# Package: hpfilter (via r-universe)

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**Type** Package

**Title** The One- And Two-Sided Hodrick-Prescott Filter

**Version** 1.0.2

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**Description** Provides two functions that implement the one-sided and
two-sided versions of the Hodrick-Prescott filter. The
one-sided version is a Kalman filter-based implementation,
whereas the two- sided version uses sparse matrices for
improved efficiency. References: Hodrick, R. J., and Prescott,
E. C. (1997) <doi:10.2307/2953682> Mcelroy, T. (2008)
<doi:10.1111/j.1368-423X.2008.00230.x> Meyer-Gohde, A. (2010)
<https://ideas.repec.org/c/dge/qmrbcd/181.html> For more
references, see the vignette.

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**Imports** Matrix

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 7.2.3

**Suggests** knitr, rmarkdown

**VignetteBuilder** knitr

**NeedsCompilation** no

**Depends** R (>= 3.5.0)

**Repository** CRAN

**Date/Publication** 2023-05-28 16:40:02 UTC

# Contents

| GDPEU | *Real Gross Domestic Product for European Union (28 countries)* |
|---|---|

#### Description

Units: Millions of Chained 2010 Euros, Seasonally Adjusted

#### Usage

    data(GDPEU)

#### Format

A dataframe containing: \*\*gdp\*\* the seasonally-adjusted real Gross Domestic Product for 28 European Union countries \*\*date\*\* the date of each observation

#### Details

Frequency: Quarterly

Eurostat unit ID: CLV10_MNAC Eurostat item ID = B1GQ Eurostat country ID: EU28

Seasonally and calendar adjusted data.

For euro area member states, the national currency series are converted into euros using the irrevocably fixed exchange rate. This preserves the same growth rates than for the previous national currency series. Both series coincide for years after accession to the euro area but differ for earlier years due to market exchange rate movements.

European Union (28 countries): Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, the Netherlands, Portugal, the United Kingdom, Austria, Finland, Sweden, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia, Slovakia, Bulgaria, Romania, and Croatia.

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#### Source

Data retrieved from FRED, Federal Reserve Bank of St. Louis.

#### References

Eurostat, Real Gross Domestic Product for European Union (28 countries) [CLVMNACSCAB1GQEU28] (Eurostat)

## Examples

```
# Load the dataset
data(GDPEU)

# Plot the y series
plot(GDPEU$date, GDPEU$y, type="l")

# Remove the date column if not needed and store in a df object
df <- GDPEU[,-1]
```

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hp1                              *One-Sided HP Filter*

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## Description

hp1 applies a one-sided Hodrick-Prescott filter derived using the Kalman filter to separate a time series into trend and cyclical components. The smoothing parameter should reflect the cyclical duration or frequency of the data.

## Usage

```
hp1(y, lambda = 1600, x_user = NA, P_user = NA, discard = 0)
```

## Arguments

| | |
|---|---|
| y | a dataframe of size Txn, where "T" is the number of observations for each variable (number of rows) and "n" - the number of variables in the dataframe (number of columns). |
| lambda | the smoothing parameter; a numeric scalar which takes the default value of 1600, if unspecified by the user. |
| x_user | user defined initial values of the state estimate for each variable in y. Takes the form of a 2xn matrix. Since the underlying state vector is 2x1, two values are needed for each variable in y. By default: if no values are provided, backwards extrapolations based on the first two observations are used. |
| P_user | a structural array with n elements, each of which being a 2x2 matrix of initial MSE estimates for each variable in y. By default: if no values are provided, a matrix with relatively large variances is used. |
| discard | the number of discard periods, expressed as a numeric scalar. The user specified amount of values will be discarded from the start of the sample, resulting in output matrices of size (T-discard)xn. By default: if no values are provided, is set to 0. |

## Details

The length of the time series should be greater than four and the value of the smoothing parameter greater than zero for the code to function. Of course, having a sufficiently long time series is paramount to achieving meaningful results.

**Value**

a (T-discard)xn dataframe, containing the trend data

**Author(s)**

Alexandru Monahov, <https://www.alexandrumonahov.eu.org/>

**References**

Balcilar, M. (2019). Miscellaneous Time Series Filters 'mFilter'. CRAN R Package Library.

Drehmann, M., and Yetman, J. (2018). Why You Should Use the Hodrick-Prescott Filter - at Least to Generate Credit Gaps. BIS Working Paper No. 744.

Eurostat (2023), Real Gross Domestic Product for European Union (28 countries) [CLVMNAC-SCAB1GQEU28], National Accounts - GDP.

Hamilton, J. D. (2017). Why You Should Never Use the Hodrick-Prescott Filter. Working Paper Series. National Bureau of Economic Research, May 2017.

Hodrick, R. J., and Prescott, E. C. (1997). Postwar U.S. Business Cycles: An Empirical Investigation. Journal of Money, Credit, and Banking 29: 1-16.

Hyeongwoo, K. (2004). "Hodrick-Prescott Filter". Notes, Auburn University.

Mcelroy, T. (2008). Exact formulas for the Hodrick-Prescott Filter. Econometrics Journal. 11. 209-217.

Meyer-Gohde, A. (2010). Matlab code for one-sided HP-filters. QM&RBC Codes 181, Quantitative Macroeconomics & Real Business Cycles.

Ravn, M., and Uhlig, H. (2002). On adjusting the Hodrick-Prescott filter for the frequency of observations, The Review of Economics and Statistics 2002; 84 (2): 371-376.

Shea, J. (2021). neverhpfilter: An Alternative to the Hodrick-Prescott Filter. CRAN R Package Library.

**See Also**

[hp2()]

**Examples**

```
# Generate the data and plot it
set.seed(10)
y <- as.data.frame(rev(diffinv(rnorm(100)))[1:100])+30
colnames(y) <- "gdp"
plot(y$gdp, type="l")

# Apply the HP filter to the data
ytrend = hp1(y)
ycycle = y - ytrend

# Plot the three resulting series
plot(y$gdp, type="l", col="black", lty=1, ylim=c(-10,30))
lines(ytrend$gdp, col="#066462")
```

```
polygon(c(1, seq(ycycle$gdp), length(ycycle$gdp)), c(0, ycycle$gdp, 0), col = "#E0F2F1")
legend("bottom", horiz=TRUE, cex=0.75, c("y", "ytrend", "ycycle"), lty = 1,
        col = c("black", "#066462", "#75bfbd"))
```

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hp2                          *Two-Sided HP Filter*

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### Description

hp2 applies a standard two-sided Hodrick-Prescott filter using sparse matrices to help reduce the compute time for large datasets. The smoothing parameter should reflect the cyclical duration or frequency of the data.

### Usage

```
hp2(y, lambda = 1600)
```

### Arguments

| | |
|---|---|
| y | a dataframe of size Txn, where "T" is the number of observations for each variable (number of rows) and "n" - the number of variables in the dataframe (number of columns). |
| lambda | the smoothing parameter; a numeric scalar which takes the default value of 1600, if unspecified by the user. |

### Details

The length of the time series should be greater than four and the value of the smoothing parameter greater than zero for the code to function. Of course, having a sufficiently long time series is paramount to achieving meaningful results.

### Value

a Txn dataframe, containing the trend data

### Author(s)

Alexandru Monahov, <https://www.alexandrumonahov.eu.org/>

### References

Balcilar, M. (2019). Miscellaneous Time Series Filters 'mFilter'. CRAN R Package Library.

Drehmann, M., and Yetman, J. (2018). Why You Should Use the Hodrick-Prescott Filter - at Least to Generate Credit Gaps. BIS Working Paper No. 744.

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Hamilton, J. D. (2017). Why You Should Never Use the Hodrick-Prescott Filter. Working Paper Series. National Bureau of Economic Research, May 2017.

Hodrick, R. J., and Prescott, E. C. (1997). Postwar U.S. Business Cycles: An Empirical Investigation. Journal of Money, Credit, and Banking 29: 1-16.

Hyeongwoo, K. (2004). "Hodrick-Prescott Filter". Notes, Auburn University.

Mcelroy, T. (2008). Exact formulas for the Hodrick-Prescott Filter. Econometrics Journal. 11. 209-217.

Meyer-Gohde, A. (2010). Matlab code for one-sided HP-filters. QM&RBC Codes 181, Quantitative Macroeconomics & Real Business Cycles.

Ravn, M., and Uhlig, H. (2002). On adjusting the Hodrick-Prescott filter for the frequency of observations, The Review of Economics and Statistics 2002; 84 (2): 371-376.

Shea, J. (2021). neverhpfilter: An Alternative to the Hodrick-Prescott Filter. CRAN R Package Library.

## See Also

[hp1()]

## Examples

```
# Generate the data and plot it
set.seed(10)
y <- as.data.frame(rev(diffinv(rnorm(100)))[1:100])+30
colnames(y) <- "gdp"
plot(y$gdp, type="l")

# Apply the HP filter to the data
ytrend = hp2(y)
ycycle = y - ytrend

# Plot the three resulting series
plot(y$gdp, type="l", col="black", lty=1, ylim=c(-10,30))
lines(ytrend$gdp, col="#066462")
polygon(c(1, seq(ycycle$gdp), length(ycycle$gdp)), c(0, ycycle$gdp, 0), col = "#E0F2F1")
legend("bottom", horiz=TRUE, cex=0.75, c("y", "ytrend", "ycycle"), lty = 1,
       col = c("black", "#066462", "#75bfbd"))
```

# Index