

AN ESTIMATION OF THE CARBON FOOTPRINT IN THE SPANISH CREDIT INSTITUTIONS' PORTFOLIO OF LOANS TO FIRMS

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OUTLINE

1. Project objectives and basic characteristics
2. Information sources and methodology
3. Main results
4. Limitations and possible improvements





Goals

- This work is **an experimental statistics** for the quantification of the carbon footprint of the portfolio of loans to resident firms held by Spanish credit institutions.
- There is **no internationally agreed methodology**: only autonomous experiences and initiatives
- This first contribution tries to be an input to the debate on the **potential indicators** to be used in the climate change strategy and for the measurement of the **carbon footprint of the financial sector**.
- It would make it possible to assess the **transition risks** linked to the change in the production model (decarbonization of the economy) in the **credit exposures** of financial institutions



Basic features

- Information sources used contain **aggregated data** (not at firm or loan level)
- Important **assumptions** and the incorporation of **simplifying hypotheses**
- Potential **improvements** (extensions to other instruments and sectors) and **enrichments** (methodological and access to new data)

Data sources

- Environmental accounts. Emissions into the atmosphere by branches of activity
- Indicator: Total greenhouse gases (thousands of tons of CO₂ equivalent)
- Frequency: annual
- Source: INE (last data: 2020)

Emissions



- Annual national accounts of Spain: aggregates by branches of activity: Level of production (euro million)

- Indicator: Production level (millions of euros)
- Frequency: annual
- Source: INE (last data: 2019)

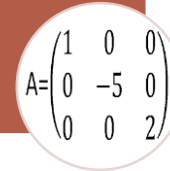
Production



- Annual National Accounts of Spain: Input-Output tables

- Indicator: coefficients of the total inverse matrix
- Source: INE (last data: 2016)

Input-Output Table



- Statement FINREP with breakdown according to economic activity (NACE sections)
- For additional details (2-digit branches) in the manufacturing, mining and telecommunications sectors, the Central Credit Register (CCR) data are used.
- Indicator: balance amount of loans (euro millions)
- Frequency: quarterly
- Source: Bank of Spain (last data: June 2021)

Loans



- The information-sets contain **data aggregated by branches of activity**
- In general, we work with the detail of **64 branches** of activity according to NACE 2009 (when there is no perfect correspondence, we proceed to homogenization, merging or estimating details that allow us to work with greater granularity)
- The information on **loans to companies** corresponds to the amounts of the principal drawn down (balances) that are classified according to the **NACE** of the companies

Methodology (I)

1. **CO2 emission coefficients** per unit of production: try to identify the intensity of emissions (direct and indirect) of carbon dioxide in the production of an economic branch

1. **Direct coefficients:** ratio between emissions and production

$$q_{it}^{\text{direct}} = \frac{\text{Greenhouse Gas Emission}_{it}}{\text{Total production}_{it}}$$

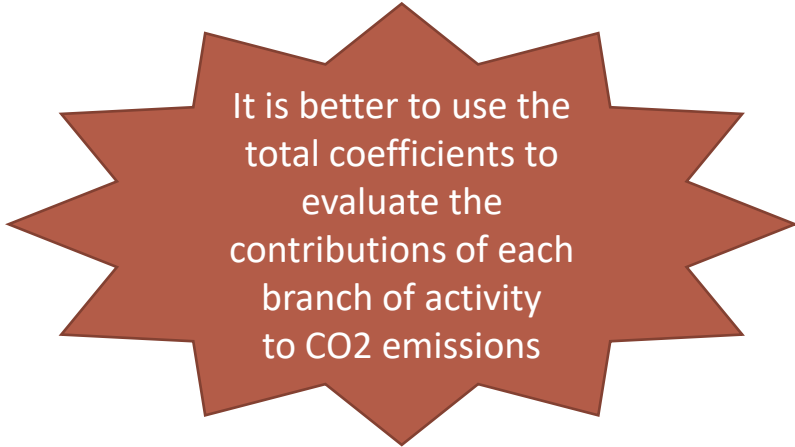
For each branch of activity (i) and year (t)

2. **Total coefficients:** add to the direct coefficients the indirect effect of the emissions produced in obtaining the intermediate inputs used by each industry

$$q_{it}^{\text{total}} = (I - A)^{-1} q_{it}^{\text{direct}}$$

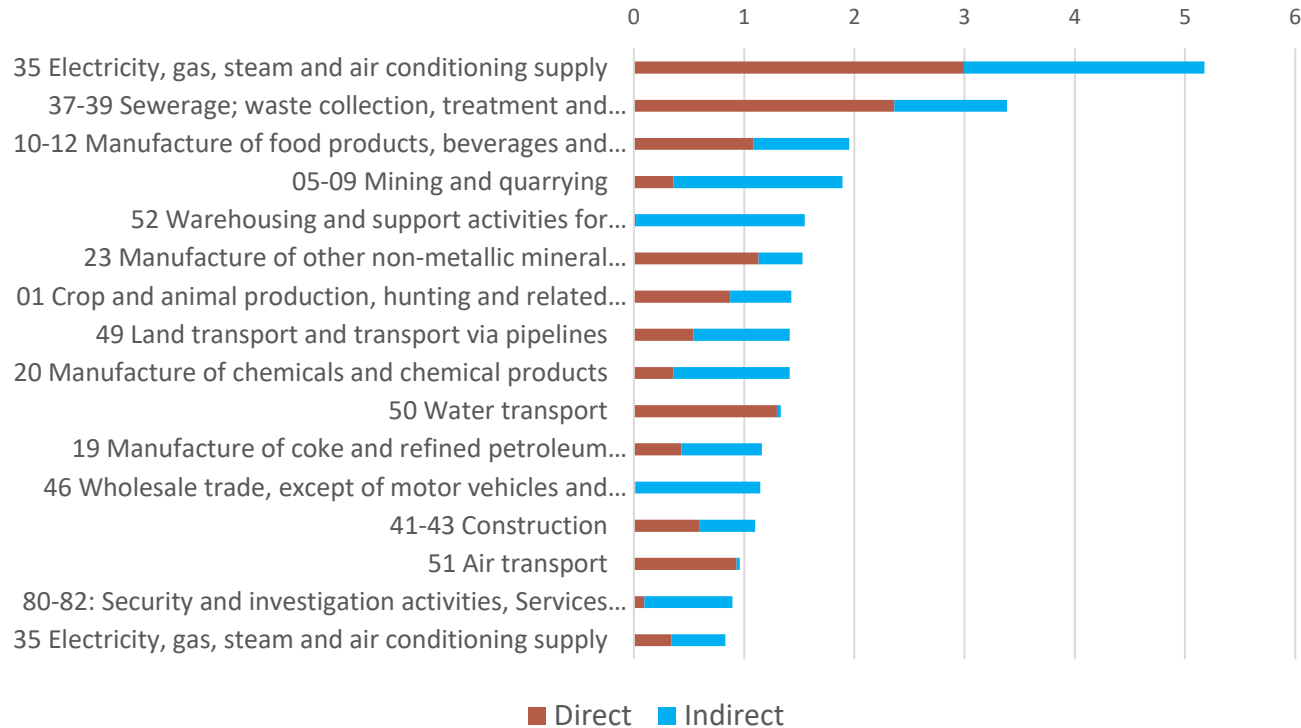
A: is the matrix of coefficients of the input-output table of the Annual National Accounts of Spain corresponding to 2016

$(I - A)^{-1}$: is the inverse Leontief matrix

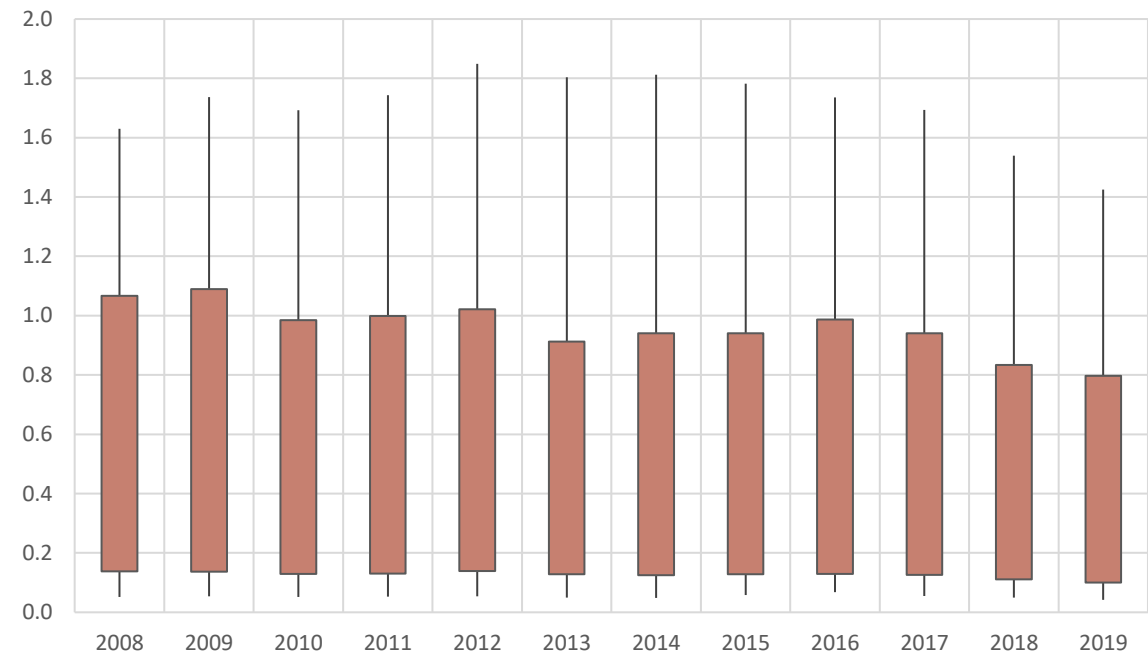


It is better to use the total coefficients to evaluate the contributions of each branch of activity to CO2 emissions

Top of most polluting branches. Total emission coefficients per production unit



Evolution of the total CO2 emission coefficients by activity branch (percentiles p90, p75, p25, p10)



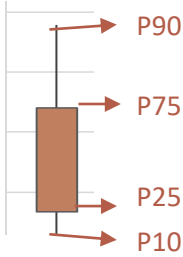
In the calculation of the **total coefficients** (incorporating the indirect effects)

The values of the coefficients will depend on the **characteristics inherent to the productive structure** of each branch of activity

These coefficients **vary over time**, although the modifications are of small magnitude and the changes in the relative positions between branches are infrequent.

The branch of **electricity and gas supply is the industry with the largest indirect component**, derived from the effect of the emissions of the inputs used in its production process.

In recent years there has been a **decrease in the intensity of emissions** in all the branches of activity analysed, **especially in the most polluting ones** (fall in the 90th and 75th percentiles)



Methodology (II)



2. **Indicator of the intensity of the carbon footprint in the portfolio of loans to companies (IHCO2P):** it is calculated as the average of the total coefficients by NACE based on the weight of each branch in the portfolio of bank loans

The IHCO2P represents the average of the polluting emission ratios carried out by productive activities that obtain bank financing in relation to the total loans granted by credit institutions in Spain.

$$IHCO2P_t = \frac{\sum_i P_{it} q_{it}^{total}}{\sum_i P_{it}}$$

P_{it}: Stock of loans from credit institutions at the end of the year by branch of activity (i) and year (t)

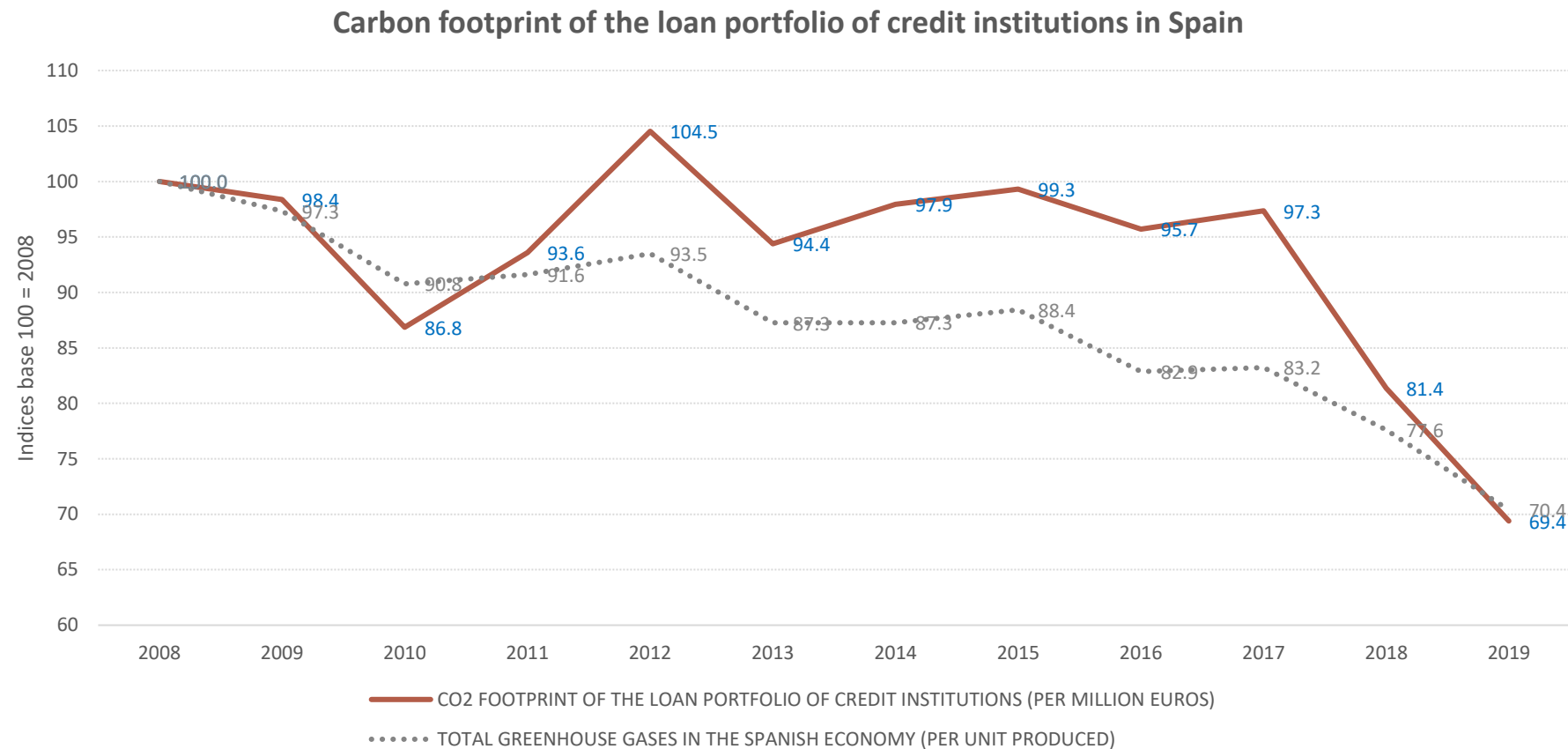
Indicator Interpretation:

-  Falls → Improvement of the carbon footprint
-  Rises → Represents a worsening

This is an approach similar to the one used in the works of:

- “[The Higher Carbon Intensity of Loans, the Higher Non-Performing Loan Ratio: The Case of China \(2017\)](#)” y;
- the **International Monetary Fund (IMF)** in its dashboard on climate change, in the block of financial indicators ([link](#))

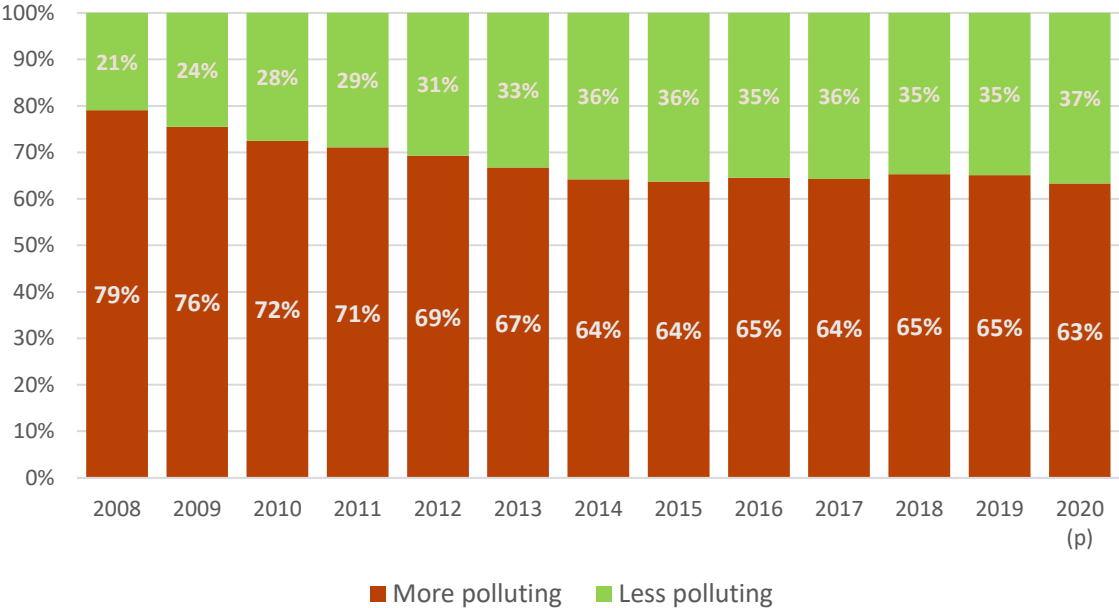
Comparison with the economy's total emissions intensity



Given the difficulty of interpreting the indicator in its original units (tons of CO₂) and to facilitate its comparability, it is restated **in terms of an index** (base year: beginning of the 2008 series)

A comparison of the IHCO2P against the evolution of the intensity of emissions in the Spanish economy between 2008-2019 would show an **accumulated reduction of a very similar magnitude**

Structure of the loan portfolio of Spanish credit institutions based on the CO2 emissions of the financed productive activities

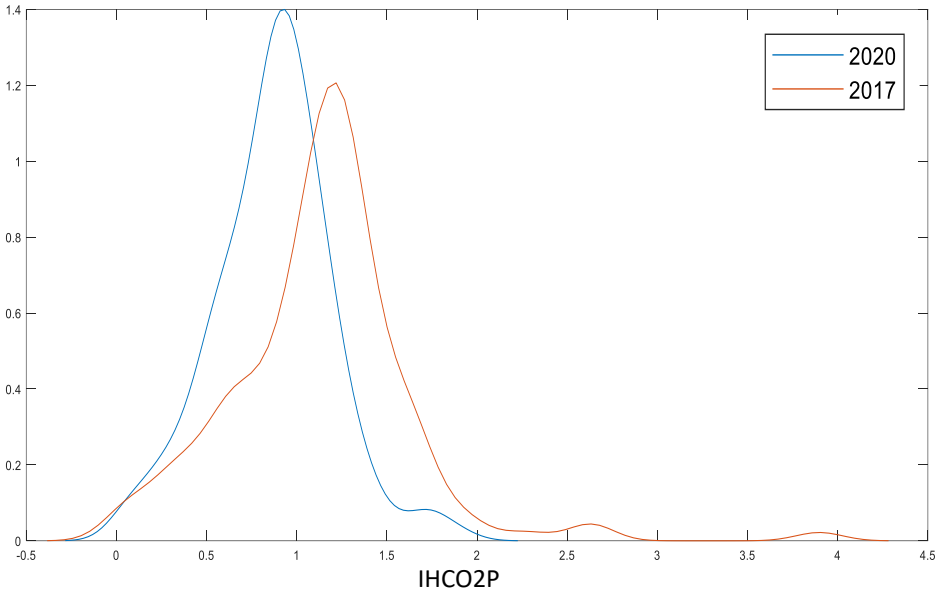


Classification of the productive branches based on the emission coefficient (average 2008-2020), in the absence of a standard, this rule is used:

- More polluting \geq P50
- Less polluting $<$ P50

A slight recomposition of the loan portfolio of Spanish credit institutions towards less polluting branches is identified

Analysis of the IHCO2P in individual data (at the credit institution level)



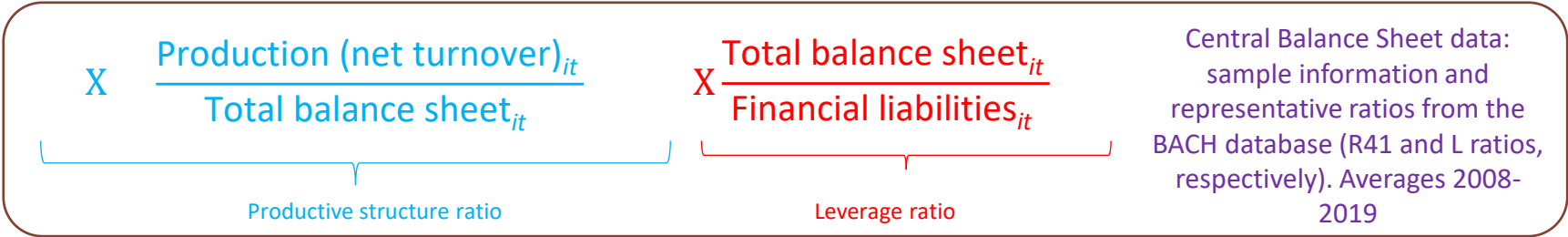
The carbon footprint of the loan portfolio has been **calculated for each credit institution in 2020** and 2017 (around 160 institutions)

Through the representation of **Kernel functions**, a shift to the left of the density function is observed in 2020 compared to 2017

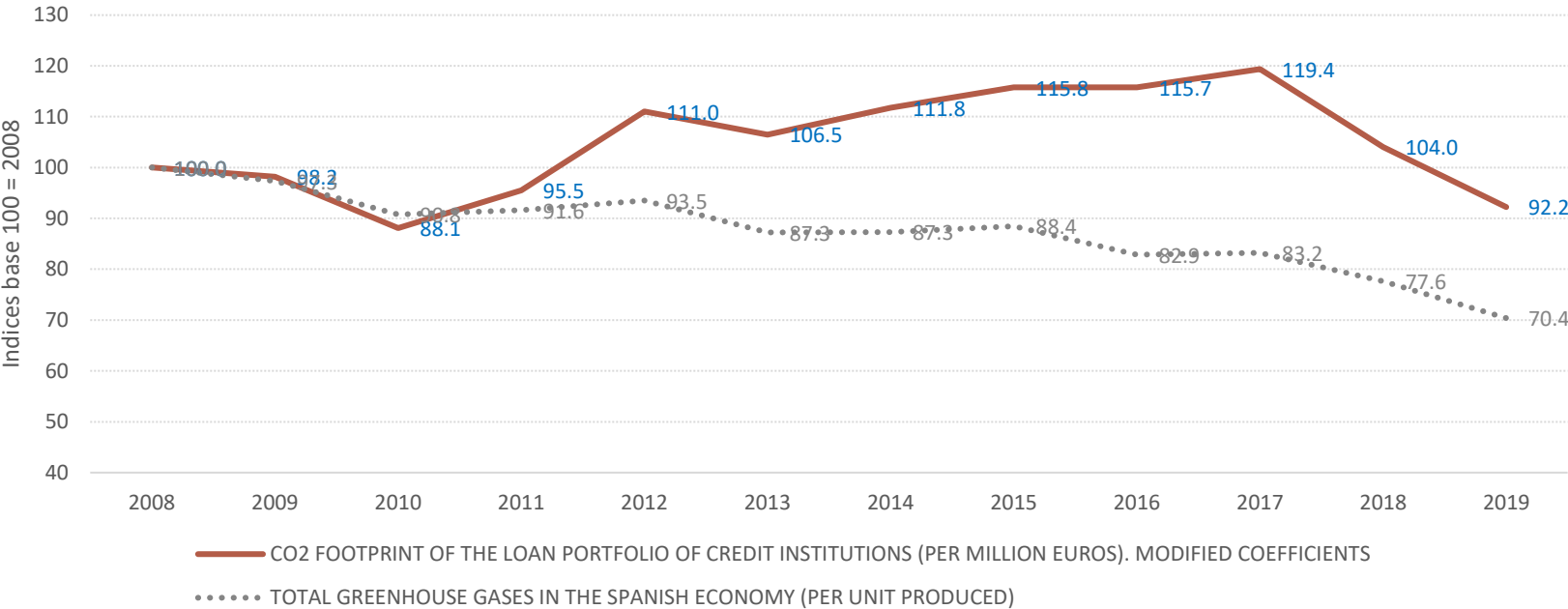
This information **would indicate a general decrease in the carbon footprint in the loan portfolio of credit institutions** in Spain in recent years

1. Incorporation in the calculation of the carbon footprint of the factors related to the productive and financial structure of the branches

$q^{\text{modified totals}}_{it} = q^{\text{totals}}_{it}$

Central Balance Sheet data:
sample information and
representative ratios from the
BACH database (R41 and L ratios,
respectively). Averages 2008-
2019

Carbon footprint of the loan portfolio of credit institutions in Spain



This modification would make it possible to adjust the "true" influence of bank loans on the development of business activities in the calculation of emission coefficients.

The results would show a less pronounced decline, almost stability

2. The current NACE has significant limitations in capturing detailed information on economic activities and polluting emissions

An example is the non-differentiation in the electricity production branch of generation with renewable energies. It is known that the current international classifications of economic activities (ISIC rev 4) have important deficiencies. The climate issue has been incorporated into the discussion for future updates

3. Treatment of loans to holding companies and headquarters: assignment of the economic activity of the subsidiary companies

4. Barriers to the use of loan information according to economic activity and non-purpose

The exercise of quantifying the footprint could be enriched if the **purpose of the loans were included in the classification** of the credit portfolio (for example, the acquisition of electric vehicles, energy saving investments) would allow a better measurement of the footprint of carbon

4. Access to individual data on emissions and loans (at company or company group level) could refine this measurement

This improvement in the estimation of the footprint of bank loans should distinguish between segments of companies with **detailed and complete** information versus other groups of companies for which it would be necessary to make estimates and imputations (individual or aggregate)

5. Extension to other financial instruments and sectors: Loans to households, securities and investment fund portfolio

THANKS FOR YOUR ATTENTION

