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The effects of changes in consumption composition and growth in recycling on decoupling household consumption from its waste footprint

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Household consumption

> **Significant changes in household consumption in the last decades**
  - Dramatic increase in volume
  - Great changes in composition

> **Decoupling as a key policy target**
  - E.g. objectives of waste prevention in this context of economic growth

The French household consumption expenditures, from 1959 to 2014 (INSEE, 2015)

Legend:
- Food and non-alcoholic beverages
- Alcoholic beverages and tobacco
- Clothing and footwear
- Housing, water, electricity, etc.
- Furnishings, household equipment, etc.
- Health
- Transport
- Communication
- Recreation and culture
- Education
- Restaurants and hotels
- Miscellaneous goods and services
- Households final consumption (Billion current euros)
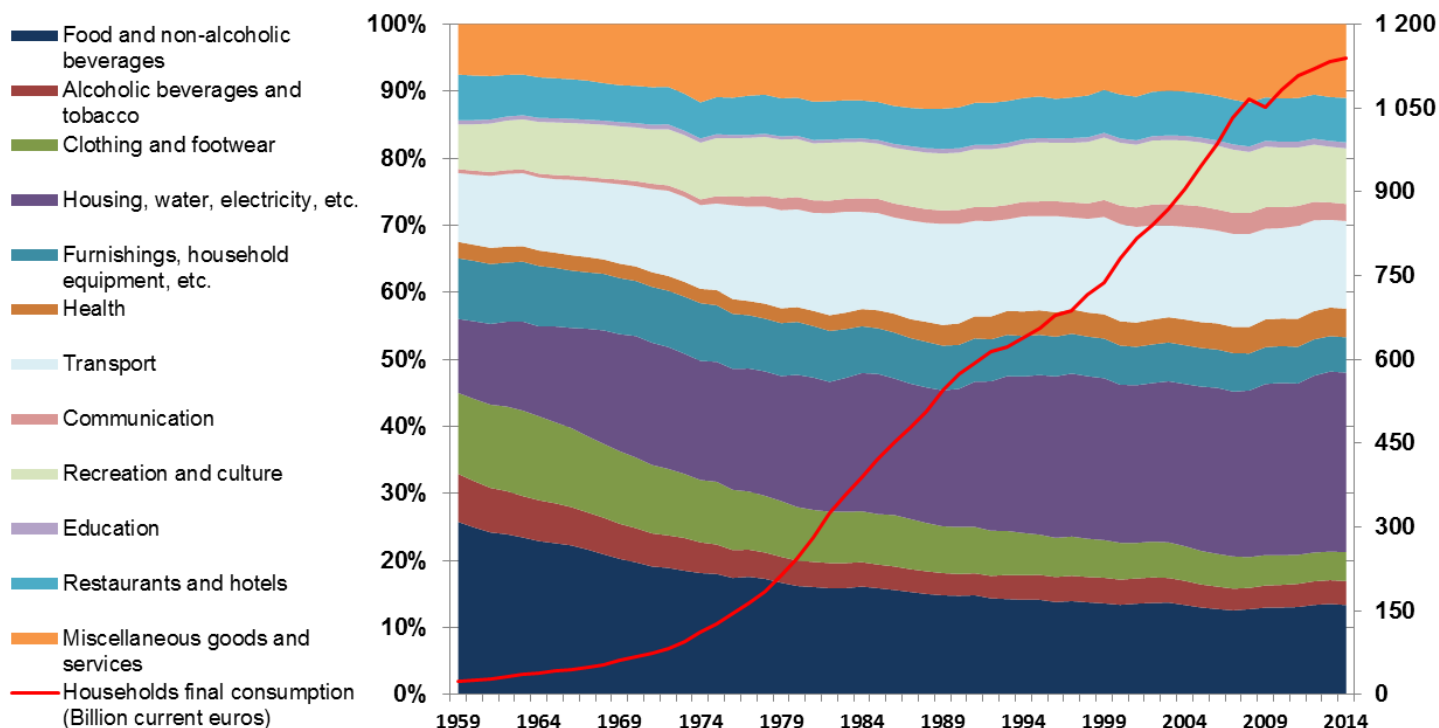
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A schematic description of the « waste footprint » of household consumption

$$\sum \text{[bin]} = \text{Waste footprint of households}$$

Coefficient-based model

End-of-life

Household consumption

Wearing apparel

Direct

| Agricultural products | Textiles | Chemicals | Energy | ... |

Indirect – Level 1

Economic activities

| Agricultural products | Fertilizers | ... | Agricultural products | Textiles | Chemicals | ... |

Indirect – Level 2

| Minerals | Chemicals | ... |

Waste Input-Output Analysis
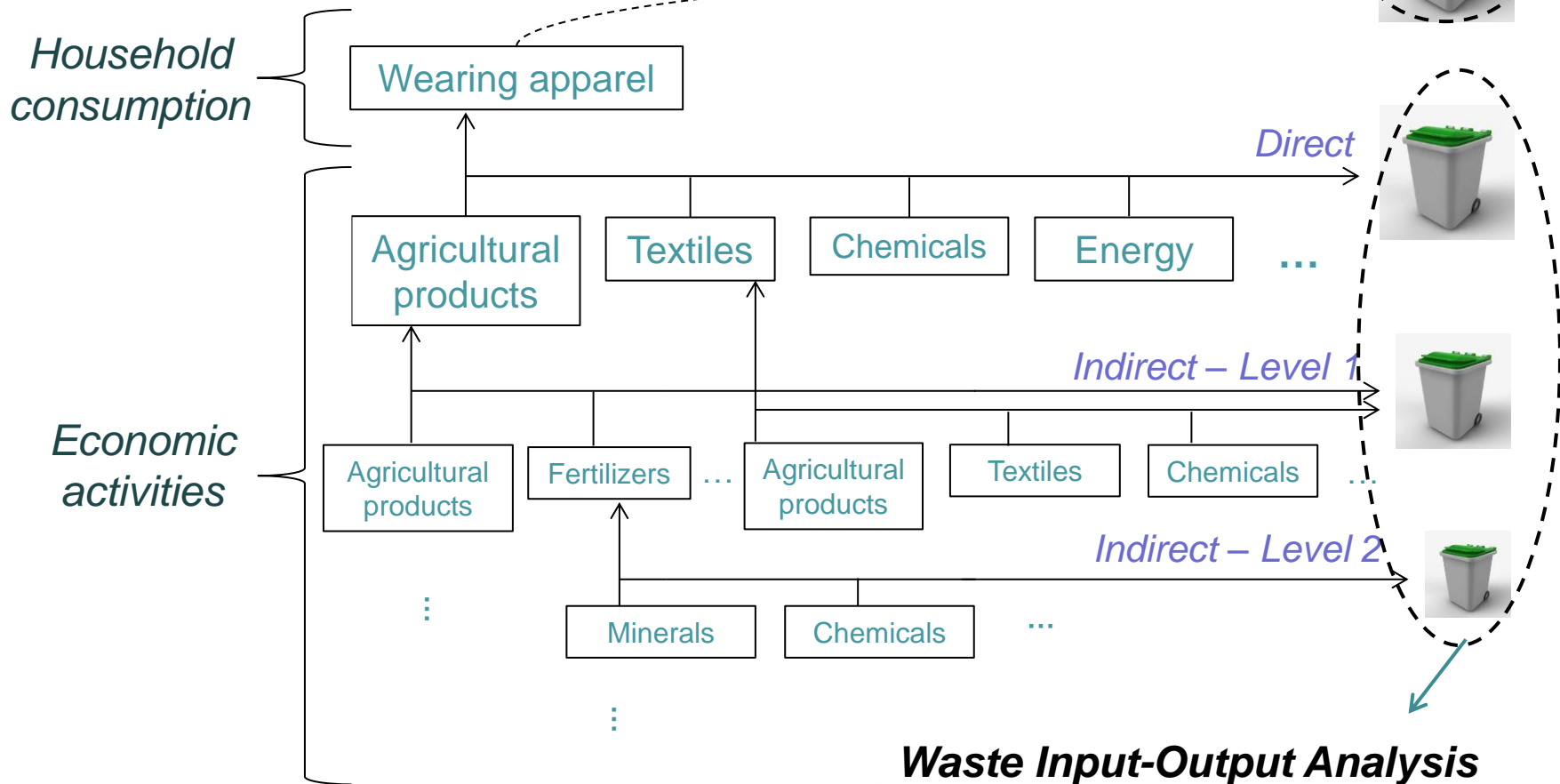
(Waste) Input Output Analysis: Theory

> ## Leontief Input-Output model

with y the vector of household consumption and W the (resulting) vector of waste induced by French household consumption

$$W = w(I - A)^{-1}\mathrm{y}$$

Technology matrix A - Coefficients in Meuros / Meuros	Excerpt from 64 economic activities		
Excerpt from 64 product categories	Food products, beverages	Computer, electronic and optical products	Motor vehicles
Products of agriculture, hunting	0.217	0.000	0.000
Fabricated metal products	0.010	0.043	0.083
Electricity, gas, steam	0.017	0.008	0.007

Table w of coefficients of waste generation (in tonnes / Meuros)	Excerpt from 64 economic activities		
Excerpt from 13 waste categories	Food products, beverages	Computer, electronic and optical products	Motor vehicles
Metallic wastes	0.344	0.481	15.99
Glass wastes	0.48	0.012	0.016
Paper and carboard wastes	1.576	0.874	0.802
Mixed and undifferentiated materials	3.51	0.767	1.505

> ## Table S of allocation of waste to treatments

$$W = S * Dw(I - A)^{-1}\mathrm{y}$$
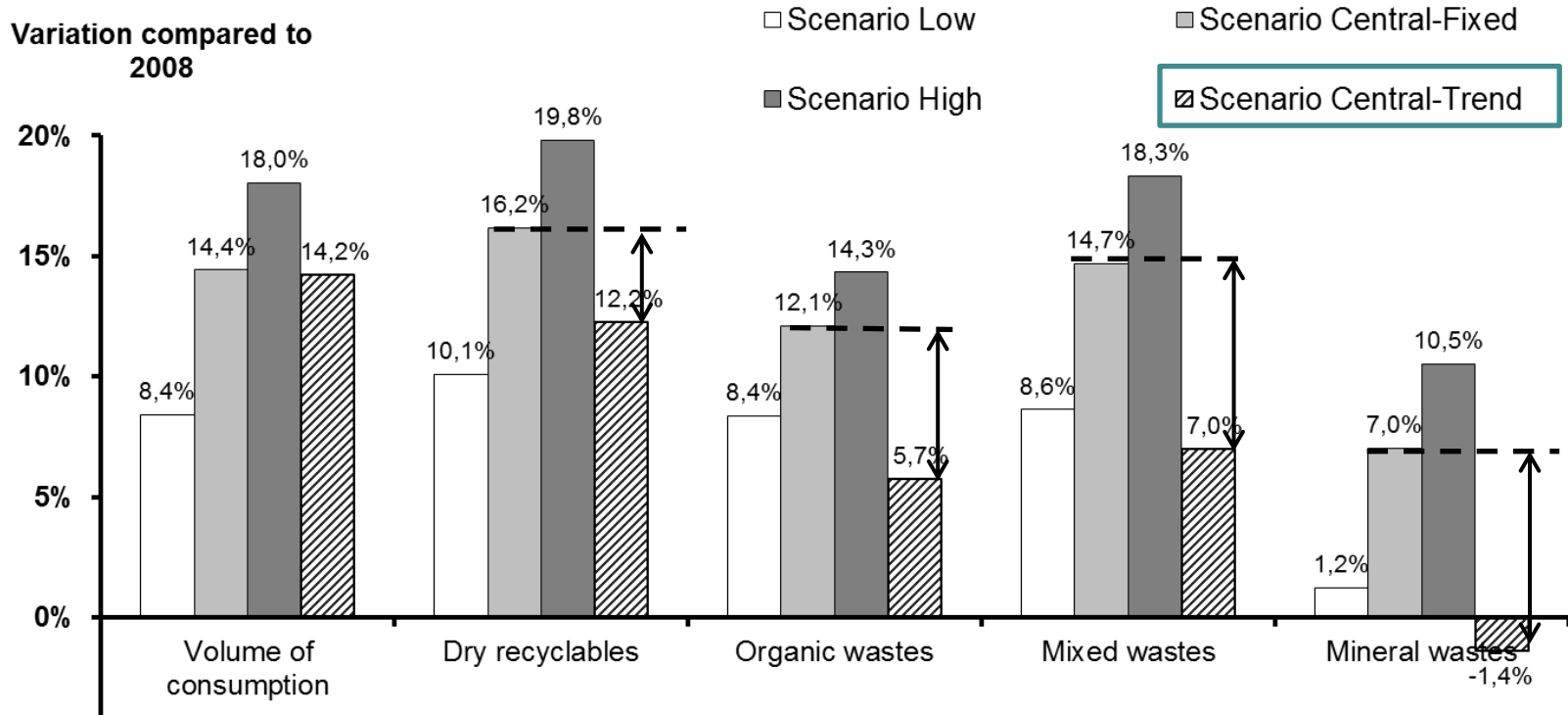
Scenarios of household consumption by 2020

> **Projections, by 2020,** of French household consumption considering "**Volume**" scenarios (High, Central, Low) and "**Composition**" scenarios ("Trend" or "Fixed"). Using the **NEMESIS model**.

> **Main model input parameters** : World GDP annual growth rate, French population, exchange rate, oil price, etc.

> **Model output**: GDP annual growth rate in « Volume » scenarios
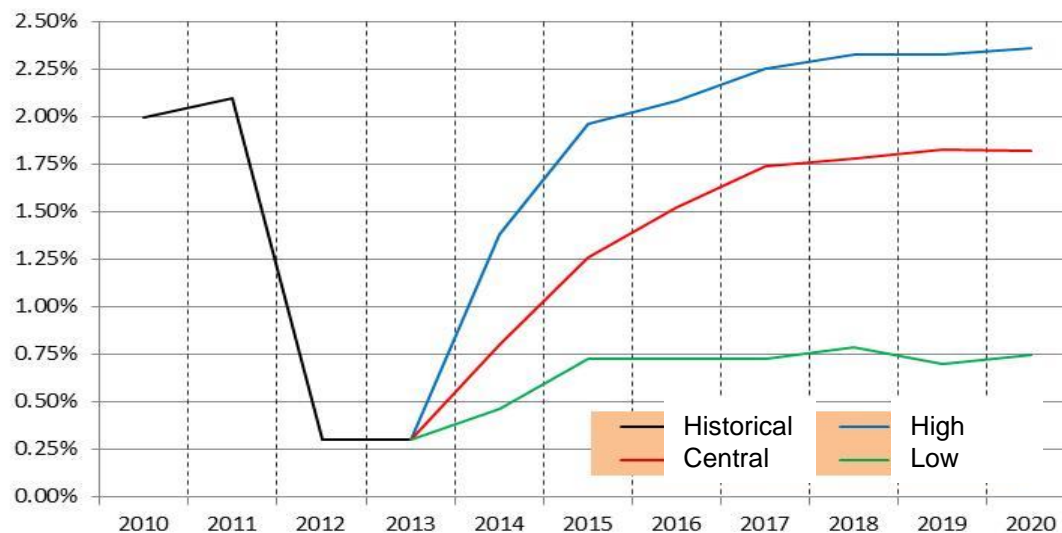
> In « Composition » scenarios, accounting for changes in consumption composition according to **past trends (1975-2010; « Trend »)** or assuming **no change (« Fixed »)**

Waste footprint of French households in 2020 compared to 2008 (in % of difference)

Variation compared to 2008

Legend:
- □ Scenario Low
- ■ Scenario Central-Fixed
- ■ Scenario High
- ▨ Scenario Central-Trend

Volume of consumption: 8,4% / 14,4% / 18,0% / 14,2%

Dry recyclables: 10,1% / 16,2% / 19,8% / 12,2%

Organic wastes: 8,4% / 12,1% / 14,3% / 5,7%

Mixed wastes: 8,6% / 14,7% / 18,3% / 7,0%

Mineral wastes: 1,2% / 7,0% / 10,5% / -1,4%

> Growth in organic, mixed and mineral waste footprints ≠ from growth in volume of consumption

> **Waste footprint of Central-Trend scenario:**
  - is **< to waste footprint of « Central-Fixed » scenario** for all waste categories **despite similar growth in volume**
  - is **< to waste footprint of « Low » scenario** for organic waste, mixed waste and mineral waste footprints, **despite a larger growth in volume**

Effects of changes in consumption composition on French household waste footprint by 2020

> If going on, the past 30-40 year-trends in changes in household consumption composition would favour:

- « **relative** » **decoupling** between « household consumption » and « waste footprint » **regarding dry recyclables, mixed wastes and organic wastes**

- « **absolute** » **decoupling regarding mineral wastes**

> **Why? A closer look at products:**

- **due to the reduction in the share of expenses related to primary needs** (in particular food products)

- and **despite the increase in the share of expenses related to secondary needs** (e.g. emerging Information and Communication Technologies).

> But « relative » decoupling is ≠ from decrease in waste generation!

Scenarios of increase in recycling by 2020

1. **Scenario « Recycling of sorted fractions »**

- Increase in the recycling of fractions sorted but not entirely recycled
- E.g. mineral waste, from 66% in 2008 to 80% in 2020

**2.** **Scenario « Sorting centers »**

Increase in the recycling of waste from economic activities disposed of at recycling centers

	2008	Hypothesis 2020
Recycling	38%	55%
Incineration with energy recovery (incl. RDF)	5%	25%
Landfilling	57%	20%

3. **Scenario « Source segregation »**

- Increase in the sorting of some waste categories mixed in household and similar waste
- +10% for organic waste, glass, papers and carboards, plastics, metals and textiles

"Non-mineral waste disposal" footprint of French households in 2020 compared to 2008 (in % of difference)
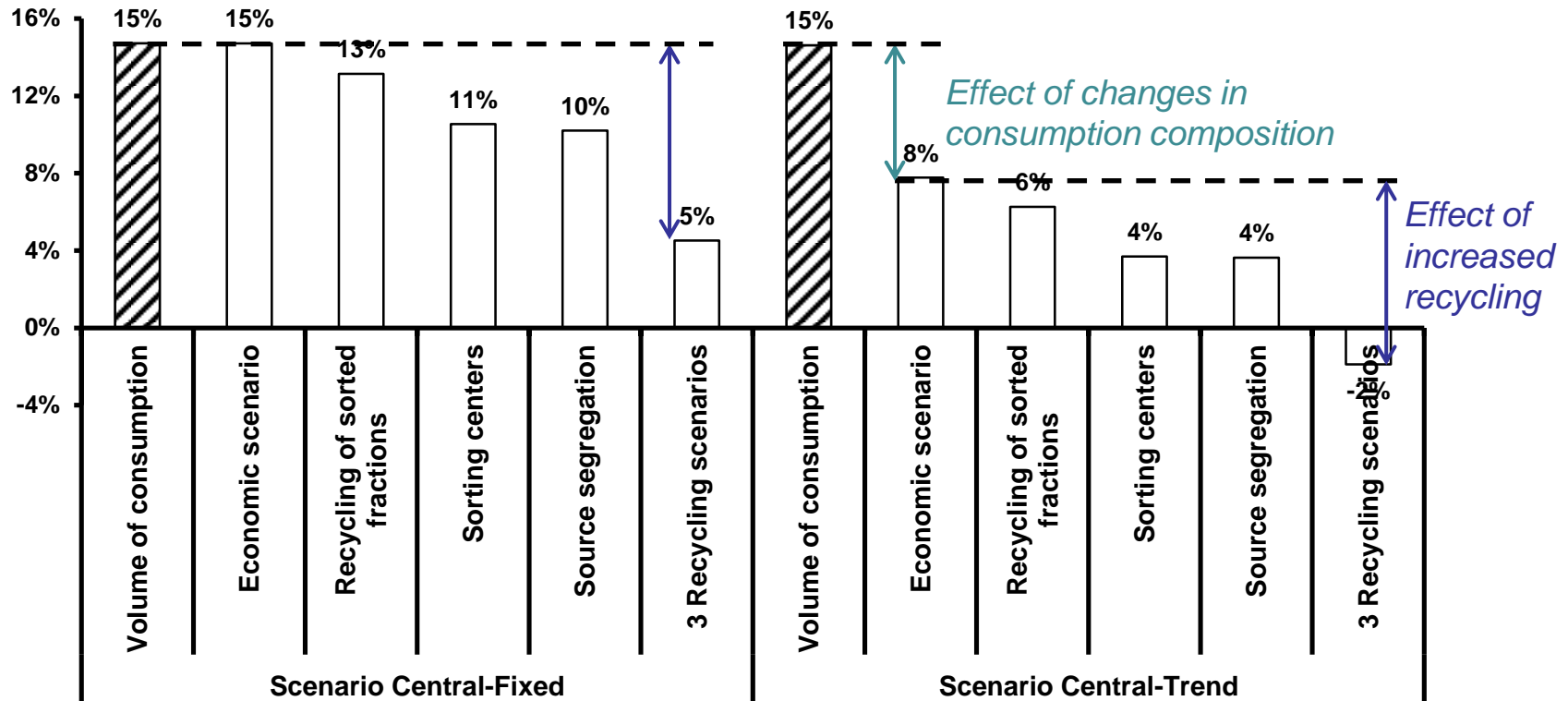
> **Recycling scenarios combined with « Central-Fixed » economic scenario:** limit the growth in non-mineral waste disposal induced by growth in consumption **(« relative » decoupling)**

> **Recycling scenarios combined with « Central-Trend » economic scenario:** **« absolute » decoupling** if simulaneously implemented with the 3 recycling scenarios

Effects of growth in recycling on the "non-mineral waste disposal" footprint of French households by 2020

> **Policies aiming at the increase in recycling may enable to limit the effects of consumption growth on French household waste footprint** between 2008 and 2020 (« Trend » context)

> **But other actions (ecodesign, prevention, etc.) would be necessary:**

- To go beyond (« absolute » decoupling)
- Because derivation to recycling is limited at some point (e.g. source segregation of mixed wastes can not be 100%-efficient)

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Thank you for your attention

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To go beyond…

Regarding theory and Input-Output data compilation

Beylot A., Boitier B., Lancesseur N. and Villeneuve J. (2016). A consumption approach to wastes from economic activities. Waste Management, Volume 49, March 2016, Pages 505-515

Regarding household waste footprint in 2020 (economic scenarios)

Beylot A., Boitier B., Lancesseur N. and Villeneuve J. (2016). The waste footprint of French households in 2020. A comparison of scenarios of consumption growth using Input-Output Analysis. Submitted to the Journal of Industrial Ecology.

Other references
INSEE (2015). Consommation finale effective des ménages par fonction à prix courants. http://www.insee.fr/