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# FRBSF WEEKLY LETTER

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## Using Consumption to Track Movements in Trend GDP

One of the goals of economic policy is to stabilize short-term fluctuations in output and employment. Policymakers try to do this by "leaning against the wind." That is, they try to stimulate aggregate demand when output and employment are "too low" and to reduce aggregate demand when output and employment are "too high." Whether output is "too low" or "too high" is determined by comparing actual GDP with its trend. Of course, trend GDP is not observable, so policymakers must rely on estimates.

Measuring trend GDP turns out to be a difficult and important problem. Its difficulty stems from the fact that accurate measurement requires high quality data about the current state of the real economy and a great deal of knowledge about economic dynamics, both of which are in short supply. Its importance stems from the fact that policymakers cannot effectively lean against the wind unless they know which way it blows. Measurement errors in trend GDP are one factor that can make policy destabilizing rather than stabilizing.

This *Weekly Letter* discusses some of the policy problems that derive from uncertainty about trend GDP. It also describes a proposal by John Cochrane (1994), who suggests that consumption can be used to track movements in trend output. His idea is quite simple: Economic theory tells us that consumption primarily reflects the expectations of private households about long-run movements in income. Therefore consumption should provide a reasonably good measure of trend GDP.

### **Why good measures are important for stabilization policy**

Macroeconomic policymakers try to stabilize short-term fluctuations in output and to maintain low inflation over the long run. The rationale for trying to prevent output from falling too far below trend is a belief that this represents a waste of resources. The rationale for trying to prevent output

from rising too far above trend is a fear that this may put upward pressure on inflation, which would conflict with long-run objectives. Thus policymakers seek to balance the risk of inefficient resource utilization against the risk of rising inflation.

Uncertainty about trend GDP puts policymakers in a difficult position. If they are unsure whether output is above or below trend, they must be more cautious about pursuing countercyclical policies. The reason is that a mistake in measuring the gap between actual and trend output might cause policy to be destabilizing rather than stabilizing. For example, suppose that GDP were at its trend level, so that no countercyclical action is needed. If policymakers were to overestimate trend GDP, they would conclude that output is below trend and might choose to stimulate aggregate demand, thus increasing the risk of a rise in inflation. Similarly, if policymakers were to underestimate trend GDP, they would conclude that output is above trend and might choose to reduce aggregate demand, thus increasing the risk of recession. In both scenarios, policy turns out to be destabilizing, in the sense that it pushes output away from trend rather than toward it.

Furthermore, Milton Friedman (1953) demonstrated many years ago that it is not enough for policymakers to guess right about as often as they guess wrong. If policymakers bat .500, attempts at countercyclical policy turn out to be destabilizing on average. Stabilization policy must offset other shocks in order to be effective. If policy actions are timed randomly, they become an additional source of variability rather than an offsetting factor. Therefore, in order for policymakers to pursue countercyclical policy, they must bat better than .500, and the more aggressive are their countercyclical actions, the higher their batting average must be. Bold countercyclical actions require that policymakers guess right *far more often* than they guess wrong.

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## Estimating trend GDP

Since trend GDP is not observable, economists must try to estimate it. One traditional approach assumes that the economy evolves along a long-run growth path that grows at a constant rate, with transitory shocks generating short-term fluctuations in output and employment. This approach implicitly assumes that all shocks are neutral in the long run. If this were the case, it would be a simple matter to estimate trend GDP: Trend growth is the same as the average rate of real GDP growth.

However, over the last 15 years, many economists have begun to doubt the assumption that all shocks are neutral in the long run. Indeed, some shocks, such as technological innovations, probably have permanent effects on output. Measuring trend GDP is much harder when some shocks are permanent and others are transitory. The traditional approach works very badly in this case. Although some movements in output reflect a short-term deviation from trend, as in the traditional model, others reflect a shift in trend GDP itself. Since there is no tendency for permanent shocks to revert to the simple trend line, measurement errors accumulate over time and ultimately grow without bound. Some progress can be made by allowing for occasional shifts in the trend growth rate, but this represents an *ex post* adjustment and therefore has limited value for policy analysis.

Since trend GDP is subject to random permanent shifts, it is essential to distinguish between permanent and transitory shocks in order to track its movements. John Cochrane (1994) proposes a way to use information about consumption to help sort between permanent and transitory shocks. His idea is based on the permanent income hypothesis, which in its simplest form states that people save when income is unusually high so that they will be able to sustain customary consumption levels in the future when income turns out to be unusually low.

For example, an ancient version of the permanent income hypothesis appears in the Biblical tale of Joseph and the Pharaoh. The Pharaoh dreamt of seven fat cows followed by seven lean cows who devoured the fat ones. Joseph interpreted the Pharaoh's dream in terms of the agricultural cycles to which ancient Egypt was subject. The seven fat cows represented seven abundant harvests, and the seven lean ones represented seven bad ones. In order to prevent starvation in the lean years, Joseph persuaded the

Pharaoh to store grain from the good harvests and distribute it during lean years.

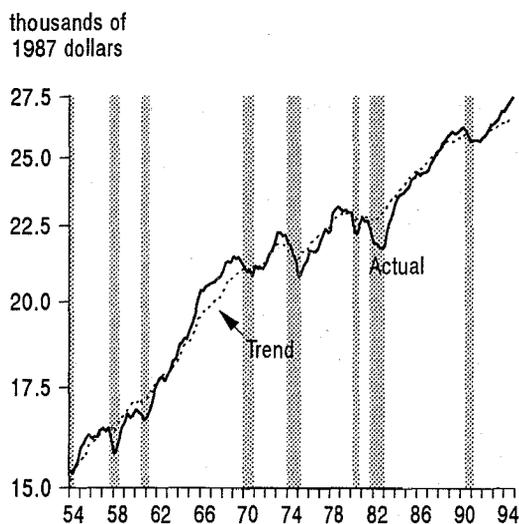
Modern versions of the permanent income hypothesis replace dreams with rational expectations and incorporate risk aversion and variation in interest rates, but they retain the same basic insight. Consumption is determined primarily by the expected present value of future income rather than by current income alone.

Cochrane applies the logic of the permanent income hypothesis to the problem of sorting between permanent and transitory movements in income. If a shock to income is transitory, it is likely to have little effect on the expected present value of lifetime income. Therefore we would not expect consumption to change much in response to transitory shocks. However, if a shock to income is permanent, it is likely to have a greater effect on the expected present value of lifetime income, and thus we would expect a greater response in consumption. If we observe a movement in income that is not accompanied by a movement in consumption, we can infer that consumers believe that the change in income is likely to be transitory. On the other hand, if consumption and income move together, then we can infer that consumers believe that the change in income is likely to be long lasting. Since consumption measures consumers' expectations of long-run GDP, it should provide a good measure of the trend in GDP.

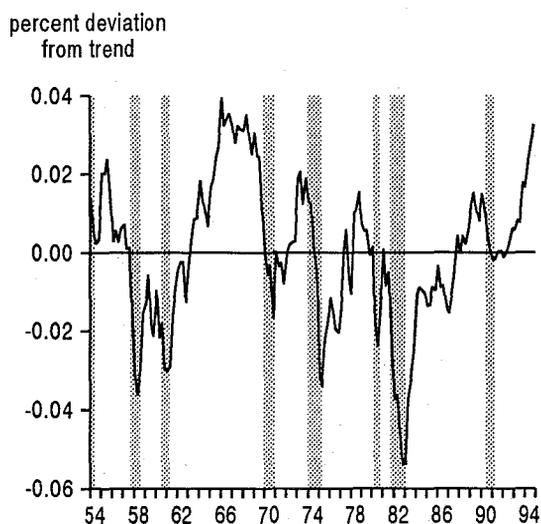
The figures illustrate the results of applying Cochrane's idea to U.S. data. Figure 1 shows per capita real GDP along with the consumption-based measure of trend, which was estimated by regressing per capita real GDP onto per capita real consumption. The fitted values from this regression illustrate movements in income that are accompanied by movements in consumption. These movements are likely to be long lasting, and they approximate movements in the trend in output. Figure 2 shows the residuals from this regression. They represent the movements in GDP that do not correspond to movements in consumption and they should be transitory. The shaded areas mark the dates of recessions as determined by the National Bureau of Economic Research (NBER). Troughs in the consumption-based measure conform quite closely to the dates of NBER recessions: They often occur in the same quarter as the NBER trough, and they always occur within plus or minus two quarters of the NBER trough. Furthermore, the consumption-based measure does not give any false signals of recession.

Another way to understand Cochrane's idea is to think about what it implies for forecasting output growth. When output is below trend, it ought to

**Figure 1**  
Per Capita Real GDP



**Figure 2**  
Cyclical Component of GDP



grow faster than average in order to catch up. Similarly, when output is above trend, it should grow more slowly than average in order to let the trend catch up. The permanent income hypothesis implies that the income-consumption ratio should be a good predictor of future output growth. This ratio should be high when consumers believe that current income is high

relative to the path of expected future income, because consumers will want to save in order to prepare for less favorable times ahead. Similarly, the income-consumption ratio should be low when consumers believe that current income is low relative to the path of expected future income, because in this case consumers will reduce current savings in order to maintain current consumption. It is clear from the figures that the income-consumption ratio is an excellent predictor of future growth. For example, the income-consumption ratio is low at the troughs of recessions, when output growth is about to pick up, and it is high near the end of expansions, when output growth is about to slow down. Cochrane uses formal statistical techniques to confirm that the income-consumption ratio has significant predictive power for future output growth.

Finally, although consumption is not an exact measure of the trend in output, it compares favorably with a number of other commonly used measures. For example, Cogley (1995) simulates a variety of models of trend and cycle and finds that the consumption-based measure is a useful, robust indicator of the unobserved true cycle.

### Conclusion

Measuring trend GDP is important because central banks cannot lean against the wind if they do not know which way it blows. This is difficult because it requires sorting between shocks that have permanent and transitory effects on output. Economic theory tells us that consumption may be useful for this purpose, and there is some empirical evidence to support this idea.

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