The Saturation of Spending Diversity and the Truth about Mr Brown and Mrs Jones

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"The preference hypothesis only acquires prima facie plausibility when it is applied to the statistical average. To assume that the representative consumer acts like an ideal consumers is a hypothesis worth testing; to assume that an actual person, the Mr. Brown or Mrs. Jones, who lives around the corner, does in fact act in such a way does not deserve a moment's consideration." J.R. Hicks - A Revision of Demand Theory (1956) -

1. Measuring Spending Diversity

- n households (indexed by i); k expenditure categories
- Total expenditures of household i: x_i (referred to as "income")
- Expenditure share of household i on good j: s_{ij}
- Calculate **Entropy** of expenditure shares to measure spending diversity

Individual Spending Diversity E_i:

$$E_i = -\sum_{j=1}^{k} \phi(s_{ij}) \qquad \begin{cases} \phi(s_{ij}) = s_{ij}\ln s_{ij} & s_{ij} > 0 \\ \phi(s_{ij}) = 0 & s_{ij} = 0 \end{cases} \qquad (1)$$

$\Rightarrow$ Entropy E_i increases when expenditure shares become more equal

Group Level Spending Diversity $\hat{E}_d$:
- Households partitioned into 50 income groups
- Average expenditure shares within group d: $\hat{s}_{jd} = [50/n]\sum_{i\in d} s_{ij}$
- Entropy of average shares: $\hat{E}_d(\hat{s}_{jd})$

Empirical approach:
- **Data**: UK Family Expenditure Survey (1990 to 2000)
- Estimate E_i and $\hat{E}$ as a function of expenditures x

1.1 The Engel Curves for Spending Diversity
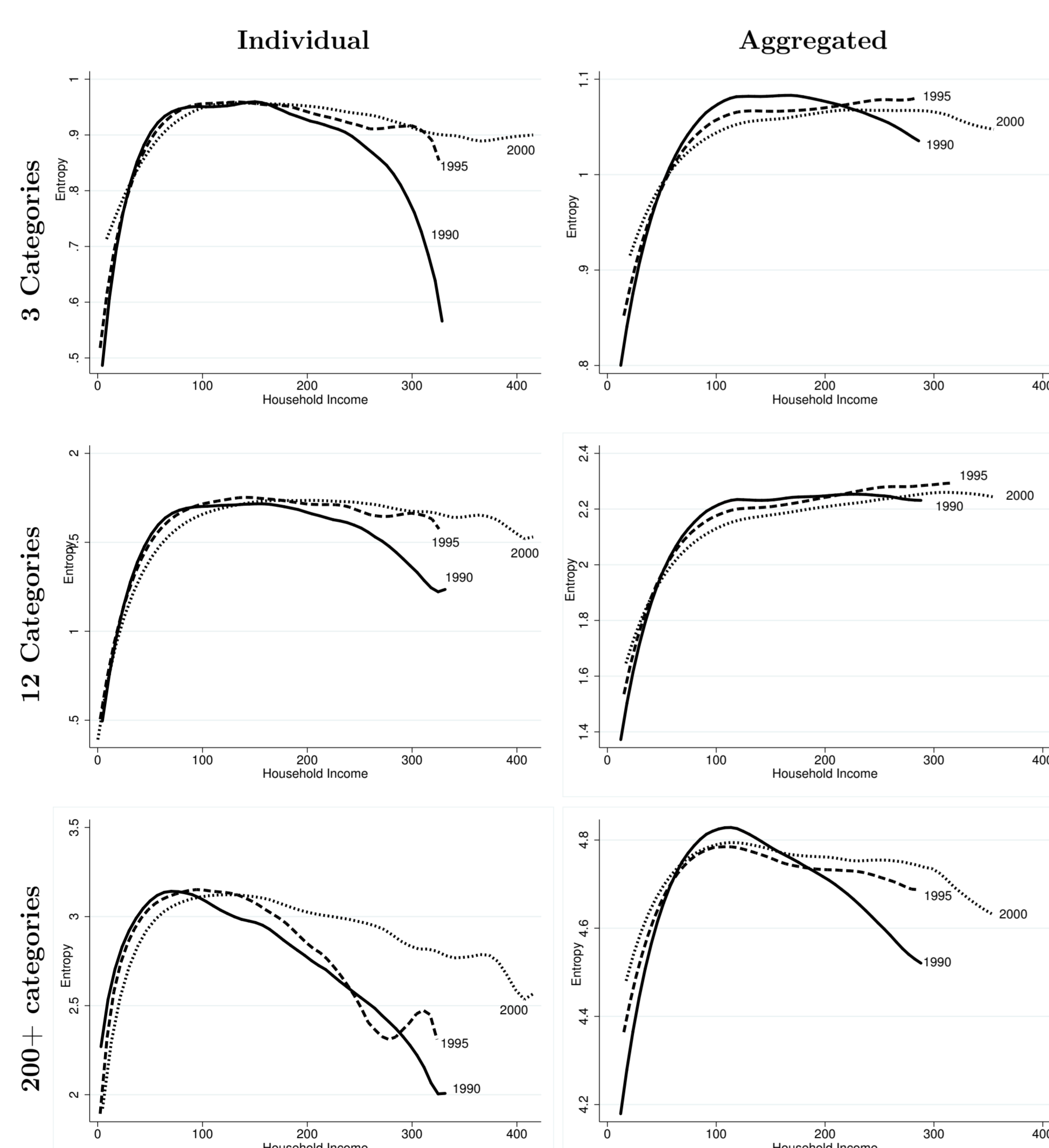
Notes: The Figures on the left show E_i, while the Figures on the right depict $\hat{E}$. Each row represents a different level of aggregation across expenditure categories. The number of observations was 6,047 in 1990, 5,984 in 1995 and 5,865 in 2000.

Differences between Group Level and Individual Spending Diversities

$\hat{E} - E_i$ with 3 expenditure categories

$\hat{E} - E_i$ with 12 expenditure categories

$\hat{E} - E_i$ with 200+ expenditure categories
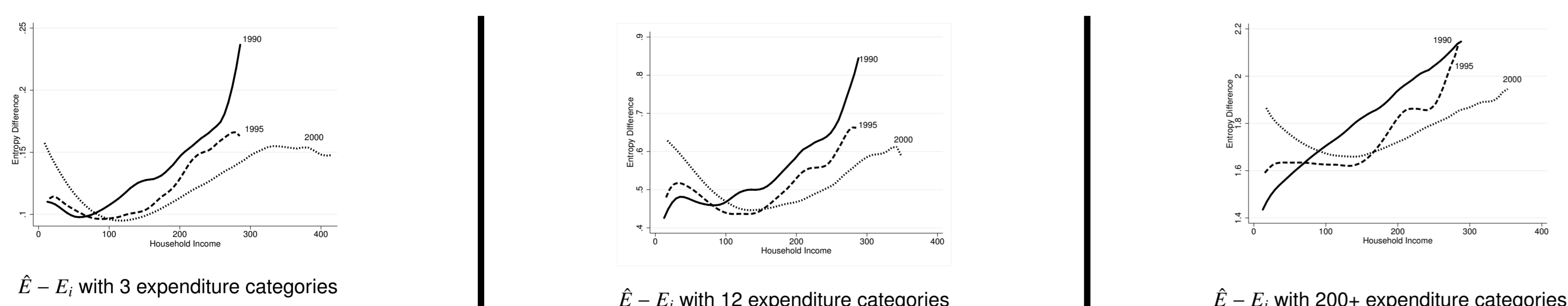
1.2 Stylized Facts

- **Stylized fact 1**: Inverse-U relation between individual spending diversity E_i and household income x_i ($\neq$ cross-country studies like Clements et al., 2006).
- **Stylized fact 2**: Positive or inverse-U relation between group level spending diversity $\hat{E}$ and average group income x.
- **Stylized fact 3**: $\hat{E}$ exceeds E_i for each level of x.
- **Stylized fact 4**: The difference $\hat{E} - E_i$ is either U-shaped in x or rises in x.

2. A Model of Spending Diversity

Generalized Stone Geary utility:

$$U_i = \left[\sum_{j=1}^{k} \beta_{ij}^{\frac{1}{\varepsilon}}\left(q_{ij} - \gamma_j\right)^{\frac{\varepsilon-1}{\varepsilon}}\right]^{\frac{\varepsilon}{\varepsilon-1}} \qquad (2)$$

- $q_{ij} \geq 0$: quantity of good j consumed by household i
- $\gamma_j \gtreqless 0$: "subsistence consumption" level of good j; **the same for all households**
- $\beta_{ij} \geq 0$ **can vary across households** ($\sum_{j=1}^{k} \beta_{ij} = 1$)
- $\varepsilon > 0$ determines substitutability between goods
- p_j denotes price of good j (**budget constraint**: $x_i = \sum_{j=1}^{k} p_j q_{ij}$)
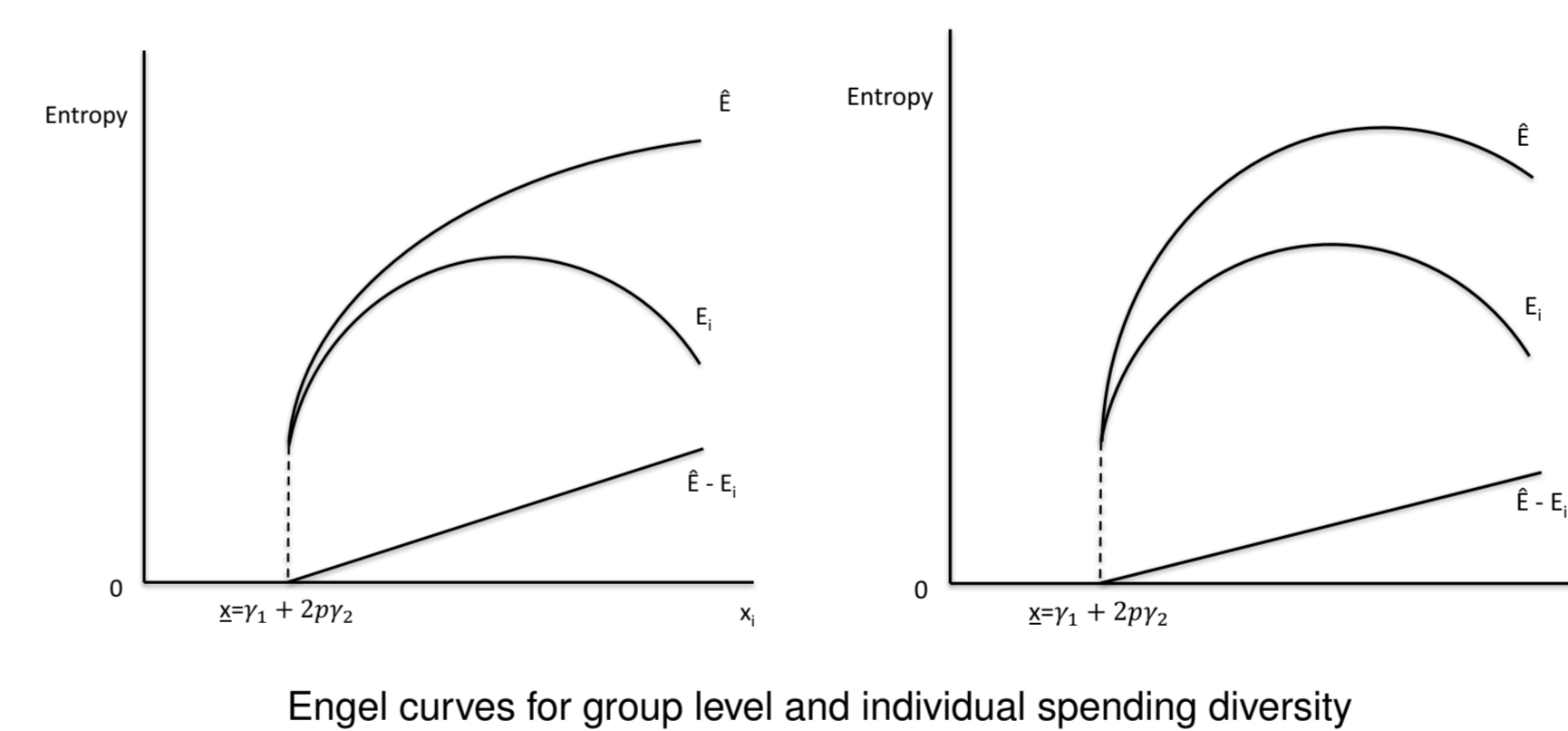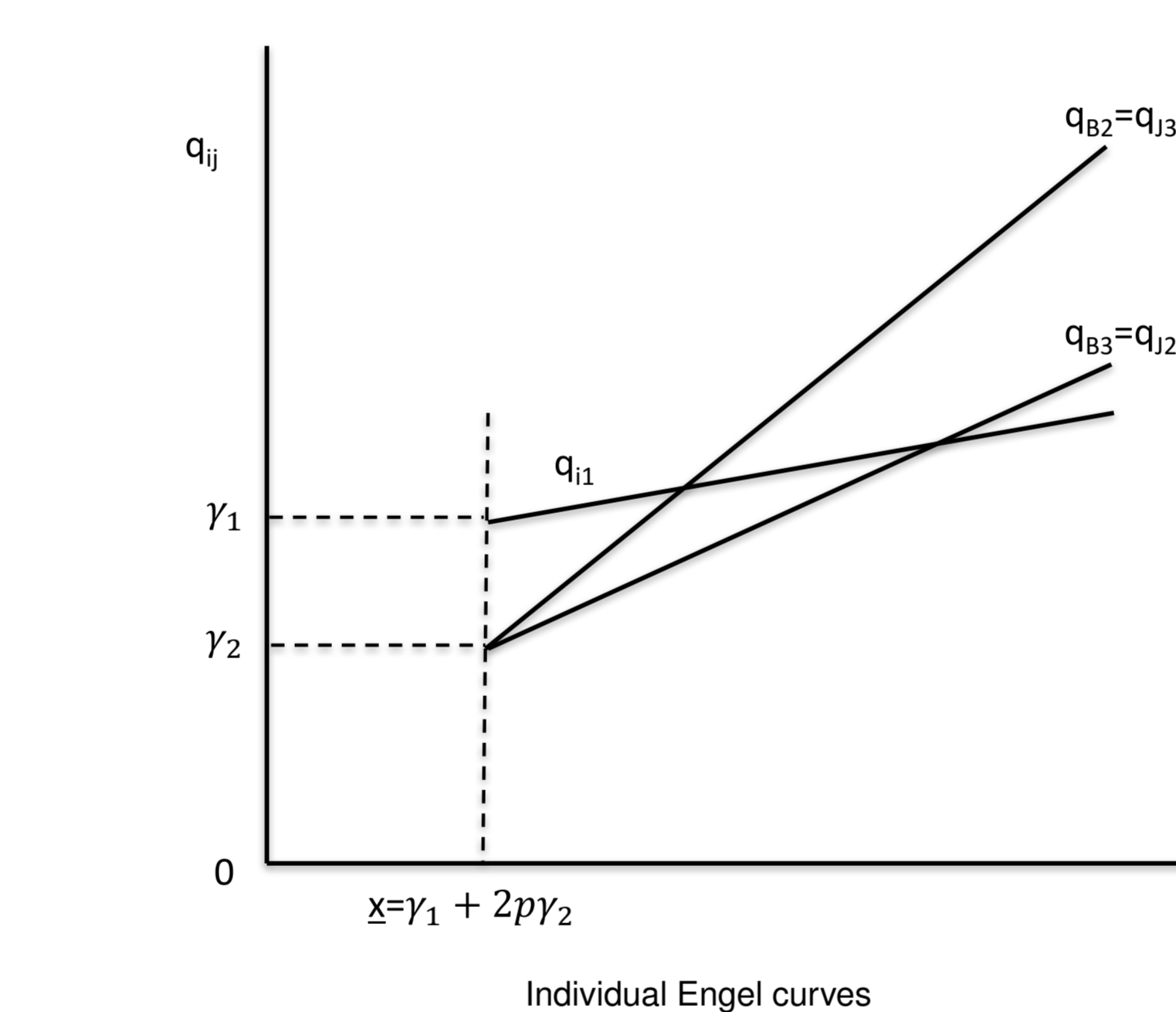
2.1 An Example with Three Goods

Setup:
- Basic need good $j = 1$ with $\gamma_1 > 0$; two more luxurious goods $j = 2$ and $j = 3$ with $\gamma_2 = \gamma_3 < \gamma_1$
- $p_1 = 1$, $p_2 = p_3 = p$
- Two (groups of) households: **Brown** and **Jones** with same expenditures x
- $\beta_{i1} = 1 - \bar{\beta}$: **equal preferences for good 1**
- **Opposite preferences regarding goods** 2 **and** 3: $\beta_{B2} = \beta_{J3}$ and $\beta_{B3} = \beta_{J2}$ ($\beta_{i2} + \beta_{i3} = \bar{\beta}$)
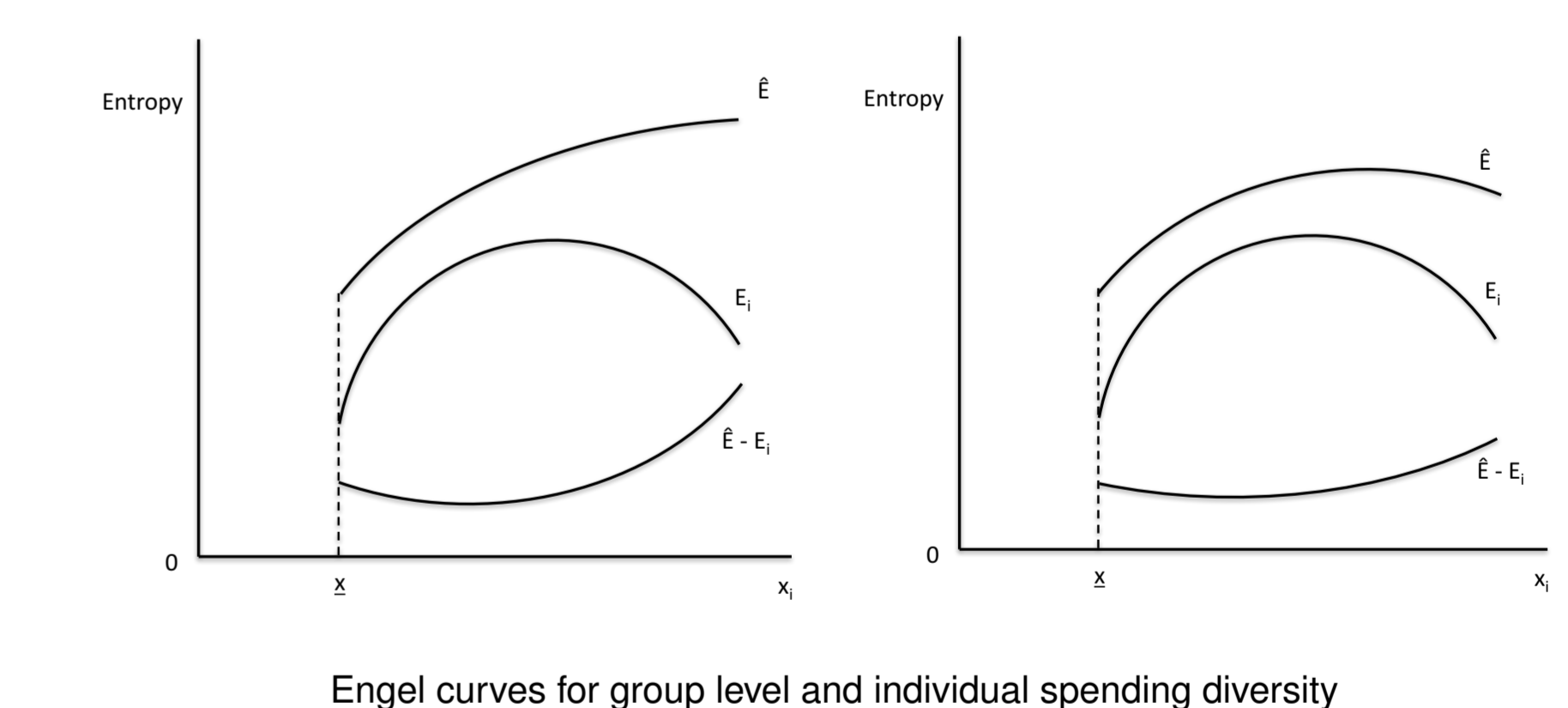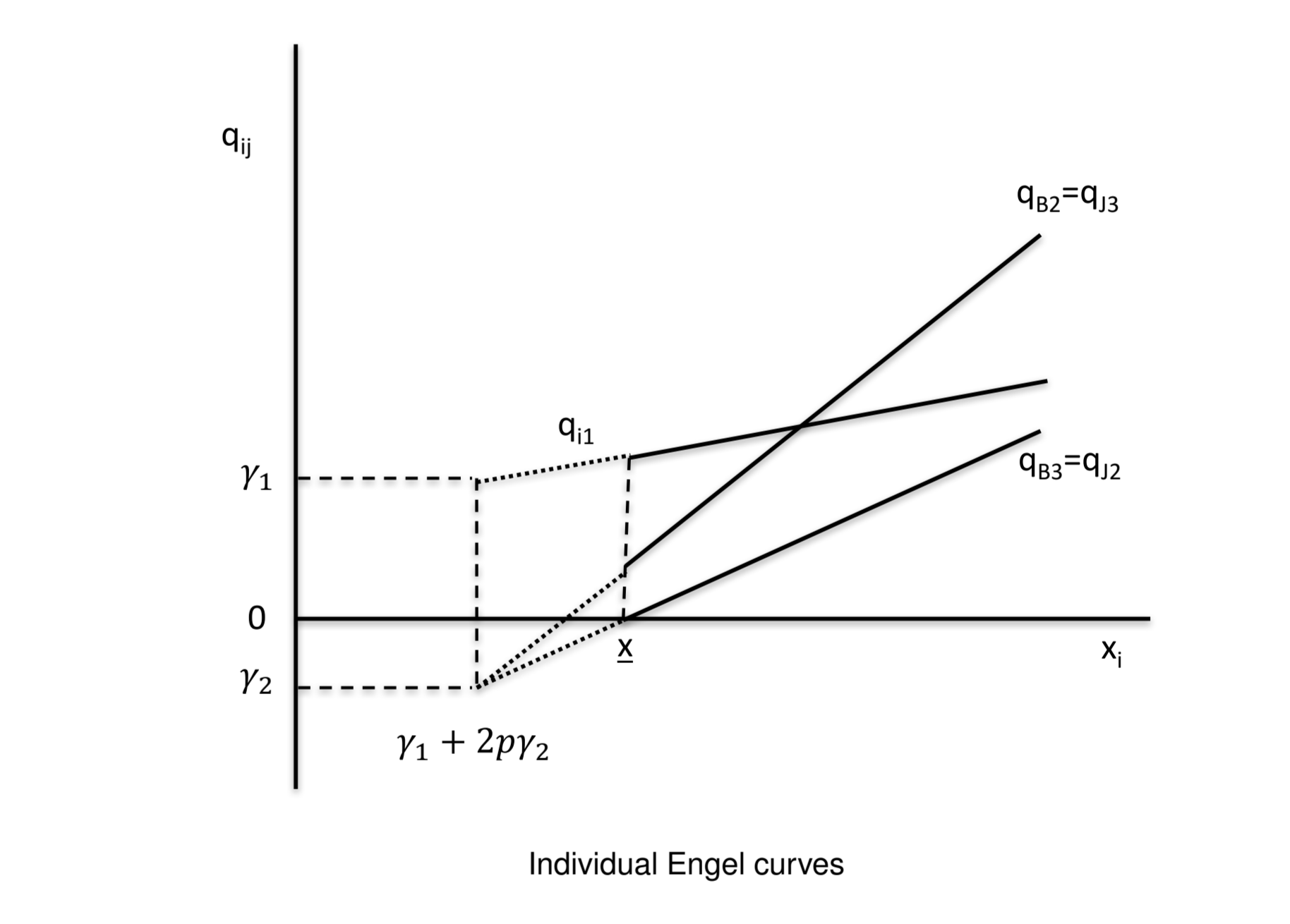
Implications:
- **Aggregated demand** $Q_j = q_{Bj} + q_{Jj}$ for each good j is **independent of preference heterogeneity**, i.e. of β_{i2} and β_{i3} (for $\bar{\beta}$, x, and p given)
- Aggregated demand can be derived from utility maximization problem of two (groups of) representative households with (per household) expenditures $x_a = x$ and **average preferences** $\beta_{a1} = 1 - \bar{\beta}$ and $\beta_{a2} = \beta_{a3} = \frac{\bar{\beta}}{2}$

For a certain parameter range, the **model can generate all stylized facts**:

Engel Curves when $\gamma_2 > 0$

Individual Engel curves

Engel Curves when $\gamma_2 < 0$

Individual Engel curves

Engel curves for group level and individual spending diversity

Engel curves for group level and individual spending diversity

2.2 The Value of Product Variety

Assumptions:
- Same setup as 2.1; however, only the basic need good exists initially
- Goods 2 and 3 ($\gamma_2 = \gamma_3 < 0$) can be simultaneously introduced through innovation or trade
- **Value of product variety**: amount F_i of good 1 that household i is willing to give up in order to be able to purchase all three goods (goods 2 and 3 at price p)

Proposition 1

A household with heterogeneous preferences ($\beta_{ij} \neq \frac{\bar{\beta}}{2}$ for $j\epsilon\{2;3\}$) values variety more than a household with average preferences ($\beta_{a2} = \beta_{a3} = \frac{\bar{\beta}}{2}$) does and the more so, the more heterogeneous these preferences are (i.e. $F_i > F_a$ holds, with $\frac{\partial F_i}{\partial \beta_{ij}} > 0$ when $\beta_{ij} > \frac{\bar{\beta}}{2}$).
Small degrees of preference heterogeneity can lead to substantial disagreement between individual and representative (average) households about the value of product variety.

Conclusion

The **truth about Mr Brown and Mrs Jones**:
- Possess different spending patterns
- Differences in spending patterns grow in income (for large incomes)
  $\Rightarrow$ **emergent consumption heterogeneity**
- **Implication**: Ignoring preference heterogeneity and focusing on representative households leads to **underestimation of value of product variety**

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