dem_regional

```
library("ggplot2")
library("knitr")
library("MCMCpack")
library("pander")
library("dplyr")
```

загружаем данные

```
h <- read.csv("./data/regional_data.csv")
n <- nrow(h)
```

Переименуем для удобства:

```
h <- dplyr::rename(h, y_star = Y, Wby_star = WbY, y_0 = ln.gdppercappp., region = X) %>%
  dplyr::select(-number)
glimpse(h)
```

```
## Observations: 75
## Variables:
## $ region        (fctr) Belgorod region, Bryansk region, Vladimir regio...
## $ y_star        (dbl) 0.090836, 0.052702, 0.048405, 0.061063, 0.030710...
## $ Wby_star      (dbl) 0.05585, 0.05657, 0.03864, 0.05281, 0.04058, 0.0...
## $ y_0           (dbl) 3.158, 2.523, 2.648, 2.572, 2.254, 2.761, 2.779,...
## $ shurban       (dbl) 66.1, 68.1, 77.5, 62.7, 80.6, 75.8, 68.0, 62.6, ...
## $ density       (dbl) 55.782, 38.278, 51.271, 45.266, 51.836, 34.413, ...
## $ numchange     (dbl) -0.07271, -1.20544, -0.77148, -0.13946, -1.29905...
## $ inv.gdp       (dbl) 0.2415, 0.1274, 0.1993, 0.2145, 0.2717, 0.1920, ...
## $ raw           (dbl) 21.8, 0.1, 0.3, 0.4, 0.3, 0.4, 0.1, 18.0, 0.6, 0...
## $ manufact      (dbl) 23.1, 21.7, 34.3, 20.0, 20.7, 27.8, 21.3, 11.9, ...
## $ govern        (dbl) 8.1, 15.5, 12.8, 14.0, 18.3, 14.6, 14.3, 11.1, 7...
## $ nogovern      (dbl) 11.9, 24.1, 20.9, 23.2, 18.0, 19.1, 14.8, 13.7, ...
## $ sharetransf   (dbl) 14.875, 40.421, 25.844, 27.621, 39.991, 26.375, ...
## $ sharehigheduc (dbl) 19.1, 29.6, 17.8, 25.3, 19.2, 22.1, 15.1, 20.6, ...
## $ patents       (dbl) 0.8070, 0.3593, 1.0992, 2.1965, 1.1990, 1.6675, ...
## $ openexp       (dbl) 0.24704, 0.25094, 0.07300, 0.10267, 0.07831, 0.0...
## $ openimp       (dbl) 0.32513, 0.32000, 0.09225, 0.08547, 0.15426, 0.1...
```

Априорные распределения:

1. $\rho \sim U[-1; 1]$
2. $\phi \sim$ diffuse
3. $\sigma^2_\varepsilon \sim$ standard diffuse ???
4. $q \sim \Gamma(a_q, b_q)$
5. $v_i^{-1}|q \sim iid\chi^2(q)$, v_i — diagonal of V
6. $Var(\varepsilon) = \sigma^2_\varepsilon V$?

Упрощенная модель

$$y^* = \rho W y^* + \alpha i + \beta y_0 + X\gamma + \varepsilon$$

Полная из статьи

$$y^* = \rho W y^* + \alpha i + \beta y_0 + \theta W y_0 + X\gamma + WX\xi + \varepsilon$$

Упрощения: $\theta = 0$, $\xi = 0$

```
X <- h[,5:17]
n
```

[1] 75

```
ncol(X)
```

[1] 13

Параметры:

$$(\alpha, \rho, \beta, \gamma, \sigma^2, v)$$

$\gamma \in R^{13}$, $v \in R^{75}$

Изначальные значения параметров

```
model_0 <- lm(data=h, y_star ~ . -region )
pander(model_0)
```

	Estimate	Std. Error	t value	Pr(>|t|)
Wby_star	0.5554	0.2037	2.726	0.008433
y_0	0.0006108	0.0119	0.05132	0.9592
shurban	0.0001636	0.0002532	0.6462	0.5207
density	-2.267e-06	2.896e-06	-0.7828	0.4369
numchange	0.0005934	0.003709	0.16	0.8735
inv.gdp	0.03852	0.02212	1.742	0.08674
raw	-0.0003209	0.0004125	-0.7779	0.4397
manufact	-0.0001263	0.0004321	-0.2924	0.771
govern	-0.002075	0.0006994	-2.967	0.004333
nogovern	0.0001131	0.0004811	0.235	0.815
sharetransf	0.0004995	3e-04	1.665	0.1012
sharehigheduc	-0.0004766	0.000595	-0.8011	0.4263
patents	-0.001199	0.003443	-0.3482	0.729
openexp	-0.02423	0.01555	-1.558	0.1245
openimp	0.04092	0.01363	3.001	0.003935
(Intercept)	0.0297	0.04594	0.6466	0.5204

Таблица 1: Fitting linear model: y_star ~ . - region

```
v_init <- rep(1, n)
sigma2_init <- deviance(model_0)/(n-ncol(h)+2)
pars_init <- c(coef(model_0), sigma2_init, v_init)
```

MCMC

```
n_sim <- 10000
n_burnin <- 1000
pars <- matrix(0, nrow=n_sim, ncol=length(pars_init))
```