Potential Output:

Interpreting the Past and Predicting the Future

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Outline

1. The scope of this talk
2. Interpreting the past:
   What happened in the U.S.?
3. Predicting the future:
   What tools should we use?
4. Past and future:
   What (hasn’t) happened in Europe?

What this talk is (and isn't) about

- Organizing framework: $Y = F(K,HN,A,Z)$
- K is capital
- N is the work-eligible population;
  H is hours worked per available person
- A is an index of **A**llocative efficiency
  - Function of market power in goods and factor markets, regulations, sectoral differences
- Z is technology
  - Prefer not to call it "TFP", which includes A

Y = F(K,HN,A,Z)

- I'll talk mostly about Z
- In the long run, it's the major driver of K
- Also changes H at low frequencies [Fernald (2005), Greenwood (2001)]
- A cannot be a source of long-run growth; effects confined to bounded range
  - Of course, it may be very important in the medium run

2. Understanding the past

The U.S. since 1995

Is ICT the story?

- Standard story: The Solow paradox was resolved. Computers showed up in the productivity statistics
- Bulk of increase in labor productivity growth not due to ICT production
- ICT should, and does, show up in ***LP*** growth in ICT-*using* industries as well
- But no reason why that should be the case for ***TFP*** in ICT-*using* industries

Is ICT the story? cont'd

- Data say that much of the U.S. productivity acceleration is an increase in TFP outside the production of ICT (Basu-Fernald-Shapiro, 2001; Bosworth-Triplett, 2004)
- If this was caused by ICT, then it's through a channel that we don't understand
  - "Factor prices don't shift production functions"

Is ICT the story? cont'd

- BFOS (2003) face this problem squarely—and run away
- Basically, GPT stories (e.g., Helpman-Trajtenberg 1998 volume) do as well
- Both are mis-measurement stories

The upshot

- We need to be much more cautious about saying that we understand even the proximate source of the U.S. revival
- Policy conclusions should be cautious as well
- Economic history may be able to help
  - Did, e.g., the advent of telegraphs or railroads really raise TFP outside those sectors?
  - Chandler and others surely believe so, often for reasons of organization and control within firms

3. Predicting the future

The U.S. Case

What are the tools?

1. Growth accounting plus one's favorite method of extrapolation from the past
2. Single- or multi-variable statistical models, and predictions based on estimated stochastic processes
3. Full economic models applied to data

Accounting plus extrapolation

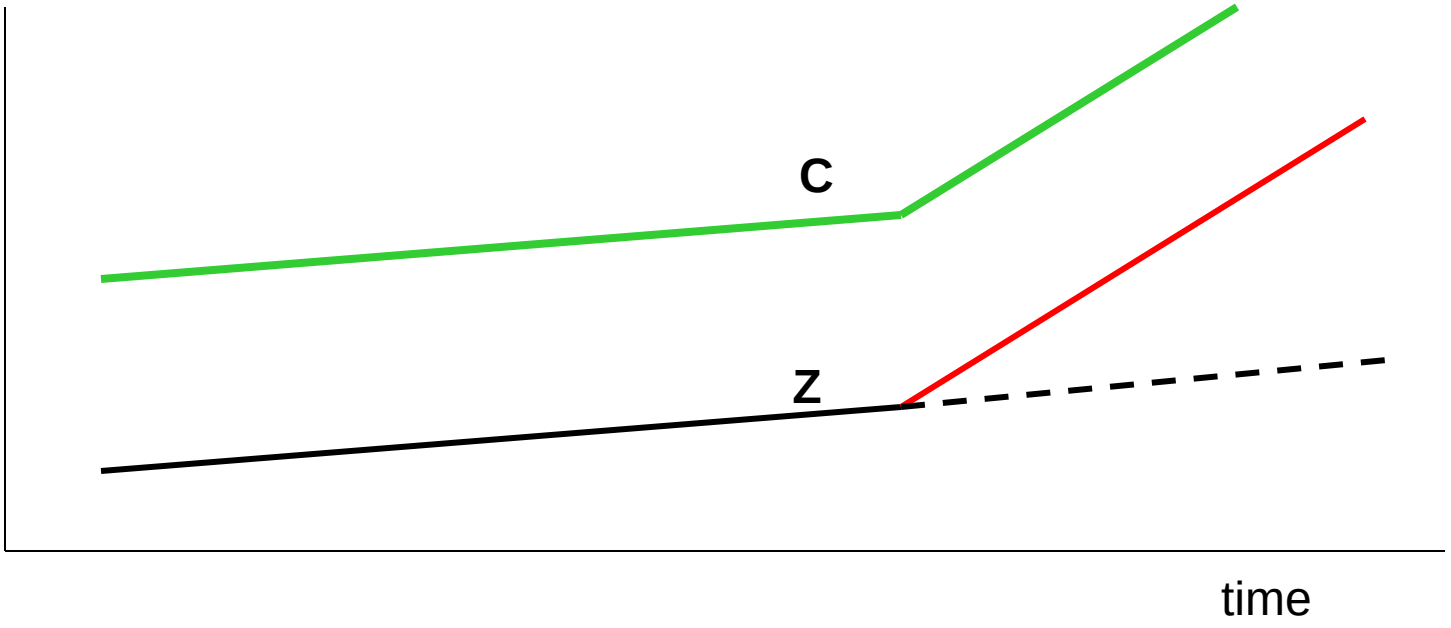
- Transparent
- Can incorporate information that is not statistical

Statistical approach: Univariate

- Can put confidence bounds on the forecasts
- Use Monte Carlo techniques to assess statistical tests

Statistical approach: Multivariate

Gain from multivariate techniques: Easier to detect a break in multiple series (Kahn-Rich, 2004)



Statistical approach, cont'd

- Both the extrapolation and the statistical approach try to forecast the future from the recent behavior of a few aggregate series
- Can one really forecast the effects of something novel?
  - Aiken/Watson forecast
- Just two observations of trend breaks in postwar U.S. data

The economic approach

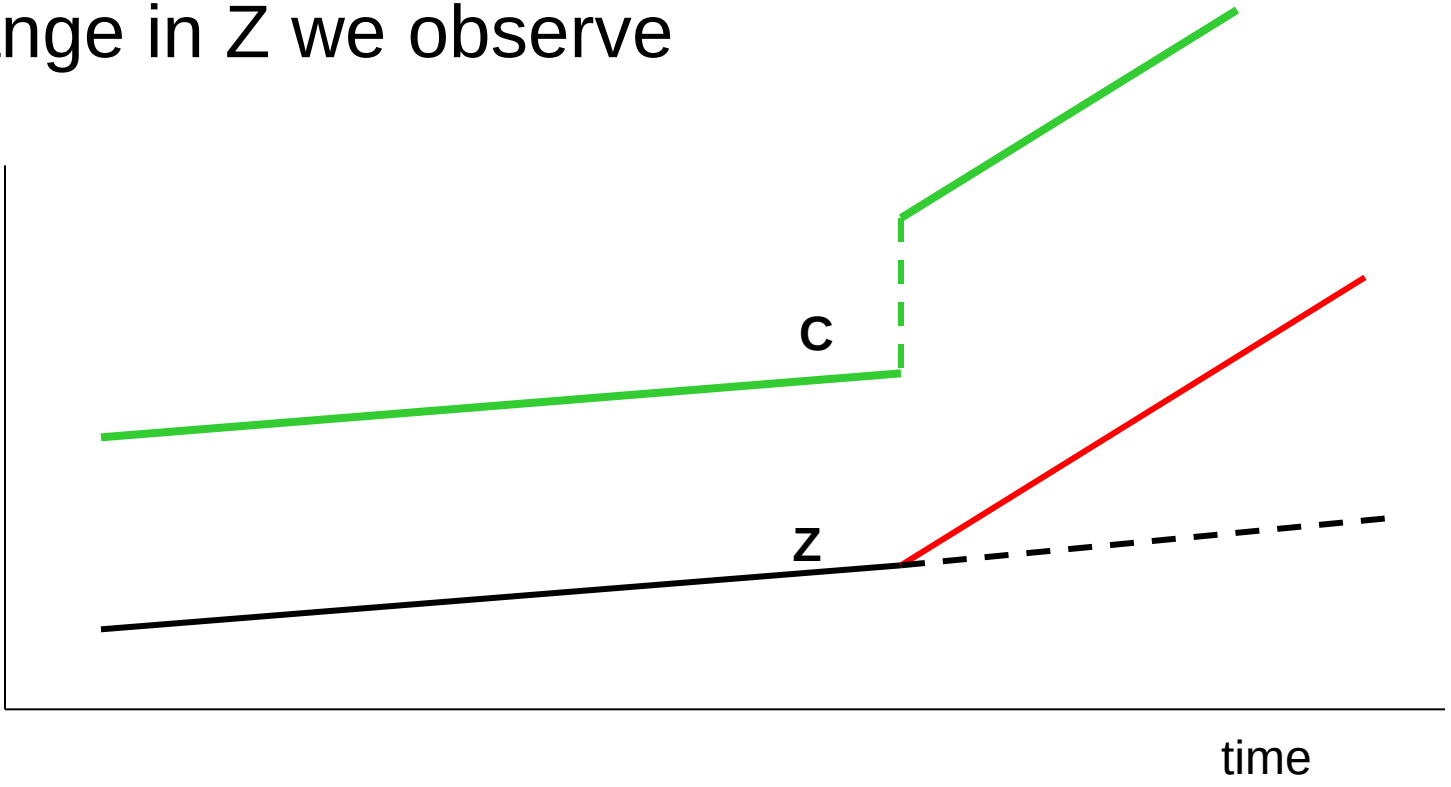
- “An intractable problem means you haven’t made enough assumptions”
- What is the economic basis for using optimization-based models to understand persistence of Z?
- The aggregate of all the agents in the economy has more information than we do, and their behavior will reveal that information to us

Some evidence

- Cochrane (1994a,b) emphasizes that a shock in C/Y forecasts future Y (even conditional on lots of other variables)
- Basic intuition is the PIH
- Barsky and Sims (2006) find evidence that innovations to “consumer confidence” are information shocks

What the economic approach adds

The size of the jump in C gives information about the expected future increase in Y, which in turn tells us about the expected persistence of the change in Z we observe



What the economic approach adds, cont'd

- The behavior of other variables (especially I and H) gives us information on whether ΔZ is perceived as a growth rate shock or as a level shock

How far should we take the economic approach?

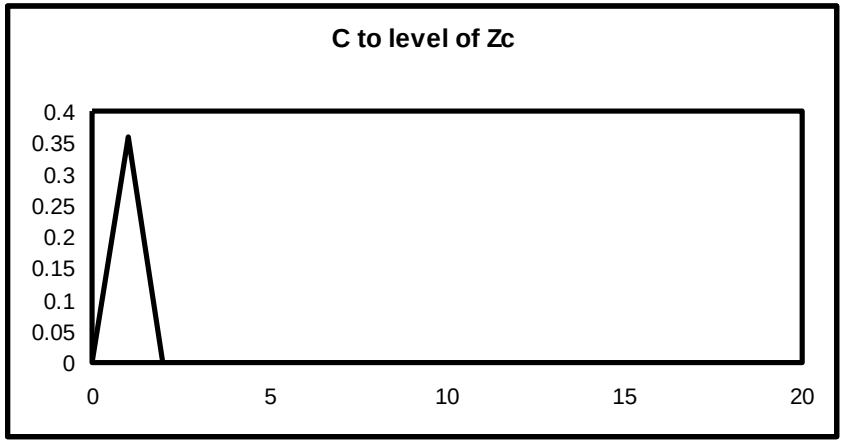
- Consider excellent recent paper by Ireland and Schuh (2006)
- They use a 2-sector RBC model with C and I technology level & growth shocks
- They demonstrate that using this framework to explain recent U.S. data, one must conclude:
  - The shock was to production technology of I, not C
  - The shock was an increase in the level but not the growth rate of technology for producing I
  - Thus pessimistic long-run forecast

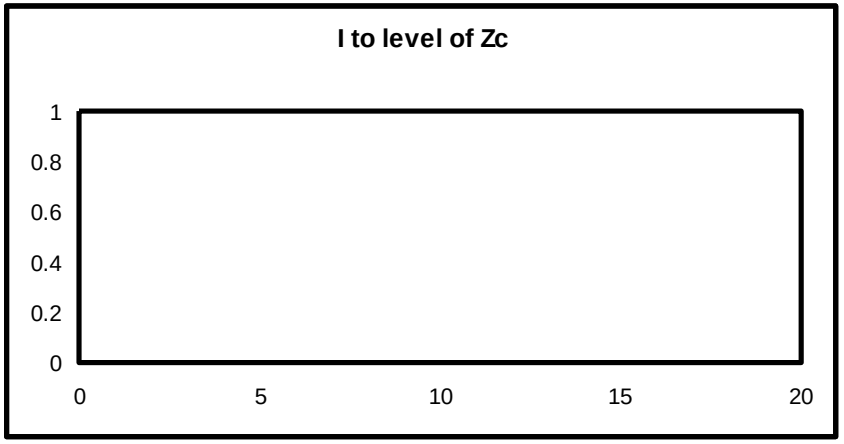
Why? Preferences are the key

$$E_0 \sum_{t=0}^{\infty} \beta^t [\ln(C_t) - (H_{ct} + H_{it})]$$

- Standard preferences imply that consumption technology shocks cannot influence H and I
- Kimball (1994)

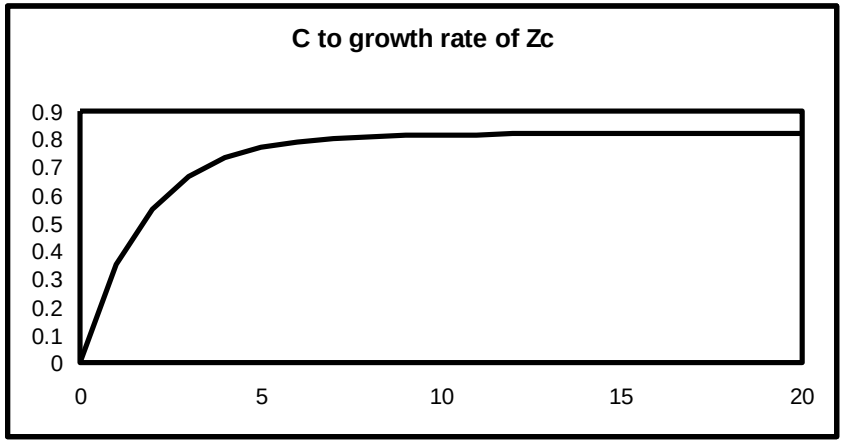
Impulse responses from estimated model (courtesy of Ireland-Schuh)

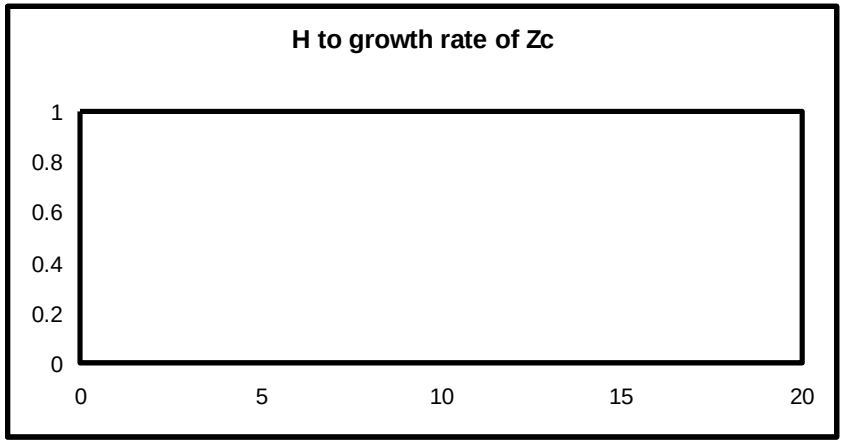




- Consumption-specific technology shocks impact only on C (Kimball 1994).

Impulse responses, cont'd





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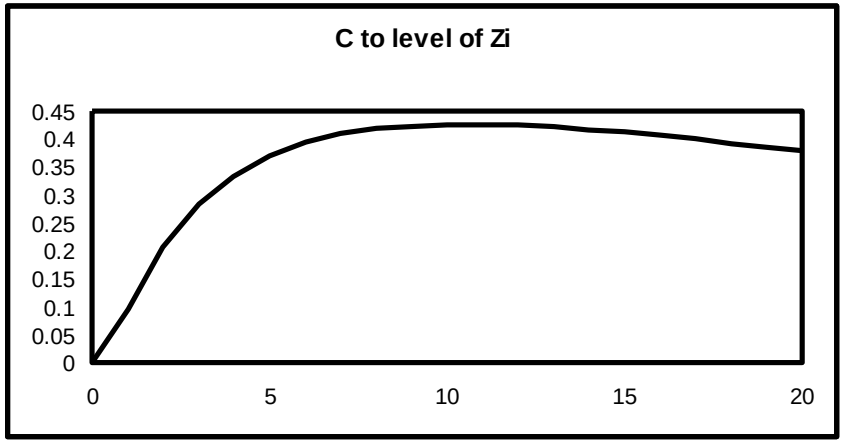
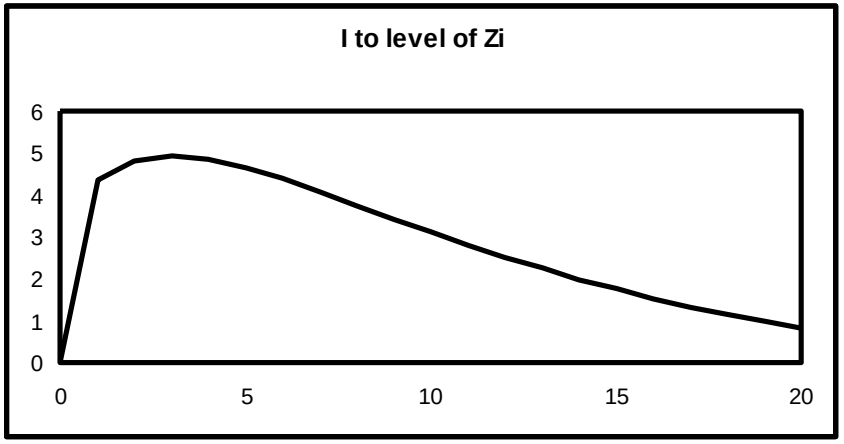
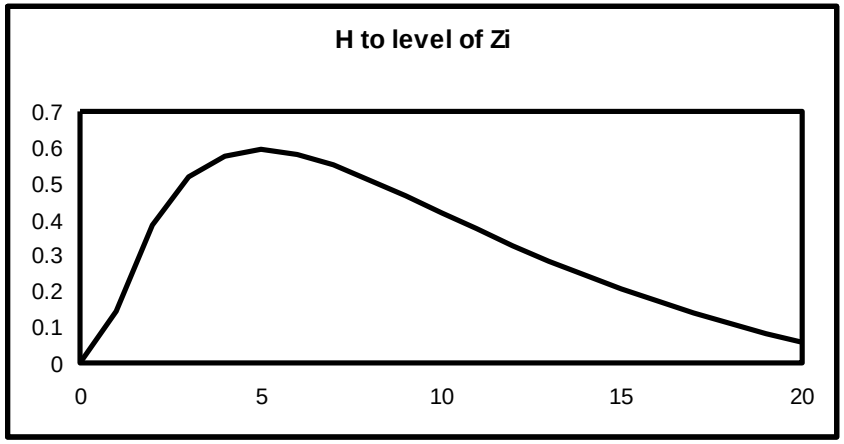
Implications

- Since the 1990s saw large increases in H and I, the main shock must not have been a shock to Z^C
- A shock to the level of Z^I fits the data…

Impulse responses to Z^I level

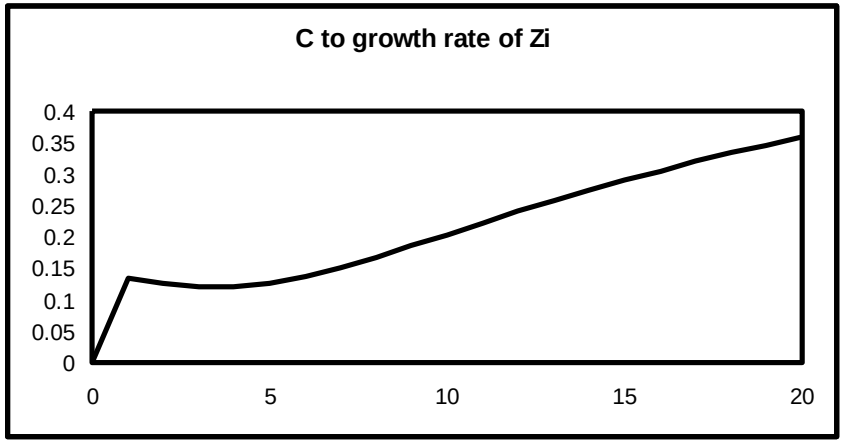


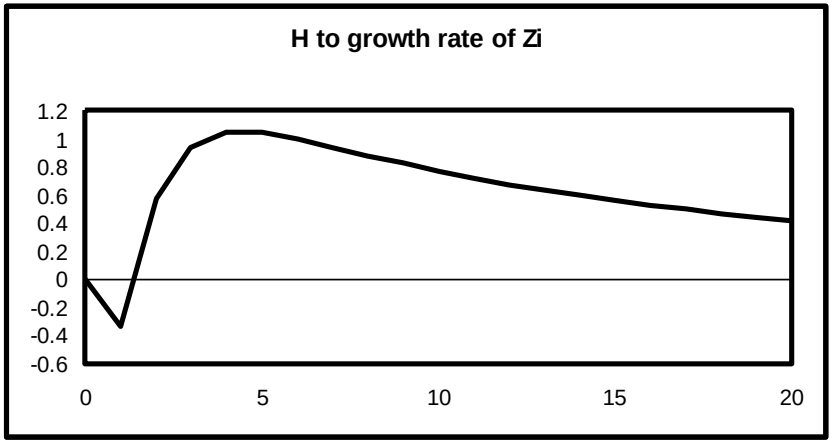




- Investment-specific technology shocks impact on C and H, but have their largest effect on I.

…but a shock to growth rate of Z^I does not





- Shocks to the growth rate of investment-specific TFP cause H to fall on impact (Linde 2004).

Why the decline in I, H?

- Preferences imply strong intertemporal substitution
- An increase in the growth rate implies that wages will be higher in future (but are not much higher now)
- So a positive growth rate shock is a good time to take a holiday
- Higher wealth implies want more C;
  $I = S = Y - C$

Assessing economic approach

- Conditional on the model, just knowing the time series for C, I, and H tells us a huge amount about the nature and persistence of the shocks that we care about
- Are we sure that we have the correct model and have drawn the right inference?
- Should we disregard the growth accounting evidence suggesting that lots of the TFP acceleration was in services?
- Are we sure there wasn't a growth rate shock?

Assessing, cont'd

- Relatively small changes to information structure change conclusions dramatically
- Edge-Laubach-Williams (2003) suggest having agents learn whether shock is to level or to growth rate
- Avoids having a contraction in the first few periods after a growth rate increase
- Their model thus estimates that the late 1990s was due to a growth rate shock

Assessing, cont'd

- But simple intuition suggests that if agents thought there had been a transitory level shock in the late 1990s, they should have accumulated assets abroad
- Instead, the U.S. ran large CA deficits
- Guerrieri-Henderson-Kim (2005) explore open-economy issues using sophisticated 2-country models with non-tradeables

Learning has implications for statistical assumptions too

- If agents learn, then C etc. may change some time *after* the shock to Z
- If agents receive signals about the future, C etc. can change *before* the shock to Z
- In either case, cannot assume coincident breaks

Assessing, cont'd

- Economic approach has great promise
- But it can impose restrictions on the data that are stronger than what we find comfortable
- Need some way to incorporate the compelling logic of the PIH while relaxing some of the strong auxiliary assumptions found in DSGE models

4. What's up in Europe?

Pessimistic story

- Quite familiar: Regulations/distortions prevent Euro area from taking advantage of new methods
- Question: Is this story fully consistent with the rapid catch-up of Europe (and Japan) after WW II?
  - Question of how new is “new”

Optimistic story

- Higher productivity growth is masked by unobserved investment to use the new technology properly
  - As Nick pointed out, at least consistent with the otherwise surprising “second jump” of measured TFP in the US
- Natural advantages to being “followers”—know what works, leapfrog leader

How might one tell them apart?

- Forward-looking variables seem a good place to start
- Asset prices: Equity and real estate
  - But only if markets are rational
  - Hobijn-Jovanovic-Rousseau work on industry winners and losers and equity valuations—reverse the sign?
- Consumption
  - But need a big RoW—otherwise both US and Europe will have a hard time increasing both C and I at once!