Marketing Analytics

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```
library('ggplot2')
```

```
## Warning: package 'ggplot2' was built under R version 4.2.3
```

```
library('ggpubr')
```

```
## Warning: package 'ggpubr' was built under R version 4.2.3
```

```
library('knitr')
```

```
## Warning: package 'knitr' was built under R version 4.2.3
```

```
library(readxl)
```

```
## Warning: package 'readxl' was built under R version 4.2.3
```

```
library(diffusion)
```

```
## Warning: package 'diffusion' was built under R version 4.2.3
```

I chose to analyze stroller Innovation that gives a benefit to carry a luggage a long with children (https://time.com/collection/best-inventions-2022/6224793/ternx-carry-on/) and then I've found historical sales data in North Americas stroller market that as the product itself is designed by North American market it is sensible to analyze their market first.

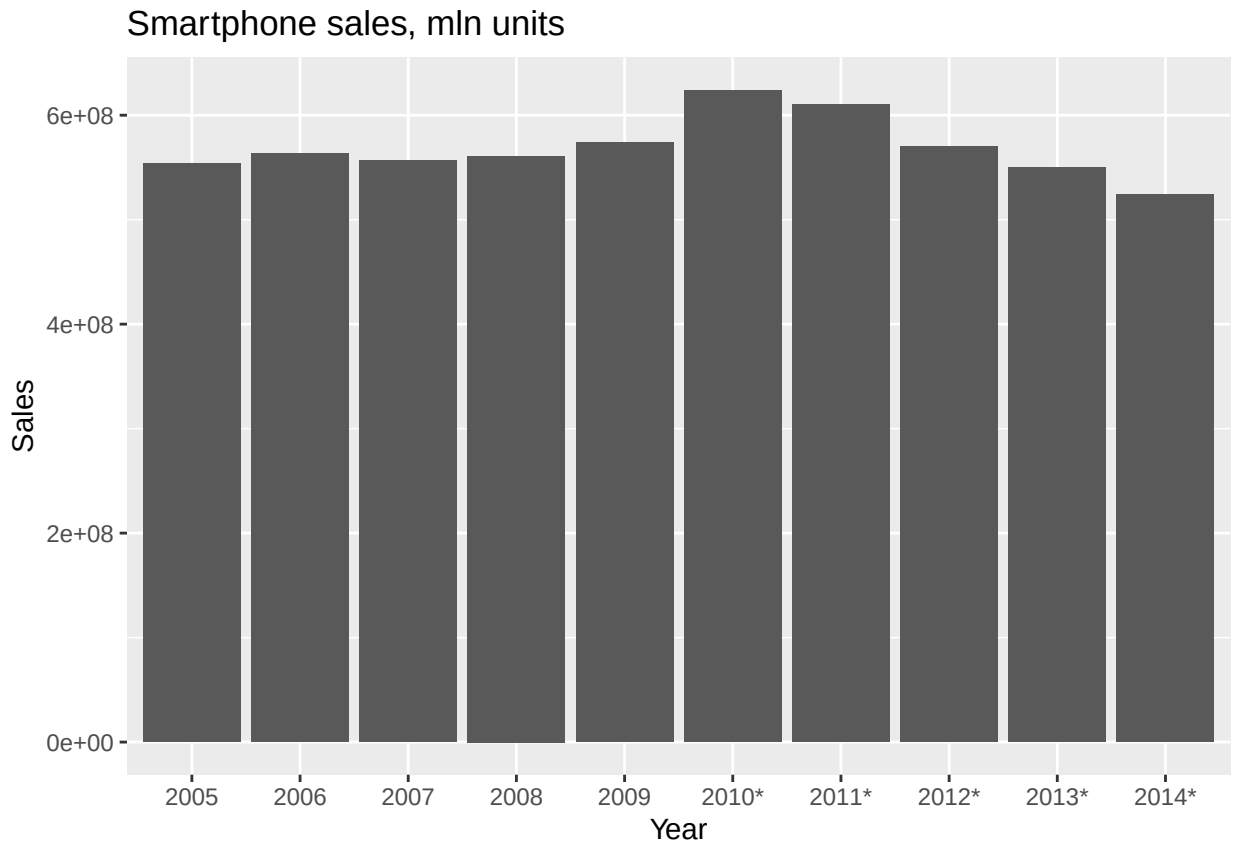
The link to data is attached in readme file

Scope : I have to analyze US's Stroller Market

```
#read Data

data<- read_excel("../data/StrollerSalesData.xlsx")

data$Sales = data$Sales * 1000000

head(data)
```

```
## # A tibble: 6 x 2
##   Year      Sales
##   <chr>     <dbl>
## 1 2005  554000000
## 2 2006  563000000
## 3 2007  557000000
## 4 2008  561000000
## 5 2009  574000000
## 6 2010* 624000000
```

```
sm_sales = ggplot(data = data, aes(x = Year, y = Sales)) +
geom_bar(stat = 'identity') +
ggtitle('Smartphone sales, mln units')

ggarrange(sm_sales)
```



Now we define model

```
sales = data$Sales
t = 1:length(sales)
bass_m = nls(sales ~ m*(((p+q)^2/p)*exp(-(p+q)*t))/(1+(q/p)*exp(-(p+q)*t))^2,start=c(list(m=sum(sales),
summary(bass_m)
```

```
##
```

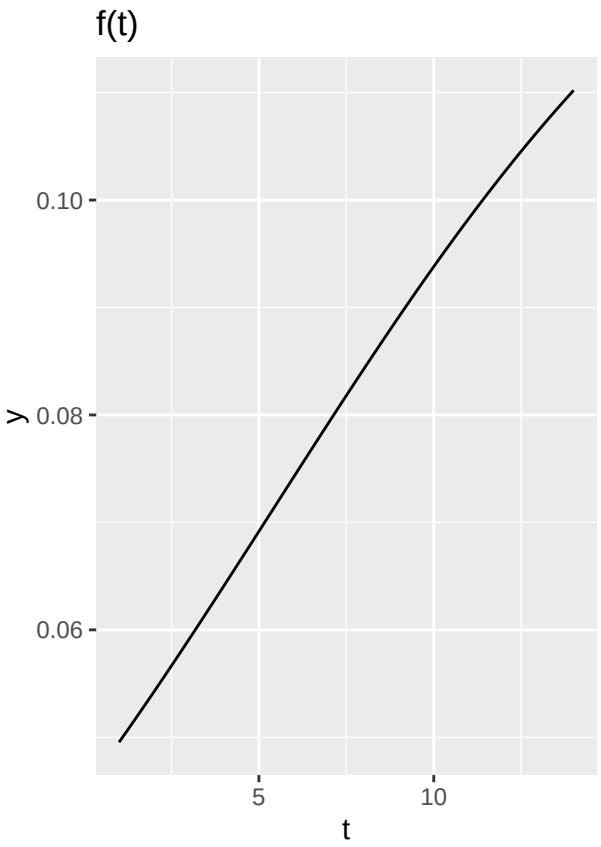
```
## Formula: sales ~ m * (((p + q)^2/p) * exp(-(p + q) * t))/(1 + (q/p) *
##     exp(-(p + q) * t))^2
##
## Parameters:
##    Estimate Std. Error t value Pr(>|t|)
## m 1.137e+10  1.366e+09   8.320 7.09e-05 ***
## p 4.503e-02  4.103e-03  10.977 1.15e-05 ***
## q 9.761e-02  2.148e-02   4.543  0.00266 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 22070000 on 7 degrees of freedom
##
## Number of iterations to convergence: 6
## Achieved convergence tolerance: 5.406e-07
```

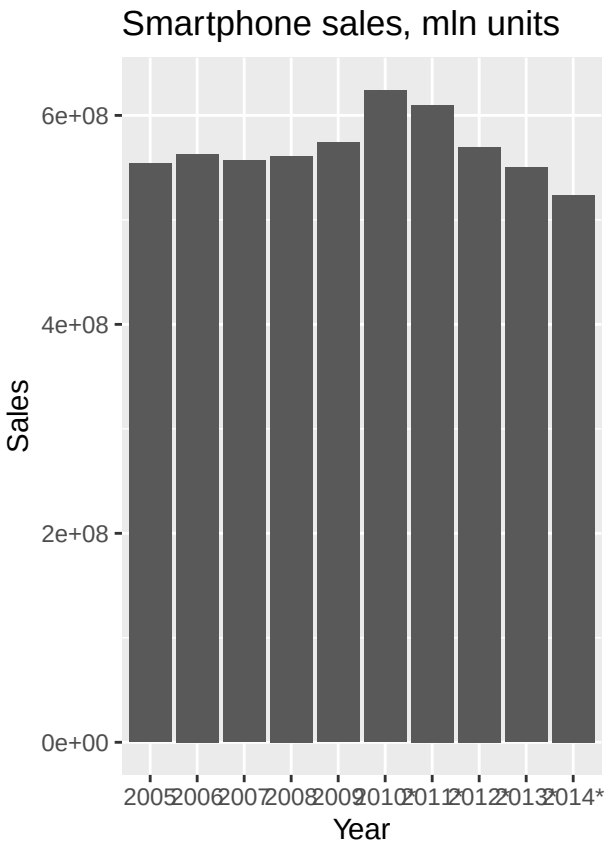
```
# I kin
```

Now we see the estimated parameters we need bass Model functions

```
bass.F <- function(t, p, q) {
  numerator <- 1 - exp(-(p + q) * t)
  denominator <- 1 + (q / p) * exp(-(p + q) * t)
  return(numerator / denominator)
}

bass.f <- function(t, p, q) {
  F_t <- bass.F(t, p, q)
  return(p + q * F_t)
}
```

```
time_ad = ggplot(data.frame(t = c(1:14)), aes(t)) +
stat_function(fun = bass.f, args = c(p=4.503e-02, q=9.761e-02)) +
labs(title = 'f(t)')

ggarrange(time_ad, sm_sales)
```





Calculating estimations using diffusion

```
diff_m = diffusion(sales)
p=round(diff_m$w,4)[1]
q=round(diff_m$w,4)[2]
m=round(diff_m$w,4)[3]
diff_m
```

```
## bass model
##
## Parameters:
##       Estimate p-value
## m 1.118569e+10      NA
## p 4.670000e-02      NA
## q 9.600000e-02      NA
##
## sigma: 18578141.7689
```

SCOPE : Our Scope is bounded in North Amerika's market as we are analyzing Sales in North America only

```
data.frame(Predicted=log(q/p)/(p+q),
Actual=which.max(data$Sales))
```

```
##       Predicted Actual
## p -2.342449e-09      6
```