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)
```

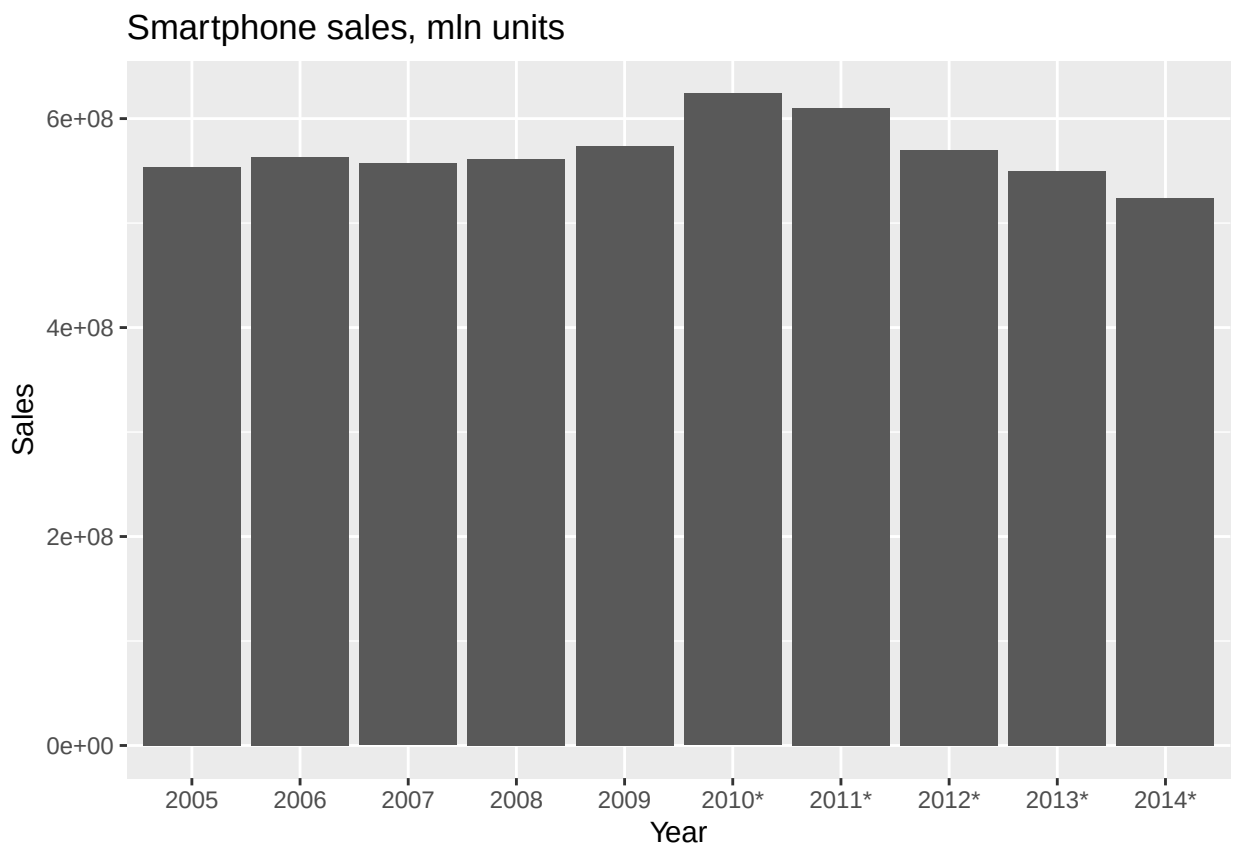
```
## Warning: package 'diffusion' was built under R version 4.2.3
```

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
```

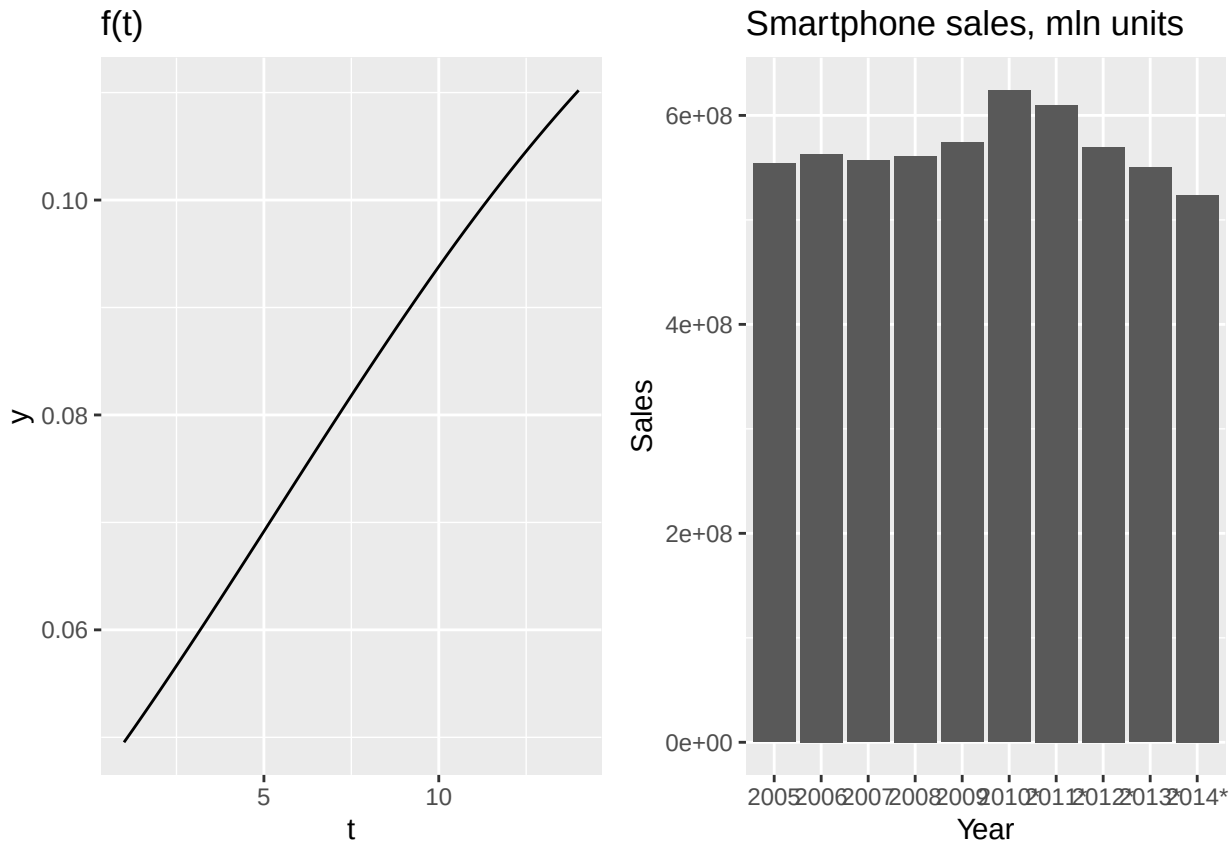
```
##
## Residual standard error: 22070000 on 7 degrees of freedom
##
## Number of iterations to convergence: 6
## Achieved convergence tolerance: 5.406e-07
```

```
# 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
```