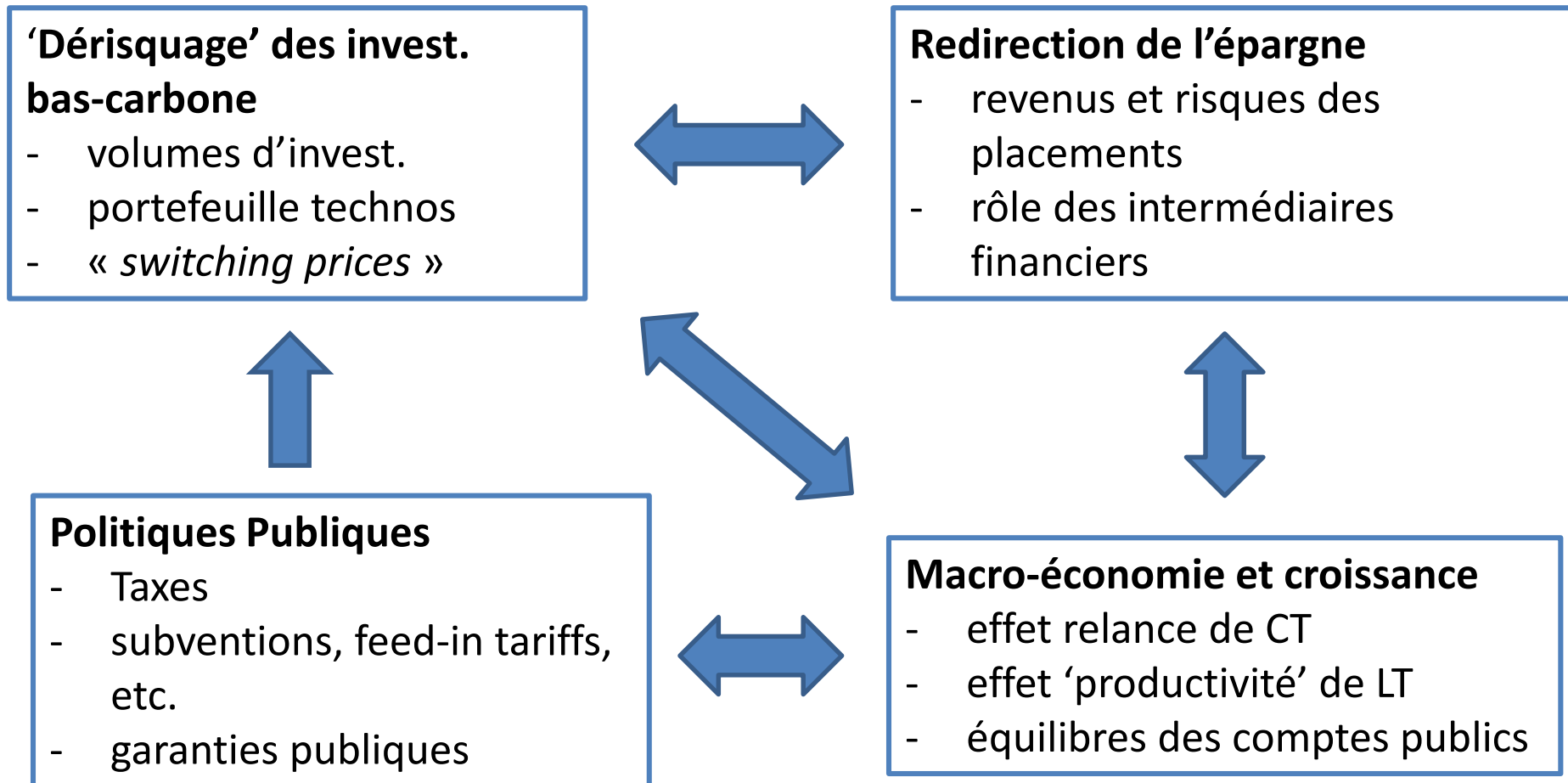


Risques d'investissements et mécanismes financiers dans IMACLIM-R

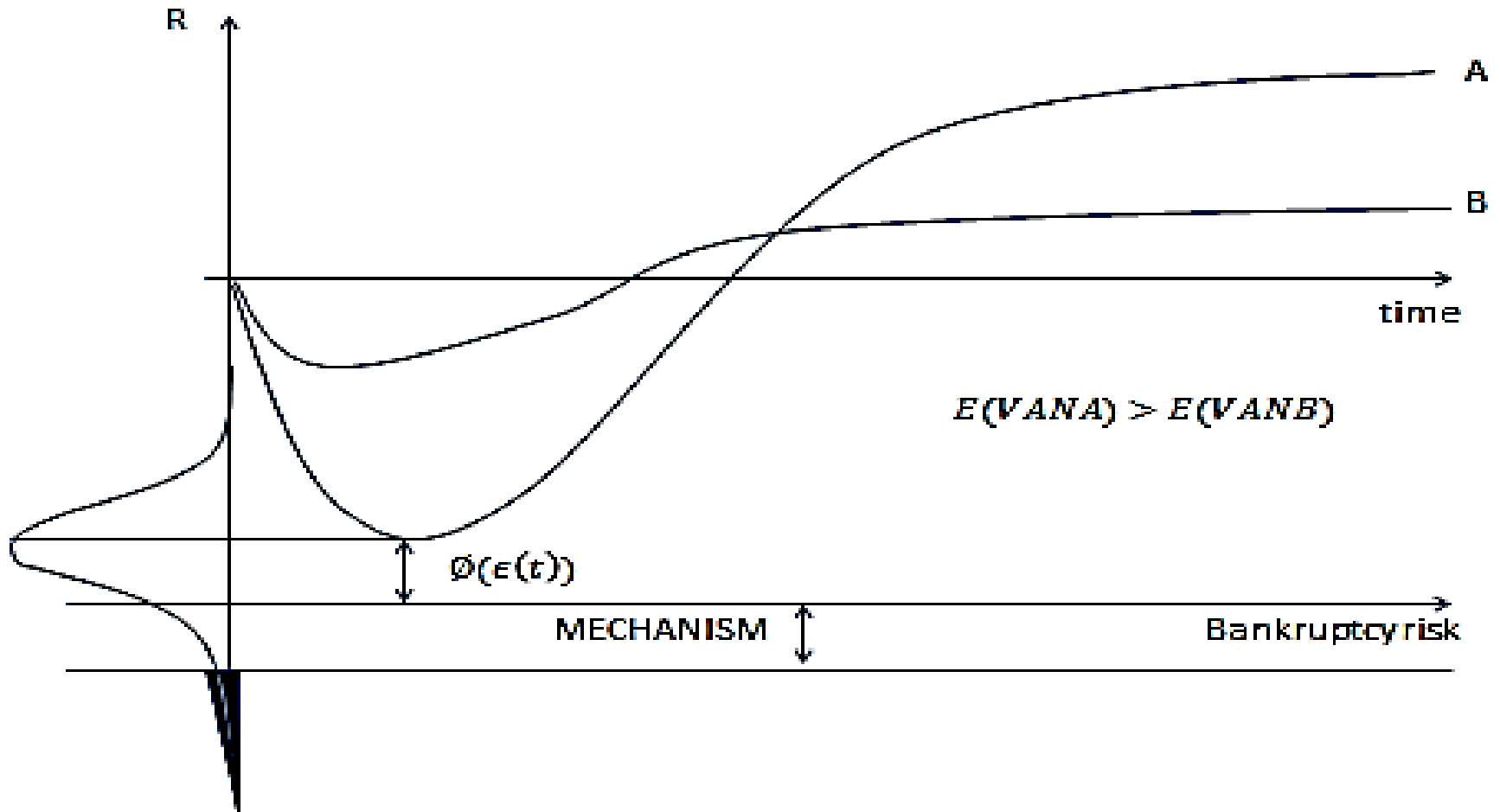
acquis et programmes en cours

La finance dans les modèles intégrés

Un retour de la question bottom-up/top-down (flèches)



Finance et détournement de non rentabilité



1. Les Risques d'Investissement dans Imaclim

- Types de risque:
 - Risques technologiques «purs»
 - Risques organisationnels (coûts de transaction)
 - Incertitudes réglementaires (normes, standards, prix du carbone ...)
 - Risques pays vu par les *rating agencies*
- Calcul 'hors modèle' des WACCs (weighted average cost of capital) propres aux technologies par pays et secteur

Country and project risks

| Rating | Maturity | Spread to US(BPS) | Charges of lending institution (BPS) | Fees = 250 |
|--------|----------|-------------------|--------------------------------------|------------|
| A | 3 years | 80 | 385 | 635 |
| | 5 years | 115 | 420 | 670 |
| | 10 years | 175 | 497 | 747 |
| | 15 years | 235 | 568 | 818 |
| BBB | 5 years | 130 | 435 | 685 |
| | 10 years | 250 | 572 | 822 |
| | 15 years | 370 | 703 | 953 |
| BB | 5 years | 200 | 505 | 755 |
| | 10 years | 350 | 672 | 922 |
| | 15 years | 500 | 833 | 1083 |
| B | 5 years | 600 | 905 | 1155 |
| | 10 years | 900 | 1222 | 1472 |
| C | 2 years | 1700 | 1988 | 2238 |
| | 5 years | | 1500 | 1750 |

1. Les Risques d'Investissement dans Imaclim

- Types de risque:
 - risque technologique ‘pur’
 - Risques organisationnels’ (coûts de transaction)
 - Incertitude réglementaires (normes, standards, prix du carbone ...)
 - Risque pays vu par les ‘rating agencies’
- Description hors modèle de ces risques en calculant les WACCs (weighted average cost of capital) propres aux technologies par pays et secteur
- De-risking via modification des WACCs
- Sentiers technologiques calculés de façon récursive via les WACCs, les prix futurs du carbone et des énergies fossiles et le caractère plus ou moins stable de la croissance donc des marchés finaux; deux étapes: sans puis avec endogénéisation (sous anticipations adaptatives)
- **Question? Qui assume le ‘risque = le détour de non rentabilité’**

Encilowcarb: A set of 'consensus' policies & measures towards factor 4

Including:

- Energy efficiency norms in new buildings
- Financial incentives for energy efficiency renovation
- Eco-taxes on trucks and kerosene



EncilowCarb PM

Reference

=> **-61%** CO₂ emissions in 2050 relative to 1990

Despite 'engineer optimism', a transition cost

| | 2010-2015 | 2010-2020 | 2020-2030 | 2030-2040 | 2040-2050 | 2010-2050 |
|-----|-----------|-----------|-----------|-----------|-----------|-----------|
| REF | 0.77 | 0.83 | 1.09 | 1.47 | 0.85 | 1.06 |
| PM | 0.73 | 0.9 | 1.32 | 1.46 | 0.9 | 1.15 |

GDP mean annual growth rate (%)

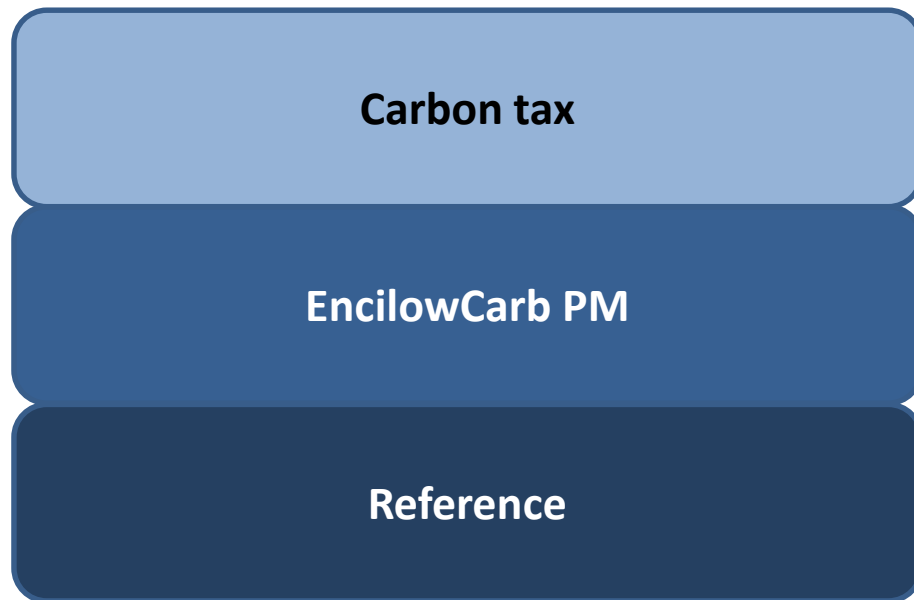
| | 2015 | 2020 | 2030 | 2040 | 2050 |
|----|------|------|------|------|------|
| PM | -2 | 26 | 183 | 254 | 307 |

Employment variation relative to BAU (1000s full-time jobs)

Computed with IMACLIM R France

- PM have positive macroeconomic implications in the long-run
- Time-lag between expenditures and benefits create short-term loss

P&M + carbon tax improve environmental performance



Quinet report carbon tax:

- 32€/tCO₂ in 2012
- 100€/tCO₂ in 2030
- 300€/tCO₂ in 2050

Revenue recycling:

- ½ labor tax cuts
- ½ 'green checks' to households

=> **-68%** CO₂ emissions in 2050 relative to 1990

But transition costs persist

| | 2010-2015 | 2010-2020 | 2040-2050 | 2010-2050 |
|--------|-----------|-----------|-----------|-----------|
| REF | 0.77 | 0.83 | 0.85 | 1.06 |
| PM | 0.73 | 0.90 | 0.90 | 1.15 |
| PM + T | 0.69 | 0.86 | 0.87 | 1.09 |

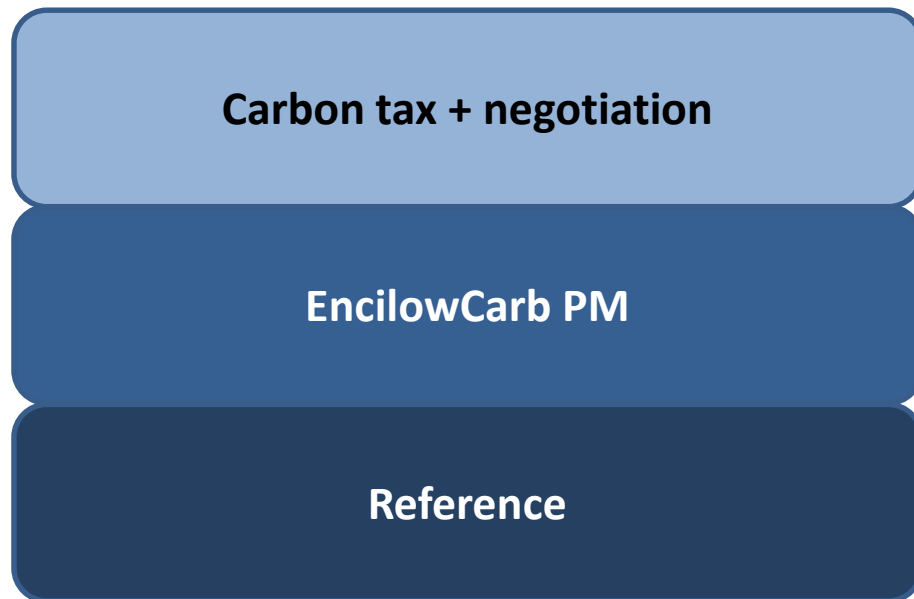
GDP mean annual growth rate (%)

| | 2015 | 2020 | 2030 | 2040 | 2050 |
|--------|------|------|------|------|------|
| PM | -2 | 26 | 183 | 254 | 307 |
| PM + T | 2 | 5 | 166 | 174 | 202 |

Employment variation relative to REF (1000s full-time jobs)

- **PM+T underperforms PM**
 - Economy-wide propagation of energy costs not compensated by lower labor taxes given recycling rule and time profile of carbon tax
- **This loss can be turn into a gain conditional upon**
 - Time profile of carbon tax
 - Ratio between cuts in labor taxes and increase in net wage

P&M + carbon tax + negotiation do not improve environmental performance

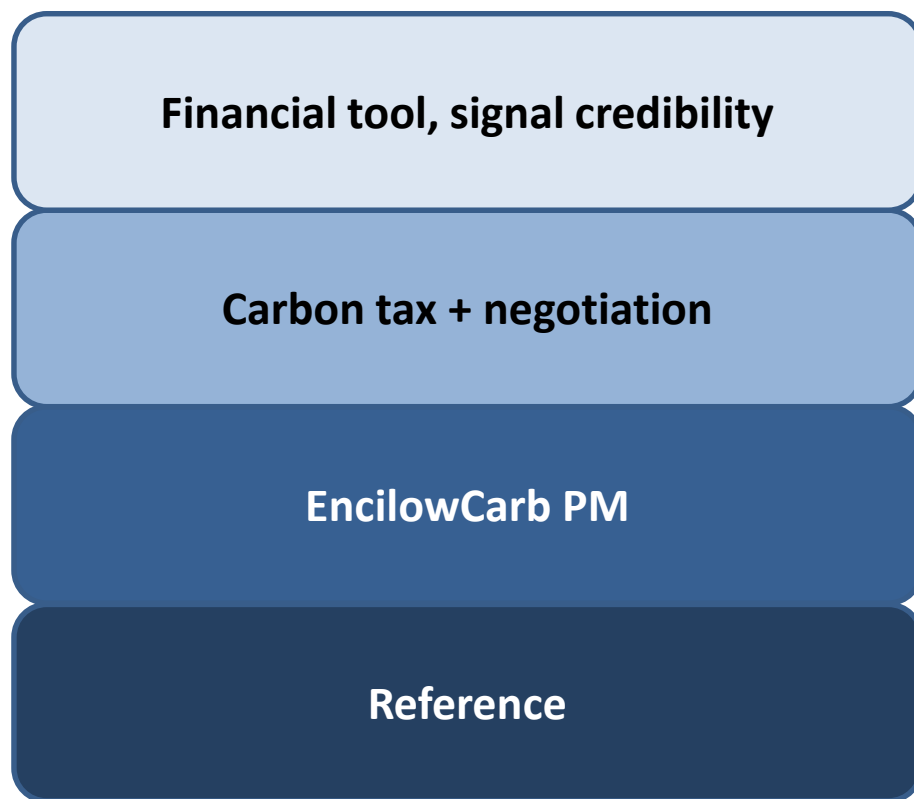


Share tax revenue between labor tax reduction and green checks to balance:

- Competitiveness risk of low reduction in labor tax
- Demand risk of low redistribution towards households

=> **-68%** CO₂ emissions in 2050 relative to 1990

Adding financial device overshoots factor 4



Financing device lowers investment risk in low-carbon projects

→ modeled as lower discount rate

Increased credibility of carbon signal

→ modeled as 'less myopic' decisions

=> **-85%** CO₂ emissions in 2050 relative to 1990

Financial device, de-risking and carbon tax

| | 2010-2015 | 2010-2020 | 2040-2050 | 2010-2050 |
|----------|-----------|-----------|-----------|-----------|
| REF | 0.77 | 0.83 | 0.85 | 1.06 |
| PM | 0.73 | 0.90 | 0.90 | 1.15 |
| PM+T | 0.69 | 0.86 | 0.87 | 1.09 |
| PM+T+N | 0.81 | 0.96 | 0.88 | 1.14 |
| PM+T+N+F | 0.77 | 0.9 | 0.94 | 1.2 |

GDP mean annual growth rate (%)

- **Trade-off between financial device and carbon tax:**
 - Lower carbon tax (50€/tCO₂ instead of 300€ in 2050) yields Factor 4 and improves growth
 - Role of de-risking + more forward looking anticipations
- **A quasi 'Keynesian compact' ...**

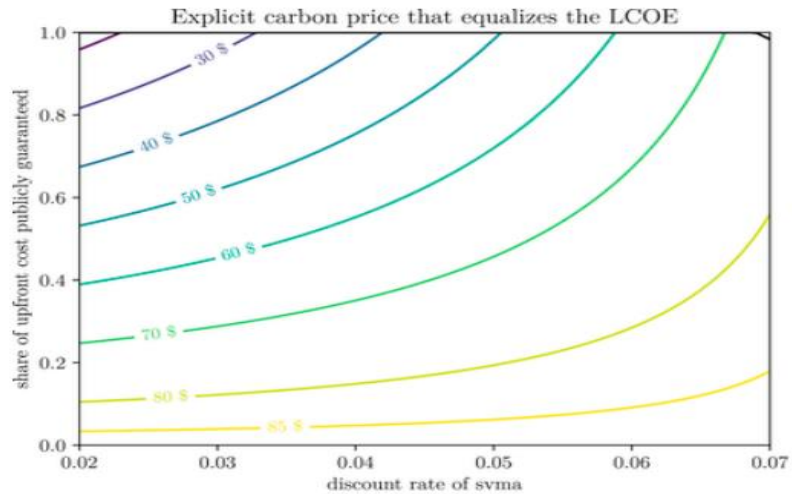
2. Finance et politique publique dans IMACLIM

- Les différents outils:
 - Taxes, subventions, feed-in etc
 - Les politiques ‘hors énergie’: marchés fonciers et immobiliers
 - Les garanties publiques
- Introduction d’une «contrainte budgétaire» et traçage de son évolution
 - Effet multiplicateur investissement/dépense publique’ (calcul exogène au modèle)
 - Traçage de l’évolution des comptes publics: provisions pour risque de défaillance vs revenus fiscaux de l’activité générée

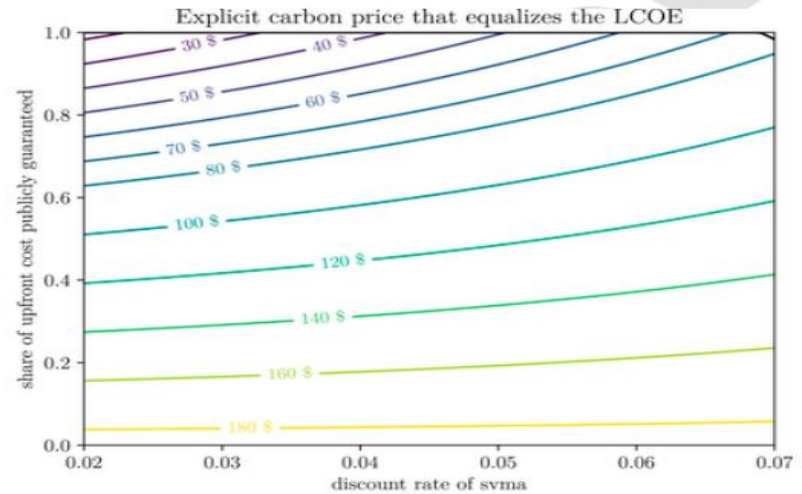
Institutions et effets multiplicateurs

| | | |
|--|-------|-------|
| 1. EFFECTIVE MULTIPLIER (2/8 or 2/16) | 5.7 | 16.3 |
| 2. Total Project Investment (3+4) | 142.9 | 204.1 |
| 3. Private Sponsor Equity (30%) | 42.9 | 61.2 |
| 4. Private Financing (70%) | 100.0 | 142.9 |
| 5. Max GICF Guarantee (4*6) | 70.0 | 100.0 |
| 6. Net Guarantee Capital (= 8-7) | 17,5 | 25.0 |
| 7. Payment to External Agency | 7.5 | 0.0 |
| 8. Total Guarantee Capital | 25.0 | 25.0 |
| | | |
| -a. Sum of each govt. set aside | 25.0 | 0.0 |
| 9. Equity Capital | 0.0 | 25.0 |
| -a. Paid-In | 0.0 | 12.5 |
| -b. Callable | | 12.5 |

SVMA et garanties publiques

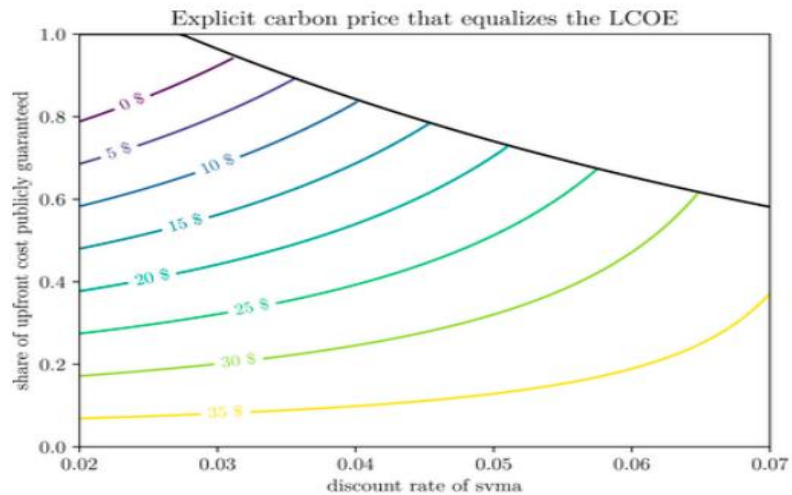


(a) private interest rate 8%

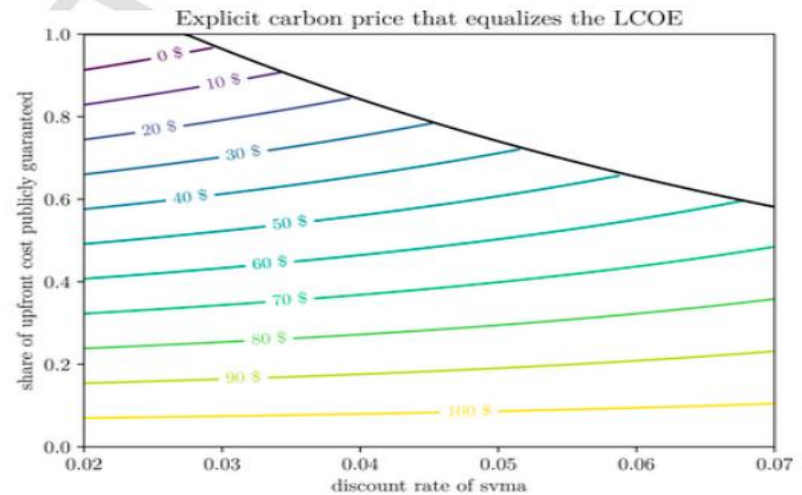


(b) private interest rate 15%

Fig. 3. Iso-curve of explicit carbon price for mitigation project in France.



(a) private interest rate 8%



(b) private interest rate 15%

Fig. 4. Iso-curve of explicit carbon price for mitigation project in India.

3. Epargne et intermédiaires financiers

- Objectifs des épargnants (ménages, entreprises, etc.): liquidité + valorisation à long terme
- Jeu des intermédiaires financiers:
 - Investisseurs institutionnels: transferts entre épargnants et entrepreneurs
 - Système bancaire: création de crédit, bilan des banques commerciales, taux de fonds propres, etc.
- Traçage des bilans par classe d'acteurs et introduction de nouvelles classes d'actifs et de dévalorisation de actifs carbonés (JF. Mercure)

4. Impacts macros

- Laissez pour discussion
- Une priorité sur la phase d'enclenchement de la transition