

# Package ‘nowcasting’

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**Type** Package

**Title** Nowcast Analysis and Create Real-Time Data Basis

**Version** 0.1.3

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## Description

Methods and tools to estimate 'forecasts' of Brazilian macroeconomic variables in the near future or the recent past, i.e. 'nowcast'. It allows: extract information in real time, creating a real time data base; estimate relationship between macroeconomic variables via dynamic factors; forecast time series in previous periods of reference; forecast time series in the current period of reference (nowcasting); recreate a data base simulating the information available in the past for evaluating forecasting models accuracy (pseudo real-time data base); access information available in a specific date in the past (real-time data base), for some variables.

**License** GPL-3

**BugReports** <https://github.com/nmecsyst/nowcasting/issues>

**URL** <https://github.com/nmecsyst/nowcasting>

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 6.0.1

**NeedsCompilation** no

**Suggests** knitr, rmarkdown

**Imports** corpcor, httr, lubridate, matlab, RCurl, xts, zoo, DBI, magic, RMySQL, Matrix

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**Repository** CRAN

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## R topics documented:

base_extraction . . . . .	2
Bpanel . . . . .	3
BRGDP . . . . .	4
month2qtr . . . . .	5
nowcast . . . . .	5
nowcast.plot . . . . .	7
nowcasting . . . . .	8
PRTDB . . . . .	9
qtr2month . . . . .	10
RTDB . . . . .	10
USGDP . . . . .	11
USGDPshort . . . . .	12
<b>Index</b>	<b>13</b>

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base_extraction	<i>Create a real time data base</i>
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### Description

Create a time series matrix mts extracting information from Bacen (Banco Central do Brasil) API.

### Usage

```
base_extraction(series_code)
```

### Arguments

series\_code      Vector with the series encoding following the Bacen (Banco Central do Brasil) standards.

### References

Central Bank of Brazil

### Examples

```
# Extracting GDP serie at real-time from Central Bank of Brasil data base
## Not run:
gdp<-base_extraction(22099)
# Industrial production (21859) serie at real-time from Central Bank of Brasil data base
ind_prod<-base_extraction(21859)

# Creating real time data base with the series:
# Vehicles production (1373);
# Industrial production, general index (21859).
mybase<-base_extraction(c(1373,21859))
```

```

# Creating real time data base with the series:
# Exchange rate - Free - United States dollar (1);
# Interest rate - CDI (12).
mybase<-base_extraction(c(1,12))

# Creating real time data base with the series:
# Vehicles production (1373);
# Credit Sales Index (1453);
# Retail sales (1455);
# Industrial production, general index (21859).
mybase<-base_extraction(c(1373,1453,1455,21859))
## End(Not run)

```

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Bpanel	<i>Balanced panel</i>
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### Description

This function transforms the original monthly time series to its stationary representation following the user specification. The time series with more than 1/3 missing, i.e. NAs, are deleted and the remaining are modified such that the missings and outliers are replaced by an approximated value.

The missings and outliers are “corrected” following the same method available in the replication files of Giannone et al. 2008. Outliers are defined as observations that lie more than 4 IQR from the median. All missings and outliers are replaced by the median. A centered moving average of degree *k* is calculated, forming a new panel. Then the missings and outliers are replaced by their equivalent observations on this new panel. We’ve made an important modification on the outlier\_correction function found in the above mentioned files: Here the median of an even-sized sample is calculated by the mean of the two most central values, rather than using the largest of those numbers. Because of this modification the results obtained with the original replication files in (USGDP) are slightly different from those found here.

### Usage

```
Bpanel(base = NULL, trans = NULL, aggregate = F, k_ma = 3)
```

### Arguments

base	A mts with the series to be transformed.
trans	A vector where each coordinate is a code for the transformation of the correspondent coordinate in the base argument. The transformation is specified by codes, as follows: <ul style="list-style-type: none"> <li>• trans = 0: the original serie is preserved;</li> <li>• trans = 1: monthly rate of change</li> </ul>

$$\frac{x_{i,t} - x_{i,t-1}}{x_{i,t-1}}$$

- trans = 2: monthly difference

$$x_{i,t} - x_{i,t-1}$$

- trans = 3: monthly difference in year-over-year rate of change

$$\frac{x_{i,t} - x_{i,t-12}}{x_{i,t-12}} - \frac{x_{i,t-1} - x_{i,t-13}}{x_{i,t-13}}$$

- trans = 4: monthly difference in year difference

$$(x_{i,t} - x_{i,t-12}) - (x_{i,t-1} - x_{i,t-13})$$

aggregate	A boolean representing if you want aggregate the monthly variables to represent quarterly quantities. If TRUE the aggregation is made following the approximation of <i>Mariano and Murasawsa 2003</i> .
k_ma	A numeric representing the degree of the moving average correction.

## References

- Giannone, D., Reichlin, L., & Small, D. (2008). Nowcasting: The real-time informational content of macroeconomic data. *Journal of Monetary Economics*, 55(4), 665-676.<doi:10.1016/j.jmoneco.2008.05.010>
- Mariano, R. S., & Murasawa, Y. (2003). A new coincident index of business cycles based on monthly and quarterly series. *Journal of applied Econometrics*, 18(4), 427-443.<doi:10.1002/jae.695>

## Examples

```
# Example from database BRGDP:
Bpanel(BRGDP, rep(3, ncol(BRGDP)))
```

---

BRGDP

*Real Time Data Base Extracted in 03/10/2017*

---

## Description

This is a panel containing a piece of the information set of a specific date for Brazilian economic activity. The panel is formatted as a matrix time series `mts` containing: Exchange rate - Free - United States dollar (1); Interest rate - CDI (12); Vehicles production (1373); Credit Sales Index (1453); Retail sales (1455); Current economic conditions index (4394); Industrial production, general index (21859); Quarterly GDP - observed data - GDP at market prices (22099).

## Usage

```
BRGDP
```

## Format

The format is: Time-Series [1:278, 1:7] from 1994 to 2018: 0.933 0.899 0.865 0.846 0.842 ... -  
`attr(*, "dimnames")=List of 2 ..$ : NULL ..$ : chr [1:7] "serie1" "serie12" "serie1373" "serie1453"`  
 ...

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month2qtr	<i>Monthly to quarterly transformation</i>
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**Description**

It transforms a monthly time series in a quarterly one, selecting the last month of the quarter to represent the value of the quarter.

**Usage**

```
month2qtr(x)
```

**Arguments**

x                    a ts or mts in monthly frequency

**Value**

The correspondent quarterly transformation.

**Examples**

```
# Selecting only last month of matrix time series BRGDP:
month2qtr(BRGDP)

# Vehicle production in the quarter from vehicle production in the month
month2qtr(stats::filter(BRGDP[,3],c(1,1,1),sides=1))
```

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nowcast	<i>Nowcasting of a quarterly time series using a dynamic factor model.</i>
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---

**Description**

Estimate nowcasting and forecasting for a quarterly series. For more details read the Vignettes.

**Usage**

```
nowcast(y, x, q = NULL, r = NULL, p = NULL, method = "2sq",
        blocks = NULL)
```

**Arguments**

y	Stationary quarterly time series.
x	A monthly time series matrix (mts) representing regressors variables. The series must be stationary.
q	Dynamic rank. Number of error terms.
r	number of common factors.
p	AR order of factor model.
method	There are three options: "2sq": "Two stages: quarterly factors" as in Giannone et al. 2008; "2sm": "Two stages: monthly factors" as in Bańbura and Rünstler 2011; "EM": Expected Maximization as in Bańbura et al. 2011.
blocks	a binary matrix Nx3 that characterizes the regressors variables in global (1st column), nominal (2nd column) and real (3rd column). If NULL, the matrix assume 1 for all cells.

**Value**

A list containing two elements:

yfcst	the original y series and its in-sample and out-of-sample estimations.
reg	regression model between y and the estimated factors. Not available for EM method.
factors	the estimated factors and DFM model coefficients.
xfcst	the original regressors and their out-of-sample estimations.
month_y	the monthly measure for quarterly y variable. Only available for EM method.

**References**

- Giannone, D., Reichlin, L., & Small, D. (2008). Nowcasting: The real-time informational content of macroeconomic data. *Journal of Monetary Economics*, 55(4), 665-676.<doi:10.1016/j.jmoneco.2008.05.010>
- Bańbura, M., & Rünstler, G. (2011). A look into the factor model black box: publication lags and the role of hard and soft data in forecasting GDP. *International Journal of Forecasting*, 27(2), 333-346. <doi:10.1016/j.ijforecast.2010.01.011>
- Bańbura M., Giannone, D. & Reichlin, L. (2011). Nowcasting, in Michael P. Clements and David F. Hendry, editors, *Oxford Handbook on Economic Forecasting*, pages 193-224, January 2011. <doi:10.1093/oxfordhb/9780195398649.001.0001>

**See Also**

[base\\_extraction](#)

## Examples

```
## Not run:
### Method 2sq (two stages: quarterly factors)
gdp <- month2qtr(x = USGDP$base[,"RGDPGR"])
gdp_position <- which(colnames(USGDP$base) == "RGDPGR")
base <- Bpanel(base = USGDP$base[,-gdp_position],
              trans = USGDP$legend$Transformation[-gdp_position],
              aggregate = TRUE)
now2sq <- nowcast(y = gdp, x = base, r = 2, p = 2, q = 2, method = '2sq')

### Method 2sm (two stages: monthly factors)
base <- Bpanel(base = USGDP$base[,-gdp_position],
              trans = USGDP$legend$Transformation[-gdp_position],
              aggregate = F)
now2sm <- nowcast(y = gdp, x = base, r = 2, p = 2, q = 2, method = '2sm')

### Method EM
# selecting and transforming y
gdp <- month2qtr(x = USGDPshort$base[,"GDPUS"])
gdp <- ts(c(gdp,NA,NA,NA,NA), start = start(gdp), frequency = 4)
gdp_stationary <- gdp/lag(gdp, k = -1) -1
gdp_position <- which(colnames(USGDPshort$base) == "GDPUS")

# selecting and transforming x
base <- USGDPshort$base[,-gdp_position]
trans <- USGDPshort$legend[-gdp_position,"transformation"]
stationaryBase <- cbind(base[,trans == 1]/lag(base[,trans == 1], k = -1) - 1,
                      diff(base[,trans == 2]))
colnames(stationaryBase) <- colnames(base)[c(which(trans == 1),which(trans == 2)) ]
stationaryBase <- stationaryBase[,colnames(base)]

# DFM estimation via EM
blocks <- matrix(c(1,0,1,1,0,1,1,1,0,1,1,0,1,1,0,1,1,0,1,1,0,1,1,0,1,1,
                  0,1,1,0,1,1,0,1,0,1,1,1,0,1,1,0,1,0,1,1,1,0,1,1,0,1,
                  1,0,1,0,1,1,0,1,1,0,1,1,0,1,1,1,0,1,1,0,1,1,0,1,1,0), byrow = T, ncol = 3)
nowEM <- nowcast(y = gdp_stationary, x = stationaryBase, r = 1, p = 1, q = 1,
                method = 'EM', blocks = blocks)

## End(Not run)
```

---

nowcast.plot

*Plot for nowcast output function*

---

## Description

Make plots to visualize the output of nowcast function

## Usage

```
nowcast.plot(out, type = "fcst")
```

## Arguments

`out` output of nowcast function.

`type` 'fcst', 'factors', 'eigenvalues', 'eigenvectors' or 'month\_y'. This last one is only available for EM method. 'eigenvalues' and 'eigenvectors' only available to two stages methods.

## Examples

```
## Not run:
gdp <- month2qtr(x = USGDP$base[, "RGDPGR"])
gdp_position <- which(colnames(USGDP$base) == "RGDPGR")
base <- Bpanel(base = USGDP$base[, -gdp_position],
              trans = USGDP$legend$Transformation[-gdp_position],
              aggregate = TRUE)
now2sq <- nowcast(y = gdp, x = base, r = 2, p = 2, q = 2, method = '2sq')

nowcast.plot(now2sq, type = "fcst")
nowcast.plot(now2sq, type = "factors")
nowcast.plot(now2sq, type = "eigenvalues")
nowcast.plot(now2sq, type = "eigenvectors")

base <- Bpanel(base = USGDP$base[, -gdp_position],
              trans = USGDP$legend$Transformation[-gdp_position],
              aggregate = FALSE)
now2sm <- nowcast(y = gdp, x = base, r = 2, p = 2, q = 2, method = '2sm')

nowcast.plot(now2sm, type = "fcst")
nowcast.plot(now2sm, type = "factors")
nowcast.plot(now2sm, type = "eigenvalues")
nowcast.plot(now2sm, type = "eigenvectors")

## End(Not run)
```

---

nowcasting

*Nowcast Analysis and Create Real-Time Data Basis*

---

## Description

This package is an initiative of the Center for Statistical and Computational Methods (NMEC) belonging to the Brazilian Institute of Economics (IBRE) of the Getulio Vargas Foundation (FGV). Our goal is to develop a real-time predictive measure of Brazilian GDP that helps IBRE researchers in their analysis about the Brazilian economy.

The purpose of this package is to disseminate to the community of R users the statistical tools and techniques of 'nowcast' already known in the academic literature. One can find in this package a simple and practical way to reproduce several of these techniques for their studies.

In this version of the package we present three methods, based on seminal articles in this literature: *Giannone et al. 2008*, *Bañbura et al. 2011* and *Bañbura and Rünstler 2011*. Some backend functions are adaptations and translations of these paper's *replication files* available in MATLAB. One



can find these *replication files* in the following url: <https://www.newyorkfed.org/research/economists/giannone/pub>

### Note

The authors would like to thank the support by the Getulio Vargas Foundation (FGV).

### Author(s)

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### References

- Giannone, D., Reichlin, L., & Small, D. (2008). Nowcasting: The real-time informational content of macroeconomic data. *Journal of Monetary Economics*, 55(4), 665-676.<doi:10.1016/j.jmoneco.2008.05.010>
- Bańbura, M., & Rünstler, G. (2011). A look into the factor model black box: publication lags and the role of hard and soft data in forecasting GDP. *International Journal of Forecasting*, 27(2), 333-346. <doi:10.1016/j.ijforecast.2010.01.011>
- Bańbura M., Giannone, D. & Reichlin, L. (2011). Nowcasting, in Michael P. Clements and David F. Hendry, editors, *Oxford Handbook on Economic Forecasting*, pages 193-224, January 2011. <doi:10.1093/oxfordhb/9780195398649.001.0001>

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PRTDB

*Pseudo Real Time Data Base*

---

### Description

Create a pseudo real time data base based on data and delays of disclosure stipulated by the user.

### Usage

```
PRTDB(mts, delay, vintage = Sys.Date())
```

### Arguments

mts	A mts with the series data.
delay	A numeric vector with the delay in days the information is available after the reference month. Each element corresponds to the series in the respective column in mts.
vintage	The day when the data is supposed to be collected.

### Value

A mts with the series transformed.

**Examples**

```
# Pseudo Real Time Data Base from data base BRGDP
PRTDB(mts = BRGDP, delay = c(1,30,60,90,20,10,30,60), vintage = "2017-10-01")
```

---

qtr2month

*Quarterly to monthly transformation*


---

**Description**

It transforms a quarterly time series in a monthly one. The values of the quarterly ts are set to the last month of the quarter.

**Usage**

```
qtr2month(x)
```

**Arguments**

x                    a ts or mts in quarterly frequency

**Value**

The correspondent monthly transformation.

**Examples**

```
# Selecting the quarterly GDP variable in BRGDP
brgdp <- month2qtr(BRGDP[,ncol(BRGDP)])

qtr2month(brgdp)
```

---

RTDB

*Create Real Time Data Base*


---

**Description**

Create a time series matrix mts replicating the information available in a given date.

**Usage**

```
RTDB(series_code = NULL, vintage = NULL)
```

**Arguments**

`series_code` vector with the series encoding following the Bacen (Banco Central do Brasil) standards.

`vintage` the vintage encoded by the day of the extraction

**References**

Central Bank of Brazil

**Examples**

```
## Not run:
# Show series available:
RTDB()

# Show vintages available for the series 1:
RTDB(series_code = 1)

# Show series 1 data at vintage 2017-04-04:
RTDB(series_code = 1, vintage = "2017-04-04")

## End(Not run)
```

---

USGDP

*Example of replication files in Giannone et al. 2008*


---

**Description**

Dataset available to replicate the results in *Giannone et al. 2008*.

**Usage**

USGDP

**Format**

A list with 2 elements:

- `base` is a `mts` with 193 series and 312 observations. There are missing values;
- `legend` is a `data.frame` with specifications of the series in `USGDP$base`.

**Source**

This dataset is available as *replication files* of the seminal work *Giannone 2008*. One can find these *replication files* in the following url: <https://www.newyorkfed.org/research/economists/giannone/pub>

**References**

Giannone, D., Reichlin, L., & Small, D. (2008). Nowcasting: The real-time informational content of macroeconomic data. *Journal of Monetary Economics*, 55(4), 665-676.<doi:10.1016/j.jmoneco.2008.05.010>

---

USGDPshort

*Example of replication files in Banbura et al. 2011*

---

**Description**

Dataset available to replicate the results in *Banbura et al. 2011*.

**Usage**

USGDPshort

**Format**

A list with 2 elements:

- base is a mts with 26 series and 358 observations. There are missing values;
- legend is a data.frame with specifications of the series in USGDPshort\$base.

**Source**

This dataset is available as *replication files* of the seminal work *Banbura et al 2011*. One can find these *replication files* in the following url: <https://www.newyorkfed.org/research/economists/giannone/pub>

**References**

Banbura, M., Giannone, D. & Reichlin, L. (2011). Nowcasting. *Oxford Handbook on Economic Forecasting*, ed. by M. P. Clements, and D. F. Hendry, pp. 63-90. Oxford University Press.

# Index

## \*Topic **datasets**

BRGDP, [4](#)

base\_extraction, [2](#), [6](#)

Bpanel, [3](#)

BRGDP, [4](#)

month2qtr, [5](#)

nowcast, [5](#)

nowcast.plot, [7](#)

nowcasting, [8](#)

nowcasting-package (nowcasting), [8](#)

PRTDB, [9](#)

qtr2month, [10](#)

RTDB, [10](#)

USGDP, [11](#)

USGDPshort, [12](#)