

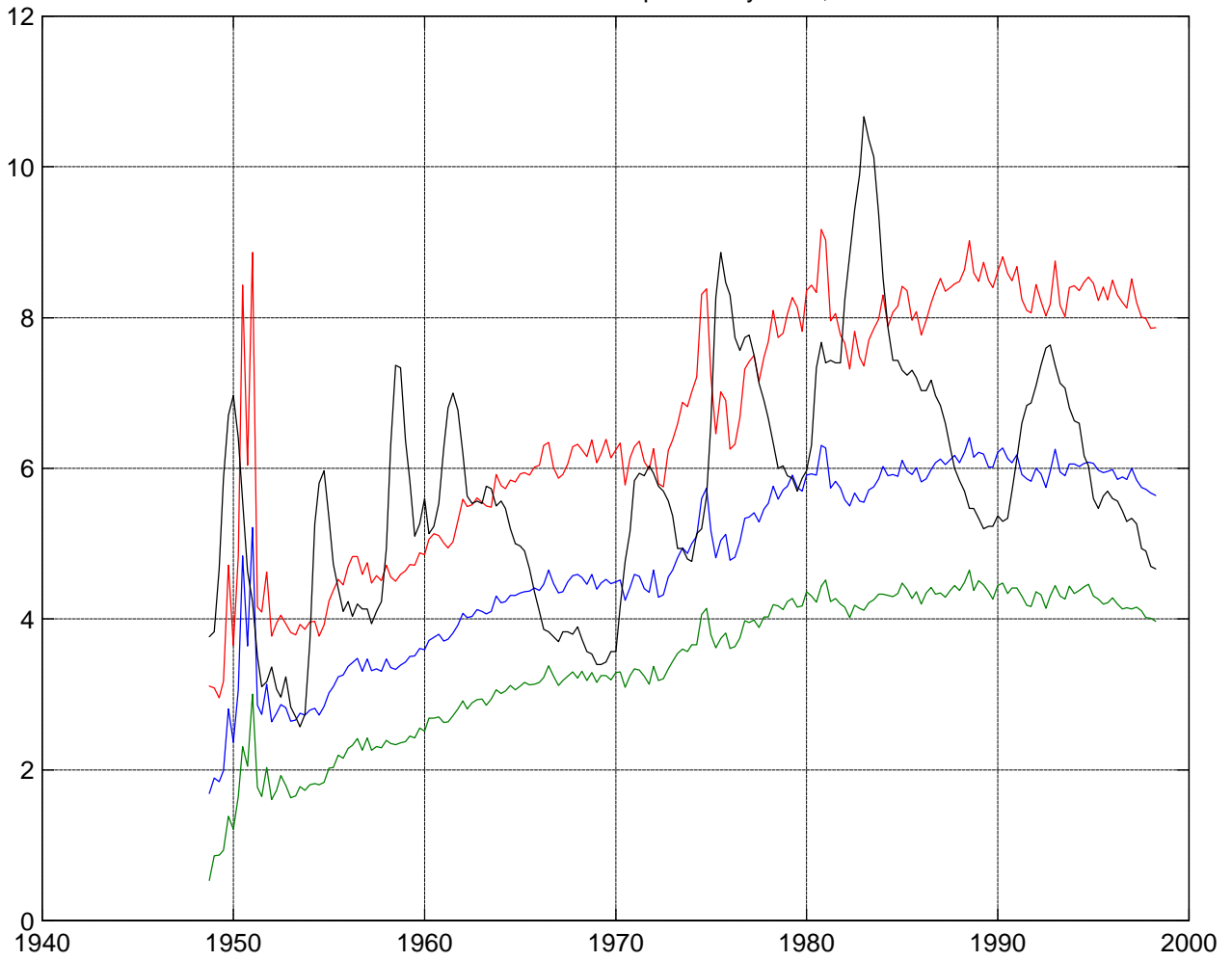
## Commentary on the Time Varying Parameters Problem

After correcting some errors in my own code, my results match those of the people who found an always-positive natural rate at the original settings of parameters. Plot of the Kalman filtered and Kalman smoothed estimates, with 68% error bands, based on 4000 random draws at each date, are attached below. The 68% bands remain positive and are estimated with more precision than the 95% bands, which start to reflect the behavior of the estimates if  $\beta$  is near zero.

It is interesting to note that in this base case the filtered estimates have error bands no wider than the smoothed estimates over part of the beginning of the sample. This may reflect unwarranted sharpness in the prior—excessively low variance in the prior. Note that the smoothed estimates show that belief in a constant NAIRU of 5% is consistent with the base case model.

It is also worth noting, despite the consistency of a constant NAIRU with the model, that the uncertainty is great enough to make NAIRU a questionable guide to policy. The smoothed estimates suggest that actual unemployment was substantially above NAIRU (above the 68% band) in 5 or 6 brief periods that correspond to recession troughs, and these periods were detectable in the filtered estimates as well. The smoothed estimates show actual unemployment below NAIRU, implying inflationary pressure, only twice, in the early 50's and in the late 70's. And the filtered estimates show that neither of these periods of inflationary pressure were detectable, in the sense of having actual unemployment below the lower 68% band on NAIRU, at the times they actually occurred. Monetary policy based on NAIRU, but acting only when actual  $U$  was clearly above or below NAIRU based on current filtered 68% bands, would have been expansionary during recessions, but would not have reacted to inflationary pressure at any time during the postwar period.

Kalman filter NAIRU with 68% probability band, actual U



Kalman smoother NAIRU with 68% probability band, actual U

