

# Mauritius time series

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## Introduction

This document aims to define whether macroeconomics variables in Mauritius are endogenous. The dataset used to produce these figures and tables is merge from various sources. It gathers data from 1964 to 2018.

## Data summary

The dataset **dbase** includes the following variables:

```
## [1] "year"      "birth"      "death"      "infmortality" "stillbirth"
## [6] "marriage"  "divorce"    "gdp"        "g"          "inf"
```

- **birth**: The number of live births in a year per 1,000 mid-year population.
- **death**: The number of deaths in a year per 1,000 mid-year population.
- **infmortality**: The number of infant deaths in a year per 1,000 live births during the year.
- **g**: Annual growth rate
- **inf**: Annual inflation rate, Percent, Not Seasonally Adjusted
- **gdp**: Gross domestic product, billions of US \$
- **marriage**: The number of persons married in a year per 1,000 mid-year population.
- **divorce**: The number of persons divorced in a year per 1,000 mid-year population.

How many observations do we have ? The function **nrow()** returns the number of rows and which is in the number of observations in our situation.

```
nrow(dbase)
```

```
## [1] 55
```

Let's look at the descriptive statistics of our variables.

```
summary(dbase)
```

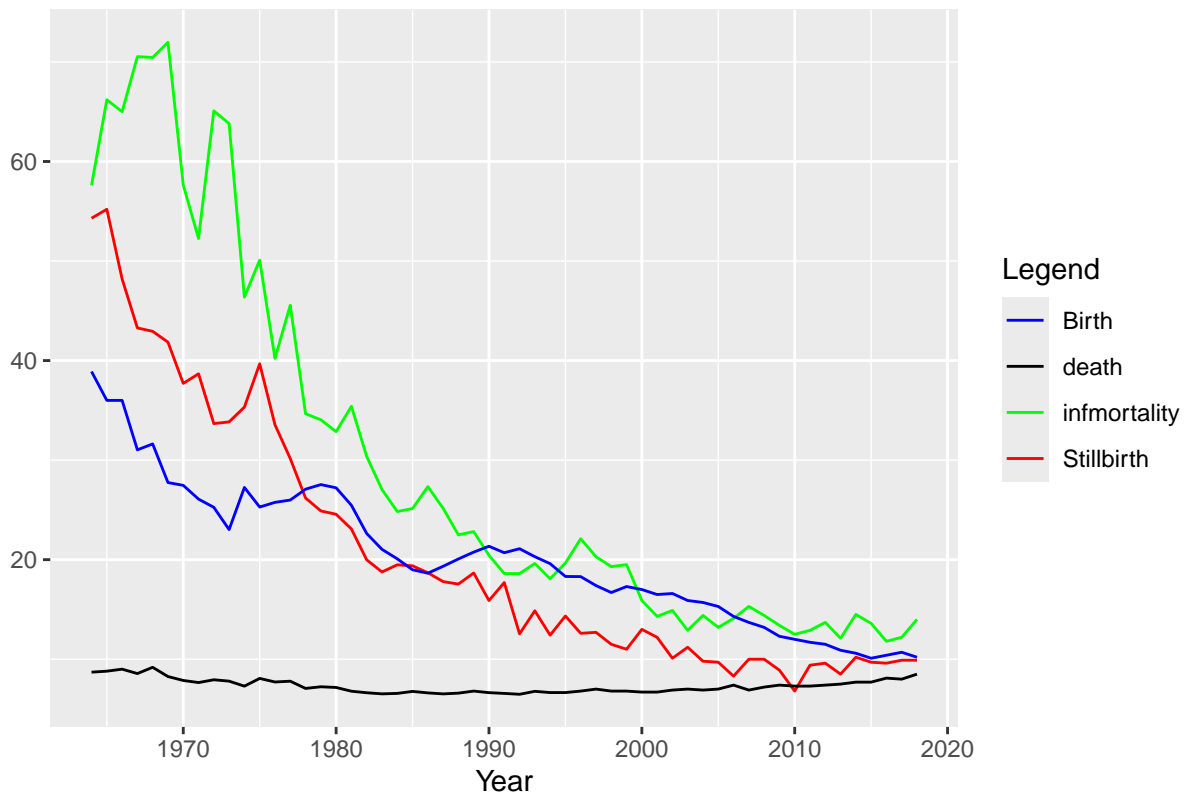
```
##      year      birth      death      infmortality      stillbirth
## Min.   :1964   Min.   :10.10   Min.   :6.476   Min.   :11.80   Min.   : 6.80
## 1st Qu.:1978   1st Qu.:15.50   1st Qu.:6.770   1st Qu.:14.40   1st Qu.:10.05
## Median :1991   Median :19.60   Median :7.162   Median :20.44   Median :15.89
## Mean   :1991   Mean    :20.29   Mean    :7.321   Mean    :29.48   Mean    :20.72
```

```
## 3rd Qu.:2004    3rd Qu.:25.61    3rd Qu.:7.752    3rd Qu.:37.81    3rd Qu.:28.18
## Max.    :2018    Max.    :38.90    Max.    :9.188    Max.    :71.97    Max.    :55.20
## marriage      divorce      gdp      g
## Min.   : 9.947    Min.   :0.2169    Min.   : 0.3163    Min.   : -0.79486
## 1st Qu.:15.741    1st Qu.:0.4878    1st Qu.: 3.2169    1st Qu.: -0.33537
## Median :18.400    Median :1.3889    Median : 6.4193    Median : -0.05803
## Mean   :17.353    Mean   :1.4790    Mean   : 7.3360    Mean   : 0.73759
## 3rd Qu.:20.057    3rd Qu.:2.1000    3rd Qu.: 9.0364    3rd Qu.: 0.35264
## Max.   :23.012    Max.   :3.8000    Max.   :41.9995    Max.   :16.65818
## inf
## Min.   : 0.3163
## 1st Qu.: 3.2169
## Median : 6.4193
## Mean   : 7.3360
## 3rd Qu.: 9.0364
## Max.   :41.9995
```

How did the variables evolve during the years ? First, the health data.

```
dbase %>%
  ggplot() +
  geom_line(aes(y = stillbirth, x = year, color = "Stillbirth")) +
  geom_line(aes(y = death, x = year, color = "death")) +
  geom_line(aes(y = infmortality, x = year, color = "infmortality")) +
  geom_line(aes(y = birth, x = year, color = "Birth")) +
  xlab('Year') +
  ylab('') +
  labs(title = "Health variables over Time - Mauritius", color = "Legend") +
  scale_color_manual(values = c("Stillbirth" = "red", "Birth" = "blue", "death" = "black",
                                "infmortality" = "green"))
```

## Health variables over Time – Mauritius

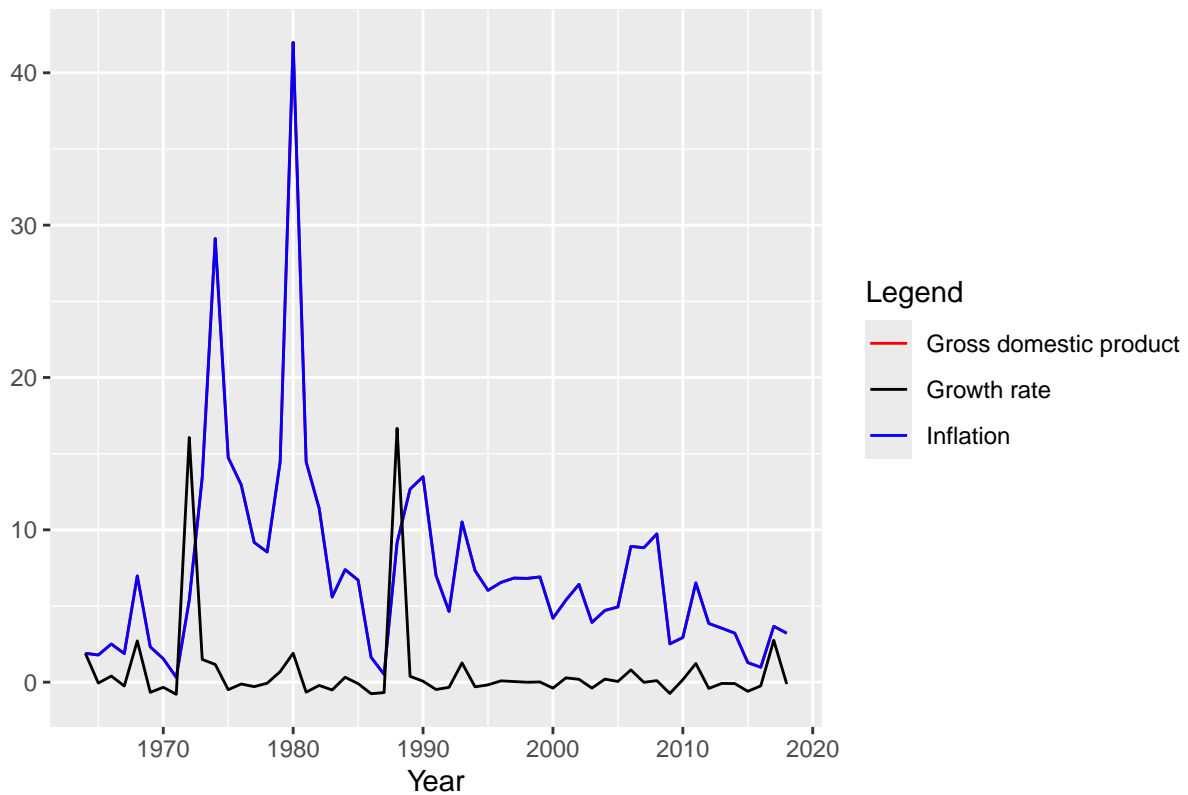


We can see that every rate is decreasing and might probably be correlated. Evaluating this effect through regression would probably be misleading as all those variable are likely to be endogenous. Methods such as Vector Auto-Regressive models suit well to identify such relationships but require high frequency data such as monthly data. The data set only provides yearly data which does not ensure the estimations to be converging.

Before we investigate this, let's consider macroeconomic data.

```
dbase%>%
ggplot() +
  geom_line(aes(y =gdp , x = year, color = "Gross domestic product")) +
  geom_line(aes(y =inf , x = year, color = "Inflation")) +
  geom_line(aes(y =g , x = year, color = "Growth rate"))+
  xlab('Year') +
  ylab('') +
  labs(title = "Macroeconomic variables over Time - Mauritius", color = "Legend") +
  scale_color_manual(values = c("Gross domestic product" = "red",
                                "Inflation" = "blue","Growth rate"="black"))
```

## Macroeconomic variables over Time – Mauritius

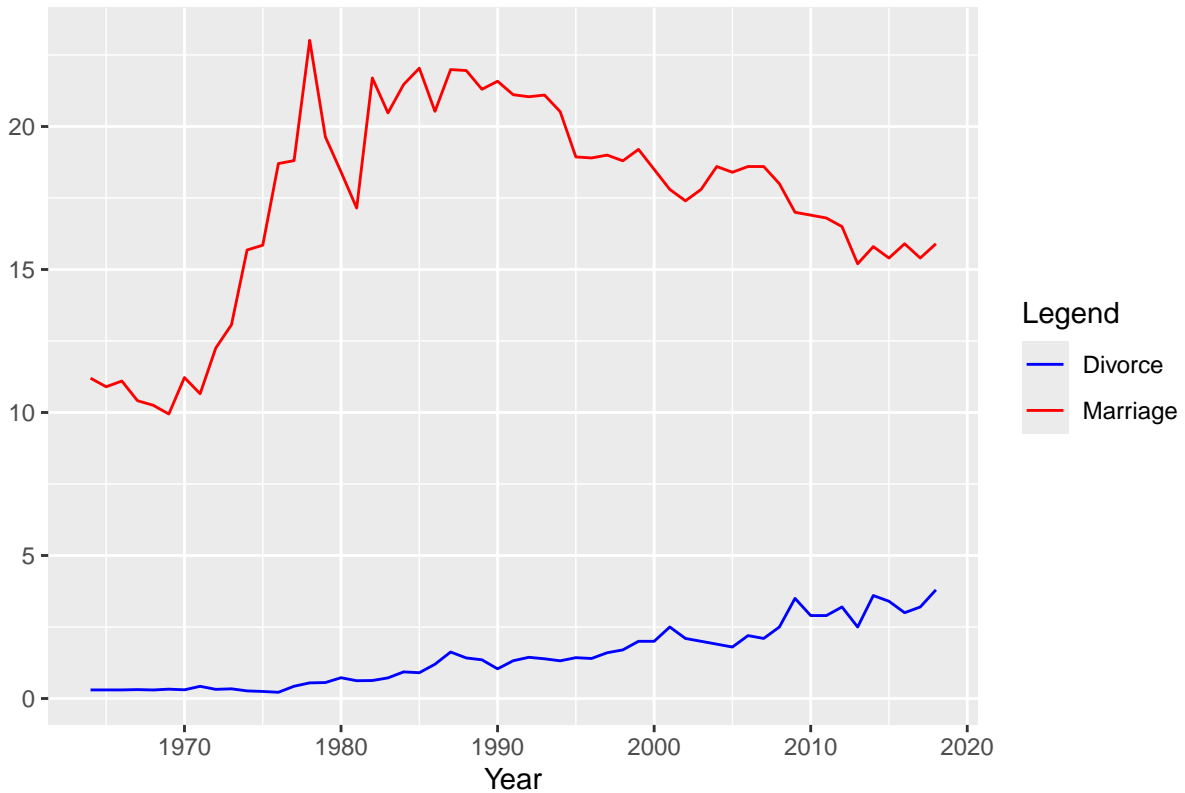


Plotting inflation, growth rate and gross domestic product such as the figure above might be misleading. Because the different values have different scales, it is misleading to plot these three time series together. Because of larger values, slight changes in smaller values are unobtrusive. Scatter plot, though they have another purpose, is more suitable to investigate such data relationship.

Finally, let's consider marriage and divorce values.

```
dbase%>%  
ggplot() +  
  geom_line(aes(y =marriage , x = year, color = "Marriage")) +  
  geom_line(aes(y =divorce , x = year, color = "Divorce")) +  
  xlab('Year') +  
  ylab('') +  
  labs(title = "Marital variables over Time - Mauritius", color = "Legend") +  
  scale_color_manual(values = c("Marriage" = "red",  
                                "Divorce" = "blue"))
```

## Marital variables over Time – Mauritius



Recall that these variables are measured on the same scale. Interpreting these values does not require the same caution as for the previous plot. At first glance, there does not seem to be any linear correlation between both variables.

In the previous figure, we did plot inflation which feature a sharp increase around **1980**. At the same period, there is inverse trend to inflation in marriage. Can we infer whether there is a relationship between marriage and divorce ? As discussed previously, the low frequency of data might hamper inference, especially if we seek to investigate long term effect.<sup>1</sup>

Finally, before embarking in the inference journey, let's take a look to the distributions of our variables.

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<sup>1</sup>Indeed, if many lags are used, a substantial share of data is to be put aside. For instance, considering 8 lags implies that the first eight observations are not considered in regressions, which almost amounts to 15% of the observations.

