Article presentation :

Chancel L., Rehm Y., The Carbon Footprint of Capital: Evidence from France, Germany and the US based on Distributional Environmental Accounts

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Outline

Introduction

1. Introduction

1.1 Carbon Footprint

1.2 Carbon Footprint of Capital : Chancel and Rehm (2024)

1.3 Key findings

Carbon Footprint

Carbon Footprint: The measure of the exclusive total amount of emissions of carbon dioxide that is directly and indirectly caused by an activity or is accumulated over the life-cycle stages of a product.

Individual Carbon Footprint: The carbon footprint associated with an individual's activities, lifestyle or choices.

Challenge: What to include in the carbon footprint?

The Consumption-based Approach

Carbon Footprint of Capital : Chancel and Rehm (2024)

"The Carbon Footprint of Capital: *Evidence from France, Germany and the US based on Distributional Environmental Accounts*"

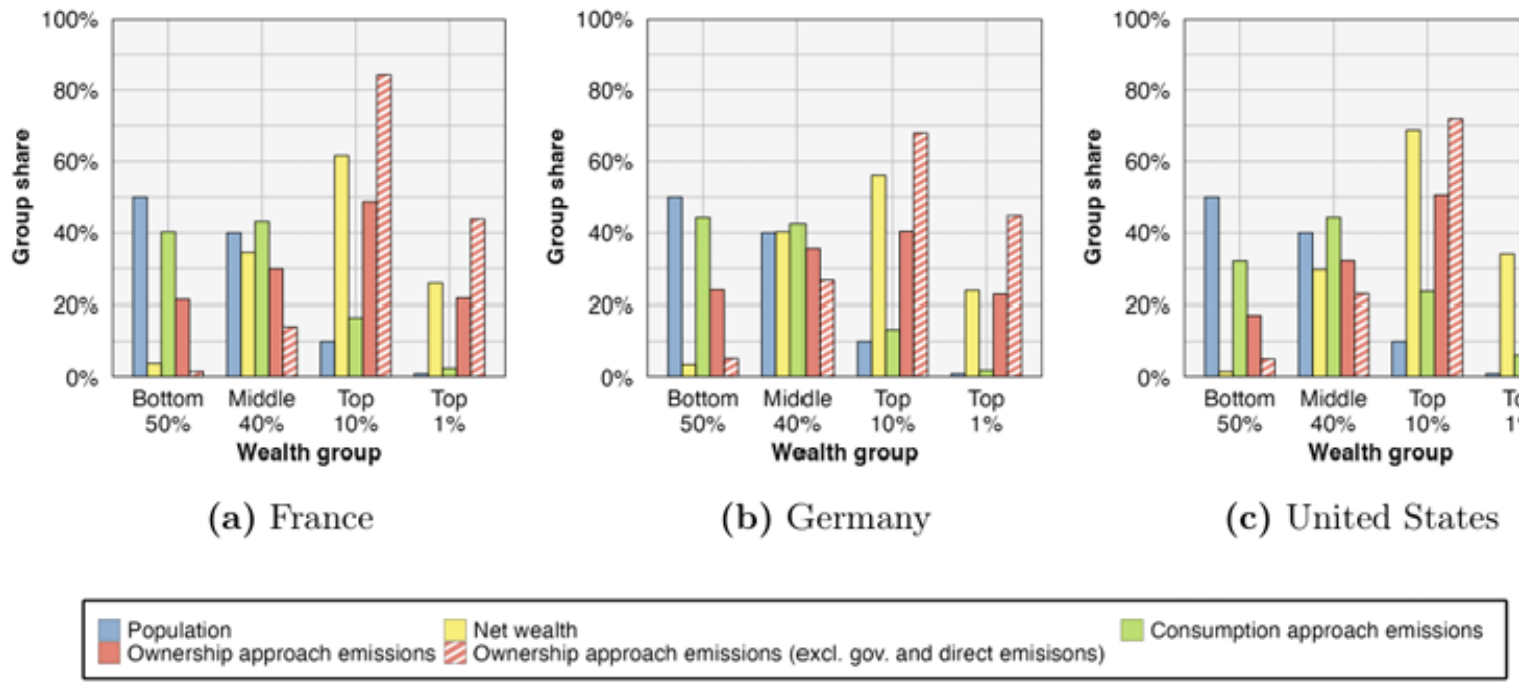
Motivations: *Individuals are not only responsible for their consumption, but also for the assets they own.*

1. Linking carbon emissions to asset ownership to construct a new framework for individual carbon footprint (3 Approaches: Consumption, Ownership and Mixed).
2. Applying this framework to France, Germany and the US.
3. Deriving new stylized facts about emissions inequality in the context of environmental and tax policy.

Key findings

1. Carbon inequalities are notable in every approach.
2. In the ownership approach, the majority of emissions for the wealthiest 10% originates from the assets they own.
3. Emissions from capital ownership appear to be even more concentrated than capital itself.

Figure 1. Distribution of emissions and wealth by wealth group



(a) France (b) Germany (c) United States

Related Literature

2. Related Literature

2.1 Measuring the Carbon Footprint

2.2 Consumption-based Approaches

2.3 Production-centered Approaches and Methods of Shared Attribution

2.4 From the Carbon Footprint of individual investment portfolios to the DINA

Measuring the Carbon Footprint

What makes a good Carbon Footprint estimate?

The 2 fundamentals or carbon accounting:

1. **Comprehensiveness:** measuring both direct and indirect emissions associated with the economic activity.
2. **Exclusivity:** no double-counting.

Together, these conditions guarantee the **macro-consistency** of the measures.
So far, the two common ways to measure the carbon footprint have been to focus on **countries and firms** or **individuals** (as final consumers).

Consumption-based Approaches

Individuals' consumption guide the resource allocation in the economy.

- Underlying assumption: *"Individuals express their preferences through consumption, which sens a signal to producers about what to manufacture and in what quantity."*
- The **"consumer-pays"** principle

Advantage: Particularly relevant at the country level (accounts for outsourced emissions).
Drawback: Puts the entire responsibility for all emissions on final consumers (despite market failures: lack of information, agency or alternatives).

Production-centered Approaches and Methods of Shared Attribution

Contrasting consumption footprints with the production footprints of firms.

Production-centered approaches: Focusing on the firm level
Critique: Firms operate through human intervention and individuals are behind their behaviors. $\rightarrow$ **Ownership-based approach**

Methods of shared attribution: Split emissions between consumers and firm owners
Critique: Hard to implement at the individual level. $\rightarrow$ **Mixed-based approach**

Income-based carbon accounting: An alternative at the individual level?

From the Carbon Footprint of individual investment portfolios to the DINA

There already were some attempts at measuring the carbon emissions of individual portfolios (GHG, PCAF). But there exists no consensus regarding these methods and their estimates were not always consistent with aggregate estimates.

Their answer: **the Distributional National and Environmental Accounts (DINA)**

- Goal of the DINA framework: *Reconciling macroeconomic studies (e.g., production, income, wealth) with microeconomic distributional analysis by integrating the study of inequality into the system of national accounts.*

Data Sources and Methodology

Key Datasets Used:

- **Wealth Data:** HFCS (France/Germany) and DINA (US).
- **Macroeconomic Data:** National accounts from Eurostat and OECD.
- **Emissions Data:** Air emission accounts (Eurostat, OECD).
- **Input-Output Tables:** Eurostat FIGARO dataset (2010–2020).

Example Insights:

- Emissions in US agriculture: **534.9 tCO_2/million dollars owned**.
- Manufacturing emissions in France: **95.1 $MtCO_2$** (ownership approach).

Carbon Footprint of the Capital

Carbon Footprint of the Capital

4. Carbon Footprint of the Capital

4.1 Capital emissions by industry and institutional sector

4.2 Capital emissions by asset class

4.3 The role of foreign capital in national emissions

Capital emissions by industry and institutional sector

Industries :

- Agriculture and mining
- Energy, water and waste
- Manufacturing
- Transport
- Real estate and construction
- Health and education
- Public administration
- Services

Results :

- Manufacturing as the largest emitting sector in FR and DE
- Agriculture and mining as the largest emitting sector in the US
- Agriculture and mining as the most carbon-intensive sector
- Similar carbon intensity for the manufacturing sector
- Difference in definition for the Real Estate and Construction sector

Following : Table 1, Emission intensities by industry groups

Capital emissions by industry and institutional sector

Industry	Mixed			Ownership		
	tCO2e/ m euros capital	tCO2e/ m euros value-added	million tCO2e	tCO2e/ m euros capital	tCO2e/ m euros value-added	million tCO2e
Panel A. France (2017)						
Agriculture and mining	65.5	291.9	10.9	528.4	2,354.9	87.8
Energy, water and waste	85.8	562.0	27.1	150.6	987.0	47.6
Manufacturing	120.0	212.9	49.6	230.2	408.4	95.1
Transport	38.3	103.1	9.8	163.5	440.5	41.7
Real estate and construction	0.8	20.4	7.7	1.0	24.7	9.3
Health and education	0.3	0.6	0.2	19.0	34.5	10.3
Public administration	0.1	1.1	0.2	3.2	30.6	4.9
Services	6.7	9.7	7.7	30.2	44.0	35.0
Panel B. Germany (2017)						
Agriculture and mining	84.0	568.3	18.2	335.3	2,269.7	72.8
Energy, water and waste	113.5	912.2	81.0	289.4	2,326.2	206.6
Manufacturing	96.6	131.9	87.9	232.6	317.8	211.7
Transport	24.0	116.0	14.9	161.9	783.5	100.5
Real estate and construction	0.8	15.5	7.0	1.2	23.2	10.5
Health and education	0.3	0.9	0.3	8.7	28.7	10.2
Public administration	0.3	1.8	0.3	4.9	30.7	5.5
Services	4.0	6.6	6.9	22.2	36.5	38.1
Panel C. United States (2019)						
Agriculture and mining	97.3	641.7	297.9	534.9	3,526.6	1,637.3
Energy, water and waste	146.7	1,262.1	455.3	431.4	3,710.8	1,338.6
Manufacturing	117.7	214.7	508.1	205.7	375.2	887.7
Transport	105.7	254.8	179.1	359.1	865.8	608.6
Construction	158.4	69.7	62.9	212.5	93.6	84.4
Services and other industries	0.9	4.1	65.5	6.6	30.2	477.5

Capital emissions by asset class

Assets :

- Housing assets
- Business assets
- Equities
- Pension assets
- Fixed income assets

Results :

- Equity is the most polluting asset class.
- Pension assets are the second most polluting asset class.
- Business assets are the third most polluting asset class.
- Housing has an important market valuation, but emits little.
- Important intensity of pension assets for Germany.

In clear, there exist important differences between types of assets.

Capital emissions by asset class

Table 2. Asset classes and emission intensity per million $/EUR owned (ownership-based approach)

Asset class	France (2017)			Germany (2017)			USA (2019)		
	b euros owned	million tCO2e	tCO2e/ m euros owned	b euros owned	million tCO2e	tCO2e/ m euros owned	b dollars owned	million tCO2e	tCO2e/ m dollars owned
Housing assets	6,808.5	0.3	0.1	6,901.2	0.5	0.1	36,475.5	260.8	7.2
Business assets	727.9	38.3	52.6	1,036.7	90.4	87.2	6,748.4	966.5	143.2
Equities	1,528.7	123.2	80.6	1,332.7	203.7	152.9	17,553.6	1,314.4	74.9
Domestic	*1,183.9*	*83.1*	*70.2*	*808.2*	*117.5*	*145.4*	*13,965.3*	*1,118.4*	*80.1*
Abroad	*344.8*	*40.1*	*116.4*	*524.6*	*86.2*	*164.4*	*3,588.3*	*196.0*	*54.6*
Pension assets	2,026.9	75.4	37.2	1,351.5	197.6	146.2	31,564.2	1,015.9	32.2
Fixed-income assets	1,552.8	0.0	0.0	2,579.9	0.0	0.0	17,363.7	0.0	0.0

Note: Emissions correspond to the average emissions of an individual who owns the asset for one year. The table presents household sector ownership-based emissions and does not include government-owned assets. Emissions attributed to assets based on the approach explained in the paper (ownership-based approach). The value of total assets owned is sourced from Eurostat national balance sheets (France and Germany) and from distributional national accounts released by Piketty et al. (2018) for the Unites States. Pension assets include life insurance assets.

The role of foreign capital in national emissions

- In France and in the US, equity held abroad represents about 20-25% of owned equities.
- In Germany, equity held abroad represents about 40% of owned equities.
- Foreign equity held by French and German citizens are more carbon intensive than those owned by the US citizens.

The Distribution of Carbon Footprints

The Distribution of Carbon Footprints

5. The Distribution of Carbon Footprints

5.1 Emissions rise with income and wealth

5.2 Emissions intensity rises with wealth

5.3 The weight of capital emissions among top groups

Emissions rise with income and wealth

Generally :

- Emissions are positively correlated with wealth.
- Consumption approach : carbon inequalities are less concentrated than income.
- Mixed-based approach : carbon inequalities are as concentrated as income.
- Ownership approach : carbon inequalities are more concentrated than wealth.

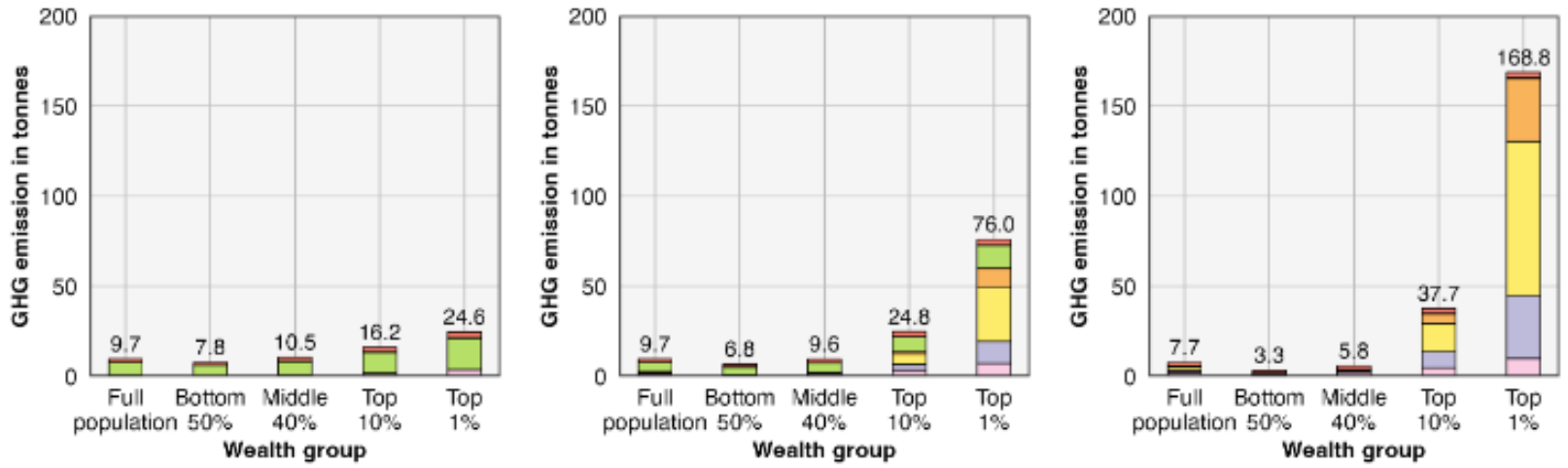
International comparison :

- The US are more carbon inequal than Germany, which is more carbon inequal than France.
- The majority of the US emit as much as the top of the distribution of France and Germany in the two first approaches.
- The top French group emits less despite owning more of the national equity than their German counterpart.

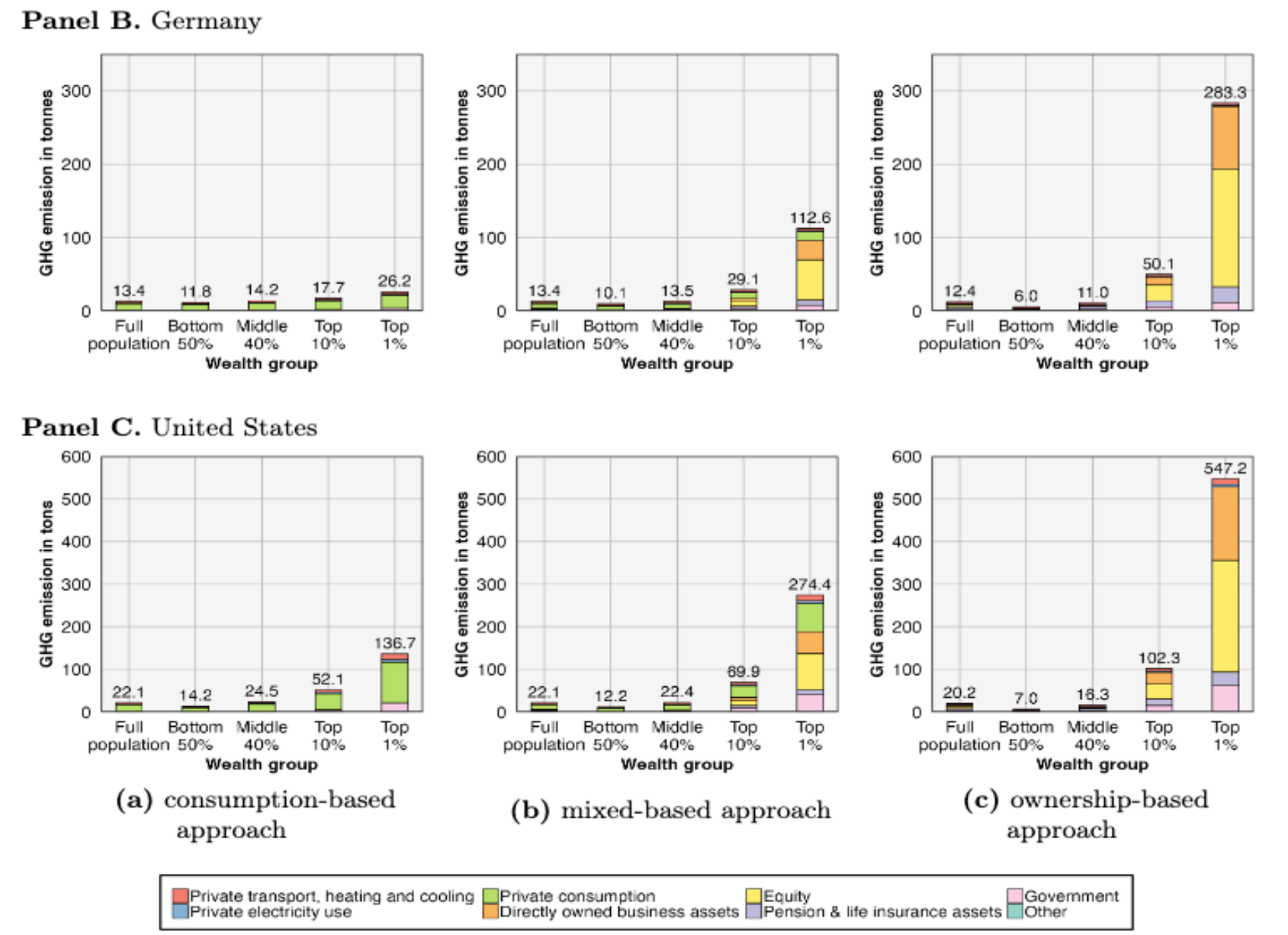
Emissions rise with income and wealth

Figure 5. Per capita emissions by wealth group

Panel A. France



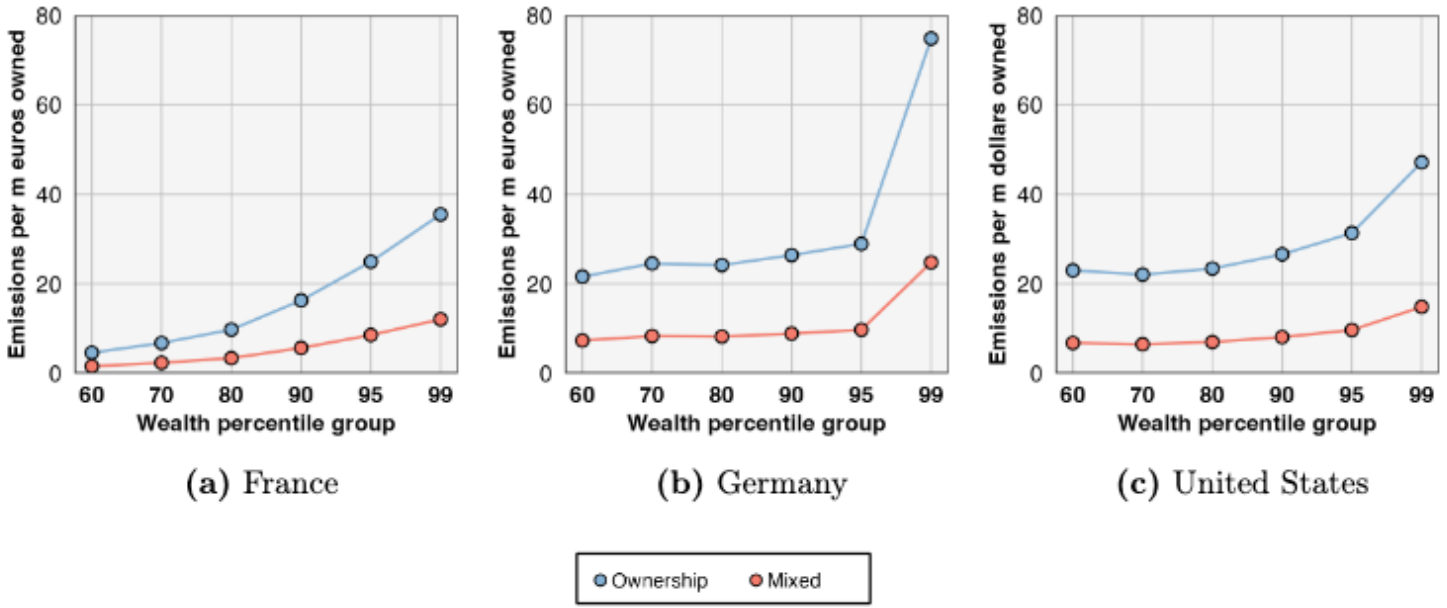
Emissions rise with income and wealth



Emissions intensity rises with wealth

Average emission intensity tends to increase alongside with wealth at the very top of the distribution. This explains the greater concentration of carbon emissions compared to wealth.

Figure 6. Average annual emissions in tonnes per million dollars or euros owned



(a) France (b) Germany (c) United States

The weight of capital emissions among top groups

- Importance of the emissions of top groups.
- Emissions of the top 1% (p.36) :

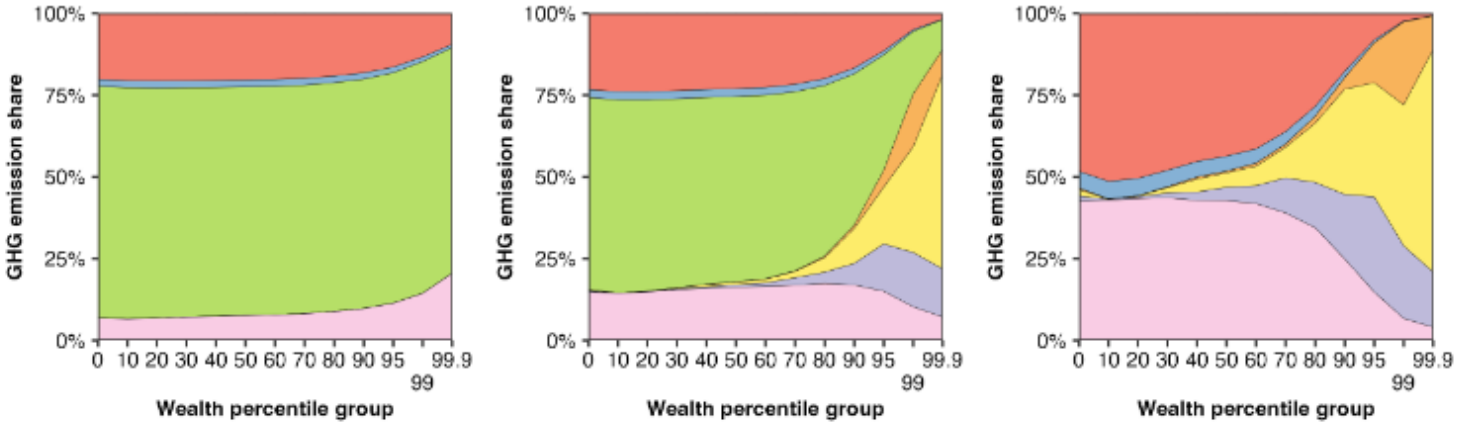
Countries	Consumption	Ownership	Multiplication in tCO2e
France	2.5%	21.5%	6
Germany	2%	22.3%	11
US	6.2%	26.9%	16

- Key role of Capital ownership in the determinant of the top of the distribution.
- Structure of the emissions alongside the wealth distribution.

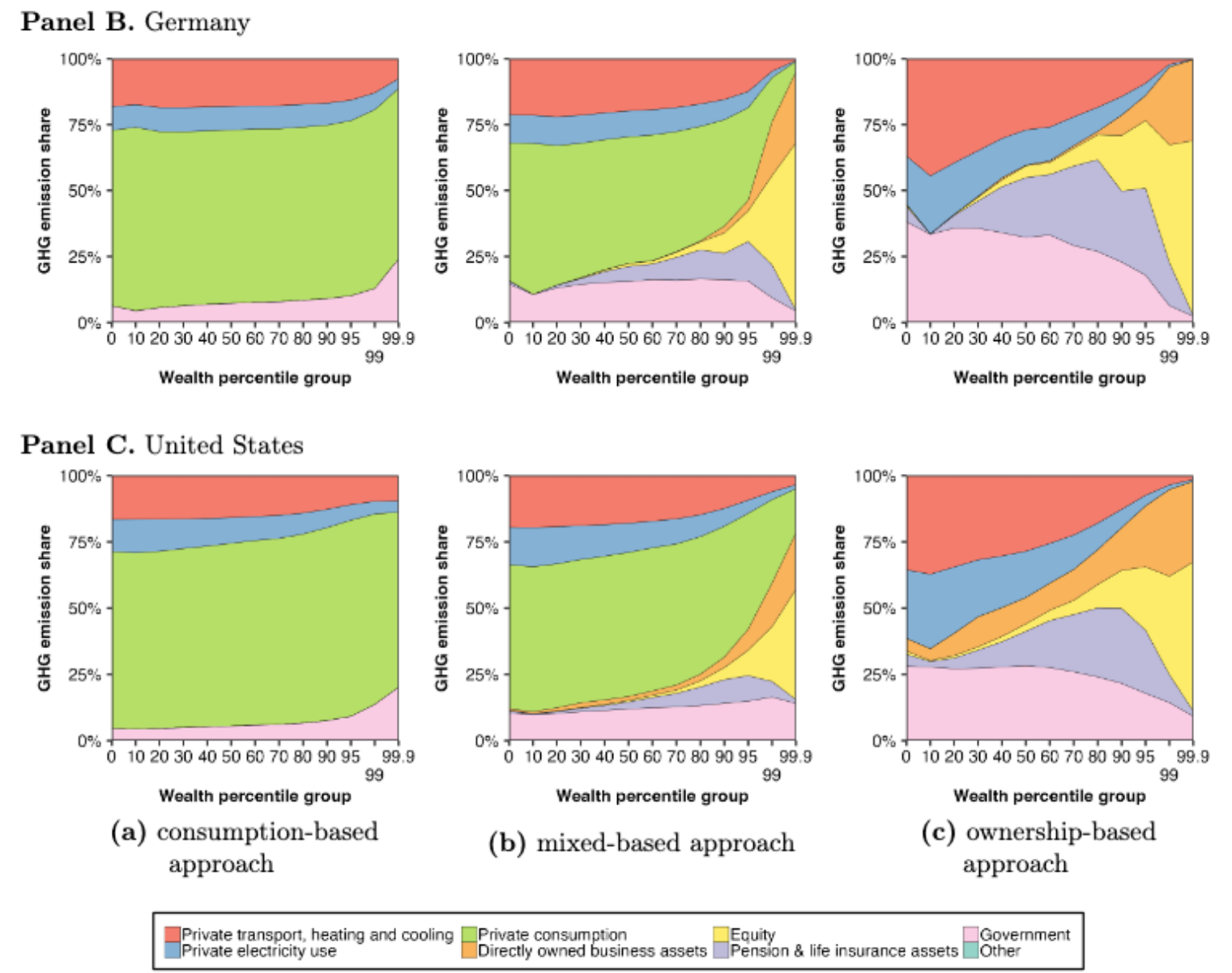
The weight of capital emissions among top groups

Figure 7. Breakdown of emissions according to the three approaches

Panel A. France



The weight of capital emissions among top groups



(a) consumption-based approach

(b) mixed-based approach

(c) ownership-based approach

Discussion

Discussion

6. Discussion

6.1 Sensitivity of the results to assumption

6.2 Scope and limitations of the data and foootprinting approaches

6.3 How our estimates compare to earlier work

6.4 Stylized facts on inequality and emissions

6.5 Distributional properties and revenue estimates for a carbon wealh tax

Sensitivity of the results to assumption

test

Include Figure 8.

Scope and limitations of the data and foootprinting approaches

- Limitations linked to data Sources
- Carbon footprints and individual responsibility

How our estimates compare to earlier work

Stylized facts on inequality and emissions

Stylized facts.

Distributional properties and revenue estimates for a carbon wealh tax

Conclusion

7. Conclusion