LCM 2021 |
Life Cycle Metrics in Sustainable Finance and Business

The reliability of input-output and lifecycle-based data for estimation of corporate carbon emissions

A comparative study of carbon footprints in the automotive sector

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6th September 2021

Background and Motivation

SUSTAINABLE FINANCE NEEDS

- EU Action Plan on Sustainable Finance, EU Taxonomy, EU SFDR, EU Climate Benchmarks –

"Reduced reporting on and assessment of indirect impacts (supply-chain, use, end-of-life)" *(EC Climate Transition Benchmark, 2019)*

- Scope 3 data is essential for prospective metrics, such as Portfolio Alignment with the Paris Agreement Scenarios (TCFD, 2021)

Research Goals

- Test the validity of different estimation methods for measuring GHG emissions at corporate level
- Understand points of difference by comparison to reported data
- Key advantages of IO and LCA methodologies and future improvements

Image Source: (left) Consultancy.aisa; (right) World Economic Forum, 2021

Data and Methods | Automobile Manufacturers

- Reporting on emissions by few companies – 36% reporting on scope 3 emissions *(Blood and Levina, 2020)*
- Risk of greenwashing amidst increase in Net Zero commitments –

Production Plans of 14 major auto manufacturers are not aligned with below 2DS; Necessary shift from ICEVs to xEVs *(2 ° investing initiative, 2020)*

When & What

Time period
FY2019

Companies compared
13 large Auto manufacturers

Impact category
GHG emissions, GWP100
ILCD 2.0 2018 midpoint:climate change: climate change total
Cradle to gate

Data and Methods | Choice of data and Methodology

Reported data

- 20% coverage (out of 110 Auto companies)
- Inconsistences in reporting and standards used

Bloomberg

CDP

Estimated top-down IO-based

- 90% of companies covered
- Revenue data by sector and country
- Lifecycle GHG multipliers

exiobase

FACTSET

! By-country emission factors for *"'Manufacture of motor vehicles, trailers and semi-trailers"*

! Revenue-based allocation

! Completeness in scope

Estimated bottom-up LCA-based

- 16% covered (13 manufactures)
- Production data by powertrain and model
- LCI by powertrain

ecoinvent

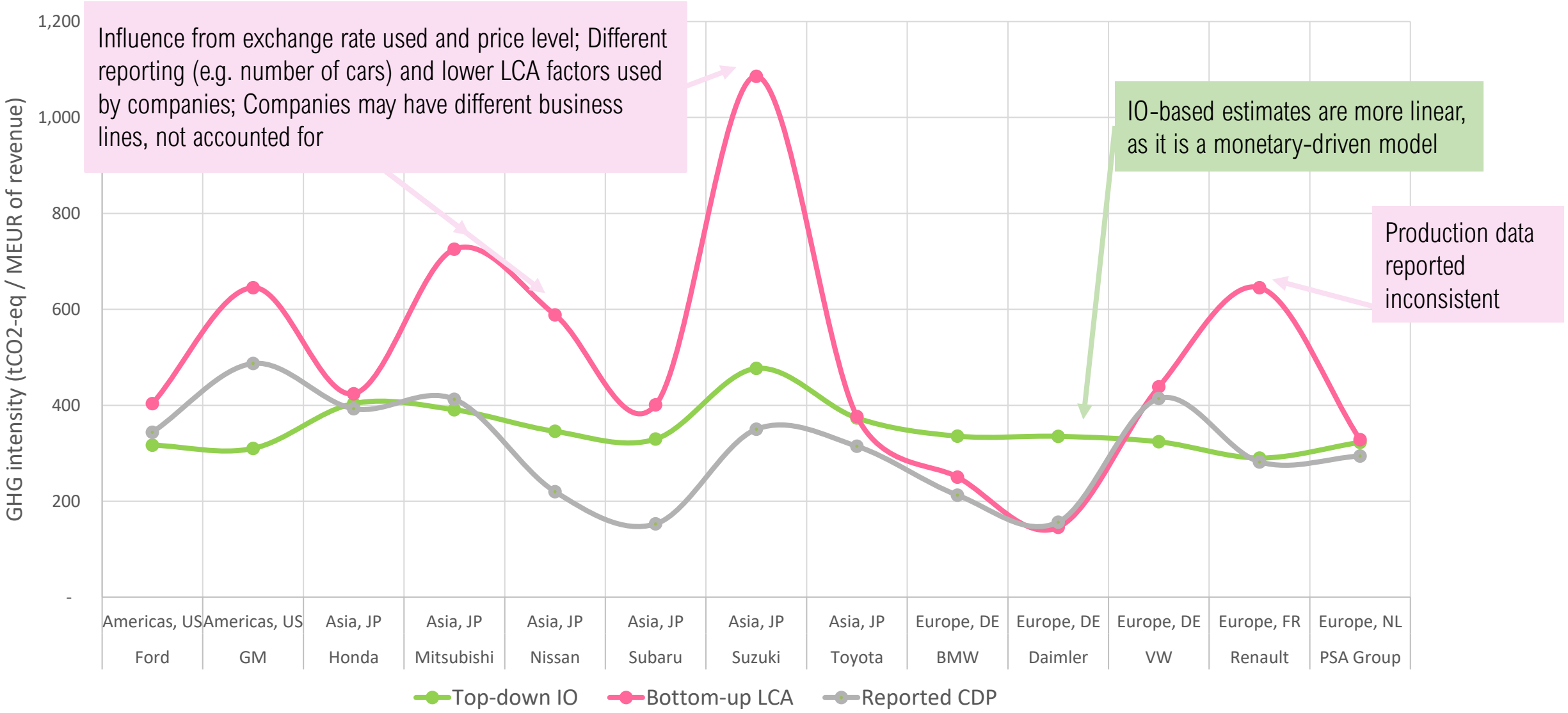
ADAC

! Limited publicly-available reporting by model and powertrain

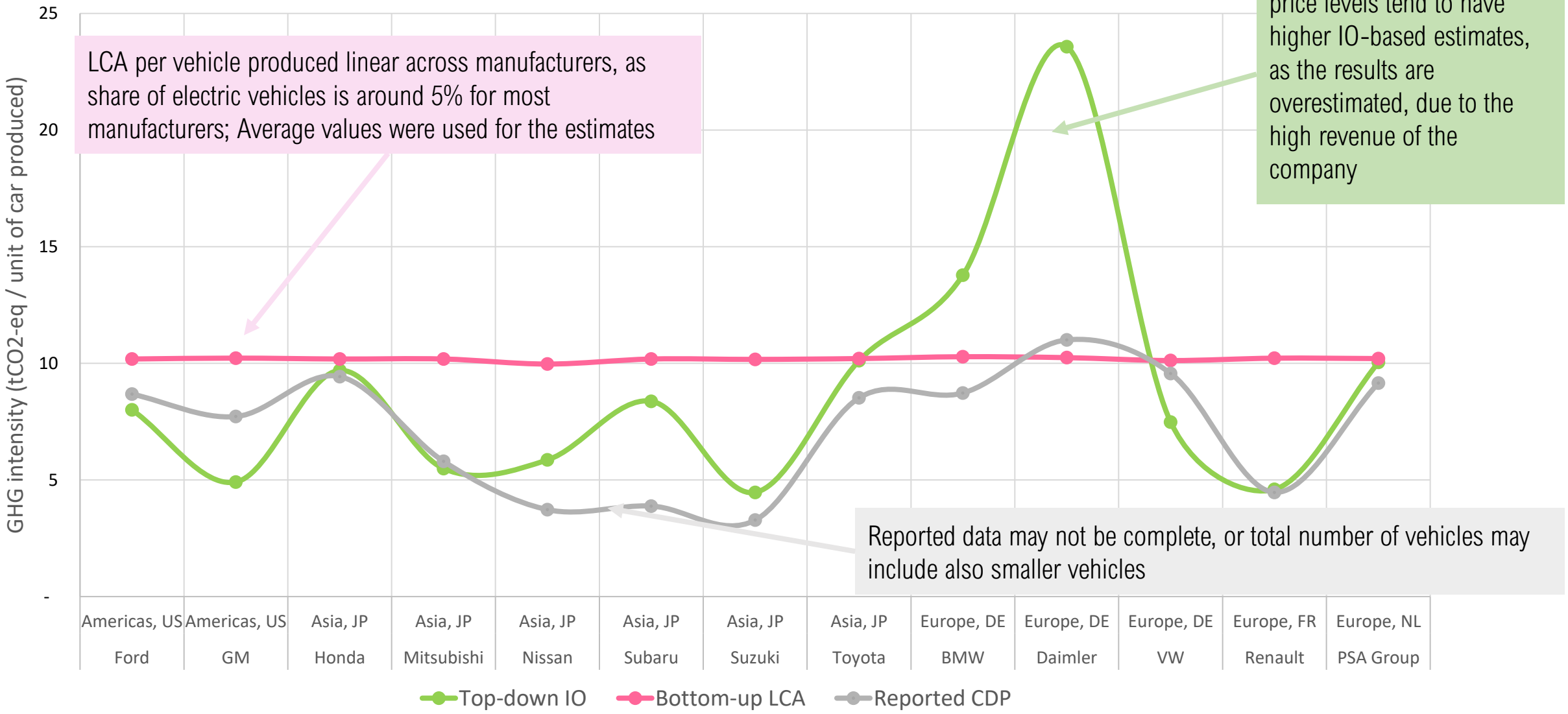
! Use of average emission factors by powertrain

! Only production of cars considered

Results | Estimated vs reported data – revenue basis



Results | Estimated vs reported data – production basis



Results | Particular cases

- For particular cases, LCA-based model is much more reliable than IO-based model
- LCA-based model is conditioned on data availability and requires more time

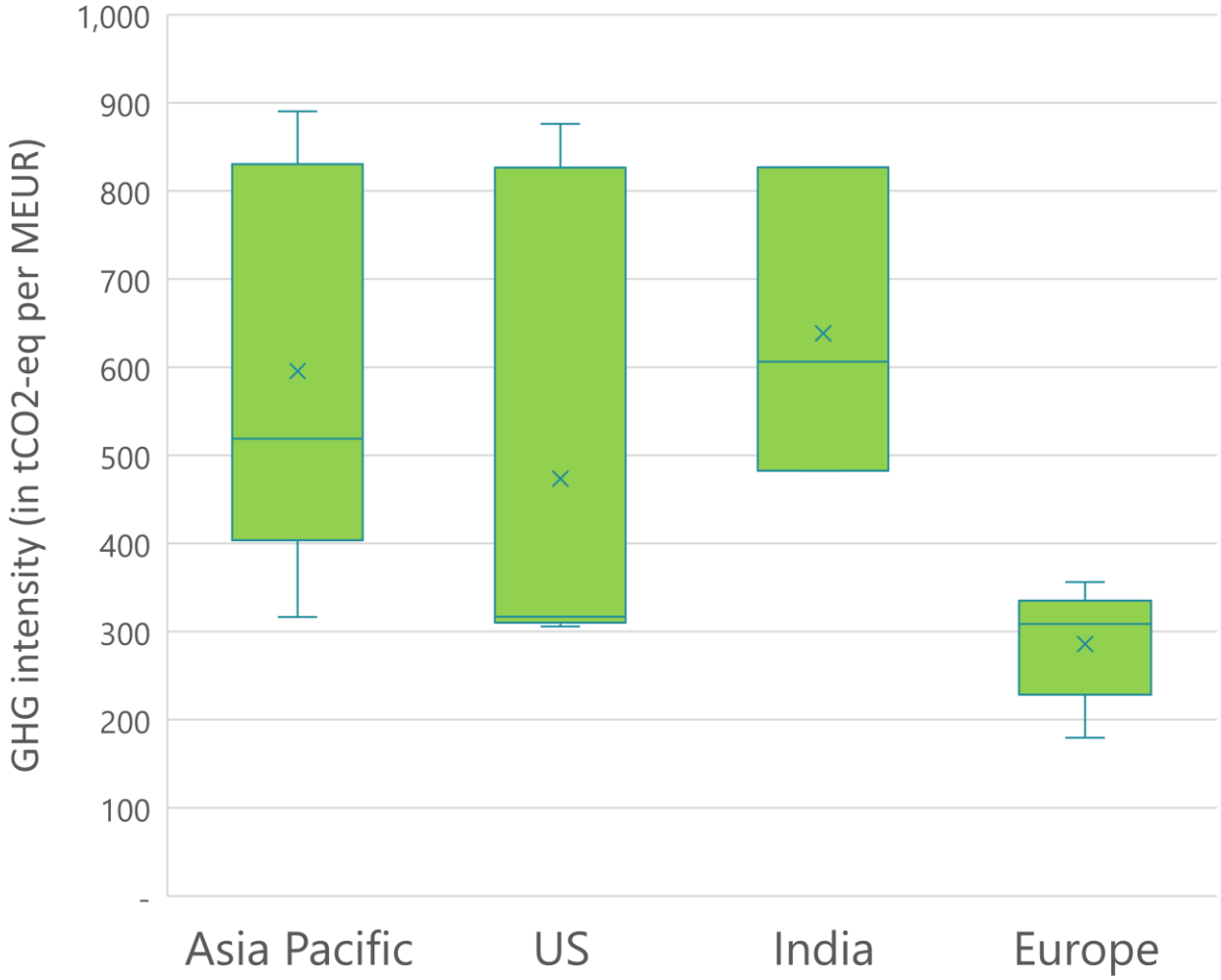
Company	IO-based (tCO2-eq / MEUR)	LCA-based (tCO2-eq / MEUR)	IO-based (tCO2-eq / vehicle)	LCA-based (tCO2-eq / vehicle)	IO-based absolute (ktCO2-eq)	LCA-based absolute (ktCO2-eq)	Reported emissions absolute (ktCO2-eq)	Units '000	Sales (EUR mil)
Tesla, Inc.	368.3	233.8	22.08	14.02	8,064	5,121	N/A	365	21,896
Geely Automobile Holdings Ltd.	865.9	1,144.5	8.03	10.61	10,934	14,452	N/A	1,361	12,628
Ferrari NV	356.1	28.5	132.41	10.61	1,341	108	106	10.1	3,767

Results | GHG estimates for remaining sample using IO data

Top-down IO GHG intensity

for companies in the category “Motor Vehicles and Passenger Car Bodies”

- Estimates for 72 companies, for which bottom-up LCA estimates are not feasible, and self-reported data on emissions is not available
- Asian-based companies have higher intensity, due to higher regional intensity factors



Conclusion | Factors affecting the reliability of estimation methods

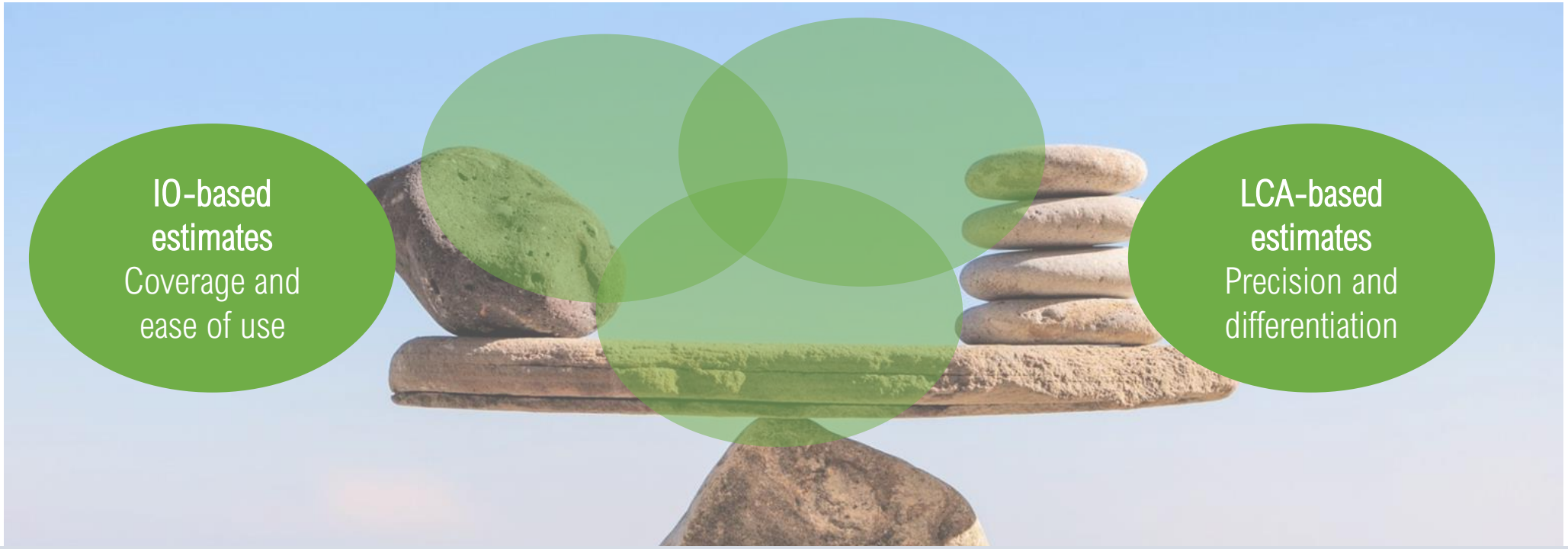
Top-down IO-based (EXIOBASE)

- The use of revenue as proxy for production data
- Exchange rates used (for revenue data)
- Sectorial aggregation
- Price level of products sold: higher price → higher overall impact (COGS could be used instead as proxy for the products a company needs...but not enough data reported on this)

Bottom-up LCA-based (ecoinvent)

- Electricity mix
- Powertrain type (ICEVs vs BEVs vs PHEVs)
- Battery size
- Production data reported vs. actual

Conclusion | OUTLOOK



- Physical data avoids results being affected by price level... BUT there is a lack of production data and physical flows and it is more work-intensive to “add up” different measurement units, compared to just money
- Different industries may require different metrics to be computed...which could be then translated into temperature scenarios (e.g. for automobile manufacturers, a better comparison would be emissions/car sold)
- Carbon footprints can be improved by using a combination of LCA and IO methods

The reliability of input-output and lifecycle-based data for estimation of corporate carbon emissions | A comparative study of carbon footprints in the automotive sector

THANK YOU !

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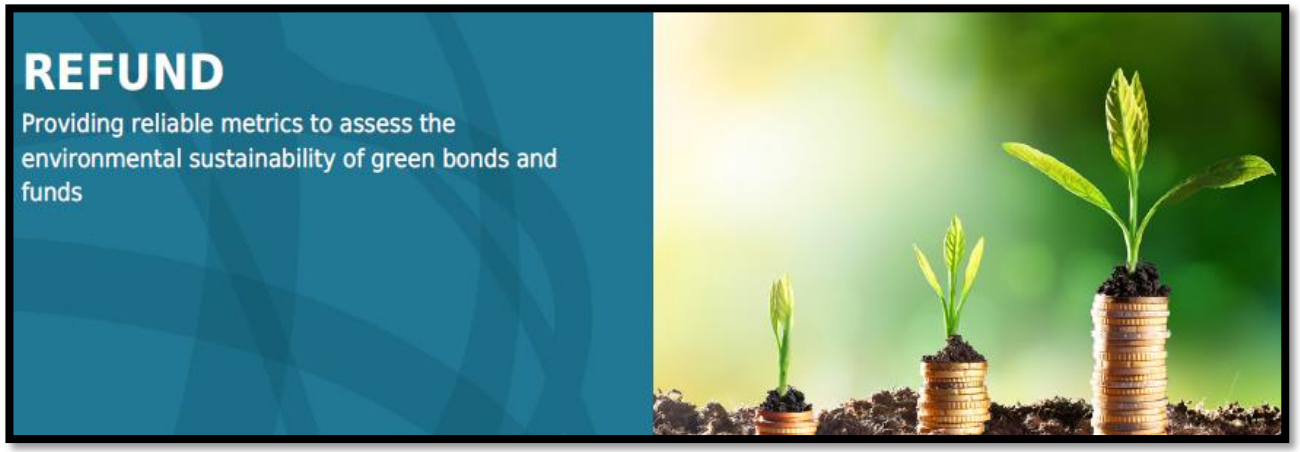
6th September 2021



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APPENDIX

Data and Methods | Sources and Computation

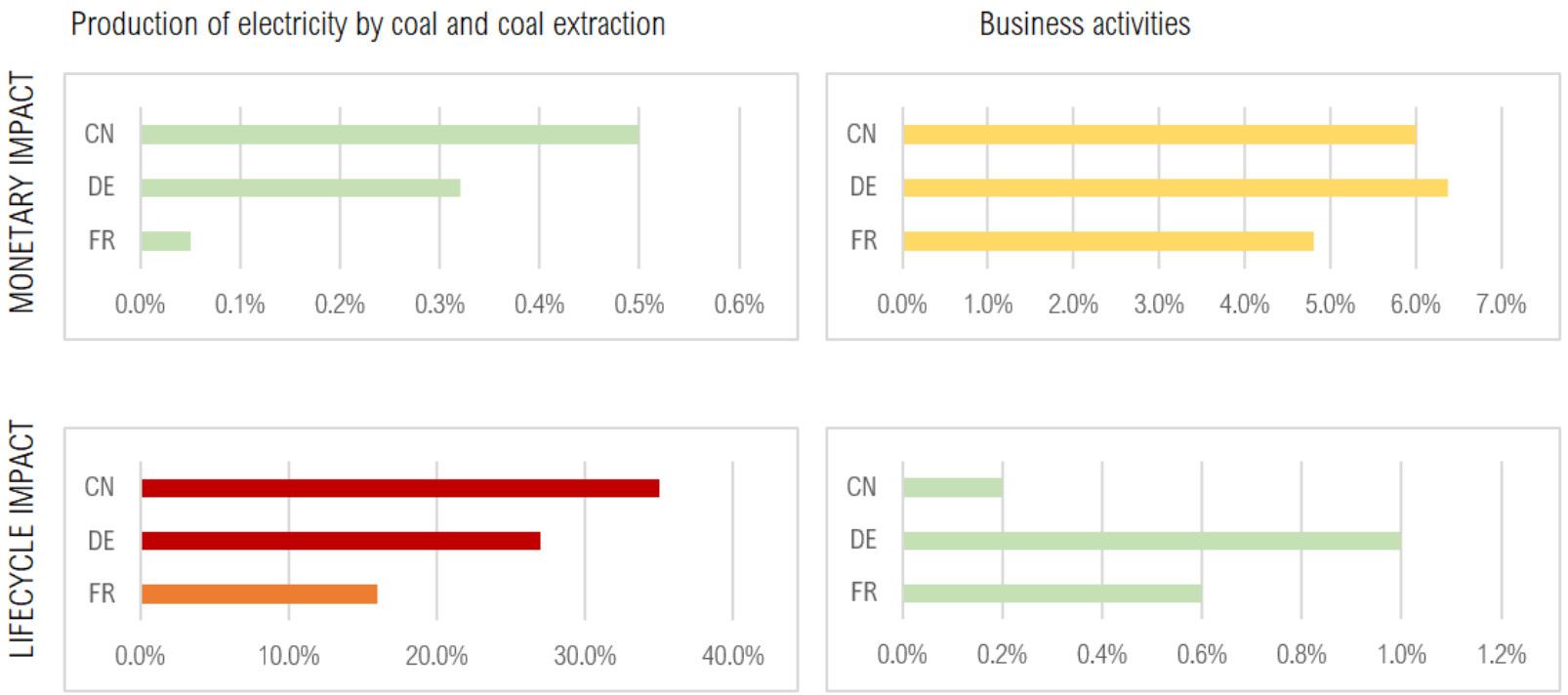
Data type & source	Method	Coverage	Notes
Reported; company reports, Bloomberg	GICS Automobiles...	110 companies	- companies do not follow the same protocol/measurement units when reporting
	Reporting to CDP, sufficient coverage of scope 3 emission categories	23 (20%)	
	Manual collection from company reporting, ADAC, Bloomberg Terminal – production data	2	
Estimated, top-down; EEMRIO EXIOBASE v3.8. monetary	FactSet RBICS and GeoRev for company revenue breakdown	90 (81%)	- model depends on company revenue disclosure – usually available, but with delay
	Lifecycle emission factors per unit of industry ($kgCO_2eq$ per MEUR or output)		
Estimated, bottom-up; LCI database ecoinvent v3.5.	Production data differentiated by vehicle type, using average LCI inventory factors	18 (16.3%)	- Emission factors per kg of car (i.e. physical units) - More precise - Data on electric vs non-electric vehicle
	Detailed production data, allowing differentiation of emission factors for regional electricity mixes	2 companies	

Data and Methods | Close-up on IO model and result drivers

Input-Output-based data

- Environmentally-Extended Multi-Regional IO (EEMRIO) database
- EXIOBASE monetary version, v3.8.: 49 regions and 163 industry groups
- Direct and lifecycle emission factors
- Allows for homogenous assessment of all companies and full consideration of upstream lifecycle impact
- Allocation based on revenue and not production | *may lead to wrong assumptions*

The contribution of different sectors to the direct monetary and lifecycle GHG emissions needs of one million EUR of output of Manufacturing of motor vehicles

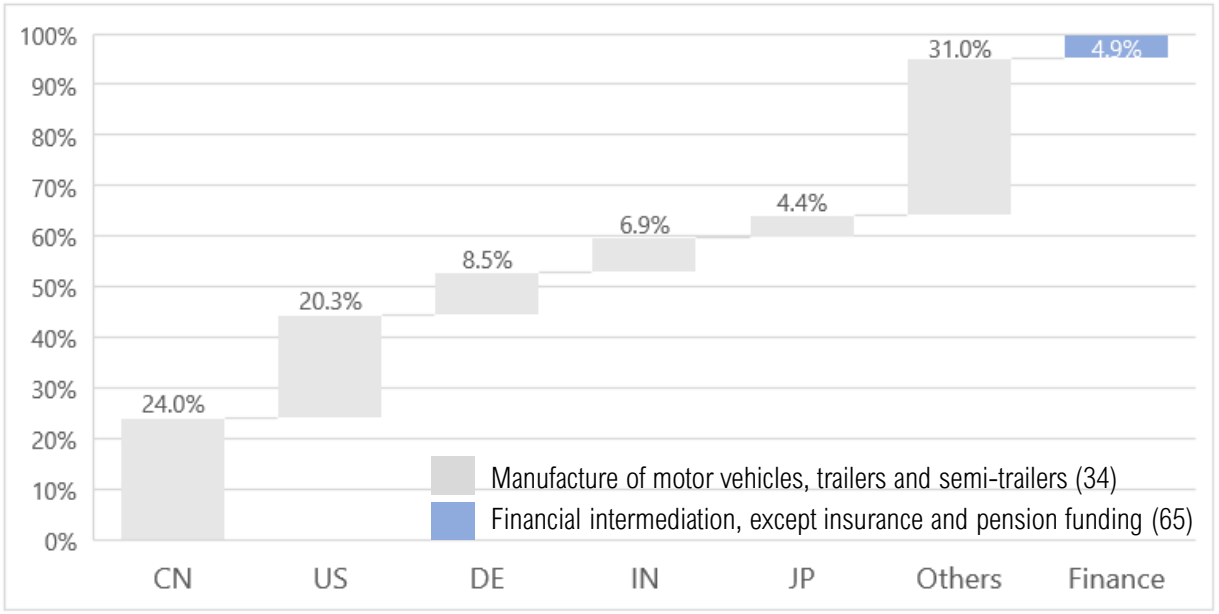


Business activities have a larger proportion in monetary terms, but significantly lower in impact.

Production of electricity by coal has a very high contribution to lifecycle GHG emissions, whereas the needs in monetary terms are very low – from 0.2% to 0.5% of total needs.

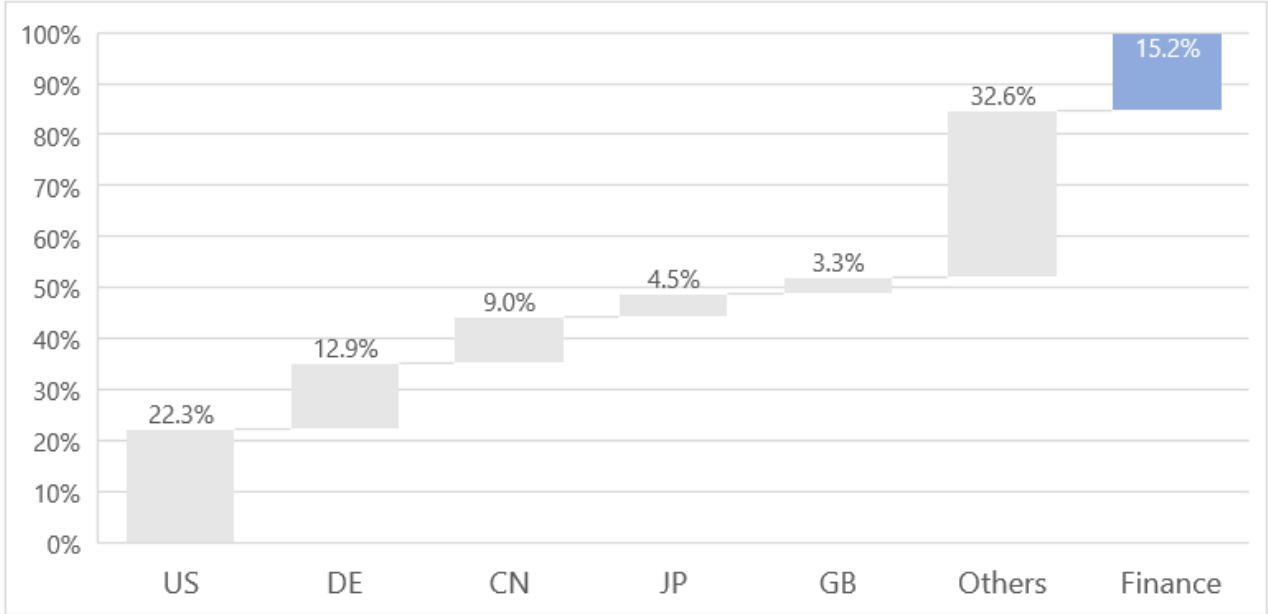
Data and Methods | Close-up on IO model and result drivers

Waterfall analysis of contributors to total emissions and revenue, for Daimler AG in FY2019



(1)

The contribution by country to total GHG emissions. China, the US and Germany are the three biggest contributors. The model thus manages to capture the differences in emissions generated depending on the country of revenue generation.
Finance activities are only 5% of the total emissions at company level.



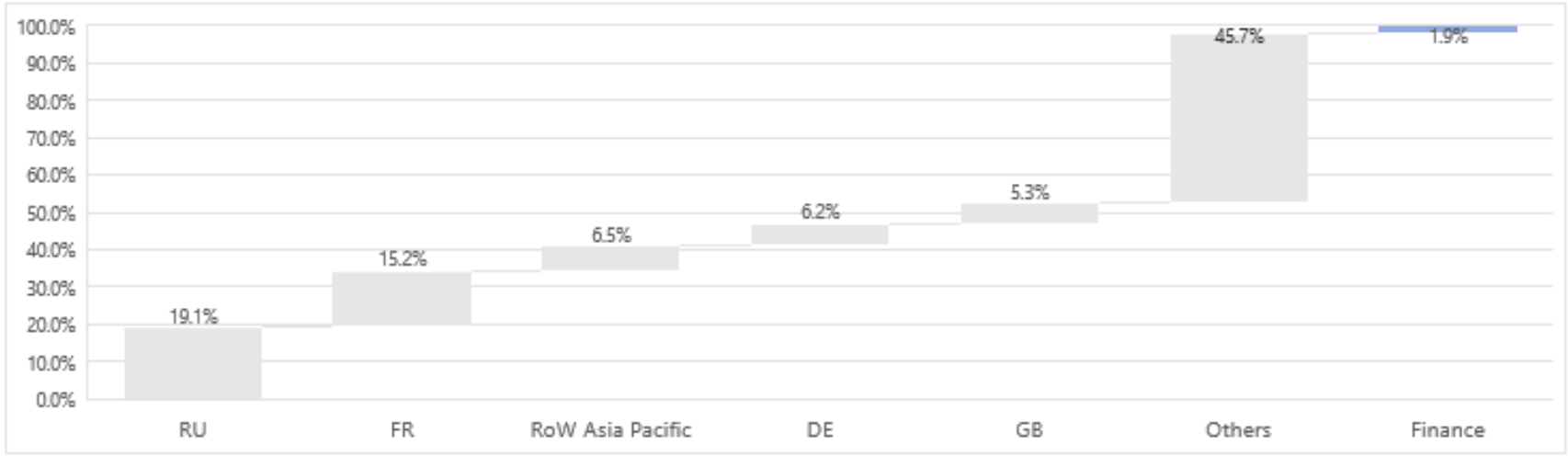
(2)

The contribution by revenue is shown. The US and Germany are the two biggest contributors, and China only comes on the third place from a revenue perspective.
Finance revenues are 15% of the total.

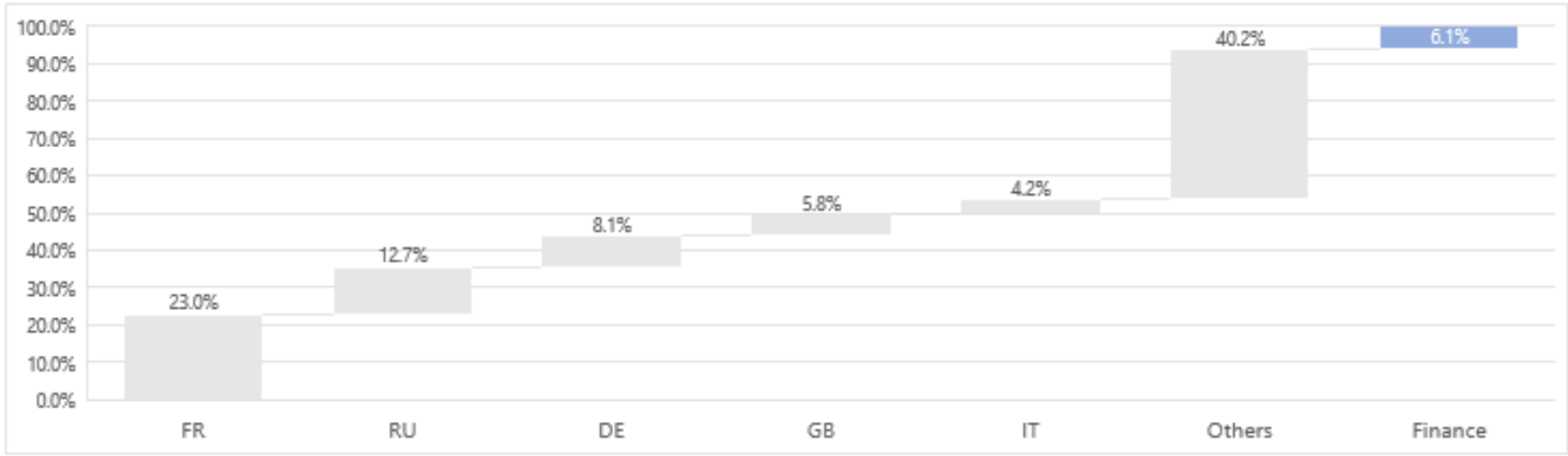
Data and Methods | Close-up on IO model and result drivers

Waterfall analysis of contributors to total emissions (1) and revenue (2), for Renault in FY2019

(1)



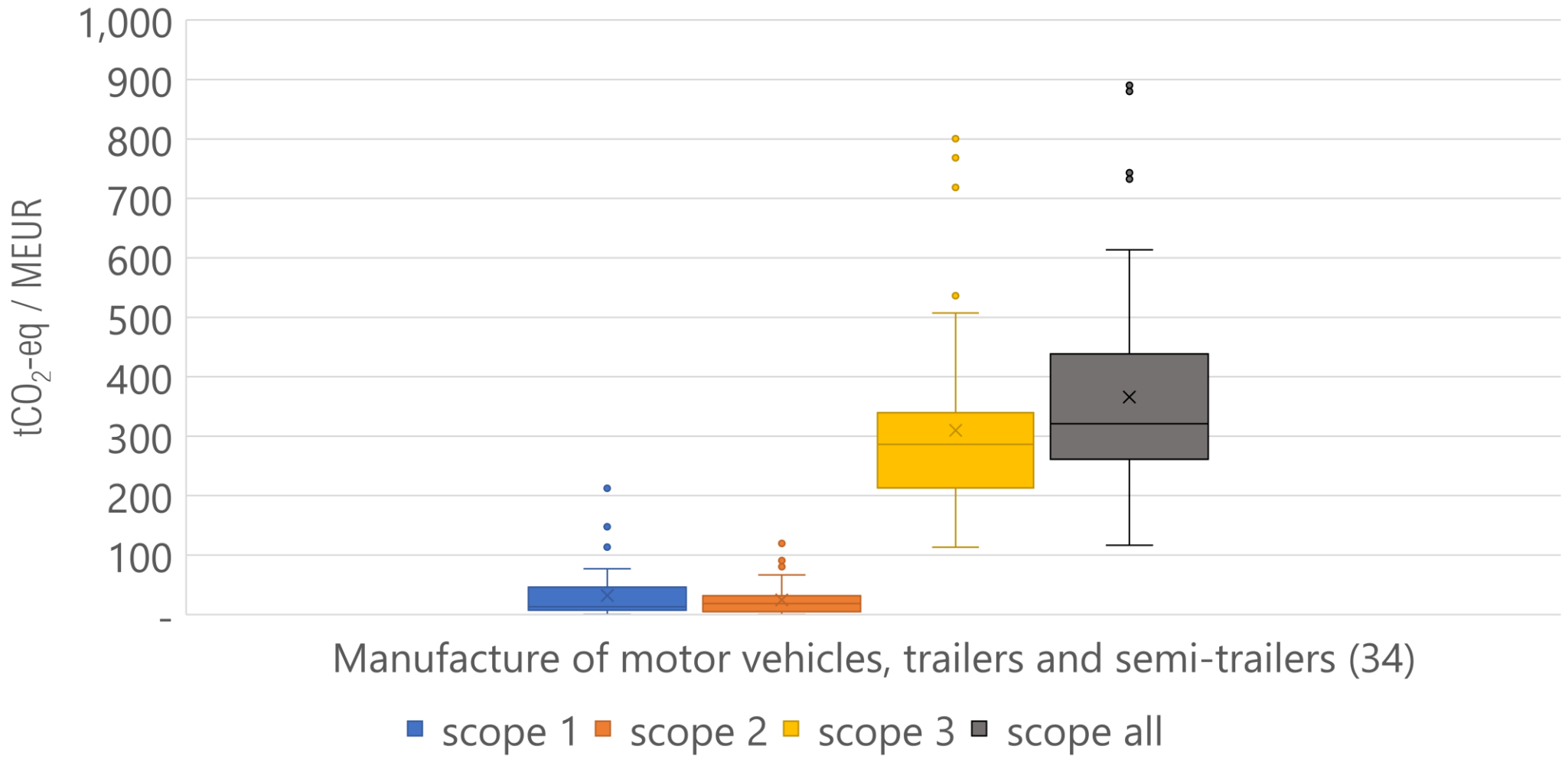
(2)



Manufacture of motor vehicles, trailers and semi-trailers (34)

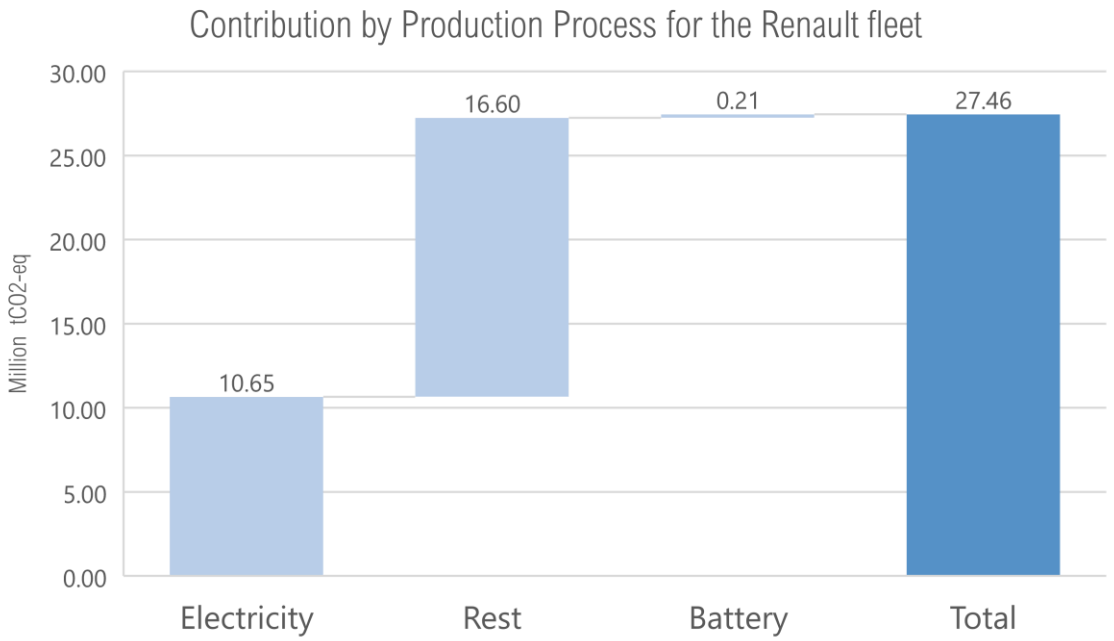
Financial intermediation, except insurance and pension funding (65)

Data and Methods | Variation of EXIOBASE factors for the industry, 2018



Results | The importance of electricity mix and detailed input data for LCA

Electricity can be contributing up to 40% to production emissions



Note. The Contribution of each aspect of production to Renault's Total Emissions in 2019. This shows the different emission hotspots in the entire production process.

The electricity mix chosen influences greatly the carbon footprint of a manufacturer