

Towards a low carbon  
competitive economy through  
innovations: the role of  
banking and green finance

# 1. (macroeconomic) Background

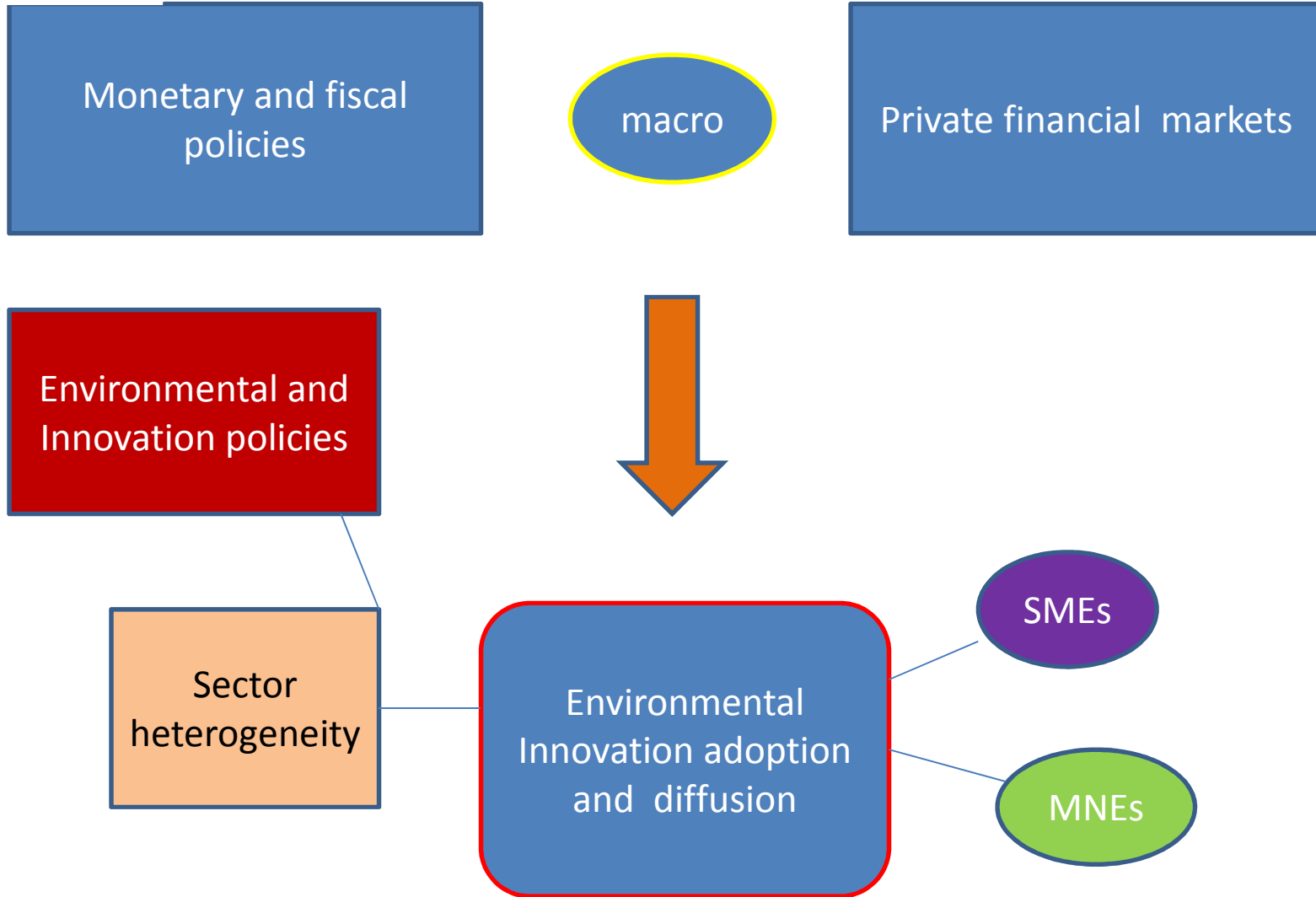
1. Green finance trends

# 2. Empirical EU analyses

1. Case studies and interviews

2. Drivers of env innovations and finance barriers

3. Complementarity finance-policy barriers



# Finance, Innovation and the environment: some issues

- **Adverse selection**
  - potential profitability, high riskiness, problems of **credit rationing**
- **Asset allocation**
  - The allocation of money by market Funds is a potential huge driver of green investments and eco innovations
- **Climate Bonds**
  - Risk sharing; Catastrophic events
- **Discounting**
  - Financial markets usually operate under strong opportunity costs determined by the return of invested capital.
  - the present value difference determined by a 10% or 2-3% social discount rates is considerable
- **Liquidity Trap**

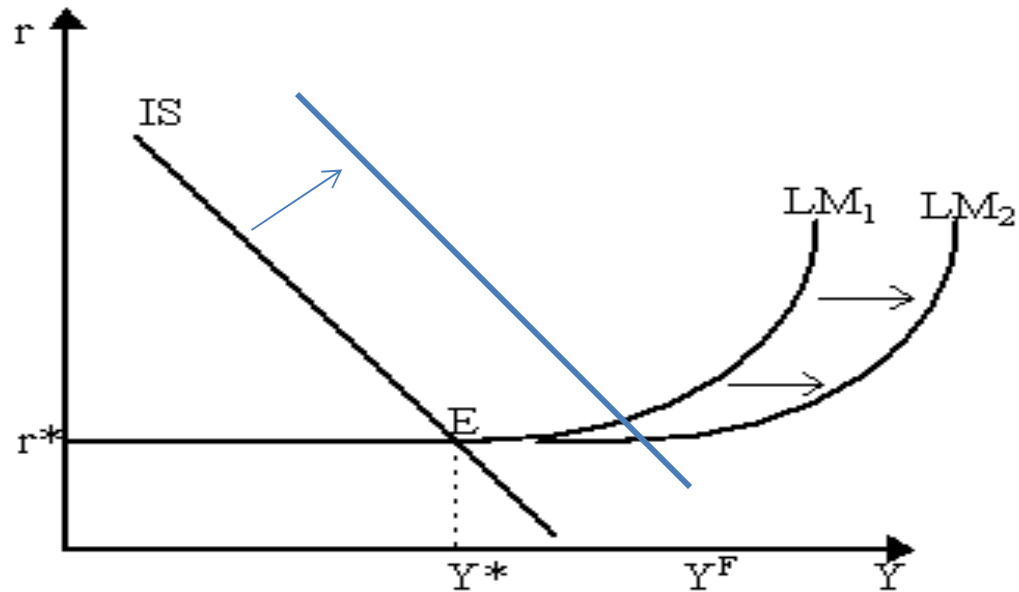
The liquidity trap we live in in the UE

Low interest rates 0% real

Monetary policy has provided effects

Expansionary Fiscal policy is now the only source of growth towards full employment

We are not in a full employment world.. 2020?



Resource efficient green economy and EU policies

*(EEA Report, July 2014)*

**THE ROLE OF FINANCE – FINANCIAL  
NEEDS FOR A TRANSITION TO A NEW  
ECONOMY**

- ❑ There is a significant gap between current investments and what is needed to meet EU energy and climate policy targets at 2020
- ❑ The financial crisis has impaired governments in financing the transition to the green economy
- ❑ UNEP (2013): private capital sources are expected to supply 80% of the amount required for the transition to the GE
- ❑ **Eco-innovation requires ‘patient’ capital: investments are long-term and risky**

- ❑ Most significant **barriers** to financing the GE are:
  - ✓ **fiscal strains over government deficits and debts;**
  - ✓ **deleveraging by banks (Basel III regulations);**
  - ✓ **not coherent risk-return profile;**
  - ✓ **lack of specialist teams in clean technology investments with experience, knowledge and data;**
  - ✓ **political risks/regulatory instability.**



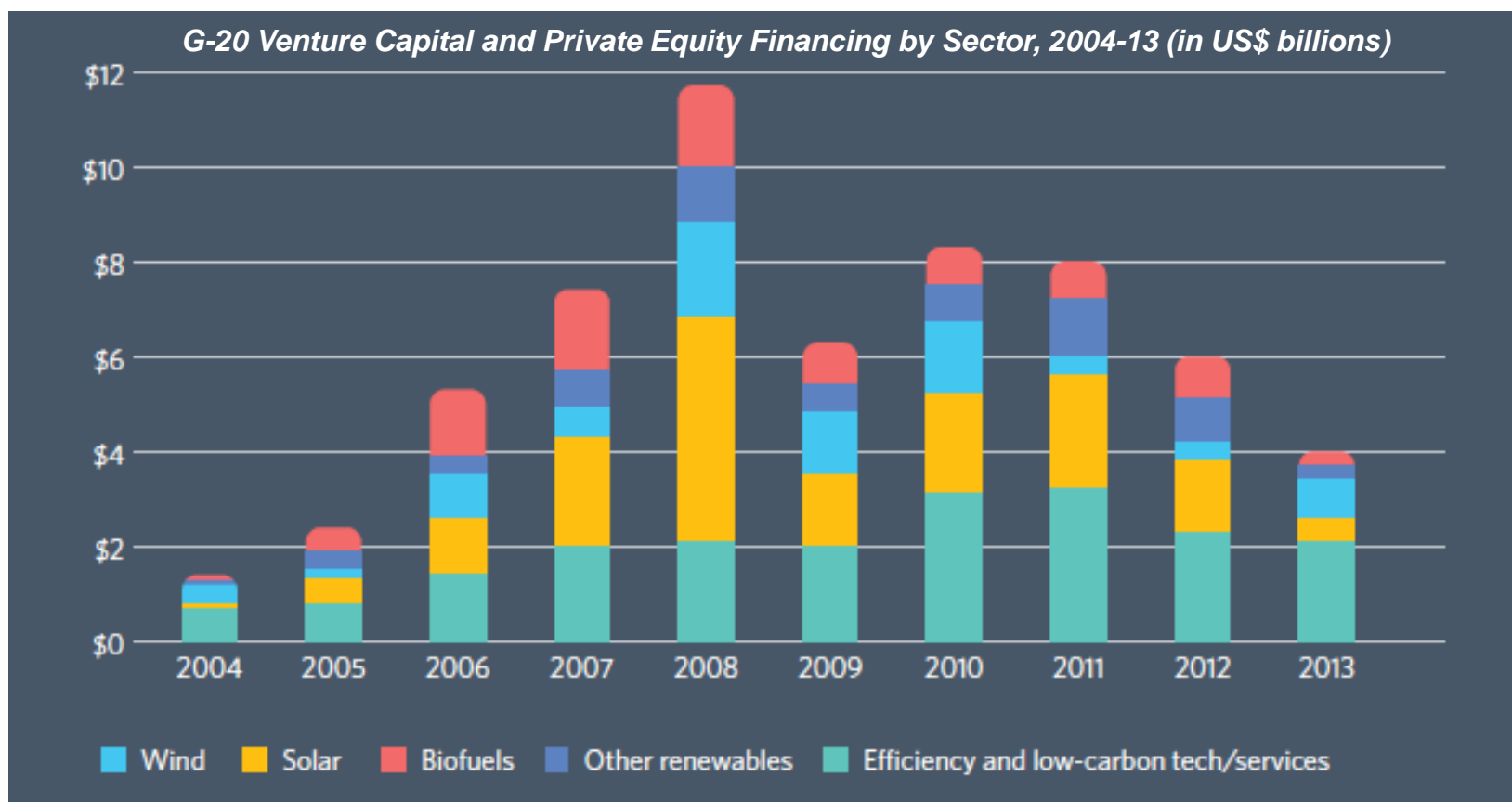
- ❑ **Institutional investors** – such as insurance companies and pension funds – represent suitable providers of ‘patient’ capital.
- ❑ **Pension funds:** 30 trillion US\$ of AuM (Towerswatson, 2013)
- ❑ **Insurance companies:** 25 trillion US\$ of AuM (ThecityUK, 2013)
- ❑ European pension funds and insurance companies together hold an estimated total of €13.8tn of assets, equating to more than 100% of EU GDP (EC, 2013).

## ***Major initiatives by institutional investors in the field of climate change***

<b><i>Group</i></b>	<b><i>Type of Investors</i></b>	<b><i>Size of Assets</i></b>	<b><i>Objectives</i></b>
IIGCC	70+ European institutional investors, including major pension funds	EUR 6tn	Catalyse greater investment in low carbon economy
Investor Network on Climate Risk (managed by Ceres)	90+ USA institutions	USD 10bn	Identify opportunities and risks in climate change, tackle the policy and governance issues that impede investor progress towards more sustainable capital markets
Investor Group on Climate Change	Australian and New Zealand investors	AUS 600bn	Raise awareness, encourage best practice in terms of analysis and provide information relating to climate change
P8	World's leading pension funds	USD 3tn	Create viable investment vehicles to combat climate change and promote sustainable development
Long-term Investors Group	Mainly public sector financing institutions	USD 3tn	Identify long-term investment fund and vehicles

□ Hypothesizing a fraction between 0.5% and 1% to be invested in climate change-related assets, this would amount to **US\$74bn-US\$148bn.**

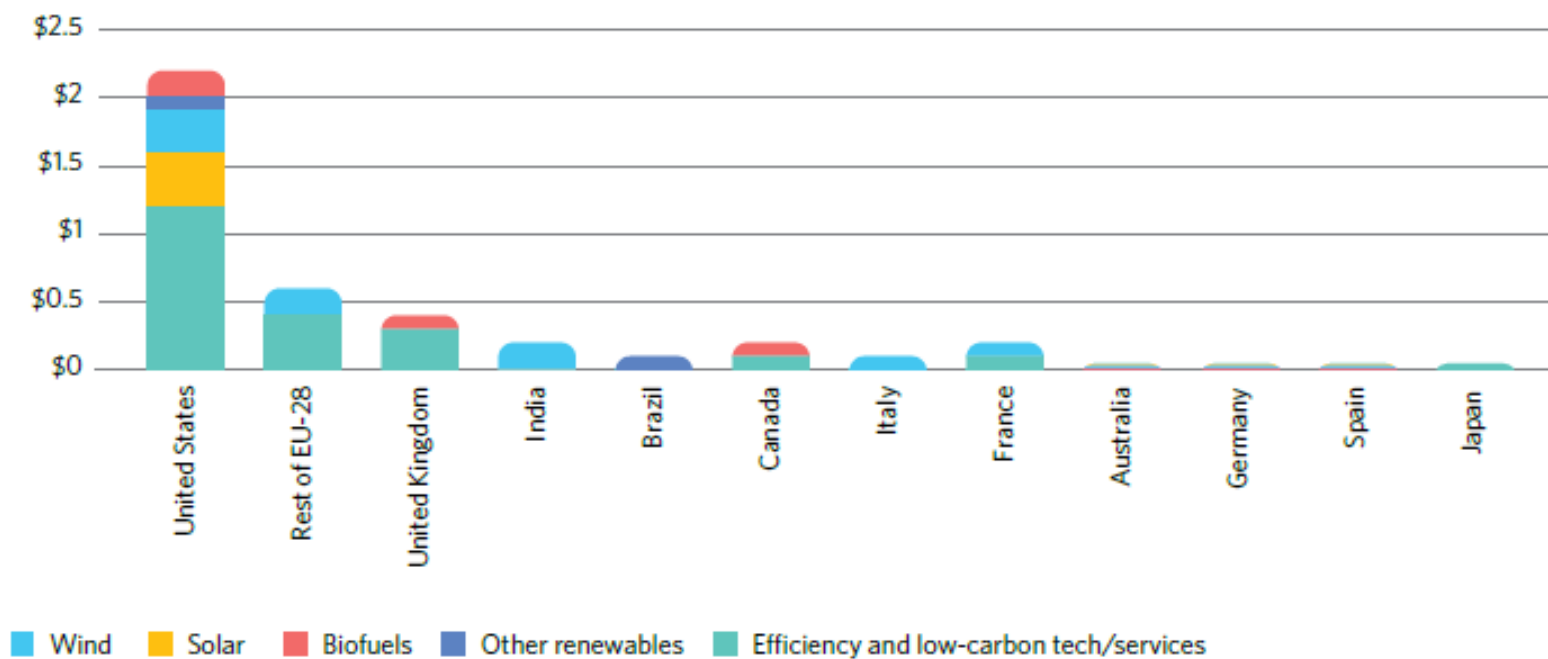
- ❑ Venture capital and private equity account for 2 percent of overall clean energy investment
- ❑ **Venture capital financing in 2013 declined by one-third, to \$4 billion.**
- ❑ Energy efficient/low-carbon technologies were the leading beneficiary of venture capital investment, attracting \$2.1 billion. Solar energy attracted \$500 million.



**Source:** Bloomberg New Energy Finance, 2014; The Pew Charitable Trust, 2014

- ❑ **USA is the leader** in venture capital and private equity financing, accounting for \$2.2 billion in 2013 followed by UK.

**Venture Capital and Private Equity Financing by Country and Sector, 2013 (in US\$ billions)**

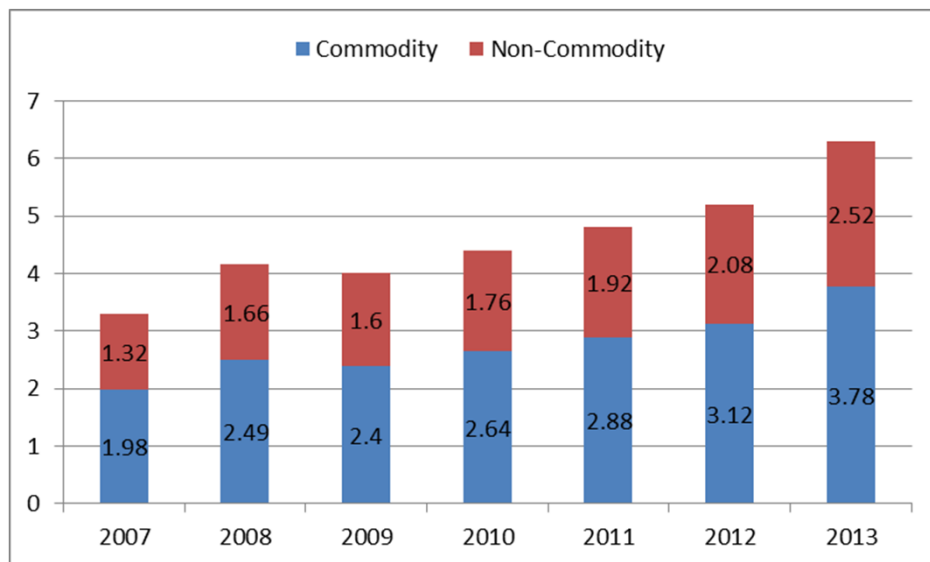


**Source:** Bloomberg New Energy Finance, 2014; The Pew Charitable Trust, 2014

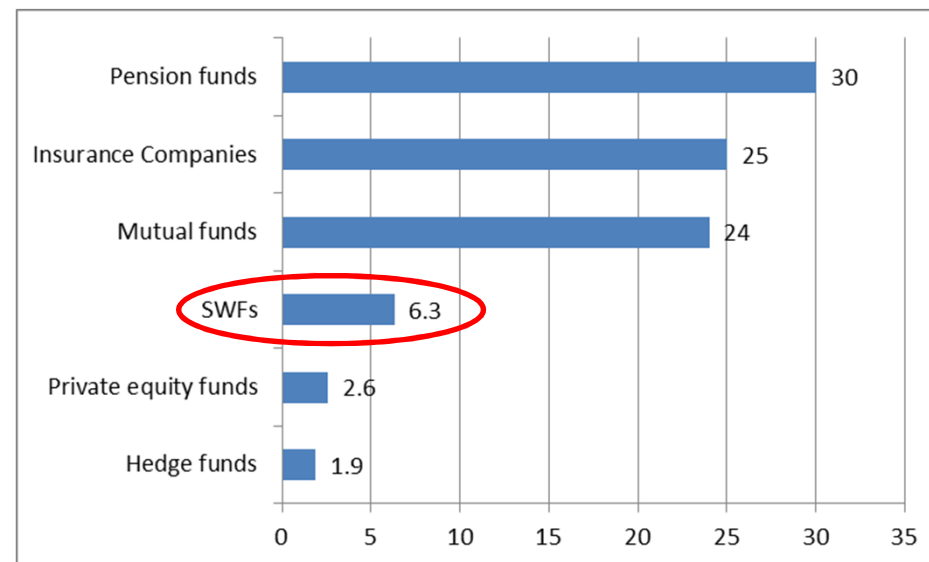
# Sovereign Wealth Funds (SWFs)

- ❑ SWFs are ideally placed to invest in green projects (long time span and absence of liquidity constraints).
- ❑ It is possible to pinpoint 69 SWFs in the world at the end of 2013, with estimated AuM of \$6.3 trillion.
- ❑ The Norwegian SWF is expected to raise its share of investments in the GE to 1% and then to 5%. In broader terms, it invested 3.6% of its portfolio in environmentally friendly companies in 2013.

SWFs' assets growth, 2007-2013, (US\$ tn)



SWFs' size compared to other investors, 2013, (US\$ tn)



Countercyclical role, mitigating the short-termism of private actors

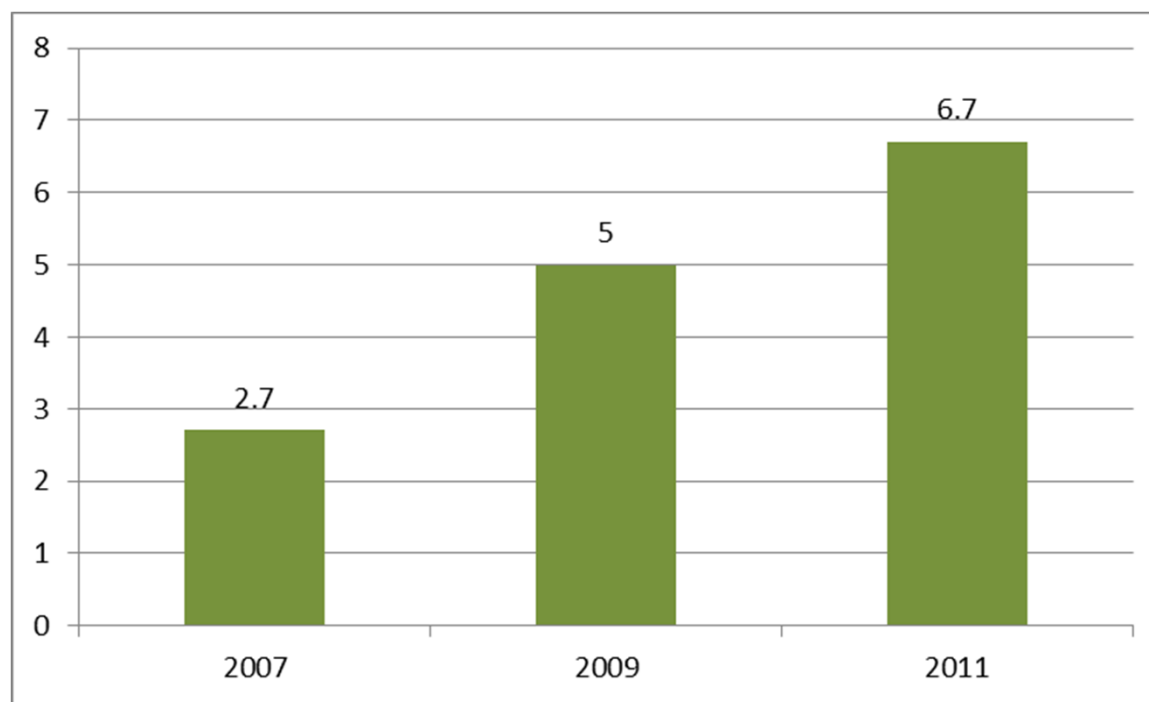


## EIB

- ❑ The **EIB** is among the largest financiers of projects on climate change in the world:
  - ❑ over **EUR 13bn in 2012**,
  - ❑ **EUR 19 billion in 2013**.
  
- ❑ EIB's 2013 to 2015 Corporate Operational Plan sets an annual target of **over 25%** of finance directed to climate action

- ❑ Social Responsible Investments are financial assets selected by fund managers according to **criteria related to the social and environmental attributes of the investment** (definition uncertain, broad concept).
- ❑ Between 2009 and 2011, capital invested in SRIs grew by 34%, 87% between 2007 and 2009.

*Evolution of SRI investments, 2007-2011 (US\$ tn)*



***Socially responsible investments in Europe, 2011, (in €Mn)***

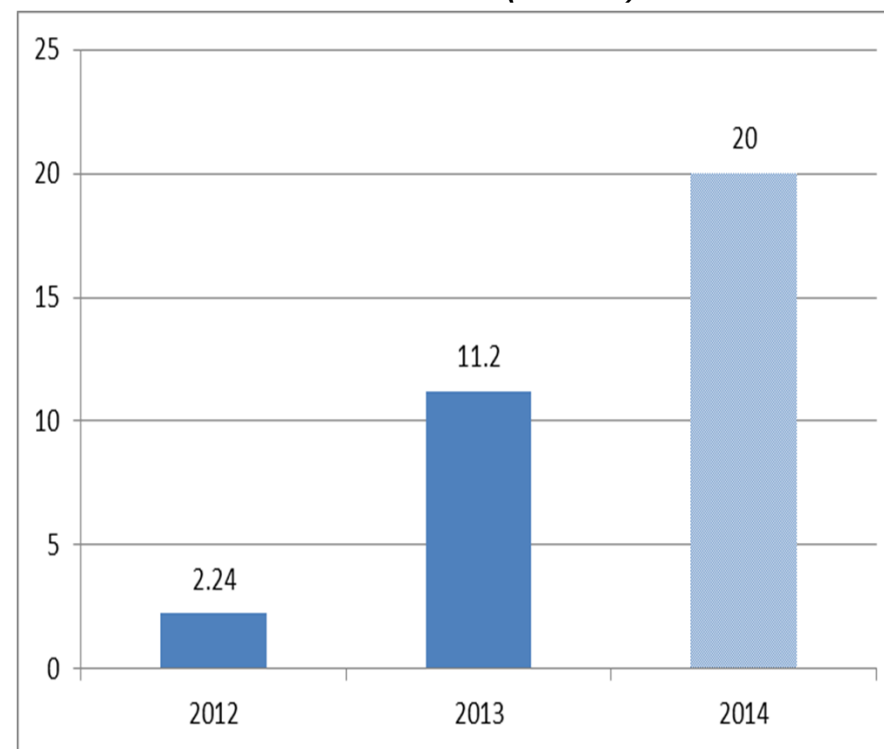
<b>Country</b>	<b>Tot SRI investment strategies</b>
Austria	8,251
Belgium	96,905
Denmark	244,227
Finland	107,600
France	1,884,000
Germany	621,020
Italy	447,592
Netherlands	666,248
Norway	574,100
Poland	1,174
Spain	57,091
Sweden	378,300
Switzerland	441,637
UK	1,235,201
<b>Europe</b>	<b>6,763,347</b>

**Source:** *Eurosif, 2012*

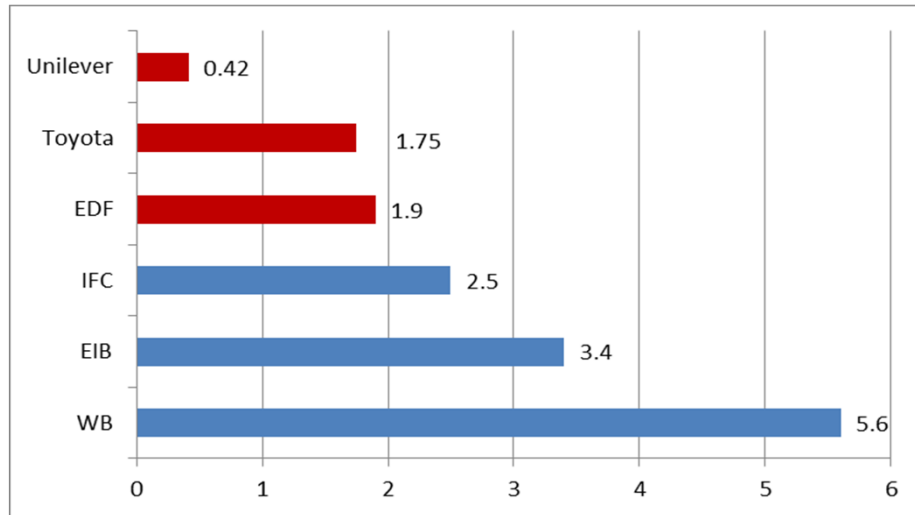


- ❑ Green bonds are intended for financing **environmentally friendly projects**
- ❑ Issuance in 2013 surpassed **\$11 billion** and is expected to reach **\$20 bn** in 2014
- ❑ They could account for **10% to 15% of global bond issuance** within 5 to 7 years.
- ❑ Main **issues** to be addressed:
  - ❑ liquidity
  - ❑ certification costs

**Green Bonds issuance (US\$ bn)**

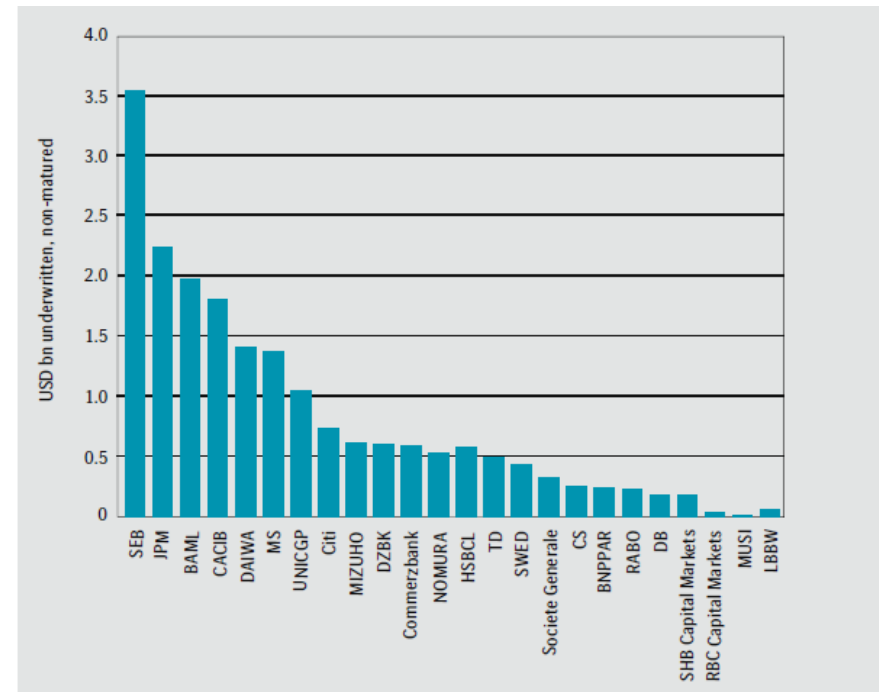


**Green Bonds main issuers (US\$ bn)**



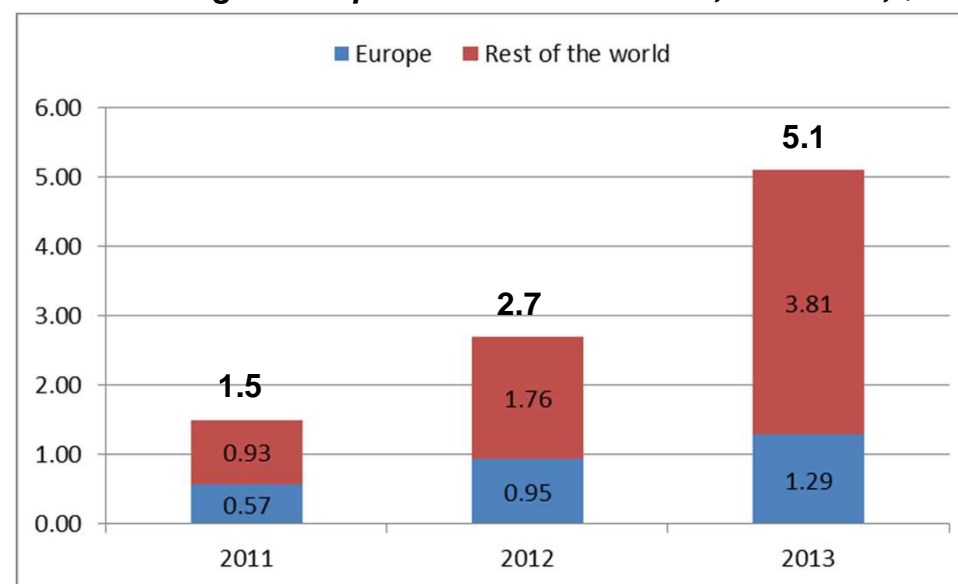
- ❑ Most of the issuance up to now concerned **supranational organizations** (WB, EIB).
- ❑ **US Government agencies** issued different types of bonds which can be considered green.
- ❑ In 2013 and 2014, many **corporate issuers** joined the group.
- ❑ On the **demand side**: pension funds and asset managers.

**Top Green Bonds underwriters, 2008 – 2013 (US\$ bn)**



- ❑ **Crowdfunding** connects directly (through the internet) those who can lend/invest money with those who need financing for a specific project.
  
- ❑ Crowdfunding can be used through different models of financing:
  - ✓ donations;
  - ✓ rewards-based;
  - ✓ pre-sales;
  - ✓ **crowd lending**;
  - ✓ **crowd investing**.
  
- ❑ An **adequate policy framework is needed** to address the following issues:
  - ✓ **Misleading** advertising;
  - ✓ payments treatment;
  - ✓ **risk of fraud**.

**Crowdfunding in Europe and rest of the world, 2011-2013, \$bn**



- ❑ **Example:** German start-up, E-volo, raised €1.2 million in a reward-based crowdfunding campaign for the development of an environment-friendly and emission-free helicopter.

- ❑ **From a central role of governments to a role for private investors and instruments**

**Money for the GE and Eco-innovation is there**

- ❑ In order to find ways to channel liquidity to GE/Eco-Innovation investments, we need:
  - ✓ Transparency, predictability and longevity of government programs
  - ✓ Appropriate instruments (SRI, green bonds) which provide a coherent risk-return profile to stimulate the role of existing and emerging investors
  - ✓ New forms of catalyzation by public financial institutions (project bonds)
  - ✓ Innovation in the finance sector (securitization, crowdfunding)

**A market for eco-attributes of investments already exists**



# **FINANCE AND ECO INNOVATION**

- Schumpeter analysis stressed the fundamental role played by finance in fostering innovation, defining bank credit as the ‘monetary complement’ of innovation, and entrusting banks the task of selecting ‘in the name of society’ the people authorized to innovate (Schumpeter, 1912)
- Reciprocal influence between innovation dynamic and finance (Dosi, 1990)

- Case study / interviews at sector representatives (ongoing)
  - SME vs MNEs
    - MNEs in some sectors – steel, chemical – often have solid healthy features
      - Banking (and local subsidies) dont necessary
      - Internal financing system (**for 2030 targets, 2050..?**)
    - Foreign ownership matters (Policy spillovers within the EU)
    - Public action is relevant to ‘create a vision’ beyond 2020...



# Sector/firm interviews

- Chemical
- Ceramics
- Steel
- Paper
- .....
- Banking and finance (e.g. Deloitte)



- Key criterion behind financial institutions choice to give or not credit is **thus firm's credit merit**, which is clearly not depending at all on the environmental aspects of any environmental project.
- there seem to be **no distinction between a green investment project and any non-green investment** one in the financing mechanism. This holds both when projects are financed externally but also when are financed internally.



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- EX LABORE FRUCTUS -

# Eco innovation and financial constraints: insights from a Eurobarometer survey

D'Este – Iammarino – Savona – von Tunzelmann, 2012, Research  
Policy

(4<sup>th</sup> UK CIS data)



**\*difference between revealed barriers and deterring barriers**

the sign of the financial constraint – innovation link is ambiguous

‘learning outcome’ or ‘insurmountable’

## *From «standard» innovation literature*

- ***Main intuition*** innovation projects → high uncertainty + complexity + specificity → firms less prone in investing in innovation in the presence of lack of financial availability
- 
- Broad investigation of linkages between financial barriers and innovation activities (**Pellegrino and Savona, 2013**).
- **Hotterott and Peters, 2012**: firms with higher innovation capabilities are more likely to face financing constraints
- **Lahr and Mina 2013**, UK firms - bi-directional effects of financial constraints and innovation
- **Savignac, 2008**: financial constraints significantly reduce the likelihood of firms to innovate
  - this pattern is even more pronounced in small firms and high-tech sectors (**Canepa and Stoneman, 2007**).

## *Data requirements:*

- **EU-coverage**
- **Combine EI and financial barriers**
- **Firm/sector level**

## *Possible data sources:*

- **Community Innovation survey (CIS)**
  - BUT merge Wave in  $t$  and in  $t-1$  : problems: selection & country anonymisation rules
- **Flash Eurobarometer Surveys (F1 315, 342, 381)**
  - F1 315: Attitudes of European Entrepreneurs Towards Eco-innovation
  - F1 342 and 381: Small and Medium Enterprises, Resource Efficiency and Green Markets, wave 1 & 2. Problem: EI meant only as “Resource Efficient Innovations”

# Data description

## *315: Attitudes of European Entrepreneurs Towards Eco-innovation*

- 2011
- EU(27): Austria (AT); Belgium (BE); Bulgaria (BG); Cyprus (CY); Czech Republic (CZ); Denmark (DK); Estonia (EE); Finland (FI); France (FR); Germany (DE); Greece (GR); Hungary (HU); Ireland (IE); Italy (IT); Latvia (LV); Lithuania (LT); Luxembourg (LU); Malta (MT); Netherlands (NL); Poland (PL); Portugal (PT); Romania (RO); Slovakia (SK); Slovenia (SI); Spain (ES); Sweden (SE); United Kingdom (GB)
- Sectors: Agriculture, *Manufacturing*, Water supply and waste management, Construction and Food services.
- 5222 managers surveyed

## Definition of EI

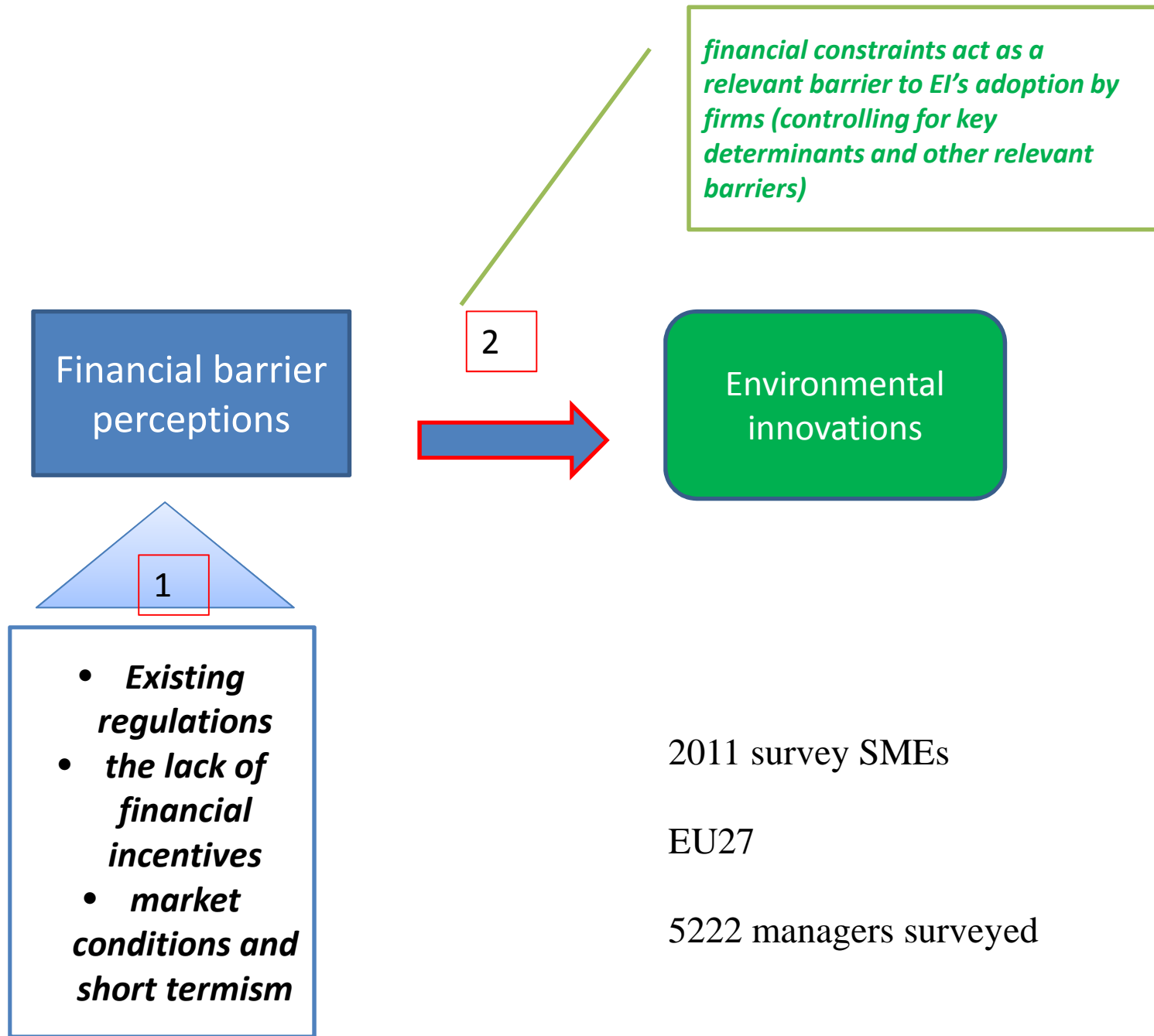
*new or significantly improved product (good or service), process, organizational change or marketing solution that reduces the use of natural resources (including materials, energy, water and land) and decreases the release of harmful substances across the whole life-cycle of the product; in the previous 24 months, disentangled in *Eiproduct* [prod,serv]; *EIprocess* [process];*  
**OVER 2010-2009**

## Set of barriers to EI (+ controls added)

- **externalFIN: Lack of external financing**
- Uncertreturn: Uncertain return of investment
- Ext\_knowledge: Weak access to information and external knowledge and lack of collaboration with Uni or Research Institutes
- Uncertdemand: Uncertain market demand
- Matpriority: Reducing material consumption is not a priority
- Enpriority: Reducing energy consumption is not a priority
- Inc: Lack of incentives for EI
- Reg: Rules and structures do not provide incentives for EI

- In the current work we aim at understanding how (and if) the weak access to financial resources constitutes a barrier for the development of EI





## *2 step LOGIT regressions*

### *1<sup>st</sup> step what affects externaFIN's perception*

- $eFIN = \alpha + \beta_0 \text{tec\_lock} + \beta_1 \text{uncertreturn} + \beta_2 \text{uncertdeman} + \beta_3 \text{market} + \beta_4 \text{reg\_bar/reg\_driv} + \beta_5 \text{inc} + \beta_6 \text{futen\_price} + \beta_6 \text{fut\_reg} + \delta \text{state}^* + \gamma \text{size}^* + \epsilon$

→ predict eFIN

### *2 step how financial barriers affect EI*

- $EI = \alpha + \beta_1 eFIN + \beta_2 \text{market} + \beta_3 \text{int\_knowledge} + \beta_4 \text{ext\_knowledge} + \beta_5 \text{demand} + \beta_6 \text{reg\_bar/reg\_driv} + \beta_7 \text{inc} + \beta_8 \text{turnover} + \delta \text{state}^* + \gamma \text{size}^* + \epsilon$

- 

- ON MANUFACTURING and WHOLE SAMPLE

## Results Step 1 on Manufacturing, Construction and All sectors

	(1) eFIN_man	(2) eFIN_manfil	(3) eFIN_filCON	(4) eFIN	(5) eFIN_fil
tec_lock	0.4470*** (0.0988)	0.4146*** (0.1240)	0.1978 (0.1933)	0.4235*** (0.0725)	0.3334*** (0.0923)
uncertreturn	0.5291*** (0.1065)	0.5361*** (0.1331)	0.5795*** (0.1982)	0.5534*** (0.0772)	0.5069*** (0.0974)
uncertdemand	0.3960*** (0.1042)	0.1727 (0.1329)	0.4498** (0.1987)	0.3522*** (0.0761)	0.2260** (0.0970)
market	0.3285*** (0.1001)	0.3205** (0.1258)	0.1555 (0.1863)	0.3292*** (0.0722)	0.2784*** (0.0924)
size2	-0.3118*** (0.1109)	-0.6501*** (0.1327)	-0.3159 (0.2255)	-0.2206*** (0.0842)	-0.5319*** (0.1010)
reg_bar	0.2999*** (0.1020)	0.2303* (0.1284)	0.1610 (0.2010)	0.3556*** (0.0745)	0.2732*** (0.0950)
reg_driv	0.0646 (0.1132)	0.0182 (0.1434)	0.0575 (0.2362)	0.1362 (0.0837)	0.0304 (0.1076)
inc	1.0817*** (0.0999)	0.9610*** (0.1248)	0.6275*** (0.1951)	1.0104*** (0.0737)	0.8530*** (0.0932)
futen_price	0.4718*** (0.1408)	0.2812 (0.1817)	0.1465 (0.2534)	0.4128*** (0.1002)	0.1549 (0.1327)
fut_reg	0.0057 (0.1176)	-0.0630 (0.1480)	0.1743 (0.2274)	-0.0257 (0.0867)	-0.0900 (0.1109)
_cons	-2.0912*** (0.2798)	-0.3717 (0.3844)	-0.3735 (0.5199)	-2.0485*** (0.2477)	-0.3699 (0.3277)
<i>N</i>	2526	1878	948	4737	3506
pseudo <i>R</i> <sup>2</sup>	0.208	0.177	0.159	0.203	0.158
D State	Included	Included	Included	Included	Included
D Sector	No	no	no	Included	Included
Sample	Manufacturing	Manufacturing only filtered firms	Construction only filtered firms	All sectors	All sectors Filtered
<i>AIC</i>	2827.2229	1852.1520	904.2092	5267.6855	3387.8816
<i>BIC</i>	3043.0954	2051.5187	1078.9660	5532.6751	3640.5331

## Results Step 2 on Manufacturing, Construction and All sectors

	(1) eFIN_man	(2) eFIN_manfil	(3) eFIN_filCON	(4) eFIN	(5) eFIN_fil
External_Fin	0.9086* (0.4801)	-1.6752** (0.7563)	-2.2164** (1.0248)	1.2786*** (0.3644)	-1.5989*** (0.5910)
size2	0.3864*** (0.1117)	0.2125 (0.1558)	0.2885 (0.2087)	0.3949*** (0.0836)	0.2239** (0.1122)
TURNLOW	-0.5457*** (0.0998)	-0.5920*** (0.1187)	-0.3742** (0.1594)	-0.3902*** (0.0721)	-0.5042*** (0.0850)
market	-0.1129 (0.1033)	-0.1223 (0.1211)	0.0591 (0.1539)	-0.1095 (0.0750)	-0.1045 (0.0861)
int_knowledge	-0.1390 (0.0913)	-0.3136*** (0.1091)	-0.0445 (0.1492)	-0.0200 (0.0663)	-0.1821** (0.0779)
ext_knowledge	0.0606 (0.0974)	-0.0844 (0.1178)	-0.1406 (0.1686)	0.0124 (0.0717)	-0.0976 (0.0851)
demand	0.5823*** (0.0977)	0.3268*** (0.1211)	0.4042** (0.1702)	0.5540*** (0.0721)	0.3709*** (0.0877)
reg_bar	-0.0062 (0.1058)	-0.0005 (0.1263)	0.1238 (0.1720)	-0.0043 (0.0798)	0.0426 (0.0931)
reg_driv	0.2344** (0.0970)	0.2301* (0.1187)	0.4074** (0.1851)	0.2453*** (0.0739)	0.2867*** (0.0883)
inc	0.0010 (0.1573)	-0.0409 (0.1836)	0.1467 (0.2244)	-0.0682 (0.1158)	-0.0402 (0.1337)
eFIN_man	0.9086*	-1.6752**	-2.2164**	1.2786***	-1.5989***
_cons	-1.3009*** (0.2732)	1.6813*** (0.5321)	1.4199* (0.7347)	-1.5895*** (0.2396)	1.2848*** (0.4219)
<i>N</i>	2526	1878	948	4737	3506
pseudo <i>R</i> <sup>2</sup>	0.063	0.087	0.049	0.056	0.064
D State	Included	Included	Included	Included	Included
D Sector	no	no	no	Included	Included
Sample	Manufacturing	Manufacturing only filtered firms	Construction only filtered firms	All sectors	All sectors filtered
<i>AIC</i>	3340.1276	2356.3132	1303.1163	6223.9422	4504.5072
<i>BIC</i>	3556.0001	2555.6798	1477.8731	6488.9317	4757.1587

# What **increases** firm's perceptions on financial constraints stringency

- Tech Lock in
- Uncertainty on returns and investments
- Non competitive Markets
- Existing regulations not providing incentives
- Lack of subsidies
- High future energy prices (NOT relevant)

# What influences Env Innov adoption

- **Financial constraints (-)**

- Este, P. D., Iammarino, S., Savona, M., & Tunzelmann, N. Von. (2012). What hampers innovation? Revealed barriers versus deterring barriers. *Research Policy*, 41(2), 482–488. doi:10.1016/j.respol.2011.09.008

- lack of skills and SMEs (-)

- Increasing Demand for green products (+)

- Existing regulations (+)

- (AMONG other factors which are not sign.)

- **non-innovative firms** *are indeed less sensitive to obstacles to innovation just because their propensity to is lower* (Mohen and Roller, 2005).
- When we exclude from our empirical analysis those firms that **do not innovate and do not perceive any barrier to innovation** results show a **detering effect**.

# Summing up

## financial constraint stringency

- Uncertainty, market barriers, lack of subsidies and incentive based regulations, Tech lock in
- **Increase financial constraint stringency perceptions**

## Environmental innovations

- The higher **financial constraint the lower EI**
- **(DETECTING BARRIER)**
- **Smaller firms are penalised**
- **Env Policy matters**
- **Green demand matters**



# COMPLEMENTARITY AMONG (FINANCIAL) BARRIERS

«successful innovations depends on the firm combining a range of capabilities, including capacity to access finance, understanding market needs, recruiting high skilled staff...» (D'Este et al., 2012)

Mohnen and Roller, 2005, European Economic Review

Antonioli, Mancinelli, Mazzanti, 2013, Research Policy

# Why this investigation?

- When a relationship of complementarity is found between two policies, this implies that if one of the two policies is implemented, it is relevant (even necessary) to implement also the other complementary policy.
- In fact, the change of one policy may have little effect if other complementary policies remain unchanged.

Are low **External financing barriers** complement to other 'policy' relaxing barriers to EI?

- **Finance + other factors**

# Complementarity tests for LOW Financial Barriers and relaxing Policy-Relevant Barriers (low policy barriers)

Dependent variable: EI (Eco-innovation adoption)

		Wald test§	Sign of the linear combination (b1+b4)+(-b2-b3)
		(Adj. p-value for: H <sub>0</sub> : coeff. 1 coeff.10+01) <sup>^</sup>	
EXT-FIN	COOP	3.23*	≥ 0
		(.963)	
EXT-FIN	LOCK-IN	6.17**	≥ 0
		(.993)	
EXT-FIN	MARKET	4.99**	≥ 0
		(.987)	
EXT-FIN	REGULATION	4.17**	≥ 0
		(.979)	
EXT-FIN	SUBSIDIES	2.63	≥ 0
		(.947)	

complementarity

No complem

§ Since we are testing one linear restriction at a time the Chi2 distribution has 1 degree of freedom. Linear restrictions: H<sub>0</sub>: b<sub>1</sub>+b<sub>4</sub>-b<sub>2</sub>-b<sub>3</sub>=0; Critical values of Chi2 distribution with one degree of freedom: 6.63, 3.84 and 2.71 (\*\*\*1%, \*\* 5% and \* 10% level of significance respectively);

<sup>^</sup>Adjusted p-value for inequality tests when the Wald Chi2 statistics has 1 degree of freedom

The Overall message

The **macroeconomic setting** is slowly moving towards green finance

Necessity: Fiscal and monetary levers / public + private funds

Nevertheless, **Financial constraints still exist TODAY**

**Finance is a deterrent for environmental innovations** (mostly in SMEs)

but

**Where Financial barriers are perceived LOW**, policies that help reducing other barriers are **complements** to support EI

Interactions and complementarity among (policy) levers

