Energy, growth and sustainability – five propositions

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Towards an Ecological Macroeconomics Workshop,

Vienna University of Economics and Business, 11th December 2009

Five Propositions

- Rebound effects are significant and limit the potential for decoupling energy consumption from economic growth
- The contribution of energy to productivity improvements and economic growth has been underestimated
- Sustainability requires both improved energy efficiency and an ethic of sufficiency
- Sustainability is incompatible with continued economic growth in rich countries
- A zero-growth economy is incompatible with a debt based monetary system

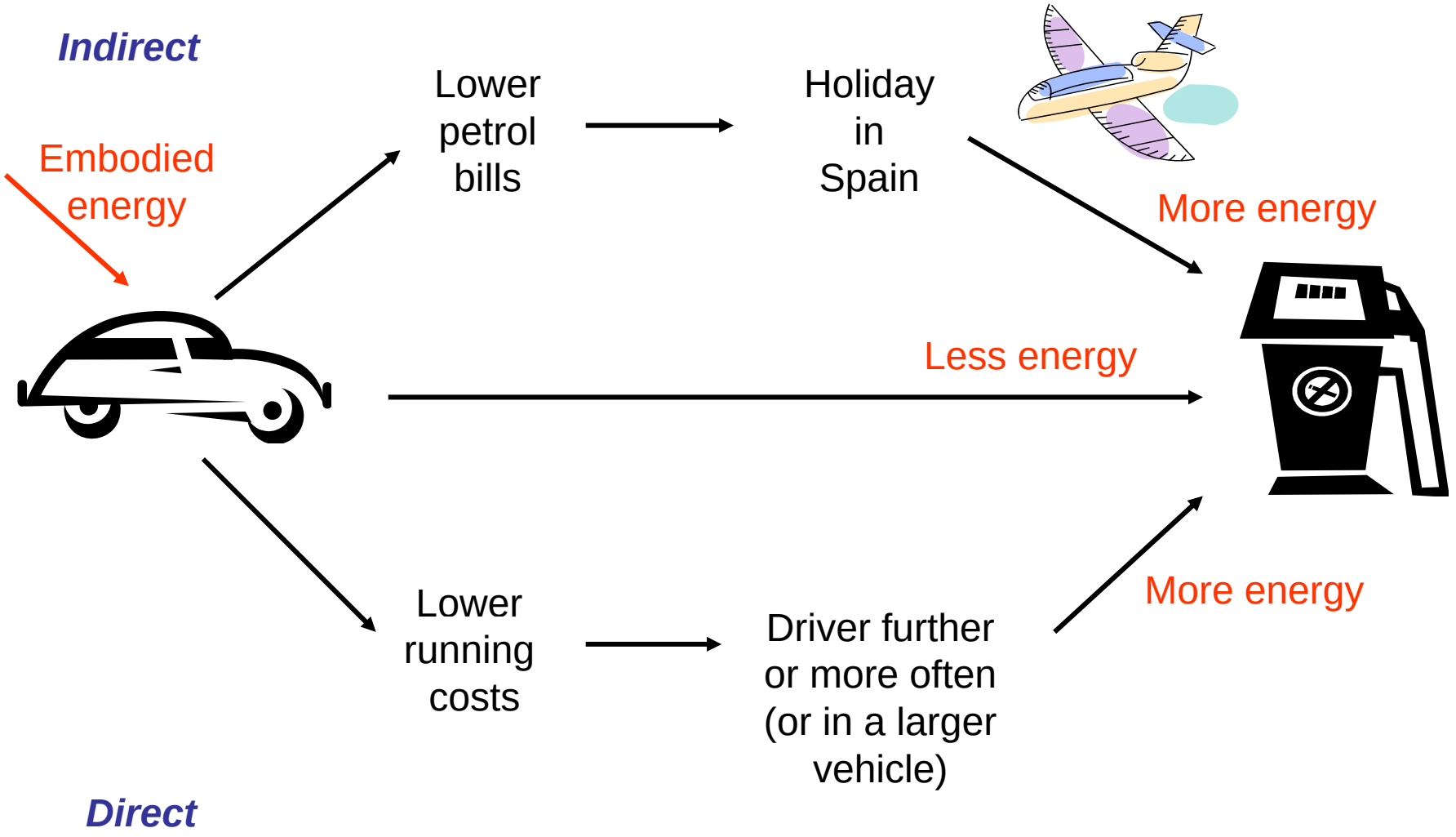
Issues and Caveats

- Aim is to highlight blind spots and taboos
- Propositions are highly controversial and the empirical evidence is equivocal
- Propositions have both deep historical roots and urgent contemporary relevance
- Propositions are linked, but acceptance of one is neither necessary nor sufficient for acceptance of another
- Investigation of the last should form part of any project on ecological macroeconomics

Proposition 1

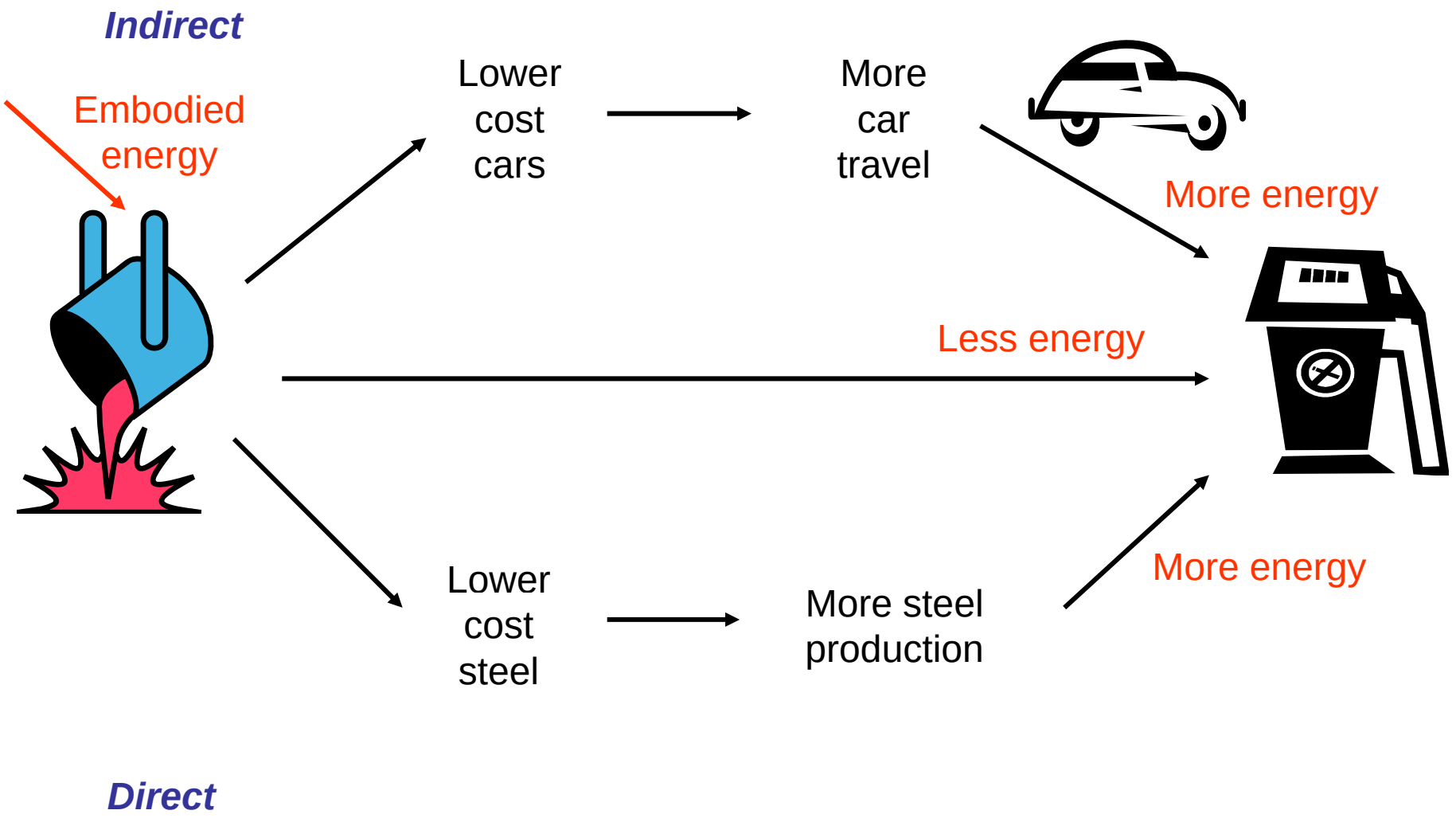
Rebound effects are significant and will limit the potential for decoupling energy consumption from economic growth

Rebound effects - consumers

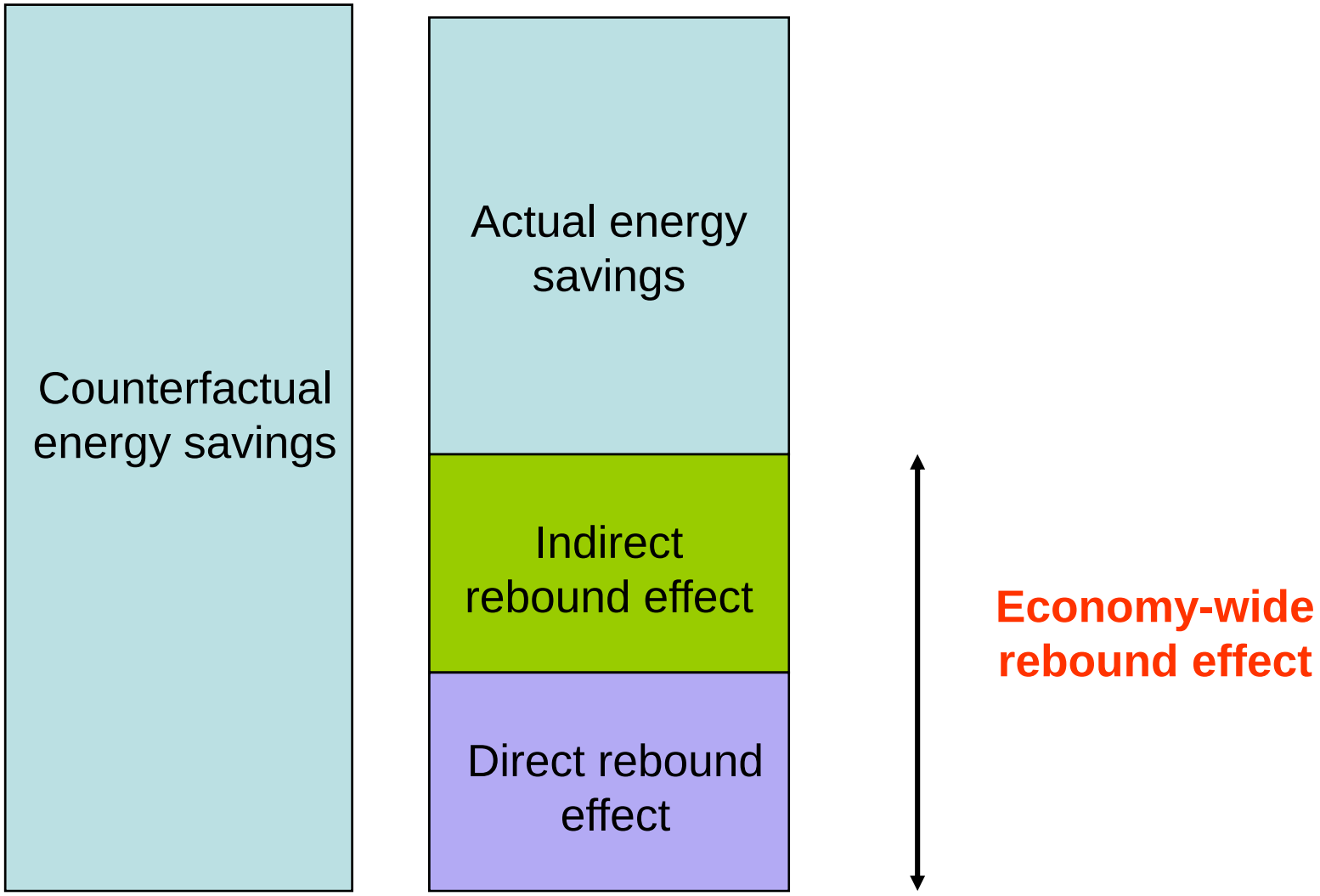


Reinforcement of rebound effects

Rebound effects - producers



Economy-wide rebound effect



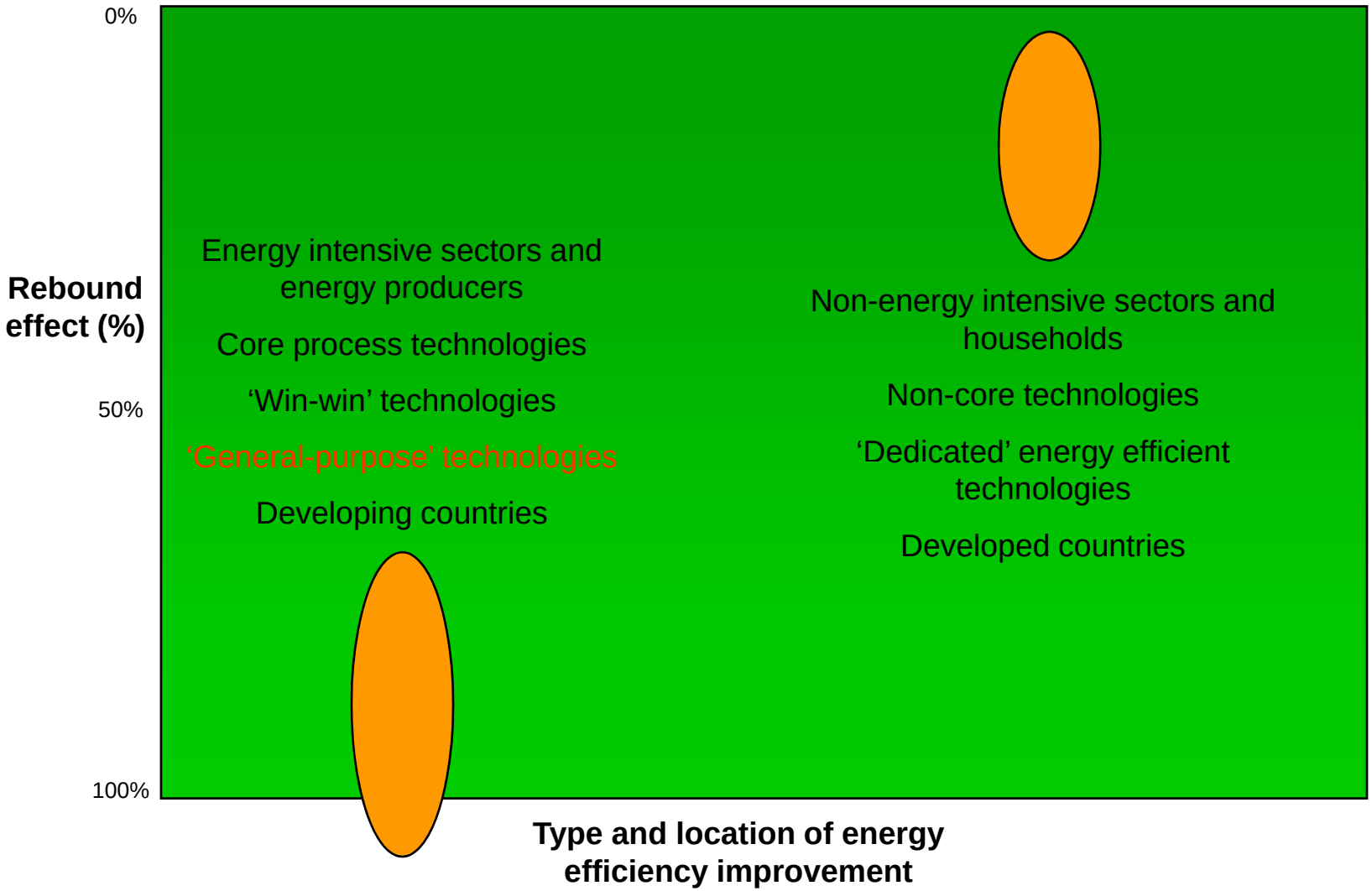
Two blind spots

- Energy efficiency may be measured in a variety of ways for a variety of system boundaries
  - So rebound effects depend on how energy efficiency is defined
- Improvements in energy efficiency rarely occur in isolation
  - So rebound effects need not be small just because the share of energy in total costs is small

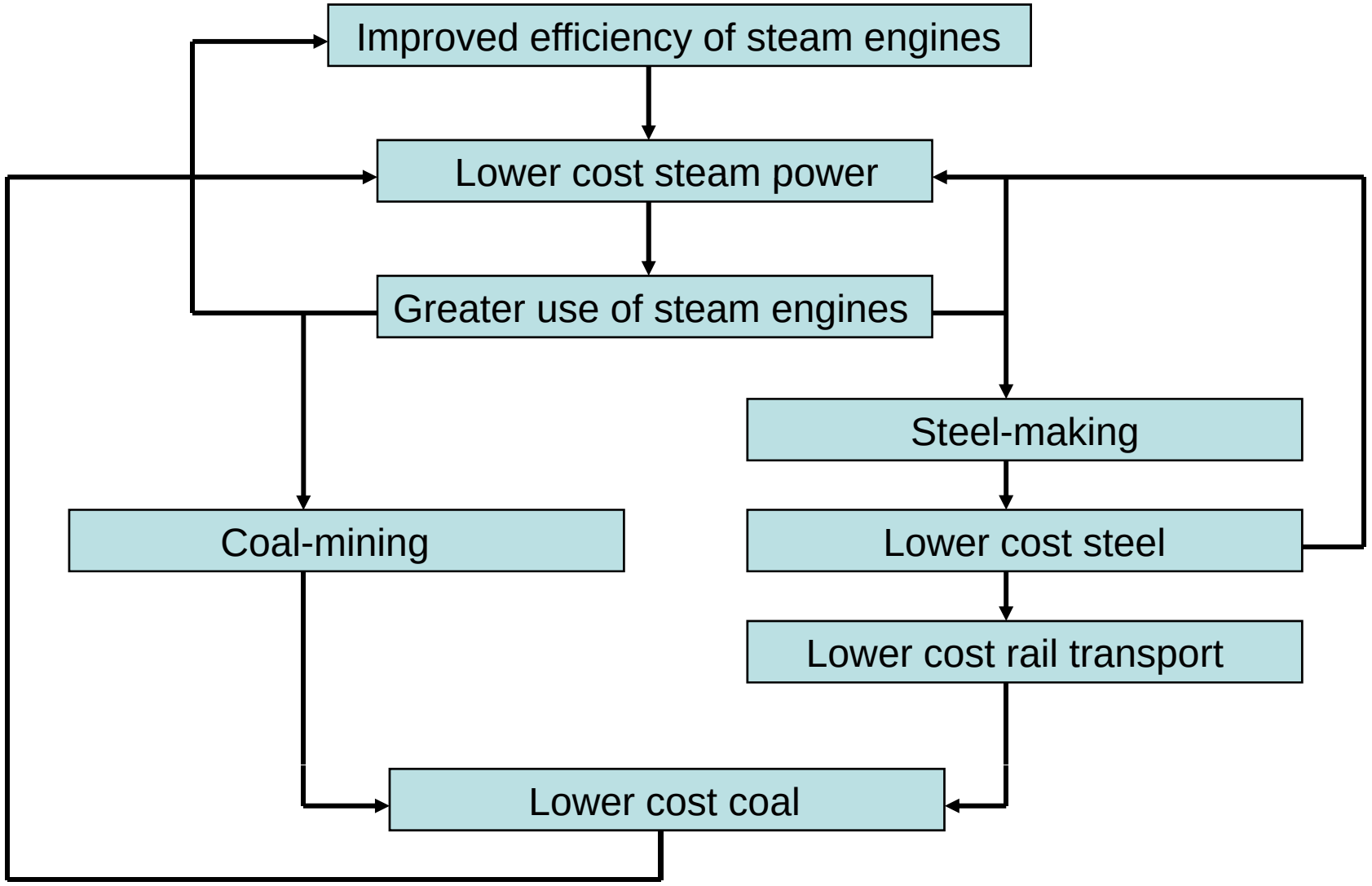
Rebound effects matter…

- *Direct*: 30% or less for car travel and space heating/cooling. Smaller for most other household energy services
  - *But*: Only limited time periods studied. Marginal consumers ignored. Only subset of variables measured. Few studies of producers and/or households in developing countries.
- *Economy-wide*: Diverse modelling studies suggest 30% to >100%
  - *But*: Depends on nature and location of energy efficiency improvement. Sensitive to assumptions. Assumes only 'pure' energy efficiency improvements
- Variable, significant and probably larger than current studies suggest

...but their magnitude is an empirical question



Jevons' Paradox holds in important cases



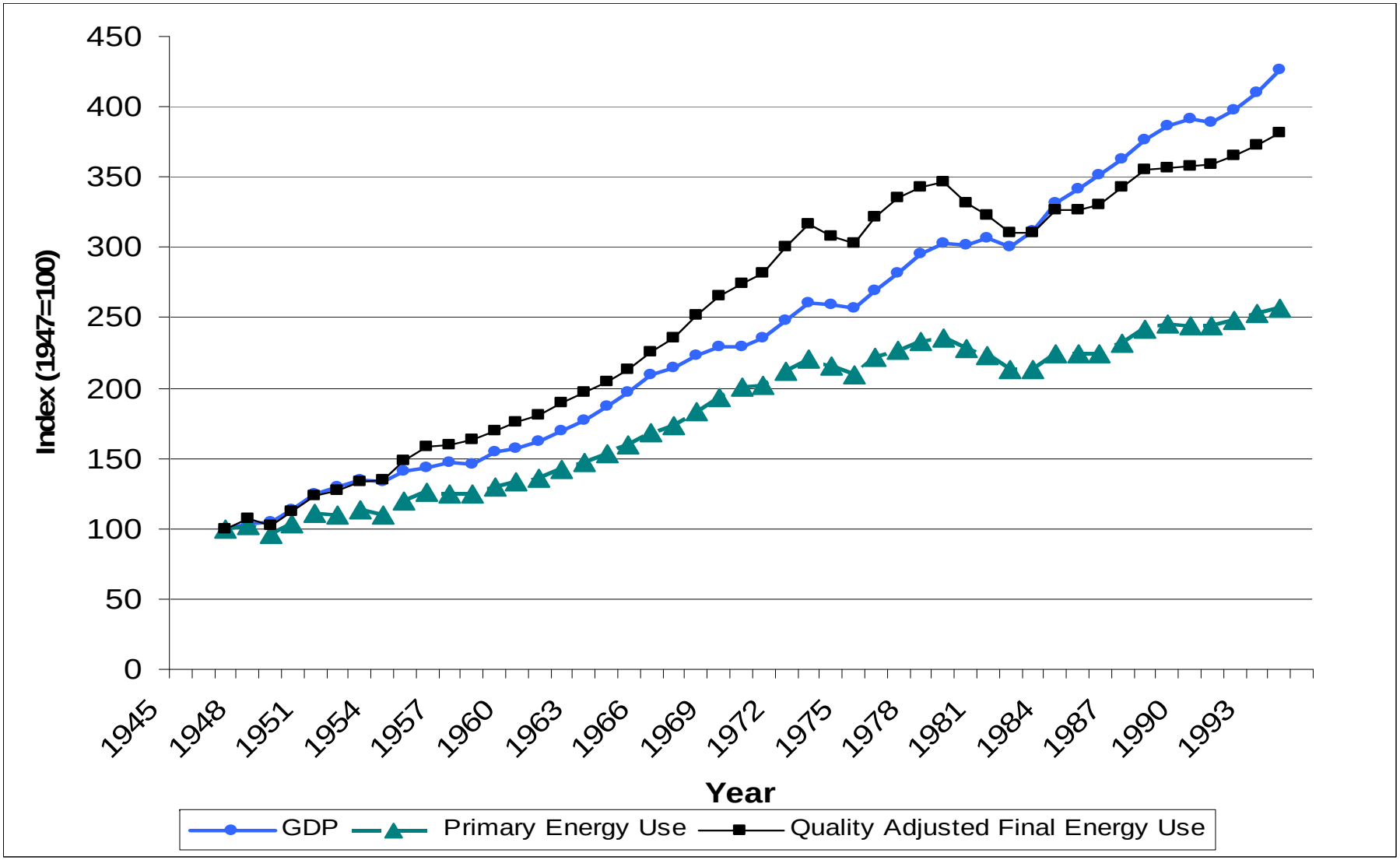
Proposition 2

The contribution of energy to productivity improvements and economic growth has been underestimated

Competing perspectives

	Conventional view	**Ecological view**
Main source of labour productivity improvements	Exogenous or endogenous technical change	Increasing availability of high-quality energy, both directly and embodied in capital equipment and technology
Marginal product of energy inputs	Proportional to share of energy in the value of output	Greater than the share of energy in the value of output
Input substitution in production	Scope for substitution indicated by substitution elasticities estimated at the sector level	Scope for substitution overestimated by substitution elasticities, since these neglect embodied energy
Energy resource scarcity	Mitigated by substitution and technical change	Accelerating due to increasing EROEI
Rebound effect	Likely to be small	Likely to be large
Decoupling of energy consumption from GDP	Has already occurred, with considerable scope for further decoupling	Overstated in part because of neglect of energy quality. More limited scope for decoupling.

Decoupling?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Primary Energy Use
Quality Adjusted Final Energy Use

Empirical illustrations

- No convincing evidence of an EKC for energy (Stern, 2004)
- Once shift towards higher quality fuels is allowed for, there is little evidence for ‘autonomous energy efficiency improvements’ (Kaufmann, 1991)
- Solow residual almost entirely explained by historical increase in ‘useful work’ inputs (Ayres and Warr, 2003)
- Most improvements in energy productivity associated with proportionally greater improvements in total factor productivity - boost in output more than offsets reduction in energy intensity leading to higher energy consumption (Brookes, 2000)

Issues and implications

- Empirical evidence is patchy, suggestive and often contradictory
- Complexity and interdependence makes causality hard to establish
- Arguments and evidence need further (econometric) investigation, but deserve to be be taken seriously
- Potential for decoupling may be more limited and costs could be higher

Proposition 3

Sustainability requires both improved energy efficiency and an ethic of sufficiency

Three approaches

- Consuming *efficiently* has limits
  - Potential for decoupling constrained by rebound effects
- Consuming *differently* has limits
  - Potential for green consumerism, service models and shifting to a service-based economy may also be overestimated
- So what about consuming *less*?
  - Respect ecological constraints while providing social and psychological benefits

Challenges to sufficiency

- Lock-in to current consumption patterns
- Rapid obsolescence of consumer goods
- Status consumption and positional goods
- Adaptation of aspirations to higher levels of income
- ‘Perfect fit’ between production and consumption of novelty
- Finding identity through consumption

Sufficiency is not sufficient

- Requires deeply held values and considerable determination
  - Likely to remain marginal unless structural conditions change
- To downshift you first need to upshift
  - Scope constrained by increasing income inequality and spiralling personal debt
- Sufficiency also has rebound effects
  - Improves equity in resource consumption, but we need absolute reduction in resource consumption
- Need citizens acting in the political process to agree collective constraints

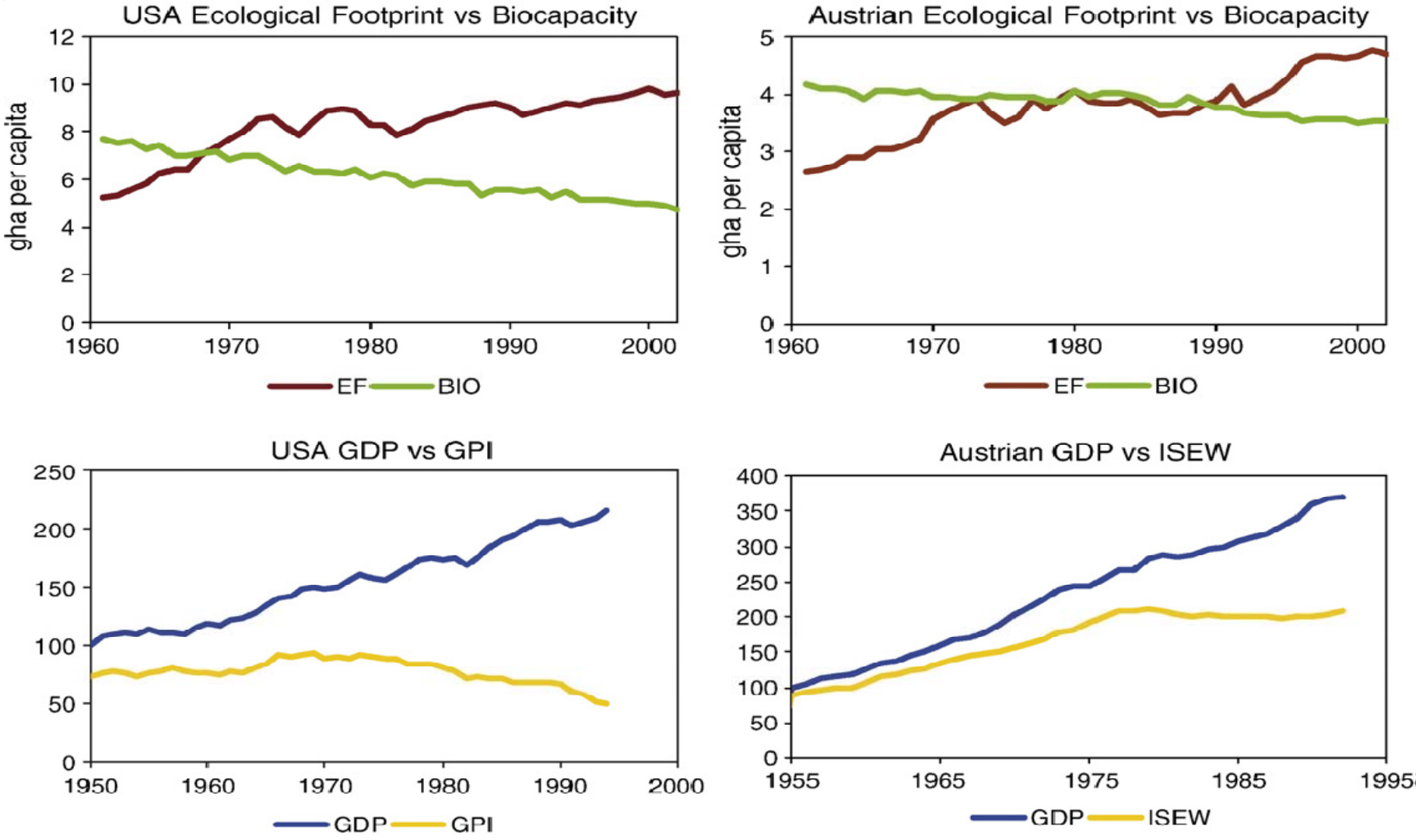
Proposition 4

Sustainability is incompatible with continued economic growth in rich countries

Competing perspectives

	Conventional view	Ecological view
Primary policy goal	Economic growth as measured by GDP. Growth should allow the solution of other problems.	Development in the sense of improved quality of life. Growth has negative side-effects.
Primary measure of progress	Gross Domestic Product (GDP)	Index of Sustainable Economic Welfare (ISEW) or some comparable indicator
Scale/carrying capacity	Not an issue because markets can overcome resource limits via substitution and technical change	Primary concern owing to limited scope for substituting natural for man-made capital.
Income distribution	Secondary concern. A 'trickle down' policy (a rising tide lifts all boats)	Primary concern. Directly affects quality of life and is often made worse by economic growth
Economic efficiency	Primary concern, but generally including only marketed goods and services	Primary concern, but including both market and non-market goods. Value human, natural and social capital
Role of 'sufficiency'	Not recognised. More is always better.	Congruent with overall aims. More is not always better

Thresholds and Footprints

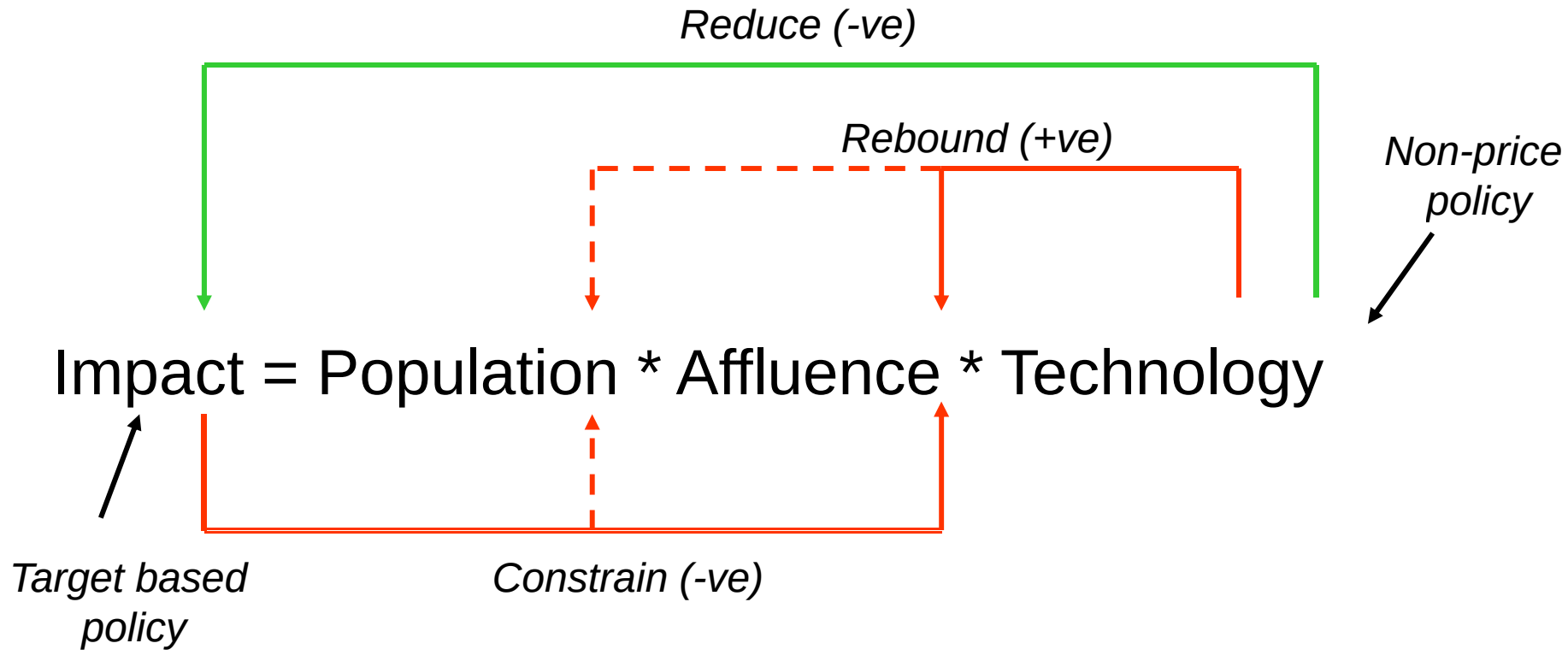


Source: Niccolucci et al. (2007)

Scale of decoupling required by 2050

- Assume 0.7%/year population growth and 1.4%/year per capita GDP growth
- For global energy and process CO_2 emissions to fall by 50% to 85% by 2050, carbon emission per unit of GDP must fall by 82% to 94%
- Implies cut of 3.8% to 6.4%/year
  - cf -1.3%/year 1970-2000 and +0.3%/year since 2000
  - If only -1.3%/year, emissions increase by 55%
- Even if emissions and population stabilised, carbon intensity in 2050 must be less than 2% of 2000 levels
- *Is this plausible?*

IPAT and Endogenity



What is the problem?

- Because "..the greatest shortcoming of the human race is our inability to understand the exponential function" (Bartlett, 1969)?
- Because short-term material interests reinforce a psychology of denial?
- Or because modern economies are structurally dependent upon continued economic growth?

Proposition 5

A zero-growth economy is incompatible with a debt based monetary system

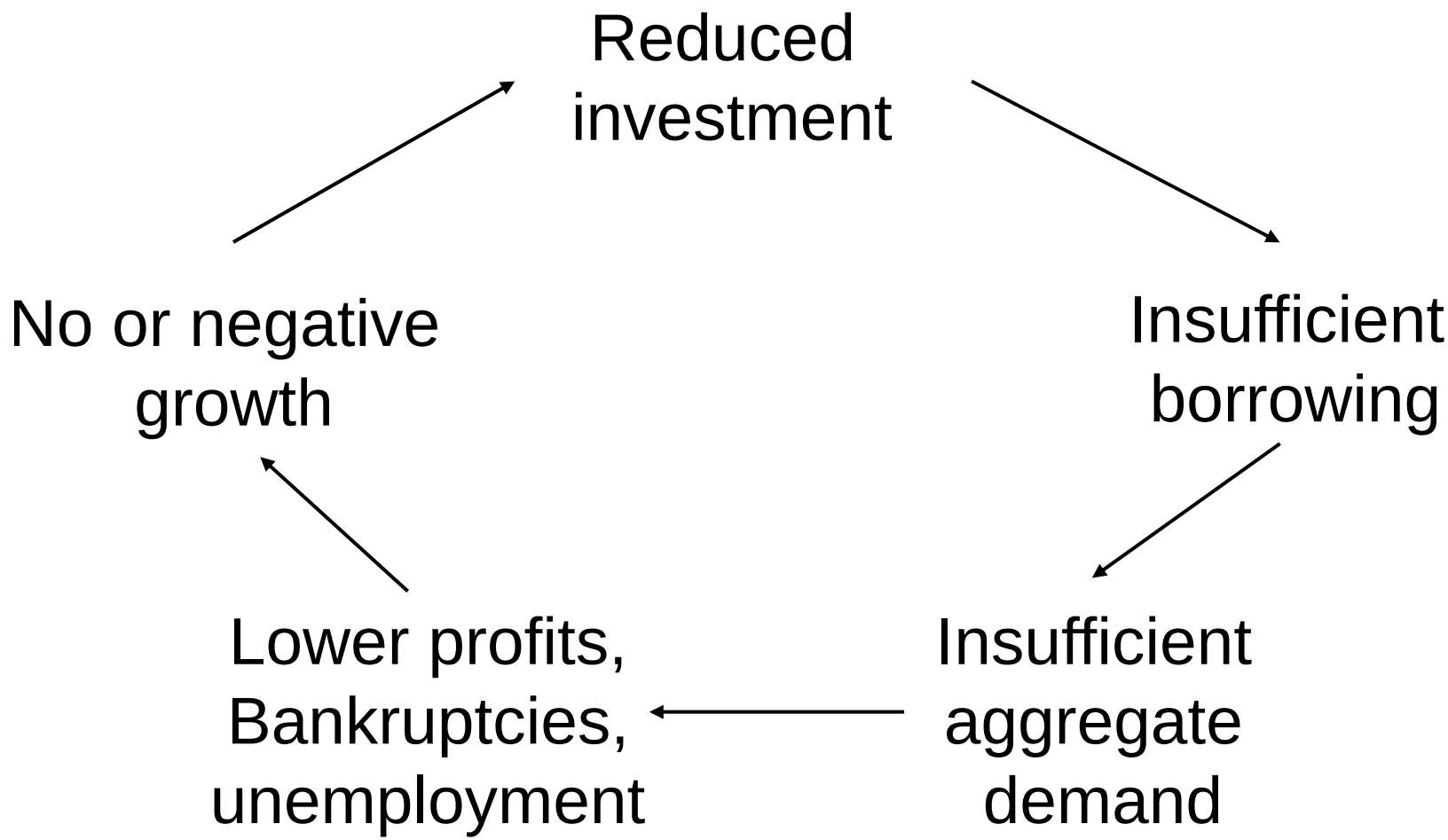
Money and debt

- Investment is required to increase aggregate demand as well as expand supply

$$\Delta GNE \approx \Delta M + \Delta V \approx \Delta M \approx \Delta Q + \Delta P$$

- The increase in money supply comes through credit creation by private banks
- The bulk of the money supply exists only because of debt
- Interest can only be repaid if more debt is undertaken
- Hence, avoiding crises requires more debt, more growth and more $\Delta Q * \Delta P$

Vicious circles



Implications

- Economic growth requires ever-increasing indebtedness, creating vulnerability to crises
- There is an increasing disconnect between debt and real physical wealth
- The monetary system creates a structural requirement for continued growth and increased consumption
- Keynes – mitigate crises with fiscal stimulus through increased government borrowing
- Heterodox – mitigate crises and growth addiction through government creation of interest-free money (*cf* Fisher, Robertson)

Reprise

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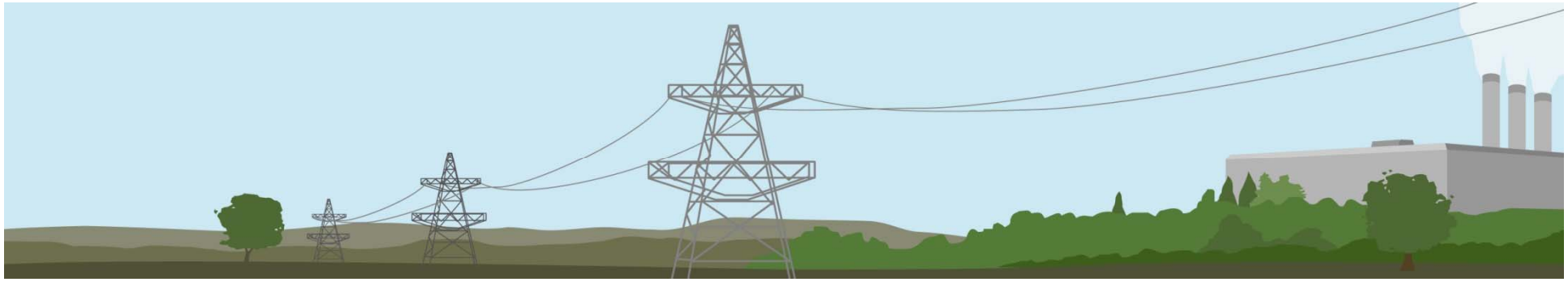

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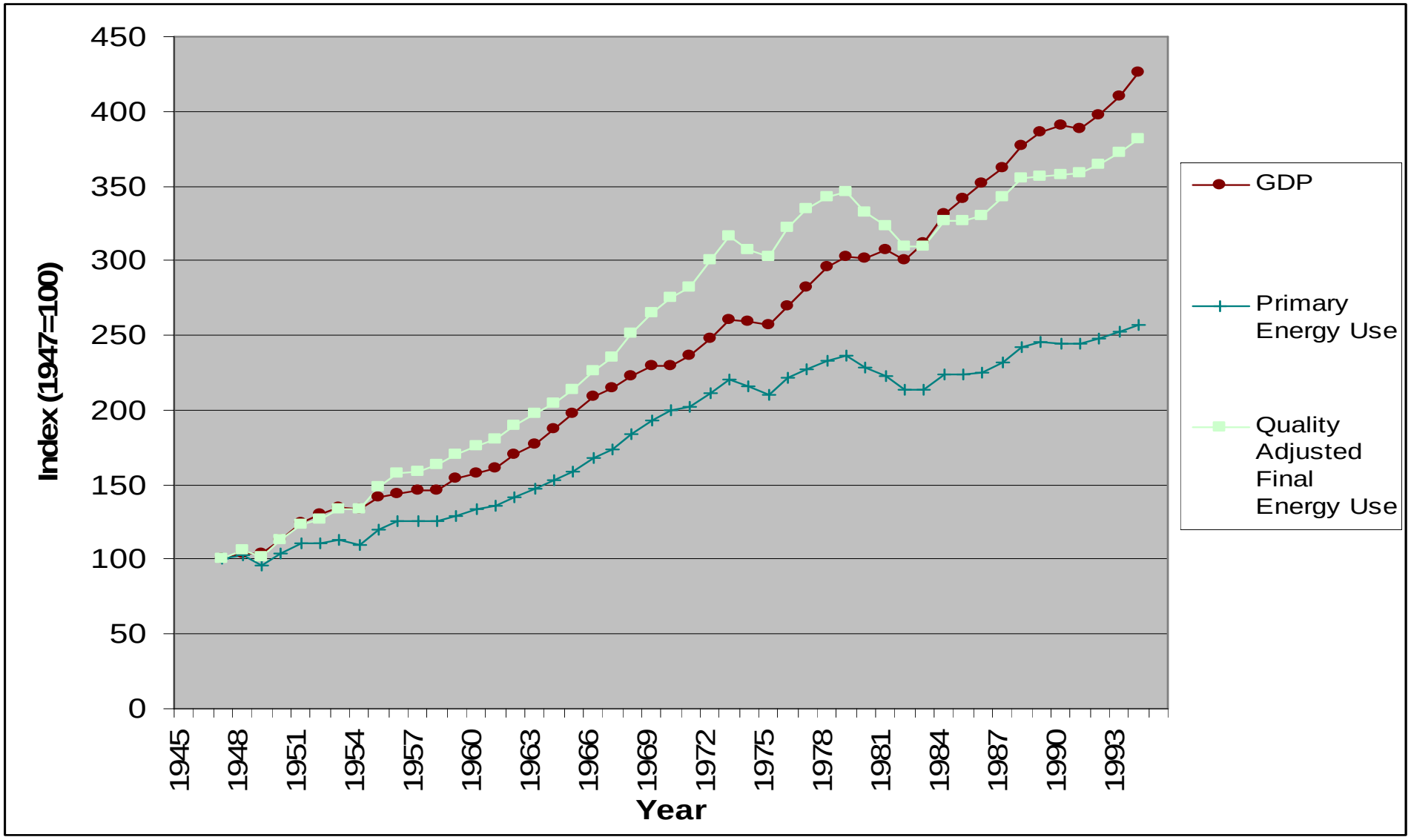
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