LK-ordered-demo

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May 25, 2017

LK Scores for democracy and autocracies (3 categories)

```
library(Amelia)
library(dplyr)
library(Lmoments)
library(reshape2)
mydata <- read.csv("https://raw.githubusercontent.com/haowang666/Veto-Fiscal/master/data/mydata.csv")

#recode democracy index based on ordered scale
mydata$demo_order <- mydata$e_v2x_polyarchy_3C
mydata$demo_order[mydata$demo_order == 0] <- "auto"
mydata$demo_order[mydata$demo_order == 1] <- "comptauto"
mydata$demo_order[mydata$demo_order == 0.5] <- "democracy"

mydata$demo_order <- as.factor(mydata$demo_order)
```

```
imp0 <- select(mydata, cowcode, year, c(56:66), demo_order)
#imp0 <- select(imp0)


#-------------------------------------------------------------------------
dv2 <- imp0
#create lagged variable
dv2 <-
    dv2 %>%
    group_by(cowcode) %>%
    mutate(diff.expend_security_EXP = expend_security_EXP - lag(expend_security_EXP, 1),
           diff.expenddefence_EXP = expenddefence_EXP - lag(expenddefence_EXP, 1),
           diff.exp_public_order_EXP = exp_public_order_EXP - lag(exp_public_order_EXP, 1),
           diff.wagessalaries_EXP = wagessalaries_EXP - lag(wagessalaries_EXP, 1),
           diff.total_welfare_EXP = total_welfare_EXP - lag(total_welfare_EXP, 1),
           diff.education_EXP = education_EXP - lag(education_EXP, 1),
           diff.health_EXP = health_EXP - lag(health_EXP, 1),
           diff.social_protection_EXP = social_protection_EXP - lag(social_protection_EXP, 1),
           diff.housing_EXP = housing_EXP - lag(housing_EXP, 1),
           diff.owelfarespend_EXP = owelfarespend_EXP - lag(owelfarespend_EXP, 1),
           diff.pensions_EXP = pensions_EXP - lag(pensions_EXP, 1))

dv2 <- select(dv2, demo_order, c(15:25))

aql <- melt(dv2, id.vars = c("demo_order"))
aql <- na.omit(aql)
a <- tapply(aql$value, aql$demo_order, function(x) Lcoefs(x))
b <- as.data.frame(matrix(unlist(a), nrow = 4))
#transpose, this is the LK score
```

```
lk_order <- t(b)[, 4]
lk_order
```

```
##        V1        V2        V3
## 0.2541798 0.3807151 0.3415659
```

With GSRE data, LK score for ordered scale: autocracy is 0.2541798, competitive autocracy is 0.3807151, democracy is 0.3415659

LK Score for always demcoracies/autocracies

??/stuck here unsolved

```
summary(mydata$demo_order)
```

```
##      auto comptauto democracy      NA's
##      3445      1192      1701       757
```

```
#create an ID var identifying always demcoraccies and autocracies
#????????
```

Exclude wage-salaries and pensions

```
dv3 <- select(dv2, -diff.wagessalaries_EXP, -diff.pensions_EXP)
aql <- melt(dv3, id.vars = c("demo_order"))
aql <- na.omit(aql)
a <- tapply(aql$value, aql$demo_order, function(x) Lcoefs(x))
b <- as.data.frame(matrix(unlist(a), nrow = 4))
#transpose, this is the LK score
lk_order <- t(b)[, 4]
lk_order
```

```
##        V1        V2        V3
## 0.1698261 0.2653230 0.2434326
```

```
dv4 <- select(dv2,
              -diff.wagessalaries_EXP,
              -diff.pensions_EXP,
              -diff.expend_security_EXP,
              -diff.total_welfare_EXP)
aql <- melt(dv4, id.vars = c("demo_order"))
aql <- na.omit(aql)
a <- tapply(aql$value, aql$demo_order, function(x) Lcoefs(x))
b <- as.data.frame(matrix(unlist(a), nrow = 4))
#transpose, this is the LK score
lk_order4 <- t(b)[, 4]
lk_order4
```

```
##         V1         V2         V3
## 0.02776819 0.16195011 0.11197426
```

Without wage and pension, LK score for ordered scale: autocracy is 0.1698261, competitive autocracy is 0.265323, democracy is 0.2434326

Without wage, pension, total security spending and total welfare spending, LK score for ordered scale: autocracy is 0.0277682, competitive autocracy is 0.1619501, democracy is 0.1119743

The total security spending and total welfare spending should be excluded as they are calculated through the combination of other categories. Making them redundant.

Use var_GDPGSRE

Results show here. I need to run the code from the beginning to include the WDI index,

```
imp0 <- select(mydata, cowcode, year, c(67:77), demo_order)
#imp0 <- select(imp0)


#-------------------------------------------------------------------------
dv2 <- imp0
#create lagged variable
dv2 <-
    dv2 %>%
    group_by(cowcode) %>%
    mutate(diff.expend_security_GDPGSRE = expend_security_GDPGSRE - lag(expend_security_GDPGSRE, 1),
           diff.expenddefence_GDPGSRE = expenddefence_GDPGSRE - lag(expenddefence_GDPGSRE, 1),
           diff.exp_public_order_GDPGSRE = exp_public_order_GDPGSRE - lag(exp_public_order_GDPGSRE, 1),
           diff.wagessalaries_GDPGSRE = wagessalaries_GDPGSRE - lag(wagessalaries_GDPGSRE, 1),
           diff.total_welfare_GDPGSRE = total_welfare_GDPGSRE - lag(total_welfare_GDPGSRE, 1),
           diff.education_GDPGSRE = education_GDPGSRE - lag(education_GDPGSRE, 1),
           diff.health_GDPGSRE = health_GDPGSRE - lag(health_GDPGSRE, 1),
           diff.social_protection_GDPGSRE = social_protection_GDPGSRE - lag(social_protection_GDPGSRE,
           diff.housing_GDPGSRE = housing_GDPGSRE - lag(housing_GDPGSRE, 1),
           diff.owelfarespend_GDPGSRE = owelfarespend_GDPGSRE - lag(owelfarespend_GDPGSRE, 1),
           diff.pensions_GDPGSRE = pensions_GDPGSRE - lag(pensions_GDPGSRE, 1))

dv2 <- select(dv2, demo_order, c(15:25))

aql <- melt(dv2, id.vars = c("demo_order"))
aql <- na.omit(aql)
a <- tapply(aql$value, aql$demo_order, function(x) Lcoefs(x))
b <- as.data.frame(matrix(unlist(a), nrow = 4))
#transpose, this is the LK score
lk_order <- t(b)[, 4]
lk_order
```

```
##        V1        V2        V3
## 0.1211742 0.3177716 0.2617671
```

With _GDPGSRE variables, LK score for ordered scale: autocracy is 0.1211742, competitive autocracy is 0.3177716, democracy is 0.2617671

Without wage pension

```
dv3 <- select(dv2, -diff.wagessalaries_GDPGSRE, -diff.pensions_GDPGSRE)
aql <- melt(dv3, id.vars = c("demo_order"))
aql <- na.omit(aql)
```

```r
a <- tapply(aql$value, aql$demo_order, function(x) Lcoefs(x))
b <- as.data.frame(matrix(unlist(a), nrow = 4))
#transpose, this is the LK score
lk_order5 <- t(b)[, 4]
lk_order5
```

```
##         V1         V2         V3
## 0.03569032 0.20548554 0.15753665
```

```r
dv4 <- select(dv2,
              -diff.wagessalaries_GDPGSRE,
              -diff.pensions_GDPGSRE,
              -diff.expend_security_GDPGSRE,
              -diff.total_welfare_GDPGSRE)
aql <- melt(dv4, id.vars = c("demo_order"))
aql <- na.omit(aql)
a <- tapply(aql$value, aql$demo_order, function(x) Lcoefs(x))
b <- as.data.frame(matrix(unlist(a), nrow = 4))
#transpose, this is the LK score
lk_order6 <- t(b)[, 4]
lk_order6
```

```
##          V1          V2          V3
## -0.06529757  0.11797561  0.04487549
```

Without wage and pension, LK score for ordered scale: autocracy is 0.0356903, competitive autocracy is 0.2054855, democracy is 0.1575367

Without wage pension total security spending and total welfare spending, LK score for ordered scale: autocracy is -0.0652976, competitive autocracy is 0.1179756, democracy is 0.0448755

LK score for bivariate classification

```r
mydata$bi_demo <- mydata$demo_order
mydata$bi_demo[mydata$bi_demo == "comptauto"] <- "auto"
mydata$bi_demo <- as.factor(mydata$bi_demo)

imp0 <- select(mydata, cowcode, year, c(56:66), bi_demo)
#imp0 <- select(imp0)


#-------------------------------------------------------------------------
dv2 <- imp0
#create lagged variable
dv2 <-
    dv2 %>%
    group_by(cowcode) %>%
    mutate(diff.expend_security_EXP = expend_security_EXP - lag(expend_security_EXP, 1),
           diff.expenddefence_EXP = expenddefence_EXP - lag(expenddefence_EXP, 1),
           diff.exp_public_order_EXP = exp_public_order_EXP - lag(exp_public_order_EXP, 1),
           diff.wagessalaries_EXP = wagessalaries_EXP - lag(wagessalaries_EXP, 1),
           diff.total_welfare_EXP = total_welfare_EXP - lag(total_welfare_EXP, 1),
           diff.education_EXP = education_EXP - lag(education_EXP, 1),
```

```
           diff.health_EXP = health_EXP - lag(health_EXP, 1),
           diff.social_protection_EXP = social_protection_EXP - lag(social_protection_EXP, 1),
           diff.housing_EXP = housing_EXP - lag(housing_EXP, 1),
           diff.owelfarespend_EXP = owelfarespend_EXP - lag(owelfarespend_EXP, 1),
           diff.pensions_EXP = pensions_EXP - lag(pensions_EXP, 1))

dv2 <- select(dv2, bi_demo, c(15:25))

aql <- melt(dv2, id.vars = c("bi_demo"))
aql <- na.omit(aql)
a <- tapply(aql$value, aql$bi_demo, function(x) Lcoefs(x))
b <- as.data.frame(matrix(unlist(a), nrow = 4))
#transpose, this is the LK score
lk_order <- t(b)[, 4]
lk_order
```

```
##        V1        V2
## 0.2884668 0.3415659
```

With GSRE data, LK score for ordered scale: autocracy is 0.2884668, democracy is 0.3415659.

For Cross-Sectional OLS

codes for generating LK score of each country

```
mydata$polity <- mydata$e_democ - mydata$e_autoc

#collapse original data to mean-substraction
d <- mydata %>%
 group_by(cowcode, country) %>%
 summarise_each(funs(mean(., na.rm = TRUE)))
#get rid of the missing
d <- d[!(is.na(d$stability_0)),]


imp0 <- select(mydata, cowcode, year, c(56:66), demo_order)
#imp0 <- select(imp0)


#-------------------------------------------------------------------------
dv2 <- imp0
#create lagged variable
dv2 <-
    dv2 %>%
    group_by(cowcode) %>%
    mutate(diff.expend_security_EXP = expend_security_EXP - lag(expend_security_EXP, 1),
           diff.expenddefence_EXP = expenddefence_EXP - lag(expenddefence_EXP, 1),
           diff.exp_public_order_EXP = exp_public_order_EXP - lag(exp_public_order_EXP, 1),
           diff.wagessalaries_EXP = wagessalaries_EXP - lag(wagessalaries_EXP, 1),
           diff.total_welfare_EXP = total_welfare_EXP - lag(total_welfare_EXP, 1),
           diff.education_EXP = education_EXP - lag(education_EXP, 1),
           diff.health_EXP = health_EXP - lag(health_EXP, 1),
```

```
          diff.social_protection_EXP = social_protection_EXP - lag(social_protection_EXP, 1),
          diff.housing_EXP = housing_EXP - lag(housing_EXP, 1),
          diff.owelfarespend_EXP = owelfarespend_EXP - lag(owelfarespend_EXP, 1),
          diff.pensions_EXP = pensions_EXP - lag(pensions_EXP, 1))

dv2 <- select(dv2, cowcode, c(15:25))

aql <- melt(dv2, id.vars = c("cowcode"))
aql <- na.omit(aql)
a <- tapply(aql$value, aql$cowcode, function(x) Lcoefs(x))
b <- as.data.frame(matrix(unlist(a), nrow = 4))
#transpose, this is the LK score
d$lk_country <- t(b)[, 4]
```

OLS

```
lm <- lm(lk_country ~ polity, data = d)
summary(lm)
```

```
##
## Call:
## lm(formula = lk_country ~ polity, data = d)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.21725 -0.08723 -0.04853  0.00699  0.50809
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.104259   0.014400   7.240 3.41e-11 ***
## polity      0.010820   0.002697   4.013    1e-04 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1612 on 131 degrees of freedom
##   (25 observations deleted due to missingness)
## Multiple R-squared:  0.1095, Adjusted R-squared:  0.1027
## F-statistic:  16.1 on 1 and 131 DF,  p-value: 0.0001004
```

```
#list cross-sectional country list
d2 <- select(d, country, lk_country, polity)
d2 <- na.omit(d2)
d2$country
```

```
##   [1] Cuba
##   [2] Haiti
##   [3] Dominican Republic
##   [4] Jamaica
##   [5] Trinidad and Tobago
##   [6] Mexico
##   [7] Guatemala
##   [8] Honduras
##   [9] El Salvador
```

```
##  [10] Nicaragua
##  [11] Costa Rica
##  [12] Panama
##  [13] Colombia
##  [14] Venezuela
##  [15] Guyana
##  [16] Suriname
##  [17] Ecuador
##  [18] Peru
##  [19] Brazil
##  [20] Bolivia
##  [21] Paraguay
##  [22] Chile
##  [23] Argentina
##  [24] Uruguay
##  [25] Spain
##  [26] Portugal
##  [27] Poland
##  [28] Hungary
##  [29] Slovakia
##  [30] Albania
##  [31] Macedonia
##  [32] Croatia
##  [33] Yugoslavia
##  [34] Slovenia
##  [35] Greece
##  [36] Cyprus
##  [37] Bulgaria
##  [38] Moldova
##  [39] Romania
##  [40] Russia
##  [41] Estonia
##  [42] Ukraine
##  [43] Belarus
##  [44] Armenia
##  [45] Georgia
##  [46] Azerbaijan
##  [47] Cape Verde
##  [48] Guinea-Bissau
##  [49] Gambia, The
##  [50] Mali
##  [51] Senegal
##  [52] Benin
##  [53] Mauritania
##  [54] Niger
##  [55] Cote d'Ivoire
##  [56] Guinea
##  [57] Burkina Faso
##  [58] Liberia
##  [59] Sierra Leone
##  [60] Ghana
##  [61] Togo
##  [62] Cameroon
##  [63] Nigeria
```

```
##  [64] Gabon
##  [65] Central African Republic
##  [66] Chad
##  [67] Congo
##  [68] Congo, the Democratic Republic of the
##  [69] Uganda
##  [70] Kenya
##  [71] Tanzania
##  [72] Burundi
##  [73] Rwanda
##  [74] Somalia
##  [75] Djibouti
##  [76] Ethiopia
##  [77] Eritrea
##  [78] Angola
##  [79] Mozambique
##  [80] Zambia
##  [81] Zimbabwe
##  [82] Malawi
##  [83] South Africa
##  [84] Namibia
##  [85] Lesotho
##  [86] Botswana
##  [87] Swaziland
##  [88] Madagascar
##  [89] Comoros
##  [90] Mauritius
##  [91] Morocco
##  [92] Algeria
##  [93] Tunisia
##  [94] Libya
##  [95] Sudan
##  [96] Iran
##  [97] Turkey
##  [98] Iraq
##  [99] Egypt
## [100] Syria
## [101] Lebanon
## [102] Jordan
## [103] Israel
## [104] Saudi Arabia
## [105] Yemen
## [106] Yemen South
## [107] Qatar
## [108] Afghanistan
## [109] Turkmenistan
## [110] Tajikistan
## [111] Kyrgyzstan
## [112] Uzbekistan
## [113] Kazakhstan
## [114] China
## [115] Mongolia
## [116] Taiwan
## [117] South Korea
```

```
## [118] Bhutan
## [119] Pakistan
## [120] Bangladesh
## [121] Burma
## [122] Sri Lanka
## [123] Nepal
## [124] Thailand
## [125] Cambodia
## [126] Laos
## [127] Vietnam
## [128] Malaysia
## [129] Philippines
## [130] Indonesia
## [131] East Timor
## [132] Papua New Guinea
## [133] Fiji
## 161 Levels: Afghanistan Albania Algeria Angola ... Zimbabwe
```

OLS with Quadratic Expression

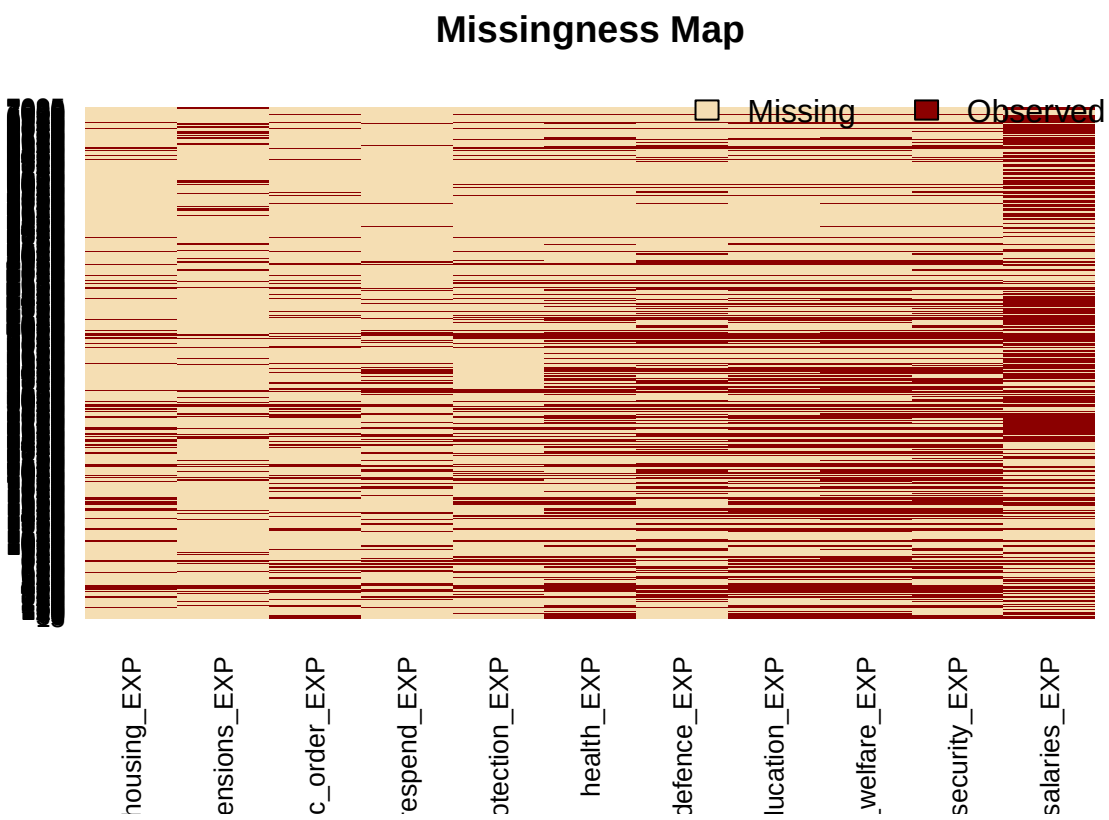
```
qlm <- lm(lk_country ~ polity +I(polity^2), data = d)
summary(qlm)
```

```
##
## Call:
## lm(formula = lk_country ~ polity + I(polity^2), data = d)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.16627 -0.10848 -0.05025  0.06306  0.48753
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.1270935  0.0205188   6.194 7.15e-09 ***
## polity       0.0108641  0.0026822   4.050 8.74e-05 ***
## I(polity^2) -0.0007987  0.0005139  -1.554    0.123
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1603 on 130 degrees of freedom
##   (25 observations deleted due to missingness)
## Multiple R-squared:  0.1257, Adjusted R-squared:  0.1123
## F-statistic: 9.345 on 2 and 130 DF,  p-value: 0.0001614
```

Number of Observations

```
library(Amelia)
library(dplyr)
library(Lmoments)
```

```
library(reshape2)
mydata <- read.csv("https://raw.githubusercontent.com/haowang666/Veto-Fiscal/master/data/mydata.csv")
GSRE <- select(mydata, c(56:66))
#if listwise deletion...
missmap(GSRE)
```




```
GSRE <- na.omit(GSRE)
nrow(GSRE)
```

```
## [1] 87
```

```
#recode democracy index based on ordered scale
mydata$demo_order <- mydata$e_v2x_polyarchy_3C
mydata$demo_order[mydata$demo_order == 0] <- "auto"
mydata$demo_order[mydata$demo_order == 1] <- "comptauto"
mydata$demo_order[mydata$demo_order == 0.5] <- "democracy"

mydata$demo_order <- as.factor(mydata$demo_order)
```

Therefore, using list-wise deletion for GSRE part, only 87 cases remain. By cases, I mean country-year observations. Total observations are 7095.

How I calculated spendings

I use all categories of GSRE, as well as GDPGSRE, then I calculated wages and pensions and repeat the calculations. In calculating the LK score, I first calculate the between year differences of each country, then

use the pooled difference items of each country to calculate the LK score of corresponding countries.

In OLS regression, LK score is pooled score for each country, other independent variables are collapsed at mean levels.