Measuring the Slowly Evolving Trend in US Inflation with Professional Forecasts

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1. Introduction

For the past 30 years US inflation has been modeled with a slowly evolving trend that captures either the Fed's inflation target or long-horizon expectations or both. The best forecasting models also have this feature in the form of a random walk within an unobserved-component (UC) model. At the same time professional forecasts (measured in the *Survey of Professional Forecasters*) are among the best inflation forecasts. They often are treated as rational expectations (RE) or more generally with sticky information (SI) in macroeconomic models. But we find that the UC and SI models are incompatible.

2. Model and Method

The UC model decomposes inflation π_t:

$$\pi_t = \tau_t + \varepsilon_t$$
$$\tau_t = \tau_{t-1} + \eta_t$$

with ε_t and η_t unpredictable. This model implies that τ_t is the long-horizon inflation expectation.

Next consider the mean *SPF* forecast *F* at time *t* and horizon 1, using either RE:

$$F_t\pi_{t+1} = E_t\pi_{t+1}$$

or SI:

$$F_t\pi_{t+1} = (1-\lambda)E_t\pi_{t+1} + \lambda F_{t-1}\pi_{t+1}.$$

To see the central idea, notice that under RE:

$$\tau_{t|t} = F_t\pi_{t+1}$$

so the observed forecast provides the filtered trend with the filtering outsourced to the professional forecasters. Then we find ε_t by subtraction and can study the historical components, their variances, and covariance.

We begin with observed forecasts, then estimate any parameters, then learn covariances between the components.

Under more general SI:

$$\tau_{t|t} = (F_t\pi_{t+1} - \lambda F_{t-1}\pi_{t+1}) / (1-\lambda)$$

so we need an estimate of stickiness, λ, either from differencing this result to find estimating equations or from the properties of mean forecast errors. Once we have this, we again can quickly and cheaply extract the trend in inflation.

3. Extensions and Tests

There are two key extensions to this basic idea. First, we allow for a persistent inflation gap ε_t:

$$\varepsilon_t = \rho\varepsilon_{t-1}+\nu_t$$

which allows forecasts to differ realistically by horizons.

Second, we allow for multiple horizons *h*, with *h=1,…4* in the *SPF*. That creates a singularity, so we appeal to measurement error and use the conventional Kalman filter to extract the trend $\tau_{t|t}$.

Once we have the components, we test for consistency of the UC and SI models by examining three features:

1. $\eta_{t|t}$ is white noise;
2. $\nu_{t|t}$ is white noise;
3. The predictability of the mean forecast error identifies stickiness:

$$\pi_{t+h} - F_t\pi_{t+h} = [\lambda/(1-\lambda)](F_t\pi_{t+h}-F_{t-1}\pi_{t+h}) + e_{ht}$$

where $e_{ht} = \pi_{t+h}-E_t\pi_{t+h}$, which gives $\hat{\lambda}= 0.4$.

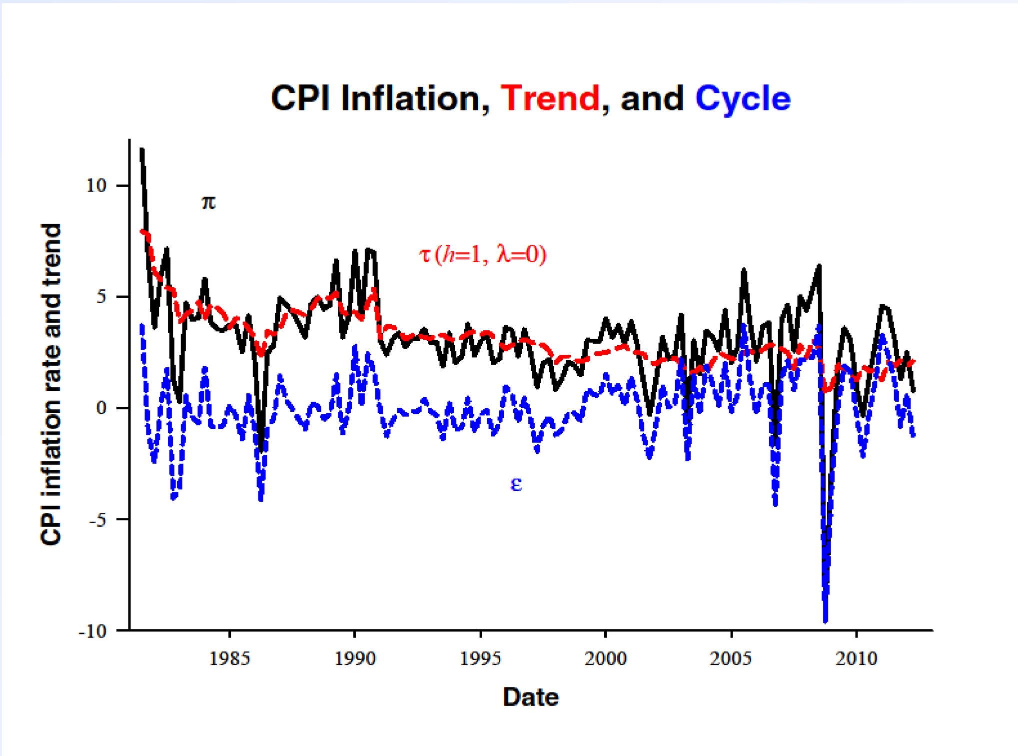
4. Results: RE

Estimation uses only inflation and SPF forecasts. Under RE we find a plausible trend. Innovation variances fall in the 1990s then rise in the 2000s. Their covariance is 0.35.

Results are similar when we use forecasts at all horizons and when we estimate a persistent inflation gap where we find $\hat{\rho}$= 0.13 (0.01).

Results also are similar for the GDP deflator and the CPI.

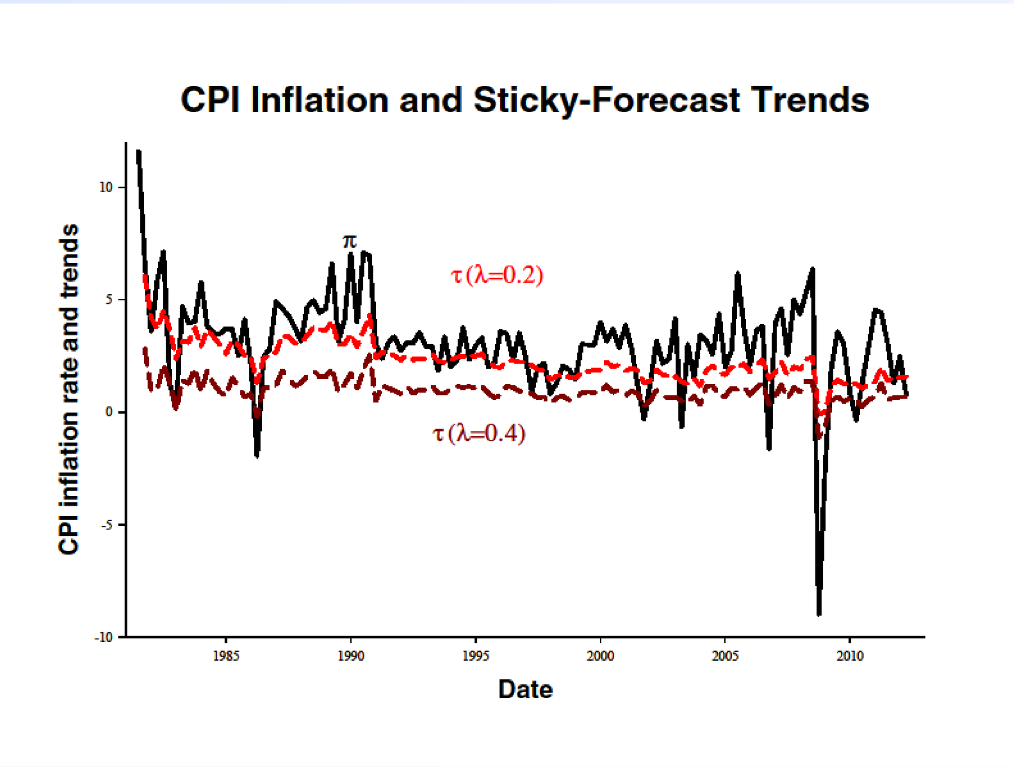
But once we include multiple horizons we fail test 1: there is evidence of persistence in $\eta_{t|t}$. And of course the RE setup fails test 3. Coibion and Gorodnichenko (2012) find mean forecast errors are predictable.



5. Results: SI

Under SI, then, we adopt λ from forecast-error regressions and also estimate it directly. As we increase λ, though, the path of the trend no longer runs through actual inflation. See the figure below for λ=0.2 and λ=0.4.

At these values of λ we then find that there is much persistence in both $\eta_{t|t}$ and $\nu_{t|t}$. Thus the UC-SI model of $\{\pi_t, F_t\pi_{t+h}\}$ cannot pass all three tests.



6. Conclusion

The UC model is widely used in forecasting and in histories of US inflation. The RE and SI models are widely used in closing macroeconomic models.

Both the UC model and the SI model restrict unobservable inflation forecasts $E_t\pi_{t+h}$. Combining these models provides a fast way to filter US inflation into trend and cycle, with the trend as long-term inflation expectations. By-products include estimates of information stickiness, λ, and inflation-gap persistence, ρ, as well as shock volatilities.

Can we reconcile the two statistical models with the properties of (a) inflation, (b) the term structure of professional forecasts, and (c) properties of mean forecast errors? We cannot. Realistic forecast stickiness does not yield a trend-cycle decomposition with unpredictable innovations.

It is not easy to reverse engineer a solution. For example, added dynamics in the UC model lead to restrictions on the inflation dynamics but also on the multi-horizon forecasts.

7. References

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