NGFS ERA Overview and Occasional Paper

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   - Barriers
   - Options/recommendations

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   - Climate-related transition risk analysis
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The NGFS ERA Overview

- Based on the Occasional Paper, the Overview provides a less technical review of the tools and methodologies covering a wide-ranging environmental/climate scenario analyses and stress tests (for transition and physical risks) as well as ESG analysis, carbon footprint accounting and natural capital risk assessment.
- Identifies several major barriers to wider adoptions of ERA by the financial services industry.
- Proposes 6 options for promoting the wider adoptions of ERA.
- Highlights that NGFS does not endorse or recommend any particular service or vendor.
The NGFS ERA Overview

Barriers for Mainstreaming ERA:

1. A lack of awareness of environmental risks
2. Inadequate environmental and loss data
3. Limited capacity to develop ERA methodologies
4. Limited application to environment-related risks and emerging market economies
5. Gaps in methodologies and data quality
The NGFS ERA Overview

6 Options for Mainstreaming ERA (with reference to previous NGFS reports):

1. Enhancing awareness of the need for ERA
2. Developing analytical capacity and databases
3. Supporting demonstration projects
4. Encouraging disclosures of environmental risk exposures and ERA results
5. Developing Key Risk Indicators (KRI) and statistics
6. Supporting development and adoption of green and brown taxonomies
The NGFS Occasional Paper

- Provides detailed case studies of ERAs currently adopted by leading organizations to identify and quantify financial risks arising from FI’s exposure to environment- and climate-related risks.
- Includes Preface by Frank Elderson and Ma Jun, one Intro Chapter, 36 chapters by third party authors with detailed methodologies.
- Highlighted by Frank and editors that the views and opinions of these chapters belong to the authors and do not reflect those of NGFS.
- Received and accepted external reviewers and NGFS members’ comments on individual chapters.
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### Acknowledgments
Some exemplar methodologies – Transition risks

Tsinghua’s Transition Risk Analysis Modelling Framework

**Step 1**
Setting climate scenarios

**Step 2**
Transition impact evaluation
- Transition impacts on macroeconomics
  - GDP, interest rate ...
- Transition impacts on Cost
  - Revised Opex ...
- Transition impacts on Revenue
  - Revised revenue ...
  - Evolution of risk factors (by sector/geography)
  - Emissions Costs

**Step 3**
Corporate impact analysis
- Financial performance
  - Net income, ROA, debt ratio ...

**Step 4**
Financial risk assessment of FIs
- For Bank
  - PD Model
  - Merton-based Risk Model
  - ...
- For Asset Owner & Asset Manager
  - Valuation Models

**Step 5**
Financial risk assessment of supervisory ratios
- Banking Regulatory
  - Common Equity Tier 1 (CET1)
  - ...
- Insurance Regulatory
  - Solvency ratio
  - ...
- Pension Funds
  - Coverage ratio
  - ...

Source: IPCC 2014

Source: Ma and Sun 2020
Research question: what would be the impact of transition risks on the Probability of Default (PD) of thermal power sector in China?

We considered five potential risk drivers that will likely have an impact within 10 years:

1) Demand drop (decline in revenue)
2) Decline in prices for thermal power companies due to competitive pressure from lower cost of renewable energy (decline in revenue)
3) Increase in carbon price (higher cost)
4) Increase in funding cost due to financial deterioration and rating downgrade (higher cost)
5) Increase in risk weight for “brown” assets (higher cost)
## Impacts on financial indicators

### Financial Indicators

Case Example: Simulated Different Financial Indicators under Different Scenarios compared to BASE scenario in 2030

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>BAU</td>
<td>0.78</td>
<td>0.90</td>
<td>0.04</td>
<td>1.34</td>
<td>0.18</td>
<td>0.00</td>
<td>1.88</td>
<td>0.90</td>
<td>0.55</td>
<td>10.74</td>
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<tr>
<td>S1: Carbon Price</td>
<td>1.28</td>
<td>1.11</td>
<td>-0.07</td>
<td>-1.38</td>
<td>-0.22</td>
<td>0.00</td>
<td>-3.43</td>
<td>1.11</td>
<td>0.44</td>
<td>10.71</td>
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<tr>
<td>S2: Demand Shock</td>
<td>1.09</td>
<td>0.60</td>
<td>-0.02</td>
<td>-0.37</td>
<td>-0.02</td>
<td>-0.08</td>
<td>-8.22</td>
<td>0.60</td>
<td>0.44</td>
<td>10.71</td>
</tr>
<tr>
<td>S3: Renewable Price Shock</td>
<td>1.25</td>
<td>0.70</td>
<td>-0.05</td>
<td>-1.00</td>
<td>-0.15</td>
<td>-0.06</td>
<td>-3.65</td>
<td>0.70</td>
<td>0.44</td>
<td>10.71</td>
</tr>
<tr>
<td>S4: Comprehensive</td>
<td>1.30</td>
<td>0.38</td>
<td>0.00</td>
<td>-0.09</td>
<td>0.04</td>
<td>-0.14</td>
<td>-3.26</td>
<td>0.38</td>
<td>0.44</td>
<td>10.71</td>
</tr>
<tr>
<td>S5a: Carbon Shock + Renewables Price</td>
<td>1.79</td>
<td>0.70</td>
<td>-0.15</td>
<td>-1.84</td>
<td>-0.59</td>
<td>-0.06</td>
<td>-1.85</td>
<td>0.70</td>
<td>0.44</td>
<td>10.71</td>
</tr>
<tr>
<td>S5b: Demand Change + Renewables Price</td>
<td>1.44</td>
<td>0.38</td>
<td>-0.06</td>
<td>-1.08</td>
<td>-0.21</td>
<td>-0.14</td>
<td>-2.54</td>
<td>0.38</td>
<td>0.44</td>
<td>10.71</td>
</tr>
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</table>
Future PD of thermal power sector in China

Logit PD Model

$$PD = \frac{1}{1 + e^{-Z}}$$

$$Z = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n$$

$X_1 = Debt\ Ratio$

$X_2 = Interest\ Coverage\ Ratio$

$X_3 = \cdots$

Source: Ma and Sun 2020
Case study by WU and UZH

Climate Value at Risk (VaR) of EU largest banks conditioned to low-carbon or high-carbon investment strategy

Source: Battiston et al. 2017
Energy sector is overwhelmingly negatively affected, with mean company valuations in the sector falling 33%, and could see valuations fall by two-thirds (-66 percent). While electric utilities with the strongest renewables strategy could see valuation double (104 percent).

Source: Vivid Economics
Mean 1-yr **probabilities of default** of bonds issued by climate-sensitive sectors under a “too late, too sudden” transition scenario (%)

Mean change in **equity value** compared to a BAU scenario under a “too late, too sudden” transition scenario for key sectors, assuming a sudden repricing in 2025 (%)

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### Change in equity value (%)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream Oil</td>
<td>-53.3%</td>
</tr>
<tr>
<td>Coal mining</td>
<td>-57.0%</td>
</tr>
<tr>
<td>Upstream gas</td>
<td>-30.8%</td>
</tr>
<tr>
<td>Coal electricity</td>
<td>-80.1%</td>
</tr>
<tr>
<td>Gas electricity</td>
<td>-20.3%</td>
</tr>
<tr>
<td>Solar PV</td>
<td>19.2%</td>
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<tr>
<td>Wind electricity</td>
<td>12.8%</td>
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<tr>
<td>Nuclear</td>
<td>19.9%</td>
</tr>
<tr>
<td>Crude steel</td>
<td>-52.0%</td>
</tr>
<tr>
<td>Cement</td>
<td>-27.0%</td>
</tr>
<tr>
<td>Automotive</td>
<td>-9.5%</td>
</tr>
<tr>
<td>Aviation</td>
<td>-21.0%</td>
</tr>
</tbody>
</table>

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Source: 2ii
Some exemplar methodologies – Physical risks

General framework of physical risk analysis by RMS

Stochastic Event Module

Hazard Module

Vulnerability Module

Financial Module

A specific case for quantifying future risks from hurricane

Define Hurricane  Assess Wind Speed  Apply Exposure  Calculate Damage  Quantify Financial Loss

Source: RMS
Case study by CISL

Cambridge Institute for Sustainability Leadership (CISL)’s physical risk analysis

Model of the effects of climate change and adaptation measures on a given set of assets (exposures)

Input data
- Exposures
- Insurance policy conditions (not modelled)

Catastrophe model
- Hazard + Climate scenario
- Vulnerability + Adaptation
- Financial

Outputs
- Benchmarking against existing analysis
- Modelling of asset price changes

Expected losses for 2 degrees and 4 degrees scenarios

<table>
<thead>
<tr>
<th>Peril</th>
<th>Asset type</th>
<th>Risk metric</th>
<th>2°C warming by end of century</th>
<th>4°C warming by end of century</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK flood risk</td>
<td>Residential mortgages</td>
<td>% increase in AAL by 2050s</td>
<td>61%</td>
<td>130%</td>
</tr>
<tr>
<td>UK flood risk</td>
<td>Investment portfolios</td>
<td>% increase in AAL by 2050s</td>
<td>40%</td>
<td>70%</td>
</tr>
<tr>
<td>North America and Pacific Rim tropical cyclones</td>
<td>Investment portfolios</td>
<td>% increase in AAL by 2050s</td>
<td>43%</td>
<td>80%</td>
</tr>
<tr>
<td>European winter wind storms</td>
<td>Investment portfolios</td>
<td>% increase in AAL by 2050s</td>
<td>6.3%</td>
<td>3.6%</td>
</tr>
</tbody>
</table>

Source: CISL
Case study by Acclimatise

Overview of analytical approach to quantifying the financial effects of physical climate risk

Illustrative example of change in asset value, decomposed into value stream impact channels

Source: Acclimatise and Vivid Economics
Some exemplar methodologies – Other approaches (1)

**Hierarchy of ESG scores**

- **ESG Letter Rating (AAA-CCC)**
  - Pre-set score-to-letter-rating matrix
- **Final Industry Adjusted Score (0-10)**
  - Adjusted relative to industry peers. Exceptional truncations
- **Weighted Average Key Issue Score (0-10)**
  - Weighted average of underlying Pillar Scores

**Water Credit Risk Tool**

Shadow price (total economic value, TEV) increases with water stress

**Procedures of introducing TEV of water into corporate bond credit analysis**

Source: MSCI 2019

Source: Ohlsen and Ridley 2020
Some exemplar methodologies – Other approaches (2)

Natural Capital Credit Risk Assessment

- **Step 1:** Assess current situation
- **Step 2a:** Estimate likely future trend
- **Step 2b:** Estimate probability of risk being priced (where relevant)
- **Step 2c:** Assess borrower’s ability to mitigate risk
- **Step 3:** Evaluate overall risk

Source: Ascui and Cojoianu 2020

Assessing credit risks derived from environmental pollution

1) Quotes of pollutants, e.g. SOx, NOx, and increasing charges
2) For thermal power industry, the downward migration rate of credit rating of customers with AA grade (including) and above reached 68%, 75% and 81% respectively

Source: ICBC 2020
Thank you!

Q & A