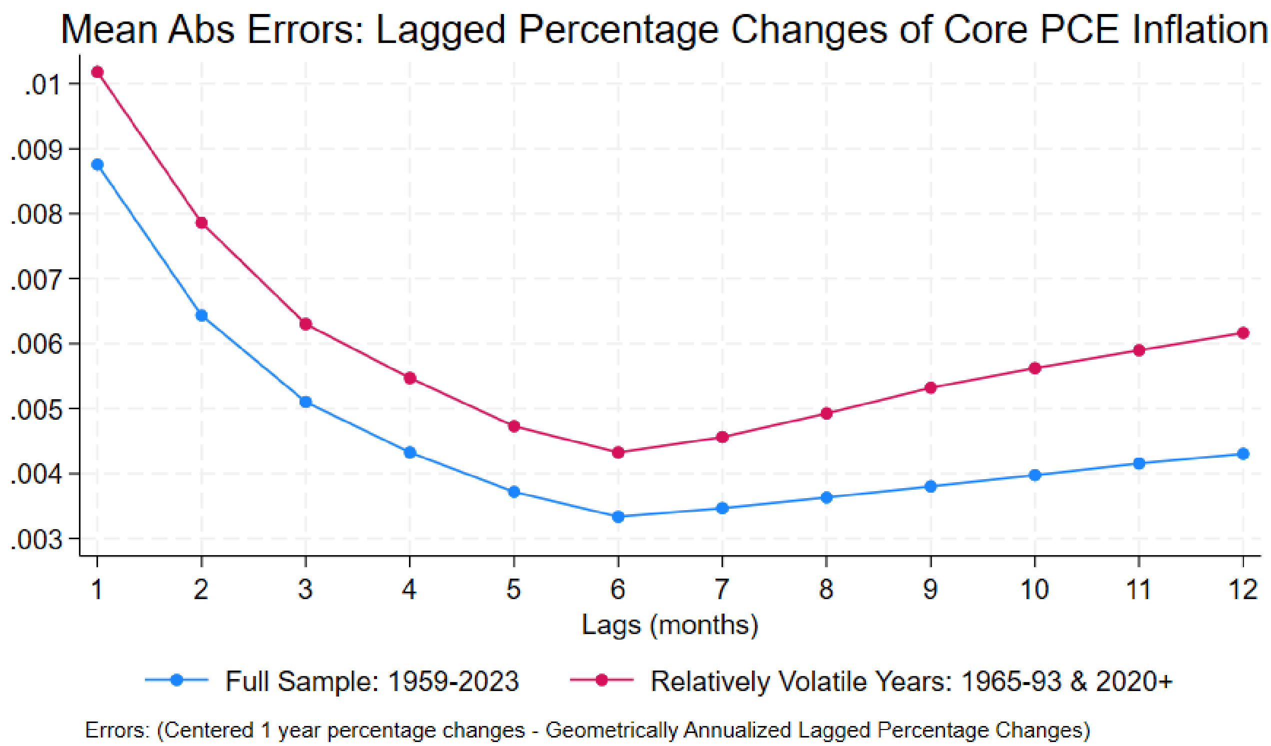
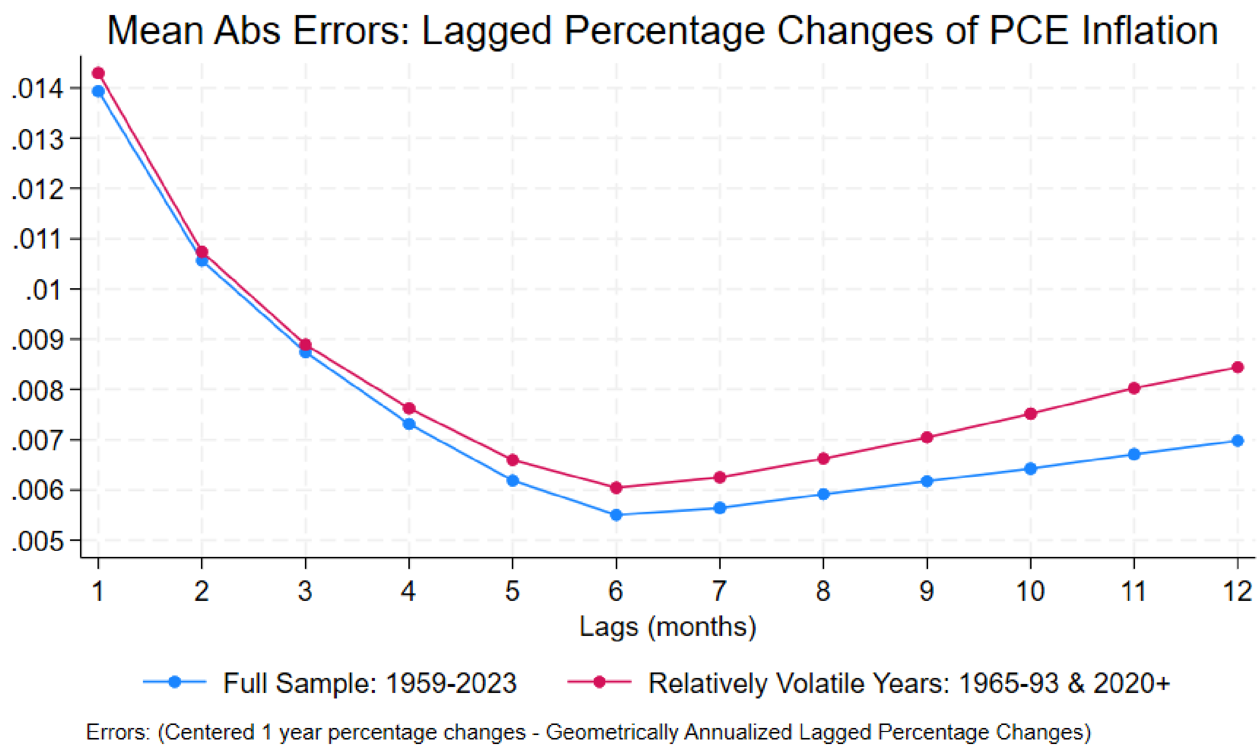
OptLagInternetAppendix200.pdf
Internet Appendix: “Forecasting the Present: Optimal Lags for Contemporaneous Core PCE Inflation”
by David K Howe
Version 0.200

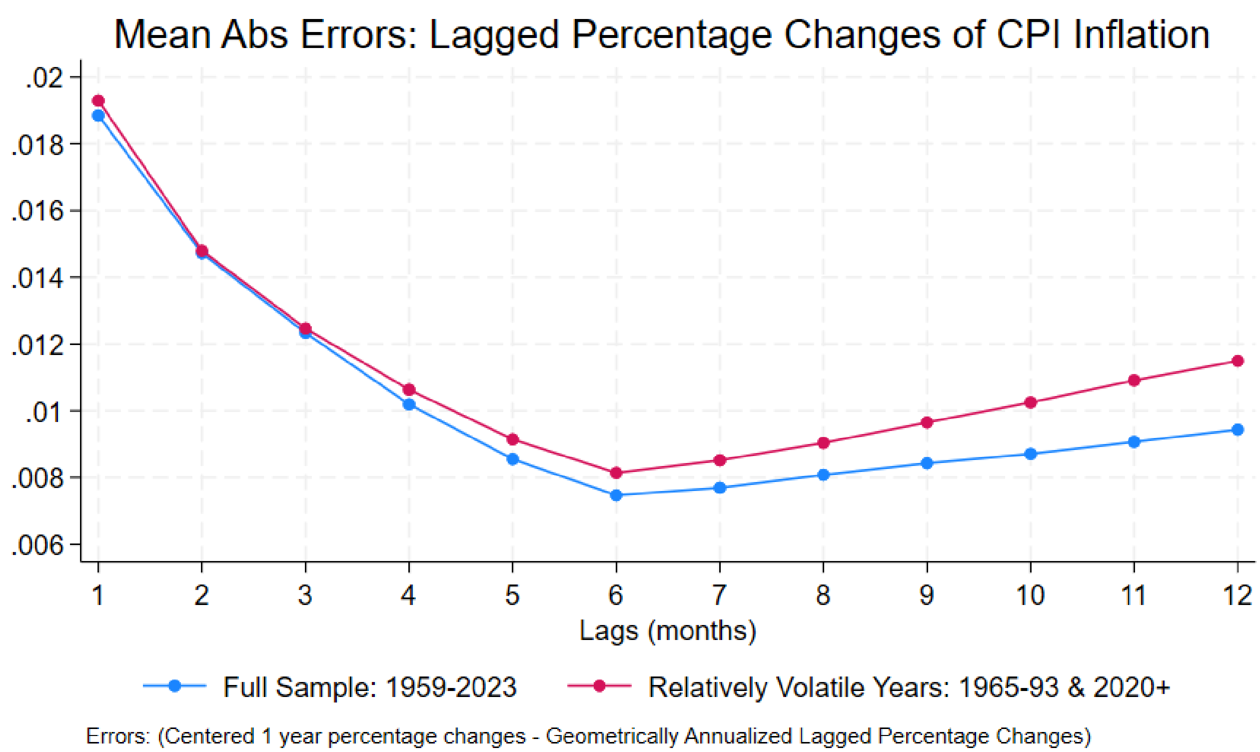
Section 1

Using geometrically annualized returns, 6 month lags fit best for Core PCE, as well as unadjusted PCE, CPI, and Core CPI.

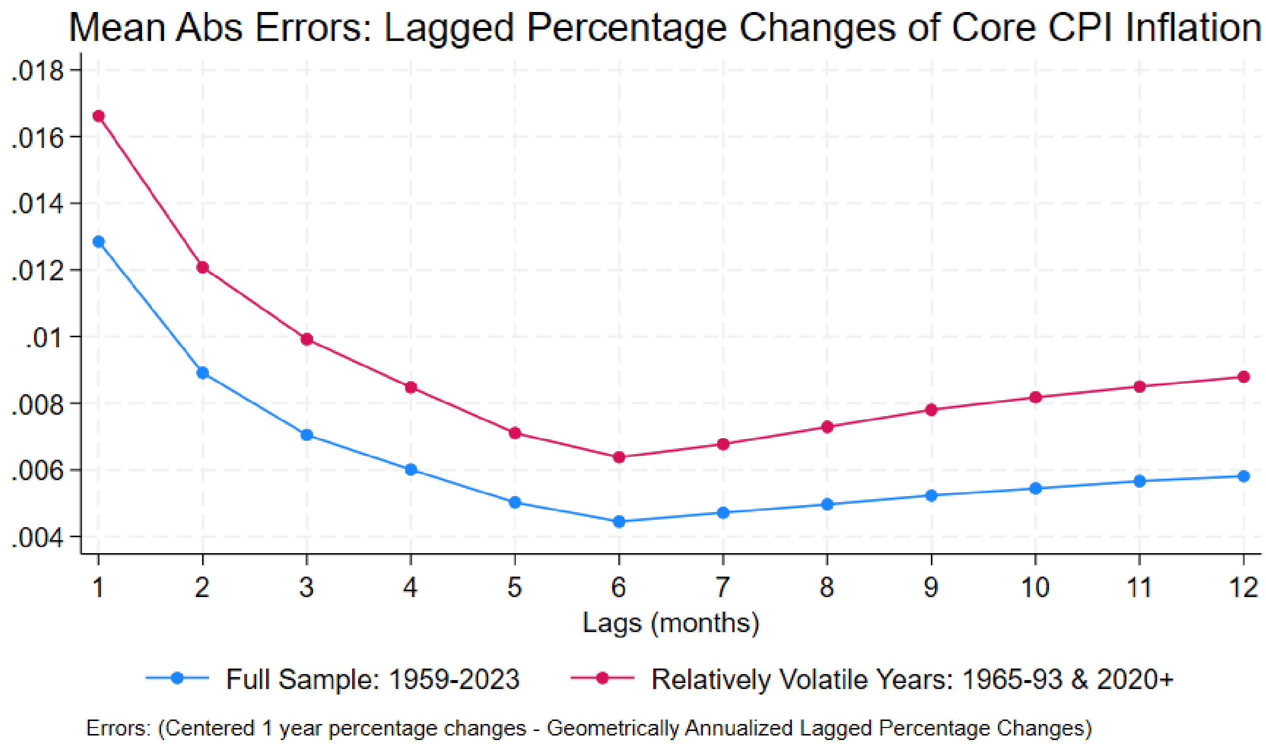




Mean Abs Errors: Lagged Percentage Changes of PCE Inflation
.014
.013
.012
.011
.01
.009
.008
.007
.006
.005
1
2
3
4
5
6
7
8
9
10
11
12
Lags (months)
Full Sample: 1959-2023
Relatively Volatile Years: 1965-93 & 2020+
Errors: (Centered 1 year percentage changes - Geometrically Annualized Lagged Percentage Changes)



Mean Abs Errors: Lagged Percentage Changes of CPI Inflation
.02
.018
.016
.014
.012
.01
.008
.006
1
2
3
4
5
6
7
8
9
10
11
12
Lags (months)
Full Sample: 1959-2023
Relatively Volatile Years: 1965-93 & 2020+
Errors: (Centered 1 year percentage changes - Geometrically Annualized Lagged Percentage Changes)



Section 2

Section 3
Table 1 Adjunct

Here I supplement Table 1 with additional summary statistics. The table covers monthly percentage changes from February 1959 through December 2023.

```
. tabstat  pcLpcecore pcLpce pcLcpicore pcLcpi ///
>   if sdate>=m(1959m2) & sdate<=m(2023m12) ///
>   , format(%8.4f) stat(n mean median sd skew kurtosis q p10 p90 min max)

             Core PCE       PCE  Core CPI       CPI
   Stats |  pcLpce~e    pcLpce  pcLcpi~e    pcLcpi
---------+----------------------------------------
       N |  779.0000  779.0000  779.0000  779.0000
    Mean |    0.0026    0.0027    0.0030    0.0030
     p50 |    0.0021    0.0022    0.0025    0.0026
      SD |    0.0020    0.0025    0.0025    0.0031
Skewness |    0.9507    0.4875    1.3066    0.2821
Kurtosis |    4.4852    5.8555    5.9397    7.1816
     p25 |    0.0013    0.0012    0.0016    0.0012
     p50 |    0.0021    0.0022    0.0025    0.0026
     p75 |    0.0037    0.0039    0.0039    0.0045
     p10 |    0.0007    0.0002    0.0003    0.0000
     p90 |    0.0054    0.0057    0.0062    0.0069
```

3 Appendix: Forecasting the Present: Optimal Lags for Contemporaneous Core PCE Inflation

```
     Min |   -0.0057   -0.0118   -0.0049   -0.0177
     Max |    0.0103    0.0123    0.0142    0.0181
--------------------------------------------------
From MonthlyPrices04b.dta and OptLag24b.do
```

Comparing p10 and p90 to the median shows that tails are somewhat longer to the right.

Compare Core PCE one month percentage changes with simply annualized and geometrically annualized versions:

```
pcLpcecore: (pcecore/L.pcecore)
pcLapcecore: pcLpcecore*12.
PcLagpcecore: (1+pcLpcecore)^12 -1.

. tabstat pcLpcecore pcLapcecore  pcLagpcecore ///
>   if sdate>=m(1959m2) & sdate<=m(2023m12) ///
>   , format(%8.4f) stat(n mean median sd skew kurtosis q p10 p90 min max)

   Stats |  pcLpce~e  pcLapc~e  pcLagp~e
---------+------------------------------
       N |  779.0000  779.0000  779.0000
    Mean |    0.0026    0.0316    0.0324
     p50 |    0.0021    0.0250    0.0253
      SD |    0.0020    0.0236    0.0245
Skewness |    0.9507    0.9507    1.0335
Kurtosis |    4.4852    4.4852    4.6135
     p25 |    0.0013    0.0153    0.0154
     p50 |    0.0021    0.0250    0.0253
     p75 |    0.0037    0.0447    0.0456
     p10 |    0.0007    0.0087    0.0088
     p90 |    0.0054    0.0650    0.0670
     Min |   -0.0057   -0.0682   -0.0661
     Max |    0.0103    0.1231    0.1303
----------------------------------------
```

Half lives are calculated with the following equation:

Half-life = ln(.5)/ln(ar(1) coefficient)

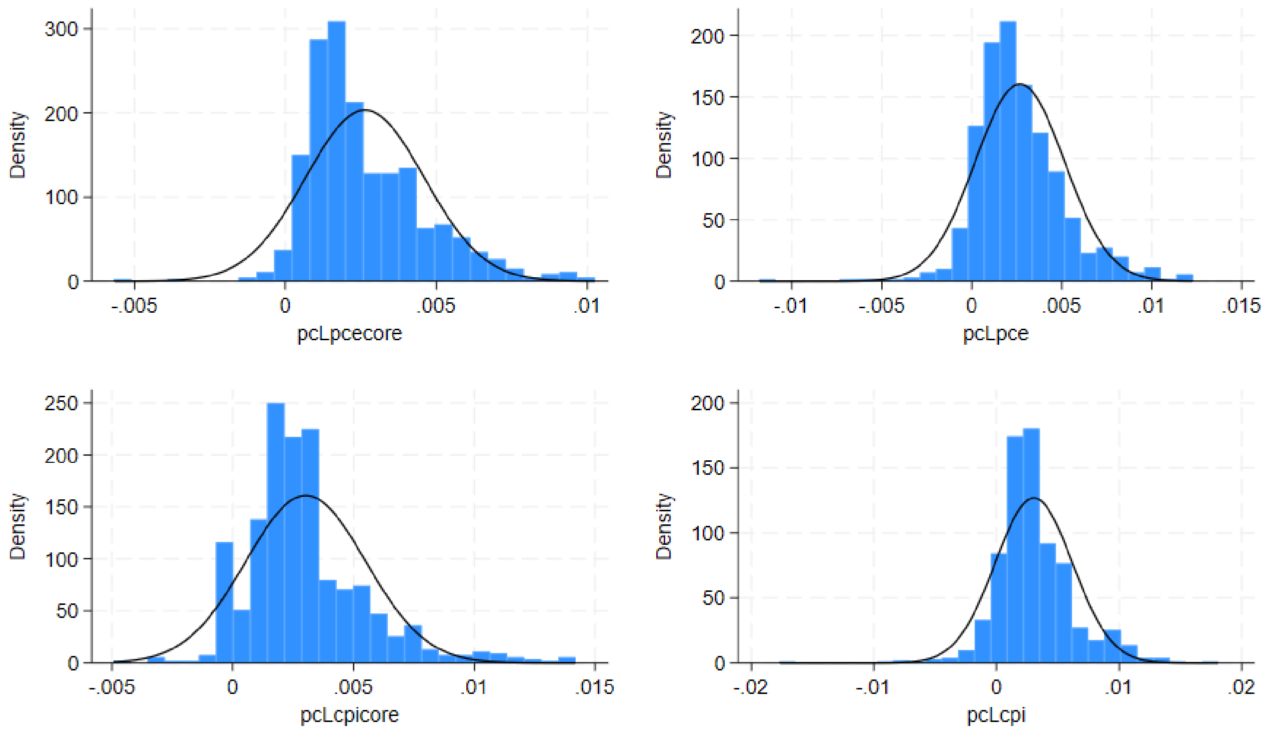
Define the upper bound by taking the ar(1) coefficient and adding 2 standard errors. Define the lower bound by subtracting 2 standard errors.

<u>Half life in Years</u>

	Core PCE	PCE	Core CPI	CPI
Half life, years	3.72	1.13	2.62	0.58
Lower bound	2.00	0.73	1.67	0.41
Upper bound	25.26	2.36	5.93	0.96

The CPI confidence interval is completely outside the Core PCE and Core CPI confidence intervals.

Histogram for monthly percentage changes of core PCE, PCE, core CPI, and CPI.



An AR(1) model is equivalent to an infinite MA(n) model. Solving for n by BIC and AIC metrics gives a rough idea of how far out the influence of a given shock actually persists. Necessarily, smaller sample frames will reduce the power of such tests. Analysis was capped at MA(48). We look at 3 sample frames a) full 1959-2023 sample, b) 1984-2004 Great Moderation sample frame studied by Stock and Watson (2007), and c) 1984-2023 sample, which includes the Great Recession and the COVID supply chain disruption. Lags are stated in months.

	Core PCE	**PCE**	**Core CPI**	**CPI**
MA(n), 1959-2023, min BIC	19	11	11	11
MA(n), 1959-2023, min AIC	32	22	37	22
MA(n), 1984-2004, min BIC	11	1	10	1
MA(n), 1984-2004, min AIC	43	18	47	13
MA(n), 1984-2023, min BIC	9	2	11	2
MA(n), 1984-2023, min AIC	25	22	28	18

The full sample was run using 2 optimization methodologies as a robustness check: they produced the same optimum lags and the same BIC and AIC values for those optimum lags. The BIC lags suggest core CPI and core PCE have memory extending beyond one quarter even during the 1984-2004 era of lower and moderate inflation, while the measures including food and energy had a memory of almost a year during that period. For the full sample Core PCE extended out 19 months by BIC criteria and a full 32 months according to AIC criteria.

Regression results for Core PCE during in the full 1959-2023 sample for MA(19) (lowest BIC) and MA(32) (lowest AIC) follow:

```
. arima dellnpcecore23, ma(1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 ///
>   19) nolog

ARIMA regression

Sample: 1959m2 thru 2023m12                     Number of obs     =        779
                                                Wald chi2(19)     =     544.24
Log likelihood = 4194.053                       Prob > chi2       =     0.0000

--------------------------------------------------------------------------------
               |                 OPG
dellnpcecore23 | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
---------------+----------------------------------------------------------------
dellnpcecore23 |
         _cons |   .0025959   .0002263    11.47   0.000     .0021524    .0030394
---------------+----------------------------------------------------------------
ARMA           |
            ma |
           L1. |   .3491279    .023089    15.12   0.000     .3038743    .3943816
           L2. |   .2193244   .0335219     6.54   0.000     .1536227    .2850261
           L3. |   .2492281   .0366906     6.79   0.000     .1773158    .3211403
           L4. |   .2317146   .0351921     6.58   0.000     .1627394    .3006898
           L5. |   .2410805   .0382535     6.30   0.000      .166105    .3160561
           L6. |   .3751552   .0406715     9.22   0.000     .2954404    .4548699
           L7. |   .3403814   .0422084     8.06   0.000     .2576546    .4231083
           L8. |   .2975098   .0413263     7.20   0.000     .2165119    .3785078
           L9. |   .3193825   .0425434     7.51   0.000      .235999    .4027659
          L10. |   .2641206   .0432189     6.11   0.000     .1794131    .3488281
          L11. |   .2182067   .0421566     5.18   0.000     .1355812    .3008321
          L12. |    .215335   .0406519     5.30   0.000     .1356588    .2950113
          L13. |   .1783892   .0413438     4.31   0.000      .097357    .2594215
          L14. |   .0908277    .041311     2.20   0.028     .0098596    .1717959
          L15. |   .1506242   .0434093     3.47   0.001     .0655436    .2357048
          L16. |   .1883014   .0403326     4.67   0.000     .1092508    .2673519
          L17. |    .219713   .0393695     5.58   0.000     .1425502    .2968757
          L18. |   .1936183   .0384801     5.03   0.000     .1181988    .2690379
          L19. |    .113158   .0386732     2.93   0.003     .0373598    .1889561
---------------+----------------------------------------------------------------
        /sigma |    .001109    .000019    58.43   0.000     .0010718    .0011462
--------------------------------------------------------------------------------
Note: The test of the variance against zero is one sided, and the two-sided
      confidence interval is truncated at zero.
```

```
. arima dellnpcecore23, ma(1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 ///
>   19 20 21 22 23 24 25 26 27 28 29 30 31 32) nolog

ARIMA regression

Sample: 1959m2 thru 2023m12                     Number of obs     =        779
                                                Wald chi2(32)     =     443.32
Log likelihood = 4215.098                       Prob > chi2       =     0.0000

--------------------------------------------------------------------------------
               |                 OPG
dellnpcecore23 | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
---------------+----------------------------------------------------------------
dellnpcecore23 |
         _cons |   .0025838   .0003312     7.80   0.000     .0019348    .0032329
---------------+----------------------------------------------------------------
ARMA           |
            ma |
           L1. |   .3159986   .0260459    12.13   0.000     .2649497    .3670476
           L2. |   .1981991   .0353528     5.61   0.000      .128909    .2674893
           L3. |   .2488131   .0407111     6.11   0.000     .1690208    .3286053
           L4. |   .2296119     .03798     6.05   0.000     .1551725    .3040514
           L5. |   .2505199   .0417336     6.00   0.000     .1687235    .3323162
           L6. |   .3752124   .0417544     8.99   0.000     .2933752    .4570496
           L7. |   .3185782   .0439522     7.25   0.000     .2324335     .404723
           L8. |   .2898487   .0434359     6.67   0.000     .2047159    .3749815
           L9. |   .3159943   .0445484     7.09   0.000     .2286811    .4033075
          L10. |   .2775714   .0444467     6.25   0.000     .1904575    .3646852
          L11. |   .2587957   .0440156     5.88   0.000     .1725267    .3450648
          L12. |   .2945654   .0447143     6.59   0.000     .2069269    .3822039
          L13. |   .2824754   .0468471     6.03   0.000     .1906568    .3742941
          L14. |   .2157713   .0460768     4.68   0.000     .1254624    .3060803
          L15. |   .2733551   .0501143     5.45   0.000     .1751329    .3715773
          L16. |   .2979904   .0482954     6.17   0.000     .2033332    .3926476
          L17. |   .3252803   .0478865     6.79   0.000     .2314245    .4191362
          L18. |   .2955999   .0458932     6.44   0.000      .205651    .3855489
          L19. |   .2376097    .048157     4.93   0.000     .1432237    .3319958
          L20. |   .1955119    .049909     3.92   0.000     .0976921    .2933318
          L21. |    .235883   .0452263     5.22   0.000     .1472411     .324525
          L22. |   .1713197   .0502954     3.41   0.001     .0727424    .2698969
          L23. |   .1605364   .0450835     3.56   0.000     .0721743    .2488984
          L24. |   .1635526   .0460505     3.55   0.000     .0732952    .2538099
          L25. |   .1260038   .0430447     2.93   0.003     .0416377      .21037
          L26. |   .0966891   .0442868     2.18   0.029     .0098885    .1834896
          L27. |   .1330819   .0423015     3.15   0.002     .0501725    .2159914
          L28. |   .1036175   .0440008     2.35   0.019     .0173776    .1898575
          L29. |   .0852929   .0416842     2.05   0.041     .0035934    .1669924
          L30. |   .1147482   .0400216     2.87   0.004     .0363073    .1931892
          L31. |   .0928838   .0409749     2.27   0.023     .0125746    .1731931
          L32. |   .0766307   .0409195     1.87   0.061    -.0035701    .1568316
---------------+----------------------------------------------------------------
        /sigma |   .0010792   .0000205    52.55   0.000     .0010389    .0011194
--------------------------------------------------------------------------------
Note: The test of the variance against zero is one sided, and the two-sided
      confidence interval is truncated at zero.
```

For the 1959-2023 specification with the lowest BIC, all MA terms are significant at the 5% level. For the run with the lowest AIC, all MA terms are significant at the 10% level.

7 Appendix: Forecasting the Present: Optimal Lags for Contemporaneous Core PCE Inflation

Regression results for Core PCE during the 1984-2004 subsample for MA(11) (lowest BIC) and MA(43) (lowest AIC) are reproduced below. In contrast to the full sample, most of the MA terms are not significant at the 5% level:

```
ARIMA regression

Sample: 1984m1 thru 2004m12                       Number of obs     =        252
                                                  Wald chi2(11)     =      66.27
Log likelihood = 1352.249                         Prob > chi2       =     0.0000

--------------------------------------------------------------------------------
               |                 OPG
dellnpcecore23 | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
---------------+----------------------------------------------------------------
dellnpcecore23 |
         _cons |   .0022025   .0001802    12.22   0.000     .0018493    .0025556
---------------+----------------------------------------------------------------
ARMA           |
            ma |
           L1. |   .0349102   .0446745     0.78   0.435    -.0526501    .1224705
           L2. |   -.025183   .0805989    -0.31   0.755     -.183154    .1327881
           L3. |   .2212228   .0866598     2.55   0.011     .0513727    .3910728
           L4. |   .2871652    .073199     3.92   0.000     .1436979    .4306325
           L5. |   .2247761    .083411     2.69   0.007     .0612936    .3882587
           L6. |   .2874275   .0912271     3.15   0.002     .1086256    .4662294
           L7. |   .0309744   .0805152     0.38   0.700    -.1268324    .1887812
           L8. |   .0031232   .0794248     0.04   0.969    -.1525467     .158793
           L9. |   .1082586   .0770297     1.41   0.160    -.0427168    .2592341
          L10. |   .1049995   .0787399     1.33   0.182    -.0493279    .2593269
          L11. |   .1467261   .0787189     1.86   0.062    -.0075601    .3010123
---------------+----------------------------------------------------------------
        /sigma |   .0011275   .0000312    36.10   0.000     .0010662    .0011887
--------------------------------------------------------------------------------
Note: The test of the variance against zero is one sided, and the two-sided
      confidence interval is truncated at zero.


ARIMA regression

Sample: 1984m1 thru 2004m12                       Number of obs     =        252
                                                  Wald chi2(35)     =      82.63
Log likelihood = 1383.526                         Prob > chi2       =     0.0000

--------------------------------------------------------------------------------
               |                 OPG
dellnpcecore23 | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
---------------+----------------------------------------------------------------
dellnpcecore23 |
         _cons |    .002329    .000351     6.64   0.000      .001641     .003017
---------------+----------------------------------------------------------------
ARMA           |
            ma |
           L1. |  -.1283078          .        .       .            .           .
           L2. |  -.0803945   .1330308    -0.60   0.546    -.3411302    .1803412
           L3. |   .1898184          .        .       .            .           .
           L4. |   .2152878   .2484426     0.87   0.386    -.2716509    .7022264
```

L5.	.0792399	.1506355	0.53	0.599	-.2160002	.37448
L6.	.2138848	.150312	1.42	0.155	-.0807213	.508491
L7.	.0740753	.	.	.	.	.
L8.	.0206695	.1617577	0.13	0.898	-.2963697	.3377086
L9.	.1539423	.1375228	1.12	0.263	-.1155975	.423482
L10.	.0747098	.	.	.	.	.
L11.	.1729866	.	.	.	.	.
L12.	.2415938	.1942855	1.24	0.214	-.1391988	.6223864
L13.	.1556449	.148714	1.05	0.295	-.1358293	.4471191
L14.	-.0060402	.	.	.	.	.
L15.	.1675236	.182318	0.92	0.358	-.1898131	.5248604
L16.	.0740143	.	.	.	.	.
L17.	.2832978	.2058333	1.38	0.169	-.120128	.6867236
L18.	.2526207	.1448565	1.74	0.081	-.0312928	.5365343
L19.	.117857	.1475729	0.80	0.425	-.1713806	.4070947
L20.	.1848281	.1128259	1.64	0.101	-.0363066	.4059629
L21.	.2091923	.2271626	0.92	0.357	-.2360381	.6544227
L22.	-.008247	.1906526	-0.04	0.965	-.3819192	.3654252
L23.	.1797052	.1455835	1.23	0.217	-.1056331	.4650436
L24.	.1803261	.1828336	0.99	0.324	-.1780212	.5386735
L25.	.1288013	.1288545	1.00	0.318	-.1237489	.3813516
L26.	.0933022	.130773	0.71	0.476	-.1630081	.3496125
L27.	.1810078	.1475332	1.23	0.220	-.1081519	.4701675
L28.	.045307	.1640956	0.28	0.782	-.2763144	.3669284
L29.	.0745893	.115192	0.65	0.517	-.1511828	.3003614
L30.	.2871661	.1474179	1.95	0.051	-.0017676	.5760998
L31.	.0486	.	.	.	.	.
L32.	-.0021713	.1140475	-0.02	0.985	-.2257002	.2213576
L33.	.0926933	.133706	0.69	0.488	-.1693656	.3547521
L34.	.1895689	.1225895	1.55	0.122	-.050702	.4298398
L35.	.1598855	.1554903	1.03	0.304	-.1448699	.4646409
L36.	.3818094	.134953	2.83	0.005	.1173063	.6463124
L37.	-.1100965	.1333486	-0.83	0.409	-.371455	.1512621
L38.	.071721	.1323208	0.54	0.588	-.187623	.331065
L39.	.2716365	.1526777	1.78	0.075	-.0276062	.5708793
L40.	.1005482	.1086569	0.93	0.355	-.1124153	.3135118
L41.	.1131648	.1136521	1.00	0.319	-.1095892	.3359188
L42.	-.047768	.0992388	-0.48	0.630	-.2422725	.1467364
L43.	-.2935904	.1310958	-2.24	0.025	-.5505334	-.0366474
/sigma	.0009253	.0001142	8.11	0.000	.0007016	.0011491

Note: The test of the variance against zero is one sided, and the two-sided confidence interval is truncated at zero.

In the 1984-2004 subsample, the MA(11), 5 out of 11 lags were significant at 10% and 7 of 11 has a z-value greater than one. For MA(43), only 5 of 43 lags were significant at 10%, while 17 of 43 (or 40%) had a z-value greater than one. Nonetheless, even in the MA(43) version, 3 out of the last 10 terms were significant at the 10% level of confidence implying at least a small degree of shock persistence 3 years out. A less reassuring 2 of the last 20 terms were significant at the 5% level of confidence.

Finally, we'll look at the 1984-2023 subsample, which includes instability during the Great Recession and the COVID supply chain disruption. Best BIC for Core PCE was MA(9) while best AIC was MA(25). The results are qualitatively similar to the full sample.

9 Appendix: Forecasting the Present: Optimal Lags for Contemporaneous Core PCE Inflation

```
. arima dellnpcecore23  if year>=1984 & year<=2023, ma(1 2 3 4 5 6 7 8 9 ) nolog ///
>   ///
>   iterate(600)

ARIMA regression

Sample: 1984m1 thru 2023m12                     Number of obs     =        480
                                                Wald chi2(9)      =     184.65
Log likelihood = 2591.34                        Prob > chi2       =     0.0000

--------------------------------------------------------------------------------
               |                 OPG
dellnpcecore23 | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
---------------+----------------------------------------------------------------
dellnpcecore23 |
         _cons |   .0019745   .0001317    14.99   0.000     .0017164    .0022326
---------------+----------------------------------------------------------------
ARMA           |
            ma |
           L1. |   .2212576   .0301824     7.33   0.000     .1621013    .2804139
           L2. |   .0925407   .0503102     1.84   0.066    -.0060654    .1911469
           L3. |   .1532423    .049366     3.10   0.002     .0564867    .2499979
           L4. |   .1574008   .0449503     3.50   0.000     .0692998    .2455019
           L5. |   .1519843   .0508968     2.99   0.003     .0522284    .2517401
           L6. |   .2804258   .0472473     5.94   0.000     .1878227    .3730288
           L7. |   .1710018    .052138     3.28   0.001     .0688131    .2731905
           L8. |   .1519439   .0473497     3.21   0.001     .0591402    .2447477
           L9. |   .1540403   .0452539     3.40   0.001     .0653443    .2427362
---------------+----------------------------------------------------------------
        /sigma |   .0010934   .0000207    52.84   0.000     .0010528    .0011339
--------------------------------------------------------------------------------
Note: The test of the variance against zero is one sided, and the two-sided
      confidence interval is truncated at zero.
```

```
. arima dellnpcecore23  if year>=1984 & year<=2023, ma(1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
> ///
>   19 20 21 22 23 24 25) nolog ///
>   ///
>   iterate(600)

ARIMA regression

Sample: 1984m1 thru 2023m12                         Number of obs     =        480
                                                    Wald chi2(25)     =     178.17
Log likelihood = 2612.691                           Prob > chi2       =     0.0000

--------------------------------------------------------------------------------
               |                 OPG
dellnpcecore23 | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
---------------+----------------------------------------------------------------
dellnpcecore23 |
         _cons |   .0019797   .0002138     9.26   0.000     .0015607    .0023987
---------------+----------------------------------------------------------------
ARMA           |
            ma |
           L1. |   .1784406   .0331436     5.38   0.000     .1134803    .2434008
           L2. |   .0532987   .0555305     0.96   0.337    -.0555391    .1621364
           L3. |   .1249215   .0513344     2.43   0.015     .0243079    .2255352
           L4. |   .1600502   .0498552     3.21   0.001     .0623358    .2577646
           L5. |   .1375174   .0517955     2.66   0.008     .0360001    .2390347
           L6. |   .2612812   .0533752     4.90   0.000     .1566677    .3658946
           L7. |   .1559928   .0595889     2.62   0.009     .0392007    .2727848
           L8. |    .149703   .0542242     2.76   0.006     .0434256    .2559805
           L9. |   .1797308   .0546776     3.29   0.001     .0725647     .286897
          L10. |    .131274    .056669     2.32   0.021     .0202048    .2423431
          L11. |   .1255397   .0556681     2.26   0.024     .0164323    .2346471
          L12. |   .1249804   .0502941     2.48   0.013     .0264058     .223555
          L13. |    .134104   .0553611     2.42   0.015     .0255982    .2426098
          L14. |   .0256646   .0531642     0.48   0.629    -.0785353    .1298646
          L15. |   .1187308   .0575807     2.06   0.039     .0058746     .231587

          L16. |   .1398913   .0589595     2.37   0.018     .0243329    .2554497
          L17. |   .1886208   .0535568     3.52   0.000     .0836513    .2935902
          L18. |   .1409799   .0618518     2.28   0.023     .0197527    .2622071
          L19. |   .0900123    .065676     1.37   0.171    -.0387103    .2187348
          L20. |   .1071035   .0585469     1.83   0.067    -.0076462    .2218532
          L21. |   .1667592   .0529338     3.15   0.002     .0630108    .2705076
          L22. |   .0905922   .0597509     1.52   0.129    -.0265174    .2077017
          L23. |   .0671505   .0547764     1.23   0.220    -.0402092    .1745102
          L24. |   .0860442   .0547362     1.57   0.116    -.0212369    .1933252
          L25. |   .0823697   .0526208     1.57   0.118    -.0207652    .1855046
---------------+----------------------------------------------------------------
        /sigma |   .0010447   .0000241    43.36   0.000     .0009975    .0010919
--------------------------------------------------------------------------------
Note: The test of the variance against zero is one sided, and the two-sided
      confidence interval is truncated at zero.
```

For the 1984-2023 subsample, all but one of the MA(9) entries was significant at the 5% level of confidence. For MA(25), 18 of 25 were significant at 10%. For the longest 10 lags, 5 were significant at the 10% level of confidence. Persistent memory does not appear to be a quality limited to 1970s inflation.

Section 4

Section 5

Section 6 Best lags for analyzing changes in inflation

Copy of Figure 2:

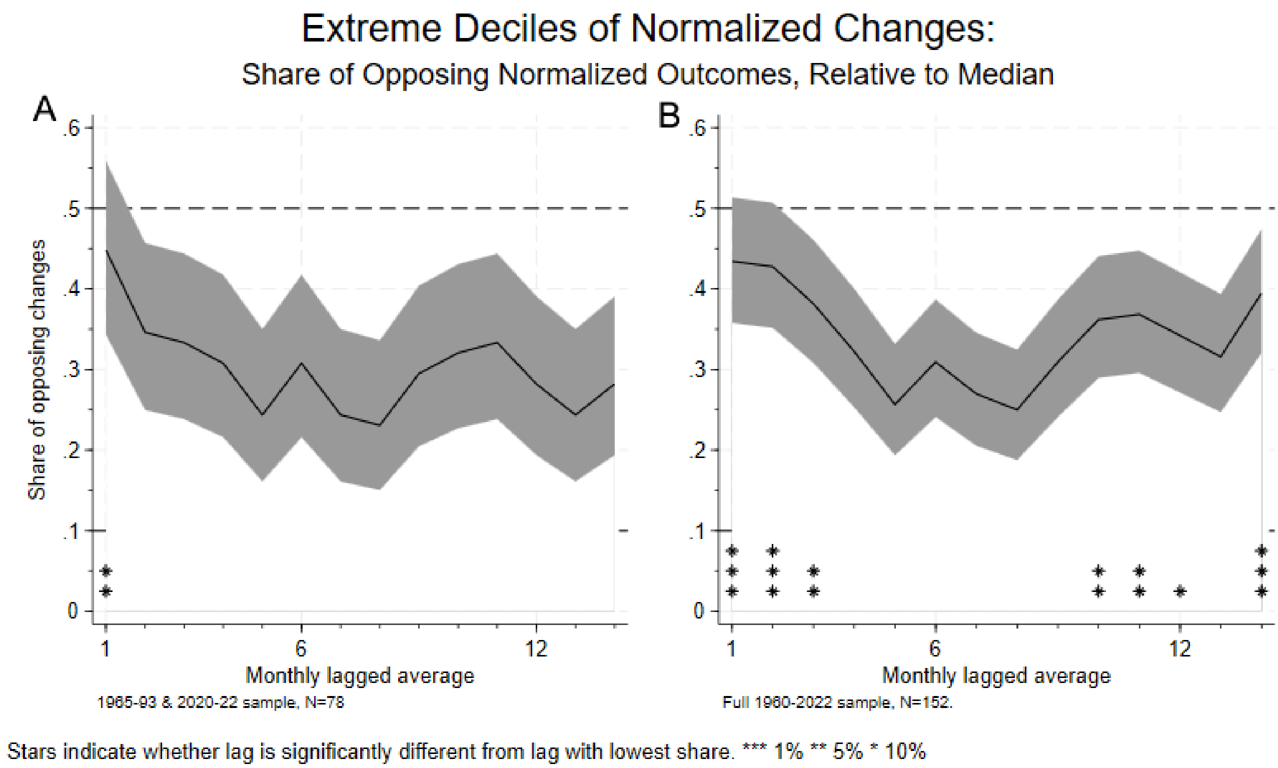


Table for Figure 2, Chart A with confidence intervals based on Agresti and Coull (1998), as recommended by Brown, Cai, and DasGupta (2001)

Proportions for double smoothed share (4), 95% conf interv: Agresti ci

Lag	lower	proportion	upper	N
1	.34331811	.44871795	.55893192	78
2	.24981182	.34615385	.45693828	78
3	.23844238	.33333333	.44387022	78
4	.21593331	.30769231	.41750431	78
5	.16111916	.24358974	.350131	78
6	.21593331	.30769231	.41750431	78
7	.16111916	.24358974	.350131	78
8	.15043294	.23076923	.33637973	78
9	.20479811	.29487179	.40420201	78
10	.22714885	.32051282	.43072626	78
11	.23844238	.33333333	.44387022	78
12	.19374592	.28205128	.39081671	78
13	.16111916	.24358974	.350131	78
14	.19374592	.28205128	.39081671	78
15	.23844238	.33333333	.44387022	78
16	.21593331	.30769231	.41750431	78
17	.21593331	.30769231	.41750431	78
18	.19374592	.28205128	.39081671	78
19	.20479811	.29487179	.40420201	78

20	.24981182	.34615385	.45693828	78
21	.27277121	.37179487	.48285387	78
22	.20479811	.29487179	.40420201	78
23	.22714885	.32051282	.43072626	78
24	.22714885	.32051282	.43072626	78

Confidence intervals based on the Clopper Pearson (1934) exact Binomial are similar:

Proportions for double smoothed share (4), 95% conf interv: Exact ci

Lag	lower	proportion	upper	N
1	.33585694	.44871795	.56559087	78
2	.24196715	.34615385	.46241176	78
3	.23058524	.33333333	.44916669	78
4	.20807964	.30769231	.42242525	78
5	.15347456	.24358974	.3539695	78
6	.20807964	.30769231	.42242525	78
7	.15347456	.24358974	.3539695	78
8	.14287281	.23076923	.33997266	78
9	.19696165	.29487179	.40892378	78
10	.21928851	.32051282	.43583865	78
11	.23058524	.33333333	.44916669	78
12	.18593799	.28205128	.39533118	78
13	.15347456	.24358974	.3539695	78
14	.18593799	.28205128	.39533118	78
15	.23058524	.33333333	.44916669	78
16	.20807964	.30769231	.42242525	78
17	.20807964	.30769231	.42242525	78
18	.18593799	.28205128	.39533118	78
19	.19696165	.29487179	.40892378	78
20	.24196715	.34615385	.46241176	78
21	.26497731	.37179487	.48866119	78
22	.19696165	.29487179	.40892378	78
23	.21928851	.32051282	.43583865	78
24	.21928851	.32051282	.43583865	78

Here are the Agresti and Coull confidence intervals for the full sample presented in Chart B of Figure 2:

Proportions for double smoothed share (4) and conf interv: Agresti ci

Lag	lower	proportion	upper
1	.35798011	.43421053	.51368433
2	.35170034	.42763158	.50713055
3	.30811999	.38157895	.46087602
4	.25310908	.32236842	.40038493
5	.19349252	.25657895	.33166593
6	.24105146	.30921053	.38677543
7	.2052763	.26973684	.34554926
8	.18762887	.25	.32469602
9	.24105146	.30921053	.38677543
10	.28965103	.36184211	.4408443
11	.29579308	.36842105	.44753581
12	.27131245	.34210526	.42068222
13	.24707231	.31578947	.39358813
14	.32050306	.39473684	.47416005
15	.30811999	.38157895	.46087602
16	.26522937	.33552632	.41393175
17	.28965103	.36184211	.4408443
18	.27741054	.34868421	.42741768
19	.28352347	.35526316	.43413831
20	.29579308	.36842105	.44753581
21	.30811999	.38157895	.46087602
22	.24105146	.30921053	.38677543
23	.2591615	.32894737	.40716605
24	.2591615	.32894737	.40716605

13 Appendix: Forecasting the Present: Optimal Lags for Contemporaneous Core PCE Inflation

Section 7

Nowcasting inflation's direction using data from the relatively volatile inflation era, 1965-1993 and Jan 2020 – Apr 2024.

Motivation:

Investors want to know where inflation is during periods of inflation volatility. But they want to know inflation's direction all the time, because they want to know whether they are entering a period of higher inflation. Moreover, analysis based upon RVIE only (the relatively volatile inflation era) was weak in the center quintile of probabilities, possibly because they were artificially selected out.

So I'll be redoing the analysis with a broader dataset. That means that I'll be taking the full 1960-2019 data to estimate standard deviation and kurtosis to apply to the model. Here are the estimates:

```
sum err1yrCforL6 if RVIE==1 & year<1995, det // So 1965-1993

                        err1yrCforL6
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -.0164346      -.0202925
 5%    -.0087437      -.0195714
10%     -.006079      -.0190785       Obs                 348
25%    -.0034021      -.0164346       Sum of wgt.         348

50%    -.0001226                      Mean           .0000516
                        Largest       Std. dev.      .0058413
75%     .0032856       .0196592
90%     .0064082       .0228871       Variance       .0000341
95%     .0079165       .0230579       Skewness       .3799975
99%     .0196592       .0246152       Kurtosis       5.998675
```

Contrast with the fuller sample:

```
. dirange pcL6agpcecore pcagC13mpcecore delhat6mn6ga err1yrCforL6
<SNIP>
   err1yrCforL6 | 559/1330     1959m7 2023m10                0

. sum err1yrCforL6, det
                        err1yrCforL6
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -.0120734      -.0202925
 5%    -.0068645      -.0195714
10%    -.0048139      -.0190785       Obs                 772
25%    -.0025424      -.0164346       Sum of wgt.         772

50%    -.0001755                      Mean          -6.30e-06
                        Largest       Std. dev.      .0047745
75%     .0022934       .0196592
90%     .0049357       .0228871       Variance       .0000228
95%     .0072557       .0230579       Skewness       .4394425
99%     .0143681       .0246152       Kurtosis       7.143043
```

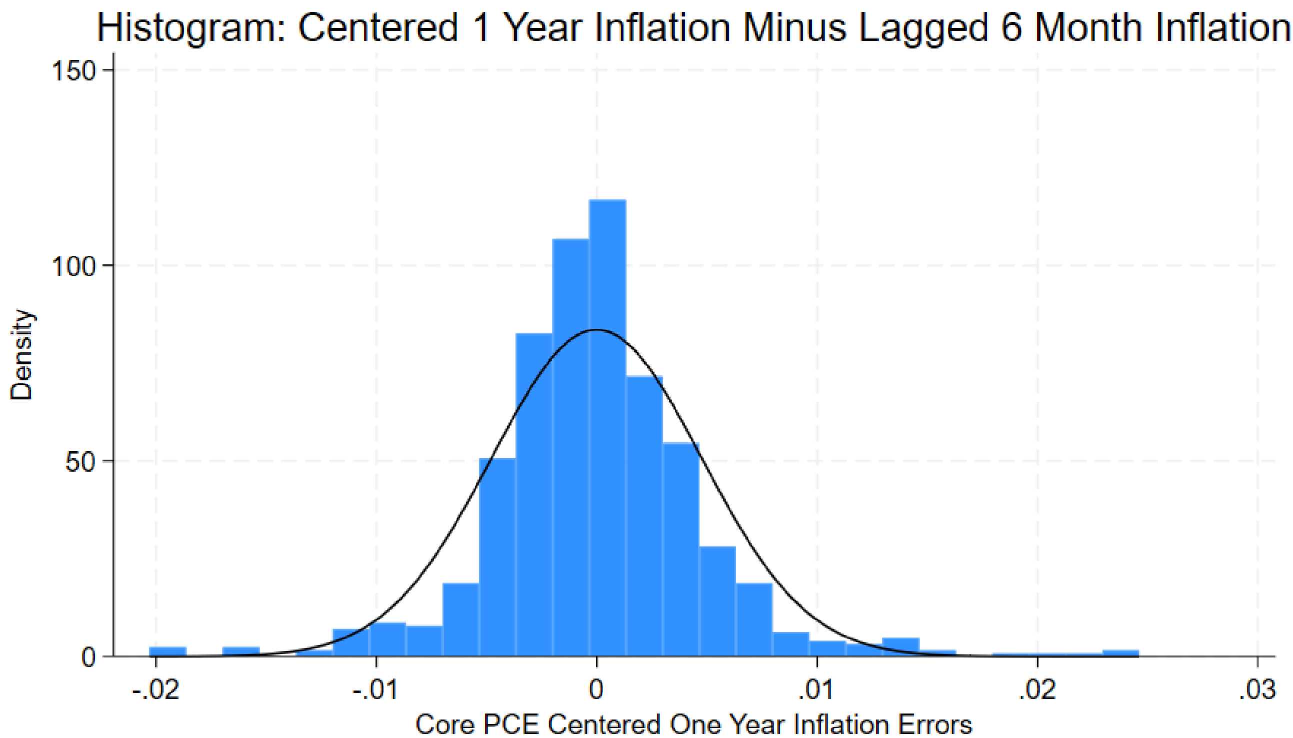
For the full sample the standard deviation is lower, but the kurtosis is higher. I think I can live with that.

But here, this Appendix will consider the RVIE subsample, walking through the results.

Reference: Stata Code for Student’s t:

```
* rv21a: Calc:

di  2*(3-2*6)/(3-6)  // kurtosis = df = 6

gen double delhat6mn6ga = pcL6agpcecore - L6.pcagC13mpcecore
tempvar probStultz probStugtz
gen double `probStultz' = t(6,-delhat6mn6ga/.00584131)
gen double probStu6gtz58 = 1-`probStultz'
note probStu6gtz58: (1-probStultz), where probStultz = t(6,-delhat6mn6ga/.00584131). Probability
that delhat6mn6ga>0, assuming a t-dist w/ 6 df (kurt=6) and delhat standardardized with
sigma=.00584131, the sd of est error for RVIE==1 & year<1995 aka 1965m1-1993m12. Created in
OptLag`vers'.do.

* For kurtosis =  6.4049, calc df
di  2*(3-2*6.4049)/(3-6.4049)  // df = 5.7621663

tempvar probStultz probStugtz
gen double `probStultz' = t(5.7621663,-delhat6mn6ga/.0055983)
gen double probStu6gtz55 = 1-`probStultz'
note probStu6gtz55: (1-probStultz), where probStultz = t(5.7621663,-delhat6mn6ga/.0055983).
Probability that delhat6mn6ga>0, assuming a t-dist w/ 5.7621663 df (kurt=6.4049) and delhat
standardardized with sigma=.0055983, the sd of est error for 1959m7-1991m9. Created in
OptLag`vers'.do.
```

Histogram of Errors:



Section 8

References

Agresti, A., and B. A. Coull. 1998. Approximate is better than “exact” for interval estimation of binomial proportions. *American Statistician* 52: 119–126. https://doi.org/10.1080/00031305.1998.10480550.

Brown, L. D., T. T. Cai, and A. DasGupta. 2001. Interval estimation for a binomial proportion. *Statistical Science* 16: 101–133. https://doi.org/10.1214/ss/1009213286.

Clopper, C. J., and E. S. Pearson. 1934. The use of confidence or fiducial limits illustrated in the case of the binomial. *Biometrika* 26: 404–413. https://doi.org/10.1093/biomet/26.4.404.