An odd relation: National Equity Prices and GDP Growth

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Introduction

In this assignment, we investigate on 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 DAX (Germany), CAC (France), FTSE (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.

Research Question and Hypothesis

Are there different levels of statistical significance for the effect of a nation's GDP growth on national equity prices?

H_0: There are no differences regarding statistical significance for the effect of a nation's GDP on national equity prices.

H_1: There are differences regarding statistical significance for the effect of a nation's GDP on national equity prices.

Descriptive Statistics

Variables of Interest

We investigate on four different dependent variables: The National stock indices of Germany, France, Great Britain and Japan. We obtain data from their average closing values.

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

We control for various covariates in our model. We lag all our covariates by one quarter.

- ECB Main Refinancing Operations (% change to previous rate)
- ECB Deposit Facility (% change to previous rate)
- GDP Growth USA (% change to previous quarter)
- West Texas Intermediate (WTI) (% change to previous quarter in U.S. $)
- Brent Crude (% change to previous quarter in U.S. $)

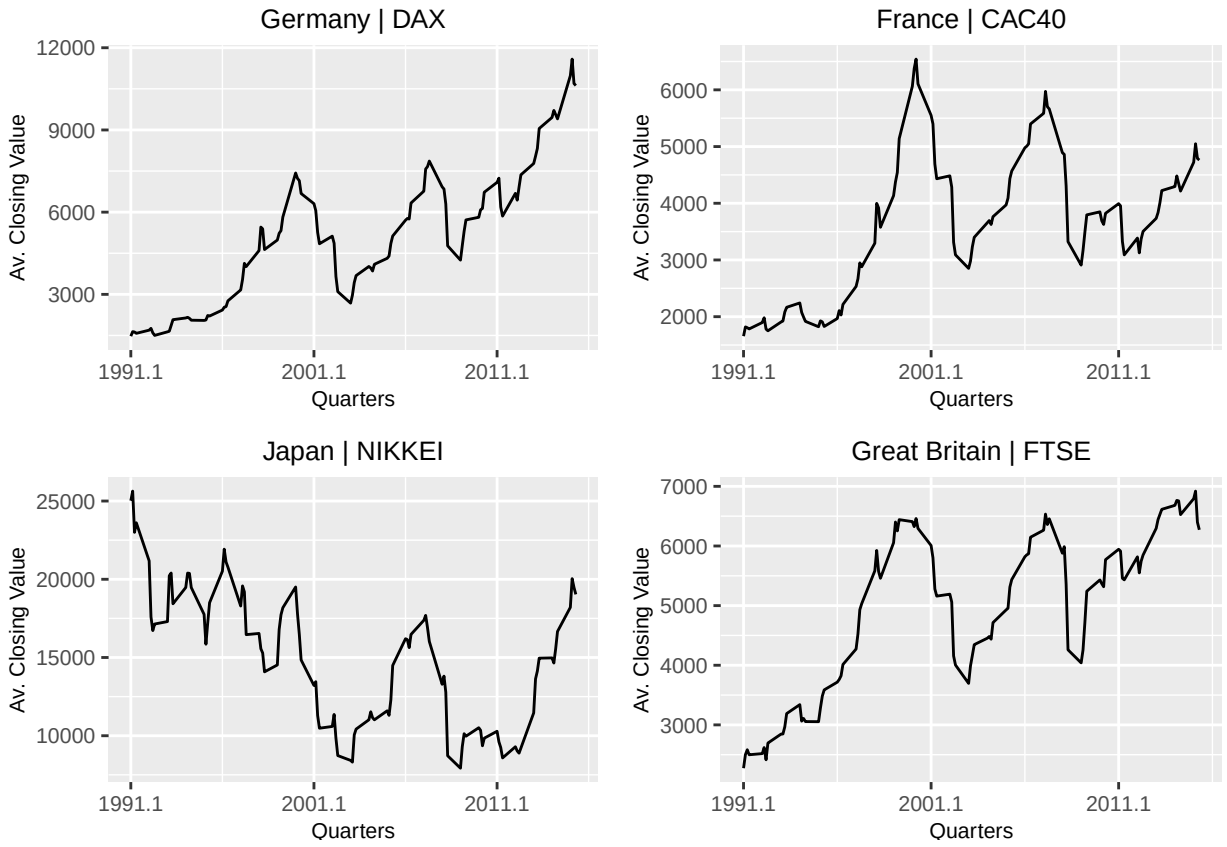
We take the quarterly GDP growth rate of the USA as a proxy for the world economy. The economy of the USA has a profound impact on other national business cycles, and national recessions in the US have sever repercussions across the globe. This was demonstrated again after 2007 when the US subprime mortgage crisis turned into a global recession. Moreover, the West Texas Intermediate and Brent Crude oil price changes are taken as an indicator of global economic health.

We also control for country-specific covariates.

- GDP Growth (% change to previous quarter)
- Unemployment (in %)
- Private Consumption (in % of GDP)

Note that for the descriptive statistics section all graphs apply the full range of our available data (i.e. Q1 1991 until Q4 2015). However, our actual analysis (under the inferential statistics section) only takes into account the time period between Q2 1999 and Q4 2015 since we also control for ECB interest rates. **Figure 1** presents a first glance at the four dependent variables from the first quarter in 1991 to the last quarter in 2015. Striking is the non-linearity of the graphs and the fact that the NIKKEI - quite contrary to the other indices - rather declined/stagnated. The DAX, CAC 40 and the FTSE shows fairly similar developments.

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



Another overview we should be interested in is given in **Figure 2**: The development of our key independent variables over the same time (i.e. Q1 1991 until Q4 2015). Note that here we also include the graph for the USA which is an external factor we assume to be influential on all four economies of interest (and in turn on the according national stock indices). Compared to the previous developments of the dependent variables, the key independent variables show a relatively more similar, congruent evolution. Remarkable is the major, well visible downturn in the aftermath of financial crisis in all five graphs.

Figure 2: ***Key Independent Variables (Quarterly GDP growth)***

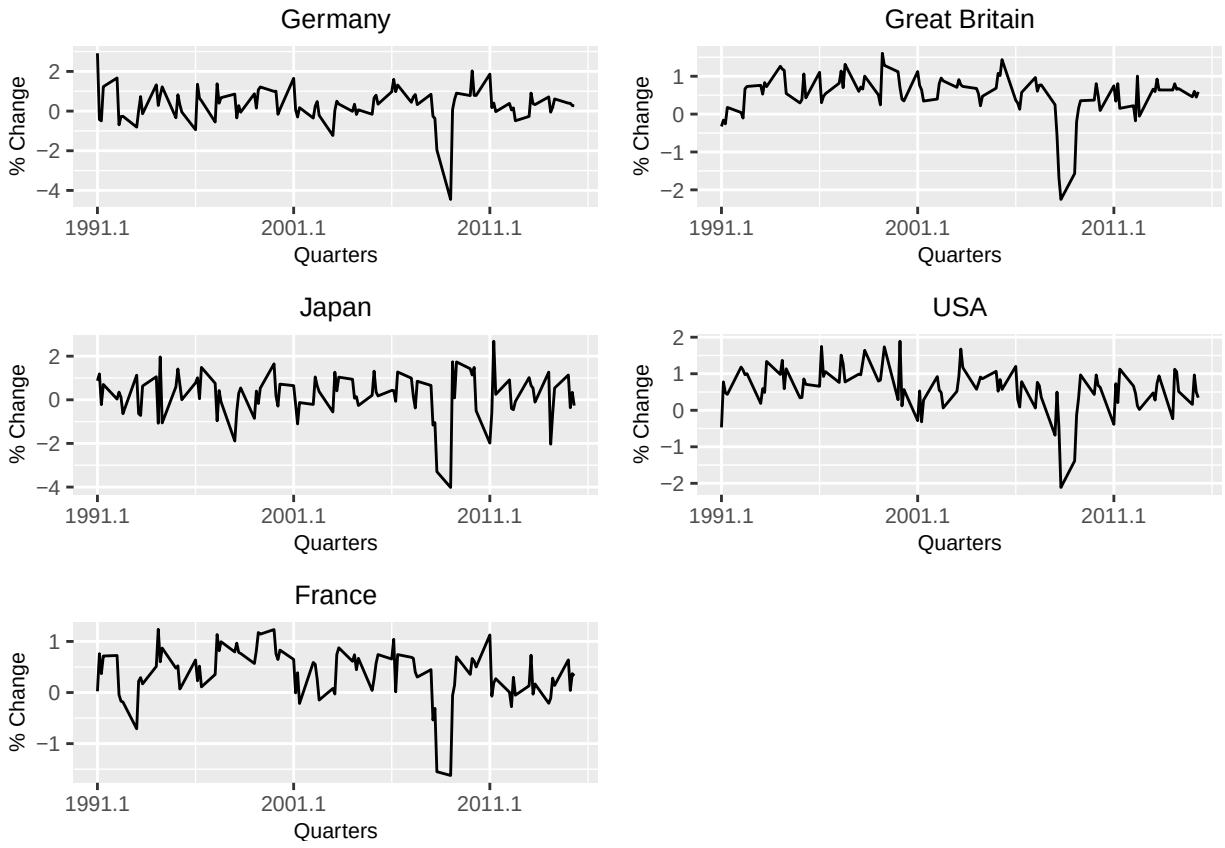


Figure 3 summarizes the main characteristics for the depent and key indepent variables.

Figure 3: ***Measures of Central Tendency for DVs & Key IVs***

```
##
## Descriptive statistics
## ================================================
## Statistic   N    Mean   St. Dev.   Min     Max
## ------------------------------------------------
## DAX.Close  100 5,108.0  2,494.1  1,473.6 11,585.4
## CAC.Close  100 3,644.9  1,264.4  1,656.1 6,542.3
## NIK.Close  100 14,964.1 4,355.9  7,924.7 25,634.9
## FTSE.Close 100 4,963.8  1,323.2  2,273.6 6,920.2
## L.DEU.GDP  99    0.3      0.9     -4.5     2.9
## L.FRA.GDP  99    0.4      0.5     -1.6     1.2
## L.JPN.GDP  99    0.2      1.0     -4.0     2.7
```

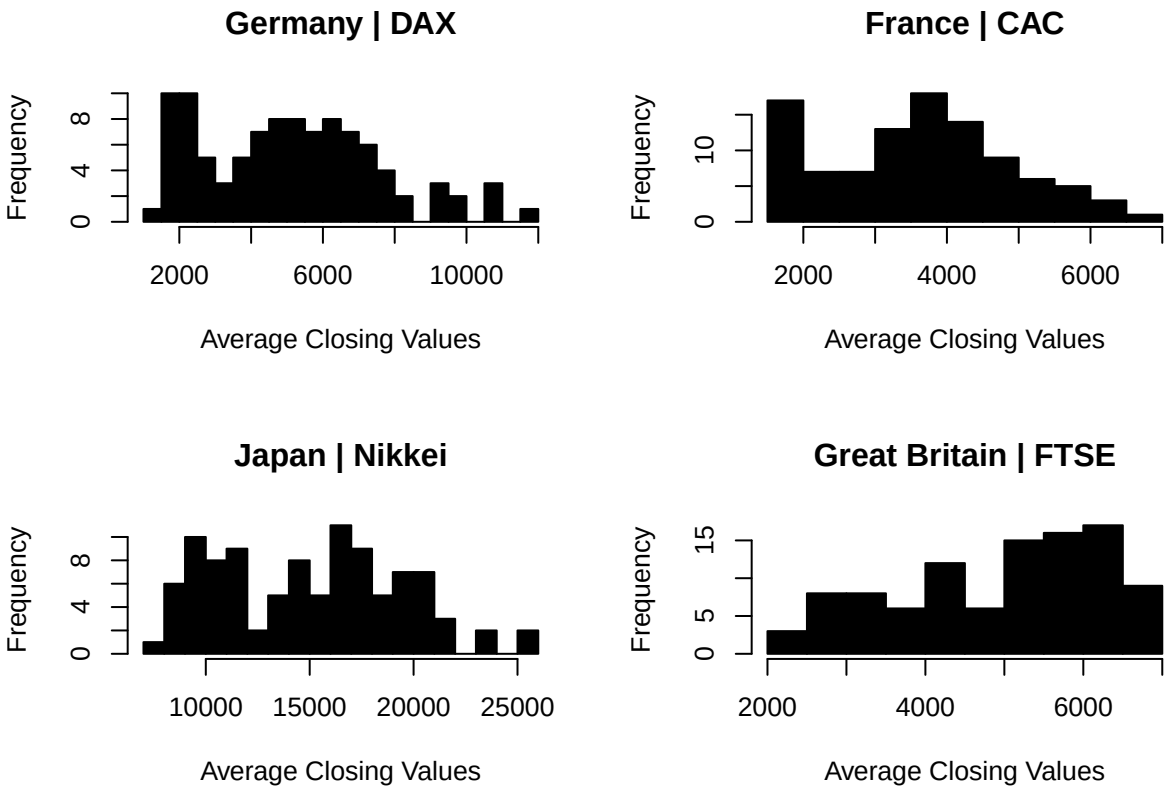
```
## L.GBR.GDP  99    0.5      0.6     -2.3     1.6
## L.USA.GDP  99    0.6      0.6     -2.1     1.9
## ------------------------------------------------
```

The according Medians for the each dependent variable are as follows:

```
## USA.GDP 0.6677445
## DEU.GDP 0.3470855
## GBR.GDP 0.620409
## JPN.GDP 0.3455435
```

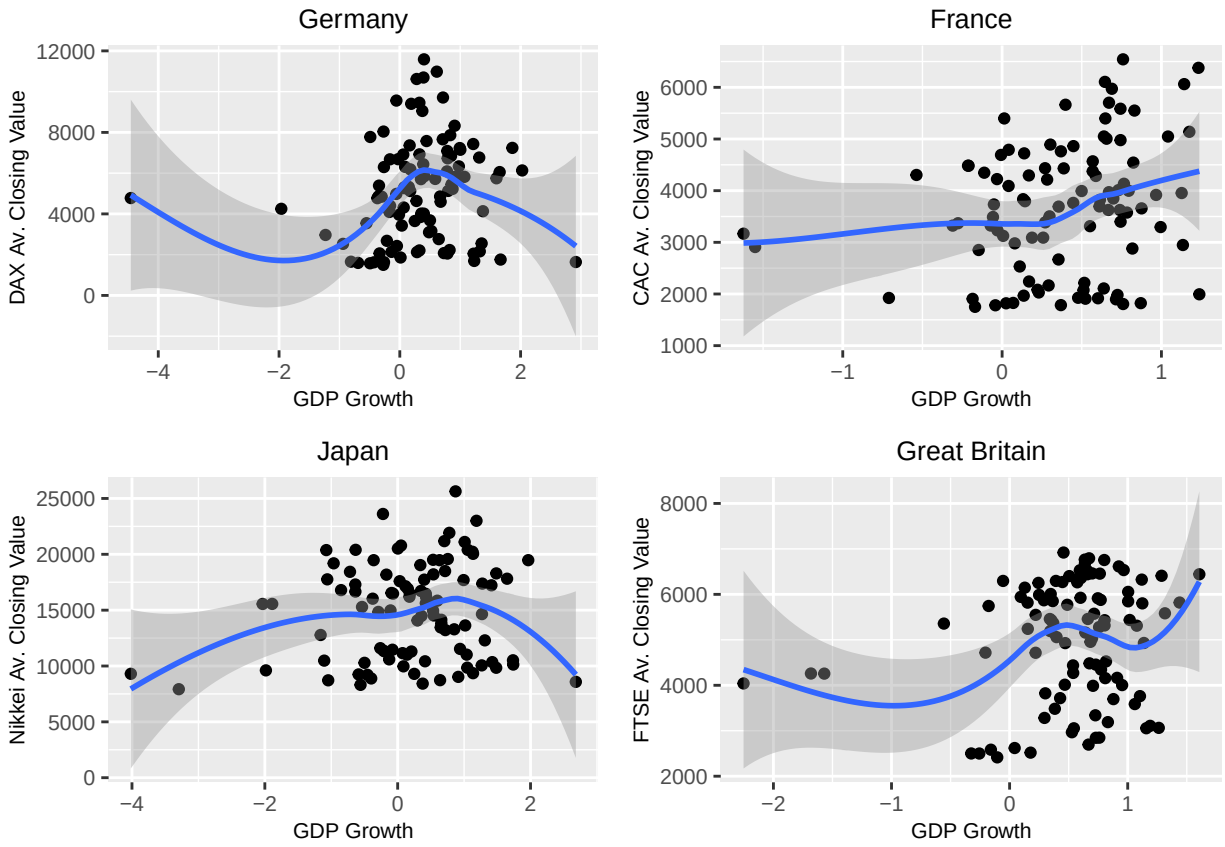
In the next step, **Figure 4** summarizes the frequency distributions of the dependent variables. For now, we assume the variables to be normally distributed. In following research to this assignment we will consider log-transformation for the variables.

Figure 4: ***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 5: ***Joint Distributions of DV and Key IV***



Inferential Statistics

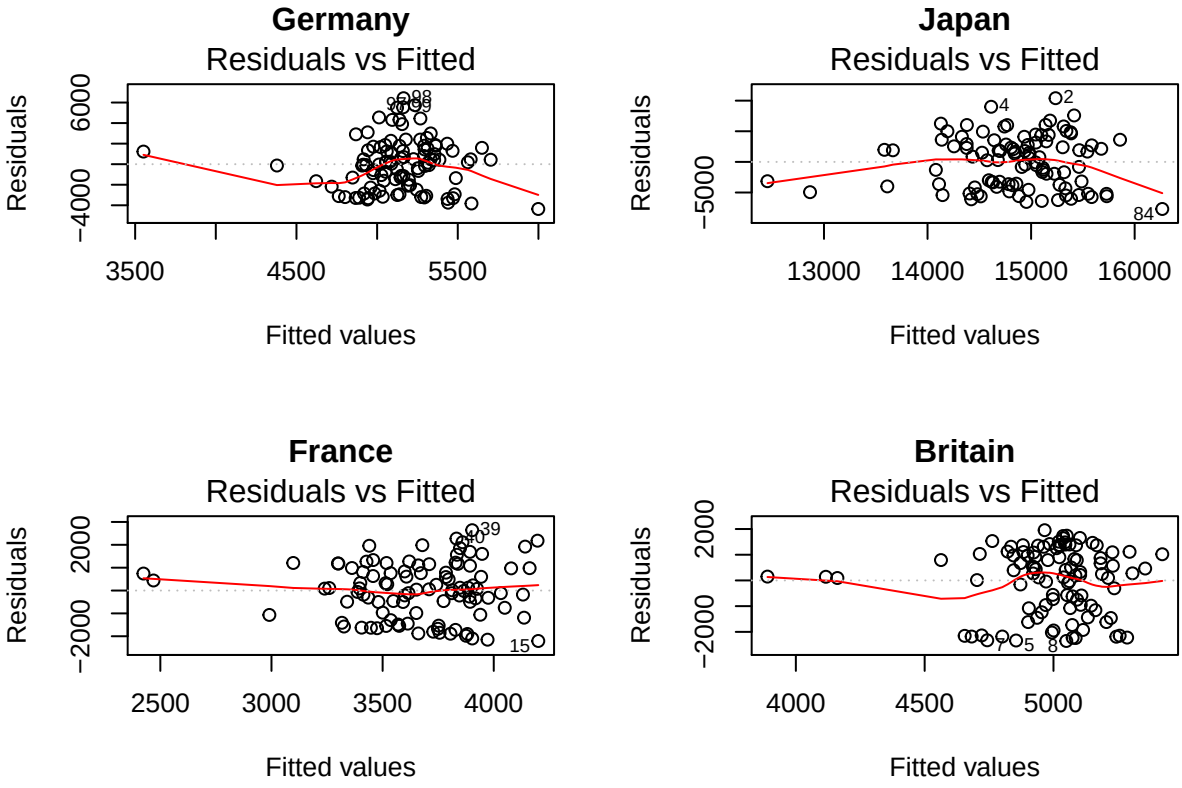
Figure 6: ***Basic Model: Pooled OLS***

```
##
## ================================================================================
##                                        Dependent variable:
##                                -----------------------------------------------
##                                   DAX         Nikkei          CAC          FTSE
##                                   (1)          (2)            (3)          (4)
## --------------------------------------------------------------------------------
## GDP Growth                      332.127
##                                (288.805)
##
## L.JPN.GDP                                    569.079
##                                             (417.340)
##
## L.FRA.GDP                                                  620.886**
##                                                            (249.517)
##
## L.GBR.GDP                                                                397.079*
##                                                                         (224.685)
##
```

```
## Constant                        5,030.927*** 14,740.380*** 3,431.650*** 4,784.416***
##                                  (267.750)    (435.317)    (154.578)    (174.369)
##
## ---------------------------------------------------------------------------------
## Observations                        99           99           99           99
## R2                                0.013        0.019        0.060        0.031
## Adjusted R2                       0.003        0.009        0.050        0.021
## Residual Std. Error (df = 97)  2,475.445    4,238.736    1,222.680    1,287.739
## F Statistic (df = 1; 97)         1.323        1.859        6.192**      3.123*
## =================================================================================
## Note:                                                  *p<0.1; **p<0.05; ***p<0.01
```

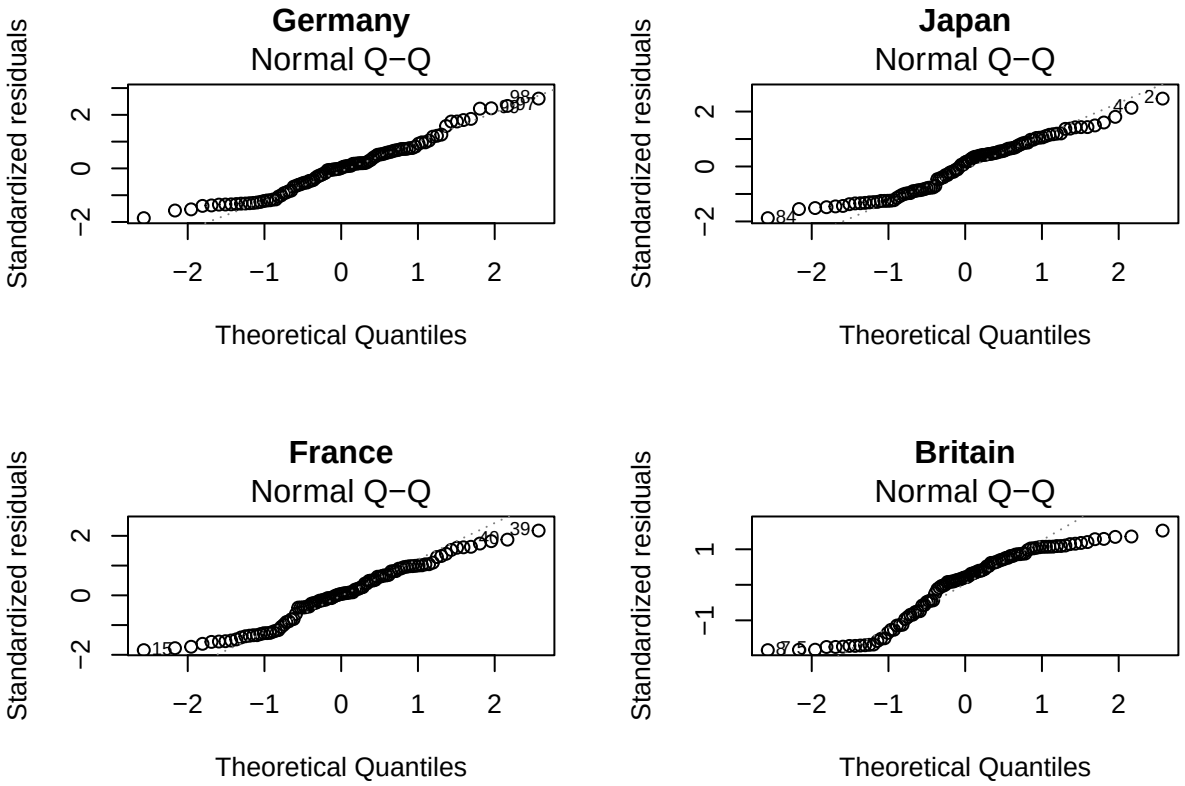
The above models show us the realtionship between national GDP and the respective stock indices. The predictors are lagged by one annual quarter to mitigate potential endogeneity. All coefficient have a positive sign but are statistically insignificant at the 5 per cent level which suggest that there is no effect differnet from zero. Only the coefficient for French GDP growth is significant at the 5 per cent level. The y-intercepts for all four regressions are positive and statistically significant at the 1 per cent level.

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.

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'd 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.

Figure 7: *Expanded Model: Pooled OLS*

```
##
## ================================================================================
##                                        Dependent variable:
##                                -----------------------------------------------
##                                    DAX         Nikkei         CAC         FTSE
##                                    (1)           (2)          (3)         (4)
## --------------------------------------------------------------------------------
## L.DEU.GDP                        390.715
##                                 (365.414)
##
## L.DEU.unempl                    -639.007***
##                                  (143.151)
##
## L.DEU.prvconsm                   -54.735
##                                 (360.335)
##
## L.JPN.GDP                                      734.644
```

```
##                                          (710.498)
##
## L.JPN.unempl                           -2,207.609
##                                        (1,400.720)
##
## L.JPN.prvconsm                          -615.533
##                                         (693.467)
##
## L.FRA.GDP                                              313.459
##                                                       (501.001)
##
## L.FRA.unempl                                           24.866
##                                                       (173.669)
##
## L.FRA.prvconsm                                      1,128.500**
##                                                       (406.917)
##
## L.GBR.GDP                                                            170.808
##                                                                     (294.564)
##
## L.GBR.unempl                                                         219.654
##                                                                     (137.288)
##
## L.GBR.prvconsm                                                       266.169
##                                                                     (275.687)
##
## L.ECB.MRO.change            768.839      1,247.980    2,089.480   -1,033.226
##                           (3,532.261)   (7,162.504)  (1,747.903) (1,747.988)
##
## L.ECB.dep.change           1,271.676     2,506.346    -375.528    2,417.245
##                           (3,580.915)   (7,080.429)  (1,809.914) (1,633.629)
##
## L.WTI.dollar.change          24.759        117.164      16.381       28.365
##                             (67.329)      (164.722)    (43.030)     (36.674)
##
## L.Brent.dollar.change        -19.129       -68.626      -26.657     -22.698
##                             (67.350)      (171.454)    (39.151)     (39.620)
##
## Constant                 11,229.810*** 23,391.690*** 3,803.982** 4,155.102***
##                           (1,139.281)   (6,290.538)  (1,554.083)  (890.827)
##
## ------------------------------------------------------------------------------
## Observations                  31            31           31           31
## R2                           0.617         0.466        0.722        0.543
## Adjusted R2                  0.500         0.303        0.638        0.404
## Residual Std. Error (df = 23) 1,230.933    3,113.167    691.380      708.719
## F Statistic (df = 7; 23)     5.288***      2.867**      8.538***     3.910***
## ==============================================================================
## Note:                                          *p<0.1; **p<0.05; ***p<0.01
```

All coefficients of lagged GDP growth exhibit a positive sign suggesting that an increase in an economy's output leads to a better performance at the stock market. The effect of the coefficients, however, is not significantly different from zero. For unemployment the coefficients are negative for Germany and Japan yet only for the former country the effect is statisitcally significant at the 1 per cent level. Unemployment

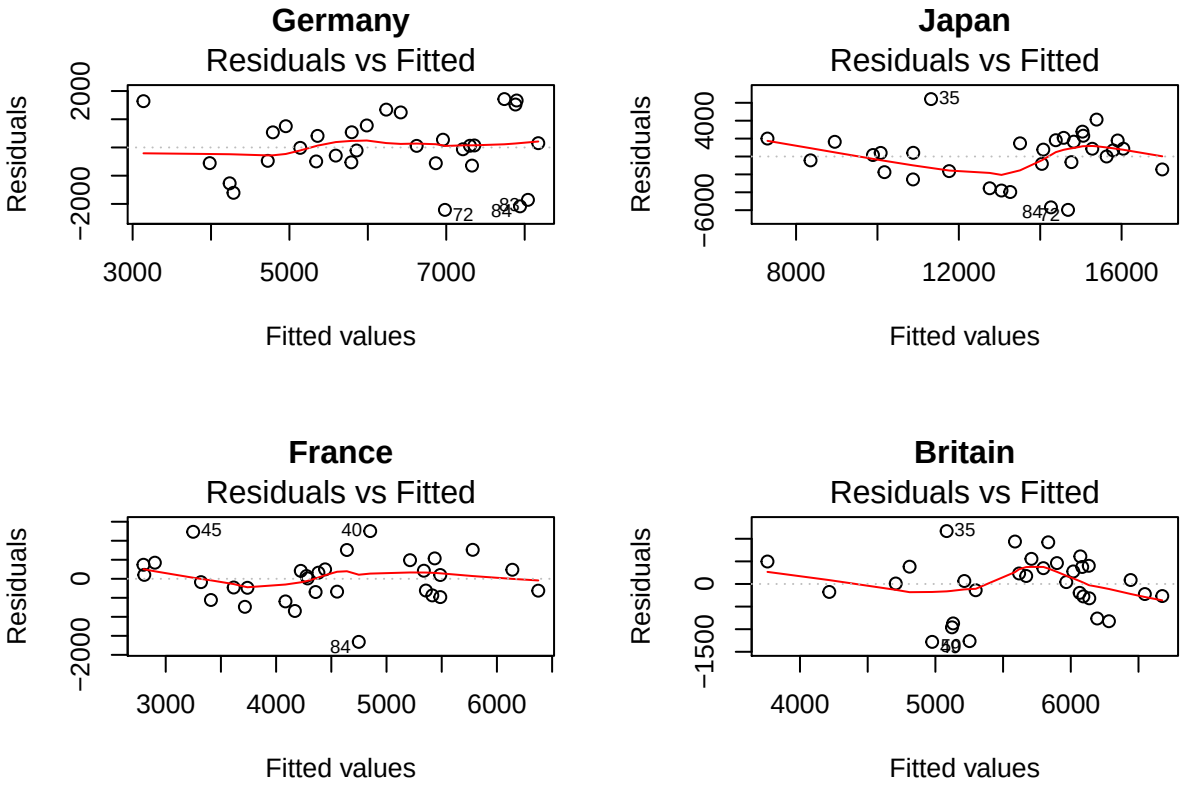
in France and Great Britain seems to improve the respective stock indices. Again, both effects are not statistically significant, thus no substantial effect can be established.

The pattern that coefficients of Germany and Japan have the same sign as compared to France and Great Britain, holds for private consumption too. For Germany and Japan an increase in private consumption decreases stock indices performances. This effect, however, is not statistically significant in both countries. In France and Great Britain signs are positive which suggests that more spending increases the stock market performance of forms relfected in the indices. This effect is only statistically significant for France (at the 5 per cent level).

Non of the coeffcients of the remaining variables are statistically significant. The signs are for all countries positive and only for Brent price changes negative. The exceptions are Great Britain where increasing change of MRO suggests a decreasing effect on the FTSE, and France where an increasing change in the ECB's deposit facility would hurt the CAC40.

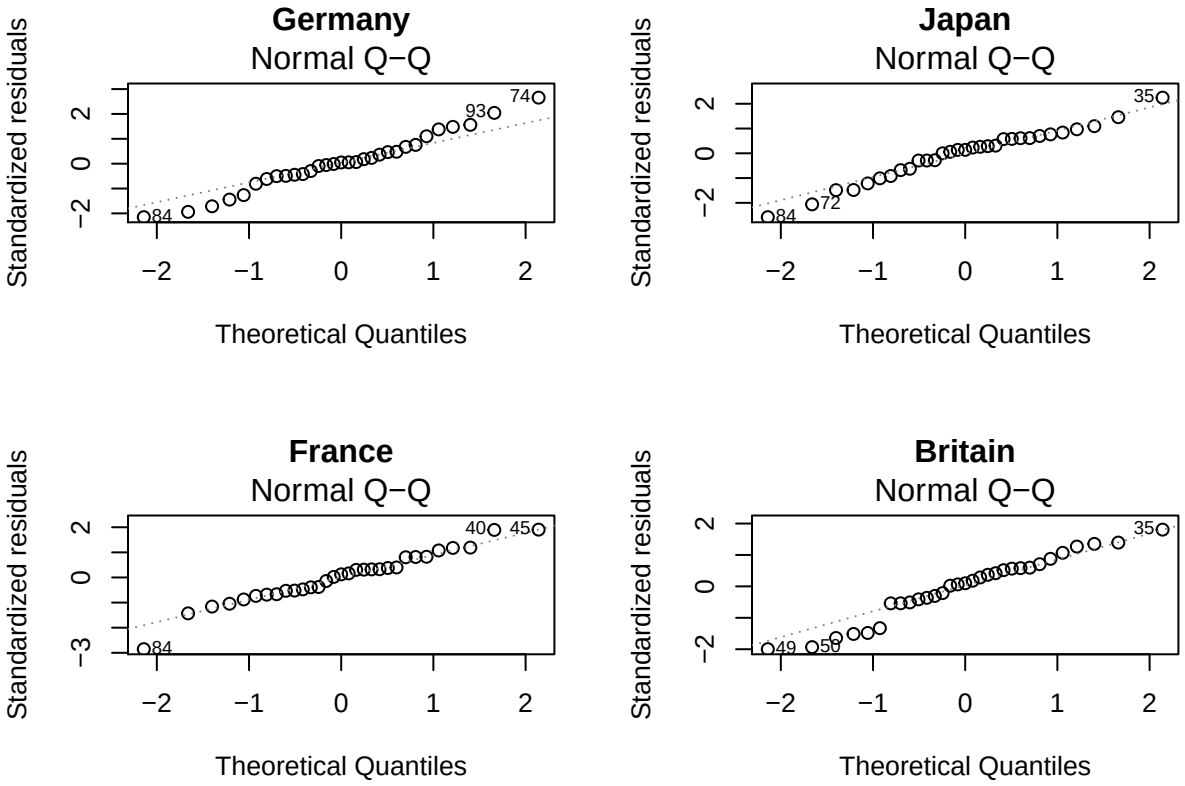
The explanatory power of the models as measured by the Adj.-R^2 is highest for France and Germany, and gets worse for Great Britain and Japan.

Heteroscedasticity Diagnose



Again, the graphs do not suggest large problem with heteroskedasticity. Nonetheless, it must be kept in mind that heteroskedasticity potentially biases the coeffcients systematically. A robust standard error might adjust statistical significance levels by increasing the s.e.-values but leaves the bias untouched.

Diagnose of non-normality of Errors



The plotted graph suggests that the standardized residuals lie along the crosswise line. The distribution of the error term is not perfectly normal but is deemed acceptable.

Figure 8: *Expanded Model: Pooled OLS w/ year dummies*

```
##
## ================================================================================
##                                        Dependent variable:
##                                -------------------------------------------------
##                                    DAX          Nikkei          CAC          FTSE
##                                    (1)           (2)            (3)           (4)
## --------------------------------------------------------------------------------
## L.DEU.GDP                       170.786
##                                (107.337)
##
## L.DEU.unempl                   -218.549
##                                (264.393)
##
## L.DEU.prvconsm                 -245.473**
##                                 (109.089)
##
## L.JPN.GDP                                      95.473
##                                               (273.511)
##
## L.JPN.unempl                                  178.624
```

```
##                                          (2,072.116)
##
## L.JPN.prvconsm                            172.645
##                                          (297.762)
##
## L.FRA.GDP                                                -38.607
##                                                         (286.093)
##
## L.FRA.unempl                                             -35.203
##                                                         (276.198)
##
## L.FRA.prvconsm                                           -97.179
##                                                         (277.903)
##
## L.GBR.GDP                                                             -41.969
##                                                                      (97.607)
##
## L.GBR.unempl                                                          118.512
##                                                                      (153.151)
##
## L.GBR.prvconsm                                                        79.973
##                                                                      (91.746)
##
## L.ECB.MRO.change              3,587.387**    8,024.823*     1,107.867     1,063.224
##                               (1,448.792)   (4,199.806)    (1,113.167)    (679.312)
##
## L.ECB.dep.change              -1,835.086     -4,104.925      122.882       138.267
##                               (1,397.727)   (3,644.012)    (1,057.228)    (630.105)
##
## L.WTI.dollar.change            -53.469*       5.206         -4.133        -2.733
##                                (27.653)      (93.894)      (26.203)      (13.522)
##
## L.Brent.dollar.change           47.833*      -34.012         8.330         4.701
##                                (23.713)      (81.817)      (22.642)      (13.546)
##
## year2000                        266.624      -3,836.130      640.562      -840.880*
##                                (604.558)    (2,346.695)    (714.539)     (382.370)
##
## year2001                        -710.364    -7,623.831***    -225.534    -1,110.662***
##                                 (475.621)    (1,799.268)    (826.711)     (300.679)
##
## year2002                        -558.337    -7,490.546***    -228.405     -928.807***
##                                 (477.242)    (2,182.190)    (730.151)     (261.755)
##
## year2003                      -2,149.450*** -9,275.790***  -1,812.507**  -2,272.496***
##                                 (413.017)    (1,982.140)    (813.321)     (253.561)
##
## year2006                        -458.380     -4,425.930**    -478.281    -1,107.949***
##                                 (676.115)    (1,877.667)    (868.109)     (346.047)
##
## year2007                        622.163      -3,388.042      163.915      -650.696*
##                                 (557.703)    (1,980.107)    (1,047.985)   (348.197)
##
## year2008                      -2,093.165**  -11,869.980***  -2,381.597*  -2,758.299***
```

```
##                                 (731.878)    (2,159.004)    (1,166.173)    (381.669)
##
## year2009                         -756.071    -9,441.703***   -1,574.602*  -1,956.831***
##                                 (549.721)    (1,644.247)     (817.828)     (430.819)
##
## year2011                        -1,521.444   -11,913.010*** -2,522.332*** -1,898.462***
##                                 (960.381)    (2,245.950)     (807.185)     (429.973)
##
## year2012                         740.090     -9,429.215***  -1,552.736**   -908.459**
##                                 (948.419)    (1,416.920)     (576.900)     (393.465)
##
## year2013                        2,755.483**    -3,968.061     -869.940      -131.581
##                                 (1,084.017)  (2,227.785)     (522.663)     (406.088)
##
## year2014                        2,851.078**    -2,537.909     -782.629       -41.823
##                                 (1,032.901)  (1,924.413)     (503.440)     (238.974)
##
## Constant                       8,079.002***   18,843.540*    5,660.619*   6,079.226***
##                                 (2,337.616)  (9,053.455)    (3,111.845)    (946.973)
##
## ------------------------------------------------------------------------------------
## Observations                       31            31            31            31
## R2                                0.989         0.972         0.982         0.988
## Adjusted R2                       0.971         0.924         0.951         0.967
## Residual Std. Error (df = 11)    296.969      1,031.441       254.762       165.703
## F Statistic (df = 19; 11)       53.689***     20.072***      31.502***     47.919***
## ====================================================================================
## Note:                                                  *p<0.1; **p<0.05; ***p<0.01
```

Taking into account year dummies, the effects change in sign or signifcance or both. In Germany, unemployment becomes statistically insignificant, whereas consumption becomes significant at the 5 per cent level. In Japan, unemployment becomes a positive sign yet the effect is remains statistically insignificant. For France, GDP growth, unemployment, and consumption become a negative sign. Consumption looses its statisticall significance. GDP growth becomes negative for Great Britain too.

The change in MRO becomes now positive for all coefficients and statistically significant for Germany at the 5 per cent level. The change in the deposit facility is negative for Germany and Japan but positive for the other two countries and throughout not statistically signifcant. Increasing percenatage changes in the WTI price suggest a negative effect on the DAX, the CAC and the FTSE. Only the NIKKEI seems to profit. No effect is statistcally significant. For Brent the signs are reversed.

The years have negative effect throughout. Only for Germany and France the year 2007 has a positive effect. For Germany the year effect becomes positive from 2012 onwards.

The Adj.-R^2 is higher for all models than previously. All models have a Adj.-R^2 above 0.9.

Confidence Intervals

```
##                             2.5 %       97.5 %
## (Intercept)            2933.943508 13224.060855
## L.DEU.GDP               -65.461172   407.033730
## L.DEU.unempl           -800.474818   363.377334
## L.DEU.prvconsm         -485.575636    -5.370344
## L.ECB.MRO.change        398.616788  6776.157856
## L.ECB.dep.change      -4911.462920  1241.290214
```

```
## L.WTI.dollar.change    -114.332810     7.395580
## L.Brent.dollar.change    -4.360415   100.025664
## year2000              -1063.998673  1597.247324
## year2001              -1757.198917   336.471680
## year2002              -1608.739304   492.064544
## year2003              -3058.495573 -1240.404831
## year2006              -1946.498766  1029.738194
## year2007               -605.332997  1849.658991
## year2008              -3704.018438  -482.311343
## year2009              -1965.999554   453.857144
## year2011              -3635.227521   592.340167
## year2012              -1347.366064  2827.545386
## year2013                369.577965  5141.388364
## year2014                577.679044  5124.476515

##                            2.5 %     97.5 %
## (Intercept)            -1082.9820 38770.0598
## L.JPN.GDP               -506.5210   697.4673
## L.JPN.unempl           -4382.0740  4739.3213
## L.JPN.prvconsm          -482.7246   828.0147
## L.ECB.MRO.change       -1218.8871 17268.5334
## L.ECB.dep.change      -12125.3417  3915.4912
## L.WTI.dollar.change     -201.4538   211.8664
## L.Brent.dollar.change   -214.0906   146.0670
## year2000                -9001.1713  1328.9111
## year2001              -11583.9930 -3663.6687
## year2002              -12293.5135 -2687.5782
## year2003              -13638.4512 -4913.1283
## year2006               -8558.6487  -293.2121
## year2007               -7746.2281   970.1435
## year2008              -16621.9154 -7118.0436
## year2009              -13060.6661 -5822.7404
## year2011              -16856.3102 -6969.7050
## year2012              -12547.8356 -6310.5951
## year2013               -8871.3824   935.2609
## year2014               -6773.5129  1697.6956

##                             2.5 %      97.5 %
## (Intercept)           -1188.50514 12509.74290
## L.FRA.GDP              -668.29387   591.07971
## L.FRA.unempl           -643.11024   572.70390
## L.FRA.prvconsm         -708.83800   514.48069
## L.ECB.MRO.change      -1342.19821  3557.93135
## L.ECB.dep.change      -2204.06140  2449.82593
## L.WTI.dollar.change     -61.80480    53.53851
## L.Brent.dollar.change   -41.50322    58.16412
## year2000               -932.12764  2213.25111
## year2001              -2045.11324  1594.04579
## year2002              -1835.45642  1378.64645
## year2003              -3602.61532   -22.39939
## year2006              -2388.97590  1432.41411
## year2007              -2142.68534  2470.51465
## year2008              -4948.32597   185.13261
## year2009              -3374.63008   225.42631
```

```
## year2011              -4298.93383  -745.72953
## year2012              -2822.48545  -282.98663
## year2013              -2020.31254   280.43232
## year2014              -1890.69298   325.43449
```

```
##                            2.5 %        97.5 %
## (Intercept)            3994.9515  8163.5005169
## L.GBR.GDP              -256.7998   172.8614641
## L.GBR.unempl           -218.5724   455.5955589
## L.GBR.prvconsm         -121.9588   281.9056740
## L.ECB.MRO.change       -431.9331  2558.3801551
## L.ECB.dep.change      -1248.5841  1525.1187448
## L.WTI.dollar.change     -32.4950    27.0284565
## L.Brent.dollar.change   -25.1140    34.5161783
## year2000              -1682.4703     0.7107676
## year2001              -1772.4518  -448.8724950
## year2002              -1504.9259  -352.6886605
## year2003              -2830.5810 -1714.4110723
## year2006              -1869.5928  -346.3055442
## year2007              -1417.0714   115.6800730
## year2008              -3598.3473 -1918.2503004
## year2009              -2905.0575 -1008.6038066
## year2011              -2844.8260  -952.0974574
## year2012              -1774.4690   -42.4481584
## year2013              -1025.3742   762.2130216
## year2014               -567.8002   484.1541041
```

Heteroscedasticity Diagnose

Diagnose of non-normality of Errors

Inferential Statistics - US ecomomy

```
##
## ================================================================================
##                                          Dependent variable:
##                                ---------------------------------------------
##                                    DAX          Nikkei          CAC          FTSE
##                                    (1)           (2)            (3)           (4)
## --------------------------------------------------------------------------------
## DEU.GDP                          146.393
##                                 (150.986)
##
## L.DEU.unempl                    -389.530
##                                 (302.553)
##
## L.DEU.prvconsm                  -106.105
##                                 (102.372)
##
## JPN.GDP                                        207.582
##                                               (268.774)
##
```

```
## L.JPN.unempl                                -739.076
##                                           (2,197.227)
##
## L.JPN.prvconsm                               253.848
##                                             (254.534)
##
## FRA.GDP                                                    149.938
##                                                          (221.916)
##
## L.FRA.unempl                                               -70.202
##                                                          (269.168)
##
## L.FRA.prvconsm                                            -221.328
##                                                          (247.200)
##
## GBR.GDP                                                                 22.453
##                                                                       (197.906)
##
## L.GBR.unempl                                                            81.157
##                                                                       (163.784)
##
## L.GBR.prvconsm                                                          -1.235
##                                                                       (106.701)
##
## L.ECB.MRO.change              1,123.208     5,027.783       338.489       592.532
##                              (1,437.957)   (5,004.385)   (1,206.240)   (863.858)
##
## L.ECB.dep.change               744.018      -1,195.655      975.020       596.714
##                               (1,289.377)   (4,328.101)   (1,040.662)   (743.882)
##
## L.WTI.dollar.change            -33.646        12.883        -17.202       -6.956
##                                (27.032)       (97.195)      (24.588)      (13.850)
##
## L.Brent.dollar.change           34.809        -32.237        21.281         9.752
##                                (27.697)       (85.844)      (23.042)      (14.026)
##
## year2000                        274.227      -3,561.202      640.759      -756.039
##                                (656.383)     (2,319.067)    (665.042)     (506.708)
##
## year2001                       -557.995     -6,647.862***      8.783      -935.456**
##                                (482.853)     (1,971.841)    (782.274)     (385.328)
##
## year2002                       -228.858     -6,664.014**     -238.813     -897.361**
##                                (465.797)     (2,268.443)    (680.368)     (312.626)
##
## year2003                    -1,884.528*** -8,599.941***  -1,801.566**  -2,266.932***
##                                (508.582)     (2,046.922)    (752.972)     (267.430)
##
## year2006                       -32.942      -4,556.542**    -465.173     -1,052.667*
##                                (798.745)     (1,848.795)    (803.090)     (491.325)
##
## year2007                        960.101      -3,637.577*      168.892      -597.824
##                                (640.800)     (1,974.874)    (966.980)     (437.910)
##
```

```
## year2008                      -1,378.237   -9,926.547***   -1,666.211   -2,326.150**
##                                (822.183)    (2,755.430)    (1,164.037)    (995.673)
##
## year2009                       -366.631    -8,254.421***   -1,115.823   -1,707.838**
##                                (593.230)    (1,962.423)     (797.260)     (653.850)
##
## year2011                      -1,742.029   -11,966.320*** -2,637.574*** -1,817.232**
##                                (969.875)    (2,201.154)     (803.492)     (648.276)
##
## year2012                       443.832    -9,352.096***  -1,364.016**    -707.702
##                                (994.960)    (1,443.784)     (551.591)     (638.597)
##
## year2013                       1,645.187    -5,116.590*     -814.554      -126.378
##                               (1,232.968)   (2,482.475)     (471.926)     (455.980)
##
## year2014                      2,260.658*     -3,255.560     -649.952       31.702
##                               (1,117.842)   (2,036.460)     (472.306)     (356.463)
##
## USA.GDP                        191.396       559.799        174.077       126.928
##                                (169.344)     (544.707)      (137.529)     (101.972)
##
## Constant                     9,220.074***   22,432.870**   5,785.830*   6,159.415***
##                               (2,547.493)   (9,482.095)    (2,954.617)    (928.686)
##
## ------------------------------------------------------------------------------------
## Observations                      31             31             31             31
## R2                               0.991          0.975          0.986          0.989
## Adjusted R2                      0.972          0.925          0.958          0.968
## Residual Std. Error (df = 10)    293.890       1,020.339       235.560        163.032
## F Statistic (df = 20; 10)       52.140***      19.547***      35.148***      47.094***
## ====================================================================================
## Note:                                                  *p<0.1; **p<0.05; ***p<0.01
```

Confidence Intervals

```
##                              2.5 %      97.5 %
## (Intercept)            3543.90514 14896.24314
## DEU.GDP                -190.02602   482.81128
## L.DEU.unempl          -1063.66017   284.59928
## L.DEU.prvconsm         -334.20296   121.99376
## L.ECB.MRO.change      -2080.75861  4327.17504
## L.ECB.dep.change      -2128.89260  3616.92932
## L.WTI.dollar.change     -93.87732    26.58503
## L.Brent.dollar.change   -26.90275    96.52108
## year2000              -1188.28606  1736.74052
## year2001              -1633.85895   517.86902
## year2002              -1266.71948   809.00301
## year2003              -3017.71928  -751.33691
## year2006              -1812.65768  1746.77302
## year2007               -467.68996  2387.89156
## year2008              -3210.17391   453.70087
## year2009              -1688.42912   955.16778
## year2011              -3903.04543   418.98710
```

```
## year2012              -1773.07719  2660.74108
## year2013              -1102.03756  4392.41106
## year2014               -230.04864  4751.36463
## USA.GDP                -185.92680   568.71839
```

```
##                            2.5 %     97.5 %
## (Intercept)             1305.4399 43560.2902
## JPN.GDP                 -391.2842   806.4479
## L.JPN.unempl           -5634.8025  4156.6502
## L.JPN.prvconsm          -313.2883   820.9851
## L.ECB.MRO.change       -6122.6809 16178.2474
## L.ECB.dep.change      -10839.2651  8447.9556
## L.WTI.dollar.change     -203.6811   229.4464
## L.Brent.dollar.change   -223.5090   159.0353
## year2000               -8728.4040  1606.0010
## year2001              -11041.3976 -2254.3271
## year2002              -11718.4208 -1609.6079
## year2003              -13160.7665 -4039.1147
## year2006               -8675.9142  -437.1698
## year2007               -8037.8712   762.7177
## year2008              -16066.0269 -3787.0667
## year2009              -12626.9723 -3881.8690
## year2011              -16870.8005 -7061.8466
## year2012              -12569.0473 -6135.1456
## year2013              -10647.8889   414.7083
## year2014               -7793.0762  1281.9559
## USA.GDP                 -653.8839  1773.4821
```

```
##                            2.5 %      97.5 %
## (Intercept)             -797.46629 12369.12654
## FRA.GDP                 -344.52134   644.39698
## L.FRA.unempl            -669.94587   529.54115
## L.FRA.prvconsm          -772.12420   329.46818
## L.ECB.MRO.change      -2349.18057  3026.15853
## L.ECB.dep.change      -1343.71869  3293.75943
## L.WTI.dollar.change     -71.98730    37.58291
## L.Brent.dollar.change   -30.06027    72.62304
## year2000               -841.04603  2122.56360
## year2001              -1734.23324  1751.79846
## year2002              -1754.76689  1277.14016
## year2003              -3479.29098  -123.84003
## year2006              -2254.56907  1324.22405
## year2007              -1985.67497  2323.45837
## year2008              -4259.84616   927.42469
## year2009              -2892.22871   660.58249
## year2011              -4427.86588  -847.28223
## year2012              -2593.03784  -134.99459
## year2013              -1866.07001   236.96290
## year2014              -1702.31651   402.41151
## USA.GDP                -132.35619   480.51087
```

```
##                            2.5 %      97.5 %
## (Intercept)             4090.17348  8228.65690
```

```
## GBR.GDP                -418.51013   463.41531
## L.GBR.unempl           -283.77616   446.08929
## L.GBR.prvconsm         -238.97836   236.50911
## L.ECB.MRO.change      -1332.26408  2517.32845
## L.ECB.dep.change      -1060.75764  2254.18584
## L.WTI.dollar.change     -37.81527    23.90335
## L.Brent.dollar.change   -21.49922    41.00313
## year2000              -1885.05341   372.97629
## year2001              -1794.02133   -76.89094
## year2002              -1593.93447  -200.78758
## year2003              -2862.80455 -1671.06006
## year2006              -2147.40828    42.07377
## year2007              -1573.54690   377.89979
## year2008              -4544.64802  -107.65293
## year2009              -3164.70535  -250.97031
## year2011              -3261.68036  -372.78264
## year2012              -2130.58427   715.17930
## year2013              -1142.36485   889.60880
## year2014               -762.54678   825.95116
## USA.GDP                -100.28059   354.13588
```

Heteroscedasticity Diagnose

Diagnose of non-normality of Errors