



Chaire Modélisation prospective
au service du développement durable



Lifestyles, time use and energy demand: a macro-micro long term analysis

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Outline

1. Introduction
2. Microeconomic data set
3. Macro-micro dialogue
4. Scenario analyses
5. Conclusion

Consumption patterns, energy and emissions

Changes in lifestyle will be necessary

(Biesiot et Noorman, 1999; Jackson, 2009; Moriarty et Honnery, 2010)

“Fundamental changes in the way societies produce and consume are indispensable for achieving global sustainable development.”

(United Nations, 2002)

“Deep cuts in emissions will require a diverse portfolio of policies, institutions, and technologies as well as changes in human behaviour and consumption patterns.”

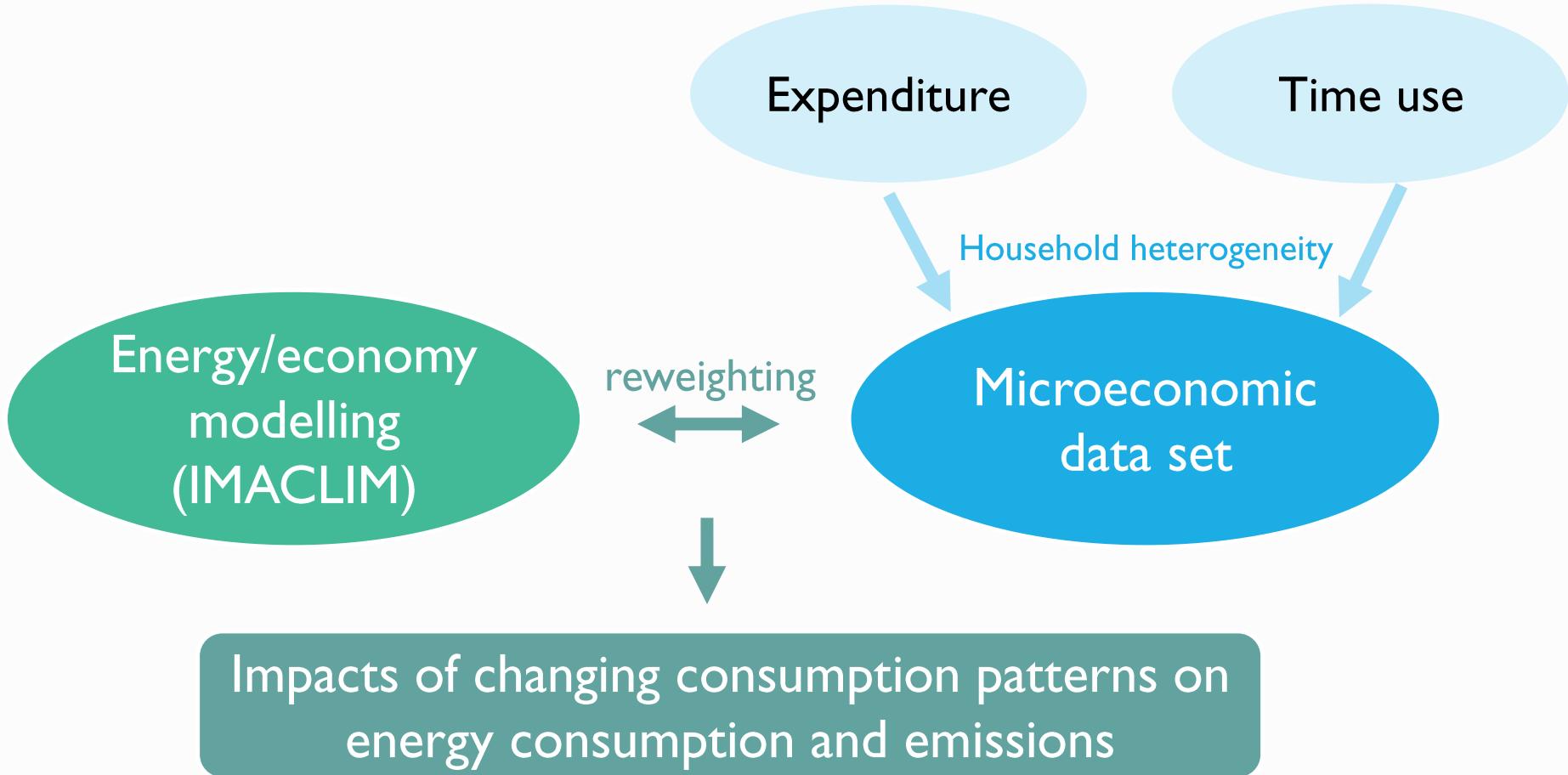
(IPCC, 2014)

Modelling household consumption

Major limits of standard CGE models:

- Lack of realism in consumption trade-offs particularly concerning energy
Nested CES functions inc. energy aggregate
- Lack of heterogeneity (“representative household”) Even when some disaggregation exists, it is limited to income

Our approach



Building the data set

Matching 2 main data sets:

- French time use survey (EDT 2009-2010)
- French expenditure survey (BDF 2010-2011)

Additional treatments:

- Disaggregation of energy expenditure by end use / activity
- Disaggregation of travel time and travel expenditure
- Price / quantity decomposition of energy expenditure



Detailed time use (plus travel time), energy use and non-energy expenditure for 13 everyday activities, for 14 535 households

Macro-micro dialogue: salient features

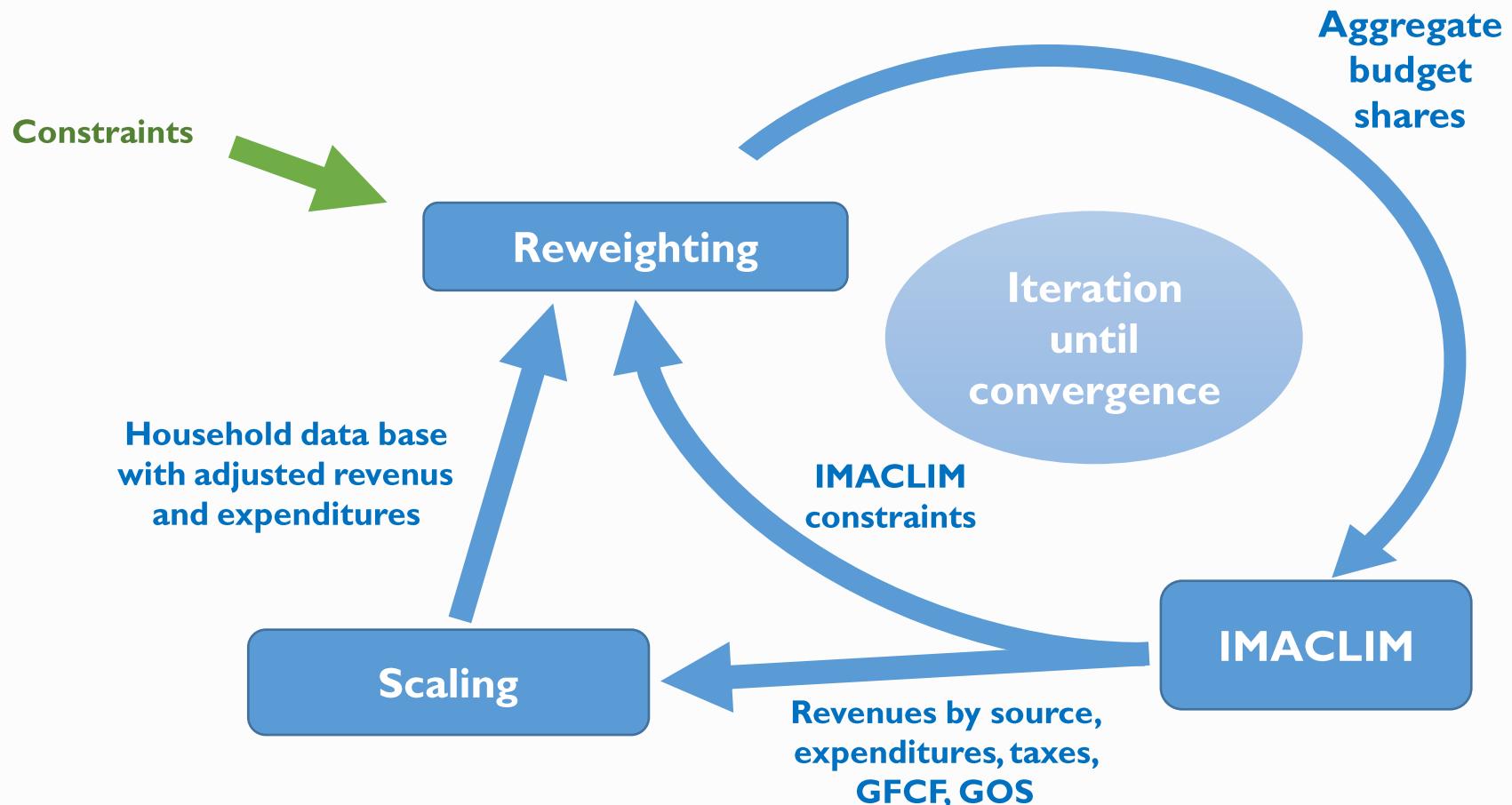
Use a **reweighting technique** to link the micro data base and the macroeconomic model



Analyse changes in lifestyle based on observed behaviour

Macro-micro dialogue overview

LIFESTYLE SCENARIOS



Scenario analyses

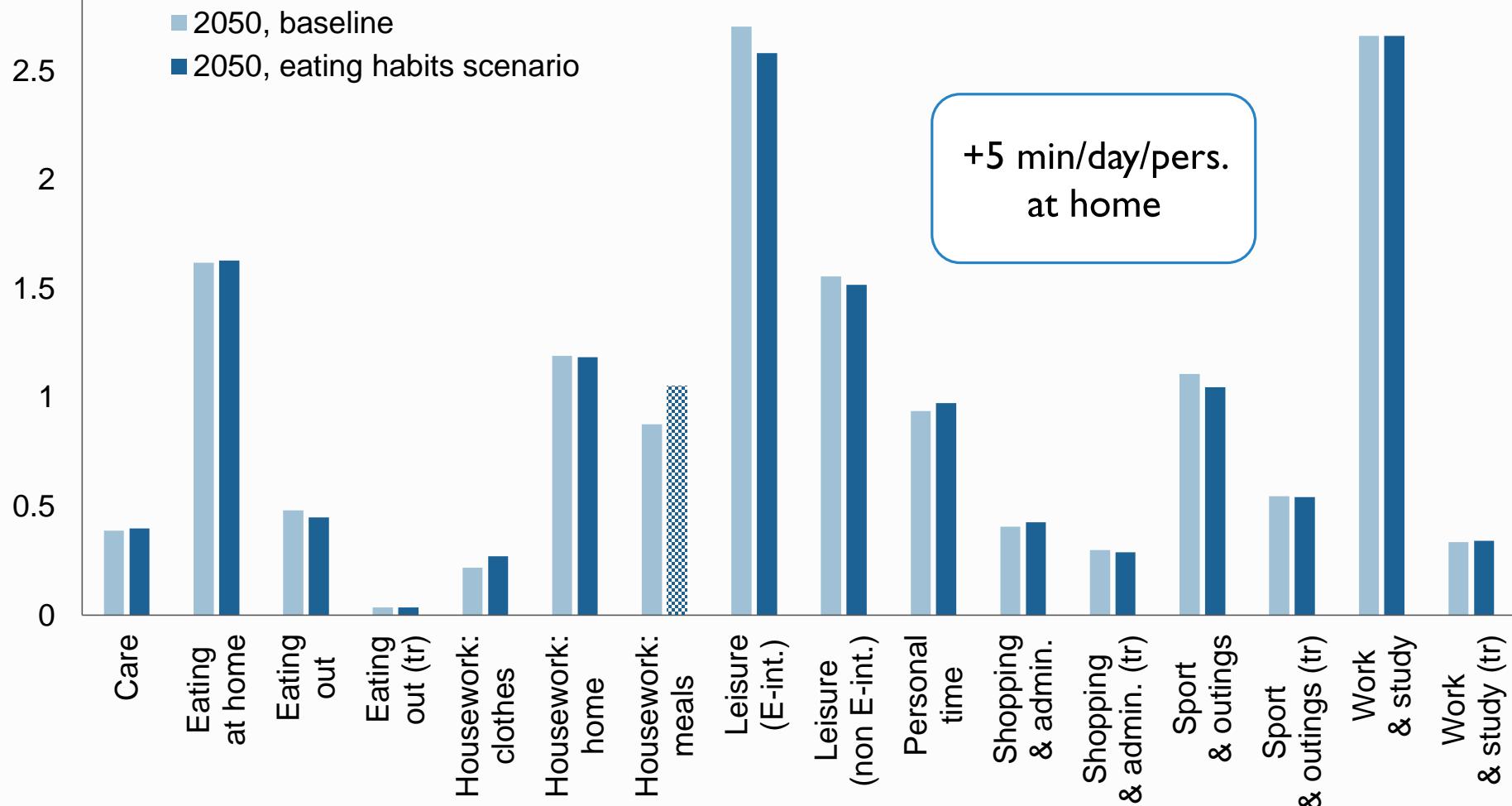
1st scenario: eating habits

Hypothesis (relative to baseline):

+20% “Housework: meals” time

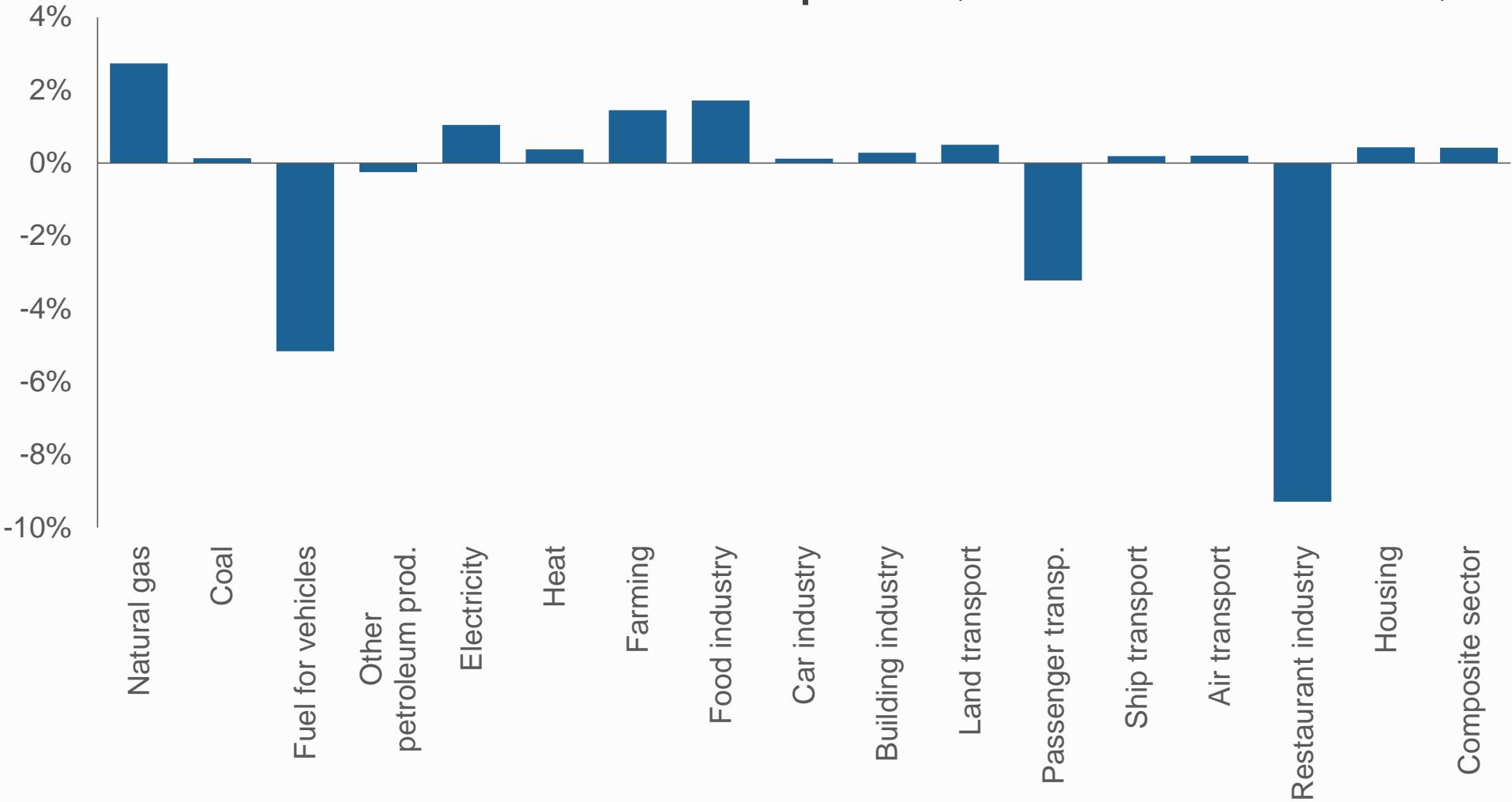
1st scenario: eating habits

Results: time use (h/day/pers.)



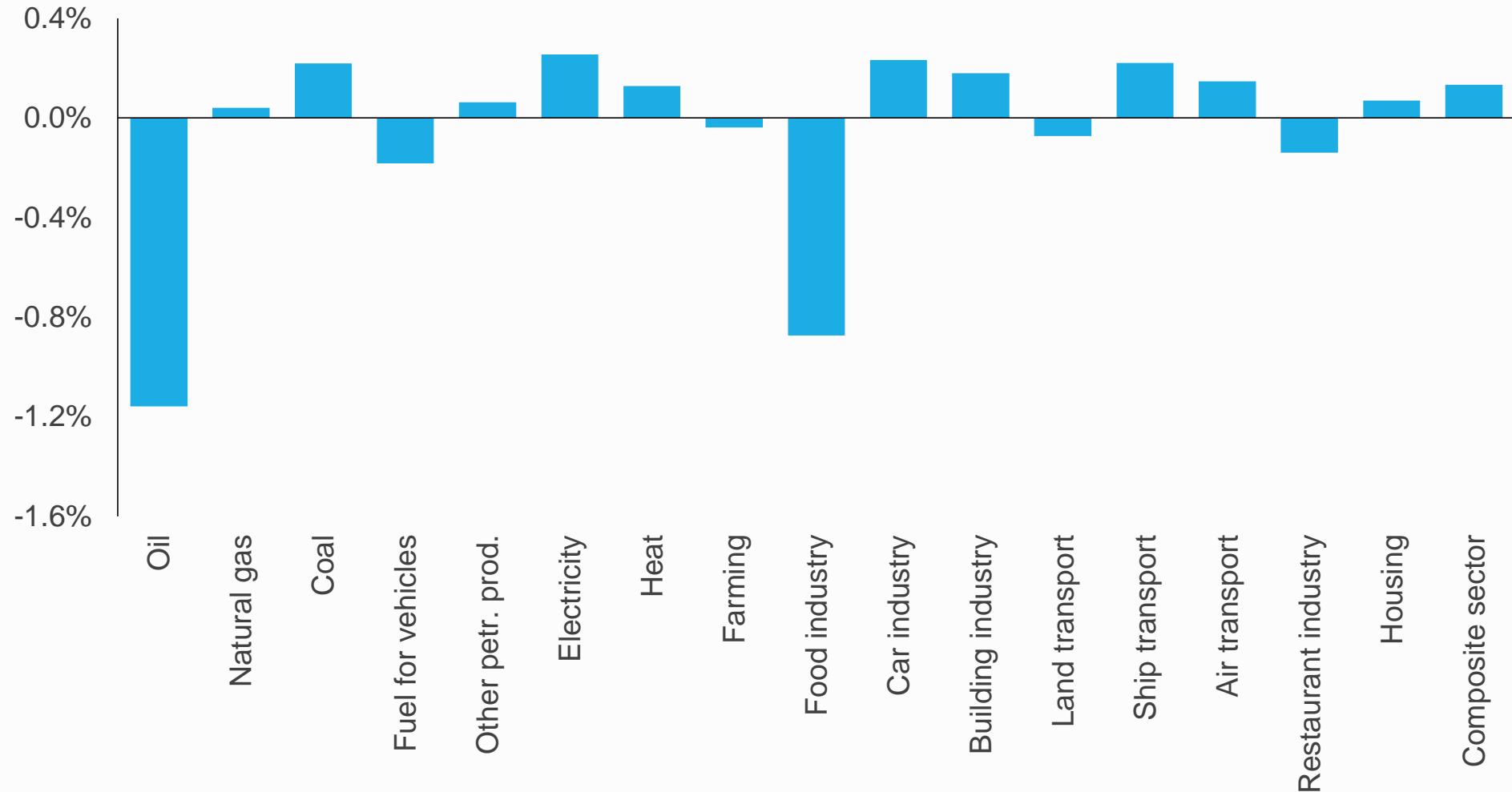
1st scenario: eating habits

Results: household consumption (volumes, relative to baseline)



1st scenario: eating habits

Results: intermediate consumption (volumes, relative to baseline)



1st scenario: eating habits

Results: energy use and emissions (relative to baseline)

	Energy use	CO ₂ emissions
Households	-0.2%	-1.3%
Firms	-0.3%	0.0%
Total	-0.3%	-0.3%

2nd scenario: e-commerce

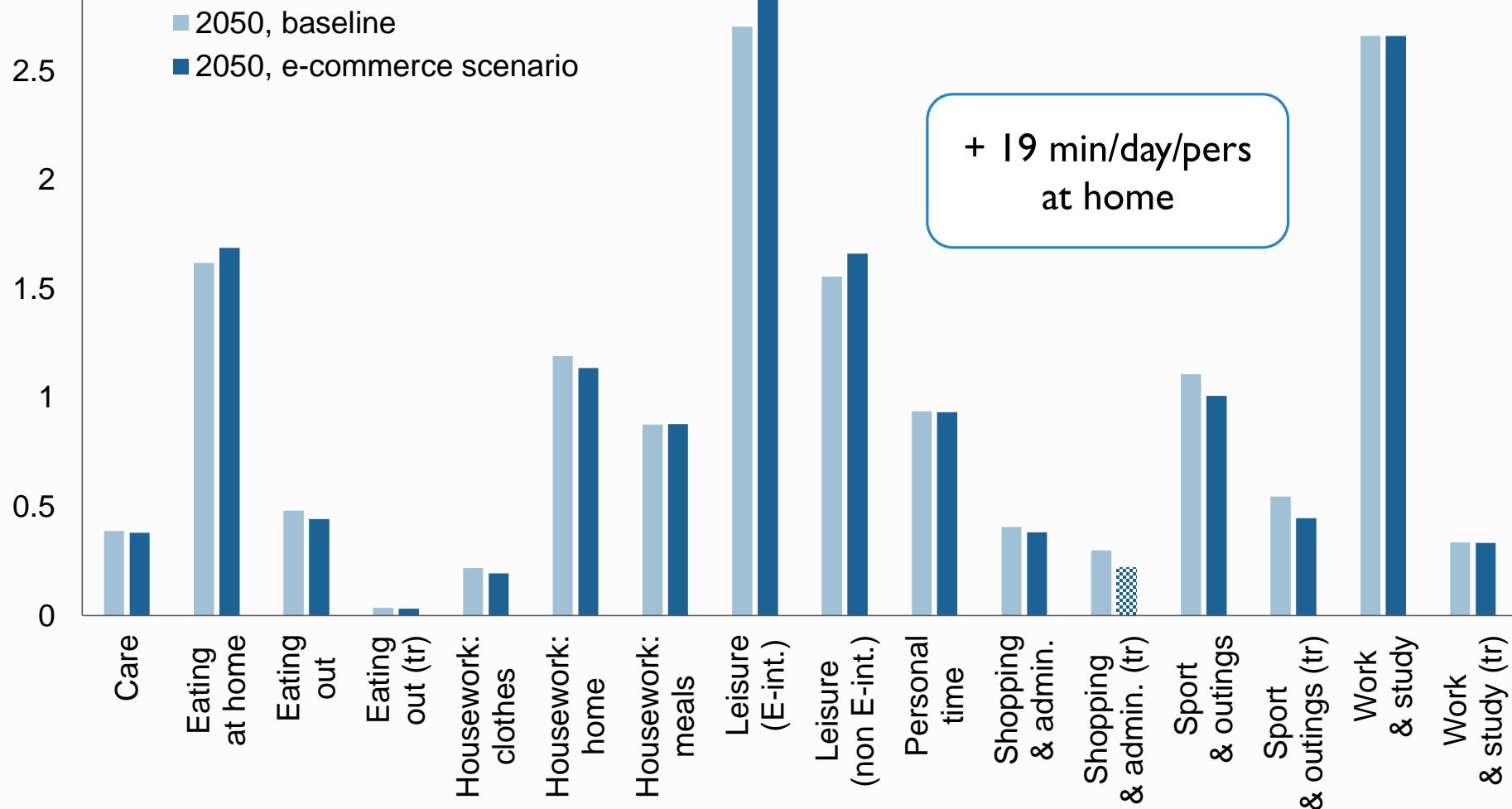
Hypotheses (relative to baseline):

- 78.0% travel associated with shopping in superstores
 - -26.5% “Shopping & admin.” travel time
- 6.6% fuel expenditure
- 7.1% expenditure on new cars
- 1.1% passenger transport expenditure

Based on an e-commerce scenario analysis by The Shift Project
(« Décarboner la mobilité dans les zones de moyenne densité », 2017)

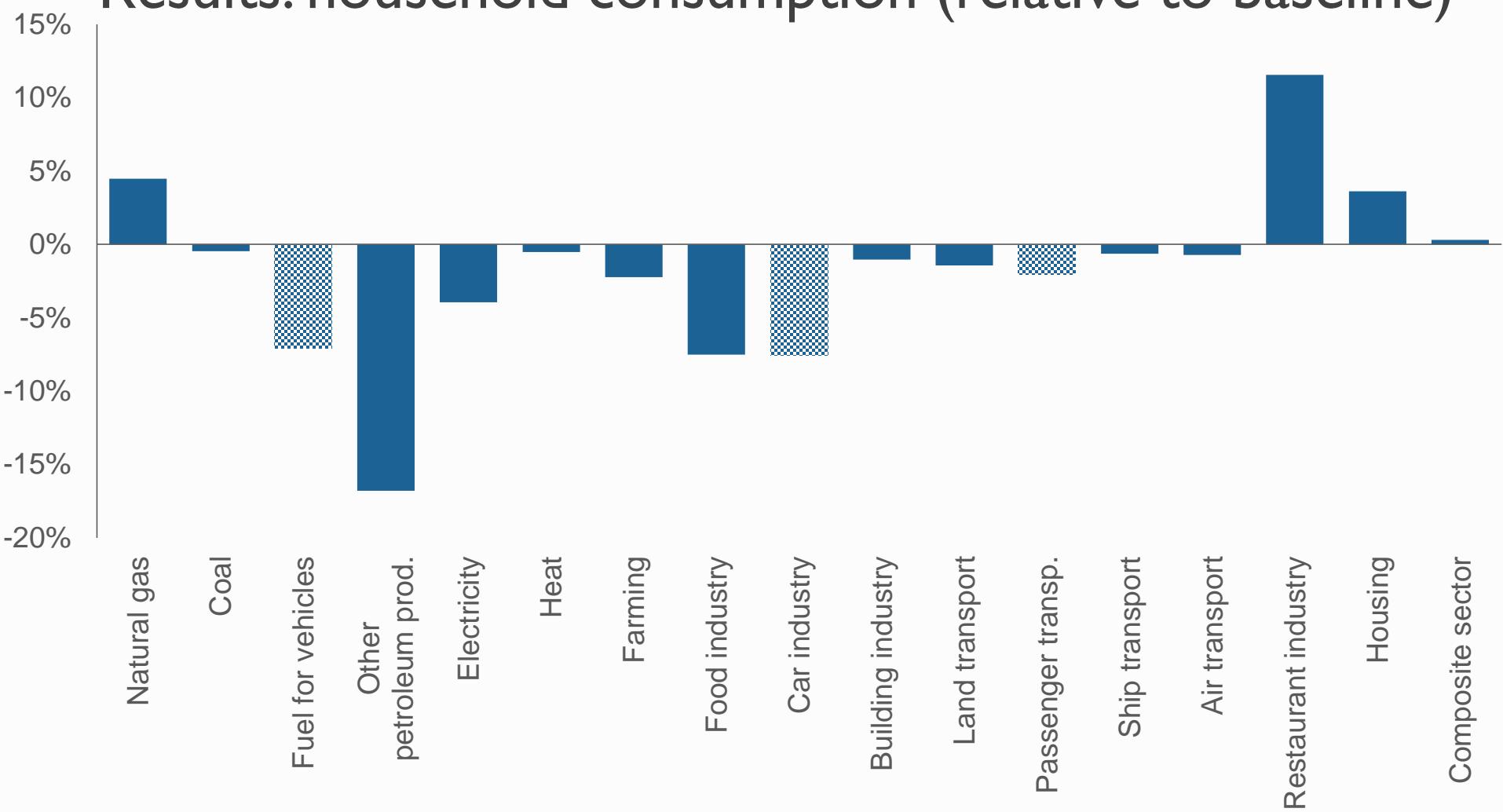
2nd scenario: e-commerce

Results: time use (h/day/pers.)



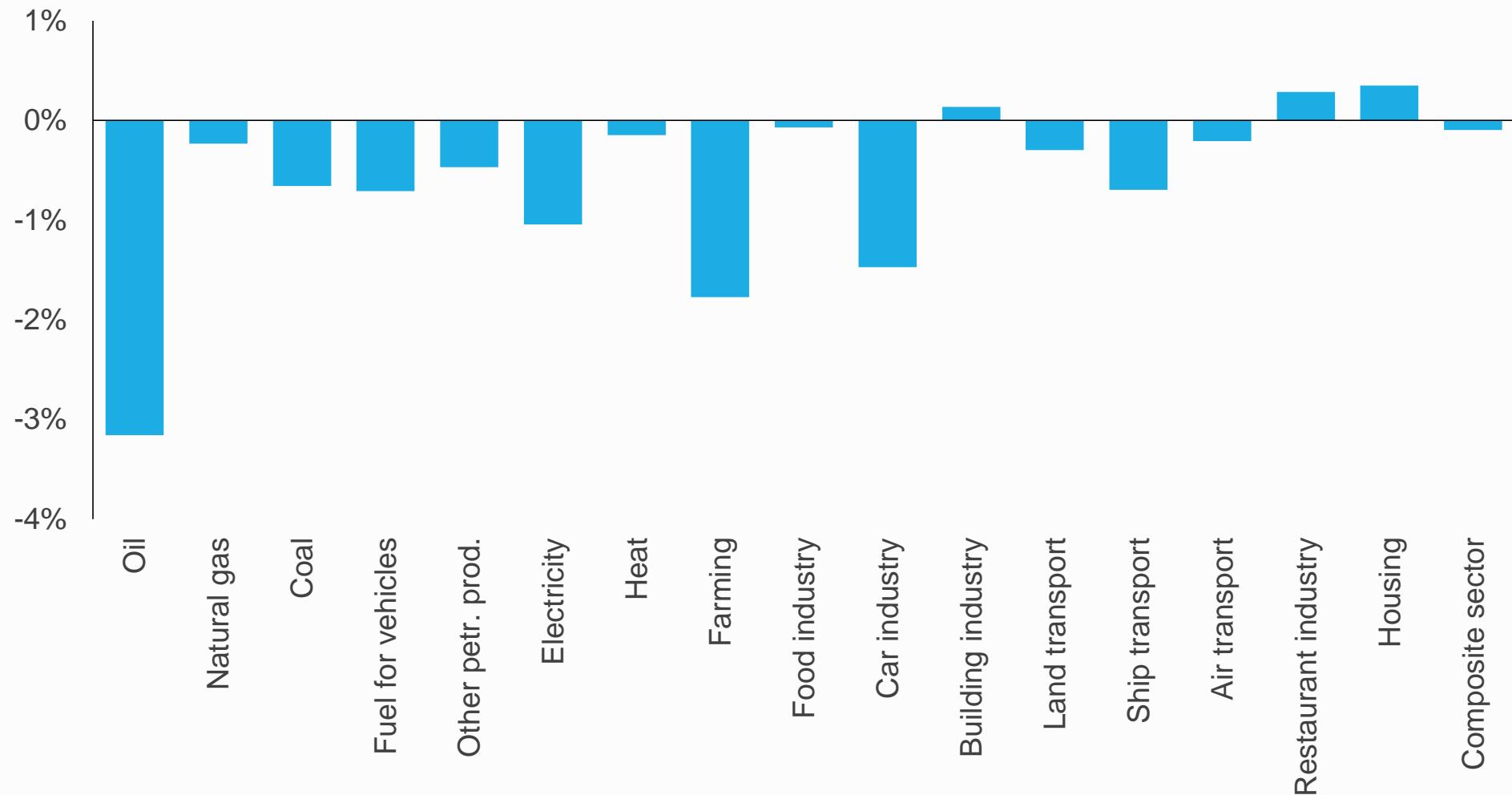
2nd scenario: e-commerce

Results: household consumption (relative to baseline)



2nd scenario: e-commerce

Results: intermediate consumption (volumes, relative to baseline)



2nd scenario: e-commerce

Results: energy use and emissions (relative to baseline)

	Energy use	CO ₂ emissions
Households	-3.4%	-4.0%
Firms	-1.3%	-0.7%
Total	-1.7%	-1.5%

Direct effect of the hypotheses (without macro effects):
-2.9% household emissions and -0.7% total emissions

Conclusion

Main advantages:

- Study of lifestyle change scenarios with coherent time use patterns, based on observed behaviours
- Time rebound effects are taken into account
- Household heterogeneity is taken into account
- Versatility (all microeconomic variables can be constrained).

Thank you

Appendix

Baseline scenario results

	2010	2050 baseline	Diff. %
Energy use (Mtep)	233.7	188.2	-19.4%
<i>Households</i>	60.0	37.7	-37.2%
<i>Industry</i>	173.6	150.5	-13.3%
CO2 emissions (Mt)	378.8	291.9	-22.9%
<i>Households</i>	131.0	66.5	-49.3%
<i>Industry</i>	247.8	225.4	-9.0%
Real GDP (M€)	1 937 168	3 037 979	+56.8%
			(+1.1% per year)

Baseline scenario results (2)

	2010	2050
Household energy expenditure share	6.7%	3.4%
Household energy consumption (Mtep)		
Electricity	13.6	13.3
Natural gas	14.4	11.0
Coal	0.5	0.2
Fuel for vehicles	23.5	9.8
Other petr. prod.	8.0	3.3
Heat	0.1	0.0

1st scenario: eating habits

Results: macroeconomic effects (relative to baseline)

Production volumes	
Restaurant industry	-7.6%
Passenger transport	-3.2%
Fuel for vehicles	-1.7%
Farming	+0.5%
Food industry	+0.5%
Real GDP	+0.1%
Real gross disposable household revenues	0.0%

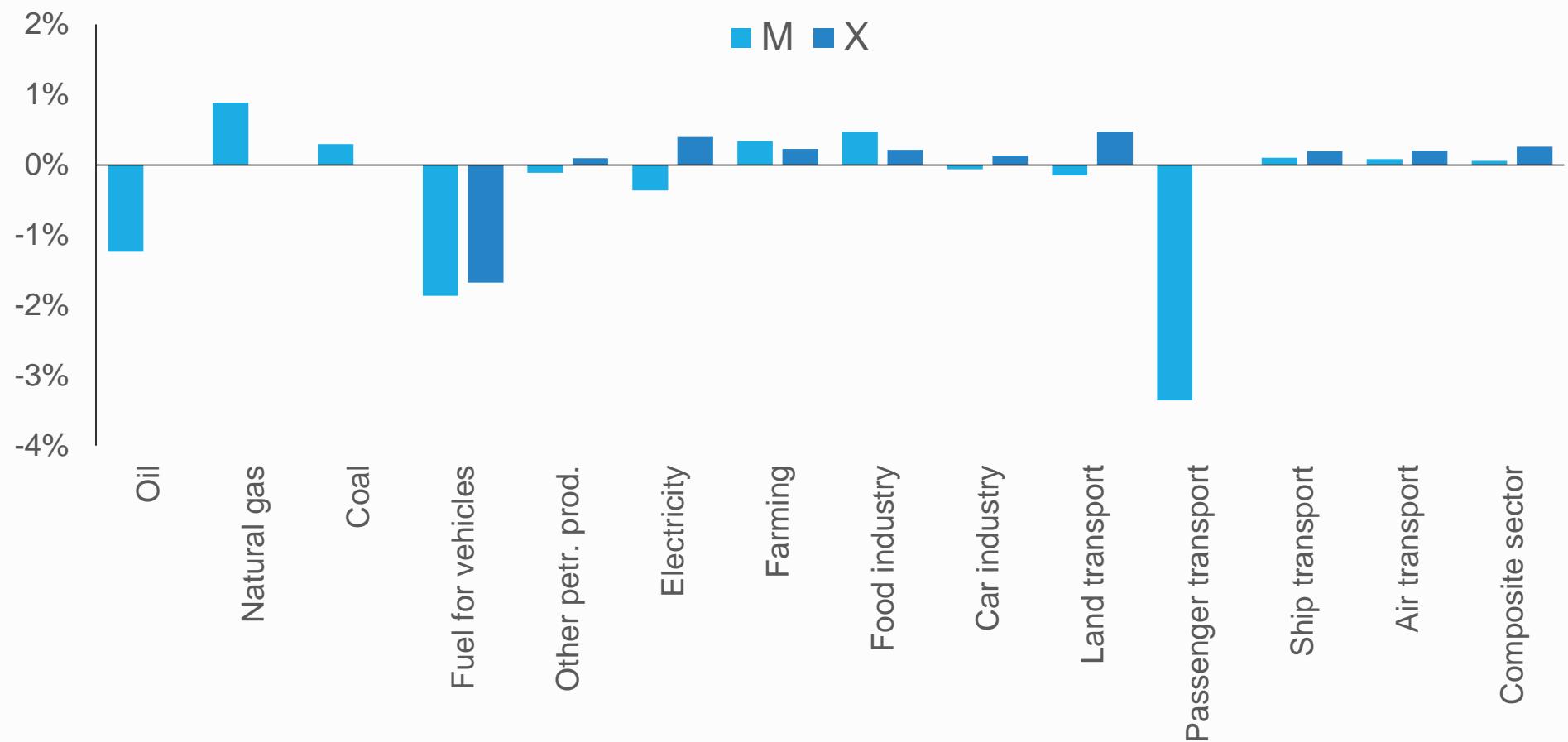
1st scenario: eating habits

Results: GDP decomposition (real terms)

	Baseline	Eating habits	Diff.	Diff. %
pC*C	1 631 685	1 633 109	1 423	+0.1%
pG*G	731 543	732 318	776	+0.1%
PI*I	633 949	635 045	1 096	+0.2%
pX*X	698 243	700 324	2 081	+0.3%
pM*M	657 441	659 566	2 124	+0.3%
GDP	3 037 979	3 041 231	3 252	+0.1%

1st scenario: eating habits

Results: trade balance



2nd scenario: e-commerce

Results: macroeconomic effects (relative to baseline)

Production volumes	
Restaurant industry	+9.4%
Other petroleum products	-4.1%
Food industry	-3.8%
<i>Car industry</i>	-3.1%
<i>Fuel for vehicles</i>	-2.8%
Housing	+2.4%
<i>Passenger transport</i>	-2.1%
Real GDP	+0.1%
Real gross disposable household revenues	+0.3%

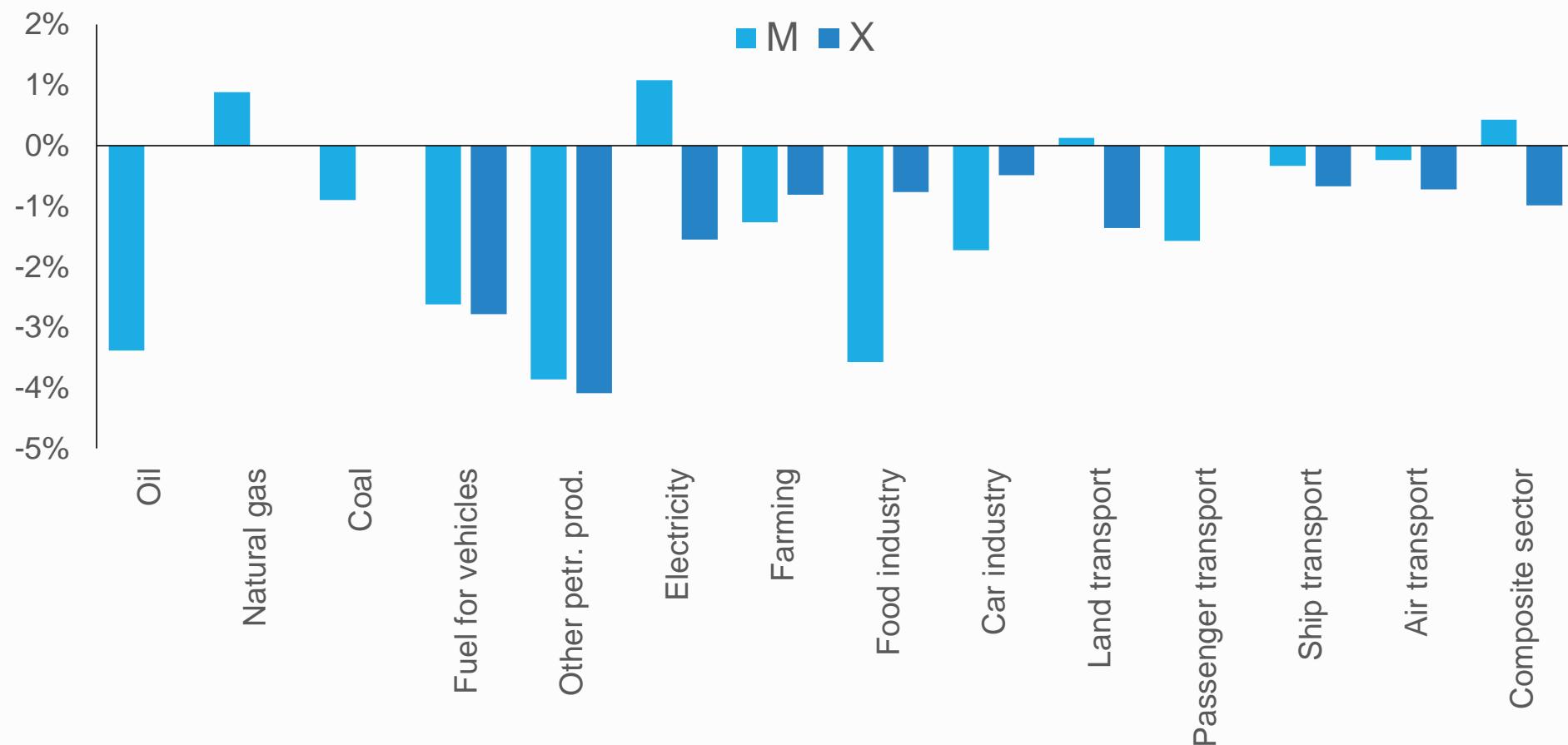
2nd scenario: e-commerce

Results: GDP decomposition (real terms)

	Baseline	E-commerce	Diff.	Diff. %
pC*C	1 631 685	1 632 923	1 238	0.1%
pG*G	731 543	732 118	575	0.1%
PI*I	633 949	634 353	404	0.1%
pX*X	698 243	689 909	-8 334	-1.2%
pM*M	657 441	649 339	-8 103	-1.2%
TOT	3 037 979	3 039 964	1 985	0.1%

2nd scenario: e-commerce

Results: trade balance



GDP shares by sector

	Reference (%)	Eating habits (%)	E-commerce (%)	Shared transport (%)
Oil	0.01%	0.01%	0.01%	0.01%
Natural gas	0.25%	0.25%	0.26%	0.25%
Coal	0.01%	0.01%	0.01%	0.01%
Fuel for vehicles	0.61%	0.60%	0.59%	0.55%
Other petr. prod.	0.12%	0.12%	0.11%	0.12%
Electricity	1.58%	1.58%	1.54%	1.57%
Heat	0.01%	0.01%	0.01%	0.01%
Farming	2.44%	2.45%	2.39%	2.40%
Food industry	3.08%	3.10%	2.95%	3.02%
Car industry	1.48%	1.48%	1.42%	1.46%
Building industry	5.25%	5.25%	5.25%	5.25%
Land transport	0.15%	0.15%	0.16%	0.16%
Passenger transport	0.42%	0.41%	0.41%	0.45%
Ship transport	0.09%	0.09%	0.09%	0.09%
Air transport	0.40%	0.40%	0.40%	0.40%
Restaurant industry	1.53%	1.41%	1.68%	1.48%
Housing	10.69%	10.72%	10.93%	10.61%
Composite sector	71.88%	71.96%	71.82%	72.16%
Total GDP (M€)	3 037 979	3 041 231	3 039 964	3 030 670

Labour share in value added

BASELINE SCENARIO

Oil	18.2%
Natural gas	45.2%
Coal	23.2%
Fuel for vehicles	1.5%
Other petr. prod.	4.2%
Electricity	22.3%
Heat	37.9%
Farming	31.0%
Food industry	23.5%
Car industry	17.5%
Building industry	73.0%
Land transport	940.6%
Passenger transport	92.8%
Ship transport	56.4%
Air transport	77.1%
Restaurant industry	73.7%
Housing	6.8%
Composite sector	69.7%