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The carbon content of Italian loans[1]

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[1] This presentation was prepared for the conference. The views expressed are those of the authors and do not necessarily reflect the views of the BIS, the IFC or the central banks and other institutions represented at the event.

The carbon content of Italian loans

by Ivan Faiella and Luciano Lavecchia[1]

Climate-related financial risks top the financial supervisors' agenda

Climate modifications, extreme climate events, and climate policies all affect the financial system through multiple channels (Carney, 2015; Batten et 2018; Breeden 2020) . More frequent and intense extreme weather events harm fixed capital assets, reducing the ability of borrowers located in the affected areas to repay their debt (**physical risk**). Energy and climate policies designed to achieve a transition to a carbon-free economy may reduce the value of carbon-intensive assets, especially if these measures are implemented abruptly (**transition risk**).

These risks are on top of the agenda of central bankers and supervisors around the world (Campiglio et al 2018; ECB, 2020; Bolton et al, 2020; Faiella and Malvolti, 2020). Some central banks (BoE, 2015; DNB, 2016 and 2018; ECB, 2019), have already started to analyses these risks or are planning to run comprehensive exercises in the coming years (BoE, 2019). Initiatives such as the Network for Greening the Financial System (NGFS), a voluntary group of central banks and supervisors, are trying to coordinate and harmonize the approaches (NGFS, 2019). But, the quantification of these risks is still limited due to a severe lack of data, the need for a forward-looking approach in evaluating risks (Bolton et al., 2020) and, for some analysts, a 'precautionary' policy approach (Chenet et al., 2019).

Assessing the exposure of the Italian financial system to transition risks

To better understand how transition risks might influence the Italian financial system, our recent paper presents some evidence on the carbon content of Italian firms' loans. We propose a simple and transparent method to define an industry-level indicator for the exposure of firms' credit portfolios to transition risk, with the objective to answer a very simple question: how many grams of greenhouse gases (GHGs) are emitted by a sector-average firm for every borrowed euro? Our method is dynamic and takes into account the development and intensity of emissions as well as the evolution of lending at a sector level.

Our focus on loans should provide a fair proxy for the exposure of the entire Italian financial system. The exposure of banks through their portfolios (equity and bonds issued by climate-exposed sectors) is not particularly significant in Italy and so it is not included. In the end, we disregard around a tenth of total assets, given the predominance of loans and sovereign bonds on bank balance sheets (68 and 11 per cent of their

[1] Bank of Italy, Directorate General for Economics, Statistics and Research and OIPE-Levi Cases. Views expressed are those of the authors and do not necessarily reflect official positions of the Bank of Italy.

assets, respectively, at the end of 2018).[2] In particular, loans to firms totalled slightly less than one-third of all banks' total assets at the end of 2018 in Italy. We also ignore interbank lending, which represents a small share of banks' balance sheets (less than 3 percent of total assets).

Three methods to estimate the carbon content of loans

We employ three methods to measure the carbon content of Italian loans, identifying the most exposed sectors: the already mentioned climate-policy-relevant sectors (CPRS); those with a loan carbon intensity (LCI) greater than the median; and the carbon-critical sectors (CCrS).

The **CPRS approach**, first proposed in Battiston et al, 2017, has been adopted in several studies, though it does not consider some sectors that contribute significantly to total emissions (e.g. agriculture). It collapses each carbon-intensive sector into one of five climate-policy-relevant groups: *energy-intensive, fossil-fuel, housing, utilities* and *transport.* The other two methods combines firms' loans by sector (from the Bank of Italy' Central Credit Register - CR) with total GHGs emissions (from Eurostat' National accounting matrix including environmental accounts – NAMEA).

The **loan carbon intensity (LCI)** is the ratio between emissions and loans for each sector, and it provides industry-level data on the emissions embedded in each euro borrowed. It can be used to compare sectoral emissions within and between countries (the latest using the ECB' Consolidated Banking data).

To overcome some of the drawbacks of the LCI method, we propose to **define a set of carbon-critical sectors (CCrS)**. This method summarizes the relative pertinence of each sector in terms of loans and emissions, identifying the most relevant sectors.

We are aware of the limits of sectoral data, in particular, how failure to consider the actual exposure towards a specific borrower/investment neglects the heterogeneity that underlies the sector-level data. Nevertheless, we think that industry-level information can be a valuable starting point given the present lack of high-quality and comparable firm-level data – the information on direct or indirect emissions of small and medium firms, which represents almost 99 percent of all firms in Europe and half the value added, is missing.

LCI and CCrS have the advantage of using a standard method of classification (the NACE codes) available at the EU level. Moreover, they take into account all sources of GHGs. Finally, they are dynamic in that they directly consider the evolution of emissions and emission intensity. There is only a partial overlap between the sectors considered - CCrS and those with an above-the-median LCI.

[2] According to ECB evaluations, banks' portfolio exposure to CPRS (equity and bonds only) for the euro area as a whole is around 1 per cent of total holdings (ECB, 2019).

The carbon content of loans in Italy

According to our estimates, the exposure of the Italian financial system in 2018 ranged between 37 (LCI) and 53 (CCrS) percent of total loans, representing 9.9, 12.9 and 14.4 percent of banks' total assets (for LCI, CPRS and CCrS respectively; Table 1).

Exposure of the Italian financial system at the end of 2018

(billions of euros and percentage points) Table 1

Method	Outstanding loans		% share of total loans		Loans as a share of total assets
	Total	Banks only	Total	Banks only	
CPRS	473.9	323.9	47.5	45.6	12.9
LCI > median	364.2	273.4	36.5	38.5	9.9
CCrS	528.0	372.8	52.9	52.4	14.4

Sources: Faiella and Lavecchia, 2020

The most exposed sectors are, according to the CPRS method, the energy-intensive and housing sectors. Using the Loan carbon intensity (LCI), Electricity and gas, sewage, and air transport are the most exposed sectors. And with the CCrS classification, electricity and gas, agriculture, wholesale and retail trade, and construction are the most exposed sectors.

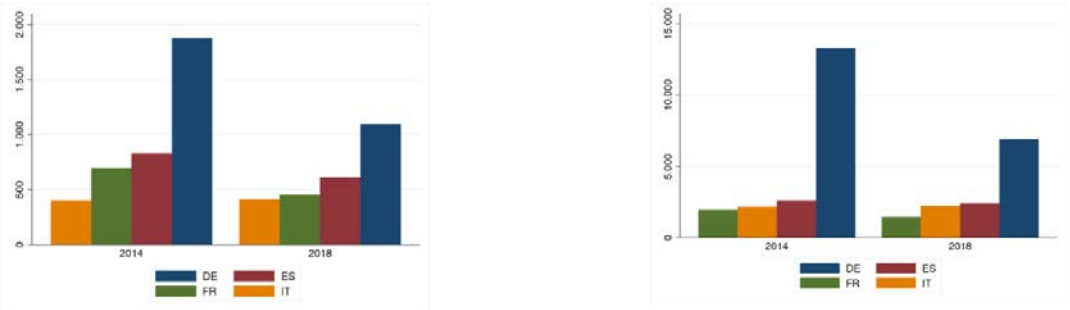
Compared with other EU-peers

Using the ECB Consolidated Banking data, it is possible to compute and compare the loan carbon intensity (LCI) across countries and sectors, merging the NACE level-1 information on loans with NAMEA. Between 2010 and 2018, the Italian LCI was, on average, 330 grams of CO2 equivalent per euro loaned, one of the lowest in the Euro system and largely below Germany's (see figure below).

LCI of manufacturing and agriculture in selected European countries Figure 1

gCO2e per €

a) Manufacturing *b) Agriculture*



Sources: Faiella and Lavecchia, 2020

As the LCI shows, in Italy, the carbon content of loans is rather small compared to the LCI of other EU-peers There are additional reasons to be optimistic about the resilience of the Italian economy in adapting to these new challenges. Italy has already reached all of its 2020 climate and energy targets (PNEC, 2019); in 2017, emissions were down by almost 21 percent with respect to 1990. Moreover, the carbon footprint of Italy's energy system is quite small compared with other EU countries, thanks in part to the fact it has one of the smallest energy intensities in the OECD countries (IEA, 2016) which is expected to keep getting smaller. Italy has planned to shut-down its coal-powered power stations by 2025 and Italian cars are among the most efficient in Europe with a significant penetration of natural gas in the transport sector (including the plan to use biogas and to extend gas use in tracks and shipping). However, there remains a big potential for improving energy efficiency and renewable deployment in the building sector. Other countries may consider borrowing some strategies from Italy to achieve their own carbon reduction goals.

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The carbon content of Italian loans

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Research question

1. What is the exposure of the Italian financial system towards transition risks?

2. Which sectors are particularly at risk?

Data

1. **Air emissions accounts (Eurostat):** GHG emissions for Kyoto gases (CO2, N2O, CH4, HFCs, PFCs, and SF6); residence principle; direct and indirect emissions from energy use (i.e. scope 1 + scope 2); no product-level emissions (very important but no up-to-date official estimates available plus issues with complexity and quality)

2. **Gross value added (Eurostat);**

3. **Central Credit Registry/Supervisory reports (Banca d'Italia):** granular data on all loans (including syndicated loans) to any institutional units (households and firms) operating in Italy from any bank (including > 80 foreign banks) or financial institutions operating in Italy (<> insurances, pension and investment funds);

4. **Consolidated banking data 2 (ECB):** aggregate consolidated balance sheets of all EU banks, with details per NACE 1-digit sector

Three methods to assess the exposure of loans to transition risk

1. loan carbon intensity (LCI);
2. carbon-critical sectors (CCrS);
3. climate-policy-relevant sectors (CPRS): see Battiston et al. (2017).

Loan carbon intensity (LCI)

LCI answers a simple question:

"How many emissions are embedded in each euro that an average bank lends to a specific industry?"

$$\mathrm{LCI}_{s,t} = \frac{E_{s,t}}{L_{s,t}}$$

where

$E_{s,t}$ Emissions of sector *s* at time *t*

$L_{s,t}$ Outstanding loans of sector *s* at time *t*

Btw 2010 and 2018, industries with an above-the-median LCI accounted for 34 per cent of all loans and 93 per cent of all emissions

LCI varies greatly across industries…

Carbon intensity of the loans' portfolio of the 10 most emitting sectors

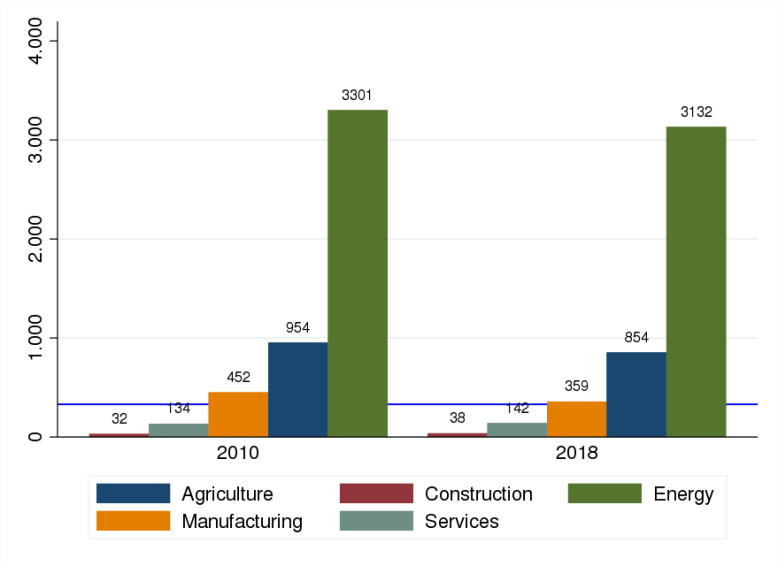
Sector	2010	2014	2018
Electricity, gas, steam and air conditioning supply (D)	3.773	2.510	3.444
Crop and animal production, hunting and related service activities (A01)	960	867	860
Manufacture of other non-metallic mineral products (C23)	2.307	2.082	1.914
Sewerage, waste collection, treatment and disposal activities; materials recovery and Remediation activities and other waste management services (E37-E39)	3.120	2.920	3.069
Water transport (H50)	1.851	1.562	2.831
Manufacture of coke and refined petroleum products (C19)	2.080	3.023	2.788
Land transport and transport via pipelines (H49)	910	973	792
Manufacture of chemicals and chemical products (C20)	1.340	1.351	1.411
Manufacture of basic metals (C24)	1.110	882	747
Wholesale trade, except of motor vehicles and motorcycles (G46)	118	135	126
Total economy	**351**	**318**	**327**

…and it is easy to compute and communicate

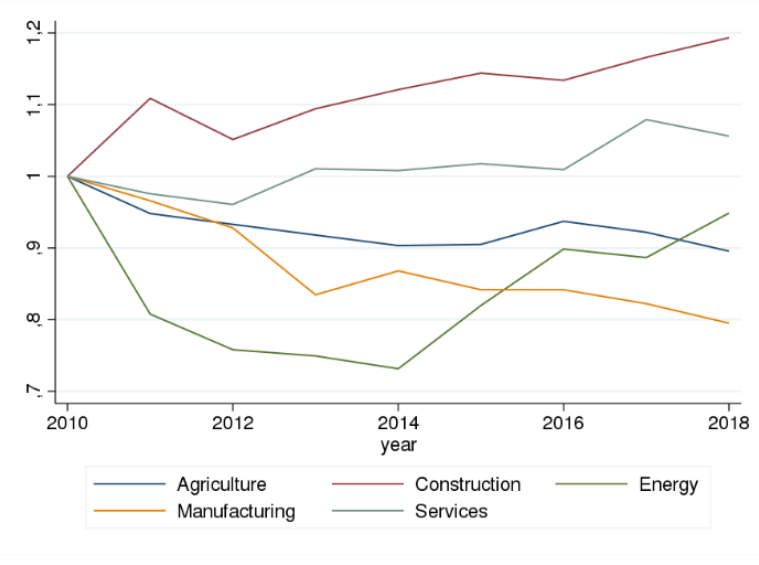
LCI per main economic sector in Italy

(gCO2e/€, base year 2010)

a) LCI in selected years



b) Trend 2010-18



Sources: Based on Eurostat and Bank of Italy's Central Credit Register data.

LCI average in Italy between 2010-2018: **330 gCO2e/€**

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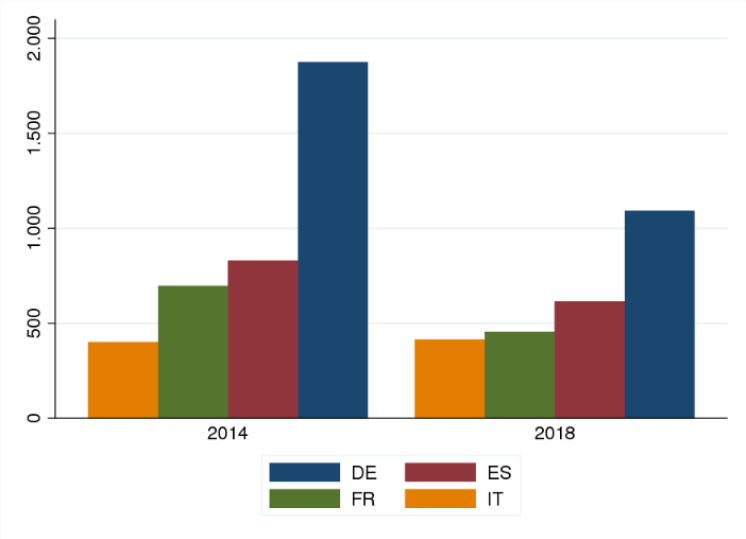
… allowing also international comparisons

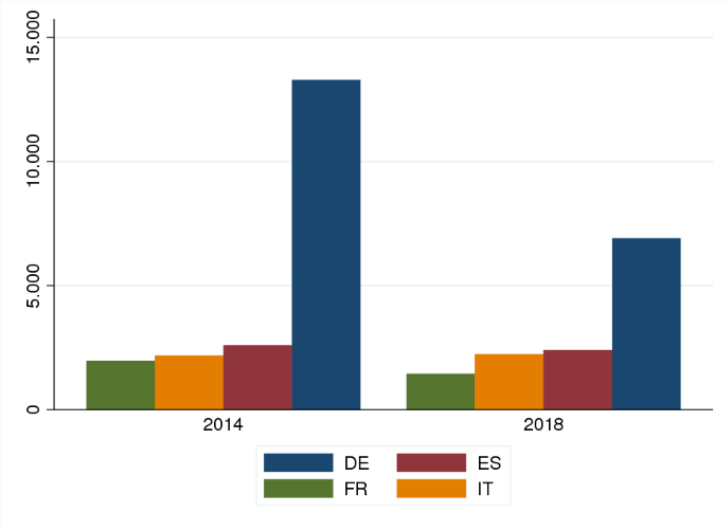
LCI of manufacturing in selected European countries

(gCO2e/€, base year 2010)

a) Manufacturing



b) Agriculture

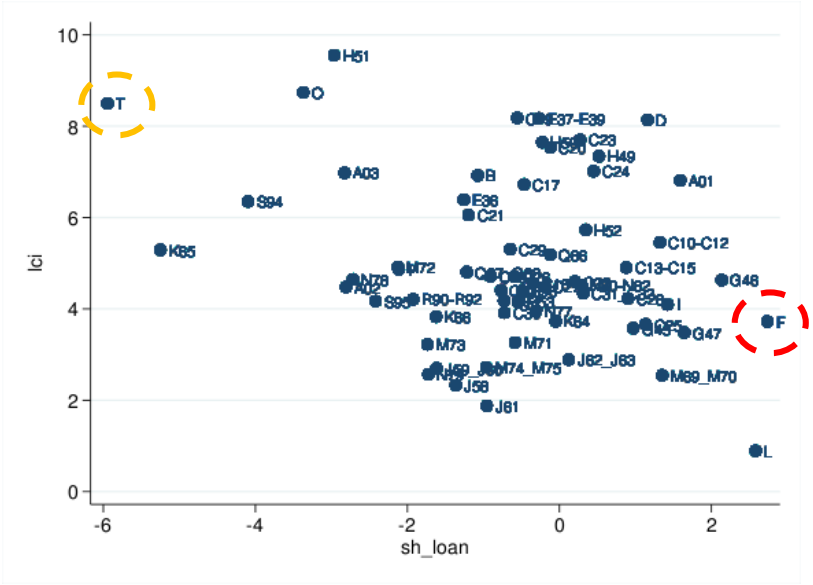


Sources: Based on Eurostat and ECB data

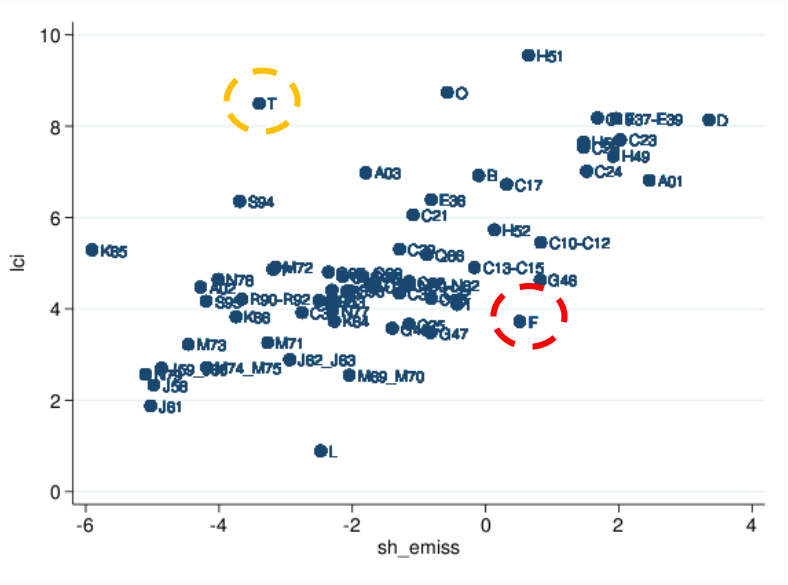
- the LCI of German manufacturing: 2X Spain, 4X Italy.
- differences decreasing due to a steep reduction of the LCI in Germany
- Similar evidence for the agricultural sector

… but it is far from perfect

a) Log LCI vs. log share of emissions



b) Log LCI vs. log share of loans



- Not all countries/sectors rely on loans in the same way
- it mixes up two phenomena (e.g. HHs as employers – T and construction - F)

A possible alternative: carbon-critical sectors (CCrS)

1. Create two separate **rank variables** that provide information on sectors' share of total emissions ($E_{s,t}$) and on the share of total loans ($L_{s,t}$) .

2. Take the **simple average** of these ranks ($avg\_rank_{s,t}$), obtaining a measure of the relevance of each sector in terms of emissions and exposition to the financial sector.

3. Define as carbon-critical sectors (CCrS) those whose average is in the **first fifth** (q_1) of the distribution of $avg\_rank_{s,t}$

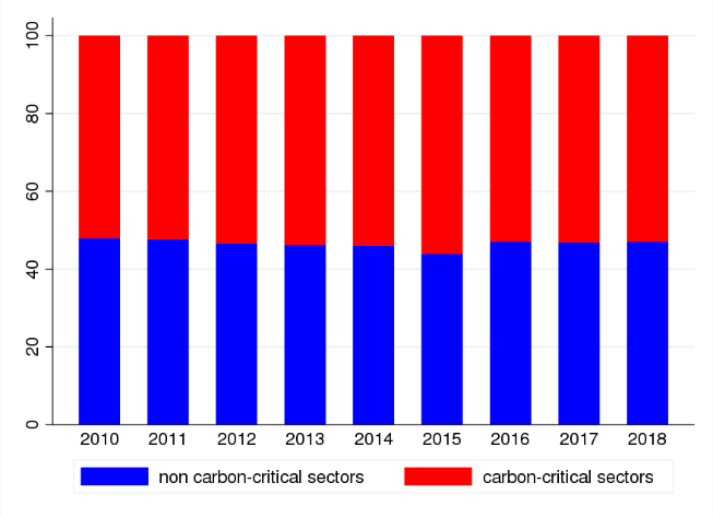
$$\mathrm{CCrS}_s = \mathrm{I}\{\mathrm{average}\left[rank_t\left(\frac{E_{s,t}}{E_t}\right), rank_t\left(\frac{L_{s,t}}{L_t}\right)\right] < q_1\}$$

CCrS account for a sizable part of loans and emissions

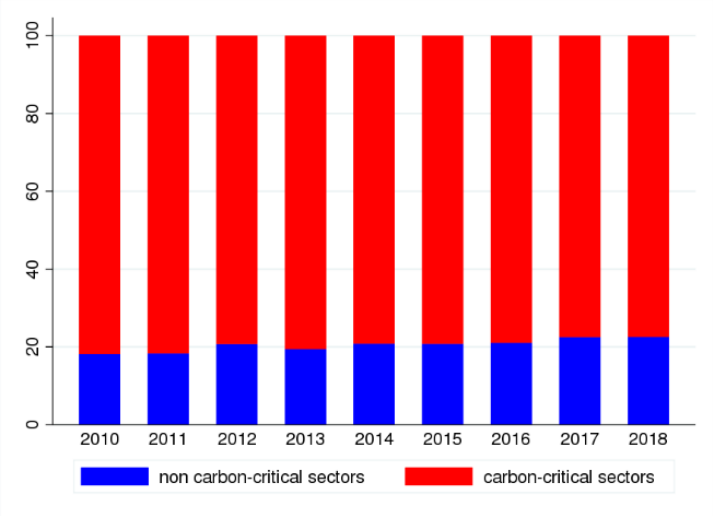
Loans and emissions: CCrS vs. non-CCrS

(billions of euro and millions of tonnes of CO2 equivalent)

a) Loans



b) Emissions



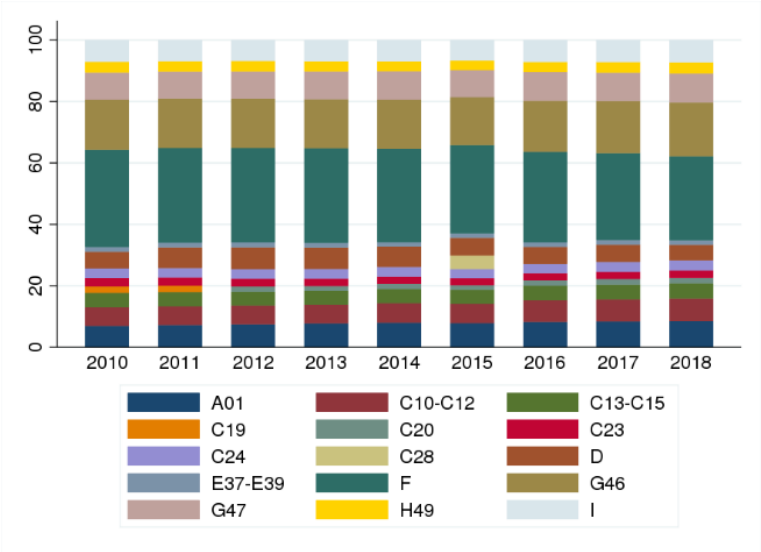
Sources: Based on Eurostat and Bank of Italy Central Credit Register data.

- Concentration: CCrS capture 53% of the loans and 80 per cent of emissions
- Analogue results using carbon GHG per unit of value added for ranking the emissions

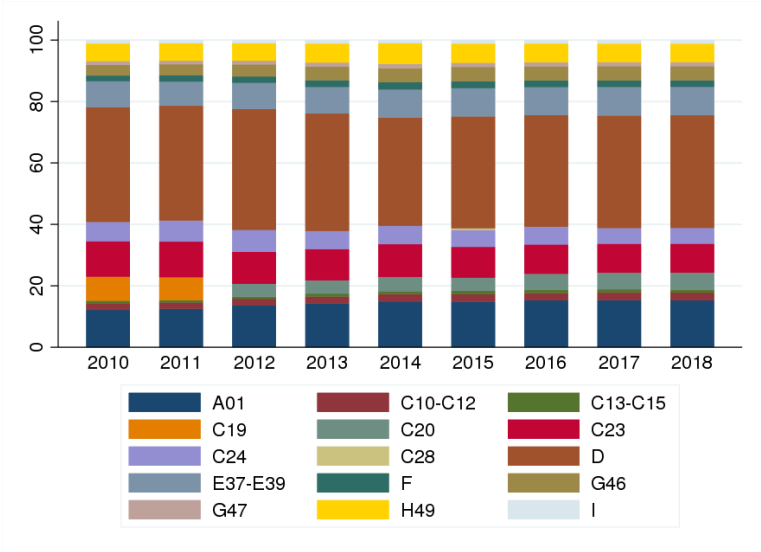
CCrS exposure by detailed sectors

Loans and emissions: CCrS in detail
(percentage points)

a) Loans



b) Emissions



Sources: Based on Eurostat and Bank of Italy Central Credit Register data. The legend of the sectors is in the Appendix.

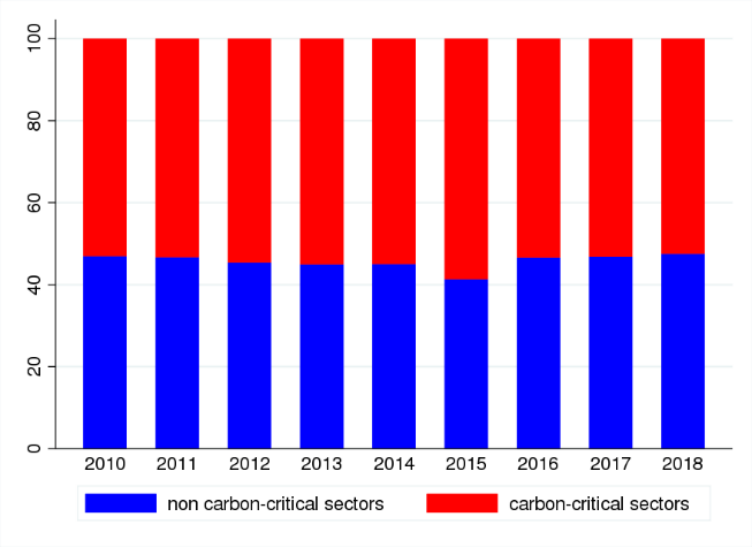
- Construction (F), Wholesale and retail trade (G46+G47) account for one-third of the loans but less than 6 per cent of GHG emissions
- the three most emitting sectors, i.e. energy (D), agriculture (A01) and the manufacture of other non-metallic mineral products (C23), account for half of the emissions but only a tenth of loans.

CCrS sector exposure by type of intermediary

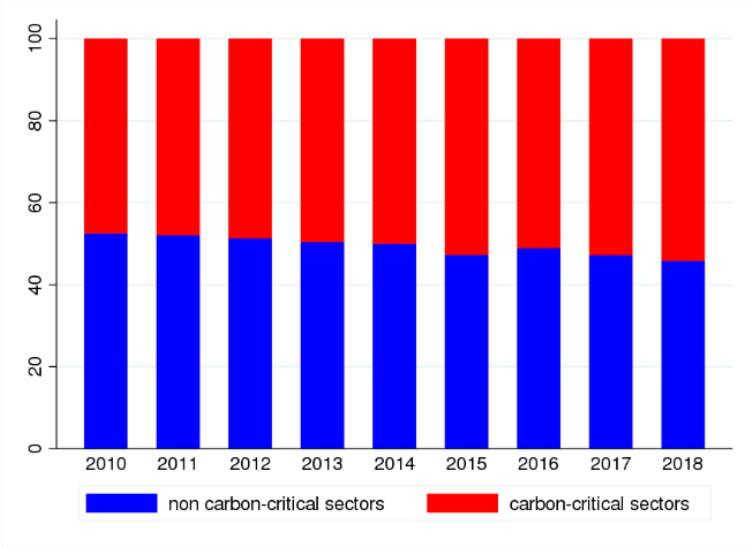
Exposure of the Italian financial system towards CCrS – by type of intermediary

(percentage points)

a) Banks



b) Other financial intermediaries



Sources: Based on Eurostat and Bank of Italy Central Credit Register data.

- Slightly decreasing share for banks, increasing for other FIs
- No difference between the 5 biggest groups and other banks or financial institutions

Summing up…

- Existing literature focuses on equity and bonds; **our work focuses on loans**
- We have devised a simple and transparent method to define an industry-level indicator for the exposure of firms' credit to transition risk.
  - **cons**: sectoral data is a second best;
  - **pros**: most of GHG; dynamic classification, includes loans, scalable to other countries, useful for modelling.
- Results:
  1. Avg. Exposition btw 38% (LCI) and 53% (CCrS);
  2. No difference between 5 biggest banking groups and other banks (or FIs) on average;
  3. sectors more exposed (CCrS): construction, machinery, wholesale and retail trade;
  4. Italy less exposed than other countries (partic. DE);

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Thank you

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