

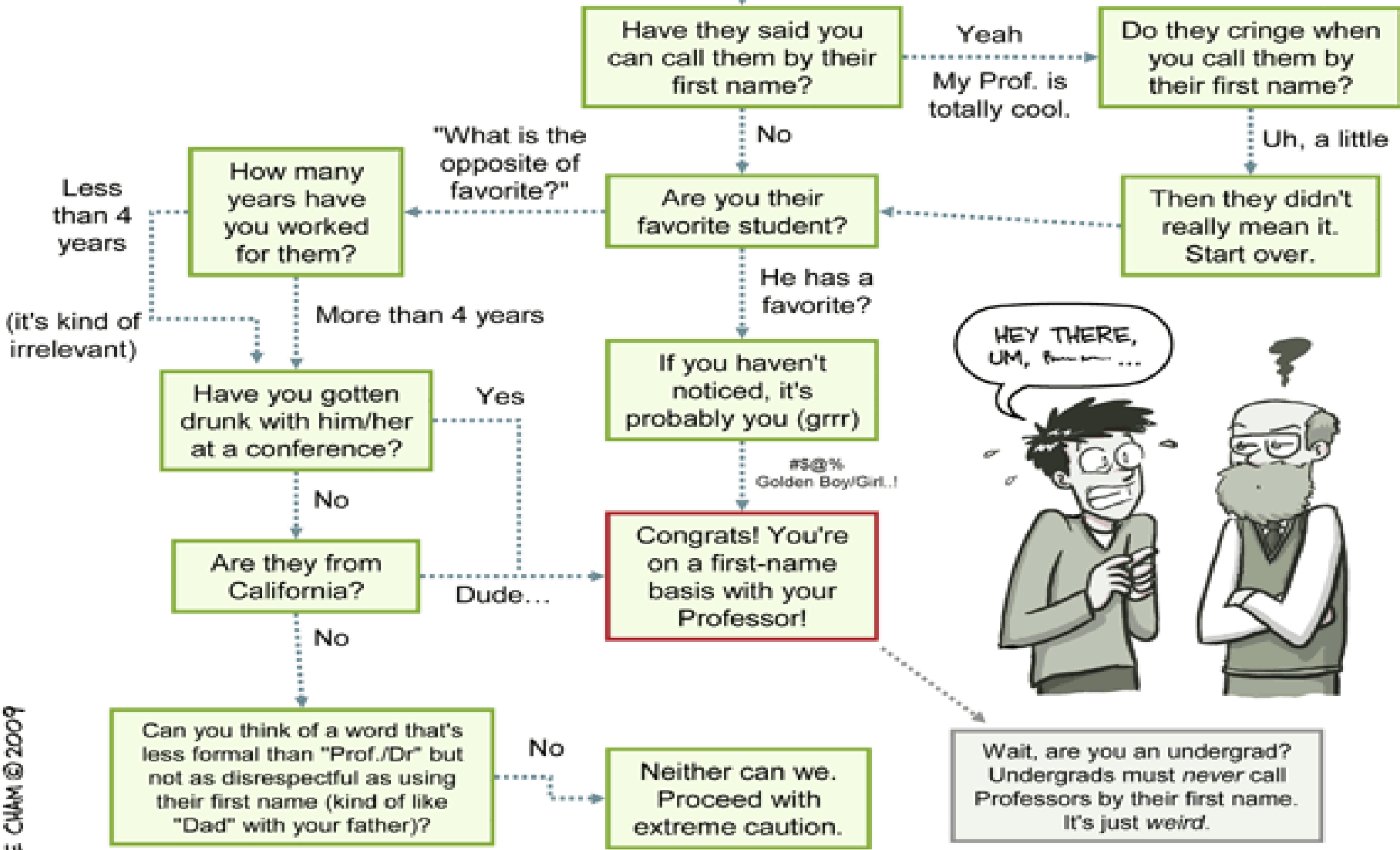
Privacy respecting modeling

Prof. dr. Koen Pauwels

Northeastern University

BI Norwegian Business School

What to call your Professor



JORGE CHAM © 2009

Outline

1. How do you decide on method?
2. Research choices and market situations
3. Theory and Empirics
4. Cool research questions in Retail Media
5. Webrooming example with machine learning

How do you decide on method ?

How do you decide on method ?

- What I learned!
- What my advisor said
- What the editor likes
- What the data calls for
- What answers the research question



Research questions

- Does smoking increase lung cancer chances?
- Is this browser a high or low value customer?
- Are price promotions profitable in long run?
- How will competitors react to my action?
- How much more sales if advertising\$ doubles?
- When can I expect this sales bump to occur?
- Which metrics are Key Performance Indicators
- How important was fake news in US election?
- Where do consumers adopt new products fast

Privacy respecting modeling

“Econometric time series analysis combines the merits of econometrics, which focuses on the *relationship* between variables, with those of time series analysis, which specifies the *dynamics* in the model” Franses (1991, p. 240)

Sims (1980): ‘structural’ models often have to place ‘incredible’ identifying restrictions on how key variables are allowed to behave and influence each other over time

Quantitative

Analytical Models

Assumes optimality and rationality
Method: Game Theory, mathematical proofs (no empirical data)

Within Marketing

Structural Models

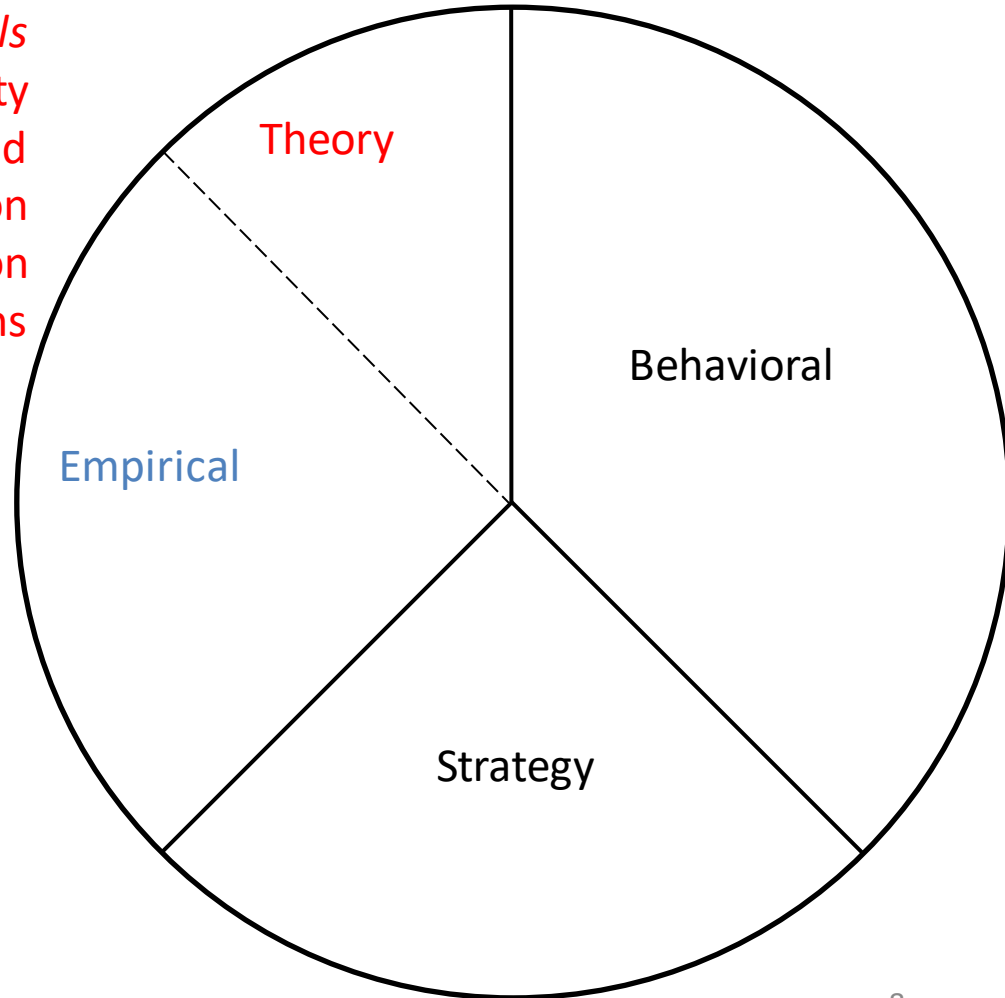
Assumes optimality and rationality
Method: creates theoretical model and estimates model parameters based on data using Bayesian estimation
Uses policy simulations

Market response model (reduced form models)

Descriptive (statistical relation between observed variables, correlational)
Method: Regression, etc.
Examines counterfactuals

Field experiments, Natural, and Quasi experiments

Method: Experimental, econometric



In the end, what matters is:

- What do you think ?
- What do your evaluators think ?

What is the purpose of your model/work ?

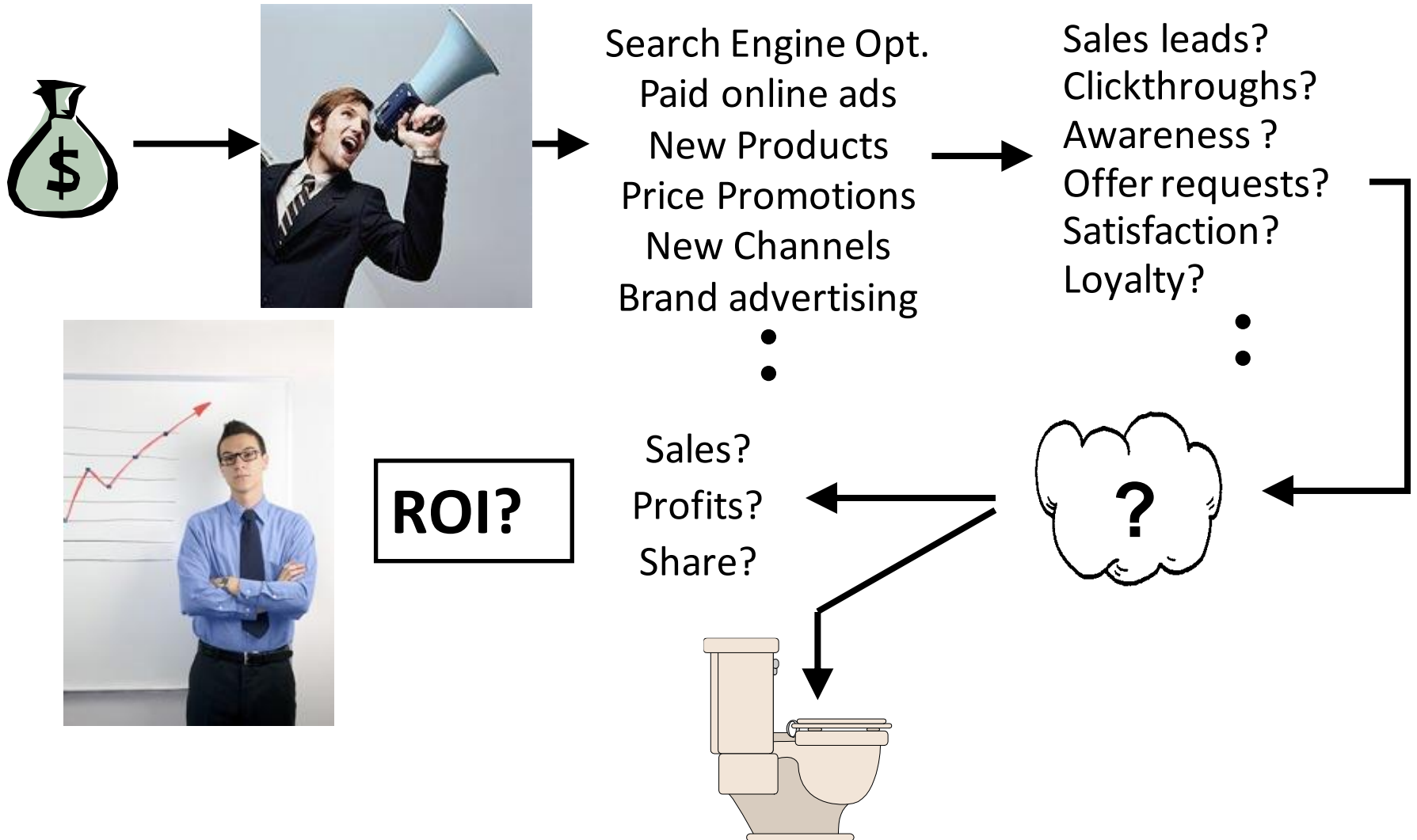
Which model is feasible given obtainable data?

How much insight would a more sophisticated model get, would a simpler model give up?

Research choices matter

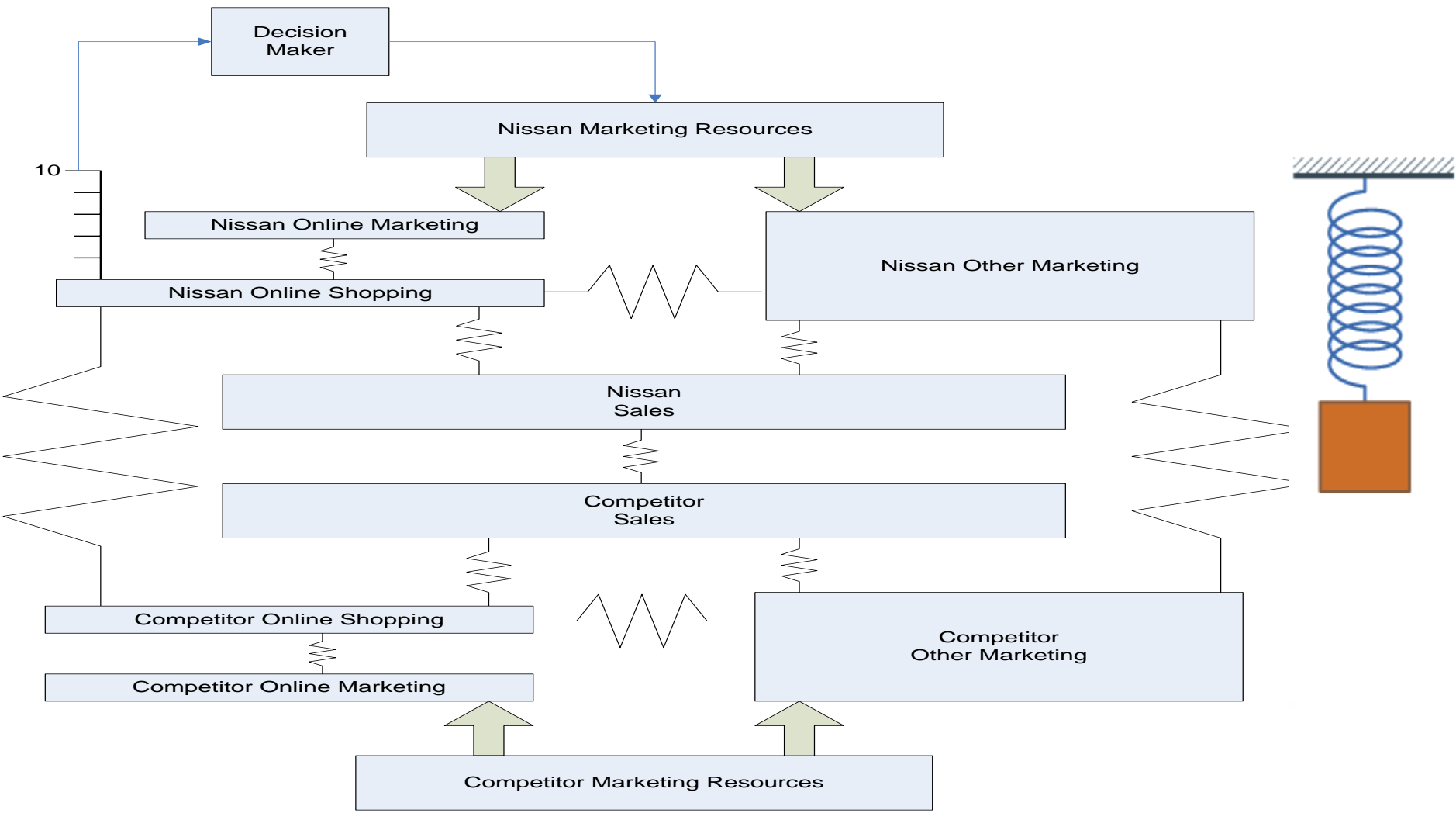
- Variables in levels, cumulative or differenced?
- Measured daily, yearly (temporal aggregation)
- For each store? (cross-sectional aggregation)
- Dependent variable: sales, distribution,...?
- Independent variables: actions, competition?
- What to control for: seasonality, trend, ...?
- Include lagged variables for dynamic effects?

Ex: Return on Marketing Investment



Key modeling challenge:

Dynamic interactions of many variables with unknown feedback loops plus noise.



Return on Marketing Investment scenarios

	One-shot Marketing	Evolving Marketing (spending more)
Stationary Performance	Business as usual <i>e.g. promotion</i>	Escalation <i>e.g. car rebates in the US</i>
Evolving Performance	Hysteresis <i>e.g. ads induce social postings</i>	Evolving business <i>e.g. AFLAC duck</i>

Example:

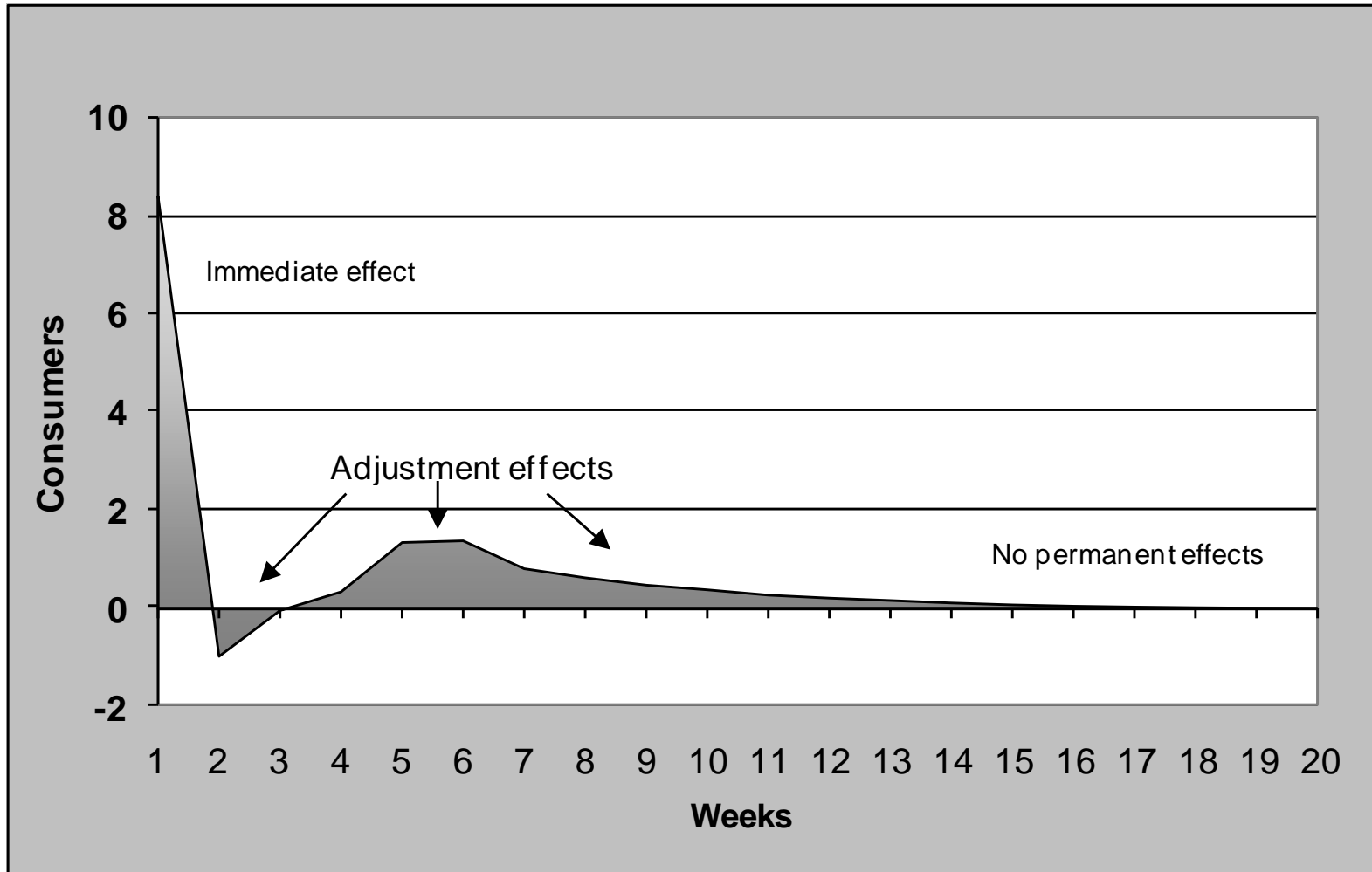


<i>Marketing Success !</i>	Pre-duck	Post-duck
Brand awareness	2% (1999)	80 % (2001) 85 % (2006)
Company Revenue	\$ 555 M (1999)	\$ 712 M (2000) \$ 919 M (2001)

Financial success: RoDuckl ?

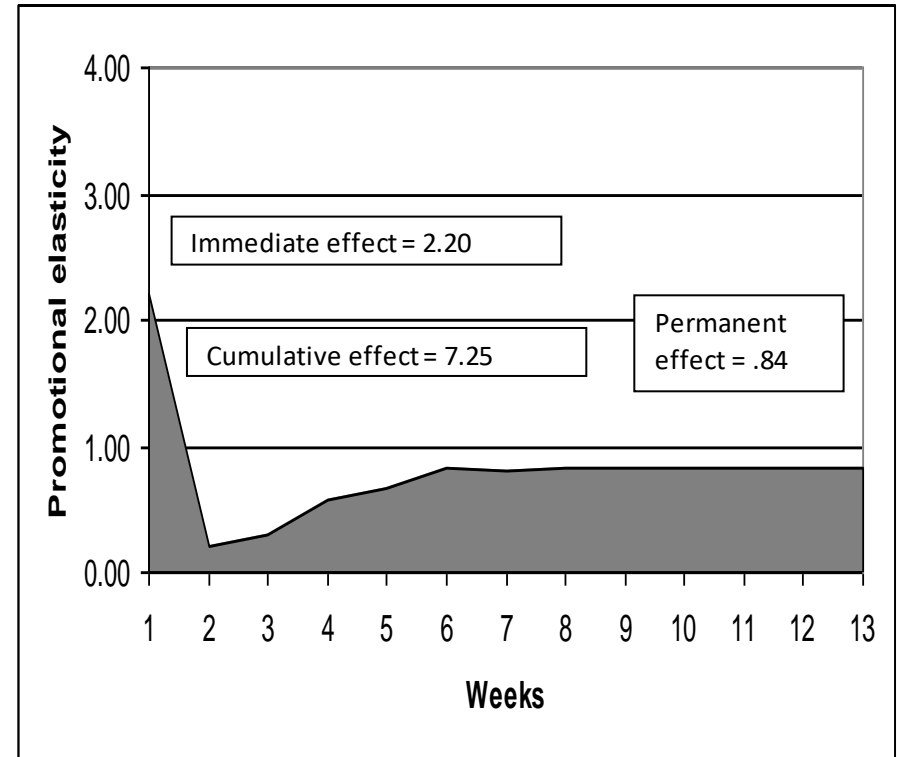
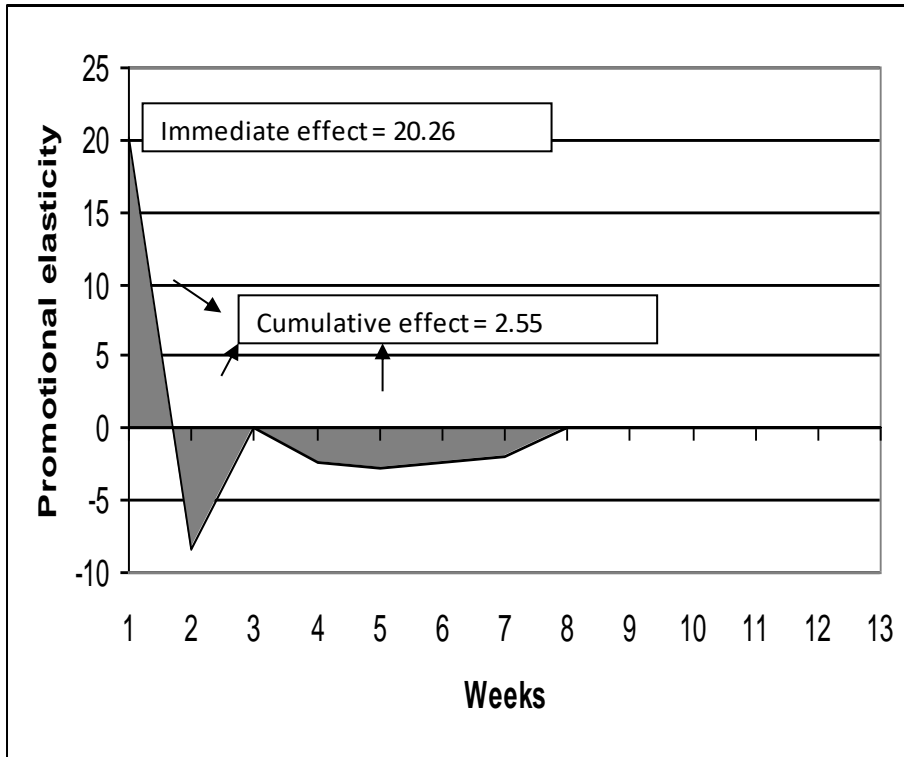
- Observable duck lift (full attribution)
Awareness increase: 3900 %
Revenue increase: 28 - 66%
- Very expensive: \$450M (2000-2006)
- Need to continue spending at high level
- Aflac CMO (2007): *Shut the duck up !*

Business as usual: Price promotion

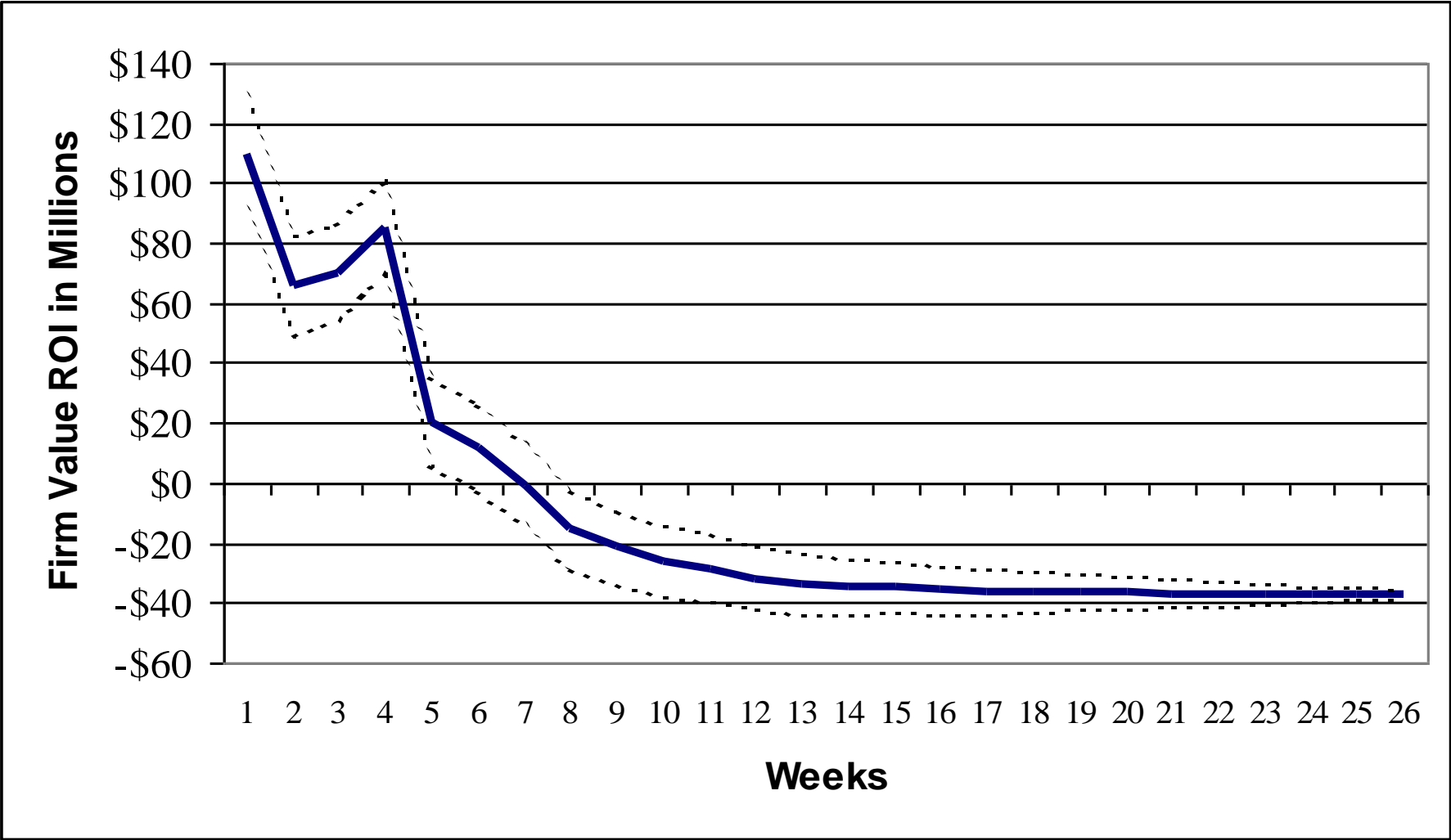


But new brand (on right) adds to base

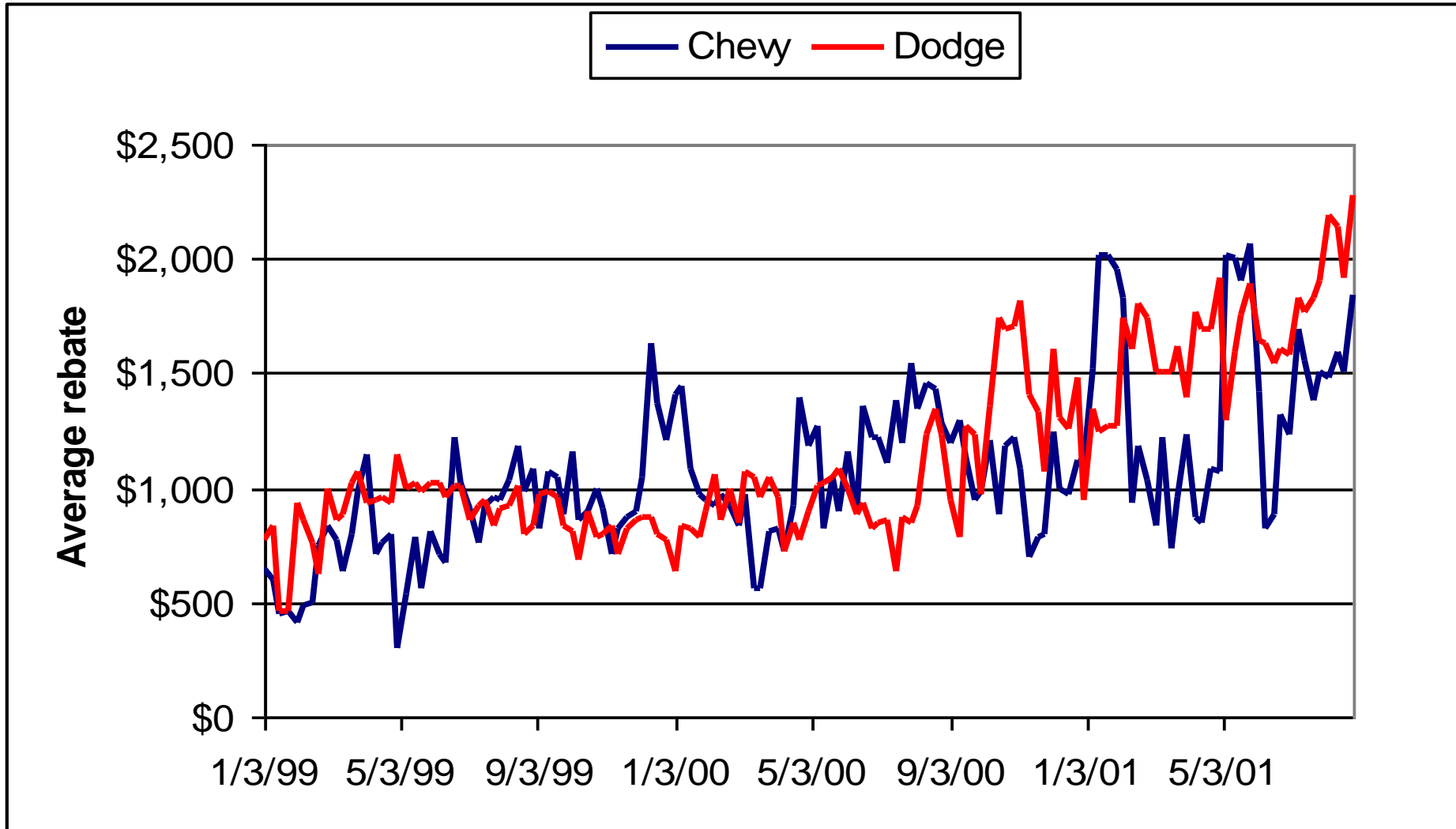
Close-up toothpaste Rembrandt (1990s)



Car Rebates Decrease GM's Firm Value



As They lead to Competitive Escalation



How to grow Return on Marketing Investment

	One-shot Marketing	Evolving Marketing (spending more)
Stationary Performance	Optimize for profit Look beyond usual for game changer	Allocate \$ to other marketing actions, brands or regions
Evolving Performance	Leverage this now! Learn to repeat Prepare for growth	Profits in long run? Ensure marketing keeps us with sales

Theory without data is blind



In marketing

Theory and findings mostly used for

1) Description

2) Prediction

3) Control, i.e. (advice for) policy intervention

Philip-Hans Franses 2005

- Policy Simulation = *“tracking the effects of various doable changes in marketing actions and picking the most preferable one”*
- Models should be:
 - 1) Descriptive: accurately capture DG patterns
 - 2) Predictive: hold-out sample, constant DGP
 - 3) Prescriptive: stability and market structure

Retail Media

Back to the Future

Koen Pauwels

Associate Dean of Research, D'Amore-McKim School of Business
Distinguished Professor of Marketing, Northeastern University
Former Principal Research Scientist at Amazon Ads

Outline

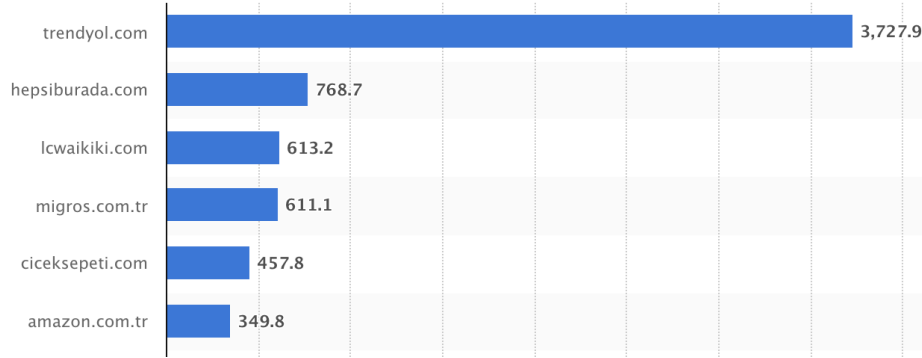
1. How large and how different from offline retail ads?
2. Why brands and consumers like retail media
3. Lower and upper funnel retail ads for advertiser goals
4. How to get started and move to full funnel advertising
5. Retail media questions for consumers, brands, and retailers
6. Case studies answering some of these questions
7. Q & A



Retail Media is the digital advertising sold to brands by retailers using their 1st party data as for targeting onsite, instore or on social or programmatic channels



Top online stores in Turkey in 2022, by e-commerce (in million U.S. dollars)



The screenshot shows the trendyol.com homepage with a search bar at the top, navigation tabs for various categories (Kadın, Erkek, Anne & Çocuk, Ev & Yaşam, Süpermarket, Kozmetik, Ayakkabı & Çanta, Elektronik, Spor&Outdoor, Çok Satanlar, Flaş Ürünler), and a grid of promotional banners for different product categories like clothing, home goods, and electronics.

The screenshot shows the hepsiburada.com homepage with a search bar, navigation tabs for various categories (Elektronik, Moda, Ev, Yaşam, Kirtasiye, Ofis, Oto, Bahçe, Yapı Market, Anne, Bebek, Oyuncak, Spor, Outdoor, Kozmetik, Kişisel Bakım, Süpermarket, Pet Shop, Kitap, Müzik, Film, Hobi), and a large promotional banner for a 'Süper ürünlerde süper fiyatlar' (Super products at super prices) featuring a baby stroller, Ariel detergent, and an HP printer.

The screenshot shows the amazon.com.tr homepage with a search bar, navigation tabs for various categories (Çok Satanlar, Günün Fırsatları, Prime, Yeni Çıkanlar, Hedye Fikirleri, Elektronik, Moda, Kitap, Bilgisayar, Amazon Ayrıcalıklar, Satış Yap, Spor ve Açık Hava Aktiviteleri), and a large promotional banner for 'Mükemmel hediye bul' (Find the perfect gift).

Mükemmel hediye bul

Kimin için alışveriş yapıyorsunuz?

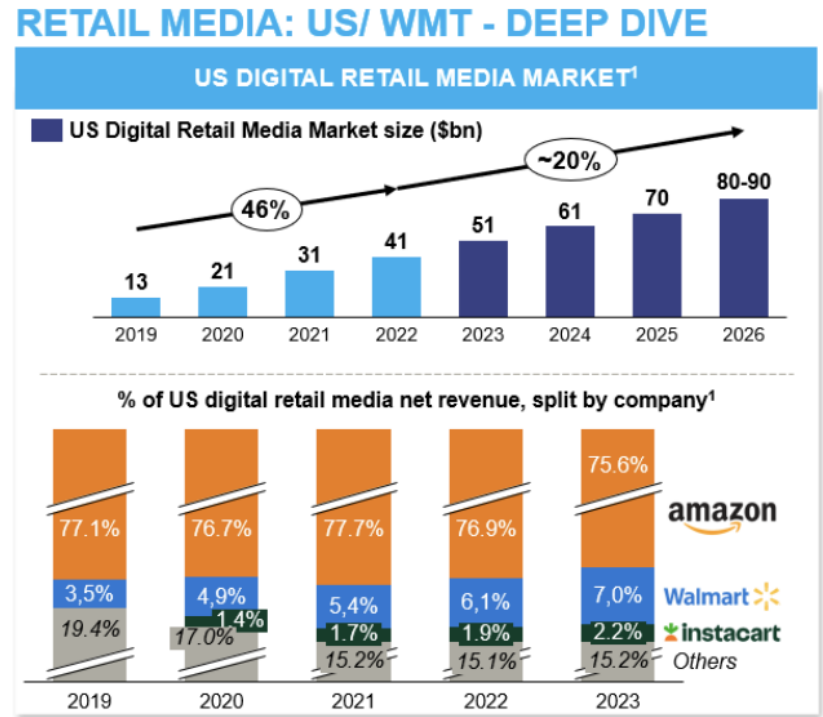


Herkesine Uygun Hediyeler

Product	Price
BRITA MAXTRA+ Yedek Su Filtresi, Altı	594,00 TL - 1.099,00 TL
COŞORI Akıllı WiFi Sıcak Hava Fritözü 5.5 Litre Akıllı Fryer-Döner Kase ve Çıkarılabilir Basket, 13...	2.780,00 TL - 3.099,00 TL
Xiaomi Mi Smart Scale 2 Akıllı Tartı, Beyaz	419,90 TL - 979,10 TL
Powerte: 8681612488046 TR 901 Profesyonel Fön Makinesi	438,00 TL - 675,00 TL
Philips MG3720/15 Erkek Bakım Seti 7'u 1 Arada, Spah	559,00 TL - 1.090,00 TL

Retail media on the rise

GroupM (biggest media buyer), expects retail media will grow 9.9% to reach \$125.7 billion in 2023 and surpass television revenue in 2028, when it will represent 15.4% of total ad revenue.



To the delight and \$\$ of retailers












“An efficient, well-run grocery store will *lose money on the business,*

but more than make up for it by selling ads to the companies that make those products

Kroger reported vendor allowances of \$8.7bn, or 7% of revenue”

(Hobart 2023)

Global Retailer Operating / EBITDA Margins

	7.1%		2.74%
	2.4%		4.4%
	3.11%		3.11%
	3.45%		4.3%
	3.23%		2.7%
	2.54%		

What's new, pussycat?

- **Data:** *"Instacart knows consumers' ordering patterns, knows the cross elasticities of demand across different products and categories, and can capture the upside from consumers trading up or trying new brands via ads."* This allows online retailers to both offer consumers large and personalized assortments, and offer brands ads targeted at the right consumer in the right buying mood.
- **Consumer ad awareness:** The offline consumer is typically unaware that the store organization and eye-level shelf placements are driven by such manufacturer payments and retail profit calculations. In contrast, *retail media ads are denoted as such to the online consumer.*

Why brands want it: data is key

Motivations for US CPG Brands to Work with Retail Media Networks, 2020 & 2021

% of respondents in each group

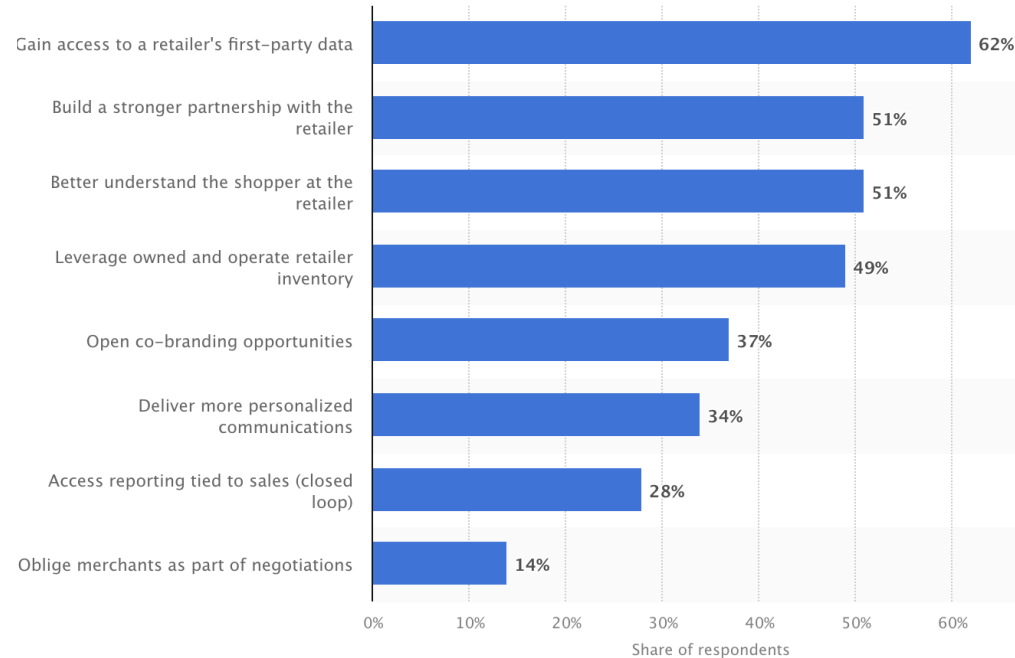
	2020	2021
Gain access to a retailer's first-party data	33%	62%
Build a stronger partnership with the retailer	49%	51%
Better understand the shopper at the retailer	19%	51%
Leverage owned and operate retailer inventory	29%	49%
Open co-branding opportunities	38%	37%
Deliver more personalized communications	43%	34%
Access reporting tied to sales (closed loop)	48%	28%
Oblige merchants as part of negotiations	48%	14%

Note: 2020 n=100; 2021 n=100

Source: Merkle, "The Evolution of Retail Media Networks" conducted by Ugam, Oct 11, 2021

270408











eMarketer | InsiderIntelligence.com



Why do some consumers like it?

- Content-integrated: fits with the reason consumer visits the site
- 3x more effective than content-separated (DeHaan et al 2016)
- 1P and 1-click shop convenience

-> More effective than video site, search, social media ads for most

Preference	Global consumers	Marketers
1.		
2.		
3.		
4.		
5.		

Largest players

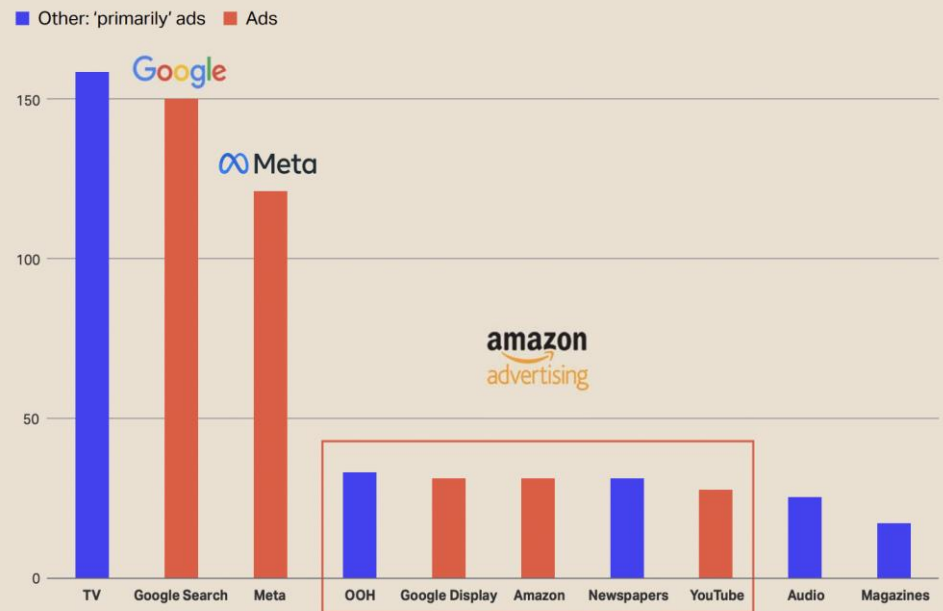
Amazon: ~75%

Walmart: ~7%

Instagram: ~2%

Amazon's Advertising business is bigger than Google Display and YouTube Advertising and Global Newspaper Advertising Revenues

Global advertising revenues



Comparing different retail media networks

	Amazon.com	Walmart.com	Instacart	Kroger	Target
Advertising auction type	2nd price	1st price	2nd price	2nd price	1st price
Placement types	Sponsored Products, Sponsored Brands, Sponsored Display, Amazon DSP (Offsite and Onsite)	Sponsored Products, Brand Amplifier, POV, Marquee, Skyline	Sponsored Products (Search & Browse), Search Keyword Banner (Display)	PLAs (Search & Browse, Savings, Basket Builder) and Targeted Onsite Ads (Display Banner)	Sponsored Products
Cost structure	CPC by product and keyword Amazon DSP is CPM	CPC by product and keyword for all except POV, Marquee, Skyline that are CPM	CPC by product and keyword; Display is CPM	CPC by product and category for everything but TOAs; TOAs are CPM	CPC by SKU
Minimum bid (\$)	0.02c	0.2 automatic 0.3 manual	0.15 CPC for SP, 15 CPM for display	0.5 for S&B, 0.6 for BB, 0.30 for Savings, \$28 CPM for TOA	Set by retailer at category level
Targeting options	Keyword, Category, and Individual SKU Targeting	Keyword Targeting	SP: Keyword Targeting SKB: Keyword and Audience	Category Targeting	Keyword and Auto Targeting
Product eligibility	Must be in stock, no minimum, must have positive contribution profit to Amazon	Must be in stock and base item (no variants), no minimum, item must meet relevancy hurdles to appear in-feed	Must be in stock, no minimum, must be loaded up by retailer	Must be in stock, no minimum	Must be in stock, no minimum
Sales attribution	14-day click attribution, same brand	3, 14, or 30-day click attribution, same brand	14-day click attribution, same item, "sales" are based on the order not the delivery	14-day click attribution, same brand, in store and online	Customizable attribution 1, 7, 14, 30-day direct click, 1, 7, 14, 30-day direct view

Amazon Advertising's view on its Propositions



Build awareness



5

Expend your reach



Increase consideration



4

Build your brand



Own your aisle



3

Stand out in your category



Drive purchase



2

Reach shoppers who are most likely to purchase



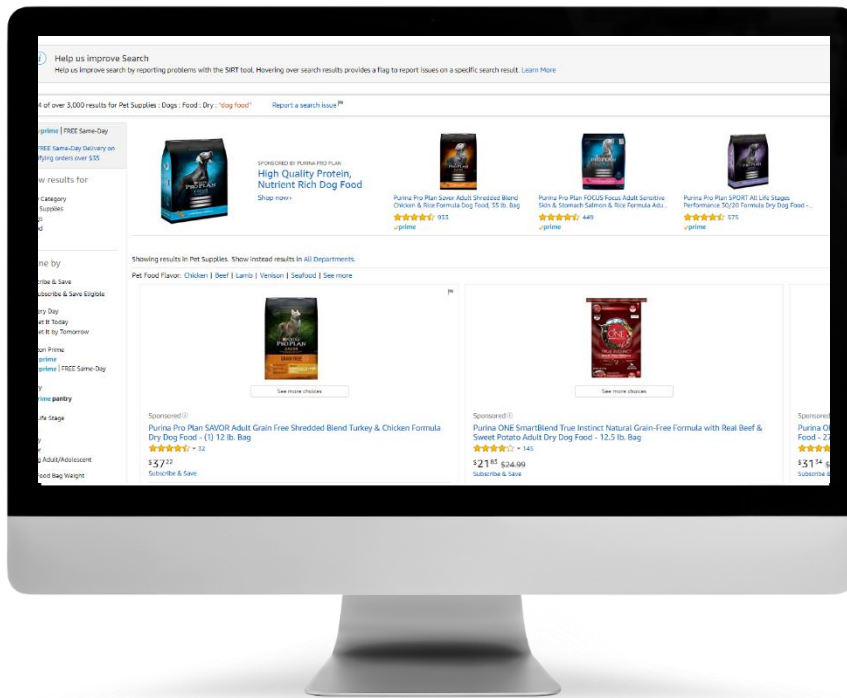
Retail & brand readiness



1

Make sure your products are ready to buy

Sponsored Products



Placements within Amazon search results and on related detail pages

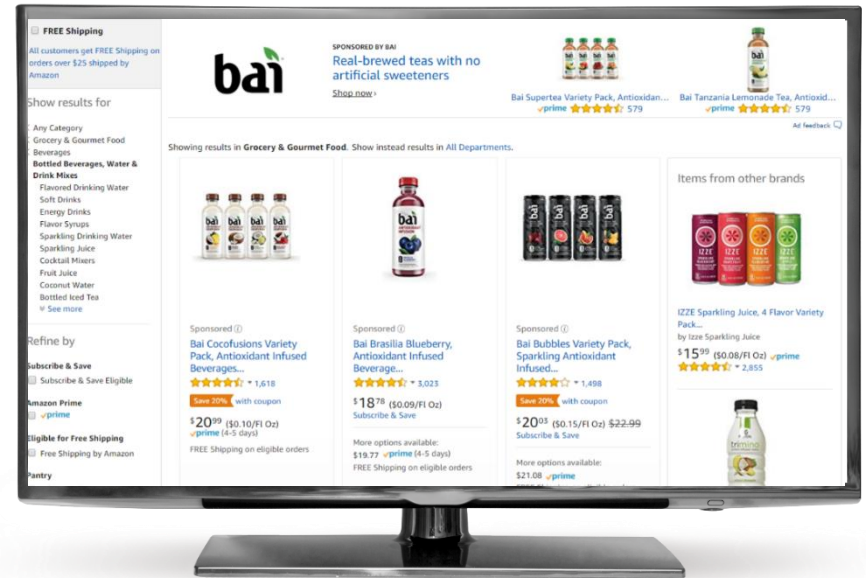
- Created from product detail page content
- Direct shoppers directly to a product detail page
- Contain native-looking creative elements familiar to Amazon
- Reach shoppers with high purchase intent

Sponsored Brands



Top placement above the search results, as well as within search results

- Direct shoppers to a page with a collection of products or the brand's Amazon store
- Feature a custom headline, logo and set of products
- Contain native-looking elements familiar to the Amazon shopping experience
- Reach shoppers with high purchase intent

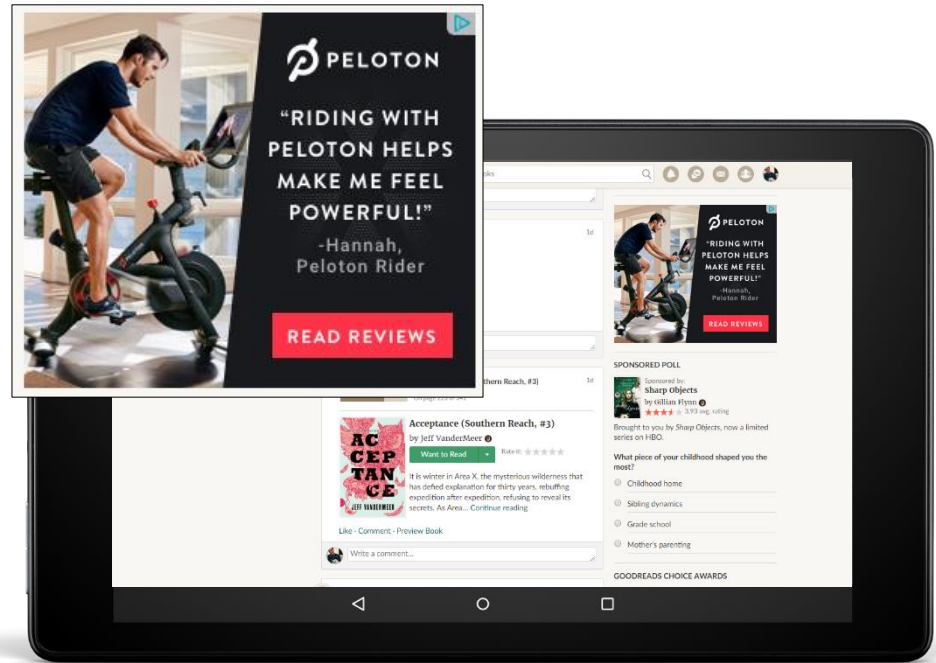


amazon advertising

Display ads

Convey key product attributes or brand differentiators

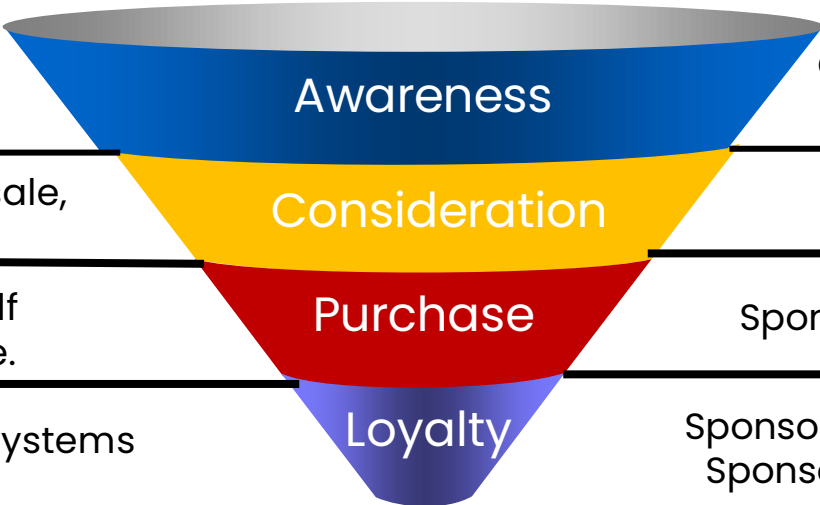
- Direct to a product detail page, brand website or custom landing page
- Tailor ad creatives
- Use eCommerce creatives with Amazon features
 - for products sold ON Amazon
- Use custom creatives



Offline to Online

Offline Equivalent

Retail Media Equivalent



TV, Print, Outdoor.

Offsite, CTV, Display, Social & Programmatic, YouTube

End of aisle, Point-of-sale, checkout.

Sponsored Display

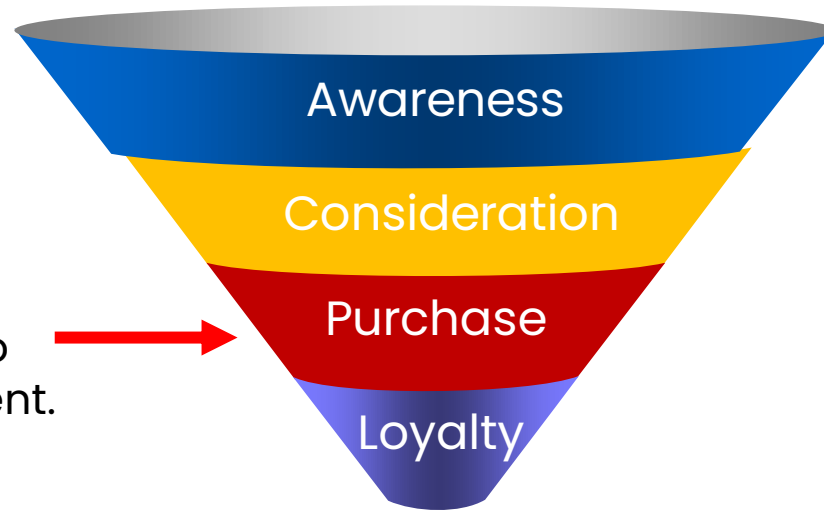
End cap aisle, shelf wobblers, signage.

Sponsored Products / Search

Loyalty or Rewards systems

Sponsored Display as Retargeting
Sponsored Search as reminder.

Use the Shopper Funnel

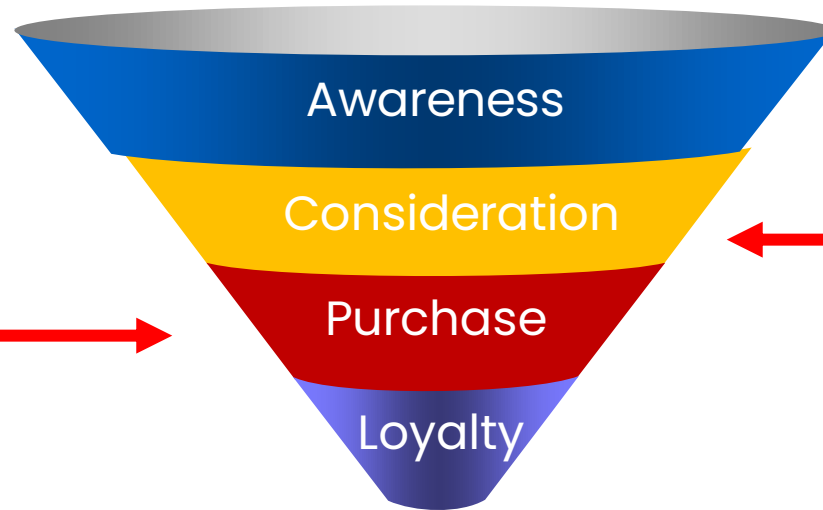


Start here...

Sponsored Search to
target shoppers' intent.



Start with Sponsored Search, Move to Sponsored Display



Sponsored Search.



Move here...
Sponsored Display
Retargeting.



Think 'Full Funnel'

End up here...

Offsite, Social &
Programmatic, YouTube



Awareness

Consideration

Sponsored Display
Retargeting.

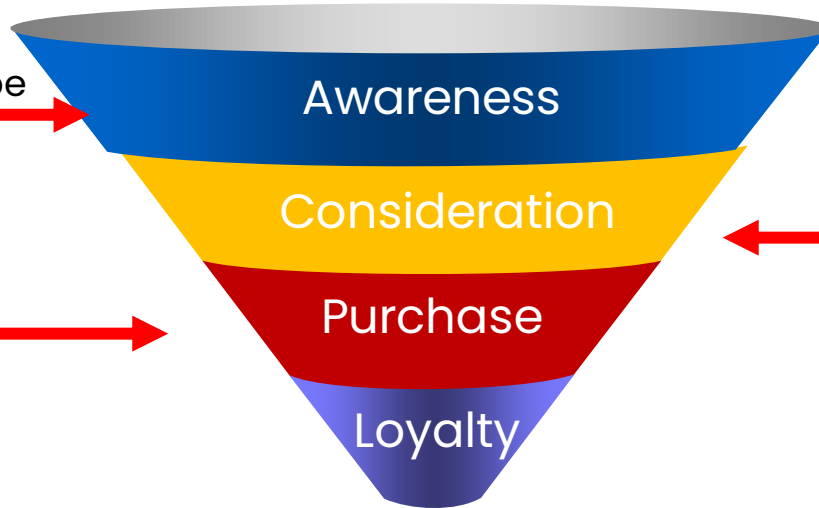


Purchase

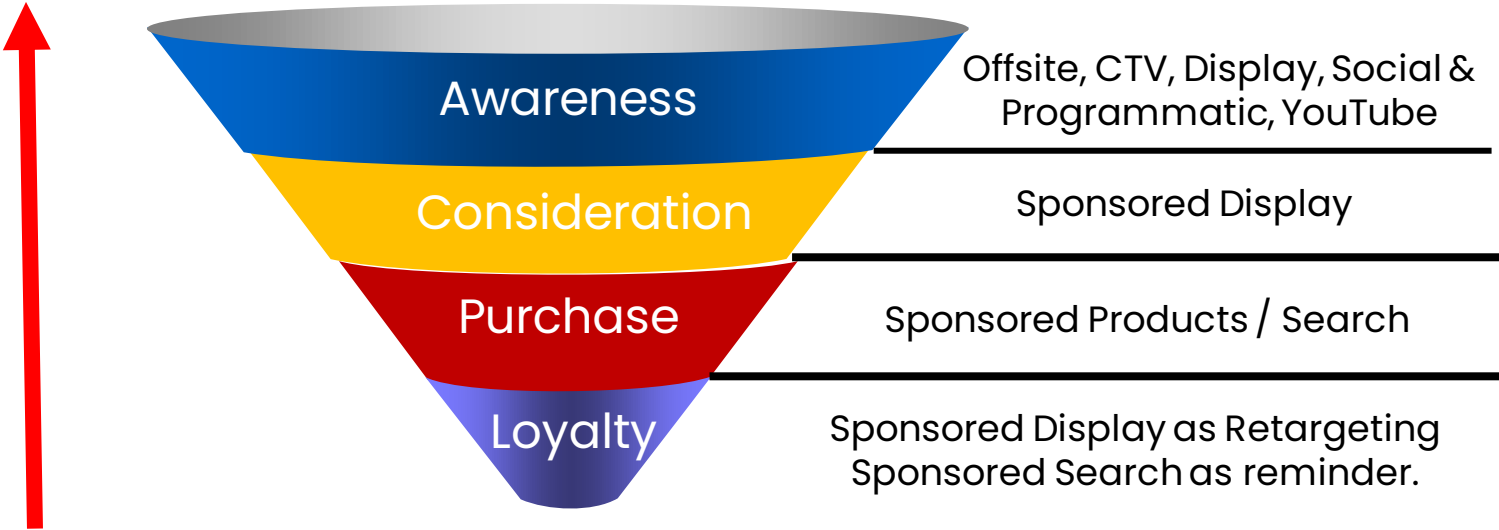
Sponsored Search.



Loyalty



Go Full Funnel



Key retail media questions for players

Consumers	Brands	Retailers
<ul style="list-style-type: none">• Ad response• Optimal exposure frequency• Tradeoff privacy, convenience, price	<ul style="list-style-type: none">• Retailer fit?• Incremental or zero-sum game? Metrics?• Budget allocation upper/lower funnel?	<ul style="list-style-type: none">• Education vs fatigue• Build in house or outsource?• How I fit into the brand's ecosystem?

Higher or lower optimal ad frequency?

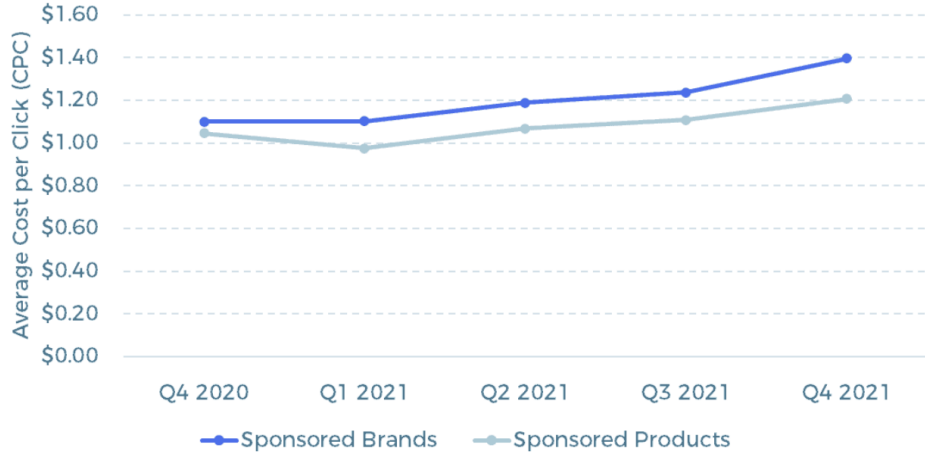
- Compared to other settings, are retail consumers **more welcoming** to ads (content integrated) or do they get **annoyed** sooner because they are paying more attention (leaning forward vs leaning backward)?
- **Inform/Educate**: Higher ad frequency may allow brands to increase conversion probabilities, and retailers to enjoy more ad revenue.
- **Persuasion fatigue**: ads are seen more as manipulative persuasion rather than as information, and should be employed sparingly to balance customer experience with ad revenue for the retailer

Lower funnel or upper funnel?

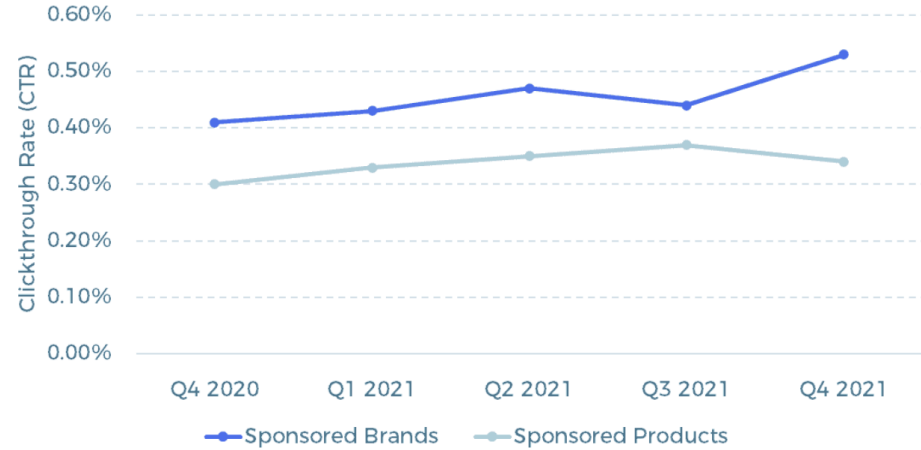
- Upper funnel costs more but also has higher click-through rate
- Lower funnel has higher conversion rate: ready-to-buy
- Return on Ad Spend (\$ revenue for \$1 spend) similar: \$6 - \$7
- Upper funnel works especially well in high season (Q4 in USA)

Source: Costello 2022 <https://skai.io/blog/amazons-advertising-numbers/>

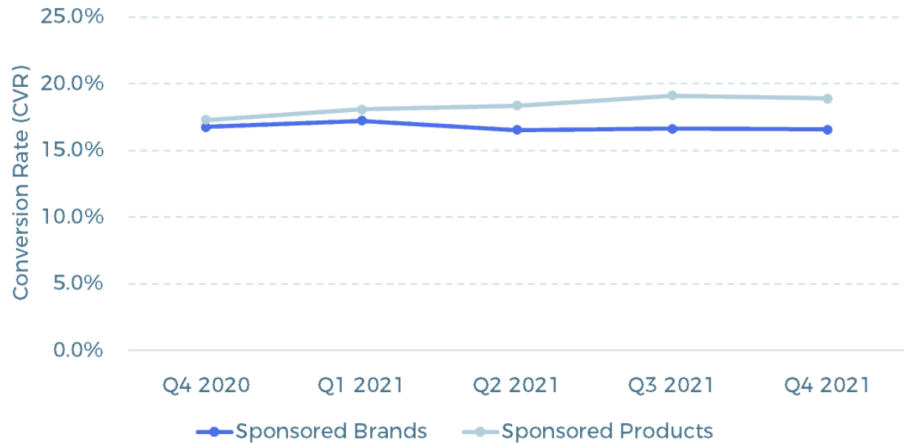
CPC by type :: Amazon



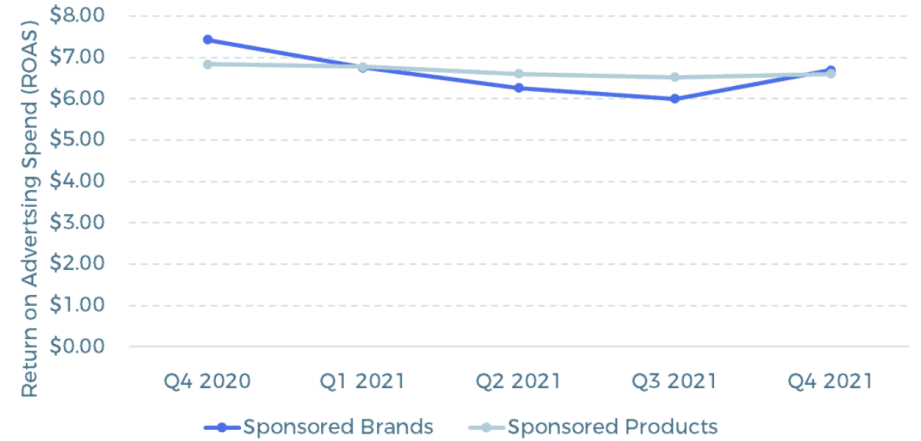
CTR by type :: Amazon



CVR by type :: Amazon



ROAS by type :: Amazon



How retail media fits in brand's system

Making the e-commerce business model more scalable

"Retail Media is a way of making the e-commerce business model more scalable. Let's not forget 80% of all of our sales come from the bricks and mortar. So omnichannel is still going to be where this is won and lost.

"Being able to take rich first-party data, connect it to in-store shoppers, and then look at your technology and advertising in-store to look at how you have different messages in different stores on different days of the week and different times of day, based on the weather."

Alex Crowe,
Head of Media Partnerships, Asda UK

Revlon's 'omni-ecosystem'



Expand scope of Amazon Ads research

SALES	Advertising	On-Amazon	Off-Amazon
On-Amazon		Ads halve time for new product to reach search, sales, reviews milestones (Bertozzi et al. 2022)	Needs data from brand managers (clean rooms, Amazon Marketing Cloud, Nielsen, Kantar)
Off-Amazon		Webrooming (Zenetti)	Outside vendors

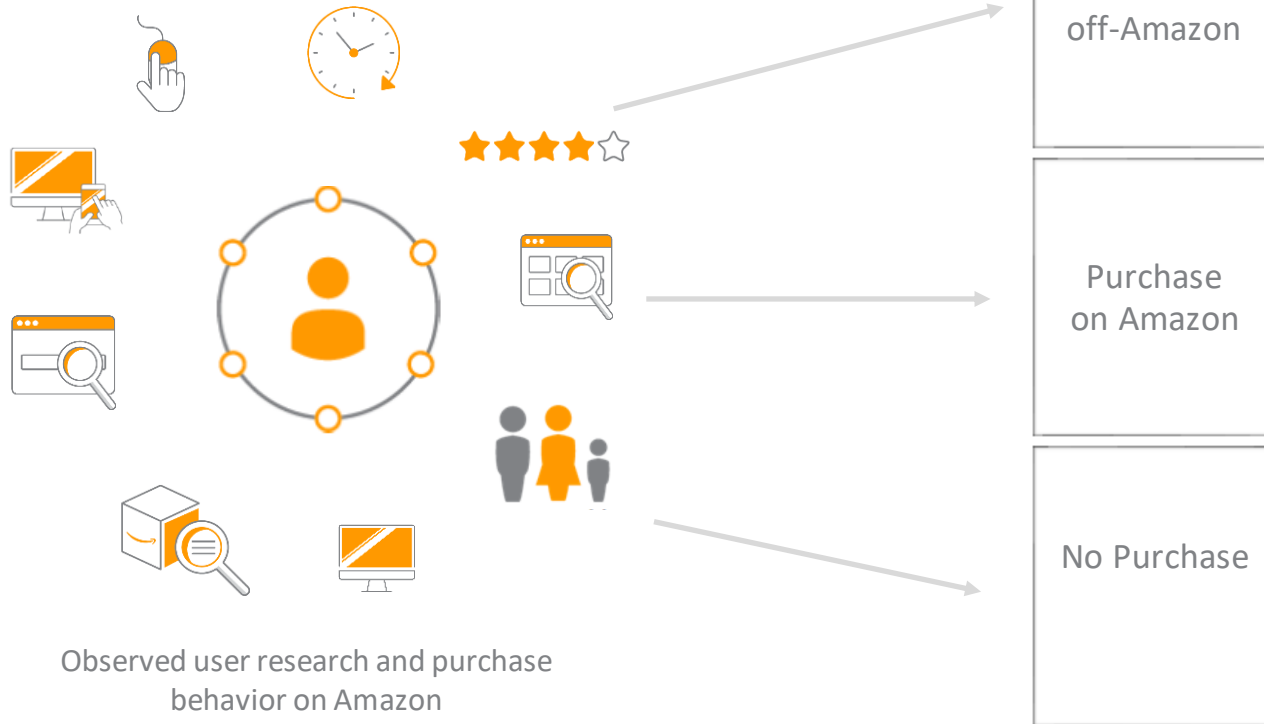
Quantifying webrooming: Data and Method

Off-Amazon Amplification: Customers who research products on Amazon but buy them elsewhere (US Survey in 2/2020)

Analytical approach to compute Amplifier Ratio and ROPES

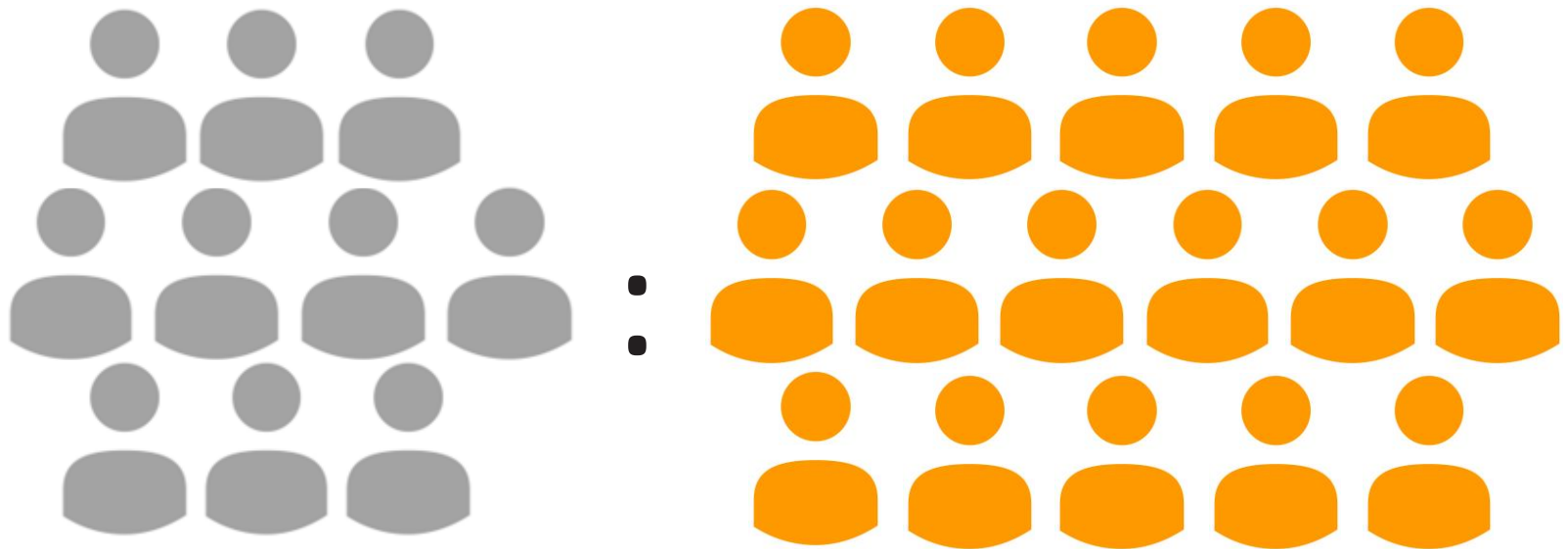
- Survey of Amazon visitors in categories of laptops and smartphones
- Use ML model to predict off-Amazon purchases with Amazon action
- Amplifier Ratio (AR) = webrooming customers / on-Amazon buyers
- ROPES = webrooming customers / on-Amazon category searchers
- Regress ROPES on different Amazon ads to quantify drivers

Amplifier Ratio

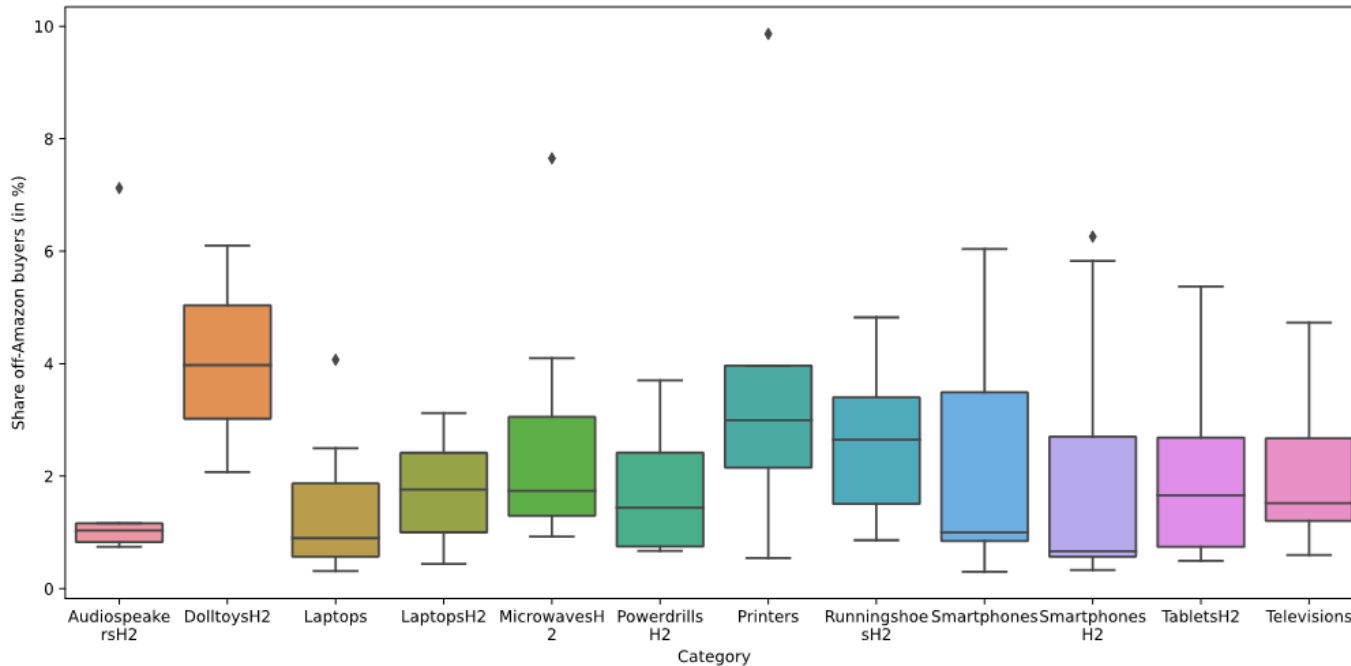


$$\text{Amplifier Ratio} = \frac{\text{Purchases off-Amazon}}{\text{Purchases on Amazon}}$$

For every 10 Amazon buyers of Laptops (Smartphones), 16 (21) users research on Amazon.com and purchase elsewhere



ROPES: Share of off-Amazon buyers to on-Amazon browsers



Total survey sample: 42K
Wave 2 (H2) in 2021
Example: The median share of off-Amazon buyers was ~4% vs. on-Amazon buyers in Doll Toys category, with lower quartile ~3%, upper quartile ~5%, min 2% and max 6% for all brands in this category covered by the survey responders

* *H2* notation at the end of a brand name indicates that this is the observation from the second wave of surveys

Source: Amazon internal data, Jul-Oct 2021, USA. 50,000 survey responders

Machine Learning model to predict ROPES

We train a **Random Forest model** to predict ROPES across categories - based on observed customer and browsing behavior variables related to:

- (1) Customer journey on Amazon in focus product category,
- (2) Past purchase behavior,
- (3) Demographic information.

RF model as good as Gradient Boosting and Deep Learning Neural Nets

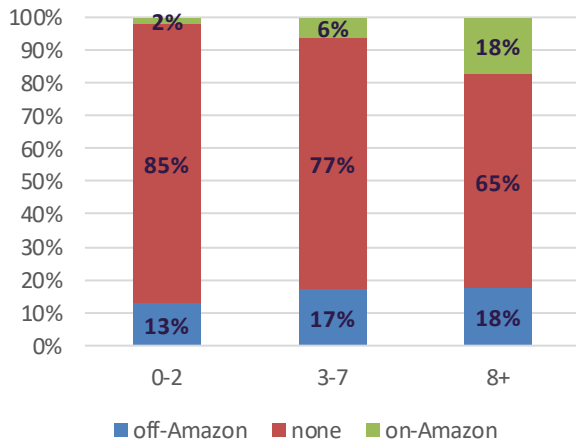
- (a) Achieves **high level of accuracy** of less than 1% error,
- (b) Accurately **predicts** proportion of off-Amazon buyers in each **activity group**,*
- (c) Accurately **predicts ROPES across categories, time periods and brands (92.1% no significant difference, average Pearson correlation = 0.83**
- (d) **Feature importance** confirmed by 2SLS Instrumental Variables (Endogeneity)

*although it predicts somewhat lower differences across activity groups than were actually observed.

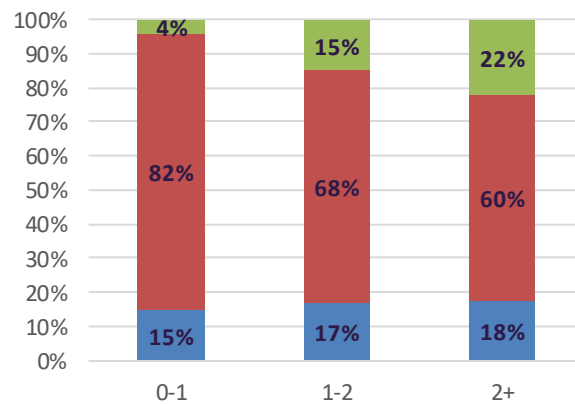
Customers who research are more likely to buy on Amazon but also off-Amazon

Total percentage of buyers on Amazon, off-Amazon and non-buyers in different activity groups

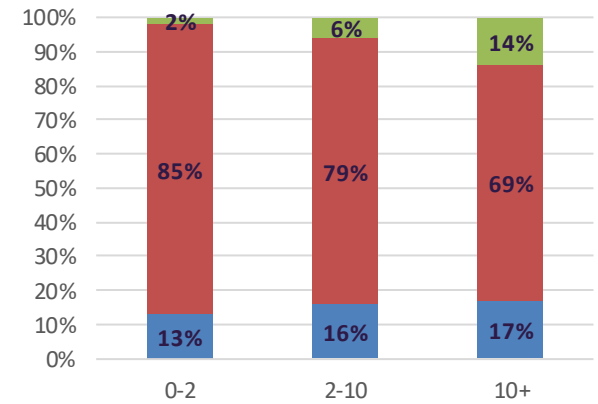
Detail Page Views



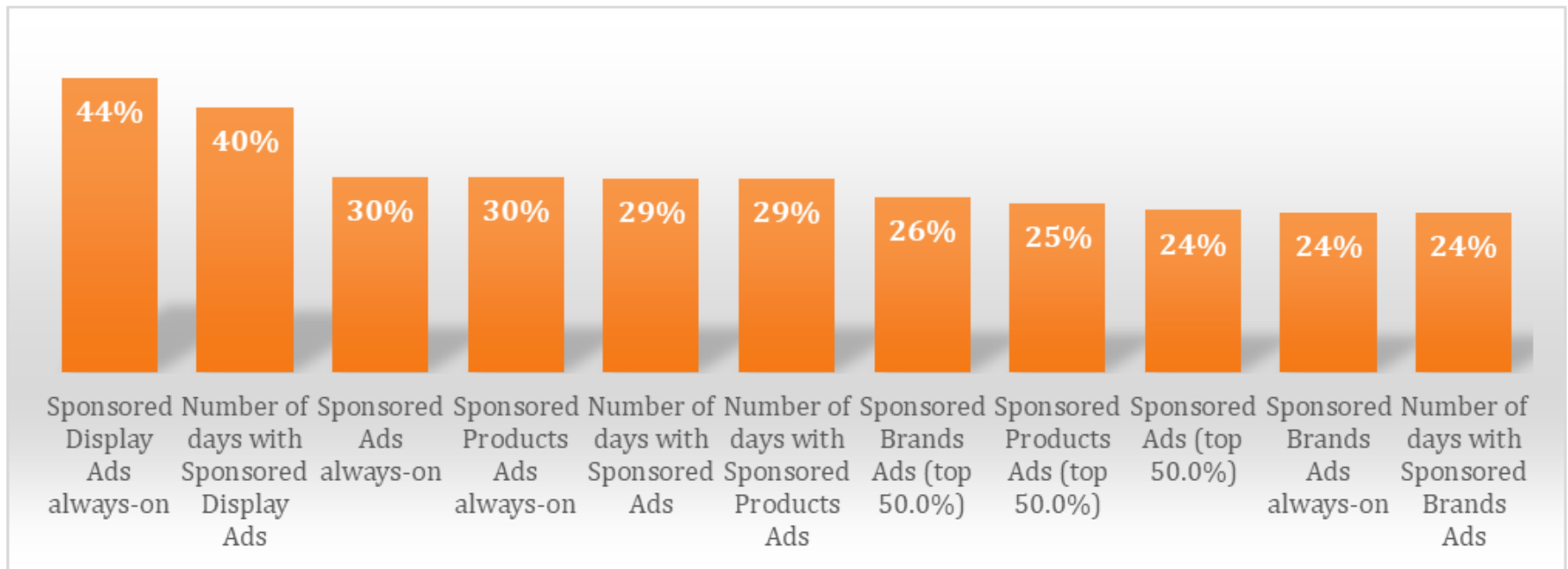
Clicks while on product page



Minutes on product page



Upper funnel ads, especially always-on, show most Off-Amazon sales



Source: Amazon internal data, Jul-Oct 2021, USA, 50,000 survey responders. (95% confidence interval - normal approximation)

Thank You!

QUESTIONS?



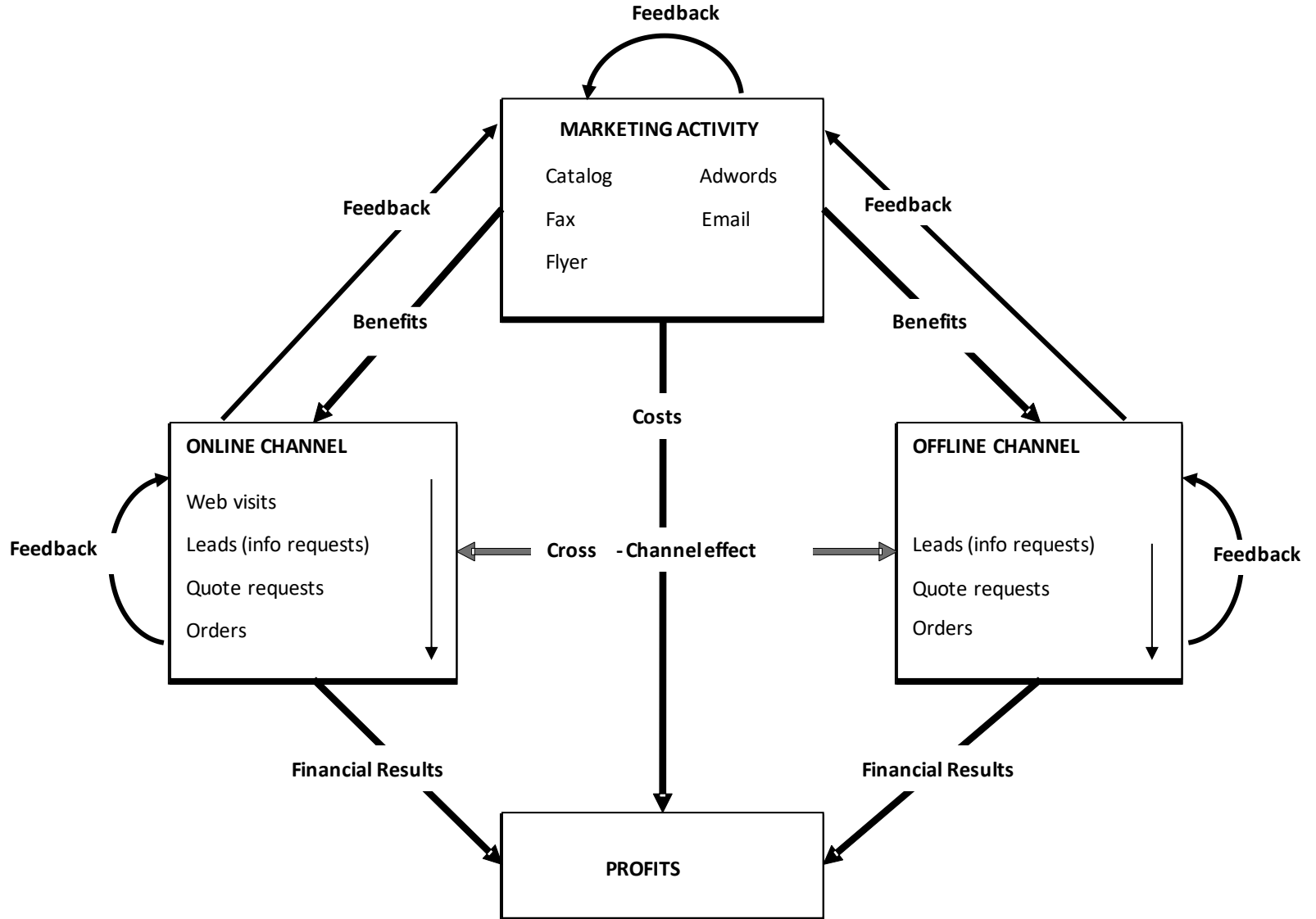
CEO, Dutch SME company Inofec

| 59

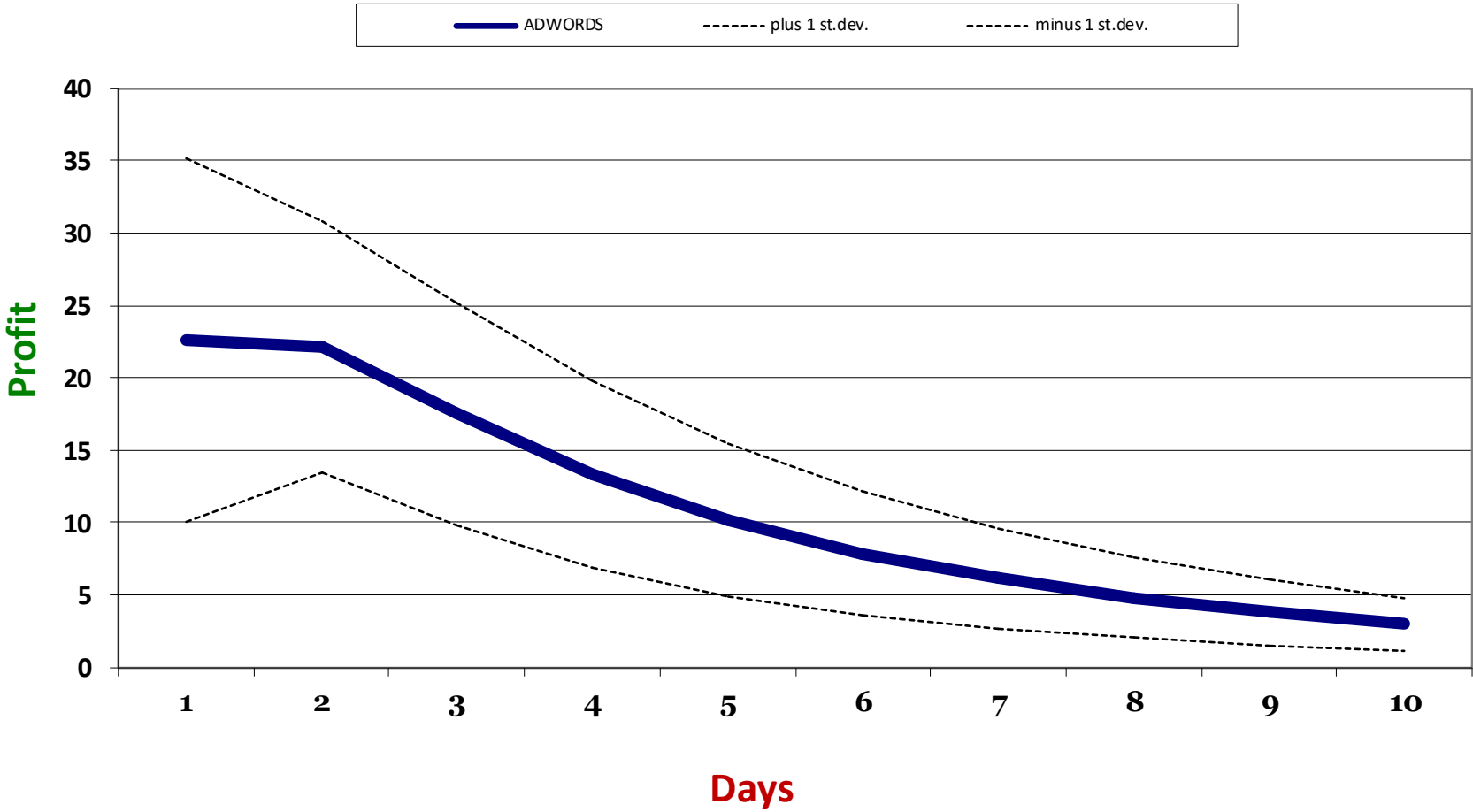
*“**Analytical marketing** is not very common in small and medium size enterprises in the business-to-business sector.*

*As such, if we had a model or decision support system to enable us to **decide how to allocate resources across channels**, we will have a **huge advantage** compared to our competitors.”*

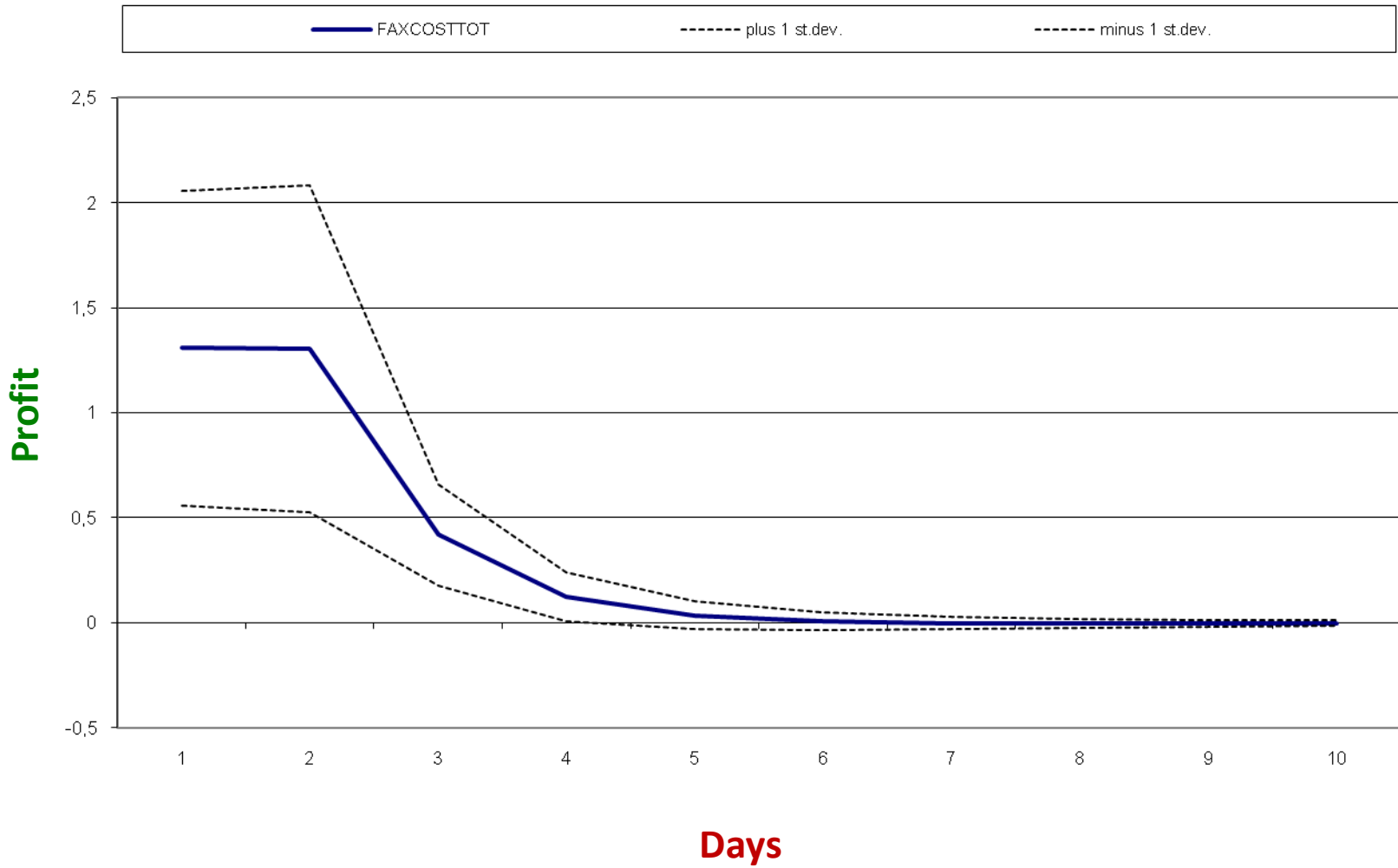
Conceptual Framework



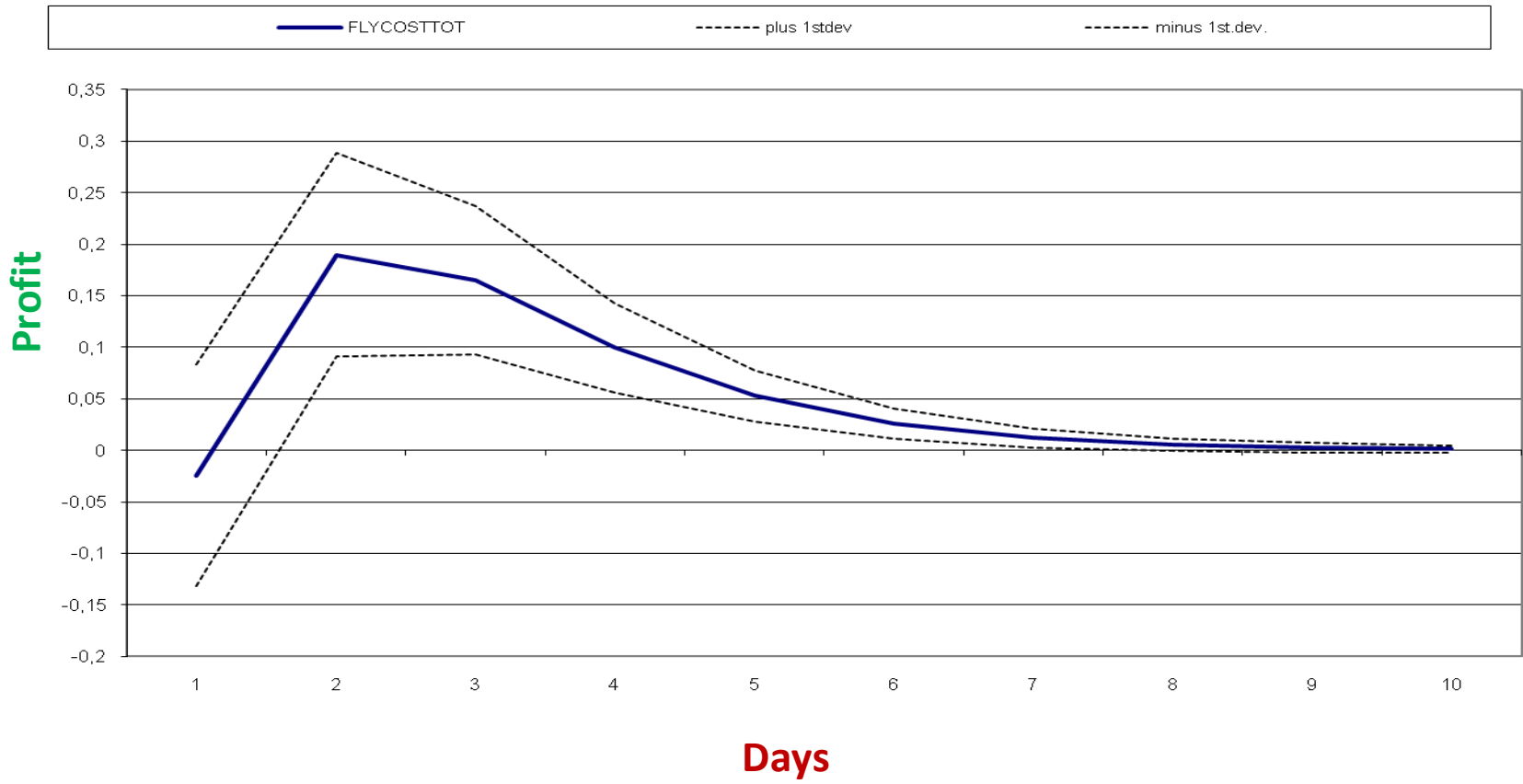
Profit Response: Adwords



Profit Response: Faxes



Profit Response: Flyers



Results

Variable	Profit Effect	Sales Elasticity	Wear-In	Wear-Out	90% Effect
Fax (€)	3.33	0.05	0	6	4
Flyers (€)	0.57	0.04	2	9	5
Adwords (€)	55.72	4.35	1	9	7
eMail (each)	0.71	0.12	2	5	5
Discount (1%)	789	0.75	0	2	1

Dashboard input and output

Marketing Dashboard Prototype

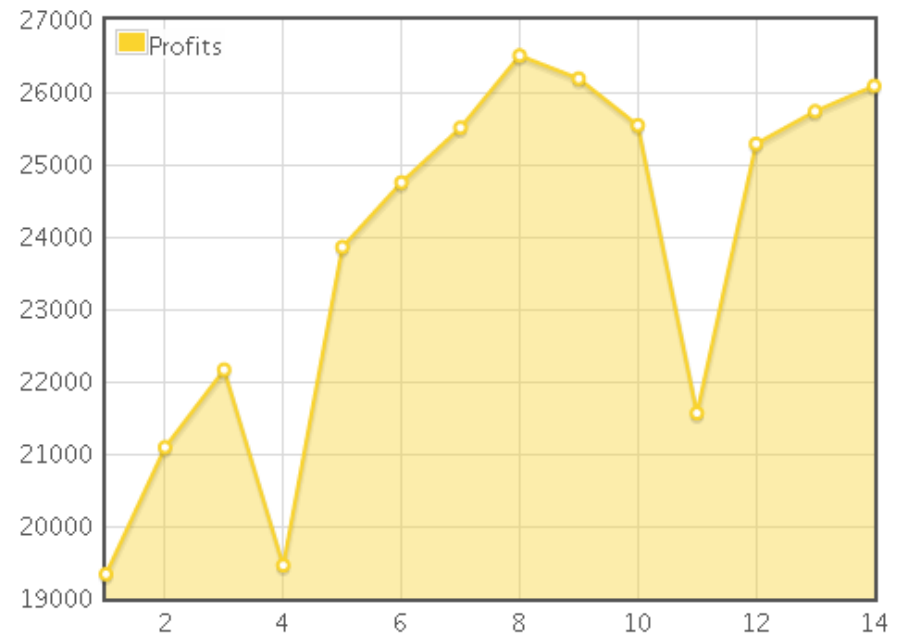
Period	Flyers	Faxes	Adwords	Discount
1	0	400	100	7
2	0	0	50	7
3	0	0	50	7
4	4000	0	100	7
5	0	0	100	7
6	0	0	100	7
7	0	400	100	7
8	0	0	100	7
9	0	0	50	7
10	0	0	50	7
11	4000	0	100	7
12	0	0	100	7
13	0	0	100	7
14	0	0	100	7
	⊗ ⊕	⊗ ⊕	⊗ ⊕	⊗ ⊕

Profits Graph (Inofec Model)

Done

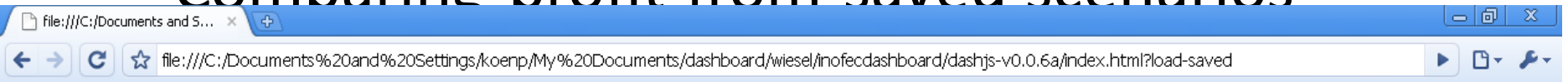
Save

Show Saved



Total Profits: \$333,068.88

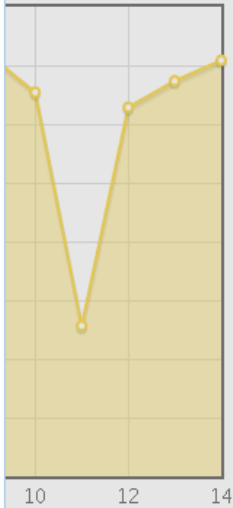
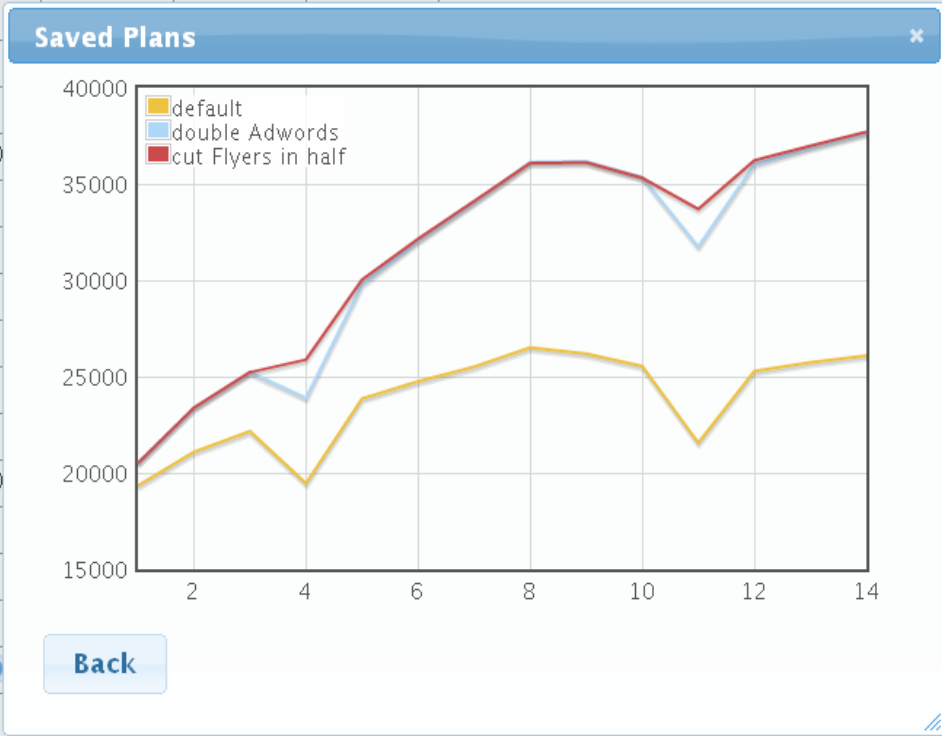
Comparing profit from saved scenarios



Marketing Dashboard Prototype

Period	Flyers	Faxes	Adwords	Discount
1				
2				
3				
4	40			
5				
6				
7				
8				
9				
10				
11	40			
12				
13				
14				

Profits Graph (Inofec Model)



Recommendations to the Company

› Increase spending on faxes

➤ Decrease spending on flyers

➤ Increase spending on Adwords

Increase use of eMail campaigns

Field Experiment – Design

Adwords

High

Base

Base

Group 1

Control

Flyers

Low

Group 2

Group 3

Field Experiment – Design

Adwords

High
(* 1.8)

Base

Base

Group 1

Control

Flyers

Low
(56%)

Group 2

Group 3

Field Experiment – Net Profit Changes

Adwords

High

Base

Flyers

Base

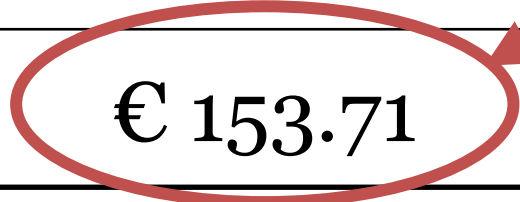
€ 81.39

€ 10.84

Low

€ 153.71

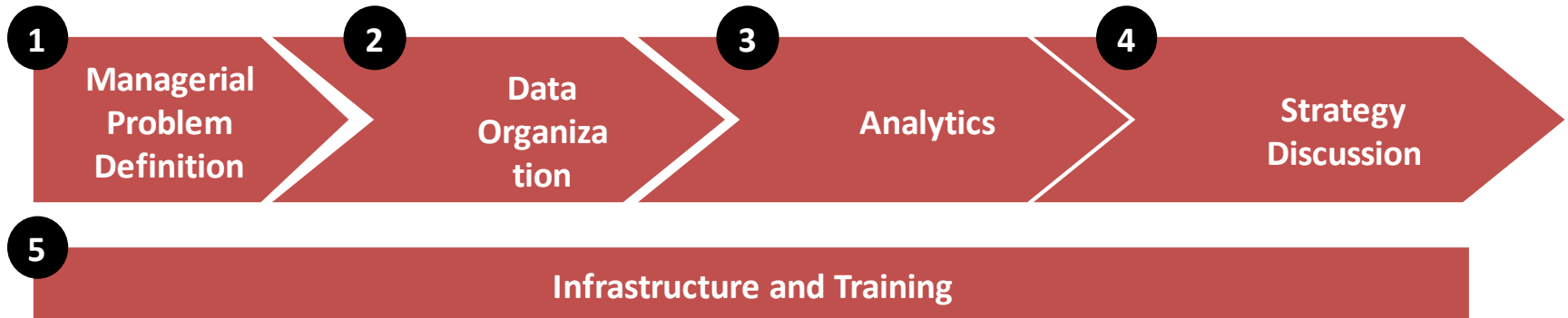
€ 135.45



Experiment Supports Our Assertions

- AdWords
 - Increase raises profits
 - Most of the profit increase shows up in offline orders
 - Higher spending of 17.66 euros per day is more than offset by the higher profits, in either 'Flyer' condition
- Flyers
 - Average daily savings of 137 euros a day are substantially higher than the profits lost from lower sales
 - Do not panic and invest in flyers if there is budget left

Collaboration Phases



1 Define managerial problem
– duration: approx. 3 months

2 Leveraging data from existing systems
– duration: **approx. 20 months**

3 Employing marketing science approaches
– duration: approx. 3 months

4 Discussing results, designing strategies, and deduct field experiment
– duration: approx. 7 months and ongoing

5 Ongoing training
– duration: throughout and ongoing

Impact Statement (1/2)

- › Cultural Impact
 - Resources allocation & marketing analytics
 - Substantial discussions (affecting mental model)
 - marketing analytics “department” (institutionalization of approach)

- › Methodological Impact
 - Applications of marketing science
 - Internal process (existing information and which other information to collect)

Impact Statement (2/2)

› Strategic Impact

- Determine where generating or losing money and plan appropriate strategic activities.
- Improved understanding of the role of marketing
- Strategic change in their focus of activities

Generating Ideas from Data

Koen Pauwels (Northeastern University)
Rick Staelin (Duke University)



Presented to the JM-AMA Research Workshop
February 13-14, 2020, San Diego, CA



Types of Contributions



Classical Research Process:

“TE”: Theory → Empirics

New idea

Develop
theory

Collect
data

Test
theory

Write
paper

Alternative Research Process: “ET”: Empirics → Theory

New
data

New
Marketing
Questions

Uncover
patterns

Propose
theory

Write
paper

Owned social media shows negative comments by competing brand fans

Should brand managers delete these posts? Does this harm or benefit these brands?

- Own fans defend brand + cross-post
- ‘rally the troops’ benefits the brands

Battle of the Brand Fans with Benefits

Ilhan, Kubler & Pauwels *JIM* 2018

Unique data: Some examples

New types of data

- From Free to Fee → How to market to get customers to pay for services they used to get for free (Pauwels & Weiss, 2008, *JM*)
- 36 Dutch brands in 15 categories: marketing, sales, brand tracking, online behavior (Pauwels & Van Ewijk, *MSI Best Paper*, 2013)

Proprietary data

Pre-Launch Forecasting New Cars (Roberts & Urban 1988, *Mgt Sc*)

- Pre-experience perceptions, evaluation and choice
- Exposure to word of mouth, test drive, and consumer reports
- Post-experience perceptions, evaluation and choice and updating

More examples:

New combinations of data

- Facebook, Twitter, YouGov, Press Releases, Media coverage, Firm Performance → How do brand crises develop (target: *JM*)
- Retail prices, Consumer purchases, Media Coverage, Stock market → How media coverage affects price wars (Van Heerde, Gijsbrechts and Pauwels, *JMR* 2015)

Longitudinal data

- 20 years of donation data → variety (Khodakarami et al. 2015, *JM*)
- 7 years of scanner data → long-term effects 4Ps (*JM(R)*, *MKSC*)
- Field experiments over several months (*Practice Prize Winner*)

Granger Causality



- Sir Clive Granger: 2004 Nobel Prize
- For a variable X to cause Y in time, changes to X must precede changes to Y
- *Forecast of Y based on past of $Y + X$ is better significantly than based on past of Y only*
- Limitation: no same-period “causality”, so we also consider strong same-period correlations

For instance, EB Games came up with these metrics:

- **Business Objectives**
 - Quantity of incremental transactions or customers
 - Incremental Customer Value (profit per sale)
 - Repeat sales rate (reflection on customer experience)
 - Defection rates by value segment & tenure
- **Marketing's Leading Indicators**
 - Consideration
 - Competitive preference
 - Inquiry
 - Trial
 - Initial sales value
- **Diagnostics (do not lead business outcomes)**
 - Response rates
 - Cost per contact
 - Cost per sale
 - Brand Awareness
 - Consideration & Preference
 - Web visits
 - Downloads
- **Long-Term Indicators**
 - Competitive Position on Key Attributes (Brand)
 - Dissatisfaction Rates (Customer Experience)
 - Customer equity (future sales potential)

Vector AutoRegression MODELS

Idea: econometric + time-series to describe complex, multiple-equation, dynamic interrelations

$$\begin{bmatrix} S_t \\ M_t \\ CM_t \end{bmatrix} = \begin{bmatrix} \gamma_{11}^1 & \gamma_{12}^1 & \gamma_{13}^1 \\ \gamma_{21}^1 & \gamma_{22}^1 & \gamma_{23}^1 \\ \gamma_{31}^1 & \gamma_{32}^1 & \gamma_{33}^1 \end{bmatrix} \begin{bmatrix} S_{t-1} \\ M_{t-1} \\ CM_{t-1} \end{bmatrix} + \dots + \begin{bmatrix} \gamma_{11}^I & \gamma_{12}^I & \gamma_{13}^I \\ \gamma_{21}^I & \gamma_{22}^I & \gamma_{23}^I \\ \gamma_{31}^I & \gamma_{32}^I & \gamma_{33}^I \end{bmatrix} \begin{bmatrix} S_{t-I} \\ M_{t-I} \\ CM_{t-I} \end{bmatrix} + \begin{bmatrix} u_{S,t} \\ u_{M,t} \\ u_{CM,t} \end{bmatrix}$$

Order determination:

- Multivariate equivalent of ACF and PACF
- Information Criterion balances power & parsimony

Return on Marketing Investment scenarios

	Stationary Marketing	Evolving Marketing
Stationary performance	Business as usual <i>e.g. beer1</i> VAR in levels	Escalation <i>e.g. car rebates</i> VAR in changes
Evolving Performance	Hysteresis <i>e.g. beer brand X</i> VAR in changes	Evolving business <i>e.g. advertising</i> VAR in changes