

Real-Time Estimates of Revised GDP Based on an Estimated Quarterly Model of Initial and Revised GDP

Baoline Chen

Office of Directors
Bureau of Economic Analysis

Abstract:

U.S. gross domestic product (GDP) is not estimated directly from survey data like employment or retail sales, but is estimated by the Bureau of Economic Analysis (BEA) using observations on related variables. GDP measures economic activities in a given quarter and as such is a quarterly variable. Within 5 years, BEA releases initial, annual, and benchmark estimates of GDP for a given quarter. The 3 initial estimates, termed advance, preliminary, and final, are released 1-3 months after the quarter for which the estimates pertain. The next 3 annual estimates are released every July, for the quarters of the previous 1-3 calendar years. Finally, benchmark estimates are released about every 5 years, after new economic census data are available. For the present work, we limit the analysis to the first 6, initial and annual, estimates of GDP and, solely for this purpose, consider the last annual estimate to be final GDP, although estimates are usually further revised due to changes in definitions or estimation methods during benchmark revisions, so that revisions are not truly final.

In the analysis, the third annual estimate is a variable in a 6-variable vector autoregressive (VAR) time-series model. Because we know the release quarters of estimates, we index them by quarters and conduct a quarterly analysis. We work with data ranging from 1977 quarter 1 to 2005 quarter 4. In the data, every variable experiences missing observations: initial estimates are available only at ends of quarters, delayed one quarter (1-3 months); the 3 annual estimates are available only every July, respectively, delayed 3-6, 7-10, and 11-14 quarters.

The data may be indexed in two ways, by "historical" quarters to which they pertain or by "real-time" quarters in which they are released. In historical form, the data set is compact and has no missing values, unless values are missing for reasons other than delays in releases. In real-time form, the data set is very sparse, with mostly missing values. The historical form has dimension $T \times 6$ and the real-time form has dimension $T \times 84$, where T is the number of quarters in the sample.

The goal of the paper is to develop and illustrate with U.S. GDP a method for estimating in any period the designated 'final' GDP for that period. How final the GDP is depends on how many estimates or variables the analysis includes. The first step is to estimate a VAR model for the included variables. This can be done by applying OLS or maximum likelihood to the VAR model and data in the compact historical form. The second step is to estimate final GDP in every quarter, using the sample information which is available through that quarter. This can be done by applying the missing-data Kalman filter and the estimated VAR model to the data in the sparse real-time form. The second estimation is a real-time filtering exercise, because in any quarter the final GDP value for that quarter will be observed only many quarters in the future. In

the application, the filtered estimates of final GDP are compared to final values eventually released in terms of root-mean-squared error (RMSE) measures of accuracy. The results show that filtered estimates of final GDP have lower RMSEs than initial values as estimates of final values. Thus, the method gives us more accurate estimates of final values at the time of release of initial values.