Financial Econometrics | Lecture 9

Dynamic Causal Effects: Multipliers, HAC and the Cumulative Test

In Class Group Activity

· SJTU, Summer School 2026 · Fatih Kansoy

How this block runs. You work in your home group of three or four, textbook open. Roles rotate: **Scribe**, **Reporter**, **Sceptic**, **Timekeeper**. All money today is in US dollars ($), pounds sterling (£) and euros (€).

- **Phase 1, Concept checks (~10 min).** Vote, talk for 90 seconds, vote again.
- **Phase 2, Desk problem (~20 min).** Read multipliers and test a cumulative effect.
- **Phase 3, Case (~25 min).** One real story, ending hidden.

A short word list. In a **distributed-lag** model $Y_t = \beta_0 + \beta_1 X_t + \beta_2 X_{t-1} + \cdots + u_t$, the **dynamic multiplier** at horizon h is the coefficient on the h-th lag (the effect h periods later); the **cumulative multiplier** is the running sum (the total effect so far); the **long-run** multiplier is the sum of all of them. The lag length r (how far the cause reaches) is a different choice from the **HAC truncation** $m \approx 0.75\,T^{1/3}$ (the memory of the error). Distributed-lag errors are serially correlated, so you report **HAC / Newey-West** standard errors and test the cumulative effect with a **linear combination**, not by reading individual lags.

Phase 1 – Concept checks ~10 MIN

ConcepTest 1. A distributed-lag regression of inflation on the current value and three lags of oil-price growth gives coefficients $b_1 = 0.014$ (current), $b_2 = 0.009$, $b_3 = 0.002$, $b_4 = 0.005$. A 1% oil-price rise happens once. By how much is the price level higher three months later (the cumulative effect at horizon 3), and which coefficient is the dynamic multiplier at horizon 2?

(a) Cumulative 0.005; dynamic-at-2 is 0.002.

(b) Cumulative 0.030; dynamic-at-2 is 0.002.

(c) Cumulative 0.014; dynamic-at-2 is 0.014.

(d) Cumulative 0.030; dynamic-at-2 is 0.009.

ConcepTest 2. You fit inflation on the current value and 6 lags of oil-price growth ($r = 6$), with $T = 749$ months. The residual autocorrelations are 0.56, 0.46, 0.39. Which standard errors, and what truncation?

(a) Ordinary SEs; no truncation, the lags already handle the dynamics.

(b) Heteroskedasticity-robust SEs; that already corrects the autocorrelation.

(c) HAC / Newey-West SEs with $m = \text{round}(0.75 \times 749^{1/3}) = 7$.

(d) HAC SEs with $m = 6$, because you included 6 lags of X.

ConcepTest 3. You regress industrial-production growth on the current value and 18 lags of a surprise oil shock. No single lag has $|t| > 2$; the joint $F(19, 676) = 1.42$, $p = 0.11$ (not jointly significant). The 18-month cumulative multiplier is -0.165 with $t = -3.6$. The right conclusion is:

(a) Oil shocks have no effect on output, because neither the individual t's nor the joint F is significant.

(b) Oil shocks do lower output: the lags are collinear, so each is imprecise, but their sum is precisely estimated and the cumulative effect is significant ($t = -3.6$).

(c) The cumulative $t = -3.6$ must be a mistake, because a sum of insignificant terms cannot be significant.

(d) Add 18 lags of output growth to keep using HAC and the individual t's will become significant.

Phase 2 – The desk problem

~20 MIN

Policy-rate pass-through to import prices

The setting. On a euro-area research desk you estimate how a change in the ECB policy rate X (percentage points) passes through to monthly euro-area import-price inflation Y (percentage points), with the current value and four lags. The sample is $T = 343$ months. The estimated dynamic multipliers (lag coefficients) are:

horizon h	0	1	2	3	4
dynamic multiplier	0.20	0.15	0.10	0.08	0.07

(a) Dynamic multipliers (worked for you). The dynamic multipliers are just the lag coefficients: $0.20, 0.15, 0.10, 0.08, 0.07$. The horizon-1 multiplier is 0.15: a one-point rate rise lifts import-price inflation by 0.15 points in the month *after* the change. The horizon-0 (impact) multiplier is 0.20.

(b) Cumulative and long-run. Compute the cumulative multiplier at each horizon by running-summing, and state the long-run cumulative multiplier. Interpret the long-run number.

(c) The HAC twist. The impact coefficient is 0.20; its ordinary SE is 0.040 and its HAC SE is 0.080. (i) Compute the t both ways. (ii) Which is honest, and why? (iii) Pick the HAC truncation m for $T = 343$ using $m = 0.75\,T^{1/3}$.

(d) The multicollinearity paradox. A different distributed lag (import-price inflation on the exchange-rate change) gives four lag coefficients, each imprecise:

lag	0	1	2	3
coefficient	0.18	0.14	0.11	0.09
individual SE	0.12	0.11	0.10	0.09

(i) Confirm no individual lag is significant at 5%. (ii) The four-lag cumulative multiplier is 0.52, and because the lags are collinear its *lincom* SE is only 0.16. Compute the cumulative t. (iii) Why would reading the individual t's, or adding the four SEs, have led you to the wrong conclusion?

Phase 3 – The case

~25 MIN

"Oil shocks do not matter for output": a desk memo, March 2018

How to run this. Read the story with your group. The ending is hidden on purpose. Commit a written position before the reveal. Do not search the internet.

The story. It is early 2018. You are a junior macro analyst at a pension fund. Oil has climbed through 2017, and your head of research asks: do oil-price spikes hurt real output, or only prices? Following Hamilton, you build a **net oil-price increase** shock (how far oil stands above its highest level of the past twelve months, zero otherwise; it is exactly zero in 78% of months, firing only on genuine spikes). You regress monthly industrial-production growth on the current value and 18 lags of this shock, US data 1960 to 2017 ($n \approx 696$), HAC standard errors. The table comes back dead:

- the impact multiplier is 0.0046, $t = 0.55$, nothing;
- not one of the 18 individual lags clears $t = 2$;
- the joint test of all the lags is $F(19, 676) = 1.42$, $p = 0.11$, not even jointly significant.

The *prices* model, by contrast, is crisp: impact 0.0139 ($t = 6.8$), six-month cumulative 0.036 ($t = 6.5$), joint $F = 9.3$. Your head of research reads the output table, sees nothing significant, and drafts the memo: "Oil-price shocks pass through to inflation but have no measurable effect on real output. We need not adjust the growth forecast." She asks you to confirm.

The story stops here.

Four discussion questions (answer all four; take a position):

1. On the individual t's and the joint F alone, is her reading defensible? What exactly does $F(19, 676) = 1.42$, $p = 0.11$ say?
2. The model has 19 collinear lag terms. What single quantity have you not yet looked at, and which command computes it with the right SE? Why can that SE not be the sum of the individual SEs?
3. **Commit a number.** Before the reveal, predict the cumulative multiplier at 12 and 18 months: (a) near zero and insignificant, (b) negative and significant, or (c) positive and significant? Write your choice and one sentence of reasoning.
4. If the cumulative effect is a real negative number, name one reason it might still be biased, and state the likely *direction* of the bias.

End of activity handout. Solutions are distributed after the block.