Laptop-Brand Analysis

Adeyinka Adewojo

Aparna Pai

Harsh Misra

Mahaalaxmi Ganesan

Sivaganesh Subramaniyan

Sumeet Birla

Business Perspective

How do local Electronics retailers determine the price of a new laptop model given its characteristics?

How do Asian brands and American Brands differ in terms of laptop configuration, vendors and revenue?

What is their bargaining power and at what competitive price do they set for a laptop to optimize their profit margin?

What can these brands do specifically to optimize their business model and surge their profits?

Research Questions

1. What are the **factors affecting the price** of a laptop?

2. Is there a **price difference** for laptops of **Asian / American brands**?

3. Is there a **difference in revenue of Asian / American** Laptop **brands**?

4. How do **laptop specifications vary across Asian / American Laptops**.

5. Can **brand revenue dramatically influence the price** of a laptop?

Process Flow

Data Extraction   Data Exploration   Data Cleaning   Data Analysis   Gathering recommendation   Recommendations

Characteristics of the Dataset

- **BASE DATA :** Obtained the dataset from Kaggle.com

- Dimension : **1303 rows** and **13 Variables**

- Data was obtained for the year 2018

- **DATA ADDITION :** Brand value data of the top companies for 2018

- Added as a new column into the base data

- Contains Attributes such as :-

Factor Variables	Numeric Variables
Company Name	Weight
Type of Laptop	Price
Ram	CPU Clock Speed
Memory	

Original Data Source

- The laptop data was scrapped from a website of a marketplace in Athens.

- The link for the website is: https://www.skroutz.gr/c/25/laptop.html?page=1

- This business can be thought of as a smaller version of Amazon having different merchants selling different products.

- The data is exhaustive in terms of the type, brand and other specifications of the laptop for the year 2018.

- The brand revenue data was obtained from a dataset of world's most valuable brands.

- The link for the website is https://knoema.com/ynmtjnc/the-world-s-most-valuable-brands

Data Cleaning

❖ Variables converted to Factors :-

   Company Name

   Type of Laptop

   Screen Resolution

   Operating System

   Memory

   Memory Type

   CPU

   RAM

❖ Variables converted to Numeric :-

   Weights

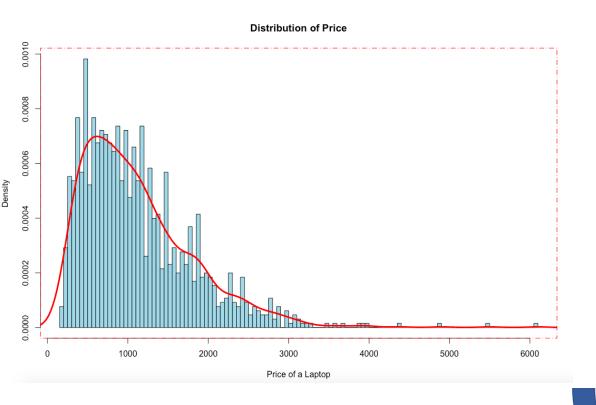   CPU clock

   Price

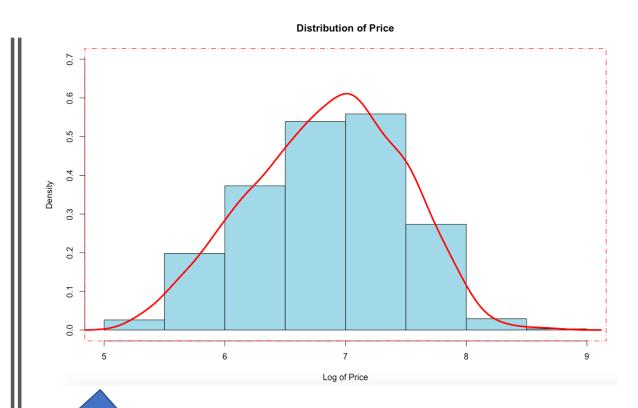❖ Unused Variables :-

   Laptop ID

   Laptop Name

No null or NA values

Data Wrangling

| Variable	Conversion	Reason
Company	Converted to Asian and American brands	Had too many factors levels but very few rows in some categories
Type Name	Combined Desktops and netbooks	Very few entries for these two categories. Moreover these are not laptops.
Screen Resolution	Divided the data into 2 parts: 1920*1080 and other	The dataset had most entries for 1920*1080 as most laptop come up with this as a preferred resolution
CPU	Kept information regarding the brand name	This can be useful in determining the preferred brand for laptop companies. The Different models pf the CPU made it difficult to compare the laptop
RAM	Converted the values to more than 8 GB and less than 8 GB	Most laptop now a days have 8 GB of RAM so we took that as a standard
GPU	Kept information regarding the brand name	This can be useful in determining the preferred brand for Graphic Cards.
Memory	Converted the values to more than 500 GB and less than 500 GB	We took 500GB as a standard and divided the variable into 2 levels
Operating System	Combined all the windows OS into one category and all the Macs into one	One unified category of all the windows and mac OS can give better insights about the brand being used.
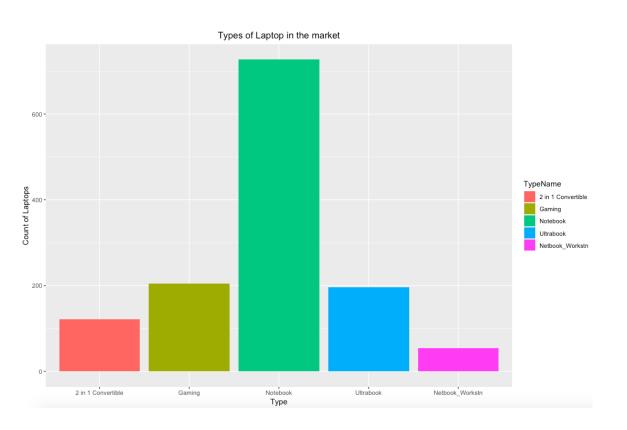
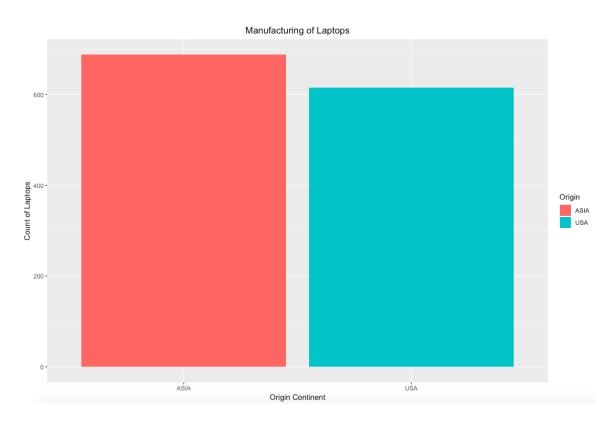# Types of Laptop and manufacturing Firms

❖ Higher number of Notebooks than any other types
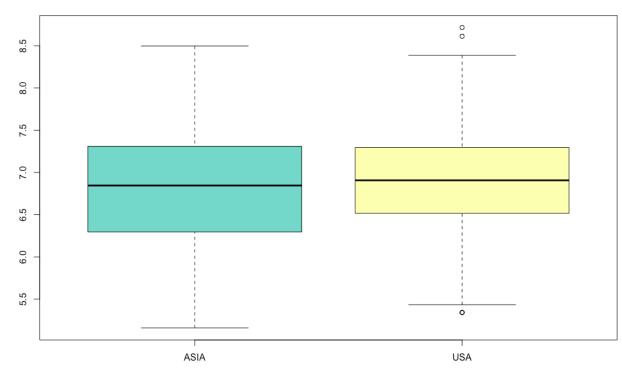
❖ Almost equal distribution of Laptop production

Bi-variate Analysis

Log of Price of laptop across origin
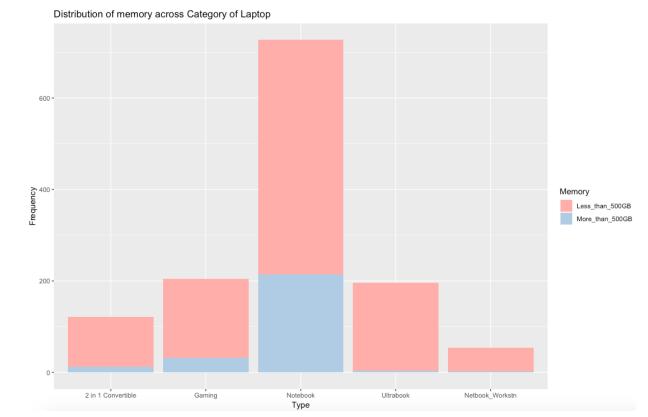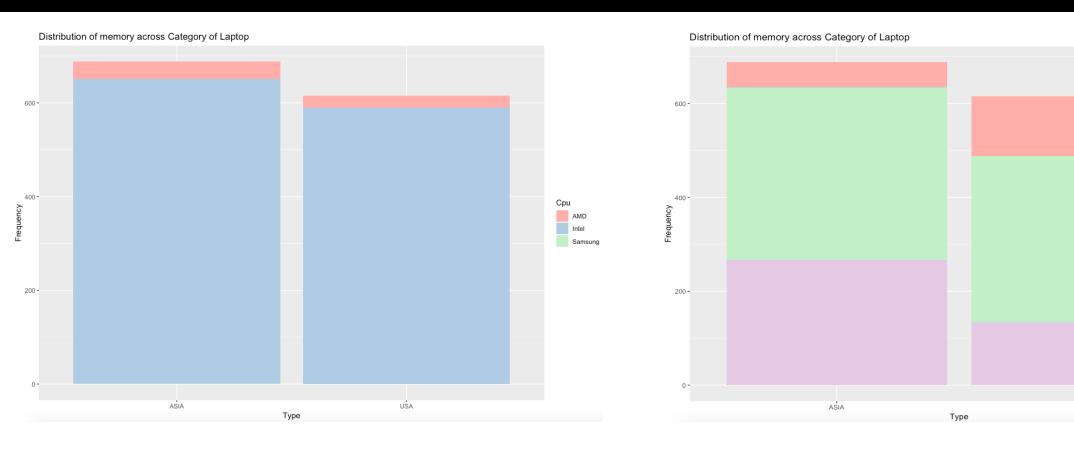
❖ Almost similar trend for the log price of laptops across Asia and USA with a slightly greater variation in the log of price of Asian laptops.

❖ Ultra books and netbooks have low power processors and hence the memory is also limited.

❖ Notebooks, Gaming laptop and 2 in 1 convertibles have some proportion of laptops which are high on memory.

Distribution of memory across Category of Laptop

Brand Comparison for CPU and Graphic Cards

Distribution of memory across Category of Laptop

❖ Intel is the industry leader for CPU as well as GPU.

❖ In Asia, Nvidia holds high market share

❖ In USA, Nvidia and AMD hold similar market share

Specs	Coefficient
TypeNameNotebook	-0.26978
CpuIntel	0.41129
CpuClockSpeed	0.30341
RamLess_than_8GB	-0.39285
RamMore_than_8GB	0.35525
MemoryTypeHDD	0.22214
MemoryTypeSSD	0.47684

Analyzing factors affecting Laptop price

➢ **HYPOTHESIS** : There is a relationship between Laptop price, CPU and RAM

➢ **RESULT** :

Following specs increase the (log) price of a laptop :-
- Intel (Compared to AMD Chip)
- CPU Clock Speed
- RAM : More than 8GB
- HDD and SSD Memory (Compared to Flash)

Following specs decrease the (log) price of a laptop :-
- Notebook (Compared to 2in1 Convertible Laptop)
- RAM : Less than 8GB

➢ **BUSINESS VALUE** :

Retailers can price their Laptops higher if they have Intel Chip, higher CPU clock speeds, more than 8GB RAM and have SSD/HDD Memory.

2in1 Convertible laptops are priced higher than Notebooks

Analyzing differences in Laptop price by Origin

```
> summary(price_origin.aov)
                Df    Sum Sq Mean Sq F value Pr(>F)
laptop$Origin     1   1772884 1772884   3.647 0.0564 .
Residuals      1294 629093472  486162
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> model4<-lm(log(Price_euros) ~ Origin, data=laptop)
> summary(model4)

Call:
lm(formula = log(Price_euros) ~ Origin, data = laptop)

Residuals:
    Min      1Q   Median      3Q      Max
-1.64176 -0.43473  0.03105  0.44897  1.81920

Coefficients:
             Estimate Std. Error t value            Pr(>|t|)
(Intercept)   6.80082    0.02360 288.117 < 0.0000000000000002 ***
OriginUSA     0.09586    0.03427   2.798             0.00522 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.616 on 1294 degrees of freedom
Multiple R-squared:  0.006012,  Adjusted R-squared:  0.005244
F-statistic: 7.827 on 1 and 1294 DF,  p-value: 0.005223

> exp(coef(model4))
(Intercept)    OriginUSA
  898.58046      1.10061
```

➢ **HYPOTHESIS** :

Laptops of American brands are priced higher than Asian Counterparts.

➢ **RESULT** :

The (log) price of a laptop of an American brand is 1.10 times more than that of an Asian Brand

Analyzing Laptop Specifications by Origin

Specs	Coefficients
TypeNameGaming	0.4697715
TypeNameNetbook_Workstn	3.42398394
RamMore_than_8GB	0.61097106
log(Price_euros)	2.42277741
MemoryTypeHDD	2.03941661

➢ **RESEARCH QUESTION :** How do the configuration trends differ across Asian / USA brands?

➢ **RESULT** :

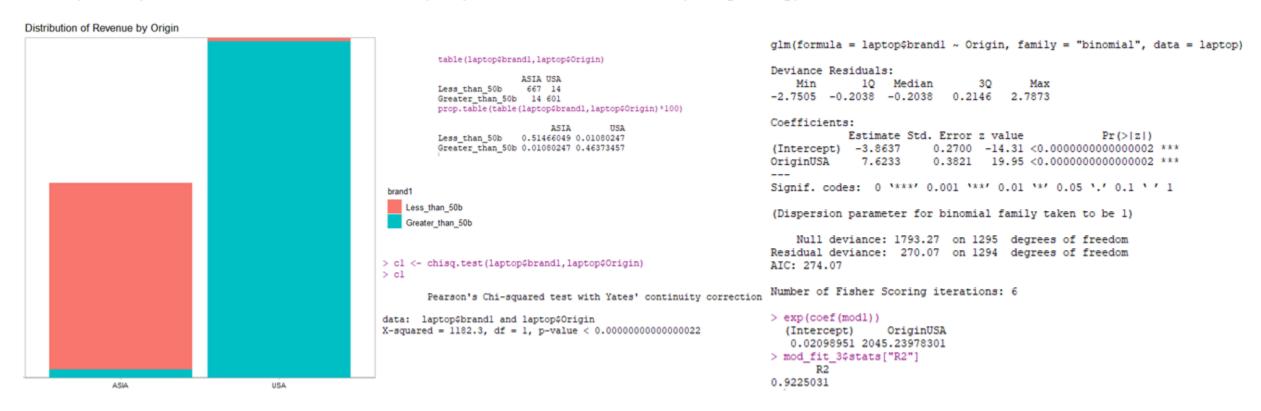 The odds of a laptop being of an Asian Brand is higher if it has :
- Gaming / Netbook / Workstation
- More than 8 GB RAM
- HDD Memory Type
- (Log) price is 2.03

➢ **BUSINESS VALUE** :

2in1 Convertible and Notebook style laptops significantly dominated by American Brands.

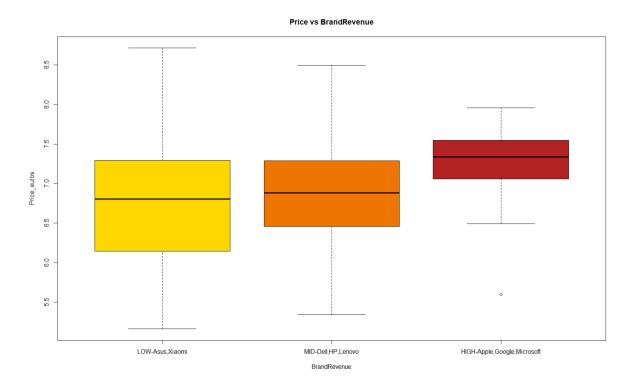This segment can be explored by Asian brands.

Analyzing Brand Revenue and Origin

- HYPOTHESIS : There is a relationship between Brand Revenue & Origin Country.

- RESULT :The odds of an American brand having revenue greater than $50B is 2045 times higher than the odds of an Asian laptop brand.

- BUSINESS VALUE : Asian Laptop brands need to re-evaluate their business model to increase revenue. This can be achieved by performing a deeper analysis into their business model and they may need a reformation in their pricing strategy and sales numbers.

Distribution of Revenue by Origin


```
table(laptop$brand1,laptop$Origin)

              ASIA USA
Less_than_50b   667  14
Greater_than_50b 14  601
prop.table(table(laptop$brand1,laptop$Origin)*100)

                   ASIA        USA
Less_than_50b   0.51466049 0.01080247
Greater_than_50b 0.01080247 0.46373457
```

brand1

- Less_than_50b
- Greater_than_50b

```
> cl <- chisq.test(laptop$brand1,laptop$Origin)
> cl

        Pearson's Chi-squared test with Yates' continuity correction

data:  laptop$brand1 and laptop$Origin
X-squared = 1182.3, df = 1, p-value < 0.00000000000000022
```

```
glm(formula = laptop$brand1 ~ Origin, family = "binomial", data = laptop)

Deviance Residuals:
    Min      1Q   Median      3Q     Max
-2.7505  -0.2038  -0.2038  0.2146  2.7873

Coefficients:
            Estimate Std. Error z value      Pr(>|z|)
(Intercept)  -3.8637     0.2700  -14.31 <0.0000000000000002 ***
OriginUSA     7.6233     0.3821   19.95 <0.0000000000000002 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1793.27  on 1295  degrees of freedom
Residual deviance:  270.07  on 1294  degrees of freedom
AIC: 274.07

Number of Fisher Scoring iterations: 6

> exp(coef(mod1))
  (Intercept)      OriginUSA
   0.02098951 2045.23978301
> mod_fit_3$stats["R2"]
       R2
0.9225031
```

Analyzing Laptop price and Brand Revenue

- **HYPOTHESIS** : There is a relationship between laptop price & Brand Revenue

- **RESULT** : The laptops belonging to higher level brands are 1.47 times more expensive than those in the lower level brands. Also laptops belonging to medium level brands are 1.14 times more expensive compared to low level brands

- **BUSINESS VALUE** : Asian brands to consider investing towards building brand value : provides an opportunity to place their products premium segment and hence, price their products higher.

Price vs BrandRevenue

Price_euros (y-axis): 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5

BrandRevenue (x-axis): LOW-Asus,Xiaomi | MID-Dell,HP,Lenovo | HIGH-Apple,Google,Microsoft

```
> #Performing the ANOVA Test to reinforce the finding
> expense_catalog_model <- aov(log(Price_euros)~ brand2, data=laptop)
> summary(expense_catalog_model)
              Df Sum Sq Mean Sq F value   Pr(>F)
brand2         2   11.8   5.879   15.77 1.72e-07 ***
Residuals   1293  482.2   0.373
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
>
```

```
> #Performing OLS Regression to reinforce the finding
> model_1 <- lm(log(Price_euros) ~ brand2, data= laptop)
> summary(model_1)

Call:
lm(formula = log(Price_euros) ~ brand2, data = laptop)

Residuals:
     Min       1Q   Median       3Q      Max
-1.70220 -0.42542  0.02617  0.43893  1.96527

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  6.96929    0.03400 204.979  < 2e-16 ***
brand2.L     0.38629    0.07071   5.463  5.6e-08 ***
brand2.Q     0.13342    0.04401   3.032  0.00248 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.6107 on 1293 degrees of freedom
Multiple R-squared:  0.02381,   Adjusted R-squared:  0.0223
F-statistic: 15.77 on 2 and 1293 DF,  p-value: 1.718e-07
```

RESULTS

➢ Following specs increase the (log) price of a laptop :-
   2in1 Convertible Model
   Intel (Compared to AMD Chip)
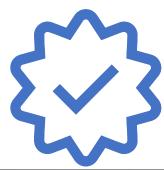   Higher CPU Clock Speeds
   RAM : More than 8GB
   HDD and SSD Memory (Compared to Flash)

➢ On an average, the (log) price of a laptop of an American brand is 1.10 times more than that of an Asian Brand

➢ On an average, the odds of an American brand having revenue >50 billion USD is 2045 times higher than that of Asian brand

➢ On an average, the laptops belonging to covetable brands price their laptops 1.47 times more than the lower valued brands

Recommendations for the Retailer

RESULT : The average Selling Price of a Laptop given its configuration & brand details can be determined using the OLS model with 74% accuracy

RECOMMENDATION : Using the 90% Confidence Interval Range as the benchmark to price a laptop would be ideal. The Upper confidence bound value could ensue maximum profit
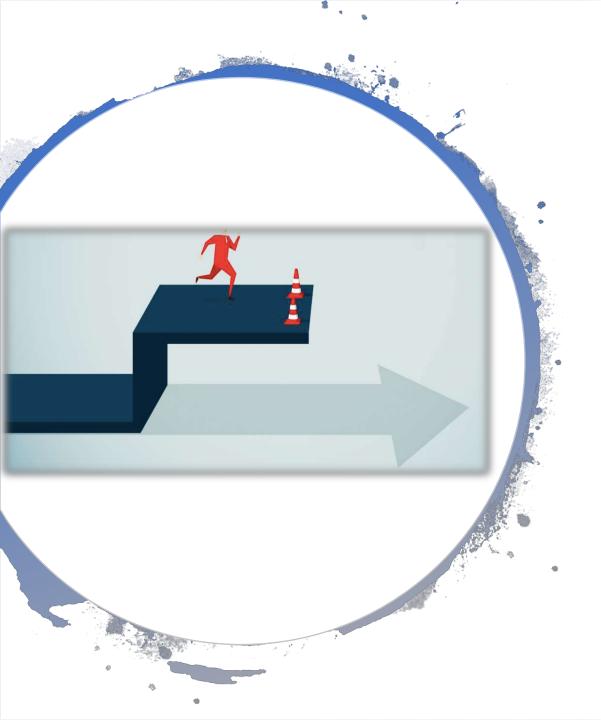
Recommendations for ASIAN Brands

RESULT : Laptops of Asian Brands are priced much lesser than American brands.

Hence, Asian brands generate lesser revenue (<50B $) than American brands.

RECOMMENDATION : Asian laptop manufacturers should price their laptops higher!

But how ?

- **EXPLOITING THE MARKET GAP -** 2in1 Convertible & Notebook style laptops segment should be explored by Asian brands which would let them price their products higher, hence, generate more revenue

- **BRAND VALUE ENHANCEMENT –** Asian brands should rebrand their company as an Aspirational brand which delivers high quality laptops, whose price shall be higher

- **STRONGER ECOSYSTEM PARTNERSHIP –** Incorporating Intel as the chip vendor, rather than AMD, shall enable Asian brands to price their laptops higher

Limitations

- The laptop data collected has no information about the following –

- **How many laptops under each of the 1300+ model types and 17 brands were sold in a year/quarter ?**

- This makes the cost-volume trade off analysis between Asian and American brands impossible to carry out

THANK YOU!