

## 1. Instalação de packages úteis

```
ssc install rhausman
```

```
net install sg164_1, from(http://www.stata-journal.com/software/sj8-1)
```

```
ssc install xttest3
```

```
ssc install xtscd
```

## 2. Ler dados

```
use wagepan.dta, clear
```

### 2.1. Descrever a base de dados

```
describe
```

Contains data from wagepan.dta

```
obs:      4,360
vars:      44                2 Apr 2002 22:39
size:     222,360
```

```
-----
```

variable name	storage type	display format	value label	variable label
nr	int	%9.0g		person identifier
year	int	%9.0g		1980 to 1987
agric	byte	%9.0g		=1 if in agriculture
black	byte	%9.0g		=1 if black
bus	byte	%9.0g		=1 if business & repair serv.
construc	byte	%9.0g		=1 if in construction
ent	byte	%9.0g		=1 if entertainment
exper	byte	%9.0g		labor mkt experience

(output longo omitido propositadamente)

```
Sorted by: nr year
```

### 2.2. Declara base de dados como painel

```
xtset nr year
```

```
panel variable: nr (strongly balanced)
time variable: year, 1980 to 1987
delta: 1 unit
```

NOTA: Primeira variável refere-se a "i", segunda variável refere-se a "t". Pode definir-se o painel de outras formas.

### 3. Estatística descritiva no contexto de painel

#### xtdescribe

```

nr: 13, 17, ..., 12548          n =          545
year: 1980, 1981, ..., 1987     T =           8
Delta(year) = 1 unit
Span(year) = 8 periods
(nr*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
-----+-----
  545   100.00 100.00 | 11111111
-----+-----
  545   100.00      | XXXXXXXX

```

#### xtsum lwage educ exper black hisp married union

Variable		Mean	Std. Dev.	Min	Max	Observations
lwage	overall	1.649147	.5326094	-3.579079	4.05186	N = 4360
	between		.3907468	.3333435	3.174173	n = 545
	within		.3622636	-2.467201	3.204687	T = 8
educ	overall	11.76697	1.746181	3	16	N = 4360
	between		1.747585	3	16	n = 545
	within		0	11.76697	11.76697	T = 8
exper	overall	6.514679	2.825873	0	18	N = 4360
	between		1.654918	3.5	14.5	n = 545
	within		2.291551	3.014679	10.01468	T = 8
black	overall	.1155963	.3197769	0	1	N = 4360
	between		.320034	0	1	n = 545
	within		0	.1155963	.1155963	T = 8
hisp	overall	.1559633	.3628622	0	1	N = 4360
	between		.3631539	0	1	n = 545
	within		0	.1559633	.1559633	T = 8
married	overall	.4389908	.4963208	0	1	N = 4360
	between		.3766116	0	1	n = 545
	within		.3236137	-.4360092	1.313991	T = 8
union	overall	.2440367	.4295639	0	1	N = 4360
	between		.3294467	0	1	n = 545
	within		.2759787	-.6309633	1.119037	T = 8

→ Enfoque na variável lwage:

*Overall* – diz respeito a todos os indivíduos da amostra, ao longo do período em análise

**sum lwage**

Variable	Obs	Mean	Std. Dev.	Min	Max
lwage	4,360	1.649147	.5326094	-3.579079	4.05186

*Between* – médias no tempo dos indivíduos da amostra

**bysort nr: egen lwage\_mean\_t=mean(lwage)**

*Within* – observações expurgadas das dinâmicas temporais

**egen lwage\_mean\_it=mean(lwage)**

**gen lwage\_within=lwage-lwage\_mean\_t**

**gen lwage\_within\_comp=lwage-lwage\_mean\_t+lwage\_mean\_it**

**xtsum lwage**

Variable		Mean	Std. Dev.	Min	Max	Observations
lwage	overall	1.649147	.5326094	-3.579079	4.05186	N = 4360
	between	.3907468	.3333435	3.174173		n = 545
	within	.3622636	-2.467201	3.204687		T = 8

**sum lwage lwage\_mean\_t lwage\_within lwage\_within\_comp**

Variable	Obs	Mean	Std. Dev.	Min	Max
lwage	4,360	1.649147	.5326094	-3.579079	4.05186
lwage_mean_t	4,360	1.649147	.3904329	.3333435	3.174173
lwage_within	4,360	1.62e-09	.3622636	-4.116348	1.55554
lwage_within_comp	4,360	1.649147	.3622636	-2.467201	3.204687

→ transformação "Within" comparável

**xttab educ**

educ	Overall		Between		Within
	Freq.	Percent	Freq.	Percent	Percent
3	8	0.18	1	0.18	100.00
5	16	0.37	2	0.37	100.00
6	40	0.92	5	0.92	100.00
7	16	0.37	2	0.37	100.00
8	144	3.30	18	3.30	100.00
9	136	3.12	17	3.12	100.00
10	376	8.62	47	8.62	100.00
11	736	16.88	92	16.88	100.00
12	1848	42.39	231	42.39	100.00
13	432	9.91	54	9.91	100.00
14	328	7.52	41	7.52	100.00
15	248	5.69	31	5.69	100.00
16	32	0.73	4	0.73	100.00
Total	4360	100.00	545	100.00	100.00

(n = 545)

**xttab married**

married	Overall		Between		Within
	Freq.	Percent	Freq.	Percent	Percent
0	2446	56.10	472	86.61	64.78
1	1914	43.90	383	70.28	62.47
Total	4360	100.00	855	156.88	63.74

(n = 545)

→ Para married==1:

*Overall* – número de indivíduos que estiveram casados, em toda a amostra

*Between* – número de indivíduos que alguma vez estiveram casados ao longo do período amostral (o *Total Between* é diferente do total da amostra porque existem indivíduos que mudaram de estado civil ao longo do período amostral)

*Within percent* – fracção do tempo, em média, em que um indivíduo permaneceu casado

*Total Within* – fracção do tempo, em média, em que um indivíduo não mudou de estado civil

**xttrans married**

married	=1 if married		Total
	0	1	
0	86.05	13.95	100.00
1	4.94	95.06	100.00
Total	52.48	47.52	100.00

**INTERPRETAÇÃO:** 95.06% dos indivíduos que eram casados permaneceram casados no período seguinte. 86.05% dos indivíduos que eram não casados permaneceram não casados no período seguinte. 13.95% dos indivíduos que eram não casados passaram a ser casados no período seguinte. 4.94% dos indivíduos que eram casados passaram a ser não casados no período seguinte

→ Valores do comando **xttrans** iguais aos do comando **xttab** se considerarmos a dinâmica subjacente:

**xttrans married**

married	=1 if married		Total
	0	1	
0	86.05	13.95	100.00
1	4.94	95.06	100.00
Total	52.48	47.52	100.00

**xttab married if year>=1981**

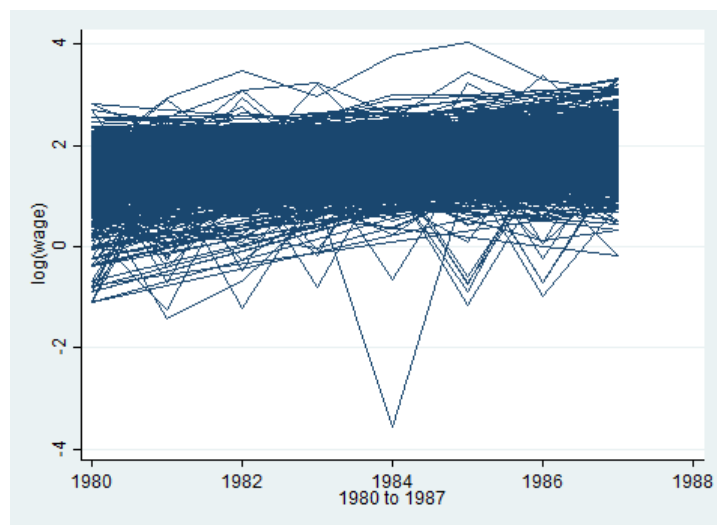
married	Overall		Between		Within
	Freq.	Percent	Freq.	Percent	Percent
0	2002	52.48	421	77.25	67.93
1	1813	47.52	382	70.09	67.80
Total	3815	100.00	803	147.34	67.87

(n = 545)

## 4. Gráficos

### 4.1. Todos os indivíduos num só gráfico

```
line lwage year
```



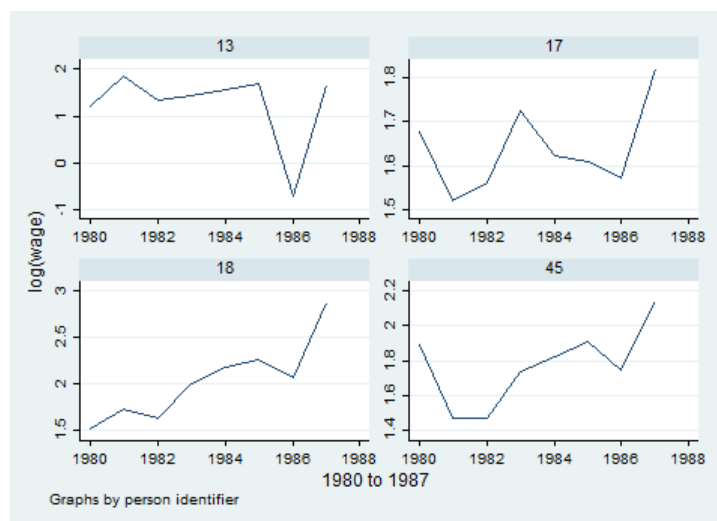
### 4.2. Um gráfico por indivíduo (todos na mesma escala)

```
xtline lwage if nr<=100
```



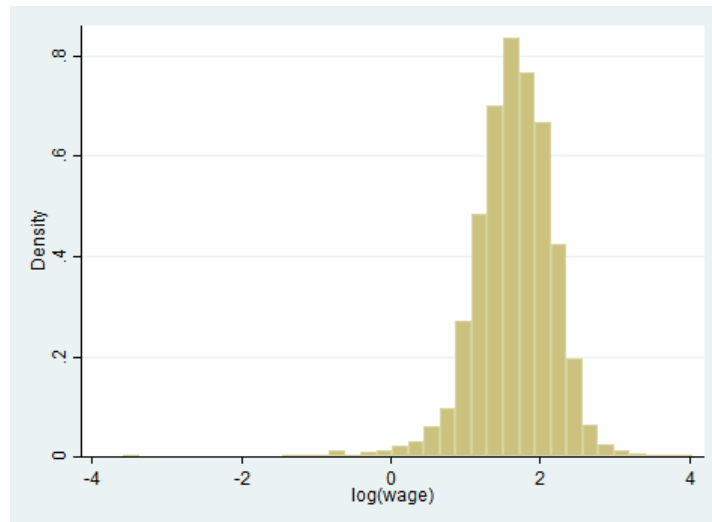
### 4.3. Um gráfico por indivíduo (uma escala por indivíduo)

```
xtline lwage if nr<=100, byopts(rescale)
```



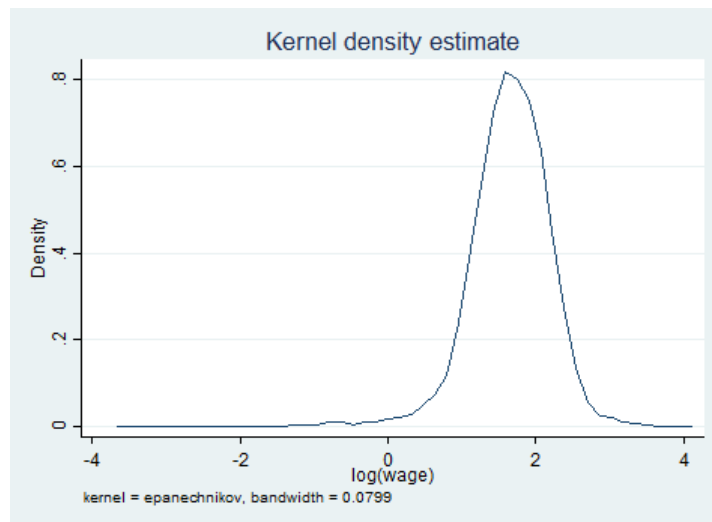
#### 4.4. Histograma

`histogram lwage`



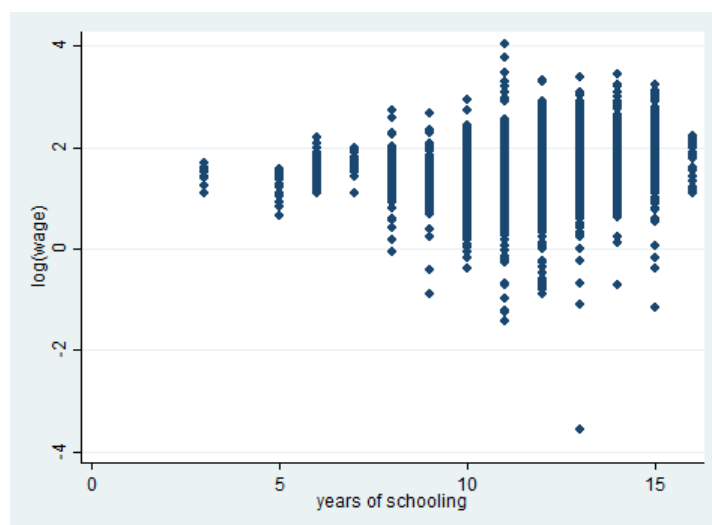
#### 4.5. Distribuição empírica (Kernel)

`kdensity lwage`



#### 4.6. Diagrama de dispersão

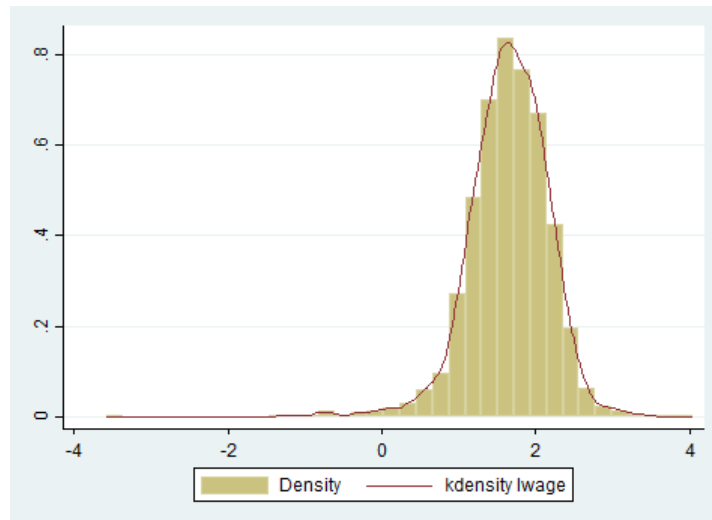
`scatter lwage educ`



#### 4.7. Utilização do comando **twoway** (vários diagramas num único output gráfico do Stata)

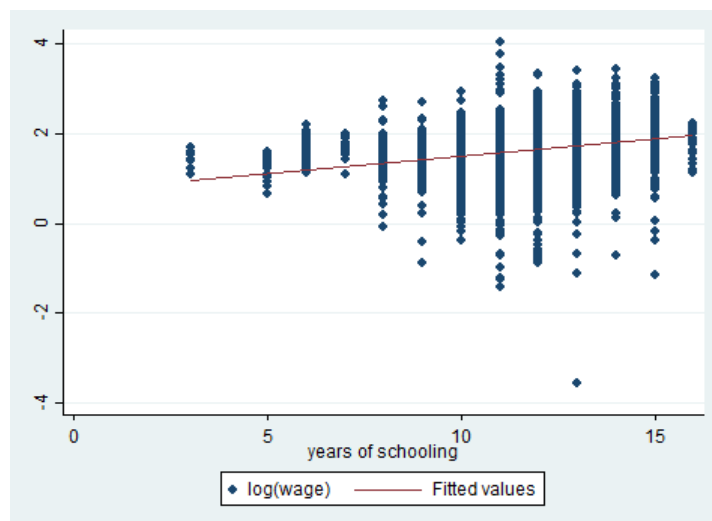
##### 4.7.1. Histograma com densidade empírica

```
twoway (histogram lwage) (kdensity lwage)
```



##### 4.7.2. Diagrama de dispersão com recta de ajustamento

```
twoway (scatter lwage educ) (lfit lwage exper)
```



NOTA: O subcomando **lfit** só se encontra disponível dentro do comando **twoway**.

## 5. Regressões e inferência estatística

### 5.1. Geração de “time dummies” e tendências

#### 5.1.1. “Time dummies”

```
tab year, gen(y)
```

1980 to			
1987	Freq.	Percent	Cum.
-----+-----			
1980	545	12.50	12.50
1981	545	12.50	25.00
1982	545	12.50	37.50
1983	545	12.50	50.00
1984	545	12.50	62.50
1985	545	12.50	75.00
1986	545	12.50	87.50
1987	545	12.50	100.00
-----+-----			
Total	4,360	100.00	

#### 5.1.2. Tendência linear

```
bysort nr: gen t=_n
```

#### 5.1.3. Tendência quadrática

```
bysort nr: gen t_sq=t^2
```



## 5.2. Regressões

### 5.2.1. “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.

```
xi: reg lwage i.year exper expersq educ black hisp married union, rob cluster(nr)
```

```
i.year          _Iyear_1980-1987      (naturally coded; _Iyear_1980 omitted)
```

```
Linear regression      Number of obs      =      4,360
                      F(14, 544)                =      47.10
                      Prob > F                  =      0.0000
                      R-squared                 =      0.1893
                      Root MSE               =      .48033
```

(Std. Err. adjusted for 545 clusters in nr)

	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
lwage						
_Iyear_1981	.05832	.028228	2.07	0.039	.0028707	.1137693
_Iyear_1982	.0627744	.0369735	1.70	0.090	-.0098538	.1354027
_Iyear_1983	.0620117	.046248	1.34	0.181	-.0288348	.1528583
_Iyear_1984	.0904672	.057988	1.56	0.119	-.0234407	.204375
_Iyear_1985	.1092463	.0668474	1.63	0.103	-.0220644	.240557
_Iyear_1986	.1419596	.0762348	1.86	0.063	-.0077791	.2917102
_Iyear_1987	.1738334	.0852056	2.04	0.042	.0064611	.3412057
exper	.0672345	.0195958	3.43	0.001	.0287417	.1057273
expersq	-.0024117	.0010252	-2.35	0.019	-.0044255	-.0003979
educ	.0913498	.0110822	8.24	0.000	.0695807	.1131189
black	-.1392342	.0505238	-2.76	0.006	-.2384798	-.0399887
hisp	.0160195	.0390781	0.41	0.682	-.060743	.092782
married	.1082529	.026034	4.16	0.000	.0571135	.1593924
union	.1824613	.0274435	6.65	0.000	.1285531	.2363695
_cons	.0920558	.1609365	0.57	0.568	-.2240773	.4081888

→ Guardar o output:

```
estimates store POLS_Rob
```

→ Efeito parcial da Educação sobre o Salário de um dado individuo  $i$  no momento  $t$

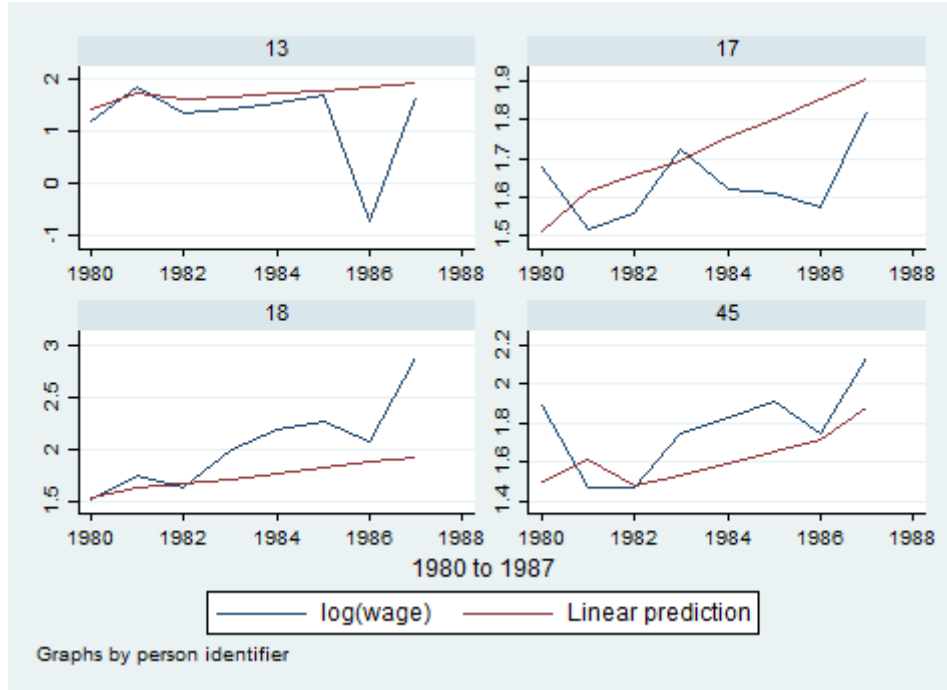
```
display (exp(_b[educ]) - 1)*100
```

9.5652184

→ Comando predict

```
quiet xi: reg lwage i.year exper expersq educ black hisp married union, rob cluster(nr)  
predict lwage_hat, xb
```

```
xtline lwage lwage_hat if nr<=100, byopts(rescale)
```



## 5.2.2. “Random effects”

```
xi: xtreg lwage i.year exper expersq educ black hisp married union, re
```

```
i.year          _Iyear_1980-1987    (naturally coded; _Iyear_1980 omitted)

Random-effects GLS regression           Number of obs   =       4,360
Group variable: nr                     Number of groups =        545

R-sq:                                   Obs per group:
    within = 0.1799                      min =           8
    between = 0.1860                     avg =          8.0
    overall = 0.1830                     max =           8

Wald chi2(14) = 957.77
corr(u_i, X) = 0 (assumed)              Prob > chi2     = 0.0000
```

```
-----+-----
      lwage |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
   _Iyear_1981 |   .040462   .0246946     1.64   0.101    - .0079385   .0888626
   _Iyear_1982 |   .0309212  .0323416     0.96   0.339    - .0324672   .0943096
   _Iyear_1983 |   .0202806  .041582     0.49   0.626    - .0612186   .1017798
   _Iyear_1984 |   .0431187  .0513163     0.84   0.401    - .0574595   .1436969
   _Iyear_1985 |   .0578155  .0612323     0.94   0.345    - .0621977   .1778286
   _Iyear_1986 |   .0919476  .0712293     1.29   0.197    - .0476592   .2315544
   _Iyear_1987 |   .1349289  .0813135     1.66   0.097    - .0244427   .2943005
      exper |   .1057545  .0153668     6.88   0.000     .0756361   .1358729
  expersq |  -.0047239  .0006895    -6.85   0.000    - .0060753  -.0033726
      educ |   .0918763  .0106597     8.62   0.000     .0709836   .1127689
     black |  -.1393767  .0477228    -2.92   0.003    - .2329117  -.0458417
      hisp |   .0217317  .0426063     0.51   0.610    - .0617751   .1052385
  married |   .063986   .0167742     3.81   0.000     .0311091   .0968629
     union |   .1061344  .0178539     5.94   0.000     .0711415   .1411273
     _cons |   .0235864  .1506683     0.16   0.876    - .271718   .3188907
-----+-----

sigma_u |   .32460315
sigma_e |   .35099001
     rho |   .46100216   (fraction of variance due to u_i)
-----+-----
```

➔ Guardar o *output*:

```
estimates store RE_NotRob
```

### 5.2.3. “Fixed effects”

```
xi: xtreg lwage i.year exper expersq educ black hisp married union, fe
```

```
i.year          _Iyear_1980-1987    (naturally coded; _Iyear_1980 omitted)
note: exper omitted because of collinearity
note: educ omitted because of collinearity
note: black omitted because of collinearity
note: hisp omitted because of collinearity
```

```
Fixed-effects (within) regression      Number of obs   =    4,360
Group variable: nr                    Number of groups =     545
```

```
R-sq:                                Obs per group:
    within = 0.1806                    min =          8
    between = 0.0286                   avg =         8.0
    overall = 0.0888                   max =          8
```

```
F(10,3805) = 83.85
corr(u_i, Xb) = -0.1222                Prob > F = 0.0000
```

lwage	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_Iyear_1981	.1511912	.0219489	6.89	0.000	.1081584	.194224
_Iyear_1982	.2529709	.0244185	10.36	0.000	.2050963	.3008454
_Iyear_1983	.3544437	.0292419	12.12	0.000	.2971125	.4117749
_Iyear_1984	.4901148	.0362266	13.53	0.000	.4190894	.5611402
_Iyear_1985	.6174823	.0452435	13.65	0.000	.5287784	.7061861
_Iyear_1986	.7654966	.0561277	13.64	0.000	.6554532	.8755399
_Iyear_1987	.9250249	.0687731	13.45	0.000	.7901893	1.059861
exper	0	(omitted)				
expersq	-.0051855	.0007044	-7.36	0.000	-.0065666	-.0038044
educ	0	(omitted)				
black	0	(omitted)				
hisp	0	(omitted)				
married	.0466804	.0183104	2.55	0.011	.0107811	.0825796
union	.0800019	.0193103	4.14	0.000	.0421423	.1178614
_cons	1.426019	.0183415	77.75	0.000	1.390058	1.461979
sigma_u	.39176195					
sigma_e	.35099001					
rho	.55472817	(fraction of variance due to u_i)				

```
F test that all u_i=0: F(544, 3805) = 9.16                Prob > F = 0.0000
```

➔ Guardar o output:

```
estimates store FE_NotRob
```

### 5.3. Testes

#### 5.3.1. Teste à existência de efeitos fixos no tempo (após regressão de Efeitos Fixos)

Válido apenas se não existir heterocedasticidade e autocorrelação no erro composto não transformado

**xi: testparm i.year**

i.year                    \_Iyear\_1980-1987     (naturally coded; \_Iyear\_1980 omitted)

- ( 1) \_Iyear\_1981 = 0
- ( 2) \_Iyear\_1982 = 0
- ( 3) \_Iyear\_1983 = 0
- ( 4) \_Iyear\_1984 = 0
- ( 5) \_Iyear\_1985 = 0
- ( 6) \_Iyear\_1986 = 0
- ( 7) \_Iyear\_1987 = 0

F( 7, 3805) = 29.24  
Prob > F = 0.0000

#### 5.3.2. Teste de Hausman clássico

**hausman FE\_NotRob RE\_NotRob**

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	FE_NotRob	RE_NotRob	Difference	S.E.
-----				
_Iyear_1981	.1511912	.040462	.1107292	.
_Iyear_1982	.2529709	.0309212	.2220497	.
_Iyear_1983	.3544437	.0202806	.3341631	.
_Iyear_1984	.4901148	.0431187	.4469961	.
_Iyear_1985	.6174823	.0578155	.5596668	.
_Iyear_1986	.7654966	.0919476	.673549	.
_Iyear_1987	.9250249	.1349289	.790096	.
expersq	-.0051855	-.0047239	-.0004616	.0001443
married	.0466804	.063986	-.0173057	.0073414
union	.0800019	.1061344	-.0261326	.0073572
-----				

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(10) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)  
          = 26.36  
Prob>chi2 = 0.0033  
(V\_b-V\_B is not positive definite)

**NOTA:** Usar as estimativas de Efeitos Fixos em primeiro lugar, uma vez que este é o estimador consistente sob a hipótese de exogeneidade (a nula) e de endogeneidade (a alternativa).

### 5.3.3. Teste de Hausman robusto (via *bootstrap*)

```
rhausman FE_NotRob RE_NotRob, reps(100) cluster
```

```
bootstrap in progress
```

```
----- 1 ----- 2 ----- 3 ----- 4 ----- 5  
..... 50  
..... 100  
-----
```

```
Cluster-Robust Hausman Test
```

```
(based on 100 bootstrap repetitions)
```

```
b1: obtained from xtreg lwage _Iyear_* exper expersq educ black hisp married union, fe
```

```
b2: obtained from xtreg lwage _Iyear_* exper expersq educ black hisp married union, re
```

```
Excluded (not identified, or only identified in one model): exper educ black hisp
```

```
Test: Ho: difference in coefficients not systematic
```

```
chi2(12) = (b1-b2)' * [V_bootstrapped(b1-b2)]^(-1) * (b1-b2)  
          =      131.34  
Prob>chi2 =      0.0000
```

### 5.3.4. Procedimento de Chamberlain-Mundlak, como alternativa ao teste de Hausman

- i) Construir médias no tempo, para cada indivíduo, das variáveis que variam no tempo:

```
foreach x of varlist exper expersq married union {  
  bysort nr: egen mean_`x' = mean(`x')  
}
```

- ii) Regressão *Pooled OLS* aumentada pelas médias no tempo das variáveis anteriores:

```
xi: reg lwage i.year exper expersq educ black hisp married union mean_exper mean_expersq mean_married  
mean_union, rob cluster(nr)
```

- iii) Teste F sobre os coeficientes estimados das médias no tempo das variáveis anteriores:

```
testparm mean_exper mean_expersq mean_married mean_union
```

```
( 1) mean_exper = 0  
( 2) mean_expersq = 0  
( 3) mean_married = 0  
( 4) mean_union = 0
```

```
F( 4, 544) = 7.79  
Prob > F = 0.0000
```

### 5.3.5. Teste BP sobre efeitos aleatórios na componente individual (após regressão de Efeitos Aleatórios)

H0:  $\text{Var}(u_i)=0$ , o caso em que a componente individual não observada é "constante" (não aleatória)

```
quiet xi: xtreg lwage i.year exper expersq educ black hisp married union, re  
xttest0
```

Breusch and Pagan Lagrangian multiplier test for random effects

$$\text{lwage}[\text{nr},\text{t}] = \text{Xb} + u[\text{nr}] + e[\text{nr},\text{t}]$$

Estimated results:

	Var	sd = sqrt(Var)
-----+-----		
lwage	.2836728	.5326094
e	.123194	.35099
u	.1053672	.3246031

Test:  $\text{Var}(u) = 0$

chibar2(01) = 3203.64  
Prob > chibar2 = 0.0000

### 5.3.6. Testes sobre as componentes do erro (após regressão de Efeitos Aleatórios)

```
quiet xi: xtreg lwage i.year exper expersq educ black hisp married union, re  
xttest1
```

Tests for the error component model:

$$\text{lwage}[\text{nr},\text{t}] = \text{Xb} + u[\text{nr}] + v[\text{nr},\text{t}], \quad v[\text{nr},\text{t}] = \lambda v[\text{nr},(\text{t}-1)] + e[\text{nr},\text{t}]$$

Estimated results:

	Var	sd = sqrt(Var)
-----+-----		
lwage	.2836728	.5326094
e	.123194	.35099001
u	.1053672	.32460315

Tests:

Random Effects, Two Sided:

ALM( $\text{Var}(u)=0$ ) = 1730.12 Pr>chi2(1) = 0.0000

Random Effects, One Sided:

ALM( $\text{Var}(u)=0$ ) = 41.59 Pr>N(0,1) = 0.0000

Serial Correlation:

ALM( $\lambda=0$ ) = 220.40 Pr>chi2(1) = 0.0000

Joint Test:

LM( $\text{Var}(u)=0, \lambda=0$ ) = 3424.04 Pr>chi2(2) = 0.0000

### 5.3.7. Teste de heterocedasticidade (após regressão de Efeitos Fixos)

```
quiet xi: xtreg lwage i.year exper expersq educ black hisp married union, fe  
xttest3
```

Modified Wald test for groupwise heteroscedasticity in fixed effect regression model

H0:  $\sigma(i)^2 = \sigma^2$  for all i

chi2 (545) = 2.7e+05  
Prob>chi2 = 0.0000

## 5.4. Revisão dos resultados obtidos

### 5.4.1. “Fixed effects” com desvios-padrão robustos

```
xi: xtreg lwage i.year exper expersq educ black hisp married union, fe rob cluster(nr)
```

```
i.year          _Iyear_1980-1987      (naturally coded; _Iyear_1980 omitted)
```

```
note: exper omitted because of collinearity
```

```
note: educ omitted because of collinearity
```

```
note: black omitted because of collinearity
```

```
note: hisp omitted because of collinearity
```

```
Fixed-effects (within) regression      Number of obs      =      4,360
```

```
Group variable: nr                    Number of groups   =       545
```

```
R-sq:                                  Obs per group:
```

```
    within = 0.1806                      min =           8
```

```
    between = 0.0286                     avg  =          8.0
```

```
    overall = 0.0888                     max  =           8
```

```
F(10,544) = 46.59
```

```
corr(u_i, Xb) = -0.1222                  Prob > F           = 0.0000
```

(Std. Err. adjusted for 545 clusters in nr)

		Robust				
lwage	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_Iyear_1981	.1511912	.0255648	5.91	0.000	.1009733	.2014091
_Iyear_1982	.2529709	.0286624	8.83	0.000	.1966684	.3092733
_Iyear_1983	.3544437	.0348608	10.17	0.000	.2859655	.422922
_Iyear_1984	.4901148	.0454581	10.78	0.000	.4008199	.5794097
_Iyear_1985	.6174823	.0568088	10.87	0.000	.5058908	.7290737
_Iyear_1986	.7654966	.071244	10.74	0.000	.6255495	.9054436
_Iyear_1987	.9250249	.0840563	11.00	0.000	.7599103	1.09014
exper	0	(omitted)				
expersq	-.0051855	.0008102	-6.40	0.000	-.0067771	-.0035939
educ	0	(omitted)				
black	0	(omitted)				
hisp	0	(omitted)				
married	.0466804	.0210038	2.22	0.027	.0054218	.0879389
union	.0800019	.0227431	3.52	0.000	.0353268	.1246769
_cons	1.426019	.0209824	67.96	0.000	1.384802	1.467235
sigma_u	.39176195					
sigma_e	.35099001					
rho	.55472817	(fraction of variance due to u_i)				

→ Guardar o output:

```
estimates store FE_Rob
```



### 5.4.2. Teste à existência de efeitos fixos no tempo, versão robusta (apenas após regressão com desvios-padrão robustos)

`xi: testparm i.year`

i.year                    \_Iyear\_1980-1987    (naturally coded; \_Iyear\_1980 omitted)

- ( 1) \_Iyear\_1981 = 0
- ( 2) \_Iyear\_1982 = 0
- ( 3) \_Iyear\_1983 = 0
- ( 4) \_Iyear\_1984 = 0
- ( 5) \_Iyear\_1985 = 0
- ( 6) \_Iyear\_1986 = 0
- ( 7) \_Iyear\_1987 = 0

F( 7, 544) = 18.07  
 Prob > F = 0.0000

### 5.4.3. Estimativas corrigidas (após conclusões retiradas da inferência habitual)

`estimates table POLS_Rob FE_Rob RE_NotRob, star(.1 .05 .01)`

Variable	POLS_Rob	FE_Rob	RE_NotRob
_Iyear_1981	.05831999**	.15119121***	.040462
_Iyear_1982	.06277442*	.25297086***	.03092116
_Iyear_1983	.06201174	.35444374***	.02028064
_Iyear_1984	.09046719	.49011479***	.04311871
_Iyear_1985	.1092463	.61748227***	.05781546
_Iyear_1986	.14195959*	.76549657***	.09194758
_Iyear_1987	.17383343**	.92502493***	.13492892*
exper	.0672345***	(omitted)	.10575452***
expersq	-.0024117**	-.0051855***	-.00472394***
educ	.09134979***	(omitted)	.09187628***
black	-.13923421***	(omitted)	-.13937673***
hisp	.01601951	(omitted)	.02173173
married	.10825295***	.04668036**	.06398602***
union	.18246128***	.08000186***	.10613443***
_cons	.09205578	1.4260185***	.02358638

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

## 5.5. Outras regressões de interesse

### 5.5.1. Máxima verosimilhança (equivalente à regressão de Efeitos Aleatórios)

```
xi: xtreg l wage i.year exper expersq educ black hisp married union, mle
```

```
i.year          _Iyear_1980-1987    (naturally coded; _Iyear_1980 omitted)
```

Fitting constant-only model:

```
Iteration 0:    log likelihood = -2621.1726
```

```
Iteration 1:    log likelihood = -2621.1724
```

Fitting full model:

```
Iteration 0:    log likelihood = -2204.5828
```

```
Iteration 1:    log likelihood = -2187.0507
```

```
Iteration 2:    log likelihood = -2186.9587
```

```
Iteration 3:    log likelihood = -2186.9587
```

```
Random-effects ML regression          Number of obs    =    4,360
```

```
Group variable: nr                    Number of groups =     545
```

```
Random effects u_i ~ Gaussian
```

```
Obs per group:
```

```
min = 8
```

```
avg = 8.0
```

```
max = 8
```

```
LR chi2(14) = 868.43
```

```
Log likelihood = -2186.9587          Prob > chi2 = 0.0000
```

```
-----+-----
```

l wage	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
-----+-----						
_Iyear_1981	.0403672	.0246825	1.64	0.102	-.0080096	.0887439
_Iyear_1982	.0307495	.0324581	0.95	0.343	-.0328673	.0943662
_Iyear_1983	.0200545	.0418377	0.48	0.632	-.0619459	.1020549
_Iyear_1984	.0428593	.051713	0.83	0.407	-.0584963	.1442149
_Iyear_1985	.0575217	.0617709	0.93	0.352	-.063547	.1785905
_Iyear_1986	.0916527	.0719097	1.27	0.202	-.0492877	.2325932
_Iyear_1987	.1347024	.0821346	1.64	0.101	-.0262784	.2956832
exper	.1059824	.0154449	6.86	0.000	.0757109	.136254
expersq	-.0047369	.0006881	-6.88	0.000	-.0060855	-.0033883
educ	.0918869	.01078	8.52	0.000	.0707585	.1130153
black	-.1393818	.0482582	-2.89	0.004	-.2339662	-.0447974
hisp	.0217738	.0430892	0.51	0.613	-.0626795	.1062271
married	.0635649	.0167793	3.79	0.000	.0306782	.0964517
union	.1054796	.0178849	5.90	0.000	.0704258	.1405334
_cons	.0231639	.1523257	0.15	0.879	-.275389	.3217168
-----+-----						
/sigma_u	.3298715	.0114704			.3081389	.3531369
/sigma_e	.3506647	.0040172			.342879	.3586273
rho	.4694743	.0185065			.4333786	.5058228
-----+-----						

```
LR test of sigma_u=0: chibar2(01) = 1590.05          Prob >= chibar2 = 0.000
```

```
estimates store MLE_NotRob
```

### 5.5.2. “Random effects” com erros idiossincráticos a seguir um processo AR(1)

```
xi: xtregar lwege i.year exper expersq educ black hisp married union, re rhotype(regress)
```

```
i.year          _Iyear_1980-1987    (naturally coded; _Iyear_1980 omitted)

RE GLS regression with AR(1) disturbances    Number of obs    =    4,360
Group variable: nr                          Number of groups =    545

R-sq:                                       Obs per group:
  within = 0.1800                          min =            8
  between = 0.1857                          avg =           8.0
  overall = 0.1828                          max =            8

Wald chi2(15) = 917.48
corr(u_i, Xb) = 0 (assumed)                 Prob > chi2      = 0.0000
```

lwege	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
_Iyear_1981	.0403896	.0242942	1.66	0.096	-.0072261	.0880053
_Iyear_1982	.0307824	.0323377	0.95	0.341	-.0325983	.0941632
_Iyear_1983	.0200269	.0415557	0.48	0.630	-.0614233	.1014771
_Iyear_1984	.0427695	.0512325	0.83	0.404	-.0576443	.1431833
_Iyear_1985	.0572992	.0610717	0.94	0.348	-.0623992	.1769976
_Iyear_1986	.0912774	.0709813	1.29	0.198	-.0478434	.2303982
_Iyear_1987	.1342057	.080975	1.66	0.097	-.0245024	.2929137
exper	.1057647	.0155199	6.81	0.000	.0753462	.1361832
expersq	-.0047171	.0007078	-6.66	0.000	-.0061044	-.0033298
educ	.0919214	.0106064	8.67	0.000	.0711332	.1127096
black	-.1391669	.0474855	-2.93	0.003	-.2322369	-.046097
hisp	.0218883	.0423899	0.52	0.606	-.0611944	.1049711
married	.0640884	.0169529	3.78	0.000	.0308613	.0973155
union	.1043425	.0178666	5.84	0.000	.0693245	.1393605
_cons	.0233262	.1499736	0.16	0.876	-.2706167	.3172691
rho_ar	.04499333	(estimated autocorrelation coefficient)				
sigma_u	.32222559					
sigma_e	.35241063					
rho_fov	.45534671	(fraction of variance due to u_i)				
theta	.62658942					

```
estimates store RE_NotRob_AR1
```

### 5.5.3. “Fixed effects” com erros idiossincráticos a seguir um processo AR(1)

```
xi: xtregar lwage i.year exper expersq educ black hisp married union, fe rhtype(regress)
```

```
i.year          _Iyear_1980-1987      (naturally coded; _Iyear_1980 omitted)
note: exper dropped because of collinearity
note: educ dropped because of collinearity
note: black dropped because of collinearity
note: hisp dropped because of collinearity
```

```
FE (within) regression with AR(1) disturbances  Number of obs    =    3,815
Group variable: nr                             Number of groups =    545
```

```
R-sq:                                           Obs per group:
  within = 0.1320                               min =           7
  between = 0.0371                              avg =          7.0
  overall = 0.0736                              max =           7
```

```
F(9,3261) = 55.12
corr(u_i, Xb) = -0.0843                         Prob > F = 0.0000
```

lwage	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_Iyear_1981	-.6646625	.070515	-9.43	0.000	-.8029207	-.5264044
_Iyear_1982	-.6070855	.0663866	-9.14	0.000	-.7372492	-.4769217
_Iyear_1983	-.5170418	.0575465	-8.98	0.000	-.6298727	-.404211
_Iyear_1984	-.3924154	.047332	-8.29	0.000	-.4852189	-.299612
_Iyear_1985	-.2779792	.0361975	-7.68	0.000	-.3489513	-.207007
_Iyear_1986	-.1443115	.0250877	-5.75	0.000	-.1935007	-.0951223
_Iyear_1987	0 (omitted)					
exper	0 (omitted)					
expersq	-.0043665	.0008372	-5.22	0.000	-.0060081	-.002725
educ	0 (omitted)					
black	0 (omitted)					
hisp	0 (omitted)					
married	.0535985	.019342	2.77	0.006	.0156748	.0915223
union	.0676536	.0203133	3.33	0.001	.0278255	.1074816
_cons	2.265653	.0853663	26.54	0.000	2.098276	2.433031
rho_ar	.04499333					
sigma_u	.39940229					
sigma_e	.32531058					
rho_fov	.60117842 (fraction of variance because of u_i)					

```
F test that all u_i=0: F(544,3261) = 9.15 Prob > F = 0.0000
```

```
estimates store FE_NotRob_AR1
```

5.5.4. “Pooled OLS” com desvios-padrão robustos à presença de heterocedasticidade e autocorrelação de primeira ordem

```
xi: xtscclwage i.year exper expersq educ black hisp married union, lag(1)
```

```
i.year          _Iyear_1980-1987    (naturally coded; _Iyear_1980 omitted)
```

```
Regression with Driscoll-Kraay standard errors    Number of obs    =    4360
Method: Pooled OLS                               Number of groups =    545
Group variable (i): nr                           F( 14,    7)    =  95799.91
maximum lag: 1                                   Prob > F        =    0.0000
                                                    R-squared       =    0.1893
                                                    Root MSE      =    0.4803
```

```
-----
```

	Drisc/Kraay					
lwage	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_Iyear_1981	.05832	.0153055	3.81	0.007	.0221283	.0945117
_Iyear_1982	.0627744	.0285012	2.20	0.063	-.0046202	.1301691
_Iyear_1983	.0620117	.0395559	1.57	0.161	-.0315231	.1555465
_Iyear_1984	.0904672	.0486179	1.86	0.105	-.024496	.2054304
_Iyear_1985	.1092463	.0553422	1.97	0.089	-.0216173	.2401099
_Iyear_1986	.1419596	.0602779	2.36	0.051	-.000575	.2844942
_Iyear_1987	.1738334	.0641219	2.71	0.030	.0222091	.3254577
exper	.0672345	.022417	3.00	0.020	.0142267	.1202423
expersq	-.0024117	.0010931	-2.21	0.063	-.0049965	.0001731
educ	.0913498	.0025271	36.15	0.000	.0853741	.0973254
black	-.1392342	.0166139	-8.38	0.000	-.1785198	-.0999486
hisp	.0160195	.007817	2.05	0.080	-.0024647	.0345037
married	.1082529	.0058966	18.36	0.000	.0943098	.1221961
union	.1824613	.0173384	10.52	0.000	.1414624	.2234601
_cons	.0920558	.0837923	1.10	0.308	-.1060815	.290193

```
-----
```

```
estimates store POLS_DKRob_AR1
```

5.5.5. “Fixed effects” com desvios-padrão robustos à presença de heterocedasticidade e autocorrelação de primeira ordem

```
xi: xtscclwage i.year exper expersq educ black hisp married union, fe lag(1)
```

```
i.year          _Iyear_1980-1987      (naturally coded; _Iyear_1980 omitted)
```

```
Regression with Driscoll-Kraay standard errors   Number of obs   =       4360
Method: Fixed-effects regression                 Number of groups =        545
Group variable (i): nr                          F( 14,         7) =       335.73
maximum lag: 1                                  Prob > F        =       0.0000
                                                within R-squared =       0.1806
```

```
-----
```

	Drisc/Kraay					
lwage	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
_Iyear_1981	.0190448	.0027545	6.91	0.000	.0125315	.0255581
_Iyear_1982	-.011322	.0047246	-2.40	0.048	-.0224939	-.0001501
_Iyear_1983	-.0419955	.0055085	-7.62	0.000	-.055021	-.0289701
_Iyear_1984	-.0384709	.0055679	-6.91	0.000	-.0516368	-.0253049
_Iyear_1985	-.0432498	.0045205	-9.57	0.000	-.0539391	-.0325606
_Iyear_1986	-.0273819	.0026252	-10.43	0.000	-.0335896	-.0211743
_Iyear_1987	0 (omitted)					
exper	.1321464	.0068163	19.39	0.000	.1160284	.1482645
expersq	-.0051855	.0004963	-10.45	0.000	-.0063591	-.0040119
educ	.0873325	.0012897	67.72	0.000	.0842829	.0903822
black	0 (omitted)					
hisp	0 (omitted)					
married	.0466804	.0103302	4.52	0.003	.0222534	.0711073
union	.0800019	.0118711	6.74	0.000	.0519311	.1080726
_cons	0 (omitted)					

```
-----
```

```
estimates store FE_DKRob_AR1
```