

Manejo de datos con R

Oscar Perpiñán Lamigueiro

<http://oscarperpinan.github.io>

Fuentes de datos

Lectura de datos

Datos agregados

Cambio de
formato

Fuentes de datos

Manejo de datos
con R

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Cambio de
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- ▶ The R Datasets Package
- ▶ Enlaces en Bibsonomy
- ▶ ...

setwd, getwd, dir

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```
getwd()  
old <- setwd("~/github/intro")  
dir()  
dir(pattern='.R')  
dir('data')
```

read.table

```
C02 <- read.table('data/C02_GNI_BM.csv', header=
  TRUE, sep=',')
head(C02)
```

	Country.Name	Country.Code	Indicator.Name
1	Finland	FIN	CO2 emissions (kg per PPP \$ of GDP)
2	Finland	FIN	CO2 emissions (metric tons per capita)
3	Finland	FIN	GNI, PPP (current international \$)
4	Finland	FIN	GNI per capita, PPP (current international \$)
5	France	FRA	CO2 emissions (kg per PPP \$ of GDP)
6	France	FRA	CO2 emissions (metric tons per capita)

	Indicator.Code	X2000	X2001	X2002	X2003
1	EN.ATM.CO2E.PP.GD	3.923481e-01	4.099378e-01	4.265803e-01	4.785172e-01
2	EN.ATM.CO2E.PC	1.007322e+01	1.087588e+01	1.174433e+01	1.321467e+01
3	NY.GNP.MKTP.PP.CD	1.318800e+11	1.374500e+11	1.434180e+11	1.428710e+11
4	NY.GNP.PCAP.PP.CD	2.548000e+04	2.649000e+04	2.758000e+04	2.741000e+04
5	EN.ATM.CO2E.PP.GD	2.384221e-01	2.370408e-01	2.231432e-01	2.287341e-01
6	EN.ATM.CO2E.PC	6.016236e+00	6.303892e+00	6.171683e+00	6.236447e+00

	X2004	X2005	X2006	X2007	X2008	X2009
1	4.289469e-01	3.389595e-01	3.786006e-01	3.341890e-01	2.792975e-01	NA
2	1.280953e+01	1.040875e+01	1.254696e+01	1.208669e+01	1.063578e+01	NA
3	1.573070e+11	1.618390e+11	1.761810e+11	1.913600e+11	2.033820e+11	1.93598e+11
4	3.009000e+04	3.085000e+04	3.345000e+04	3.618000e+04	3.828000e+04	3.62600e+04
5	2.212615e-01	2.105801e-01	1.918882e-01	1.770519e-01	1.720425e-01	NA
6	6.232062e+00	6.219341e+00	6.026120e+00	5.864109e+00	5.873142e+00	NA

	X2010	X2011
1	NA	NA
2	NA	NA
3	1.98866e+11	NA
4	3.70700e+04	NA
5	NA	NA
6	NA	NA

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read.csv, read.csv2

- read.csv y read.csv2 son como read.table con valores por defecto para encabezado y separadores

```
C02 <- read.csv('data/C02_GNI_BM.csv')
```

```
names(C02)
```

```
head(C02)
```

```
tail(C02)
```

```
summary(C02)
```

```
Country.Name Country.Code
Brazil : 4    BRA       : 4
China  : 4    CHN       : 4
Finland: 4    DEU       : 4
France : 4    ESP       : 4
Germany: 4    FIN       : 4
Greece : 4    FRA       : 4
(Other):16    (Other):16
```

	Indicator.Name	Indicator.Code
CO2 emissions (kg per PPP \$ of GDP)	:10	EN.ATM.CO2E.PC :10
CO2 emissions (metric tons per capita)	:10	EN.ATM.CO2E.PP.GD:10
GNI per capita, PPP (current international \$):10		NY.GNP.MKTP.PP.CD:10
GNI, PPP (current international \$)	:10	NY.GNP.PCAP.PP.CD:10

X2000		X2001		X2002	
Min.	:0.000e+00	Min.	:0.000e+00	Min.	:0.000e+00
1st Qu.	:1.000e+00	1st Qu.	:1.000e+00	1st Qu.	:1.000e+00

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table, data.frame de ejemplo

```
chromosome <- gl(3, 10, labels = c('A', 'B', 'C'))
probeset <- gl(3, 10, labels = c('X', 'Y', 'Z'))
ensg <- gl(3, 10, labels = c('E1', 'E2', 'E3'))
symbol <- gl(3, 10, labels = c('S1', 'S2', 'S3'))
XXA_00 <- rnorm(30)
XXA_36 <- rnorm(30)
XXB_00 <- rnorm(30)
```

```
chromo <- data.frame(chromosome, probeset, ensg,
                     symbol,
                     XXA_00, XXA_36, XXB_00)
head(chromo)
```

	chromosome	probeset	ensg	symbol	XXA_00	XXA_36	XXB_00
1	A	X	E1	S1	0.57811069	0.69023479	-0.912831441
2	A	X	E1	S1	2.62985388	-2.25858845	-0.075770956
3	A	X	E1	S1	-0.62543151	0.05400126	-0.026919292
4	A	X	E1	S1	0.48633691	0.54937528	0.007499449
5	A	X	E1	S1	-0.93266839	0.08601025	-1.849097295
6	A	X	E1	S1	0.06494275	0.61840691	-0.543166077

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```
table(chromo$chromosome, chromo$XXA_00 > 0)
```

	FALSE	TRUE
A	4	6
B	6	4
C	7	3

```
table(chromo$probeset,  
      chromo$XXA_00 > -1 & chromo$XXA_00 < 1)
```

	FALSE	TRUE
X	2	8
Y	3	7
Z	3	7

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```
xtables(XXA_00 > 1 ~ chromosome + probeset,  
data=chromo)
```

```
      probeset  
chromosome X Y Z  
A 1 0 0  
B 0 0 0  
C 0 0 1
```

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```
tapply(CO2$X2000, CO2$Indicator.Name,
       FUN=mean)
```

CO2 emissions (kg per PPP \$ of GDP)	4.777875e-01
CO2 emissions (metric tons per capita)	7.580861e+00
GNI per capita, PPP (current international \$)	1.981000e+04
GNI, PPP (current international \$)	2.078196e+12

```
tapply(CO2$X2000,
       CO2[,c("Indicator.Name", "Country.Name")],
       FUN=mean)
```

Indicator.Name	Country.Name	
	Brazil	China
CO2 emissions (kg per PPP \$ of GDP)	2.699746e-01	1.140619e+00
CO2 emissions (metric tons per capita)	1.892645e+00	2.696862e+00
GNI per capita, PPP (current international \$)	6.820000e+03	2.340000e+03
GNI, PPP (current international \$)	1.188790e+12	2.948850e+12

Indicator.Name	Country.Name	
	Finland	France
CO2 emissions (kg per PPP \$ of GDP)	3.923481e-01	2.384221e-01
CO2 emissions (metric tons per capita)	1.007322e+01	6.016236e+00
GNI per capita, PPP (current international \$)	2.548000e+04	2.566000e+04
GNI, PPP (current international \$)	1.318800e+11	1.558990e+12

Indicator.Name	Country.Name	
	Germany	Greece
CO2 emissions (kg per PPP \$ of GDP)	3.929031e-01	4.598579e-01
CO2 emissions (metric tons per capita)	1.012147e+01	8.391709e+00
GNI per capita, PPP (current international \$)	2.549000e+04	1.832000e+04
GNI, PPP (current international \$)	2.095450e+12	2.000130e+11

Indicator.Name	Country.Name	
	India	Norway
CO2 emissions (kg per PPP \$ of GDP)	7.448517e-01	2.391275e-01
CO2 emissions (metric tons per capita)	1.125975e+00	8.641315e+00
GNI per capita, PPP (current international \$)	1.500000e+03	3.565000e+04
GNI, PPP (current international \$)	1.575930e+12	1.601000e+11

Indicator.Name	Country.Name	
	Spain	United States
CO2 emissions (kg per PPP \$ of GDP)	3.428950e-01	5.568755e-01
CO2 emissions (metric tons per capita)	7.312922e+00	1.953626e+01
GNI per capita, PPP (current international \$)	2.115000e+04	3.569000e+04

aggregate

```
aggregate(X2000 ~ Indicator.Name,  
          data=C02, FUN=mean)
```

```
          Indicator.Name      X2000  
1      CO2 emissions (kg per PPP $ of GDP) 4.777875e-01  
2      CO2 emissions (metric tons per capita) 7.580861e+00  
3 GNI per capita, PPP (current international $) 1.981000e+04  
4      GNI, PPP (current international $) 2.078196e+12
```

```
aggregate(cbind(X2000, X2001) ~ Indicator.Name,  
          data=C02, FUN=mean)
```

```
          Indicator.Name      X2000      X2001  
1      CO2 emissions (kg per PPP $ of GDP) 4.777875e-01 4.591328e-01  
2      CO2 emissions (metric tons per capita) 7.580861e+00 7.725765e+00  
3 GNI per capita, PPP (current international $) 1.981000e+04 2.066300e+04  
4      GNI, PPP (current international $) 2.078196e+12 2.182390e+12
```

```
aggregate(X2000 ~ Indicator.Name + Country.Name,  
          data=C02, FUN=mean)
```

```
          Indicator.Name Country.Name      X2000  
1      CO2 emissions (kg per PPP $ of GDP)      Brazil 2.699746e-01  
2      CO2 emissions (metric tons per capita)      Brazil 1.892645e+00  
3 GNI per capita, PPP (current international $)      Brazil 6.820000e+03  
4      GNI, PPP (current international $)      Brazil 1.188790e+12  
5      CO2 emissions (kg per PPP $ of GDP)      China 1.140619e+00  
6      CO2 emissions (metric tons per capita)      China 2.696862e+00  
7 GNI per capita, PPP (current international $)      China 2.340000e+03  
8      GNI, PPP (current international $)      China 2.948850e+12  
9      CO2 emissions (kg per PPP $ of GDP)      Finland 3.923481e-01
```

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aggregate

```
aggregate(cbind(X2000, X2001) ~  
          Indicator.Name + Country.Name,  
          data=CO2, FUN=mean)
```

	Indicator.Name	Country.Name	X2000
1	CO2 emissions (kg per PPP \$ of GDP)	Brazil	2.699746e-01
2	CO2 emissions (metric tons per capita)	Brazil	1.892645e+00
3	GNI per capita, PPP (current international \$)	Brazil	6.820000e+03
4	GNI, PPP (current international \$)	Brazil	1.188790e+12
5	CO2 emissions (kg per PPP \$ of GDP)	China	1.140619e+00
6	CO2 emissions (metric tons per capita)	China	2.696862e+00
7	GNI per capita, PPP (current international \$)	China	2.340000e+03
8	GNI, PPP (current international \$)	China	2.948850e+12
9	CO2 emissions (kg per PPP \$ of GDP)	Finland	3.923481e-01
10	CO2 emissions (metric tons per capita)	Finland	1.007322e+01
11	GNI per capita, PPP (current international \$)	Finland	2.548000e+04
12	GNI, PPP (current international \$)	Finland	1.318800e+11
13	CO2 emissions (kg per PPP \$ of GDP)	France	2.384221e-01
14	CO2 emissions (metric tons per capita)	France	6.016236e+00
15	GNI per capita, PPP (current international \$)	France	2.566000e+04
16	GNI, PPP (current international \$)	France	1.558990e+12
17	CO2 emissions (kg per PPP \$ of GDP)	Germany	3.929031e-01
18	CO2 emissions (metric tons per capita)	Germany	1.012147e+01
19	GNI per capita, PPP (current international \$)	Germany	2.549000e+04
20	GNI, PPP (current international \$)	Germany	2.095450e+12
21	CO2 emissions (kg per PPP \$ of GDP)	Greece	4.598579e-01
22	CO2 emissions (metric tons per capita)	Greece	8.391709e+00
23	GNI per capita, PPP (current international \$)	Greece	1.832000e+04
24	GNI, PPP (current international \$)	Greece	2.000130e+11
25	CO2 emissions (kg per PPP \$ of GDP)	India	7.448517e-01
26	CO2 emissions (metric tons per capita)	India	1.125975e+00
27	GNI per capita, PPP (current international \$)	India	1.500000e+03
28	GNI, PPP (current international \$)	India	1.575930e+12

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```
aggregate(cbind(XXA_00, XXA_36, XXB_00) ~  
          ensg + chromosome + symbol,  
          data = chromo, FUN = mean)
```

	ensg	chromosome	symbol	XXA_00	XXA_36	XXB_00
1	E1	A	S1	0.1267151	-0.01306984	-0.60356658
2	E2	B	S2	-0.5128565	-0.49513675	0.40317719
3	E3	C	S3	-0.1186584	-0.15563442	0.03129759

```
aggregate(cbind(XXA_00, XXA_36, XXB_00) ~ ensg ,  
          data = chromo, FUN = mean)
```

	ensg	XXA_00	XXA_36	XXB_00
1	E1	0.1267151	-0.01306984	-0.60356658
2	E2	-0.5128565	-0.49513675	0.40317719
3	E3	-0.1186584	-0.15563442	0.03129759

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► Primero escogemos un subconjunto

```

C02China <- subset(C02,
                    subset=(Country.Name=='China' &
                             Indicator.Name=='C02_
                             emissions_(kg_per_PPP_$_of
                             _GDP)'),
                    select=-c(Country.Name, Country.Code
                              ,
                              Indicator.Name, Indicator.
                              Code))

head(C02China)

```

	X2000	X2001	X2002	X2003	X2004	X2005	X2006	X2007
29	1.140619	1.054772	1.007715	1.098485	1.133811	1.079371	1.027606	0.9255433
	X2008	X2009	X2010	X2011				
29	0.8556903	NA	NA	NA				

► Pasamos de formato wide a long

```
stack(CO2China)
```

```
      values  ind
1  1.1406188 X2000
2  1.0547715 X2001
3  1.0077152 X2002
4  1.0984850 X2003
5  1.1338112 X2004
6  1.0793710 X2005
7  1.0276060 X2006
8  0.9255433 X2007
9  0.8556903 X2008
10         NA X2009
11         NA X2010
12         NA X2011
```

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formato

- ▶ Primer intento

```
C02long <- reshape(C02,
                    varying=list(names(C02)[5:16]),
                    direction='long')
head(C02long)
```

	Country.Name	Country.Code	Indicator.Name	
1.1	Finland	FIN	CO2 emissions (kg per PPP \$ of GDP)	
2.1	Finland	FIN	CO2 emissions (metric tons per capita)	
3.1	Finland	FIN	GNI, PPP (current international \$)	
4.1	Finland	FIN	GNI per capita, PPP (current international \$)	
5.1	France	FRA	CO2 emissions (kg per PPP \$ of GDP)	
6.1	France	FRA	CO2 emissions (metric tons per capita)	
	Indicator.Code	time	X2000	id
1.1	EN.ATM.CO2E.PP.GD	1	3.923481e-01	1
2.1	EN.ATM.CO2E.PC	1	1.007322e+01	2
3.1	NY.GNP.MKTP.PP.CD	1	1.318800e+11	3
4.1	NY.GNP.PCAP.PP.CD	1	2.548000e+04	4
5.1	EN.ATM.CO2E.PP.GD	1	2.384221e-01	5
6.1	EN.ATM.CO2E.PC	1	6.016236e+00	6

Cambio de formato

- ▶ Añadimos argumentos

```
C02long <- reshape(C02,
                    varying=list(names(C02)[5:16]),
                    timevar='Year', v.names='Value',
                    times=2000:2011,
                    direction='long')
head(C02long)
```

	Country.Name	Country.Code		Indicator.Name
1.2000	Finland	FIN		CO2 emissions (kg per PPP \$ of GDP)
2.2000	Finland	FIN		CO2 emissions (metric tons per capita)
3.2000	Finland	FIN		GNI, PPP (current international \$)
4.2000	Finland	FIN		GNI per capita, PPP (current international \$)
5.2000	France	FRA		CO2 emissions (kg per PPP \$ of GDP)
6.2000	France	FRA		CO2 emissions (metric tons per capita)
	Indicator.Code	Year	Value id	
1.2000	EN.ATM.CO2E.PP.GD	2000	3.923481e-01	1
2.2000	EN.ATM.CO2E.PC	2000	1.007322e+01	2
3.2000	NY.GNP.MKTP.PP.CD	2000	1.318800e+11	3
4.2000	NY.GNP.PCAP.PP.CD	2000	2.548000e+04	4
5.2000	EN.ATM.CO2E.PP.GD	2000	2.384221e-01	5
6.2000	EN.ATM.CO2E.PC	2000	6.016236e+00	6

Cambio de formato

reshape: long a wide

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- Primero escogemos las columnas de interés

```
C02subset <- C02long[c("Country.Name",  
                        "Indicator.Name",  
                        "Year", "Value")]  
  
head(C02subset)
```

	Country.Name	Indicator.Name	Year
1.2000	Finland	CO2 emissions (kg per PPP \$ of GDP)	2000
2.2000	Finland	CO2 emissions (metric tons per capita)	2000
3.2000	Finland	GNI, PPP (current international \$)	2000
4.2000	Finland	GNI per capita, PPP (current international \$)	2000
5.2000	France	CO2 emissions (kg per PPP \$ of GDP)	2000
6.2000	France	CO2 emissions (metric tons per capita)	2000
	Value		
1.2000	3.923481e-01		
2.2000	1.007322e+01		
3.2000	1.318800e+11		
4.2000	2.548000e+04		
5.2000	2.384221e-01		
6.2000	6.016236e+00		

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reshape: long a wide

► Ahora cambiamos formato

```
CO2wide <- reshape(CO2subset,  
                    idvar=c('Country.Name','Year'),  
                    timevar='Indicator.Name',  
                    direction='wide')  
  
head(CO2wide)
```

	Country.Name	Year	Value.CO2 emissions (kg per PPP \$ of GDP)
1.2000	Finland	2000	0.3923481
5.2000	France	2000	0.2384221
9.2000	Germany	2000	0.3929031
13.2000	Greece	2000	0.4598579
17.2000	Norway	2000	0.2391275
21.2000	Spain	2000	0.3428950

	Value.CO2 emissions (metric tons per capita)
1.2000	10.073216
5.2000	6.016236
9.2000	10.121466
13.2000	8.391709
17.2000	8.641315
21.2000	7.312922

	Value.GNI, PPP (current international \$)
1.2000	1.31880e+11
5.2000	1.55899e+12
9.2000	2.09545e+12
13.2000	2.00013e+11
17.2000	1.60100e+11
21.2000	8.51462e+11

	Value.GNI per capita, PPP (current international \$)
1.2000	25480

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► Y ponemos nombres al gusto

```
names(CO2wide)[3:6] <- c('CO2.PPP', 'CO2.capita',  
                          'GNI.PPP', 'GNI.capita')
```

```
head(CO2wide)
```

	Country.Name	Year	CO2.PPP	CO2.capita	GNI.PPP	GNI.capita
1.2000	Finland	2000	0.3923481	10.073216	1.31880e+11	25480
5.2000	France	2000	0.2384221	6.016236	1.55899e+12	25660
9.2000	Germany	2000	0.3929031	10.121466	2.09545e+12	25490
13.2000	Greece	2000	0.4598579	8.391709	2.00013e+11	18320
17.2000	Norway	2000	0.2391275	8.641315	1.60100e+11	35650
21.2000	Spain	2000	0.3428950	7.312922	8.51462e+11	21150

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Alternativa: reshape2

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- ▶ reshape2 es un paquete que puede facilitar la transformación de `data.frame` y matrices.

```
library(reshape2)
```

Alternativa: reshape2

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con R

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- Para cambiar de *wide* a *long* usamos melt:

```
C02long2 <- melt(C02, id.vars = 1:4,  
                 variable.name = 'Year',  
                 value.name = 'Value')
```

```
head(C02long2)
```

	Country.Name	Country.Code		Indicator.Name
1	Finland	FIN		CO2 emissions (kg per PPP \$ of GDP)
2	Finland	FIN		CO2 emissions (metric tons per capita)
3	Finland	FIN		GNI, PPP (current international \$)
4	Finland	FIN		GNI per capita, PPP (current international \$)
5	France	FRA		CO2 emissions (kg per PPP \$ of GDP)
6	France	FRA		CO2 emissions (metric tons per capita)

	Indicator.Code	Year	Value
1	EN.ATM.CO2E.PP.GD	X2000	3.923481e-01
2	EN.ATM.CO2E.PC	X2000	1.007322e+01
3	NY.GNP.MKTP.PP.CD	X2000	1.318800e+11
4	NY.GNP.PCAP.PP.CD	X2000	2.548000e+04
5	EN.ATM.CO2E.PP.GD	X2000	2.384221e-01
6	EN.ATM.CO2E.PC	X2000	6.016236e+00

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Alternativa: reshape2

- Para cambiar de *long* a *wide* usamos dcast:

```
C02wide2 <- dcast(C02subset,  
                  Country.Name + Year ~ Indicator.Name)  
head(C02wide2)
```

Using Value as value column: use value.var to override.

	Country.Name	Year	CO2 emissions (kg per PPP \$ of GDP)
1	Brazil	2000	0.2699746
2	Brazil	2001	0.2682859
3	Brazil	2002	0.2535986
4	Brazil	2003	0.2377887
5	Brazil	2004	0.2297965
6	Brazil	2005	0.2211286

	CO2 emissions (metric tons per capita)
1	1.892645
2	1.921640
3	1.869526
4	1.787963
5	1.855444
6	1.881677

	GNI per capita, PPP (current international \$)
1	6820
2	6910
3	7110
4	7280
5	7830
6	8270

	GNI, PPP (current international \$)
1	1.18879e+12
2	1.22264e+12
3	1.27527e+12

Manejo de datos
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