FRBSF Weekly Letter

June 7, 1991

Using Consumption to Forecast Income

Economists use a wide variety of sophisticated statistical models and methods to forecast the course of the economy. These generally are complex and involve numerous relationships among a variety of economic variables. This *Weekly Letter* discusses a much simpler method of constructing output forecasts, one that relies upon the relationship between output and the information contained in individuals' consumption decisions. The intuition underlying this approach is straightforward: consumers are likely to base their consumption decisions on the amount of income they expect to receive in the future. Assuming that consumers are not far off base in estimating their income prospects, aggregate consumption data should provide useful information about future GNP. This approach is especially relevant now, since it provides an independent means of judging the likely severity of the current recession.

The permanent income hypothesis

The theory underlying the method is known as the rational expectations version of the permanent income hypothesis of consumption. Milton Friedman, the economist who developed the permanent income hypothesis (PIH), provides a clear, illustrative example. Friedman points out that we do not expect a person who receives a paycheck every Friday to consume her entire paycheck that day and to consume nothing the remaining six days of the week. Instead, the worker will smooth out her consumption over all seven days of the week. The intuition underlying this example carries over to longer periods as well. Thus, the worker's consumption decisions at any point in time depend upon the level of income she expects to receive in the future.

The next step is to determine how the individual arrives at an estimate of her permanent income. Here, the rational expectations hypothesis implies that she will use all available information in order to forecast future income. And even though her predictions may be wrong from time to time, we do not expect that she will *systematically* over-predict or under-predict income. Thus, we expect that the individual's consumption today will reflect her best forecast of future income.

Is there any reason to expect that incorporating information about individuals' forecasts of their income (by incorporating information about their consumption decisions) will add anything to the forecasts that economists can construct by looking at economy-wide data? One reason is that individuals may be more familiar with their own circumstances. For example, individuals may know that their factory is not getting enough new orders and is likely to lay off some workers soon, which would lead them to reduce consumption now.

While this method of forecasting income may appear unfamiliar at first glance, the logic underlying this approach is similar to the one used by economists and policymakers when trying to interpret changes in long-term interest rates, for instance. It is well-known that interest rates contain a premium for inflation; the higher the expected rate of inflation, the higher interest rates will be. Economists often rely on this fact and look at long-term interest rates to obtain information about market participants' expectations of inflation. In a similar manner, looking at consumption should provide information about consumers' expectations of future income.

The empirical framework

Building on Campbell's (1987) work, Cochrane (1990) proposed a model based on the PIH to forecast real GNP rather than "income," even though real GNP is not the exact empirical counterpart of the PIH concept of income. For "consumption" the model uses real expenditures on nondurables and services. The omission of durable goods expenditures from the measure of "consumption" is standard practice, because it is generally agreed that such data do not provide information about the rate at which these goods actually are consumed. For instance, someone who buys a new car today and sells it after two years will have a very different consumption pattern from someone else who buys a new car

today and keeps it six years. (For brevity, the sum of nondurable and services consumption will be referred to as consumption, and the prefix "real" will generally be dropped, as all the variables discussed are measured in real, or inflation-adjusted, terms. Further, the terms "output" and "income" will be used interchangeably.)

We use what is known as a "vector error correction model" to estimate the relationship between these variables. This specification implies a stable long-run relationship between consumption and GNP, while allowing short-run deviations from this relationship. In other words, while shocks to either variable could cause a temporary change in the ratio of consumption to GNP, this ratio will tend to return to its mean value over time.

However, the empirical specification provides no guidance about which of the two variables will adjust to achieve the long-run value. This is where the rational expectations PIH comes in. Since the level of consumption is based on all information known to the individual, the individual will only change consumption upon receiving new information about her income. Thus, past income should provide no information about the change in consumption today. By contrast, past consumption should provide information that helps to predict the change in future income. Thus, in general, it is the level of output that will be observed to adjust to ensure that the consumption-output ratio returns to its long-run mean.

Before discussing the estimation results, it is useful to see how knowledge of what happens to consumption helps us interpret what a change in output means. Suppose output declines. If individuals react by reducing their rate of saving in order to keep consumption constant, it means that they do not see the output decline as permanent. Empirically, we will observe an above average consumption-output ratio and can predict that output will rise to bring this ratio back to normal. On the other hand, a fall in output that is accompanied by a comparable fall in consumption but little change in the saving rate would imply that consumers had interpreted it as a decline in their permanent income. The consumption-output ratio would not move as much, and so we would not predict a quick bounce-back in output.

The results

The model is estimated using data for the period from 1947Q1 to 1991Q1. It turns out that past changes in consumption and output provide almost no information about the change in consumption today, a result that is consistent with the PIH. It is noticeably easier to predict output growth, even though our forecasts of output are far from perfect. Of particular interest is the result that the consumption-output ratio contains a significant amount of information about future output growth.

The chart provides one way of looking at the estimated relationship between these variables. The top panel of the chart shows how output and consumption respond to a consumption shock, while the bottom panel shows how the two variables respond to an output shock. The top panel shows that positive shocks to consumption are not reversed, but instead lead to permanent increases in consumption. Output tends to overshoot the new, higher level of consumption in the beginning, but then falls back gradually to the long-run level of consumption. By contrast, as the bottom panel shows, shocks to output that do not simultaneously affect consumption are largely reversed over time. Specifically, only about a quarter of any such shock persists in the long run. Thus, in either case, shocks to the consumption-output ratio are reversed largely by the level of output moving towards the level of consumption. This is what the PIH implies as well, since current consumption is already supposed to be at the level consistent with a rational forecast of future income.

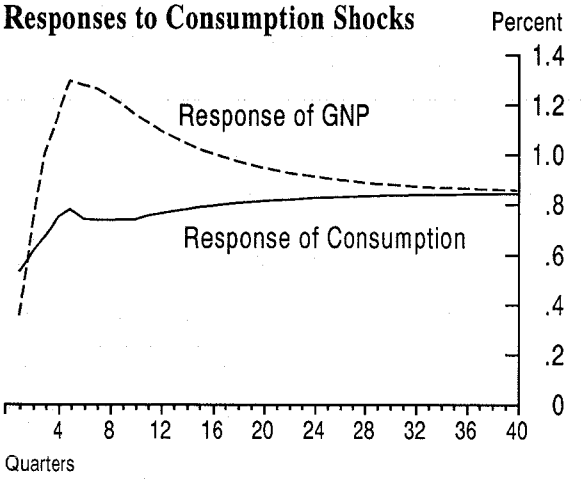
A severe recession?

These results imply that today's consumption contains significant information about future output; this finding is especially interesting right now because it allows us to obtain a measure of how severe consumers expect the current recession to be. We do this by using the model discussed above to forecast real GNP growth over the next year.

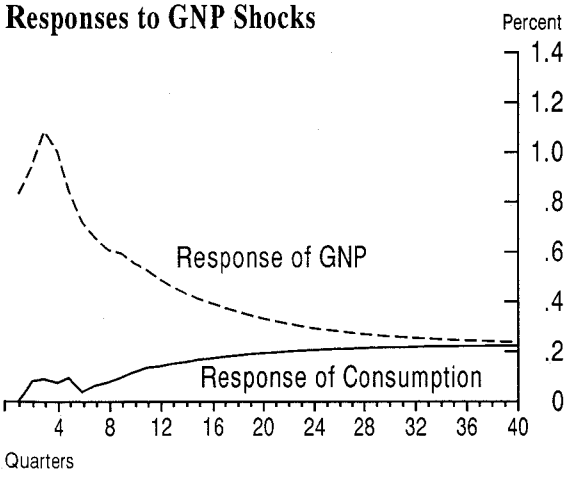
The model predicts that GNP will decline slightly in the second quarter (by around ¾ percent at an annual rate) but will then grow at a rate close to 1½ percent over the remainder of this year. And GNP is expected to grow by more than 3 percent next year. Without placing too much weight on the precise numerical forecast obtained from this

model it is worth pointing out that the model predicts a relatively small recession. A word of caution is also in order. Like all other forecasting techniques, this approach does not rule out adverse developments in the future that might make the recession worse. Instead, our results are more naturally interpreted as showing that currently available data do not suggest either a severe or prolonged recession.

Responses to Consumption Shocks



Responses to GNP Shocks



Conclusions

The simple model presented here is not meant to rival existing models of forecasting real GNP. Instead the model shows that commonly available information can be used to forecast income without specifying the complex relationships that may exist between different macroeconomic variables. The use of consumption to forecast income in this way is similar to the more common exercise of using long-term interest rates as predictors of inflation. Our model also provides an alternative estimate of how severe the current recession is likely to be. It suggests that the current recession is unlikely to be severe, and that the economy should be well on the road to recovery in the second half of the year. It is reassuring to note that this forecast is similar to those available from other sources.

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