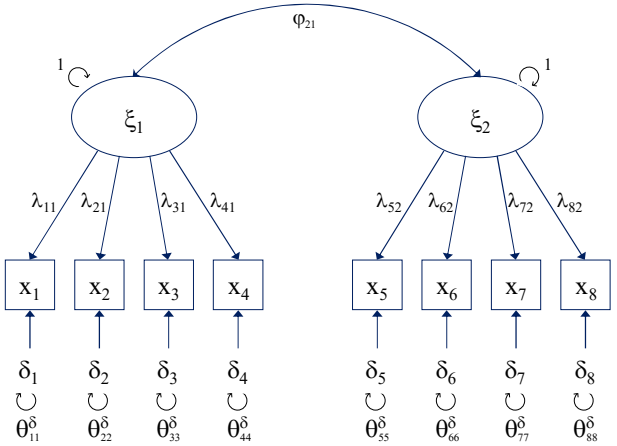
VOORBEELD EXAMENVRAAG



Wat zou wijzen op goede discriminant validiteit in het meetmodel in de figuur?

1. hoge waarden voor λ's, Θ's en φ_{21}
2. hoge waarden voor λ's, Θ's, maar lage waarde voor φ_{21}
3. hoge waarde voor λ's, maar lage waarden voor Θ's en φ_{21}
4. Geen van de andere antwoordopties is correct.

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MARKTONDERZOEK

	Hoorcolleges	**Werkcolleges**
contact	– bert.weijters@ugent.be	– Niet-periodegebondenevaluatie: teamwork rond case Comeos by Insites
evaluatie	– Examen met meerkeuzevragen	– Iedereen is geslaagd voor dit onderdeel
Materiaal	– Handouts + notities hoorcolleges – Artikels	

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MARKTONDERZOEK 7: CONJOINT ANALYSIS

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PART A
CONCEPTUAL BACKGROUND

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VALUE OF GOOD DESIGN

Conjoint Analysis is a systematic approach for matching **product design** with the **needs and wants of customers**, especially in the early stages of the New Product Development process.

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WHAT DOES CONJOINT ANALYSIS DO?

MEASURE IMPORTANCE BY ASSESSING PREFERENCES

- The basic outputs of conjoint analysis are:
  - A numerical assessment of the relative **importance** that customers attach to **attributes** of a product category
  - The value (or **utility**) provided to customers by each potential feature (or **attribute level**) of an offering
  - Identification of product designs that maximize market share or other indices.

- Examples:
  - Courtyard by Marriott : Should we offer our business travellers more room space or a larger desk in their room?
  - Deutsche Bahn: Keeping prices constant, should we enhance train connection reliability versus frequency

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EXAMPLE OF CONJOINT ANALYSIS OUTCOME (1)

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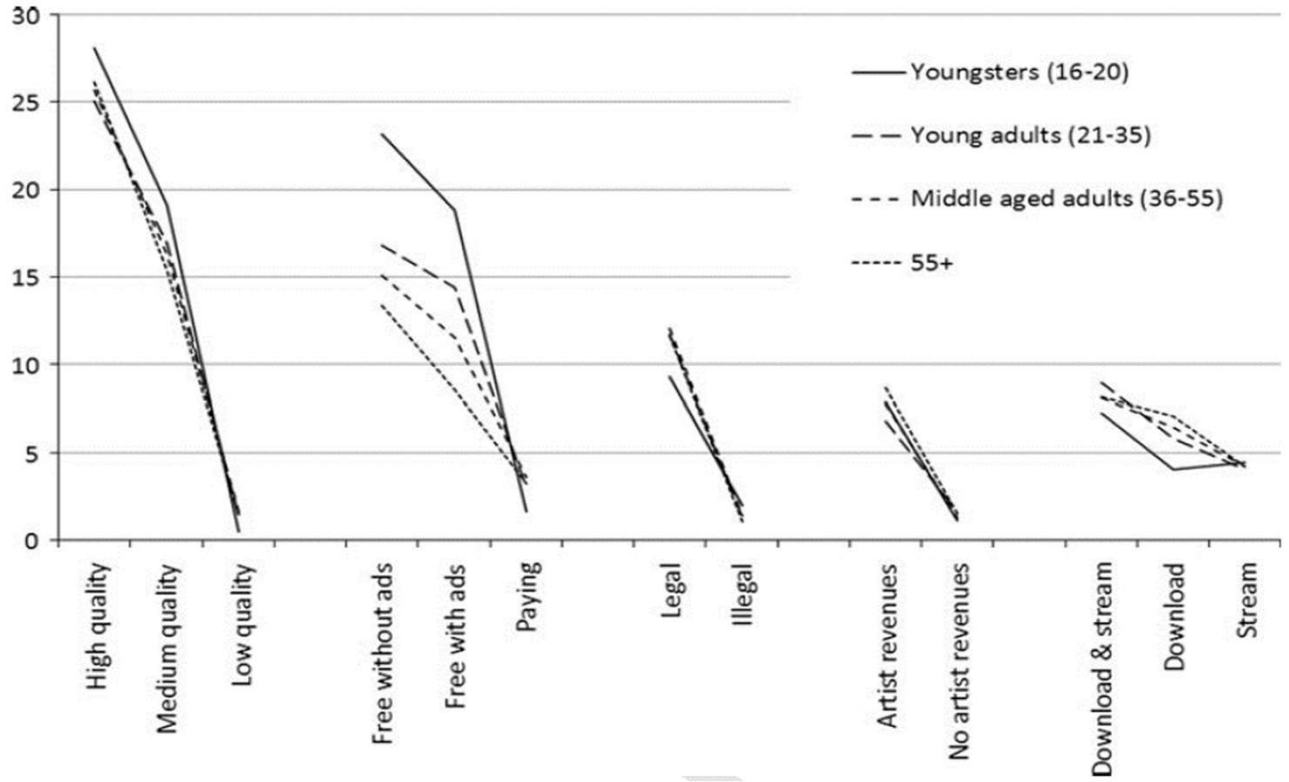
Goedertier, F., Geskens, K., Geuens, M., & Weijters, B. (2012). Increasing choice satisfaction through goal-based labeling. *Marketing Letters*, *23*(1), 119-136.

EXAMPLE OF CONJOINT ANALYSIS OUTCOME (2)



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Weijters, B., Goedertier, F., & Verstreken, S. (2014). Online music consumption in today's technological context: putting the influence of ethics in perspective. *Journal of Business Ethics*, *124*(4), 537-550.

WHY IS CUSTOMER VALUE ASSESSMENT THROUGH CONJOINT USEFUL?

- Design new offerings that enhance customer value.
- Forecast sales/market share/profit of alternative offerings.
- Identify market segments for which a given concept/offering has high value.
- Identify the “best” concept/offering for a target segment.
- Explore impact of alternative pricing and service strategies.
- Plan production in flexible manufacturing systems.

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SIMPLE EXAMPLE OF CONJOINT ANALYSIS

Stimuli

Product option	Cuisine	Distance	Price range
1	Italian	Near	€10
2	Italian	Near	€15
3	Italian	Far	€10
4	Italian	Far	€15
5	Japanese	Near	€10
6	Japanese	Near	€15
7	Japanese	Far	€10
8	Japanese	Far	€15

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SIMPLE EXAMPLE OF CONJOINT ANALYSIS

DATA

Stimuli				Response
Product option	Cuisine	Distance	Price range	Preference rating /10
1	Italian	Near	€10	8
2	Italian	Near	€15	6
3	Italian	Far	€10	4
4	Italian	Far	€15	2
5	Japanese	Near	€10	7
6	Japanese	Near	€15	5
7	Japanese	Far	€10	3
8	Japanese	Far	€15	1

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SIMPLE EXAMPLE OF CONJOINT ANALYSIS

Attribute

DATA

Product option	Cuisine	Distance	Price range	Preference rating /10
1	Italian	Near	€10	8
2	Italian	Near	€15	6
3	Italian	Far	€10	4
4	Italian	Far	€15	2
5	Japanese	Near	€10	7
6	Japanese	Near	€15	5
7	Japanese	Far	€10	3
8	Japanese	Far	€15	1

Attribute level (or feature)

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SIMPLE EXAMPLE OF CONJOINT ANALYSIS

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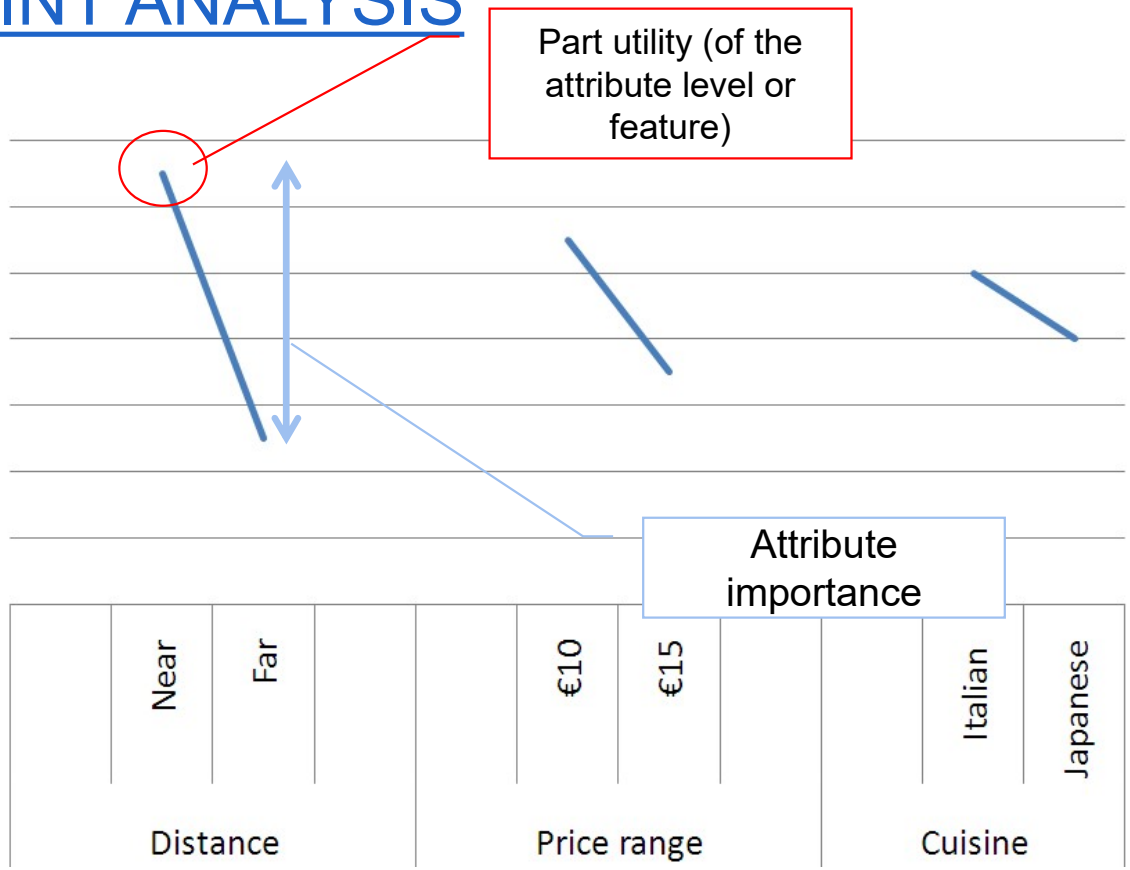
SIMPLE EXAMPLE OF CONJOINT ANALYSIS



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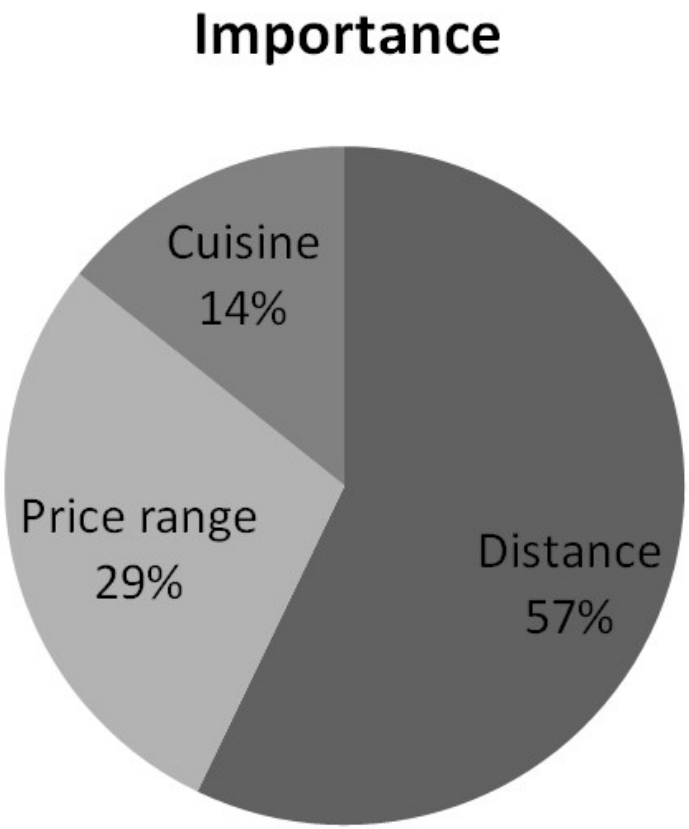
SIMPLE EXAMPLE OF CONJOINT ANALYSIS



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CONJOINT ANALYSIS: ANALYTICAL APPROACH

- For each individual respondent, a multiple regression analysis model can be estimated (e.g., using the lm procedure in R)
- Attribute levels = independent variables
- Rating = dependent variable
- Result: individual-level regression weights estimates that capture part worth utility of each attribute level

LIMITATION

- Importance estimates depend on the selected attribute levels
  - E.g.: setting price levels at 8€ vs. 16€ would boost price importance
- So: select relevant non-extreme attribute levels

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DERIVED ANALYSES

- Utility segmentation
- Market simulation

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UTILITY SEGMENTATION

Segmentation based on individuals' part utilities

- Segments = Clusters
- Segments are groups of customers with more homogeneous needs (similar part utilities)
- Each segment has a different ideal offer

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MARKET SIMULATION: MARKET SHARE APPROXIMATIONS
(UNDER SIMPLIFYING ASSUMPTIONS)

- Given = current product profiles in the market, defined in terms of the attributes and attribute levels used in the conjoint
  - I.e. 'existing product profiles'
- Simulations
  - Market shares of current products (as is, before entry of new offers)
  - Market shares of current and newly introduced products:
    - New product profiles (user-specified product)
      - The company can assess the market share potential for a product that has been designed

    OR

    - Optimal product profiles (simulation-based product)
      - The simulation can point toward the product that will maximize estimated market share potential

EXAMPLES OF BUSINESS ISSUES ADDRESSED BY CONJOINT ANALYSIS

- Given a target cost for a product, would it be more profitable for us to enhance product reliability or its performance?
- Are we pricing our new product according to its value for customers?
- How many units of the new product can we hope to sell?
- What will happen to sales of our product when a competitor alters its product line?
- Which customer segments will find our new product to be most attractive?
- Would it be profitable to offer different product versions to different segments?
- How valuable is my brand to customers?
- Why do our customers buy our products?

PART B
DATA ANALYSIS APPLICATION

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OBJECTIVE

- **Analyze your personal pizza preferences using conjoint analysis**
- Learn how to create a conjoint design in R
- Learn how to analyze conjoint ratings at the individual level in R
- Understand part worth utilities:
  - Analytical rationale
  - Marketing relevance

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METHODOLOGY

- ❑Step 1: Define attributes and attribute levels
- ❑Step 2: Create a design
- ❑Step 3: Collect data
- ❑Step 4: Estimate utilities
- ❑Step 5: Report / visualize
- ❑Step 6: Market analysis - see business case

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DESIGNING A FROZEN PIZZA

- Crust:
  - Pan
  - Thin
  - Thick
- Type of cheese
  - Romano
  - Mixed cheese
  - Mozzarella
- Amount of cheese
  - 60 g
  - 180 g

- Topping
  - Hawaï (pineapple)
  - Veggie
  - Sausage
  - Peppers

- Price
  - €1.80
  - €2.40
  - €3.60

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```
##############Step 1: Define attributes and attribute levels#################
#generate grid with all possible combinations of attribute levels (factor levels)
c<-expand.grid(
  Crust <-c("Pan", "Thin", "Thick"),
  Cheese <- c("Romano", "Mixed", "Mozzarella"),
  Amount <-c("60g", "180g"),
  Topping <-c("Hawai","Veggie","Sausage", "Pepperoni"),
  Price <-c("1.80EUR", "2.40EUR", "3.60EUR")
  )

#Assign names to the attributes
names(c) <-c("Crust", "Cheese", "Amount","Topping","Price")
```

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METHODOLOGY

- ❑Step 1: Define attributes and attribute levels
- ❑Step 2: Create a design
- ❑Step 3: Collect data
- ❑Step 4: Estimate utilities
- ❑Step 5: Report / visualize
- ❑Step 6: Market analysis - see business case

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CREATE ORTHOGONAL DESIGN

- Attributes
  - Type of crust (3 types)
  - Type of cheese (3 types)
  - Price (3 levels)
  - Topping (4 varieties)
  - Amount of cheese (2 levels)

- A total of 216 (3x4x3x2x3) different pizzas can be developed from these options

- Full-profile fractional design : 16 product bundles (e.g., thin crust, 60g cheese, mozzarella, veggie, 2.40 EUR)

```
##################Step 2: Create a design################
#Select an orthogonal design from c
mydesign <- caFactorialDesign(data=c, type="fractional")
#Randomize presentation order
mydesign<-mydesign[order(sample(1:16)),]
#add an empty rating column
mydesign$rating<-rep(0,16)
print(mydesign)

# Save design into an excel file
# (install and) open xlsx package
#install.packages("xlsx")
library(xlsx)
#replace 'bweijter' with your own user name on your pc
#(or save mydesign to another location)
write.xlsx(as.data.frame(mydesign), "C:/Users/bweijter/Desktop/mydesign.xlsx")
```

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METHODOLOGY

- ❑Step 1: Define attributes and attribute levels
- ❑Step 2: Create a design
- ❑Step 3: Collect data
- ❑Step 4: Estimate utilities
- ❑Step 5: Report / visualize
- ❑Step 6: Market analysis - see business case

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PLEASE INDICATE HOW LIKELY YOU WOULD BE TO BUY THE FOLLOWING PRODUCT:

Thick crust pizza with 180g mozzarella and hawaï topping priced at €2.40

1. Would definitely not buy
2.
3.
4.
5.
6.
7.
8.
9.
10. 10 = would definitely buy

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```
#################Step 3: Collect data#################################
# Now open 'mydesign.xlsx' which you just created on your desktop in Excel
# Type in ratings for each product profile
# Use scores from 1='not attractive at all' to 10 = 'very attractive'
# After rating the products in Excel, copy your ratings to the clipboard
# Select the ratings (include only your ratings, but not the header 'rating') and select
copy or press CTRL-C
# Read the clipboard into a vector with your ratings
ratings<-as.vector(unlist((read.table("clipboard"))))

#create a dataset for analysis
mydata<-mydesign
#insert your ratings
mydata$rating<-ratings
```

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METHODOLOGY

- ❑Step 1: Define attributes and attribute levels
- ❑Step 2: Create a design
- ❑Step 3: Collect data
- ❑Step 4: Estimate utilities
- ❑Step 5: Report / visualize
- ❑Step 6: Market analysis - see business case

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ESTIMATE PART WORTH UTILITIES

$Y = a + b1*X1 + b2*X2 + \ldots + e$

Rating = Intercept + PartUtilityThickCrust * ThickCrust + ….. + e

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```
############Step 4: Estimate utilities#########################
#Run a regression analysis with your ratings as the dependent variable
#The attribute factors are the independent variables
myconjoint<-lm(ratings~Crust+Cheese+Amount+Topping+Price,data=mydata)
```

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METHODOLOGY

- ❑Step 1: Define attributes and attribute levels
- ❑Step 2: Create a design
- ❑Step 3: Collect data
- ❑Step 4: Estimate part worth utilities
- ❑Step 5: Report part worth utilities and interpret
- ❑Step 6: Market analysis - see business case

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```
##############Step 5: Report / visualize###############
# output
summary(myconjoint)
myconjoint$coefficients
# Plot your part worth utilities
#install.packages("jtools")
library(jtools)
#install.packages("ggstance")
library(ggstance)
plot_coefs(myconjoint)
plot_coefs(myconjoint, omit.coefs=NULL)
```

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```
Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)       1.55852    0.96837   1.609 0.168436
CrustThin         0.86546    0.66027   1.311 0.246910
CrustThick        0.59266    0.67443   0.879 0.419749
CheeseMixed      -0.23648    0.70010  -0.338 0.749244
CheeseMozzarella -0.25071    0.69189  -0.362 0.731904
Amount180g        0.05509    0.54178   0.102 0.922959
ToppingVeggie     6.96976    0.77359   9.010 0.000281 ***
ToppingSausage    3.40946    0.81887   4.164 0.008793 **
ToppingPepperoni  3.77614    0.74838   5.046 0.003947 **
Price2.40EUR     -1.03670    0.69151  -1.499 0.194109
Price3.60EUR     -1.89325    0.66627  -2.842 0.036180 *
---
```

```
# Plot your part worth utilities
install.packages("jtools")
library(jtools)
install.packages("ggstance")
library(ggstance)
install.packages("broom.mixed")
library(broom.mixed)
plot_coefs(myconjoint)
```

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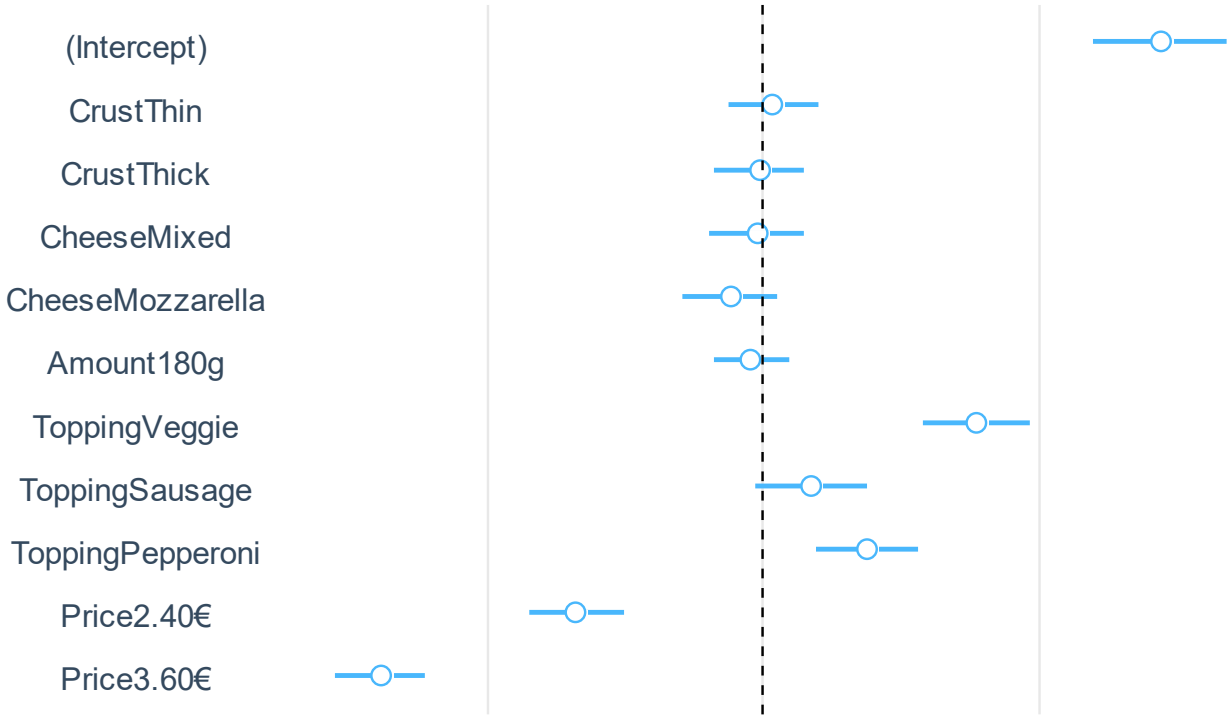
REPORT PART WORTH UTILITIES AND INTERPRET



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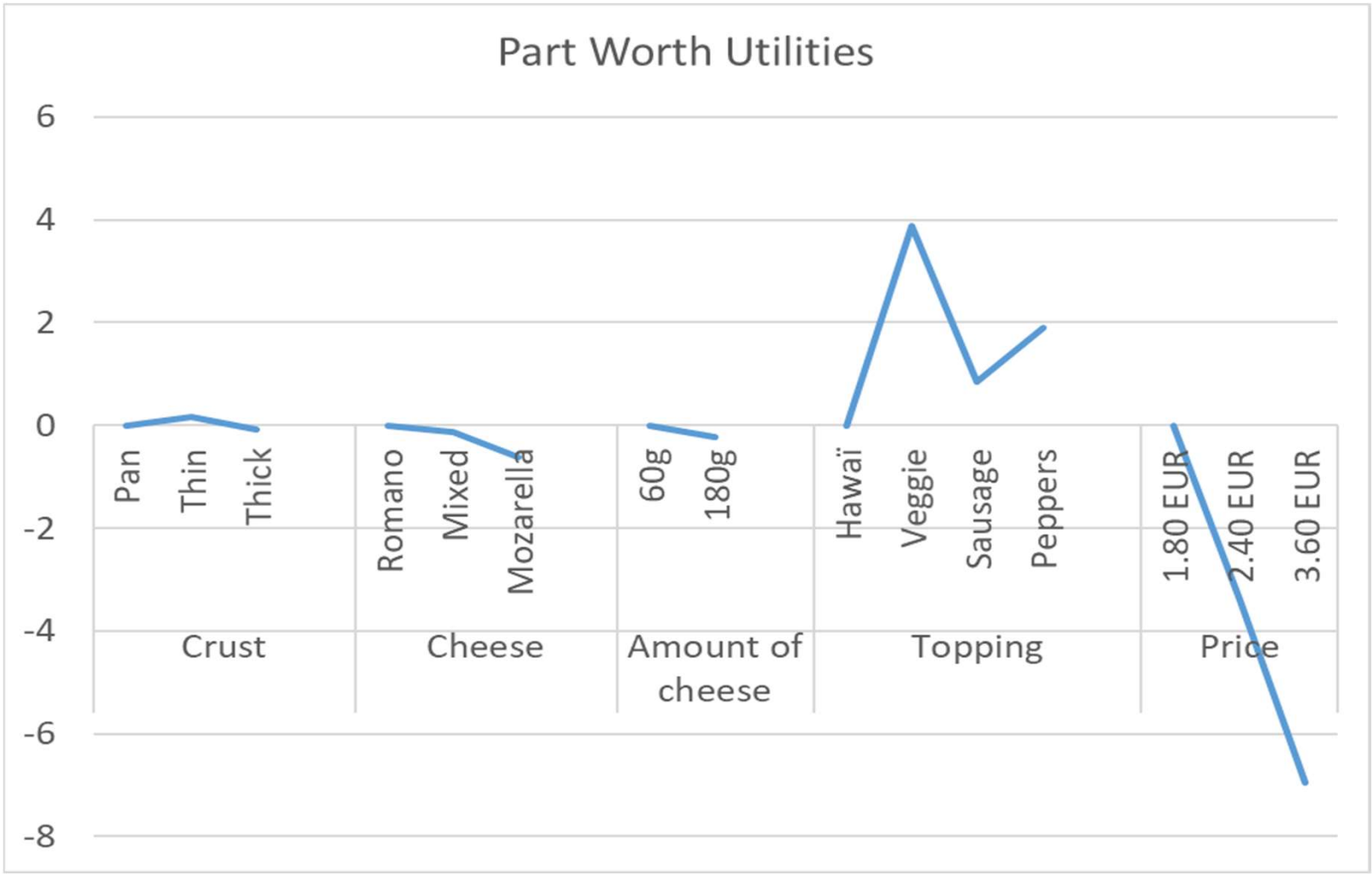

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PART C
BUSSINES CASE

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CONJOINT CASE: PIZZA DESIGN

- Retailer starts up a new retail format focusing on convenience, speed and value-for-money
- Need for well-targeted small assortments in all categories
- In the frozen pizza category, the retailer will probably offer three varieties:
  - Basic (private label)
  - Veggie premium (bio/organic private label)
  - ...
- A pizza manufacturer needs to propose one product for inclusion in this category

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RESEARCH QUESTION

- Which product(s) to push and why?
- Select a product from your existing portfolio (possibly planning a slight adaptation)

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OTHER PRODUCTS THAT CURRENTLY ARE ALREADY IN THE ASSORTMENT

Attributes / Existing Product Profiles	**Basic pizza (private label)**	**Veggie premium (private label)**
Crust	Thick	Thin
Amount of cheese	180 g	60 g
Type of cheese	Mixed	Mozzarella
Topping	Sausage	Veggie
Price	1.80 EUR	3.60 EUR

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DESIGNING A FROZEN PIZZA

- Attributes
  - Type of crust (3 types)
  - Type of cheese (3 types)
  - Price (3 levels)
  - Topping (4 varieties)
  - Amount of cheese (2 levels)

- **A total of 216 (3x4x3x2x3) different pizzas can be developed from these options!**

- 1 of those should be selected as the candidate to complement the retailer's assortment

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DESIGNING A FROZEN PIZZA

- Crust:
  - Pan
  - Thin
  - Thick
- Type of cheese
  - Romano
  - Mixed cheese
  - Mozzarella
- Amount of cheese
  - 60 g
  - 180 g

- Topping
  - Hawaï (pineapple)
  - Veggie
  - Sausage
  - Peppers

- Price
  - €1.80
  - €2.40
  - €3.60

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METHODOLOGY

- Online survey N = 900
- Conjoint
  - Full-profile fractional design : 16 product bundles (e.g., thin crust, 60g cheese, mozzarella, veggie, 2.40 EUR)
  - 10-point rating scale
    - 1 = would definitely not buy
    - 10 = would definitely buy

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OUTCOMES

- Part utilities for all attribute levels
- Utility segmentation: 4 clusters
- Market simulation (based on the assumption that retailer will offer a basic and a premium product):
  - Including product variety taken from current product offer
  - Including a new to-be-developed product

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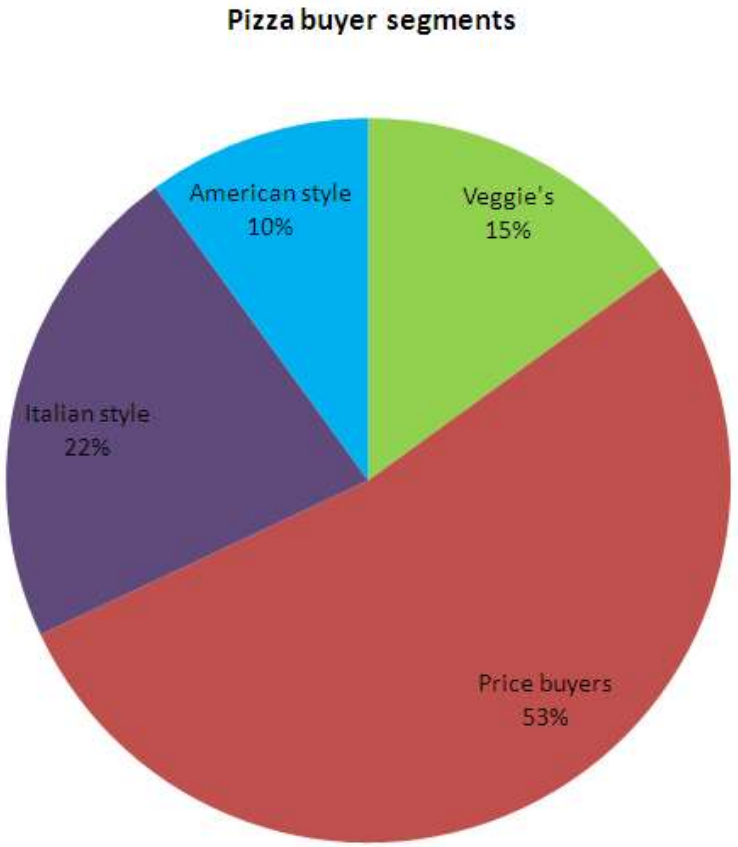
SEGMENTATION (SEGMENT SIZES)



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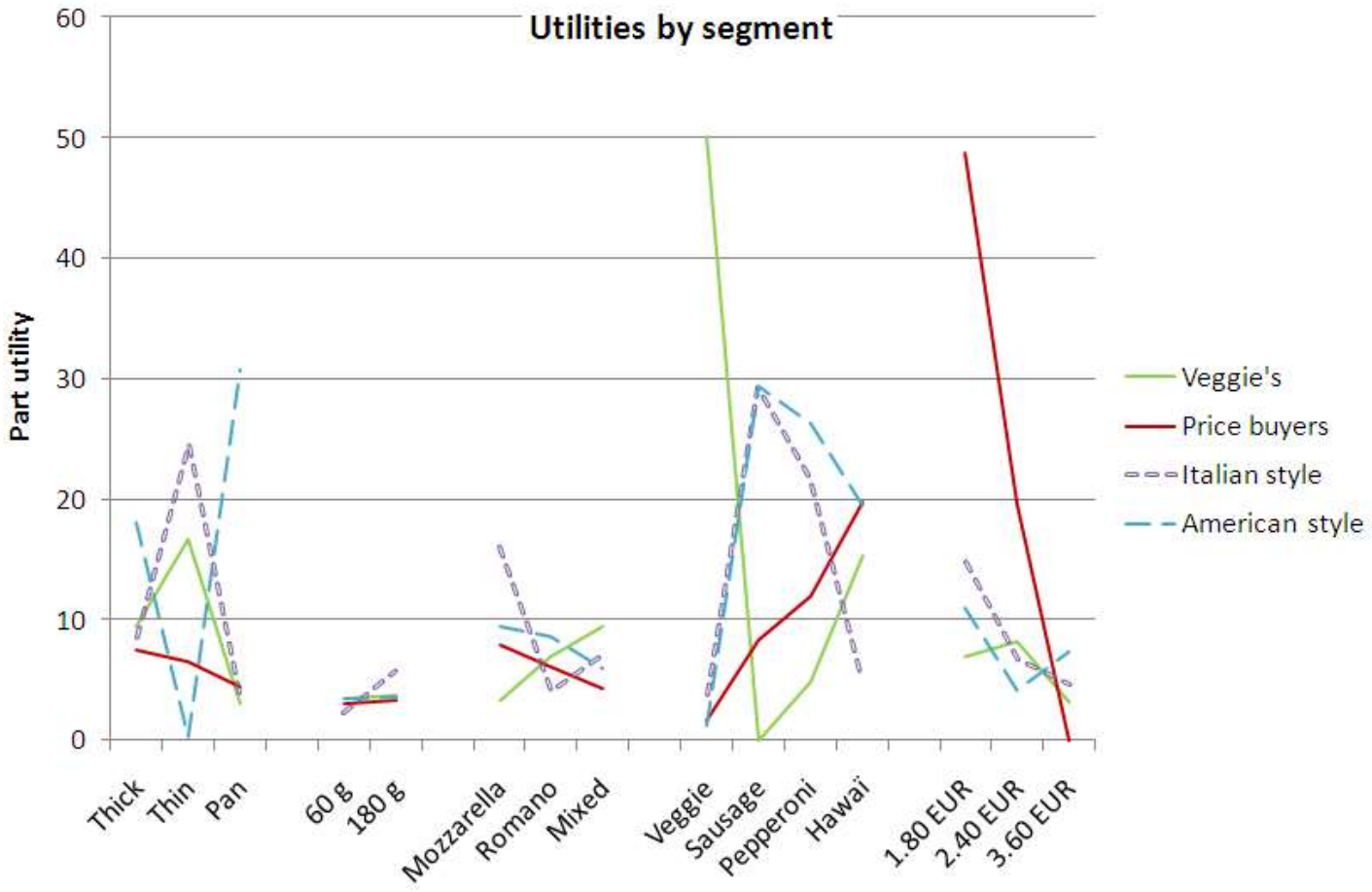
SEGMENTATION (UTILITIES)



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IF YOU WERE ALONE IN THE MARKET AND YOU WANTED TO PLEASE EACH SEGMENT, THIS MIGHT BE YOUR OFFER

Ideal pizza by segment

Veggie's	Price buyers	Italian style	American style
Thin	Thick	Thin	Pan
180 g	180 g	180 g	180 g
Mixed	Mozzarella	Mozzarella	Mozzarella
Veggie	Hawaï	Sausage	Sausage
2.40 EUR	1.80 EUR	1.80 EUR	1.80 EUR

... BUT YOU'RE NOT ALONE

Attributes / Existing Product Profiles	Basic pizza (private label)	Veggie premium (private label)	?
Crust	Thick	Thin	…
Amount of cheese	180 g	60 g	…
Type of cheese	Mixed	Mozzarella	…
Topping	Sausage	Veggie	…
Price	1.80 EUR	3.60 EUR	…

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CANDIDATE PRODUCTS

Optimal Product Profiles ***New Product Profiles***

Optimal Product 1	**Optimal Product 2**	**Vegetariana**	**Don Pepe**	**Americana**
Thin	Thin	Thin	Thin	Pan
180 g	60 g	60 g	180 g	180 g
Mozzarella	Mozzarella	Mozzarella	Mozzarella	Mixed
Hawaï	Hawaï	Veggie	Peppers	Sausage
1.80 EUR	1.80 EUR	3.60 EUR	2.40 EUR	1.80 EUR

generated by the simulation tool

user defined

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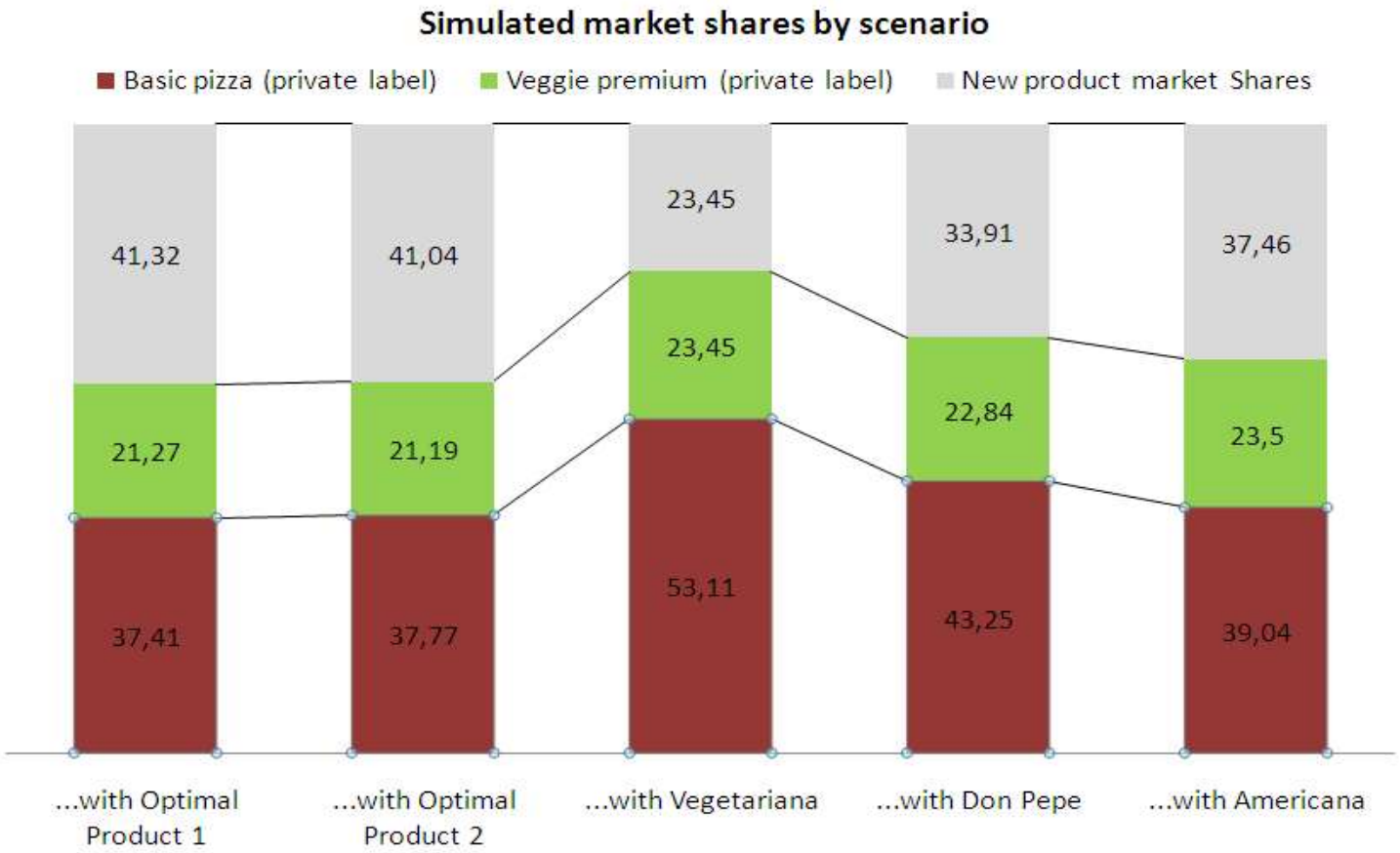
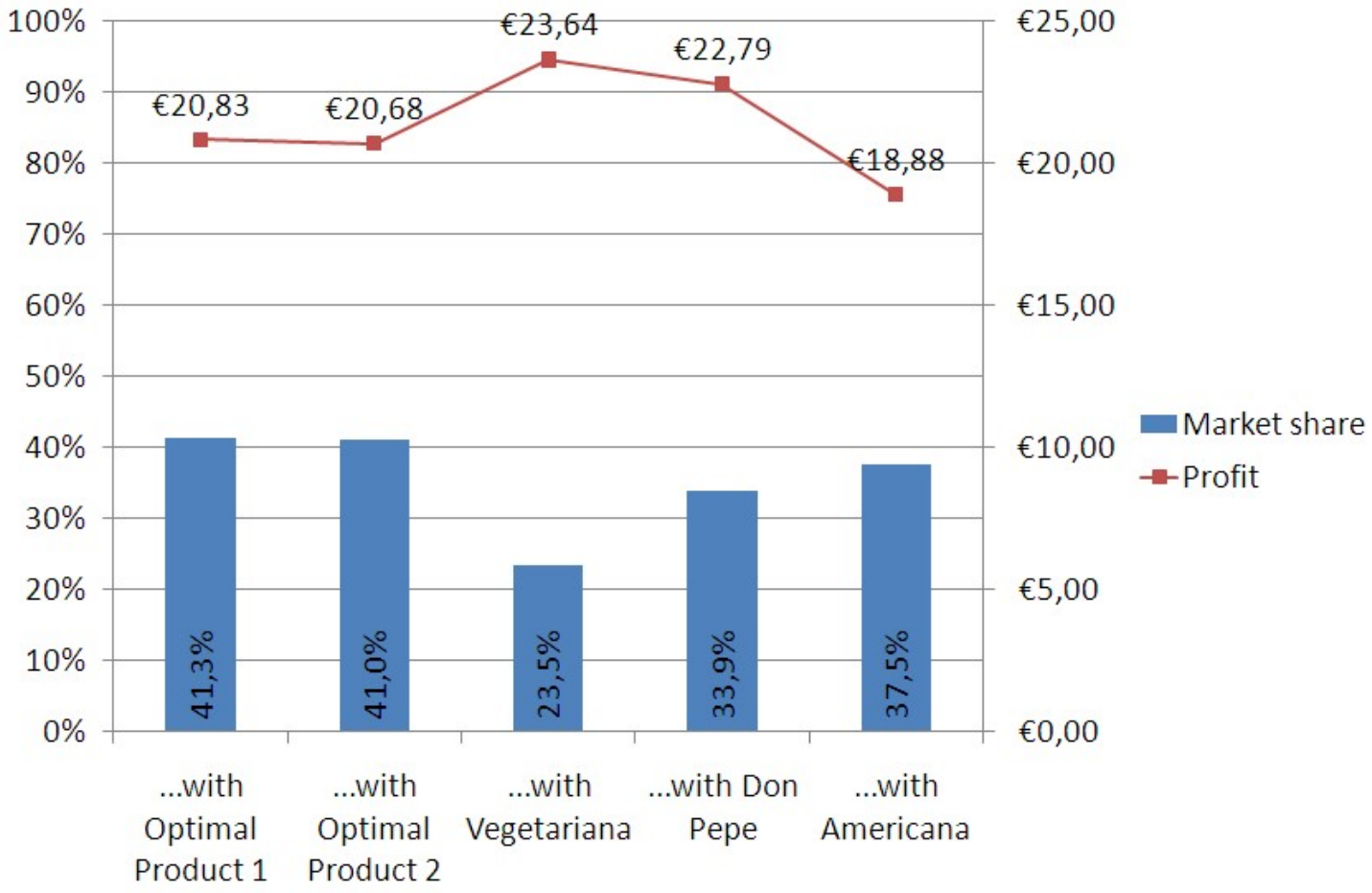


Optimal Product 1	Optimal Product 2	Vegetariana	Don Pepe	Americana
Thin	Thin	Thin	Thin	Pan
180 g	60 g	60 g	180 g	180 g
Mozzarella	Mozzarella	Mozzarella	Mozzarella	Mixed
Hawaï	Hawaï	Veggie	Peppers	Sausage
1.80 EUR	1.80 EUR	3.60 EUR	2.40 EUR	1.80 EUR

MARKET SHARE VS PROFIT* BY SCENARIO



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* For market of N = 100 at a 28% margin

RECOMMENDATION

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ALSO SEE: CHOICE BASED CONJOINT

What Can Conjoint Analysis Do For You?

This video is a fun introduction to the classic market research technique, conjoint analysis. Help Jane figure out how to build and market a better "bazoogle" to beat her competitor Bob. This white-boarding video explains how conjoint analysis tools (especially choice-based conjoint, CBC) are used to design and price near-optimal products and services.

https://www.sawtoothsoftware.com/support/videos?id=1361

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