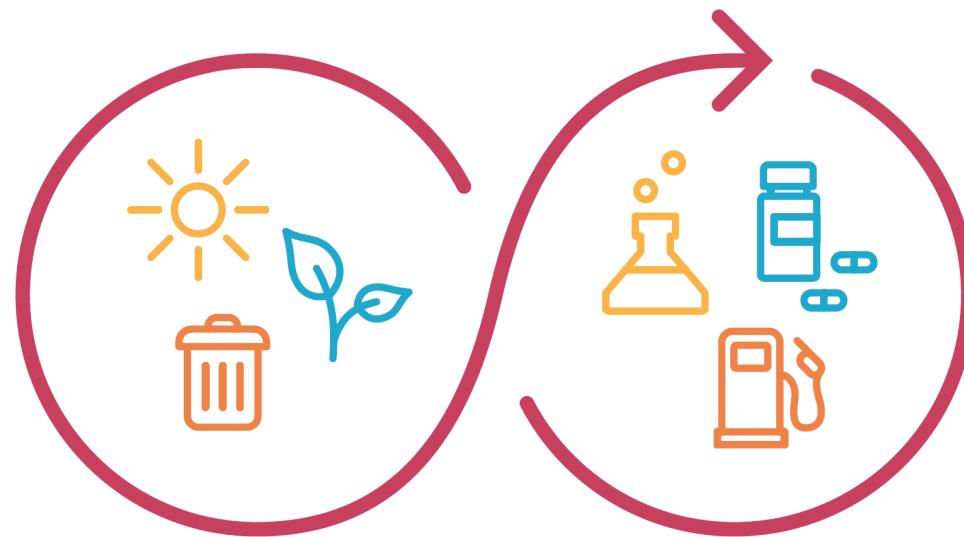


The role of finance for the transition to a sustainable industry



Bjarne Steffen

The role of finance for the transition to a sustainable industry

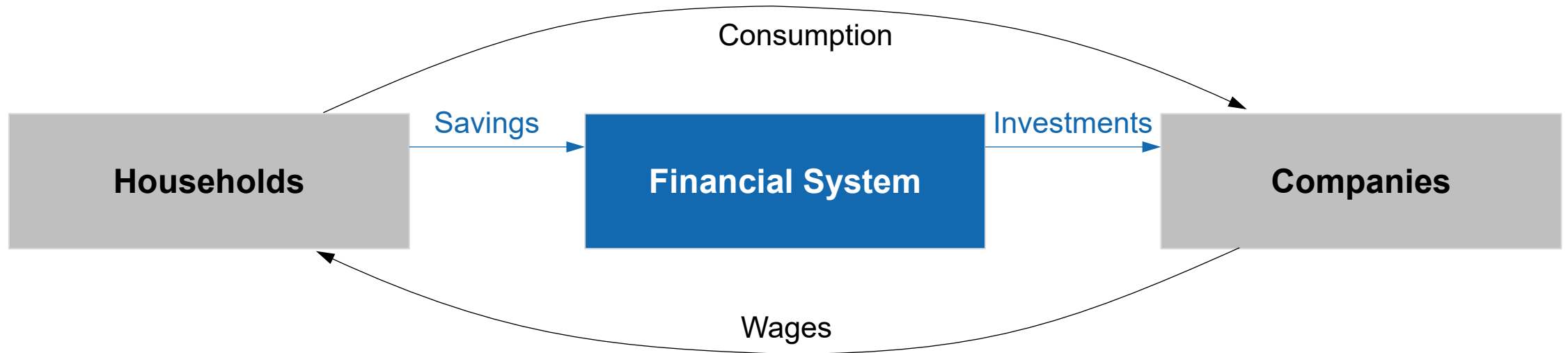
Agenda for today

1. Introduction to the financial system
2. Problems: Importance of finance for sustainability transitions
3. Solutions: Public policy interventions, and financial instruments

Introduction to the financial system

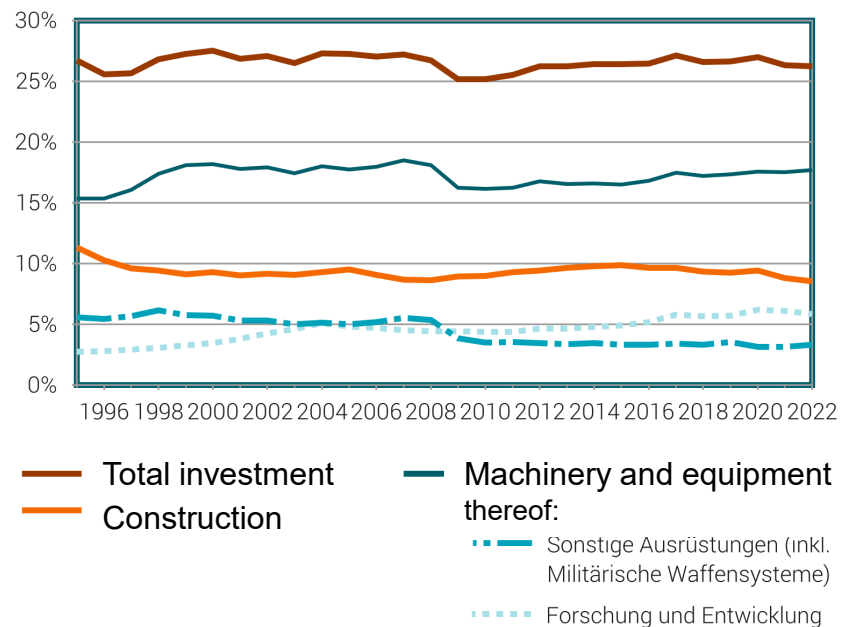
- Role of finance in the economy
- Financial markets
- Financial intermediaries

Role of finance in the economy



Capital formation in the Swiss economy

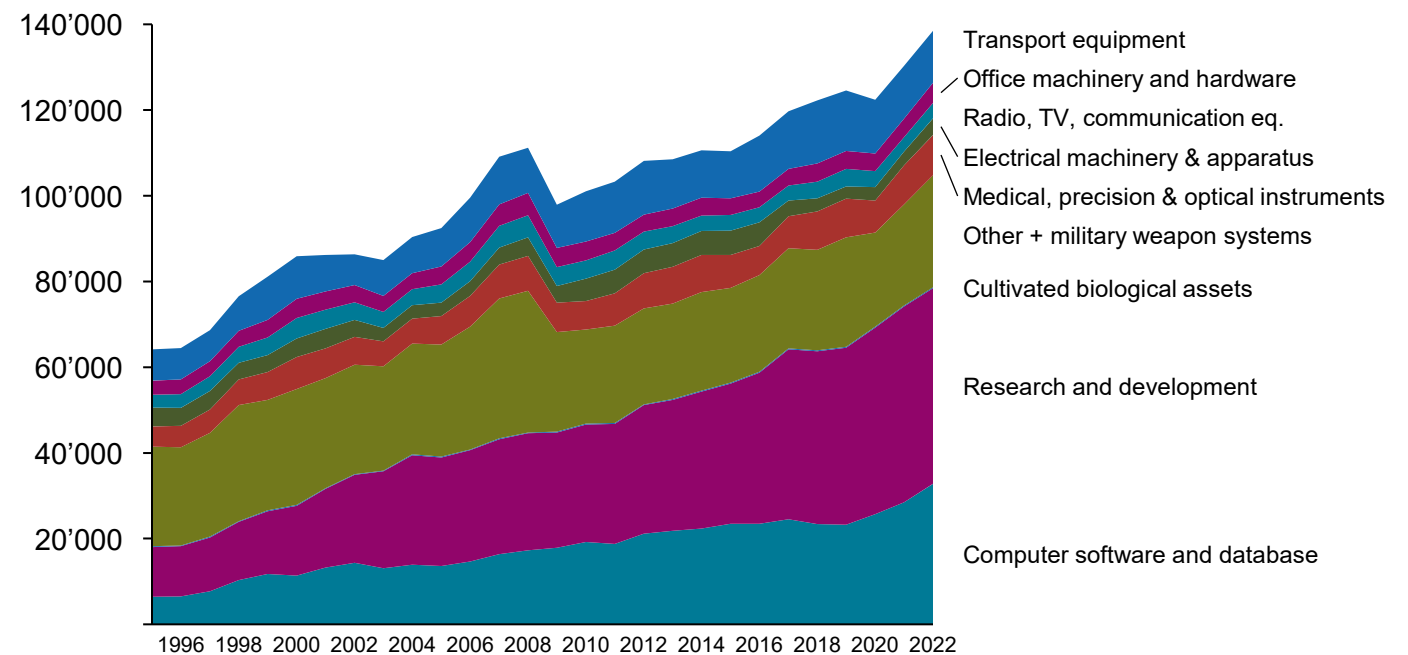
Investment ratio



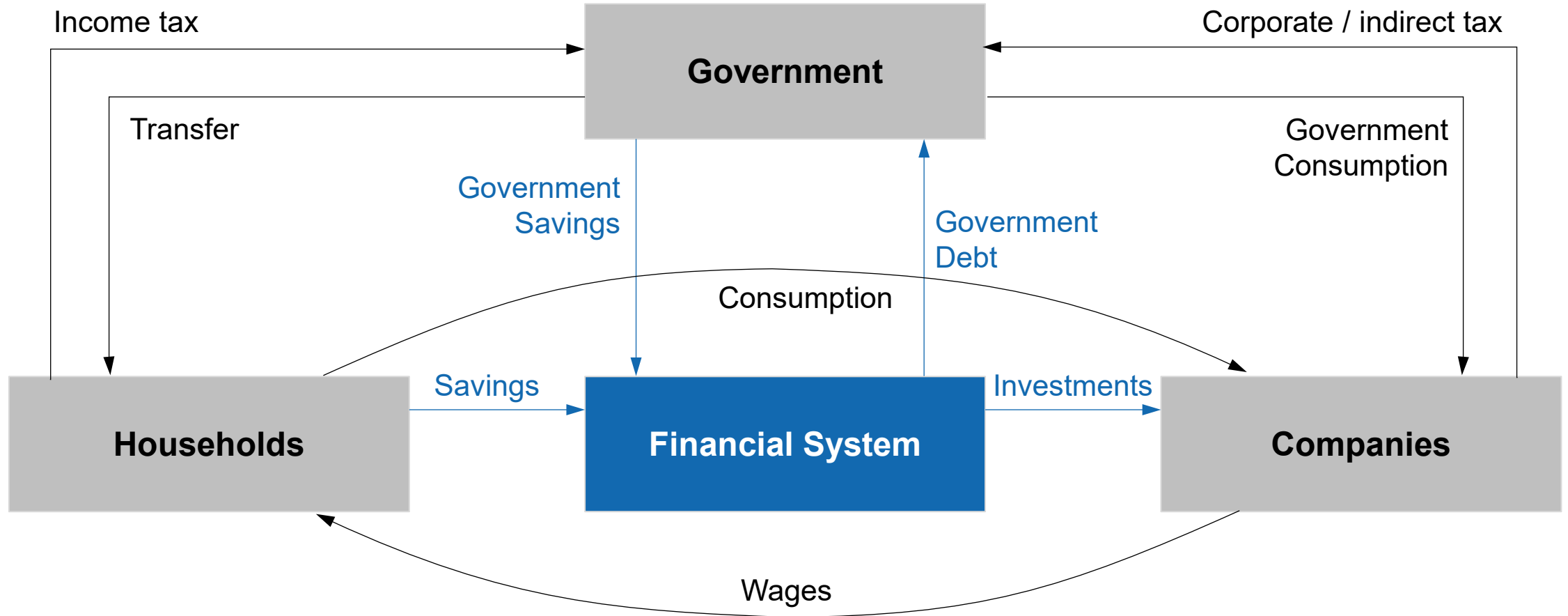
Quelle: BFS – Volkswirtschaftliche Gesamtrechnung (VGR)

© BFS 2023

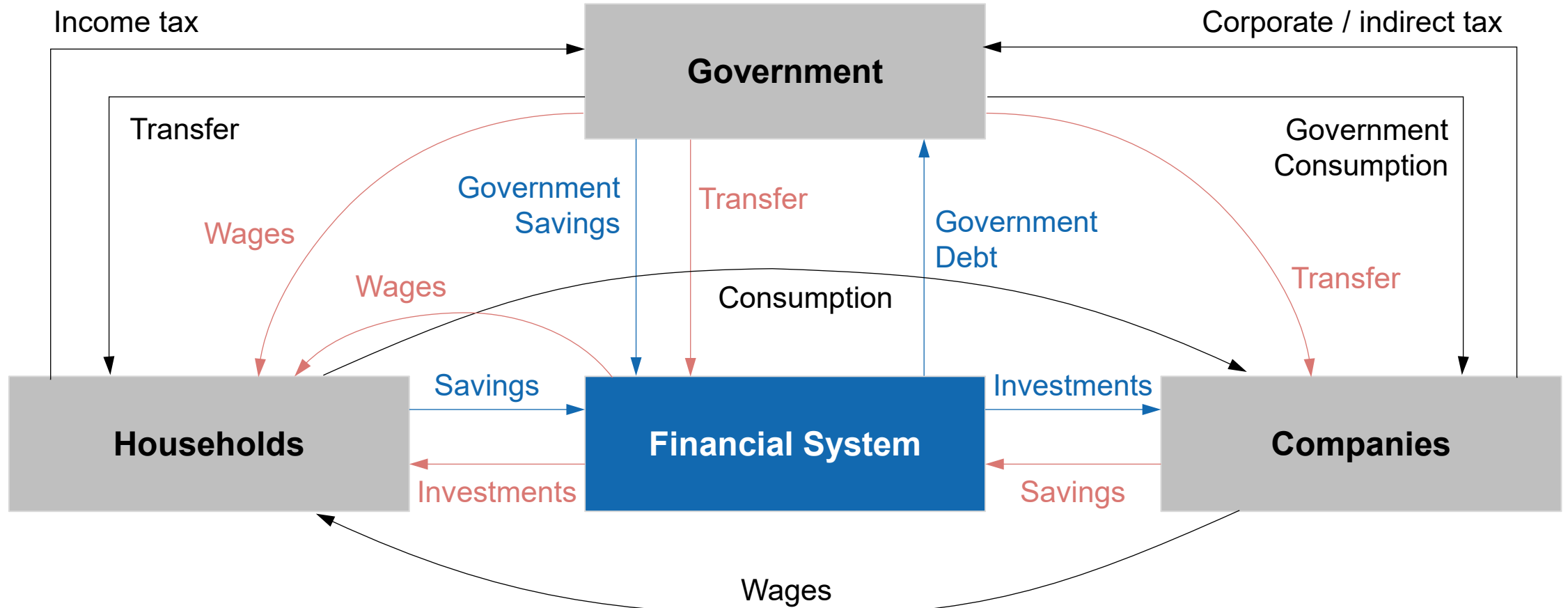
Machinery and equipment investment (mio. CHF)



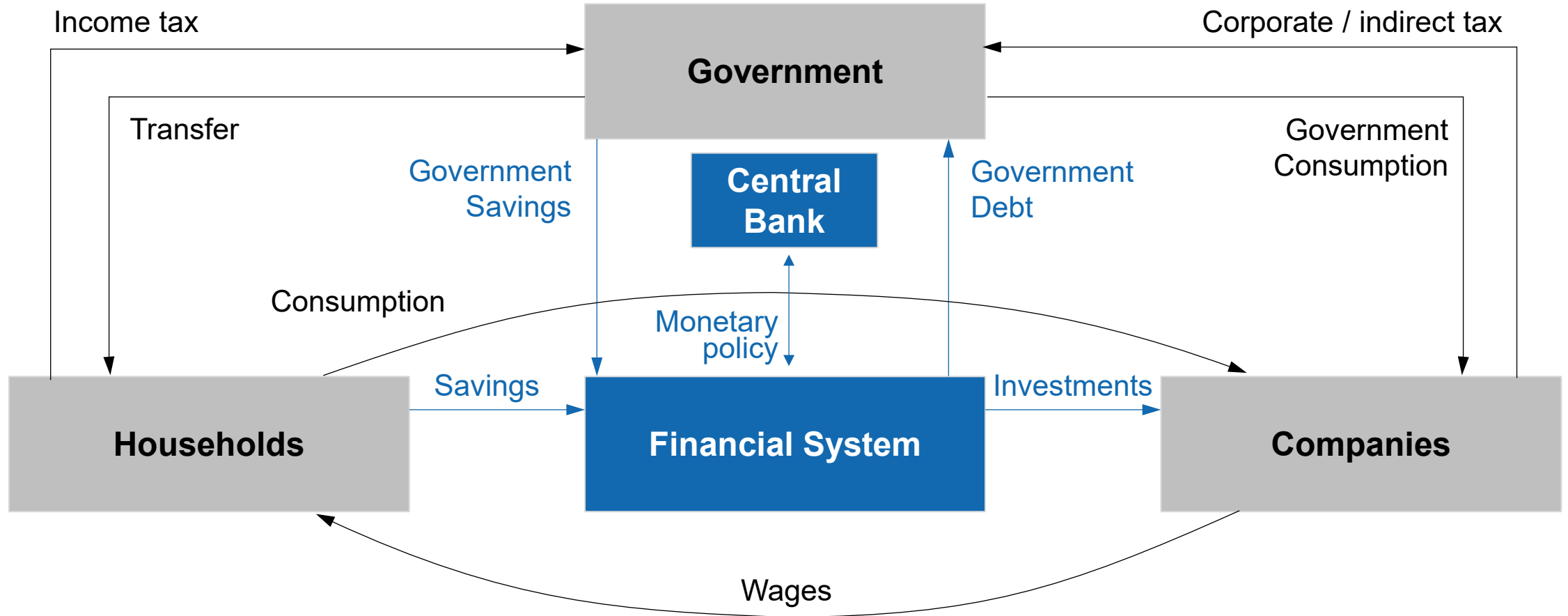
Role of finance in the economy



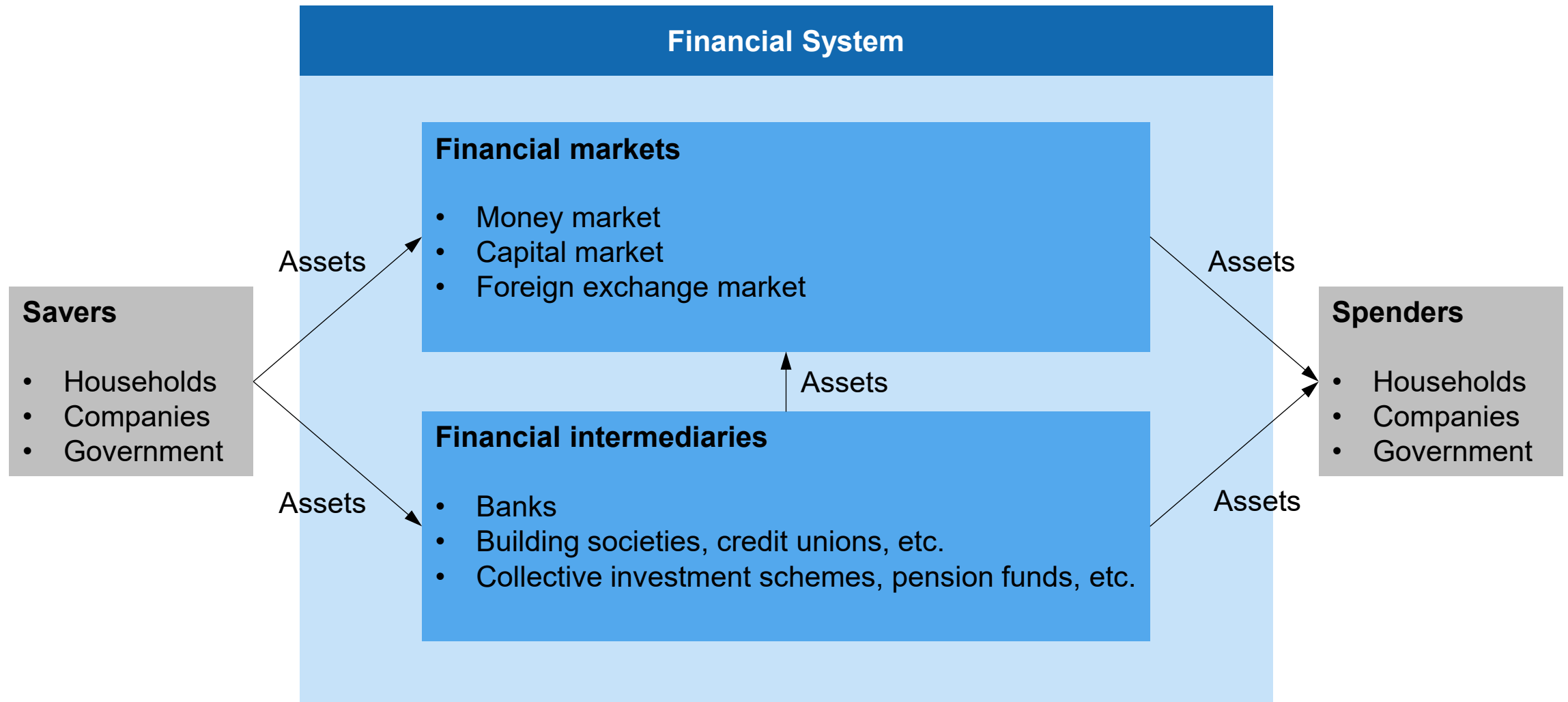
Role of finance in the economy



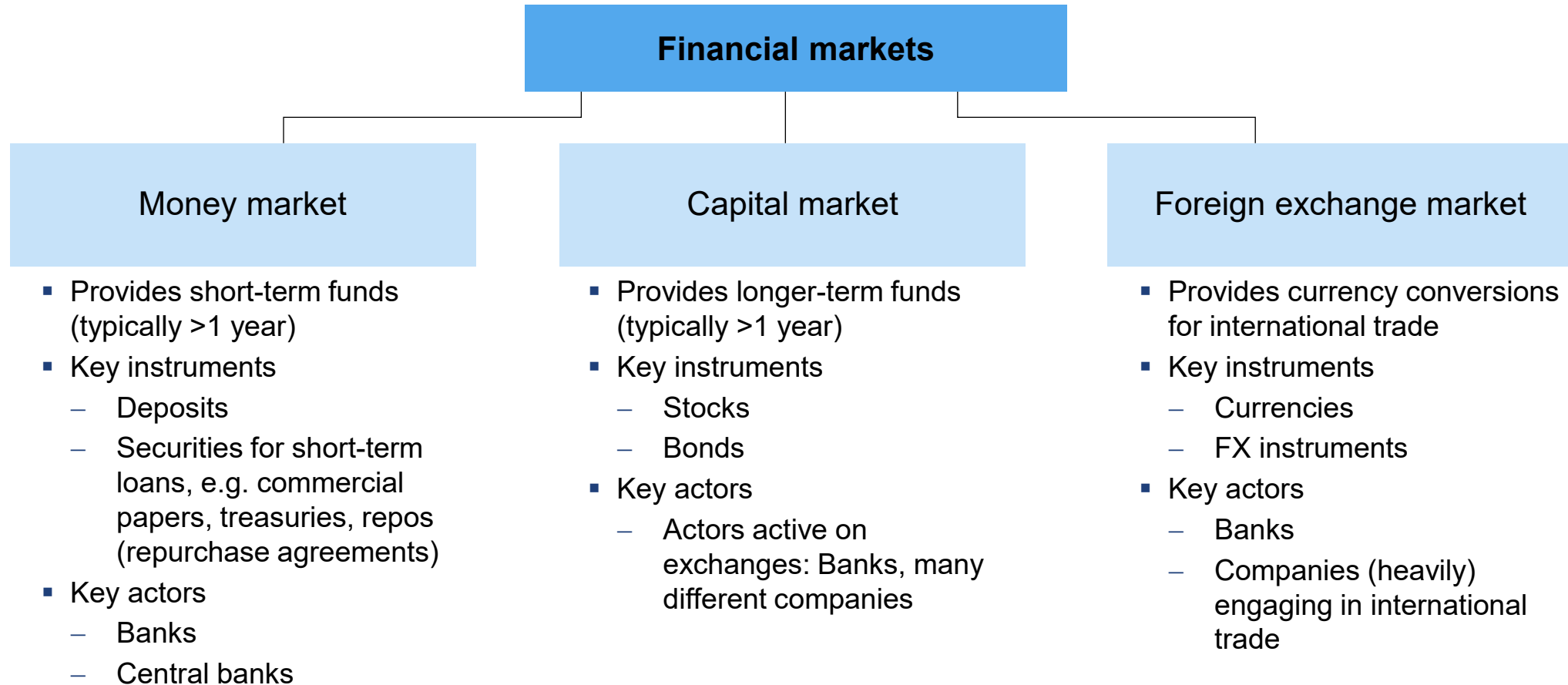
Role of finance in the economy



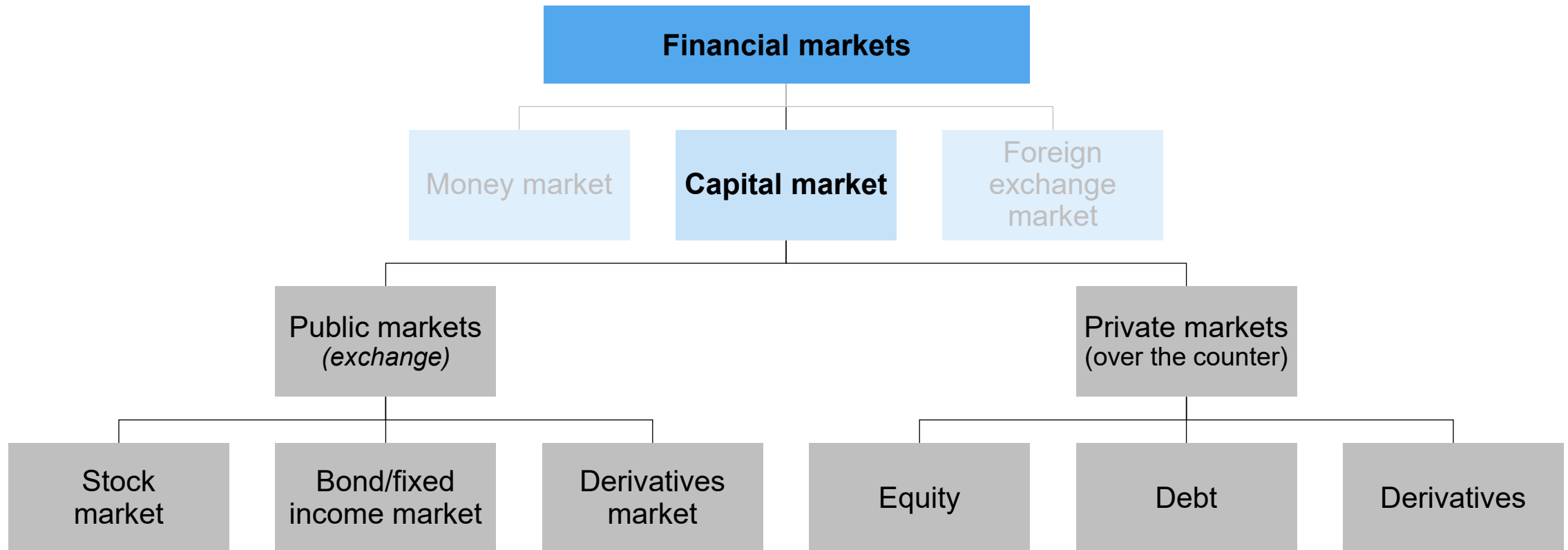
Elements of the financial system



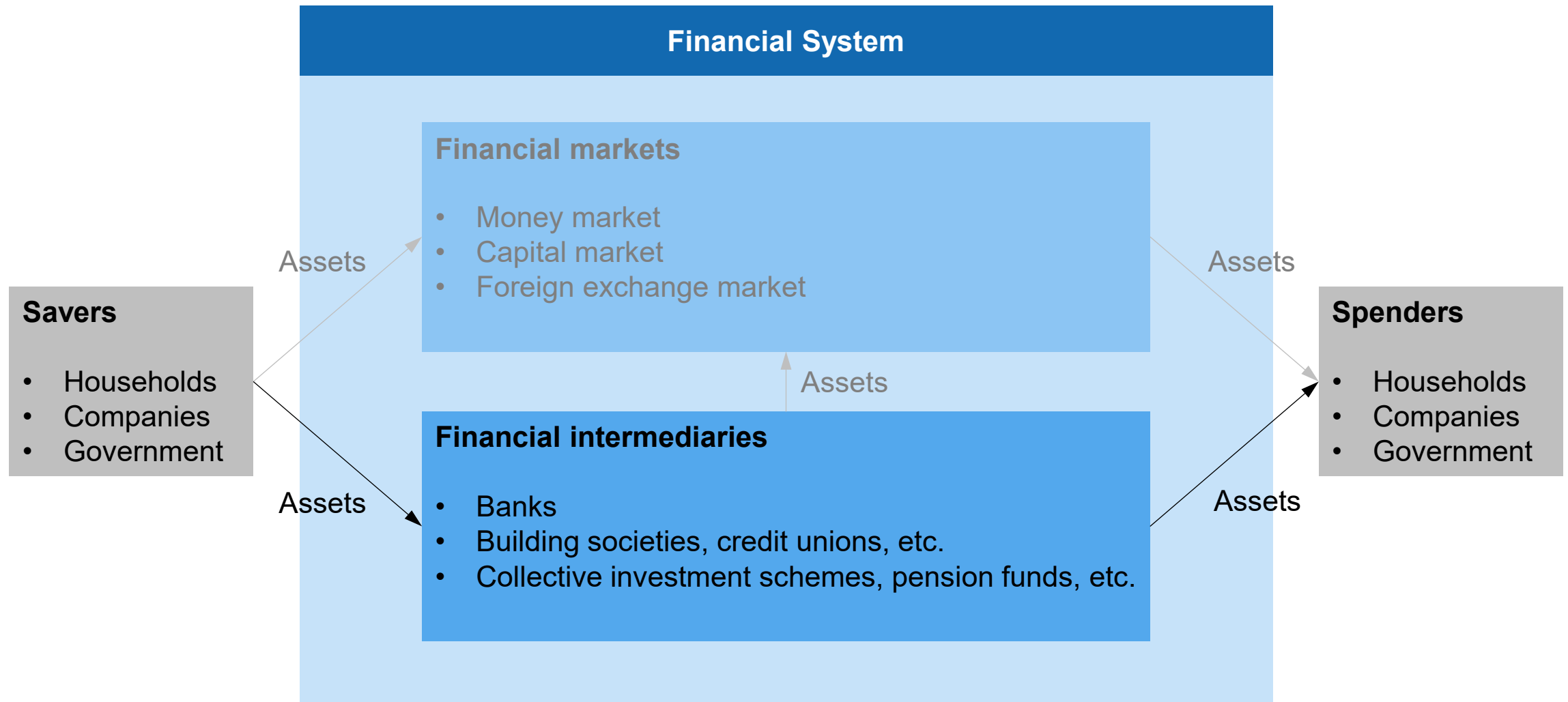
Types of financial markets



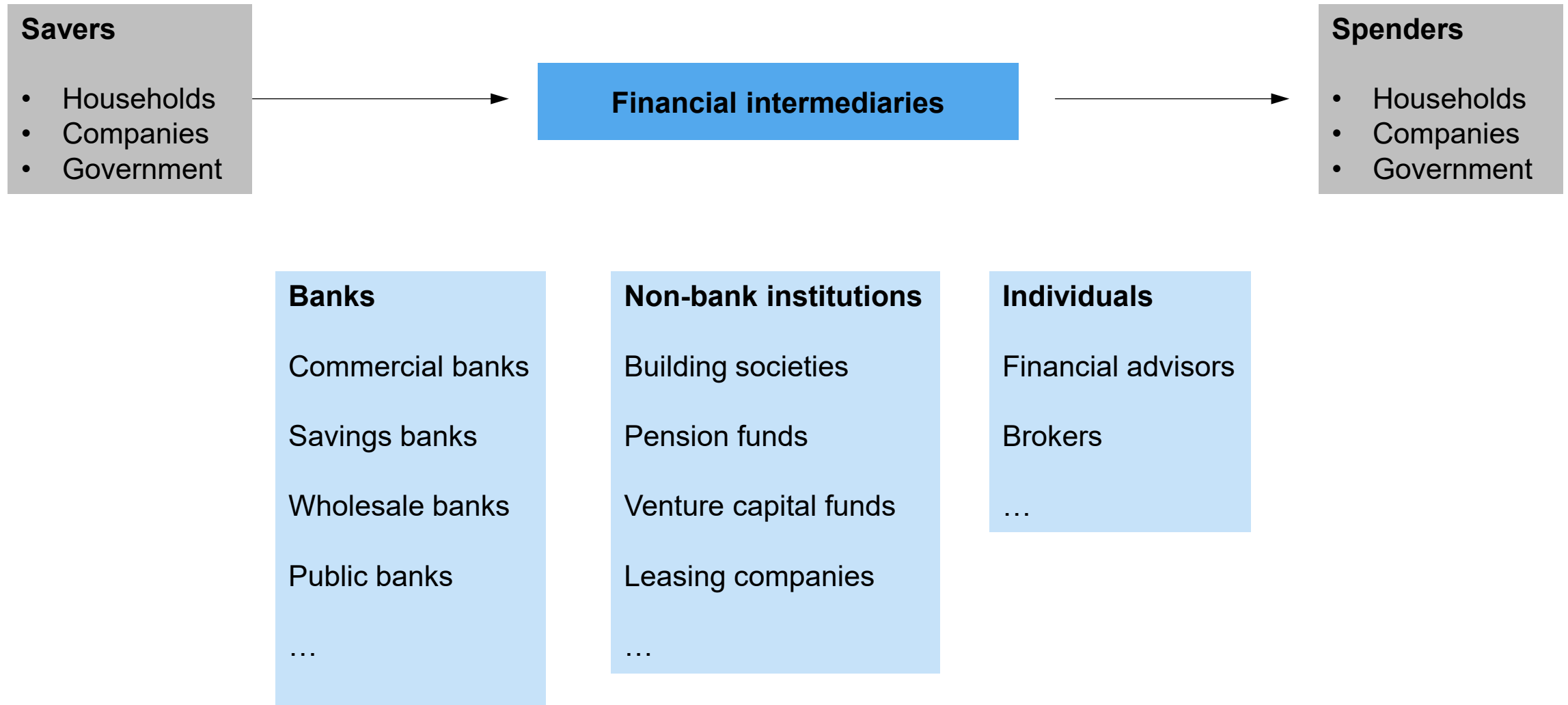
Deep dive into capital markets



Elements of the financial system



What are financial intermediaries



Deep dive banks: their functions in the financial system

Functions provided by banks

Payment operation

- Issue of money
- Settlement of payments

Matching savers and spenders

- Size transformation
- Risk transformation
- Maturity transformation

Why are there banks...

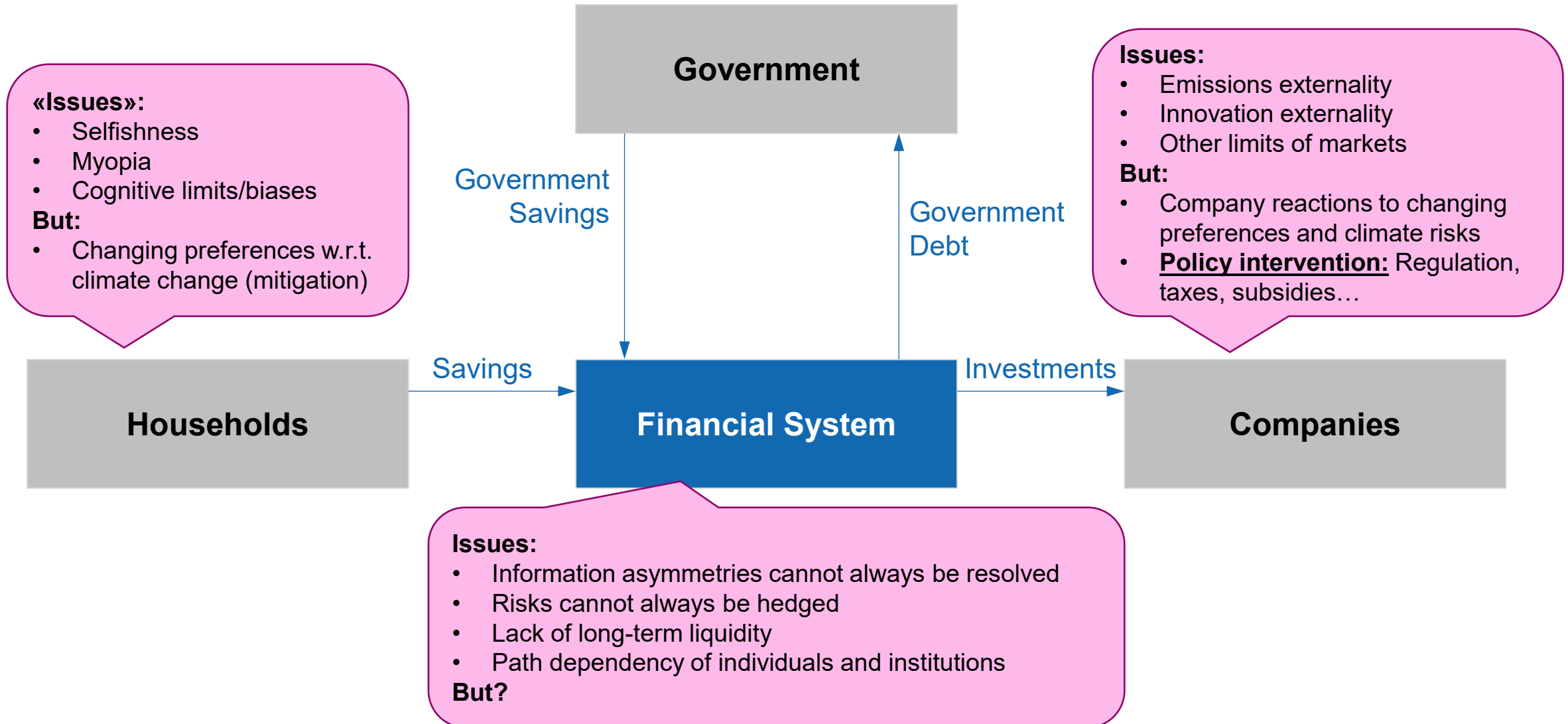
... and not just money markets?

... and not just capital markets?

Importance of finance for sustainability transitions

- Imperfections of capital markets
- Capital intensity of low-carbon techs
- Tech novelty and learning curve investments

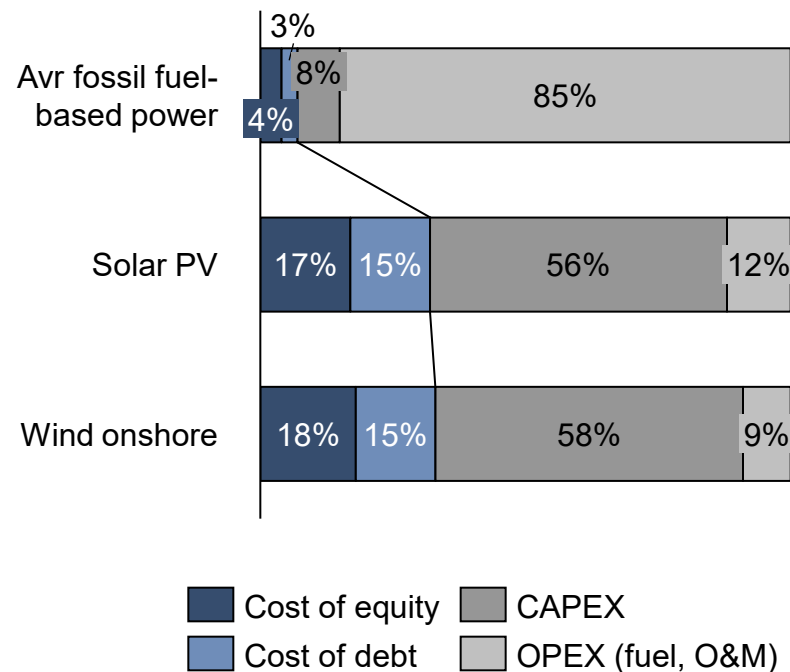
Imperfection of the capital market w.r.t. tackling climate change



Many clean energy technologies are capital-intensive: Example electricity

Renewables w/ high upfront investment...

Percentage of LCOE¹

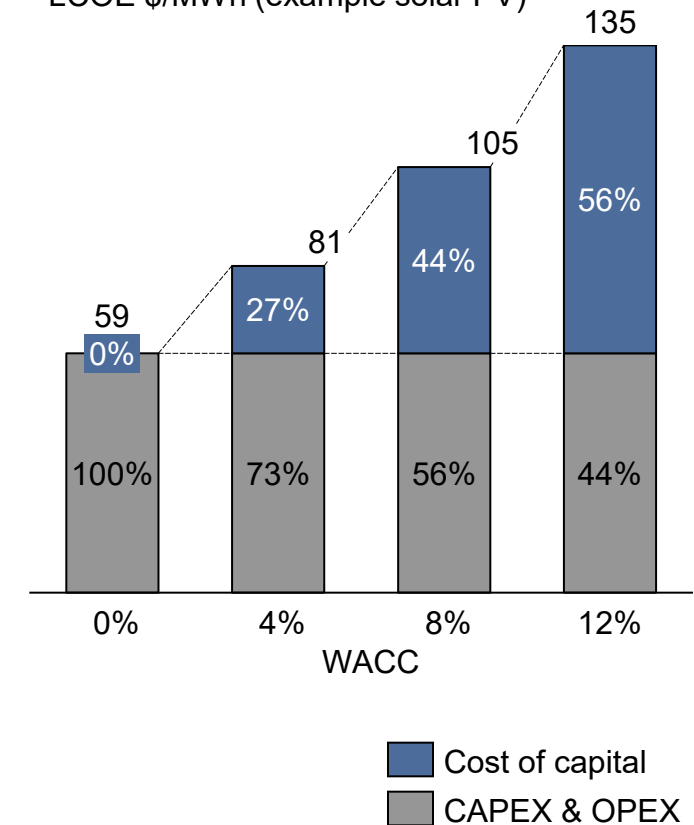


...so capital needs are high...



...and LCOE are sensitive to WACC

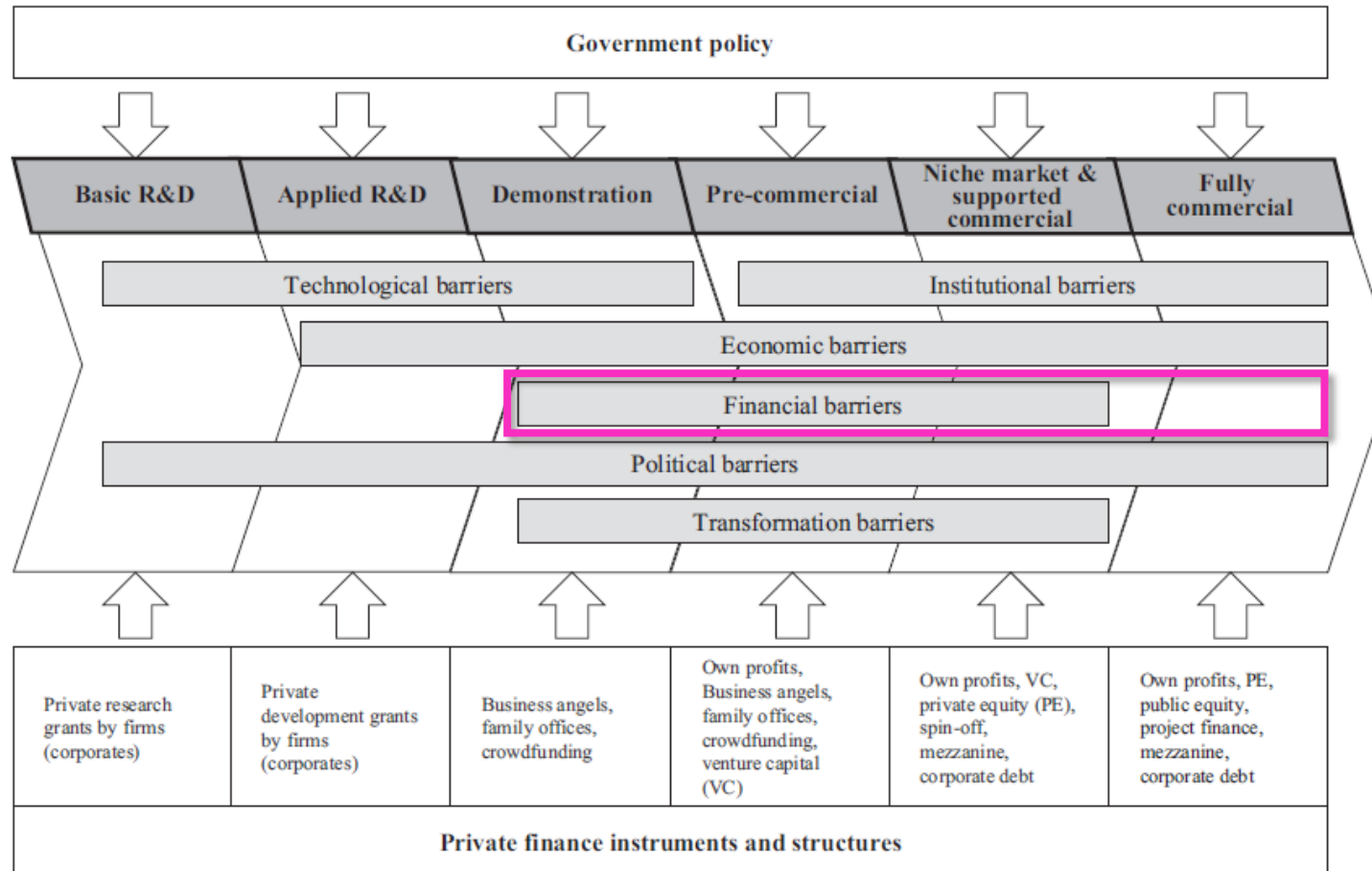
LCOE \$/MWh (example solar PV)



Note: LCOE = Levelized cost of electricity; WACC = Weighted average cost of capital

1. Assumes 5% cost of debt, 10% cost of equity, European fuel costs. Fossil fuel based power is the average of hard coal, natural gas, and diesel plants.

Further, many low-carbon technologies are new: “Valley of death”

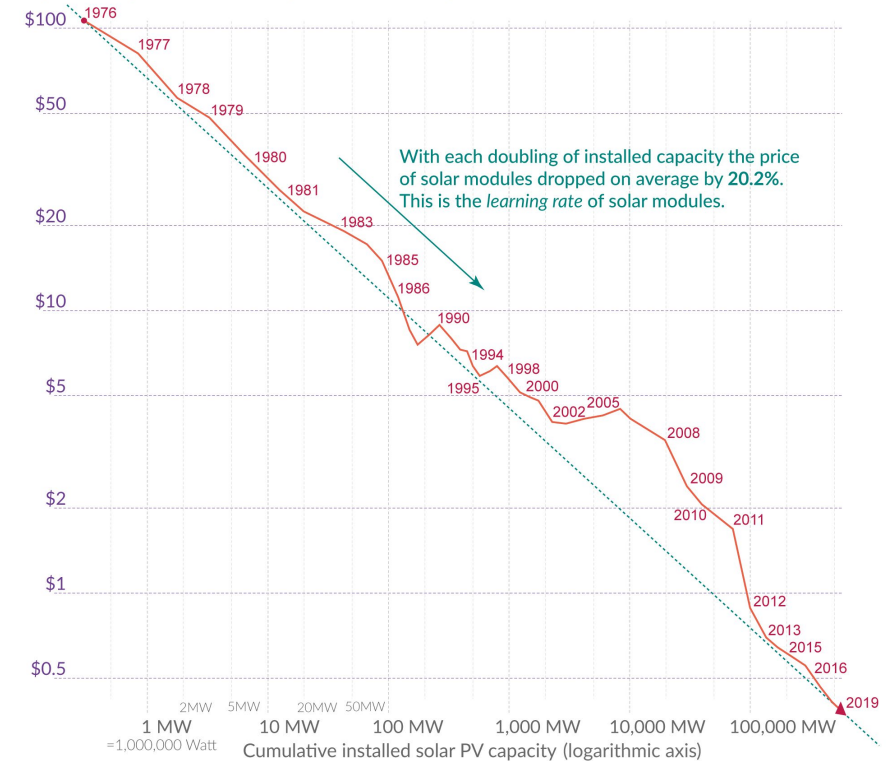


Source: F Polzin (2017), Mobilizing private finance for low-carbon innovation – A systematic review of barriers and solutions, Renewable and Sustainable Energy Reviews 77, 525-535.

In commercialization phase, still need to “buy down the learning curve”



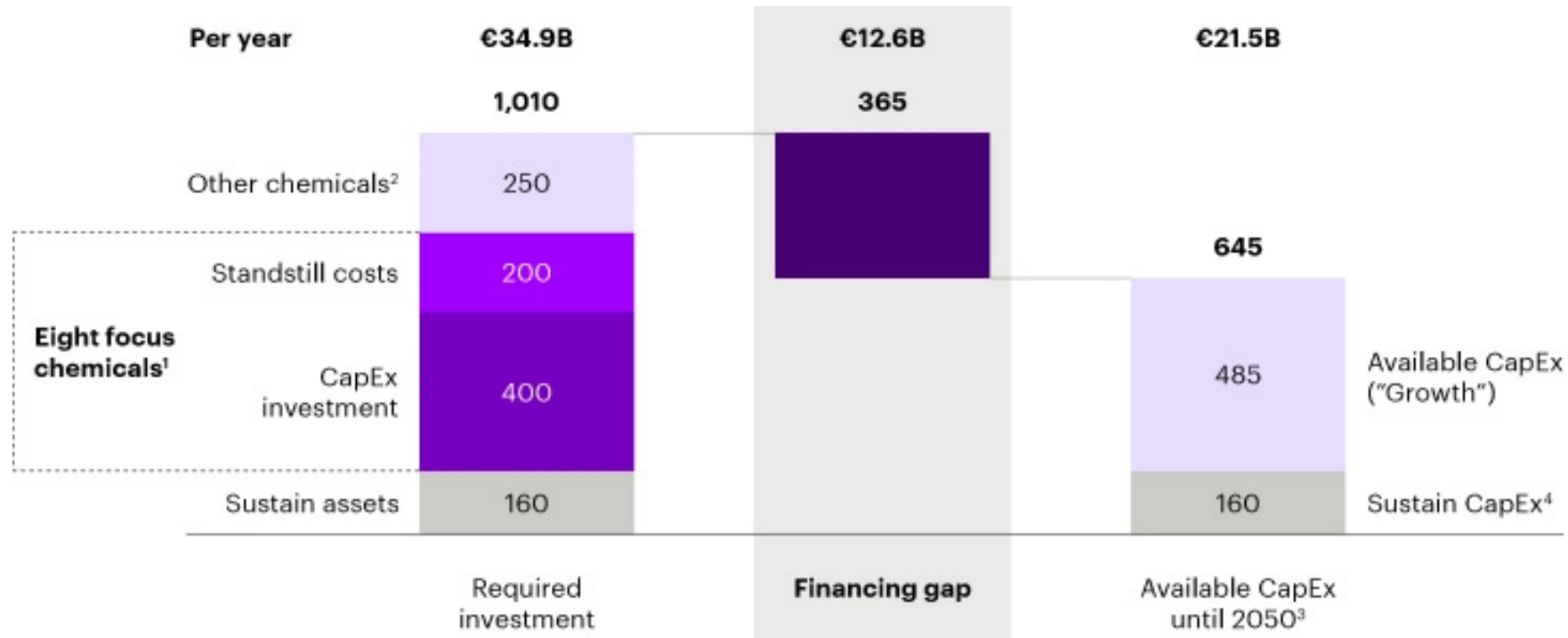
Price per Watt of solar photovoltaics (PV) modules (logarithmic axis)
The prices are adjusted for inflation and presented in 2019 US-\$.



Data: Lafond et al. (2017) and IRENA Database; the reported learning rate is an average over several studies reported by de La Tour et al (2013) in Energy. The rate has remained very similar since then. OurWorldinData.org – Research and data to make progress against the world's largest problems.

Licensed under CC-BY by the author Max Roser

Example: Estimate of capital needs for chemical industry in the EU



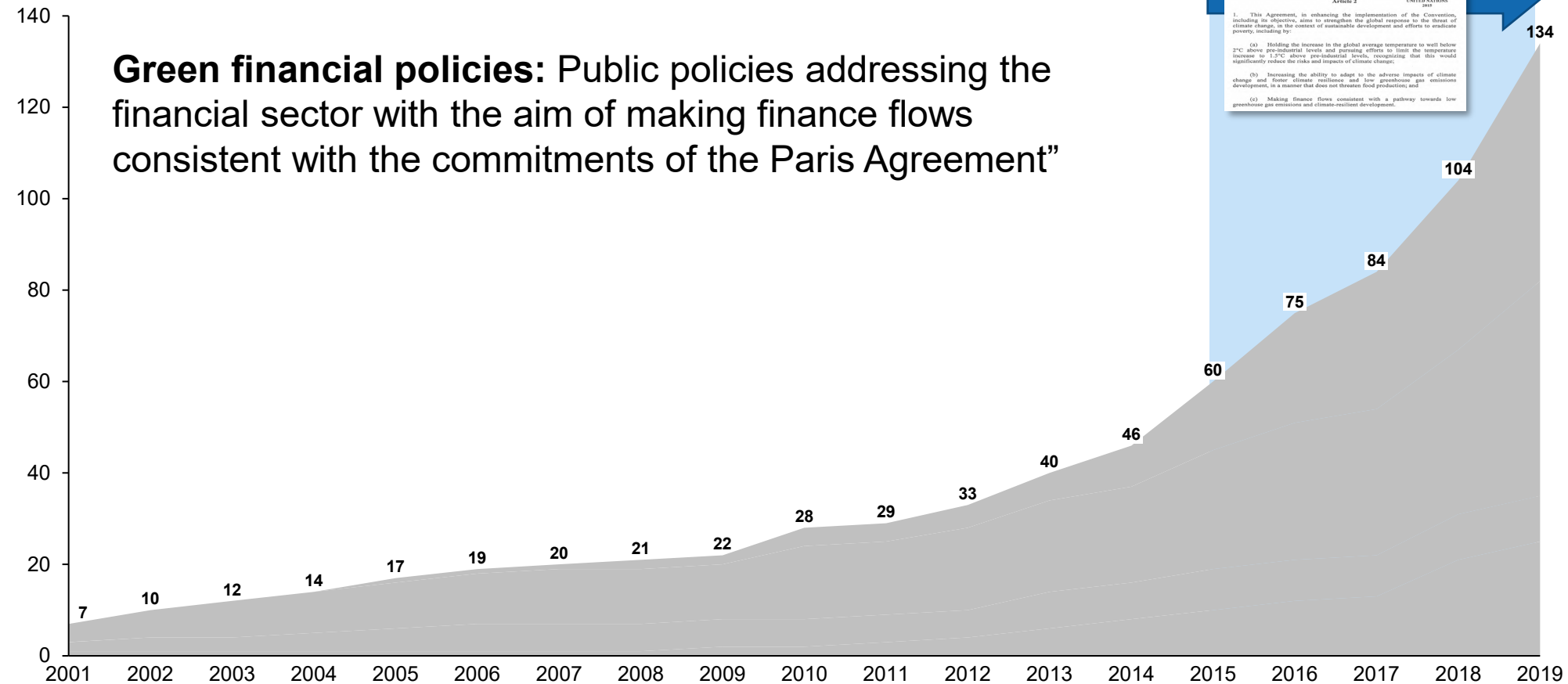
Source: Study by consulting company Accenture, <https://www.accenture.com/fi-en/insights/chemicals/eu-green-deal>

Solutions: Public policy interventions, and financial instruments

- Green financial policies
- Green bonds

Public policies: interventions to “green financial flows” increasing rapidly

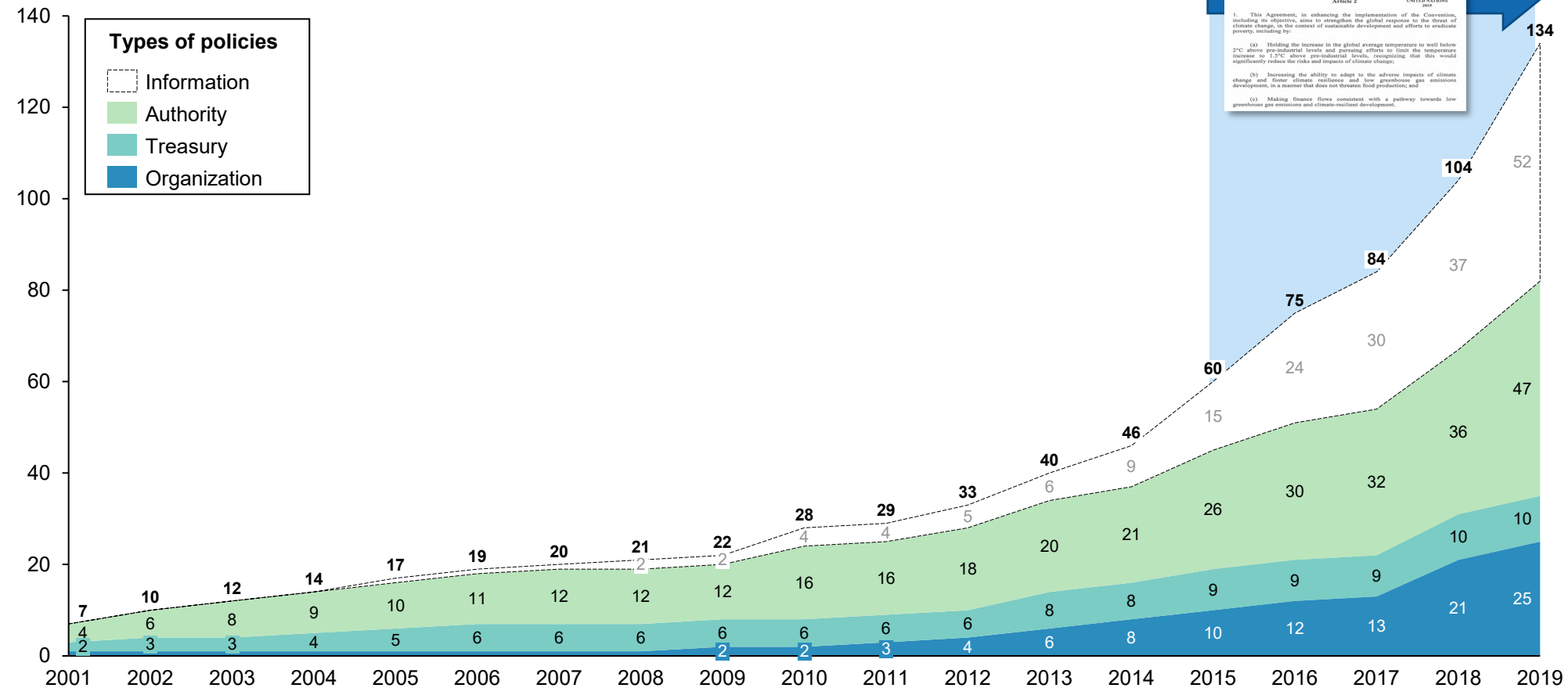
No. of **green financial policies** in OECD countries



Source: Steffen, B. (2021). A comparative analysis of green financial policy output in OECD countries. *Environmental Research Letters*, 16(7), 074031.

Public policies: interventions to “green financial flows” increasing rapidly

No. of low-carbon financial policies in OECD countries



Source: Steffen, B. (2021). A comparative analysis of green financial policy output in OECD countries. *Environmental Research Letters*, 16(7), 074031.

“Authority”: Disclosure requirements and government labels

Authority

Examples



How could it help

Mandating standardized climate-related financial disclosures

- Data availability for investors/lenders/underwriters (e.g. scope 1/2/3)
- Development and upscaling of new financial products

Preventing greenwashing and building trust

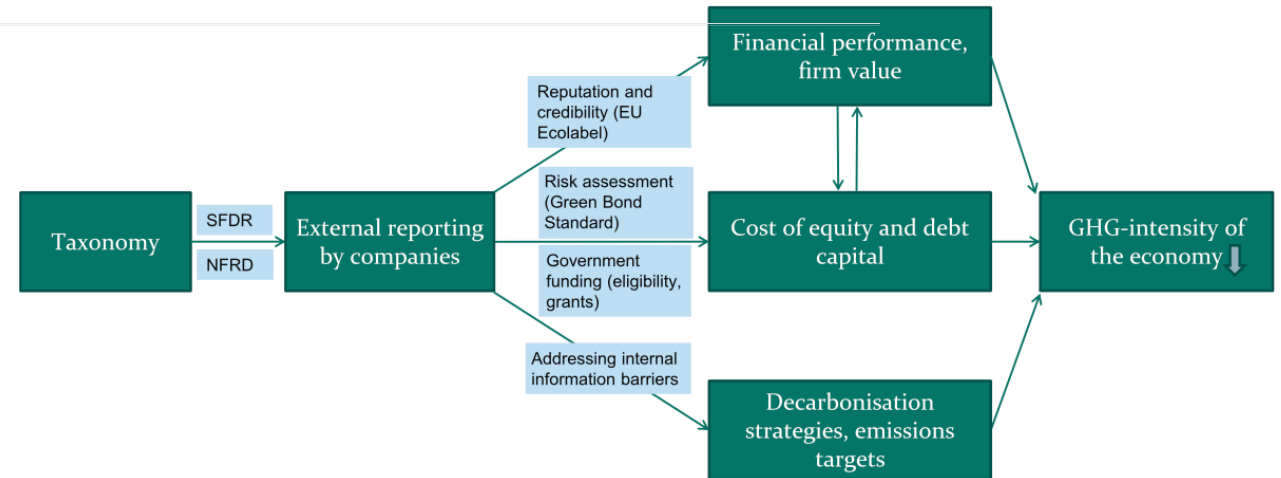
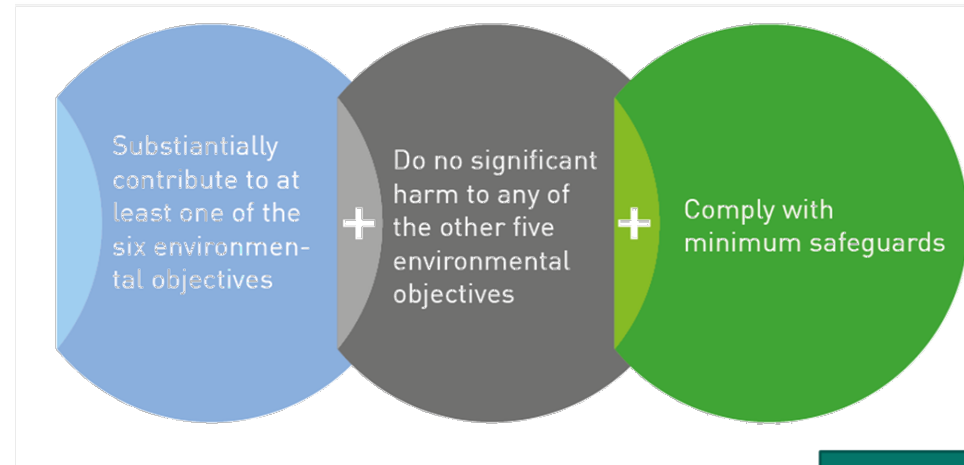
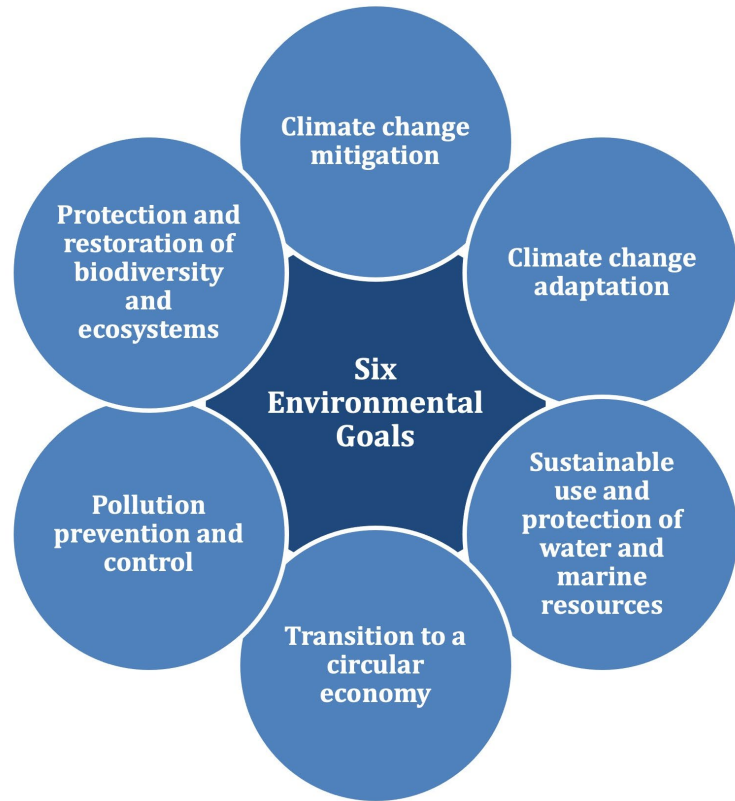
- Real climate impact especially for listed securities/mass market products

Accelerating structural change within financial sector

- Requirement for measures at all corporates and asset managers

Example EU taxonomy

Authority



Source: Franziska Schütze & Jan Stede: The EU sustainable finance taxonomy and its contribution to climate neutrality

Example EU taxonomy (Example reporting by BASF)

Authority

E.U. taxonomy indicators: 2022 turnover

Close

Economic activities	Substantial contribution criteria		DNSH criteria ("do no significant harm")										Proportion of taxonomy-aligned turnover	Category (enabling activity)	Category (transitional activity)
	Turnover	Proportion of turnover	Climate change mitigation	Climate change adaptation	Climate change mitigation	Climate change adaptation	Water and marine resources	Circular economy	Pollution	Bio-diversity and eco-systems safeguards	Minimum safeguards				
	Million €	in %	in %	in %	Yes/no	Yes/no	Yes/no	Yes/no	Yes/no	Yes/no	Yes/no				
A. Taxonomy-eligible activities															
A.1. Environmentally sustainable activities (taxonomy-aligned)															
3.05 Manufacture of energy efficiency equipment for buildings	63	0.1	100.0	–	–	Yes	Yes	Yes	Yes	Yes	Yes	0.1	Yes	–	–
3.12 Manufacture of soda ash	6	0.0	100.0	–	–	Yes	Yes	–	Yes	Yes	Yes	0.0	–	–	Yes
3.14 Manufacture of organic basic chemicals	249	0.3	100.0	–	–	Yes	Yes	–	Yes	Yes	Yes	0.3	–	–	Yes
3.17 Manufacture of plastics in primary form	20	0.0	100.0	–	–	Yes	Yes	–	Yes	Yes	Yes	0.0	–	–	Yes
Total taxonomy-aligned activities	339	0.4	100.0	–								0.4	0.1%	0.3%	
A.2. Taxonomy-eligible but not environmentally sustainable activities (not taxonomy-aligned)															
3.04 Manufacture of batteries	1,423	1.6													
3.05 Manufacture of energy efficiency equipment for buildings	3	0.0													
3.10 Manufacture of hydrogen	25	0.0													
3.12 Manufacture of soda ash	6	0.0													
3.13 Manufacture of chlorine	1	0.0													
3.14 Manufacture of organic basic chemicals	2,931	3.4													
3.15 Manufacture of anhydrous ammonia	296	0.3													
3.16 Manufacture of nitric acid	217	0.2													
3.17 Manufacture of plastics in primary form	6,374	7.3													
Total not taxonomy-aligned activities	11,277	12.9										–			
Sum A.1. + A.2.	11,616	13.3										0.4	0.1%	0.3%	
B. Taxonomy-non-eligible activities															
Turnover from taxonomy-non-eligible activities	75,710	86.7													
Total	87,327	100.0													

Source: BASF EU taxonomy report

“Organization”: Leverage existing market activity of public sector

Government organization

Examples



How could it help

Piloting financial products without immediate return upside

- “Market testing” for instruments and practices with unknown potential

Rapidly up-scaling financial instruments and practices

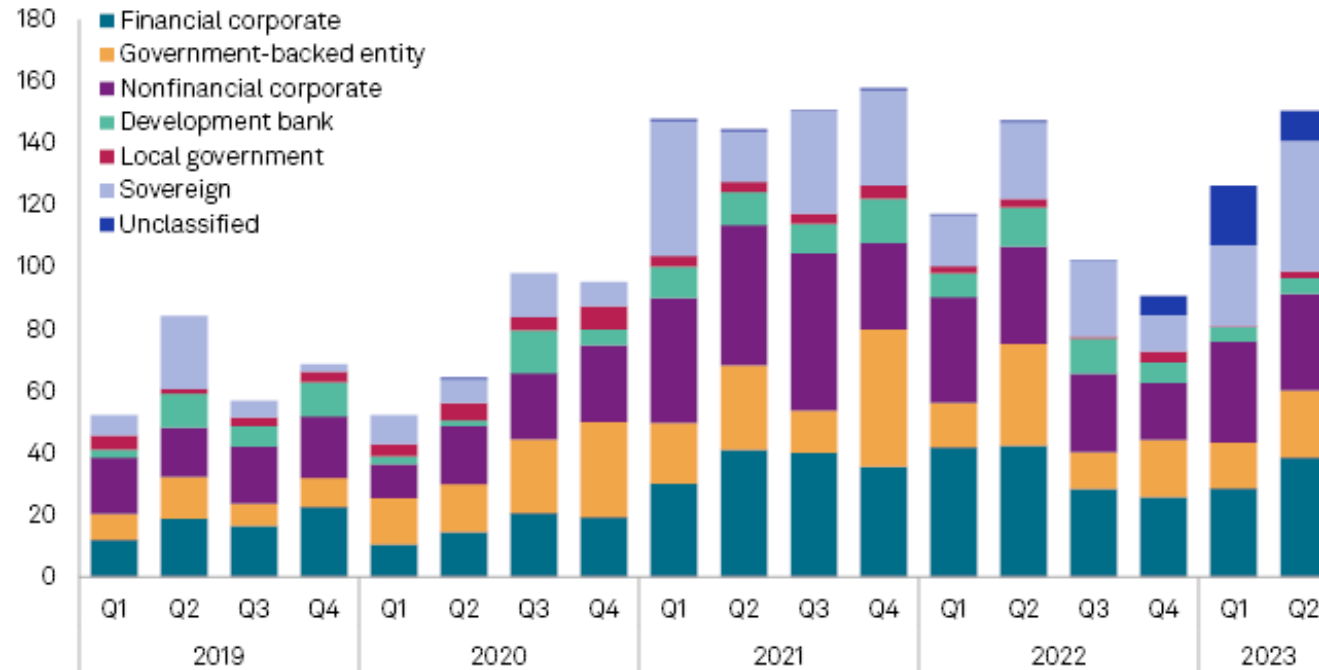
- Often large volumes/AUM managed by public sector actors

Accelerating structural change within financial sector

- Increased acceptance, part of the mainstream

Green bond issuance over time

Global green bonds by issuer type (\$B)



Data compiled Aug. 15, 2023.

Sample includes the top 10 economies in the world by 2022 nominal GDP, excluding Russia.

Internationally aligned green bonds are limited to those where at least 95% of proceeds are designated for green projects aligned with the Climate Bonds Taxonomy.

Does not include nonaligned bonds, or bonds that had not been tagged as either aligned or nonaligned due to insufficient information.

Data compiled on a best-efforts basis.

Source: Climate Bonds Initiative.

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Financial instrument: Green bonds

BASF issues €2.0 billion in corporate bonds, including its first green bond

On May 28, 2020, BASF successfully placed bonds with a total volume of €2.0 billion on the capital market. The first tranche has an issue volume of €1.0 billion, a term of 3 years and an annual coupon of 0.101% and will be used for general corporate financing purposes. With the second tranche, BASF issued its first green bond.



Ressources and Ecosystems

06 MARCH 2023

Air Products Issues Inaugural Green Bonds Across \$600 Million and €700 Million Debt Offerings

Air Products has successfully issued its registered green bond offerings of \$600 million aggregate principal amount of U.S. dollar-denominated fixed-rate notes and €700 million aggregate principal amount of euro-denominated fixed-rate notes.



Use of proceeds: Example BASF

GBP/GLP Category	Eligible Green Products / Project Categories	UN SDGs	EU Environmental Objective (Taxonomy Regulation) ³
Eco-efficient and circular economy products, production technologies and processes	<p>Accelerator Solutions Only the highest level of sustainable products (solutions referred to as "Accelerator") is eligible. These products have a substantial sustainability contribution in the value chain and no negative impacts on any other relevant sustainability criteria (see Figure 2 and Appendix).</p> <p>Carbon Management Carbon Management bundles BASF's global activities and a long-term research and development program to reduce greenhouse gas emissions. The objective is to achieve the company's climate protection target and set the course for low-carbon chemical production.</p>	2 ZERO HUNGER	<p>The project categories contribute mainly to (but not limited to) the following objectives:</p> <p>EU Environmental Objective 1: Article 6: Substantial contribution to Climate Change Mitigation</p> <p>EU Environmental Objective 2: Article 7: Substantial contribution to Climate Change Adaptation</p> <p>EU Environmental Objective 3: Article 8: Substantial contribution to sustainable use and protection of water and marine resources</p> <p>EU Environmental Objective 4: Article 9: Substantial contribution to Transition to the circular economy, waste prevention and recycling:</p> <p>EU Environmental Objective 5: Article 10: Substantial contribution to pollution prevention and control <u>Including:</u> Article 10.1.c: minimising significant adverse effects on human</p>
		3 GOOD HEALTH AND WELL-BEING	
		6 CLEAN WATER AND SANITATION	
		7 AFFORDABLE AND CLEAN ENERGY	
		8 DECENT WORK AND ECONOMIC GROWTH	
		9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	
		11 SUSTAINABLE CITIES AND COMMUNITIES	
		12 RESPONSIBLE CONSUMPTION AND PRODUCTION	
		13 CLIMATE ACTION	
		15 LIFE ON LAND	

GBP/GLP Category	Eligible Green Products / Project Categories	UN SDGs	EU Environmental Objective (Taxonomy Regulation) ³
	Electric vehicle battery materials and plants Development, manufacturing, acquisition of low carbon transportation components, as for example battery materials.	11 SUSTAINABLE CITIES AND COMMUNITIES	
	Recycling: ChemCycling products and plants Since mechanical recycling is limited, e.g., due to high sorting requirements and decreasing material quality in each cycle, BASF is developing innovative technologies that promote recycling of plastics. This includes research and development on new materials and additives that facilitate recycling processes as well as several chemical recycling processes to create value out of waste. Chemical recycling allows to recycle waste for which there are no recycling solutions or missing capacities today and is therefore complementary to mechanical recycling.	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	<p>health and the environment of the production and use of chemicals.</p> <p>EU Environmental Objective 6: Article 11: Substantial contribution to protection of healthy ecosystems</p> <p>For a full list of indicators for the contributions in the value chain see Appendix.</p>
Renewable Energy	Provision of capital for the planning, construction, development and installation of renewable energy production and storage units	7 AFFORDABLE AND CLEAN ENERGY 13 CLIMATE ACTION	

Source: BASF Green Finance Framework

Use of proceeds: Example Air Products

Green Project Category

Pollution Prevention and Control – Green and Blue Hydrogen and Green and Blue Ammonia

Eligibility Criteria

- Expenditures and investments related to the development, construction, and installation of hydrogen or ammonia production projects and assets, including electrolytical hydrogen or ammonia production using renewable energy (i.e., Green hydrogen) and/or hydrogen production using hydrocarbons as feedstock in combination with carbon capture utilization and storage technologies (i.e., Blue hydrogen), or repair and maintenance of such assets and projects (and including where applicable the related installation of Qualifying Renewable Energy⁶).
 - Eligible Blue hydrogen projects are expected to have related lifecycle greenhouse gas emissions not exceeding 4.37 tCO₂e / tH₂⁷
- Investments related to infrastructure dedicated towards eligible hydrogen or ammonia conversion and/or disassociation
- Expenditures for R&D related to the improvement of existing, and development of new, products and solutions which will reduce the environmental impact of construction, installation, and maintenance of hydrogen and ammonia projects and assets
- To the extent to be used in connection with production of Blue hydrogen as set forth above:
 - Expenditures related to the development, construction, and installation of carbon capture units which enable carbon utilization or long-term sequestration
 - Expenditures to facilitate the transport of captured CO₂ including by pipeline, including conversion of existing networks and terminals, into CO₂ transportation networks

UN SDG



Green Project Category

Renewable Energy

Eligibility Criteria

- Expenditures in renewable energy generation and procurement including:
 - Expenditures and investments related to the design, construction, installation, and maintenance of Qualifying Renewable Energy assets
 - Long-term power purchase agreements (PPAs) or virtual power purchase agreements (vPPAs) from Qualifying Renewable Energy sources with a term of at least five years

UN SDG



Green Project Category

Sustainable Aviation Fuel⁸

Eligibility Criteria

- Expenditures and investments related to the development, construction, and installation of aircraft fuels manufacturing facilities that utilize renewable and non-fossil fuel based inputs, with a resulting lifecycle emissions intensity of 50% to 75%⁹ less than a conventional aircraft fuel

UN SDG



Source: Air Products Green Finance Framework

“Organization”: Leverage existing market activity of public sector

Government organization

Examples



How could it help

Piloting financial products without immediate return upside

- “Market testing” for instruments and practices with unknown potential

Rapidly up-scaling financial instruments and practices

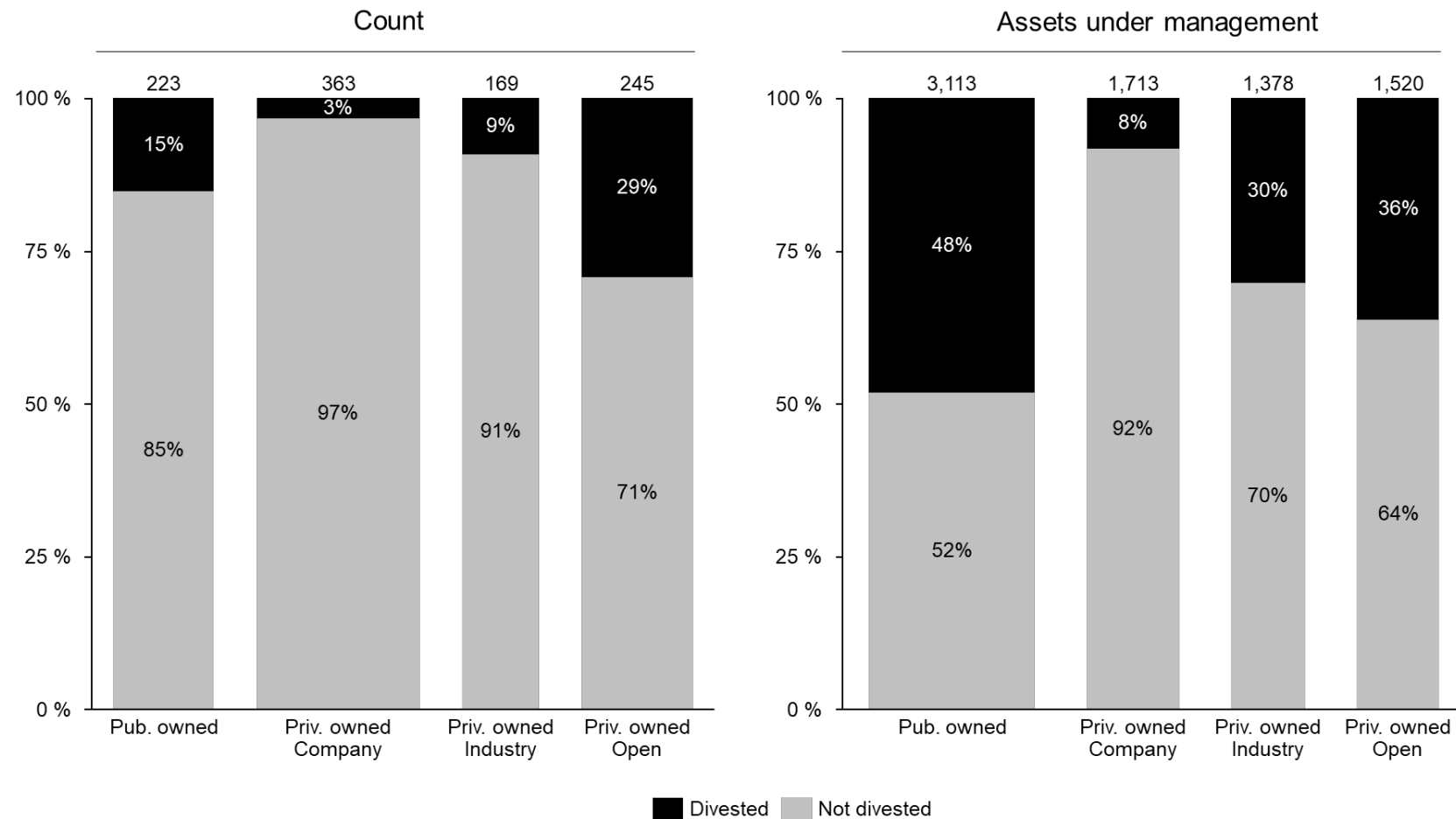
- Often large volumes/AUM managed by public sector actors

Accelerating structural change within financial sector

- Increased acceptance, part of the mainstream

Example: Fossil fuel divestment of European pension funds

Government organization



Source: Egli, F., Schärer, D., & Steffen, B. (2022). Determinants of fossil fuel divestment in European pension funds. *Ecological Economics*, 191, 107237.

Example: Green State Investment Banks

Government organization

Examples

KFW IPEX-Bank



INVESTNL

How could it help

A. Capital Provision and De-risking Roles

- Direct funding for crucial gaps
- De-risking instruments (e.g., guarantees)



B. Signaling Role

- Crowding-in privates by reputation of SIB
- SIB participation with effect on financing cost



C. Educational Role

- Specialist internal expertise (e.g. risk assessment)
- Financial innovation and standardization



D. First or Early Mover

- For new technologies, new deal structures, new manufacturers and developers



Source: Geddes, A., Schmidt, T. S., & Steffen, B. (2018). The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany. *Energy policy*, 115, 158-170.

Recap

1. Introduction to the financial system
 - Role of finance in the economy
 - Financial markets
 - Financial intermediaries
2. Problems: Importance of finance for sustainability transitions
 - Imperfections of capital markets
 - Capital intensity of low-carbon techs
 - Tech novelty and learning curve investments
3. Solutions: Public policy interventions, and financial instruments
 - Green financial policies
 - Green bonds