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Demand Estimation and Merger Simulation with Differentiated Products: Applications to Merger Control

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Demand estimation and merger simulation with differentiated products

Applications to merger control - FMCG

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OUTLINE

- Merger control – Unilateral effects: demand estimation and merger simulation techniques
- Brief description of discrete choice models
  - Nested logit model
  - Advantages and limitations of NL models
- Brief description of AIDS (multistage budgeting)
  - Advantages and limitations of AIDS
- Application – DEMB/Mondelez Transaction

Merger control: assessing unilateral effects

MERGER CONTROL UNILATERAL EFFECTS

Notification

Phase I – Phase II investigations

Investigations focused on the potential anti-competitive effects of the merger:

- Unilateral effects ➔ incentives to increase prices post-merger
  - Depends greatly on the nature of competition, closeness of substitution between the merging parties relative to others, and margins earned by the parties
  - Tools: market shares, concentration measures, qualitative analysis of closeness of substitution, analysis of margins, demand estimation and merger simulation.
  - Key ➔ Assessing the degree of closeness of substitution + quantify incentives to increase prices post-merger
- Coordinated effects ➔ incentives to collude in the post-merger scenario
  - Depends greatly on structural and institutional characteristics of the market (number of competitors, price transparency, barriers to entry, mechanisms of exchange of information, etc)
  - Tools: mostly qualitative analysis. But there are merger simulation techniques which can be used (Davis and Huse 2010)

ASSESSING THE DEGREE OF CLOSENESS OF COMPETITION

Differentiated products:

- Competition takes place on size, format, taste, packaging and promotional activity as well as price.

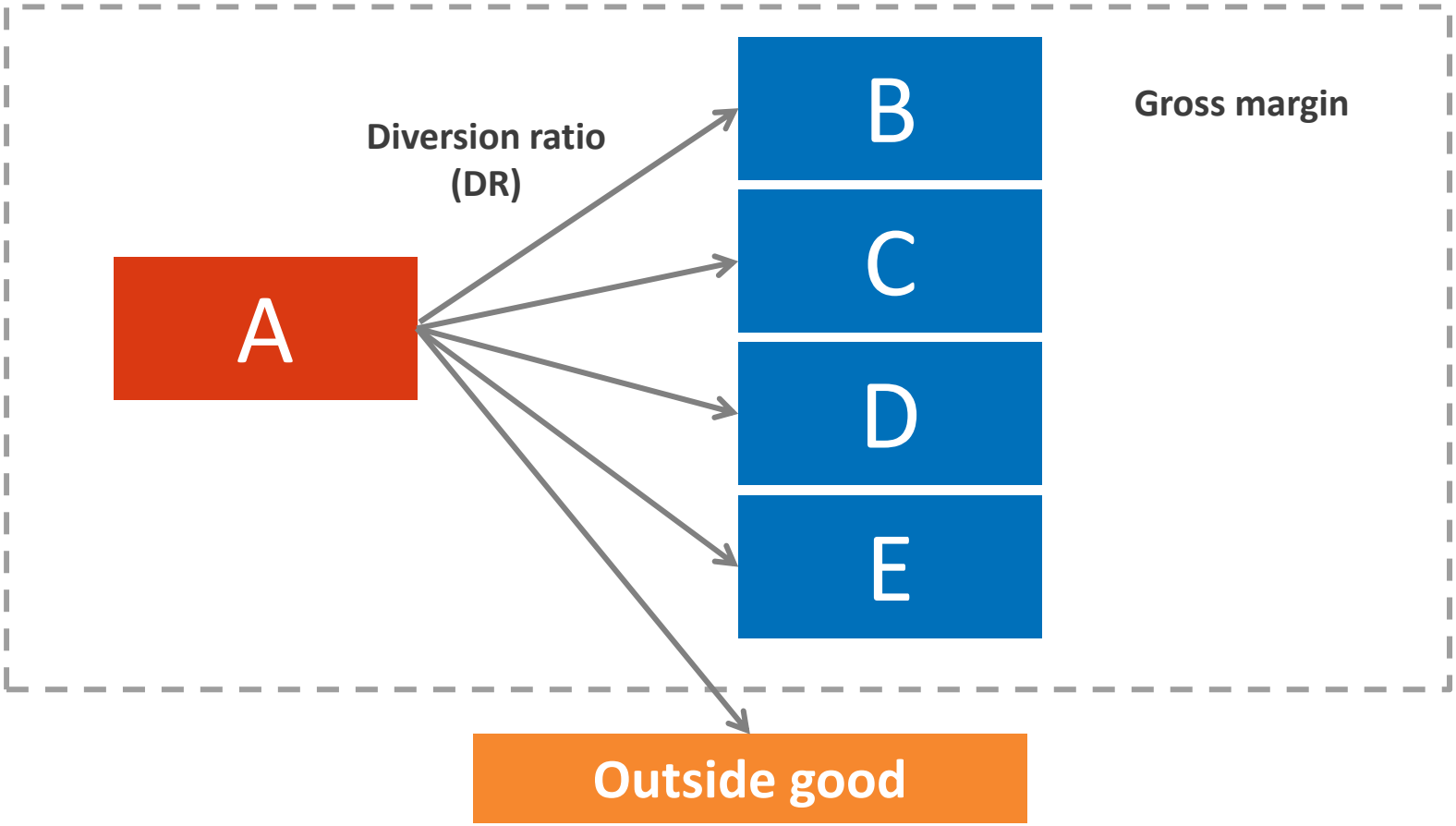
Market shares:

- Can be misleading when products are differentiated
  - May overstate degree of competition if products are not close substitutes.
  - May understate degree of competition if products are close substitutes.
- UPP and other methods [non-equilibrium, changes in reaction curves, based on shares]

Unilateral effects:

- Closeness of competition between products (merging and non-merging parties).
- Margins

NON-COORDINATED EFFECTS IN DIFFERENTIATED PRODUCTS MARKETS



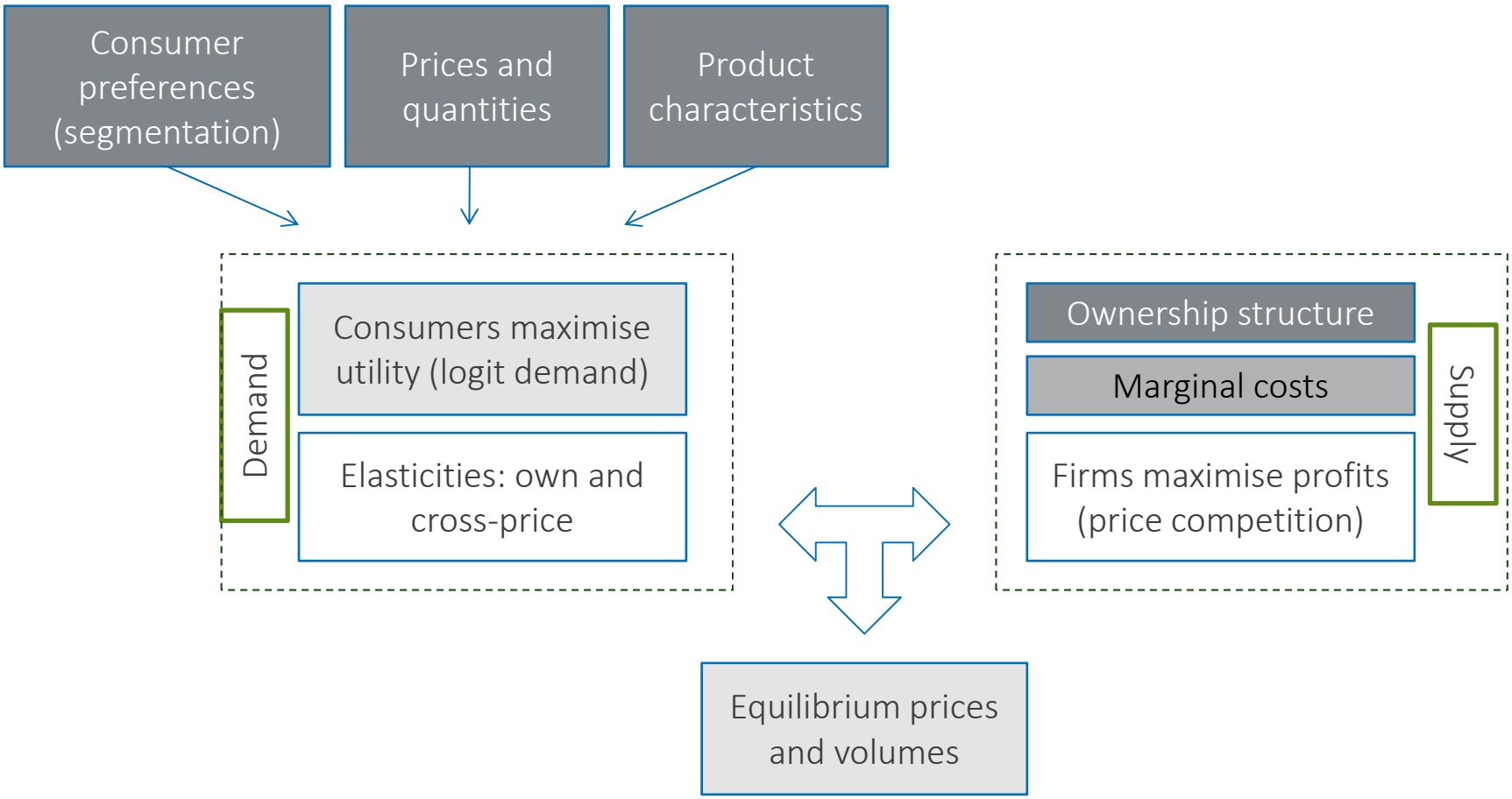
UPP on A increases as: (i) DR from A to B increases; and (ii) gross margin of B increases

KEY EMPIRICAL QUESTIONS

- What are the DRs?
  - Characterisation of demand - preferences
- What are the gross margins?
- How do firms behave?
  - Competitive interaction

Key information that needs to be combined to assess quantitatively the likely competitive effects of the merger

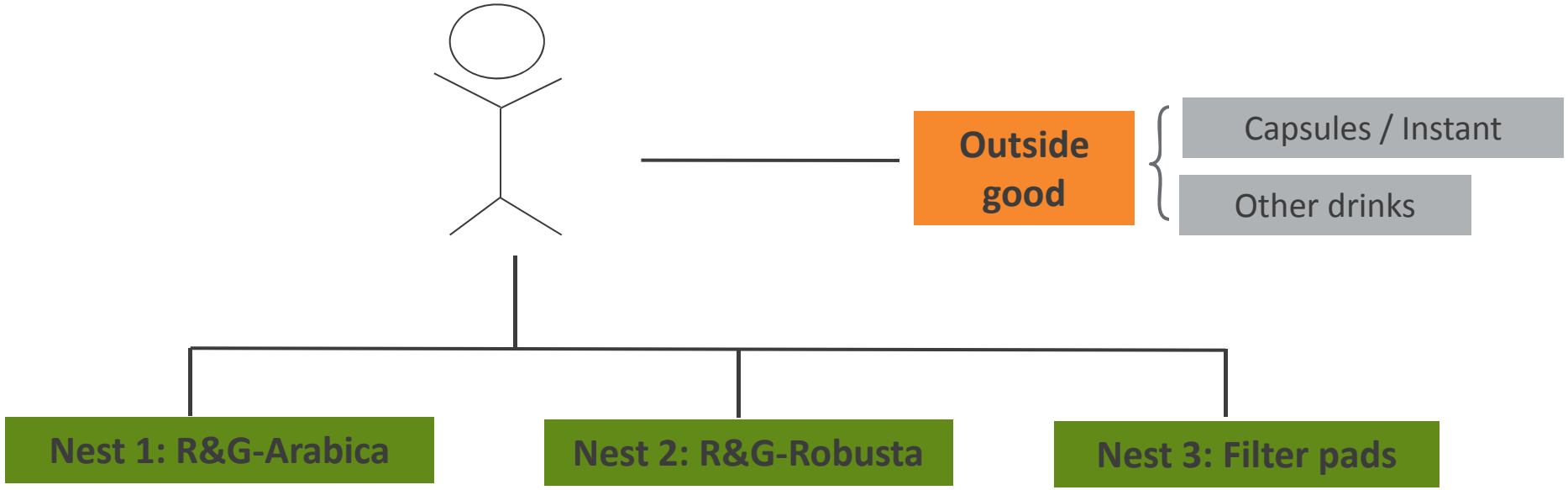
CONCEPTUAL FRAMEWORK



DEMAND MODELS

Nested logit

Almost Ideal Demand System (AIDS)



NESTED LOGIT: ADVANTAGES AND LIMITATIONS

Advantages

- Computationally attractive.
- Data needs. SKU level data. Typically, cross section variability suffices.
- Relatively easy way of modelling substitution patterns between different segments.
- Model can be calibrated easily as only two parameters define demand (together with volume sales and prices). Estimation requires IV, but not typically difficult to find appropriate instruments (á la Berry).

Limitations

- Structure ➔ Rigidity: it imposes restrictions on patterns of substitution among the differentiated products.
- Independence of Irrelevant Alternatives (IIA) ➔ IIA property implies that if the price of one good increases, consumers switch to other goods in proportion to the latter's market shares (within the nest).
- Cross-price elasticities are proportional to shares ➔ Closeness of substitution within a nest depends on the relative size of the shares of the brands.
- σ is the same for all nests ➔ Arabica-Robusta, Arabica-Filter pads. This may be unrealistic.
- Lack of complementarity.
- Elasticities are proportional to prices: all else equal, more expensive products tend to have higher elasticities. Not particularly helpful to capture potential vertical differentiation (premium vs. standard).
- Segmentation (nesting) is key

AIDS: ADVANTAGES AND LIMITATIONS

Advantages

- More flexibility as compared to NL: substitution patterns less restricted.
- Cross-price elasticities within a segment do not depend on market shares ➔ Better assessment of closeness of substitution.
- Flexible on cross-nest elasticities.
  - Example: there may be more substitution between Arabica and Pads (premium) than between Robusta and Pads.
- “alpha and sigma” vary across nests and allows for complementarity.
- Aggregate elasticity (at the segment level) can be estimated.

Limitations

- Computationally more difficult.
- More data is needed. Time series variability is key.
- Aggregation across SKUs – brand level estimates (aggregation considerations)
- Identification ➔ Endogeneity
  - With weekly data endogeneity issue is alleviated (Hausman)
  - IV using scanner data by city or region
- Stockpiling – Difficult to assess directly given timing and/or data limitations
- As in the NL model, segmentation is key.

Nested logit models

DEMAND: NESTED LOGIT

$$u_{ij} = \delta_j + \zeta_{iG_j} + (1-\sigma)\varepsilon_{ij}$$

$$\delta_j = x_j\beta - \alpha p_j + \zeta_j$$

- Mean valuation for product j
- Characteristics of product j
- Price of product j
- Consumer's utility common to all products belonging to product's nest
- Correlation of the consumers' utility across products belonging to the same group

$$\ln s_j - \ln s_0 = x_j\beta - \alpha p_j + \sigma \ln s_{jG_j} + \zeta_j$$

Demand is a function of …

α, σ, xβ, nest structure, market size

DEMAND: NESTED LOGIT MODEL

- We expect the value of α to be positive as this means that consumers respond to a price increase by reducing demand.
  - Everything else held constant, a high value of α implies that all elasticities are large in absolute terms.
- The value of σ should be between zero and one. It measures the correlation of the consumers' utility across products belonging to the same nest (segment).
  - If $\sigma=1$ (there is a perfect correlation of preferences), products of the same group are perceived as perfect substitutes.
  - If $\sigma=0$ (there is no correlation of preferences) → Consumers are equally likely to choose a product in the same nest or in a different nest when considering how to respond to a price increase ➔ nesting is irrelevant ➔Logit model.
- The vector of parameters β captures the impact on consumers' choice of each of the product characteristics included in the analysis

DEMAND: ELASTICITIES

- The main parameters of interest are α and σ, which are the main determinants of the own and (intra-nest and inter-nest) cross price elasticities for each product in the sample.
- Own-price elasticities:

$$\varepsilon_{jj} = -\frac{\partial q_j}{\partial p_j}\frac{p_j}{q_j} = \alpha \cdot p_j \left[\frac{1}{1-\sigma} - \frac{\sigma}{1-\sigma}\frac{q_j}{Q_{G_j}} - \frac{q_j}{N}\right]$$

- Intra-nest cross-price elasticities:

$$\varepsilon_{\substack{jk \\ k\in G_j \\ k\neq j}} = \frac{\partial q_j}{\partial p_k}\frac{p_k}{q_j} = \alpha \cdot p_k \left[\frac{\sigma}{1-\sigma}\frac{q_k}{Q_{G_k}} + \frac{q_k}{N}\right]$$

- Inter-nest cross-price elasticities:

$$\varepsilon_{\substack{jk' \\ k'\notin G_j}} = \frac{\partial q_j}{\partial p_{k'}}\frac{p_{k'}}{q_j} = \alpha \cdot p_{k'}\frac{q_{k'}}{N}$$

NESTED LOGIT ESTIMATION

- Estimation based on AC Nielsen data on annual (or monthly) volume and value sales at the SKU level and on AC Nielsen classification of SKUs (e.g. Arabica, Robusta, Pads).

$$\ln s_{jt} - \ln s_{ot} = x_{jt}\beta - \alpha p_{jt} + \sigma \ln s_{jtG_{tj}} + \upsilon_{jt}$$

  - s_{jt} is the market share of each individual SKU j defined over the "entire market" in period t;
  - s_{ot} is the market share of the outside good in period t, and is assumed, for simplicity, to be constant throughout the period of analysis;
  - X_{jt} is the vector of characteristics for each SKU j in period t (size of the package in grams; chocolate type (dark, white or milk chocolate), additional ingredients (liqueur, cookies, caramel, fruit, nuts, honey);
  - p_{jt} is the real price per kg of SKU j in period t measured in £ per kg;
  - s_{jtGjt} is the share of SKU j within the nest Gj to which it belongs in period t; and
  - υ_{jt} stands for the standard estimation error.

- The main parameters of interest are α and σ, which are the main determinants of the own and (intra-nest and inter-nest) cross price elasticities for each product in the sample.
- Endogeneity – need to use Instrumental Variables techniques.

Merger simulation with NL demand

DEMAND: ELASTICITIES

- The main parameters of interest are α and σ, which are the main determinants of the own and (intra-nest and inter-nest) cross price elasticities for each product in the sample.
- Own-price elasticities:

$$\varepsilon_{jj} = -\frac{\partial q_j}{\partial p_j}\frac{p_j}{q_j} = \alpha \cdot p_j \left[\frac{1}{1-\sigma} - \frac{\sigma}{1-\sigma}\frac{q_j}{Q_{G_j}} - \frac{q_j}{N}\right]$$

- Intra-nest cross-price elasticities:

$$\varepsilon_{\substack{jk \\ k\in G_j \\ k\neq j}} = \frac{\partial q_j}{\partial p_k}\frac{p_k}{q_j} = \alpha \cdot p_k \left[\frac{\sigma}{1-\sigma}\frac{q_k}{Q_{G_k}} + \frac{q_k}{N}\right]$$

- Inter-nest cross-price elasticities:

$$\varepsilon_{\substack{jk' \\ k'\notin G_j}} = \frac{\partial q_j}{\partial p_{k'}}\frac{p_{k'}}{q_j} = \alpha \cdot p_{k'}\frac{q_{k'}}{N}$$

SUPPLY: BERTRAND MODEL

The profit-maximizing firm f solves, for each product j, the following first-order condition:

$$q_j + \frac{\partial q_j}{\partial p_j}(p_j - c_j) + \sum_{\substack{k \in G_j \\ k \neq j \\ k \in S_f}} \frac{\partial q_k}{\partial p_j}(p_k - c_k) + \sum_{\substack{k' \notin G_j \\ k' \in S_f}} \frac{\partial q_{k'}}{\partial p_j}(p_{k'} - c_{k'}) = 0$$

Using demand, FOC can be restated as:

$$(p_j - c_j) = \frac{1}{\alpha}\left[\frac{1}{1-\sigma} - r_{G_j} Q^f_{G_j} - r_0 \Lambda_j \sum_{\substack{k' \notin G_j \\ k' \in S_f}} \frac{q_{k'}}{\Lambda_{k'}}\right]^{-1}$$

Price is a function of …

α, σ, quantity, nest structure, market size, ownership structure, marginal costs

Notes: taxes must be taken into account but they are not included here

EQUILIBRIUM

In equilibrium, both demand and supply are satisfied

Demand

$$\ln s_j - \ln s_0 = x_j\beta - \alpha p_j + \sigma \ln s_{jG_j} + \zeta_j$$

Supply

$$(p_j - c_j) = \frac{1}{\alpha}\left[\frac{1}{1-\sigma} - r_{G_j} Q^f_{G_j} - r_0 \Lambda_j \sum_{\substack{k' \notin G_j \\ k' \in S_f}} \frac{q_{k'}}{\Lambda_{k'}}\right]^{-1}$$

Therefore, the equilibrium is a function of the following variables:

α, σ, xβ, quantities, prices, nest structure, market size, ownership structure, marginal costs

MODEL CALIBRATION: ESTIMATED ELASTICITIES APPROACH A

Variables	Full Fledged
Prices	Market data
Quantities	Market data
α	**Estimated**
σ	**Estimated**
Nest structure	Assumption / market data
Ownership structure	Market data
Marginal costs	Calibrated and market data
Market size	Assumption (aggregate elasticity)

- These two parameters define elasticities

- Calibrated parameters must be consistent with market data.
- In particular, calibrated marginal costs must be consistent with market data on marginal costs.

- We get the predicted price increase for a particular combination of a and s (estimated a and s).

MODEL CALIBRATION: CALIBRATED ELASTICITIES APPROACH B

Merger simulation as a screening device

- Reduce the need to estimate elasticities
- Instead works out all possible combinations of α and σ, which are consistent with supply side of the model.
- There is a limit to the number of combinations because:
  - Elasticities are related to marginal costs
  - Marginal costs have to be positive, lower than prices and broadly consistent with financial information
- Once we have a set of feasible combinations of α and σ, we run the simulation model for each set of these combinations:
  - This gives us a predicted price increase for each set of feasible combinations of α and σ
  - Thus provides the *range* of possible price increases resulting from the merger.

MODEL CALIBRATION: CALIBRATED ELASTICITIES APPROACH B

Variables	Screening device
Prices	Market data
Quantities	Market data
α	Range
σ	Range (0-1)
Nest structure	Assumption / market data
Ownership structure	Market data
Marginal costs	Calibrated and market data
Market size	Assumption (aggregate elasticity)

- For each possible combination of α and σ, we calibrate the model and obtain a vector of calibrated marginal costs.
- Select those combinations of α and σ that are consistent with actual calibrated marginal costs

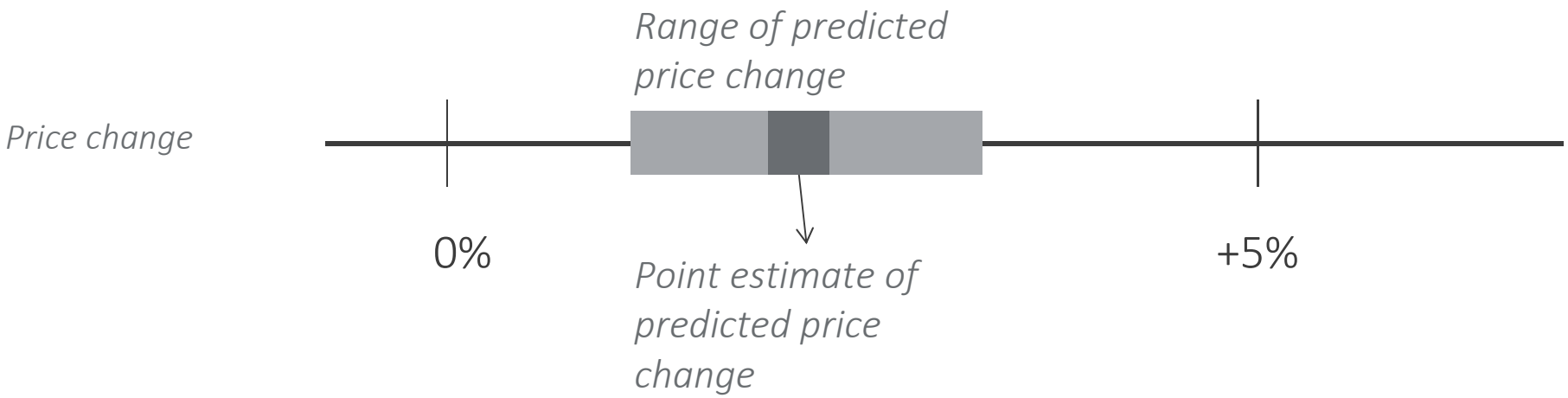
- We get the predicted price increase for each selected combination of a and s.
- Any estimated a and s (approach A) should lie in the range of selected alphas and sigmas.

SCREENING DEVICE

1. For each possible combination of a and s , we calibrate the model and obtain a vector of calibrated marginal costs.
2. We select those combinations of a and s that are consistent with actual estimates of marginal costs (i.e. weighted average marginal costs).
3. Selected combinations should also be consistent with public information on price elasticities (if available).
4. For each selected combination of a and s , we can compute the matrix of elasticities (plausible calibrated elasticities).
5. For each selected combination of a and s, we simulate the effect of the merger (i.e. a change in the ownership structure and potential efficiencies).
6. With this method we get the upper bound of the precise increase. No need for a precise estimation of elasticities (a and s).
7. We can simulate alternative product classifications into nests, and alternative nests structures.

[The set of plausible calibrated elasticities can be used to compute a set of plausible Diversion Ratios in order to illustrate results as regards calibrated preferences and patterns of substitution]

TWO COMPLEMENTARY APPROACHES



- In these situations, the precise estimation of demand and of predicted price change is arguably less relevant.
- Use as a screening device – far superior than UPP type of analysis based on loose DRs measures.

Demand – AIDS

AIDS (ALMOST IDEAL DEMAND SYSTEM)

- Originally proposed by Deaton & Muellbauer, AER, (1980). It gives an arbitrary first-order approximation to any demand system
- Derived from expenditure function. The solution to the constrained expenditure minimization function gives the Marshallian demand functions.
- Deaton & Muellbauer express Marshallian demand functions in terms of budget shares.
  - Select a functional form for the expenditure function such that the demand functions are flexible and satisfies utility maximization.
- Focus on the linear version. LA-AIDS allows for a second order flexible demand system, i.e., the price elasticities are unconstrained at the point of approximation.
- LA-AIDS can be interpreted as a Marshallian demand system where the revenue or expenditure share is a function of total expenditure and prices.
- System is flexible – relatively few restrictions on preferences.
- Symmetry and adding up restrictions from consumer theory can be imposed (and tested) to decrease the number of unknown parameters.

AIDS (ALMOST IDEAL DEMAND SYSTEM)

- The revenue share of product i is specified as follows:

$$s_{it} = \alpha_i + \sum_{j=1}^{J} \gamma_{ij} \log p_{jt} + \beta_i \log(M / P^*_t) + \varepsilon_{it} \qquad i = 1,...,J \qquad t = 1,...,T$$

- P_t^* is the Stone Price Index:

$$\log P_t^* = \sum_{k}^{J} s_{kt} \log p_{kt}$$

- p_{jt} is the price of the jth brand in period t

- Revenue shares add up to one: $\sum_{i=1}^{J} s_{int} = 1$

- The parameters of the model must satisfy:

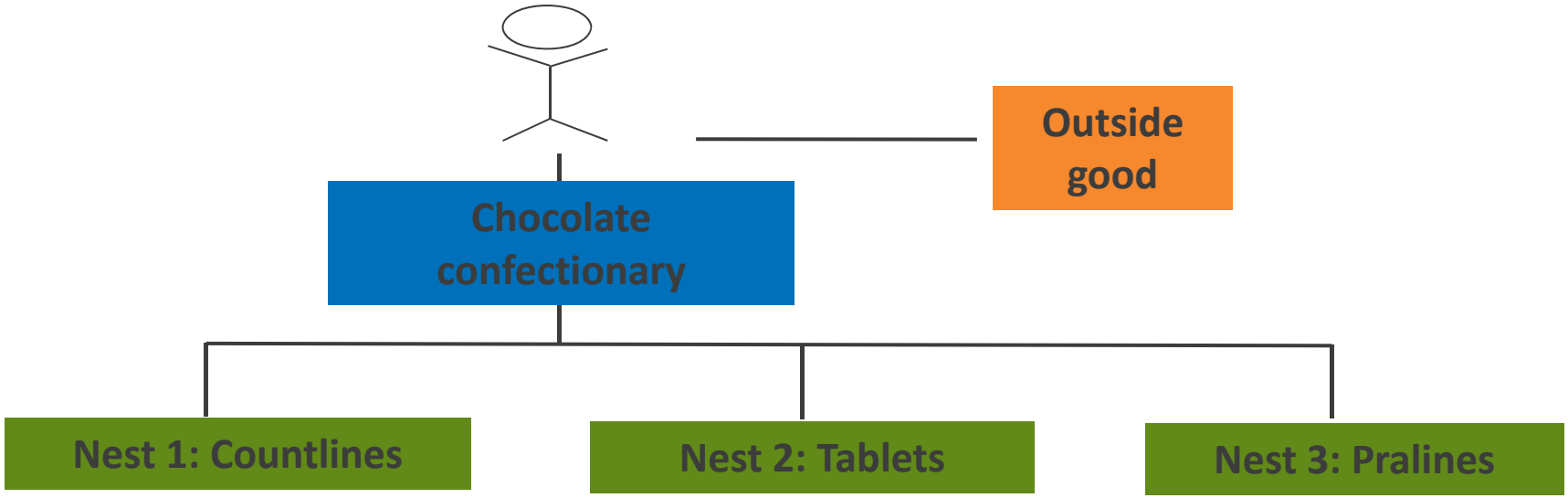
$$\sum_{i=1}^{J} \alpha_{in} = 1 \qquad \sum_{i=1}^{J} \beta_i = 0 \qquad \sum_{i=1}^{J} \gamma_{ij} = 0 \quad \text{for all j}$$

- Homogeneity of degree zero in prices and spending (no money illusion) , and Slutsky symmetry

$$\gamma_{ij} = \gamma_{ji} \qquad \sum_{j=1}^{J} \gamma_{ij} = 0 \quad \text{for all i}$$

EMPIRICAL APPROACH: MULTI-STAGE BUDGETING

- Many parameters to be estimated: Tablets, Countlines, and Pralines
- Impose some structure ➔ Multi-stage budgeting approach
- Top level corresponds to overall demand (chocolate)
- Middle level corresponds to different segments for the product: Tablets, Pralines, Countlines
  - As with NL, segmentation is an issue
- Bottom level: competition among brands in a given segment ➔ AIDS



EMPIRICAL APPROACH: MULTI-STAGE BUDGETING

Two-stage demand system following Gorman's (1971) multistage budgeting approach.

- The top level corresponds to the "aggregate" demand for different segments of the group of products under analysis (e.g. tablets and countlines). Measure of substitution between segments (i.e. Tablets vs. Countlines / Tablets vs. Pralines), and measuring the conditional "aggregate" own-price elasticity at the segment level.
- The bottom level of the demand system corresponds to competition among brands in a given segment

We estimate the model in reverse order beginning at the lowest level and then use the theory of price indices to allow for consistent estimation at the top level of demand.

- The econometric specification at the lowest level is the "almost ideal demand system" (AIDS) of Deaton and Muellbauer (1980), which expresses Marshallian demand functions in terms of budget shares. The AIDS model is based on a flexible functional form demand system and is a first order approximation to any demand system.
- To specify the top level demand system we use the log-log demand system where quantities are a function of total expenditures and prices.

We estimate these two levels of the demand system and we obtain:

- direct estimates of own and cross-price elasticities for each segment; and
- overall own and cross prices elasticities for each brand, by combining the estimates from each level.

EMPIRICAL APPROACH: BOTTOM LEVEL

At the bottom level, we estimate a linear version of the AIDS, which allows for a second order flexible demand system, i.e. the price elasticities are unconstrained at the point of approximation, and for a convenient specification for non-homothetic behaviour.

The linear AIDS can be interpreted as a Marshallian demand system for each segment where the revenue share is a function of total expenditure and prices. Then, for each brand within a segment we estimate:

$$s_{it} = \alpha_i + \beta_i \log\left(X_t / P_t^*\right) + \sum_{j=1}^{J} \gamma_{ij} \log(p_{it}) + \varepsilon_{it} \qquad [1]$$

- S_{it} is the revenue share over total segment expenditure of brand i in period t,
- X_t is the overall segment expenditure,
- P_t^* is the Stone Price Index ($\log P_t^* = \sum_k s_{kt} \log p_{kt}$) and
- p_{jt} is the price of brand j in period t.
- γ_{ij} are free pattern of cross price elasticities.

The fact that $\sum_{i=1}^{J} s_{int} = 1$, called the adding-up condition, requires the parameters fulfil the following conditions: $\sum_{i=1}^{J} \alpha_{in} = 1$, $\sum_{i=1}^{J} \beta_i = 0$ and $\sum_{i=1}^{J} \gamma_{ij} = 0$ for all j

Homogeneity of degree zero in prices and spending and Slutsky symmetry are guaranteed by the restrictions, $\gamma_{ij} = \gamma_{ji}$ and $\sum_{j=1}^{J} \gamma_{ij} = 0$ for all i, which reduce the number of parameters to be estimated.

EMPIRICAL APPROACH: TOP LEVEL

Given the estimates from the equation [1] we calculate a price index for each segment (e.g. Price index for Tablets segment) and proceed to estimate the top level of the demand for each segment, as follows:

$$\log q_{st} = \alpha_s + \beta_s \log X_t + \sum_{j=1}^{J} \delta_j \log P_{jt} + \varepsilon_{st} \qquad [2]$$

- q_{st} is the logarithm of the quantity of the s^{th} segment in period t,
- X_t is the total coffee expenditure, and
- P_{jt} are the segment price indices.

1. Symmetry restrictions are not required.
   - Then, average substitution from, say, Tablets to Countlines may be different to that from Countlines to Tablets.
2. By combining the estimates from this and the bottom level, we are able to estimate weighted average cross-price elasticities between brands in different segments.

EMPIRICAL APPROACH: ELASTICITIES

Elasticities can be obtained by combining the estimated parameters in the top and bottom levels.

Using the estimated coefficients from [1] and [2] we can compute:

1. Conditional and unconditional elasticities:
   - within group (or conditional) elasticities, that measure the direct effect of a price change in a product on the quantities purchased within the same segment, given an unchanged segment expenditure.
   - total (or unconditional) elasticity. A price change in a product will also cause an indirect effect. It will affect the group price index and thus the allocation of expenditures between segments. Total or unconditional elasticities take this indirect effect into account.

2. Compensated and uncompensated elasticities:
   - uncompensated (Marshallian) price elasticities measure both the substitution and income effects that arise when prices change.
   - compensated (Hicksian) elasticities measure only substitution effect. Measures the relative change in the quantity purchased in response to a change in price adjusting income so that products being purchased before the price increase continue to be affordable.

ESTIMATION: IMPLEMENTATION

- The AIDS demand system is estimated on aggregate-level data, and can be treated as the demand system for a representative consumer (Deaton and Muellbauer)
- Equations [1] and [2] above are estimated simultaneously using SURE (Seemingly Unrelated Equations) techniques.
- Estimation of the AIDS demand system could raise concerns as regards identification, since prices are included as an independent regressor while there may exist some unobserved factors affecting both consumer demand and prices. If this were the case, prices on the right hand side of the equations would be correlated with the error terms causing a bias in the estimated coefficients (endogeneity bias).
  - When high-frequency data (e.g. weekly data) is used, endogeneity is unlikely to be an issue. This is because retailers are unlikely to alter prices to equilibrate supply and demand in a given week, and therefore, during the measurement period, prices may be considered as pre-determined. [Hausman, J., G. Leonard and J.D. Zona (1994), "Competitive Analysis with Differentiated Products", Annales D'Économie et de Statistique, 34: 159-180.]
- Note that endogeneity causes the price coefficients in the demand equations to be biased upward and the implied price elasticity of demand to be biased downwards. Therefore if, despite using weekly data, endogeneity were, to some extent an issue, correcting for endogeneity would result in higher (in absolute terms) estimated own-price elasticities.
- Effect of endogeneity on cross-price elasticities (strategic complements?)

ESTIMATED ELASTICITIES AT THE SEGMENT LEVEL

Estimated own-price and cross-price elasticities at the segment level (conditional)

Elasticity of demand for	with respect to the price of		
	Tablets	Countlines	Pralines
Tablets	-2.020	0.600	0.200
Countlines	0.648	-2.125	0.398
Pralines	0.261	0.288	-1.356

ESTIMATED ELASTICITIES AT THE BRAND LEVEL

Estimated (unconditional) own-price and cross-price elasticities at the brand level

Elasticity of the demand for		With respect to the price of														
		Tablets						Countlines					Pralines			
		B1	B2	B3	B4	B5	B6	B1	B2	B3	B4	B5	B1	B2	B3	B4
Tablets	Brand1	**-2.277**	0.064	0.236	0.098	0.092	0.012	0.218	0.157	0.072	0.036	0.024	0.315	0.107	0.104	0.017
	Brand2	0.502	**-1.958**	0.430	0.094	0.039	0.006	0.109	0.078	0.036	0.018	0.012	0.158	0.053	0.052	0.009
	Brand3	0.774	0.461	**-3.235**	0.164	0.297	0.199	0.164	0.119	0.055	0.027	0.018	0.238	0.081	0.079	0.013
	Brand4	0.821	0.220	0.449	**-3.219**	0.131	0.070	0.187	0.135	0.062	0.031	0.021	0.272	0.092	0.090	0.015
	Brand5	0.933	0.086	0.902	0.152	**-3.744**	0.508	0.143	0.103	0.047	0.024	0.016	0.207	0.070	0.068	0.011
	Brand6	0.556	0.069	0.743	0.124	0.575	**-2.761**	0.085	0.061	0.028	0.014	0.010	0.123	0.042	0.041	0.007
Countlines	Brand1	0.377	0.199	0.151	0.051	0.051	0.048	**-3.240**	-0.465	0.010	0.013	0.077	0.313	0.106	0.103	0.017
	Brand2	0.164	0.086	0.066	0.022	0.022	0.021	0.231	**-2.446**	0.329	0.199	0.120	0.136	0.046	0.045	0.007
	Brand3	0.230	0.121	0.092	0.031	0.031	0.029	0.632	0.519	**-3.651**	0.299	-0.001	0.191	0.065	0.063	0.010
	Brand4	0.259	0.137	0.104	0.035	0.035	0.033	0.564	0.580	0.556	**-4.237**	0.057	0.215	0.073	0.071	0.012
	Brand5	0.307	0.162	0.123	0.042	0.042	0.039	0.977	0.347	0.108	0.052	**-4.205**	0.255	0.086	0.084	0.014
Pralines	Brand1	0.121	0.064	0.049	0.017	0.017	0.015	0.133	0.096	0.044	0.022	0.015	**-2.651**	0.037	0.363	0.072
	Brand2	0.083	0.044	0.034	0.011	0.011	0.011	0.092	0.066	0.030	0.015	0.010	0.501	**-2.196**	0.178	0.015
	Brand3	0.119	0.063	0.048	0.016	0.016	0.015	0.131	0.095	0.043	0.022	0.015	1.122	0.057	**-3.438**	0.117
	Brand4	0.087	0.046	0.035	0.012	0.012	0.011	0.096	0.069	0.032	0.016	0.011	1.685	0.081	0.817	**-4.150**

Price effects - AIDS

ANALYSING THE LIKELY EFFECTS OF A MERGER

To estimate the likely effects of the increase in market power, we have calculated Indicative Price Rises ('IPRs').

- IPRs measure the incentive for merging firms to increase prices post-merger.
- This incentive arises because the merged firm takes into account the fact that if it raises the price of one of its products, some of the lost demand will divert to other products it owns post-merger but which it did not own pre-merger.
- The diversion of lost demand to competing products constraints the firms from increasing prices. Post-merger this constraint will be reduced because some previously competing products will be controlled by the merged firm.
- The price increases measured by IPRs are partial equilibrium price increases and do not take into account the reaction of competitors.
- IPRs do not take into account other constraints on the parties' prices such as brand repositioning, supply-side substitution, and potential entry

INDICATIVE PRICE RISES ('IPRS')

We assume the following points when calculating IPRs:

- The merging firms are asymmetric.
- Each firm can control multiple products pre-merger.
- The demand system is linear.
- Firms follow Nash-Bertrand competition.
- There are no cost efficiencies arising from the merger.

We use the following inputs:

- Retail prices obtained from Nielsen data.
- Manufacturer margin estimates from actual data from the merging parties.
- Own- and cross-price elasticities from the AIDS demand estimation.

There are three steps to the IPR calculation:

1. Calculating wholesale prices and costs given pre-merger data.
2. Solving the linear demand system given pre-merger data.
3. Estimating the likely price increases when we combine the merging firms into a single entity.

STEP 1: WHOLESALE PRICES AND COSTS

We are interested in analysing the merger at the wholesale level because the merger is between two manufacturers. Accordingly, we need data on wholesale prices and costs.

- Manufacturer margins from the merging parties
- We also received estimates of the 'retail margin'.
  - This 'retail margin' is not the operational margin of the retailer, but rather it is the difference between the retail and wholesale prices relative to the retail price net of VAT.

We calculate the wholesale prices and costs for merging parties brands as follows:

1. Take the retail prices and net out VAT.
2. Compute the cash margin that belongs to the retailer.
3. The wholesale price can be computed by subtracting the 'retail margin' from the retail price net of VAT.
   - Assume this 'retail margin' is constant pre- and post-merger in cash terms.
4. Wholesale cash margin is calculated by multiplying the wholesale price by the variable manufacturer margin.
5. Wholesale costs can be obtained by subtracting wholesale cash margin from the wholesale price.

STEP 2: SOLVING THE DEMAND SYSTEM AT THE WHOLESALE LEVEL

An example of a linear demand system with two products is defined as follows:

$$q_1 = a_1 + b_{11} * p_1 + b_{12} * p_2$$

$$q_2 = a_2 + b_{22} * p_2 + b_{21} * p_1$$

Pre-merger we have information on the quantities of each product, as well as the calculated wholesale prices. We calculate the b coefficients using estimated AIDS elasticities as follows, where epsilon is the elasticity:

$$b_{ij} = \frac{\partial q_i}{\partial p_j} = \varepsilon_{ji} * \frac{q_i}{p_j}$$

We then have the q, p and b values in the above equation. Given these, we calculate the a value.

The a and b coefficients stay constant pre- and post-merger. With these calculated, we can solve for the post-merger wholesale price.

STEP 3: CALCULATING THE POST-MERGER PRICE

To calculate the wholesale prices post-merger, we assume the merged firm maximises its profit given the assumed linear demand system. This means that the merged firm will take into account in its first-order conditions the fact that if it raises the price on one of its products, some of the lost demand will divert to other products it owns.

The set of profit-maximising wholesale prices can be solved using the first-order conditions of the merged firm as follows:

$$p^* = -1 * (B + \mathrm{B}')^{-1} * (a - \mathrm{B}' * c)$$

where B is a matrix consisting of the b coefficients, a is a vector of the a coefficients, and c is the wholesale cost vector.

The post-merger prices are at the wholesale level. We convert these to retail prices by adding the 'retail cash margin' and VAT. Note that as set out previously, we assume the retail cash margin is constant pre- and post-merger.

The IPR for product i is then calculated as follows: $$IPR_i = \frac{p_i^* - p_i}{p_i}$$

where p* is the post-merger retail price and p is the pre-merger retail price.

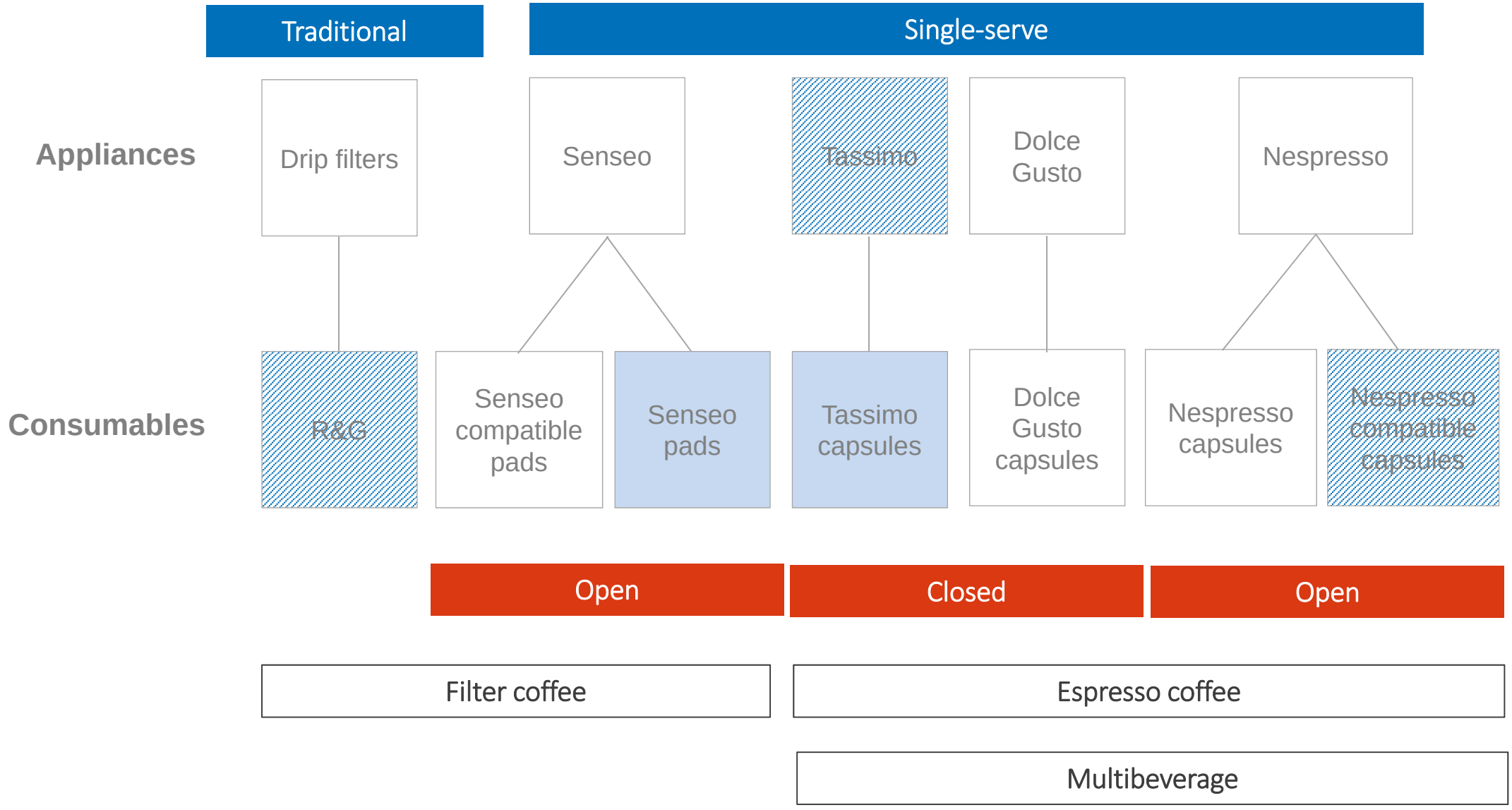
We computed the quantity-weighted average IPRs by segment.

The DEMB/Mondelez merger

BACKGROUND

- Merger between DEMB and Mondelez – Large distributors of coffee products in Europe
- The transaction would result in significant overlaps in a number of European countries:
  - France – R&G and pads
  - Spain – R&G (Marcilla/Saimaza)
  - UK – R&G and instant
  - Denmark – R&G
  - CZ – R&G
  - Greece – Non-greek R&G and instant
  - Baltics – R&G
- Economic analysis submitted in pre-Notification, phase I, and phase II:
  - Merger simulation based on calibrated NL demand: all countries above (most of them in pre-notification)
  - AIDS demand estimation: Spain and France (conducted but not submitted for the UK).
- Merger was cleared with conditions in Phase II (no Statement of Objections)
- Focus of this presentation:
  - Analysis conducted in France; and
  - Assessment of CL work by CET.

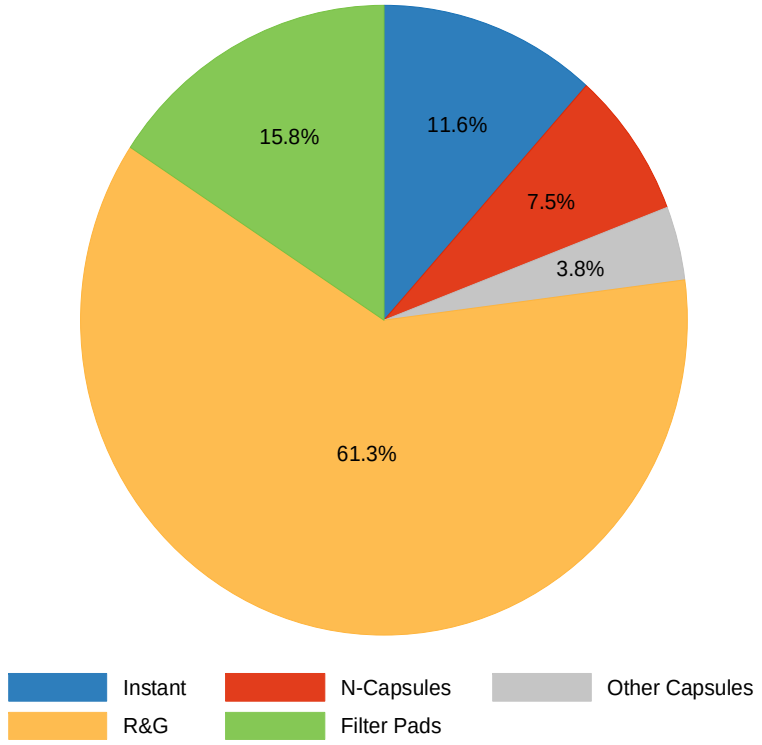
OVERVIEW OF THE MAIN IN-HOME COFFEE SYSTEMS



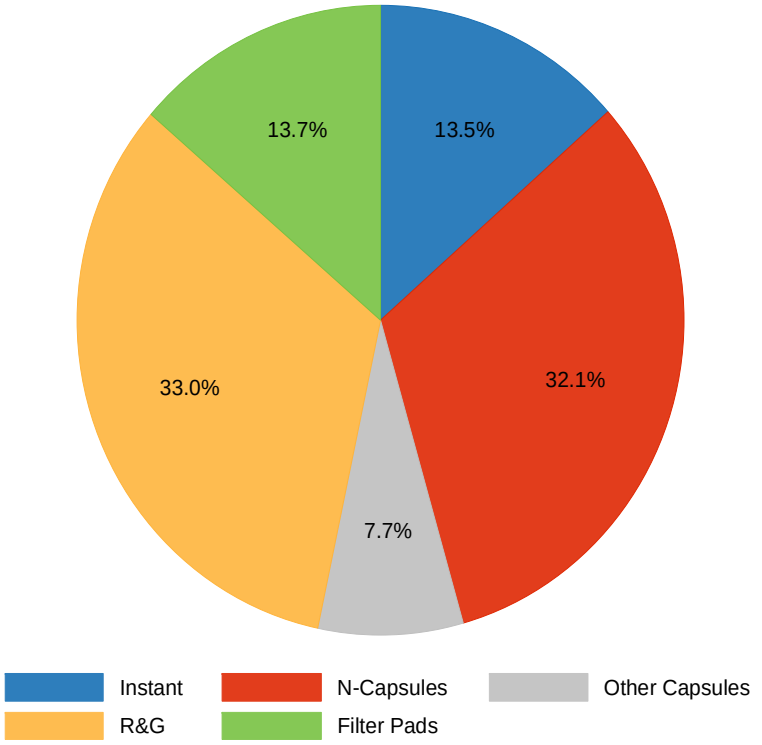
Analysis of unilateral effects in France

FRENCH IN-HOME MARKET BY TYPE OF COFFEE

Split of sales by volume (tonnes)



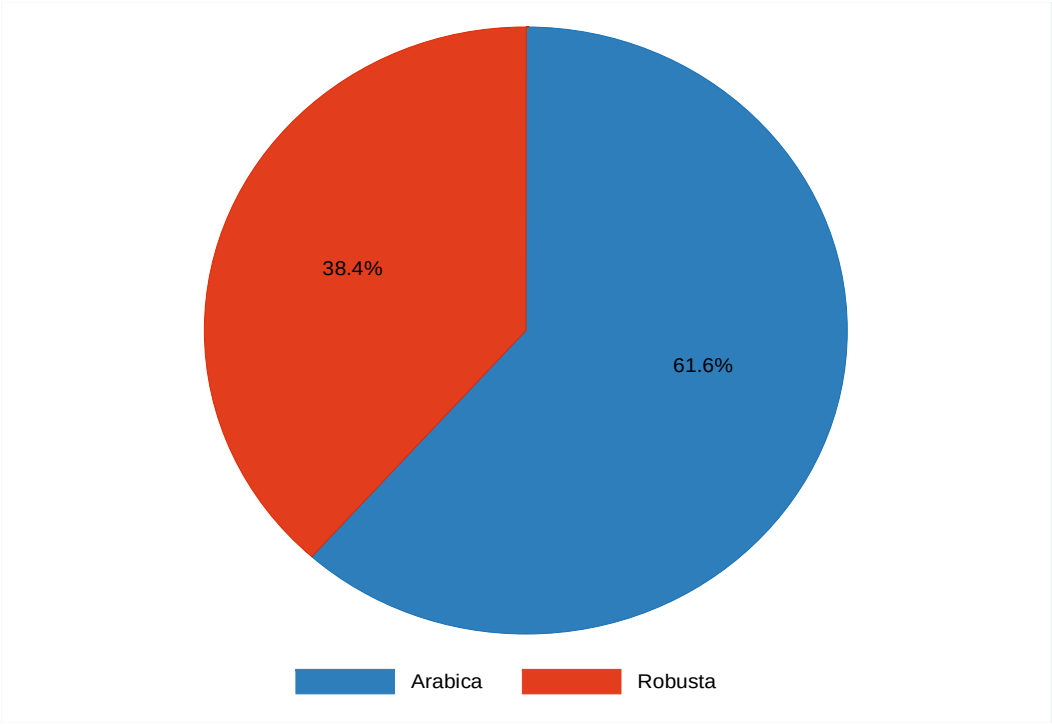
Split of sales by value (euros)



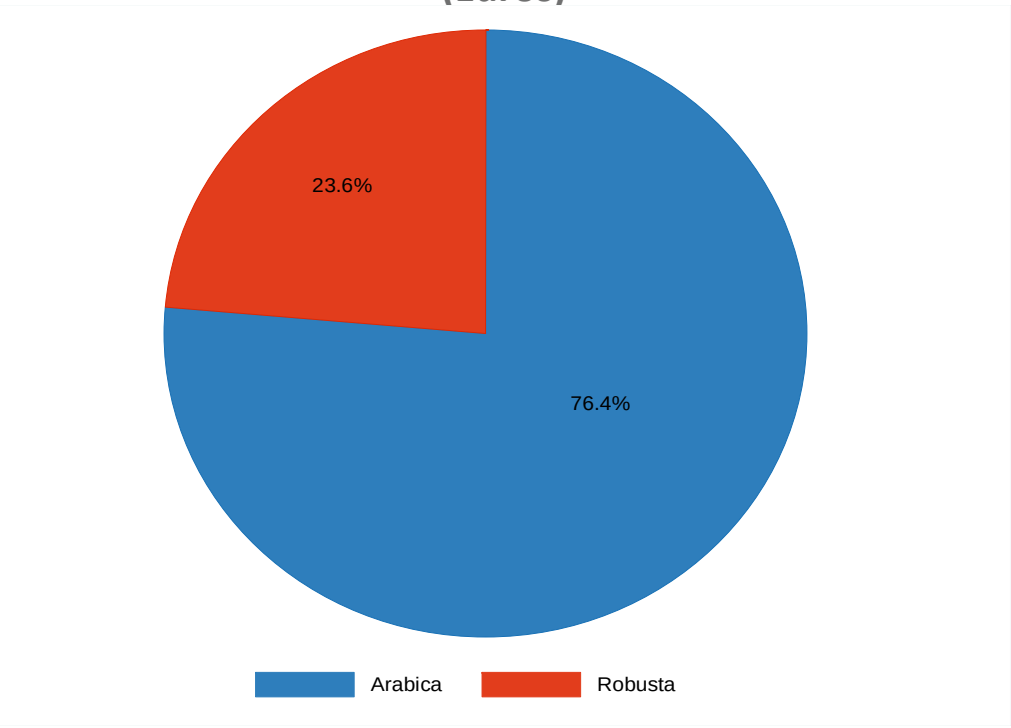
FRANCE IN-HOME R&G MARKET BY TYPE OF COFFEE

There are two main types of R&G coffee sold in France: (1) Arabica, and (2) Robusta. The R&G segmentation in France is linked to the quality of the beans: Arabica is a more premium product than Robusta.

Split of sales by volume (tonnes)



Split of sales by value (Euros)



VALUE SHARES INCLUDING PRIVATE LABELS

Segment	DEMB	Mondelez	Combined
Total Coffee			
R&G + Filter Pads + Capsules + Instant	10-20%	20-30%	30-40%
R&G + Filter Pads	**20-30%**	**30-40%**	**50-60%**
Roast & Ground			
R&G (Beans and Ground)	**10-20%**	**40-50%**	**50-60%**
▪ Arabica (Beans and Ground)	10-20%	40-50%	50-60%
▪ Robusta (Beans and Ground)	10-20%	30-40%	50-60%
Filter pads & Capsules			
Filter Pads	**40-50%**	**10-20%**	**60-70%**
▪ Nespresso compatible capsules	0-10%	0-10%	0-10%
▪ Other capsules	-	40-50%	40-50%
Instant			
Instant (Pure and Mixes & Specialties)	-	10-20%	10-20%
Instant Pure	-	10-20%	10-20%
Instant Mixes & Specialties	-	10-20%	10-20%

VALUE SHARES EXCLUDING PRIVATE LABELS

Segment	DEMB	Mondelez	Combined
Total Coffee			
R&G + Filter Pads + Capsules + Instant	10-20%	20-30%	40-50%
R&G + Filter Pads	**30-40%**	**40-50%**	**70-80%**
Roast & Ground			
R&G (Beans and Ground)	**10-20%**	**50-60%**	**70-80%**
▪ Arabica (Beans and Ground)	10-20%	50-60%	70-80%
▪ Robusta (Beans and Ground)	10-20%	50-60%	70-80%
Filter pads & Capsules			
Filter Pads	**60-70%**	**20-30%**	**80-90%**
▪ Nespresso compatible capsules	0-10%	0-10%	0-10%
▪ Other capsules	-	40-50%	40-50%
Instant			
Instant (Pure and Mixes & Specialties)	-	20-30%	20-30%
Instant Pure	-	20-30%	20-30%
Instant Mixes & Specialties	-	10-20%	10-20%

MERGING PARTIES' BRANDS POSITION IN THE MARKET

R&G – Arabica %			
Owner	Brand	Volume	Value
RETAILERS	PRIVATE LABELS	30-40	20-30
MONDELEZ	**CARTE NOIRE**	**20-30**	**30-40**
DEMB	**L'OR**	**10-20**	**10-20**
MONDELEZ	**VELOURS NOIR**	**0-10**	**0-10**
MONDELEZ	**JACQUES VABRE**	**0-10**	**0-10**
MONDELEZ	**GRAND MERE**	**0-10**	**0-10**
DEMB	**OTHERS**	**0-10**	**0-10**
OTHERS	OTHERS	10-20	10-20

R&G – Robusta %			
Owner	Brand	Volume	Value
RETAILERS	PRIVATE LABELS	30-40	30-40
MONDELEZ	**GRAND MERE**	**30-40**	**30-40**
DEMB	**MA TRADITION**	**0-10**	**0-10**
MONDELEZ	**JACQUES VABRE**	**0-10**	**0-10**
MONDELEZ	**OTHERS**	**0**	**0**
OTHERS	OTHERS	10-20	10-20

Filter pads %			
Owner	Brand	Volume	Value
DEMB	**SENSEO**	**30-40**	**40-50**
RETAILERS	PRIVATE LABELS	30-40	20-30
MONDELEZ	**CARTE NOIRE**	**10-20**	**10-20**
MONDELEZ	**GRAND MERE**	**0-10**	**0-10**
DEMB	**OTHERS**	**0-10**	**0-10**
MONDELEZ	**OTHERS**	**0-10**	**0-10**
OTHERS	OTHERS	0-10	0-10

SIMULATION USING NESTED LOGIT – R&G + FP

Outside good

- Instant
- Capsules
- Other drinks

Nest 1: R&G Arabica (Ground & Beans)

- Brand 1
- Brand 2
- .....

Nest 2: R&G Robusta (Ground & Beans)

- Brand 1
- Brand 2
- .....

Nest 3: Filter pads

- Brand 1
- Brand 2
- .....

Competition between segments

Competition among brands within a segment

SIMULATED PRICE CHANGES BY MARKET AND NEST (NO DIVESTMENT)

Nest Structure	Nest	All products		Merging parties' brands	
		Mean	Range	Mean	Range
Nest Structure 2 (R&G Arabica / R&G Robusta / Filter pads)	R&G	3-5%	3-5%	5-7%	5-7%
	Filter pads	3-5%	3-5%	3-5%	3-5%
	R&G and Filter pads	3-5%	3-5%	5-7%	5-7%

SIMULATED PRICE CHANGES BY MARKET AND NEST (WITH DIVESTMENT OF L'OR AND GRAND MERE)

Nest Structure	Nest	All products		Merging parties' brands	
		Mean	Range	Mean	Range
Nest Structure 2 (R&G Arabica / R&G Robusta / Filter pads)	R&G	<0%	-<0%	<0%	-<0%
	Filter pads	0-2%	0-3%	0-3%	2-5%
	R&G and Filter pads	0-2%	-<0% - *2%*	0-2%	0-2%

KEY FINDINGS OF MERGER SIMULATION

- Merger simulation results show moderate predicted price changes across R&G and filter pad products following the merger.
- These price effects turn quite small (or even negative) after the divestment of L'Or and Grand Mere.
- Overall, merger simulation results indicate that after the divestment of L'Or and Grand Mere, the transaction is not likely to have a significant effect on prices in any of the affected segments.

AIDS – R&G + FILTER PADS

- More flexible model – fewer restrictions on substitution patterns
- Focus: constraint imposed by R&G competing brands on merging parties' brands in filter pads

Outside good

- Instant
- Capsules
- Other drinks

Nest 1: R&G Arabica (Ground & Beans)

- Brand 1
- Brand 2
- .....

Nest 2: R&G Robusta (Ground & Beans)

- Brand 1
- Brand 2
- .....

Nest 3: Filter pads

- Brand 1
- Brand 2
- .....

Competition between segments

Competition among brands within a segment

ESTIMATED ELASTICITIES AT THE SEGMENT LEVEL

Estimated own-price and cross-price elasticities at the segment level
(conditional on expenditure)

Elasticity of demand for	with respect to the price of		
	R&G Arabica	R&G Robusta	Filter pads
R&G Arabica	-1.390	0.397	0.426
R&G Robusta	0.648	-2.663	0.398
Filter pads	0.261	0.288	-2.020

There is significant substitution between R&G Arabica and Filter pads

- A 10% increase in the price of all R&G Arabica products would lead to an increase of 2.61% in Filter pads volume sales.
- A 10% increase in the price of all filter pads would lead to an increase of 4.26% and 3.98% in the volume sales of R&G Arabica and R&G Robusta products, respectively.

ESTIMATED ELASTICITIES AT THE SEGMENT LEVEL

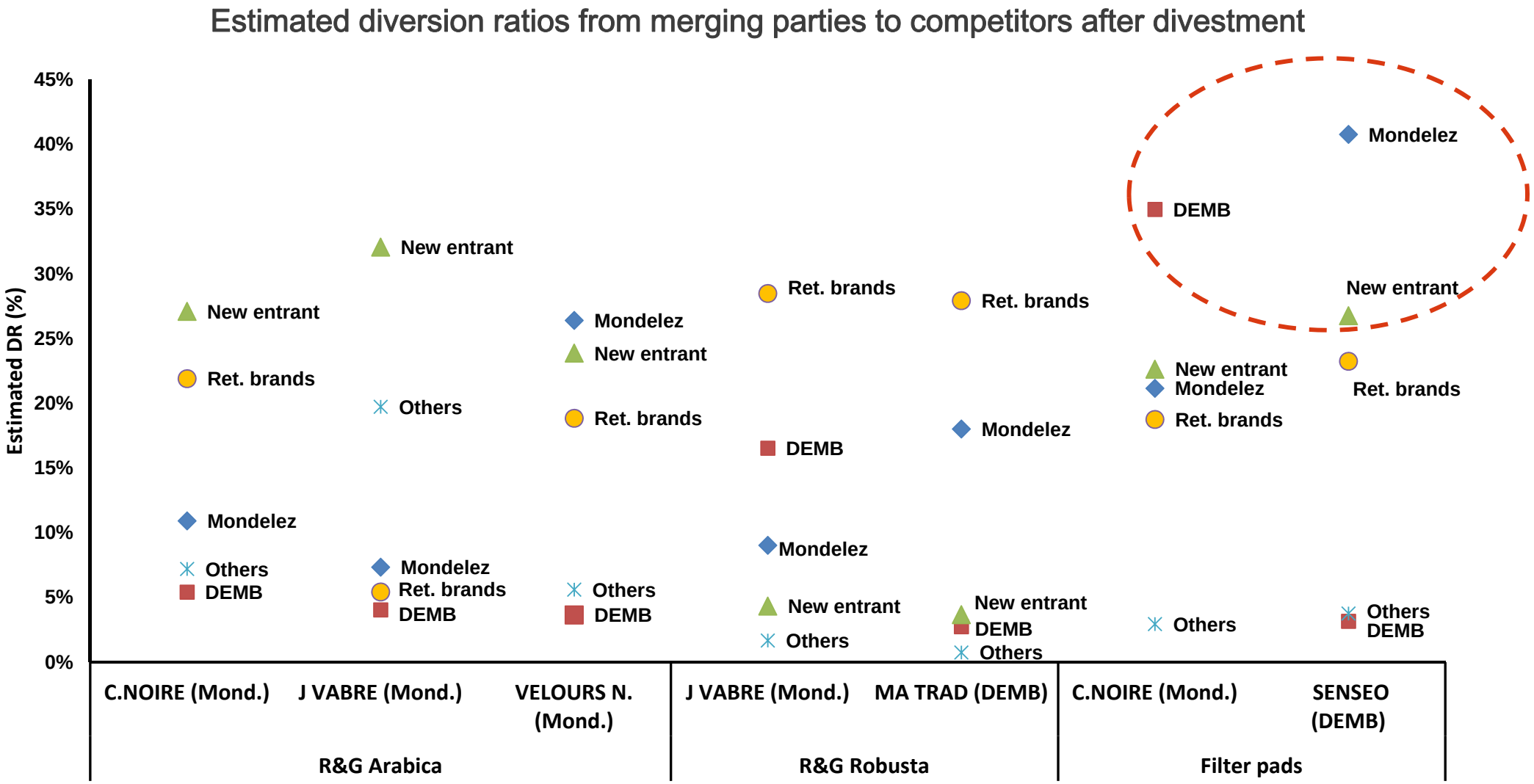
Estimated (unconditional) own-price and cross-price elasticities at the brand level

Elasticity of the demand for		With respect to the price of														
		R&G Arabica						R&G Robusta					Filter Pads			
		CARTE NOIRE	PLs	L'OR	VEL. NOIR	LAVAZZA	JAC. VABRE	G. MERE	PLs	MA TRAD	JAC. VABRE	LEGAL	SENSEO	PLs	CARTE NOIRE	G. MERE
R&G Arabica	C. NOIRE	**-2.277**	0.064	0.236	0.098	0.092	0.012	0.218	0.157	0.072	0.036	0.024	0.315	0.107	0.104	0.017
	PLs	0.502	**-1.958**	0.430	0.094	0.039	0.006	0.109	0.078	0.036	0.018	0.012	0.158	0.053	0.052	0.009
	L'OR	0.774	0.461	**-3.235**	0.164	0.297	0.199	0.164	0.119	0.055	0.027	0.018	0.238	0.081	0.079	0.013
	VEL. NOIR	0.821	0.220	0.449	**-3.219**	0.131	0.070	0.187	0.135	0.062	0.031	0.021	0.272	0.092	0.090	0.015
	LAVAZZA	0.933	0.086	0.902	0.152	**-3.744**	0.508	0.143	0.103	0.047	0.024	0.016	0.207	0.070	0.068	0.011
	JAC. VABRE	0.556	0.069	0.743	0.124	0.575	**-2.761**	0.085	0.061	0.028	0.014	0.010	0.123	0.042	0.041	0.007
R&G Robusta	G. MERE	0.377	0.199	0.151	0.051	0.051	0.048	**-3.240**	-0.465	0.010	0.013	0.077	0.313	0.106	0.103	0.017
	PLs	0.164	0.086	0.066	0.022	0.022	0.021	0.231	**-2.446**	0.329	0.199	0.120	0.136	0.046	0.045	0.007
	MA TRAD	0.230	0.121	0.092	0.031	0.031	0.029	0.632	0.519	**-3.651**	0.299	-0.001	0.191	0.065	0.063	0.010
	JAC. VABRE	0.259	0.137	0.104	0.035	0.035	0.033	0.564	0.580	0.556	**-4.237**	0.057	0.215	0.073	0.071	0.012
	LEGAL	0.307	0.162	0.123	0.042	0.042	0.039	0.977	0.347	0.108	0.052	**-4.205**	0.255	0.086	0.084	0.014
Filter Pads	SENSEO	0.121	0.064	0.049	0.017	0.017	0.015	0.133	0.096	0.044	0.022	0.015	**-2.651**	0.037	0.363	0.072
	PLs	0.083	0.044	0.034	0.011	0.011	0.011	0.092	0.066	0.030	0.015	0.010	0.501	**-2.196**	0.178	0.015
	C. NOIRE	0.119	0.063	0.048	0.016	0.016	0.015	0.131	0.095	0.043	0.022	0.015	1.122	0.057	**-3.438**	0.117
	G. MERE	0.087	0.046	0.035	0.012	0.012	0.011	0.096	0.069	0.032	0.016	0.011	1.685	0.081	0.817	**-4.150**

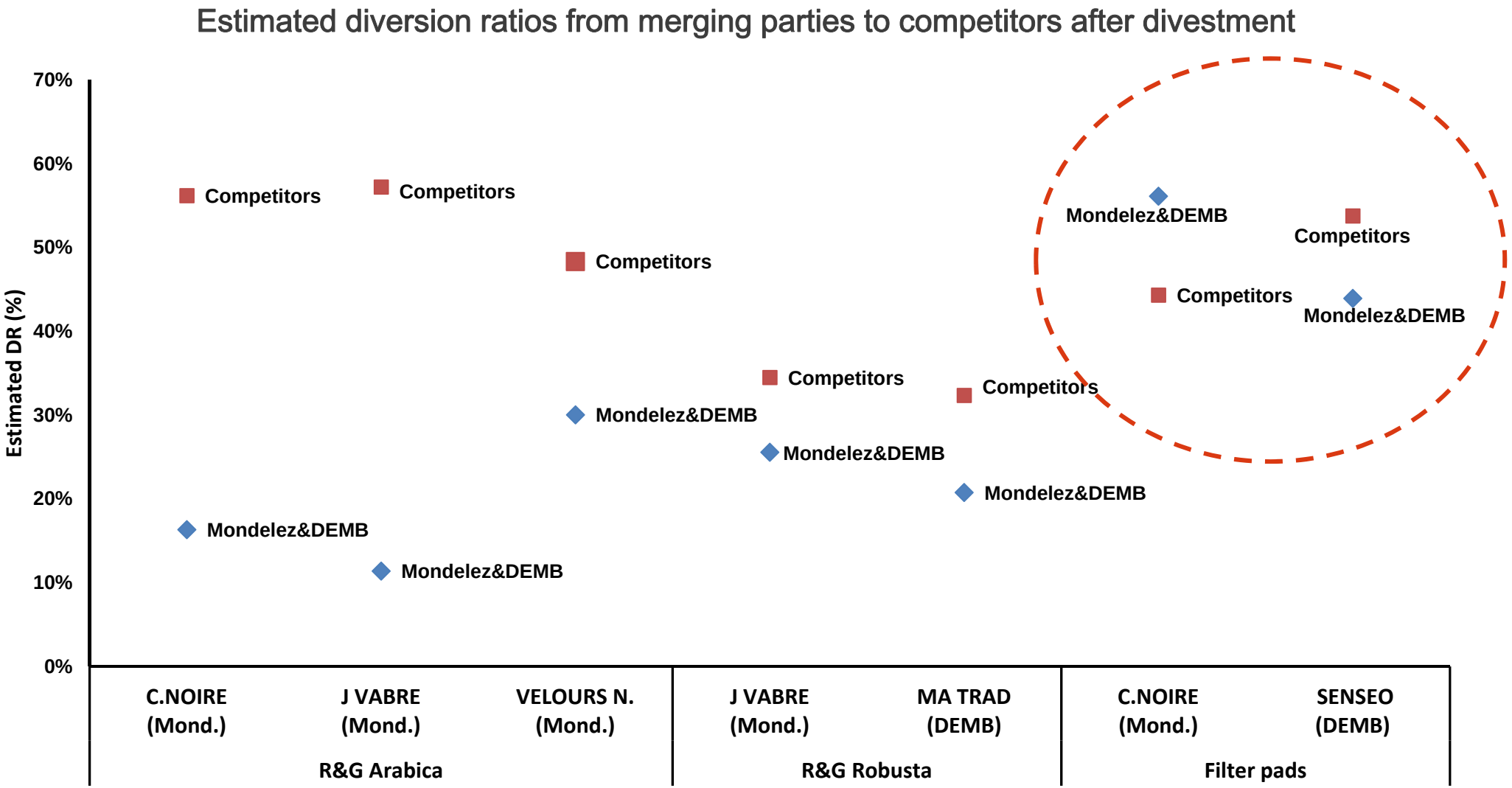
Elasticity of Carte Noire with respect to the price of L'Or is 0.236. This means that a 10% increase in the price of L'Or would lead to a 2.36% increase in Carte Noire volume sales

Own-price elasticity of L'Or is -3.235. This means that a 10% increase in the price of L'Or would lead to a 32% reduction in L'Or volume sales

ESTIMATED DIVERSION RATIOS AFTER DIVESTMENT



ESTIMATED DIVERSION RATIOS AFTER DIVESTMENT



SIMULATED PRICE EFFECTS WITHOUT DIVESTMENTS

SEGMENT	Nested Logit	AIDS
R&G Arabica	3-5%	5-7%
R&G Robusta	3-5%	3-5%
Filter Pads	3-5%	4-7%
R&G and Filter pads	3-5%	3-6%

SIMULATED PRICE EFFECTS POST-DIVESTMENT

SEGMENT	Nested Logit	AIDS
R&G Arabica	<0%	<0%
R&G Robusta	<0%	<0%
Filter Pads	0-3%	0-2%
R&G and Filter pads	<0-1%	<0-1%

MAIN FINDINGS FROM DEMAND ESTIMATION

- R&G products impose a significant competitive constraint on Filter pad products.
- The brands to be divested (L'Or, and Grand Mère) are close competitors to the brands which will stay under the control of the new entity post-merger.
  - The closest competitors to Carte Noire (the largest brand in the R&G Arabica segment) are L'Or, retailer brands, and Grand Mère.
  - L'Or and Grand Mère are also found to be close competitors to Jacques Vabre and Velours Noir, the two other brands of the new entity in the R&G Arabica segment.
  - Proposed divested brands impose a significant constraint on the merging parties' brands in the Filter pad segment (Senseo and Carte Noire)
  - Carte Noir is the closest competitor to Senseo (and the other way around)
- Private labels exert a significant constraint on manufacturer branded products in France.
  - This is particularly the case in the R&G segments (Arabica and Robusta).
  - To a lesser extent, this is also the case in the Filter pad segment.

EC's assessment and discussion

EC'S ASSESSMENT OF CL ANALYSIS FOR FRANCE

- Merger simulation
  - Cost calibration.
  - Aggregate demand elasticity is too high – underestimation of price effects.
  - Nesting (segmentation).
    - EC argues that CL's simulation models are flawed because they focus on the interaction between filter pads and R&G products and only include capsules as part of the outside market. Capsules should be included in the merger simulation models in a different way.
- Demand estimation
  - Weekly data – stockpiling ➔ overestimation of own-price elasticities
  - Monthly data – endogeneity➔ underestimation of own-price elasticities!
  - Lack of robustness when using monthly data – need to include same set of controls!
  - Overestimation of the constraint imposed by R&G on Filter pads

MS – COST CALIBRATION

- Calibration involves obtaining a plausible range of retail own-price and cross-price elasticities at the brand level that are consistent with: (i) utility maximising behaviour on the side of consumers, and (ii) profit maximising behaviour on the side of the manufacturers, given the observed current level of prices, sales and costs.
- Select as plausible those combinations of α and σ such that (i) the corresponding calibrated costs are positive for all brands included in the model, and (ii) the calibrated costs across all products included in the simulation are, on average, within a plausible range.
- CET initially criticised our approach and suggested to select the demand parameters so that calibrated costs matched, on average, observed costs for DEMB and Mondelez products only.
- We conducted the sensitivity tests suggested by the Commission and found no material changes in the predicted price effects.
- The Commission dropped this criticism.

MS – AGGREGATE DEMAND ELASTICITY

- Art 6(1)c claims that the aggregate elasticity for R&G and filter pads used in-home in CL's simulations, ranging between -0.75 and -1, is too high.
- The Decision cites various academic papers reporting estimated elasticities of demand for coffee between -0.2 and -0.5.
- The academic papers cited in the Decision to claim that CL's aggregate elasticity for R&G and filter pads used in-home was too high do not provide a relevant benchmark.
- This is because all of them estimate the elasticity of demand for a much wider range of coffee products than the products included in CL simulations.
  - The academic literature referred to in the Decision considers markets for all coffee products, all roasted coffee products or all green coffee products, both in-home and out-of-home.
  - The elasticity of demand that is relevant for CL's models is the elasticity of demand for R&G and filter pads used in-home
  - As is well-known, the more products are included in a putative market, the lower is the aggregated elasticity of demand in that market.
  - Products in CL model account for approximately 75% of in-home coffee sales in France. Out-of-home sales account for about 35% of all coffee sales ➔ Less than 50% of total sales are part of the analysis ➔ this must have an impact on the relevant elasticity!!
- The Commission dropped this criticism.

MS – TREATMENT OF CAPSULES - FRANCE

- CL simulated likely price effects of the merger in the in-home R&G and filter pads segments in France. (77% of in-home coffee volume sales in France in 2013)
- The Decision argues that these results are likely to underestimate the price effect of the merger because it only includes capsules as part of the outside good
  - The Parties only overlap in Nespresso-compatible capsules where their combined volume share is less than 10% in the absence of remedies (0.3% increment).
- Consumers cannot readily switch between Nespresso capsules and Senseo filter pads, unless they own both types of appliance, which is rather infrequent.
  - According to the information provided by Europanel, 95% of consumers who own a filter pads brewer do not have any other on-demand brewer.
  - Above 90% of owners of a Nespresso-compatible brewer do not have another on-demand brewer.
- Therefore, the Parties' overlap in Nespresso capsules should not affect its pricing incentives in filter pads.
- Even if we artificially assume that consumers can readily switch across the different capsule systems and pads (as if they owned all of the appliances), results are not materially changed.
  - Note that this approach artificially reduces the substitution between R&G and filter pads, the key element to assess sufficiency of remedies.

DEMAND ESTIMATION – EC CRITICISMS

- The Decision claims that the coffee demand model estimated by CL cannot be relied upon because
  - coffee was often put on promotion and consumers stockpiled during promotions and
  - CL's demand model does not account for stockpiling behaviour by consumers
- According to the Commission failing to account for stockpiling implies that
  a. estimated own-price elasticities are larger in absolute terms than they are likely to be in reality, and hence over-estimate the price sensitivity of coffee consumers; and
  b. estimated cross-price elasticities are larger than they are likely to be in reality and hence incorrectly point to significant inter-segment substitution.
- Stockpiling may cause demand models to over-estimate the price elasticity of demand as well as the degree of substitution across segments.
- The Commission did not support their claims with any evidence suggesting that stockpiling was an issue.

DEMAND ESTIMATION – CL REBUTTAL

- The magnitude of this effect typically will vary significantly from one product to another and from one geography to another.
- It will also depend on how frequently products are placed on promotion and the magnitude of those promotions.
- This means that no conclusion can be reached without assessing (i) the frequency and magnitude of promotions; and (ii) the likely impact of stockpiling on consumer demand in the case at hand.

Actions

- Investigate both the frequency and magnitude of promotions.
- Investigate the likely impact of stockpiling on consumer demand in the case at hand – patterns of sales
  - Data restrictions – the ideal way of testing for stockpiling behaviour requires data at the household level
- Strip-out promotional sales and re-estimate demand using weekly data
- Estimate using monthly data (instead of weekly data) – endogeneity is more likely to be a problem.

DEMAND ESTIMATION - CL REBUTTAL

Coffee promotions are relatively infrequent.

- In France, less than 20% of coffee sales were made on promotion.

Promotions do not seem to impact consumer behaviour in a significant way.

- Sales are not correlated negatively over time, which is what we would expect to see if consumers were stockpiling in promotional periods and then depleting their stocks in subsequent periods.

Elasticity estimates are robust to using monthly data.

- Estimating the model using monthly observations rather than weekly observations does not have a significant impact on the estimated elasticities.
- The differences in elasticities are small. No change in the overall qualitative conclusions regarding substitution: significant substitution between R&G and pads.
- As expected precision of the estimates is deteriorated [set of controls]

Strip-out promotional sales from the weekly series

- Slightly lower own-price elasticities. Same conclusions as regards substitution between R&G and filter pads.

CL's elasticity estimates are consistent with the results in the relevant literature.

- The brand elasticities estimated using weekly data are in line with those estimated in the literature for in-home R&G coffee for France.

DEMAND ESTIMATION – EC'S FINAL ASSESSMENT

- Too much uncertainty around the results.
- Combined shares in the segment are high.
- Dynamic competition arguments neglected.
- Therefore, divestment of Carte Noire (licensing) was required.
- Role of internal documents and "market test"
- Discussion:
  - The economic analysis be disregarded without solid reasons when results may allegedly involve "significant" uncertainty.
  - Role of the preponderance of evidence

Thank you for your time!

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