



Chaire Modélisation prospective
au service du développement durable

Centre International de Recherche sur
l'Environnement et le
Développement
Paris, France



Hybrid Input-Output tables for CGE model calibration and consequences on energy policy analysis

Gaëlle LE TREUT

Emmanuel COMBET

Frédéric GHERSI

Julien LEFEVRE

GTAP, Dakar - June 18th, 2014

Why building hybrid Input-Output table

- ❑ Overcoming the limits of Bottom-Up and Top-Down approaches
 - Articulation between technical systems and the global economy
 - ❑ Enriching the picture of the economy (material content)
 - To embark the most relevant information available
- ➡ In practice: building accounting tables both in monetary values and physical quantities
- Combining input-output tables and balances of physical flows
 - Simultaneous equilibrium of economic and material flows linked by price system (*Arrow-Debreu*)

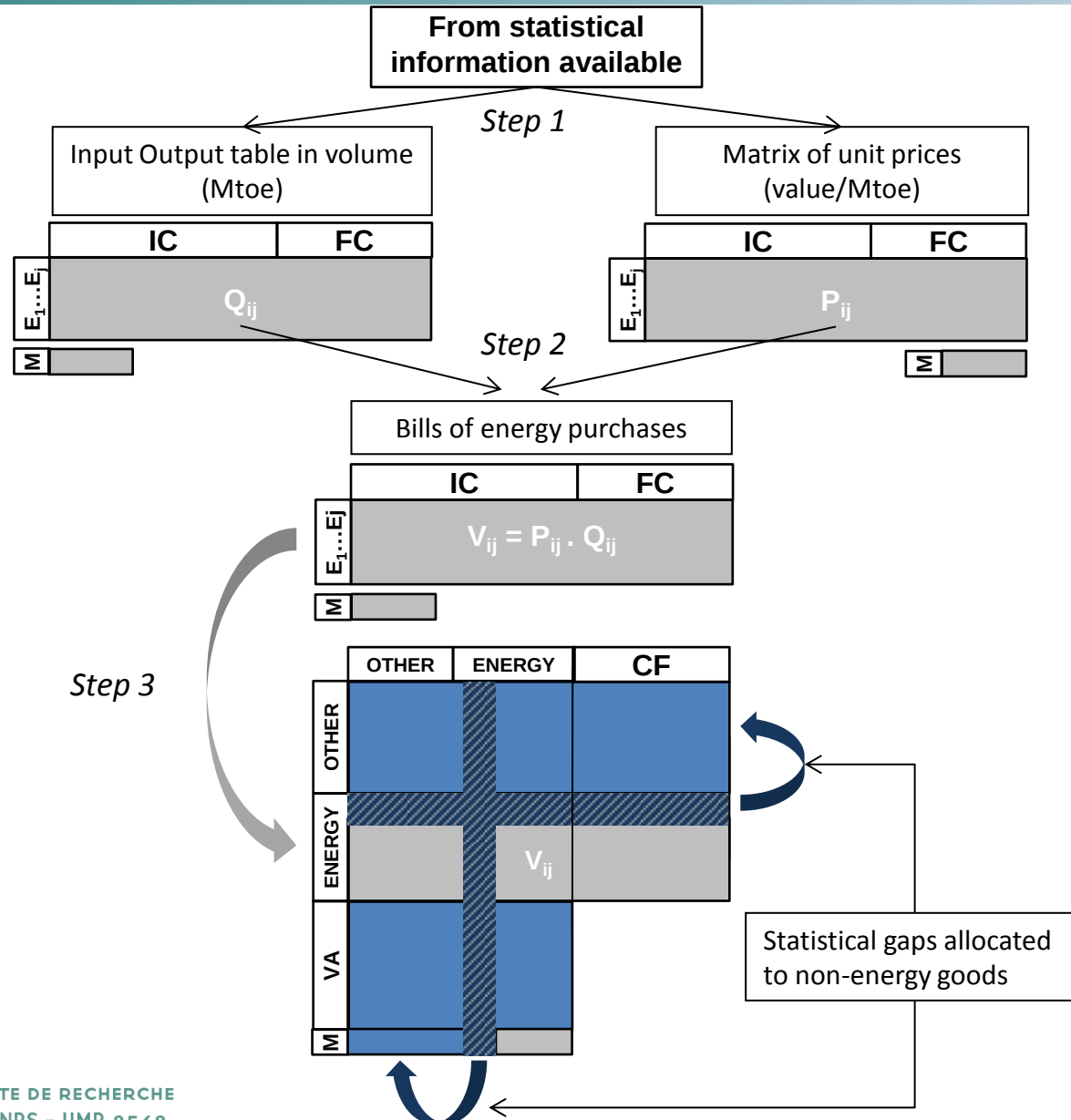
Outlines

- ❑ An illustration of hybridization: procedure for IMACLIM
- ❑ Application on French data (2010)
- ❑ CGE model calibration: consequences for energy policy analysis
 - Calibration on IMACLIM hybrid matrices
 - “Standard” calibration on non-hybrid matrices

Hybridization procedure for IMACLIM models

- ❑ **Basic accounting principles for consistent methods**
 - Physical and money descriptions must respect conservation principles **and** must be linked by a system of price
- ➡ Different procedures for bridging statistical gaps
- ❑ **Choices made in developing hybrid methods for the IMACLIM modelling framework**
 - The total size of the economy is preserved (GDP)
 - Data on energy quantities and prices faced by economic agents are introduced

IMACLIM hybridization procedure



Input-Output tables - Aggregated results

France 2010

National accounts values

2010 - Million of euros	Intermediate consumption		Final consumption				Total uses
	Composite	Energy	HH Cons	Gov	Invest	Exports	
Composite	1 563 850	40 288	1 010 980	521 643	376 721	444 564	3 958 046
Energy	80 001	88 622	80 350	-	-	15 589	264 561
Labour net	732 458	8 010					4 222 607
Labour taxes	401 063	4 386					
Output taxes	55 339	1 967					
Operating surplus	522 131	16 061					
Total output	3 354 841	159 333					
Imports	448 519	64 145					
VAT	120 266	15 313					
Excise E IC	-	-					
Excise E FC	-	-					
Excise Oth.	34 420	25 770					
Total supply	3 958 046	264 561	4 222 607				

Hybrid values

2010 - Million of euros	Intermediate consumption		Final consumption				Total uses
	Composite	Energy	HH Cons	Gov	Invest	Exports	
Composite	1 651 628	27 516	1 019 041	521 643	376 721	443 497	4 040 047
Energy	59 387	34 229	72 289	-	-	16 656	182 561
Labour net	734 346	6 122					4 222 607
Labour taxes	402 097	3 352					
Output taxes	55 836	1 470					
Operating surplus	526 016	12 176					
Total output	3 429 310	84 865					
Imports	454 823	57 841					
p/cost marg compo	-	9 279					
p/cost marg Energy	-	-17 346					
p/cost marg HH cons	-	8 913					
p/cost marg Gov	-	-					
p/cost marg Invest	-	-					
p/cost marg Exports	-	-846					
VAT	120 847	14 732					
Excise E IC	-	7 199					
Excise E FC	-	16 378					
Excise Oth.	35 067	1 546					
Total supply	4 040 047	182 561	4 222 607				

Energy price for
HH/composite
ratio

National Acc.	1
Hybrid Acc.	2.0

	Energy share in uses	Firms share in energy expenses	Energy share in HH consumption	Energy cost share in compo output
--	-------------------------	--------------------------------------	--------------------------------------	--------------------------------------

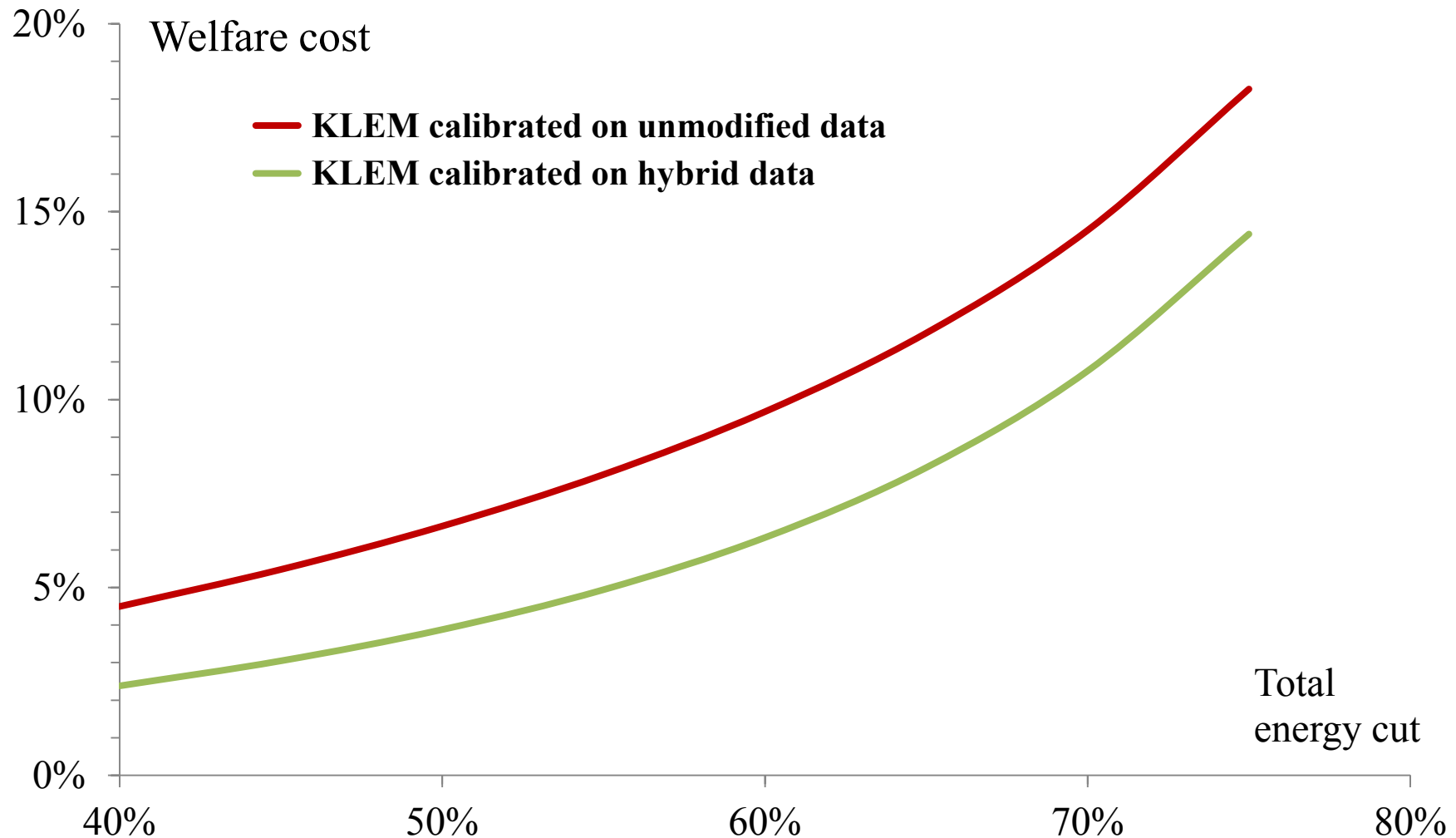
National Acc.	6.3%	67.7%	7.4%	2.4%
Hybrid Acc.	4.3%	56.4%	6.6%	1.7%

Comparative exercises to illustrate impacts of data treatments

- General equilibrium impacts using a standard KLEM model
 - Calibrated on either IOT from national accounts or Hybrid IOT from IMACLIM procedure
 - Comparison of the impacts on welfare of different levels of energy cuts (driven by an excise tax)

- Applying a given excise tax to levy the same tax revenue
 - Adjusting tax on “quasi-quantities”

Impacts on welfare of different levels of total energy cuts



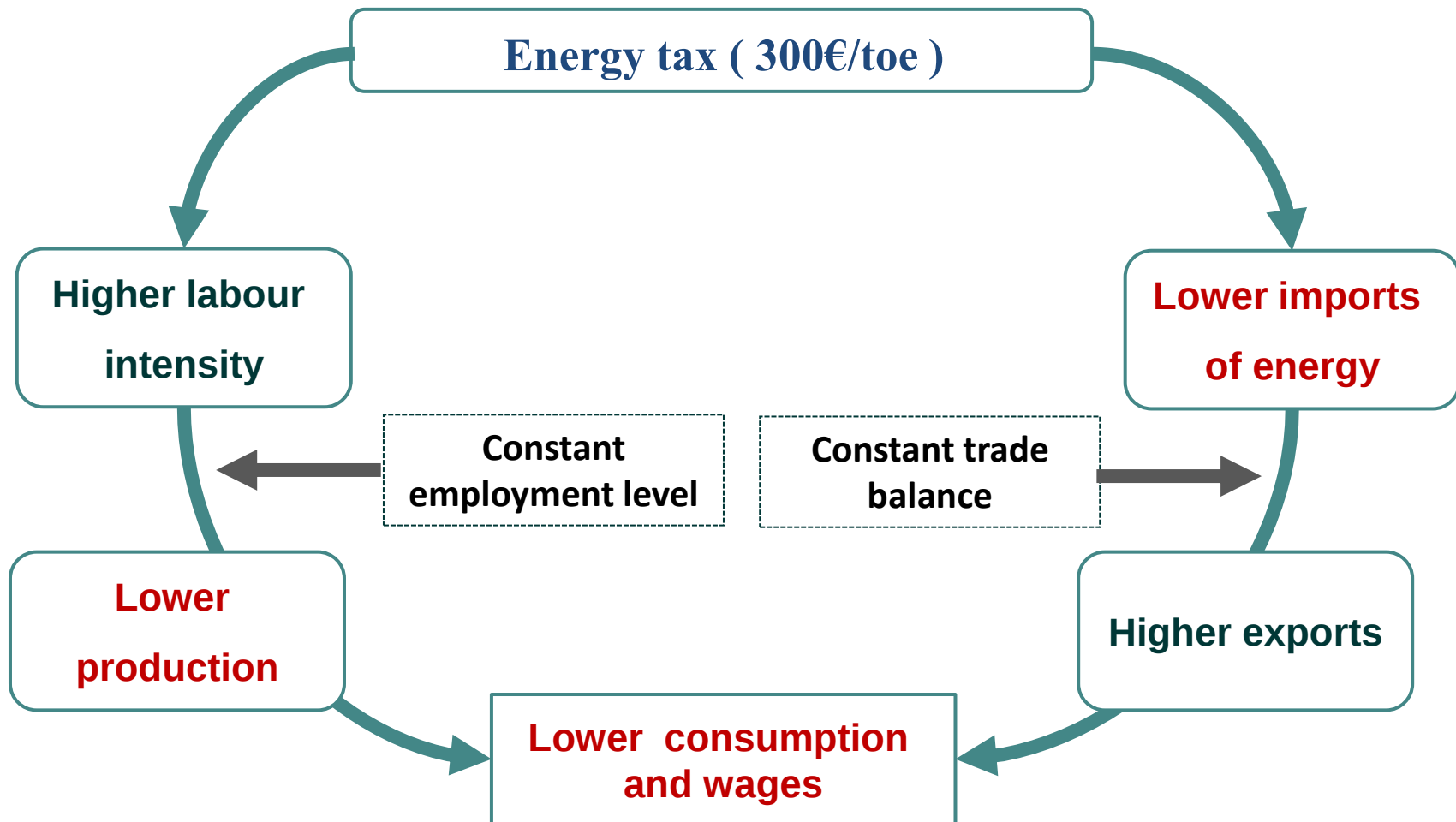
Comparative exercise with a mean same level of tax

- Some key results taxing all economic agents
 - Fixing tax at 300€/toe

Relative change on..	Variation	Hybrid IOT	Unmodified IOT
Final consumption	$\Delta C_{compo} / C_{compo}$	-0.3%	-0.8%
Nominal salary	$\Delta w_{compo} / w_{compo}$	-2.5%	-3.2%
Purchasing power of wages	$\Delta PP_{compo} / PP_{compo}$	-3.3%	-3.8%

Tax has less negative effect in hybrid case

A mechanisms of potential synergy



A key driver : production prices hybrid vs. non hybrid

- Solving $\begin{cases} P_{comp} = f^1(P_{comp}, P_E + t) \\ P_E = f^2(P_{comp}, P_E + t) \end{cases} \Rightarrow \delta P_{comp} / \delta t$
- Impact of indirect effects (multiplier effects of IO analysis)
 - ↓ with energy cost share of inputs
 $Cost\ Share\ E /_{Compo, Hybrid} < Cost\ Share\ E /_{Compo, Nat. Acc}$
 - ↓ with specific margins of energy sales

$$\Rightarrow \frac{\delta P_{comp, Hybrid}}{\delta t} < \frac{\delta P_{comp, Nat. Acc}}{\delta t} \quad \text{Gap : 17\%}$$

Tax has less effect on production price in hybrid case

Conclusions and perspectives

- Proposing a procedure to combine national accounts and energy balances
 - Systematical method at regional scale
 - Solving statistical gaps preserving key information for energy-economy analysis

- Analyzing impacts on results of a calibration on IMACLIM hybrid data

- Going further:
 - Comparison of existing hybrid methods (impacts on empirical features)
 - Impacts on results with different CGE behavioural assumptions



Chaire Modélisation prospective
au service du développement durable

Centre International de Recherche sur
l'Environnement et le
Développement
Paris, France



Hybrid Input-Output tables for CGE model calibration and consequences on energy policy analysis

Thank you for your attention

Contact :

Gaëlle LE TREUT

Personal web page : [here](#)

CIREN Website : www.centre-cired.fr