Climate policy after the crash

Klaus Hasselmann
Max Planck Institute for Meteorology
Hamburg

Tallinn, 18th August 2009

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but: what must we do? :

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1958:

- Global financial crisis and recession

→ Widespread uncertainty: Can we believe the economists on what must be done?

:

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- of producers, in the demand for the products supplied
- of consumers, in the security of their jobs

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Questions

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2. How can science better advise climate policy?

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The Economist

JULY 18TH–24TH 2009

Economist.com

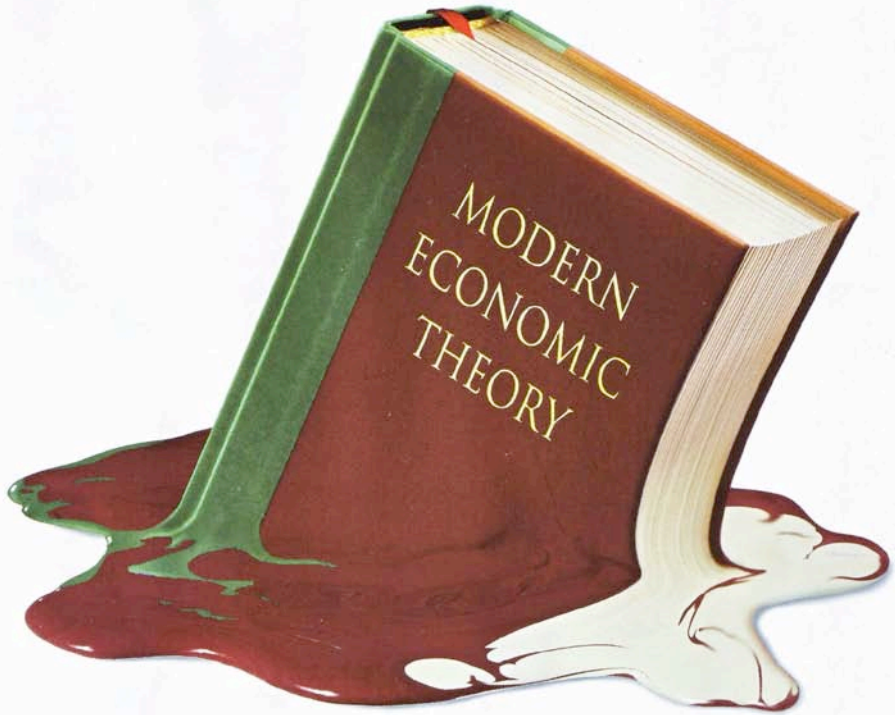
Britain agonises about Afghanistan

The rot in Japan's governing party

Europe's energy insecurity

Goldman Sachs's record profits

Summer camp for atheists



Where it went wrong–and how the crisis is changing it

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Albania ALL680 Croatia HRK48 France €5.50 Ireland €5.50 Latvia LVL4.25 Nigeria Naira 700 Romania RON26 South Africa R40.00
Austria €5.50 Cyprus €5.50 Gibraltar GIP4.00 Israel NIS34.90 Lebanon LL10,000 Norway NKr50 Saudi Arabia Rials35 Sweden SEK55
Bahrain Dinar3.50 Czech Rep. CZK150 Greece €5.50 Italy €5.50 Lithuania LTL23.10 Poland PLN26.5 Serbia RSD660 Switzerland Sfr10
Belgium €5.50 Denmark DKr47 Hungary HUF1,730 Kenya KSh4490 Luxembourg €5.50 Portugal cont. €5.50 Slovakia(sc)€5.60 €45.50 Turkey TRY12
Bulgaria BGN13 Estonia EEK92 Iceland IKr500 Kuwait Dinar 2.80 Malta €5.50 Qatar Rials35 Slovenia €5.50 UAE Dirhams 35

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  - The need for government regulation to stabilize the system (John Maynard Keynes, 1936)

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A simple explanation (from a climate scientist):

The long-standing dichotomy between

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– which have dominated the free-market thinking of the western world since the collapse of communism

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(Francois Quesnay, Adam Smith, David Ricardo, Karl Marx, John Maynard Keynes, Joseph Schumpeter,…)

Main stream general equilibrium theory:

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Dynamic system, governed by behaviour of many competing actors pursuing conflicting goals. Free-running system produces instabilities, creates social inequities, conflicts, etc. Task of government: stabilize system by balancing private and public interests, creating a socially just society.	Competition between individual economic actors results automatically in an optimal economic outcome (Adam Smith's "Invisible hand"). Inequities more than compensated by growth. Economic system inherently stable, interference by government produces sub-optimal outcome.

Mathematical and software tools

Mental models of classical economists (but tools were not available for original authors):

Main stream general equilibrium theory:

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Need for a new approach:

a family of easily understandable dynamical models

instead of

highly complex general equilibrium models

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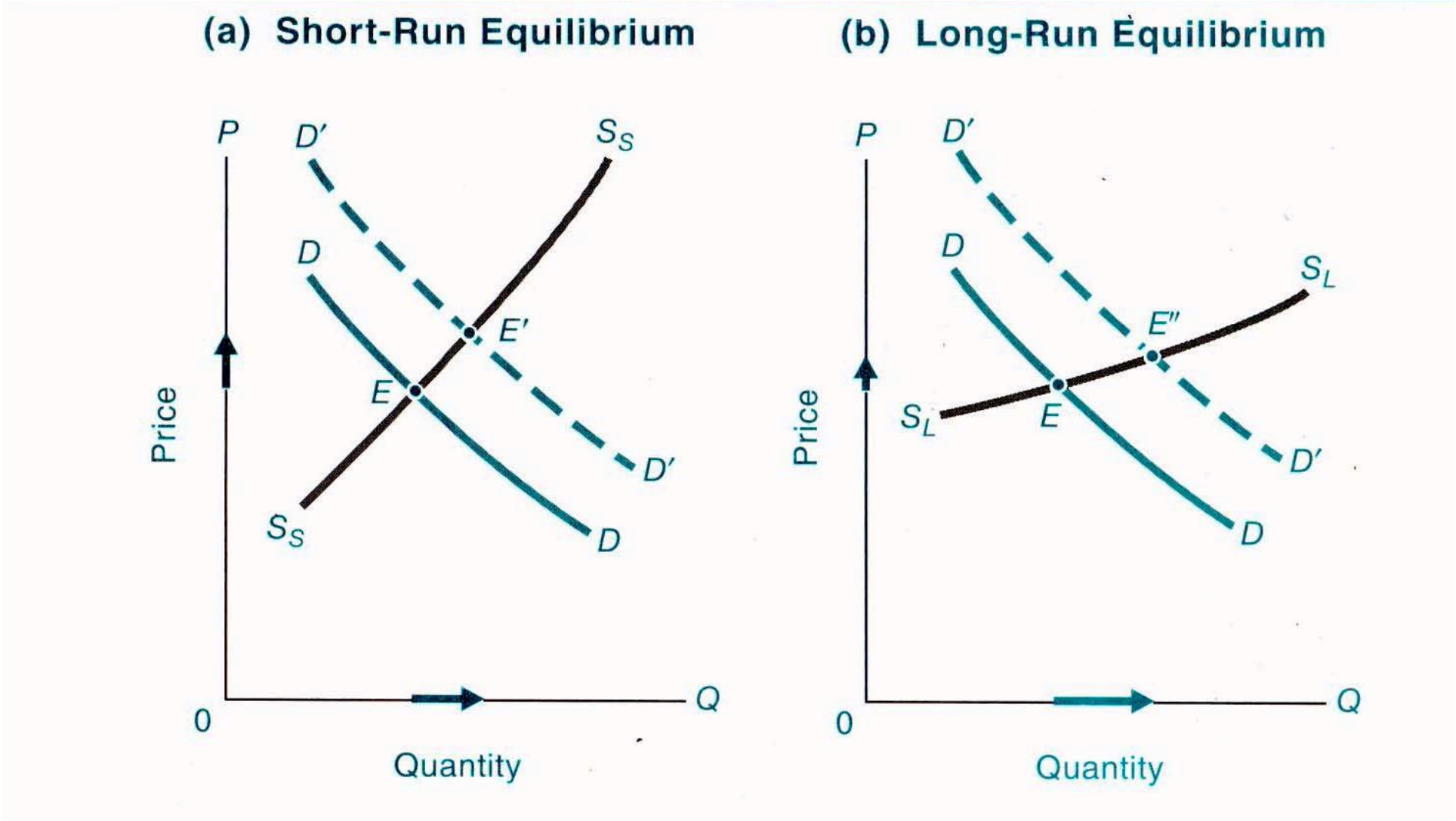
Textbook view of equilibrium in supply and demand in relation to price (Samuelson and Nordhaus)



System dynamics representation of supply-demand-price interdependence

$dS/dt = F(S,D,P)$	(S = supply)
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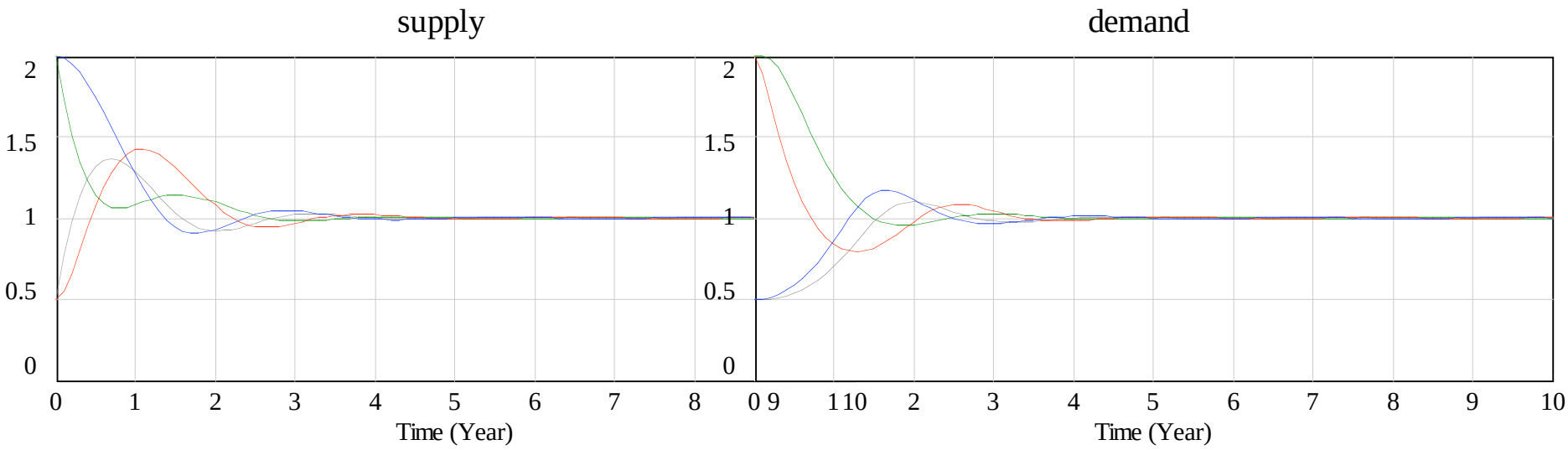
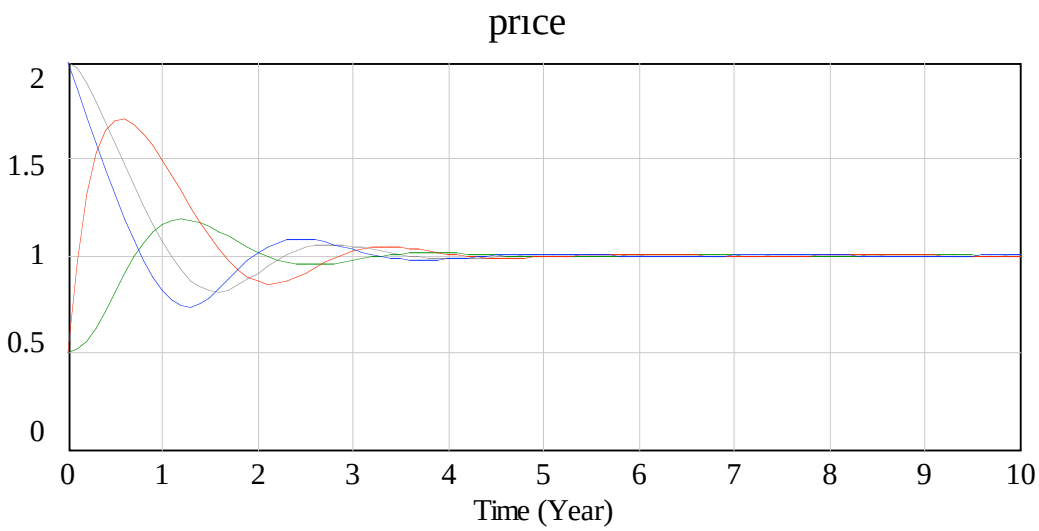
Result: stable equilibrium





General equilibrium model: evolution to joint equilibrium in supply, demand and price for four different initial conditions

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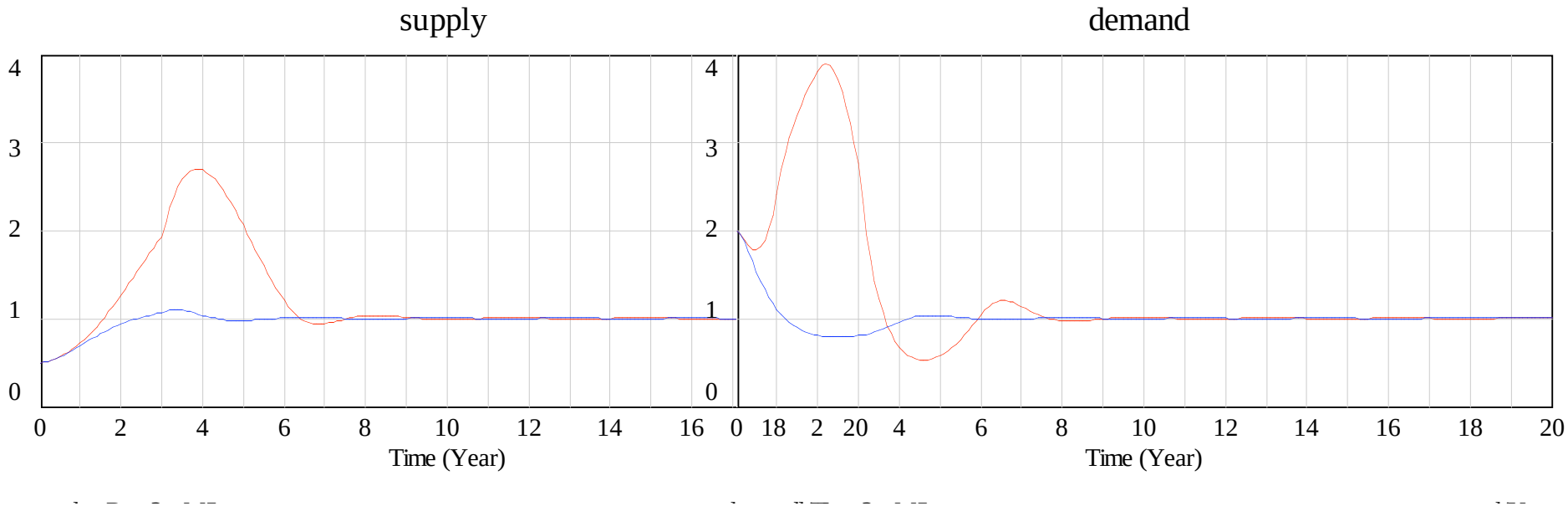
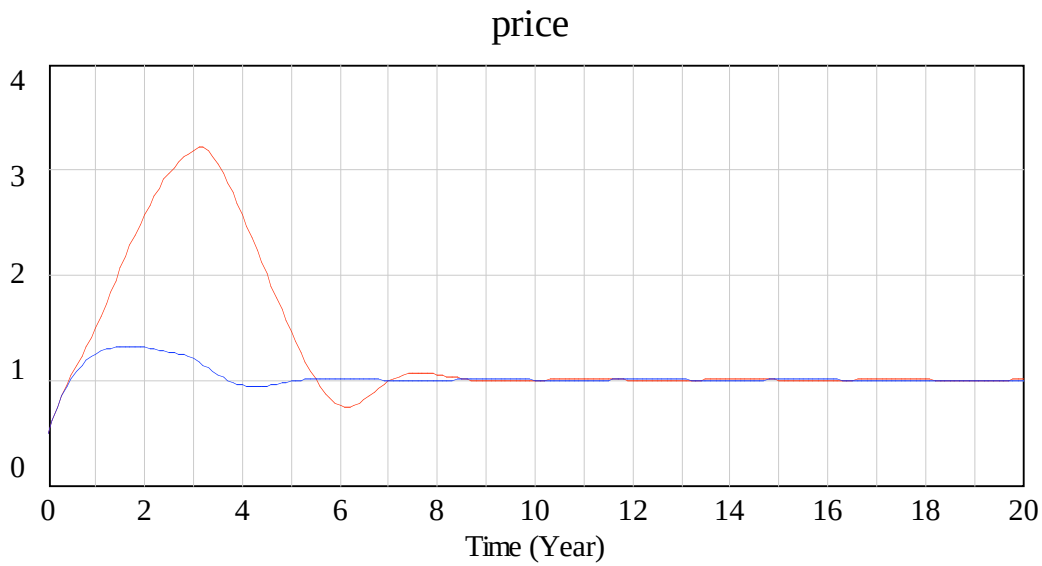
Hypothesis 2: P↑ induces dD/dt↑ [speculation, herding], otherwise as in Hypothesis 1.

Result: unstable boom - bust event





Boom-bust model:

Equilibrium model:

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Hypothesis 3: S↓ induces dD/dt ↓, dP/dt ↓
D↓ induces dS/dt ↓
P↓ induces dS/dt ↑

Result: business cycle

Business cycle model: two-feedback loops, one postive (unstable), one negative (stabilizing)

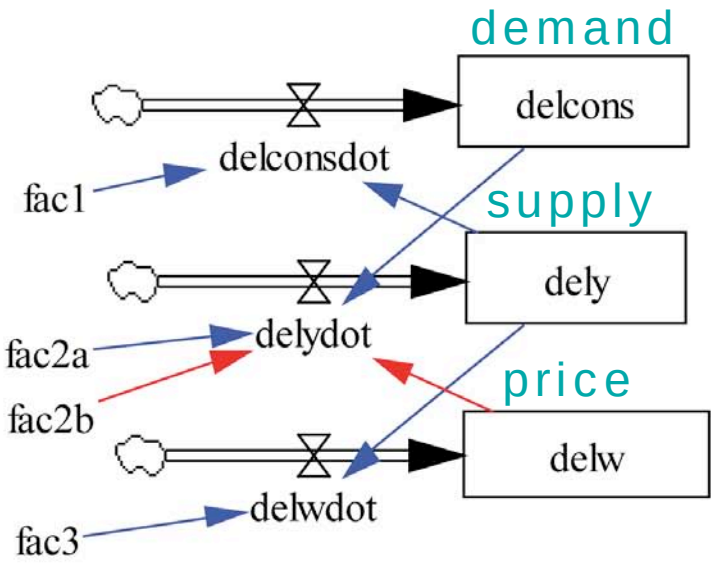
positive loop

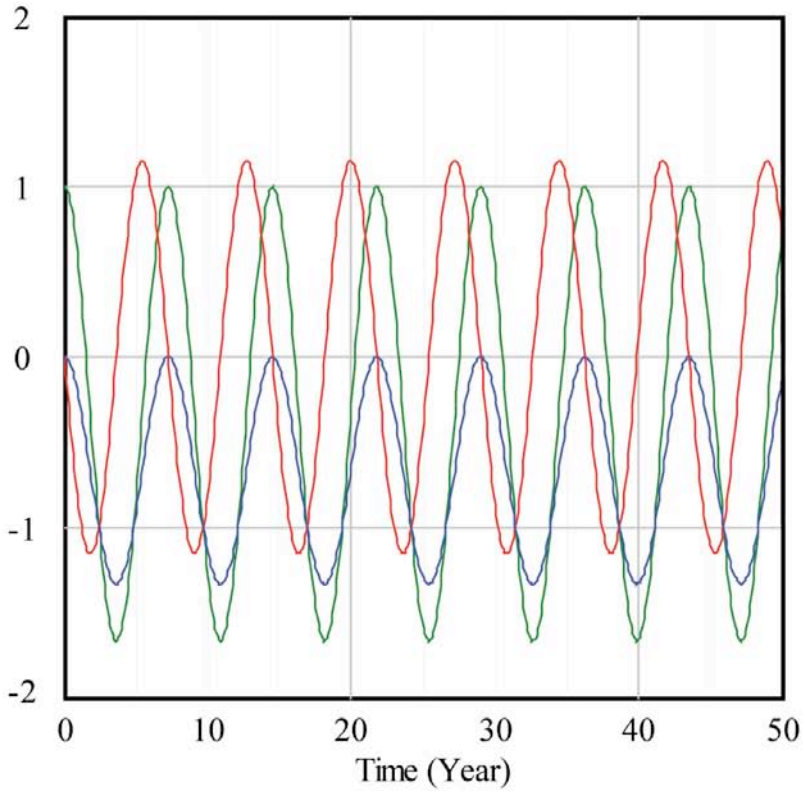
consumption decrease *delcons*

production decrease *dely*

increase

negative loop wage decrease *delw* → employm. increase





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General result: A system of three first-order ordinary differential equations can have solutions representing:

- a damped periodic, monotonic or non-monotonic (e.g. boom-bust) transition to an equilibrium point
- a stable convergence to a periodic attractor
- an unstable trajectory diverging to infinity
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Which type of solution is realized depends on the initial conditions and the behaviour of the economic actors

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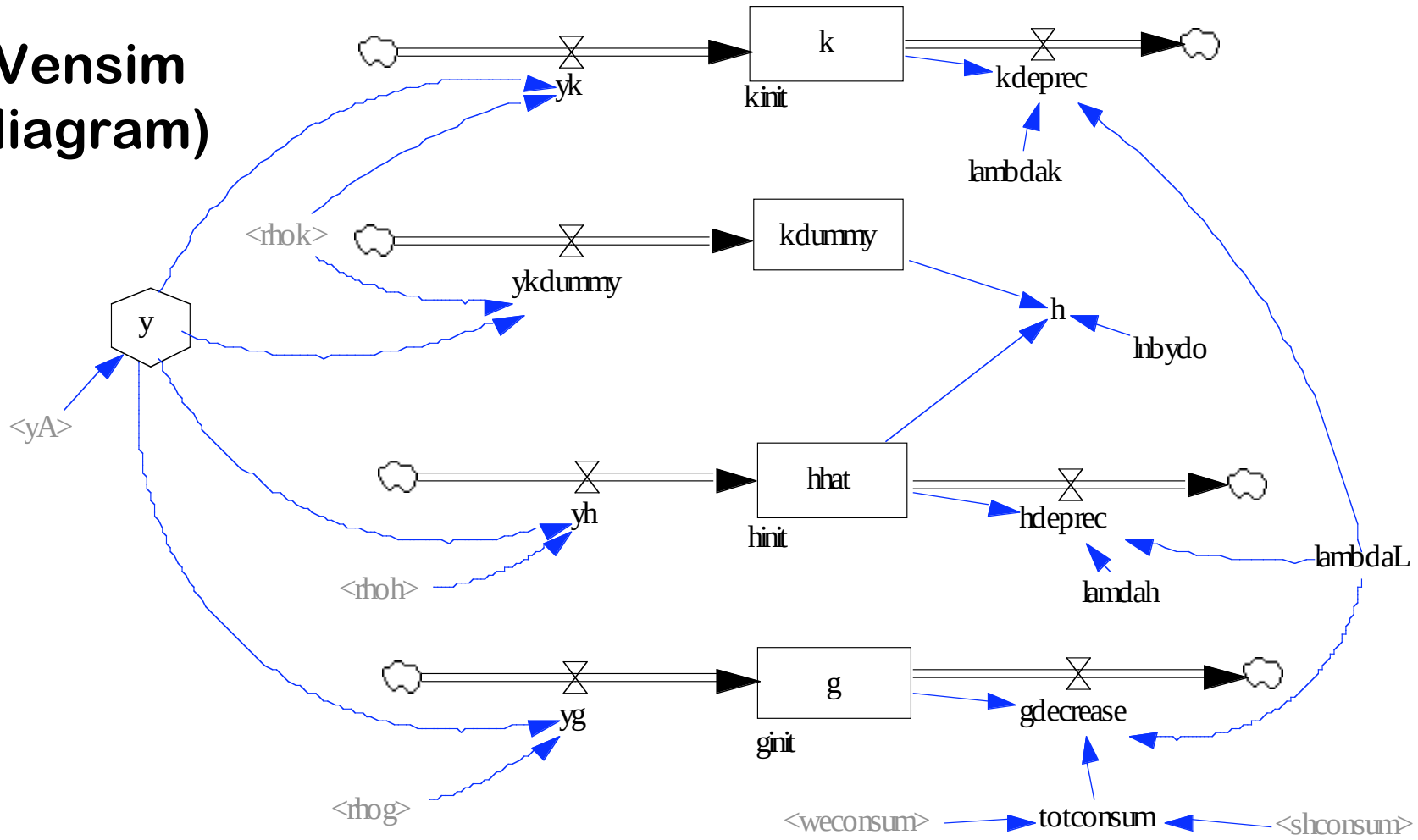
Apply modern software tools based on graphical representation of dynamic feedback processes (e.g. Stella or Vensim)

The “real economy”: Production output in physical units

(Vensim diagram)



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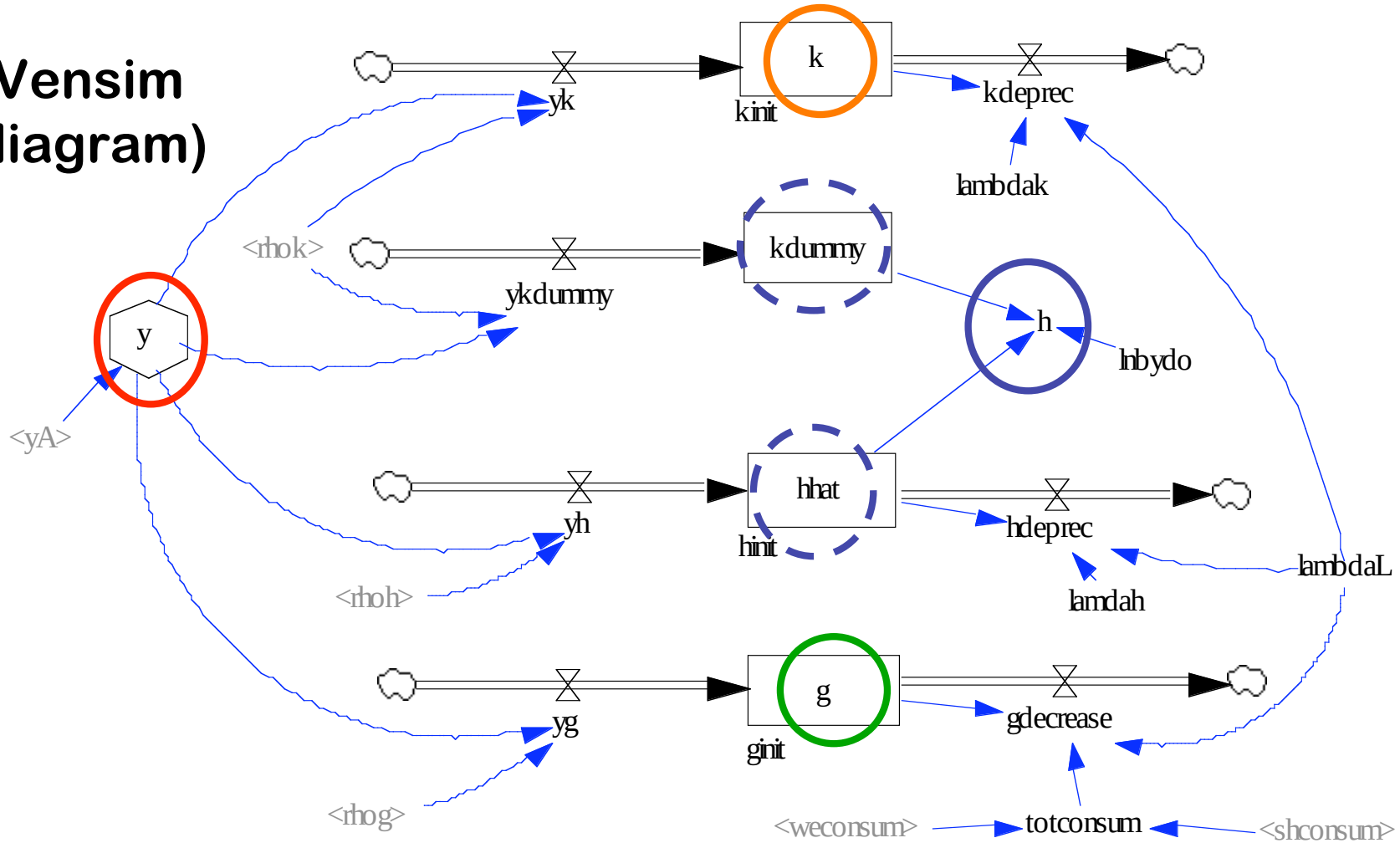
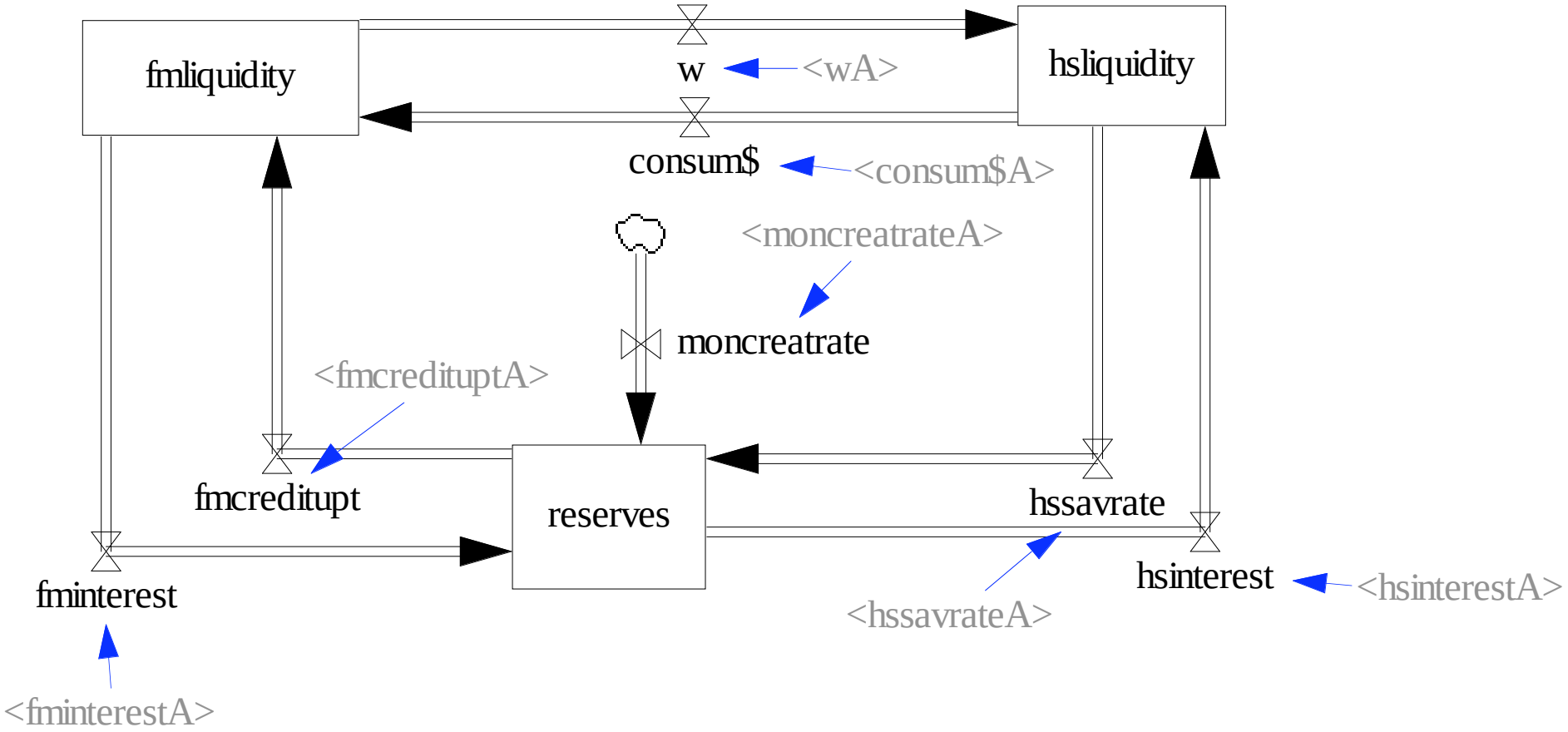


y: total production, invested in:

- k: physical capital
- h: human capital
- g: consumer goods and services

The “virtual economy” (financial system): money circulation between firms, banks and households



And: apply Occam's razor:

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Example: how should one balance the current-account surpluses of countries like China, Japan and Germany?

Economist,
8-14 August 2009:

Shift production from exports to domestic consumption (standard main-stream answer).

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From the viewpoint of climate policy:
short-sighted!

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Appropriate response:
shift production to renewable energy technologies!

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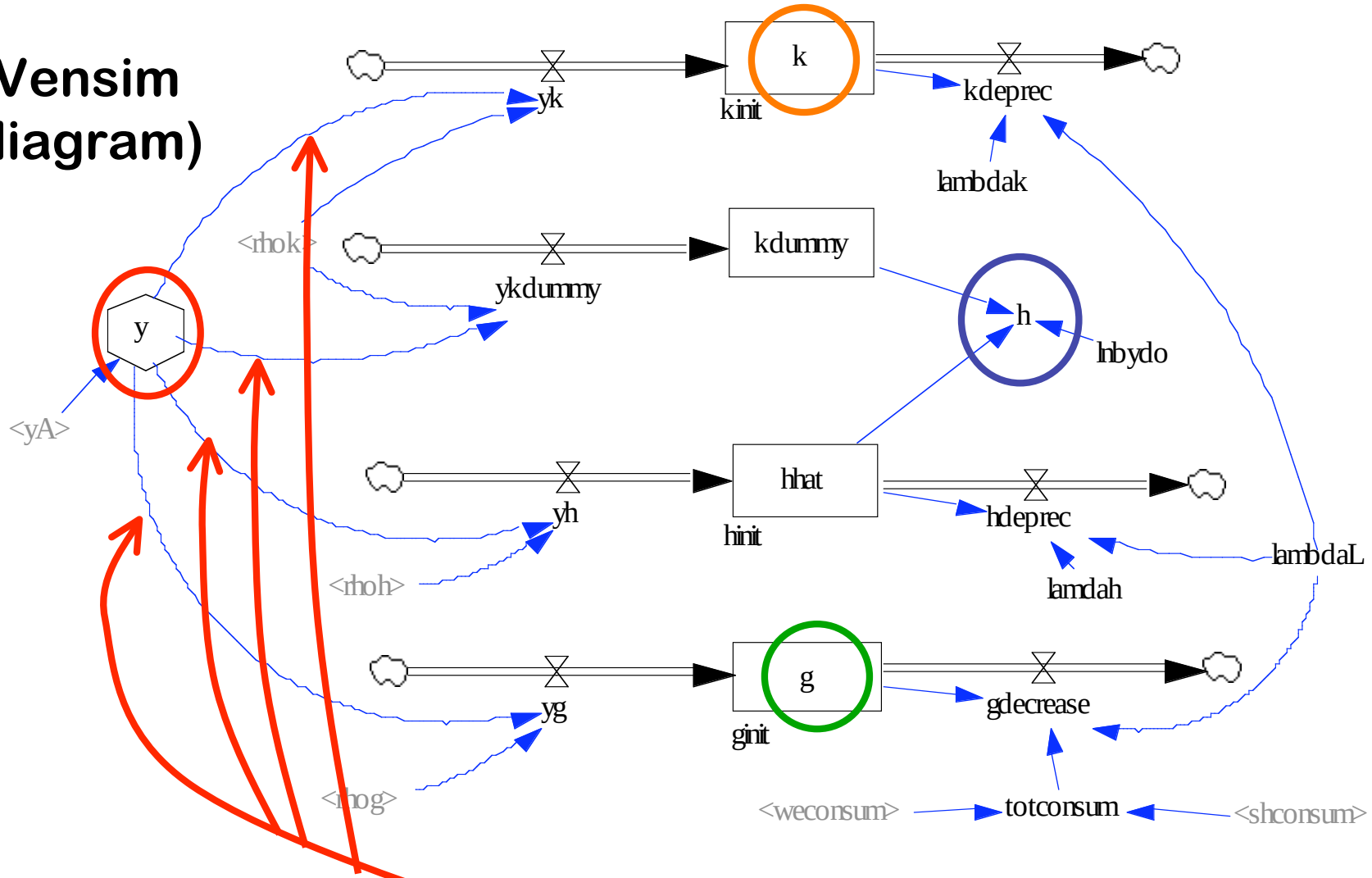
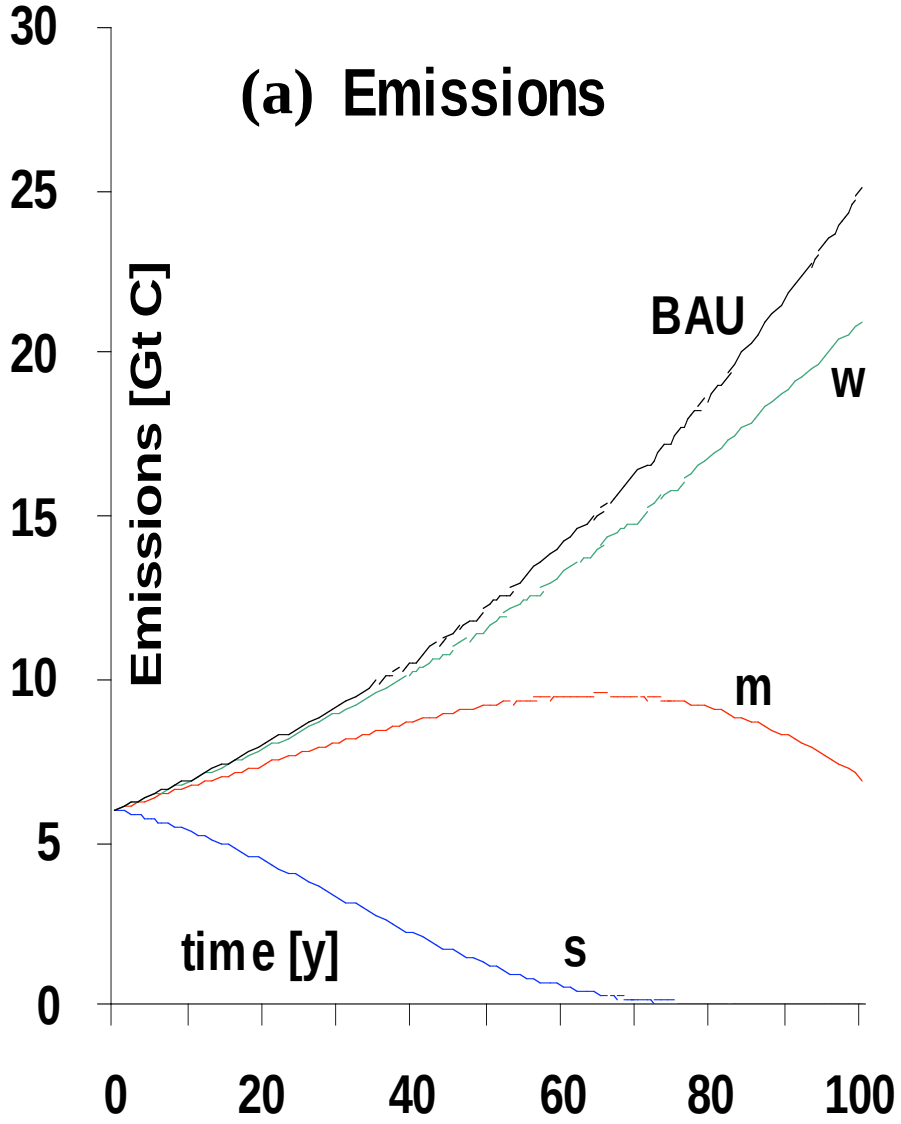
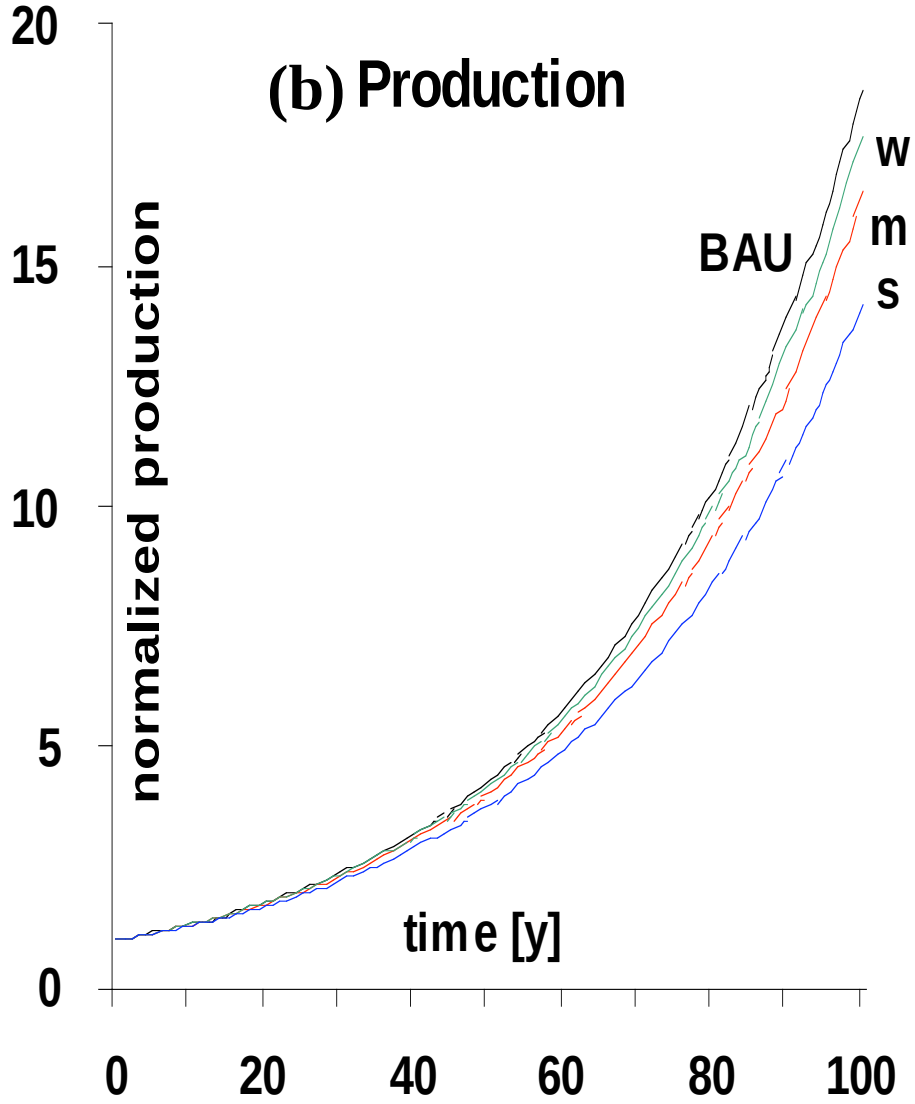


Balancing the current-account surplus: apply climate policy instruments to shift production streams from exports to renewables (maintaining level of domestic consumption).

Model M3.0.

mitigation measures: w: weak, m: moderate, s: strong





Estimates of the costs of climate change mitigation:

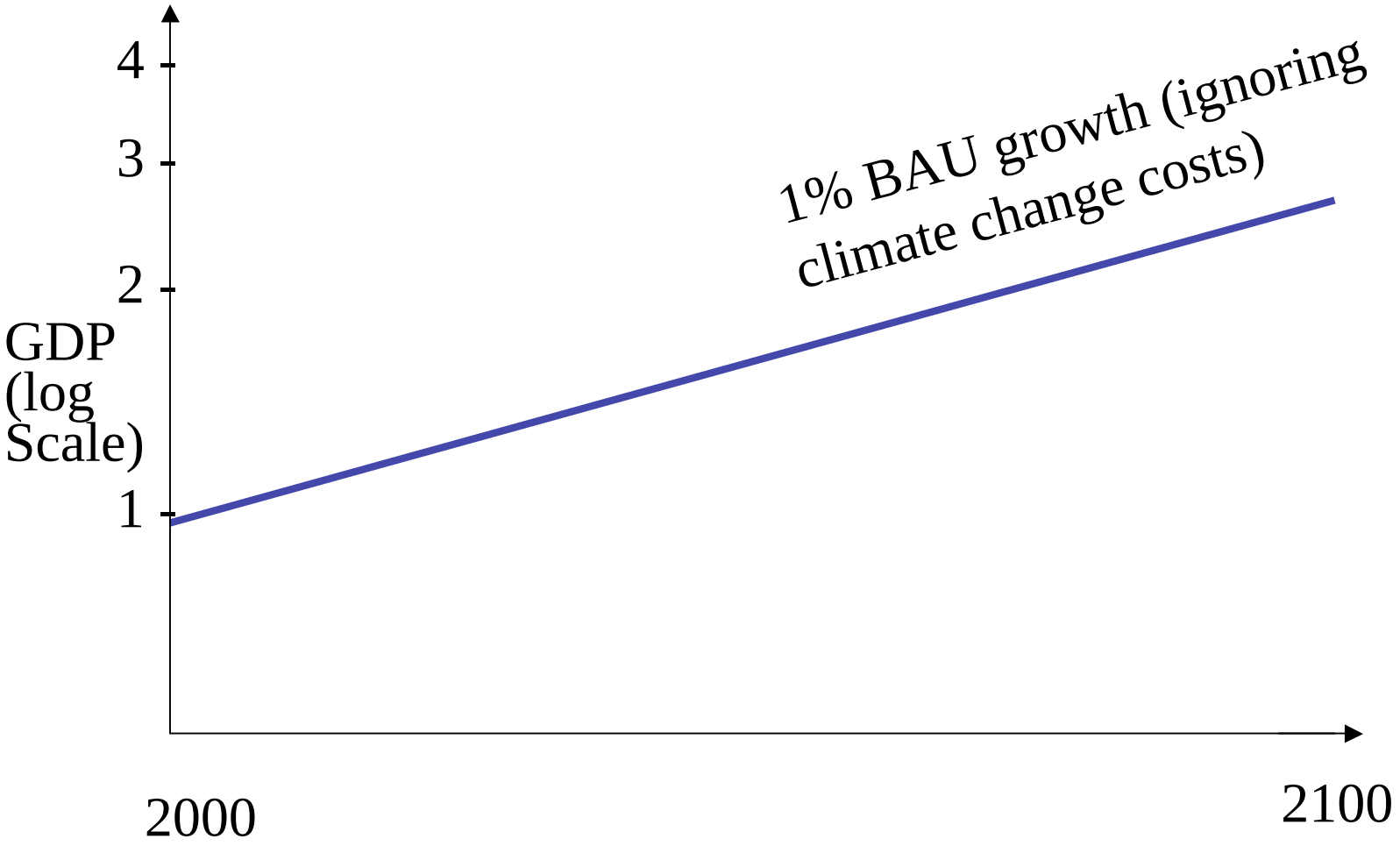
1 % of GDP

Consistent with: IPCC 4th Assessment Report; macro-economic model intercomparison, The Energy Journal, Special Issue, 2006; the Stern Review, 2006).

Range of other estimates:

-1 % to + 4% of GDP

Is climate change mitigation affordable?



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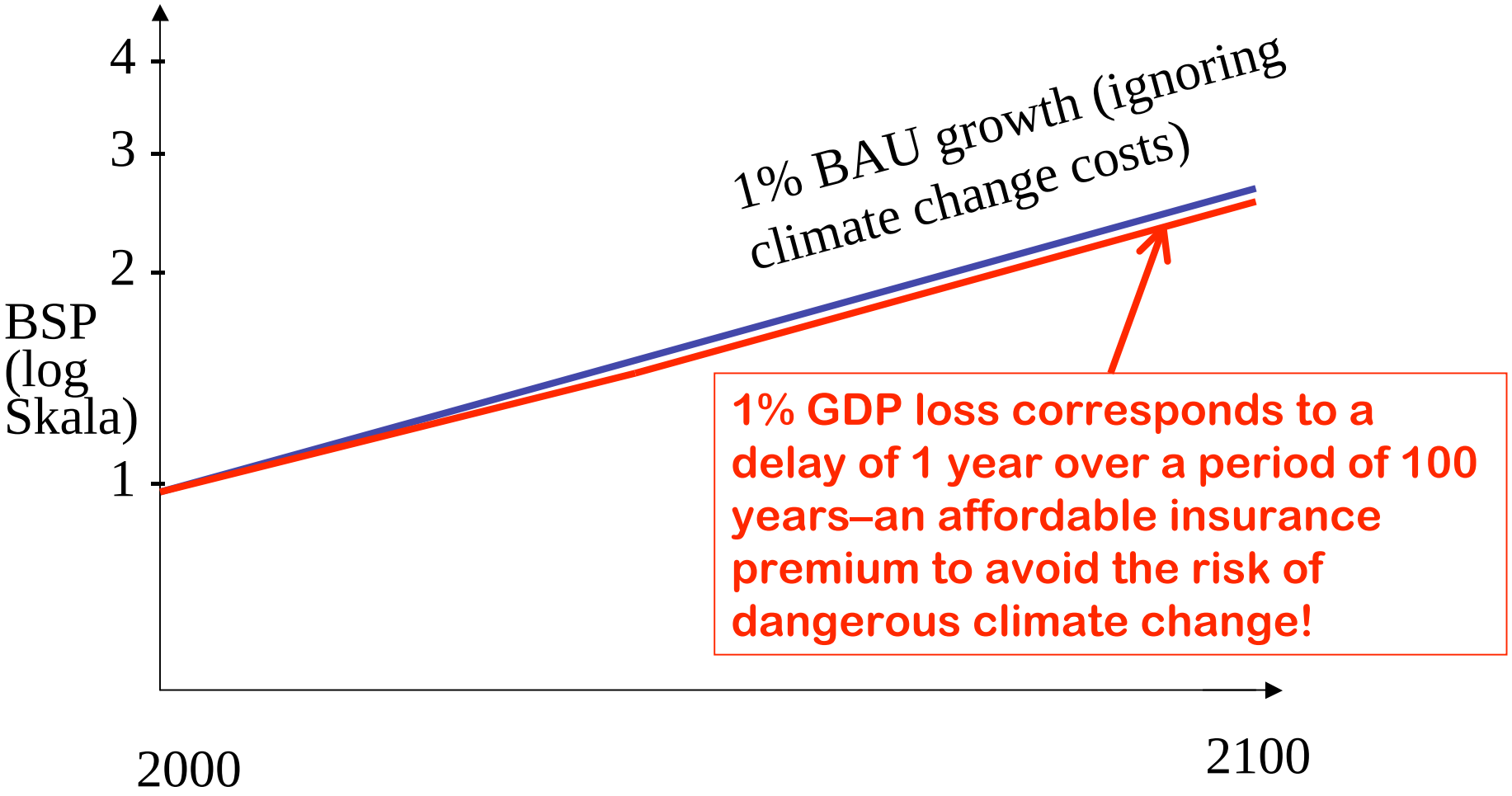

Challenge for global climate policy: arrive at an equitable international agreement structured on a combination on the four basic instruments:

1. carbon price
2. subsidies
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