

PhD dissertation defence

Implementing policy instruments for a low carbon mobility of passengers in urban areas

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— PARIS-EST



Introduction

Urban mobility as the relevant scale for policy action

- CO₂ emissions from transport concentrate at the urban scale
 - “Starting from the bottom” is more relevant (Guesnerie & Tulkens, 2008) and tends to form a paradigm in policy action (Crescenzi & Rodríguez-Pose, 2011)
- ➔ I analyze the implementation of *indirect* measures existing at the urban mobility scale as a sound policy design to tackle CO₂ emissions on the short term

Panel of *indirect* measures :

Price incentive

Encouraging low carbon alternatives

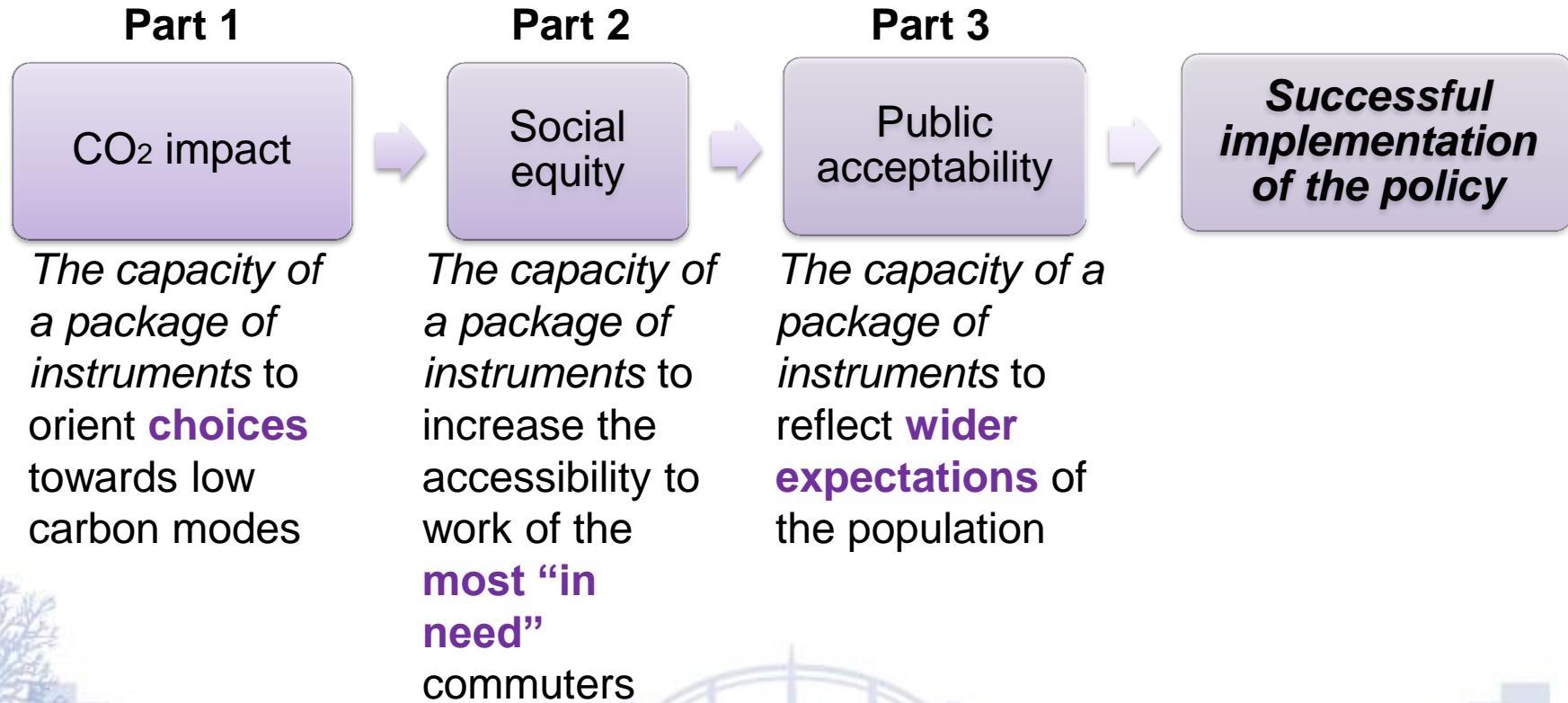
Accessibility-oriented tools

How to appraise the pertinence of those *indirect* tools to reduce CO₂ from the urban mobility of people?

Structure of the dissertation (1/2)

Practical contribution of my research

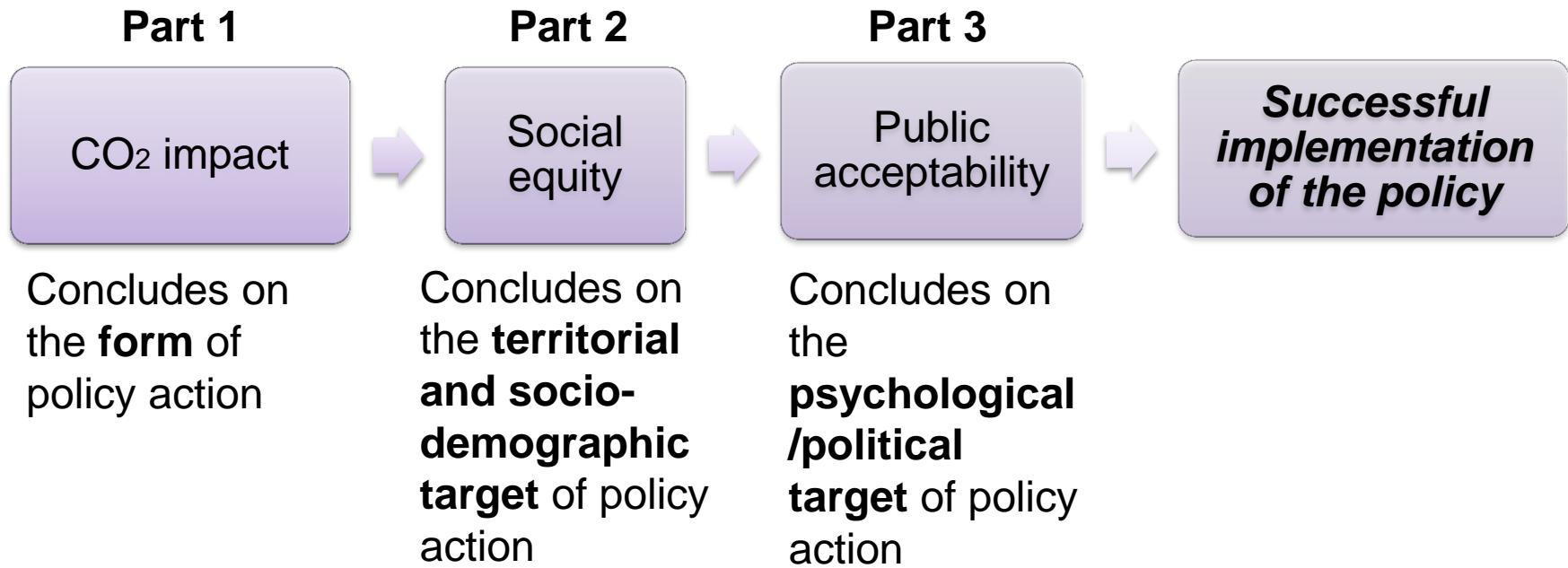
- Assorting an evaluation criterion to each condition



Structure of the dissertation (2/2)

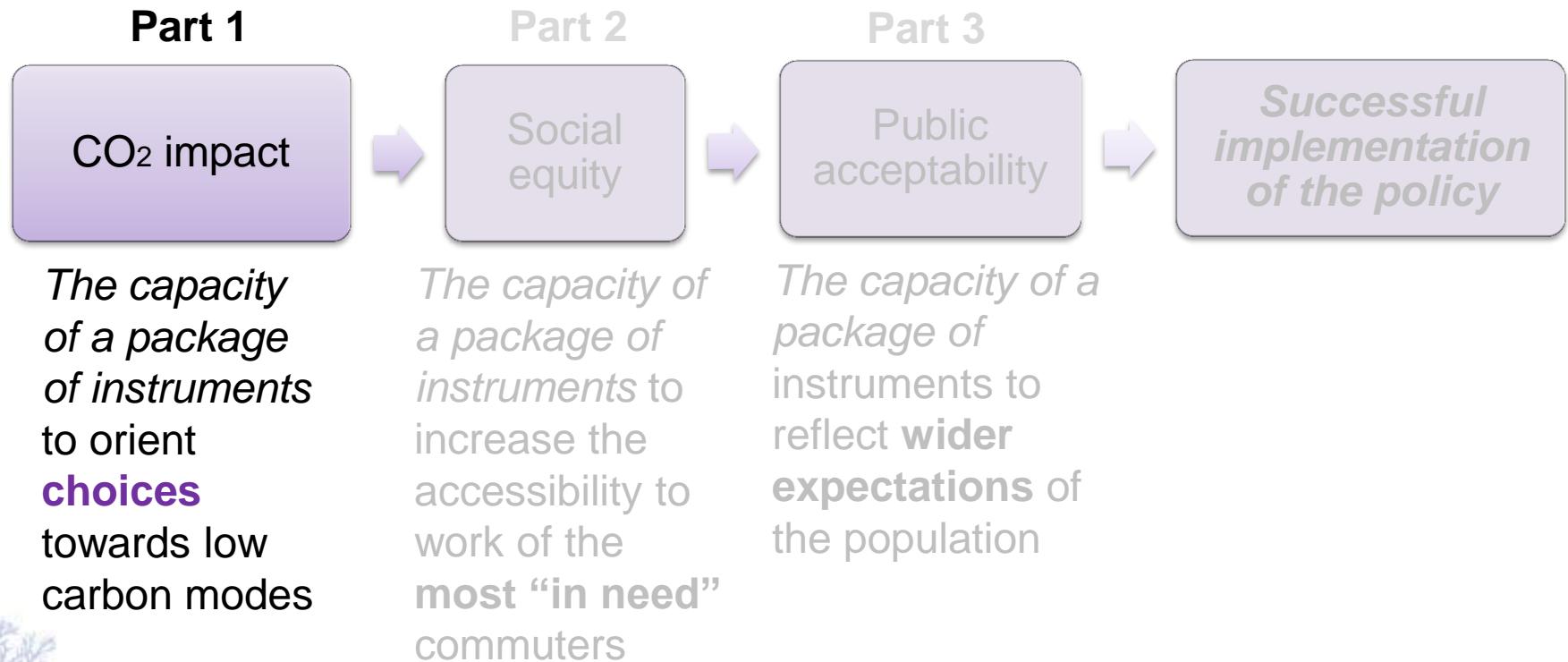
Theoretical contribution of my research

- Assessing the pertinence of the instruments by stage



Part 1

Pertinence of the instruments to induce modal shift towards low carbon alternatives



Part 1

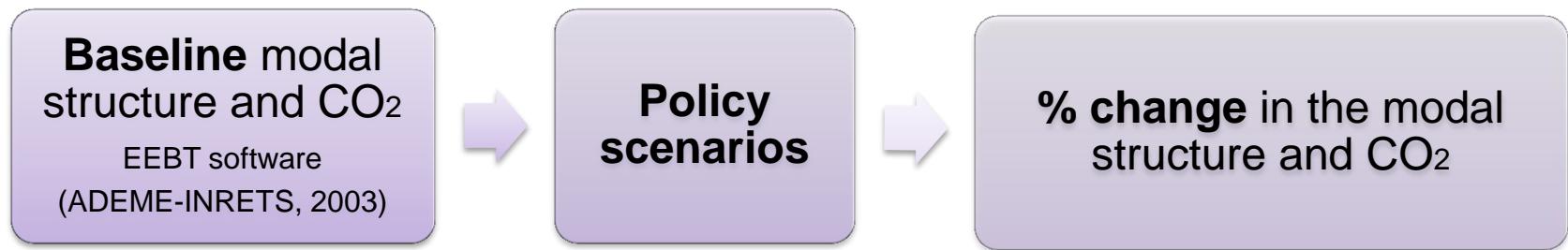
Pertinence of the instruments for inducing modal shift towards low carbon alternatives

Objective

Direct vs. indirect tools => less CO₂ via the highest shift to low carbon modes

Methodology

Using Household Travel Survey data of 2006, we estimate a mode choice model for the large Lille urban area (*LMCU*)



Policy instruments

Direct tool: additional fuel tax 1.9 €c/l diesel, 1.6 €c/l petrol (De Perthuis, 2013)

Indirect tools: €1.20 cordon toll (PREDIT, 2008)

10% and then 50% increase in parking fares

10% reduction in PT travel times

Part 1

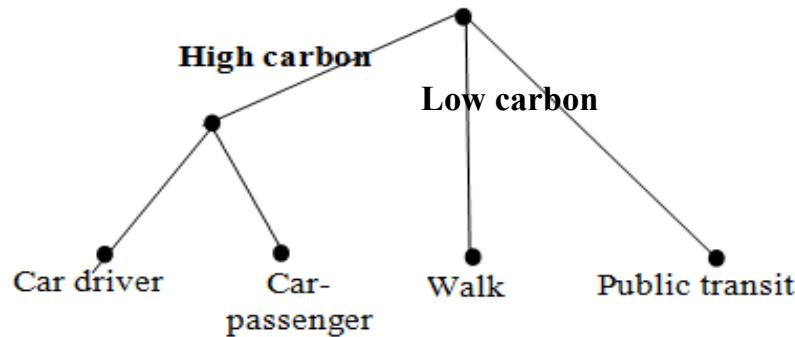
Pertinence of the instruments to induce modal shift towards low carbon alternatives

Estimating a nested logit model

Based on the Random Utility Theory (Domencich and McFadden, 1975)

Reconstruction of the trips not observed => circumstances of mode choice

Calibration of 4 modal utility functions



Policy scenarios change the time and cost parameters in the modal utility functions

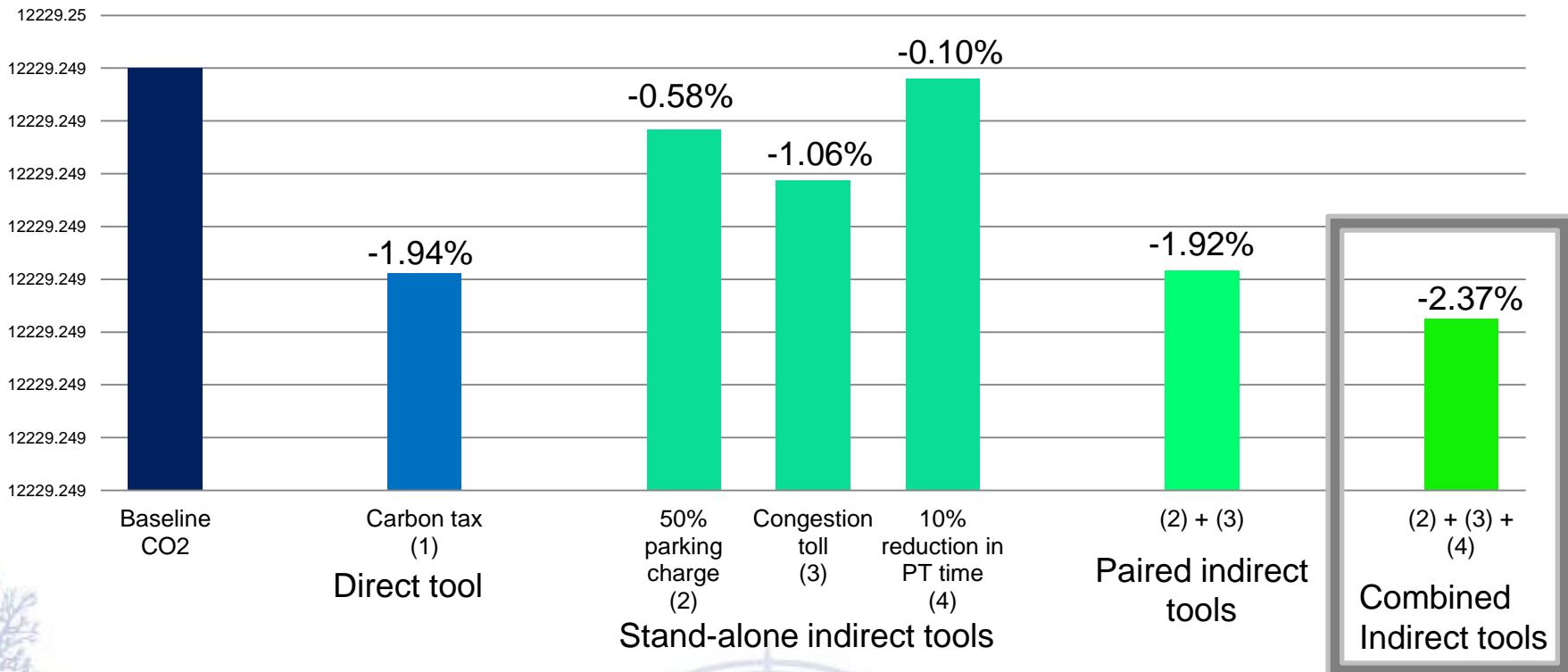
- Change the modal structure
- Change the “CO₂ budget” of the trips

Part 1

Pertinence of the instruments to induce modal shift towards low carbon alternatives

Result

Changes in tons of CO₂ emissions (reduction rate)

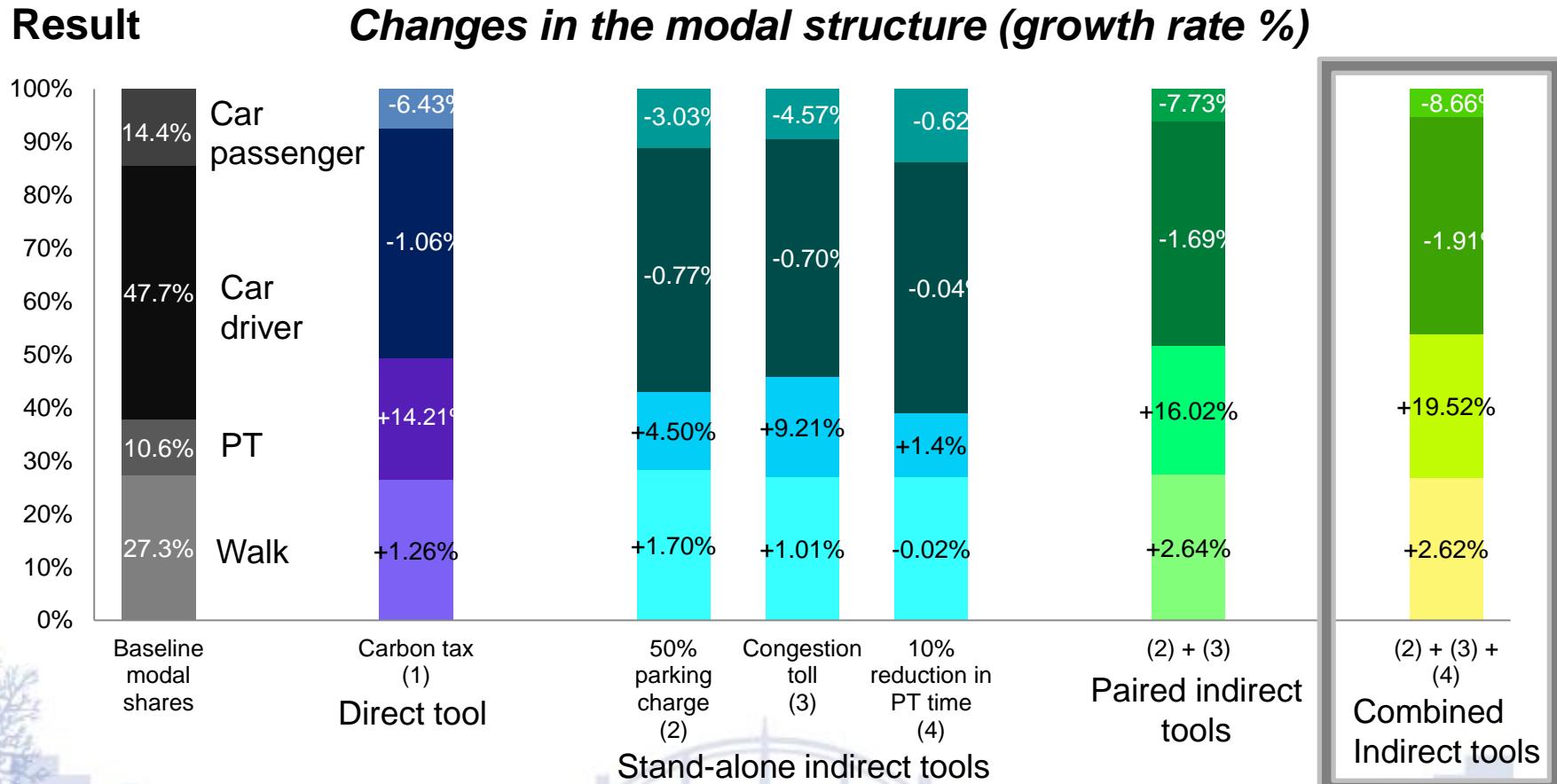


→ The combination of indirect tools reduces more CO₂ than the direct carbon tax (synergy effect)

Part 1

Pertinence of the instruments to induce a shift towards low carbon modes

Result



→ The combination of indirect tools induces a higher shift towards low carbon modes than the direct carbon tax (synergy effect)

Part 2

Pertinence of the instruments to increase the accessibility to work by PT of the “most in need”

Part 1

CO₂ impact

The capacity of a package of instruments to orient choices towards low carbon modes

Part 2

Social equity

The capacity of a package of instruments to increase the accessibility to work of the most “in need” commuters

Part 3

Public acceptability

The capacity of a package of instruments to reflect wider expectations of the population

Successful implementation of the policy



Part 2

Pertinence of the instruments to increase the accessibility to work by PT of the “most in need”

Objective

Applying the theoretical framework of Martens (2011), I define:

The “good to redistribute” \Leftrightarrow accessibility to work by PT

“Members of society” \Leftrightarrow gender, diploma, SPC, immigration and HH structure

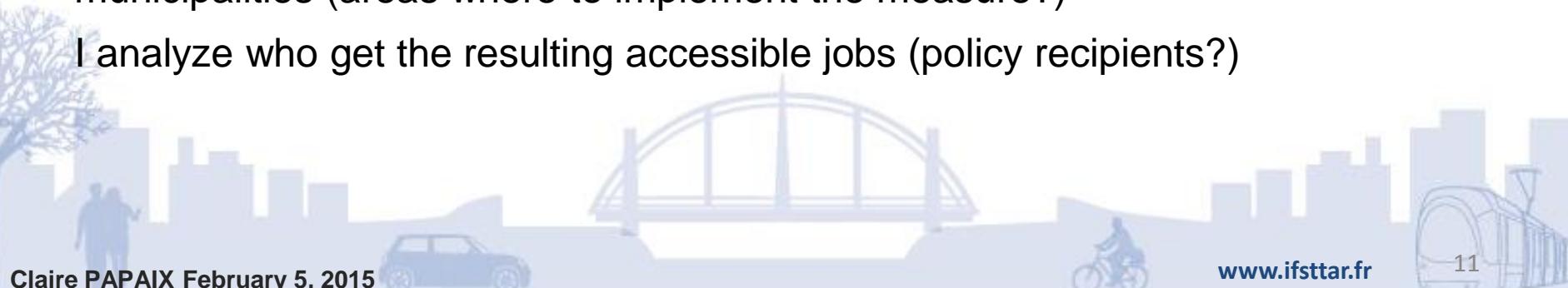
“Yardstick rule” \Leftrightarrow the sufficiency approach (Sen, 1982)

Methodology

Using commuting trips from census data 2006 (MobPro, Insee) in the LMCU

I calculate an indicator of the potential accessibility to work by PT for the 85 municipalities (areas where to implement the measure?)

I analyze who get the resulting accessible jobs (policy recipients?)



Part 2

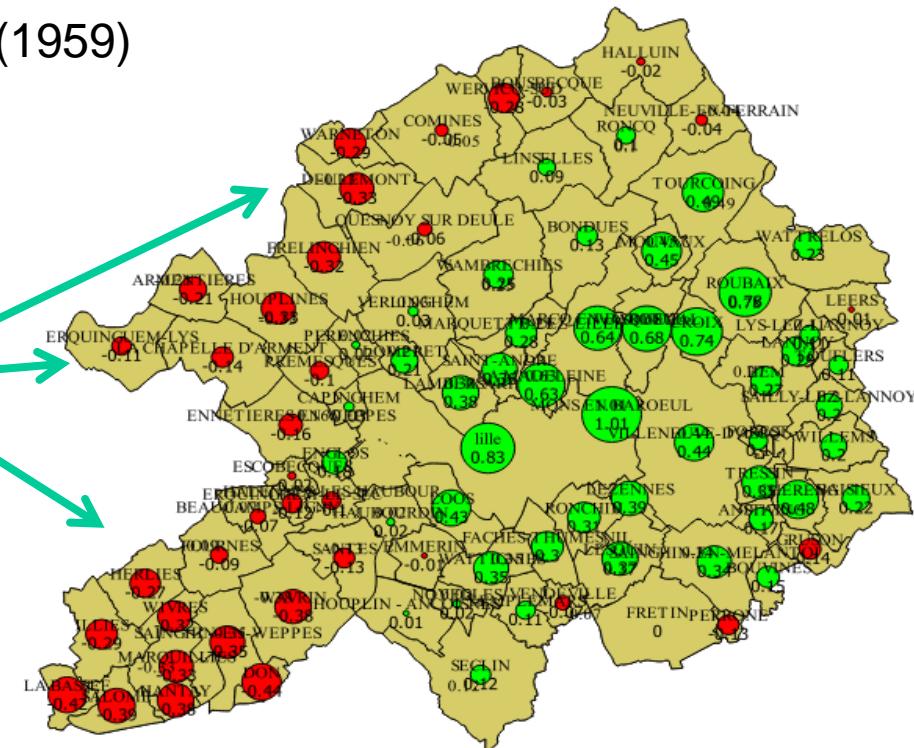
Pertinence of the instruments to increase the accessibility to work by PT of the “most in need”

Computing an indicator of the accessibility to work by PT

Potential measure of Hansen (1959)

$$Ai = \sum_j Oj \cdot f(Cij)$$

37 municipalities with the highest theoretical PT time to reach the potential 249,361 jobs (the « average potential job market »)



Policy instruments

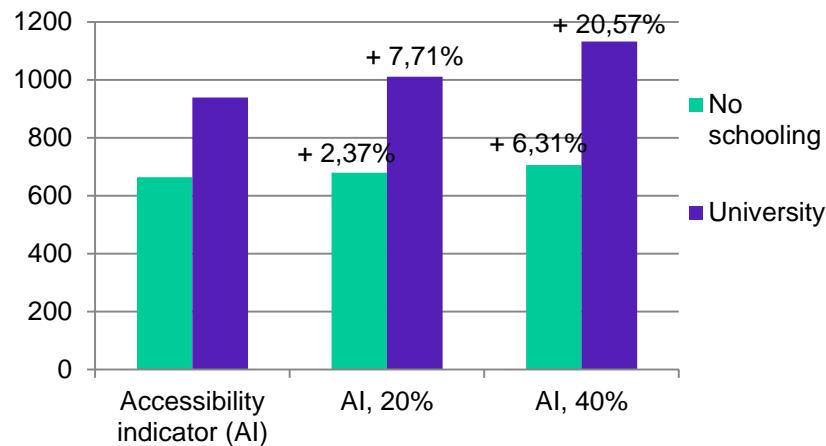
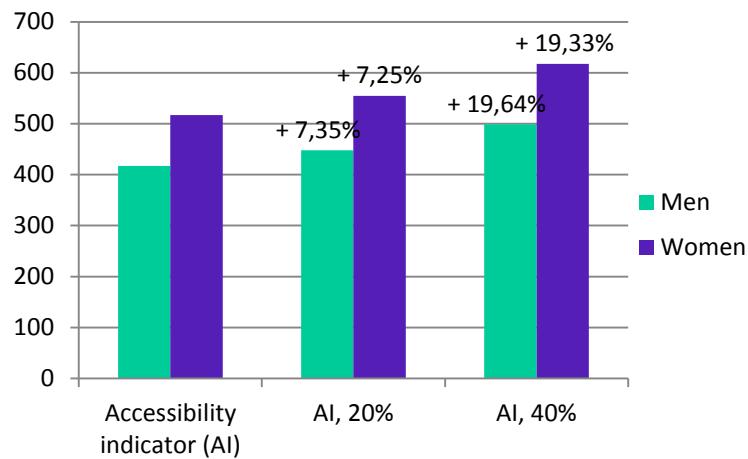
Reducing the commuting time to work by PT from those red areas (20% then 40%)

Part 2

Pertinence of the instruments to increase the accessibility to work by PT of the “most in need”

Results

Accessibility Indicator (jobs accessible / commuting time by PT) per category of commuters



Accessible jobs get higher for the most “well-off” → against the “sufficiency rule”
transport oriented policy alone is not the panacea, need for cross-sectoral
solutions (relocation of jobs/housing, time schedule management)

Part 3

Pertinence of the instruments for reflecting psychological/policy expectations of the population

Part 1

CO₂ impact



The capacity of a package of instruments to orient choices towards low carbon modes

Part 2

Social equity



The capacity of a package of instruments to increase the accessibility to work of the most “in need” commuters

Part 3

Public acceptability



Successful implementation of the policy



Part 3

Pertinence of the instruments to reflect psychological/policy expectations of the population

Objective

In the frame of the Planned Behaviour Theory of Ajzen (1991), determining the arguments to “market” at first for a favorable public opinion towards a given policy tool in a particular city

Methodology

Using acceptability survey data 2011 in Stockholm, Helsinki and Lyon

I build on Hamilton *et al.* (2014) findings:

‘General attitudes’ and ‘Policy-specific beliefs’ are more stable predictors than ‘self-interest’ and ‘socio-demographics’

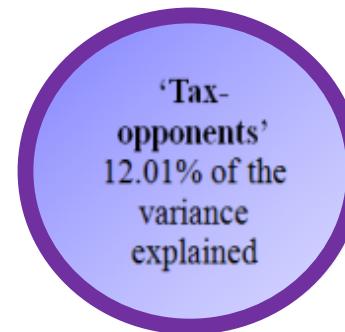
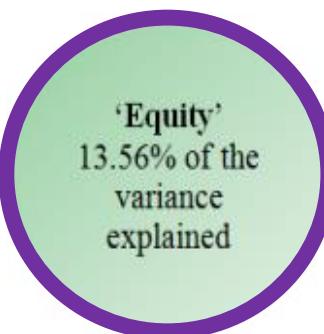
➔ I analyze those attitudinal variables and see how they are formed

Part 3

Pertinence of the instruments to reflect psychological/policy expectations of the population

Performing a principal component analysis

We obtain 4 synthetic factors



That I enter into ordinal logit models, next to the rest of the variables, to explain favorable opinions (classes of acceptability) towards

Policy instruments

Congestion charge (from the EXPACC research project)

Free PT

New roads building

Part 3

Pertinence of the instruments to reflect psychological/policy expectations of the population

Results

<i>Ordered logit models</i>	Congestion charging	Free PT	New roads building
	T-test	T-test	T-test
'Environment/Trust' Stockholm	12.70***	6.51***	-2.27**
'Environment/Trust' Helsinki	10.68***	4.46***	-3.62***
'Environment/Trust' Lyon	12.12***	1.68*	2.06**
'Equity' Stockholm	1.10	3.99***	-2.33**
'Equity' Helsinki	1.34	4.36***	-0.25
'Equity' Lyon	-4.94***	6.40***	0.64
'Pricing' Stockholm	5.32***	1.06	1.57
'Pricing' Helsinki	5.86***	1.10	-0.72
'Pricing' Lyon	2.84***	2.15**	3.46***
'Tax-opponents' Stockholm	-8.75***	0.30	14.80***
'Tax-opponents' Helsinki	-1.65*	0.44	5.31***
'Tax-opponents' Lyon	-7.11***	2.15**	11.28***

Conclusions

Synergy effects of the *indirect* instruments

Combining *specific forms* of indirect instruments (congestion charging, parking faring and PT time reduction) has the **highest impact on CO₂** through modal shift to low carbon alternatives

Targeting *specific geographical areas and social groups of commuters* makes the policy package (PT time reduction and cross-sectoral solutions) **more socially equitable**

Balancing the *specific (segmented) expectations* of the population increases the **public acceptability** of the policy package (congestion charge, free PT and new roads)

→ **extended scope of validity of the *indirect* instruments**

Thank you !

Perspectives

Among the *soft measures*, analyzing the role of ICT on the attractiveness of PT in the perspective of a urban mobility system less carbon intensive, more equitable and acceptable

[*The implementation of information-based mobility management measures in a smartphone travel survey. Conceptual and methodological issues related with its design*
J. de Abreu e Silva et al. (2014)]

Short Term Scientific Mission in Lisbon, TEA COST Action TU 1209]

Carrying out a comparative mode choice analysis in another territory (notions of 'transferability' and 'universality' vs 'specificity' of a policy)

[*Responsiveness of urban travelers to modal shift policy measures: an intra-regional comparison* (2015) H. Hammadou, A. Mahieux and C. Papaix]

Abstract accepted to the 14th International Association for Travel Behaviour Research (IATBR) conference 2015]