Discussion of “Tradeoffs and Sacrifice over Rate Cycles: Activity, Inflation and the Price Level” by Kristin Forbes, Jongrim Ha and M. Ayhan Kose

Comments by Mark W. Watson

This paper by Forbes, Ha and Kose (FHK hereafter) offers an empirical investigation of tradeoffs between output and inflation covering 24 countries over 1970-2024. It differs from much of the previous research in two important ways: (1) it relies on “rate cycles” as the time unit for measuring tradeoffs, and (2) it documents the tradeoff between output and changes in the price level in addition to changes in inflation. Both of these changes lead to interesting new insights into the role of central banks in navigating the tradeoffs between output growth and inflation/prices. My comments will focus on the use of a rate cycle as the time unit of interest.

As FHK note, the use cycles as a unit of measurement has a long tradition in business cycle analysis. Research at the NBER – notably the contributions by Mitchell (1927) and Burns and Mitchell (1927) – exemplifies this tradition. In empirical macroeconomics, these “cycle-methods” have been largely supplanted by structural models (e.g., the early simultaneous equation models such as Klein and Goldberger (1955) and DSGE extensions such as Smets and Wouters (2007)) and discrete-time linear time series models like VARs (Sims (1980)) or local projections (Jorda (2005)). But, despite the decline of interest in Burns and Mitchell methods among academic researchers, business cycle analysis – notably the dating of recessions and expansisons by the NBER and others – continues to generate popular interest, and it remains common practice to include shaded recession regions when plotting macroeconomic time series. FHK borrow from this business cycle tradition, but instead of business cycles they instead isolate “interest rate cycles” – alternating periods of tightening and loosening of interest rates by policy makers – and study the evolution and comovement of output, inflation and prices over these cycles.

My comments focus on the question of what can be learned from cycle-methods that goes beyond what can be learned from standard linear time series methods. That is, what can cyclical concepts like "phase durations," "amplitudes," or (as proposed by FHK, "initial velocity") tell us that we would not learn from standard linear time series concepts like autocorrelations, impluse responses, variance decompositions or spectra.

Researchers have pointed to several features of macro data that are missed by linear time series models. For example, Figure 1 plots the unemployment rate on a FRED graph that, by default, includes business cycle shading. As noted by Burns and Mitchell (1927), Neftci (1984), DeLong and Summers (1984), Romer and Romer (2020) and Hall and Kudlyak (2022), unemployment exhibits a sharp cyclical asymmetry – increasing rapidly during recessions and declining more slowly during expansions. It is as if time speeds up during recessions – an idea formalized by Stock (1987) in his work on time deformation where "business cycle time" differs from calendar time. More generally, one can imagine a process with different stochastic processes operating during recession and expansions and where the economy switches back and forth between these regimes – an idea formalized in by the Markov switching models in Hamilton (1989). Many of the descriptive statistics used in the cycle literature seem well-suited for describing these kind of phenomena.

Figure 1: U.S. Unemployment Rate and Business Cycles

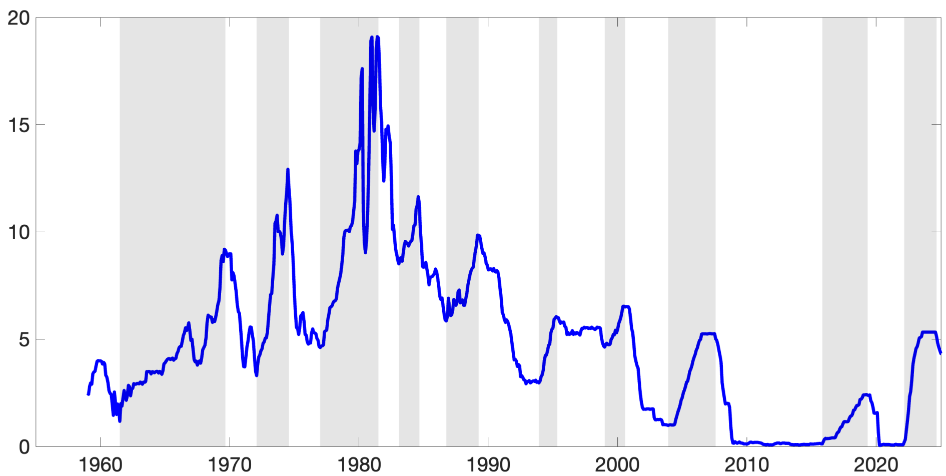
With these kinds of features in mind, a natural question is whether cycle statistics are useful for diagnosing potential misspecification of linear models. One answer to this question procedes as follows: Let Y^{Data} denote a historical time series and let $S(Y^{Data})$ denote a cyclical statistic such as the length or amplitude of an expansionary cycle. Let Y denote a stochastic process, with say $Y \sim F$. Computing the statistic S using Y produces the random variable $S(Y)$, where $S(Y) \sim G$ and where the distribution G depends on probability law for Y (that is, F) and the function S. One can then ask whether a statistic computed from the historical data, that is $S(Y^{Data})$, looks like a draw from G. If $S(Y^{Data})$ is inconsistent with G, then the cycle statistic S suggests that Y^{Data} is not well described by the stochastic process F.

Adelman and Adelman (1959) carry out such an exercise. They use versions of the Klein-Goldberger model as F, the stochastic process under study, and business cycle statistics like those in Burns and Mitchell as S. They found that $S(Y^{Data})$ is inconsistent with $S(Y)$ when the model is driven only by observable exogenous variables, but that $S(Y^{Data})$ is generally consistent with $S(Y)$ when stochastic error terms are added to the equations in the model. In this sense, realizations from the Klein-Goldberger model look like the macroeconomic series analyzed by Burns and Mitchell.

As an aside, an important challenge for the Adelmans was the calculation of the statistic S, because the Burns and Mitchell statistics require the calculation of a "reference cycle," which in turn requires determining peak and trough dates for the variables under study. Judgment played a role in Burns and Mitchell's choice of these dates, and the Adelman's relied on their judgment for their caculations. In an important contribution, Bry and Boschan (1971) developed an algorithm that replicated many of the judgments made by Burns and Mitchell and codified the algorithm in FORTRAN code. When King and Plosser (1994) carried out an exercise like the Adelmans (using a real business model in place of the Klein-Goldberger model) they re-discovered the Bry-Boschen computer code and used it to determine business cycle turning points. Subsequently, other researchers refined the Bry-Boschan program – most notably Harding and Pagan (2002) extended the progam, which was written to determine turning points in monthly time series – to compute turing points in quarterly series. One of the contributions of FHK is a further extension of the program to compute turning points in policy rates, which involves new rules to enforce the minimum length of cycles, handle periods of stable interest rates and other important subtleties necessary for computing interest rate cycles.

Figure 2 plots the Federal Funds rate along with interest rate cycles computing using the Bry-Boschan program with FHK modifications. The Federal Funds rate does not exhibit the sharp asymmetry shown in Figure 1 for the unemployment rate, but does show symptoms of nonlinearity associated with the zero lower bound.

Figure 2: U.S. Federal Funds Rate and Interest Rate Cycles



I have carried out an exercise like the Adelmans, but rather than asking whether the Klein-Goldberger model describes Burns and Mitchell business cycles, it asks whether a AR(12) model can describe (a subset of) FHK's interest rate cycles. In particular I used an AR(12) model with homoskesdatic Gaussian errors and AR coefficients estimated by OLS over 1960m1-2025m2. Figure 3 show the resulting distribution of cycle durations, amplitudes, and intial velocities associated with F (that is, the distribution of $S(Y)$ computed from the AR(12) model) and the values found in the data ($S(Y^{Data})$). The results suggest that the cycle durations and amplitudes found in the data are generally consistent with the values that are implied by AR(12) model. But the velocity of interest rate increases appears to be somewhat faster in the data than is implied by the AR(12) model.

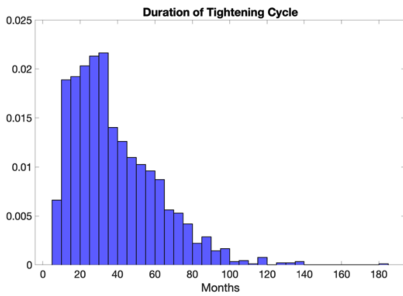
Argubaly a more interesting exercise would involve generating data from a multivariate model (e.g., a VAR or large-scale factor model) as this would allow the calculation of the various sacrifice ratios computed in FHK. Unfortunately I have not had the time to carry out such an exercise – but I conjecture that, like the results in Adelman and Adelman (1959), King and Plosser (1994) and the simple AR(12) model, it too would find that relatively simple linear models produce cycle statistics that are generally in line with the data. One interpretation of these results is that the Adelman's exercise – comparing $S(Y^{Data})$ to the distribution of $S(Y)$ is a crude tool for uncovering cyclical nonlinearities in time series.

What then are we to make of the usefulness of cycle statistics like those computed by Burns and Mitchell and FHK? My take is that these statistics are useful, not because they

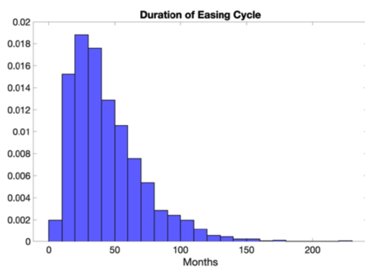
Figure 3: Cycle Statistics: From an AR(12) Model and from Federal Funds Data

(a) Durations

Model Data



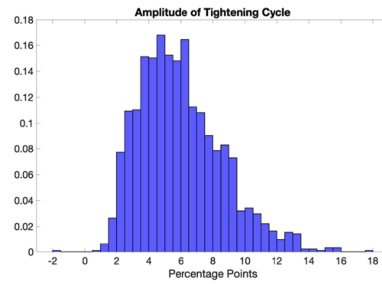
n = 10
mean = 37
sd = 24
min = 16
max = 97



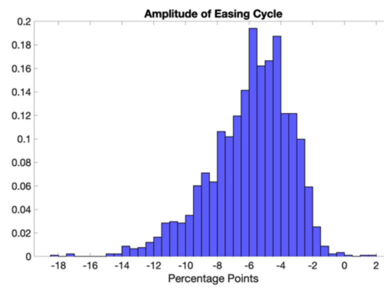
n = 10
mean = 40
sd = 24
min = 20
max = 100

(b) Amplitude

Model Data



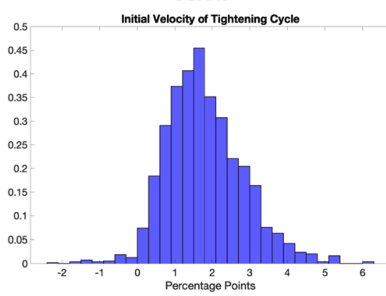
n = 10
mean = 5.6
sd = 4.0
min = 1.9
max = 14.5



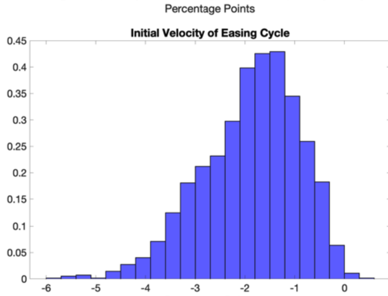
n = 10
mean = -5.5
sd = 2.8
min = -10.6
max = -1.4

(c) Initial Velocity (Change in First 6 Months)

Model Data



n = 10
mean = 0.91
sd = 0.66
min = 0.05
max = 2.25



n = 10
mean = -1.97
sd = 2.4
min = -6.7
max = -0.15

tell us much about the *stochastic process* describing Y^{Data}, but rather because they are useful descriptions of the Y^{Data} *realizations*. That is, these statistics systematically isolate particular times in history when interesting things have happened (recessions, interest rate tightening, etc.), and these periods are worth studying, perhaps using formal methods such as the narrative approach described in Romer and Romer (2023), VAR versions like those in Antolin-Diaz and Rubio-Ramirez (2018) and Giacomini, Kitagawa, and Read (2022), or using less formal methods. In this regard, the interest rate chronology developed by Forbes, Ha and Kose – covering 24 countries and more that 50 years – will serve as an invaluable tool for the historical study of central bank policy decisions and their implications for the macroeconomy.

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