Market Models

EBM077A05.2022-2023.1

FREE EDITION*

SUMMARY OF EVERYTHING FROM WEEK 1

Enhanced with a dynamic table of contents.

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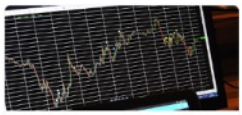

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Grades Testimony:

COURSE CODE	TITLE	SCORE	DATE	RESULT
EBS001A10	Business Research Methods for Pre-MSc	8	21-12-2021	8
EBS002A05	Mathematics for Pre-MSc	9	10-11-2021	9
EBS003A05	Organization Theory & Design for Pre-MSc	7	05-11-2021	7
EBB098A05	Contemporary Theories on Business and Management	6	11-05-2022	6
EBB649C05	Strategic Management B&M	8	15-06-2022	8
EBB617B05	Human Resource Management B&M	8	08-04-2022	8
EBB104A05	Behavioural Decision Making	7	03-11-2021	7
EBB085A05	Marketing Research for E&BE	8	04-04-2022	8
EBS008B10	Research Paper for Pre-MSc Marketing	7	05-07-2022	7
EBM043A05	Business Ethics	8	14-11-2022	8
EBB105B05	Digital Marketing Analytics	8	21-01-2022	8
EBM213A05	Data Engineering for MADS	7	01-11-2022	7
EBM214A05	Statistical Learning in Marketing	8	02-11-2022	8
EBM215A05	Companies, Brands, and Consumers	8	05-11-2022	8
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Week 1

Lecture 1: Introduction to Marketing Models

Model building

- ***What is a model?***
  - A stylized representation of reality
- ***What is the goal of models?***
  - Understand this reality
- ***What are the basic elements of every model?***

  - A model should contain the most important elements, but is never complete.
  - Make as simple as possible

3 Type of Models: Iconic, analog and symbolic

- **Iconic Models:** resemble reality but use other materials or another scale: for example to capture design ideas.
  - *Examples:* sketches, prototypes, virtual, reality and scale models.
- **Analog Model:** specific characteristics of an idea or system
  - Focus on key elements
  - Do not contain details
  - Do not resemble reality but are helpful in analyzing its functions
  - *Examples: flow charts, circuit diagrams*
- **Symbolic Models:** represent ideas using code, an abstract representation of reality
  - **Examples:** numbers, mathematical formulas, words, music notes

$$S_{ijt} = \beta_{ij}\left[\prod_{r=1}^{n}\left(\left(\frac{P_{rjt}}{\overline{P}_{\cdot jt}}\right)^{\beta_{ri}}\prod_{\ell=1}^{3}\gamma_{\ell ri}^{D_{\ell rjt}}\right)\right]\left[\prod_{t=1}^{T}\delta_{jt}^{X_t}\right]\left[\prod_{j=1}^{J}\lambda_{ij}^{Z_j}\right]\beta_5^{T_t}e^{u_{ijt}}$$

Famous SCAN*PRO model: co-developed by Nielsen

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Reasons to use Models

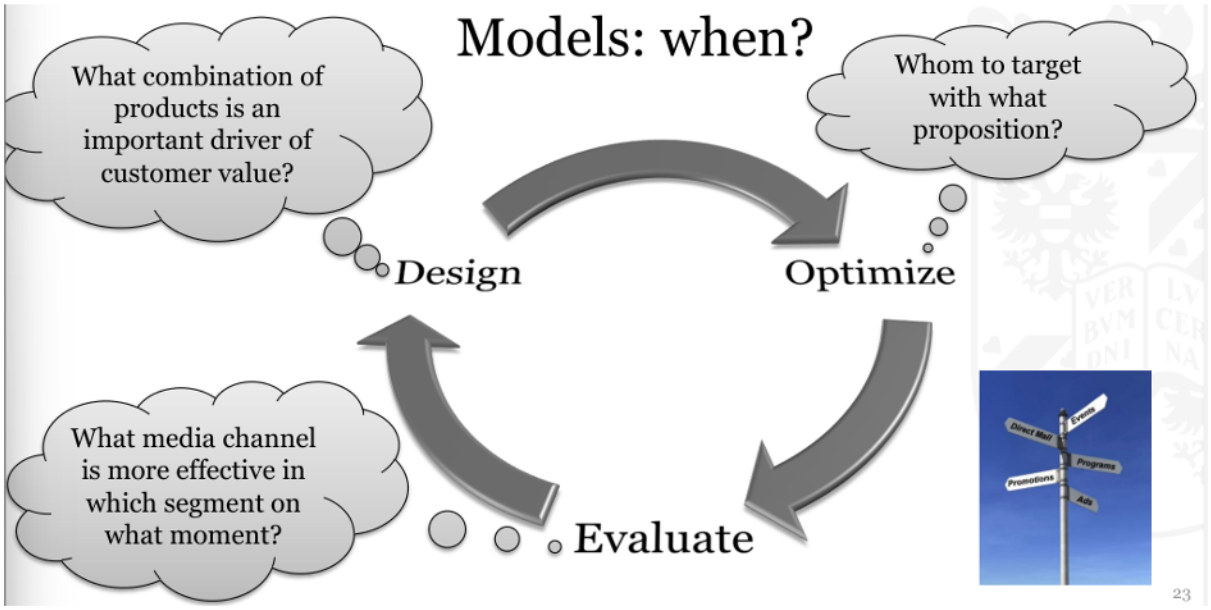
- Forces one to abstract away from details
- Puts focus only on the key elements
- Less ad-hoc than one-time analyses
- Include more than one factor simultaneously
    - Effectiveness above the line and below the line
- Can be used to describe/predict/prescribe
    - Not limited to observed cases

Reasons to not use Models

- Time consuming
- Data availability constraints

When to use models?

- **Design**: e.g., how should we design our product to appeal to customers?
- **Optimize**: e.g., who to target with what proposition
- **Evaluate**: e.g., what media channels are more effective?



The 4 Steps of Marketing Model Building

- **Specification (1):** deriving the model equation, what do we include?
- **Estimation (2):** get the data and estimate the model (betas)
- **Validation (3):** check e.g., linear model assumptions
- **Use (4)**

Reading 1: Market Models Chapter 1

1.2 Verhouten Case

The first six chapters are based on the sweets company Verhouten, here is a briefing on the company:

The chocolate factory Verhouten is a family company founded in 1889 by Cornelis Verhouten in Haarlem in the Netherlands. Since then, the company has grown continuously. In 1899 there were two employees and at this moment there are 125. The turnover was 6,647 guilders in the first year, whereas last year's (2014) turnover was about 100 million Euro. Currently, a grand-grand child of the founder, Frans Verhouten, is member of the board of directors.

In the first years Verhouten sold only chocolate bars of 75 g. The assortment consists now of four product classes: chocolate bars, candy bars, specialties, and seasonal products. The chocolate bars carry the brand name Verhouten and they are available in three weight classes (100, 200 and 400 g), and four flavors: milk, pure, almond-milk and white. The candy bars are sold under the brand names Tiger and Dream. The specialties are Belgian bonbons and pastilles. Seasonal products are sold in December (chocolate letters, and Christmas chocolates), and at Easter (Chocolate Easter eggs and Chocolate Easter bunnies). Verhouten products are distributed through several distribution channels. The supermarket channel distributes 75 %, candy stores 10 %, sport canteens 8 %, gasoline stations 4 %, and tobacco stores 3 %. The most important supermarkets in the Netherlands are Albert Heijn (33 % of the supermarket channel), and Jumbo. In this case we focus on the most important category for Verhouten: chocolate bars.

1.3 Typologies of Marketing Models

In this section we focus on (1.3.2) distinction between *decision models* and models that advance marketing knowledge, (1.3.3) classify models based on degree of explicitness, (1.3.4) classify models based on the intended use and (1.3.5) level of demand.

1.3.2 Decision Models vs. Models That Advance Marketing Knowledge

- **Decision Models < vs. > Models-AMK:**
  - *Target audience:* Practitioners < > Marketing Scientists
  - *Insights obtained are:* Case-specific < > Generalizable
  - *Knowledge Scope:* Short-term < > Long-term

An empirical generalization

> . . . "is a pattern or regularity that repeats over different circumstances and that can be described simply by mathematical, graphic or symbolic methods. A pattern that repeats but need not be universal over *all* circumstances" (Bass 1995, p. G7).

- **Two Types of Research Tradition in Marketing**
  - (1) **Theoretical-in-Isolation (TiI):**
    - 1 – construct a theoretical model or analysis approach
    - 2 – test it on a set of data
  - (2) **Empirical-then-Theoretical (EtT):**
    - 1 – establish a generalizable empirical patten
    - 2 – develop a low-level theoretical model or explanation

- **Generalizable knowledge** about market phenomena can be generated in several ways:
  - 1 – Find *regularities* in customer behavior data
    - *Example:* smaller brands have fewer buyers and buyers of smaller brands tend to have a low purchase frequency
  - 2 – Studies that cover *many circumstances* (such as brands, markets or countries) and *long time periods*.
    - Panel data are used for that purpose
    - *Example:* investigating ad expenditure in 37 countries covering four key media forms (magazine, newspaper …)
  - 3 – Doing *meta*-analyses, which is: the statistical analysis of results from several individual studies for the purpose of generalizing the individual findings

1.3.3 Degree of Explicitness: Implicit vs. Verbal vs. Formalized vs. Numerically-Specified Models

In this section we consider a number of ways of representing the "*most important elements of a perceived real-world system"* (*models*).

- **Implicit Models:** type of model that is only present in the brain of a decision maker.
  - *Example:* a manager uses intuition and experience to reach a solution. Think of intuition and experience as our IVs.
- **Verbal Models:** the first step in making a model explicit is to state in words what the important elements surrounding a problem are.
  - *Example:* a manager says how he made the decision:

> *"I will change my price in steps with each change equal to plus or minus Δp, until the increase in profit is less than a predetermined amount δ, with the restriction that price stays below the value p_c."*

- **Formalized Models:** the representation of a system through formalized relationships between the most important variables of a system.
  - Specify which variables influence which other variables and what the directions of causality between these variables are.
  - **2 Classes of Formalized Models:**
    - **Logical Flow/Graphical/Conceptual Model:** represents an extension of the verbal model by the use of a diagram.
      - Shows the sequence of questions and actions leading to a solution of the problem.
    - **Formalized Mathematical Model:** represents a part of the model by specifying relations between some explanatory variables (*predictors*) and some effect variable (*criterion*)
  - *Examples of both:*

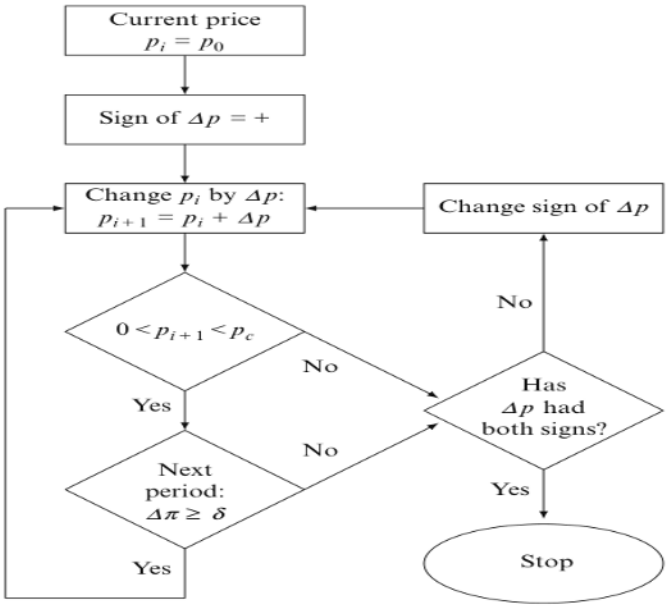


Fig. 1.2 Logical flow model for profit satisficing monopolist

$$\max_{p}(\pi) \tag{1.1}$$

$$\text{subject to} \quad 0 < p < p_c \tag{1.2}$$

$$\text{where} \quad \pi = (p - c)q - FC \tag{1.3}$$

$$q = f(p) \tag{1.4}$$

Fig. 1.3 Formalized mathematical model for profit optimizing monopolist

Equation (1.3) states that profit is equal to sales revenue (pq), minus variable production costs (cq), minus fixed costs (FC). This type of model is not very useful from a managerial decision making point of view because nothing is said about *how* demand (q) depends on price. In the logical flow model this relation is *approached* by trial-and-error.

- **Numerically Specified Models:** in these models the various components and their interrelations are quantified.
  - Benefits of such models:
    - **(1)** Enables managers to quantify the effects of multiple, potentially conflicting forces.
    - **(2)** *Myriad of actions:* May be used to explore the consequences of alternative courses of action and market events.
  - Disadvantage: costs money and the more complicated/explicit the model, the more expensive it is.
  - *Example:*

$$\max_{p}(\pi) \tag{1.5}$$

$$\text{subject to } 0 < p < p_c \tag{1.6}$$

$$\text{where } \pi = (p - c)q - 100 \tag{1.7}$$

$$q = 10\, p^{-2} \tag{1.8}$$

Fig. 1.4 Numerically specified model for a profit optimizing monopolist

The difference between Figs. 1.3 and 1.4 is the numerically specified relation[5] between q and p [relation (1.8)]. This relation is of the form:

$$q = \alpha p^{\beta} \tag{1.9}$$

and is generally known as a multiplicative function or relation. The coefficients α and β are referred to as the model parameters, are unknown, but can be estimated

1.3.4 Intended Use: Descriptive, Predictive and Normative Models

Models can be classified according to their intended usage, we distinguish between descriptive, predictive and normative models.

- **Descriptive Models:** are intended to describe decision or other processes, in other words when tracing the steps that lead to a decision, and identifying the forces that influence the outcome of said decision.
- **Predictive Models:** the main purpose is to forecast or predict future events.

- **Normative & Prescriptive Models:** these models has as one of their outputs a *recommended course of action*, the objective is defined against which alternative actions can be evaluated and compared.

1.3.5 Level of Demand

Another classification that distinguishes models on level of demand. Here we distinguish between models for individual demand and models for aggregate demand.

- **Different types of Aggregate Demand models:**
  - 1 – **Industry Sales/Product Class Sales model:** total number of units of a product category purchased by the population of all spending units.
  - 2 – **Brand Sales model:** total number of units of a particular brand bought by the population of all spending units
  - 3 – **Market Share model:** number of units of a particular brand purchased, relative to the total number of units purchased of the product class.
- These models can be defined at segment level and individual level as well, leading to models with different **aggregation levels:** market, store, segment, household and so on. *For example:*
  - Category sales for a household, brand sales for a household, *share of wallet (*the proportion of a category sales accounted for by the brand, for the household.
- In model specifications it is common to use ***unit sales*** as representation for demand variables.

1.4 Benefits from Using Marketing Decision Models

1.4.1 Direct Benefits

1. Suppose a model indicates that a firm is overspending on advertising, i.e. the marginal cost from advertising exceeds the marginal revenue. Adjusting the spending level will result in higher profitability.
2. A promotion budget can be allocated over different instruments such as displays, featuring (support of retailers' advertising by manufacturers), bonuses, refunds, samples, etc. A model can help in this allocation process by showing how the different instruments contribute to the profit resulting from any possible allocation.
3. Marketing managers are often faced with the question whether they should increase their advertising budget *or* whether they should decrease their prices. A marketing decision model may incorporate the empirical generalization that the optimal price depends on the advertising expenditures.[8]
4. In sealed competitive bidding, suppliers submit a price and the lowest bidder wins. Systematizing information on past bidding behavior into a model may result in a pricing strategy that will lead to an increase in expected profit.

1.4.2 Indirect Benefits

- Explication alone will often lead to an improved understanding of the role of advertising and how advertising effectiveness might depend on a variety of other marketing and environmental conditions.
- Models may work as problem-finding instruments. Managers may identify problems by discovering differences between their perception of the environment and a model of that environment.
- Models can be instrumental in improving the process by which decision makers deal with existing information.
- Models can help managers decide what information should be collected. Thus, models may lead to improved data collection, and their use may avoid the collection and storage of large amounts of data without apparent purpose. This issue is becoming more and more relevant in the 'Big Data' era.
- Models can also guide research by identifying areas in which information is lacking, and by pointing out the kinds of experiments that can provide useful information.
- A model often allows management to pinpoint changes in the environment faster than is possible otherwise. This points to a very useful aspect of models namely, their diagnostic capacity.
- Models provide a framework for discussion. If a relevant performance measure (such as market share) is decreasing, the model user may be able to defend himself to point to the effects of changes in the environment that are beyond his control, such as new product introductions by the competition.
- A model may result in a beneficial reallocation of management time, which means less time spent on programmable, structured, or routine and recurring activities, and more time on less structured ones.

1.5 The Model Building Process

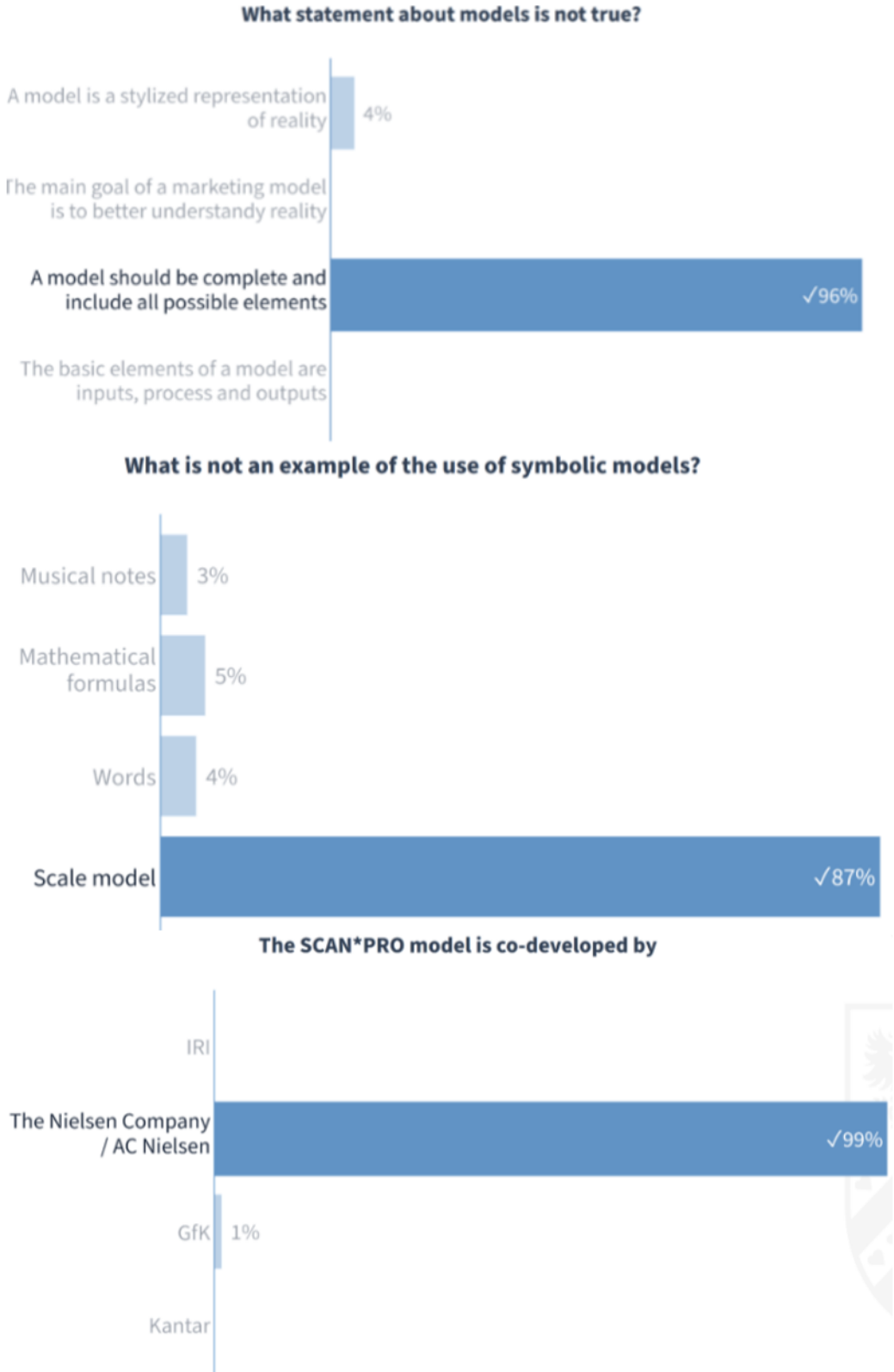
The model building process proposed has model implementation as a central role, we distinguish the following steps:

- (1) **Opportunity Identification**: evaluate whether the development/use of a model can improve managerial decision making.
    - Model builder and manager work together to *define the problem*, to *agree on an approach* and to *determine that the expected benefits exceed the costs of model building*.

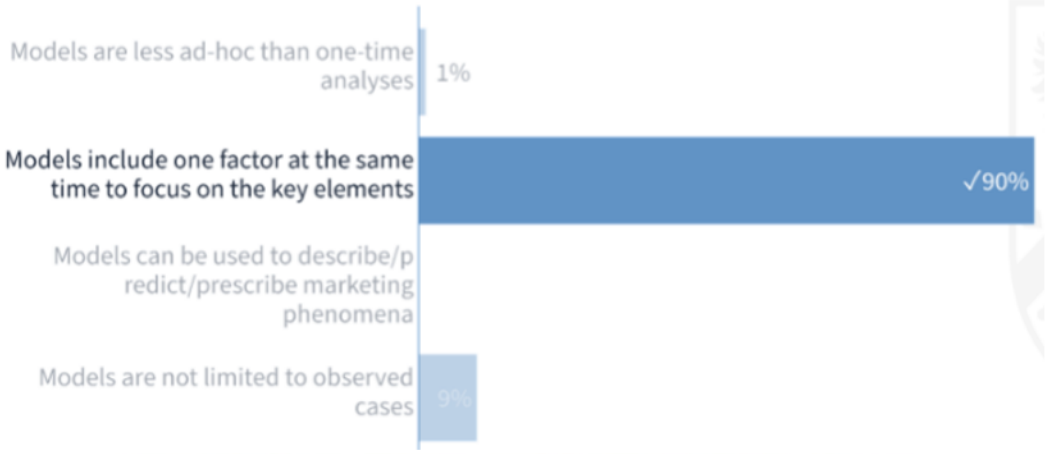
- (2) **Model Purpose**: intended use of the model should be defined as precisely as possible.
  - Model builder needs to *know the level of demand* for which forecasts are required.
  - Model builder also needs to *learn what the manager believes to be the relevant determinants of demand* so that model-based forecasts can be developed.
- (3) **Model Scope:** Model building can take place for a specific type of decision or for a broader set of decisions.
- (4) **Data Availability:** One reason a manager may ask for a model-building effort is the increasing availability of large amounts of data.
- (5) **Specification** (or **Representation** or **Structure**): the expression of the most important elements of a real-world system in mathematical terms.
  - 1 – Specifying the **variables to be included** in the model, making a distinction between:
    - **Dependent/Criterion** variables
    - **Explanatory/Independent/Predictor** variables
  - 2 – Specifying the **functional relationship between the variables**.
    - Effects of IVs can be: *linear, non-linear, immediate* and/or *lagged, additive* or *multiplicative,* etc.
- (6) **Estimation**: the determination of parameter estimates for a model.
  - We need to choose a technique, depending on:
    - the kind of data available and/or needed;
    - the kind of variables (observable/unobservable) in the model;
    - the assumptions (of a statistical nature) that are necessary and/or acceptable;
    - the computational effort and expense considered to be reasonable.
  - Based on data availability, we consider: *data-based parameterization* (parameter estimation from historical data) and *subjective estimation* (judgment-based parameter estimation).
- (7) **Validation** (or **Verification** or **Evaluation**) of a model and its parameters implies assessing the quality or the success of the model.
  - Possible *criteria* are:
    (a) the degree to which the results are in accordance with theoretical expectations or well-known empirical facts;
    (b) the degree to which the results satisfy statistical criteria or tests;
    (c) the degree to which the result is relevant to the original purpose:
      - is the model useful for clarifying and describing market phenomena?
      - does the model provide an acceptable degree of predictive accuracy?
      - are the model results suitable for the determination of optimal marketing-policies?

- (8) **Cost-Benefit Considerations:** At this point both benefits and cost should be known with a fair amount of precision. Before the model is implemented and incorporated in a manager's decision- making process, it is appropriate to re-examine the cost–benefit trade-off.
- (9) **Use:** Use of the model requires that the manager fully understands both its strengths and its weaknesses.
- (10) **Updating**: Even without this, the continued comparison of actual outcomes with those predicted by the model may suggest that the model needs to be expanded (e.g. an additional variable or greater complexity in effects) or that the parameters need to be updated.
    - Refers to updating of both the model specification and the estimation.
    - Requires that differences (errors) be analyzed so that one can distinguish between errors due to e.g. model specification, measurement error, aggregation, and changes in the environment.

Quiz 1: Questions + Answers



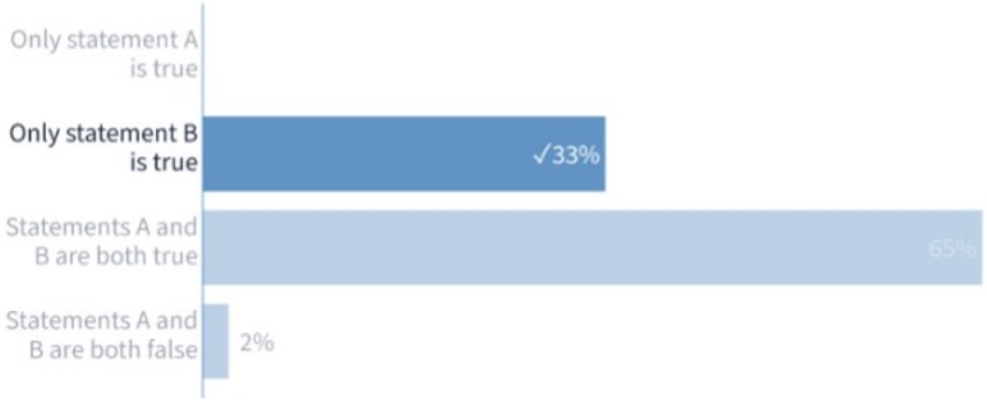
Which of the statements below was not included in the list of reasons to work with models?



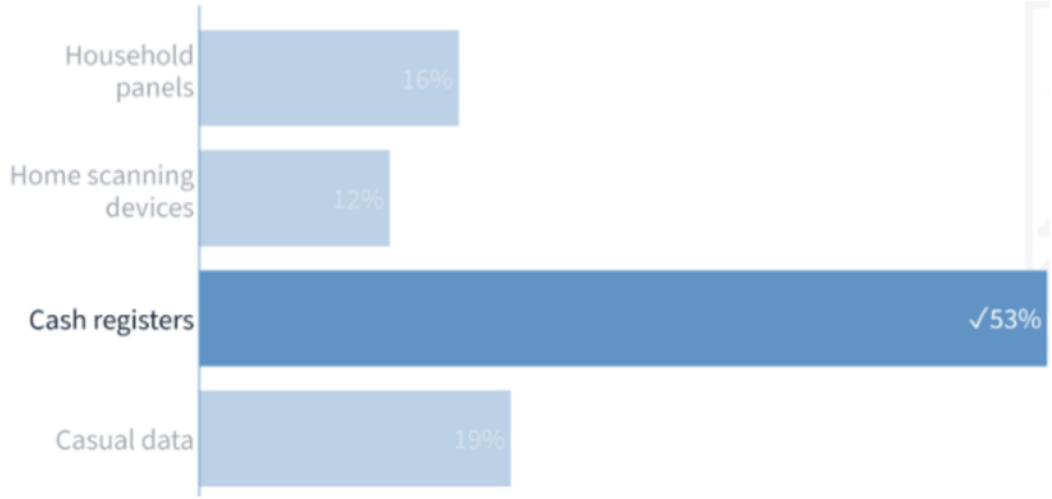
Consider the following statements about the steps in model building:

A. In the specification step the data provides the basis for specifying the model

B. In the validation step the assumptions that underlie the estimations are checked



What is the starting point of the data delivery process of the Nielsen Company?



Which of the divisions in the Nielsen Company allow for a granular analysis of store level data

Cluster analyses are typically conducted within the focus area:

Consider the following statements about assortment optimalization:

A. About 20% of the SKUs are generally in the long tail

B. Items with higher incrementality are more valuable to the category

Benefits of assortment optimization include:

A. Top-line growth due to having the right SKUs

B. Meeting all customer needs by providing a complete assortment