Expert Elicitation of Long Run Economic Growth

Modeling Uncertainty Project

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July 29, 2013
Outline

1. Research Question
2. Motivation
3. Uncertainty in Long Run Growth
4. Expert Elicitation Protocol
5. Timeline and Feedback
Primary Question

How can we construct a pdf for long run economic growth?

1. What information and estimates are currently available?
2. What are the important dimensions of uncertainty?
3. How should we think about dependence?
Why Uncertainty in Economic Growth?

- Productivity growth is a critical determinant of emissions and the SCC

- PAGE (Hope 2006)
  - increase in year 2000 global GDP from PAGE95 to ($33.3 trillion US) to PAGE2002 ($43.6 trillion US) lead to an 82% rise in mean marginal impact of CO₂

- DICE (Nordhaus 2007)
  - a 2-sigma increase in g(TFP) is associated with a 163% increase in global CO₂ emissions in 2100
  - a 2-sigma increase in productivity growth g(TFP) is associated with a greater than 70% increase in the social cost of carbon
Existing Estimates of Long Run Growth Rates

1. European Union - “2050 Global Europe”
   - scenario approach

2. PwC: “World in 2050”

3. HSBC: “World in 2050”

4. Goldman: 'Dreaming With BRICs: The Path to 2050’
Existing Work on Uncertainty

1 known survey: Nordhaus 1995 (unpublished)

- Sent to 7 experts (economists in research institutions)
- Elicits estimates of per capita GDP (PPP)
  1. experts report rates or magnitudes
  2. 4 periods
     - 1990-2025
     - 2025-2050
     - 2050-2100
     - 2100-2200
What did we learn?

1. Experts may prefer to think in terms of rates rather than levels
2. Precise definitions
3. Estimates beyond 2100?
4. Compression at zero
5. Outliers may be important

Table: Deviations across Quartiles

<table>
<thead>
<tr>
<th></th>
<th>mean</th>
<th>sd</th>
</tr>
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<tbody>
<tr>
<td>Q1</td>
<td>1.332031</td>
<td>.702503</td>
</tr>
<tr>
<td>median</td>
<td>2.20016</td>
<td>1.464048</td>
</tr>
<tr>
<td>Q3</td>
<td>3.078125</td>
<td>1.332533</td>
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</tbody>
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World Growth Rates

The diagram shows the estimated growth rates (GDP per capita, PPP) for different time periods: 1990−2025, 2025−2050, 2050−2100, and 2100−2200. The growth rates are represented by box plots with quartiles Q1, Q2 (median), and Q3, with upper and lower bounds indicated by error bars. The growth rates are categorized into Q1 (25%), Q2 (median), and Q3 (75%).

- **1990−2025**: Growth rates are generally lower and more consistent across quartiles.
- **2025−2050**: There is a slight increase in growth rates compared to the previous period, with Q2 and Q3 showing higher values.
- **2050−2100**: The growth rates continue to rise, with Q3 showing the highest values.
- **2100−2200**: Growth rates stabilize, with Q2 remaining the median and Q3 showing slight increases over Q2.
Regional Growth

- China
- EU
- Japan
- USA

Estimated growth rate (GDP per capita, PPP)

Graphs by region

Q1 – 25%
Q2 – median
Q3 – 75%
5 Objectives of the Protocol Design

1. Maximize Response Rate
2. Ensure Clarity
3. Focus on Useful Information
4. Incorporate Dependence
5. Incorporate Heterogeneity in Expertise
Objective 1: Maximize Response Rate

1. Parsimony: 4 questions

2. Administered electronically or by mail

3. Potential Sample
   - Experts on Growth (regionally stratified)
   - Experts on Trade
   - Experts on Development (Yale Growth Center)
   - IAM Modeling Community
   - IGM Economic Experts Panel (Booth School of Business)
Objective 2: Ensure Clarity

1. Parameter Definition – GDP per capita
   - defined according to IMF (PPP exchange rates)
   - average annual rate

2. Regional Heterogeneity
   - Regional Groupings
     - World
     - United States
     - China
     - High Income (including US)
       - >$30,000 per year
     - Middle Income (including China and India)
       - $2,000-30,000 per year
     - Low Income:
       - <$2,000 per year

3. Definition of regions in elicitation protocol
   - Aggregated by IMF per capita GDP (2007, PPP exchange rates)
     - shares of global GDP provided
     - list of countries provided
Objective 3: Focus on Useful Information

1. Percentiles
   - 25th %ile
   - 50th %ile
   - 75th %ile
   - (10th/90th %iles)

2. Temporal Intervals:
   - 2010-2025
   - 2025-2050
   - 2050-2075
   - 2075-2100
Objective 4: Incorporate Dependence

1. Regional Dependence: Experts are asked to estimate correlations between US growth rate and other regions
   - “Assume US grows at 25th and 75th percentile rates and provide IQR for other regions”

2. Dependence due to common information:
   - experts report use of source materials
Objective 5: Incorporate Heterogeneity in Expertise

1. Predictions about short run growth (2014)

2. Self Reported Measures
   - rank of expertise
   - time to complete survey
Timeline

1. Design
   - February 2013 - Decision to undertake TFP Elicitation
   - April 2013 - Draft #1 of Elicitation

2. Development
   - July 2013: Round #1 Pilot: Graduate Students
   - August 2013: Round #2 Pilot: Broader Research Community
   - Remainder of 2013: Constant Pretesting

3. Deliver
   - Early 2014: Finalize Instrument (digital instrument) and Sample
   - March/April 2014: Administer Elicitation
Thank You