 2013. "Exploiting Topic Based Twitter Sentiment for Stock Prediction." *ACL (2)* 2013: 24–29.

Singh, Dharmendra. 2010. "Causal Relationship Between Macro-Economic Variables and Stock Market: A Case Study for India." *Pakistan Journal of Social Sciences* 30 (2): 263–74.

Sraer, David, and David Thesmar. 2007. "Performance and Behavior of Family Firms: Evidence from the French Stock Market." *Journal of the European Economic Association* 5 (4). Wiley Online Library: 709–51.

Symeonidis, Lazaros, George Daskalakis, and Raphael N Markellos. 2010. "Does the Weather Affect Stock Market Volatility?" *Finance Research Letters* 7 (4). Elsevier: 214–23.

Tan, Lin, Thomas C Chiang, Joseph R Mason, and Edward Nelling. 2008. "Herding Behavior in Chinese Stock Markets: An Examination of a and B Shares." *Pacific-Basin Finance Journal* 16 (1). Elsevier: 61–77.

Tetlock, Paul C. 2007. "Giving Content to Investor Sentiment: The Role of Media in the Stock Market." *The Journal of Finance* 62 (3). Wiley Online Library: 1139–68.

Van Nieuwerburgh, Stijn, Frans Buelens, and Ludo Cuyvers. 2006. "Stock Market Development and Economic Growth in Belgium." *Explorations in Economic History* 43 (1). Elsevier: 13–38.

Yartey, Charles Amo. 2008. "The Determinants of Stock Market Development in Emerging Economies: Is South Africa Different?" *IMF Working Papers*, 1–31.

Yoon, Seong-Min, and Sang Hoon Kang. 2009. "Weather Effects on Returns: Evidence from the Korean Stock Market." *Physica A: Statistical Mechanics and Its Applications* 388 (5). Elsevier: 682–90.

Zhang, Xue, Hauke Fuehres, and Peter A Gloor. 2011. "Predicting Stock Market Indicators Through Twitter 'I Hope It Is Not as Bad as I Fear'." *Procedia-Social and Behavioral Sciences* 26. Elsevier: 55–62.