Identifying systemic climate- and biodiversity-related vulnerabilities: an IO approach

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CLIMATE FINANCE, RISK AND UNCERTAINTY MODELLING

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SUSTAINABILITY

How sustainable are Net Zero development trajectories?

15th AFD International Research Conference on Development

CALL FOR PAPERS

APPLY BEFORE JUNE 15TH 2022 11:59 PM,
CENTRAL EUROPEAN TIME (UTC+01:00)

STRONG SUSTAINABILITY TRAJECTORIES: AFD LAUNCHES A CALL FOR RESEARCH PAPERS
0.1 **Main source**

Developing countries’ macroeconomic exposure to the low-carbon transition


0.1 Hybrid IO tables

- Direct inputs, $A$, and indirect inputs, $L = (I - A)^{-1}$
- Direct and indirect emissions: $e^T = e(I - A)^{-1}$
- GLORIA MRIO database Release 055 (March 2022)
Outline

1. The economic structure matters
   1. Exposure, vulnerability and risk
   2. Definition of potential sunset industries

2. Multidimensional analysis
   1. Multidimensional footprints
   2. Multidimensional exposure

3. From exposure to risk
   1. Exposure in different dimensions
   2. Risk in developing and emerging economies
1.1 Conceptual framework
Exposure, vulnerability and risk

• Ecological transition and structural change
  o It is unique type of structural change, where low-footprint industries grow and high-footprint industries decline
  o The process is led by deliberate policies, changes in preferences and technological changes
  o Countries are impacted differently according to their structure of production, trade and finance

• Sunset industries are sunset…
  o … because they are directly impacted by the transition…
  o … or because they depend from industries impacted by the transition…
  o … or because they rely on industries impacted by the transition
1.1 Conceptual framework
Cascades of assets stranding - supply

1.1 Conceptual framework
Cascades of assets stranding - demand

1.1 Conceptual framework
Exposure, vulnerability and risk

Scenario: CO2e intensity defines the sunset industries

Countries’ dependence on sunset industries

Countries’ sensitivity to changes

Countries’ capacity to adapt

Current context: countries’ structures

Exposure

Vulnerability

Risk
### 1.2 Conceptual framework

Defining potential sunset industries globally

<table>
<thead>
<tr>
<th></th>
<th>Low upstream</th>
<th>Medium upstream</th>
<th>High upstream</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low downstream</td>
<td>All other sectors</td>
<td>Electrical and mach. Other manufacturing</td>
<td>Recycling</td>
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<td></td>
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<td>Textiles</td>
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<td></td>
<td></td>
<td>Transport equipment</td>
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<tr>
<td>Medium downstream</td>
<td></td>
<td></td>
<td>Chemicals* Metal Products Electricity**</td>
</tr>
<tr>
<td>High downstream</td>
<td></td>
<td>Mining and Quarrying</td>
<td></td>
</tr>
</tbody>
</table>

(*) Petroleum, chemicals and non-metal minerals; (**) Electricity, Gas and Water

- **What are the potential sunset industries?**
  - Mining and Quarrying;
  - Petroleum, Chemical and Non-Metallic Mineral Products
  - Metal Products
  - Electricity, Gas and water
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2.1 Multidimensional footprints
Defining potential sunset industries globally – CO2e

- Cement, lime and plaster products
- Electric power generation, transmission and distribution
- Road transport
- Gas extraction
- Lignite and peat
- Other ceramics n.e.c.
- Basic organic chemicals
- Basic inorganic chemicals
- Dyes, paints, glues, detergents and other chemical products
- Growing fibre crops
- Coke oven products
- Basic aluminium
- Basic non-ferrous metals n.e.c.
- Basic lead/zinc/silver
- Basic petrochemical products
- Basic tin
- Materials recovery
- Basic nickel
- Rubber products
- Basic iron and steel
- Distribution of gaseous fuels through mains
- Nitrogenous fertilizers
- Clay building materials
- Tin ores

CO2 emission-intensity (direct and indirect), kg per USD
2.1 Multidimensional footprints
Adding biodiversity
2.2 Multidimensional exposure

The different role of industries

- Transition risks: change in world demand impacts countries that depends on sunset industries; they are important for
  - Raising foreign currency and avoiding BoP constraints, especially because the transition demands imported inputs – **External exposure**
  - Avoiding fiscal imbalances, especially because the transition demands relevant public investments and expenses – **Fiscal Exposure**
  - Guaranteeing employment and wages – even though the impact is positive, it is not homogenous – **Social Exposure**
2.2 Country analysis
External exposure, by country

[Bar chart showing net foreign currency revenues from selected industries (% of total) for various countries.]

Industry:
- Chemicals, etc
- Electricity, etc.
- Metal Products
- Mining and Quarrying

Country codes: UKR, IDN, BHR, COL, PRK, ECU, MMR, CMR, SYR, AZE, KAZ, TKM, SAU, OMN, BOL, IRN, NOR, RUS, NGA, GIN, GAB, KWT, QAT, TTO, COG, YEM, BRN, VEN, LBY, AGO, IRQ, DZA

Net foreign currency revenues from selected industries (% of total) scale from 0 to 80.
2.2 Country analysis

External vulnerability
2.2 Importance of sunset industries for the country

Fiscal exposure, by country
2.2 Importance of sunset industries for the country
Fiscal vulnerability
2.2 Importance of sunset industries for the country
Socio-economic exposure, by country
2.2 Importance of sunset industries for the country
Socio-economic vulnerability
2.2 Adding financial variables
Combining financial fragility with financial impacts

2.2 Adding financial variables
Dependency of the French financial portfolio to ecosystem services

Share of the portfolio dependent (through scope 1, direct operations) to \( n \) ecosystem services at least Highly or at least Very Highly

- **42%** of the value of securities held by French financial institutions were issued by companies that are directly highly or very highly dependent on at least one ecosystem service (\( \approx 420 \) billion EUR)

- **9%** of the value of securities held by French financial institutions were issued by companies that are directly very highly dependent on at least one ecosystem service (\( \approx 90 \) billion EUR)

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Exposure in different dimensions
3.1 From exposure to risk
Clustering countries
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Clustering countries
3.2 From exposure to risk
Exposure, vulnerability and risk

Scenario: CO2e intensity defines the sunset industries

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Vulnerability

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Countries’ capacity to adapt

Risk
3.2 From exposure to risk
Risk in developing and emerging economies

- **Structure of the economy matters**
  - Domestic and international cascading effects
  - Demand and supply constraints, with different timing

- **Consider multidimensional impacts**
  - Dependency to climate and biodiversity
  - Impacts on climate and biodiversity
  - Role of industries and objectives of policy

- **Institutional analysis**
  - Context matters: risk will materialize in a specific socio-politico-ecological context
  - Macro-financial vulnerabilities which could transform a vulnerable sector into a risky one
Example of dynamic physical risk

For a small open developing economy

- Domestic Climate Change
  - Damages Productivity
  - Damages Production
  - Damages Capital

- Unit Costs
- Inflation

- Production
- Capital Stock

- Damages Productivity
- Damages Production
- Damages Capital

- Trade Balance
- Nominal Exchange Rate
- Real Exchange Rate

- Global Climate Damages

- NIIP
- Country Risk
- Foreign Rate

- External Finance
- Reserves

- Public finance Risk?
- Currency Crisis?
THANK YOU

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