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Comment   Robert E. Hall

Auerbach and Gorodnichenko provide impressive evidence about what happens in a panel of advanced economies when government purchases rise or fall. They find that changes in purchases in a weak economy have large effects in the same direction on output and employment. Their point estimate is that one added dollar of government purchases results in about $3.50 of added GDP when the economy is weak, with a 90 percent confidence interval running from 0.6 to 6.3. By contrast, in times of a strong economy, added government purchases *reduce* GDP, according to the point estimate. The confidence interval for that finding includes moderate positive values.

Auerbach and Gorodnichenko (henceforth, AG) identify weak and strong economies in two ways. One is the eighteen-month change in the departure of an activity measure (real GDP, unemployment, and others) from its slow-
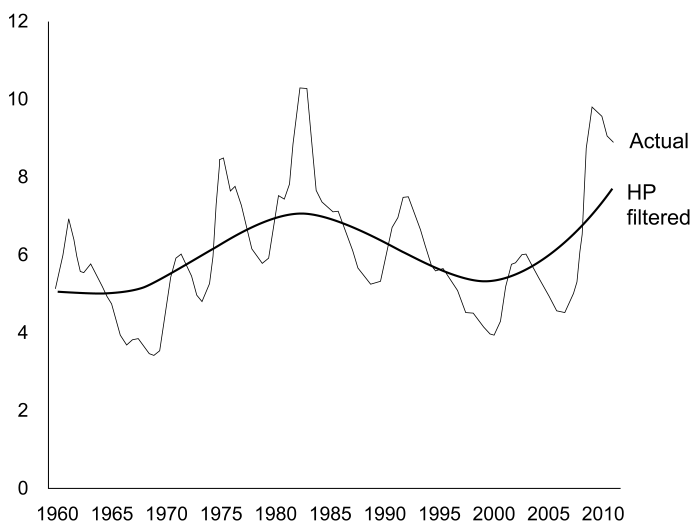
Fig. 2C.1   Actual and HP-filtered trend unemployment

moving trend. The second is the departure from trend itself. They think of these as rate-of-change and level measures, respectively. They measure the trend using the Hodrick-Prescott filter with a smoothing parameter of 10,000, well above the amount of smoothing conventionally used for semi-annual data. That said, it turns out that they remove quite a bit of the cyclical movement of the activity variables. Figure 2C.1 shows semiannual data for US unemployment over the period 1960 through 2011, along with its HP trend. According to the figure, unemployment only barely exceeded trend following the 2001 recession. More significantly, most of the high level of unemployment in late 2011 was the result of a high trend value. The signal from the variable that AG use is that the slump following the financial crisis of 2008 was practically over at that time, despite an unemployment rate of 8.9 percent. The HP filter is least reliable at the beginning and end of the data. Here, it plainly overstates the movement of the trend over the past five years.

One of the puzzles in the chapter is the similarity of the results for the rate-of-change specification of the variable z that signals the strength of the economy—the authors' favored one—and the alternative level specification. If the detrended activity variable were a sine wave and the rate of change not taken over an extended period (so it would be a cosine wave), the two measures would be out of phase and have a correlation of zero. One quarter of the time, both would be signaling strength (the second half of an expansion); one quarter of the time, activity would be positive but rate of change negative (the first half of a contraction); one quarter of the time, both would be signaling weakness (the second half of a contraction); and one quarter
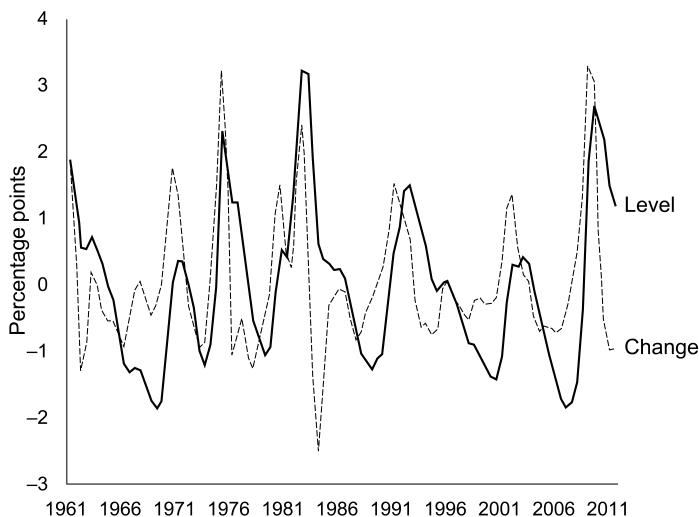
Fig. 2C.2   Change and level variables constructed from US unemployment, 1960–2011

of the time, activity would be negative but rate of change positive (the first half of an expansion).

AG's use of an eighteen-month period to measure growth radically changes the relation between the two measures. The fact that activity is not a pure sine wave does as well. Figure 2C.2 shows that the two measures used in the chapter are actually quite similar. As the authors note, the rate-of-change measure leads the level measure, but not by much, and otherwise the two variables are sending the same signal about the strength of the economy most of the time. The single big exception was the rapid improvement following the 1981 recession, when unemployment was high but falling rapidly.

The figure makes it clear that both measures rise rapidly at the beginning of a recession and then return to normal well before unemployment falls back to normal. The findings would not support the proposition that purchases policy would be unusually effective in, say, early 2012, four years after the beginning of the contraction at the end of 2007. Interestingly, Stock and Watson (2010) find that inflation responds in the same way to slack as does the purchases multiplier. Their preferred measure of slack in the economy for a simple Phillips curve is the difference between unemployment and its minimum over the prior three years, a variable that looks a lot like the ones in figure 2C.2.

I conclude that the chapter uncovers a proposition of great importance in macroeconomics—that the response to government purchases is substantially greater in weak economies than in strong ones. The finding is a true challenge to current thinking. The first thing to clear away is that the

finding has little to do with the current thought that the multiplier is much higher when the interest rate is at its lower bound of zero. The authors do not appear to report the ending date of their sample period, but the sample surely includes only a few years when any country apart from Japan was near the lower bound.

Standard macro models have labor and product supply functions that are close to linear over the range of activity in the OECD post-1960 sample. The simple idea that output and employment are constrained at full employment is not reflected in any modern model that I know of. The cutting edge of general-equilibrium modeling—seen primarily in the dynamic stochastic general equilibrium models (DSGE) popular at central banks around the world—incorporates price and wage stickiness that makes supply quite elastic both above and below full employment, defined as the level of employment that would occur absent any price and wage frictions. A new development in this line of work (see Gertler, Sala, and Trigari 2008) embodies wage frictions in the Diamond-Mortensen-Pissarides framework, so unemployment is an explicit variable in the model. Such a model constrains unemployment to be nonnegative, so with enough expansionary policy, the nonlinearity of the unemployment response will come into play. But the models with this feature are still pretty close to linear around the normal level of unemployment and do not become visibly nonlinear over the range of variation seen in AG's data.

According to current macro thinking, the feature of the economy that controls the government purchases multiplier is not labor or product supply, but rather the response of monetary policy as expressed in the central bank's Taylor rule. The reason that an economy at its zero lower bound has a much higher multiplier is that, with the interest rate fixed at zero, the bank loses its power to offset a fiscal expansion. In normal times, higher government purchases raise inflation and output. The Taylor rule instructs the bank to raise the interest rate on both accounts. The higher rate inhibits activity and offsets a large part of the expansion that would otherwise occur.

Within the framework of current macro models, I conclude that the explanation for the findings of AG's chapter is a Taylor rule with some combination of the following features, all absent from the usual Taylor rule:

- *The response of the interest rate to unemployment is smaller when unemployment is high (nonlinear response).* The notion that the central bank is highly attentive to an overheated economy and raises the interest rate aggressively in that case (but is reluctant to stimulate by cutting the rate when the economy is slack) rings true. For example, commentators are quick to suggest high unemployment arises for "structural" reasons, but rarely suggest that unemployment is low for similar reasons.
- *The coefficient telling how much to raise the interest rate when inflation rises is smaller when unemployment is high.* This response might occur

if the central bank believes that higher inflation is more likely to be transitory in a slack economy than a strong one.

- *The Taylor rule ties the interest rate directly to government purchases; the tie is strong when unemployment is low and weak when it is high (another nonlinear response).* The central bank might behave this way if it believed that supply functions are nonlinear rather than accepting their economists' implicit beliefs that they are linear.

Because econometric identification of policy response functions is notoriously challenging, it will be hard to determine if the Taylor rule based explanations for the findings of this chapter are correct. Maybe we will have to reconsider our views about the linearity of labor and product supply. That would be a wrenching change for many of us macroeconomists.

The authors mention briefly that there is no correlation between government purchases and their measure of the economic activity. They do not pursue the point, but it illustrates a principle that recent US experience demonstrates remarkably: governments do not crank up purchases to cure a slack economy. Hall (2010) reviews the US data on this point. Notwithstanding the highly publicized attempts of the Obama administration, government purchases sagged below their established growth path following the financial crisis in 2008. The same principle applies, on average, among all the advanced economies of the OECD.

AG's chapter gives macroeconomists—especially those pursuing general-equilibrium aggregate models—a lot to chew on. We face a choice between discarding our belief in the near-linearity of product and labor supply, rethinking the Taylor rule, or something else that has escaped me so far. It will be interesting to see how the assimilation of the results of this chapter plays out.

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