

Towards Greener Economies: Does Financial Development Mitigate CO_2 emissions ?

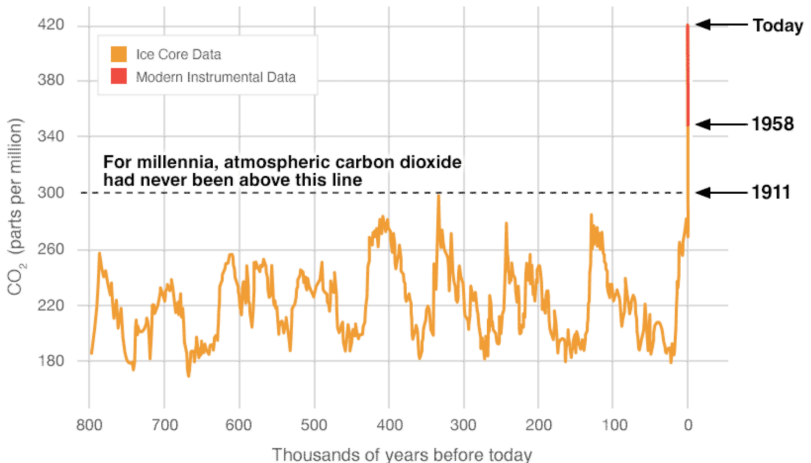
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Introduction

- Defining the best response to fight Climate Change is one of the most important current policy issues
- Despite the COPs, the Kyoto Protocol, Earth Summits, the Paris Agreement (2016)... **GHG are still increasing**

Anthropogenic pollution

*CO*₂ atmospheric concentration over 800,000 years (NOAA, 2024)



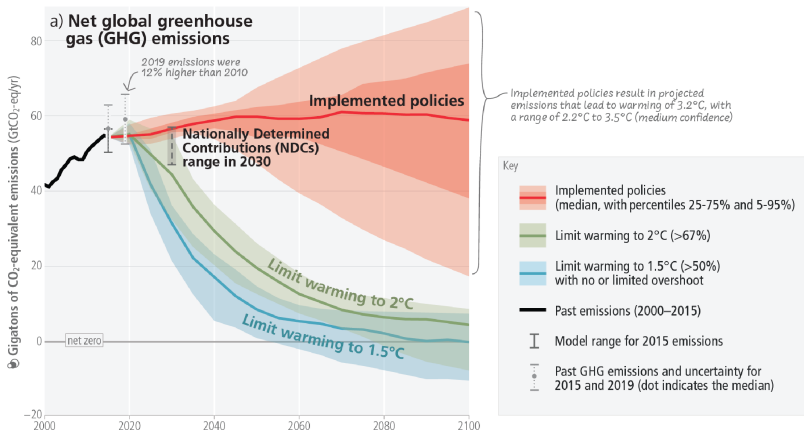
Rising CO₂ emissions

Carbon emissions from 1750 to 2022 (GCP, 2024)



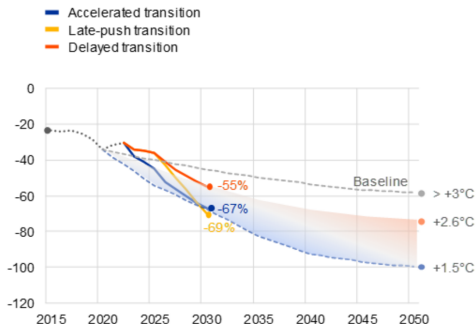
Failure to mitigate CO₂ emissions

GHG emissions projections (IPCC, 2023)



Scenarios reducing GHG emissions in Europe

EU GHG emission reductions in three scenarios (in %)



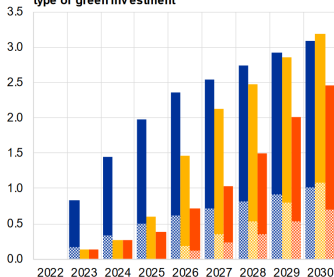
Source : ECB (2023)

Green investment required in Europe

(EUR trillions)

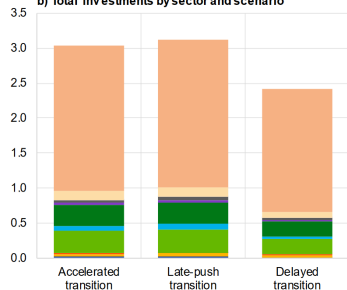
- Accelerated transition
- Late-push transition
- Delayed transition
- Investments into renewable energy
- Investments into carbon mitigation

a) Cumulative investments over time by scenario and type of green investment



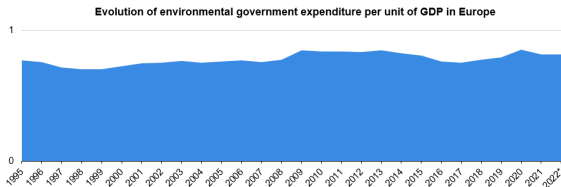
- Agriculture
- Construction
- ITC
- Manufacturing
- Mining and quarrying
- Others
- Real estate
- Transport
- Water supply
- Wholesale and retail
- Electricity, gas, steam

b) Total investments by sector and scenario

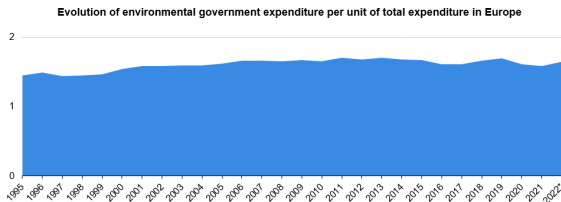


Source : ECB (2023)

Share of government environmental expenditure remains constant over time



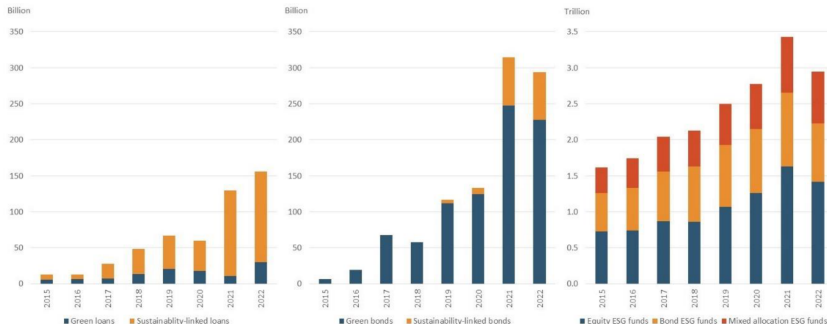
Source: Eurostat



Source: Eurostat

Green finance is expanding

Sustainable bank lending and sustainable capital market financing in Europe (outstanding amount in EUR billion and AUM in EUR trillion (EBA, 2023))



Research question

- Does financial development help mitigate CO_2 emissions? → I assess the relationship between financial banking and market development and CO_2 intensities at country and industry level

Two mechanisms

- ① **Financial Development** → **decreasing CO_2 intensity** :
 - Financial Development can facilitate the adoption of greener and less energy intensive technology.
 - Financial development can establish strong corporate governance and the generation of both reputational and financial benefits, to initiate sustainable projects.
- ② **Financial Development** → **increasing CO_2 intensity** :
 - Financial development promotes economic growth through risk diversification and technological advancement, which subsequently raises energy consumption.
 - Financial development allows both households and firms to access affordable credit and funds, enabling the purchase of energy-intensive equipment by households and the expansion of business operations with energy-intensive equipment by firms.

Litterature review (1)

- Negative effect of financial development :
 - Tamazian et al. (2009) examine BRIC countries from 1992 to 2004.
 - Shahbaz et al. (2013, 2015, 2018) provide case study analysis of France, South Africa and Malaysia.
- Positive effect of financial development :
 - Shahbaz et al. (2015, 2016) provide case study analysis of India and Pakistan.
 - Acheampong (2019) examine 46 sub-Saharan Africa countries from 2000 to 2015.

Literature review (2)

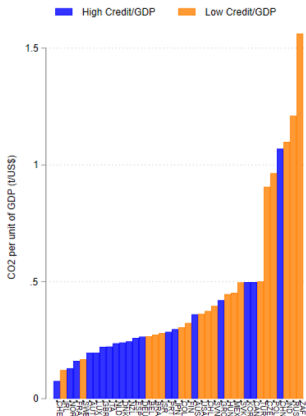
- Not significant effect of financial development :
 - Abbasi and Riaz (2016) focus on Pakistan from 1971–2011. They find no significant effect of financial development on CO_2 emissions per capita.
 - De Haas and Popov (2022) focus on 48 countries from 1990–2015. Financial development tends to have no impact on CO_2 emissions and Financial structure (market-oriented) reduce pollution.
- Non linear effect of financial development :
 - Kim et al. (2020) focus on 86 developing and advanced countries from 1989 to 2013. Financial development and CO_2 emissions are inverted U shaped and Financial structure and CO_2 emissions U shaped.

Contribution

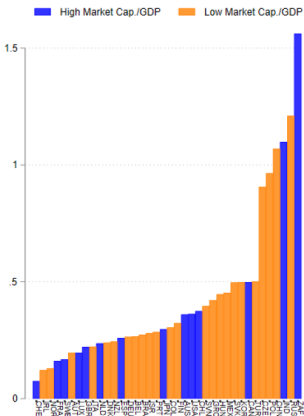
- First study to examine simultaneously the effect of financial banking (Credit/GDP) and market development (Market Cap./GDP) on CO_2 intensities
- Examine financial development effect at both the country and industry level
- First study to find that financial banking development is carbon mitigating and financial market development carbon increasing

Financial development and CO_2 emissions per unit of GDP (1995-2019)

Panel A. Financial Banking Development



Panel B. Financial Market Development



Data

Country dataset

- Unbalanced dataset covering 38 OECD and BRICS countries from 1995 to 2019
- The data contains information on CO_2 emissions per US\$ of GDP, CO_2 emissions per Capita, market capitalisation per GDP, domestic credit per GDP, market capitalisation per domestic credit, industry share per GDP, renewable energy consumption share to total energy, patent per capita, trade openness per GDP, FDI per GDP.

Industry dataset

- Unbalanced dataset covers 7 industries (WIOD) from 32 OECD and BRICS countries from 2000 to 2014
- The data contains information on CO_2 emissions per US\$ of industry value added

Country level

Equation (1) :

$$\begin{aligned} \left(\frac{CO_2}{GDP} \right)_{it} = & \beta_1 \left(\frac{Credit}{GDP} \right)_{i,t} + \beta_2 \left(\frac{Market}{GDP} \right)_{i,t} + \beta_3 \left(\frac{Market}{Credit} \right)_{i,t} \\ & + \beta_4 \left(\frac{Patent}{Capita} \right)_{i,t} + \beta_5 \left(\frac{Industry}{GDP} \right)_{i,t} + \beta_6 \left(\frac{Renewable}{Energy} \right)_{i,t} \\ & + \beta_7 \left(\frac{Trade}{GDP} \right)_{i,t} + \beta_8 \left(\frac{FDI}{GDP} \right)_{i,t} + \alpha_i + v_t + \epsilon_{it} \end{aligned}$$

Country level

Equation (2) :

$$\begin{aligned} \left(\frac{CO_2}{GDP}\right)_{it} &= \beta_1 \left(\frac{Credit}{GDP}\right)_{i,t} + \beta_2 \left(\frac{Market}{GDP}\right)_{i,t} + \beta_3 \left(\frac{Market}{Credit}\right)_{i,t} \\ &+ \beta_4 \left(\frac{Patent}{Capita}\right)_{i,t} + \beta_5 \left(\frac{Patent}{Capita}\right)_{i,t} * \left(\frac{Credit}{GDP}\right)_{i,t} + \\ \beta_6 \left(\frac{Patent}{Capita}\right)_{i,t} * \left(\frac{Market}{GDP}\right)_{i,t} &+ \beta_7 \left(\frac{Industry}{GDP}\right)_{i,t} + \beta_8 \left(\frac{Renewable}{Energy}\right)_{i,t} \\ &+ \beta_9 \left(\frac{Trade}{GDP}\right)_{i,t} + \beta_{10} \left(\frac{FDI}{GDP}\right)_{i,t} + \alpha_i + v_t + \epsilon_{it} \end{aligned}$$

Industry level

$$\left(\frac{CO_2}{VA}\right)_{ijt} = \sum_{j=1}^{n=7} \beta_{1j} \left(\left(\frac{Credit}{GDP}\right)_{i,t} * dummy_j \right) + \sum_{j=1}^{n=7} \beta_{2j} \left(\left(\frac{Market}{GDP}\right)_{i,t} * dummy_j \right) + \beta_2' X_{i,t} + \alpha_i + \delta_j + v_t + \gamma_{ij} + \epsilon_{ijt}$$

- $X_{i,t}$ is a vector of k observed time-varying exogenous characteristics of country i :
 - share of renewable energy to total energy use
 - share of industry value added per unit of GDP
 - ratio of trade openness per unit of GDP
 - logarithm of the total number of patent filed by resident and non-resident per capita
- Time invariant FE : α_i , δ_j and γ_{ij}
- Time variant FE : v_t

	(1) CO2/GDP	(2) CO2/Capita	(3) CO2/GDP	(4) CO2/Capita
Credit	-0.00062*** (-3.265)	-0.00059*** (-3.362)	-0.00476*** (-6.801)	-0.00331*** (-4.414)
Market	0.00032*** (2.594)	0.00057*** (4.606)	0.00112* (1.686)	0.00060 (0.805)
Structure	-0.00019 (-1.250)	-0.00016 (-1.047)	0.00008 (0.514)	0.00001 (0.075)
Patent	0.02492*** (2.976)	0.04131*** (5.067)	0.05632*** (6.091)	0.06276*** (5.857)
Credit*Patent			-0.00056*** (-5.892)	-0.00036*** (-3.676)
Market*Patent			0.00009 (1.207)	0.00000 (0.049)
Industry	0.00442*** (2.618)	0.00740*** (4.389)	0.00494*** (3.117)	0.00745*** (4.589)
Renewable	-0.01360*** (-9.064)	-0.01487*** (-9.687)	-0.01296*** (-8.357)	-0.01419*** (-9.063)
Trade	-0.00223*** (-5.770)	-0.00221*** (-5.907)	-0.00216*** (-5.583)	-0.00211*** (-5.547)
FDI	0.00005 (0.239)	0.00025 (1.082)	-0.00001 (-0.040)	0.00021 (0.944)
GDP		0.75044*** (19.306)		0.77826*** (19.369)
Observations	681	681	681	681

	CO2/VA	
Agriculture*Market	0.0009 (1.371)	Agriculture*Credit -0.0025 (-1.257)
Construction*Market	-0.0008 (-1.013)	Construction*Credit -0.0045*** (-3.629)
Electricity*Market	0.0006 (0.898)	Electricity*Credit 0.0004 (0.382)
Manufacture*Market	0.0010 (1.242)	Manufacture*Credit 0.0044** (2.273)
Mining*Market	0.0003 (0.733)	Mining*Credit -0.0012* (-1.838)
Service*Market	-0.0001 (-0.281)	Service*Credit -0.0021** (-2.553)
Transport*Market	-0.0005 (-0.938)	Transport*Credit -0.0030** (-2.312)
		Renewable -0.0084*** (-2.749)
		Industry -0.0033 (-0.578)
		Trade -0.0007 (-0.774)
		Patent 0.0057 (0.334)
		Observations 2725

Conclusion

- Asymmetric effect of financial development on pollution at the country level
 - Financial banking development reduce CO_2 intensity
 - Financial market development increase CO_2 intensity
- Industry level results suggests
 - Financial banking is carbon mitigating in construction, mining, service, and transport industries and carbon intensive in manufacturing industry
 - Financial market development exhibit no significant effect

→ **Future environmental policy should reconsider the substantial greening impact of banks and reassess the role of financial markets**

Thank you for your attention