OptLagInternetAppendix080a.pdf
Internet Appendix: “Forecasting the Present: Optimal Lags for Contemporaneous Core PCE Inflation”
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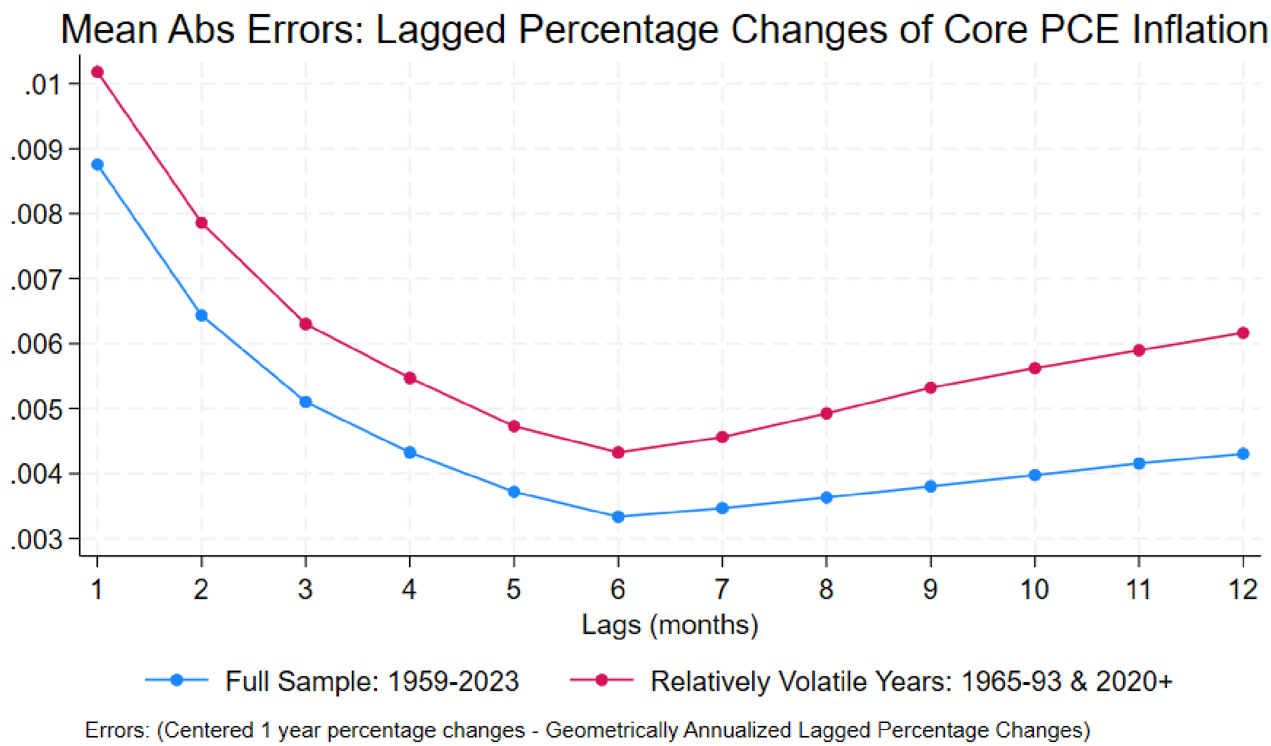
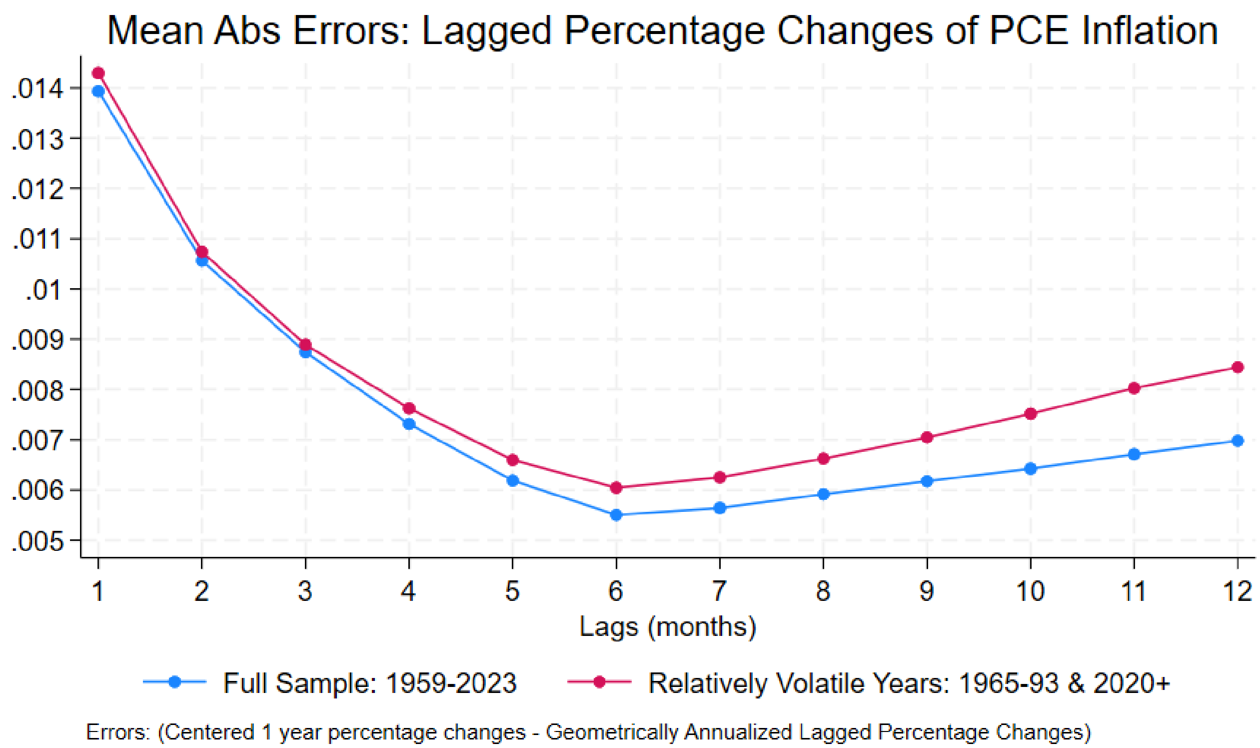
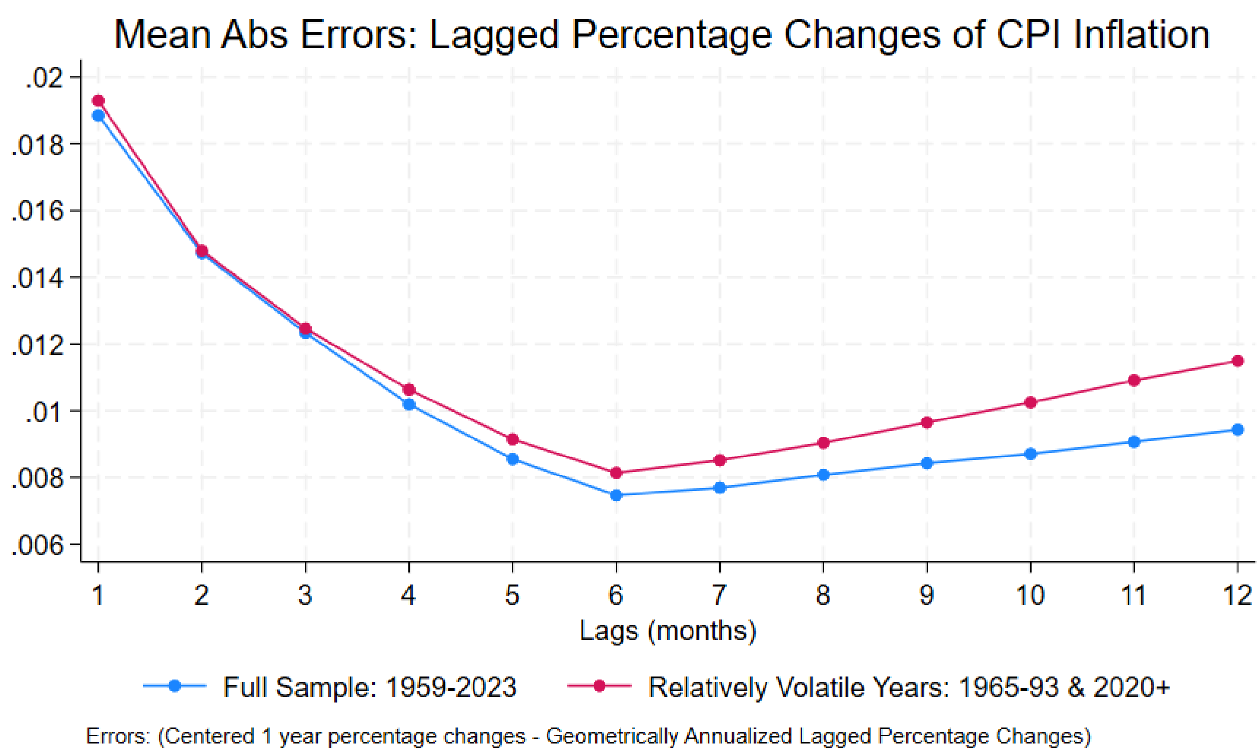
Version 0.080a

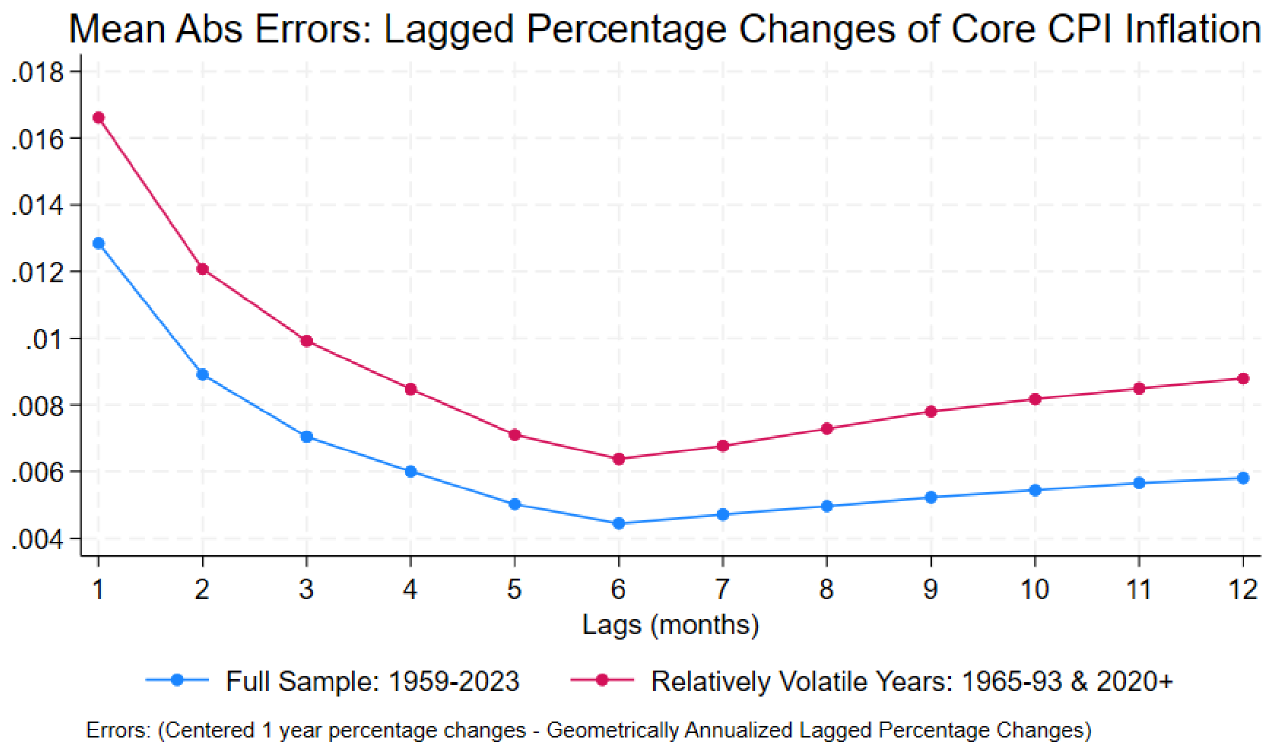
Section 1

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

<u>Table 1 Adjunct</u>

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
```

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```
     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)

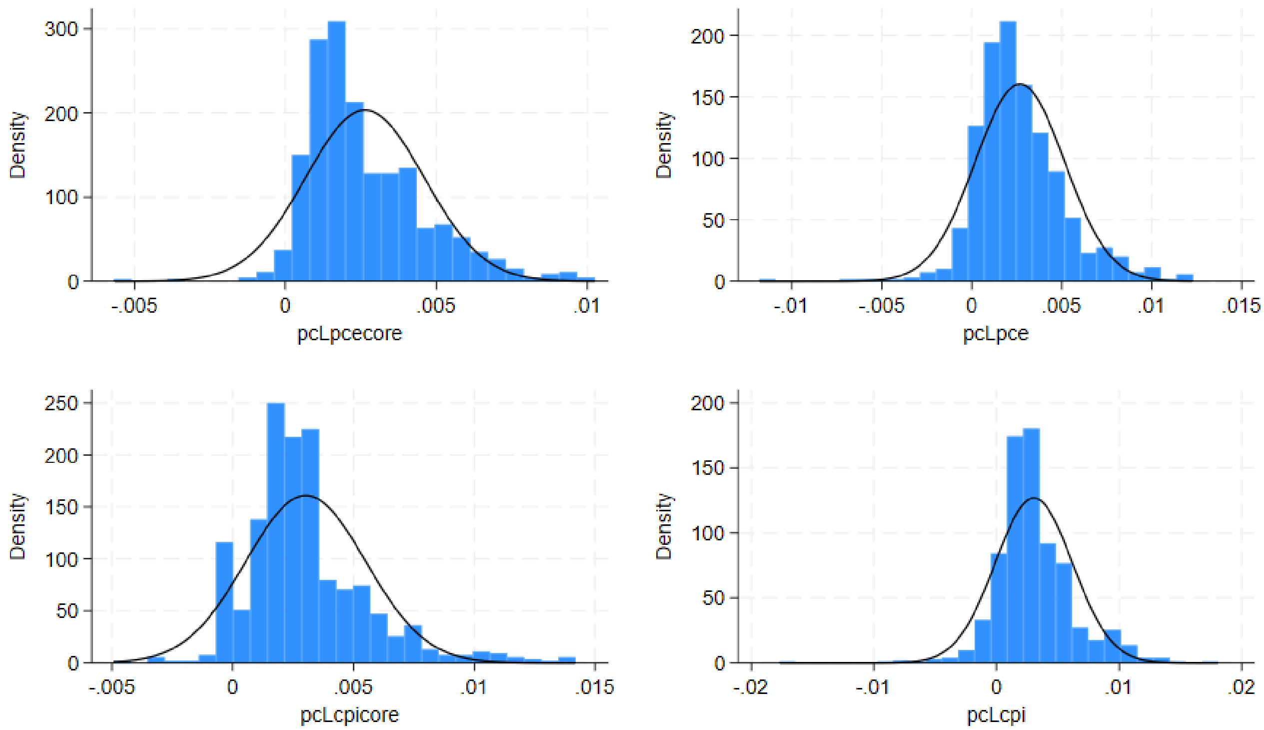
Define the upper bound by taking the ar(1) coefficient and adding 2 standard errors. Define the lower bound by subtracting 2 standard errors.

<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.



Section 4

Section 5

Section 6 Best lags for analyzing changes in inflation

Copy of Figure 2:

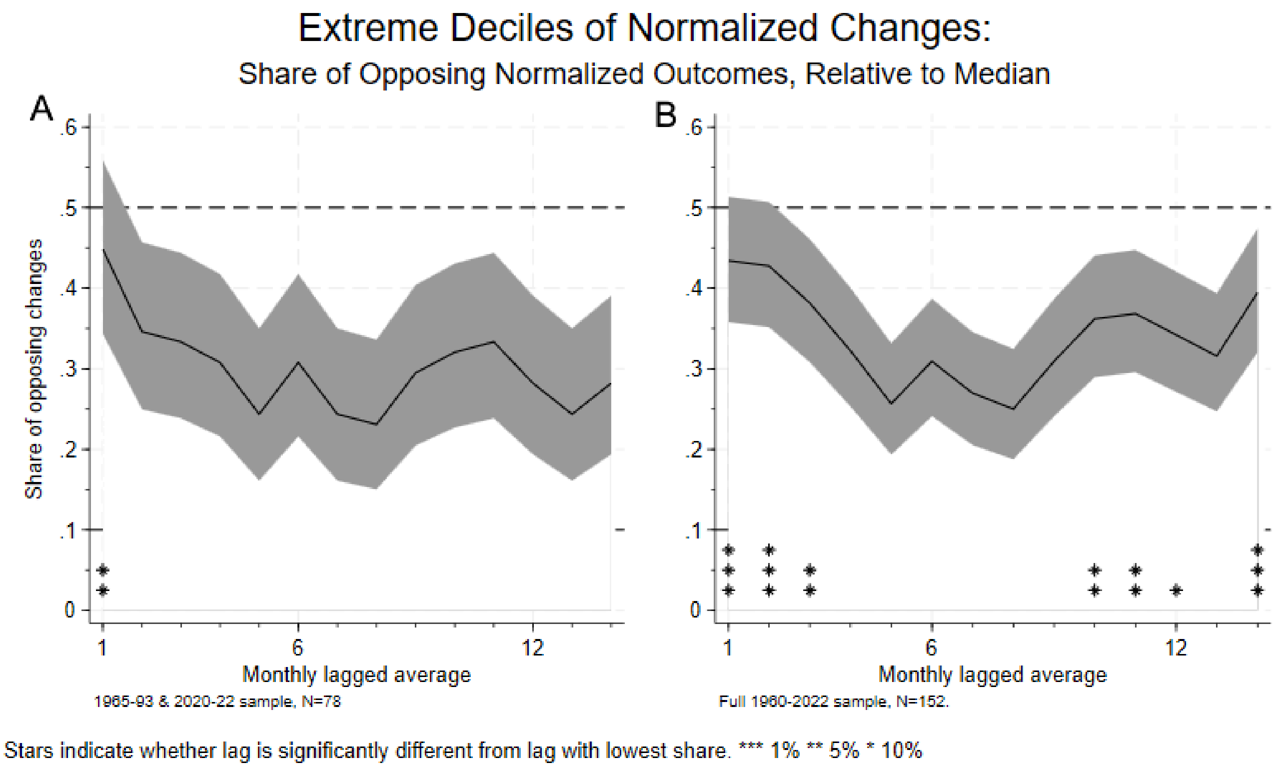


Table for Figure 2, Chart A with confidence intervals based on Agresti and Coull (1998), as recommended by Brown, Cai, and DasGupta (2001)

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

7 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
```

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

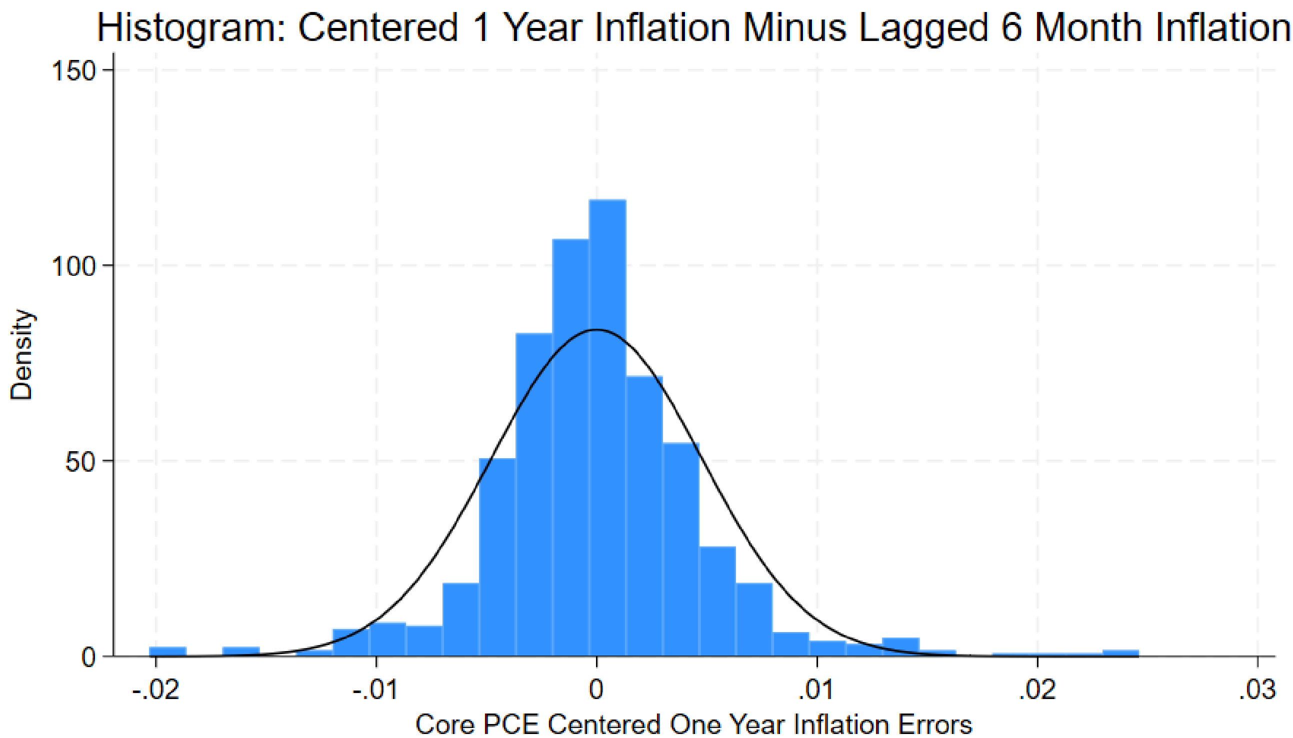
For the full sample the standard deviation is lower, but the kurtosis is higher. I think I can live with that.

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.