



# Unemployment Rate in the US and UK

## Panel Data Regression

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## Variables Description

Variable	Description	Source
Unemployment rate (%)	Annual unemployment rate	ONS(UK), FRED
Country	Two levels: US and UK	-
Year	Time period 1985 - 2018	-
Inflation (%)	Annual inflation	FRED
Gross domestic product (% change)	Annual GDP	FRED
Stock market	UK: FTSE 100 index US: S&P 500 index	Yahoo Finance



## Dataset Structure

```
> str(d)
'data.frame':   68 obs. of  6 variables:
 $ country: chr   "UK" "UK" "UK" "UK" ...
 $ year   : num   1985 1986 1987 1988 1989 ...
 $ inf     : num    6.1  3.4  4.1  4.2  5.8  8.1  7.5  4.6  2.6  2.2 ...
 $ unemp   : num   11.4 11.3 10.4  8.6  7.2  7.1  8.9  9.9 10.4  9.5 ...
 $ s.p     : num   1315 1607 2029 1802 2195 ...
 $ gdp     : num    4.2  3.14  5.3  5.76  2.57  0.74 -1.09  0.37  2.53  3.89 ...
```

# Summary Statistics

UK

```
> stargazer(uk[c("inf", "unemp", "s.p", "gdp")], type = "text")
```

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
inf	34	2.900	1.776	0.400	1.800	3.475	8.100
unemp	34	7.100	2.087	4.100	5.325	8.475	11.400
s.p	34	4,606.112	1,822.602	1,314.800	3,027.300	6,219.900	7,367.100
gdp	34	2.351	1.814	-4.250	1.898	3.395	5.760

US

```
> stargazer(us[c("inf", "unemp", "s.p", "gdp")], type = "text")
```

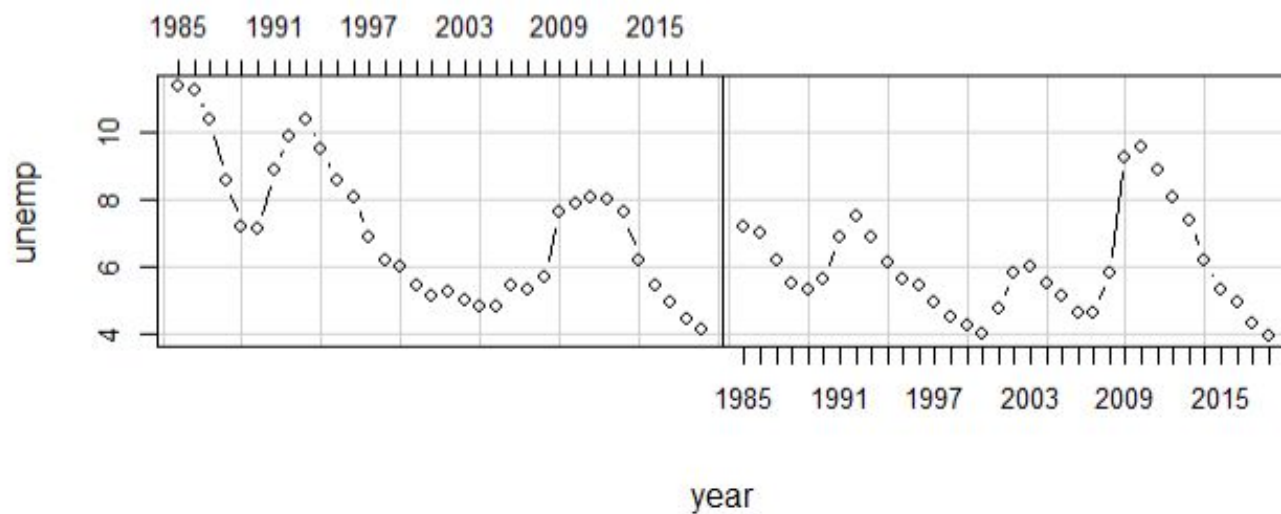
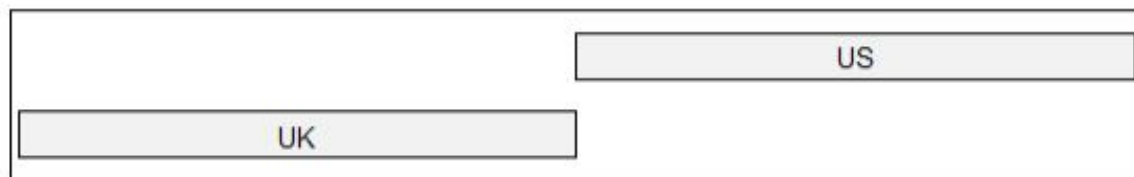
Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
inf	34	2.685	1.061	1.000	1.875	3.225	5.000
unemp	34	5.965	1.486	3.900	4.900	6.900	9.600
s.p	34	1,069.869	658.473	186.850	453.640	1,366.185	2,709.980
gdp	34	4.888	1.858	-0.800	4.225	6.300	7.800



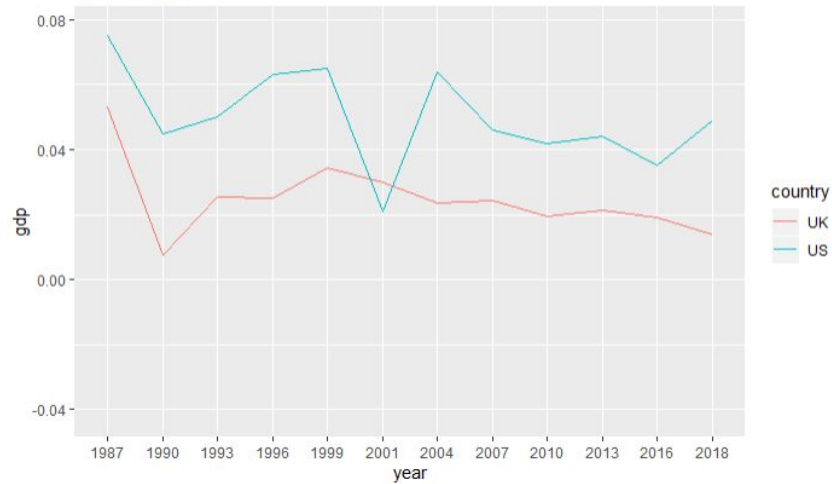
# Problem Statement

- Aims at studying the association of economic factors with change in unemployment rate within USA and UK

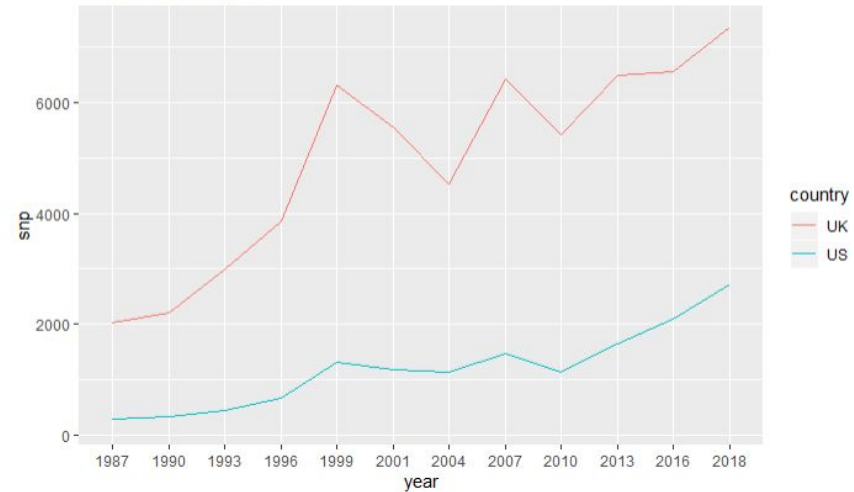
Given : country



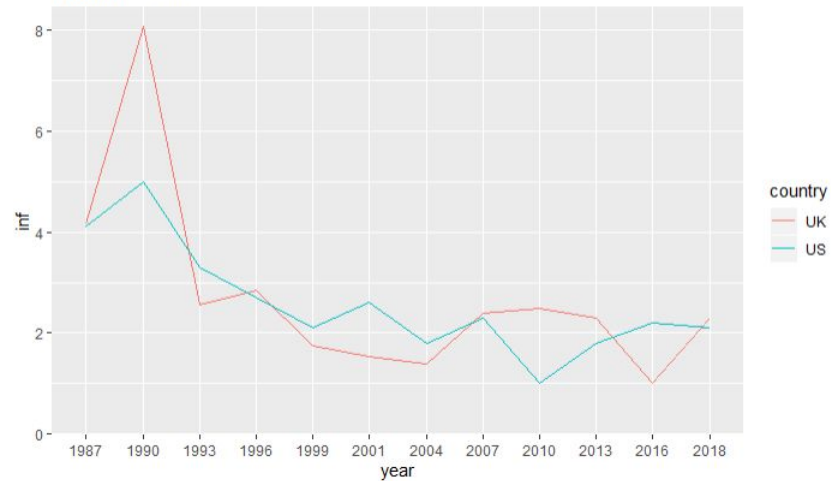
### GDP Trend



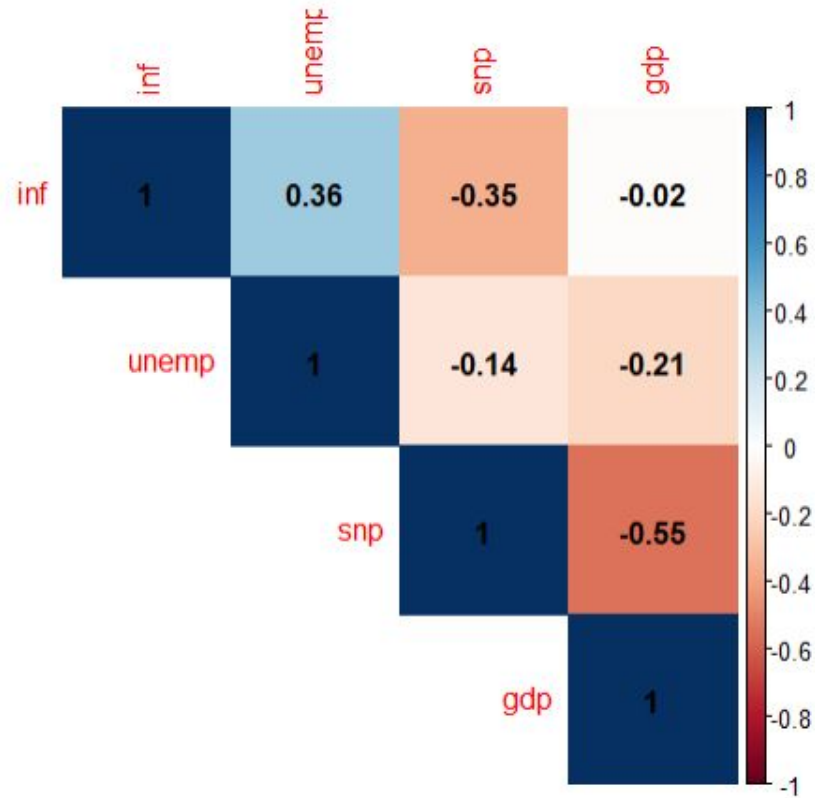
### Market Index Trend



### Inflation Trend



# Correlation Matrix





# Pooled Effects Model

```
> pooled <-plm(unemp ~ inf + gdp + snp, data=a, model="pooling")
```

```
> summary(pooled)
```

Pooling Model

Call:

```
plm(formula = unemp ~ inf + gdp + snp, data = a, model = "pooling")
```

Balanced Panel: n = 2, T = 34, N = 68

Residuals:

Min.	1st Qu.	Median	3rd Qu.	Max.
-2.48086	-1.24925	-0.56813	1.15146	4.19319

Coefficients:

	Estimate	Std. Error	t-value	Pr(> t )
(Intercept)	7.04204323	0.98697992	7.1349	1.078e-09 ***
inf	0.35866600	0.16078945	2.2307	0.02922 *
gdp	-0.27412652	0.11804322	-2.3223	0.02341 *
snp	-0.00018291	0.00012498	-1.4635	0.14823

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares: 238.45

Residual Sum of Squares: 191.57

R-Squared: 0.19658

Adj. R-Squared: 0.15892

F-statistic: 5.21982 on 3 and 64 DF, p-value: 0.0027528

# Fixed Effects - Within Model

```
> # Fixed Effects Model
> fixed_w <- plm(unemp ~ inf + gdp + snp , data=a, model="within")
> summary(fixed_w)
Oneway (individual) effect within Model
```

```
Call:
plm(formula = unemp ~ inf + gdp + snp, data = a, model = "within")
```

Balanced Panel: n = 2, T = 34, N = 68

Residuals:

	Min.	1st Qu.	Median	3rd Qu.	Max.
	-2.88511	-0.96033	-0.17268	0.88002	3.19089

Coefficients:

	Estimate	Std. Error	t-value	Pr(> t )
inf	-0.23018800	0.15439764	-1.4909	0.14098
gdp	-0.19035321	0.09282889	-2.0506	0.04447 *
snp	-0.00107337	0.00016771	-6.4001	2.192e-08 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares: 216.54

Residual Sum of Squares: 114.39

R-Squared: 0.47174

Adj. R-Squared: 0.4382

F-statistic: 18.7531 on 3 and 63 DF, p-value: 8.3292e-09

```
> summary(fixef(fixed_w))
```

	Estimate	Std. Error	t-value	Pr(> t )
UK	13.15910	1.21289	10.849	4.725e-16 ***
US	8.66168	0.80783	10.722	7.683e-16 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

# Fixed Effects - Within Two-ways Model

```
> fixed_w2 <-plm(unemp ~ inf + gdp + snp , data=a, model="within", effect="twoways")
```

```
> summary(fixed_w2)
```

Twoways effects Within Model

Call:

```
plm(formula = unemp ~ inf + gdp + snp, data = a, effect = "twoways",  
     model = "within")
```

Balanced Panel: n = 2, T = 34, N = 68

Residuals:

	Min.	1st Qu.	Median	3rd Qu.	Max.
	-1.3393e+00	-3.7843e-01	2.4633e-16	3.7843e-01	1.3393e+00

Coefficients:

	Estimate	Std. Error	t-value	Pr(> t )
inf	-0.37373631	0.22627524	-1.6517	0.1090
gdp	0.08764085	0.17069304	0.5134	0.6114
snp	-0.00107293	0.00019017	-5.6418	3.808e-06 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares: 48.569

Residual sum of Squares: 23.363

R-Squared: 0.51897

Adj. R-Squared: -0.074311

F-statistic: 10.7885 on 3 and 30 DF, p-value: 5.668e-05

```
> summary(fixef(fixed_w2))
```

	Estimate	Std. Error	t-value	Pr(> t )
UK	12.9198	1.2892	10.0213	4.354e-11 ***
US	7.6878	1.2216	6.2931	6.164e-07 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

# Fixed Effects - Comparison

```
> stargazer(pooled,fixed_w,fixed_w2,type='text',summary=FALSE)
```

=====			
Dependent variable:			
-----			
	(1)	unemp (2)	(3)
-----			
inf	0.359** (0.161)	-0.230 (0.154)	-0.374 (0.226)
gdp	-0.274** (0.118)	-0.190** (0.093)	0.088 (0.171)
snp	-0.0002 (0.0001)	-0.001*** (0.0002)	-0.001*** (0.0002)
Constant	7.042*** (0.987)		
-----			
Observations	68	68	68
R2	0.197	0.472	0.519
Adjusted R2	0.159	0.438	-0.074
F Statistic	5.220*** (df = 3; 64)	18.753*** (df = 3; 63)	10.789*** (df = 3; 30)
=====			
Note:	*p<0.1; **p<0.05; ***p<0.01		

```
> |
```

# Fixed Effects - Comparison

```
> stargazer(summary(fixef(fixed_w)), type = "text", summary =  
  FALSE, title = "Intercept for Within one way ")
```

Intercept for Within one way

=====				
	Estimate	Std. Error	t-value	Pr(>   t  )
-----				
UK	13.159	1.213	10.849	0
US	8.662	0.808	10.722	0
-----				

```
> stargazer(summary(fixef(fixed_w2)), type = "text", summary  
  = FALSE, title = "Intercept for Within Two way ")
```

Intercept for Within Two way

=====				
	Estimate	Std. Error	t-value	Pr(>   t  )
-----				
UK	12.920	1.289	10.021	0
US	7.688	1.222	6.293	0.00000
-----				

# PLM Tests

```
> pFtest(fixed_w, pooled)
```

F test for individual effects

```
data: unemp ~ inf + gdp + snp  
F = 42.511, df1 = 1, df2 = 63, p-value = 1.361e-08  
alternative hypothesis: significant effects
```

```
> plmtest(fixed_w, effect = "individual")
```

Lagrange Multiplier Test - (Honda) for balanced panels

```
data: unemp ~ inf + gdp + snp  
normal = 2.1062, p-value = 0.01759  
alternative hypothesis: significant effects
```

```
> plmtest(fixed_w2, effect="twoways", type="bp")
```

Lagrange Multiplier Test - two-ways effects (Breusch-Pagan) for balanced panels

```
data: unemp ~ inf + gdp + snp  
chisq = 7.5561, df = 2, p-value = 0.02287  
alternative hypothesis: significant effects
```



# Conclusion

- ❖ Fixed Effects one way - GDP , S&P significant on Unemployment rate
- ❖ Fixed Effects Two way - S&P significant on Unemployment rate



[illegible]