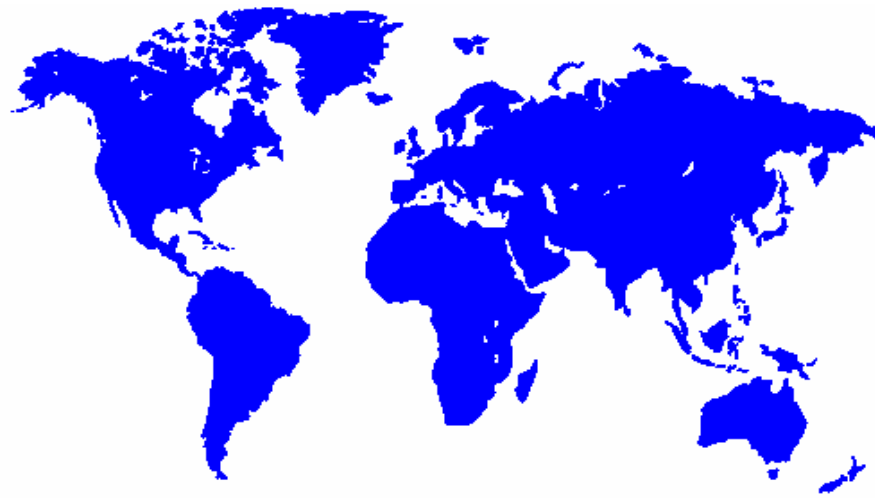
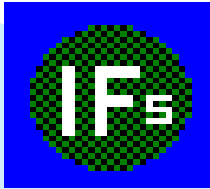


Global Modeling and World Futures



June 2003
Scanning for the Future
Turku, Finland

Barry Hughes
University of Denver



Outline of Discussion

1. Credentials, background
2. What have I have learned about modeling/forecasting?
3. What can we say about the world future?



Credentials: How I got Gray Beard

1. In late 1970s I forecast world oil prices $>$ \$50 in 1970 dollars by 2000.
 - ◆ Underestimated demand-side reactions in energy markets
2. In mid 1980s I was “declinist” with respect to US global role – expected shrinking of U.S. share of global economy as productivity continued to lag behind Japan, Europe.
 - ◆ Underestimated rise of ICT and U.S. leads on a new technological wave.
3. In the early 1990s, I believed that Gorbachev would be revered as founder of Russian democracy, liberator of Russians from totalitarianism.
 - ◆ Underestimated the nationalistic attachment many Russians had to the Russian empire, to the Soviet Union’s role in the world, and to the importance of security and order in their lives.



Credentials: Why I Keep Going

1. In the early 1970s (before the 1973 oil shock) I foresaw that significant U.S. entry into the world oil market put considerable upward pressure on global oil prices
2. In the early 1980s I worked at the Science Center in Berlin and ran the Berlin wall with a friend. We forecast that we would see the fall of the wall in our lifetimes (and agreed to circumnavigate it again then on bicycles, or if necessary in electric wheelchairs).
3. In the late 1990s, I argued that the New Economy had more hype than broad reality and that markets were inflated as a result.



What Have I Learned?

1. Those who live by crystal ball are bound to eat some meals of broken glass.
2. It is hard to forecast even nearly inevitable turning points, particularly the timing of them. (Timing, of course, also helps with failed forecasts: Oil may still reach \$50 dollars; Gorbachev may still be revered; the US relative decline may ultimately come.)
3. Keep looking at trends, relationships and dynamics, key uncertainties, possible surprises, likely timing.



Common Approach to Scanning: Alternative Forecast Horizons

1. Short-term (6 months to 2 years)
2. Mid-range (1-5 years)
3. Long-range (5-15 years +)
4. Longer-range (10-50 years)
5. Major-transitional-range (50-150 years)



Alternative Approach: Differential Certainty of High Importance Developments

1. Almost certain and highly important
2. Uncertain, but of known importance
3. Potentially surprising, controversial and very important



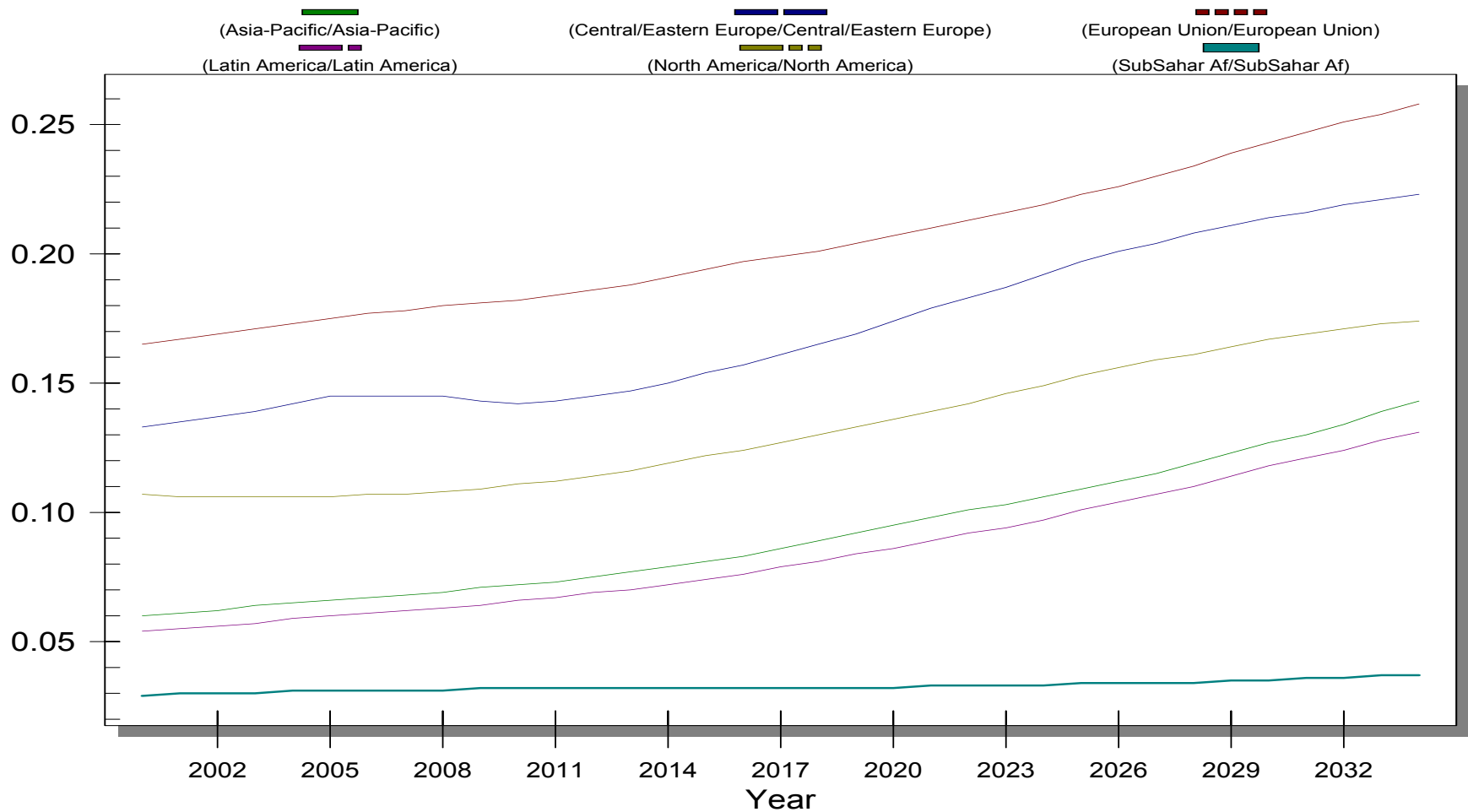
Demographics

1. Almost certain
 - ◆ Aging almost everywhere. Pension crises.
2. Uncertain, known importance
 - ◆ Future fertility in low-fertility countries (1.2? 2.1?)
3. Potentially surprising, controversial
 - ◆ Still in period of demographic dividend
 - ◆ US/European divergence; Chinese/Indian divergence; US/Chinese convergence



Demographic: The Spread of Gray Hair and Waistlines

Population Above 65 Over Total Population

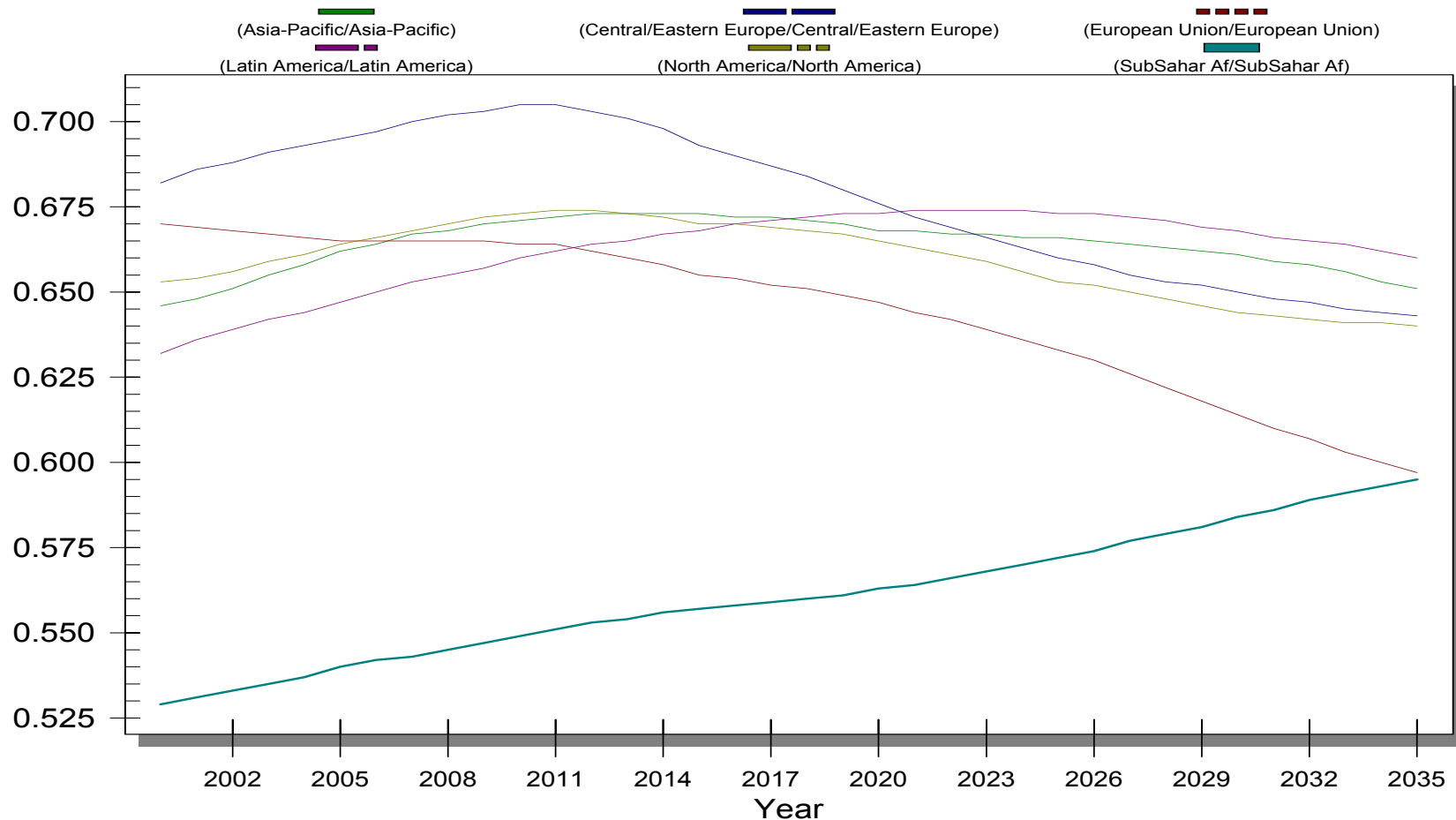


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Demographic: Obtaining Demographic Dividend, but the Center Will Not Hold

Population 15-65 Over Total Population



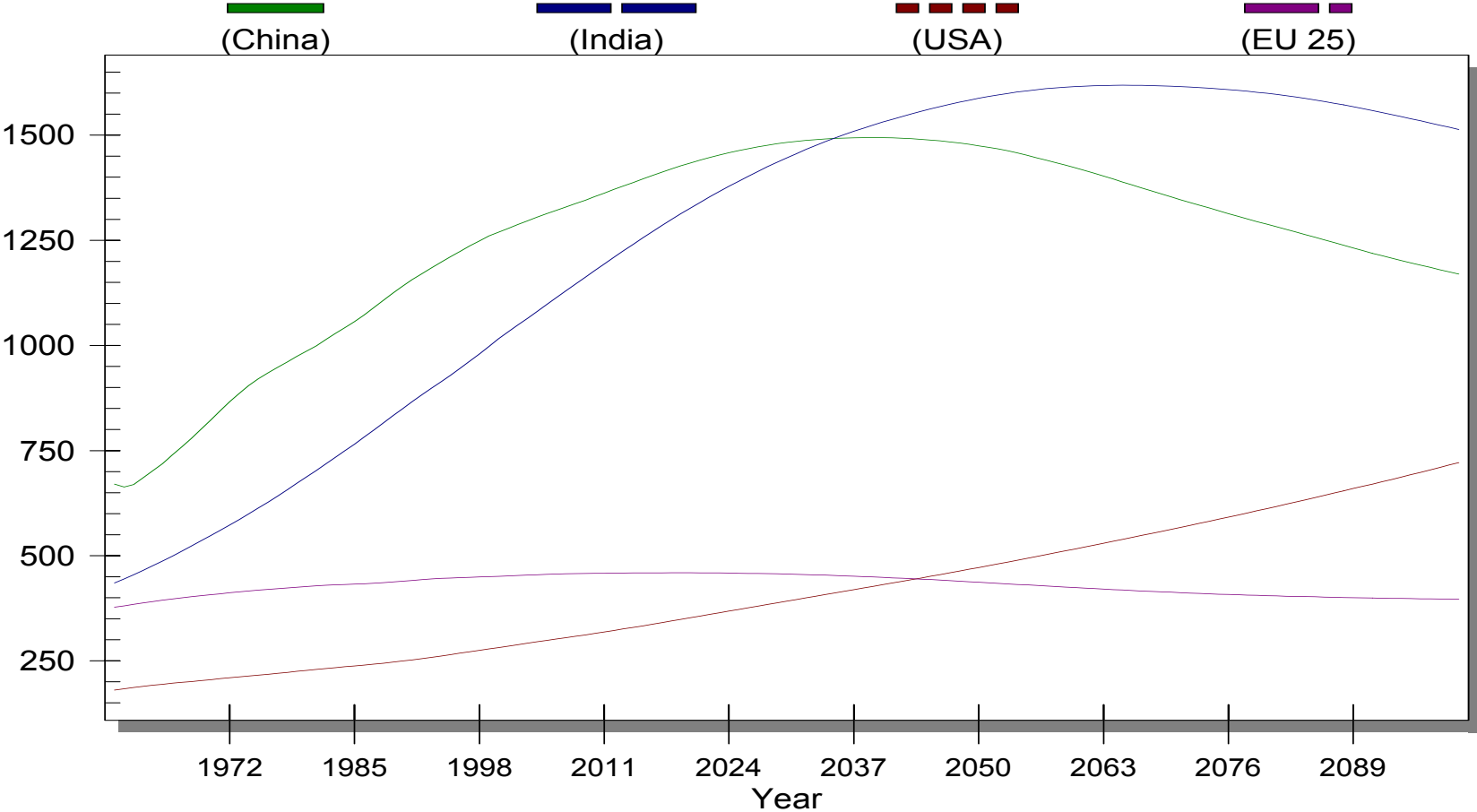
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Demographic: Country Re-alignments

Global Population Futures

Millions



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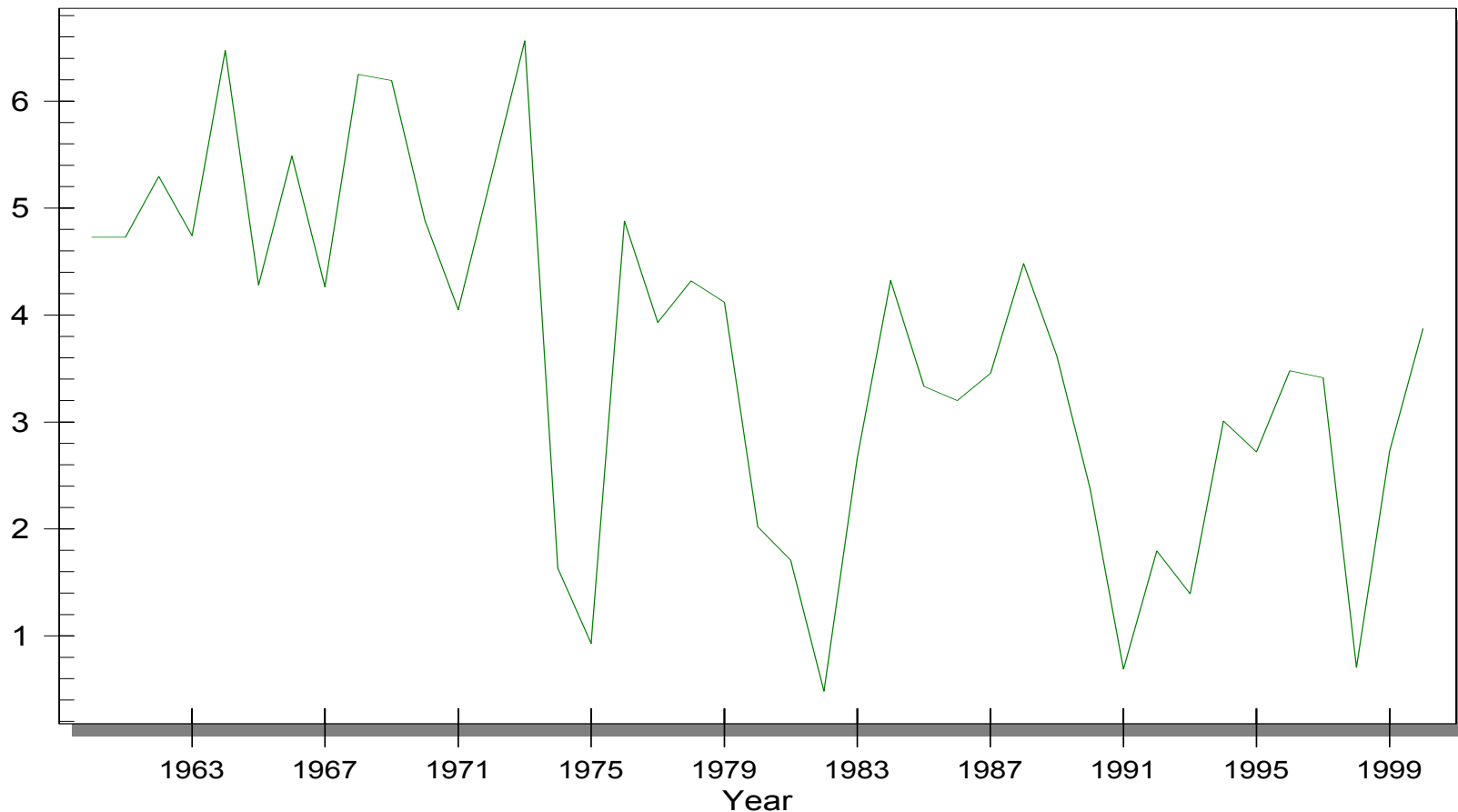
Economics

1. Almost certain
 - ◆ New ICT-based economy and step-up of global growth
2. Uncertain, known importance
 - ◆ Start of next long wave – 4-6 years?
3. Potentially surprising, controversial
 - ◆ N-S gap now decreasing
 - ◆ European technology leadership
 - ◆ Russian Dutch disease



Economic: Historic Global Growth and the End of the Golden Age (far below 4%)

Global Real GDP Growth Rate
Percent per Year



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Economics: The Great Debate

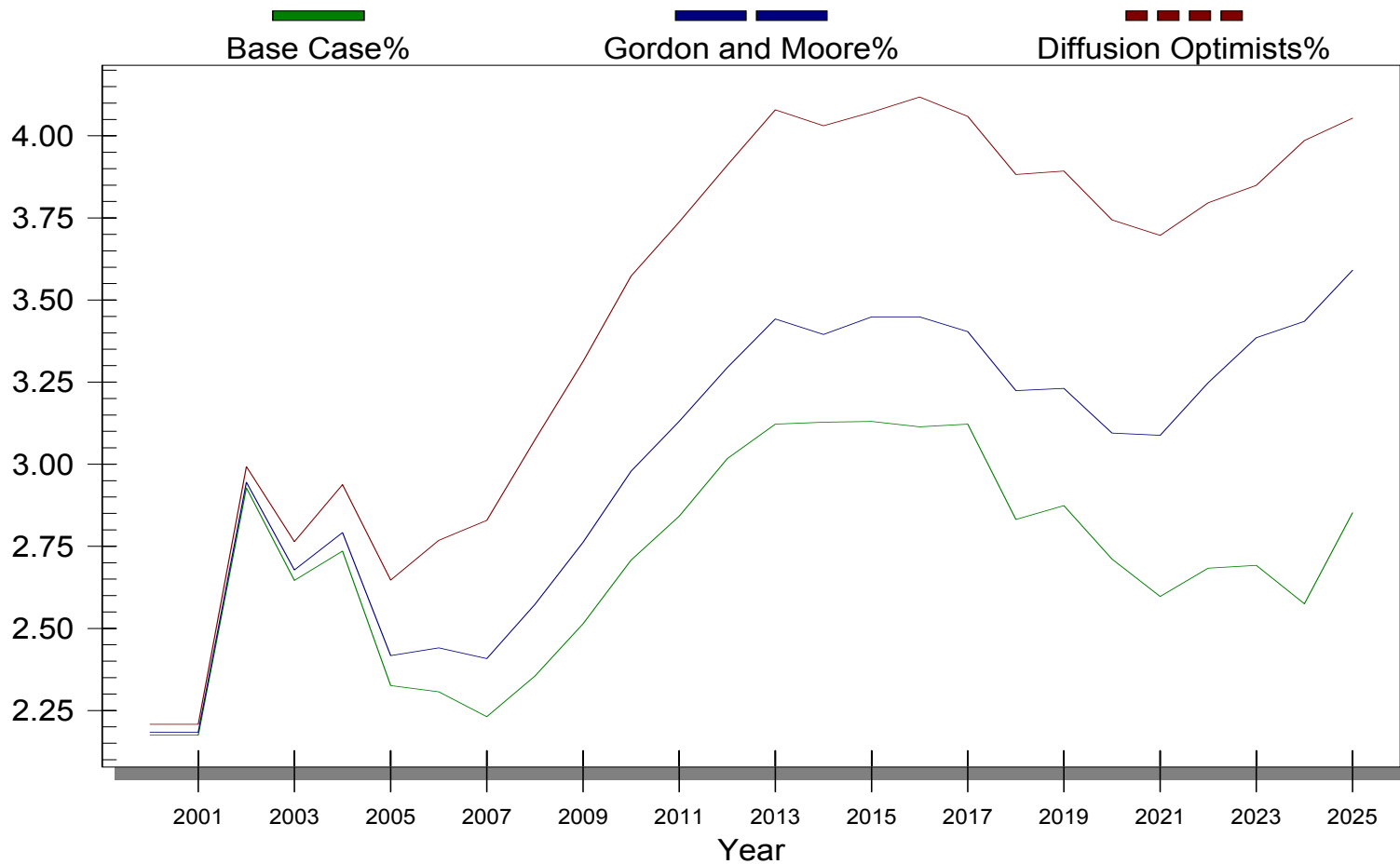
1. Robert Gordon says ICT a sector-specific one-off
2. Many analysts argue it is diffusing and creating new wave
 - ◆ Across sectors
 - ◆ Across countries/regions
3. Evidence in the late 1990s mixed and unclear



Economics: Three Scenarios

Three Productivity-Driven Scenarios

Global Annual Growth Rates

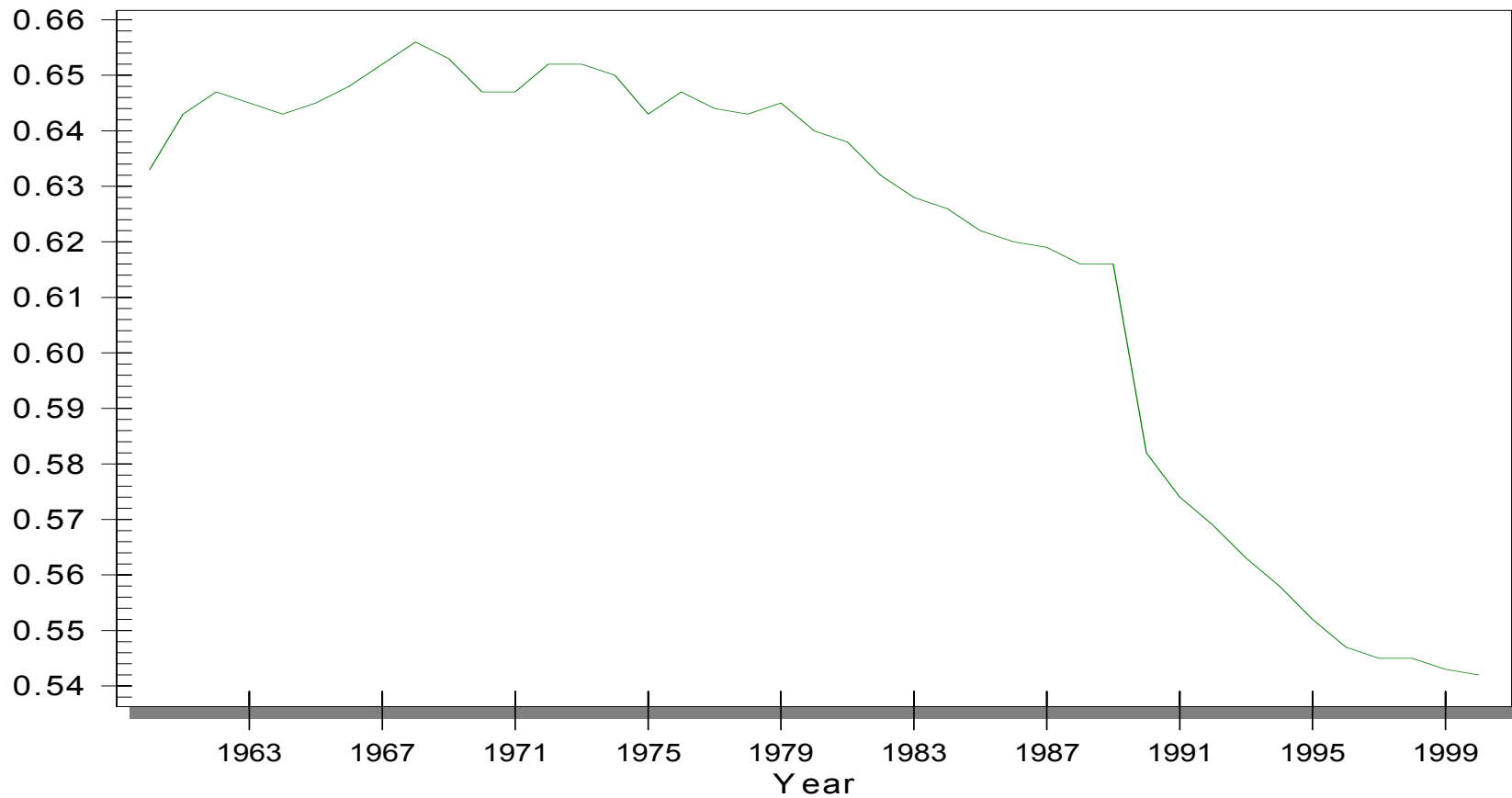


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Economics: N-S Gap

Gini Index of Global GDP at Purchasing Power Parity
Higher Numbers Show Greater Inequality



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Energy

1. Almost certain
 - ◆ Movement to renewables
2. Uncertain, known importance
 - ◆ Speed – two Great Debates
3. Potentially surprising, controversial
 - ◆ Huge renewable needed by 2100



Energy: The Great Debates

1. Renewable Energy Speed

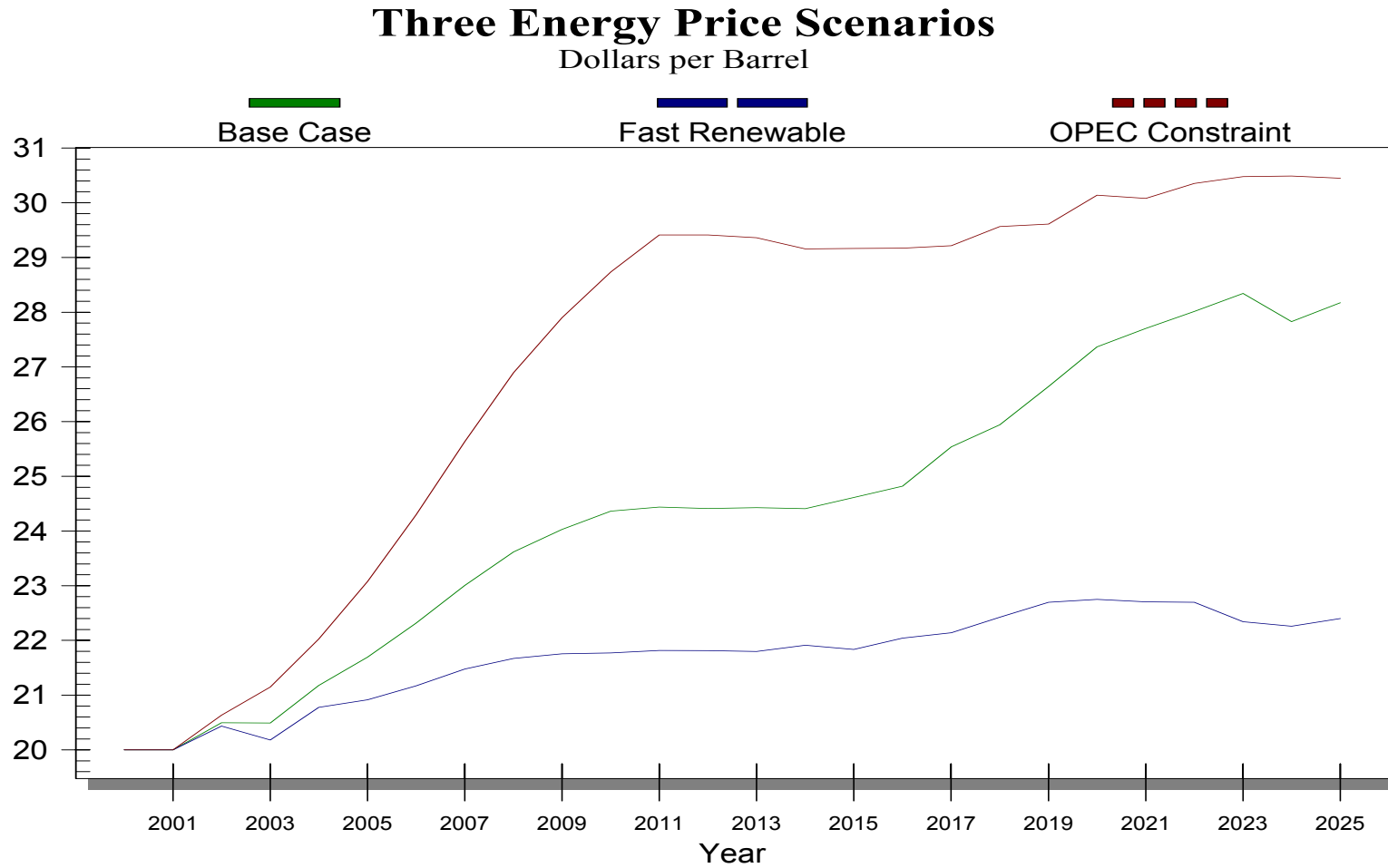
- ◆ Rifkin, Brown and other enthusiasts see huge growth
- ◆ The US Energy Information Agency annual outlooks see no increased share of renewable through 2020

2. OPEC Supply and Russian Contribution

- ◆ Will increase substantially to meet demand
- ◆ Will be constrained through conscious action or instability/disruption



Energy: Three Price Scenarios

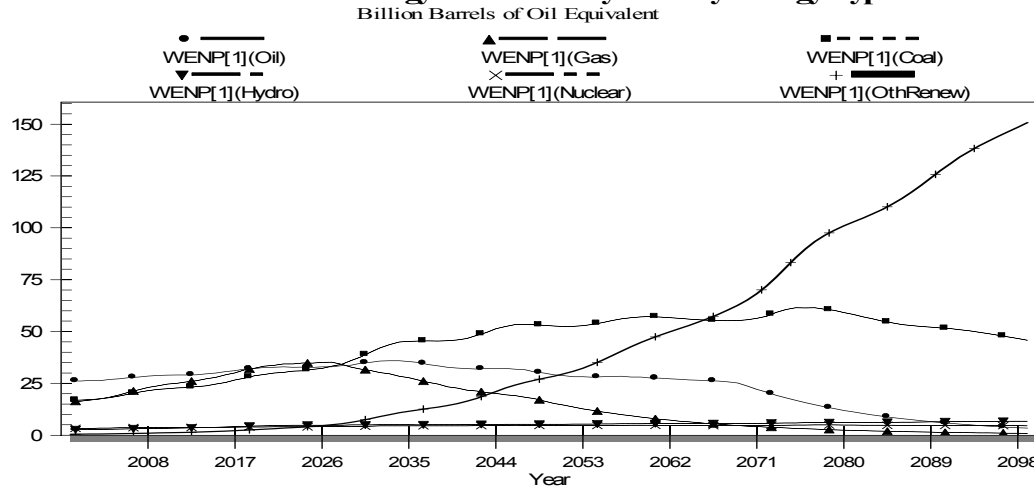


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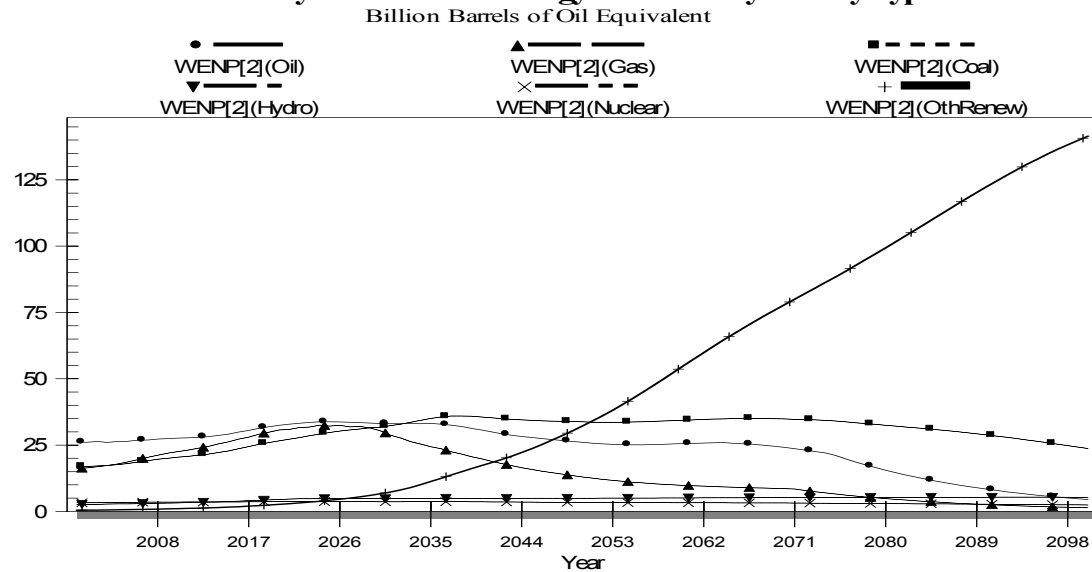


Energy: Renewable Needs

Base Case World Energy Production by Primary Energy Type



Sustainability Scenario World Energy Production by Primary Type



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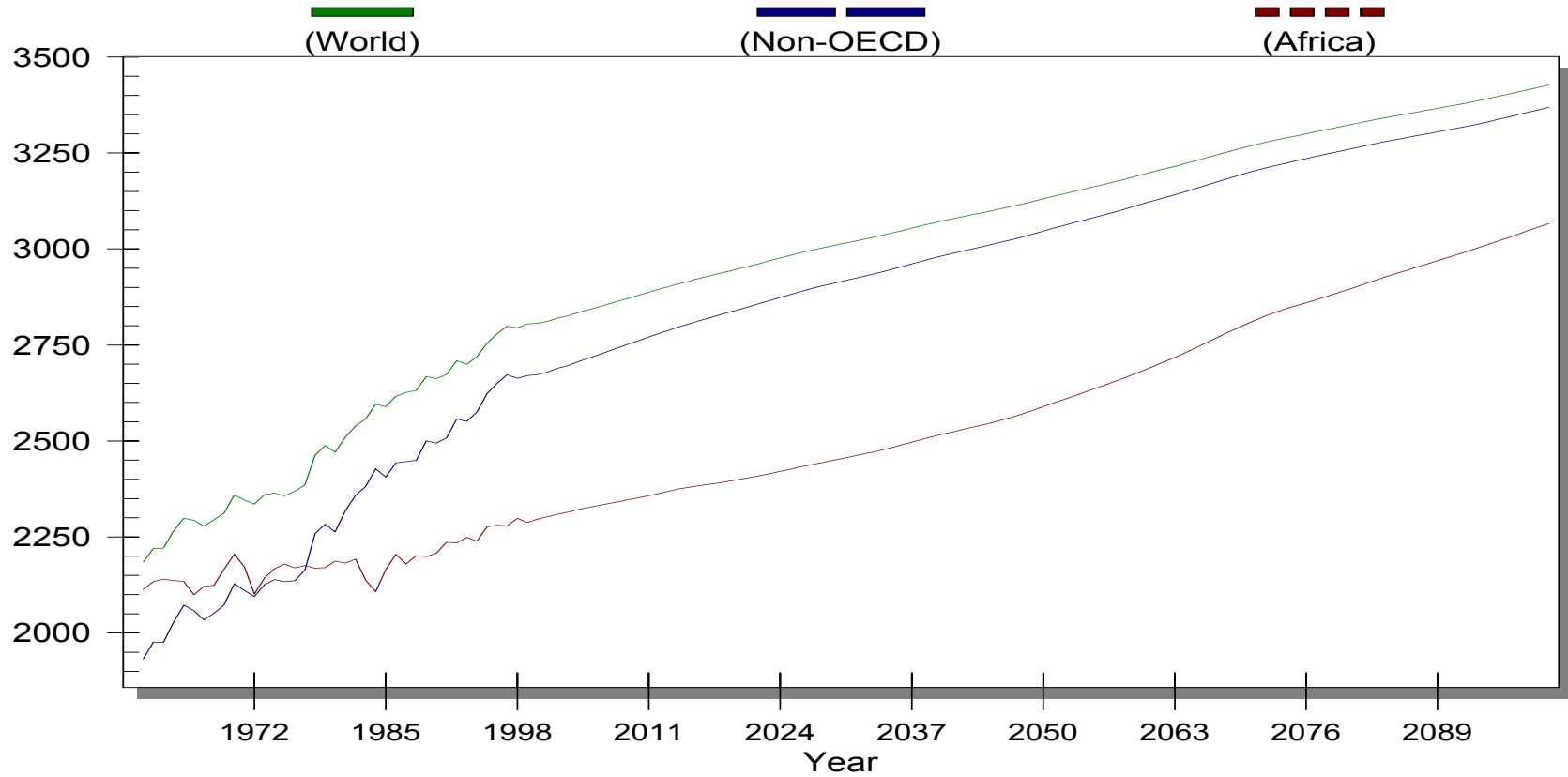
Food and Agriculture

1. Almost certain
 - ◆ Growth of calories per capita and decline of malnutrition
2. Uncertain, known importance
 - ◆ Extent of GMOs
3. Potentially surprising, controversial
 - ◆ Reversal of deforestation



Food: Calories and Malnutrition

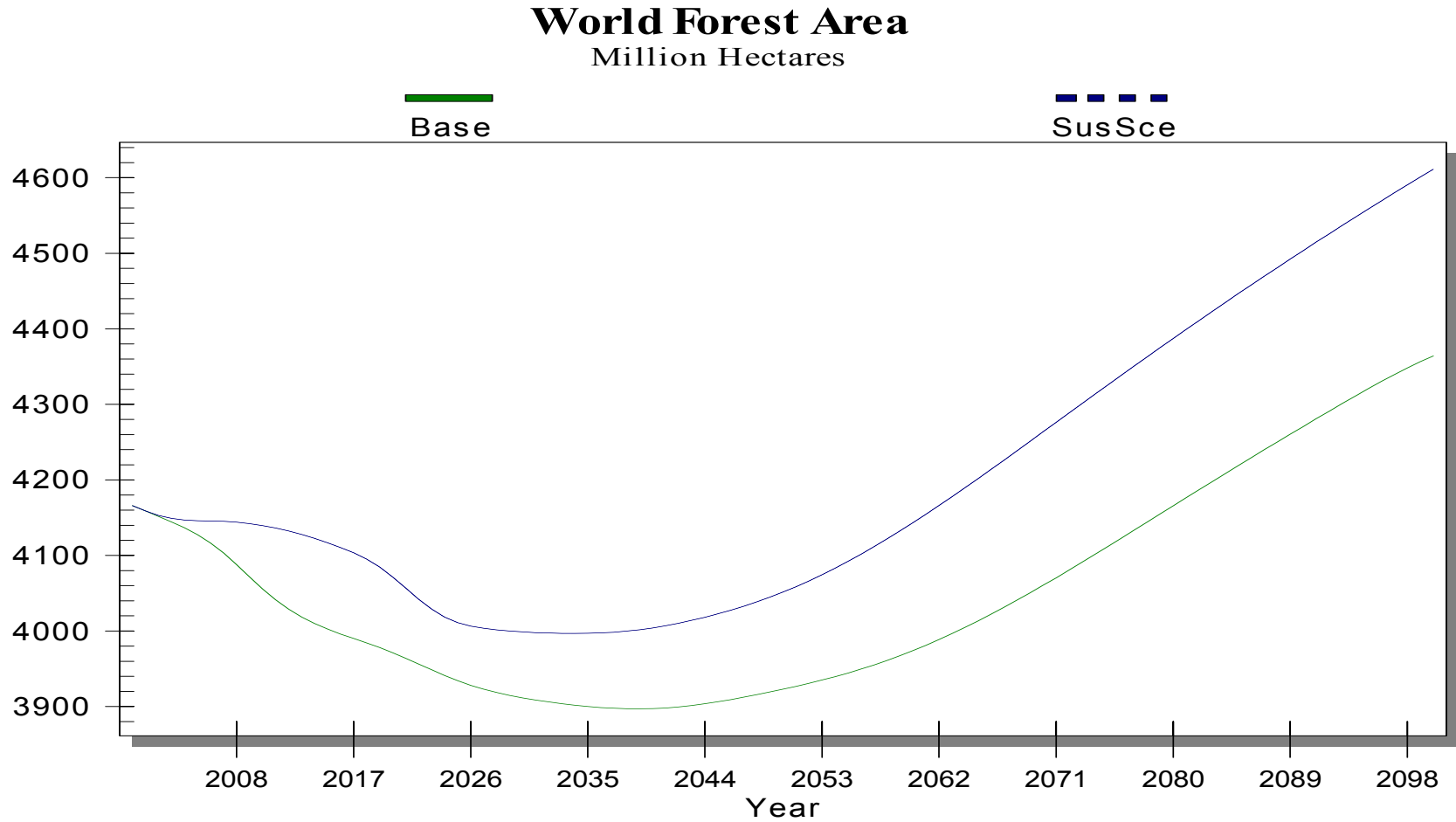
Calories per Capita
Daily: IFs Data and Base Forecast



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Food: The Reversal of Deforestation



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Socio-Political

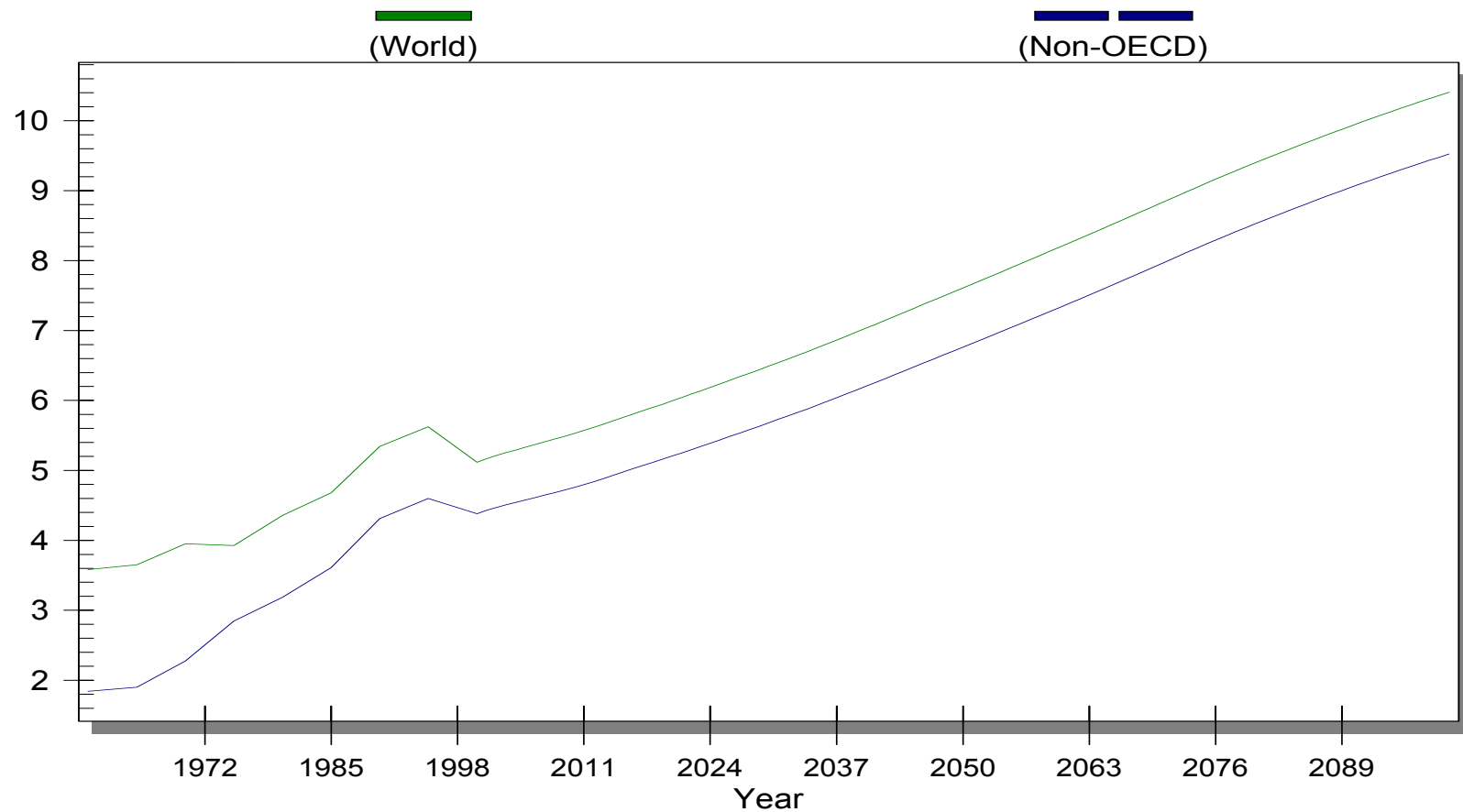
1. Almost certain
 - ◆ Advance of democracy and education
2. Uncertain, known importance
 - ◆ Democracy levels in the Middle East and transition
3. Potentially surprising, controversial
 - ◆ HDI of world above 1.0?
 - ◆ Globalization set-backs



Socio-Political: The Spread of Education

Years of Formal Education

Population 25-Years of Age and Older



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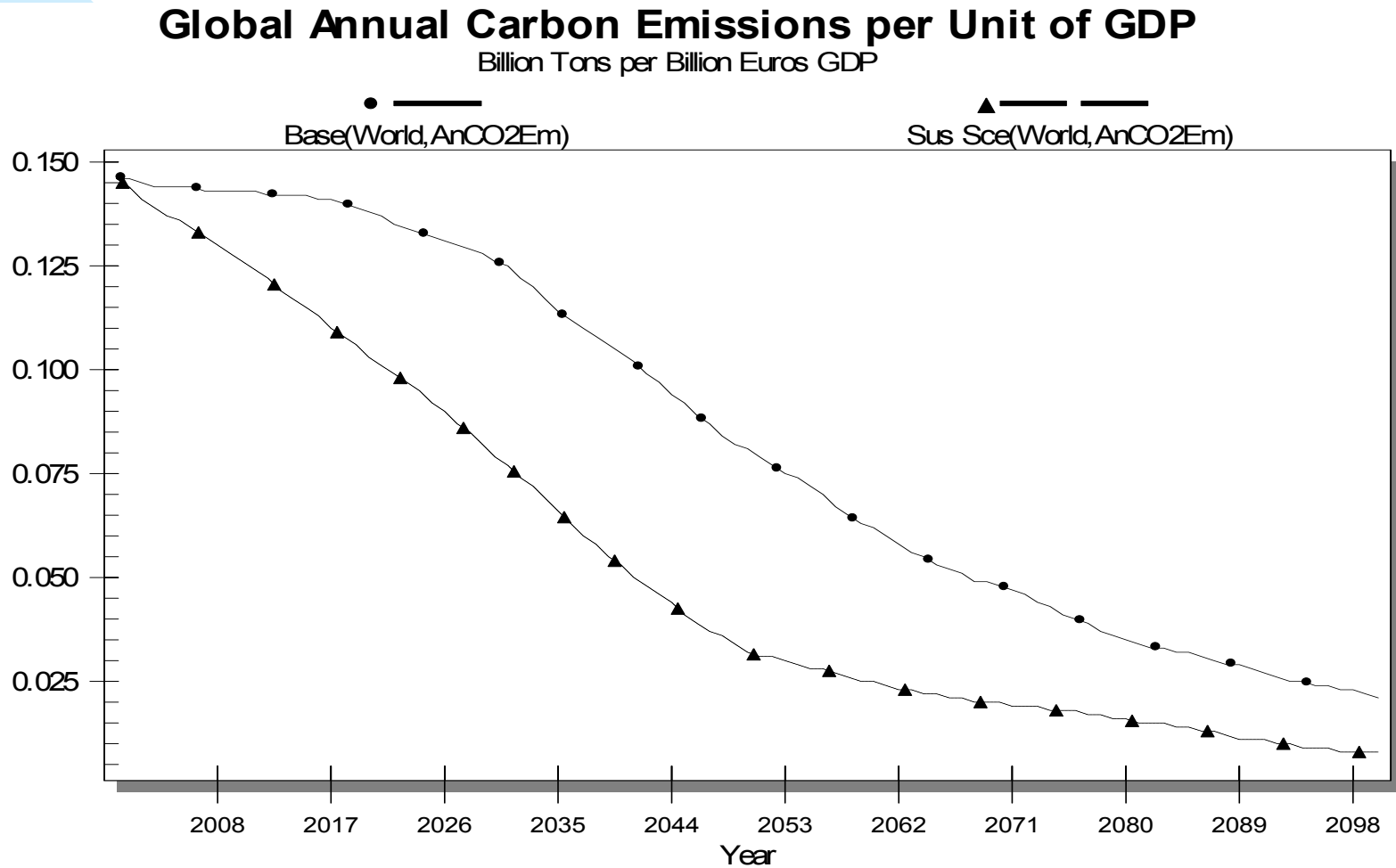


Environmental

1. Almost certain
 - ◆ Carbon-dioxide and Greenhouse Effect
2. Uncertain, known importance
 - ◆ Political reaction, especially U.S.
 - ◆ Disease future: HIV/AIDS, malaria, etc.
3. Potentially surprising, controversial
 - ◆ Climate and civilization switches
 - ◆ Plagues and peoples



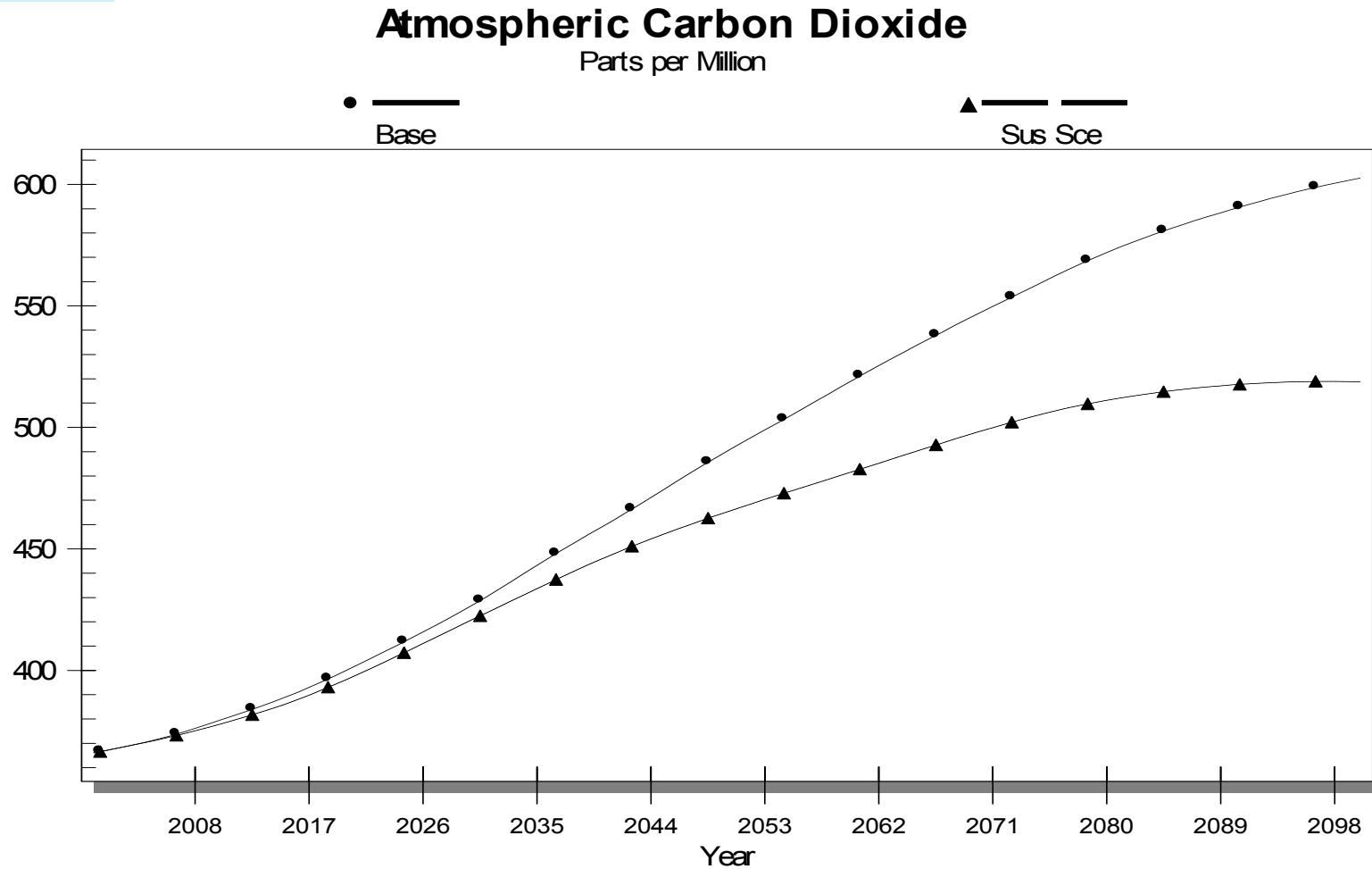
Environment: We Can and Must Try (ASA Analysis)



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Environment: But the Issue Will Only Grow (ASA Analysis)



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Conclusions

1. Trends are helpful
2. Attention to relationships and dynamics is essential
3. Insofar as possible identify key uncertainties and possible surprises
4. Timing may still elude us

