

# Package ‘neverhpfiler’

June 18, 2021

**Type** Package

**Title** An Alternative to the Hodrick-Prescott Filter

**Version** 0.4-0

**Description** In the working paper titled “Why You Should Never Use the Hodrick-Prescott Filter”, James D. Hamilton proposes a new alternative to economic time series filtering. The neverhpfiler package provides functions and data for reproducing his work. Hamilton (2017) <[doi:10.3386/w23429](https://doi.org/10.3386/w23429)>.

**Depends** R (>= 3.5.0), xts (>= 0.11-0), zoo (>= 1.8-0)

**License** GPL-3

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 7.1.1

**Suggests** knitr, rmarkdown, tinytest

**VignetteBuilder** knitr

**URL** <https://justinmshea.github.io/neverhpfiler/>

**BugReports** <https://github.com/JustinMShea/neverhpfiler/issues>

**NeedsCompilation** no

**Author** Justin M. Shea [aut, cre]

**Maintainer** Justin M. Shea <[jshea@roosevelt.edu](mailto:jshea@roosevelt.edu)>

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EXPGSC1	<i>Real Exports of Goods and Services</i>
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### Description

EXPGSC1 Real Exports of Goods and Services

### Usage

`data(EXPGSC1)`

### Format

An `xts` object of Real Exports of Goods and Services.

- **Release:** Gross Domestic Product
- **Seasonal Adjustment:** Seasonally Adjusted Annual Rate
- **Frequency:** Quarterly
- **Units:** Billions of Chained 2012 Dollars
- **Date Range:** 1947-01-01 to 2021-01-01
- **Last Updated** 2021-04-29 7:53 AM CDT

### Notes

BEA Account Code: A020RX

A Guide to the National Income and Product Accounts of the United States (NIPA) - (<http://www.bea.gov/national/pdf/nipagu>)

### Source

U.S. Bureau of Economic Analysis <https://fred.stlouisfed.org/data/EXPGSC1.txt>

### Examples

```
data(EXPGSC1)
tail(EXPGSC1)
plot(EXPGSC1,grid.col = "white", col="blue")
```

---

FEDFUNDS

*Effective Federal Funds Rate*

---

### Description

FEDFUNDS All Employees: Total Nonfarm

### Usage

```
data(FEDFUNDS)
```

### Format

An `xts` object of the Fed Funds figures.

- **Release:** H.15 Selected Interest Rates
- **Seasonal Adjustment:** Not Seasonally Adjusted
- **Frequency:** Monthly
- **Units:** Percent
- **Date Range:** 1954-07-01 to 2021-04-01
- **Last Updated** 2021-05-03 3:23 PM CDT

### Notes

Averages of daily figures.

The federal funds rate is the interest rate at which depository institutions trade federal funds (balances held at Federal Reserve Banks) with each other overnight. When a depository institution has surplus balances in its reserve account, it lends to other banks in need of larger balances. In simpler terms, a bank with excess cash, which is often referred to as liquidity, will lend to another bank that needs to quickly raise liquidity. (1) The rate that the borrowing institution pays to the lending institution is determined between the two banks; the weighted average rate for all of these types of negotiations is called the effective federal funds rate.(2) The effective federal funds rate is essentially determined by the market but is influenced by the Federal Reserve through open market operations to reach the federal funds rate target.(2) The Federal Open Market Committee (FOMC) meets eight times a year to determine the federal funds target rate. As previously stated, this rate influences the effective federal funds rate through open market operations or by buying and selling of government bonds (government debt). (2) More specifically, the Federal Reserve decreases liquidity by selling government bonds, thereby raising the federal funds rate because banks have less liquidity to trade with other banks. Similarly, the Federal Reserve can increase liquidity by buying government bonds, decreasing the federal funds rate because banks have excess liquidity for trade. Whether the Federal Reserve wants to buy or sell bonds depends on the state of the economy. If

the FOMC believes the economy is growing too fast and inflation pressures are inconsistent with the dual mandate of the Federal Reserve, the Committee may set a higher federal funds rate target to temper economic activity. In the opposing scenario, the FOMC may set a lower federal funds rate target to spur greater economic activity. Therefore, the FOMC must observe the current state of the economy to determine the best course of monetary policy that will maximize economic growth while adhering to the dual mandate set forth by Congress. In making its monetary policy decisions, the FOMC considers a wealth of economic data, such as: trends in prices and wages, employment, consumer spending and income, business investments, and foreign exchange markets.

The federal funds rate is the central interest rate in the U.S. financial market. It influences other interest rates such as the prime rate, which is the rate banks charge their customers with higher credit ratings. Additionally, the federal funds rate indirectly influences longer- term interest rates such as mortgages, loans, and savings, all of which are very important to consumer wealth and confidence.(2)

References (1) Federal Reserve Bank of New York. "Federal funds." Fedpoints, August 2007. (2) Board of Governors of the Federal Reserve System. "Monetary Policy". <http://www.federalreserve.gov/monetarypolicy/default.htm>

### Source

Board of Governors of the Federal Reserve System (US) <https://fred.stlouisfed.org/data/FEDFUNDS.txt>

### Examples

```
data(FEDFUNDS)
tail(FEDFUNDS)
plot(FEDFUNDS, grid.col = "white", col="green")
```

---

GCEC1

*Real Government Consumption Expenditures and Gross Investment*

---

### Description

GCEC1 Real Government Consumption Expenditures and Gross Investment

### Usage

```
data(GCEC1)
```

### Format

An `xts` object containing observations of Real Exports of Goods and Services.

- **Release:** Gross Domestic Product
- **Seasonal Adjustment:** Seasonally Adjusted Annual Rate
- **Frequency:** Quarterly
- **Units:** Billions of Chained 2012 Dollars
- **Date Range:** 1947-01-01 to 2021-01-01
- **Last Updated** 2021-04-29 7:52 AM CDT

**Notes**

BEA Account Code: A822RX

A Guide to the National Income and Product Accounts of the United States (NIPA) - (<http://www.bea.gov/national/pdf/nipagu>)

**Source**

U.S. Bureau of Economic Analysis <https://fred.stlouisfed.org/data/GCEC1.txt>

**Examples**

```
data(GCEC1)
tail(GCEC1)
plot(GCEC1, grid.col = "white", col="blue")
```

---

GDPC1

*Gross Domestic Product*

---

**Description**

GDPC1 Real Gross Domestic Product

**Usage**

```
data(GDPC1)
```

**Format**

An `xts` object of Real Gross Domestic Product.

- **Release:** Gross Domestic Product
- **Seasonal Adjustment:** Seasonally Adjusted Annual Rate
- **Frequency:** Quarterly
- **Units:** Billions of Chained 2012 Dollars
- **Date Range:** 1947-01-01 to 2021-01-01
- **Last Updated** 2021-04-29 7:52 AM CDT

**Notes**

Real gross domestic product is the inflation adjusted value of the goods and services produced by labor and property located in the United States.

For more information see the Guide to the National Income and Product Accounts of the United States (NIPA) - <https://www.bea.gov/resources/methodologies/nipa-handbook>.

BEA Account Code: A191RX

**Source**

U.S. Bureau of Economic Analysis <https://fred.stlouisfed.org/data/GDPC1.txt>

**Examples**

```
data(GDPC1)
log_RGDP <- 100*log(GDPC1)

gdp_cycle <- yth_filter(log_RGDP, h = 8, p = 4, output = c("cycle", "random"), family = gaussian)

main <- "Log of Real GDP cycle and random walk"
plot(gdp_cycle, grid.col = "white", legend.loc = "topright", main = main)
```

---

GDPDEF

*Gross Domestic Product: Implicit Price Deflator*

---

**Description**

GDPDEF Gross Domestic Product: Implicit Price Deflator

**Usage**

```
data(GDPDEF)
```

**Format**

An `xts` object containing observations of Real Exports of Goods and Services.

- **Release:** Gross Domestic Product
- **Seasonal Adjustment:** Seasonally Adjusted Annual Rate
- **Frequency:** Quarterly
- **Units:** Index 2012 = 100
- **Date Range:** 1947-01-01 to 2021-01-01
- **Last Updated** 2021-04-29 7:52 AM CDT

**Notes**

BEA Account Code: A191RD

The number of decimal places reported varies over time. A Guide to the National Income and Product Accounts of the United States (NIPA) - (<http://www.bea.gov/national/pdf/nipaguid.pdf>)

**Source**

U.S. Bureau of Economic Analysis <https://fred.stlouisfed.org/data/GDPDEF.txt>

**Examples**

```
data(GDPDEF)
tail(GDPDEF)
plot(GDPDEF, grid.col = "white", col="blue")
```

---

GPDIC1

*Real Gross Private Domestic Investment*

---

**Description**

GPDIC1 Real Gross Private Domestic Investment

**Usage**

```
data(GPDIC1)
```

**Format**

An `xts` object of Real Exports of Goods and Services.

- **Release:** Gross Domestic Product
- **Seasonal Adjustment:** Seasonally Adjusted Annual Rate
- **Frequency:** Quarterly
- **Units:** Billions of Chained 2012 Dollars
- **Date Range:** 1947-01-01 to 2021-01-01
- **Last Updated** 2021-04-29 7:52 AM CDT

**Notes**

BEA Account Code: A006RX

A Guide to the National Income and Product Accounts of the United States (NIPA) - (<http://www.bea.gov/national/pdf/nipagu>)

**Source**

U.S. Bureau of Economic Analysis <https://fred.stlouisfed.org/data/GPDIC1.txt>

**Examples**

```
data(GPDIC1)
tail(GPDIC1)
plot(GPDIC1, grid.col = "white", col="blue")
```

---

GS10

*10-Year Treasury Constant Maturity Rate*

---

### Description

GS10 10-Year Treasury Constant Maturity Rate

### Usage

```
data(GS10)
```

### Format

An `xts` object containing observations of the 10-Year Treasury Constant Maturity Rate.

- **Release:** H.15 Selected Interest Rates
- **Seasonal Adjustment:** Not Seasonally Adjusted
- **Frequency:** Monthly
- **Units:** Percent
- **Date Range:** 1953-04-01 to 2021-04-01
- **Last Updated** 2021-05-03 3:23 PM CDT

### Notes

Averages of business days.

For further information regarding treasury constant maturity data, please refer to <http://www.federalreserve.gov/releases/h15/> and <http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/yieldmethod.aspx>.

### Source

Board of Governors of the Federal Reserve System (US) <https://fred.stlouisfed.org/data/GS10.txt>

### Examples

```
data(GS10)
tail(GS10)
plot(GS10, grid.col = "white", col="green")
```



---

Hamilton\_table\_2      *Hamilton\_table\_2*

---

### Description

Standard deviation of cyclical component and correlation with cyclical component of GDP for as-sorted macroeconomic series.

### Usage

```
data("Hamilton_table_2")
```

### Format

A data.frame containing 13 economic time series observations of 5 variables.

- **cycle.sd** Standard deviation of the cycle component, computed with function `'yth_filter(x, output = "cycle")'`
- **gdp.cor** Correlation of `'cycle.sd'` with the cycle.sd of  $100 * \log(\text{RealGDP})$
- **random.sd** Standard deviation of a Random-walk, computed by a rolling differencing the series by period `'h'`, the same passed to `'yth_filter(x, output = "cycle")'` to compute `'cycle.sd'`.
- **gdp.rand.cor** Correlation of `'random.sd'` with the random.sd of  $100 * \log(\text{RealGDP})$ .

### Notes

Filtered series were based on the full sample available for that variable, while correlations were calculated using the subsample of overlapping values for the two indicators. Note that the regression residuals lose the first 11 observations and the random-walk calculations lose the first 8 observations.

### Source

"Why You Should Never Use the Hodrick-Prescott Filter", pg. 40 <http://econweb.ucsd.edu/~jhamilto/hp.pdf>

### Examples

```
print(Hamilton_table_2)
```

---

IMPGSC1

*Real imports of goods and services*

---

### Description

IMPGSC1 Real imports of goods and services

### Usage

```
data(IMPGSC1)
```

### Format

An `xts` object of Real imports of goods and services.

- **Release:** Gross Domestic Product
- **Seasonal Adjustment:** Seasonally Adjusted Annual Rate
- **Frequency:** Quarterly
- **Units:** Billions of Chained 2012 Dollars
- **Date Range:** 1947-01-01 to 2021-01-01
- **Last Updated** 2021-04-29 7:53 AM CDT

### Notes

BEA Account Code: A021RX

A Guide to the National Income and Product Accounts of the United States (NIPA) - (<http://www.bea.gov/national/pdf/nipagu>)

### Source

U.S. Bureau of Economic Analysis <https://fred.stlouisfed.org/data/IMPGSC1.txt>

### Examples

```
data(IMPGSC1)
tail(IMPGSC1)
plot(IMPGSC1,grid.col = "white", col="blue")
```

---

PAYEMS

*Employment Situation*

---

### Description

PAYEMS All Employees: Total Nonfarm

### Usage

data(PAYEMS)

### Format

An `xts` object containing observations of All Employees: Total Nonfarm.

- **Release:** Employment Situation
- **Seasonal Adjustment:** Seasonally Adjusted
- **Frequency:** Monthly
- **Units:** Thousands of Persons
- **Date Range:** 1939-01-01 to 2021-03-01
- **Last Updated** 2021-04-02 7:44 AM CDT

### Notes

All Employees: Total Nonfarm, commonly known as Total Nonfarm Payroll, is a measure of the number of U.S. workers in the economy that excludes proprietors, private household employees, unpaid volunteers, farm employees, and the unincorporated self-employed. This measure accounts for approximately 80 percent of the workers who contribute to Gross Domestic Product (GDP).

This measure provides useful insights into the current economic situation because it can represent the number of jobs added or lost in an economy. Increases in employment might indicate that businesses are hiring which might also suggest that businesses are growing. Additionally, those who are newly employed have increased their personal incomes, which means (all else constant) their disposable incomes have also increased, thus fostering further economic expansion.

Generally, the U.S. labor force and levels of employment and unemployment are subject to fluctuations due to seasonal changes in weather, major holidays, and the opening and closing of schools. The Bureau of Labor Statistics (BLS) adjusts the data to offset the seasonal effects to show non-seasonal changes: for example, women's participation in the labor force; or a general decline in the number of employees, a possible indication of a downturn in the economy. To closely examine seasonal and non-seasonal changes, the BLS releases two monthly statistical measures: the seasonally adjusted All Employees: Total Nonfarm (FEDFUNDS) and All Employees: Total Nonfarm (PAYNSA), which is not seasonally adjusted.

The series comes from the 'Current Employment Statistics (Establishment Survey).

The source code is: CES0000000001

**Source**

U.S. Bureau of Economic Analysis <https://fred.stlouisfed.org/data/PAYEMS.txt>

**Examples**

```
data(PAYEMS)
tail(PAYEMS)

PAYEMS_qtr <- xts::to.quarterly(PAYEMS["1947/"], OHLC = FALSE)
log_Employment <- 100*log(PAYEMS_qtr)

employ_trend <- yth_filter(log_Employment, h = 8, p = 4, output = c("x", "trend"),
                          family = gaussian)

main <- "Log of Employment and trend"
plot(employ_trend, grid.col = "white", legend.loc = "topleft", main = main)

employ_cycle <- yth_filter(log_Employment, h = 8, p = 4, output = c("cycle", "random"),
                          family = gaussian)

main <- "Log of Employment cycle and random walk"
plot(employ_cycle, grid.col = "white", legend.loc = "topright", main = main)
```

---

PCECC96

*Real Personal Consumption Expenditures*

---

**Description**

PCECC96 Real Personal Consumption Expenditures

**Usage**

```
data(PCECC96)
```

**Format**

An `xts` object of Real Personal Consumption Expenditures.

- **Release:** Gross Domestic Product
- **Seasonal Adjustment:** Seasonally Adjusted Annual Rate
- **Frequency:** Quarterly
- **Units:** Billions of Chained 2012 Dollars
- **Date Range:** 1947-01-01 to 2021-01-01
- **Last Updated** 2021-04-29 7:52 AM CDT

**Notes**

BEA Account Code: DPCERX

A Guide to the National Income and Product Accounts of the United States (NIPA) - (<http://www.bea.gov/national/pdf/nipagu>)

**Source**

U.S. Bureau of Economic Analysis <https://fred.stlouisfed.org/data/PCECC96.txt>

**Examples**

```
data(PCECC96)
tail(PCECC96)
plot(PCECC96, grid.col = "white", col="blue")
```

---

 SP500

*U.S. Stock Markets and CAPE Ratio*


---

**Description**

SP500 Robert Schiller's data set for U.S. Stock Markets 1871-2021 and CAPE Ratio.

**Usage**

```
data(SP500)
```

**Format**

An `xts` object containing observations of U.S. Stock Markets 1871-Present and CAPE Ratio.

- **Frequency:** Monthly
- **Date Range:** 1871-01 to 2020-03
- **Data updated:** 2021-05-05 05:08 PM CST
- **SP500:** Nominal prices of the S&P composite index, April 2021 observation is 04/05 close
- **Dividends:** Nominal dividends
- **Earnings:** Nominal Earnings, S&P 500 estimated
- **CPI:** Schiller's Consumer Price Index data Schiller used for transformation to Real prices
- **GS10:** Schiller's Long term interest rate 10-Year Treasury Constant Maturity Rate, April 2021 observation is 04/05 close
- **Real\_SP500:** Real prices of the S&P 500 composite index
- **Real\_Dividends:** Real Dividends
- **Real\_SP500\_TR:** Real Total Return Price of the S&P 500 composite index
- **Real\_Earnings:** Real Earnings
- **Real\_Earnings\_TR:** Real Total Return Scaled Earnings

- **CAPE:** Cyclically Adjusted Price Earnings Ratio. P/E10 or CAPE.
- **CAPE\_TR:** Cyclically Adjusted Total Return Price Earnings Ratio. P/E10\_TR or CAPE\_TR.
- **CAPE\_Yield:** Excess Cape Yield.
- **Bond\_TR:** Total Bond Returns.
- **Real\_Bond\_TR:** Real Total Bond Returns.

### Notes from Schiller

This data set consists of monthly stock price, dividends, and earnings data and the consumer price index (to allow conversion to real values), all starting January 1871. The price, dividend, and earnings series are from the same sources as described in Chapter 26 of my earlier book (*Market Volatility*, Cambridge, MA: MIT Press, 1989), although now I use monthly data, rather than annual data. Monthly dividend and earnings data are computed from the S&P four-quarter totals for the quarter since 1926, with linear interpolation to monthly figures. Dividend and earnings data before 1926 are from Cowles and associates (*Common Stock Indexes*, 2nd ed., Bloomington, Ind.: Principia Press, 1939), interpolated from annual data. Stock price data are monthly averages of daily closing prices. The CPI-U (Consumer Price Index-All Urban Consumers) published by the U.S. Bureau of Labor Statistics begins in 1913; for years before 1913, I spliced to the CPI Warren and Pearson's price index, by multiplying it by the ratio of the indexes in January 1913. December 1999 and January 2000 values for the CPI-U are extrapolated. See George F. Warren and Frank A. Pearson, *Gold and Prices* (New York: John Wiley and Sons, 1935). Data are from their Table 1, pp. 11–14.

### Source

Schiller, Robert J. *Irrational Exuberance*, Princeton University Press 2000, Broadway Books 2001, 2nd ed. 2005, 3rd ed. 2015. <http://www.econ.yale.edu/~shiller/data.htm>

Download .xls file directly from here: [http://www.econ.yale.edu/~shiller/data/ie\\_data.xls](http://www.econ.yale.edu/~shiller/data/ie_data.xls)

### Examples

```
data(SP500)

SP500_qtr <- xts::to.quarterly(SP500$SP500, OHLC = FALSE)
log_SP500 <- 100*log(SP500_qtr)

SP500_trend <- yth_filter(log_SP500, h = 8, p = 4, output = c("x", "trend"),
                          family = gaussian)

main <- "Log of SP500 and trend"
plot(SP500_trend, grid.col = "white", legend.loc = "topleft", main = main)

SP500cycle <- yth_filter(log_SP500["1900/"], h = 8, p = 4,
                        output = c("cycle", "random"), family = gaussian)

main <- "Log of SP500 cycle and random walk"
plot(SP500cycle, grid.col = "white", legend.loc = "topright", main = main)
```

---

UNRATENSA

*Civilian Unemployment Rate*

---

### Description

UNRATENSA Civilian Unemployment Rate

### Usage

```
data(UNRATENSA)
```

### Format

An `xts` object of the Civilian Unemployment Rate.

- **Release:** Employment Situation
- **Seasonal Adjustment:** Not Seasonally Adjusted
- **Frequency:** Monthly
- **Units:** Percent
- **Date Range:** 1948-01-01 to 2021-03-01
- **Last Updated** 2021-04-02 7:44 AM CDT

### Notes

The unemployment rate represents the number of unemployed as a percentage of the labor force. Labor force data are restricted to people 16 years of age and older, who currently reside in 1 of the 50 states or the District of Columbia, who do not reside in institutions (e.g., penal and mental facilities, homes for the aged), and who are not on active duty in the Armed Forces.

This rate is also defined as the U-3 measure of labor underutilization.

The series comes from the 'Current Population Survey (Household Survey)'

The source code is: LNU04000000

### Source

U.S. Bureau of Labor Statistics <https://fred.stlouisfed.org/data/UNRATENSA.txt>

### Examples

```
data(UNRATENSA)
tail(UNRATENSA)
plot(UNRATENSA, grid.col = "white", col="green")
```

---

USREC

*Recession Indicators Series*

---

### Description

USREC NBER based Recession Indicators for the United States from the Period following the Peak through the Trough

### Usage

```
data(USREC)
```

### Format

An `xts` object containing monthly observations of NBER based Recession Indicators

#

- **Release:** Recession Indicators Series (Not a Press Release)
- **Seasonal Adjustment:** Not Seasonally Adjusted
- **Frequency:** Monthly
- **Units:** +1 or 0
- **Date Range:** 1854-12-01 to 2021-04-01
- **Last Updated** 2021-05-03 6:01 PM CDT

### Notes

This time series is an interpretation of US Business Cycle Expansions and Contractions data provided by The National Bureau of Economic Research (NBER) at <http://www.nber.org/cycles/cyclesmain.html>. Our time series is composed of dummy variables that represent periods of expansion and recession. The NBER identifies months and quarters of turning points without designating a date within the period that turning points occurred. The dummy variable adopts an arbitrary convention that the turning point occurred at a specific date within the period. The arbitrary convention does not reflect any judgment on this issue by the NBER's Business Cycle Dating Committee. A value of 1 is a recessionary period, while a value of 0 is an expansionary period. For this time series, the recession begins the first day of the period following a peak and ends on the last day of the period of the trough. For more options on recession shading, see the notes and links below.

The recession shading data that we provide initially comes from the source as a list of dates that are either an economic peak or trough. We interpret dates into recession shading data using one of three arbitrary methods. All of our recession shading data is available using all three interpretations. The period between a peak and trough is always shaded as a recession. The peak and trough are collectively extrema. Depending on the application, the extrema, both individually and collectively, may be included in the recession period in whole or in part. In situations where a portion of a period is included in the recession, the whole period is deemed to be included in the recession period.

The first interpretation, known as the midpoint method, is to show a recession from the midpoint of the peak through the midpoint of the trough for monthly and quarterly data. For daily data, the recession begins on the 15th of the month of the peak and ends on the 15th of the month of the



trough. Daily data is a disaggregation of monthly data. For monthly and quarterly data, the entire peak and trough periods are included in the recession shading. This method shows the maximum number of periods as a recession for monthly and quarterly data. The Federal Reserve Bank of St. Louis uses this method in its own publications. A version of this time series represented using the midpoint method can be found at: <https://fred.stlouisfed.org/series/USRECM>

The second interpretation, known as the trough method, is to show a recession from the period following the peak through the trough (i.e. the peak is not included in the recession shading, but the trough is). For daily data, the recession begins on the first day of the first month following the peak and ends on the last day of the month of the trough. Daily data is a disaggregation of monthly data. The trough method is used when displaying data on FRED graphs. The trough method is used for this series.

The third interpretation, known as the peak method, is to show a recession from the period of the peak to the trough (i.e. the peak is included in the recession shading, but the trough is not). For daily data, the recession begins on the first day of the month of the peak and ends on the last day of the month preceding the trough. Daily data is a disaggregation of monthly data. A version of this time series represented using the peak method can be found at: <https://fred.stlouisfed.org/series/USRECP>

## Source

Federal Reserve Bank of St. Louis <https://fred.stlouisfed.org/data/USREC.txt>

## Examples

```
data(USREC)
USREC[["2007/2009"]]
plot(USREC[["1947/"]], grid.col = "white", col="red")
```

---

yth\_filter

*Filtered xts object*

---

## Description

yth\_filter returns an `xts` object containing user defined combinations of the original, trend, cycle, and random walk series.

## Usage

```
yth_filter(x, h = 8, p = 4, output = c("x", "trend", "cycle", "random"), ...)
```

## Arguments

`x` A univariate `xts` object of any `zoo` index class, such as `Date`, `yearmon`, or `yearqtr`. For converting objects of type `timeSeries`, `ts`, `irts`, `fts`, `matrix`, `data.frame` or `zoo`, please read [as.xts](#).

h	An <a href="#">integer</a> , defining the lookahead period. Defaults to $h = 8$ . The default assumes economic data of quarterly periodicity with a lookahead period of 2 years. This function is not limited by the default parameter, and Econometricians may change it as required.
p	An <a href="#">integer</a> , indicating the number of lags. A Default of $p = 4$ , assumes data is of quarterly periodicity. If data is of monthly periodicity, one may choose $p = 12$ or aggregate the series to quarterly periodicity and maintain the default. Econometricians should use this parameter to accommodate the Seasonality of their data.
output	A <a href="#">character</a> vector. Defaults to <code>output = c("x", "trend", "cycle", "random")</code> , which returns the original time series ( <code>x</code> ), <code>yth_glm fitted.values</code> ("trend"), <code>yth_glm residuals</code> ("cycle"), and a random walk series defined by differencing $y_{t+h}$ and $y_t$ ("random"). Arguments "x", "trend", "cycle", and "random" extract their corresponding univariate series and can be merged in any combination. For example <code>c("x", "trend")</code> returns both the original series "x" and the "trend" components. <code>c("cycle", "random")</code> will return both the "cycle" and "random" components.
...	other arguments passed to the function <a href="#">glm</a>

### Details

For time series of quarterly periodicity, Hamilton suggests parameters of  $h = 8$  and  $p = 4$ , or an  $AR(4)$  process, additionally lagged by 8 lookahead periods. Econometricians may explore variations of  $h$ . However,  $p$  is designed to correspond with the seasonality of a given periodicity and should be matched accordingly.

$$y_{t+h} = \beta_0 + \beta_1 y_t + \beta_2 y_{t-1} + \beta_3 y_{t-2} + \beta_4 y_{t-3} + v_{t+h}$$

$$\hat{v}_{t+h} = y_{t+h} - \hat{\beta}_0 + \hat{\beta}_1 y_t + \hat{\beta}_2 y_{t-1} + \hat{\beta}_3 y_{t-2} + \hat{\beta}_4 y_{t-3}$$

Which can be rewritten as:

$$y_t = \beta_0 + \beta_1 y_{t-8} + \beta_2 y_{t-9} + \beta_3 y_{t-10} + \beta_4 y_{t-11} + v_t$$

$$\hat{v}_t = y_t - \hat{\beta}_0 + \hat{\beta}_1 y_{t-8} + \hat{\beta}_2 y_{t-9} + \hat{\beta}_3 y_{t-10} + \hat{\beta}_4 y_{t-11}$$

### Value

An [xts](#) object defined by the output parameter.

### References

James D. Hamilton. [Why You Should Never Use the Hodrick-Prescott Filter](#). NBER Working Paper No. 23429, Issued in May 2017.

### See Also

[yth\\_glm](#)

**Examples**

```

data(GDPC1)

gdp_filter <- yth_filter(100*log(GDPC1), h = 8, p = 4)

knitr::kable(head(gdp_filter, 15), align = 'l')

#-----#

data(PAYEMS)

log_Employment <- 100*log(xts::to.quarterly(PAYEMS["1947/2016-6"], OHLC = FALSE))

employ_trend <- yth_filter(log_Employment, h = 8, p = 4, output = c("x", "trend"))

plot(employ_trend, grid.col = "white", legend.loc = "topleft",
     main = "Log of Employment and trend")

#-----#

quarterly_data <- 100*log(merge(GDPC1, PCECC96, GPDIC1, EXPGSC1, IMPGSC1, GCEC1, GDPDEF))

cycle <- do.call(merge, lapply(quarterly_data, yth_filter, output = "cycle"))
random <- do.call(merge, lapply(quarterly_data, yth_filter, output = "random"))

cycle.sd <- t(data.frame(lapply(cycle, sd, na.rm = TRUE)))
GDP.cor <- t(data.frame(lapply(cycle, cor, cycle[,1], use = "complete.obs")))
random.sd <- t(data.frame(lapply(random, sd, na.rm = TRUE)))
random.cor <- t(data.frame(lapply(random, cor, random[,1], use = "complete.obs")))

my_table_2 <- round(data.frame(cbind(cycle.sd, GDP.cor, random.sd, random.cor)), 2)
names(my_table_2) <- names(Hamilton_table_2)[1:4]

knitr::kable(my_table_2, align = 'l')

```

y<sub>th</sub>\_glm*Fits Hamilton's alternative model***Description**

y<sub>th</sub>\_glm fits a generalized linear model suggested by James D. Hamilton as a better alternative to the Hodrick-Prescott Filter.

**Usage**

```
yth_glm(x, h = 8, p = 4, ...)
```

**Arguments**

x	A univariate <code>xts</code> object of any <code>zoo</code> index class, such as <code>Date</code> , <code>yearmon</code> , or <code>yearqtr</code> . For converting objects of type <code>timeSeries</code> , <code>ts</code> , <code>irts</code> , <code>fts</code> , <code>matrix</code> , <code>data.frame</code> or <code>zoo</code> to <code>xts</code> , please read <a href="#">as.xts</a> .
h	An <code>integer</code> , defining the lookahead period. Defaults to $h = 8$ , suggested by Hamilton. The default assumes economic data of quarterly periodicity with a lookahead period of 2 years. This function is not limited by the default parameter, and Econometricians may change it as required.
p	An <code>integer</code> , indicating the number of lags. A Default of $p = 4$ , suggested by Hamilton, assumes data is of quarterly periodicity. If data is of monthly periodicity, one may choose $p = 12$ or aggregate the series to quarterly periodicity and maintain the default. Econometricians should use this parameter to accommodate the Seasonality of their data.
...	all arguments passed to the function <code>glm</code>

**Details**

For time series of quarterly periodicity, Hamilton suggests parameters of  $h = 8$  and  $p = 4$ , or an  $AR(4)$  process, additionally lagged by 8 lookahead periods. Econometricians may explore variations of  $h$ . However,  $p$  is designed to correspond with the seasonality of a given periodicity and should be matched accordingly.

$$y_{t+h} = \beta_0 + \beta_1 y_t + \beta_2 y_{t-1} + \beta_3 y_{t-2} + \beta_4 y_{t-3} + v_{t+h}$$

$$\hat{v}_{t+h} = y_{t+h} - \hat{\beta}_0 + \hat{\beta}_1 y_t + \hat{\beta}_2 y_{t-1} + \hat{\beta}_3 y_{t-2} + \hat{\beta}_4 y_{t-3}$$

Which can be rewritten as:

$$y_t = \beta_0 + \beta_1 y_{t-8} + \beta_2 y_{t-9} + \beta_3 y_{t-10} + \beta_4 y_{t-11} + v_t$$

$$\hat{v}_t = y_t - \hat{\beta}_0 + \hat{\beta}_1 y_{t-8} + \hat{\beta}_2 y_{t-9} + \hat{\beta}_3 y_{t-10} + \hat{\beta}_4 y_{t-11}$$

**Value**

`yth_glm` returns a generalized linear model object of class `glm`, which inherits from `lm`.

**References**

James D. Hamilton. [Why You Should Never Use the Hodrick-Prescott Filter](#). NBER Working Paper No. 23429, Issued in May 2017.

**See Also**

[glm](#)

**Examples**

```
data(GDPC1)

gdp_model <- yth_glm(GDPC1, h = 8, p = 4, family = gaussian)

summary(gdp_model)

plot(gdp_model)
```

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