

working paper

DB

June 17, 2016

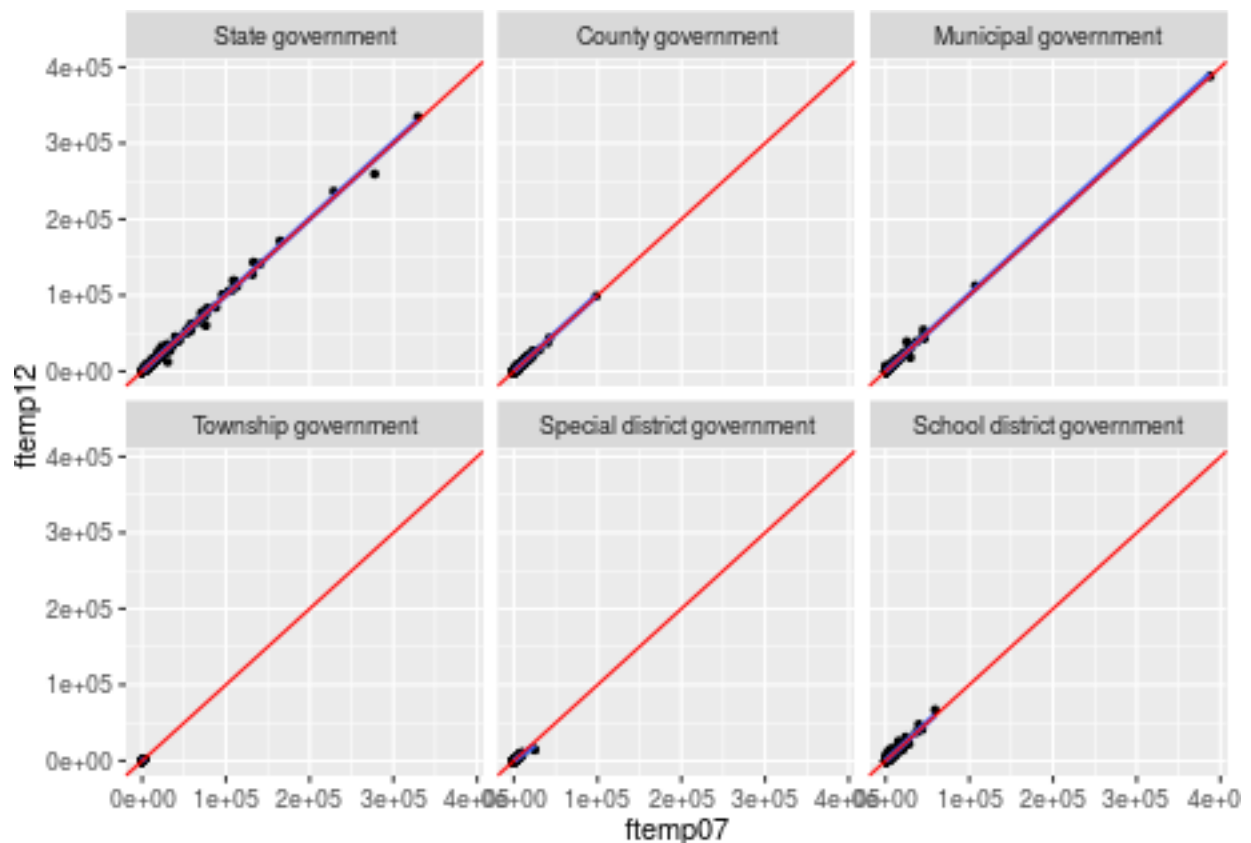
Pre-requisite

Execute :

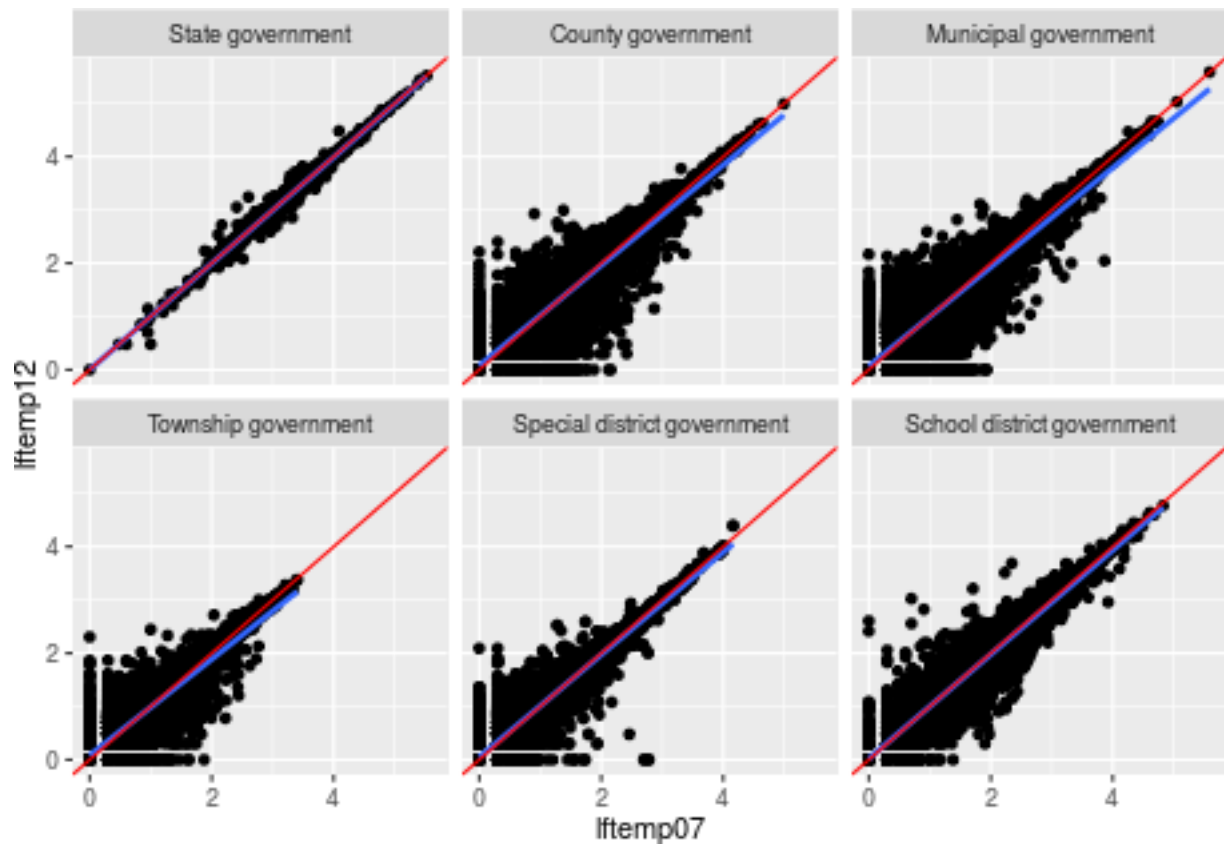
```
devtools::install_github(  
  "DanielBonnery/pubBonneryLahiriTran2016")  
library(pubBonneryLahiriTran2016)
```

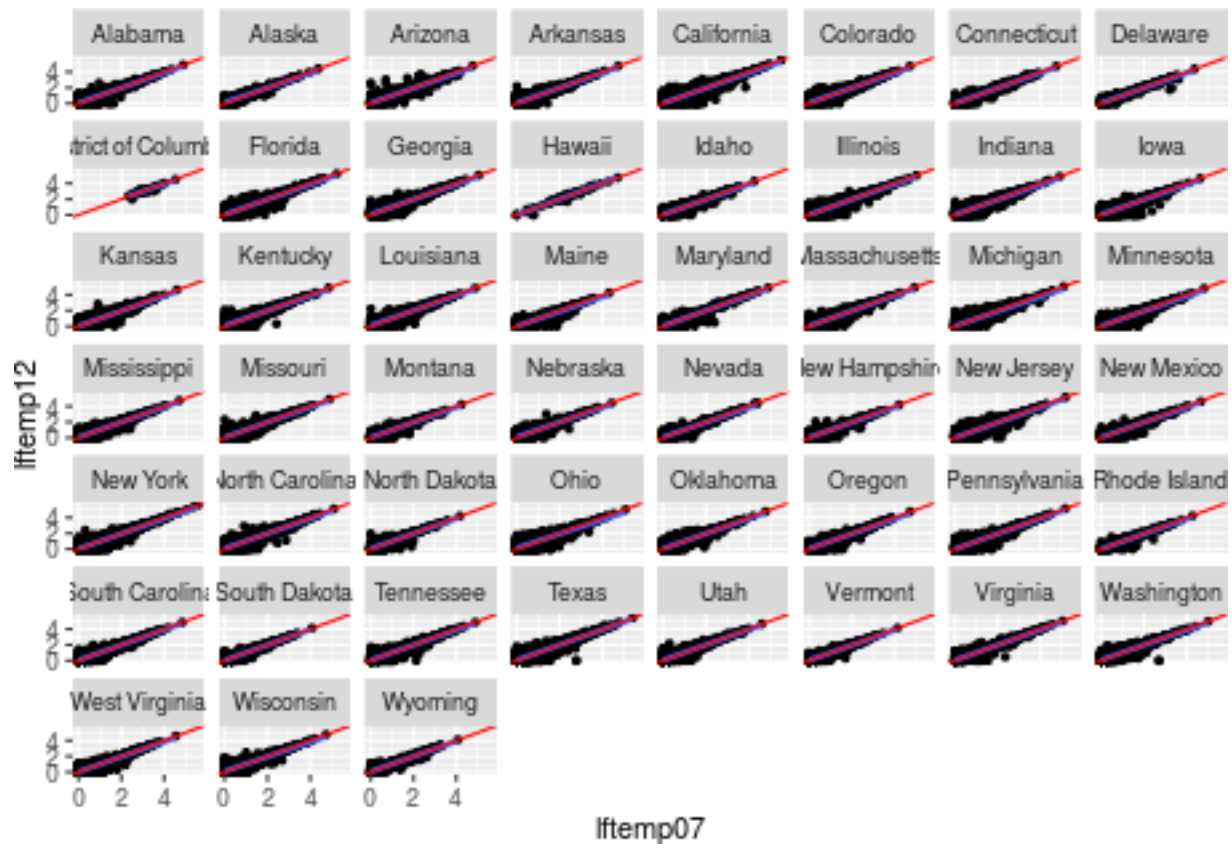
Descriptive statistics and graphs

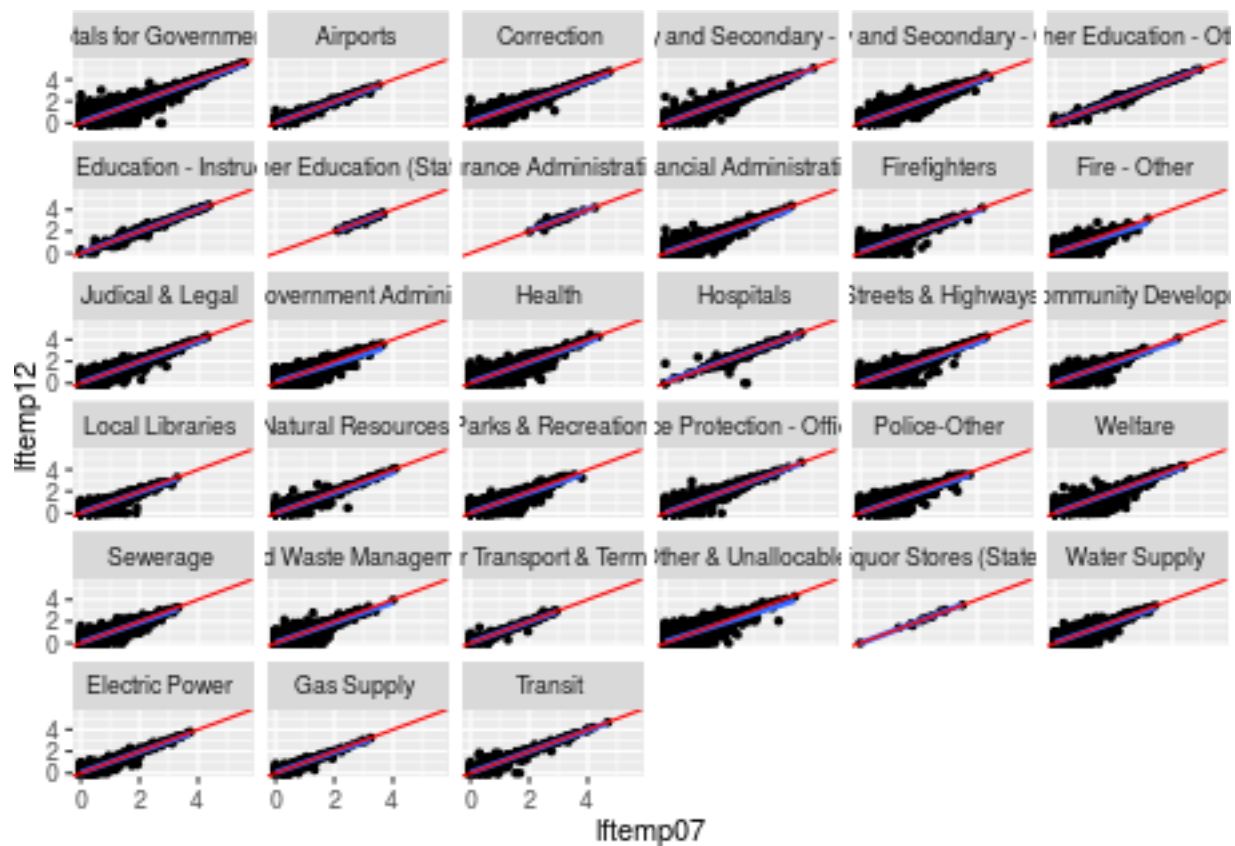
```
demo(descriptive)
```



log scale:







Frequentist analysis

```
demo(freq1)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: lftemp12 ~ lftemp07 + (lftemp07 | state/type_of_gov/itemcode)
## Data: xy
## REML criterion at convergence: -87890.13
## Random effects:
## Groups Name Std.Dev. Corr
## itemcode:(type_of_gov:state) (Intercept) 0.055627
## lftemp07 0.051588 -0.74
## type_of_gov:state (Intercept) 0.041186
## lftemp07 0.042147 -0.75
## state (Intercept) 0.000000
## lftemp07 0.006799 NaN
## Residual 0.196323
## Number of obs: 224982, groups:
## itemcode:(type_of_gov:state), 4371; type_of_gov:state, 267; state, 51
## Fixed Effects:
## (Intercept) lftemp07
## 0.06548 0.93682
## convergence code 0; 2 optimizer warnings; 0 lme4 warnings
```

Simple model

$$\begin{aligned} \ln(\text{ftemp}_{2012,k}) \\ = & \beta_{0,\text{state}_k,\text{code}_k,\text{type}_k} \\ & + \beta_{1,\text{state}_k,\text{code}_k,\text{type}_k} \times \ln(\text{ftemp}_{2007,k}) + \varepsilon_k \end{aligned}$$

with all fixed parameters, normal prior on all the β . inverse gamma prior on variance parameter.

The model used in jags is:

```
"model {
  for (i in 1:N) {
    lftemp12[i]~
      dnorm(beta0[state[i],itemcode[i],type_of_gov[i]]+
        beta1[state[i],itemcode[i],type_of_gov[i]]*
          lftemp07[i],tau)}
  for (i1 in 1:dime[1]) {
    for (i2 in 1:dime[2]) {
      for (i3 in 1:dime[3]) {
        beta0[i1,i2,i3]~ dnorm (0 ,1.0E-4);
        beta1[i1,i2,i3]~ dnorm (1 ,1.0E-4);}}
    tau~ dgamma (1.0E-4 ,1.0E-4);
    sigma <- 1/tau
  }
}"
```

To execute:

```
library(pubBonneryLahiriTran2016)
demo(mcmc1)
```

Model discussed

The jags model is:

```
"model {
  for (i in 1:N) {
    lftemp12[i]~dnorm(beta0[state[i],itemcode[i],type_of_gov[i]]+beta1[state[i],itemcode[i],type_of_gov[i]]*
      lftemp07[i],tau)}
  for (i1 in 1:dime[1]) {
    for (i2 in 1:dime[2]) {
      for (i3 in 1:dime[3]) {
        beta0[i1,i2,i3]~ dnorm (a1[i1]+a2[i2]+a3[i3]+b1[i2,i3]+b2[i1,i3]+b3[i1,i2] ,1.0E-4);
        beta1[i1,i2,i3]~ dnorm (c1[i1]+c2[i2]+c3[i3]+d1[i2,i3]+d2[i1,i3]+d3[i1,i2] ,1.0E-4);}}
    for (i1 in 1:dime[1]) {a1[i1]~dnorm(0,1.0E-4);c1[i1]~dnorm(0,1.0E-4)}
    for (i2 in 1:dime[2]) {a2[i2]~dnorm(0,1.0E-4);c2[i2]~dnorm(0,1.0E-4)}
    for (i3 in 1:dime[3]) {a3[i3]~dnorm(0,1.0E-4);c3[i3]~dnorm(0,1.0E-4)}
  }
}"
```

```

for (i1 in 1:dime[1]) {
  for (i2 in 1:dime[2]) {b3[i1,i2]~dnorm(0,tau_1[1,1]);d3[i1,i2]~dnorm(0,tau_1[2,1])}}
  for (i1 in 1:dime[1]) {
    for (i3 in 1:dime[3]) {b2[i1,i3]~dnorm(0,tau_1[1,2]);d2[i1,i3]~dnorm(0,tau_1[2,2])}}
    for (i2 in 1:dime[2]) {
      for (i3 in 1:dime[3]) {b1[i2,i3]~dnorm(0,tau_1[1,3]);d1[i2,i3]~dnorm(0,tau_1[2,3])}}
      for (i in 1:2) {for (j in 1:3){tau_1[i,j]~dgamma (1.0E-4 ,1.0E-4)}}
      sigma_1~ dgamma (1.0E-4 ,1.0E-4);
      sigma <- 1/sigma_1
      tau<-1/tau_1
    }
  }
}

```

To run: