Tyndall°Centre
for Climate Change Research

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Adaptation and Mitigation Strategies:
Supporting European Climate Policy

The new research agenda for climate modelling:

towards AR5 and after the "21C Greater Depression"

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"How can climate policy models shape real decisions?
From the best use of state-of-the-art to a new research agenda"
IDDRI and CIRED, Paris, March 25, 2009

AR4 WG3 and towards AR5: revealed research gaps

1. No integration of large-scale or even intermediate- scale climate models and E3 models
2. Insufficient studies of stringent mitigation (<450ppmv CO2-eq) to draw reliable conclusions
3. Inadequate treatment of the risks of climate change, adaptation and mitigation
   - Conversion of risk to certainty-equivalence in many models
4. Lack of treatment of robustness in results to changes in the baseline, e.g. for a global depression
5. No integration of air-pollution-reduction and other co-benefits, such as energy security and

1. More integration

- Gradual time-consuming process, but worth promoting
- Software systems being developed to run models remotely and utilize web computing power
- Coupled E3-atmospheric-pollution modelling being developed

2. “New engineering” – an economist’s view of new modelling for decarbonisation (1)

- Problem: how to decarbonise whole systems at lowest costs as soon as possible
- A trade-off between doing a good job and doing it even faster
- Conditions
  - Technologies being developed (e.g. CCS, electric vehicles, expert systems)
  - Relative prices (oil, carbon) changing
  - Policies being discussed
  - Inertia in human and physical systems

2. “New engineering” – an economist’s view of new modelling for decarbonisation (2)

- Problem separable into interacting engineered systems
  - Electricity, vehicles, dwellings, offices, steel, cement, etc
  - Can be decarbonised, but a fit required
- Enabling structures and networks
  - Direct current grid
  - Reliable and sustained global carbon prices
  - Global technological agreements and standards

3. Risk analysis: "The economics of climate change is shaped by the science." Stern, 2007, p.1

- The science and the politics ("dangerous") both emphasise that the problem is one of risk and uncertainty – the economics is increasingly following the science
- The Stern Review changed the terms of the economics debate by not using traditional cost-benefit analysis for climate change assessment, but developing an uncertainty analysis
- It gives a separate assessment of costs of climate change (5 to 20% global GDP) and costs of mitigation (-1 to +3.5% GDP)
- Message: the costs of doing nothing far outweigh costs of mitigation - therefore act urgently
- Compare this with the message from cost-benefit analysis:
  - Nordhaus "optimal" temperature increase above pre-industrial is at least about 3.7ºC, requiring a very low carbon tax (c \$20/tCO_2 or less by 2050 (2002, p.197)
  - but such "optimal" temperature rises ignore the unquantifiable risks of catastrophe

3. Why a risk analysis?

- Risks are different for climate change, adaptation and mitigation
  - for countries and time periods
  - outcomes are not smooth, but can be abrupt and irreversible
  - risks can be asymmetrical: (unbounded?) risks of higher rather than lower temperatures and sea level rise
- There are possibilities of catastrophe (IPCC WG1 Box 10.2: approx. 3% probability of climate sensitivity leading to > 8ºC).
  - conventional cost-benefit analysis is "*especially and unusually* misleading" (Wietzman, 2007)
  - and a sea level rise of several meters over this century cannot be ruled out (Hansen *et al*, 2008)
- Assets such as the Amazon rainforest or coral reefs cannot be substituted by money, partly because their loss is effectively irreversible
- Economic assessment should cover both costs & benefits *and* such risks

4. The baseline:

The Big Crunch changes everything

- With the bankruptcy of Lehman Brothers (15/09/08), the global money stock was abruptly reduced by an unknown amount
- Many if not all banks with substantial exposure to “toxic” debt may now be insolvent
- The crisis became apparent when banks ceased to trust one another in summer of 2007, but has been concealed by creative accounting and failure to value assets at realizable values
- The crisis is one of international money: the banks have been creating new forms of money that are now seen to have a highly uncertain worth, i.e. “bad money”
- The Fed’s failing solutions:
  - 19/09/08: exchange the bad money for good government-backed money, then gradually liquidate the underlying debt
  - 12/11/08: abandon plans to buy toxic assets in favour of recapitalisation
  - March 2009: quantitative easing – printing money, with unknown risks
  - And now offsetting private risks of buying toxic debt with public money

The Big Crunch changes everything: economic activity is based on trust, and trust in money has gone

- Trust underlies our use of money
- Private banks lost some of our trust
- No trust = no banking
- No banking means no bank loans for real investment (or consumption)
- The Big Crunch = global financial catastrophe
  - Non-linear event with extreme outcomes
  - Unprecedented in economic history in its scale
  - Unlike the tulip mania or South Sea Bubble, it is not primarily based on speculation, but on banks creating money
  - The bail-outs deepen and prolong the depression

The Big Crunch: implications for climate policy

- The period of the creation of the bad money has seen a massive mis-allocation of investment funds towards the financial services
- The real investments supported by these services and the incomes from them (buildings, luxury goods etc) will stop and engender a global recession
- The gap in global effective demand could be closed by a massive effort to invest in decarbonising the real economy, but requires
  - Recognition of the opportunity
  - Rapid development and deployment of mitigation policies aimed at raising investment especially where real resources are becoming unemployed (construction, vehicle manufacture)

Post-AR4 WG3: current research opportunities

- Employment-creation via a global “Green New Deal” aimed at defossilizing the global economy

E3MG modelling of the crisis and solutions
A. Trend projections (no financial crisis)

- World economy as it was projected by 4CMR in 2007 before the effects of the banking crisis became clear
- GDP growth about 3.4%pa, UK about 2.5%pa
- Global CO_2 emissions set to rise to dangerous levels

B. The crisis with current policy responses

- Banks cut own investment, encourage saving and restrict lending
- Interest rates fall towards zero
- Savings rates revert back to normal in USA, UK etc over the next 3 years
- Investment is reduced by all sectors in response to uncertainty about future prices
- Fiscal stimulus packages are introduced according to Government announcements (as collated by IMF, HSBC papers)

C. The solution: a seven-point plan

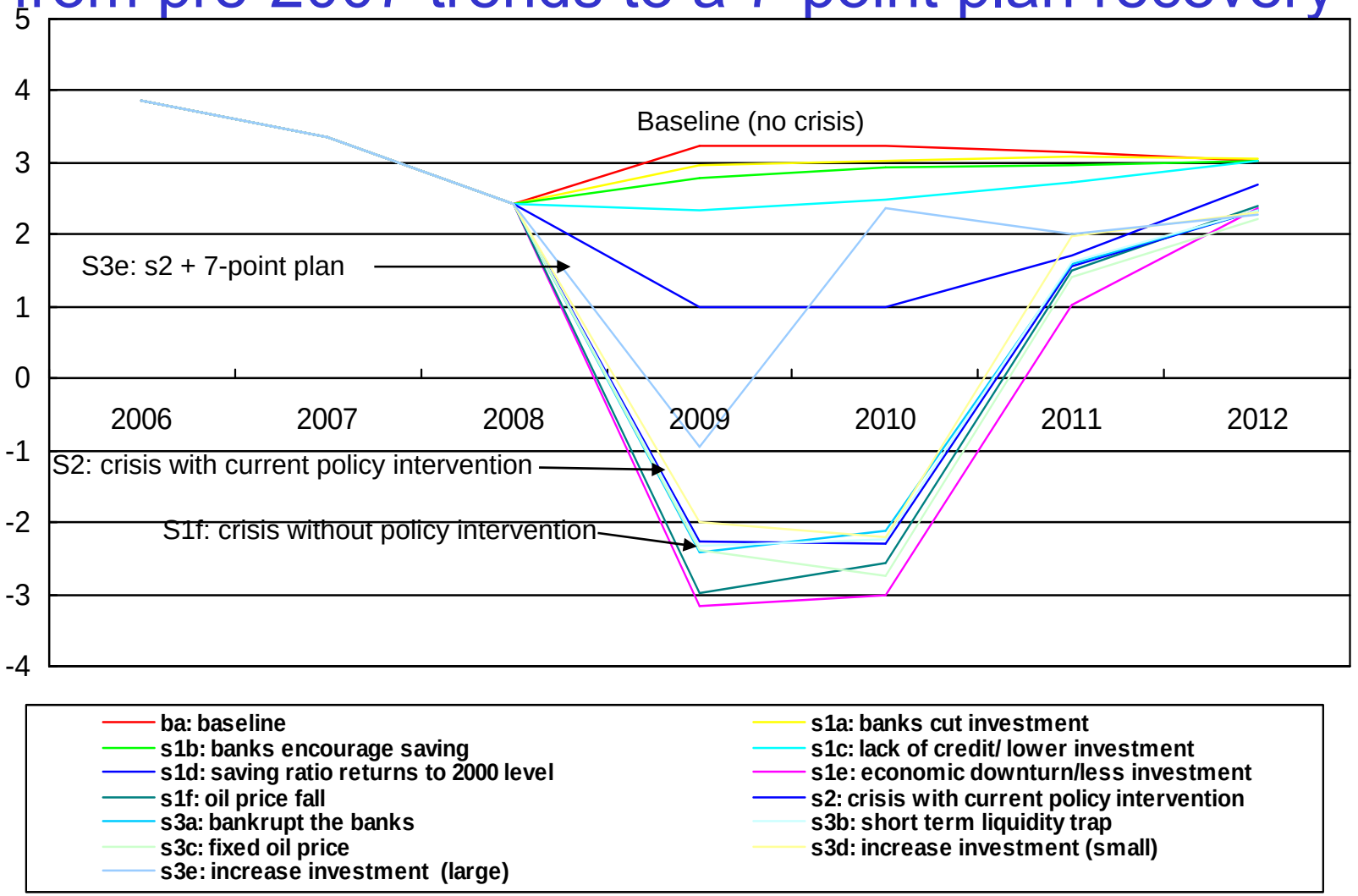
1) Allow markets to work and bankrupt bad banks, whilst maintaining their institutional knowledge.
2) Co-ordinate an global interest-rate cut to zero.
3) Temporarily (for 5 years?) fix exchange rates (implement capital controls) and fix key international prices (e.g. carbon, coal, oil, gas).
4) Consolidate the bad debt into regional banks.
5) Reflate via an agreed global investment plan, supported by the good banks and scaled to maintain effective demand.
6) Reduce the risks of regulatory capture by a global regulatory authority having the power to “name and

5) Reflate via a global investment plan

- Investment (starting with a “Green New Deal”) should be justified by cost-benefit analysis, allowing for all risks.
- This is the opportunity to accelerate the decarbonisation of all economies
- The programme should be co-ordinated on a global, macro scale but tailored by governments to regional needs and conditions.
- Investment backed by good banks may restore banks and the “real” economy

World GDP growth (%pa) as modelled by the 4CMR project:

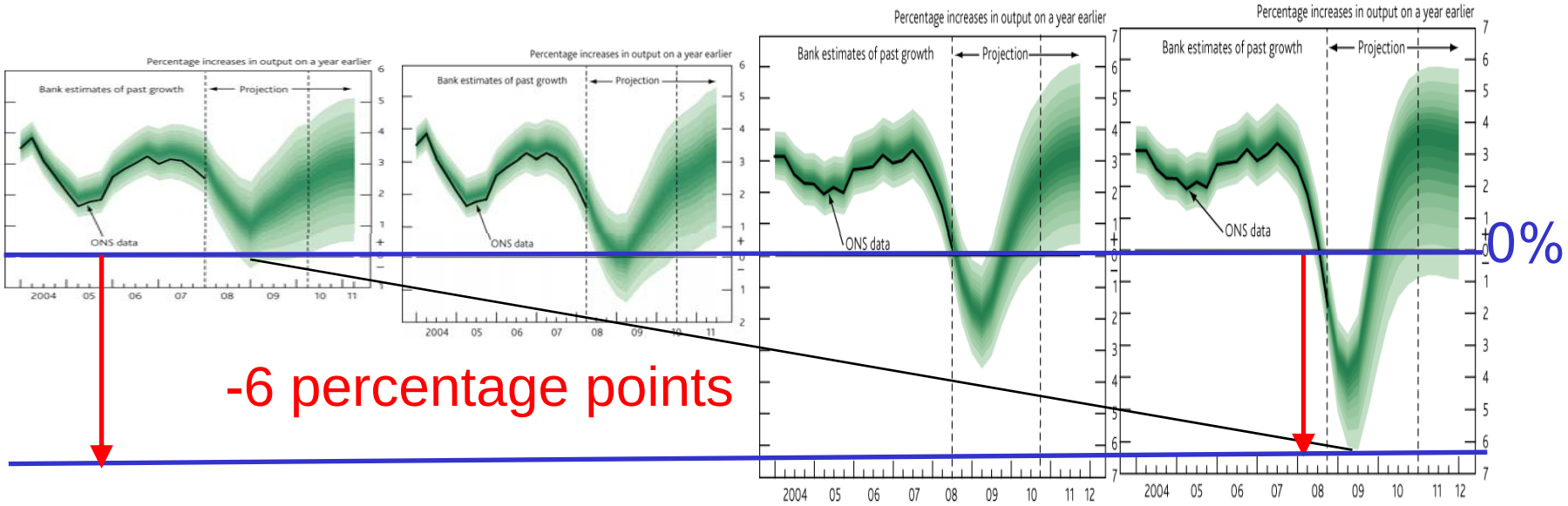
from pre-2007 trends to a 7-point plan recovery



Source: E3MG, January/February 2009. Note policies are as announced by end January 2009.

Bank of England's Inflation Report

May 2008	August 2008	November 2008	February 2009
Jan09	March09	March09	June09
7 months	7 months	4 months	4 months
-0.5%pa	-1.5%pa	-3.5%pa	-6%pa



turning point date

months after forecast

lowest growth rate

Interpretation and conclusions

- Due to the unprecedented nature of the crisis and its rapid progression, the forecasting community has difficulty catching up
  - Forecasts for 2009 are being rapidly revised downwards as we speak
  - 2010 is largely projected as a return to “normal growth”, but there appears to be little basis for this from new theory
  - Equilibrium economics contributes to the forecasts, not in the models (since these are unsuited to short-term projections), but in the expectation by traditional economists that the recovery will come in perhaps 7 to 4 months from the date of their forecast – what evidence is there for this?
  - Unemployment is expected to rise, but the lags in forecasting seem longer, and the rise seems more difficult to reverse (hysteresis effects)
- Projections are much more than usual contingent on national and global policy responses, which are changing by the month, and, with a global liquidity trap, a greater 21^{C} Depression seems likely but is not yet in 4CMR projections
- A coordinated global reflation-market fix (led by a “Green New Deal”) could return to normal by 2011 (2010 now too late) but present policies may lead to years of decline