Income and Democracy

Bachelor's/Master's Thesis submitted

to

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Humboldt-Universität zu Berlin
School of Business and Economics
Institute for Statistics and Econometrics
Chair of Econometrics

by

your name
(your matriculation number)

in partial fulfillment of the requirements
for the degree of
Bachelor/Master of Science
Berlin, September 30, 2007

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

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

List of Figures

- F1

```
1  library(maptools)
2
3  pointLabel(x=F1_revise$lrgdpch,y=F1_revise$fhpolrigaug,labels=F1_revise$code,
       col="black")
```

We handle around 150 data in a figure and if we just plot by "text" command, we cannot distinguish each label. Therefore, we introduce "maptools" package for the figure in order to fix place of each label automatically to be able to recognize each one. "pointLabel" is a command to function automatically adjustment of "maptools" package. We need same texts to call "pointLabel" command with "text" command which uses to change labels form dots to specific names.

- F5

```
1  x<-1945
2  for (i in 1:11) {
3    x<-x+5
4    plot(fhpolrigaug~lrgdpch,data=X5yr_panel, subset=year==x,
5         xlim=c(6,10),ylim=c(0,1),ann=F, xaxt="n",yaxt="n")  #setting for length
             of graph by xlim and ylim, and erase whole title and axis by ann=F
6    text(6.3,0.95,x, cex=1.5)                #label setting for each graph
7    if (i %in% c(8:11)) { axis(1, col="black", col.axis="black", at=
         seq(6, 10, 2)) }
8    if (i %in% c(1, 5, 9)) { axis(2, col="black", col.axis="black",
         at=seq(0, 1, 0.5)) }
9    result<-lm(formula=fhpolrigaug~lrgdpch, data=X5yr_panel, subset=year==x)
10   abline(result, col="blue")
11   box(col="grey60")
12 }
```

Figure5 shows each year panel data in each separate graph. Since we should make 11 figures and avoid to use same command for 11 times, we use "for" command to iterate same command for 11 times. We introduce a variable "x" in the command to refer each year data. Variable "x" is added 5 for each repeat and through this, the command can refer same

number of year data with "x" from data set. Also, we add "if" command to add tick mark to 1st, 5th, and 9th graph in vertical axis and 8th to 11th in horizontal axis. Through this command, "axis" command function in typical number of variable "i" which means number of iterate.

List of Tables

Table 1: Descriptive Statistics

	All countries	High-income countries	Low-income countries
Panel A			
Freedom House measure of	0.57	0.78	0.36
democracy	(0.36)	(0.30)	(0.30)
Log GDP per capita$_{t-1}$			
(chain weighted 1996 price)	8.16	9.02	7.30
Observations	945	473	472
Countries	150	93	98
Panel B			
Polity measure of democracy$_t$	0.57	0.79	0.36
	(0.38)	(0.31)	(0.31)
Observation	854	427	427
Countries	136	81	88

Note: Panel A refers to the sample in Table ??; Panel B refers to the sample in Table ??.

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: **?** *shows that... Alternative Forms of the Wald test are considered (***?***).*
- 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
- Data description

We use the Freedom House Political Right Index as one of proxies of political right. It has researched since 1950 and now researches 209 countries and territories. It measures how countries has ideal democratic political situation and a country gets highest score, which is 1, if it has ideal political situation for democracy. Worst score is 7 and it means it is least free in terms democracy nation. For each country and territory, Freedom in the World analyzes the electoral process, political pluralism and participation, the functioning of the government, freedom of expression and of belief, associational and organizational rights, the rule of law, and personal autonomy and individual rights. Also, because Freedom House index changed the way of the estimation in 1972, we use 1972 data for 1970, and scattering pattern has been changed from before ones before and after 1965. To enhance accuracy of our estimation, we use supplement index with the related variables from Kenneth A. Bollen (1990, 2001) for 1950 to 1965 data.

We also introduce PolityIV political right index. PolityIV estimate the level of each countrys democracy by the competitiveness of political participation, the competitiveness of executive recruitment, the openness of executive recruitment, and the constraints on the chief executive. If the country has best democratic political situation, it is scored 10, the maximum points. Worst score means autocracy and scores 0. Since this proxy has long term data which is from 1800 to recent data, we can analyze before the World War Second through this data set. To compare both two proxies, we normalize them between 0 to 1, and o is worst situation for democracy, and 1 means best political situation for democracy.

GDP per capita data for post war period are from Ala Heston, Robert Summers, and Bettina Atten (2002) and GDP per capita(in contrast 1990 dollars) for the longer sample are from Maddison (2003).

We prepare three data sets from "Income and Democracy"(2008) data set which is written by Daron Acemoglu, Simon Johnson, James A. Robinson, and Pierre Yared in American Economic Association.

Table1 describe three main variables. The sample period is 1960-2000, and each observations have 5 years interval. High-income countries and low income countries in Table1 are splited by median of income data.

Figure1 plots income and Freedom House Index data of each county. We use so much samples in a graph. Thus, we set "G" groups to reduce the number of plots in the graph. Each country in same group has similar combination of log GDP per capita and Freedom House Political Right Index. G01 is Angola and Mauritania; G02 is Nigeria and Chad; G03 is Kenya and Cambodia; G04 is Algeria and Lebanon; G05 is Burkina Faso, Niger, and Yemen; G06 is Gabon and Malaysia; G07 is Dominica Republic and Slovenia; G08 is Brazil and Venezuela; G09 is Botswana, Dominica, Poland, and St. Vincent and the Grenadines; G10 is Hungry and Uruguay; G11 is Costa Rica and Grenada; G12 is Belize and St. Lucia; G13 is St. Kitts and Nevis and Trinidad and Tobago; G14 is Greece and Malta; G15 is Barbados, Cyprus, Spain , and Portugal; G16 is Finland, United Kingdom, Ireland, and New Zealand; G17 is Australia, Austria, Belgium, Canada, Germany, Denmark, France, Israel, Italia, Netherland, Norway, and Sweden; and G18 is Switzerland and USA. According to this figure, countries which has large GDP per capita tend to have good score of Freedom House Index through one of the latest data.

Figure2 and 3 show the outline of change of each countrys data. Vertical axis means changes from 1975 to 1995 of Freedom house index in Figure2 and PolityIV in Figure3, and horizontal axis is Change in log GDP per capita. The "G" prefix corresponds to the average for groups of countries. G01 is Fiji and Kenya; G02 is Colombia and India; G03 is Iran, Jamaica, and Slovakia; G04 is Chile and Dominica Republic; G05 is Cote dIvoire and Rwanda; G06 is Switzerland, Costa Rica, and New Zealand; G07 is Algeria and Sweden; G08 is Australia, Denmark, Morocco, and Netherland; G09 is Belgium, Canada, France, and United Kingdom; G10 is Austria, Egypt, Iceland, Italia, Paraguay, and USA; G11 is Barbados, Norway, and Tunisia; G121 is Ireland and Syrian Arab Republic; G13 is Burundi and Tanzania; G14 is Gabon, Mexico, and Trinidad and Tobago; G15 is Peru and Senegal;

G16 is Haiti and Jordan; G17 is Lesotho and Nepal; G18 is Brazil and Congo Republic; G19 is Argelia and Honduras; G20 is Benin and Mali; G21 is Greece, Malawi, and Panama; and G22 is Ecuador and Hungry.

For Figure3, G01 is Switzerland, Costa Rica, and New Zealand; G02 is Australia, Denmark, and Netherland; G03 is Belgium, Canada, Finland, United Kingdom, and Turkey; G04 is Austria, Colombia, IND, Iceland, Israel, Italia, and USA; G05 is Ireland and Syria; G06 is Kenya, Morocco, and Uruguay; G07 is Bolivia and Mali; G08 is Malawi and Panama; G09 is Greece and Lesotho; and G10 is Brazil and Spain.

Through these figures, we can say that in terms Freedom House Index, expansion of GDP per capita shows positive relation between democracy score, on the other hand in terms of PolityⅣ, it shows negative. However, plots in both figures are dispersed and degree of positive and negative relation is little.

Figure 5 is a scatter diagram of panel data for each 5 year from 1950 to 2000. Vertical axis is Freedom House Index and horizontal axis shows income per capita. Blue line in each graph is standard regression line of freedom house index and income of each country. Independent variable is Freedom House index and dependent variable is Log GDP per capita. Each year data always shows countries which has large log GDP per capita has get good score of Freedom House Political Right Index.

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:

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

The democracy score of coutry 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 coutry 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 2: FIXED EFFECTS RESULTS USING FREEDOM HOUSE MEASURE OF DEMOCRACY

	Base sample, 1960-2000				
	Five-year data			Ten-year data	Twenty-year data
	Pooled OLS (1)	Fixed effects OLS (2)	Fixed effects OLS (3)	Fixed effects OLS (4)	Fixed effects OLS (5)
	Dependent variable is democracy				
Democracy$_{t-1}$	0.706***	0.379***		-0.025	-0.581***
	(0.035)	(0.051)		(0.088)	(0.198)
Log GDP per capita$_{t-1}$	0.072***	0.010	0.054	0.053	-0.030
	(0.010)	(0.035)	(0.046)	(0.066)	(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 **??** *shows how to include and reference graphics. The graphic must be labelled before. Files must be in* `.eps` *format.*

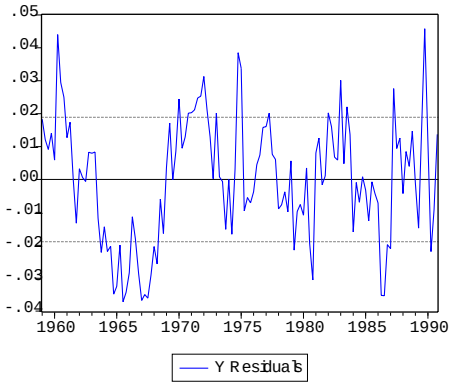


Figure 1: Estimated residuals from model XXX. ...

- 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 betweem them.

Table 3: 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	*Dependent variable is democracy*							
Democracy_{t-1}			0.359 (0.054)		0.363 (0.056)			
$\text{Log GDP per capita}_{t-1}$	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	*First stage for log GDP per capita*$_{t-1}$							
Democracy_{t-1}					0.144** (0.066)		[0.24]	
Labor share_{t-1}						0.329* (0.187)		
$\text{Savings rate}_{t-2}$				1.356*** (0.277)	1.343*** (0.270)	1.202*** (0.315)	1.173*** (0.254)	1.022*** (0.218)
$\text{Savings rate}_{t-3}$								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 codefficients 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 standrad 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 4: 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)
	Dependent variable is democracy			
Democracy$_{t-1}$	0.283***	0.362***	0.353***	0.351***
	(0.058)	(0.052)	(0.053)	(0.055)
Log GDP per capita$_{t-1}$	-0.031	0.005	0.015	-0.001
	(0.049)	(0.035)	(0.041)	(0.049)
Log population$_{t-1}$			-0.109	-0.042
			(0.100)	(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 5: 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 (1)	Fixed effects OLS (2)	Fixed effects OLS (3)	Fixed effects OLS (4)	Fixed effects OLS (5)
Democracy$_{t-1}$	0.749***	0.449***		0.060	-0.516***
	(0.034)	(0.063)		(0.091)	(0.165)
Log GDP per capita$_{t-1}$	0.053***	-0.006	-0.011	0.007	-0.126
	(0.010)	(0.039)	(0.055)	(0.070)	(0.164)
Observations	854	854	880	419	168
R^2	0.772	0.396	0.248	0.257	0.544

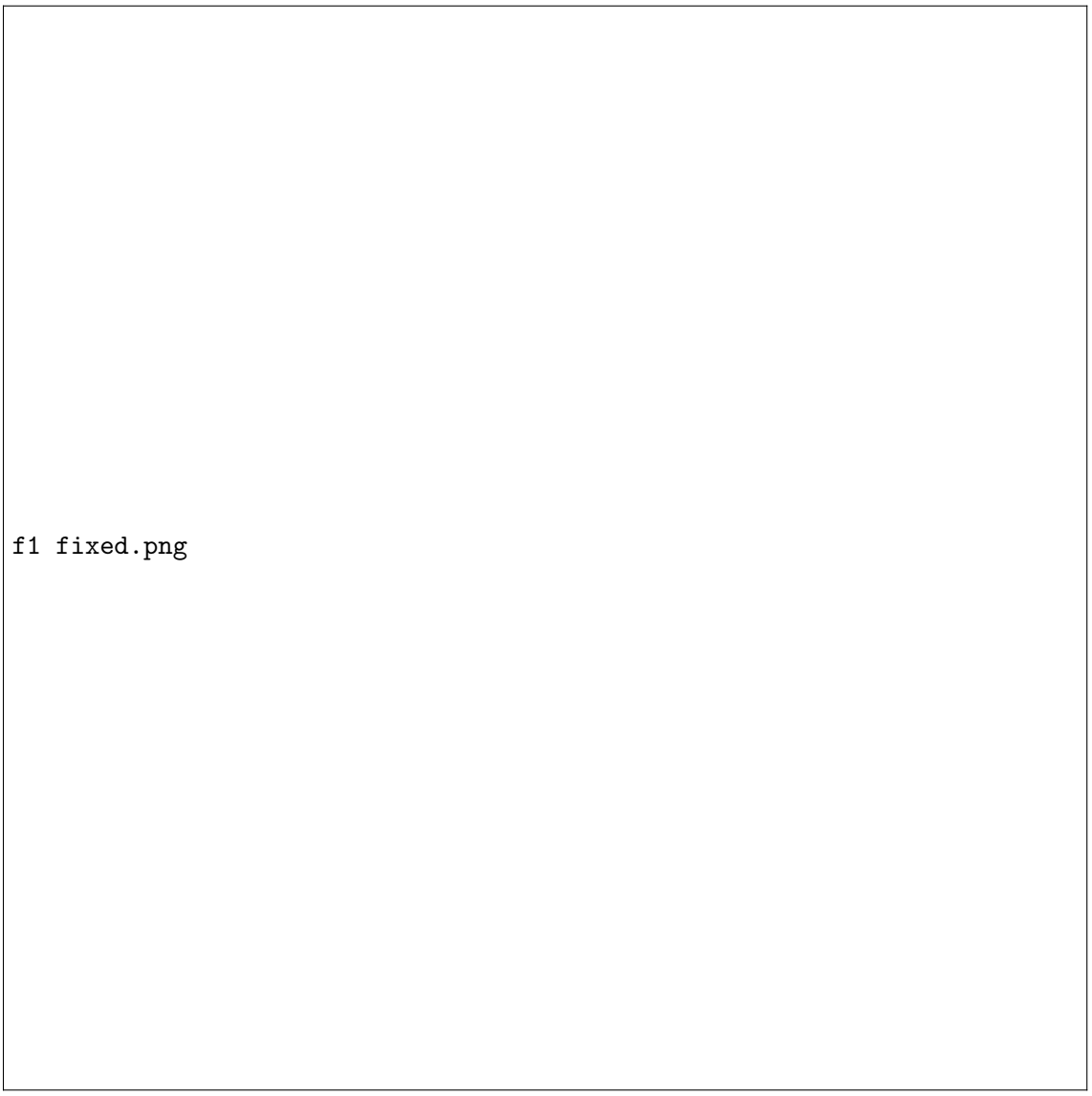
Notes:

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.

fixed.png

```
f1 fixed.png
```



fixed.png

```
f2 fixed.png
```

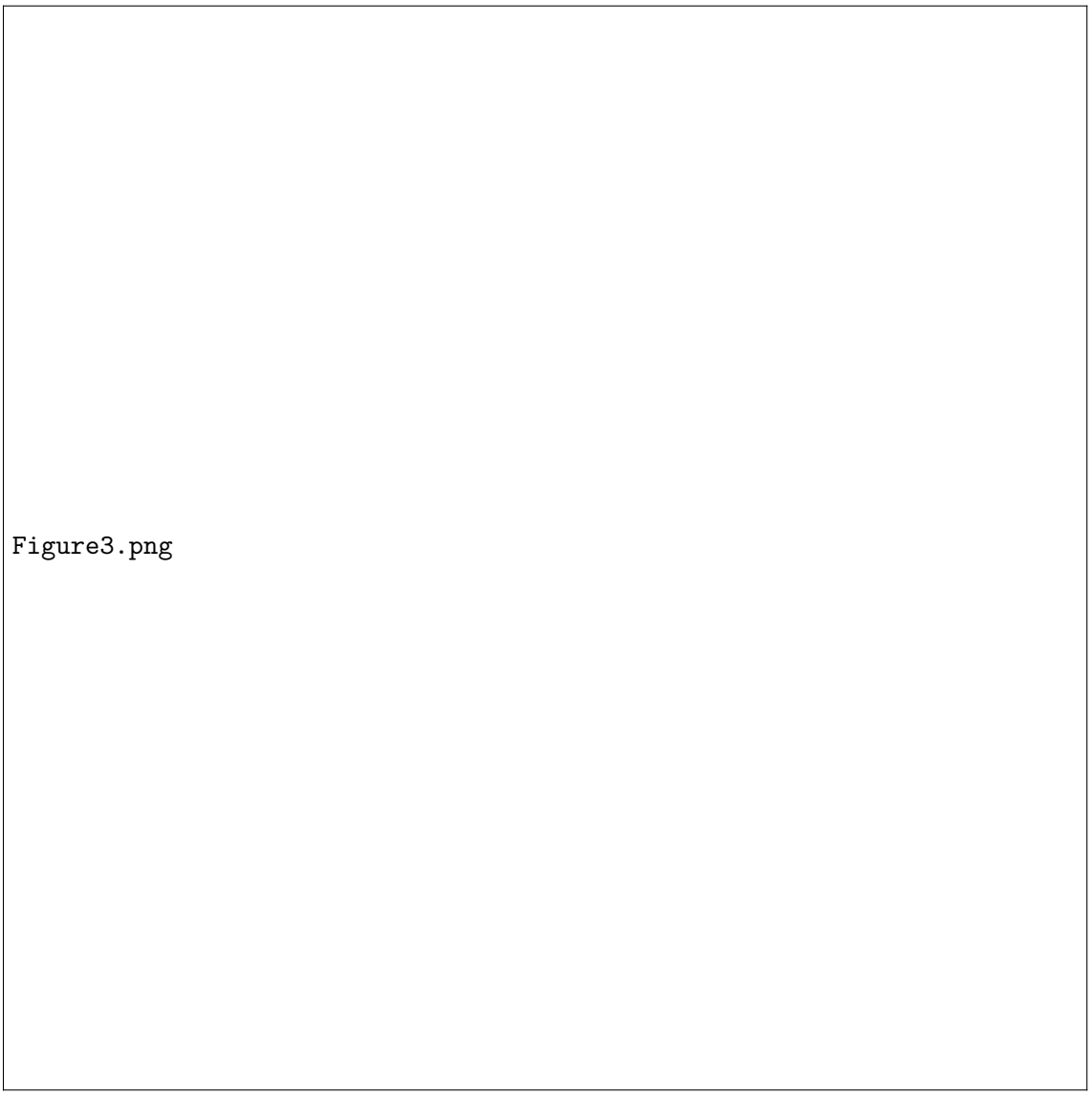


Figure3.png

F4final.pdf

Heston, Alan, Robert Summer, and Bettina Aten 2002. Penn World Table Version6.1. Philadelphia: Center for International Comparisons at the University of Pennsylvania http://datacentre2.chass.utoronto.ca/pwt61/

Barro, Robert J. 1999. "Determinants of Democracy." Journal of Political Economy, 107(6): S15883

Bollen, Kenneth A. 1990. "Political Democracy: Conceptual and Measurement Traps." Studies in Comparative International development, 25(1): 724.

Bollen, Kenneth A. "Cross-National Indicators of Liberal Democracy, 19501990." and ICPSR version. Chapel Hill, NC: University of North Carolina, 1998. Inter-university Consortium for Political and Social Research, 2001.

A Source Code Listing

```
require("sandwich")
require("lmtest")
require("stargazer")



clse = function(reg) {
  # index(reg, "id") returns the id or entity variable vector
  G = length(unique(index(reg,"id")))
  N = length(index(reg,"id"))
  dfa = (G/(G - 1))*(N-1)/reg$df.residual   # note Bluhm multiplies this by
      finite-sample df adjustment
  rob = sqrt(diag(dfa*vcovHC(reg, type = "HC0",
                             cluster = "group", adjust = T)))
  return(rob)
}

stargazer(F_pols, F_fols, F_folswod,se=list(clse(F_pols),clse(F_fols),clse(F_
    folswod)), title="Panel regression, clustered SEs", type="text", column.
    labels=c("Pooled OLS", "Fixed Effects OLS", "Fixed Effects OLS"), df=FALSE,
     digits=3)
```

```
#rm(list=ls())
getwd()
#setwd()
setwd("C:/myR/Dem_data")


#Import data set
One=read.csv("Annual_panel.csv")
Five=read.csv("5yr_panel.csv")
Ten=read.csv("10yr_panel.csv")
Twenty=read.csv("20yr_panel.csv")

require(plm)
require(lmtest)
require(tseries)
require(car)
#Base sample with Five-year data
#T2. C1
```

```
F_pols = plm(fhpolrigaug ~ lag(fhpolrigaug)+lag(lrgdpch)+factor(year), data =
    Five, subset = sample == "1", index = c("code","year"), model = "pooling")
summary(F_pols)


#Test for multicollinearity by using pooled data
#VIF(Variance inflation factior)
vif(F_pols)

#Breusch-Godfrey test
pbgtest(F_pols)

#Breusch-Pagan test for homoskedastisity
plmtest(F_pols, type="bp")


#T2. C2
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")
summary(F_fols)

#Breusch-Godfrey test
pbgtest(F_fols)

#Breusch-Pagan test for homoskedastisity
plmtest(F_fols, type="bp")


#T2. C5
F_folswod = plm(fhpolrigaug ~ lag(lrgdpch)+factor(year)+factor(country), data =
     Five, subset = sample =="1", index = c("code","year"), model = "within",
    effect = "individual")
summary(F_folswod)

#Breusch-Godfrey test
pbgtest(F_folswod)

#Breusch-Pagan test for homoskedastisity
plmtest(F_folswod, type="bp")

```

```
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")
summary(Pooled_pols_p)

#Test for multicollinearity by using pooled data
#VIF(Variance inflation factior)
vif(Pooled_pols_p)

#Breusch-Godfrey test
pbgtest(Pooled_pols_p)

#Breusch-Pagan test for homoskedastisity
plmtest(Pooled_pols_p, type="bp")


#T3. C2
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")
summary(FE_fols_p_2)

#Breusch-Godfrey test
pbgtest(FE_fols_p_2)

#Breusch-Pagan test for homoskedastisity
plmtest(FE_fols_p_2, type="bp")


#T3. C5
FE_folswod_p = plm(polity4 ~ lag(lrgdpch)+factor(year)+factor(country), data =
    Five, subset = sample =="1", index = c("code","year"), model = "within",
    effect = "individual")
summary(FE_folswod_p)

#Breusch-Godfrey test
pbgtest(FE_folswod_p)

#Breusch-Pagan test for homoskedastisity
plmtest(FE_folswod_p, type="bp")


#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 pbgtest(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 pbgtest(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 pbgtest(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(clse(Pooled_pols_p),clse(FE_fols_p_2),clse(FE_folswod_p),
                   clse(FE_fols_p_7),clse(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 pbgtest(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 pbgtest(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")
```

F1

```
1  library(maptools)
2
3  result<-lm(fhpolrigaug~lrgdpch,data=F1_revise)
4  R2=signif(summary(result)$r.squared,digit=4)
5  R="R^2="
6
7  plot(fhpolrigaug~lrgdpch,data=F1_revise,col="white",
8       ylab="Freedom House measure of democracy",xlab="Log GDP per pacita(Penn
           World Tables)",
9       main="Figure1.Democacy and Income , 1990s",sub=paste(R,R2))
10 pointLabel(x=F1_revise$lrgdpch,y=F1_revise$fhpolrigaug,labels=F1_revise$code,
       col="black")
11
12 abline(result)
```

F2

```
1  library(maptools)
2
3  result<-lm(s5fhpolrigaug~s5lrgdpch,data=F2)
4  R2=signif(summary(result)$r.squared,digit=4)
5  R="R^2="
6
7  plot(s5fhpolrigaug~s5lrgdpch,data=F2,type="n",
8       ylab="Change in Freedom House measure of democracy",xlab="Change in Log
           GDP per pacita(Penn World Tables)",
9       main="Figure2. Change in Democracy and Income, 1970-1995")
10 pointLabel(x=F2$s5lrgdpch,y=F2$s5fhpolrigaug,labels=F2$code)
11 resultf2<-lm(s5fhpolrigaug~s5lrgdpch,data=F2)
12 abline(resultf2)
```

F3

```
1  library(maptools)
2
3  result3<-lm(s5polity4~s5lrgdpch,data=F3)
```

```
R2.3=signif(summary(result3)$r.squared,digit=4)
R="R^2="

plot(s5polity4~s5lrgdpch,data=F3,type="n",
     ylab="Changes in Polity of democracy",xlab="Changes in Log GDP per pacita(Penn World Tables)",
     main="Figure3. Change in Democracy and Income, 1975-1990",sub=paste(R,R2.3))
pointLabel(x=F3$s5lrgdpch,y=F3$s5polity4,labels=F3$code)

abline(result3)
```

F4

```
par(mfrow = c(3,4 ))            ##par is graphic parameter, mflow is to devide the graph in 12 areas
par(cex = 0.6)                  #zoom rate for characters
par(mar = c(0, 0, 0, 0), oma = c(4, 4, 4, 2))      #oma is for setting vacant space

x<-1945
for (i in 1:11) {
  x<-x+5
  plot(fhpolrigaug~lrgdpch,data=X5yr_panel, subset=year==x,
       xlim=c(6,10),ylim=c(0,1),ann=F, xaxt="n",yaxt="n") #setting for length of graph by xlim and ylim, and erase whole title and axis by ann=F
  text(6.3,0.95,x, cex=1.5)                 #label setting for each graph
  if (i %in% c (8:11) ) { axis (1 , col = " black ", col.axis= " black ", at = seq (6 , 10 , 2) ) }
  if (i %in% c(1 , 5 , 9) ) { axis (2 , col = " black ", col.axis = " black ", at = seq (0 , 1 , 0.5) ) }
  result<-lm(formula=fhpolrigaug~lrgdpch, data=X5yr_panel, subset=year==x)
  abline(result, col="blue")
  box(col = "grey60")
}
mtext("Freedom House measure of democracy",
      side = 2, outer = TRUE, cex = 1, line = 2.2,col = "grey20")
mtext("Log GDP per capita(Penn World Tables)",
      side = 1, outer = TRUE, cex = 1, line = 2.2,col = "grey20")
mtext("Figure4: Each Five Year Data",
      side = 3, outer = TRUE, cex = 1.3, line = 2.2,col = "grey20")
```

B Figures

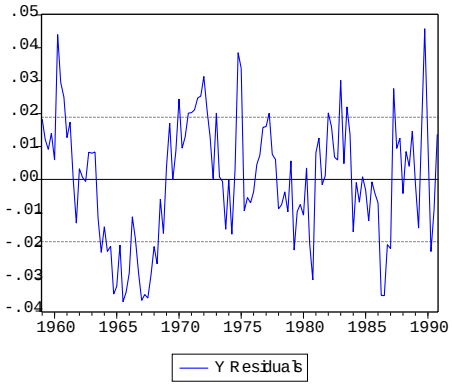


Figure 2: Estimated residuals (2) from model XXX. ...

C Tables

	3m	6m	1yr	2yr	3yr	5yr	7yr	10yr	12yr	15yr
Mean	3.138	3.191	3.307	3.544	3.756	4.093	4.354	4.621	4.741	4.878
Median	3.013	3.109	3.228	3.490	3.680	3.906	4.117	4.420	4.575	4.759
Min	1.984	1.950	1.956	2.010	2.240	2.615	2.850	3.120	3.250	3.395
Max	5.211	5.274	5.415	5.583	5.698	5.805	5.900	6.031	6.150	6.295
StD	0.915	0.919	0.935	0.910	0.876	0.825	0.803	0.776	0.768	0.762

Table 6: Detailed descriptive statistics of location and dispersion for 2100 observed swap rates for the period from February 15, 1999 to March 2, 2007. Swap rates measured as 3.12 (instead of 0.0312).