Research context and goals
Development of an algorithmic language
Effectivity of an instrument

Assessing the effectivity of public policy instruments

via an algorithmic language

Adam Baïz - Michel Nakhla

Insee, Mines ParisTech CGS, Sciences Po Paris

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Structure of the presentation

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2 Development of an algorithmic language

3 Effectivity of an instrument

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Research context and goals

Research context and goals
Development of an algorithmic language
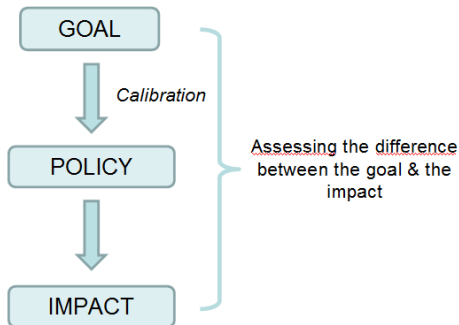Effectivity of an instrument

Research context
Research goals

Research context

- Insee economist in the French Ministry of Environment
- Regulation is based on *standard* instruments (tax, ban, market, etc.) & *innovative* ones (contract, quota, nudge, certificates, etc.)
    - Increasing number of involved actors
    - Coexistence of multiple and diverse means of influence (command-and-control, soft law, etc.)

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Research context
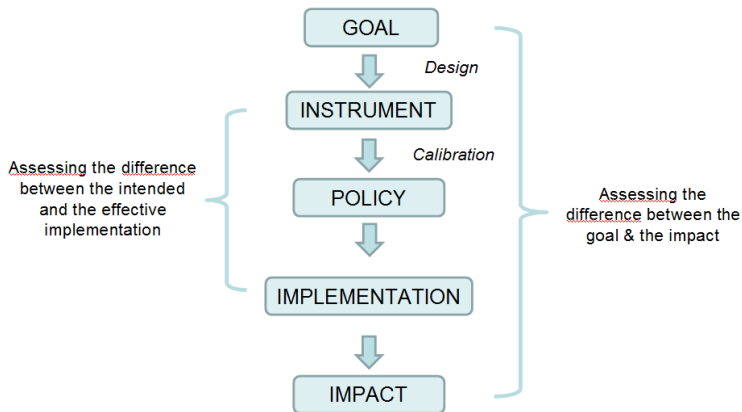Research goals

Research context

- Insee economist in the French Ministry of Environment
- Regulation is based on *standard* instruments (tax, ban, market, etc.) & *innovative* ones (contract, quota, nudge, certificates, etc.)
    - Increasing number of involved actors
    - Coexistence of multiple and diverse means of influence (command-and-control, soft law, etc.)
- Is Regulatory Impact Analysis able to face and assimilate the increasing diversity and complexity of instruments ?
    - Rationalization of public action
    - Transparency of public decisions
    - Clarity of the law
- ▶ Example : the Energy Savings Certificates Scheme is allegedly an innovative instrument : new (hybrid) but not effective (implementation biases) !

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Research context
Research goals

Going from...

- Example : We'd like to reduce pollution $\rightarrow$ we implement a tax $\rightarrow$ if not sufficient, we modulate its level

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Research context
Research goals

... to

- Now, we first characterize an instrument & assess its effectivity... can I explain my new method in 15/20 minutes ?

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Elements of the language
The design rules
An example : "the tax"

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Development of an algorithmic language

- So far... an instrument is defined as a generic mean of influencing people through collective action :
  - Ban, market, roads, control of wages, agricultural land reforms, etc.
  - It's too vague a definition !

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Development of an algorithmic language

- So far... an instrument is defined as a generic mean of influencing people through collective action :
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  - It's too vague a definition !

- So far... instruments are mainly characterized *via* dimensional classifications (*typologies*)

Resources / Constraint	Financial	Non-financial
High		Obligation
Intermediate	Taxes	(Taxes ?)
Low	Market, Subsidies (Taxes ?)	Sensitization

Ambivalence → What is the true and specific essence of a tax ? of any instrument ?

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- A new definition : an instrument is the *intended* causal chain of a collective action
  - If the firm pollutes, then it pays a sum that is proportional, and that discourages it from polluting (again)

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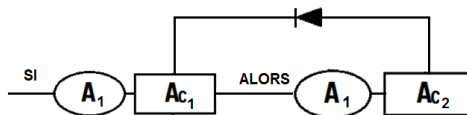
The language elements

- A comprehensive, minimalistic & user-friendly language :
  - 5 impact vectors : making something certain / impossible / more likely / less likely / possible
  - 3 variables : actors, actions, events
  - 5 logical operators : if/else (or else), as long as/do, do/until, and/or, not
- ▶ An instrument is a unique & specific combination of these elements
- ▶ We have developed an equivalent graphic language

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The design rules

- All causal chains should be :
    - complete (example : actor-action)
    - consistant (example : two Boolean impact vectors can not coexist at the same spot)
    - connected (i.e. all elements are related in one way or another)

- ▶ It's our conceptual & generative language (Pahl & Beitz 1977)

- ▶ An instrument $=$ a C^3 causal chain, as expressed in this algorithmic language

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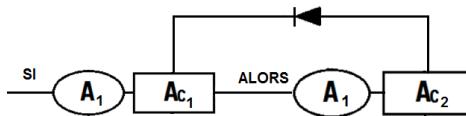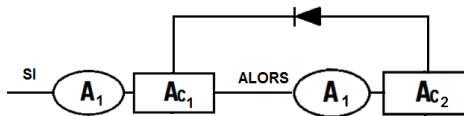An example : "the tax"

An example : "the tax"

- The tax *can* be represented as :

- ► Examples of *concretization* :
  - ► If the firm pollutes, then it pays a sum that is proportional, and that discourages it from polluting (again)

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- The tax *can* be represented as :

▶ Examples of *concretization* :
  ▶ If the firm pollutes, then it pays a sum that is proportional, and that discourages it from polluting (again)
  ▶ If the firm pollutes, then it announces it publicly, and that discourages it from polluting (again)

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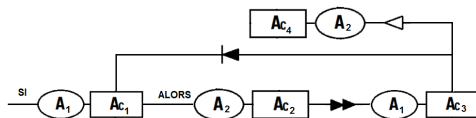An example : "the tax"

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- The tax *can* be represented as :

▶ Examples of *concretization* :

  ▶ If the firm pollutes, then it pays a sum that is proportional,
    and that discourages it from polluting (again)
  ▶ If the firm pollutes, then it announces it publicly, and that
    discourages it from polluting (again)
  ▶ If my flatmate uses my microwave, then he cleans all the
    kitchen, and that discourages him from using my microwave
    (again)

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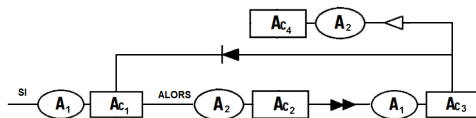An example : "the tax"

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- The tax *can* also be represented as (see instrumental *extension* & *fractalization*) :

▶ Examples of *concretization* :
  ▶ If the firm pollutes, then the fiscal administration sends a tax notice to compel the firm to pay a sum that is proportional to its pollution, in order to discourages it from polluting and to make it possible to subsidize public research in clean energies

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▶ Examples of *concretization* :

    ▶ If the firm pollutes, then the fiscal administration sends a tax notice to compel the firm to pay a sum that is proportional to its pollution, in order to discourages it from polluting and to make it possible to subsidize public research in clean energies

    ▶ If my flatmate uses my microwave, then I speak to him to have him clean all the kitchen, in order to discourage him from using my microwave and in order to allow me to spare some time

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- There is no one "tax" but an infinite number of taxes $\rightarrow$ a heuristic reverse designing (cf. *halo-instruments*)

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Effectivity of an instrument

- An instrument is *effective* if it undoubtedly performs in the social reality

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- As an instrument = a C^3 causal chain, we know all its fundamental features

- An instrument is effective if and only if we *observe* the effectiveness of all its elements in the social reality :
  - The starting "actor-action" modules
  - The vectors impact between all the "actor-action"
  - The logical operators

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Effectivity of an instrument

- Development of an extended "difference-in-difference evaluation" method
- Example 1 : "X makes Y more likely" is effective if :
    - Y is at the end more likely to be realized than is used to be at the beginning (i.e.
      $P(Y = 1|X = 1, T = 1) \geq P(Y = 1|X = 1, T = 0) + \alpha_1$)
    - The fact that Y becomes more likely is not only due to X-independent factor (i.e.
      $[P(Y = 1|X = 1, T = 1) - P(Y = 1|X = 1, T = 0)] - [P(Y = 1|X = 0, T = 1) - P(Y = 1|X = 0, T = 0)] \geq \alpha_2$)

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- Development of an extended "difference-in-difference evaluation" method
- Example 1 : "X makes Y more likely" is effective if :
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- A subsidy to promote hybrid cars is given in region A, and not in region B (the conterfactual). One year later, the proportion of hybrid cars among the sold cars...
  - ... went from 5% to 10% in region A
  - ... went from 5.5% to 12% in region B
  - $\rightarrow$ The impact vector is not effective !

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- Example 2 : "X makes Y impossible" is effective if :
  - Y is at the end very unlikely to be realized (i.e. $P(Y = 1 | X = 1, T = 1) \leq \alpha_1$)
  - The fact that Y was quite possible at the beginning (i.e. $P(Y = 1 | X = 1, T = 0) \geq \alpha_2$ and $P(Y = 1 | X = 0, T = 0) \geq \alpha_3$ where $\alpha_2, \alpha_3 \geq \alpha_1$)
  - The fact that Y becomes very unlikely is not only due to X-independent factor (i.e. $P(Y = 1 | X = 0, T = 1) \geq \alpha_4$ where $\alpha_4 \geq \alpha_1$)

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- Example 2 : "X makes Y impossible" is effective if :
  - Y is at the end very unlikely to be realized (i.e.
    $P(Y = 1 | X = 1, T = 1) \leq \alpha_1$)
  - The fact that Y was quite possible at the beginning (i.e.
    $P(Y = 1 | X = 1, T = 0) \geq \alpha_2$ and
    $P(Y = 1 | X = 0, T = 0) \geq \alpha_3$ where $\alpha_2, \alpha_3 \geq \alpha_1$)
  - The fact that Y becomes very unlikely is not only due to
    X-independent factor (i.e. $P(Y = 1 | X = 0, T = 1) \geq \alpha_4$
    where $\alpha_4 \geq \alpha_1$)

- A wall is built around a garden to prevent people from going
  through. One month later, the number of people going
  through each day...
  - ... went from 5 to 1
  - ... would have been stable without the wall
  - $\rightarrow$ The impact vector is effective (or maybe not)

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- A way of identifying *really* effective instruments (ex-post evaluation)... but also a way of assessing the potential effectivity of an instrument before its implementation (ex-ante evaluation)
  - Questioning the power of will (non-neutrality of instruments)
  - Enlighting the (micro, meso, macro) intricacies and entanglements of instruments

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Applications

- Now, a few months of intervention research :
    - With simple examples (*forbidding plastic bags*, *encouraging students*, etc.)
    - Around the the Energy Savings Scheme to make it effective

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A simple example

GOAL : Ban on distributing plastic bags (i.e. having the using rate going
from 60% to 0%)

↓

POLICY : If a business distributes plastic bags, so he must pay a $10k€$
fine, which prevents it from distributing plastic bags (again) (*prohibitive
tax*)

↓

IMPACT : 25% of businesses keep on distributing plastic bags

▶ GOAL vs. IMPACT : a 25-point difference

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A simple example

GOAL : Ban on distributing plastic bags (i.e. having the using rate going from 60% to 0%)

↓

GENERIC INSTRUMENT : If an actor A takes actions Ac, so he takes action Ac', which prevents it from taking action Ac (again)

↓

CONCRETE INSTRUMENT (=POLICY) : If a business distributes plastic bags, so he must pay a 10k€ fine, which prevents it from distributing plastic bags (again) (*prohibitive tax*)
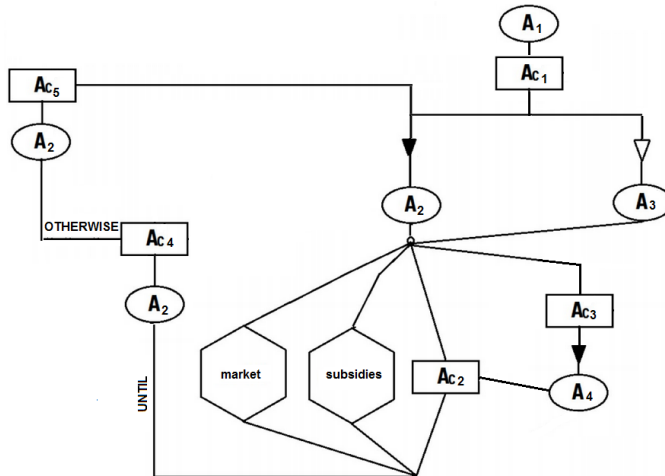
↓

IMPLEMENTATION : 30% of businesses distributing pastic bags don't pay the fine, and 10% of those paying it weren't discouraged afterwards

↓

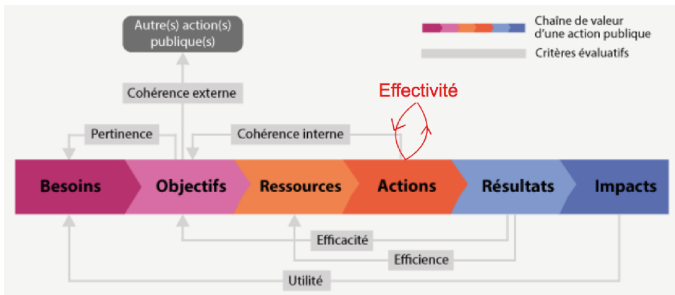IMPACT : 25% of businesses keep on distributing plastic bags

▶ A 25-point difference... and two biaises ($\rightarrow$ non-effectivity)

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The Energy Saving Certificates Scheme

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Conclusion & future prospects

- This approach, around a common language & method, allows :
  - The identification of the set of (innovative) instruments
  - The comparison of heuristics of (reverse)-designing
  - The evaluation of *effectivity* (alongside efficacy, efficiency, etc.)
  - The design of innovative instruments

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Questions, suggestions and remarks

Thank you for your attention !

- Article online : "Développement d'une approche algorithmique pour caractériser la nature protéiforme et fractale des instruments" (*Developing an algorithmic approach to caracterize the fractal & protean nature of instruments*)