MODELOS DINÂMICOS

1. Instalação de packages úteis

```
ssc install xtabond2
```

2. Ler dados

```
use blundbondbalanc_usbal89v2.dta, clear
```

2.1. Declara base de dados como painel

```
xtset id year
```

```
       panel variable:  id (strongly balanced)
        time variable:  year, 1982 to 1989
                delta:  1 year
```

3. Estatística descritiva no contexto de painel

```
xtdescribe
```

```
      id:  886, 1030, ..., 989349                            n =        492
    year:  1982, 1983, ..., 1989                             T =          8
           Delta(year) = 1 year
           Span(year)  = 8 periods
           (id*year uniquely identifies each observation)

Distribution of T_i:   min      5%     25%       50%       75%     95%     max
                         8       8       8         8         8       8       8

     Freq.  Percent    Cum. |  Pattern
 ---------------------------+----------
      492    100.00  100.00 |  11111111
 ---------------------------+----------
      492    100.00         |  XXXXXXXX
```

```
xtsum ly ln lk year
```

```
Variable         |      Mean   Std. Dev.       Min        Max |    Observations
-----------------+--------------------------------------------+----------------
ly       overall |  5.905447   1.991932   1.134937   11.67105 |     N =    3936
         between |             1.976804   1.408586   11.49127 |     n =     492
         within  |             .2588288   4.189762   7.355696 |     T =       8
                 |                                            |
ln       overall |  4.752687   2.283474  -2.253844   11.23016 |     N =    3936
         between |             2.270097  -.8955042   11.14857 |     n =     492
         within  |             .2647287   3.152142   6.033032 |     T =       8
                 |                                            |
lk       overall |  3.863383   2.081006  -1.295894   10.13477 |     N =    3936
         between |             2.065382  -.3310543   9.906047 |     n =     492
         within  |             .2690222   2.357184   5.506763 |     T =       8
                 |                                            |
year     overall |    1985.5   2.291579       1982       1989 |     N =    3936
         between |                    0     1985.5     1985.5 |     n =     492
         within  |             2.291579       1982       1989 |     T =       8
```

4. Regressões e inferência estatística

4.1. "Pooled OLS", com desvios-padrão robustos

Sob as hipóteses clássicas, o erro composto é equiautocorrelacionado por blocos, devido à existência do efeito individual não observado.

```
reg ly l.ly ln l.ln lk l.lk D85-D89, robust cluster(id)

Linear regression                               Number of obs     =      3,444
                                                F(10, 491)        =   64189.42
                                                Prob > F          =     0.0000
                                                R-squared         =     0.9940
                                                Root MSE          =     .15413

                                  (Std. Err. adjusted for 492 clusters in id)
------------------------------------------------------------------------------
             |               Robust
          ly |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |   .9549228   .0063588   150.17   0.000     .9424289    .9674167
             |
          ln |
         --. |   .4032651   .0237055    17.01   0.000     .3566884    .4498418
         L1. |  -.3787446    .023116   -16.38   0.000    -.4241632    -.333326
             |
          lk |
         --. |   .2762369   .0394051     7.01   0.000     .1988135    .3536603
         L1. |  -.2629995   .0398051    -6.61   0.000    -.3412089   -.1847901
             |
         D85 |  -.0162282   .0092101    -1.76   0.079    -.0343244    .0018679
         D86 |   .0020344   .0096333     0.21   0.833    -.0168932     .020962
         D87 |   .0456957   .0083061     5.50   0.000     .0293758    .0620155
         D88 |   .0283299   .0077957     3.63   0.000     .0130128     .043647
         D89 |   -.019879   .0080914    -2.46   0.014    -.0357771   -.0039809
       _cons |   .1075486   .0140298     7.67   0.000     .0799827    .1351145
------------------------------------------------------------------------------
```

➔ Guardar o *output*:

```
estimates store POLS
```

4.2. "Random effects"

```
xtreg ly l.ly ln l.ln lk l.lk D85-D89, re

Random-effects GLS regression                   Number of obs     =      3,444
Group variable: id                              Number of groups  =        492

R-sq:                                           Obs per group:
     within  = 0.6643                                         min =          7
     between = 0.9992                                         avg =        7.0
     overall = 0.9940                                         max =          7

                                                Wald chi2(10)     =  564467.44
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
          ly |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |   .9549228   .0055856   170.96   0.000     .9439753    .9658703
             |
          ln |
         --. |   .4032651   .0150251    26.84   0.000     .3738164    .4327139
         L1. |  -.3787446   .0152075   -24.91   0.000    -.4085508   -.3489384
             |
          lk |
         --. |   .2762369   .0276643     9.99   0.000     .2220159    .3304579
         L1. |  -.2629995   .0278997    -9.43   0.000     -.317682    -.208317
             |
         D85 |  -.0162282   .0086046    -1.89   0.059    -.0330929    .0006364
         D86 |   .0020344   .0086261     0.24   0.814    -.0148725    .0189414
         D87 |   .0456957    .008597     5.32   0.000     .0288459    .0625454
         D88 |   .0283299   .0086217     3.29   0.001     .0114317    .0452281
         D89 |   -.019879   .0086635    -2.29   0.022    -.0368592   -.0028988
       _cons |   .1075486   .0127425     8.44   0.000     .0825738    .1325235
-------------+----------------------------------------------------------------
     sigma_u |          0
     sigma_e |  .13688086
         rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

➔ Guardar o *output*:

```
estimates store RE
```

NOTA: estimativas "Random effects" iguais às estimativas "Pooled OLS" porque a estimativa para a variância da heterogeneidade individual, σ_μ^2, é degenerada, isto é, $\hat{\sigma}_\mu^2 = 0$. Recordemos a transformação de efeitos aleatórios, quando os efeitos no tempo são fixos (*time dummies*):

$$y_{it}^* = y_{it} - \theta \overline{y}_{i\bullet},$$

onde $\theta = 1 - \left(\sigma_v \big/ \sqrt{T\sigma_\mu^2 + \sigma_v^2} \right)$ e $\bar{y}_{i\bullet} = \frac{1}{T}\sum_{t=1}^{T} y_{it}$. Sendo que $\hat{\sigma}_\mu^2 = 0$, então $\hat{\theta} = 1 - \left(\sigma_v \big/ \sqrt{0 + \sigma_v^2} \right) = 0$, logo $y_{it}^* = y_{it}$, isto é, as variáveis transformadas são iguais às variáveis originais, daí a igualdade nas estimativas.

4.3. "Fixed effects"

```
xtreg ly l.ly ln l.ln lk l.lk D85-D89, fe robust cluster(id)

Fixed-effects (within) regression               Number of obs     =      3,444
Group variable: id                              Number of groups  =        492

R-sq:                                           Obs per group:
     within  = 0.6957                                         min =          7
     between = 0.9929                                         avg =        7.0
     overall = 0.9884                                         max =          7

                                                F(10,491)         =     354.42
corr(u_i, Xb)  = 0.9027                         Prob > F          =     0.0000

                                  (Std. Err. adjusted for 492 clusters in id)
------------------------------------------------------------------------------
             |               Robust
          ly |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |   .5389381   .0231172    23.31   0.000     .4935173     .584359
             |
          ln |
         --. |   .3769492   .0249701    15.10   0.000     .3278878    .4260107
         L1. |  -.2058936   .0253065    -8.14   0.000    -.2556159   -.1561712
             |
          lk |
         --. |   .4266013    .085347     5.00   0.000      .258911    .5942917
         L1. |  -.3395489   .0771182    -4.40   0.000    -.4910712   -.1880265
             |
         D85 |   .0146888   .0087216     1.68   0.093    -.0024475     .031825
         D86 |   .0297936   .0102001     2.92   0.004     .0097525    .0498348
         D87 |   .0761801   .0092962     8.19   0.000     .0579149    .0944454
         D88 |   .0922333   .0107569     8.57   0.000      .071098    .1133686
         D89 |   .0635988   .0115088     5.53   0.000     .0409863    .0862113
       _cons |   1.532408   .0969649    15.80   0.000     1.341891    1.722925
-------------+----------------------------------------------------------------
     sigma_u |   .3993573
     sigma_e |  .13688086
         rho |  .89487099   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

➔ Guardar o *output*:

```
estimates store FE
```

4.4. Primeiras Diferenças

```
reg D.(ly l.ly ln l.ln lk l.lk D85-D89), nocons robust cluster(id)
```

```
Linear regression                               Number of obs     =      2,952
                                                F(10, 491)        =      92.65
                                                Prob > F          =     0.0000
                                                R-squared         =     0.3326
                                                Root MSE          =     .14912

                                   (Std. Err. adjusted for 492 clusters in id)
------------------------------------------------------------------------------
             |               Robust
        D.ly |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         LD. |  -.0481349    .023618    -2.04   0.042    -.0945397   -.0017301
             |
          ln |
         D1. |   .3613453   .0269482    13.41   0.000     .3083974    .4142932
         LD. |   .0948679    .023779     3.99   0.000     .0481468     .141589
             |
          lk |
         D1. |   .6017026   .0937748     6.42   0.000     .4174531    .7859521
         LD. |  -.3178057   .0750133    -4.24   0.000    -.4651923   -.1704191
             |
         D85 |
         D1. |   .0072105     .00775     0.93   0.353    -.0080168    .0224378
             |
         D86 |
         D1. |   .0136521   .0123988     1.10   0.271    -.0107091    .0380133
             |
         D87 |
         D1. |   .0607204   .0152415     3.98   0.000     .0307738     .090667
             |
         D88 |
         D1. |   .1126837   .0176334     6.39   0.000     .0780376    .1473299
             |
         D89 |
         D1. |   .1019289   .0194654     5.24   0.000     .0636831    .1401748
------------------------------------------------------------------------------
```

➔ Guardar o *output*:

```
estimates store FD
```

4.5. Revisão dos resultados obtidos

```
estimates table FE FD, star(.1 .05 .01)

---------------------------------------------
    Variable |      FE              FD
-------------+-------------------------------
          ly |
         L1. |  .53893815***
         LD. |                 -.0481349**    ← Estimativa para o sinal do enviesamento
             |
          ln |
         --. |  .37694922***
         L1. | -.20589356***
         D1. |                  .3613453***
         LD. |                 .09486793***
             |
          lk |
         --. |  .42660133***
         L1. | -.33954886***
         D1. |                 .60170257***
         LD. |                -.31780568***
             |
         D85 |  .01468876*
         D86 |  .02979362***
         D87 |  .07618012***
         D88 |  .09223327***
         D89 |   .0635988***
             |
         D85 |
         D1. |                 .00721047
             |
         D86 |
         D1. |                  .0136521
             |
         D87 |
         D1. |                 .06072037***
             |
         D88 |
         D1. |                 .11268374***
             |
         D89 |
         D1. |                 .10192894***
             |
       _cons |  1.5324082***
---------------------------------------------
           legend: * p<.1; ** p<.05; *** p<.01
```

```
estimates table POLS RE FE, star(.1 .05 .01)
```

Variable	POLS	RE	FE
ly			
L1.	.95492282***	.95492282***	.53893815***
ln			
--.	.40326513***	.40326513***	.37694922***
L1.	-.37874461***	-.37874461***	-.20589356***
lk			
--.	.27623688***	.27623688***	.42660133***
L1.	-.26299951***	-.26299951***	-.33954886***
D85	-.01622825*	-.01622825*	.01468876*
D86	.00203443	.00203443	.02979362***
D87	.04569568***	.04569568***	.07618012***
D88	.02832991***	.02832991***	.09223327***
D89	-.01987897**	-.01987897**	.0635988***
_cons	.10754862***	.10754862***	1.5324082***

legend: * p<.1; ** p<.05; *** p<.01

4.6. *Estimador de Arellano & Bond*

4.6.1. GMM a 1 passo, com desvios-padrão robustos, variáveis estritamente exógenas

```
xtabond2 ly l.ly ln l.ln lk l.lk D85-D89, iv(ln lk D85-D89) gmm(l.ly) robust noleveleq
```

```
Dynamic panel-data estimation, one-step difference GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      2952
Time variable : year                            Number of groups   =       492
Number of instruments = 28                      Obs per group: min =         6
Wald chi2(10) =   1234.57                                      avg =      6.00
Prob > chi2   =     0.000                                      max =         6
------------------------------------------------------------------------------
             |               Robust
          ly |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |   .3607257    .094404     3.82   0.000     .1756972    .5457542
             |
          ln |
         --. |   .3571752   .0363046     9.84   0.000     .2860196    .4283309
         L1. |  -.2724825   .1588374    -1.72   0.086     -.583798     .038833
             |
          lk |
         --. |   .2467726   .2049215     1.20   0.229    -.1548661    .6484114
         L1. |   .0348403   .2254312     0.15   0.877    -.4069967    .4766773
             |
         D85 |  -.0039102   .0143686    -0.27   0.786    -.0320722    .0242518
         D86 |   .0050872   .0170338     0.30   0.765    -.0282985    .0384729
         D87 |   .0463691   .0276202     1.68   0.093    -.0077656    .1005038
         D88 |   .0518713   .0416839     1.24   0.213    -.0298278    .1335703
         D89 |   .0257267   .0456622     0.56   0.573    -.0637696    .1152229
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(ln lk D85 D86 D87 D88 D89)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/7).L.ly
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -3.53  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -0.82  Pr > z =  0.410
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(18)   = 179.26  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(18)   = 111.55  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(ln lk D85 D86 D87 D88 D89)
    Hansen test excluding group:     chi2(11)   =  60.07  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(7)    =  51.48  Prob > chi2 =  0.000
```

➔ Guardar o *output*:

```
estimates store AB1_R_Exo
```

NOTA:

Pretende-se estimar o seguinte modelo:

$$y_{it} = \rho y_{i,t-1} + \mathbf{X}_{it}\boldsymbol{\beta} + u_{it}$$

com y_{it} vector $NT \times 1$, ρ é o parâmetro autorregressivo escalar, $\mathbf{X}_{it}$ é matriz de regressores $NT \times K$, $\boldsymbol{\beta}$ é vector de parâmetros desconhecidos $K \times 1$ e $u_{it} = c_i + v_{it}$, com $c_i \sim N\left(0, \sigma_c^2\right)$ e $v_{it} \sim N\left(0, \sigma_v^2\right)$.

1) Teste de Arellano-Bond (vd. Arellano & Bond, 1991), de autocorrelação de segunda ordem em Δv_{it} (primeiras diferenças do erro idiossincrático):

$$H_0 : E\left(\Delta v_{it} \Delta v_{i,t-2}\right) = 0 \qquad \text{vs.} \qquad H_1 : E\left(\Delta v_{it} \Delta v_{i,t-2}\right) \neq 0$$

O valor esperado em teste só será igual a zero no caso em que o erro idiossincrático é um passeio aleatório. Se, pelo contrário, o erro idiossincrático verificar as condições de estacionariedade de um processo $AR(1)$, então é serialmente correlacionado, logo $E\left(\Delta v_{it} \Delta v_{i,t-2}\right) \neq 0$ e a hipótese nula do teste de Arellano-Bond será, em princípio, rejeitada.

2) Teste de Sargan e de Hansen:

Através do teste de Sargan é possível testar a validade dos instrumentos sobre-identificados, sob a hipótese de homocedasticidade condicionada e ausência de autocorrelação no erro idiossincrático:

$$\begin{cases} H_0 : \text{Condições definidas para instrumentos sobre-identificados estão correctas} \\ H_1 : \text{Negação de } H_0 \end{cases}$$

$$m = \left(\Delta \hat{v}\right)' W \left[\sum_{i=1}^{N} W_i' \left(\Delta \hat{v}\right) \left(\Delta \hat{v}\right)' W_i \right]^{-1} W' \left(\Delta \hat{v}\right) \sim \chi^2_{(p-K-1)}$$

onde $\Delta \hat{v}$ são resíduos da estimação a um passo (aqueles que são usados pelo *Stata*), W é a matriz de instrumentos $N \times p$, com p o número de colunas da matriz W.

Por sua vez, o teste de Hansen generaliza o teste de Sargan, na medida em que utiliza a matriz de pesos óptima (da estimação do GMM óptimo) e, respectivamente, os resíduos da estimação a dois passos.

3) Teste diferencial de Hansen:

O teste diferencial de Hansen corresponde à diferença entre dois testes de Hansen:

$$DH = J_1 - J_2 \sim \chi^2_{(p_1 - p_2)}$$

com $p_1 > p_2$. O termo J_1 corresponde à estatística do teste de Hansen para a situação em que se está a testar a validade de um conjunto de p_1 instrumentos sobre-identificados e J_2 é a estatística do teste de Hansen para a situação em que se está a testar a validade de um conjunto de p_2 instrumentos sobre-identificados. A diferença corresponderá a um teste à validade de um <u>subconjunto</u> de instrumentos sobre-identificados.

4.6.2. GMM a 2 passos, sem correcção de Windmeijer, variáveis estritamente exógenas

```
xtabond2 ly l.ly ln l.ln lk l.lk D85-D89, iv(ln lk D85-D89) gmm(l.ly) noleveleq twostep
```

```
Dynamic panel-data estimation, two-step difference GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      2952
Time variable : year                            Number of groups   =       492
Number of instruments = 28                      Obs per group: min =         6
Wald chi2(10) =   1390.01                                      avg =      6.00
Prob > chi2   =     0.000                                      max =         6
------------------------------------------------------------------------------
          ly |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |   .2579909   .0776479     3.32   0.001     .1058038    .4101781
             |
          ln |
         --. |    .351696   .0320126    10.99   0.000     .2889524    .4144396
         L1. |    -.08922    .136251    -0.65   0.513    -.3562671    .1778271
             |
          lk |
         --. |  -.2380191   .1794581    -1.33   0.185    -.5897505    .1137124
         L1. |   .4943994    .192347     2.57   0.010     .1174061    .8713926
             |
         D85 |  -.0319181   .0126418    -2.52   0.012    -.0566956   -.0071406
         D86 |  -.0150941   .0154121    -0.98   0.327    -.0453013     .015113
         D87 |   .0556096   .0242792     2.29   0.022     .0080233    .1031959
         D88 |   .0569106   .0364868     1.56   0.119    -.0146021    .1284233
         D89 |   .0289487   .0398036     0.73   0.467     -.049065    .1069624
------------------------------------------------------------------------------
Warning: Uncorrected two-step standard errors are unreliable.

Instruments for first differences equation
  Standard
    D.(ln lk D85 D86 D87 D88 D89)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/7).L.ly
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.92  Pr > z =  0.004
Arellano-Bond test for AR(2) in first differences: z =  -1.06  Pr > z =  0.291
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(18)   = 179.26  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(18)   = 111.55  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(ln lk D85 D86 D87 D88 D89)
    Hansen test excluding group:     chi2(11)   =  60.07  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(7)    =  51.48  Prob > chi2 =  0.000
```

➔ Guardar o *output*:

```
estimates store AB2_NW_Exo
```

4.6.3. GMM a 2 passos, com correcção de Windmeijer, variáveis estritamente exógenas

```
xtabond2 ly l.ly ln l.ln lk l.lk D85-D89, iv(ln lk D85-D89) gmm(l.ly) noleveleq twostep robust
```

```
Dynamic panel-data estimation, two-step difference GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      2952
Time variable : year                            Number of groups   =       492
Number of instruments = 28                      Obs per group: min =         6
Wald chi2(10) =    979.61                                      avg =      6.00
Prob > chi2   =     0.000                                      max =         6
------------------------------------------------------------------------------
             |              Corrected
          ly |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |   .2579909   .1553482     1.66   0.097     -.046486    .5624679
             |
          ln |
         --. |    .351696   .0548053     6.42   0.000     .2442795    .4591125
         L1. |    -.08922   .2305849    -0.39   0.699    -.5411582    .3627181
             |
          lk |
         --. |  -.2380191   .2493832    -0.95   0.340    -.7268012    .2507631
         L1. |   .4943994   .3316273     1.49   0.136    -.1555781    1.144377
             |
         D85 |  -.0319181   .0194909    -1.64   0.102    -.0701196    .0062834
         D86 |  -.0150941    .023903    -0.63   0.528    -.0619432    .0317549
         D87 |   .0556096   .0398656     1.39   0.163    -.0225254    .1337447
         D88 |   .0569106   .0601591     0.95   0.344    -.0609992    .1748204
         D89 |   .0289487   .0654539     0.44   0.658    -.0993385     .157236
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(ln lk D85 D86 D87 D88 D89)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/7).L.ly
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.51  Pr > z =  0.130
Arellano-Bond test for AR(2) in first differences: z =  -0.97  Pr > z =  0.333
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(18)   = 179.26  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(18)   = 111.55  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(ln lk D85 D86 D87 D88 D89)
    Hansen test excluding group:     chi2(11)   =  60.07  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(7)    =  51.48  Prob > chi2 =  0.000
```

➔ Guardar o *output*:

```
estimates store AB2_W_Exo
```

4.6.4. GMM a 2 passos, com correcção de Windmeijer, variáveis pré-determinadas

```
xtabond2 ly l.ly ln l.ln lk l.lk D85-D89, iv(D85-D89) gmm(l.ly) gmm(ln lk) noleveleq twostep robust
```

```
Dynamic panel-data estimation, two-step difference GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      2952
Time variable : year                            Number of groups   =       492
Number of instruments = 80                      Obs per group: min =         6
Wald chi2(10) =    724.03                                      avg =      6.00
Prob > chi2   =     0.000                                      max =         6
------------------------------------------------------------------------------
             |              Corrected
          ly |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |    .263689   .1062724     2.48   0.013     .0553988    .4719791
             |
          ln |
         --. |   .1686736   .0948458     1.78   0.075    -.0172208     .354568
         L1. |  -.0130641   .0668589    -0.20   0.845    -.1441051     .117977
             |
          lk |
         --. |   .5975928    .457579     1.31   0.192    -.2992456    1.494431
         L1. |  -.3582566   .3431924    -1.04   0.297    -1.030901    .3143881
             |
                              (time dummies omitidas)
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(D85 D86 D87 D88 D89)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/7).(ln lk)
    L(1/7).L.ly
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.14  Pr > z =  0.032
Arellano-Bond test for AR(2) in first differences: z =  -1.57  Pr > z =  0.117
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(70)   = 329.89  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(70)   = 189.84  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  gmm(L.ly, lag(1 .))
    Hansen test excluding group:     chi2(49)   = 143.76  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(21)   =  46.08  Prob > chi2 =  0.001
  gmm(ln lk, lag(1 .))
    Hansen test excluding group:     chi2(16)   =  81.91  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(54)   = 107.93  Prob > chi2 =  0.000
  iv(D85 D86 D87 D88 D89)
    Hansen test excluding group:     chi2(65)   = 165.94  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(5)    =  23.90  Prob > chi2 =  0.000
```

➔ Guardar o *output*:

```
estimates store AB2_W_Pre
```

4.6.5. GMM a 2 passos, com correcção de Windmeijer, variáveis endógenas

```
xtabond2 ly l.ly ln l.ln lk l.lk D85-D89, iv(D85-D89) gmm(l.ly) gmm(ln lk, lag(2 .)) noleveleq twostep robust

Dynamic panel-data estimation, two-step difference GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      2952
Time variable : year                            Number of groups   =       492
Number of instruments = 68                      Obs per group: min =         6
Wald chi2(10) =    721.49                                      avg =      6.00
Prob > chi2   =     0.000                                      max =         6
------------------------------------------------------------------------------
             |              Corrected
          ly |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |   .3659584   .1183862     3.09   0.002     .1339256    .5979911
             |
          ln |
         --. |   .1595663   .1041746     1.53   0.126     -.044612    .3637447
         L1. |  -.0528153   .1173594    -0.45   0.653    -.2828356    .1772049
             |
          lk |
         --. |   .3901708   .4647875     0.84   0.401    -.5207959    1.301138
         L1. |  -.1666249   .3411393    -0.49   0.625    -.8352458    .5019959
             |
                              (time dummies omitidas)
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(D85 D86 D87 D88 D89)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(2/7).(ln lk)
    L(1/7).L.ly
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.57  Pr > z =  0.010
Arellano-Bond test for AR(2) in first differences: z =  -1.31  Pr > z =  0.190
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(58)   = 270.64  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(58)   = 165.51  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  gmm(L.ly, lag(1 .))
    Hansen test excluding group:     chi2(37)   = 121.69  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(21)   =  43.82  Prob > chi2 =  0.002
  gmm(ln lk, lag(2 .))
    Hansen test excluding group:     chi2(16)   =  82.50  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(42)   =  83.01  Prob > chi2 =  0.000
  iv(D85 D86 D87 D88 D89)
    Hansen test excluding group:     chi2(53)   = 149.88  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(5)    =  15.64  Prob > chi2 =  0.008
```

➔ Guardar o *output*:

```
estimates store AB2_W_End
```

4.7. Estimador de Blundell & Bond

4.7.1. GMM a 1 passo, com desvios-padrão robustos, variáveis pré-determinadas

```
xtabond2 ly l.ly ln l.ln lk l.lk D85-D89, iv(D85-D89) gmm(l.ly) gmm(ln lk) robust

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      3444
Time variable : year                            Number of groups   =       492
Number of instruments = 101                     Obs per group: min =         7
Wald chi2(10) =  32531.41                                      avg =      7.00
Prob > chi2   =     0.000                                      max =         7
------------------------------------------------------------------------------
             |               Robust
          ly |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |   .8929906   .0221431    40.33   0.000      .849591    .9363903
             |
          ln |
         --. |   .4235704   .0261299    16.21   0.000     .3723567     .474784
         L1. |  -.3513513   .0254912   -13.78   0.000    -.4013132   -.3013894
             |
          lk |
         --. |   .3056063   .0468686     6.52   0.000     .2137455    .3974671
         L1. |  -.2793262   .0479421    -5.83   0.000    -.3732911   -.1853614
             |
         D85 |  -.0145902   .0091882    -1.59   0.112    -.0325987    .0034182
         D86 |   .0044502   .0095962     0.46   0.643    -.0143581    .0232584
         D87 |   .0485603   .0084196     5.77   0.000     .0320582    .0650624
         D88 |    .035345   .0087457     4.04   0.000     .0182038    .0524861
         D89 |  -.0114121   .0096189    -1.19   0.235    -.0302647    .0074406
       _cons |   .1897415   .0434431     4.37   0.000     .1045947    .2748884
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(D85 D86 D87 D88 D89)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/7).(ln lk)
    L(1/7).L.ly
Instruments for levels equation
  Standard
    D85 D86 D87 D88 D89
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(ln lk)
    D.L.ly
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -9.39  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -1.13  Pr > z =  0.260
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(90)   = 360.70  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(90)   = 216.10  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)
```

```
Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(70)   = 177.62  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(20)   =  38.48  Prob > chi2 =  0.008
  gmm(L.ly, lag(1 .))
    Hansen test excluding group:     chi2(63)   = 175.98  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(27)   =  40.12  Prob > chi2 =  0.050
  gmm(ln lk, lag(1 .))
    Hansen test excluding group:     chi2(22)   = 118.38  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(68)   =  97.72  Prob > chi2 =  0.011
  iv(D85 D86 D87 D88 D89)
    Hansen test excluding group:     chi2(85)   = 213.96  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(5)    =   2.14  Prob > chi2 =  0.830
```

➔ Guardar o *output*:

```
estimates store BB1_R_Pre
```

4.7.2. GMM a 2 passos, com correcção de Windmeijer, variáveis pré-determinadas

```
xtabond2 ly l.ly ln l.ln lk l.lk D85-D89, iv(D85-D89) gmm(l.ly) gmm(ln lk) robust twostep

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      3444
Time variable : year                            Number of groups   =       492
Number of instruments = 101                     Obs per group: min =         7
Wald chi2(10) =  24605.71                                      avg =      7.00
Prob > chi2   =     0.000                                      max =         7
------------------------------------------------------------------------------
             |              Corrected
          ly |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |   .9036462   .0285792    31.62   0.000      .847632    .9596604
             |
          ln |
         --. |   .4022506   .0330145    12.18   0.000     .3375434    .4669578
         L1. |  -.3399643   .0313528   -10.84   0.000    -.4014146    -.278514
             |
          lk |
         --. |   .2546666   .0604567     4.21   0.000     .1361737    .3731595
         L1. |  -.2300356   .0610962    -3.77   0.000     -.349782   -.1102893
             |
         D85 |  -.0246696   .0097939    -2.52   0.012    -.0438652   -.0054739
         D86 |    .008147   .0097878     0.83   0.405    -.0110368    .0273308
         D87 |   .0371509   .0091836     4.05   0.000     .0191514    .0551503
         D88 |   .0291649   .0094761     3.08   0.002     .0105921    .0477378
         D89 |  -.0206698   .0106621    -1.94   0.053    -.0415672    .0002276
       _cons |   .1903367   .0516716     3.68   0.000     .0890621    .2916112
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(D85 D86 D87 D88 D89)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/7).(ln lk)
    L(1/7).L.ly
Instruments for levels equation
  Standard
    D85 D86 D87 D88 D89
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.(ln lk)
    D.L.ly
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -8.68  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -1.42  Pr > z =  0.156
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(90)   = 360.70  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(90)   = 216.10  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)
```

```
Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(70)    = 177.62  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(20)    =  38.48  Prob > chi2 =  0.008
  gmm(L.ly, lag(1 .))
    Hansen test excluding group:     chi2(63)    = 175.98  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(27)    =  40.12  Prob > chi2 =  0.050
  gmm(ln lk, lag(1 .))
    Hansen test excluding group:     chi2(22)    = 118.38  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(68)    =  97.72  Prob > chi2 =  0.011
  iv(D85 D86 D87 D88 D89)
    Hansen test excluding group:     chi2(85)    = 213.96  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(5)     =   2.14  Prob > chi2 =  0.830
```

➔ Guardar o *output*:

```
estimates store BB2_W_Pre
```

4.7.3. GMM a 2 passos, com correcção de Windmeijer, variáveis endógenas

```
xtabond2 ly l.ly ln l.ln lk l.lk D85-D89, iv(D85-D89) gmm(l.ly, lag(2 .)) gmm(ln lk, lag(2 .)) robust twostep

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      3444
Time variable : year                            Number of groups   =       492
Number of instruments = 80                      Obs per group: min =         7
Wald chi2(10) =  14748.06                                      avg =      7.00
Prob > chi2   =     0.000                                      max =         7
------------------------------------------------------------------------------
             |              Corrected
          ly |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |   .8494778   .0386191    22.00   0.000     .7737858    .9251698
             |
          ln |
         --. |   .4831333   .0738855     6.54   0.000     .3383203    .6279463
         L1. |  -.3994172   .0766808    -5.21   0.000    -.5497088   -.2491256
             |
          lk |
         --. |   .0782297   .0878465     0.89   0.373    -.0939463    .2504057
         L1. |  -.0146383   .0906699    -0.16   0.872    -.1923482    .1630715
             |
         D85 |  -.0319646   .0095612    -3.34   0.001    -.0507042   -.0132251
         D86 |   .0044814   .0100757     0.44   0.656    -.0152667    .0242294
         D87 |   .0431378   .0096607     4.47   0.000     .0242031    .0620725
         D88 |   .0192073   .0098169     1.96   0.050    -.0000334     .038448
         D89 |  -.0343525   .0116592    -2.95   0.003    -.0572041    -.011501
       _cons |   .2741216   .0676298     4.05   0.000     .1415697    .4066736
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(D85 D86 D87 D88 D89)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(2/7).(ln lk)
    L(2/7).L.ly
Instruments for levels equation
  Standard
    D85 D86 D87 D88 D89
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(ln lk)
    DL.L.ly
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -8.16  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -1.19  Pr > z =  0.235
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(69)   = 226.16  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(69)   = 171.13  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)
```

```
Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(51)    = 132.24  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(18)    =  38.89  Prob > chi2 =  0.003
  gmm(L.ly, lag(2 .))
    Hansen test excluding group:     chi2(50)    = 137.15  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(19)    =  33.98  Prob > chi2 =  0.018
  gmm(ln lk, lag(2 .))
    Hansen test excluding group:     chi2(14)    =  20.97  Prob > chi2 =  0.102
    Difference (null H = exogenous): chi2(55)    = 150.16  Prob > chi2 =  0.000
  iv(D85 D86 D87 D88 D89)
    Hansen test excluding group:     chi2(64)    = 167.48  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(5)     =   3.65  Prob > chi2 =  0.601
```

➔ Guardar o *output*:

```
estimates store BB2_W_End
```

4.7.4. GMM a 2 passos, com correcção de Windmeijer, variáveis com padrão de endogeneidade grave

```
xtabond2 ly l.ly ln l.ln lk l.lk D85-D89, iv(D85-D89) gmm(l.ly, lag(3 .)) gmm(ln lk, lag(3 .)) robust twostep

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      3444
Time variable : year                            Number of groups   =       492
Number of instruments = 60                      Obs per group: min =         7
Wald chi2(10) =  27007.23                                      avg =      7.00
Prob > chi2   =     0.000                                      max =         7
------------------------------------------------------------------------------
             |              Corrected
          ly |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |   .9436161   .0435045    21.69   0.000     .8583489    1.028883
             |
          ln |
         --. |   .1158596   .0750913     1.54   0.123    -.0313167     .263036
         L1. |  -.1031035   .0778615    -1.32   0.185    -.2557093    .0495022
             |
          lk |
         --. |   .0976223   .0865112     1.13   0.259    -.0719366    .2671812
         L1. |  -.0524615   .0862948    -0.61   0.543    -.2215962    .1166732
             |
         D85 |  -.0648566   .0098095    -6.61   0.000     -.084083   -.0456303
         D86 |  -.0397294   .0110046    -3.61   0.000    -.0612981   -.0181608
         D87 |   .0090195   .0094482     0.95   0.340    -.0094985    .0275376
         D88 |   -.005667   .0097416    -0.58   0.561    -.0247601    .0134261
         D89 |  -.0531789   .0108084    -4.92   0.000     -.074363   -.0319948
       _cons |   .1581968   .0566362     2.79   0.005     .0471919    .2692018
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(D85 D86 D87 D88 D89)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(3/7).(ln lk)
    L(3/7).L.ly
Instruments for levels equation
  Standard
    D85 D86 D87 D88 D89
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL2.(ln lk)
    DL2.L.ly
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -7.49  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -1.64  Pr > z =  0.102
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(49)   = 107.44  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(49)   =  90.64  Prob > chi2 =  0.000
  (Robust, but weakened by many instruments.)
```

```
Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(34)    =  49.49  Prob > chi2 =  0.042
    Difference (null H = exogenous): chi2(15)    =  41.15  Prob > chi2 =  0.000
  gmm(L.ly, lag(3 .))
    Hansen test excluding group:     chi2(38)    =  70.65  Prob > chi2 =  0.001
    Difference (null H = exogenous): chi2(11)    =  19.99  Prob > chi2 =  0.045
  gmm(ln lk, lag(3 .))
    Hansen test excluding group:     chi2(6)     =   4.43  Prob > chi2 =  0.618
    Difference (null H = exogenous): chi2(43)    =  86.21  Prob > chi2 =  0.000
  iv(D85 D86 D87 D88 D89)
    Hansen test excluding group:     chi2(44)    =  66.08  Prob > chi2 =  0.017
    Difference (null H = exogenous): chi2(5)     =  24.56  Prob > chi2 =  0.000
```

➔ Guardar o *output*:

```
estimates store BB2_W_End2
```

4.7.5. GMM a 2 passos, com correcção de Windmeijer, variáveis com padrão de endogeneidade muito grave

```
xtabond2 ly l.ly ln l.ln lk l.lk D85-D89, iv(D85-D89) gmm(l.ly, lag(4 .)) gmm(ln lk, lag(4 .)) robust twostep

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      3444
Time variable : year                            Number of groups   =       492
Number of instruments = 43                      Obs per group: min =         7
Wald chi2(10) =  21213.99                                      avg =      7.00
Prob > chi2   =     0.000                                      max =         7
------------------------------------------------------------------------------
             |              Corrected
          ly |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |   .9833622   .0417485    23.55   0.000     .9015366    1.065188
             |
          ln |
         --. |   .2557388   .1254398     2.04   0.041     .0098814    .5015962
         L1. |  -.2671557   .1202421    -2.22   0.026     -.502826   -.0314855
             |
          lk |
         --. |   .0883515   .0898293     0.98   0.325    -.0877108    .2644138
         L1. |  -.0690573    .095936    -0.72   0.472    -.2570884    .1189739
             |
         D85 |  -.0545872   .0115012    -4.75   0.000    -.0771292   -.0320452
         D86 |  -.0285395   .0141852    -2.01   0.044    -.0563419   -.0007371
         D87 |   .0201869   .0112856     1.79   0.074    -.0019324    .0423062
         D88 |   .0057823   .0100815     0.57   0.566     -.013977    .0255415
         D89 |  -.0476441   .0110362    -4.32   0.000    -.0692747   -.0260135
       _cons |   .1267245   .0698956     1.81   0.070    -.0102683    .2637174
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(D85 D86 D87 D88 D89)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(4/7).(ln lk)
    L(4/7).L.ly
Instruments for levels equation
  Standard
    D85 D86 D87 D88 D89
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL3.(ln lk)
    DL3.L.ly
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -8.18  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -1.39  Pr > z =  0.163
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(32)   =  57.21  Prob > chi2 =  0.004
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(32)   =  46.39  Prob > chi2 =  0.048
  (Robust, but weakened by many instruments.)
```

```
Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(20)    =  26.59  Prob > chi2 =  0.147
    Difference (null H = exogenous): chi2(12)    =  19.79  Prob > chi2 =  0.071
  gmm(L.ly, lag(4 .))
    Hansen test excluding group:     chi2(27)    =  33.45  Prob > chi2 =  0.183
    Difference (null H = exogenous): chi2(5)     =  12.94  Prob > chi2 =  0.024
  gmm(ln lk, lag(4 .))
    Hansen test excluding group:     chi2(0)     =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(32)    =  46.39  Prob > chi2 =  0.048
  iv(D85 D86 D87 D88 D89)
    Hansen test excluding group:     chi2(27)    =  35.32  Prob > chi2 =  0.131
    Difference (null H = exogenous): chi2(5)     =  11.07  Prob > chi2 =  0.050
```

➔ Guardar o *output*:

```
estimates store BB2_W_End3
```

4.7.6. GMM a 2 passos, com correcção de Windmeijer, variáveis com padrão de endogeneidade muito grave (2 períodos)

```
xtabond2 ly l.ly ln l.ln lk l.lk D85-D89, iv(D85-D89) gmm(l.ly, lag(4 5)) gmm(ln, lag(4 5)) gmm(lk, lag(4 5))
robust twostep

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: id                              Number of obs      =      3444
Time variable : year                            Number of groups   =       492
Number of instruments = 36                      Obs per group: min =         7
Wald chi2(10) =  15496.51                                      avg =      7.00
Prob > chi2   =     0.000                                      max =         7
------------------------------------------------------------------------------
             |              Corrected
          ly |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          ly |
         L1. |    1.00054   .0466697    21.44   0.000     .9090693    1.092011
             |
          ln |
         --. |   .1964188   .1160436     1.69   0.091    -.0310225      .42386
         L1. |   -.213861   .1170393    -1.83   0.068    -.4432538    .0155318
             |
          lk |
         --. |   .0858132   .0893386     0.96   0.337    -.0892872    .2609135
         L1. |  -.0805152   .0951348    -0.85   0.397    -.2669759    .1059455
             |
         D85 |  -.0568992     .01129    -5.04   0.000    -.0790271   -.0347712
         D86 |  -.0330473   .0133709    -2.47   0.013    -.0592539   -.0068408
         D87 |   .0204952   .0110167     1.86   0.063     -.001097    .0420875
         D88 |   .0034532   .0108009     0.32   0.749     -.017716    .0246225
         D89 |  -.0446895   .0122087    -3.66   0.000     -.068618   -.0207609
       _cons |   .1094794   .0856162     1.28   0.201    -.0583252    .2772841
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(D85 D86 D87 D88 D89)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(4/5).lk
    L(4/5).ln
    L(4/5).L.ly
Instruments for levels equation
  Standard
    D85 D86 D87 D88 D89
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL3.lk
    DL3.ln
    DL3.L.ly
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -7.92  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -1.47  Pr > z =  0.140
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(25)    =  38.94  Prob > chi2 =  0.037
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(25)    =  28.14  Prob > chi2 =  0.301
  (Robust, but weakened by many instruments.)
```

```
Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(12)    =  11.16  Prob > chi2 =  0.515
    Difference (null H = exogenous): chi2(13)    =  16.99  Prob > chi2 =  0.200
  gmm(L.ly, lag(4 5))
    Hansen test excluding group:     chi2(21)    =  24.70  Prob > chi2 =  0.260
    Difference (null H = exogenous): chi2(4)     =   3.44  Prob > chi2 =  0.486
  gmm(ln, lag(4 5))
    Hansen test excluding group:     chi2(13)    =  22.41  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(12)    =   5.73  Prob > chi2 =  0.929
  gmm(lk, lag(4 5))
    Hansen test excluding group:     chi2(11)    =  10.45  Prob > chi2 =  0.491
    Difference (null H = exogenous): chi2(14)    =  17.70  Prob > chi2 =  0.221
  iv(D85 D86 D87 D88 D89)
    Hansen test excluding group:     chi2(20)    =  22.73  Prob > chi2 =  0.302
    Difference (null H = exogenous): chi2(5)     =   5.41  Prob > chi2 =  0.368
```

➔ Guardar o *output*:

```
estimates store BB2_W_End4
```

4.8. Revisão dos resultados obtidos

estimates table AB*, star(.1 .05 .01)

Variable	AB1_R_Exo	AB2_NW_Exo	AB2_W_Exo	AB2_W_Pre	AB2_W_End
ly					
L1.	.36072567***	.25799093***	.25799093*	.26368897**	.36595836***
ln					
--.	.35717523***	.35169603***	.35169603***	.1686736*	.15956634
L1.	-.27248254*	-.08922002	-.08922002	-.01306406	-.05281532
lk					
--.	.24677264	-.23801906	-.23801906	.59759284	.39017085
L1.	.03484028	.49439937**	.49439937	-.35825665	-.16662494
D85	-.00391024	-.03191809**	-.03191809	.00569565	-.01015616
D86	.00508719	-.01509415	-.01509415	.01154484	-.00151855
D87	.04636913*	.05560961**	.05560961	.04262972	.03686598
D88	.05187125	.0569106	.0569106	.07860308**	.0588645
D89	.02572667	.02894871	.02894871	.06363883	.03656995

legend: * p<.1; ** p<.05; *** p<.01

estimates table BB*, star(.1 .05 .01)

Variable	BB1_R_Pre	BB2_W_Pre	BB2_W_End	BB2_W_End2	BB2_W_End3	BB2_W_End4
ly						
L1.	.89299064***	.90364619***	.84947777***	.94361609***	.98336222***	1.0005402***
ln						
--.	.42357038***	.40225061***	.48313327***	.11585963	.25573881**	.19641878*
L1.	-.35135132***	-.33996429***	-.39941724***	-.10310352	-.26715571**	-.213861*
lk						
--.	.3056063***	.25466661***	.07822969	.09762232	.08835151	.08581318
L1.	-.27932622***	-.23003565***	-.01463834	-.05246152	-.06905725	-.08051522
D85	-.01459023	-.02466959**	-.0319646***	-.06485662***	-.05458718***	-.05689915***
D86	.00445017	.00814699	.00448135	-.03972942***	-.02853952**	-.03304735**
D87	.04856031***	.03715088***	.04313783***	.00901953	.02018689*	.02049521*
D88	.03534497***	.02916492***	.01920726*	-.00566699	.00578226	.00345325
D89	-.01141206	-.02066982*	-.03435253***	-.05317892***	-.04764412***	-.04468948***
_cons	.18974151***	.19033666***	.27412162***	.15819682***	.12672454*	.10947944

legend: * p<.1; ** p<.05; *** p<.01

```
estimates table FE RE BB2_W_End4, star(.1 .05 .01)

-------------------------------------------------------------
    Variable |      FE               RE           BB2_W_End4
-------------+-----------------------------------------------
          ly |
         L1. |  .53893815***    .95492282***    1.0005402***
             |
          ln |
         --. |  .37694922***    .40326513***    .19641878*
         L1. | -.20589356***   -.37874461***     -.213861*
             |
          lk |
         --. |  .42660133***    .27623688***    .08581318
         L1. | -.33954886***   -.26299951***   -.08051522
             |
         D85 |  .01468876*     -.01622825*     -.05689915***
         D86 |  .02979362***    .00203443      -.03304735**
         D87 |  .07618012***    .04569568***    .02049521*
         D88 |  .09223327***    .02832991***    .00345325
         D89 |   .0635988***   -.01987897**    -.04468948***
       _cons |  1.5324082***    .10754862***    .10947944
-------------------------------------------------------------
                           legend: * p<.1; ** p<.05; *** p<.01
```

<u>NOTA:</u> estudos de simulação mostram que as estimativas obtidas através do estimador "*Fixed effects*" são negativamente enviesadas e as estimativas obtidas através do estimador "*Random effects*" são positivamente enviesadas. Logo, a estimativa consistente deverá situar-se entre as estimativas "*Fixed effects*" e as estimativas "*Random effects*". No entanto, como é possível observar, na prática esta relação dificilmente se verifica.

Bibliografia:

Arellano, M. and Bond, S. (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *The Review of Economic Studies*, 58(2), 277-297

Baltagi, B. (2013), *Econometric Analysis of Panel Data*, 5th edition, Wiley

Bond, S. (2002), "Dynamic panel data models: a guide to micro data methods and practice", *Portuguese Economic Journal*, 1(2), 141-162

Roodman, D (2006), "How to Do xtabond2: An Introduction to "Difference" and "System" GMM in Stata", *Center for Global Development*, Working paper 103

Wooldridge, J. (2010), *Econometric Analysis of Cross Section and Panel Data*, 2nd edition, MIT Press