

# Modelling and forecasting the dynamics of mobile devices market shares

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Marketing Analytics  
and Forecasting



Lancaster University  
Management School

# Introduction

Competition on the market of computer technologies is dense...

SAMSUNG



LG

htc

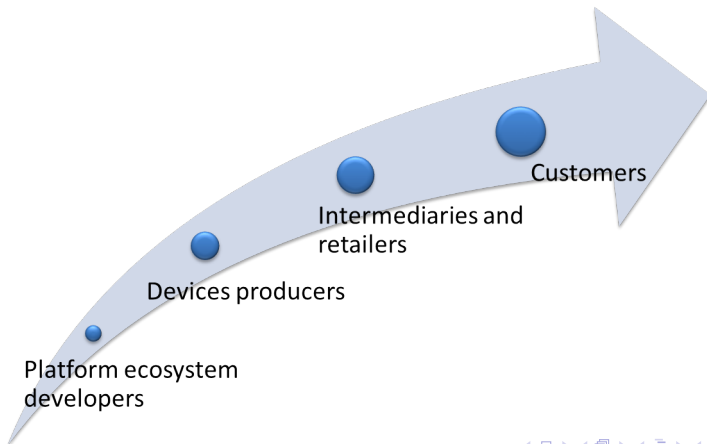
NOKIA



The winner of technological competitions is often 'who has the best platform strategy and the best ecosystem to back it up' (Cusumano, 2010).

# Market structure

The market has several levels...



# Introduction

The wisest strategy is to create the ecosystem.

But can it be distinguished from monopoly?

1. Microsoft bundling its browser to its operating system (Winkler, 2014);
2. Google services as main on the mobile devices (Edelman, 2015);
3. Investigating Google's tactics on mobile devices market (Kendall and Barr, 2015).

# Introduction

Rezitis (2010) examines whether it is the concentration in the market that causes the firms to mutually collude to enhance market power, or there are some other factors responsible for it.

Claessens & Laeven (2004) observe that when the size of the firm increases, its share in market also increases and provides an opportunity for that firm to earn higher profits.

# Introduction

Analysing market shares helps in determining concentration on the market:

- Herfindahl-Hirschman index (HHI) for average amount of competition:  $HHI = \sum_{j=1}^k s_j^2$
- Coefficient of variation of market shares:

$$v = k \sqrt{\frac{1}{k} \sum_{j=1}^k \left(s_j - \frac{1}{k}\right)^2}$$

$s_j$  is the market share of the  $j$ -th company on the whole market.

$k$  is the number of companies on the market.

# Introduction

In addition:

- Coefficient of segment concentration (Salihova, 2006).
  - ▶ For each company:  $SC_j = \frac{\sum_{i=1}^m |s_{i,j} - s_j|}{1 + (m-2)s_j}$
  - ▶ For the whole market:  $SC = \frac{1}{k} \sum_{j=1}^k SC_j$

where  $m$  is the number of segments on the market.

$s_{i,j}$  is the market share of  $j^{th}$  company on the segment  $i$ .

- $SC = 0$  - uniform distribution of market shares over all segments,
- $SC = 1$  - high concentration of one company on all the segments.

# Motivation

All these coefficients are static.

But market is dynamic.

If there is a connection between the segments over time, then this is probably an ecosystem.

If we can forecast market shares, we can diagnose the expected situation on the market.



# Data

# Data

Three segments in Europe: PCs, smartphones and tablets.

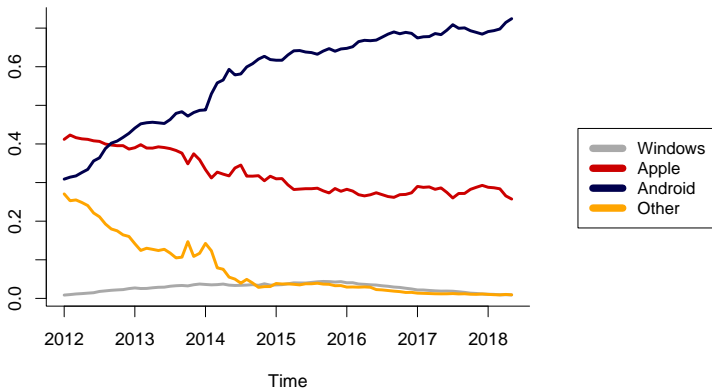
Several platforms:

- Windows,
- Apple,
- Android,
- Other (Linux, Chrome OS, Symbian, etc).

Usage of platforms on different devices.

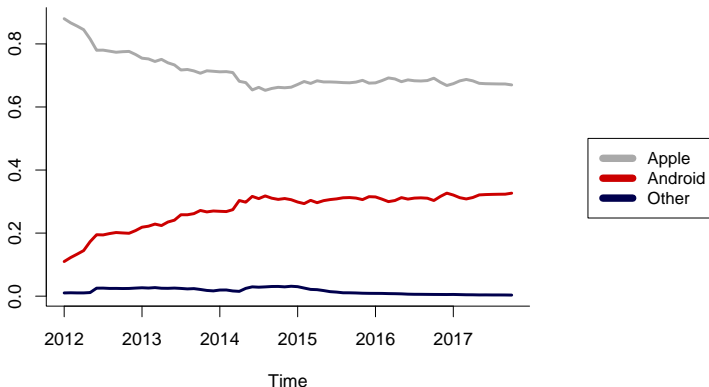
Monthly shares of each platform from StatCounter  
(<http://gs.statcounter.com>) from 2012 to 2018.

# Phones segment market shares



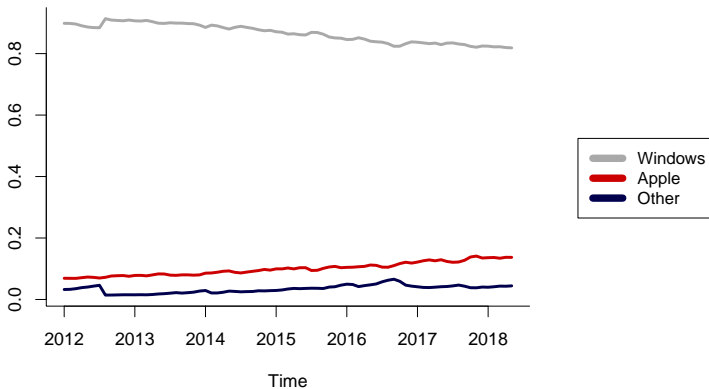
Data from <http://gs.statcounter.com>

# Tablets segment market shares



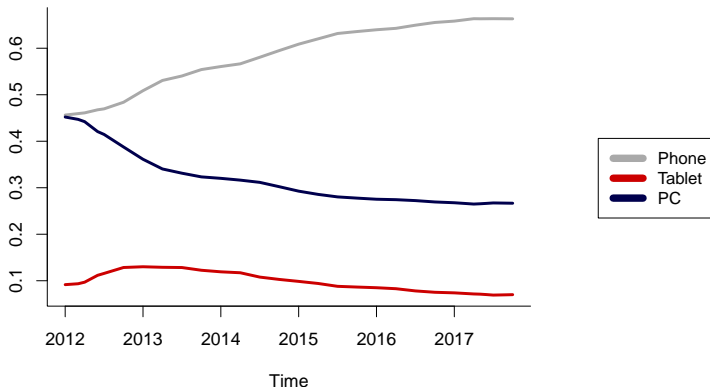
Data from <http://gs.statcounter.com>

# PCs segment market shares



Data from <http://gs.statcounter.com>

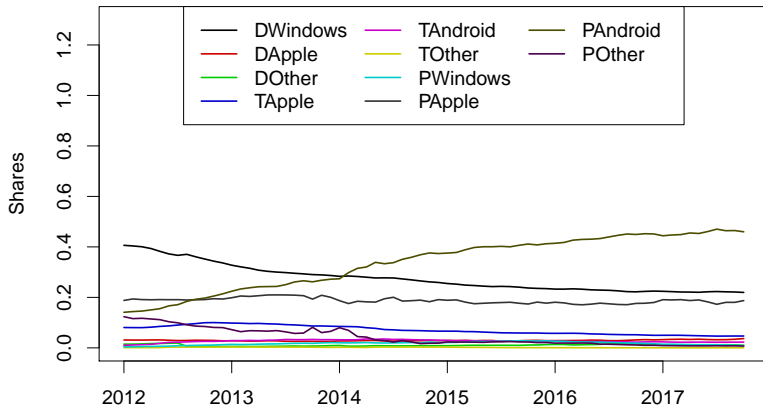
# Devices market shares



Based on the sales in millions USD from <https://statista.com>

# Shares for each OS in each segment

Combining everything, we end up with the following mess:



## Shares for each OS in each segment

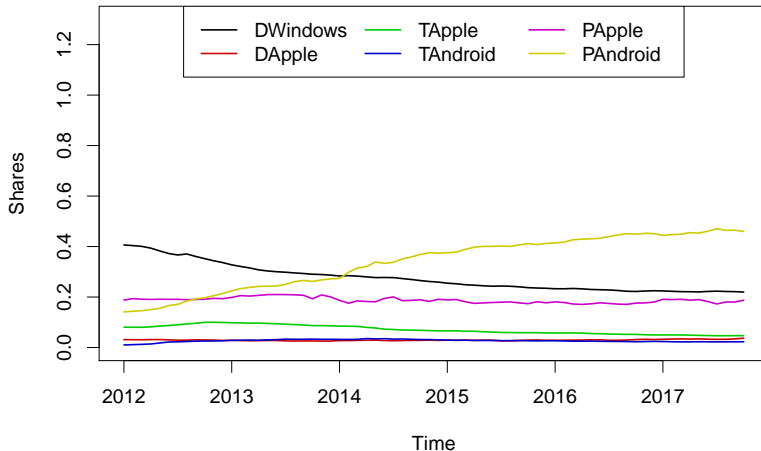
Some platforms have died out over the years,

The others have just appeared, but don't have a big share (less than 1%).

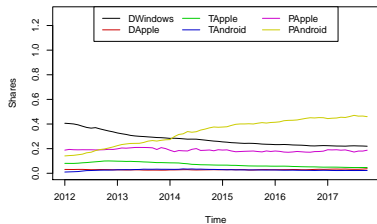
We removed those that don't have large share at the end of series...



# Shares for each OS in each segment



# Shares for each OS in each segment



## Observations:

- Android phones are dominating.
- Apple phones maintain the high share.
- Windows PCs are losing shares.

# Methodology

# Methodology

Modelling shares should take several aspects into account (Terui, 2000):

- Each share should be in  $(0, 1)$ ;
- Shares should add up to one.

Terui (2000) formulates BVAR and models shares directly, making sure that the logical consistency is satisfied.

Ribeiro Ramos (2003) uses VAR and BVAR models directly, ignoring the limitations.

# Methodology

Agrawal and Schorling (1996) compare forecasting performance of Multinomial Logistic Regression (MNL) with Neural Networks.

Fok and Franses (2001) use attraction model in order to obtain shares and acknowledge both limitations. They use regression in order to produce forecasts of shares.

# Methodology

We use MNL to transform the data.

Then we apply statistical model with additive errors.

Finally we produce forecasts and return to the original scale.

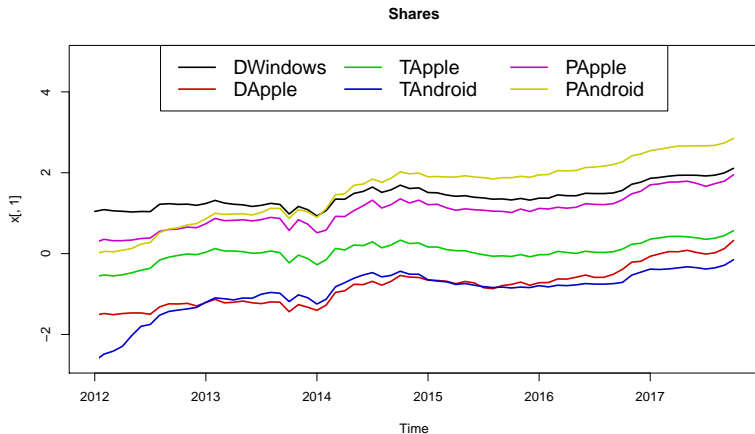
We use Vector Exponential Smoothing (VES from de Silva et al., 2010) for forecasting.

We use VAR for the analysis of the connections.

# Analysis and forecasting

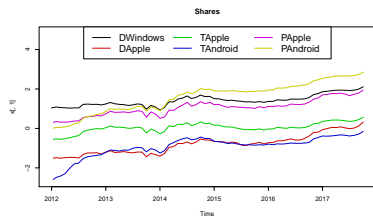
# Shares for each OS in each segment

Transform the data using logit:





# Shares for each OS in each segment

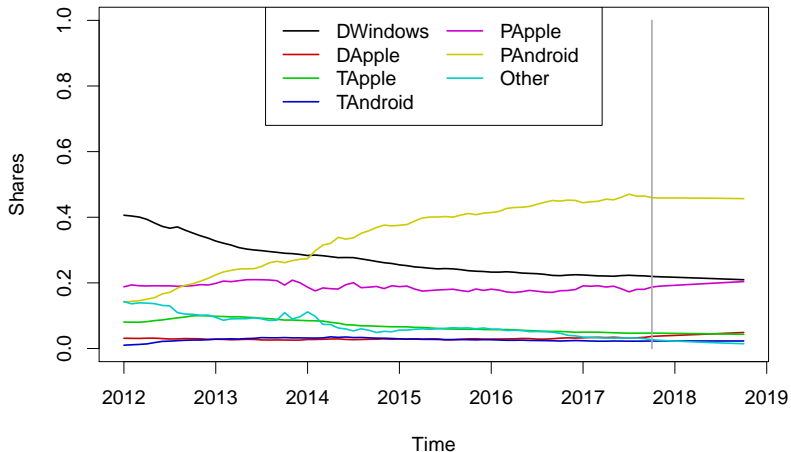


Time series have similar dynamics (correlated).

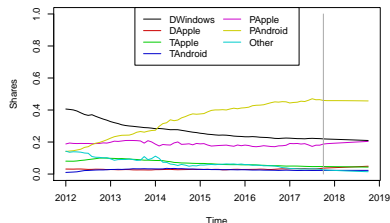
Use VES, which captures that.

We use local-trend model, produce forecasts and then transform to the original scale.

# Overall dynamics



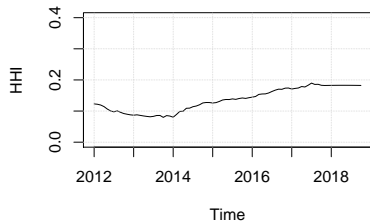
# Overall dynamics



In short:

- The share of Windows for desktops is slowly decreasing;
- The share of Apple for desktops is slowly increasing;
- Shares of tablets are decreasing;
- Share of Apple phones is expected to increase at the expense of the share of Android phones.

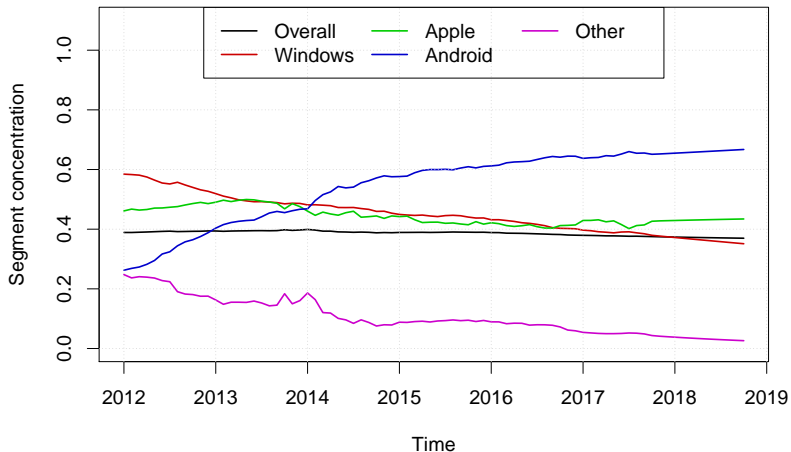
# Herfindahl–Hirschman Index



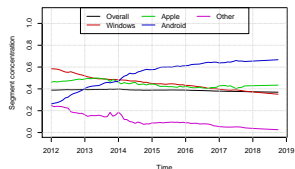
Normalised HHI tells us that this is moderately concentrated market.

The concentration has been increasing lately.

# Segment concentration coefficient



# Segment concentration coefficient



Segment concentration shows:

- Microsoft is losing position, because it loses on phones and tablets segments;
- Android is dominating, mainly because of phones;
- Apple preserves its position;
- Others are almost non-existent;
- Overall, the market is moderately concentrated.

# Analysis of the relations

## Analysis of the dynamics

Finally we fit VAR in order to see if there is relation between different segments.

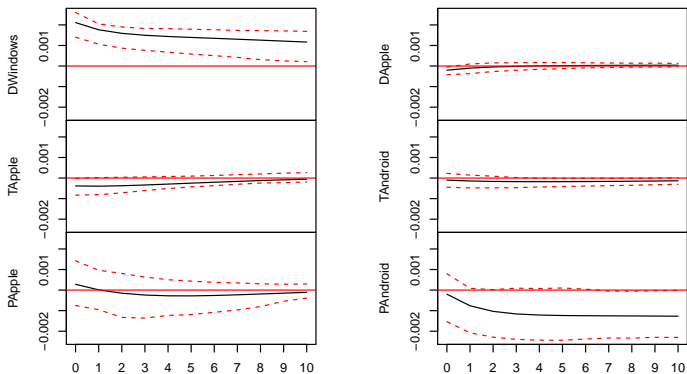
The optimal order is VAR(1) according to AIC.

Then we can analyse Impulse Response Functions.



# IRF, Desktops, Windows

Orthogonal Impulse Response from DWindows

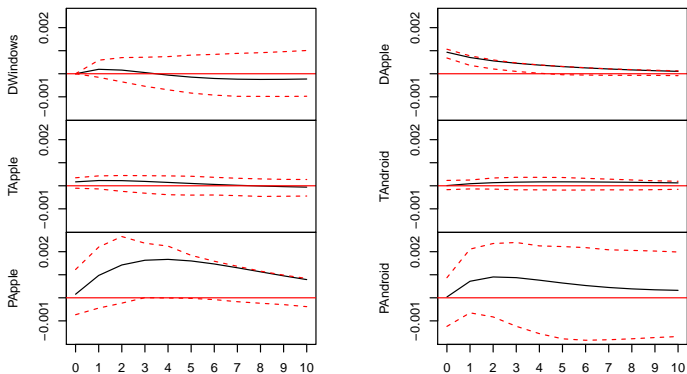


95 % Bootstrap CI, 100 runs



# IRF, Desktops, Apple

### Orthogonal Impulse Response from DApple

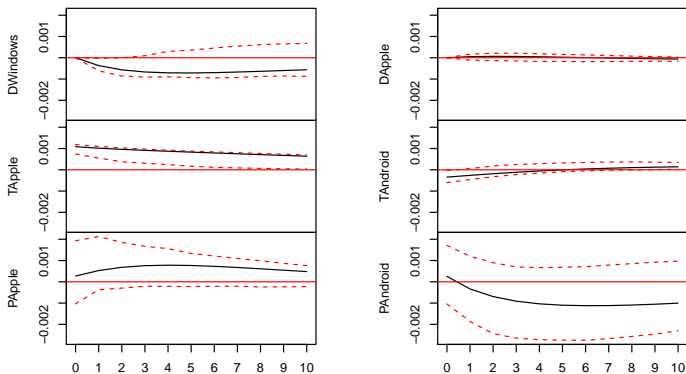


95 % Bootstrap CI, 100 runs



# IRF, Tablets, Apple

## Orthogonal Impulse Response from TApple

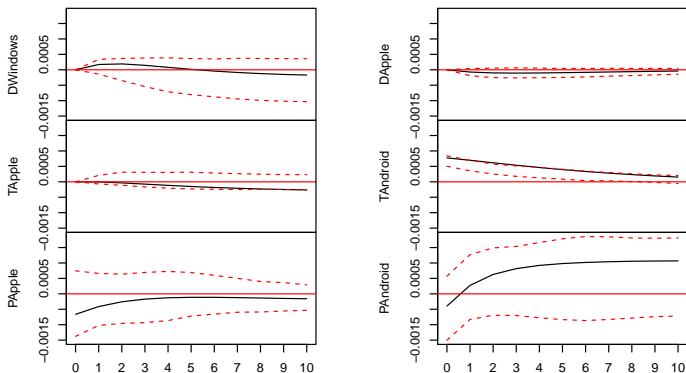


95 % Bootstrap CI, 100 runs



# IRF, Tablets, Android

Orthogonal Impulse Response from TAndroid

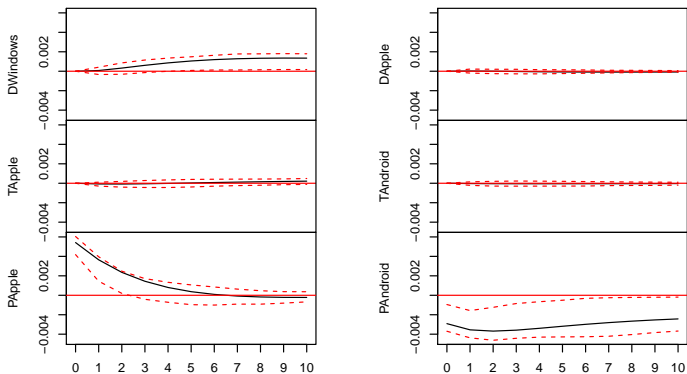


95 % Bootstrap CI, 100 runs



# IRF, Phones, Apple

## Orthogonal Impulse Response from PApple

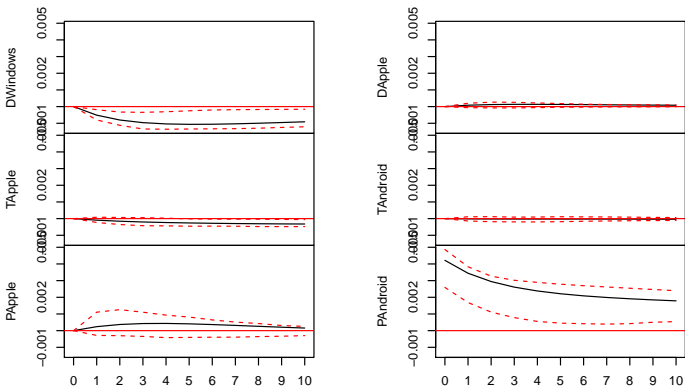


95 % Bootstrap CI, 100 runs



# IRF, Phones, Android

Orthogonal Impulse Response from PAndroid



95 % Bootstrap CI, 100 runs



## IRF, Conclusions

Overall, there are connections in dynamics between platforms for Apple and Android devices.

e.g. Apple tablets share  $\uparrow$ , the share of Apple phones  $\uparrow$ .

Android tablets share  $\uparrow$ , the share of Android phones  $\uparrow$ .

There are features of ecosystems for both.

Phones and tablets segments are competitive, desktop is not.

# Conclusions



# Conclusions

Analysing the platforms we find:

- Segments of smartphones and tablets are relatively competitive;
- Apple dominates tablets;
- Apple maintains the high share over several segments;
- Apple has ecosystem, where shares on different segments are interconnected;
- Android dominates the phones segment;
- Android has ecosystem for tablets and phones;



# Conclusions

And also:

- Microsoft is monopoly on PCs segment;
- But MS does not have ecosystem, so it loses overall over time;
- Overall market is moderately concentrated;
- And the concentration has been increasing lately;
- But the companies do not have equal shares in segments.



# Thank you for your attention!

Questions?

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