

The Environmental Pressures of National Financial Systems

Switzerland, the United States and the Euro Area

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Sustainability in (Re-)Insurance Conference 2026 – October 1st, 2026

Why measure the pressures a financial system finances?

Financed pressures: environmental pressures that occur in the real economy because they are enabled by the activities a financial institution decides to finance

- **The problem.** Financial institutions shape environmental change through their financing:
 - disclosures are incomplete
 - intermediation chains hide who is responsible for what
 - territorial and consumption-based accounts do not see finance at all
 - no measure of what a *whole* financial system finances
- **Objective:** a system-wide, independently verifiable measure of financed pressures
 - benchmark a financial centre as a whole, not institution by institution
 - track it over time, on official statistics rather than voluntary disclosure
- **Double materiality**, on the asset side of every balance sheet
 - *impact*: capital allocation decides what gets built, extracted and emitted
 - *risk*: the same exposures carry transition, physical and liability risk
- **Six pressures:** GHG, land, blue water, fossil fuels, metal ores, non-metallic minerals

Three financial systems, one framework

Switzerland

A financial centre far larger than its economy: effective exposure $9.4\times$ GDP, two thirds abroad

United States

Market-based: firms issue securities, funds and pension funds hold them

Euro area

Bank-based: credit is the main source of corporate finance

- ① **How large is what each system finances?** Against territorial and consumption-based footprints
- ② **Who finances it?** Banks, funds, insurers, pension funds, once intermediation chains are resolved
- ③ **Where does it land?** The geography of the foreign book turns out to decide the result

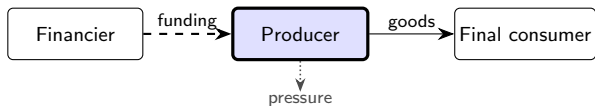
One variable runs through the three cases: **the share of the book held abroad**, 16% (U.S.), 39% (EA), 68% (Switzerland). It decides how far the financed footprint departs from the domestic economy.

Part I — Method

From national financial accounts to financed environmental pressures

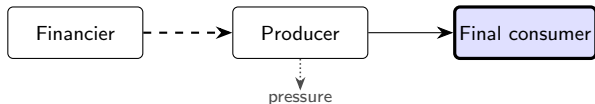
A third lens on the same pressure

(A) Territorial (production-based)



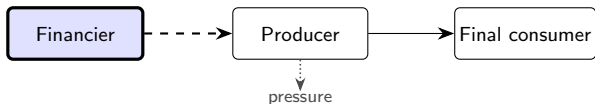
Where is it produced?
→ producing economy

(B) Consumption-based



Whose demand drives it?
→ consuming economy

(C) Financed



Whose finance enables it?
→ financier's economy

A domestic financier funding foreign production sold to foreign consumers: **only the third lens records the pressure at home**. This is the configuration that dominates the Swiss case.

Two traps in measuring “financed emissions”

- Institution-level disclosure: financed emissions ($> 99\%$ of a bank's total) rarely reported
- Bottom-up estimates cannot be summed: one borrower, different types of lenders

Trap 1: direct versus overall exposure (intermediation chain $\rightarrow$ chain of responsibility)

Households $\rightarrow$ Pension funds $\rightarrow$ Investment funds $\rightarrow$ Corporate securities
(decides) (decides)

Trap 2: assets under management versus balance sheet (depository vs custody role)

Households $\rightarrow$ Bank $\rightarrow$ Loans to NFC bank's decision
(depositor) (deposit)

Households $\rightarrow$ Bank $\rightarrow$ Shares of NFC household's decision
(investor) (custody)

$\Rightarrow$ Solution: Solve the intermediation chain, attribute to the right institutions who decide

The framework, in five steps

A macro-accounting framework for the financed pressures of a national financial system.

- 1 **National financial accounts:** every asset and liability, by sector $\times$ instrument
- 2 **From-where-to-where matrices:** who holds a claim on whom, balance-sheet consistent
- 3 **Look-through:** consolidate the intermediation chains, identify responsibility
- 4 **EE-MRIO (Exiobase):** GHG, land, water, fossil fuels, metal ores, minerals by agent
- 5 **Attribution:** pressure in proportion to effective exposure

	Switzerland	U.S. and euro area
Sample	1999–2022	2001–2022
Financial institutions	SNB, CB, IF, OFI, ICPF	MFI, IF, IS, PEN, OFI
Real economy	households, non-financial	corporations, government, rest of world

Reconstructing the From-Where-To-Where (FWTW) matrix

For each instrument (deposits, loans, debt securities, equity, fund shares), a matrix $V^{(\alpha)}$ records who holds a claim on whom:

$$V^{(\alpha)} = \left(\begin{array}{c|c} \mathbf{V}_{FF}^{(\alpha)} & \mathbf{V}_{FR}^{(\alpha)} \\ \hline \mathbf{V}_{RF}^{(\alpha)} & \mathbf{V}_{RR}^{(\alpha)} \end{array} \right)$$

	$\mathbf{V}_{FF}$ inside finance (2,561)					$\mathbf{V}_{FR}$ real econ (5,167)					
Holder	SNB	CB	IF	OFI	ICPF	HH	NFC	GG	RoW		A_f
SNB	0	1	0	1	0	3	2	1	816		824
CB	586	270	55	47	16	794	390	76	610		2,843
IF	26	122	206	61	15	6	149	30	564		1,179
OFI	56	38	44	18	8	109	104	8	884		1,269
ICPF	18	98	831	34	10	39	82	24	478		1,613
Total	685	528	1,136	162	49	950	727	138	3,352		7,728

Switzerland, all instruments, 2022, CHF bn. Row totals are each holder's financial assets A_f ; totals computed before rounding.

- Financial accounts give row sums and column sums, not always bilateral links
- Switzerland: SNB financial accounts; U.S.: Federal Reserve Z.1 FWTW matrices; euro area: ECB sector accounts
- Missing bilateral links filled by iterative proportional fitting

Look-through, and the two properties it imposes

Effective exposure:

$$W_F = \text{diag}(A_F) \left(\underbrace{S_{FR}}_{\text{direct}} + \underbrace{S_{FF} S_{FR}}_{\text{2nd round}} + \dots \right) = \underbrace{\text{diag}(A_F) (I - S_{FF})^{-1} S_{FR}}_{\text{full chain}}$$

with $S_{FF} = \text{diag}(A_F)^{-1} V_{FF}$ and $S_{FR} = \text{diag}(A_F)^{-1} V_{FR}$, shares of each holder's assets

Down a column $\sum_f W_{f,k} \geq \sum_f V_{f,k}$

Responsibilities overlap, as in Scope 3: the **CHF 2,561 bn of intra-financial claims** is redistributed onto the real economy, and counted again.

Across a row $\sum_k W_{f,k} = A_f$

The row totals are **the same** as previous slide: the look-through conserves balance sheets, not liabilities.

W_F	HH	NFC	GG	RoW	A_f
SNB	3	2	1	817	824
CB	889	452	88	1,415	2,843
IF	63	214	42	861	1,179
OFI	125	121	11	1,011	1,269
ICPF	118	253	57	1,185	1,613
sum W_F	1,198	1,042	199	5,289	7,728
memo V_{FR}	950	727	138	3,352	5,167

Switzerland, 2022, CHF bn.

- Headline numbers are the **sum of responsibilities**; we also report the consolidated claim
- Their ratio measures the depth of intermediation: 1.50 (SW), 1.47 (U.S.), 1.70 (EA)

Attribution: from exposures to financed pressures

- $W_{f,k}$: effective exposure of group f to agent k , after look-through
- TC_k : total claims outstanding on k , all instruments (debt + equity, $\approx$ EVIC)
- P_k : environmental pressure of k (GHG emissions)

$$\underbrace{FP}_{\text{Financed pressure}} = \underbrace{W}_{\text{Effective exposure}} \times \sum_k \underbrace{\left(\frac{W_k}{W} \right)}_{\text{Exposure weight}} \times \underbrace{\left(\frac{P_k}{TC_k} \right)}_{\text{Pressure intensity}} = \sum_k \underbrace{\left(\frac{W_k}{TC_k} \right)}_{\text{Attribution factor}} \times \underbrace{P_k}_{\text{Pressure}}$$

Three levers: **how big** the system is, **where** the money goes, **how dirty** the destination.

The right-hand form is the PCAF attribution rule (outstanding amount over EVIC), applied to a whole system rather than to one portfolio.

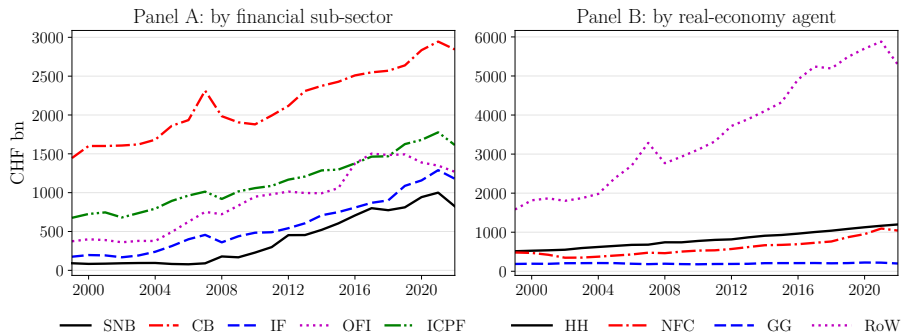
Summed over all direct holders of claims on k , financial or not, the attributed pressures add up to P_k : no double counting at the consolidated level.

- Financial accounts record *how much* goes abroad, never *where*; intensities differ by an order of magnitude across countries
- World intensities vary by an order of magnitude $\Rightarrow$ geography decides the foreign footprint
- **Baseline:** IMF CPIS (securities) + BIS banking statistics (loans), offshore conduits re-attributed to the ultimate parent (Coppola et al., 2021)
- **Volume is fixed by the accounts.** These sources supply shares, not levels
- CPIS + BIS observe 86.0% (U.S.) and 78.2% (EA) of 2022 foreign claims; at most 76% for Switzerland, where SNB reserves (24%) lie outside CPIS by design

Part II — Switzerland

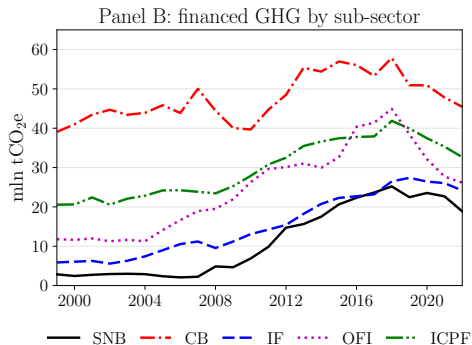
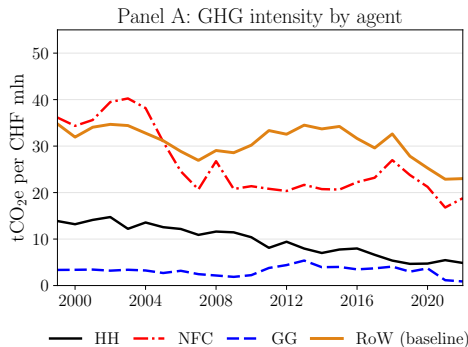
A small economy with a large, outward-oriented financial centre

Effective exposure, 1999–2022 (CHF)



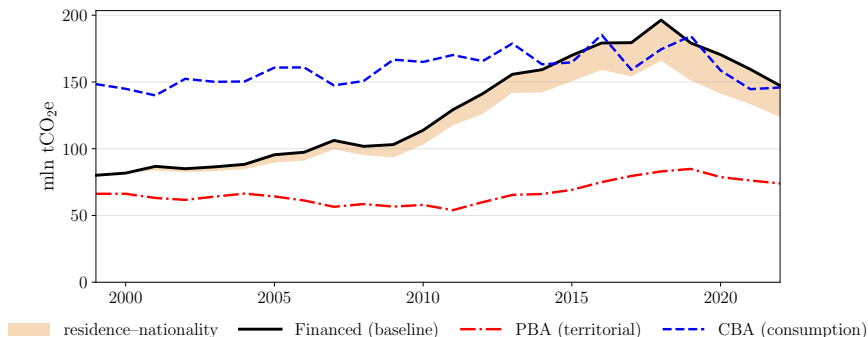
- **Scale:** CHF 2.75 → 7.73 trn (+4.6% a year), **9.4×** Swiss GDP in 2022; direct exposure CHF 5.2 trn (6.3×
- **Mostly foreign:** RoW CHF 1.58 → 5.29 trn, **68.4%** of effective exposure (64.9% of direct exposure)
- **Insurers and pension funds** invest mostly through funds: their exposure is $\times 2.6$ once the chain is resolved
- **SNB exposure** almost entirely foreign reserves, from CHF 90 bn in 2007 to 824 bn in 2022

Carbon intensity, and who finances the emissions



- NFC intensity falls from 36.1 to 18.8 tCO₂e/CHF mln; foreign from 34.8 to 23.0
- Banks lead in level (45.4 Mt CO₂e) but are the **least intensive per franc**, because of mortgages
- Insurers and pension funds: 32.6 Mt CO₂e, **22% of the total**, second after the banks

Financed emissions against the territorial and consumption benchmarks



- **Total financed emissions:** from 80 Mt CO₂e in 1999 to **147.3 Mt CO₂e** (2022)
- **3.5 times reported territorial emissions** (41.7) and twice the Exiobase production-based estimate (74)
- Similar to consumption-based footprint (146): Swiss finance enables as much as Swiss demand

83% of the Swiss financed footprint is generated abroad (121.7 of 147.3 Mt CO₂e). Domestic progress on territorial emissions says little about it.

Where the pressures land: money lens against pressure lens

2022	Claim share	GHG (Mt)	Intensity ratio
Switzerland	–	25.6	–
United States	42.2%	44.4	0.87
China	4.5%	25.0	4.61
Germany	11.1%	9.2	0.68
Australia	1.8%	4.6	2.10
India	0.3%	4.2	11.78
Canada	2.9%	4.1	1.15
Indonesia	0.2%	3.9	14.70
United Kingdom	10.0%	3.9	0.32
France	5.8%	2.2	0.31
All destinations	100%	147.3	

- Concentrated: top five destinations carry 72% of foreign-financed GHG, top ten 85%
- Advanced economies are below their money weight, emerging economies far above it
- China: 4.5% of claims, 20.6% of the foreign pressure

Intensity ratio: share of foreign-financed GHG over share of foreign claims.

- **Custody and discretionary mandates are outside the account**

- Financial accounts record the *owner* of a claim: assets held in custody stay on the client's balance sheet
- CHF **6,837 bn** of securities in custody accounts at end-2022, more than 8× Swiss GDP
- That is the *facilitated* or *managed* layer (PCAF, Part B), not the *financed* one
- Estimates that start from assets under management mix the two

- **Commodity trading is outside the account**

- Commodities rarely cross the Swiss border; traders are non-financial firms
- A parallel channel, methodologically distinct from finance

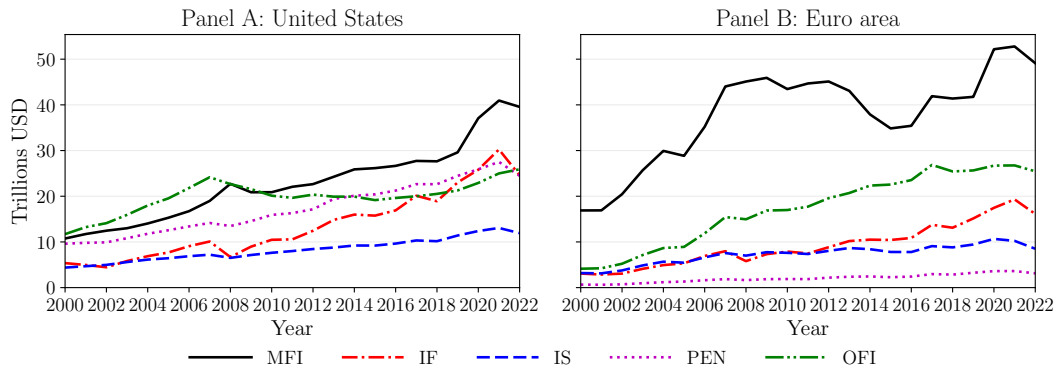
- **System-level accounting**, not a tool to rate individual firms: sector averages, fungibility within issuer groups

For Switzerland, what the financial centre *manages* is far larger than what it *owns*.

Part III — United States and Euro Area

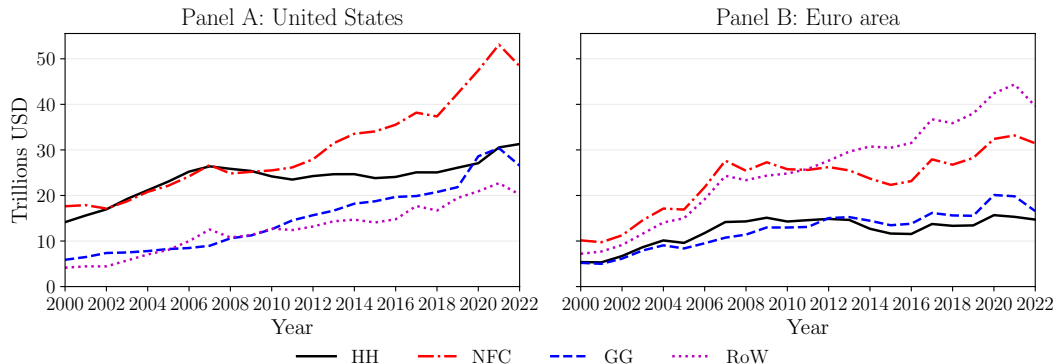
Market-based against bank-based: what each system finances, and where

Two systems, two structures



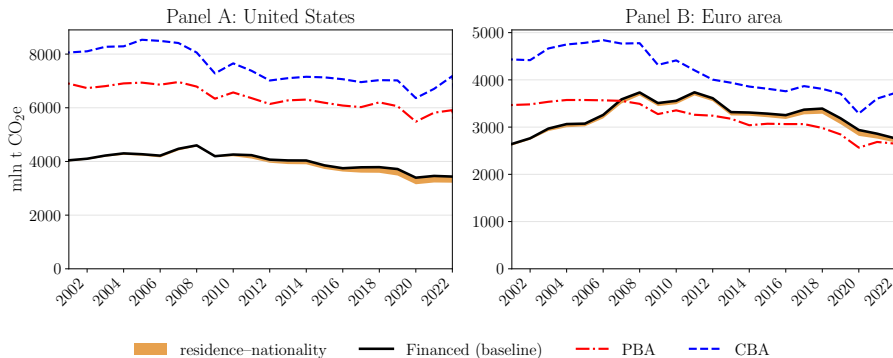
- **Euro area:** MFIs dominate (above half until 2013, 44–48% since); pension funds marginal at 3%
- **United States:** no type above 32% (MFI 31%, OFI 21%, IF, insurers and pension funds 19% each)
- U.S. pension funds $7.8\times$ their euro-area counterpart: funded against pay-as-you-go.
- 2022 exposure USD 126.4 trn against 102.3 trn.

Where the money goes



- **U.S.:** over 80% domestic throughout, NFCs the largest recipient
- **Euro area:** the rest of the world rises to $\approx 40\%$ of exposure by 2022, above domestic NFCs
- Two post-crisis forces: breaking the bank–sovereign doom loop, and the negative-rate search for yield

Financed emissions against the territorial and consumption benchmarks



- **U.S.:** financed = 54–58% of territorial emissions
- **Euro area:** financed = **101–104% of territorial**, three quarters of consumption-based
- Counting each claim once instead of summing responsibilities: 41% and 61% of territorial emissions

What euro-area finance enables worldwide is as large as what the **entire euro-area production system** emits.

Same dollar, different reach

2022, nationality basis	U.S.	EA
Effective exposure (trn USD)	126.4	102.3
Share abroad	0.16	0.39
<i>Financed GHG (Mt CO₂e)</i>		
Total	3,437	2,761
domestic leg	2,588	1,477
foreign leg	849	1,284
<i>Intensity (tCO₂e/M\$)</i>		
All	27.2	27.0
Domestic	24.4	23.5
Foreign	42.0	32.4
Financed / territorial	58%	104%
Foreign leg / territorial	14%	48%
Extraterritorial share ϕ	0.25	0.47

- Per dollar, the two systems are **the same**: 27.2 against 27.0 tCO₂e/M\$
- What differs is the **destination**: 16% abroad against 39%
- EA finances **1,284 Mt CO₂e outside its jurisdiction** against 849 $\Rightarrow$ 1.5 times as much, from a book 20% smaller
- Not a dirtier foreign book: the U.S. foreign leg is *more* intensive (42 vs 32.4 tCO₂e/M\$)

A pure **value** effect: how much of the book is invested abroad.

Foreign leg: did the financial systems finance dirtier counterparts?

We decompose how much is invested abroad (the attribution factor) into *reach* and *composition*:

Reach: the share of all foreign liabilities the system holds (how *much*)

Composition: which counterparts are over- or under-held (*where*, and how *dirty*)

Change in foreign financed GHG, 2010–2022	United States	Euro area
Attribution factor, foreign (Mt CO ₂ e)	+85	–96
Reach (Mt CO ₂ e)	+60	–81
Composition (Mt CO ₂ e)	+26	–14
<i>memo</i> : domestic reach (Mt CO ₂ e)	–689	–243

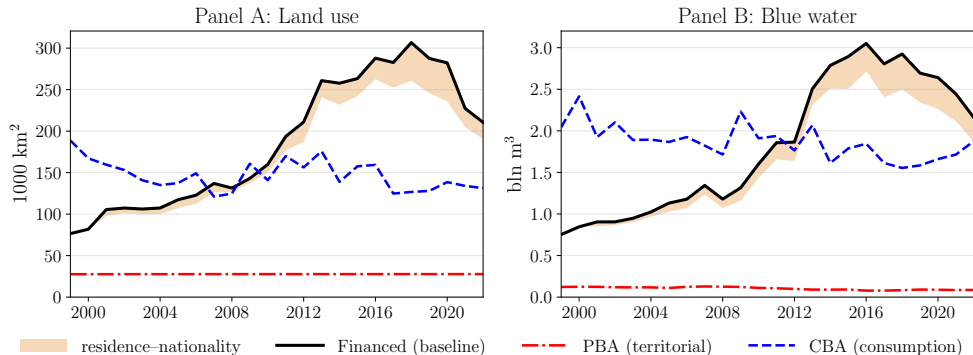
- All foreign terms are an **order of magnitude below** the domestic reach and pressure terms
- The euro area *withdrew* slightly (6.6% → 6.2% of foreign liabilities) and recomposed toward *cleaner* counterparts

Over 2010–2022, neither system shifted its foreign book toward higher-pressure counterparts. The difference between them is the **standing size of the foreign book**, not a drift abroad.

Part IV — Beyond carbon

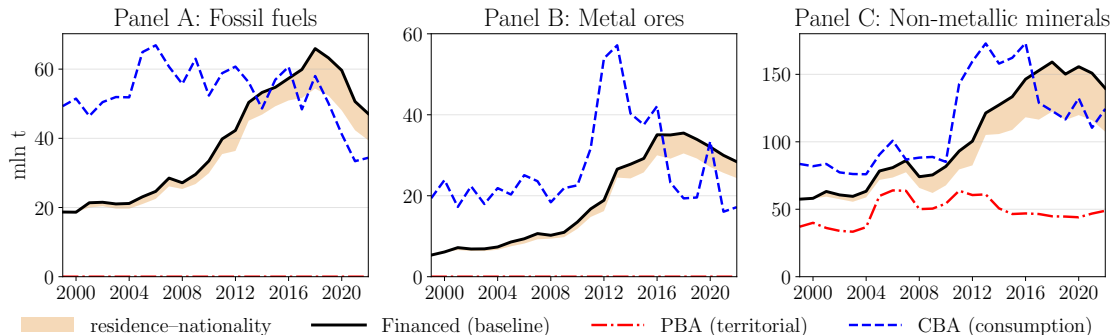
Land use, water, and material extraction: the other pressures that finance enables

Beyond carbon (Switzerland): land use and blue water



- Domestic production pressure does not move: 27.7 thousand km² of land, 0.1 bn m³ of water
- Consumption footprints are 4.7× (land) and 21.7× (water) larger: [embodied in imports](#)
- Financed land and water: of the order of the consumption footprint, above it since the early 2010s

Beyond carbon (Switzerland): material extraction



- Switzerland extracts neither fossil fuels nor metal ores: **the territorial benchmark is zero**
- Financed extraction: 47.1 Mt of fossil fuels, 28.4 Mt of metal ores, 139.6 Mt of non-metallic minerals in 2022
- Metal ores are the only pressure that observed positions raise over the passive benchmark (+18%); Australia alone accounts for 12.3 Mt

	Switzerland		United States		Euro area	
2022	Financed	/PBA	Financed	/PBA	Financed	/PBA
GHG emissions (Mt CO ₂ e)	147.3	2.0	3,437	0.58	2,761	1.04
Land use (1000 km ²)	210.6	7.6	4,859	0.67	3,664	1.6
Blue water (bn m ³)	2.16	25.0	67.6	0.65	46.0	1.6
Fossil fuels (Mt)	47.1	–	1,194	0.63	606	3.5
Metal ores (Mt)	28.4	–	534	0.84	368	6.2
Non-metallic minerals (Mt)	139.6	2.9	2,464	0.75	2,668	1.2

PBA: Exiobase production-based pressure, the same basis for all three systems. Against the Swiss national GHG inventory (FOEN, 41.7 Mt CO₂e) the Swiss GHG ratio is 3.5. –: Switzerland extracts no fossil fuels or metal ores, so the ratio is undefined.

- **Switzerland** above its territorial benchmark on **every** dimension, most for water (25×) and land (7.6×); banks lead on every pressure (31%), insurers and pension funds second (22–23%)
- **U.S.** below territorial benchmark on **every** one
- **EA** far above for fossil fuels and metal ores: **upstream extraction outside the euro area**. Non-metallic minerals the least extreme: construction chains are local

Synthesis

Three systems, and what they mean for insurers and pension funds

Three systems side by side, 2022

	Switzerland	United States	Euro area
Financed GHG (Mt CO ₂ e)	147	3,437	2,761
Financed / territorial*	3.5	0.58	1.04
Share of effective exposure abroad	68%	16%	39%
Share of financed GHG generated abroad	83%	25%	47%
Depth of intermediation (effective / direct)	1.50	1.47	1.70
Banks' share of financed GHG	31%	27%	42%

* For Switzerland, territorial emissions from the national GHG inventory (FOEN, 41.7 Mt CO₂e); for the U.S. and euro area, from Exiobase.

- The ranking by financed-over-territorial follows the ranking by [share abroad](#), not the system's size
- In all three, banks carry well under half of the footprint

The more a financial system looks outward, the more its footprint decouples from the domestic economy, and the less territorial climate policy reaches it.

What this means for insurers and pension funds

2022	Switzerland ICPF	United States IS / PF	Euro area IS / PF
Share of the system's financed GHG	22%	12% / 21%	8% / 3%
Effective / direct exposure	2.59	1.63 / 1.46	2.09 / 2.31
<i>all financial institutions</i>	<i>1.50</i>	<i>1.47</i>	<i>1.70</i>
Share of effective exposure abroad	73%	22% / 16%	42% / 53%
<i>all financial institutions</i>	<i>68%</i>	<i>16%</i>	<i>39%</i>
GHG per unit of exposure, system = 1	1.06	1.23 / 1.07	0.94 / 0.96

- **The look-through matters most for them:** they hold the real economy through funds (52% of Swiss ICPF assets)
- **Their weight follows pension design:** U.S. pension funds finance 713 Mt CO₂e, nine times the EA's 81
- **Their books are more foreign than their system's:** more exposed to carbon policy set abroad

A Scope 3 Category 15 figure computed on direct holdings misses a large share of their exposure (SW, EA).

From financed pressure to risk exposure

We measure *exposure*, not losses. But transition and physical risk travel through the same claims, so the account says [where the exposure is](#).

What the account shows (SW / U.S. / EA)	What it implies for risk
Footprint generated abroad: 0.83 / 0.25 / 0.47	Exposure that reprices under carbon policy home authorities do not set
Depth of intermediation: 1.50 / 1.47 / 1.70	A borrower shock reaches insurers and funds that never lent to it directly
Top ten counterparts: 85% / 92% / 84% of foreign GHG	Concentrated. India and Indonesia are small books with intensity ratios above ten
Metal ores: no domestic extraction (SW), 6.2× territorial (EA)	Nature-related exposure a carbon lens does not see

No supervisor caps financed emissions. Built from official statistics, the account is the [exposure layer](#) a scenario analysis needs, and an independent check on disclosed Scope 3 Category 15 figures.

- ① Financed pressures can be measured **system-wide** without disclosures: national accounts + EE-MRIO, with a look-through that makes responsibility attributable
- ② **Switzerland**: 147 Mt CO₂e in 2022, 3.5 times territorial emissions and 83% abroad; the same holds for land, water and extraction. Insurers and pension funds carry a fifth of it.
- ③ **U.S. and euro area**: per dollar the two systems finance the same carbon (27.2 against 27.0 tCO₂e/M\$). What differs is where the dollar goes: 16 cents abroad against 39. Over 2010–2022 neither recomposed its foreign book, and both footprints fell by about 800 Mt CO₂e.
- ④ **The size of the foreign book is the structural variable.** It decides how far a financed footprint drifts from the domestic economy, and how much of it domestic policy can reach.

Thank you

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