

Data insertion

In [30]:

```
library(ggplot2)
library(dplyr)
library(tidyverse)
library(xts)
```

Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

```
filter, lag
```

The following objects are masked from 'package:base':

```
intersect, setdiff, setequal, union
```

Warning message:

"package 'tidyverse' was built under R version 4.1.2"

-- Attaching packages

tidyverse 1.3.1 --

v tibble 3.1.2 v purrr 0.3.4

v tidyr 1.1.3 v stringr 1.4.0

v readr 1.4.0 v forcats 0.5.1

-- Conflicts

tidyverse_conflicts() --

x dplyr::filter() masks stats::filter()

x purrr::flatten() masks jsonlite::flatten()

x dplyr::lag() masks stats::lag()

Warning message:

"package 'xts' was built under R version 4.1.1"

Loading required package: zoo

```
Attaching package: 'zoo'
```

```
The following objects are masked from 'package:base':
```

```
as.Date, as.Date.numeric
```

```
Attaching package: 'xts'
```

```
The following objects are masked from 'package:dplyr':
```

```
first, last
```

```
In [3]:
```

Your code contains a unicode char which cannot be displayed in your current locale and R will silently convert it to an escaped form when the R kernel executes this code. This can lead to subtle errors if you use such chars to do comparisons. For more information, please see <https://github.com/IRkernel/repr/wiki/Problems-with-unicode-on-windows>

```
Error: '\U' used without hex digits in character string starting "'C:\U"
Traceback:
```

```
In [20]:
```

```
setwd('C:/Users/Alexandros/Desktop/Rtimeseries/Timeseries')
```

```
In [64]:
```

```
library(readxl)
whole_data <- read_excel('pwt100.xlsx', sheet='Data')
```

```
In [65]:
```

```
whole_data
print(str(whole_data))
```

A tibble: 12810 × 52

countrycode	country	currency_unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_x	cs_h_y
<chr>	<chr>	<chr>	<dbl> >	<dbl>	<dbl>	<dbl>	<dbl>	<dbl> >	<dbl>	...	<dbl>	<dbl>
ABW	Aruba	Aruban Guilder	1950	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1951	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1952	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1953	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1954	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1955	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1956	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1957	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1958	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1959	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1960	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1961	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1962	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1963	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1964	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban	1965	NA	NA	NA	NA	NA	NA	...	NA	NA

countrycode	country	currency_unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_x	cs_h_r
<chr>	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	...	<dbl>	<dbl>
		Guilder										
ABW	Aruba	Aruban Guilder	1966	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1967	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1968	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1969	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1970	400.0817	463.3041	0.059063	NA	NA	NA	...	0.5074270	-0.49849
ABW	Aruba	Aruban Guilder	1971	436.4861	504.6843	0.059440	NA	NA	NA	...	0.5170011	-0.47073
ABW	Aruba	Aruban Guilder	1972	476.1609	550.4886	0.059840	NA	NA	NA	...	0.5090488	-0.45990
ABW	Aruba	Aruban Guilder	1973	519.4187	599.4626	0.060243	NA	NA	NA	...	0.5554803	-0.45847
ABW	Aruba	Aruban Guilder	1974	566.9457	652.4761	0.060528	NA	NA	NA	...	0.6533826	-0.51404
ABW	Aruba	Aruban Guilder	1975	618.7150	712.0463	0.060657	NA	NA	NA	...	0.6332902	-0.51360
ABW	Aruba	Aruban Guilder	1976	674.7798	776.6794	0.060586	NA	NA	NA	...	0.6327534	-0.50400
ABW	Aruba	Aruban Guilder	1977	736.0187	849.0198	0.060366	NA	NA	NA	...	0.6087170	-0.52996
ABW	Aruba	Aruban Guilder	1978	802.8256	924.4768	0.060103	NA	NA	NA	...	0.6237502	-0.49477
ABW	Aruba	Aruban Guilder	1979	875.7748	1006.4696	0.059980	NA	NA	NA	...	0.6687525	-0.49016
...
ZWE	Zimbabwe	US Dollar	1990	55114.99	55290.63	10.43242	4.568093	NA	1.802814	...	0.05236289	-0.06454

countrycode	country	currency_ unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_x	cs_h_r
<chr>	<chr>	<chr>	<dbl> >	<dbl>	<dbl>	<dbl>	<dbl>	<dbl> >	<dbl>	...	<dbl>	<dbl>
ZWE	Zimbabwe	US Dollar	1991	64479.61	65961.07	10.68099	4.672102	NA	1.840177	...	0.03596576	-0.05871
ZWE	Zimbabwe	US Dollar	1992	57687.84	60167.47	10.90050	4.764517	NA	1.878313	...	0.04362961	-0.07635
ZWE	Zimbabwe	US Dollar	1993	60193.09	61321.49	11.09277	4.843699	NA	1.917240	...	0.04391443	-0.06275
ZWE	Zimbabwe	US Dollar	1994	67239.56	67541.46	11.26174	4.965652	NA	1.956974	...	0.05778782	-0.06557
ZWE	Zimbabwe	US Dollar	1995	64223.92	66349.68	11.41071	5.052032	NA	1.997531	...	0.05115205	-0.07831
ZWE	Zimbabwe	US Dollar	1996	73254.92	74411.09	11.54122	5.057806	NA	2.011584	...	0.05342868	-0.07640
ZWE	Zimbabwe	US Dollar	1997	63096.64	64145.96	11.65324	5.041758	NA	2.025736	...	0.06464565	-0.10166
ZWE	Zimbabwe	US Dollar	1998	55969.33	55145.49	11.74707	5.012619	NA	2.039988	...	0.05839083	-0.05890
ZWE	Zimbabwe	US Dollar	1999	51810.57	51630.21	11.82272	4.968816	NA	2.054339	...	0.07569685	-0.08700
ZWE	Zimbabwe	US Dollar	2000	42878.47	39882.63	11.88148	5.065894	NA	2.068792	...	0.10476929	-0.05265
ZWE	Zimbabwe	US Dollar	2001	44335.37	45106.70	11.92391	5.144075	NA	2.105179	...	0.05906266	-0.08326
ZWE	Zimbabwe	US Dollar	2002	39335.82	38900.39	11.95429	5.218606	NA	2.142206	...	0.13076402	-0.13983
ZWE	Zimbabwe	US Dollar	2003	28165.54	27228.90	11.98222	5.304144	NA	2.179884	...	0.13382465	-0.11365
ZWE	Zimbabwe	US Dollar	2004	25710.45	25505.20	12.01991	5.402245	NA	2.218225	...	0.14312214	-0.17449
ZWE	Zimbabwe	US Dollar	2005	21581.51	21755.91	12.07670	5.448280	NA	2.257240	...	0.12054949	-0.20640
ZWE	Zimbabwe	US Dollar	2006	18039.26	16519.85	12.15549	5.504240	NA	2.279855	...	0.74807733	-0.30173
ZWE	Zimbabwe	US Dollar	2007	18921.92	18695.63	12.25592	5.554227	NA	2.302697	...	0.29609334	-0.33510
ZWE	Zimbabwe	US Dollar	2008	14028.38	14817.71	12.37955	5.624591	NA	2.325768	...	0.17755204	-0.31246
ZWE	Zimbabwe	US Dollar	2009	25497.34	26465.28	12.52697	5.681129	NA	2.349070	...	0.13702269	-0.22948
ZWE	Zimbabwe	US Dollar	2010	27993.35	28976.10	12.69772	5.753274	NA	2.372605	...	0.17614010	-0.37184
ZWE	Zimbabwe	US Dollar	2011	29494.24	31580.89	12.89432	5.856591	NA	2.415823	...	0.16897421	-0.47951
ZWE	Zimbabwe	US Dollar	2012	34897.95	36233.02	13.11515	5.983072	NA	2.459828	...	0.17172454	-0.36586
ZWE	Zimbabwe	US Dollar	2013	37219.42	38243.52	13.35037	6.124177	NA	2.504635	...	0.14079416	-0.35253
ZWE	Zimbabwe	US Dollar	2014	37861.21	38674.86	13.58671	6.265931	NA	2.550258	...	0.11920944	-0.28525
ZWE	Zimbabwe	US Dollar	2015	40141.62	39798.64	13.81463	6.393752	NA	2.584653	...	0.14017171	-0.28769

countrycode	country	currency_ unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_x	cs_h_
<chr>	<chr>	<chr>	<dbl >	<dbl>	<dbl>	<dbl>	<dbl>	<dbl >	<dbl>	...	<dbl>	<dbl>

ZWE	Zimbabwe	US Dollar	2016	41875.20	40963.19	14.03033	6.504374	NA	2.616257	...	0.13191965	-0.25123
ZWE	Zimbabwe	US Dollar	2017	44672.18	44316.74	14.23659	6.611773	NA	2.648248	...	0.12672158	-0.20282
ZWE	Zimbabwe	US Dollar	2018	44325.11	43420.90	14.43880	6.714952	NA	2.680630	...	0.14448480	-0.26365
ZWE	Zimbabwe	US Dollar	2019	42296.06	40826.57	14.64547	6.831017	NA	2.713408	...	0.21356182	-0.27095

tibble [12,810 x 52] (S3: tbl_df/tbl/data.frame)

```

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```

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$ csh_m      : num [1:12810] NA NA NA NA NA NA NA NA NA NA NA ...
$ csh_r      : num [1:12810] NA NA NA NA NA NA NA NA NA NA NA ...
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$ pl_n       : num [1:12810] NA NA NA NA NA NA NA NA NA NA NA ...
$ pl_k       : num [1:12810] NA NA NA NA NA NA NA NA NA NA NA ...

```

NULL

Handle dates and subselecting

In [66]:

```
num_only = whole_data %>% select_if(is.numeric)
```

In [69]:

```
data = bind_cols(whole_data[,1:3], num_only)
```

In [70]:

```
data
```

A tibble: 12810 × 47

countrycode	country	currency_ unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	csh_x	csh_y
<chr>	<chr>	<chr>	<dbl> >	<dbl>	<dbl>	<dbl>	<dbl>	<dbl> >	<dbl>	...	<dbl>	<dbl>
ABW	Aruba	Aruban Guilder	1950	NA	NA	NA	NA	NA	NA	...	NA	NA

countrycode	country	currency_unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_x	cs_h_y
<chr>	<chr>	<chr>	<dbl> >	<dbl>	<dbl>	<dbl>	<dbl>	<dbl> >	<dbl>	...	<dbl>	<dbl>
ABW	Aruba	Aruban Guilder	1951	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1952	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1953	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1954	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1955	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1956	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1957	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1958	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1959	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1960	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1961	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1962	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1963	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1964	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1965	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban	1966	NA	NA	NA	NA	NA	NA	...	NA	NA

countrycode	country	currency_unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_x	cs_h_r
<chr>	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	...	<dbl>	<dbl>
		Guilder										
ABW	Aruba	Aruban Guilder	1967	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1968	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1969	NA	NA	NA	NA	NA	NA	...	NA	NA
ABW	Aruba	Aruban Guilder	1970	400.0817	463.3041	0.059063	NA	NA	NA	...	0.5074270	-0.49849
ABW	Aruba	Aruban Guilder	1971	436.4861	504.6843	0.059440	NA	NA	NA	...	0.5170011	-0.47073
ABW	Aruba	Aruban Guilder	1972	476.1609	550.4886	0.059840	NA	NA	NA	...	0.5090488	-0.45990
ABW	Aruba	Aruban Guilder	1973	519.4187	599.4626	0.060243	NA	NA	NA	...	0.5554803	-0.45847
ABW	Aruba	Aruban Guilder	1974	566.9457	652.4761	0.060528	NA	NA	NA	...	0.6533826	-0.51404
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ABW	Aruba	Aruban Guilder	1976	674.7798	776.6794	0.060586	NA	NA	NA	...	0.6327534	-0.50400
ABW	Aruba	Aruban Guilder	1977	736.0187	849.0198	0.060366	NA	NA	NA	...	0.6087170	-0.52996
ABW	Aruba	Aruban Guilder	1978	802.8256	924.4768	0.060103	NA	NA	NA	...	0.6237502	-0.49477
ABW	Aruba	Aruban Guilder	1979	875.7748	1006.4696	0.059980	NA	NA	NA	...	0.6687525	-0.49016
...
ZWE	Zimbabwe	US Dollar	1990	55114.99	55290.63	10.43242	4.568093	NA	1.802814	...	0.05236289	-0.06454
ZWE	Zimbabwe	US Dollar	1991	64479.61	65961.07	10.68099	4.672102	NA	1.840177	...	0.03596576	-0.05871

countrycode	country	currency_ unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_x	cs_h_r
<chr>	<chr>	<chr>	<dbl> >	<dbl>	<dbl>	<dbl>	<dbl>	<dbl> >	<dbl>	...	<dbl>	<dbl>
ZWE	Zimbabwe	US Dollar	1992	57687.84	60167.47	10.90050	4.764517	NA	1.878313	...	0.04362961	-0.07635
ZWE	Zimbabwe	US Dollar	1993	60193.09	61321.49	11.09277	4.843699	NA	1.917240	...	0.04391443	-0.06275
ZWE	Zimbabwe	US Dollar	1994	67239.56	67541.46	11.26174	4.965652	NA	1.956974	...	0.05778782	-0.06557
ZWE	Zimbabwe	US Dollar	1995	64223.92	66349.68	11.41071	5.052032	NA	1.997531	...	0.05115205	-0.07831
ZWE	Zimbabwe	US Dollar	1996	73254.92	74411.09	11.54122	5.057806	NA	2.011584	...	0.05342868	-0.07640
ZWE	Zimbabwe	US Dollar	1997	63096.64	64145.96	11.65324	5.041758	NA	2.025736	...	0.06464565	-0.10166
ZWE	Zimbabwe	US Dollar	1998	55969.33	55145.49	11.74707	5.012619	NA	2.039988	...	0.05839083	-0.05890
ZWE	Zimbabwe	US Dollar	1999	51810.57	51630.21	11.82272	4.968816	NA	2.054339	...	0.07569685	-0.08700
ZWE	Zimbabwe	US Dollar	2000	42878.47	39882.63	11.88148	5.065894	NA	2.068792	...	0.10476929	-0.05265
ZWE	Zimbabwe	US Dollar	2001	44335.37	45106.70	11.92391	5.144075	NA	2.105179	...	0.05906266	-0.08326
ZWE	Zimbabwe	US Dollar	2002	39335.82	38900.39	11.95429	5.218606	NA	2.142206	...	0.13076402	-0.13983
ZWE	Zimbabwe	US Dollar	2003	28165.54	27228.90	11.98222	5.304144	NA	2.179884	...	0.13382465	-0.11365
ZWE	Zimbabwe	US Dollar	2004	25710.45	25505.20	12.01991	5.402245	NA	2.218225	...	0.14312214	-0.17449
ZWE	Zimbabwe	US Dollar	2005	21581.51	21755.91	12.07670	5.448280	NA	2.257240	...	0.12054949	-0.20640
ZWE	Zimbabwe	US Dollar	2006	18039.26	16519.85	12.15549	5.504240	NA	2.279855	...	0.74807733	-0.30173
ZWE	Zimbabwe	US Dollar	2007	18921.92	18695.63	12.25592	5.554227	NA	2.302697	...	0.29609334	-0.33510
ZWE	Zimbabwe	US Dollar	2008	14028.38	14817.71	12.37955	5.624591	NA	2.325768	...	0.17755204	-0.31246
ZWE	Zimbabwe	US Dollar	2009	25497.34	26465.28	12.52697	5.681129	NA	2.349070	...	0.13702269	-0.22948
ZWE	Zimbabwe	US Dollar	2010	27993.35	28976.10	12.69772	5.753274	NA	2.372605	...	0.17614010	-0.37184
ZWE	Zimbabwe	US Dollar	2011	29494.24	31580.89	12.89432	5.856591	NA	2.415823	...	0.16897421	-0.47951
ZWE	Zimbabwe	US Dollar	2012	34897.95	36233.02	13.11515	5.983072	NA	2.459828	...	0.17172454	-0.36586
ZWE	Zimbabwe	US Dollar	2013	37219.42	38243.52	13.35037	6.124177	NA	2.504635	...	0.14079416	-0.35253
ZWE	Zimbabwe	US Dollar	2014	37861.21	38674.86	13.58671	6.265931	NA	2.550258	...	0.11920944	-0.28525
ZWE	Zimbabwe	US Dollar	2015	40141.62	39798.64	13.81463	6.393752	NA	2.584653	...	0.14017171	-0.28769
ZWE	Zimbabwe	US Dollar	2016	41875.20	40963.19	14.03033	6.504374	NA	2.616257	...	0.13191965	-0.25123
ZWE	Zimbabwe	US Dollar	2017	44672.18	44316.74	14.23659	6.611773	NA	2.648248	...	0.12672158	-0.20282

countrycode	country	currency_ unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_x	cs_h_m
<chr>	<chr>	<chr>	<dbl> >	<dbl>	<dbl>	<dbl>	<dbl>	<dbl> >	<dbl>	...	<dbl>	<dbl>

ZWE	Zimbabwe	US Dollar	2018	44325.11	43420.90	14.43880	6.714952	NA	2.680630	...	0.14448480	-0.26365
-----	----------	-----------	------	----------	----------	----------	----------	----	----------	-----	------------	----------

ZWE	Zimbabwe	US Dollar	2019	42296.06	40826.57	14.64547	6.831017	NA	2.713408	...	0.21356182	-0.27095
-----	----------	-----------	------	----------	----------	----------	----------	----	----------	-----	------------	----------

Now character variables (except countries) have been cleaned

Now let's create date types

In [75]:

```
data$date = paste(data$year, "-01-", "01", sep="")
```

In [77]:

```
data$date = as.Date(data$date, format = "%Y-%m-%d")
```

In [78]:

```
data$date %>% class
```

'Date'

In [:

Selecting a single country , group_by,summarize

In [82]:

```
Greece <- data %>% filter(country=="Greece")
```

Greece

A tibble: 70 × 48

countrycode	country	currency_ unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_m
<chr>	<chr>	<chr>	<dbl> >	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	...	<dbl>
GRC	Greece	Euro	1950	NA	NA	NA	NA	NA	NA	...	NA

countrycode	country	currency_ unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_m
<chr>	<chr>	<chr>	<dbl> >	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	...	<dbl>
GRC	Greece	Euro	1951	27866.44	28382.46	7.534017	3.375124	2312.551	1.530985	...	-0.11909737 0.03
GRC	Greece	Euro	1952	27284.54	27776.46	7.619589	3.411953	2302.988	1.571550	...	-0.10310113 0.03
GRC	Greece	Euro	1953	30582.95	31562.30	7.702201	3.447424	2293.464	1.613189	...	-0.07057871 0.04
GRC	Greece	Euro	1954	31201.29	32225.16	7.777397	3.479544	2283.980	1.655931	...	-0.08376227 0.04
GRC	Greece	Euro	1955	33540.57	34448.26	7.848462	3.509788	2274.535	1.699806	...	-0.08316190 0.05
GRC	Greece	Euro	1956	36508.89	37509.41	7.912975	3.537074	2265.129	1.751953	...	-0.08868376 0.04
GRC	Greece	Euro	1957	39206.93	40426.30	7.977222	3.556257	2255.762	1.803263	...	-0.09076545 0.05
GRC	Greece	Euro	1958	41333.40	42421.13	8.053002	3.582899	2246.434	1.856075	...	-0.09496316 0.05
GRC	Greece	Euro	1959	42845.27	44114.26	8.136785	3.592490	2237.144	1.910434	...	-0.09357471 0.05
GRC	Greece	Euro	1960	43583.57	44976.65	8.205011	3.608476	2227.893	1.966385	...	-0.12695821 0.04
GRC	Greece	Euro	1961	49677.05	51181.01	8.274618	3.622871	2217.991	1.978133	...	-0.12066440 0.03
GRC	Greece	Euro	1962	48991.16	50332.30	8.324062	3.586620	2208.133	1.989951	...	-0.12187397 0.02
GRC	Greece	Euro	1963	55401.79	56826.08	8.354993	3.536403	2198.319	2.001839	...	-0.12258137 0.02
GRC	Greece	Euro	1964	59468.27	60928.23	8.385345	3.490451	2188.548	2.013798	...	-0.11973988 -0.02
GRC	Greece	Euro	1965	65921.38	67527.59	8.424662	3.466035	2178.821	2.025829	...	-0.13319990 -0.02

countrycode	country	currency_ unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_m
<chr>	<chr>	<chr>	<dbl> >	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	...	<dbl>
GRC	Greece	Euro	1966	71372.83	72821.42	8.487050	3.434796	2169.138	2.037931	...	-0.12849030 0.01
GRC	Greece	Euro	1967	75421.22	76522.28	8.588329	3.393642	2159.497	2.050107	...	-0.11494037 0.00
GRC	Greece	Euro	1968	80244.48	81596.96	8.612295	3.352915	2149.899	2.062354	...	-0.12322594 -0.00
GRC	Greece	Euro	1969	89619.87	90865.95	8.643824	3.342786	2140.344	2.074675	...	-0.12281716 -0.00
GRC	Greece	Euro	1970	97693.84	99292.14	8.663571	3.339480	2098.643	2.087069	...	-0.13119432 -0.00
GRC	Greece	Euro	1971	105198.30	107107.87	8.716873	3.355520	2099.605	2.106050	...	-0.12460233 -0.00
GRC	Greece	Euro	1972	115594.85	117832.92	8.774514	3.372595	2101.094	2.125203	...	-0.11454974 -0.00
GRC	Greece	Euro	1973	124461.41	126495.14	8.840315	3.416343	2102.546	2.144530	...	-0.13501510 -0.00
GRC	Greece	Euro	1974	115193.70	118751.24	8.919244	3.437624	2103.960	2.164033	...	-0.15478271 -0.00
GRC	Greece	Euro	1975	120608.49	125681.33	9.014085	3.445170	2105.333	2.183714	...	-0.15699418 0.01
GRC	Greece	Euro	1976	128672.27	133812.86	9.127049	3.483696	2106.665	2.203573	...	-0.16951907 0.01
GRC	Greece	Euro	1977	132502.58	136359.28	9.254978	3.506772	2107.954	2.223613	...	-0.17891949 0.02
GRC	Greece	Euro	1978	142195.52	146023.39	9.388728	3.525628	2109.610	2.243835	...	-0.16585229 0.02
GRC	Greece	Euro	1979	145471.02	149153.41	9.515746	3.567876	2111.049	2.264242	...	-0.18313792 0.03
...
GRC	Greece	Euro	1990	181332.4	181550.2	10.22599	4.062554	2111.623	2.529926	...	-0.2217695 0.00

countrycode	country	currency_ unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_m	
<chr>	<chr>	<chr>	<dbl> >	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	...	<dbl>	
GRC	Greece	Euro	1991	193430.4	192950.9	10.31511	3.977802	2112.891	2.557113	...	-0.2077743	0.00
GRC	Greece	Euro	1992	198890.6	196230.2	10.42024	4.045194	2112.869	2.576525	...	-0.2497078	0.02
GRC	Greece	Euro	1993	201528.1	200895.1	10.53381	4.099039	2112.144	2.595133	...	-0.2305024	0.02
GRC	Greece	Euro	1994	212694.5	211749.6	10.64495	4.198669	2110.199	2.613876	...	-0.2053703	0.03
GRC	Greece	Euro	1995	223337.6	219416.6	10.74550	4.256538	2110.706	2.632755	...	-0.2254094	0.02
GRC	Greece	Euro	1996	232633.5	226501.1	10.83214	4.247651	2109.400	2.651769	...	-0.2437220	0.02
GRC	Greece	Euro	1997	252283.1	247353.1	10.90626	4.238947	2107.945	2.670921	...	-0.2211871	0.04
GRC	Greece	Euro	1998	269264.8	261940.8	10.97012	4.426493	2108.434	2.690211	...	-0.2426516	0.03
GRC	Greece	Euro	1999	274464.8	267494.7	11.02790	4.434241	2104.852	2.709641	...	-0.2376382	0.04
GRC	Greece	Euro	2000	281180.6	281012.0	11.08210	4.452403	2107.638	2.729211	...	-0.2305128	0.03
GRC	Greece	Euro	2001	293539.4	291715.2	11.13446	4.466327	2101.130	2.749764	...	-0.2264739	0.02
GRC	Greece	Euro	2002	308082.5	303662.8	11.18230	4.578461	2093.215	2.770473	...	-0.2318590	0.03
GRC	Greece	Euro	2003	319420.8	305441.7	11.21888	4.645930	2091.479	2.791337	...	-0.2911444	0.04
GRC	Greece	Euro	2004	340496.4	319653.6	11.23499	4.753021	2082.552	2.812358	...	-0.3091860	0.07
GRC	Greece	Euro	2005	338297.7	326492.3	11.22479	4.778794	2136.239	2.833538	...	-0.3145362	0.06
GRC	Greece	Euro	2006	369233.1	351992.5	11.18523	4.833973	2125.336	2.854877	...	-0.3304232	0.05

countrycode	country	currency_ unit	year	rgdpe	rgdpo	pop	emp	avh	hc	...	cs_h_m
<chr>	<chr>	<chr>	<dbl> >	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	...	<dbl>
GRC	Greece	Euro	2007	379983.3	352220.4	11.12036	4.858281	2110.989	2.876377	...	-0.3650210 0.04
GRC	Greece	Euro	2008	390628.3	362663.5	11.04031	4.872009	2106.260	2.898039	...	-0.4125414 0.05
GRC	Greece	Euro	2009	380753.8	350892.5	10.95927	4.796369	2081.212	2.919864	...	-0.3379070 0.04
GRC	Greece	Euro	2010	347717.3	324407.4	10.88764	4.637154	2019.571	2.941853	...	-0.3462678 0.05
GRC	Greece	Euro	2011	314638.8	294014.8	10.82908	4.301328	2037.700	2.962745	...	-0.3783078 0.05
GRC	Greece	Euro	2012	299430.7	281534.4	10.78112	4.033718	2055.374	2.983787	...	-0.3900793 0.06
GRC	Greece	Euro	2013	294988.5	281881.1	10.74050	3.941757	2059.220	3.004977	...	-0.3519731 0.07
GRC	Greece	Euro	2014	294032.6	278412.3	10.70146	3.990398	2020.882	3.026318	...	-0.3723105 0.09
GRC	Greece	Euro	2015	294728.6	280679.1	10.65975	4.030078	2031.140	3.047810	...	-0.3125427 0.08
GRC	Greece	Euro	2016	290349.4	274068.9	10.61519	4.048787	2030.090	3.069455	...	-0.3196695 0.08
GRC	Greece	Euro	2017	295748.2	279853.4	10.56945	4.101669	2045.241	3.091254	...	-0.3546067 0.10
GRC	Greece	Euro	2018	297786.7	279920.6	10.52225	4.161405	2044.431	3.113208	...	-0.3945373 0.09
GRC	Greece	Euro	2019	302222.3	284893.6	10.47345	4.235073	2036.464	3.135318	...	-0.3774150 0.10

In [85]:

```
data %>% group_by(country) %>% summarize (mean_rgdpe = mean(rgdpe,na.rm=T))
```

A tibble: 183 × 2

country	mean_rgdpe
<chr>	<dbl>
Albania	16571.3547
Algeria	271741.1165
Angola	77176.4781
Anguilla	239.7350
Antigua and Barbuda	1088.4761
Argentina	328244.7456
Armenia	20384.1689
Aruba	2783.9661
Australia	523112.7550
Austria	211978.7614
Azerbaijan	81762.2224
Bahamas	8650.2852
Bahrain	25350.8463
Bangladesh	210530.6611
Barbados	4374.0136
Belarus	136423.5911
Belgium	271152.0414
Belize	1554.9350
Benin	11102.1386
Bermuda	2769.0882
Bhutan	2782.4556
Bolivia (Plurinational State of)	24972.2264
Bosnia and Herzegovina	26840.3733
Botswana	12825.3707
Brazil	1167743.2729
British Virgin Islands	557.0067

country	mean_rgdpe
<chr>	<dbl>
Brunei Darussalam	22849.8427
Bulgaria	91437.5499
Burkina Faso	13742.6907
Burundi	4474.2584
...	...
Sri Lanka	81071.3172
St. Vincent and the Grenadines	781.4864
State of Palestine	10600.7245
Sudan	68308.5827
Suriname	4283.9846
Sweden	255643.1416
Switzerland	274584.4155
Syrian Arab Republic	44080.6103
Taiwan	439562.9036
Tajikistan	18194.8323
Thailand	374740.4338
Togo	6519.1182
Trinidad and Tobago	18919.5061
Tunisia	58874.8234
Turkey	658125.9536
Turkmenistan	68968.1393
Turks and Caicos Islands	375.0477
U.R. of Tanzania: Mainland	45062.2753
Uganda	24245.0494
Ukraine	411915.7755
United Arab Emirates	337550.6420

country	mean_rgdpe
<chr>	<dbl>
United Kingdom	1485557.4746
United States	9588951.9857
Uruguay	34343.8052
Uzbekistan	187390.1609
Venezuela (Bolivarian Republic of)	166366.5074
Viet Nam	211456.7087
Yemen	45131.3131
Zambia	19852.4855
Zimbabwe	30081.9686

In []:

```
data %>% group_by(country) %>% summarize (mean_rgdpe = mean(rgdpe,na.rm=T))
```

In [89]:

```
#arrange by descending order
data %>% group_by(country) %>% summarize (mean_rgdpe = mean(rgdpe,na.rm=T)) %>%
arrange(desc(mean_rgdpe))
```

A tibble: 183 × 2

country	mean_rgdpe
<chr>	<dbl>
United States	9588952.0
China	5142910.8
Japan	2836343.7
Russian Federation	2674483.4
India	2126586.4
Germany	2072470.9
France	1492104.6
United Kingdom	1485557.5
Italy	1327930.0
Brazil	1167743.3

country	mean_rgdpe
<chr>	<dbl>
Mexico	1021812.0
Indonesia	893115.8
Canada	850153.9
Spain	798147.1
Republic of Korea	708572.9
Saudi Arabia	682671.5
Turkey	658126.0
Poland	535655.1
Australia	523112.8
Iran (Islamic Republic of)	459780.6
Netherlands	443748.4
Taiwan	439562.9
Ukraine	411915.8
Thailand	374740.4
South Africa	344029.8
United Arab Emirates	337550.6
Argentina	328244.7
Pakistan	317369.1
Czech Republic	291048.8
Nigeria	284327.3
...	...
Barbados	4374.0136
Suriname	4283.9846
Curaçao	4031.4407
Liberia	3337.7179
Central African Republic	3294.6939

country	mean_rgdpe
<chr>	<dbl>
Lesotho	2882.4391
Gambia	2800.6274
Aruba	2783.9661
Bhutan	2782.4556
Bermuda	2769.0882
Maldives	2704.1324
Cayman Islands	2427.3170
Djibouti	2164.9240
Guinea-Bissau	1655.4603
Belize	1554.9350
Saint Lucia	1450.4820
Comoros	1359.6078
Cabo Verde	1322.6280
Sint Maarten (Dutch part)	1310.7491
Seychelles	1258.2258
Antigua and Barbuda	1088.4761
St. Vincent and the Grenadines	781.4864
Grenada	742.8435
Saint Kitts and Nevis	645.6431
Dominica	577.4574
British Virgin Islands	557.0067
Turks and Caicos Islands	375.0477
Sao Tome and Principe	343.5461
Anguilla	239.7350
Montserrat	154.5870

tsibble for better difference and lag handling

In [91]:

```
library(tsibble)
```

In [93]:

```
data %>% group_by(country) %>% summarize (mean_rgdpe =  
mean(difference(rgdpe)/lag(rgdpe),na.rm=T))
```

A tibble: 183 × 2

country	mean_rgdpe
<chr>	<dbl>
Albania	0.03742005
Algeria	0.03912011
Angola	0.04996736
Anguilla	0.04226259
Antigua and Barbuda	0.04142267
Argentina	0.04649902
Armenia	0.02767254
Aruba	0.04927572
Australia	0.03509048
Austria	0.03732890
Azerbaijan	0.05705263
Bahamas	0.03438252
Bahrain	0.07139134
Bangladesh	0.04003547
Barbados	0.01718730
Belarus	0.01351257
Belgium	0.03064817
Belize	0.03513737
Benin	0.04176519
Bermuda	0.03109301
Bhutan	0.06091008

country	mean_rgdpe
<chr>	<dbl>
Bolivia (Plurinational State of)	0.04528743
Bosnia and Herzegovina	0.07682175
Botswana	0.09080180
Brazil	0.05367021
British Virgin Islands	0.06365418
Brunei Darussalam	0.02656851
Bulgaria	0.03169538
Burkina Faso	0.04107863
Burundi	0.02721688
...	...
Sri Lanka	0.037836317
St. Vincent and the Grenadines	0.034000051
State of Palestine	0.065843900
Sudan	0.051094993
Suriname	0.035247091
Sweden	0.029678769
Switzerland	0.031914166
Syrian Arab Republic	0.048713741
Taiwan	0.069763263
Tajikistan	0.007469562
Thailand	0.060682198
Togo	0.042712651
Trinidad and Tobago	0.043079863
Tunisia	0.051077114
Turkey	0.053443306
Turkmenistan	0.053441898
Turks and Caicos Islands	0.087217872

country	mean_rgdpe
<chr>	<dbl>
U.R. of Tanzania: Mainland	0.044945360
Uganda	0.045597549
Ukraine	0.001585155
United Arab Emirates	0.053647249
United Kingdom	0.027225041
United States	0.031806644
Uruguay	0.025239841
Uzbekistan	0.041988493
Venezuela (Bolivarian Republic of)	0.004492255
Viet Nam	0.063921024
Yemen	0.077832071
Zambia	0.037444337
Zimbabwe	0.038836928

In [97]:

```
data %>% group_by(country) %>% summarize (mean_rgdpe =
mean(difference(rgdpe)/lag(rgdpe),na.rm=T)) %>% arrange(
  desc(mean_rgdpe))
```

A tibble: 183 × 2

country	mean_rgdpe
<chr>	<dbl>
Equatorial Guinea	0.10660138
Botswana	0.09080180
Maldives	0.08727755
Turks and Caicos Islands	0.08721787
Singapore	0.08477236
Qatar	0.08361043

country	mean_rgdpe
<chr>	<dbl>
China, Macao SAR	0.08070265
Yemen	0.07783207
Bosnia and Herzegovina	0.07682175
Mongolia	0.07280215
Republic of Korea	0.07197053
Kuwait	0.07176555
Bahrain	0.07139134
Lao People's DR	0.07086276
Iraq	0.07066376
Jordan	0.07064408
Taiwan	0.06976326
Oman	0.06922995
State of Palestine	0.06584390
Congo	0.06565977
Egypt	0.06550899
Saudi Arabia	0.06484644
Lebanon	0.06407109
Viet Nam	0.06392102
British Virgin Islands	0.06365418
China, Hong Kong SAR	0.06341565
Malaysia	0.06325218
Panama	0.06236242
Indonesia	0.06233810
Gabon	0.06114760
...	...
Burundi	0.0272168781
Madagascar	0.0272023931

country	mean_rgdpe
<chr>	<dbl>
Brunei Darussalam	0.0265685060
Jamaica	0.0263587061
Lithuania	0.0258561682
Niger	0.0252682066
Uruguay	0.0252398405
Dominica	0.0249321646
D.R. of the Congo	0.0239542155
Slovenia	0.0239323423
Russian Federation	0.0238408765
Haiti	0.0229860385
Croatia	0.0221441050
Slovakia	0.0216216836
Czech Republic	0.0201125548
Sint Maarten (Dutch part)	0.0198706408
Guinea	0.0198515202
Barbados	0.0171873027
Central African Republic	0.0161552329
Republic of Moldova	0.0142694066
Latvia	0.0140770558
Belarus	0.0135125675
Georgia	0.0132845098
Serbia	0.0080217435
Tajikistan	0.0074695616
Venezuela (Bolivarian Republic of)	0.0044922550
Kyrgyzstan	0.0024686603
Ukraine	0.0015851546

country	mean_rgdpe
<chr>	<dbl>

Montserrat	0.0001771679
Curaçao	-0.0031398217

make custom fucntion to mutate as growth rates

Make a function to get growth rates, depends on difference and lag of tsibble

In []:

In [99]:

```
growth <- function(x) {
  gr= difference(x)/lag(x)
  return(gr)
}
```

In [105]:

```
diffff=Greece[,5:47] %>% mutate_all(growth)
diffff
```

A tibble: 70 × 43								
rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda	c
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<
NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA
-0.02088155	-0.02135129	0.011358056	0.0109119645	-0.0041353467	0.026495548	0.01633322	-0.033611182	-0.016
0.12088918	0.13629694	0.010842099	0.0103960870	-0.0041353467	0.026495483	0.02900052	0.084362352	0.121
0.02021832	0.02100149	0.009762874	0.0093170982	-0.0041353467	0.026495506	0.10858119	0.032357211	0.017
0.07497393	0.06898665	0.009137482	0.0086919068	-0.0041353467	0.026495513	0.01832066	0.051487897	0.071

rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda	c
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
0.08849928	0.08886220	0.008219722	0.0077742737	-0.0041353467	0.030678650	0.06429220	0.101498023	0.084
0.07390110	0.07776434	0.008119222	0.0054233867	-0.0041353467	0.029287139	0.05712359	0.072300596	0.073
0.05423706	0.04934481	0.009499617	0.0074916752	-0.0041353467	0.029287028	0.03250445	0.062017016	0.055
0.03657728	0.03991230	0.010403906	0.0026769110	-0.0041353467	0.029287107	0.01477447	0.038760370	0.032
0.01723188	0.01954902	0.008384848	0.0044497620	-0.0041353467	0.029287055	0.02265810	0.046339215	0.020
0.13981141	0.13794624	0.008483475	0.0039890860	-0.0044444947	0.005974149	0.07953799	0.149201355	0.136
-0.01380707	-0.01658238	0.005975475	-0.0100059748	-0.0044444947	0.005974166	0.04927685	0.004265834	-0.017
0.13085294	0.12901808	0.003715818	-0.0140011790	-0.0044444947	0.005974151	0.04804511	0.134007891	0.129
0.07339980	0.07218784	0.003632783	-0.0129940832	-0.0044444947	0.005974164	0.09607835	0.113996666	0.072
0.10851348	0.10831365	0.004688793	-0.0069951441	-0.0044444947	0.005974085	0.07507622	0.117600725	0.107
0.08269616	0.07839504	0.007405355	-0.0090127644	-0.0044444947	0.005974149	0.07085195	0.043477195	0.083
0.05672173	0.05082103	0.011933369	-0.0119816084	-0.0044444947	0.005974236	0.08038929	0.055873093	0.057
0.06395094	0.06631637	0.002790527	-0.0120010825	-0.0044444947	0.005974110	0.06979632	0.085730271	0.064
0.11683534	0.11359482	0.003660960	-0.0030208752	-0.0044444947	0.005974123	0.06153909	0.129517044	0.117
0.09009128	0.09273207	0.002284510	-0.0009890405	-0.0194833794	0.005974155	0.07837800	0.087413433	0.094
0.07681619	0.07871445	0.006152428	0.0048033122	0.0004584012	0.009094333	0.04899395	0.078574938	0.079
0.09882808	0.10013321	0.006612578	0.0050885060	0.0007090903	0.009094333	0.05499924	0.105318778	0.098
0.07670372	0.07351272	0.007499105	0.0129717268	0.0006911826	0.009094380	0.05472841	0.098594163	0.075
-0.07446253	-0.06121894	0.008928302	0.0062291762	0.0006724373	0.009094354	0.01468486	-0.087173269	-0.058
0.04700602	0.05835801	0.010633300	0.0021950362	0.0006529210	0.009094361	0.07974634	0.055972105	0.057
0.06685915	0.06469960	0.012531943	0.0111827677	0.0006327029	0.009094284	0.05532732	0.060837287	0.059
0.02976791	0.01902972	0.014016469	0.0066238781	0.0006118537	0.009094336	0.08748173	0.019385063	0.027
0.07315282	0.07087240	0.014451682	0.0053771066	0.0007853014	0.009094291	0.06787278	0.059324212	0.070
0.02303518	0.02143503	0.013528776	0.0119829800	0.0006823909	0.009094359	0.05685502	0.013815551	0.022
...
0.024717860	0.0110461254	0.0069191529	0.010159342	1.099378e-03	0.010241818	0.052053255	0.042431403	0.022
0.066717701	0.0627966101	0.0087145580	-0.020861831	6.004618e-04	0.010746113	0.042166526	0.067254982	0.066

rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda	c
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<
0.028227848	0.0169956620	0.0101917508	0.016941928	-1.036587e-05	0.007591390	0.030811586	0.008482341	0.028
0.013261454	0.0237724599	0.0108998491	0.013310841	-3.432030e-04	0.007222259	0.015345071	0.009679828	0.012
0.055408282	0.0540306096	0.0105502138	0.024305786	-9.208667e-04	0.007222288	0.033801244	0.024455714	0.047
0.050039721	0.0362081595	0.0094461702	0.013782691	2.404875e-04	0.007222400	0.060001810	0.059980754	0.045
0.041622308	0.0322877460	0.0080627217	-0.002087803	-6.186609e-04	0.007222320	0.039326254	0.041624737	0.035
0.084466162	0.0920611523	0.0068422300	-0.002049064	-6.901086e-04	0.007222320	0.084764457	0.061849929	0.082
0.067312023	0.0589752275	0.0058557212	0.044243478	2.322912e-04	0.007222306	0.078495633	0.090383769	0.062
0.019311728	0.0212028495	0.0052669428	0.001750291	-1.698899e-03	0.007222363	0.028223507	0.014676312	0.022
0.024468759	0.0505330188	0.0049151697	0.004095802	1.323625e-03	0.007222312	0.042815481	0.048450410	0.028
0.043953291	0.0380880129	0.0047241029	0.003127435	-3.087815e-03	0.007530964	0.062935963	0.045635616	0.049
0.049544029	0.0409564767	0.0042972908	0.025106530	-3.767162e-03	0.007530857	0.062365448	0.050475064	0.054
0.036802841	0.0058581636	0.0032711503	0.014736200	-8.295563e-04	0.007530935	0.001660261	0.048116568	0.038
0.065980549	0.0465290326	0.0014357934	0.023050383	-4.268220e-03	0.007530932	0.040515500	0.041323403	0.066
-0.006457392	0.0213941557	-0.0009079668	0.005422557	2.577953e-02	0.007530931	0.048084149	0.009590396	0.011
0.091444240	0.0781034852	-0.0035246091	0.011546661	-5.103662e-03	0.007530931	0.051285153	0.106133748	0.083
0.029114995	0.0006475635	-0.0057996136	0.005028420	-6.750835e-03	0.007530844	0.026147183	0.043491613	0.025
0.028014555	0.0296492236	-0.0071984193	0.002825720	-2.239964e-03	0.007531002	0.072216281	0.035799079	0.034
-0.025278504	-0.0324570849	-0.0073401025	-0.015525367	-1.189236e-02	0.007530981	0.004337048	-0.054748167	-0.030
-0.086766196	-0.0754791353	-0.0065364743	-0.033194896	-2.961777e-02	0.007530868	-0.089422818	-0.102244105	-0.084
-0.095130356	-0.0936866814	-0.0053783939	-0.072420694	8.976916e-03	0.007101858	-0.048933686	-0.103739603	-0.088

rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda	c
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<
-0.048335085	-0.0424482273	-0.0044282621	-0.062215794	8.673413e-03	0.007101911	-0.057826551	-0.066867103	-0.05
-0.014835443	0.0012316436	-0.0037681596	-0.022797875	1.871080e-03	0.007101770	-0.054727684	-0.035633251	-0.015
-0.003240698	-0.0123059410	-0.0036352125	0.012339798	-1.861787e-02	0.007101834	-0.011637948	-0.010563364	-0.00
0.002367191	0.0081417017	-0.0038972267	0.009943871	5.076408e-03	0.007101938	-0.008158081	-0.004464245	0.000
-0.014858479	-0.0235505855	-0.0041806797	0.004642269	-5.169721e-04	0.007101843	-0.009933601	-0.011112106	-0.015
0.018594409	0.0211060061	-0.0043084506	0.013061245	7.463203e-03	0.007101862	0.023630972	0.025063515	0.024
0.006892370	0.0002400811	-0.0044660791	0.014563890	-3.962214e-04	0.007101837	0.007983781	0.012435981	0.006
0.014895311	0.0177658642	-0.0046369378	0.017702561	-3.897165e-03	0.007101918	0.018144728	0.009729195	0.014

A data.frame: 70 × 44

Greece\$ year	rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1950	NA	NA	NA	NA	NA	NA	NA	NA
1951	NA	NA	NA	NA	NA	NA	NA	NA
1952	-0.02088155	-0.02135129	0.011358056	0.0109119645	-0.0041353467	0.026495548	0.01633322	-0.033611
1953	0.12088918	0.13629694	0.010842099	0.0103960870	-0.0041353467	0.026495483	0.02900052	0.0843623
1954	0.02021832	0.02100149	0.009762874	0.0093170982	-0.0041353467	0.026495506	0.10858119	0.0323572
1955	0.07497393	0.06898665	0.009137482	0.0086919068	-0.0041353467	0.026495513	0.01832066	0.0514878
1956	0.08849928	0.08886220	0.008219722	0.0077742737	-0.0041353467	0.030678650	0.06429220	0.1014980
1957	0.07390110	0.07776434	0.008119222	0.0054233867	-0.0041353467	0.029287139	0.05712359	0.0723005
1958	0.05423706	0.04934481	0.009499617	0.0074916752	-0.0041353467	0.029287028	0.03250445	0.0620170
1959	0.03657728	0.03991230	0.010403906	0.0026769110	-0.0041353467	0.029287107	0.01477447	0.0387603
1960	0.01723188	0.01954902	0.008384848	0.0044497620	-0.0041353467	0.029287055	0.02265810	0.0463392

Greece\$ year	rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1961	0.13981141	0.13794624	0.008483475	0.0039890860	-0.00444444947	0.005974149	0.07953799	0.1492013
1962	-0.01380707	-0.01658238	0.005975475	-0.0100059748	-0.00444444947	0.005974166	0.04927685	0.0042658
1963	0.13085294	0.12901808	0.003715818	-0.0140011790	-0.00444444947	0.005974151	0.04804511	0.1340078
1964	0.07339980	0.07218784	0.003632783	-0.0129940832	-0.00444444947	0.005974164	0.09607835	0.1139966
1965	0.10851348	0.10831365	0.004688793	-0.0069951441	-0.00444444947	0.005974085	0.07507622	0.1176007
1966	0.08269616	0.07839504	0.007405355	-0.0090127644	-0.00444444947	0.005974149	0.07085195	0.0434771
1967	0.05672173	0.05082103	0.011933369	-0.0119816084	-0.00444444947	0.005974236	0.08038929	0.0558730
1968	0.06395094	0.06631637	0.002790527	-0.0120010825	-0.00444444947	0.005974110	0.06979632	0.0857302
1969	0.11683534	0.11359482	0.003660960	-0.0030208752	-0.00444444947	0.005974123	0.06153909	0.1295170
1970	0.09009128	0.09273207	0.002284510	-0.0009890405	-0.0194833794	0.005974155	0.07837800	0.0874134
1971	0.07681619	0.07871445	0.006152428	0.0048033122	0.0004584012	0.009094333	0.04899395	0.0785749
1972	0.09882808	0.10013321	0.006612578	0.0050885060	0.0007090903	0.009094333	0.05499924	0.1053187
1973	0.07670372	0.07351272	0.007499105	0.0129717268	0.0006911826	0.009094380	0.05472841	0.0985941
1974	-0.07446253	-0.06121894	0.008928302	0.0062291762	0.0006724373	0.009094354	0.01468486	-0.0871732
1975	0.04700602	0.05835801	0.010633300	0.0021950362	0.0006529210	0.009094361	0.07974634	0.0559721
1976	0.06685915	0.06469960	0.012531943	0.0111827677	0.0006327029	0.009094284	0.05532732	0.0608372
1977	0.02976791	0.01902972	0.014016469	0.0066238781	0.0006118537	0.009094336	0.08748173	0.0193850
1978	0.07315282	0.07087240	0.014451682	0.0053771066	0.0007853014	0.009094291	0.06787278	0.0593242
1979	0.02303518	0.02143503	0.013528776	0.0119829800	0.0006823909	0.009094359	0.05685502	0.0138155
...
1990	0.024717860	0.0110461254	0.0069191529	0.010159342	1.099378e-03	0.010241818	0.052053255	0.0424314
1991	0.066717701	0.0627966101	0.0087145580	-0.020861831	6.004618e-04	0.010746113	0.042166526	0.0672549
1992	0.028227848	0.0169956620	0.0101917508	0.016941928	-1.036587e-05	0.007591390	0.030811586	0.0084823
1993	0.013261454	0.0237724599	0.0108998491	0.013310841	-3.432030e-04	0.007222259	0.015345071	0.0096798

Greece\$ year	rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1994	0.055408282	0.0540306096	0.0105502138	0.024305786	-9.208667e-04	0.007222288	0.033801244	0.0244557
1995	0.050039721	0.0362081595	0.0094461702	0.013782691	2.404875e-04	0.007222400	0.060001810	0.0599807
1996	0.041622308	0.0322877460	0.0080627217	-0.002087803	-6.186609e-04	0.007222320	0.039326254	0.0416247
1997	0.084466162	0.0920611523	0.0068422300	-0.002049064	-6.901086e-04	0.007222320	0.084764457	0.0618499
1998	0.067312023	0.0589752275	0.0058557212	0.044243478	2.322912e-04	0.007222306	0.078495633	0.0903837
1999	0.019311728	0.0212028495	0.0052669428	0.001750291	-1.698899e-03	0.007222363	0.028223507	0.0146763
2000	0.024468759	0.0505330188	0.0049151697	0.004095802	1.323625e-03	0.007222312	0.042815481	0.0484504
2001	0.043953291	0.0380880129	0.0047241029	0.003127435	-3.087815e-03	0.007530964	0.062935963	0.0456356
2002	0.049544029	0.0409564767	0.0042972908	0.025106530	-3.767162e-03	0.007530857	0.062365448	0.0504750
2003	0.036802841	0.0058581636	0.0032711503	0.014736200	-8.295563e-04	0.007530935	0.001660261	0.0481165
2004	0.065980549	0.0465290326	0.0014357934	0.023050383	-4.268220e-03	0.007530932	0.040515500	0.0413234
2005	-0.006457392	0.0213941557	-0.0009079668	0.005422557	2.577953e-02	0.007530931	0.048084149	0.0095903
2006	0.091444240	0.0781034852	-0.0035246091	0.011546661	-5.103662e-03	0.007530931	0.051285153	0.1061337
2007	0.029114995	0.0006475635	-0.0057996136	0.005028420	-6.750835e-03	0.007530844	0.026147183	0.0434916
2008	0.028014555	0.0296492236	-0.0071984193	0.002825720	-2.239964e-03	0.007531002	0.072216281	0.0357990
2009	-0.025278504	-0.0324570849	-0.0073401025	-0.015525367	-1.189236e-02	0.007530981	0.004337048	-0.054748
2010	-0.086766196	-0.0754791353	-0.0065364743	-0.033194896	-2.961777e-02	0.007530868	-0.089422818	-0.102244
2011	-0.095130356	-0.0936866814	-0.0053783939	-0.072420694	8.976916e-03	0.007101858	-0.048933686	-0.103739
2012	-0.048335085	-0.0424482273	-0.0044282621	-0.062215794	8.673413e-03	0.007101911	-0.057826551	-0.066867
2013	-0.014835443	0.0012316436	-0.0037681596	-0.022797875	1.871080e-03	0.007101770	-0.054727684	-0.035633

Greece\$ year	rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
2014	-0.003240698	-0.0123059410	-0.0036352125	0.012339798	-1.861787e-02	0.007101834	-0.011637948	-0.0105633
2015	0.002367191	0.0081417017	-0.0038972267	0.009943871	5.076408e-03	0.007101938	-0.008158081	-0.0044642
2016	-0.014858479	-0.0235505855	-0.0041806797	0.004642269	-5.169721e-04	0.007101843	-0.009933601	-0.011112
2017	0.018594409	0.0211060061	-0.0043084506	0.013061245	7.463203e-03	0.007101862	0.023630972	0.0250635
2018	0.006892370	0.0002400811	-0.0044660791	0.014563890	-3.962214e-04	0.007101837	0.007983781	0.0124359
2019	0.014895311	0.0177658642	-0.0046369378	0.017702561	-3.897165e-03	0.007101918	0.018144728	0.0097291

In [107]:

```
Greece_rate = cbind(Greece$year,difff)
Greece_rate
```

A data.frame: 70 × 44

Greece\$ year	rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1950	NA	NA	NA	NA	NA	NA	NA	NA
1951	NA	NA	NA	NA	NA	NA	NA	NA
1952	-0.02088155	-0.02135129	0.011358056	0.0109119645	-0.0041353467	0.026495548	0.01633322	-0.033611
1953	0.12088918	0.13629694	0.010842099	0.0103960870	-0.0041353467	0.026495483	0.02900052	0.0843623
1954	0.02021832	0.02100149	0.009762874	0.0093170982	-0.0041353467	0.026495506	0.10858119	0.0323572
1955	0.07497393	0.06898665	0.009137482	0.0086919068	-0.0041353467	0.026495513	0.01832066	0.0514878
1956	0.08849928	0.08886220	0.008219722	0.0077742737	-0.0041353467	0.030678650	0.06429220	0.1014980
1957	0.07390110	0.07776434	0.008119222	0.0054233867	-0.0041353467	0.029287139	0.05712359	0.0723005
1958	0.05423706	0.04934481	0.009499617	0.0074916752	-0.0041353467	0.029287028	0.03250445	0.0620170
1959	0.03657728	0.03991230	0.010403906	0.0026769110	-0.0041353467	0.029287107	0.01477447	0.0387603
1960	0.01723188	0.01954902	0.008384848	0.0044497620	-0.0041353467	0.029287055	0.02265810	0.0463392

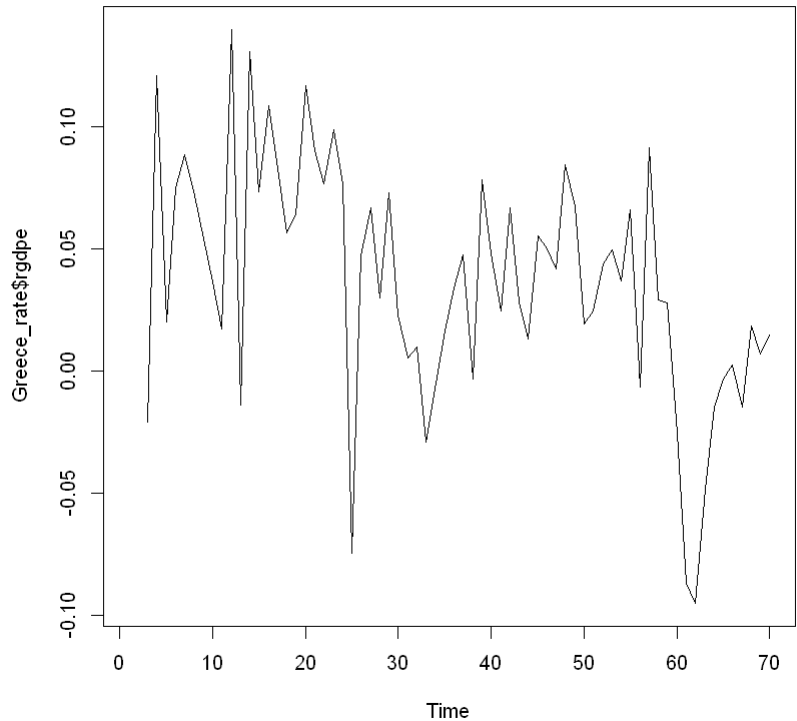
Greece\$ year	rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1961	0.13981141	0.13794624	0.008483475	0.0039890860	-0.00444444947	0.005974149	0.07953799	0.1492013
1962	-0.01380707	-0.01658238	0.005975475	-0.0100059748	-0.00444444947	0.005974166	0.04927685	0.0042658
1963	0.13085294	0.12901808	0.003715818	-0.0140011790	-0.00444444947	0.005974151	0.04804511	0.1340078
1964	0.07339980	0.07218784	0.003632783	-0.0129940832	-0.00444444947	0.005974164	0.09607835	0.1139966
1965	0.10851348	0.10831365	0.004688793	-0.0069951441	-0.00444444947	0.005974085	0.07507622	0.1176007
1966	0.08269616	0.07839504	0.007405355	-0.0090127644	-0.00444444947	0.005974149	0.07085195	0.0434771
1967	0.05672173	0.05082103	0.011933369	-0.0119816084	-0.00444444947	0.005974236	0.08038929	0.0558730
1968	0.06395094	0.06631637	0.002790527	-0.0120010825	-0.00444444947	0.005974110	0.06979632	0.0857302
1969	0.11683534	0.11359482	0.003660960	-0.0030208752	-0.00444444947	0.005974123	0.06153909	0.1295170
1970	0.09009128	0.09273207	0.002284510	-0.0009890405	-0.0194833794	0.005974155	0.07837800	0.0874134
1971	0.07681619	0.07871445	0.006152428	0.0048033122	0.0004584012	0.009094333	0.04899395	0.0785749
1972	0.09882808	0.10013321	0.006612578	0.0050885060	0.0007090903	0.009094333	0.05499924	0.1053187
1973	0.07670372	0.07351272	0.007499105	0.0129717268	0.0006911826	0.009094380	0.05472841	0.0985941
1974	-0.07446253	-0.06121894	0.008928302	0.0062291762	0.0006724373	0.009094354	0.01468486	-0.0871732
1975	0.04700602	0.05835801	0.010633300	0.0021950362	0.0006529210	0.009094361	0.07974634	0.0559721
1976	0.06685915	0.06469960	0.012531943	0.0111827677	0.0006327029	0.009094284	0.05532732	0.0608372
1977	0.02976791	0.01902972	0.014016469	0.0066238781	0.0006118537	0.009094336	0.08748173	0.0193850
1978	0.07315282	0.07087240	0.014451682	0.0053771066	0.0007853014	0.009094291	0.06787278	0.0593242
1979	0.02303518	0.02143503	0.013528776	0.0119829800	0.0006823909	0.009094359	0.05685502	0.0138155
...
1990	0.024717860	0.0110461254	0.0069191529	0.010159342	1.099378e-03	0.010241818	0.052053255	0.0424314
1991	0.066717701	0.0627966101	0.0087145580	-0.020861831	6.004618e-04	0.010746113	0.042166526	0.0672549
1992	0.028227848	0.0169956620	0.0101917508	0.016941928	-1.036587e-05	0.007591390	0.030811586	0.0084823
1993	0.013261454	0.0237724599	0.0108998491	0.013310841	-3.432030e-04	0.007222259	0.015345071	0.0096798

Greece\$ year	rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1994	0.055408282	0.0540306096	0.0105502138	0.024305786	-9.208667e-04	0.007222288	0.033801244	0.0244557
1995	0.050039721	0.0362081595	0.0094461702	0.013782691	2.404875e-04	0.007222400	0.060001810	0.0599807
1996	0.041622308	0.0322877460	0.0080627217	-0.002087803	-6.186609e-04	0.007222320	0.039326254	0.0416247
1997	0.084466162	0.0920611523	0.0068422300	-0.002049064	-6.901086e-04	0.007222320	0.084764457	0.0618499
1998	0.067312023	0.0589752275	0.0058557212	0.044243478	2.322912e-04	0.007222306	0.078495633	0.0903837
1999	0.019311728	0.0212028495	0.0052669428	0.001750291	-1.698899e-03	0.007222363	0.028223507	0.0146763
2000	0.024468759	0.0505330188	0.0049151697	0.004095802	1.323625e-03	0.007222312	0.042815481	0.0484504
2001	0.043953291	0.0380880129	0.0047241029	0.003127435	-3.087815e-03	0.007530964	0.062935963	0.0456356
2002	0.049544029	0.0409564767	0.0042972908	0.025106530	-3.767162e-03	0.007530857	0.062365448	0.0504750
2003	0.036802841	0.0058581636	0.0032711503	0.014736200	-8.295563e-04	0.007530935	0.001660261	0.0481165
2004	0.065980549	0.0465290326	0.0014357934	0.023050383	-4.268220e-03	0.007530932	0.040515500	0.0413234
2005	-0.006457392	0.0213941557	-0.0009079668	0.005422557	2.577953e-02	0.007530931	0.048084149	0.0095903
2006	0.091444240	0.0781034852	-0.0035246091	0.011546661	-5.103662e-03	0.007530931	0.051285153	0.1061337
2007	0.029114995	0.0006475635	-0.0057996136	0.005028420	-6.750835e-03	0.007530844	0.026147183	0.0434916
2008	0.028014555	0.0296492236	-0.0071984193	0.002825720	-2.239964e-03	0.007531002	0.072216281	0.0357990
2009	-0.025278504	-0.0324570849	-0.0073401025	-0.015525367	-1.189236e-02	0.007530981	0.004337048	-0.054748
2010	-0.086766196	-0.0754791353	-0.0065364743	-0.033194896	-2.961777e-02	0.007530868	-0.089422818	-0.102244
2011	-0.095130356	-0.0936866814	-0.0053783939	-0.072420694	8.976916e-03	0.007101858	-0.048933686	-0.103739
2012	-0.048335085	-0.0424482273	-0.0044282621	-0.062215794	8.673413e-03	0.007101911	-0.057826551	-0.066867
2013	-0.014835443	0.0012316436	-0.0037681596	-0.022797875	1.871080e-03	0.007101770	-0.054727684	-0.035633

Greece\$ year	rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
2014	-0.003240698	-0.0123059410	-0.0036352125	0.012339798	-1.861787e-02	0.007101834	-0.011637948	-0.010563
2015	0.002367191	0.0081417017	-0.0038972267	0.009943871	5.076408e-03	0.007101938	-0.008158081	-0.004464
2016	-0.014858479	-0.0235505855	-0.0041806797	0.004642269	-5.169721e-04	0.007101843	-0.009933601	-0.011112
2017	0.018594409	0.0211060061	-0.0043084506	0.013061245	7.463203e-03	0.007101862	0.023630972	0.0250635
2018	0.006892370	0.0002400811	-0.0044660791	0.014563890	-3.962214e-04	0.007101837	0.007983781	0.0124359
2019	0.014895311	0.0177658642	-0.0046369378	0.017702561	-3.897165e-03	0.007101918	0.018144728	0.0097291

In [110]:

```
plot.ts(Greece_rate$rgdpe)
```



In [116]:

```
Greece_diff= Greece[,5:47]  %>% mutate_all(difference)
Greece_diff=cbind(Greece$year,Greece_diff)
```

Greece_diff

A data.frame: 70 × 44

Greece\$ year	rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda	cgdp
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1950	NA	NA	NA	NA	NA	NA	NA	NA	NA
1951	NA	NA	NA	NA	NA	NA	NA	NA	NA
1952	-581.8945	-606.0020	0.08557178	0.036829233	-9.5632015	0.04056430	372.3770	-949.5625	-454.199
1953	3298.4062	3785.8457	0.08261233	0.035470963	-9.5236543	0.04163897	671.9746	2303.2461	3283.76
1954	618.3359	662.8555	0.07519562	0.032119989	-9.4842707	0.04274225	2588.9121	957.9375	534.5879
1955	2339.2832	2223.1055	0.07106582	0.030243874	-9.4450500	0.04387474	484.2520	1573.6250	2210.517
1956	2968.3164	3061.1484	0.06451218	0.027286053	-9.4059914	0.05214775	1730.5059	3261.8047	2778.660
1957	2698.0469	2916.8945	0.06424720	0.019182920	-9.3670944	0.05130970	1636.4062	2559.3281	2630.530
1958	2126.4688	1994.8281	0.07578055	0.026642323	-9.3283582	0.05281222	984.3379	2354.0273	2130.190
1959	1511.8633	1693.1250	0.08378268	0.009591103	-9.2897822	0.05435908	461.9609	1562.5000	1311.35
1960	738.3047	862.3906	0.06822571	0.015985727	-9.2513657	0.05595100	718.9297	1940.4219	868.7422
1961	6093.4805	6204.3594	0.06960700	0.014394522	-9.9018568	0.01174748	2580.8809	6537.2148	5821.620
1962	-685.8945	-848.7031	0.04944477	-0.036250353	-9.8578481	0.01181769	1726.1328	214.7930	-841.816
1963	6410.6367	6493.7773	0.03093070	-0.050216913	-9.8140349	0.01188827	1765.9180	6776.3398	6181.937
1964	4066.4805	4102.1523	0.03035187	-0.045952320	-9.7704165	0.01195931	3701.0664	6536.9180	3877.320
1965	6453.1094	6599.3594	0.03931715	-0.024416208	-9.7269919	0.01203060	3169.8984	7512.3320	6226.78
1966	5451.4453	5293.8281	0.06238762	-0.031238556	-9.6837603	0.01210260	3216.1328	3103.9375	5316.007
1967	4048.3906	3700.8594	0.10127910	-0.041154385	-9.6407209	0.01217508	3907.5977	4162.3359	3967.773
1968	4823.2578	5074.6797	0.02396596	-0.040727377	-9.5978728	0.01224756	3665.4258	6743.4219	4750.312
1969	9375.3906	9268.9922	0.03152927	-0.010128736	-9.5552151	0.01232076	3457.3555	11061.0156	9129.007
1970	8073.9688	8426.1875	0.01974690	-0.003306150	-41.7011314	0.01239443	4674.3711	8432.1641	8209.703
1971	7504.4688	7815.7266	0.05330200	0.016040564	0.9620203	0.01898050	3150.9570	8242.1328	7543.453
1972	10396.5469	10725.0547	0.05764100	0.017074585	1.4888093	0.01915312	3710.4766	11915.4844	10145.07
1973	8866.5547	8662.2188	0.06580100	0.043748379	1.4522392	0.01932740	3895.2734	12329.4766	8520.843

Greece\$ year	rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda	cgdp
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1974	-9267.7109	-7743.8984	0.07892900	0.021281004	1.4138301	0.01950312	1102.3906	-11976.0625	-7130.13
1975	5414.7969	6930.0859	0.09484100	0.007545710	1.3737195	0.01968050	6074.4609	7019.2500	6549.55
1976	8063.7812	8131.5312	0.11296400	0.038526535	1.3320505	0.01985931	4550.4922	8056.4062	7243.570
1977	3830.3047	2546.4219	0.12792900	0.023075581	1.2889709	0.02004004	7593.1719	2723.2500	3529.703
1978	9692.9375	9664.1094	0.13375000	0.018856287	1.6553794	0.02022219	6406.5391	8495.5312	9230.040
1979	3275.5000	3130.0156	0.12701800	0.042247534	1.4395785	0.02040625	5730.8125	2095.8281	3151.290
...
1990	4374.0312	1983.5156	0.070269	0.040857792	2.31892142	0.02564836	7333.7969	8161.641	4024.640
1991	12098.0781	11400.7344	0.089115	-0.084752321	1.26794892	0.02718687	6250.0938	13485.344	11913.7
1992	5460.1250	3279.3281	0.105129	0.067391634	-0.02190194	0.01941204	4759.5938	1815.188	5530.540
1993	2637.5781	4664.8750	0.113579	0.053844929	-0.72514301	0.01860833	2443.4531	2089.016	2466.937
1994	11166.3281	10854.4844	0.111134	0.099630356	-1.94500299	0.01874280	5464.8906	5328.906	9532.17
1995	10643.1719	7667.0625	0.100554	0.057868958	0.50747642	0.01887846	10028.8281	13389.453	9609.093
1996	9295.8281	7084.4688	0.086638	-0.008886814	-1.30581150	0.01901460	6967.4688	9849.188	7707.968
1997	19649.6562	20851.9531	0.074116	-0.008703709	-1.45571544	0.01915193	15608.3906	15244.016	18701.87
1998	16981.6875	14587.7031	0.063864	0.187545776	0.48965711	0.01929021	15679.2500	23654.500	15212.00
1999	5199.9688	5553.8906	0.057779	0.007747650	-3.58201612	0.01942968	6080.0781	4188.125	5782.234
2000	6715.8125	13517.3125	0.054204	0.018161774	2.78603434	0.01956987	9483.8906	14029.031	7575.968
2001	12358.8125	10703.1875	0.052353	0.013924599	-6.50799683	0.02055359	14537.5781	13854.219	13560.90
2002	14543.1250	11947.6250	0.047848	0.112133980	-7.91529772	0.02070808	15312.4375	16022.688	15694.84
2003	11338.3125	1778.9062	0.036579	0.067469120	-1.73643986	0.02086425	433.0625	16044.969	11777.3
2004	21075.5625	14211.9062	0.016108	0.107090473	-8.92689039	0.02102137	10585.6094	14442.750	20907.3
2005	-2198.7188	6838.7188	-0.010201	0.025773525	53.68719874	0.02117968	13072.0938	3490.406	3861.28
2006	30935.3750	25500.1875	-0.039563	0.055179119	-10.90264275	0.02133918	14612.7188	38997.625	28455.70
2007	10750.2188	227.9375	-0.064870	0.024307251	-14.34779620	0.02149963	7832.2188	17676.562	9235.123
2008	10645.0625	10443.0625	-0.080049	0.013728142	-4.72853947	0.02166200	22197.5312	15182.844	13072.12

Greece\$ year	rgdpe	rgdpo	pop	emp	avh	hc	ccon	cda	cgdp
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
2009	-9874.5000	-11771.0000	-0.081037	-0.075639725	-25.04840036	0.02182508	1429.3750	-24050.625	-11861.6
2010	-33036.5625	-26485.0625	-0.071635	-0.159214973	-61.64083972	0.02198911	-29599.1875	-42456.344	-31799.4
2011	-33078.4688	-30392.6562	-0.058558	-0.335825920	18.12951800	0.02089262	-14748.7812	-38672.938	-30817.3
2012	-15208.0938	-12480.4062	-0.047954	-0.267610550	17.67381711	0.02104115	-16576.2500	-22341.344	-17504.9
2013	-4442.1875	346.7500	-0.040625	-0.091960192	3.84576997	0.02119017	-14780.7656	-11109.531	-4702.50
2014	-955.9688	-3468.8125	-0.039044	0.048640490	-38.33828231	0.02134085	-2971.1406	-3176.031	-493.406
2015	696.0312	2266.7500	-0.041706	0.039680004	10.25882045	0.02149272	-2058.5000	-1328.062	220.0938
2016	-4379.2188	-6610.1562	-0.044565	0.018708706	-1.05004298	0.02164507	-2486.0625	-3290.969	-4462.21
2017	5398.8750	5784.5000	-0.045735	0.052882195	15.15097577	0.02179885	5855.3281	7340.344	7054.28
2018	2038.4062	67.1875	-0.047204	0.059736252	-0.81036838	0.02195358	2024.9844	3733.406	1881.406
2019	4435.6250	4973.0312	-0.048791	0.073667526	-7.96748527	0.02210975	4638.9219	2957.125	4267.218

In [118]:

```
Greece %>% select (csh_i,year) %>% arrange(desc(csh_i))
```

A tibble: 70 × 2

csh_i	year
<dbl>	<dbl>
0.5091612	1973
0.4705571	1972
0.4397216	1971
0.4298891	1974
0.4231052	1970
0.4216093	1969
0.4136718	1976
0.4099203	1975
0.4053367	1965
0.3749206	1964

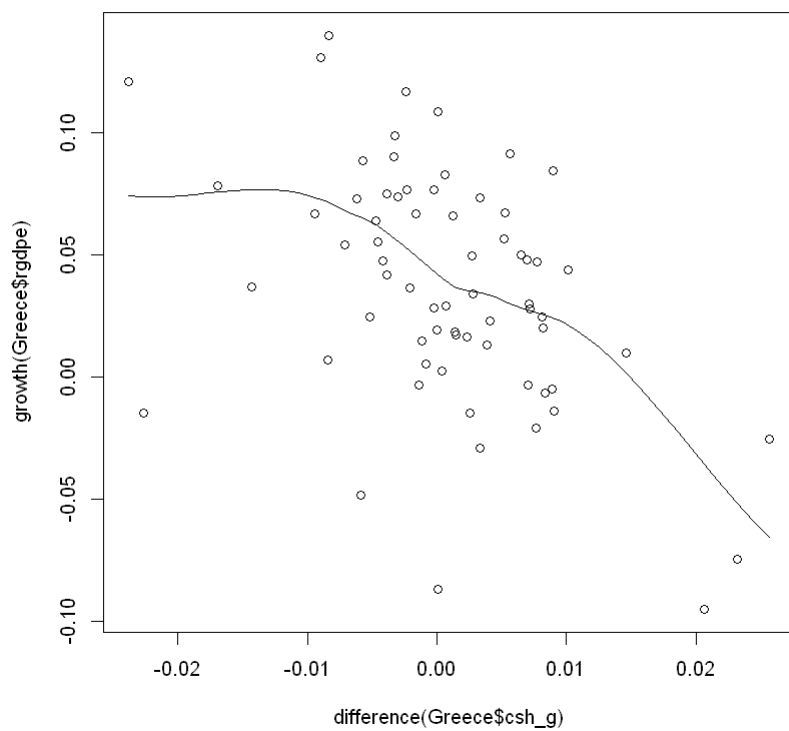
csch_i	year
<dbl>	<dbl>
0.3734561	1968
0.3730841	1966
0.3699302	1977
0.3601460	1978
0.3573026	1967
0.3494774	1963
0.3347074	2007
0.3300208	1980
0.3293078	1979
0.3288548	1986
0.3181261	1961
0.3156390	1985
0.3137035	1982
0.3109345	1991
0.3082411	2006
0.3077087	2008
0.3052385	1981
0.2978515	1988
0.2953874	1983
0.2935536	1992
...	...
0.2701624	1994
0.2686563	1960
0.2685311	1987
0.2650308	2000
0.2595568	1999
0.2574646	1997

csch_i	year
<dbl>	<dbl>

0.2573332	2005
0.2528473	2001
0.2439011	2002
0.2422982	1959
0.2403116	2009
0.2240916	1958
0.2219344	2010
0.2041482	1951
0.2006830	1957
0.1913140	1953
0.1901224	1956
0.1720693	2018
0.1664184	2017
0.1649292	2014
0.1647667	2015
0.1644737	2016
0.1633303	2011
0.1629990	2013
0.1624325	2019
0.1595537	1955
0.1567431	1952
0.1511179	2012
0.1345498	1954
NA	1950

In [151]:

```
scatter.smooth(difference(Greece$csch_g), growth(Greece$rgdpe))
```

In [126]:

```
#check if growth is right
```

```
difference(Greece$rgdpe)/lag(Greece$rgdpe) == growth(Greece$rgdpe)
```

1. <NA>
2. <NA>
3. TRUE
4. TRUE
5. TRUE
6. TRUE
7. TRUE
8. TRUE
9. TRUE
10. TRUE
11. TRUE
12. TRUE
13. TRUE
14. TRUE
15. TRUE
16. TRUE
17. TRUE
18. TRUE
19. TRUE
20. TRUE

21.TRUE
22.TRUE
23.TRUE
24.TRUE
25.TRUE
26.TRUE
27.TRUE
28.TRUE
29.TRUE
30.TRUE
31.TRUE
32.TRUE
33.TRUE
34.TRUE
35.TRUE
36.TRUE
37.TRUE
38.TRUE
39.TRUE
40.TRUE
41.TRUE
42.TRUE
43.TRUE
44.TRUE
45.TRUE
46.TRUE
47.TRUE
48.TRUE
49.TRUE
50.TRUE
51.TRUE
52.TRUE
53.TRUE
54.TRUE
55.TRUE
56.TRUE
57.TRUE
58.TRUE
59.TRUE
60.TRUE
61.TRUE
62.TRUE
63.TRUE
64.TRUE
65.TRUE
66.TRUE

67.TRUE

68.TRUE

69.TRUE

70.TRUE

In [160]:

```
library(gridExtra )
```

```
p1 <- ggplot(data=Greece) +  
geom_point(aes(x=difference(csh_i),y=growth(rgdpe)))
```

```
p2 <- ggplot(data=Greece) +  
geom_point(aes(x=difference(csh_c),y=growth(rgdpe)))
```

```
p3 <- ggplot(data=Greece) +  
geom_point(aes(x=difference(csh_g),y=growth(rgdpe)))
```

```
p4 <- ggplot(data=Greece) +  
geom_point(aes(x=difference(csh_x - csh_m),y=growth(rgdpe)))
```

```
grid.arrange(p1, p2,p3,p4, nrow = 2)
```

Warning message:

"Removed 2 rows containing missing values (geom_point)."

Warning message:

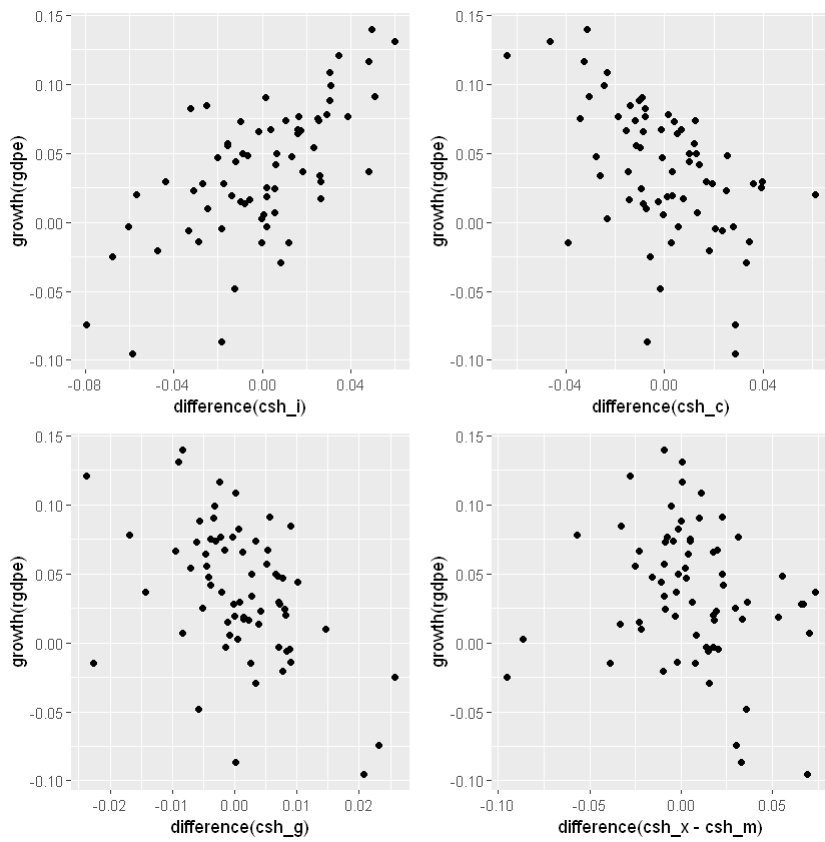
"Removed 2 rows containing missing values (geom_point)."

Warning message:

"Removed 2 rows containing missing values (geom_point)."

Warning message:

"Removed 2 rows containing missing values (geom_point)."

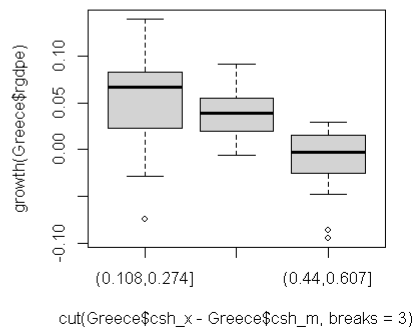
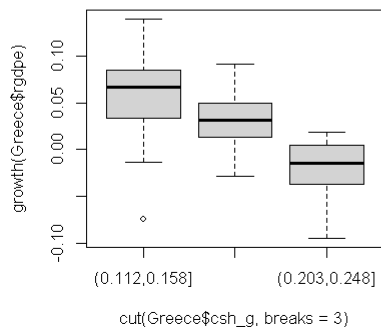
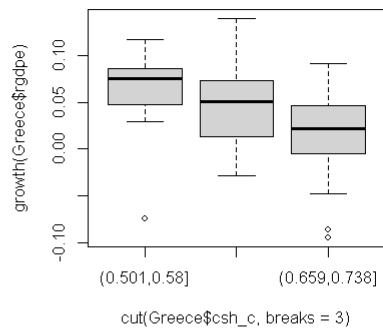
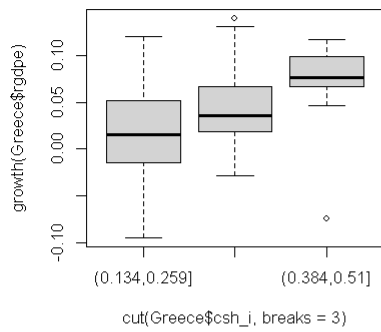


In []:

In [161]:

```
par(mfrow=c(2,2))
boxplot(growth(Greece$rgdpe)~cut(Greece$csh_i,breaks=3))
boxplot(growth(Greece$rgdpe)~cut(Greece$csh_c,breaks=3))
boxplot(growth(Greece$rgdpe)~cut(Greece$csh_g,breaks=3))
boxplot(growth(Greece$rgdpe)~cut(Greece$csh_x - Greece$csh_m,breaks=3))

par(mfrow=c(1,1))
```

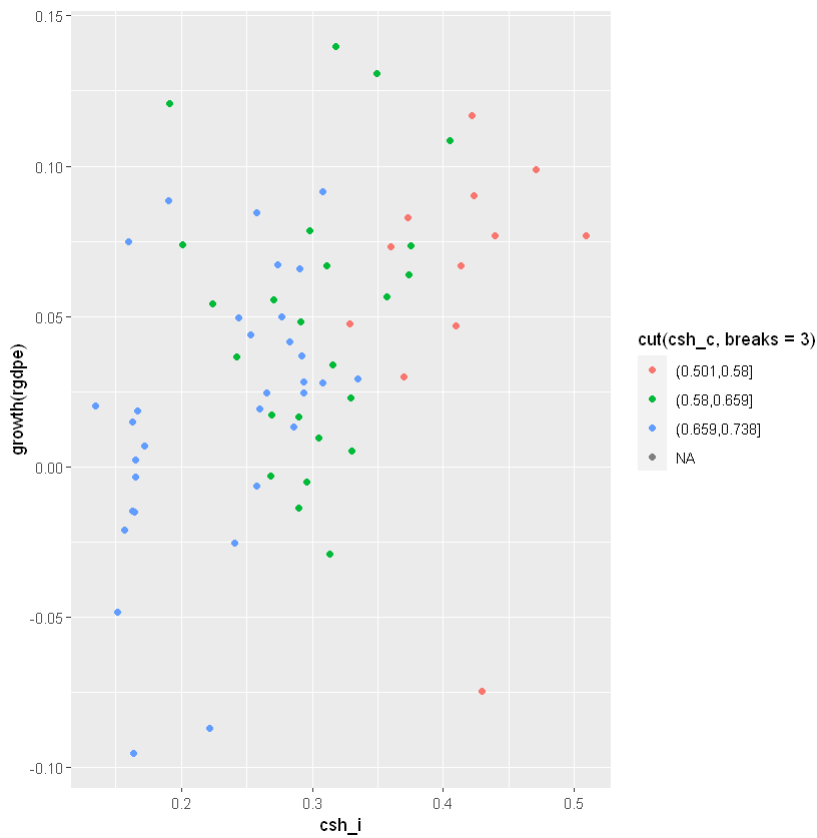


In [162]:

```
ggplot(data=Greece) +
  geom_point(aes(x=csh_i,y=growth(rgdpe),color=cut(csh_c,breaks=3)))
```

Warning message:

"Removed 2 rows containing missing values (geom_point)."



In []:

In [163]:

```
ggplot(Greece[Greece$year>2000,], aes(x = csh_i, y = growth(rgdpe))) +
  geom_path(color = 4, lineend="round") +
  geom_point(size = 2, color = 4) +
  geom_text(aes(label = year))
```

Warning message:

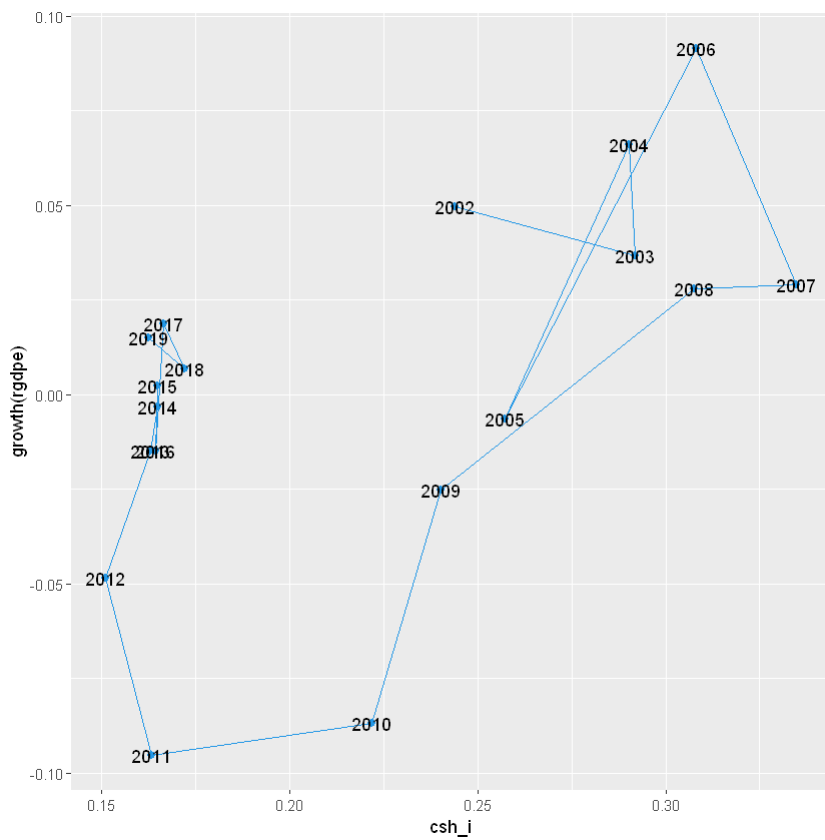
"Removed 1 row(s) containing missing values (geom_path)."

Warning message:

"Removed 1 rows containing missing values (geom_point)."

Warning message:

"Removed 1 rows containing missing values (geom_text)."



In [164]:

```
ggplot(data=Greece)+
  geom_point(
    aes(x=scale(difference(csh_i)),
        y=scale(growth(rgdpe/emp)),
        color=cut(csh_c,breaks=3))
  ) +
  geom_smooth (
    aes(x=scale(difference(csh_i)),
        y=scale(growth(rgdpe/emp)),
        color=cut(csh_c,breaks=3))
  )

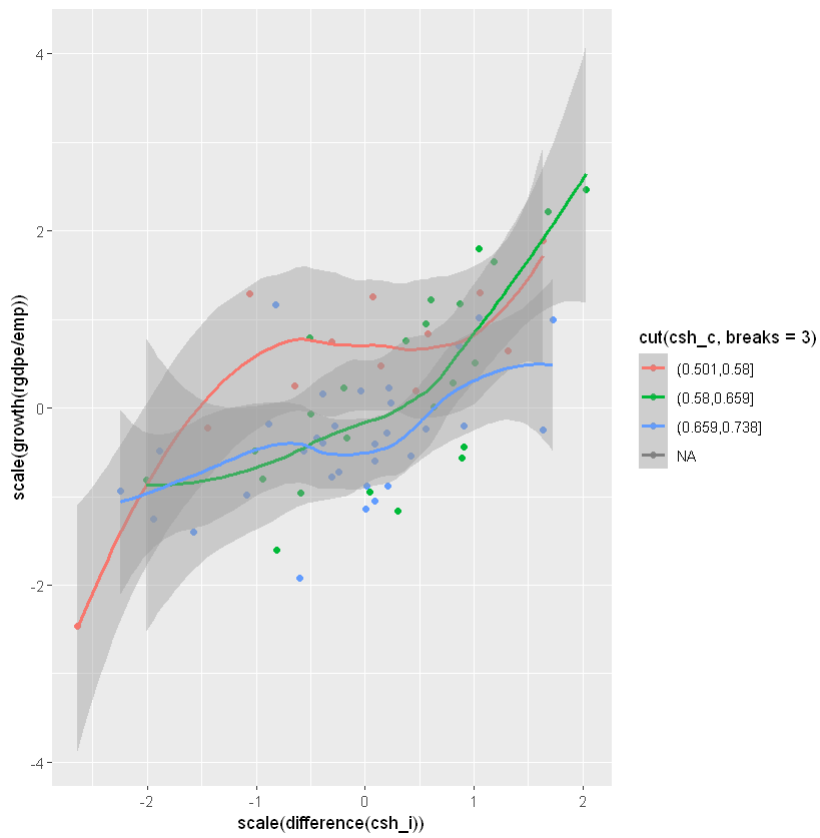
`geom_smooth()` using method = 'loess' and formula 'y ~ x'
```

Warning message:

"Removed 2 rows containing non-finite values (stat_smooth)."

Warning message:

"Removed 2 rows containing missing values (geom_point)."

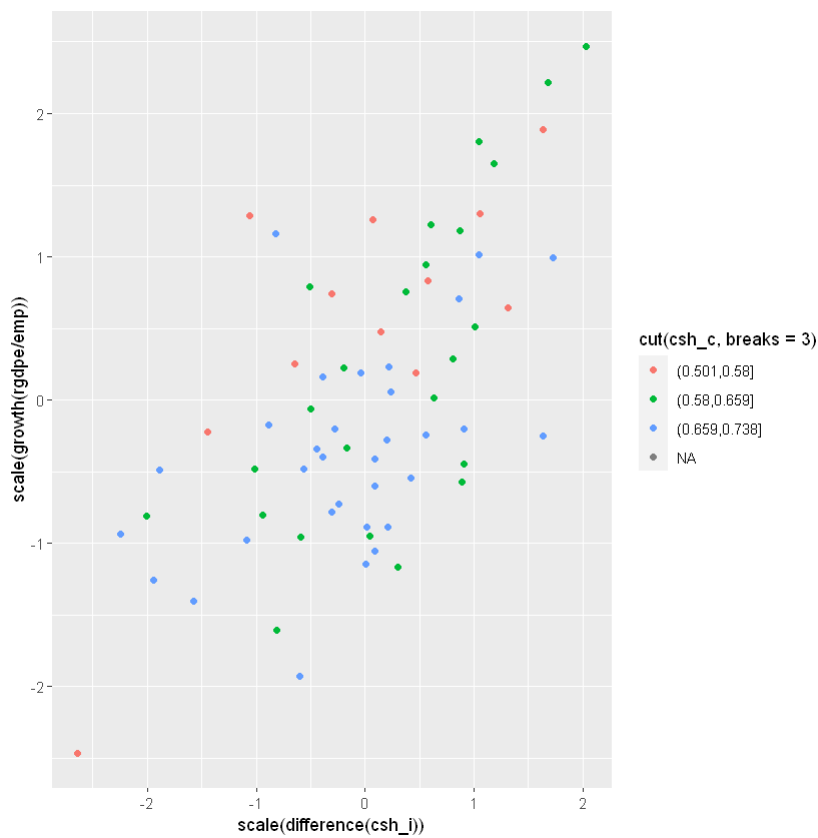


In [166]:

```
ggplot(data=Greece)+
  geom_point(
    aes(x=scale(difference(csh_i)),
        y=scale(growth(rgdpe/emp)),
        color=cut(csh_c,breaks=3))
  )
```

Warning message:

"Removed 2 rows containing missing values (geom_point)."



In [167]:

```
library(plotly)
plotted <- ggplot(data=Greece)+
  geom_point(
    aes(x=scale(difference(csh_i)),
        y=scale(growth(rgdpe/emp)),
        color=cut(csh_c,breaks=3))
  )
```

```
ggplotly(plotted)
```

Warning message:

"package 'plotly' was built under R version 4.1.2"

Attaching package: 'plotly'

The following object is masked from 'package:ggplot2':

last_plot

The following object is masked from 'package:stats':

filter

The following object is masked from 'package:graphics':

layout

XTS and rolling functions

In [128]:

```
colnames(Greece)
```

1. 'countrycode'
2. 'country'
3. 'currency_unit'
4. 'year'
5. 'rgdpe'
6. 'rgdpo'
7. 'pop'
8. 'emp'
9. 'avh'
10. 'hc'
11. 'ccon'
12. 'cda'
13. 'cgdpe'
14. 'cgdpo'
15. 'cn'
16. 'ck'
17. 'ctfp'
18. 'cwtfp'
19. 'rgdpna'
20. 'rconna'
21. 'rdana'
22. 'rnna'
23. 'rkna'
24. 'rtfpna'
25. 'rwtfpna'
26. 'labsh'
27. 'irr'
28. 'delta'
29. 'xr'
30. 'pl_con'

```

31.'pl_da'
32.'pl_gdpo'
33.'cor_exp'
34.'statcap'
35.'csh_c'
36.'csh_i'
37.'csh_g'
38.'csh_x'
39.'csh_m'
40.'csh_r'
41.'pl_c'
42.'pl_i'
43.'pl_g'
44.'pl_x'
45.'pl_m'
46.'pl_n'
47.'pl_k'
48.'date'

```

In [133]:

```
Greece_xts = as.xts(Greece[,5:length(Greece)-1],order.by=Greece$date)
```

In [134]:

```
Greece_xts
```

	year	rgdpe	rgdpo	pop	emp	avh	hc
1950-01-01	1950	NA	NA	NA	NA	NA	NA
1951-01-01	1951	27866.44	28382.46	7.534017	3.375124	2312.551	1.530985
1952-01-01	1952	27284.54	27776.46	7.619589	3.411953	2302.988	1.571550
1953-01-01	1953	30582.95	31562.30	7.702201	3.447424	2293.464	1.613189
1954-01-01	1954	31201.29	32225.16	7.777397	3.479544	2283.980	1.655931
1955-01-01	1955	33540.57	34448.26	7.848462	3.509788	2274.535	1.699806
1956-01-01	1956	36508.89	37509.41	7.912975	3.537074	2265.129	1.751953
1957-01-01	1957	39206.93	40426.30	7.977222	3.556257	2255.762	1.803263
1958-01-01	1958	41333.40	42421.13	8.053002	3.582899	2246.434	1.856075
1959-01-01	1959	42845.27	44114.26	8.136785	3.592490	2237.144	1.910434
1960-01-01	1960	43583.57	44976.65	8.205011	3.608476	2227.893	1.966385
1961-01-01	1961	49677.05	51181.01	8.274618	3.622871	2217.991	1.978133
1962-01-01	1962	48991.16	50332.30	8.324062	3.586620	2208.133	1.989951
1963-01-01	1963	55401.79	56826.08	8.354993	3.536403	2198.319	2.001839
1964-01-01	1964	59468.27	60928.23	8.385345	3.490451	2188.548	2.013798
1965-01-01	1965	65921.38	67527.59	8.424662	3.466035	2178.821	2.025829
1966-01-01	1966	71372.83	72821.42	8.487050	3.434796	2169.138	2.037931
1967-01-01	1967	75421.22	76522.28	8.588329	3.393642	2159.497	2.050107
1968-01-01	1968	80244.48	81596.96	8.612295	3.352915	2149.899	2.062354
1969-01-01	1969	89619.87	90865.95	8.643824	3.342786	2140.344	2.074675

1970-01-01	1970	97693.84	99292.14	8.663571	3.339480	2098.643	2.087069
1971-01-01	1971	105198.30	107107.87	8.716873	3.355520	2099.605	2.106050
1972-01-01	1972	115594.85	117832.92	8.774514	3.372595	2101.094	2.125203
1973-01-01	1973	124461.41	126495.14	8.840315	3.416343	2102.546	2.144530
1974-01-01	1974	115193.70	118751.24	8.919244	3.437624	2103.960	2.164033
1975-01-01	1975	120608.49	125681.33	9.014085	3.445170	2105.333	2.183714
1976-01-01	1976	128672.27	133812.86	9.127049	3.483696	2106.665	2.203573
1977-01-01	1977	132502.58	136359.28	9.254978	3.506772	2107.954	2.223613
1978-01-01	1978	142195.52	146023.39	9.388728	3.525628	2109.610	2.243835
1979-01-01	1979	145471.02	149153.41	9.515746	3.567876	2111.049	2.264242
1980-01-01	1980	146225.25	151922.53	9.627002	3.624331	2111.699	2.284833
1981-01-01	1981	147638.05	152191.12	9.719841	3.815258	2111.784	2.308234
1982-01-01	1982	143356.27	147360.83	9.796829	3.781866	2111.394	2.331875
1983-01-01	1983	142656.27	145494.20	9.860739	3.804281	2108.866	2.355757
1984-01-01	1984	145004.08	148956.22	9.916482	3.798948	2108.495	2.379884
1985-01-01	1985	149934.31	154543.28	9.968238	3.900652	2107.469	2.404259
1986-01-01	1986	157058.45	160981.11	10.015119	3.921319	2107.813	2.428883
1987-01-01	1987	156567.14	159643.97	10.057297	3.924997	2110.071	2.453759
1988-01-01	1988	168838.86	171204.88	10.101352	4.004634	2107.255	2.478889
1989-01-01	1989	176958.33	179566.64	10.155723	4.021697	2109.304	2.504278
1990-01-01	1990	181332.36	181550.16	10.225992	4.062554	2111.623	2.529926
1991-01-01	1991	193430.44	192950.89	10.315107	3.977802	2112.891	2.557113
1992-01-01	1992	198890.56	196230.22	10.420236	4.045194	2112.869	2.576525
1993-01-01	1993	201528.14	200895.09	10.533815	4.099039	2112.144	2.595133
1994-01-01	1994	212694.47	211749.58	10.644949	4.198669	2110.199	2.613876
1995-01-01	1995	223337.64	219416.64	10.745503	4.256538	2110.706	2.632755
1996-01-01	1996	232633.47	226501.11	10.832141	4.247651	2109.400	2.651769
1997-01-01	1997	252283.12	247353.06	10.906257	4.238947	2107.945	2.670921
1998-01-01	1998	269264.81	261940.77	10.970121	4.426493	2108.434	2.690211
1999-01-01	1999	274464.78	267494.66	11.027900	4.434241	2104.852	2.709641
2000-01-01	2000	281180.59	281011.97	11.082104	4.452403	2107.638	2.729211
2001-01-01	2001	293539.41	291715.16	11.134457	4.466327	2101.130	2.749764
2002-01-01	2002	308082.53	303662.78	11.182305	4.578461	2093.215	2.770473
2003-01-01	2003	319420.84	305441.69	11.218884	4.645930	2091.479	2.791337
2004-01-01	2004	340496.41	319653.59	11.234992	4.753021	2082.552	2.812358
2005-01-01	2005	338297.69	326492.31	11.224791	4.778794	2136.239	2.833538
2006-01-01	2006	369233.06	351992.50	11.185228	4.833973	2125.336	2.854877
2007-01-01	2007	379983.28	352220.44	11.120358	4.858281	2110.989	2.876377
2008-01-01	2008	390628.34	362663.50	11.040309	4.872009	2106.260	2.898039
2009-01-01	2009	380753.84	350892.50	10.959272	4.796369	2081.212	2.919864
2010-01-01	2010	347717.28	324407.44	10.887637	4.637154	2019.571	2.941853
2011-01-01	2011	314638.81	294014.78	10.829079	4.301328	2037.700	2.962745
2012-01-01	2012	299430.72	281534.38	10.781125	4.033718	2055.374	2.983787
2013-01-01	2013	294988.53	281881.12	10.740500	3.941757	2059.220	3.004977
2014-01-01	2014	294032.56	278412.31	10.701456	3.990398	2020.882	3.026318

2015-01-01	2015	294728.59	280679.06	10.659750	4.030078	2031.140	3.047810
2016-01-01	2016	290349.38	274068.91	10.615185	4.048787	2030.090	3.069455
2017-01-01	2017	295748.25	279853.41	10.569450	4.101669	2045.241	3.091254
2018-01-01	2018	297786.66	279920.59	10.522246	4.161405	2044.431	3.113208
2019-01-01	2019	302222.28	284893.62	10.473455	4.235073	2036.464	3.135318

	ccon	cda	cgdpe	cgdpo	cn	ck
1950-01-01	NA	NA	NA	NA	NA	NA
1951-01-01	22798.75	28251.39	27371.11	26709.21	246552.5	NA
1952-01-01	23171.12	27301.82	26916.91	26353.31	242473.9	NA
1953-01-01	23843.10	29605.07	30200.68	30117.87	239764.0	NA
1954-01-01	26432.01	30563.01	30735.26	30702.36	236133.0	NA
1955-01-01	26916.26	32136.63	32945.78	32718.57	233668.4	0.01597458
1956-01-01	28646.77	35398.44	35724.44	35512.21	233392.3	0.01535434
1957-01-01	30283.18	37957.77	38354.98	38242.35	233158.4	0.01476237
1958-01-01	31267.51	40311.79	40485.18	40359.74	235254.4	0.01435283
1959-01-01	31729.47	41874.29	41796.53	41869.15	238912.6	0.01397434
1960-01-01	32448.40	43814.71	42665.27	42307.99	244330.2	0.01345295
1961-01-01	35029.29	50351.93	48486.90	48165.32	253719.3	0.01328942
1962-01-01	36755.42	50566.72	47645.09	47692.21	261935.9	0.01304273
1963-01-01	38521.34	57343.06	53827.02	53856.77	275158.1	0.01322217
1964-01-01	42222.40	63879.98	57704.34	57765.77	291509.7	0.01343124
1965-01-01	45392.30	71392.31	63931.12	64144.23	312465.0	0.01371884
1966-01-01	48608.43	74496.25	69247.13	69388.70	334621.3	0.01403118
1967-01-01	52516.03	78658.59	73214.91	73166.42	353423.3	0.01435324
1968-01-01	56181.46	85402.01	77965.22	78243.60	374770.9	0.01455303
1969-01-01	59638.81	96463.02	87094.23	87342.02	406064.3	0.01515169
1970-01-01	64313.18	104895.19	95303.93	95914.70	440468.8	0.01605260
1971-01-01	67464.14	113137.32	102847.38	103868.41	473942.4	0.01672595
1972-01-01	71174.62	125052.80	112992.46	114498.72	521912.8	0.01748194
1973-01-01	75069.89	137382.28	121513.30	122382.44	576683.1	0.01844680
1974-01-01	76172.28	125406.22	114383.17	114527.05	608983.2	0.01854215
1975-01-01	82246.74	132425.47	120932.73	122410.96	635652.4	0.01892199
1976-01-01	86797.23	140481.88	128176.30	129775.90	668765.3	0.01922635
1977-01-01	94390.41	143205.12	131706.00	131956.56	714004.5	0.01951473
1978-01-01	100796.95	151700.66	140936.05	141341.89	767068.9	0.01983543
1979-01-01	106527.76	153796.48	144087.34	143539.64	827866.6	0.02022200
1980-01-01	107784.60	155811.83	146009.83	145527.89	871054.1	0.02017348
1981-01-01	109026.16	153528.28	147659.78	145794.59	879511.2	0.02024948
1982-01-01	111659.55	156323.30	143890.89	142375.70	855286.4	0.01994686
1983-01-01	114545.57	156138.33	142743.27	140807.48	821682.3	0.01948686
1984-01-01	115235.79	156901.59	144241.67	143784.42	796128.9	0.01860365
1985-01-01	117155.51	164687.00	149465.47	150588.14	800266.4	0.01815270
1986-01-01	118048.91	170079.58	156440.78	158217.77	827654.9	0.01806726
1987-01-01	122780.48	164991.67	155712.02	157192.92	870885.5	0.01802363
1988-01-01	129010.73	179209.92	167858.53	168537.64	930769.2	0.01854199

1989-01-01	140890.27	192349.06	175493.44	176550.06	1011245.8	0.01950234
1990-01-01	148224.06	200510.70	179518.08	178151.61	1109733.5	0.02079286
1991-01-01	154474.16	213996.05	191431.80	191429.03	1227751.8	0.02265299
1992-01-01	159233.75	215811.23	196962.34	192733.03	1345674.6	0.02438650
1993-01-01	161677.20	217900.25	199429.28	196848.64	1470769.4	0.02585647
1994-01-01	167142.09	223229.16	208961.45	207605.02	1573784.4	0.02646308
1995-01-01	177170.92	236618.61	218570.55	214878.64	1630685.0	0.02660062
1996-01-01	184138.39	246467.80	226278.52	220574.33	1648182.9	0.02595702
1997-01-01	199746.78	261711.81	244980.39	240673.95	1626937.8	0.02485058
1998-01-01	215426.03	285366.31	260192.39	255861.62	1621645.5	0.02400443
1999-01-01	221506.11	289554.44	265974.62	262171.22	1618829.8	0.02327357
2000-01-01	230990.00	303583.47	273550.59	273905.78	1595588.6	0.02194689
2001-01-01	245527.58	317437.69	287111.56	284401.34	1495197.6	0.01997460
2002-01-01	260840.02	333460.38	302806.41	297745.12	1511131.8	0.01981391
2003-01-01	261273.08	349505.34	314583.72	302168.06	1584033.4	0.02071328
2004-01-01	271858.69	363948.09	335491.03	317179.75	1666725.9	0.02146157
2005-01-01	284930.78	367438.50	339352.31	320625.97	1650414.4	0.02103189
2006-01-01	299543.50	406436.12	367808.09	346782.50	1926316.1	0.02384838
2007-01-01	307375.72	424112.69	377043.22	348773.19	2085866.4	0.02536203
2008-01-01	329573.25	439295.53	390115.34	356578.38	2200111.8	0.02649080
2009-01-01	331002.62	415244.91	378253.69	350554.25	2273038.8	0.02777291
2010-01-01	301403.44	372788.56	346454.28	321649.66	2055301.4	0.02536233
2011-01-01	286654.66	334115.62	315636.94	290582.91	1979632.9	0.02393583
2012-01-01	270078.41	311774.28	298132.00	275916.16	2391202.0	0.02715100
2013-01-01	255297.64	300664.75	293429.50	278327.66	2638888.2	0.02870767
2014-01-01	252326.50	297488.72	292936.09	273827.88	2726219.2	0.02859386
2015-01-01	250268.00	296160.66	293156.19	278531.28	2679372.8	0.02751704
2016-01-01	247781.94	292869.69	288693.97	274133.38	2568974.2	0.02600151
2017-01-01	253637.27	300210.03	295748.25	279853.41	2612084.0	0.02588830
2018-01-01	255662.25	303943.44	297629.66	280591.56	2587820.0	0.02522610
2019-01-01	260301.17	306900.56	301896.88	286884.53	2565751.0	0.02429801

	ctfp	cwtfp	rgdpna	rconna	rdana	rnna
1950-01-01	NA	NA	NA	NA	NA	NA
1951-01-01	NA	NA	38966.64	33192.40	43046.60	464479.2
1952-01-01	NA	NA	38374.86	33645.44	42333.98	454424.7
1953-01-01	NA	NA	41727.06	34629.92	44907.61	448592.4
1954-01-01	NA	NA	43580.65	38483.37	47898.31	440649.8
1955-01-01	0.3778353	0.3708225	45909.51	39242.14	49878.51	435803.7
1956-01-01	0.4021420	0.4023261	49945.45	42160.98	54602.67	434393.2
1957-01-01	0.4244407	0.4241631	53519.28	44708.60	58323.20	435075.3
1958-01-01	0.4411052	0.4394806	55981.07	46274.20	61310.02	438519.5
1959-01-01	0.4427300	0.4417891	58060.10	47368.59	63472.66	444000.2
1960-01-01	0.4372269	0.4531640	59409.77	47915.45	65411.38	452221.6
1961-01-01	0.4890265	0.5121055	67254.14	51099.64	73451.82	469115.9
1962-01-01	0.4734368	0.5027841	67499.48	53339.02	74639.31	483355.7

1963-01-01	0.5179097	0.5538188	75494.71	56209.75	83430.97	507000.3
1964-01-01	0.5313475	0.5923897	82598.52	61876.89	92829.34	535166.2
1965-01-01	0.5667288	0.6327993	91492.73	66406.17	103148.63	570892.8
1966-01-01	0.5841841	0.6271297	97434.73	70971.18	107995.58	604999.9
1967-01-01	0.6004129	0.6442295	102958.79	76152.22	114274.84	638797.0
1968-01-01	0.6191042	0.6715309	110375.65	81253.96	123669.14	677616.8
1969-01-01	0.6664038	0.7314075	123139.12	86568.88	138543.05	729516.8
1970-01-01	0.7110668	0.7754489	134136.17	93862.23	150155.47	785195.2
1971-01-01	0.7332597	0.7938922	144654.02	98880.34	161136.06	847957.0
1972-01-01	0.7615470	0.8246003	159351.09	104768.97	177125.47	929743.6
1973-01-01	0.7601960	0.8528867	172246.38	111257.26	194174.73	1015093.6
1974-01-01	0.7220756	0.7905425	161156.73	112651.52	176178.39	1059666.6
1975-01-01	0.7618589	0.8317729	171417.30	122061.81	185093.09	1111280.6
1976-01-01	0.7705779	0.8324262	183162.62	128906.15	197318.80	1167082.9
1977-01-01	0.7551266	0.8104618	188549.44	139649.89	202610.62	1232397.1
1978-01-01	0.7760689	0.8245224	202213.38	149427.95	215341.03	1308627.1
1979-01-01	0.7627139	0.8136465	208850.17	158026.77	218977.06	1388374.5
1980-01-01	0.7571966	0.8161879	210264.36	158663.00	220154.73	1448512.6
1981-01-01	0.7229281	0.7635890	206997.44	160030.94	215531.98	1497819.9
1982-01-01	0.7165995	0.7844393	204652.89	163470.20	216997.47	1542927.1
1983-01-01	0.6941815	0.7580512	202445.45	167420.39	215574.88	1592150.0
1984-01-01	0.6932838	0.7342942	206515.78	168955.06	215803.95	1625669.6
1985-01-01	0.7019125	0.7423437	211698.41	171163.39	223890.56	1665081.5
1986-01-01	0.7114041	0.7394527	212794.28	168796.89	226353.83	1703598.8
1987-01-01	0.6873688	0.7000582	207987.55	172358.08	217141.75	1737059.6
1988-01-01	0.6964806	0.7248664	216905.78	177514.31	230142.91	1771932.9
1989-01-01	0.6968427	0.7483628	225148.20	189069.17	242551.20	1810462.2
1990-01-01	0.6620755	0.7360061	225148.19	193298.31	247719.91	1851127.8
1991-01-01	0.6823561	0.7600532	232127.80	197934.97	258137.44	1893632.1
1992-01-01	0.6310884	0.7022745	233752.69	200065.27	254856.78	1931227.8
1993-01-01	0.6151236	0.6717373	230012.64	199614.91	251839.17	1963707.5
1994-01-01	0.6208531	0.6582396	234612.88	201846.75	253684.25	1992078.1
1995-01-01	0.6260728	0.6810555	239539.11	208336.84	263030.69	2021978.1
1996-01-01	0.6298279	0.6949051	246395.00	215210.38	274207.00	2056954.5
1997-01-01	0.6833012	0.7337873	257443.88	221278.78	281960.47	2092135.0
1998-01-01	0.6921983	0.7580121	267471.06	230527.72	301407.72	2143041.2
1999-01-01	0.6951696	0.7463659	275689.38	238516.42	309140.03	2196987.5
2000-01-01	0.7124961	0.7596316	286495.75	245154.50	324244.78	2249798.0
2001-01-01	0.7590045	0.8129390	298332.66	254724.78	337325.06	2304313.2
2002-01-01	0.7859710	0.8380817	310035.88	266568.72	351130.12	2353935.5
2003-01-01	0.7568868	0.8310691	328001.00	277843.28	377285.97	2416310.8
2004-01-01	0.7470053	0.8090506	344601.38	288154.28	387273.66	2478102.0
2005-01-01	0.7388713	0.7854630	346666.03	298219.94	388152.25	2521138.8
2006-01-01	0.7387036	0.8090172	366261.09	309026.38	418337.88	2583640.8
2007-01-01	0.7117258	0.8172040	378251.56	322821.47	441018.88	2662564.2

2008-01-01	0.7077488	0.8290100	376983.75	329838.88	438561.00	2724349.5
2009-01-01	0.6955207	0.8006486	360770.69	326951.12	410114.94	2762201.0
2010-01-01	0.6727276	0.7519096	341005.41	307320.28	382152.44	2773866.0
2011-01-01	0.6399761	0.7060951	306395.66	281968.19	335407.53	2759982.5
2012-01-01	0.5734149	0.6225595	284695.62	262373.19	305865.16	2732633.5
2013-01-01	0.5550165	0.5801675	276889.94	251212.97	293195.03	2704918.5
2014-01-01	0.5427212	0.5693558	278823.03	250864.19	294339.56	2677834.2
2015-01-01	0.5440898	0.5577920	277674.53	251189.09	296146.69	2652249.5
2016-01-01	0.5475764	0.5651501	276314.31	250052.50	297195.25	2629299.8
2017-01-01	0.5431008	0.5604293	279853.41	253637.27	300210.03	2612084.0
2018-01-01	0.5387478	0.5611171	284216.25	255620.31	304013.50	2591668.0
2019-01-01	0.5436917	0.5593889	289493.22	260046.00	307537.50	2569462.2

	rkna	rtfpna	rwtfpna	labsh	irr	delta
1950-01-01	NA	NA	NA	NA	NA	NA
1951-01-01	NA	NA	NA	0.4881878	0.09178414	0.02692584
1952-01-01	NA	NA	NA	0.4881878	0.09868184	0.02621043
1953-01-01	NA	NA	NA	0.4881878	0.12071946	0.02550694
1954-01-01	NA	NA	NA	0.4881878	0.11524695	0.02480785
1955-01-01	0.1438940	0.5994794	0.6071423	0.4881878	0.12478051	0.02416559
1956-01-01	0.1425605	0.6445658	0.6568869	0.4881878	0.14179283	0.02361958
1957-01-01	0.1421243	0.6816701	0.6924856	0.4881878	0.15624006	0.02316111
1958-01-01	0.1427501	0.7003332	0.7149906	0.4881878	0.16807815	0.02277648
1959-01-01	0.1441252	0.7131845	0.7268021	0.4881878	0.16766611	0.02245339
1960-01-01	0.1464466	0.7135879	0.7323999	0.4881878	0.16774337	0.02217989
1961-01-01	0.1517089	0.7912232	0.8055415	0.4881878	0.16877234	0.02197583
1962-01-01	0.1560615	0.7859713	0.8101758	0.4881878	0.14040783	0.02181858
1963-01-01	0.1640075	0.8622934	0.8883237	0.4881878	0.15885600	0.02181981
1964-01-01	0.1736495	0.9214406	0.9653521	0.4881878	0.14424770	0.02201822
1965-01-01	0.1859333	0.9882326	1.0385835	0.4881878	0.14755118	0.02226135
1966-01-01	0.1977076	1.0236214	1.0576377	0.4881878	0.15322231	0.02247390
1967-01-01	0.2094371	1.0556389	1.0922146	0.4881878	0.15763463	0.02265954
1968-01-01	0.2223024	1.1033556	1.1524153	0.4881878	0.15243091	0.02274565
1969-01-01	0.2402529	1.1838611	1.2416375	0.4881878	0.15385272	0.02285052
1970-01-01	0.2600231	1.2473599	1.3016444	0.4881878	0.15445811	0.02315601
1971-01-01	0.2818304	1.2818664	1.3310992	0.4881878	0.15388034	0.02350493
1972-01-01	0.3091267	1.3371276	1.3854924	0.4881878	0.15125220	0.02366221
1973-01-01	0.3382984	1.3649762	1.4344094	0.4881878	0.14238888	0.02375249
1974-01-01	0.3547275	1.2368134	1.2604154	0.4881878	0.11114793	0.02398400
1975-01-01	0.3715374	1.2773099	1.2856928	0.4881878	0.12196981	0.02406124
1976-01-01	0.3899666	1.3179727	1.3235592	0.4881878	0.12091047	0.02394298
1977-01-01	0.4107082	1.3107717	1.3130141	0.4881878	0.11100143	0.02377636
1978-01-01	0.4343758	1.3559239	1.3460389	0.4881878	0.10418279	0.02349435
1979-01-01	0.4598449	1.3458774	1.3154511	0.4881878	0.09366284	0.02325228
1980-01-01	0.4800076	1.3094372	1.2780634	0.4881878	0.08529038	0.02316714
1981-01-01	0.4966272	1.2293191	1.1932096	0.4881878	0.08032170	0.02313908

1982-01-01	0.5125845	1.1951716	1.1813332	0.4881878	0.08426984	0.02316938
1983-01-01	0.5285605	1.1554178	1.1469238	0.4881878	0.08062755	0.02314813
1984-01-01	0.5401834	1.1607101	1.1306685	0.4881878	0.08198629	0.02307723
1985-01-01	0.5540140	1.1540114	1.1377155	0.4881878	0.08111525	0.02306945
1986-01-01	0.5660745	1.1385452	1.1289729	0.4881878	0.07476220	0.02292324
1987-01-01	0.5758525	1.0965660	1.0672008	0.4881878	0.07283423	0.02263024
1988-01-01	0.5873674	1.1161735	1.1039860	0.4881878	0.07364342	0.02243130
1989-01-01	0.6016862	1.1358148	1.1406381	0.4881878	0.07238790	0.02243515
1990-01-01	0.6169814	1.1096634	1.1381228	0.4881878	0.07113410	0.02255291
1991-01-01	0.6336578	1.1339612	1.1755129	0.4881878	0.07399043	0.02270345
1992-01-01	0.6494557	1.1142709	1.1324936	0.4881878	0.07406979	0.02292395
1993-01-01	0.6633786	1.0740256	1.0962046	0.4881878	0.07193093	0.02316116
1994-01-01	0.6757393	1.0692744	1.0777951	0.4881878	0.07424931	0.02335419
1995-01-01	0.6892086	1.0696651	1.0949219	0.4881878	0.07566722	0.02359145
1996-01-01	0.7069496	1.0836058	1.1241477	0.4813082	0.07870826	0.02393792
1997-01-01	0.7263628	1.1141292	1.1374874	0.4909200	0.07971668	0.02441492
1998-01-01	0.7558392	1.1064117	1.1622504	0.4927249	0.07913668	0.02518365
1999-01-01	0.7854905	1.1145691	1.1650581	0.5037293	0.07622650	0.02615935
2000-01-01	0.8154134	1.1297480	1.1919053	0.5022809	0.07500215	0.02699730
2001-01-01	0.8458838	1.1508614	1.2130430	0.5073507	0.07438989	0.02781927
2002-01-01	0.8744348	1.1597855	1.2244449	0.5380308	0.06840191	0.02874282
2003-01-01	0.9096278	1.1911356	1.2772093	0.5416118	0.07007112	0.02970878
2004-01-01	0.9388479	1.2161188	1.2740380	0.5303936	0.07524629	0.03041262
2005-01-01	0.9586432	1.1869601	1.2388889	0.5413948	0.07351070	0.03069949
2006-01-01	0.9922141	1.2252394	1.3045560	0.5461194	0.07305000	0.03116256
2007-01-01	1.0382754	1.2356011	1.3429507	0.5431663	0.07388190	0.03224815
2008-01-01	1.0732136	1.2076144	1.3096071	0.5396585	0.07323042	0.03342031
2009-01-01	1.0914949	1.1594868	1.2286990	0.5512407	0.06791110	0.03396819
2010-01-01	1.0975037	1.1277033	1.1780822	0.5501760	0.06869192	0.03401142
2011-01-01	1.0852348	1.0521153	1.0736406	0.5515783	0.06019714	0.03356099
2012-01-01	1.0635158	1.0129328	1.0144607	0.5285727	0.06003503	0.03251740
2013-01-01	1.0440361	1.0012716	0.9883408	0.5077701	0.06202219	0.03137107
2014-01-01	1.0299102	1.0146627	0.9984978	0.5217449	0.06110358	0.03059429
2015-01-01	1.0188425	1.0041640	0.9983454	0.5183294	0.06359274	0.03019228
2016-01-01	1.0067015	0.9989908	1.0016254	0.5380005	0.06112178	0.02982354
2017-01-01	1.0000000	1.0000000	1.0000000	0.5388110	0.06356653	0.02955497
2018-01-01	0.9916177	1.0078133	1.0049154	0.5508901	0.06257118	0.02944034
2019-01-01	0.9827644	1.0189706	1.0090827	0.5508901	0.06515764	0.02931728

	xr	pl_con	pl_da	pl_gdpo	cor_exp	statcap
1950-01-01	NA	NA	NA	NA	NA	NA
1951-01-01	0.04399118	0.13511904	0.12310940	0.12616026	NA	NA
1952-01-01	0.04399118	0.14197646	0.13171774	0.13453472	NA	NA
1953-01-01	0.07621421	0.09745013	0.08808222	0.08832438	NA	NA
1954-01-01	0.08804109	0.09358603	0.08824696	0.08834153	NA	NA
1955-01-01	0.08804109	0.10033296	0.09372576	0.09437663	NA	NA

1956-01-01	0.08804109	0.10896442	0.09997591	0.10057339	NA	NA
1957-01-01	0.08804109	0.10967521	0.09978785	0.10008176	NA	NA
1958-01-01	0.08804109	0.11055706	0.09900229	0.09930998	NA	NA
1959-01-01	0.08804109	0.11189765	0.09934010	0.09916779	NA	NA
1960-01-01	0.08804109	0.11517730	0.10160925	0.10246734	NA	NA
1961-01-01	0.08804109	0.11554645	0.10232456	0.10300773	NA	NA
1962-01-01	0.08804109	0.11730333	0.10941417	0.10930607	NA	NA
1963-01-01	0.08804109	0.12149773	0.10952264	0.10946213	NA	NA
1964-01-01	0.08804109	0.12471069	0.11558355	0.11546065	NA	NA
1965-01-01	0.08804109	0.13014092	0.12027246	0.11987288	NA	NA
1966-01-01	0.08804109	0.13460132	0.12407038	0.12381725	NA	NA
1967-01-01	0.08804109	0.13756897	0.12669007	0.12677403	NA	NA
1968-01-01	0.08804109	0.13911602	0.12942536	0.12896487	NA	NA
1969-01-01	0.08804109	0.14412197	0.13336885	0.13299046	NA	NA
1970-01-01	0.08804109	0.15031461	0.13780892	0.13693137	NA	NA
1971-01-01	0.08804109	0.15562761	0.14181155	0.14041755	NA	NA
1972-01-01	0.08804197	0.16344385	0.14936800	0.14740303	NA	NA
1973-01-01	0.08694101	0.19274279	0.18382598	0.18252049	NA	NA
1974-01-01	0.08804197	0.23746374	0.22152928	0.22125097	NA	NA
1975-01-01	0.09406112	0.25358984	0.23597966	0.23312998	NA	NA
1976-01-01	0.10716826	0.25630590	0.24311882	0.24012214	NA	NA
1977-01-01	0.10810981	0.28737000	0.27464923	0.27412772	NA	NA
1978-01-01	0.10783688	0.32865474	0.31400809	0.31310648	NA	NA
1979-01-01	0.10869675	0.38177463	0.37812835	0.37957114	NA	NA
1980-01-01	0.12506701	0.40134144	0.38932073	0.39061001	0.7126206	NA
1981-01-01	0.16260724	0.37906402	0.35449177	0.35902688	NA	NA
1982-01-01	0.19604744	0.38561508	0.37948737	0.38352591	NA	NA
1983-01-01	0.25844241	0.34835768	0.34622130	0.35098103	NA	NA
1984-01-01	0.33078968	0.32909369	0.33292407	0.33398280	NA	NA
1985-01-01	0.40533847	0.32178032	0.31991544	0.31753039	0.7292383	NA
1986-01-01	0.41080313	0.37435815	0.36038661	0.35633904	NA	NA
1987-01-01	0.39744534	0.44311514	0.42158121	0.41760957	NA	NA
1988-01-01	0.41631842	0.47388455	0.45429868	0.45246810	NA	NA
1989-01-01	0.47664441	0.46492320	0.45108050	0.44838086	NA	NA
1990-01-01	0.46519124	0.55567420	0.54530960	0.54949224	NA	NA
1991-01-01	0.53489777	0.56754446	0.54924875	0.54925668	NA	NA
1992-01-01	0.55942553	0.61425579	0.59005886	0.60300696	NA	NA
1993-01-01	0.67278017	0.57260650	0.54561830	0.55277121	NA	NA
1994-01-01	0.71196718	0.58629888	0.55803198	0.56167805	NA	NA
1995-01-01	0.67986129	0.66279942	0.62627906	0.63703936	NA	NA
1996-01-01	0.70641685	0.67779750	0.64459562	0.66126519	0.7669692	NA
1997-01-01	0.80134366	0.60477781	0.58433169	0.59478724	NA	NA
1998-01-01	0.86729011	0.56651759	0.55508852	0.56448412	NA	NA
1999-01-01	0.89698196	0.57044554	0.56078404	0.56891948	NA	NA
2000-01-01	1.07233620	0.48557582	0.48151681	0.48089236	NA	NA

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2005-01-01	0.80412000	0.74939942	0.73014623	0.77279091	0.7496551	NA
2006-01-01	0.79714083	0.76961297	0.74306065	0.78811282	NA	NA
2007-01-01	0.73063750	0.88436639	0.84468192	0.91314816	NA	NA
2008-01-01	0.68267471	0.94751269	0.90863883	0.99409819	NA	NA
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2010-01-01	0.75504495	0.88256615	0.85678071	0.92285305	NA	NA
2011-01-01	0.71935525	0.90533173	0.89541364	0.97261608	0.7506863	NA
2012-01-01	0.77829360	0.82858628	0.81190062	0.87727213	0.7311802	NA
2013-01-01	0.75315918	0.84543514	0.81274736	0.85684633	0.7390826	NA
2014-01-01	0.75373074	0.83600539	0.80323148	0.85928243	0.7258495	NA
2015-01-01	0.90165896	0.69402760	0.66625923	0.70124269	0.7150205	NA
2016-01-01	0.90403513	0.68936688	0.66760141	0.70306098	0.7179778	NA
2017-01-01	0.88520551	0.70298880	0.67667407	0.71510708	0.7048156	NA
2018-01-01	0.84677267	0.73708254	0.71313381	0.75643665	NA	NA
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1953-01-01	0.6519800	0.1913140	0.1396794	0.03804643	-0.07057871	0.0495587923
1954-01-01	0.7130497	0.1345498	0.1478617	0.04257051	-0.08376227	0.0457305722
1955-01-01	0.6786525	0.1595537	0.1440077	0.04796289	-0.08316190	0.0529850498
1956-01-01	0.6683574	0.1901224	0.1383164	0.04241015	-0.08868376	0.0494773351
1957-01-01	0.6565944	0.2006830	0.1352811	0.04539063	-0.09076545	0.0528163165
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1988-01-01	0.6017513	0.2978515	0.1637200	0.07238488	-0.15757748	0.0218697712
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2013-01-01	0.6974233	0.1629990	0.2198324	0.19202313	-0.35197306	0.0796951950
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2015-01-01	0.6796985	0.1647667	0.2188289	0.16234934	-0.31254268	0.0868992135
2016-01-01	0.6825272	0.1644737	0.2213465	0.16313572	-0.31966954	0.0881864354
2017-01-01	0.6835486	0.1664184	0.2227733	0.18129636	-0.35460669	0.1005701050
2018-01-01	0.6968079	0.1720693	0.2143466	0.21167460	-0.39453727	0.0996389911
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1952-01-01	0.14801162	0.07417154	0.11554375	0.1304452	0.1048997	0.05511846
1953-01-01	0.10299394	0.04931769	0.07157338	0.1184266	0.1011787	0.03630170
1954-01-01	0.09782094	0.05408519	0.07316355	0.1248652	0.1057800	0.03932013
1955-01-01	0.10524518	0.05965898	0.07718354	0.1371560	0.1113618	0.04284390
1956-01-01	0.11261919	0.06183844	0.09130421	0.1479717	0.1165245	0.04502920
1957-01-01	0.11423445	0.06077335	0.08754662	0.1488241	0.1212432	0.04478362
1958-01-01	0.11426314	0.05905558	0.09185915	0.1484459	0.1185886	0.04386014
1959-01-01	0.11509575	0.06006443	0.09587628	0.1400875	0.1194469	0.04496029
1960-01-01	0.11846427	0.06287540	0.09870666	0.1378421	0.1071829	0.04598984
1961-01-01	0.11840844	0.07209782	0.10095256	0.1423903	0.1098764	0.05052351
1962-01-01	0.12004456	0.08841912	0.10357910	0.1444322	0.1206479	0.06006987
1963-01-01	0.12453380	0.08501393	0.10633864	0.1498462	0.1218304	0.05819955
1964-01-01	0.12717567	0.09778979	0.11249258	0.1549260	0.1279606	0.06728335
1965-01-01	0.13300492	0.10304356	0.11650286	0.1592269	0.1326935	0.07103992
1966-01-01	0.13768470	0.10429689	0.12018888	0.1648009	0.1372563	0.07200609
1967-01-01	0.13897766	0.10483617	0.13111836	0.1703815	0.1410599	0.07174959
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In [139]:

```
### NEW FUNCTION FOR GROWTH XTS
```

```
growth_xts <- function(x) {
  rate=diff(x)/stats::lag(x)
  return(rate)
}
```

In [143]:

```
length(Greece_xts$year)
```

70

In [147]:

```
#get average gdp for every 10 years
```

```
rollapply(growth_xts(Greece_xts$rgdpe),width=10,by=10,mean,na.rm=T)
```

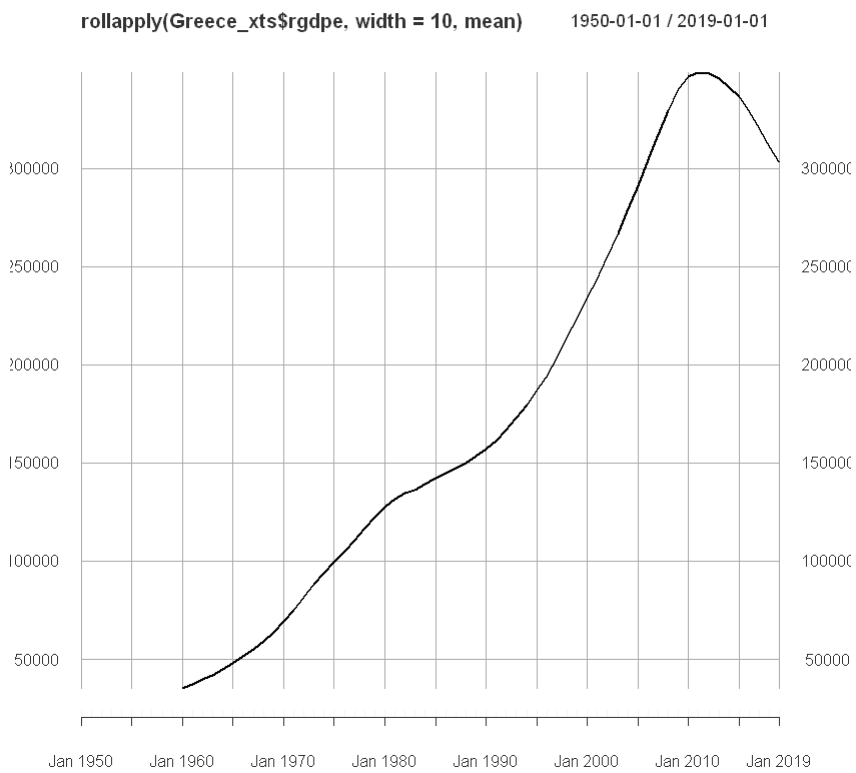
	rgdpe
1950-01-01	NA
1951-01-01	NA
1952-01-01	NA
1953-01-01	NA
1954-01-01	NA
1955-01-01	NA
1956-01-01	NA
1957-01-01	NA
1958-01-01	NA
1959-01-01	0.05605182
1960-01-01	NA
1961-01-01	NA
1962-01-01	NA
1963-01-01	NA
1964-01-01	NA
1965-01-01	NA
1966-01-01	NA
1967-01-01	NA
1968-01-01	NA

1969-01-01	0.07762066
1970-01-01	NA
1971-01-01	NA
1972-01-01	NA
1973-01-01	NA
1974-01-01	NA
1975-01-01	NA
1976-01-01	NA
1977-01-01	NA
1978-01-01	NA
1979-01-01	0.05077978
1980-01-01	NA
1981-01-01	NA
1982-01-01	NA
1983-01-01	NA
1984-01-01	NA
1985-01-01	NA
1986-01-01	NA
1987-01-01	NA
1988-01-01	NA
1989-01-01	0.02022771
1990-01-01	NA
1991-01-01	NA
1992-01-01	NA
1993-01-01	NA
1994-01-01	NA
1995-01-01	NA
1996-01-01	NA
1997-01-01	NA
1998-01-01	NA
1999-01-01	0.04510851
2000-01-01	NA
2001-01-01	NA
2002-01-01	NA
2003-01-01	NA
2004-01-01	NA
2005-01-01	NA
2006-01-01	NA
2007-01-01	NA
2008-01-01	NA
2009-01-01	0.03375874
2010-01-01	NA
2011-01-01	NA
2012-01-01	NA
2013-01-01	NA

2014-01-01	NA
2015-01-01	NA
2016-01-01	NA
2017-01-01	NA
2018-01-01	NA
2019-01-01	-0.02204170

In [148]:

```
plot(rollapply(Greece_xts$rgdpe,width=10,mean))
```



In [: