

Income and Democracy

Bachelor's/Master's Thesis submitted

to

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School of Business and Economics

Institute for Statistics and Econometrics

Chair of Econometrics

by

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Abstract

This is the template for a thesis at the Chair of Econometrics of Humboldt–Universität zu Berlin. A popular approach to write a thesis or a paper is the IMRAD method (Introduction, Methods, Results and Discussion). This approach is not mandatory! You can find more information about formal requirements in the booklet ‘Hinweise zur Gestaltung der äußeren Form von Diplomarbeiten’ which is available in the office of studies.

The abstract should not be longer than a paragraph of around 10 to 15 lines (or about 150 words). The abstract should contain a concise description of the econometric/economic problem you analyse and of your results. This allows the busy reader to obtain quickly a clear idea of the thesis content.

Contents

List of Abbreviations	4
List of Figures	5
List of Tables	6
1 Introduction: Sharon, Soichi	1
2 Statistical Theory: Hyerin	1
3 Implementation	2
4 Empirical Study	3
4.1 Data description: Soichi	3
4.2 Regression Specification: Hyerin	3
4.3 Regression Estimates	4
4.3.1 Fixed Effects: Soichi	4
4.3.2 Instrumental Variable: Hyerin	5
4.4 Robustness Tests: Sharon	6
5 Conclusions	7
References	8
A Source Code Listing	9
B Figures	17

List of Abbreviations

CPI	Consumer Price Index	ETF	Equity Traded Funds
ETH	Eat the Horse	XLM	Xetra Liquidity

List of Figures

1	Estimated residuals from model XXX.	4
2	Estimated residuals (2) from model XXX.	17

List of Tables

1	FIXED EFFECTS RESULTS USING FREEDOM HOUSE MEASURE OF DEMOCRACY	4
2	FIXED EFFECTS RESULTS USING FREEDOM HOUSE MEASURE OF DEMOCRACY: TWO-STAGE LEAST SQUARES WITH SAVINGS RATE INSTRUMENT	5
3	FIXED EFFECTS RESULTS WITH ALTERNATIVE SAMPLES AND ADDITIONAL CONTROL VARIABLES	6
4	FIXED EFFECTS RESULTS USING AN ALTERNATIVE DEPENDENT VARIABLE: POLITY MEASURE	7

1 Introduction: Sharon, Soichi

- What is the subject of the study? Describe the economic/econometric problem.
- What is the purpose of the study (working hypothesis)?
- What do we already know about the subject (literature review)? Use citations: *Gallant (1987) shows that... Alternative Forms of the Wald test are considered (Breusch and Schmidt, 1988).*
- What is the innovation of the study?
- Provide an overview of your results.
- Outline of the paper:
The paper is organized as follows. The next section describes the model under investigation. Section ?? describes the data set and Section ?? presents the results. Finally, Section ?? concludes.
- The introduction should not be longer than 4 pages.

2 Statistical Theory: Hyerin

Describe the statistical theory that you implement and the corresponding algorithm(s) that was (were) designed. Avoid describing how the design was produced, rather, show different versions of the design if relevant.

- Panel Data analysis
- Fixed Effects
- Clustering by group
- Instrumental Variable

3 Implementation

Show the implementation. The goal of this section is to show and explain the most important parts of the code. Listing the code with highlighting and possibly line numbering is essential. Explain the code by referring to line numbers, function calls and variable names. Leave out trivial parts (initialization, parameter-tuning, etc...).

- PLM
- CLSE
- Stargazer
- Figure

4 Empirical Study

4.1 Data description: Soichi

- Describe the data and its quality.
- How was the data sample selected?
- Provide descriptive statistics such as:
 - time period,
 - number of observations, data frequency,
 - mean, median,
 - min, max, standard deviation,
 - skewness, kurtosis, Jarque–Bera statistic,
 - time series plots, histogram.
- Allows the reader to judge whether the sample is biased or to evaluate possible impacts of outliers, for example.

4.2 Regression Specification: Hyerin

In this section, we discuss the causal effect of income on democracy. The relation between democracy scores and income per capita is estimated using the following simple econometric model:

$$d_{i,t} = \alpha d_{i,t-1} + \gamma y_{i,t-1} + X'_{i,t-1} \beta + \mu_t + \delta_i + u_{i,t} \quad (1)$$

The democracy score of country i in time period t is denoted by $d_{i,t}$. To capture persistency of it, the lagged value of this variable, $d_{i,t}$, is included as a regressor in the model. $y_{i,t-1}$ denotes the lagged value of country i 's log income per capita and the estimated coefficient, γ , measures the causal effect of income per capita on democracy. If an increase in income per capita leads to an higher score of democracy, then the coefficient on the lagged value of log income per capita γ should be positive. A full set of country dummies and time effects δ_i μ_t . All other potential covariates are denoted in the vector formation, $X'_{i,t-1}$. To control for country-specific factors a full set of country dummies, δ_i , is included in the right-hand side. In addition, to capture common shocks over all sample countries, it introduces μ_t as a full set of time effects. An error term is denoted as $u_{i,t}$.

4.3 Regression Estimates

4.3.1 Fixed Effects: Soichi

Table 1: FIXED EFFECTS RESULTS USING FREEDOM HOUSE MEASURE OF DEMOCRACY

	Base sample, 1960-2000				
	Five-year data			Ten-year data	Twenty-year data
	Pooled OLS	Fixed effects OLS	Fixed effects OLS	Fixed effects OLS	Fixed effects OLS
	(1)	(2)	(3)	(4)	(5)
<i>Dependent variable is democracy</i>					
Democracy _{t-1}	0.706*** (0.035)	0.379*** (0.051)		-0.025 (0.088)	-0.581*** (0.198)
Log GDP per capita _{t-1}	0.072*** (0.010)	0.010 (0.035)	0.054 (0.046)	0.053 (0.066)	-0.030 (0.156)
Observations	945	945	958	457	192
R ²	0.725	0.242	0.118	0.122	0.452

Notes:

- Organize material and present results.
- Use tables, figures (but prefer visual presentation):
 - Tables and figures should supplement (and not duplicate) the text.
 - Tables and figures should be provided with legends.

Figure 1 shows how to include and reference graphics. The graphic must be labelled before. Files must be in .eps format.

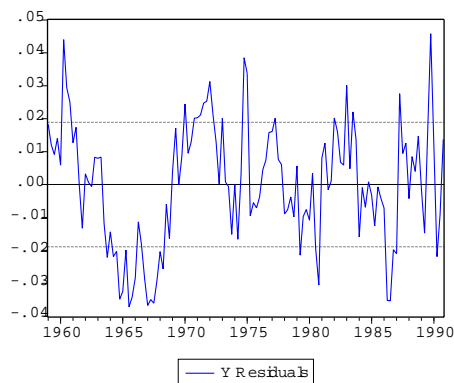


Figure 1: Estimated residuals from model XXX. ...

- Tables and graphics may appear in the text or in the appendix, especially if there are many simulation result tabulated, but is also depends on the study and number of tables resp.figures. The key graphs and tables must appear in the text!

4.3.2 Instrumental Variable: Hyerin

Since the fixed effects estimation does not necessarily examine the causal effect of income on democracy, we need a instrumental variable to estimate the causal relation between them.

Table 2: FIXED EFFECTS RESULTS USING FREEDOM HOUSE MEASURE OF DEMOCRACY: TWO-STAGE LEAST SQUARES WITH SAVINGS RATE INSTRUMENT

	Base sample, 1960-2000							
	All countries							
	Pooled OLS (1)	Fixed effects OLS (2)	Fixed effects OLS (3)	Fixed effects 2SLS (4)	Fixed effects 2SLS (5)	Fixed effects 2SLS (6)	Fixed effects 2SLS (7)	Fixed effects 2SLS (8)
Panel A	<i>Dependent variable is democracy</i>							
Democracy _{t-1}			0.359 (0.054)		0.363 (0.056)			
Log GDP per capita _{t-1}	0.233*** (0.013)	0.044 (0.051)	0.009 (0.038)	-0.035 (0.094)	-0.020 (0.081)	-0.036 (0.191)	-0.074 (0.113)	0.016 (0.095)
Labor share _{t-1}						0.250 (0.199)		
Panel B	<i>First stage for log GDP per capita_{t-1}</i>							
Democracy _{t-1}					0.144** (0.066)		[0.24]	
Labor share _{t-1}						0.329* (0.187)		
Savings rate _{t-2}				1.356*** (0.277)	1.343*** (0.270)	1.202*** (0.315)	1.173*** (0.254)	1.022*** (0.218)
Savings rate _{t-3}								0.720*** (0.182)
Observations	891	900	766	900	891	471	733	796
R ²	0.226	0.115	0.225	0.571	0.571	0.725	0.541	0.536

Notes: This table summarizes the coefficients of each cross-sectional regression. All regression model includes year dummies to capture country-invariant factors. Except for column 1, country dummies are included in the regressions. The robust standard errors clustered by country are summarized in parentheses.

***Significant at the 1 percent level

**Significant at the 5 percent level

*Significant at the 10 percent level

4.4 Robustness Tests: Sharon

Table 3: FIXED EFFECTS RESULTS WITH ALTERNATIVE SAMPLES AND ADDITIONAL CONTROL VARIABLES

	Five-year data			
	Balanced panel 1970-2000	Base sample, 1960-2000, without former socialist countries	Base sample, 1960-2000	
	Fixed effects OLS (1)	Fixed effects OLS (2)	Fixed effects OLS (3)	Fixed effects OLS (4)
	<i>Dependent variable is democracy</i>			
Democracy _{t-1}	0.283*** (0.058)	0.362*** (0.052)	0.353*** (0.053)	0.351*** (0.055)
Log GDP per capita _{t-1}	-0.031 (0.049)	0.005 (0.035)	0.015 (0.041)	-0.001 (0.049)
Log population _{t-1}			-0.109 (0.100)	-0.042 (0.108)
Education _{t-1}				-0.007 (0.020)
Age Structure _{t-1}			[0.05]	[0.19]
Observations	630	908	863	676
Countries	90	128	142	95
R ²	0.215	0.221	0.241	0.235

Notes:

- Discuss results:
 - Do the results support or do they contradict economic theory ?
 - What does the reader learn from the results?
 - Try to give an intuition for your results.
 - Provide robustness checks.
 - Compare to previous research.

Table 4: FIXED EFFECTS RESULTS USING AN ALTERNATIVE DEPENDENT VARIABLE: POLITY MEASURE

	Base sample, 1960-2000				
	Five-year data			Ten-year data	Twenty-year data
	Pooled OLS	Fixed effects OLS	Fixed effects OLS	Fixed effects OLS	Fixed effects OLS
	(1)	(2)	(3)	(4)	(5)
Democracy _{<i>t</i>-1}	0.749*** (0.034)	0.449*** (0.063)		0.060 (0.091)	-0.516*** (0.165)
Log GDP per capita _{<i>t</i>-1}	0.053*** (0.010)	-0.006 (0.039)	-0.011 (0.055)	0.007 (0.070)	-0.126 (0.164)
Observations	854	854	880	419	168
R ²	0.772	0.396	0.248	0.257	0.544

Notes:

5 Conclusions

- Give a short summary of what has been done and what has been found.
- Expose results concisely.
- Draw conclusions about the problem studied. What are the implications of your findings?
- Point out some limitations of study (assist reader in judging validity of findings).
- Suggest issues for future research.

References

- BREUSCH, T. S. AND P. SCHMIDT (1988): “Alternative Forms of the Wald test: How Long is a Piece of String,” *Communications in Statistics, Theory and Methods*, 17, 2789–2795.
- GALLANT, A. R. (1987): *Nonlinear Statistical Models*, New York: John Wiley & Sons.

A Source Code Listing

```
1 require("sandwich")
2 require("lmtest")
3 require("stargazer")
4
5
6
7 else = function(reg) {
8   # index(reg, "id") returns the id or entity variable vector
9   G = length(unique(index(reg,"id")))
10  N = length(index(reg,"id"))
11  dfa = (G/(G - 1))*(N-1)/reg$df.residual # note Bluhm multiplies this by
      finite-sample df adjustment
12  rob = sqrt(diag(dfa*vcovHC(reg, type = "HC0",
13                           cluster = "group", adjust = T)))
14  return(rob)
15 }
16
17 stargazer(F_pols, F_fols, F_folswod, se=list(else(F_pols), else(F_fols), else(F_
      folswod)), title="Panel regression, clustered SEs", type="text", column.
      labels=c("Pooled OLS", "Fixed Effects OLS", "Fixed Effects OLS"), df=FALSE,
      digits=3)

1 #rm(list=ls())
2 getwd()
3 #setwd()
4 setwd("C:/myR/Dem_data")
5
6
7 #Import data set
8 One=read.csv("Annual_panel.csv")
9 Five=read.csv("5yr_panel.csv")
10 Ten=read.csv("10yr_panel.csv")
11 Twenty=read.csv("20yr_panel.csv")
12
13 require(plm)
14 require(lmtest)
15 require(tseries)
16 require(car)
17 #Base sample with Five-year data
18 #T2. C1
```

```

19 F_pols = plm(fhpolrigaug ~ lag(fhpolrigaug)+lag(lrgdpch)+factor(year), data =
      Five, subset = sample == "1", index = c("code","year"), model = "pooling")
20 summary(F_pols)
21
22
23 #Test for multicollinearity by using pooled data
24 #VIF(Variance inflation factor)
25 vif(F_pols)
26
27 #Breusch-Godfrey test
28 pbgttest(F_pols)
29
30 #Breusch-Pagan test for homoskedastisity
31 plmtest(F_pols, type="bp")
32
33
34 #T2. C2
35 F_fols = plm(fhpolrigaug ~ lag(fhpolrigaug)+lag(lrgdpch)+factor(country)+factor
      (year), data = Five, subset = sample == "1",index = c("country","year"),
      model = "within", effect = "individual")
36 summary(F_fols)
37
38 #Breusch-Godfrey test
39 pbgttest(F_fols)
40
41 #Breusch-Pagan test for homoskedastisity
42 plmtest(F_fols, type="bp")
43
44
45 #T2. C5
46 F_folswod = plm(fhpolrigaug ~ lag(lrgdpch)+factor(year)+factor(country), data =
      Five, subset = sample == "1", index = c("code","year"), model = "within",
      effect = "individual")
47 summary(F_folswod)
48
49 #Breusch-Godfrey test
50 pbgttest(F_folswod)
51
52 #Breusch-Pagan test for homoskedastisity
53 plmtest(F_folswod, type="bp")
54

```



```

55
56 #T2. C6
57 O_fols = plm(fhpolrigaug ~ lag(fhpolrigaug, 1:5)+lag(lrgdpch, 1:5)+factor(
      country)+factor(year), data = One, subset = sample == "1",index = c("
      country","year"), model = "within", effect = "individual")
58 summary(O_fols)
59
60 #Breusch-Godfrey test
61 pbgtest(O_fols)
62
63 #Breusch-Pagan test for homoskedastisity
64 plmtest(O_fols, type="bp")
65
66
67
68 #T2. C7
69 T_fols = plm(fhpolrigaug ~ lag(fhpolrigaug)+lag(lrgdpch)+factor(country)+factor
      (year), data = Ten, subset = sample == "1",index = c("country","year"),
      model = "within", effect = "individual")
70 summary(T_fols)
71
72 #Breusch-Godfrey test
73 pbgtest(T_fols)
74
75 #Breusch-Pagan test for homoskedastisity
76 plmtest(T_fols, type="bp")
77
78
79 #T2. C9
80 Tw_fols = plm(fhpolrigaug ~ lag(fhpolrigaug)+lag(lrgdpch)+factor(country)+
      factor(year), data = Twenty, subset = sample == "1",index = c("country",
      year"), model = "within", effect = "individual")
81 summary(Tw_fols)
82
83 #Breusch-Godfrey test
84 pbgtest(Tw_fols)
85
86 #Breusch-Pagan test for homoskedastisity
87 plmtest(Tw_fols, type="bp")

1 #T3. C1
2 Pooled_pols_p = plm(polity4 ~ lag(polity4)+lag(lrgdpch)+factor(year), data =

```

```

    Five, subset = sample == "1", index = c("code", "year"), model = "pooling")
3  summary(Pooled_pols_p)
4
5  #Test for multicollinearity by using pooled data
6  #VIF(Variance inflation factor)
7  vif(Pooled_pols_p)
8
9  #Breusch-Godfrey test
10 pbgttest(Pooled_pols_p)
11
12 #Breusch-Pagan test for homoskedastisity
13 plmtest(Pooled_pols_p, type="bp")
14
15
16 #T3. C2
17 FE_fols_p_2 = plm(polity4 ~ lag(polity4)+lag(lrgdpch)+factor(country)+factor(
    year), data = Five, subset = sample == "1", index = c("country", "year"),
    model = "within", effect = "individual")
18 summary(FE_fols_p_2)
19
20 #Breusch-Godfrey test
21 pbgttest(FE_fols_p_2)
22
23 #Breusch-Pagan test for homoskedastisity
24 plmtest(FE_fols_p_2, type="bp")
25
26
27 #T3. C5
28 FE_folswod_p = plm(polity4 ~ lag(lrgdpch)+factor(year)+factor(country), data =
    Five, subset = sample == "1", index = c("code", "year"), model = "within",
    effect = "individual")
29 summary(FE_folswod_p)
30
31 #Breusch-Godfrey test
32 pbgttest(FE_folswod_p)
33
34 #Breusch-Pagan test for homoskedastisity
35 plmtest(FE_folswod_p, type="bp")
36
37
38 #T3. C6

```

```

39 FE_fols_p_6 = plm(polity4 ~ lag(polity4, 1:5)+lag(lrgdpch, 1:5)+factor(country
    )+factor(year), data = One, subset = sample == "1", index = c("country", "
    year"), model = "within", effect = "individual")
40 summary(FE_fols_p_6)
41
42 #Breusch-Godfrey test
43 pbgttest(FE_fols_p_6)
44
45 #Breusch-Pagan test for homoskedastisity
46 plmtest(FE_fols_p_6, type="bp")
47
48
49
50 #T2. C7
51 FE_fols_p_7 = plm(polity4 ~ lag(polity4)+lag(lrgdpch)+factor(country)+factor(
    year), data = Ten, subset = sample == "1", index = c("country", "year"),
    model = "within", effect = "individual")
52 summary(FE_fols_p_7)
53
54 #Breusch-Godfrey test
55 pbgttest(FE_fols_p_7)
56
57 #Breusch-Pagan test for homoskedastisity
58 plmtest(FE_fols_p_7, type="bp")
59
60
61
62 #T2. C9
63 FE_fols_p_9 = plm(polity4 ~ lag(polity4)+lag(lrgdpch)+factor(country)+factor(
    year), data = Twenty, subset = sample == "1", index = c("country", "year"),
    model = "within", effect = "individual")
64 summary(FE_fols_p_9)
65
66 #Breusch-Godfrey test
67 pbgttest(FE_fols_p_9)
68
69 #Breusch-Pagan test for homoskedastisity
70 plmtest(FE_fols_p_9, type="bp")
71
72
73 library(stargazer)

```

```

74 stargazer(Pooled_pols_p, FE_fols_p_2, FE_folswod_p, FE_fols_p_7, FE_fols_p_9,
    type="html", style = "aer",
75     se=list( cse(Pooled_pols_p), cse(FE_fols_p_2), cse(FE_folswod_p),
        cse(FE_fols_p_7), cse(FE_fols_p_9)),
76     column.labels = c("Five-year data", "Ten-year data", "Twenty-year
        data"), column.separate = c(3,1,1),
77     no.space = TRUE, dep.var.labels="Dependent variable is democracy",
        omit = c("factor", "Constant"), omit.stat = c("f"),
78     covariate.labels=c("Democracy_{t-1}", "Log GDP per capita_{t-1}"),
79     object.names = TRUE,
80     title="Table 3-Fixed Effects Results Using Polity Measure of
        Democracy", align=TRUE, out = "Table 3.htm")

1  #T4.C1
2  F_fols_b = plm(fhpolrigaug ~ lag(fhpolrigaug)+lag(lrgdpch)+factor(year)+factor(
    country), data = Five, subset = samplebalancefe == "1", index = c("code", "
    year"), model = "within", effect = "individual")
3  summary(F_fols_b)
4
5  #Breusch-Godfrey test
6  pbgtest(F_fols_b)
7
8  #Breusch-Pagan test for homoskedastisity
9  plmtest(F_fols_b, type="bp")
10
11
12 #T4.C3
13 F_fols_c = plm(fhpolrigaug ~ lag(fhpolrigaug)+lag(lrgdpch)+factor(year)+factor(
    country), data = Five, subset= sample == "1" & socialist != "1", index = c("
    code", "year"), model = "within", effect = "individual")
14 summary(F_fols_c)
15
16 #Breusch-Godfrey test
17 pbgtest(F_fols_c)
18
19 #Breusch-Pagan test for homoskedastisity
20 plmtest(F_fols_c, type="bp")
21
22
23 #T4.C5
24 #reg fhpolrigaug L.fhpolrigaug L.lrgdpch L.lpop L.medage L.age_veryyoung L.age_
    young L.age_midage L.age_old yr* cd* if sample==1, cluster(code)

```

```

25
26 F_fols_add = plm(fhpolrigaug ~ lag(fhpolrigaug)+lag(lrgdpch)+ lag(lpop)+lag(
      medage)+ lag(age_veryyoung)+ lag(age_young)+lag(age_midage)+lag(age_old)+
      factor(year)+factor(country), data = Five, subset = sample == "1", index =
      c("code", "year"), model="within", effect="individual")
27 summary(F_fols_add)
28
29 #Breusch-Godfrey test
30 pbgttest(F_fols_add)
31
32 #Breusch-Pagan test for homoskedastisity
33 plmtest(F_fols_add, type="bp")
34
35
36 #T4.C7
37 # reg fhpolrigaug L.fhpolrigaugL.education L.lrgdpch L.lpop L.medage L.age_
      veryyoung L.age_young L.age_midage L.age_old yr* cd* if sample==1, cluster
      (code)
38 F_fols_we = plm(fhpolrigaug ~ lag(fhpolrigaug)+lag(lrgdpch)+ lag(lpop)+lag(
      education)+lag(medage)+ lag(age_veryyoung)+ lag(age_young)+lag(age_midage)+
      lag(age_old)+factor(year)+factor(country), data = Five, subset = sample ==
      "1", index = c("code", "year"), model="within", effect="individual")
39 summary(F_fols_we)
40
41 #Breusch-Godfrey test
42 pbgttest(F_fols_we)
43
44 #Breusch-Pagan test for homoskedastisity
45 plmtest(F_fols_we, type="bp")
46
47
48
49 library(stargazer)
50 stargazer(F_fols_b, F_fols_c, F_fols_add, F_fols_we, type="html", style = "aer"
      ,
51          se=list( clse(F_fols_b), clse(F_fols_c), clse(F_fols_add), clse(F_fols_
      we)),
52          column.labels = c("Balanced panel, 1970–2000", "Base sample,
      1960–2000, without former socialist countries", "Base sample,
      1960–2000"), column.separate = c(1,1,2),
53          no.space = TRUE, dep.var.labels="Dependent variable is democracy

```

```

    using five-year data and fixed effects OLS", omit = c("factor", "
    Constant", "age"), omit.stat = c("f"),
54 covariate.labels=c("Democracy_{t-1}", "Log GDP per capita_{t-1}", "
    Log population_{t-1}", "Education_{t-1}"),
55 title="Table 4-Fixed Effects Results Using Freedom House Measure of
    Democracy: Robustness Checks", align=TRUE, out = "Table 4.htm")

```

B Figures

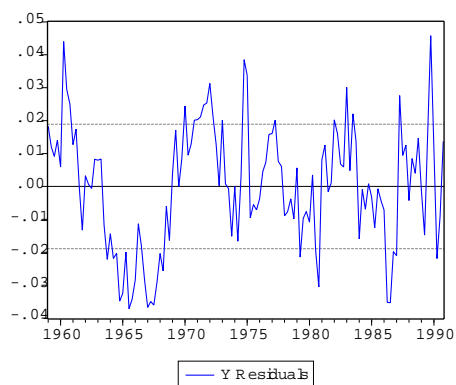


Figure 2: Estimated residuals (2) from model XXX. ...