

Tyndall° Centre

for Climate Change Research

The effects of the financial system and financial crises on global growth and the environment

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What are links between the financial system and the environment?

- Finance and Pollution
 - The Environmental Kuznets Curve and pollution
 - FDI and the pollution haven hypothesis
- Financial instruments for environmental policy
- Financial Crises and the Environment
 - Banking crises and economic growth
 - The effects of the great recession on long-term world growth and the environment
- Finance for Green Investment

Financial system - banks, securities markets, pension funds, regulatory and supervisory authorities, central banks and so on.

The financial system uses financial instruments, facilitates monetary transactions and channels money from savings to investments.

Financial instrument - a contract that gives rise to a financial asset of one entity and a financial liability or equity instrument of another entity.

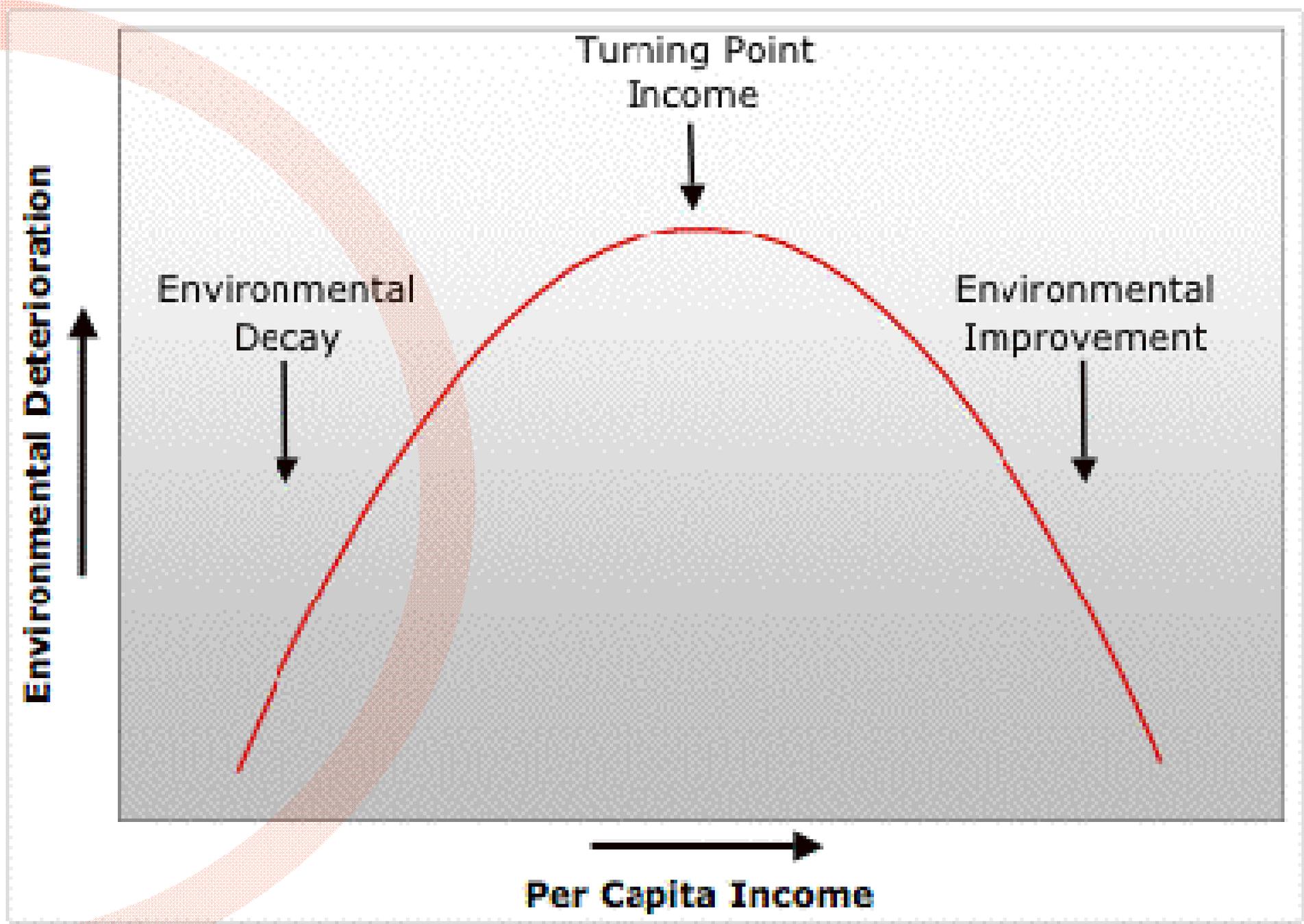
Financial assets - cash, equity based (stocks) and debt based (loans) assets (IAS 32).

The Environmental Kuznets Curve (**EKC**) relates to the tendency of the growth of pollution to first increase with that of economic activity as measured by the growth of GDP over time and later for the pollution to decline as the economy matures.

Reasons:

- Structural switch to services as economies grow
- Increasing demand for better living conditions

Econometric literature has tested whether the EKC is affected by financial variables



FDI effects on the Environmental Kuznets Curve

Study	Where and when	Pollutant	Effects of FDI on pollution
He, 2006	Provinces of China, 1991 - 2004	SO ₂	+, supports "pollution haven" idea
Acharyya, 2009	India, 1980 - 2003	CO ₂	+, supports "pollution haven" idea
Tamazian et al., 2010	24 economies in transition, 1993 - 2004	CO ₂	-, reduces CO ₂
Yuxiang & Chen, 2010	Provinces China, 1999 - 2006	Waste water, effluent discharges, SO ₂	-, reduces pollution but effect is weak and barely significant
Jalil & Feridun, 2011	China, 1953 - 2006	CO ₂	-, reduces CO ₂ emissions
Atici, 2012	ASEAN 1971 - 2008	CO ₂	-, reduces CO ₂ emissions or no significant effect
Mutafoglu, 2012	Turkey, 1987Q1-2007Q4	CO ₂	+, supports "pollution haven" idea
Shahbaz et al., 2013	Malaysia, 1971 - 2011	CO ₂	+, more FDI increases CO ₂ emissions
Shahbaz et al., 2013	South Africa, 1965 - 2008	CO ₂	-, reduces CO ₂ emissions
Shahbaz et al., 2014	110 countries, 1985 - 2006	CO ₂	+, more FDI increases CO ₂ emissions, but high FDI reduces CO ₂ in high-income countries

Financial variable effects on the Environmental Kuznets Curve

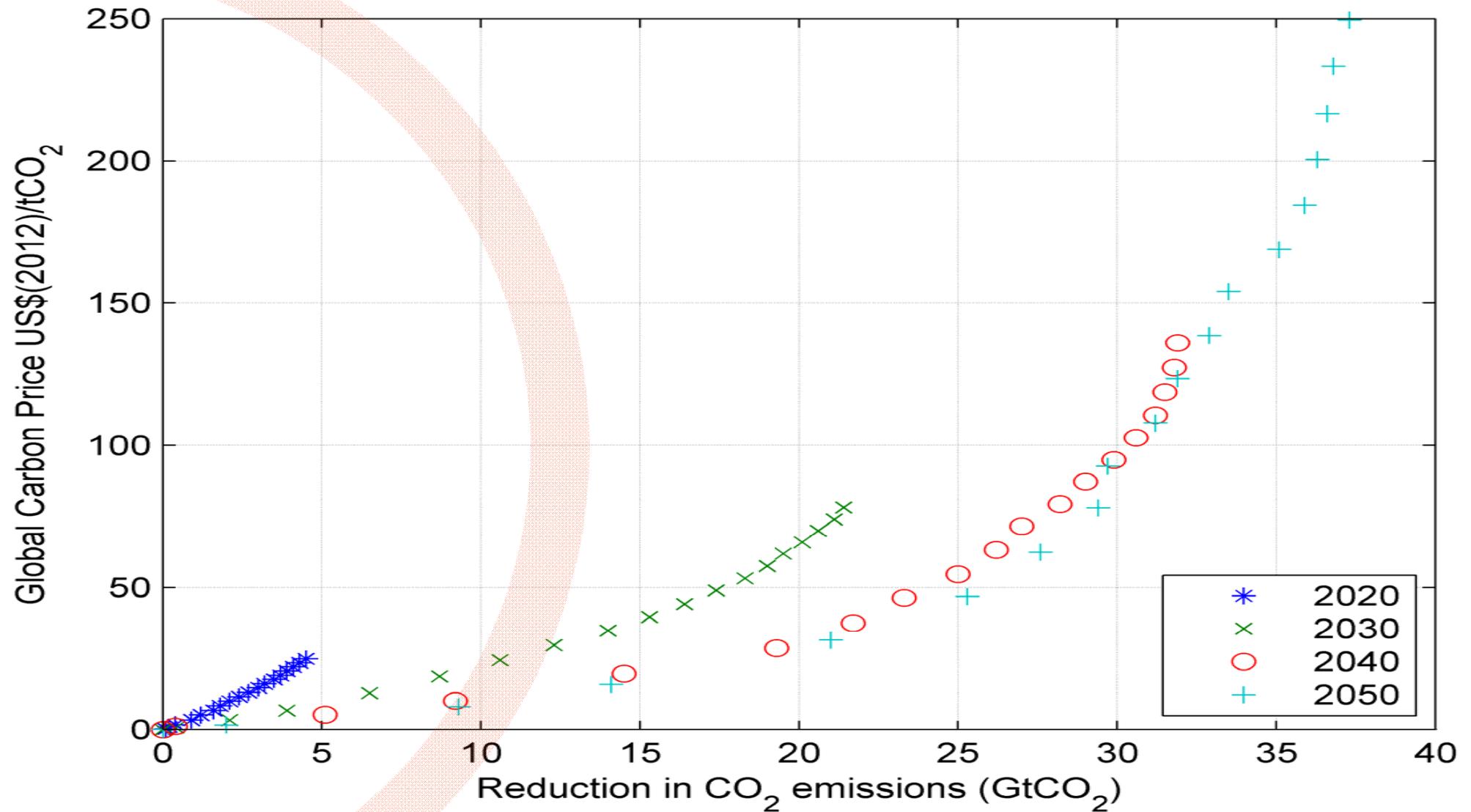
Study	Where and when	Pollutant	Financial variable(s)	Effects
Tamazian et al., 2008	BRIC countries, 1992 - 2004	CO ₂	Six financial variables	-, reduces CO ₂ emissions
Dean et al., 2009	Chinese provinces, 1993 - 1996	Pollution levies, effluent discharges	Equity Joint Ventures	+ supports "pollution haven" idea, but not from high income countries
Tamazian et al., 2010	24 economies in transition, 1993 - 2004	CO ₂	price & financial liberalisation	-, price liberalisation reduces CO ₂ ,
Yuxiang & Chen, 2010	Provinces of China, 1999 - 2006	Waste water, effluent discharges, SO ₂	Loans/GDP,	-, financialisation reduces pollution
Jalil & Feridun, 2011	China 1953 - 2006	CO ₂	Bank deposits or loans	-, reduces CO ₂ emissions
Shahbaz et al., 2013	Indonesia, 1975Q1-2011Q4	CO ₂	Domestic bank credit to the private sector	-, reduces CO ₂ emissions
Shahbaz et al., 2013	Malaysia, 1971 - 2011	CO ₂	Domestic bank credit to the private sector	-, more credit reduces CO ₂ emissions and
Shahbaz et al., 2013	South Africa, 1965 - 2008	CO ₂	Domestic bank credit to the private sector	-, reduces CO ₂ emissions
Shahbaz et al., 2014	Bangladesh, 1975 - 2010	CO ₂	Domestic bank credit to the private sector	+, reduces CO ₂ emissions via trade openness

Financialisation might improve environmental performance:

- required investments can be financed at lower costs
- exposure of firms to the financial market leads to better governance and management and so to better environmental awareness and adherence to regulations
- valuation of firms on capital markets, as well as their ability to borrow from banks is increased when the firms have evidence of good environmental performance
- financial development is also linked to technological change and indeed may well induce such change.

- Tradable pollution allowances are financial instruments specifically designed to improve environmental performance.
- Create a price for pollution and encourage investment into cleaner technologies.
- The largest functioning market (spot and future market) of tradable allowances is the European Carbon Market that covers about 45% of CO₂ emissions in Europe.
- Barker et al. (2014) modelled various carbon price scenarios

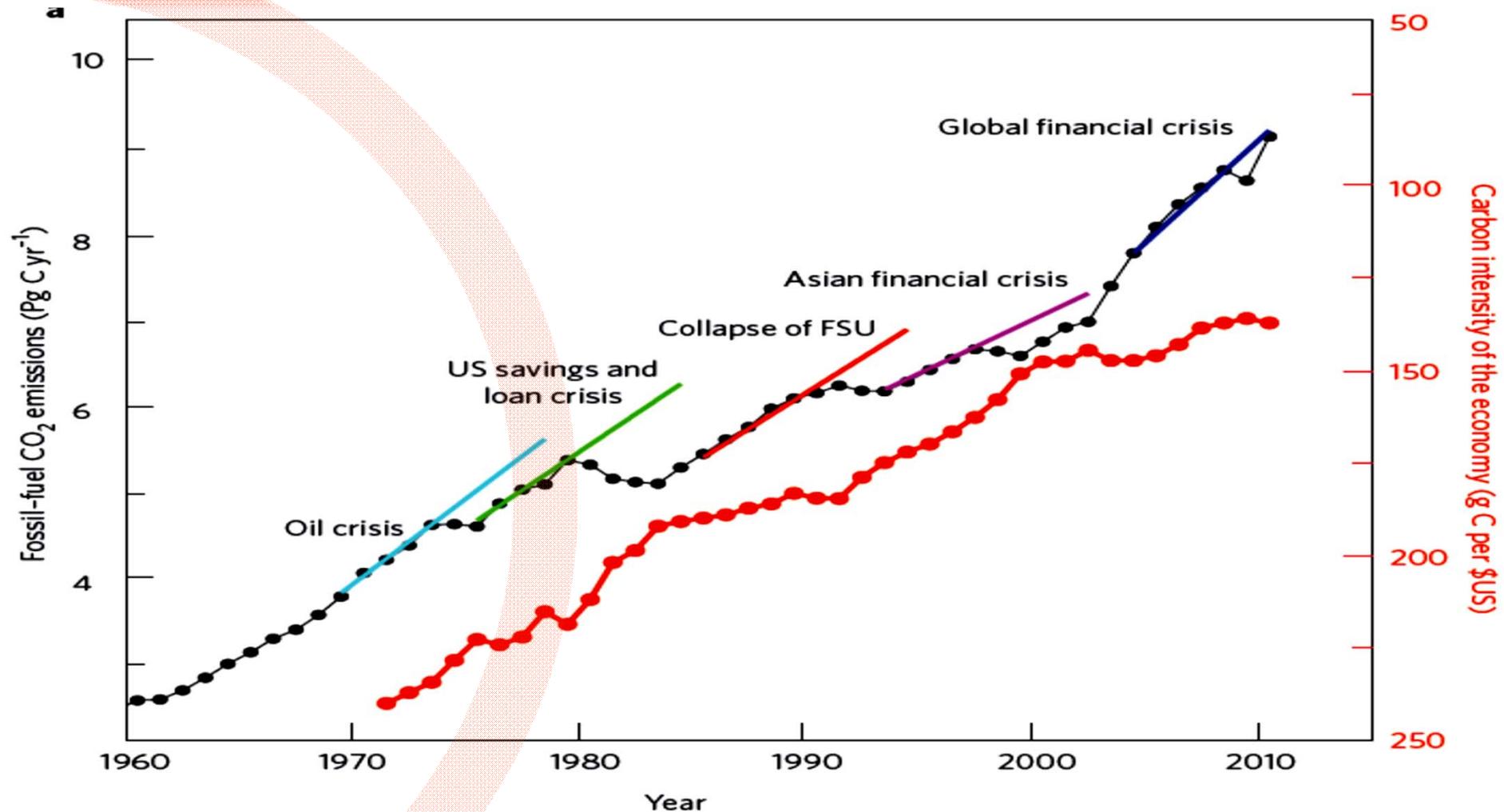
Carbon price & CO₂ emissions



Source: E3MG solutions reported in (Barker et al., 2014)

	Percentage point difference: average growth rates after less average growth before a banking crisis (21 countries, 1870-2007)	
	10 years after & before	20 years after & before
Number of observations	56	47
GDP per worker: mean : standard deviation : number of + as %	-0.21 (0.45) 54%	-0.31 (0.22) 47%
Capital stock per worker: mean : standard deviation : number of + as %	-0.79 (1.41) 32%	-0.82 (0.24) 36%

Source: (Dwyer et al., 2014)

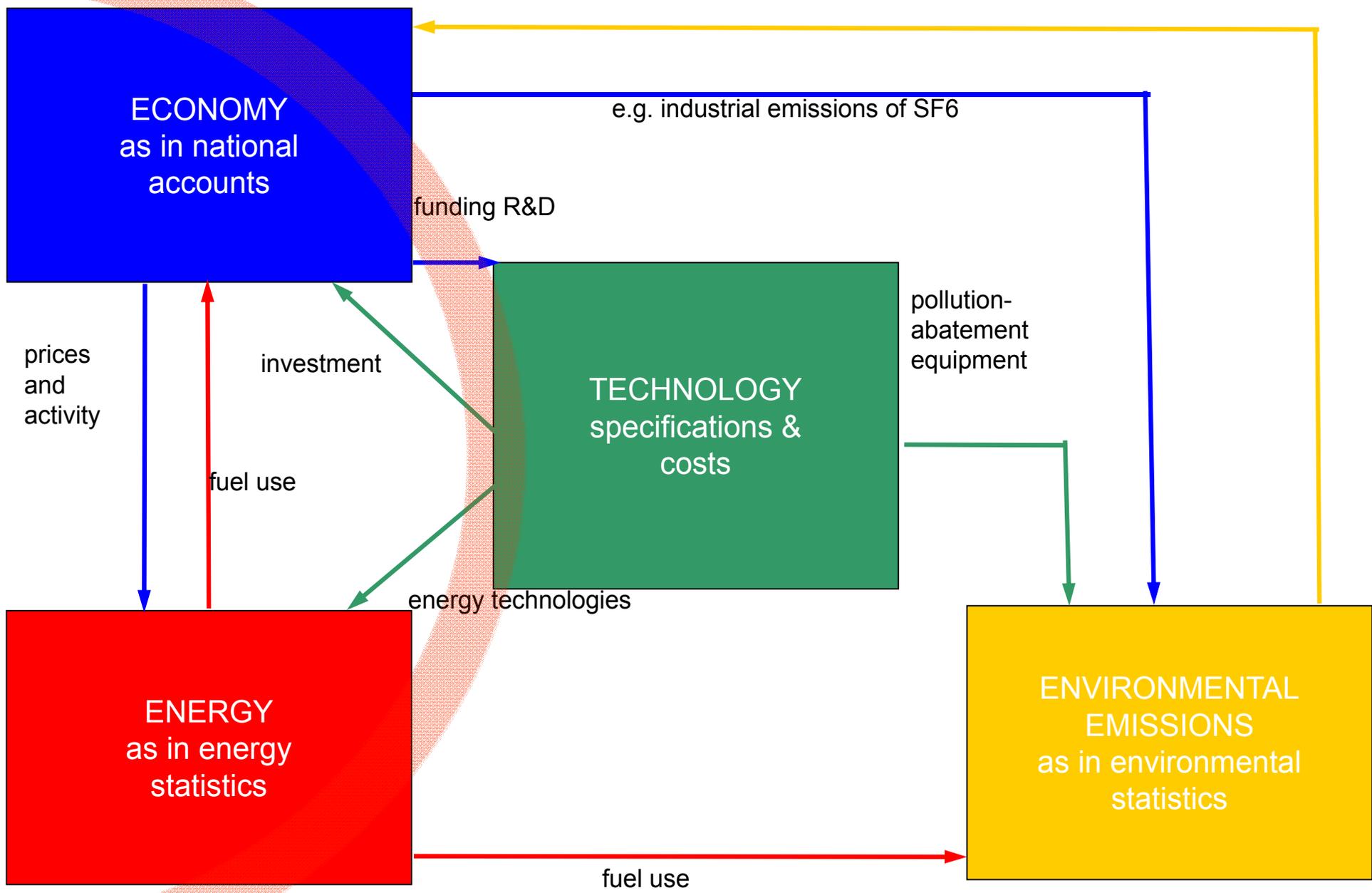


Source: Peters, G.P., G. Marland, C. Le Quéré, T. Boden, J.G. Canadell and M. R. Raupach (2012) Rapid growth in CO₂ emissions after the 2008–2009 global financial crisis, *Nature Climate Change* 2, January, pp. 1-4.

Energy-Environment-Economy(E3) Model at the Global level - **E3MG**

- 20 political regions including 14 countries (incl. India, China, Brazil)
- forecasting up to 2100 (annually up to 2050)
- sector and product disaggregation (42 categories)
- an input-output framework
- regions linked using international bilateral trade data
- two-way linkages between the economy and the energy system
- 14 atmospheric pollutants (GHG and non-GHG)
- dynamic econometrically-estimated equations (data 1970-2010)
- Not a CGE model – Post Keynesian

E3MG structure



A study looking at decarbonising global economy to have a medium chance to achieve 2 degrees target by 2100

Focus on 2050

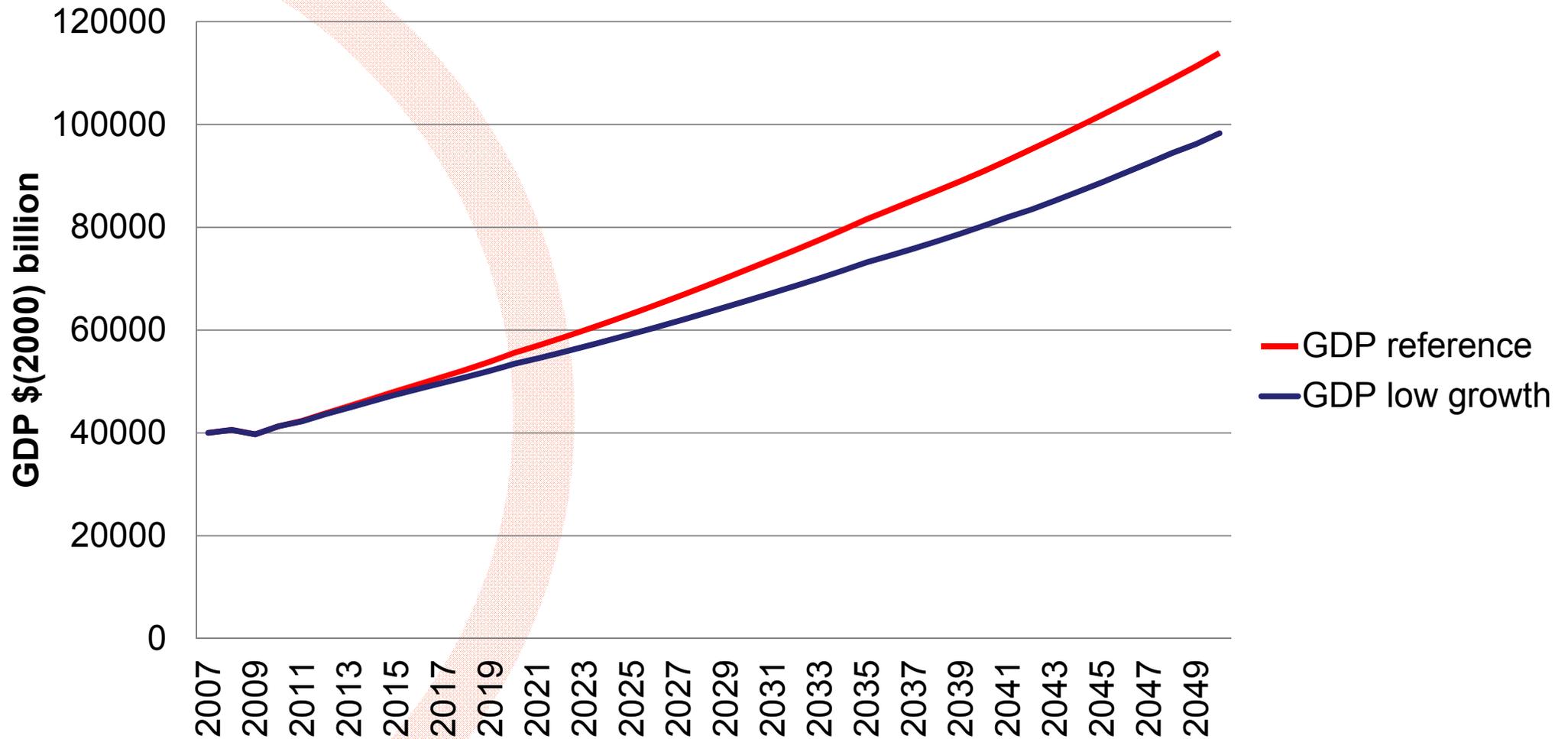
- **Reference scenario** - no new climate change policies, but all currently existing policies in place over the entire study period 2013 - 2050
- **Decarbonisation scenario** with a portfolio of climate policies to achieve the target (450 ppm)
- **Low growth scenario** – reference scenario with more savings
- **Low growth scenario with decarbonisation**
- **Lower growth scenario** – reference scenario with even more savings
- **Lower growth scenario with decarbonisation**

Potential long-term effects on global GDP and CO₂

	GDP (% pa 2010-50)	CO₂ (% pa 2010-50)
Reference scenario	2.57	1.51
- with decarbonisation	2.73	-2.45
Low growth scenario	2.19	1.44
- with decarbonisation	2.45	-2.73
Lower growth scenario	1.93	1.54
- with decarbonisation	2.09	-2.69

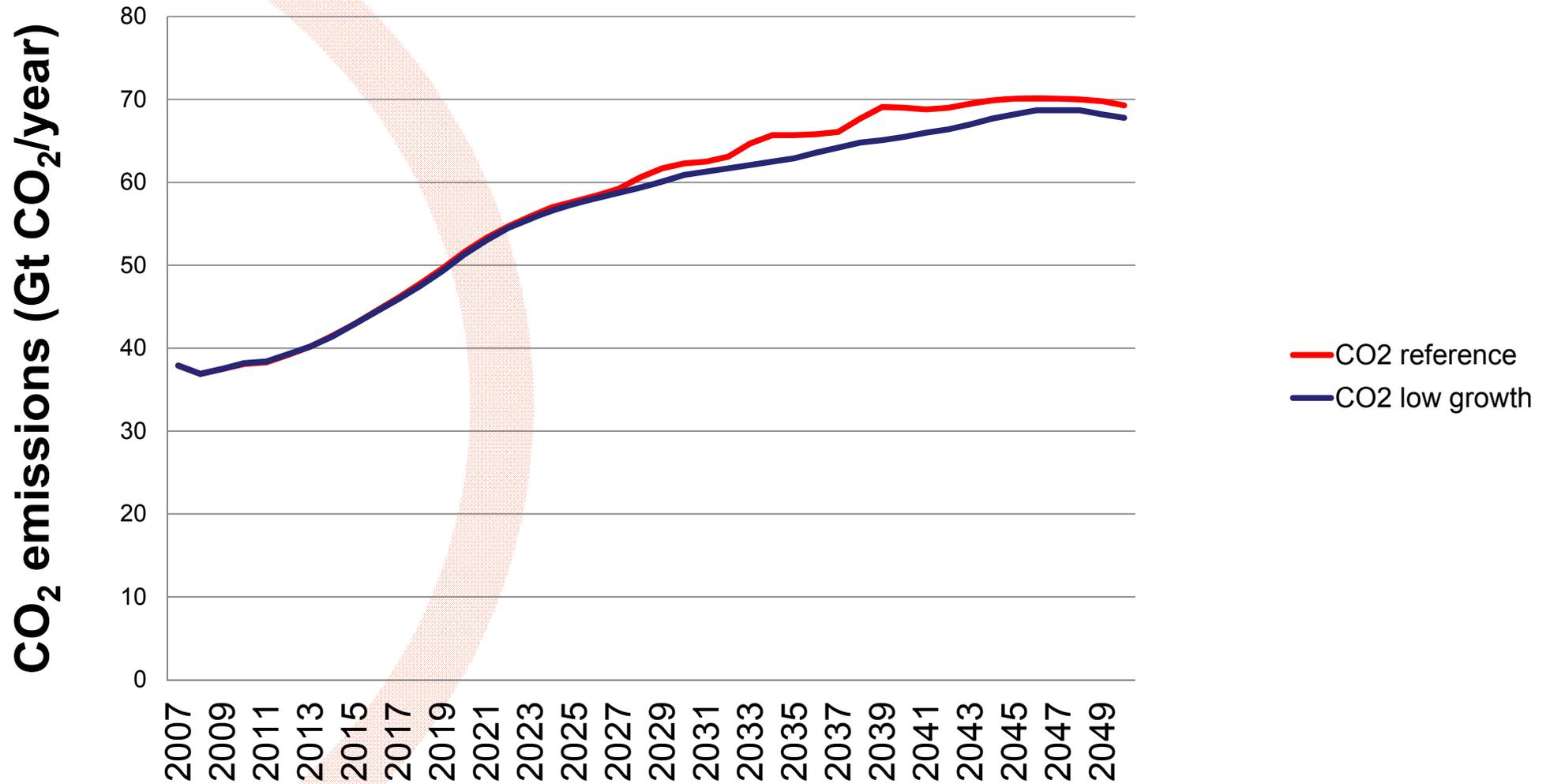
Source: E3MG modelling reported in (Barker et al., 2014).

Potential long-term effects on world GDP



Source: E3MG modelling reported in (Barker et al., 2014).

Potential long-term effects on world CO₂



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- Decarbonisation on the reference and lower-growth scenarios increases the growth rate. Higher investment in relation to GDP.
- For the reference scenario, only the lowest growth results in higher CO₂ emissions and this is due to switching to higher levels coal consumption to satisfy the global energy demand.
- The less extreme growth reduction does bring about some reductions in CO₂ emissions, but these are very small reductions compared to those brought about by targeted climate policy.
- Policies that aim to lower consumption *per se* may result in more CO₂ emissions by reducing the rate of investment and the rate of technological change, so reducing the switch away from coal.

A study looking at decarbonising global economy to have a medium chance to achieve 2 degrees target by 2100

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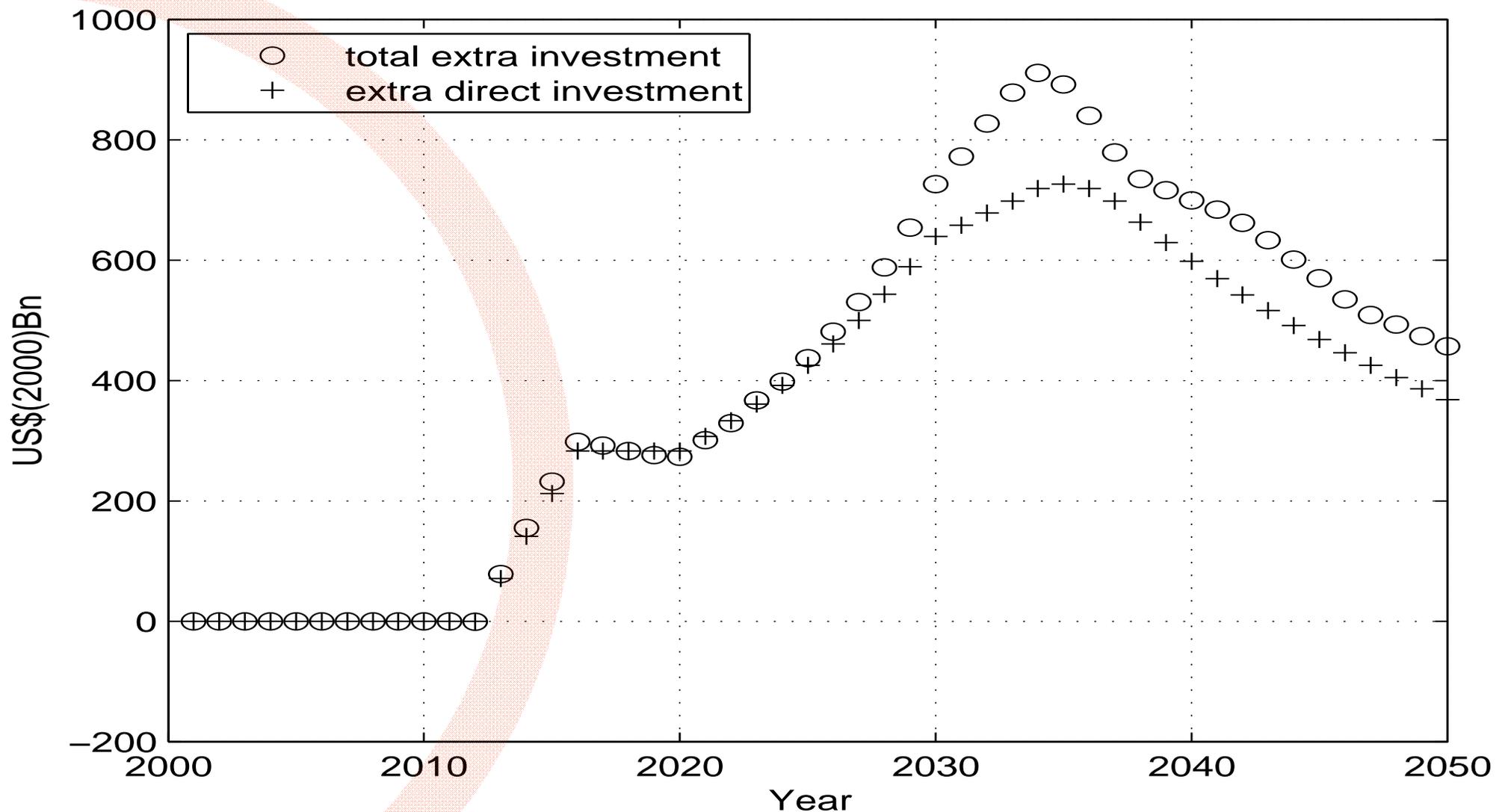
Decarbonisation scenario - with a portfolio of climate policies to achieve the target (450 ppm) including green investment

Altogether 20+ different scenarios were modelled

Additional investment in 2020 required for the decarbonisation scenario (billion 2000US\$) compared with total investment

Region	Additional investment	Total investment
United States	82	2623
European Union	75	3151
China	70	2577
	135	5101
RoW of which OPEC	16	600
World	360	13452

Investment required



Additional investment associated with extra regulations for building, industry (non-power) and transport, direct and total (assumed plus induced) Source: E3MG modelling and IEA WEO, 2010.

The reasons for establishing an independent **Green Investment Bank**:

- Development of specialised knowledge and experience of green technologies and institutions
- The need for a rapid build-up of the scale of investment required to meet environmental targets
- Reduction of risk
- Develop and enable access to new forms of credit
- Acting as a saviour for viable green projects abandoned by commercial banks in difficulties

- The overall impression is that the development of the financial sector tends to reduce pollution. Problems with economic models.
- Carbon allowances support emission reductions and incentivise investment in new technologies
- The effects of financial crises on the environment are usually to reduce emissions associated with economic activity. However, there may be also a switch of production to lower-cost more pollution-intensive activities, such as use of coal instead of gas for electricity production.
- Investment needs for decarbonisation relatively low, but associated with risks and need to be supported publicly and through economic growth

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