Accounting for Climate Change and Environmental Activity: Implementation Challenges in the US

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*Disclaimer: Any views expressed here are those of the authors and not necessarily those of the Bureau of Economic Analysis or the U.S. Department of Commerce.*
Core Questions

• How does the world measure economic and financial dimensions of climate change and the environment?
  – A very brief introduction to environmental economic accounts:
    • What do other countries (or their national statistical offices) measure?
    • What does the U.S. government measure currently?
• What impediments do the U.S. and other countries face when measuring environmental economic activity accounts?
  – Lessons and challenges from the U.S. public and private sectors:
    • Can “Big Data” solve our problems?
    • Or, does it have to start from the accounting? How might government and firm accounting change to harmonize classifications and definitions for the world to better measure environmental economic accounts in the 21st century?
Figure 1 from Bagstad et al. (2021)
System of Environmental-Economic Accounts

- **SEEA Central Framework includes:**
  - Physical flow accounts (Ch. 3)
  - **Environmental Activity Accounts (Ch. 4)**
    - e.g. environmental protection expenditures, environmental goods and services sector (EGSS), tax and subsidy accounts
  - Environmental Asset Accounts (Ch. 5)
    - e.g. mineral and energy, land, soil, timber, aquatic/water resources, etc.

- **Information from these accounts is used by policymakers, researchers, and the private sector. They also help countries with international reporting for:**
  - According to the UN Statistics Division (UNSD), **90 countries** around the world have compiled these accounts
  - Sustainable Development Goals (SDGs), U.N. Framework Convention on Climate Change, and for organizations like the OECD and the **IMF tracking climate change indicators** and disseminating environmental-economic data
Where is the United States??

Government Expenditure on Environmental Protection

Summary

Government expenditures on a specified set of activities related to environmental protection.

<table>
<thead>
<tr>
<th>Country</th>
<th>ISO2</th>
<th>ISO3</th>
<th>Indicator</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Arab Emirates</td>
<td>AE</td>
<td>ARE</td>
<td>Expenditure on waste water management</td>
<td>Domestic Currency</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>AE</td>
<td>ARE</td>
<td>Expenditure on waste water management</td>
<td>Percent of GDF</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>GB</td>
<td>GBR</td>
<td>Expenditure on biodiversity &amp; ecosystem health</td>
<td>Domestic Currency</td>
</tr>
<tr>
<td>United Kingdom</td>
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<td>GBR</td>
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<td>Percent of GDF</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>GB</td>
<td>GBR</td>
<td>Expenditure on environment protection</td>
<td>Domestic Currency</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>GB</td>
<td>GBR</td>
<td>Expenditure on environmental protection</td>
<td>Percent of GDF</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>GB</td>
<td>GBR</td>
<td>Expenditure on pollution abatement</td>
<td>Domestic Currency</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>GB</td>
<td>GBR</td>
<td>Expenditure on pollution abatement</td>
<td>Percent of GDF</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>GB</td>
<td>GBR</td>
<td>Expenditure on waste management</td>
<td>Domestic Currency</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>GB</td>
<td>GBR</td>
<td>Expenditure on waste management</td>
<td>Percent of GDF</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>GB</td>
<td>GBR</td>
<td>Expenditure on waste water management</td>
<td>Domestic Currency</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>GB</td>
<td>GBR</td>
<td>Expenditure on waste water management</td>
<td>Percent of GDF</td>
</tr>
<tr>
<td>Uruguay</td>
<td>UY</td>
<td>URY</td>
<td>Expenditure on environment protection</td>
<td>Domestic Currency</td>
</tr>
<tr>
<td>Uruguay</td>
<td>UY</td>
<td>URY</td>
<td>Expenditure on environment protection</td>
<td>Percent of GDF</td>
</tr>
</tbody>
</table>

https://climatedata.imf.org/datasets/d22a6decd9b147fd9040f793082b219b_0/explore
I. Starting point: Government expenditures

• Identify – by separating out – the environmental expenditures by various economic actors (institutional units)
  
  – Start with Government (Federal, State, Local)

What does the U.S. do currently?

• The U.S. does not currently produce formal environmental-economic accounts, but...
  – **Related satellite accounts** produced by BEA
    • Outdoor Recreation Satellite Account
    • Marine Economy Satellite Account
  – **Interagency research** producing pilot accounts as proof-of-concept work:
    • Land (Wentland et al 2020)
    • Water (Bagstad et al 2020)
    • Ecosystem services (Warnell et al 2020)
    • Urban ecosystems (Heris et al 2021)
  – Environmental activity accounts (this paper)
<table>
<thead>
<tr>
<th>Classification of Functions of Government (COFOG)</th>
<th>National Income &amp; Product Accounts (NIPA) used by BEA</th>
<th>Office of Management and Budget (OMB)</th>
<th>Census Bureau</th>
<th>House (Congressional) Budget* and White House Budget Tables**</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 General Public Services</td>
<td>General Public Services</td>
<td>General Government plus International Affairs plus net interest plus allowances</td>
<td>Government Administration Plus interest on general debt Plus general expenditures not elsewhere classified</td>
<td>800 General Government 150 International Affairs 900 Net interest 920 Allowances</td>
</tr>
<tr>
<td>03 Public order and safety</td>
<td>Public order and safety</td>
<td>Administration of Justice</td>
<td>Public safety 750 Administration of Justice</td>
<td></td>
</tr>
<tr>
<td>04 Economic Affairs</td>
<td>Economic Affairs</td>
<td>Agriculture plus Energy plus Natural Resources and Environment plus Transportation plus Commerce and housing credit plus General science, space and technology</td>
<td>Transportation plus Utility expenditure plus Liquor store expenditure</td>
<td>350 Agriculture 270 Energy (partial) 300 Natural Resources and Environment (partial) 400 Transport 370 Commerce and housing credit 250 General Science, Space, and Technology</td>
</tr>
<tr>
<td>05 Environmental Protection</td>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3) 270 Energy (partial) 300 Natural Resources &amp; Environment (partial)</td>
</tr>
<tr>
<td>06 Housing and Community amenities</td>
<td>Housing and Community services</td>
<td>Community and regional development</td>
<td>Environment and housing</td>
<td>450 Community and regional development</td>
</tr>
<tr>
<td>07 Health</td>
<td>Health</td>
<td>Health plus Medicare plus Veterans benefits and services</td>
<td>(4)</td>
<td>550 Health 570 Medicare 700 Veterans benefits and services</td>
</tr>
<tr>
<td>08 Recreation, culture and religion</td>
<td>Recreation and culture</td>
<td>(5)</td>
<td>(3)</td>
<td>(6)</td>
</tr>
<tr>
<td>09 Education</td>
<td>Education</td>
<td>Education, training, employment, and social services</td>
<td>Education services</td>
<td>500 Education, training, employment, and social services</td>
</tr>
<tr>
<td>10 Social protection</td>
<td>Income security</td>
<td>Income security plus social security plus Undistributed offsetting receipts</td>
<td>Social services and income maintenance plus Insurance trust expenditure</td>
<td>600 Income security 650 Social Security 950 Undistributed offsetting receipts</td>
</tr>
</tbody>
</table>

1. Contained largely in the housing and community services and economic affairs function.
2. Contained largely in the natural resources and environment function and community and regional development function.
3. Contained largely in the environment and housing function.
4. Contained largely in the social services and maintenance function.
5. Contained largely in the natural resources and environment function.
6. Recreation is included in 300 Natural resources and environment; Culture is included in 500 Education, training, employment, and social services.
Table 4 - Environmental Activity Account for the U.S. Government by Environmental Domain – nominal estimates (millions USD$)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Wastewater management</td>
<td>102</td>
<td>20,980</td>
<td>20,602</td>
<td>18,868</td>
<td>17,931</td>
<td>17,931</td>
<td>18,744</td>
<td>19,411</td>
<td>20,089</td>
<td>21,388</td>
</tr>
<tr>
<td>3 Waste management</td>
<td>103</td>
<td>10,472</td>
<td>10,480</td>
<td>10,431</td>
<td>10,083</td>
<td>9,634</td>
<td>9,754</td>
<td>9,926</td>
<td>11,796</td>
<td>13,662</td>
</tr>
<tr>
<td>II. Resource Management (RM)</td>
<td>-</td>
<td>17,167</td>
<td>16,567</td>
<td>16,511</td>
<td>17,039</td>
<td>17,196</td>
<td>17,833</td>
<td>18,379</td>
<td>18,941</td>
<td>19,880</td>
</tr>
<tr>
<td>14 Management of water resources</td>
<td>101</td>
<td>17,167</td>
<td>16,567</td>
<td>16,511</td>
<td>17,039</td>
<td>17,196</td>
<td>17,833</td>
<td>18,379</td>
<td>18,941</td>
<td>19,880</td>
</tr>
</tbody>
</table>

*Line refer to the corresponding lines in the National Income and Product Accounts (NIPA) Table 3.15.5 - Government Consumption Expenditures and Gross Investment by Function, while the categories underlying Environmental Protection (2 & 3) and Resource Management (14) correspond to CEA categories.*
Lessons and Takeaways from Govt. Accounts

• Govt. environmental protection expenditures and resource management data
  – What can we do? ➔ Begin with coarse estimates from the NIPA tables
    • Some functions encompass too much (e.g., energy) and need to be pared down
    • Some functions are missing or lumped in elsewhere (i.e., other environmental protection expenditures, mitigation, and adaptation expenditures).
    • In both cases above, finer detailed data is required for better estimates
  – What should we do? ➔ Align classifications and definitions in government accounting with SEEA and use supplemental surveys to fill gaps
    • Adopting a consistent system across the US government (USG) more aligned with COFOG and SEEA
    • Obtaining finer detailed data in the collection process (e.g., census of state and local governments reporting categories) or in government budgeting
  – What did we learn? ➔ Accounting definitions and classifications matter.
    • e.g. Water, Sewerage, and Sanitation are a massive part of the U.S. resource management expenditures ➔ How much of these coarse categories are “primarily environmental”? Climate?
II. Private Sector Environmental Activities: Data?

• United States
  – EPA & Census Bureau used to conduct annual surveys of enterprises collecting data on pollution abatement and control expenditures (PACE) from 1973-1994, 1999 and 2005
    • No longer collected
  – BEA Annual Survey of US Direct Investment Abroad
    • Do not ask about environmental activity specifically
  – Census surveys (e.g., Economic Census, Annual Business Survey, etc.) collect sector-specific data, including some data useful for environmental activity accounts
    • Not designed with SEEA in mind - more on this later

• Other countries have extensive surveys and data collection efforts
  – Canada: Annual Survey of Environmental Goods and Services
  – E.U.: Environmental Goods and Services Sector Questionnaire

• In the 21st century, national statistical offices are increasingly figuring out ways to be less reliant on long, costly surveys
  – Big Data, proprietary data, administrative data, “blended data”
Data – What do firms disclose publicly?

• 21st century corporate trend toward reporting on sustainability (Environmental, Social, and Governance (ESG) reports and disclosures based on KPMG report)
  – 96% of the largest companies (Top 250 by market cap)
  – 80% of large and mid-cap companies (5,200 companies, top 100 in 52 countries)

• ESG ratings/scores are increasingly commonplace
  – MSCI, Sustainalytics, Bloomberg, Thomson Reuters Refinitiv, and RobecoSAM
    • Refinitiv has distilled public information from these disclosures and reports into a single database that includes both ratings and underlying data
Exceeded 2020 reduction goals; progressing further greenhouse gas reductions

By the end of 2020, ExxonMobil delivered on its goal to significantly reduce methane emissions and flaring versus 2016 levels. The Company’s goals includes a 15 percent reduction in methane and a 25 percent reduction in flaring. Both goals were achieved through targeted improvements at facilities in the United States, Equatorial Guinea, Angola and Nigeria, eliminating approximately 6 million tonnes of CO₂ equivalent emissions (CO₂e).

Since 2000, ExxonMobil has invested over $10 billion in projects to research, develop and deploy lower-emission energy solutions. ExxonMobil also continues to expand collaborative efforts with other companies and academic institutions. See pages 22 to 29 for more information on these collaborations.

Annual Reports (10K) Example: ExxonMobil
Lessons and Takeaways for Private Sector Accounts

• EGSS, private firm expenditure data, and ESG reporting
  – What can we do? → Coarse estimates from industry data (for EGSS) and proprietary data from public firm disclosures
    • The North American Industry Classifications (NAICS), even at the 6 digit level, are sometimes too coarse or some classifications lump in non-environmental activities
      – In progress: what does a U.S. EGSS account look like if we use the EU’s corresponding NACE codes and percentages?
    • Private firm data issues – Big Data alone cannot save us here! (yet)
      – Multinational firms do not disaggregate their ESG reporting by country and often not even by year.
      – Accounting definitions and classifications are not harmonized with SEEA. What does a firm consider environmental R&D, for example?
Lessons and Takeaways for Private Sector Accounts

• EGSS, private firm expenditure data, and ESG reporting
  – What should we do?
    • We argue that better alignment of definitions and classifications in private sector accounting with SEEA would provide more informative public disclosures for national accounts
      – The U.S. Securities and Exchange Commission (SEC) has called for public comment on climate change disclosures and an evaluation of how the SEC can best “regulate, monitor, review, and guide climate change disclosures in order to provide more consistent, comparable, and reliable information” → Why not consider national statistical offices as a key stakeholder? If the selection of a standard to rally around is arbitrary, why not something more consistent with SEEA?
    • Embrace the trend that survey response costs are a real issue → if we can, use surveys and/or admin data to complement public data (e.g., ESG disclosures) and fill in the gaps
      – Traditional approach of national statistical offices: large costly surveys to firms and individuals
      – 21st century approach: use surveys more sparingly and employ Big Data, administrative data, and other data sources when possible
While economic activity associated with adaptation to climate change is not considered an environmental activity per se, it is recognized that information on this activity may be of particular interest.
Lessons and Takeaways for Climate Statistics

• Environmental economic accounts are not exactly synonymous with climate change statistics
  – In the paper, we identify where this is overlap and where there is not by exploring relationships between expenditures related to 1) EPE/RM, 2) climate change, and 3) disaster/hazard risk.

• Helpful to consider all three inter-related types of expenditures
  – climate change, disaster/hazard risk, environmental protection/resource management – at the same time rather than separately.
  – Need to avoid double counting when developing new statistics.

• Challenges with determining the selection criteria
  – ‘Primary purpose’ used for EPE/RM appears too restrictive to apply for climate change and disaster expenditures. Policy intent does not cover all CC-related expenditures.
  – One overarching practical challenge is how to determine if a given environmental expenditure, whose “primary purpose” is already environmental, is also climate-specific
    • What precisely do we mean by climate-specific?
Thank You!

Additional questions/comments?

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Annex Slides
Should disaster recovery expenditures be thought of as part of “climate change expenditures”? 

Climate change (CC) related expenditures

A = CC mitigation and adaptation expenditures

B = CC mitigation & adaptation AND hazard preventive/adaptive for CC

C = Recovery expenditures for CC-related hazards

D = Recovery for non-CC hazards (volcanos, earthquakes, technological failures, etc.)

E = Preventive/adaptive expenditures for non-CC hazards

Disaster/hazard risk related expenditures
Environmental protection and Resource management expenditures

Climate change related expenditures

Disaster/hazard risk related expenditures

EP&RM + Climate change + Disaster/hazard
<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EPE-RM but not climate mitigation or disaster/hazard related</td>
</tr>
<tr>
<td>2</td>
<td>EPE-RM which are also CC mitigation but not disaster/hazard related</td>
</tr>
<tr>
<td>3</td>
<td>EPE-RM which are also disaster/hazard recovery and adaptive/preventive related</td>
</tr>
<tr>
<td>4a</td>
<td>CC Adaptations to the natural environment that are not EPE-RM expenditures (do not have environmental protection or resource management as ‘primary purpose’)</td>
</tr>
<tr>
<td>4b</td>
<td>CC Adaptation of human systems that are not EPE-RM or disaster/hazard related</td>
</tr>
<tr>
<td>4b1</td>
<td>CC Adaptation of human systems that are also disaster/hazard recovery related</td>
</tr>
<tr>
<td>4b2</td>
<td>CC Adaptation of human systems that are also disaster/hazard adaptive/preventive related</td>
</tr>
<tr>
<td>5a</td>
<td>Disaster/hazard adaptive/preventive related that are not related to climate or EPE-RM (primary purpose)</td>
</tr>
<tr>
<td>5b</td>
<td>Disaster/hazard recovery related that are not related to climate or EPE-RM (primary purpose)</td>
</tr>
</tbody>
</table>