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Growth-Driving Science and Technology as the Ultimate Deus-Ex-Machina for Policymaking

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Growth-Driving Science and Technology

Structure of Talk

- Deus-ex-machina?
- Growth driving?
  - Is it?
  - Should it be?
- Making the marriage work
  - What role for science?
  - What Science?

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- Can Economies Grow Continuously?
  - National Income (Net National Product, NNP)
  - Per Capita National Income (Net National Product, NNP)
- What Are Ultimate Sources of Growth?
  - Capital Accumulation
  - Population Growth
  - Technical Progress:
    - better production processes – higher productivity
    - better products – higher real incomes (may not show up in GNP)

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- Exogenous Growth Theory: Solow-Swan Growth Model
  - Capital Accumulation Affects Rate of Growth only in Short Run
  - Long-Run Rate of Growth of NNP affected by:
    - Population Growth
    - Technical Progress
  - Growth of Per capita NNP affected only by
    - Technical Progress:
- Technical Progress Exogenous – Deus Ex Machina

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- Endogenous growth
  - Rate of technical progress – and hence rate of growth – arises from decisions made about resources devoted to creation, dissemination and adoption of knowledge embodied in new products and processes
    - Research & Development
    - Education & Skill creation
  - Interest is in the factors/incentives influencing these decisions
  - In particular big role for policy

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- S&T Policy:
  - Stems from public good nature of knowledge
    - Expensive to produce but almost costless to disseminate widely
  - Market failure – in absence of intervention not enough incentive to create knowledge, so very significant underinvestment

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- Organise Science and Technology differently
  - Science (fundamental research):
    - Public funding – through research and teaching;
    - Publish results;
    - Priority is major incentive (Nobel Prizes)
  - Technology (applied research)
    - Privately funded
    - IP protected through patents, secrecy etc.
    - Profits are reward/incentive
- Science provides “science base” for technology
- BUT less focus on what science, what technology

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- However still market failures and many policy issues of interest to academics:
  - Length and breadth of patents;
  - How tough should patents be;
  - Should companies be compelled to license
- Also interesting shift:
  - Companies moving to open source
  - Universities seeking greater protection of IP
    - Should fundamental research be patented?
    - Should companies become more open?
- Directing science
  - Emphasis on Impact

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- Bottom line is
  - Science & Technology is growth-driving
  - But NOT deus-ex-machina
  - Promoting growth is major policy objective
  - So policies towards S&T matter
  - BUT essentially just create right environment and let S&T get on with it

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- However two challenges to the view that promoting growth is feasible or desirable
  - Green Considerations:
    - Finite Non-renewable resources and/or environmental problems – e.g. global warming
    - May mean that sustainable growth unachievable
  - Social considerations:
    - Other Policy objectives – e.g. fairness
    - Rising per-capita NNP doesn't make people feel better off
    - May face trade-off
- Lead to somewhat different role for S&T in order for marriage to work

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- Non-Renewable resources
  - While it is no-longer inevitable that economies can sustain positive growth in the long-run, it is still possible, provided sufficient resources are devoted to S&T to offset declining resources
  - This is true even if we recognise that the degree of substitutability between different types of capital – natural, physical, intellectual – is difficult to estimate with precision but probably low and also if we recognise that individuals derive benefit from both the consumption of physical goods as well as various ecological services

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- Environmental concerns
  - Conditions for economies to be able to sustain growth in long-run are more stringent – people need to be willing to give up physical consumption in order to sustain future growth indefinitely
- These two green issues have three common conclusions.
  1. S&T is a sufficient condition for sustainable long-run growth – but no longer necessary.
  2. However some part of S&T will have to be directed towards finding new greener technologies and products

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3. In order to help policy-makers understand the trade-offs and focus on policies that drive the "right" measure of performance, the relevant concept of NNP that we should be looking at is one that measures:
   - Consumption +
   - Accumulation of Physical Capital +
   - Increase in intellectual capital (measuring new knowledge when discoveries are made) –
   - Reduction in stocks of non-renewable resources -
   - Reductions in "environmental quality"
   - Conventional measures of NNP take account of just first 2
   - Last two help produce a measure of what is called "Green National Income"

- Turning the abstract principles into practical measures that are statistically reliable is major policy challenge

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- Key Differences between Non-Renewable Issues and Environmental Concerns
- To extent non-renewable resources are traded on competitive markets can use market prices to value the changing stocks that should enter Green NNP calculations
- The anticipated rising price of these resources will provide incentives to undertake S&T that produces technologies that are less dependent on the on-renewable resources.

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- In case of environmental issues the prices that could in principle both give good incentives for S&T AND correct NNP measures (and so give good measures of policy performance) are policy-induced – emissions tax or price of tradeable emission permits.
- For some environmental issues there is the political will and ability to implement these policies
- However for issues such as climate change there are very considerable policy challenges
- This issue illustrates challenges of making marriage work

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- Features of climate change:
  - Global pollutant – all contribute and all will be affected
  - But big differences across countries in relative extent to which they contribute and are affected
  - Major source of emissions – energy production -affects virtually all economic activity
  - Inter-temporal pollutant – cumulative stock of emissions that matters.
  - Significant uncertainties – about whether happening and what likely damages will be

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- Policy Challenges
  - Co-ordinated international action; hard to get agreement on sharing burdens fairly – across countries and time
  - Also need to co-ordinate across time - Commitment to future policies - to give incentives for S&T to develop alternative technologies
  - Key role for S&T in shaping understanding of what is happening and communicating to electorates in terms of impact on human lives

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- Policy challenge to economists and other social scientists to design mechanisms to deliver these outcomes
- AND need to win political agreement by electorate
  - Important role for Science in gaining public trust regarding evidence. Essentially need to guarantee it IS rational
  - Know from experiments individuals care about fairness and about welfare of others. Need to understand how to harness this, and communicate it.
  - But also how to handle the still considerable uncertainties
  - Make it matter
- Stern Review

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- Social Issues
- Promoting growth may result in rising inequality – but not inevitable.
- As with Green issues challenge is to find ways of translating concern with fairness into incentives to do the “right” S&T
- E.g. Design clever mechanisms to ensure that drugs are developed and distributed to poor in developing countries

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- Conclusions
  - S&T has key role to play but more than just as rather passive discoverer of new technologies as is often depicted in much of thinking about growth
  - Huge challenge to social/behavioural sciences to design policies, institutions and mechanisms that will generate incentives that steer S&T in "right" direction
  - S&T Key role to play in shaping understanding
    - In part by working within institutional frameworks that help ensure it IS rational and perceived to be so
    - In part by working with other sciences concerned with human behaviour to help communicate findings in way that harnesses human concern with fairness and welfare of others to activate policy