

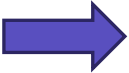
# CONSEQUENTIAL MODELLING

## - IN LIFE CYCLE INVENTORY ANALYSIS

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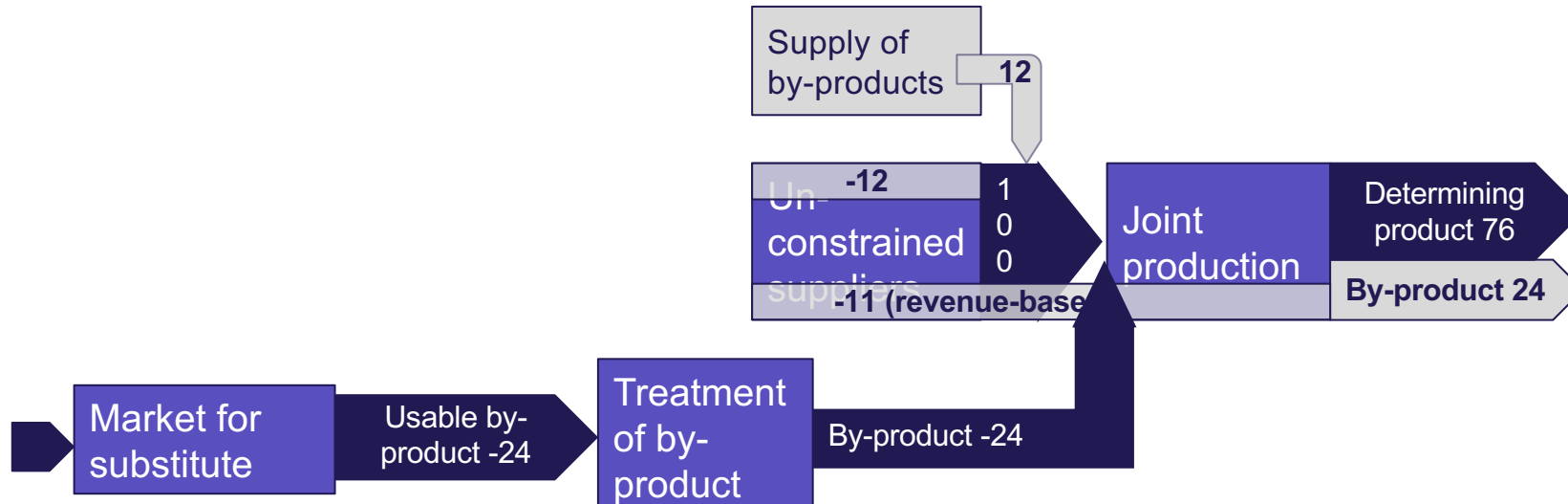
# Overview of videos

- 1) Attributional and consequential responsibility
- 2) ISO 14040/44: A standard for consequential LCA
-  3) How to fully reflect both physical and monetary causalities in LCA
- 4) Temporal issues in LCA
- 5) Learning from non-intuitive results
- 6) *The comparability algorithm*: Defining the functional unit
- 7) *The linking algorithm*: Composing a consumption mix
- 8) Identifying determining products
- 9) *The co-product algorithm*
- 10) Errors in background databases

# How to fully reflect both physical and economic causalities in LCA - Basics

Issues included in consequential models, not in attributional:

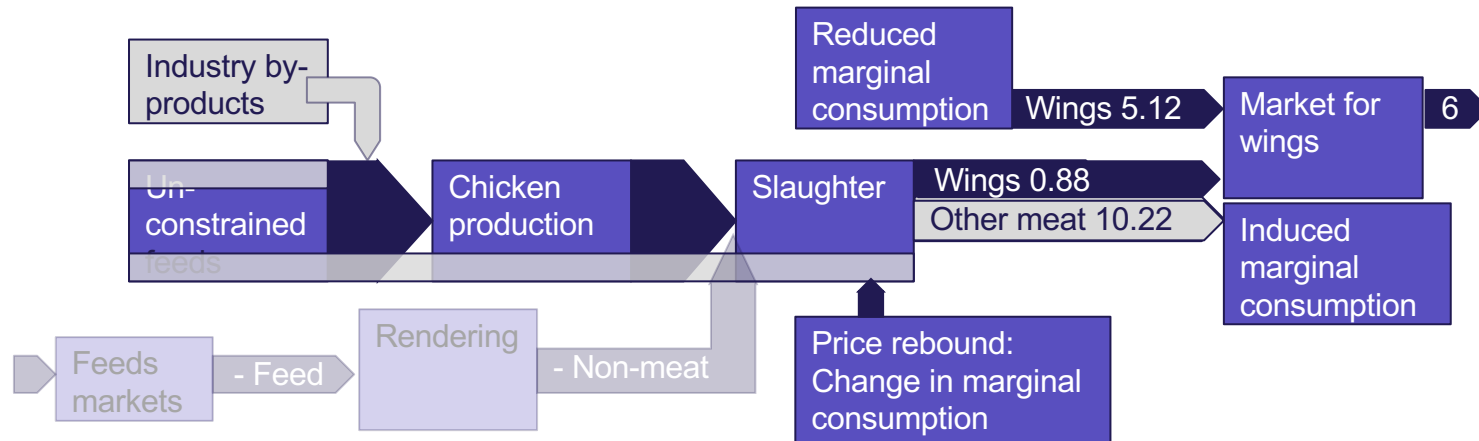
- 1) The full upstream production that is able to change its output, not an average that includes supplies that are constrained
- 2) The full induced upstream production, not only an allocated part
- 3) The reduction in upstream production displaced by by-products



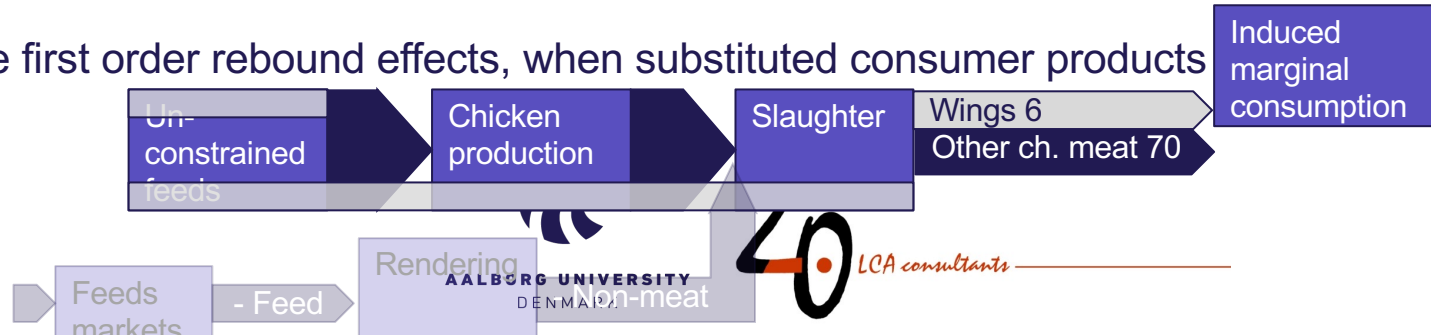
# How to fully reflect both physical and economic causalities in LCA - **Advanced**

Issues included in consequential models, not in attributional:

- 4) The induced changes in consumption when markets are constrained

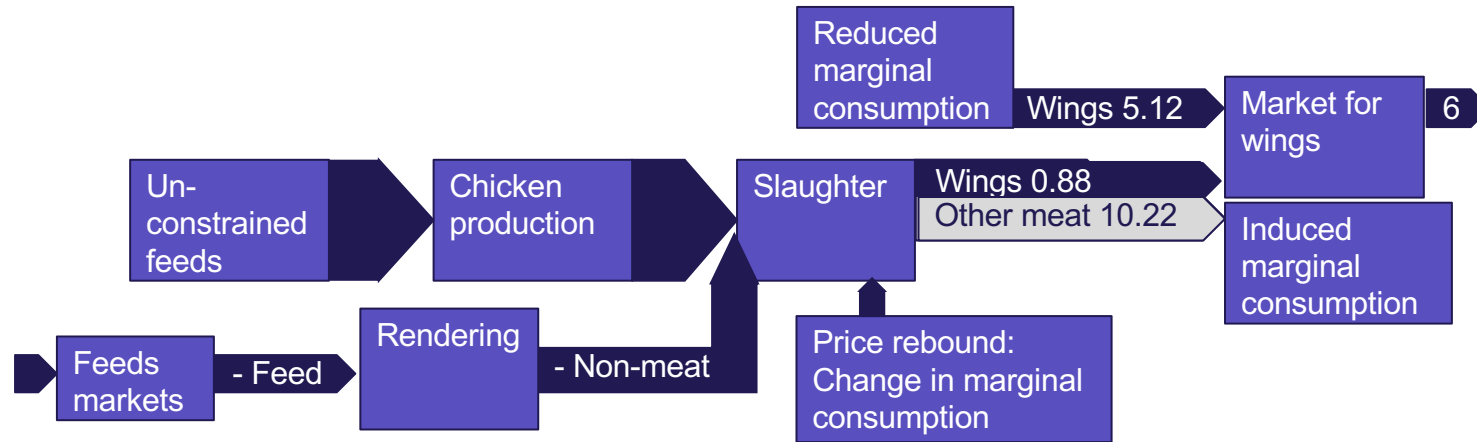


- 5) The first order rebound effects, when substituted consumer products



# How to fully reflect both physical and economic causalities in LCA

Issues included in consequential models:



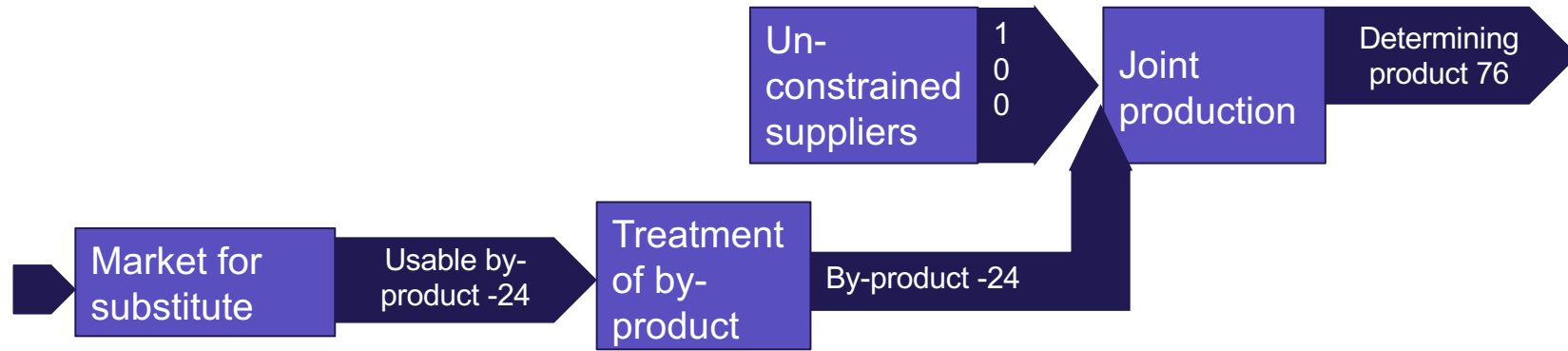
- 6) Since no partitioning and no cut-offs are made, the consequential models maintain all mass, energy and monetary balances in every dataset and every product life cycle

# Uncertainty of parameters used to model economic causalities

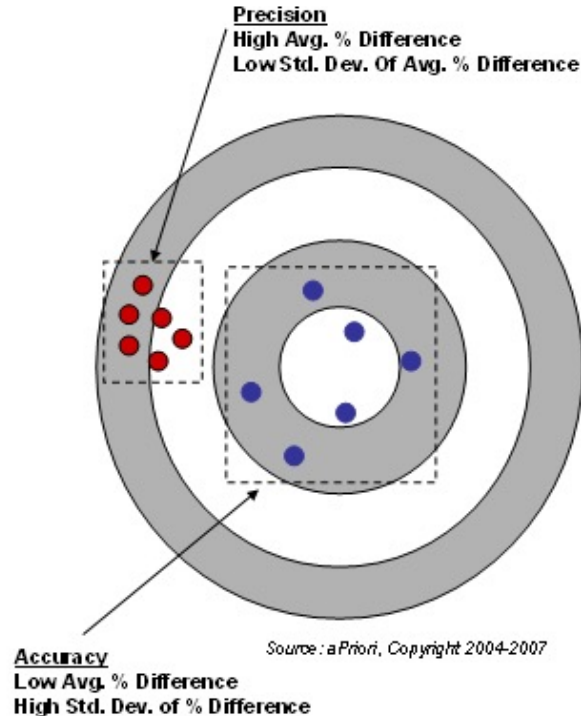
- Some parameters are related to specific data points (production volumes, market trends) → can be treated as for any other datapoints (including the variation and the additional uncertainty from data quality)
- Some uncertainty is related to fixed model parameters:
  - market delimitations (global, continental, country boundaries?)
  - capital replacement rate (lifetime of technologies)
  - technology levels (is a technology constrained or not)
  - market constraints or elasticities

which can only be assessed by sensitivity analyses with manual modifications for each model run (although parameterisation may be used to facilitate this).

Same kind of uncertainty when linking  
positive and negative inputs to their markets



# Reflecting the full uncertainty of the choice to be made



Accuracy and Precision

- Main source of uncertainty in consequential models is the actual variability and lack of precision in the underlying data
- Attributional models are often presented as having very low uncertainty, because only the precision is measured, while the accuracy is implicit or ignored
- When accuracy matters → clear advantage of consequential models



# The system boundary of consequential LCA

- No cut-offs of any part of the life cycle:
  - No consequences of co-production are allocated away
  - Price rebound effects are included when comparing products with different prices
  - Geographically, the system is global
  - No general cut-off criteria applied (e.g., for ILUC, capital goods, or a % of inputs)
  - Temporally, the system traces consequences forward in time

THANKS FOR YOUR ATTENTION