

Discussion of "The Challenges of Estimating Potential Output in Real Time" by Bob Arnold

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Disclaimer!

- The views exhibited in this discussion are those of the author only and are not necessarily shared by the Federal Reserve Board or any of its staff. All errors are mine.
- This presentation makes use of FRB/US model vintages and associated databases, and Greenbook forecast and historical databases (the latter of which are permissible to use only for forecasts dated December 2002 or later).

What I'm going to cover...

1 Motivation

- Why and for whom it matters.

2 The CBO Methodology

- What they do
- The history of economic thought viz. potential
- Why so little change?

3 Critique

- Okun's Law
- Econometric identification
- Deterministic time trends

4 Where could we go from here

Different parties care for different reasons...

- 1 *Growth in potential* and its constituent parts:
 - Pins down the tax base for *fiscal authorities* and law makers
 - Provides a baseline for GDP growth for *forecasters*
 - Establishes a benchmark for *traders* to interpret the real-time data
- 2 Affects intercept terms in policy rules for *monetary authorities*
 - *Level of potential* defines the output gap, given the data:
 - The output gap initializes error-correction terms for *forecasters*
 - Influences future inflation...or at least it used to...for *monetary authorities*

A Taylor-type rule

- Quite apart of the usual reasons why any macromodeler would care about potential output...
- ...central banks care for potential's influences on policy choices...
- Consider the following inflation-forecast-based *Taylor rule*:

$$R_t = \underbrace{\frac{\partial rr^*}{\partial \Delta y^*} \geq 1}_{rr^*} + \phi_\pi \cdot \underbrace{\frac{\partial E\pi}{\partial y^*} < 0}_{E_t \pi_{t+1}} + \phi_y \cdot \underbrace{\frac{\partial (y - y^*)}{\partial y^*} < 0}_{(y_t - y_t^*)}$$

- The growth rate of potential influences the equilibrium real rate and expected future inflation through unit labor costs
- The level of potential influences the output gap, and expected future inflation through the Phillips curve.

What Arnold (2008) does:

- Begin with estimates of the NAIRU as an exogenous variable taken from another paper.

- Estimate *cyclic-adjustment equations* like so:

$$\log(X) = c + \alpha(u - u^*) + \beta_1 T_{1953} + \beta_2 T_{1957} + \dots \beta_8 T_{1990} + \epsilon_t$$

- where the $\beta_j T_t$ represent predetermined trend breaks at business cycle peaks
 - call on adding a new break is made long after the fact
- Set the cyclic terms to zero...
 - and build up the pieces of potential from its constituent parts
 - use a two-factor CRTS Cobb-Douglas production function

A blast from the past:

A 1978 Carnegie-Rochester Conference

- Jeffrey Perloff and Michael Wachter (1979) "A Production Function-Nonaccelerating Inflation Approach to Potential Output"
 - Take the NAIRU from Wachter (1976)
 - Estimate *potential labor input* like so (eq. 18, p. 137):

$$\log(L) = c + \alpha(u - u^*) + \beta_1 t + \beta_2 t^2 + \beta_3 t^3 + \epsilon_t$$

- where the $\beta_j t^k$ represent polynomials in time
 - Do the same with components of potential capital input
 - Use a *cyclically sensitive translog production function* with polynomials in time added
- Set the cyclic terms to zero...and so on.

From the discussants:

- Robert Gordon (1979)
 - "[W]ithout making any statistically significant difference in the wage equation, one could come up with an estimated increase in U^* between 1956 and 1974 ranging anywhere from 0.58 to 1.61 percentage points...(p. 190)."
 - "Taking this set of data for U^* , one can compute an acceptable and consistent natural output series without any use of production functions at all." (p. 188).
- Charles Plosser and William Schwert (1979)
 - "[A]ggregate demand policies are not necessarily appropriate in a world where actual output is viewed as the outcome of the interaction of supply and demand...In such an equilibrium world, 'potential output' ceases to have any significance." (p. 184)

Why the *deja vu* experience?

- The methodology employed by the CBO and MA is not peculiar to them. The Board staff use something similar.
- The gap between academic treatment and professional practice has probably never been larger
- Is this because practitioners have been particularly slow witted? *I don't think so....*
- Is it because forecasters and policy institutions are interested in different problems? *In part, I think yes.*

Whence the differences?

- 1 Strong prior in policy institutions that output fluctuations are driven largely by demand shocks
- 2 Weak identification of unobserved components models
- 3 The need to be able to "tell stories"
- 4 **Non-scalability of econometric tools**

What the CBO gets in terms of gaps:

The CBO output and unemployment gap:

Figure 1. Okun's Law: The Output Gap and the Unemployment Gap

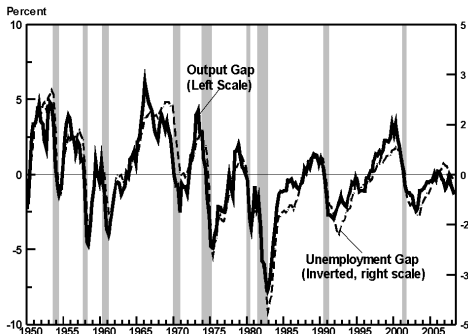


Figure: CBO output and unemployment gaps

Is Okun's Law really a law?

- Consider the standard Cobb-Douglas CRTS production function:

$$y = a + \alpha L + (1 - \alpha)k$$

- Let's evaluate *potential output* in the usual way:

$$y^* = a^* + \alpha L^* + (1 - \alpha)k$$

- Then we can subtract one from the other to come up with gaps:

$$y - y^* = (a - a^*) + \alpha(L - L^*)$$

where $(y - y^*)$ is the output gap; $(L - L^*)$ is the labor market gap; and $(a - a^*)$ may be labor hoarding, variable capital utilization, etc.

- Okun's Law tells us (as do the CBO gaps) that $y - y^*$ is just a rescaling of $L - L^*$ which means that $a - a^*$ must be acyclical.
- But wouldn't one expect $(a - a^*)$ to behave differently if it moves because a^* moves (a pure productivity shock) as opposed to when a moves (a labor adjustment "shock")?

The vanishing sacrifice ratio?

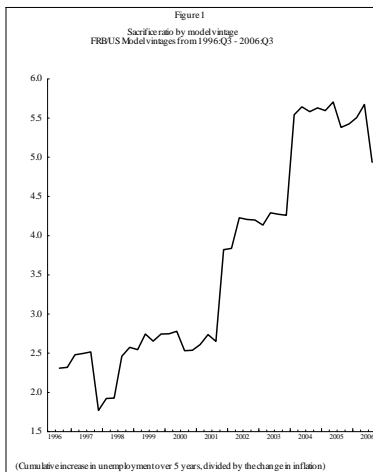


Figure: Real-time FRB/US sacrifice ratio

Version of a chart from Tetlow and Ironside (JMCB 2007)

A UC model with and without the Phillips curve

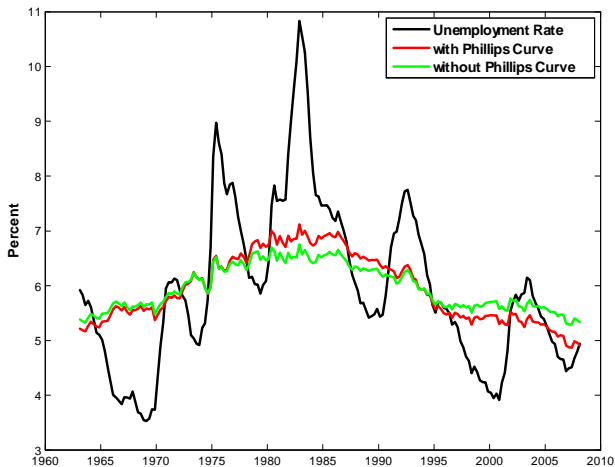


Figure: NAIUs with and without identification from the Phillips curve

The real-time issues

Bob spends some time at the end discussing the late-1990s productivity boom

Emphasizes some reasons why estimating potential in real time is difficult

- 1 Volatility of the underlying data makes it hard to distinguish local trends
- 2 Cyclical properties of employment data (e.g., "jobless recoveries" are common but not ubiquitous)
- 3 Revisions can be substantial and persistent
- 4 **Origins of growth are sometimes obscure**

It's not as bad as Bob says....*it's worse.*

We could add to his list, the following:

- 1 Quite apart from revisions, the data are of poor quality to begin with
- 2 The empirical relationships that underscore estimates of potential are breaking down
- 3 **Network externalities are impairing the usefulness the causality-cum-accounting exercises**

The parable of the fax machine

- Larry Summers is credited, perhaps apocryphally, with observing, *"the first fax machine was worthless...but the second one, now you've got something..."*
- The point is that the first fax machine couldn't do anything unless there was at least one other fax machine to fax to.
- The value of the first fax machine rises monotonically with each added fax machine—a network externality
- The growth accounting would show that it was capital deepening the leads any fax-machine induced output expansion
- But that interpretation would be spurious owing to the fact the TFP is residual
- The broader implication is the inference of causality from growth accounting is dubious.

Real-time estimates of four-quarter potential GDP growth

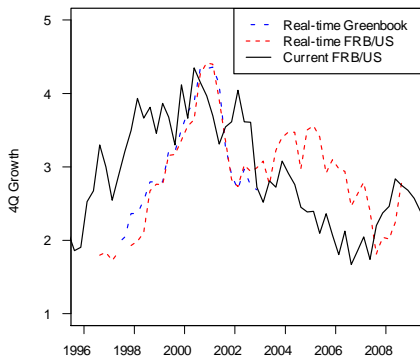


Figure: Real-time estimates of potential GDP growth

Real-time estimates for 1996 by vintage

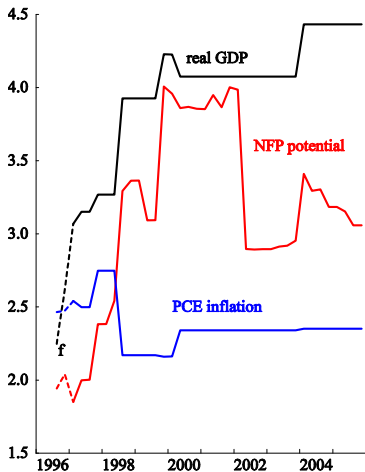


Figure: Estimates of key macro variables for 1996 by data vintage

What about a system approach with potential taken as stochastic?

Consider a UC model with potential an $I(2)$ variable, the NAIRU an $I(1)$ variables, and other stuff.

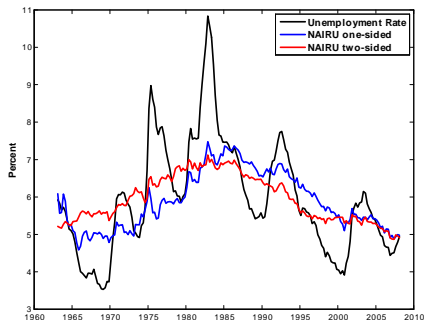


Figure: 1- and 2-sided estimates of the NAIRU

It can work...but it is important not to expect too much.

Where does this leave us?

- First, take potential output (and the NAIRU) as stochastic variables, rather than deterministic
- Second, prepare for failure: design policy with uncertainty explicitly in mind (there is a literature on this...)
- Third, invest in real-time error-detection and response mechanisms
- Fourth, invest—or have statistical agencies invest—in better and more timely data

Conclusions

- Bob Arnold has laid out a sophisticated and thoughtful approach to measuring potential output
- He has demonstrated a supple grasp of the real-time issues
- He and his colleagues have pushed this framework as far as it can go
- The question is whether the questions the CBO asks would lend themselves to taking a stochastic approach