

STRATEGY VIEWS

A Fifth of the Gain: Prices Stayed Lower After Productivity Booms Whose Gains Lasted

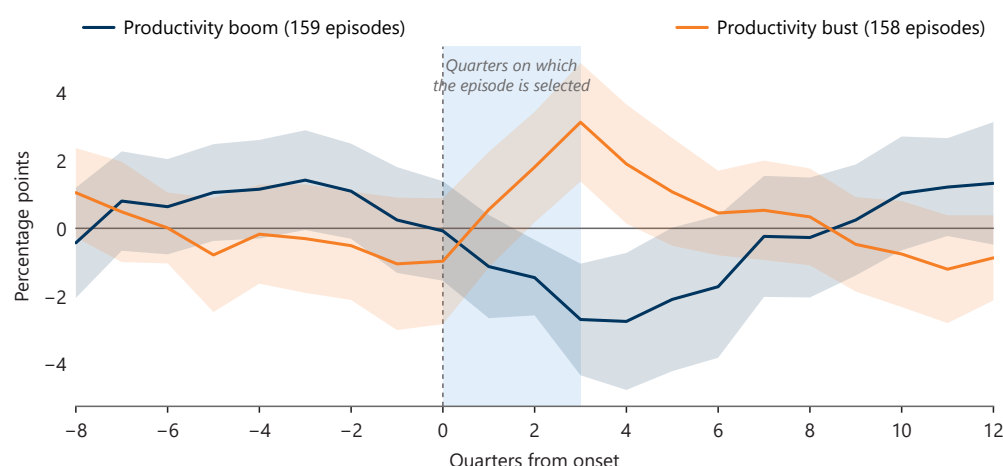
1. If artificial intelligence raises productivity as much as its advocates expect, it should lower what things cost to make, and some of that saving should reach prices. A recent post from the Federal Reserve Bank of St. Louis documents lower relative producer price inflation after productivity booms in American industries since 2006. Rebuilt here from the same public sources, the pattern is there ([Exhibit 1](#)). This note asks what the dip adds up to. Across industries, relative prices have moved about a fifth as far as relative productivity, in the opposite direction, and on average they stayed lower after the booms whose measured gains lasted. Nearly half of the booms, though, left no lasting gain.

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Exhibit 1: Relative producer price inflation dips after a productivity boom and rises after a bust

Year-on-year producer price inflation less the cross-industry mean, by quarter from episode onset, percentage points



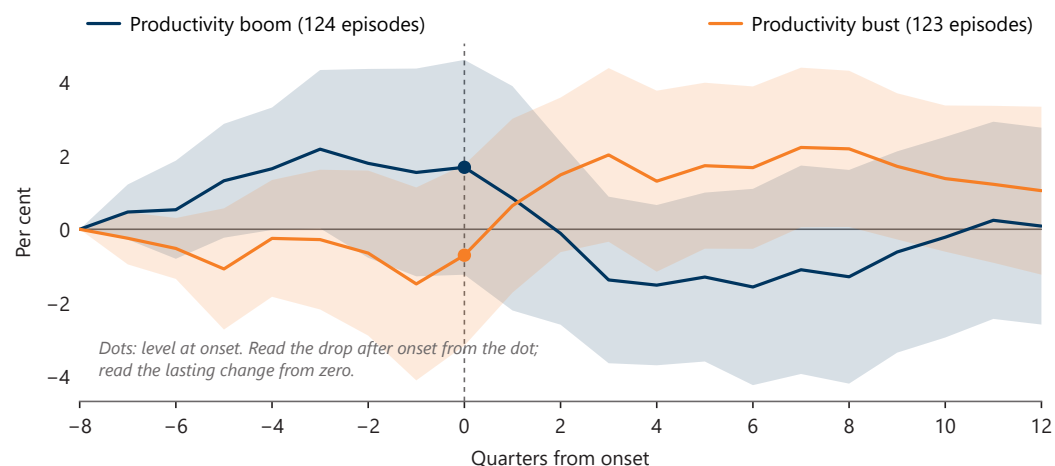
Source: Federal Reserve Bank of Chicago Quarterly Industry-Level Labor Productivity data (QILP, version of 7 October 2025, through 2025Q2); BLS producer price indexes by industry via FRED, through 2026Q2, retrieved 1 October 2026; SAM calculations. 53 industries. A boom (bust) begins in the first quarter whose four-quarter sum of productivity growth, net of industry and quarter averages, is in the top (bottom) tenth of all industry-quarters; the shaded quarters 0 to 3 are that selection window. Onsets 2006Q3 to 2024Q3. Legend counts are totals; between 150 and 159 episodes have data at each quarter. Bands are two standard errors of the episode mean, treating episodes as independent.

2. The rebuild uses 53 industries rather than the 85 in the published analysis, counting each industry once at its most detailed level and dropping the twelve with no industry producer price index. It finds 159 booms and 158 busts, against a published 164 and 174. Relative inflation bottoms 2.7 points below average four quarters into a boom, against a published 3.7, and peaks 3.1 points above average three quarters into a bust, against 4.0. The trough comes one quarter after the four on which a boom is selected, but year-on-year inflation at that quarter spans three of those four, so “after onset” here does not mean after the productivity growth.

Someone weighing artificial intelligence cares about the level of prices, not the quarter in which relative inflation dips, so the next exhibit adds relative price changes up into a relative price level ([Exhibit 2](#)). How far prices fall depends on where the count starts. Measured from the onset of a boom, the relative price level is 3.2 per cent lower a year later and 1.6 per cent lower after three years. Measured from two years before onset, it ends close to where it started: prices rose 1.7 per cent relative to other industries in the two years before the boom, and three years after onset the level is 0.1 per cent above its starting point, with a standard error of 1.4. At two years it is still 1.3 per cent below, so the return is a three-year finding.

Exhibit 2: Measured from two years before, the price level ends close to where it started

Relative producer price level by quarter from episode onset, per cent (100 times the log), set to zero two years before onset; dots mark the level at onset



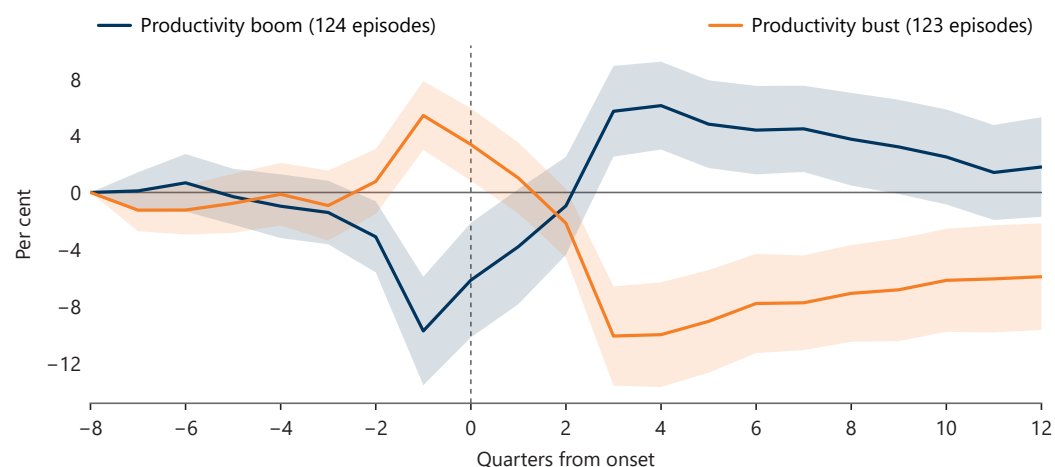
Source: QILP and BLS producer price indexes via FRED, retrieved 1 October 2026; SAM calculations. Quarterly log changes in each industry's price index less the cross-industry mean, cumulated. The 124 booms and 123 busts whose window from two years before to three years after onset is complete for both price and productivity, with onsets from 2008 to 2022; Exhibits 2, 3, 4 and 7 all describe these episodes. Bands are two standard errors of the episode mean.

3. The difference between those two readings is what happened before the boom, and the productivity record shows it ([Exhibit 3](#)). The measure here is each industry's productivity relative to other industries with its own long-run trend also removed, as in the published design; prices in the previous exhibit are relative to other industries only, a difference the methodology page checks. On average, booms start from a slump. Two quarters before onset, productivity is 3.1 per cent below its level two years earlier,

and in the quarter just before onset 9.7 per cent below. Part of that last drop is built into how episodes are dated: an episode starts in the first quarter its four-quarter window clears the threshold, which happens most easily just after a weak quarter. Productivity then climbs to 6.1 per cent above the starting level a year after onset and gives much of it back. Three years on it is 1.8 per cent above, with a standard error of 1.8; counted from onset, 8.0 per cent.

Exhibit 3: Booms start from a slump and partly fade

Relative labor productivity path with each industry's own trend removed, by quarter from episode onset, per cent (100 times the log), set to zero two years before onset

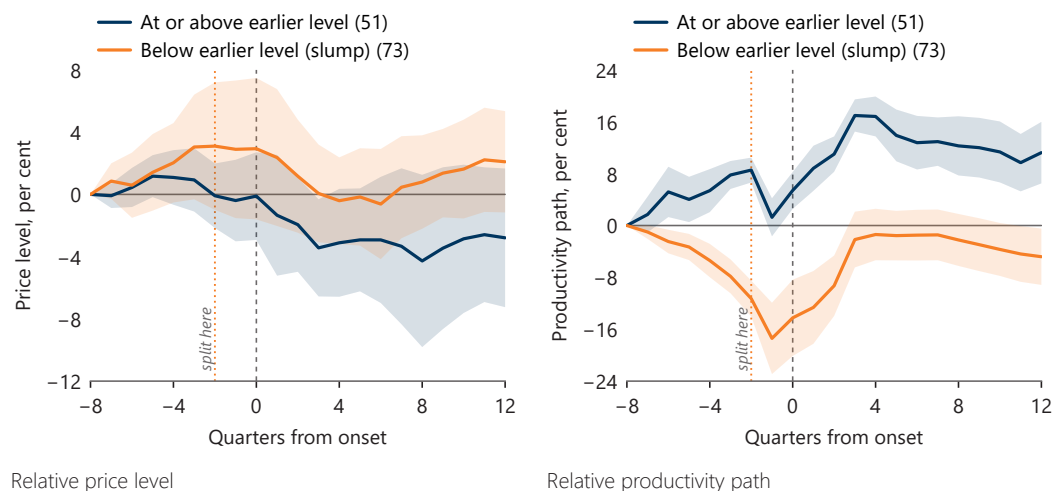


Source: QILP, retrieved 1 October 2026; SAM calculations. Quarterly productivity growth with industry and quarter averages removed, cumulated; the 2018Q1 quarter, where the source changes industry definitions, contributes zero. Same episodes as [Exhibit 2](#). Bands are two standard errors of the episode mean.

4. Where a boom started says a good deal about how it ended ([Exhibit 4](#)). Of the 124 booms, 73 began from a slump: two quarters before onset, their productivity was on average 11.3 per cent below its level two years earlier and their relative prices 3.1 per cent above it. Three years after onset, 44 of those 73 had no lasting gain, and on average their productivity ended 4.8 per cent below the starting level and their prices 2.1 per cent above, with a standard error of 1.7. Of the 51 that began at or above their earlier level, on average 8.6 per cent above it, 12 had no lasting gain; on average their productivity ended 11.2 per cent higher and their prices 2.8 per cent lower, with a standard error of 2.3. The price bands are wide and overlap zero, but the productivity contrast is large. The split is taken two quarters before onset, chosen before it was computed, because the dating rule depresses the quarter just before onset. Split at onset instead, the contrast is sharper, 49 of 74 against 7 of 50; that comparison is recorded in the note's data and not charted.

Exhibit 4: Booms that began from a slump mostly ended with no lasting gain

Relative price and productivity levels for booms split by where productivity stood two quarters before onset, per cent (100 times the log), set to zero two years before onset



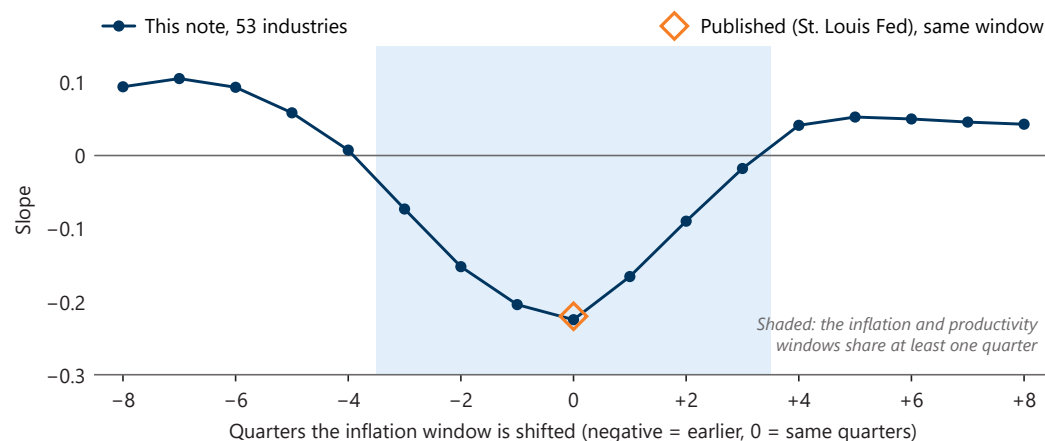
Source: QILP and BLS producer price indexes via FRED, retrieved 1 October 2026; SAM calculations. The 124 booms of [Exhibit 2](#), split by whether productivity two quarters before onset (the dotted line) was below (73, began from a slump) or at or above (51) its level two years before onset. No lasting gain means productivity three years after onset at or below that starting level: 44 of 73 and 12 of 51. Productivity is measured as in [Exhibit 3](#). Bands are two standard errors of the episode mean.

5. The timing of the price change is the next thing to pin down. The published summary is a slope of -0.22 : a point of relative productivity growth goes with 0.22 points less relative inflation, over the same four quarters. The rebuild reproduces it, at -0.22 ([Exhibit 5](#)). That figure is the slope through fifty bin means; fitted to the industry-quarters directly, the same relation is -0.15 . Shift the inflation window a year later and the binned slope is $+0.04$; a year earlier, $+0.01$. The negative relation appears only where the two windows overlap. Year-on-year inflation in any quarter sums the four quarterly changes ending there, so the windows in the published chart overlap, and the chart does not by itself establish that the effect builds over the following year.

Shift the inflation window six to eight quarters earlier and the sign flips: the slope is about $+0.1$. That is consistent with the run-up in [Exhibit 2](#), though this exhibit covers all industry-quarters, not only booms.

Exhibit 5: The negative relation lives inside the productivity window

Slope of relative four-quarter inflation on four-quarter productivity growth, by how far the inflation window is shifted from the productivity window

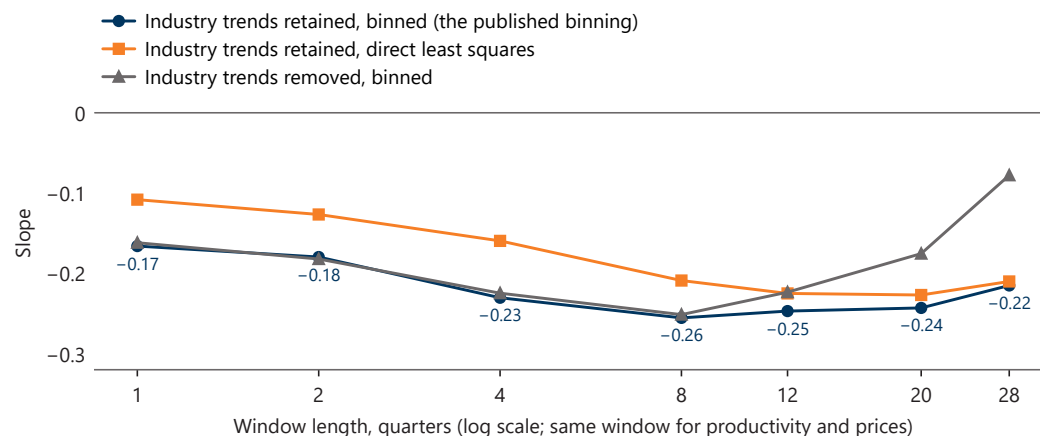


Source: QILP and BLS producer price indexes via FRED, retrieved 1 October 2026; SAM calculations. Productivity: four-quarter sum of growth net of industry and quarter averages, quarters t to $t + 3$. Inflation: relative year-on-year inflation ending in quarter $t + 3$ plus the shift. Slope: least-squares slope through 50 equal-sized bins of industry-quarters, the published summary; the slope through the industry-quarters themselves is in the exhibit data (-0.15 at a shift of zero). Descriptive summaries, not estimated effects. The diamond is the published value.

6. How far that proportion holds depends on the window and on the summary ([Exhibit 6](#)). Measured between industries, over the same window for productivity and prices, the binned slope stays between -0.17 and -0.26 from one quarter to seven years. Fitted directly, it is flatter at short horizons, -0.11 at one quarter and -0.16 at four, and agrees with the binned slope from three years on, at about -0.22 . Remove each industry's own trend, as the published design does, and the relation is substantially weaker at the longest windows, -0.18 at five years and -0.08 at seven, so over long windows it is mostly a difference between industries. Over three years and more, between industries, relative prices have moved by roughly a fifth as much as relative productivity, in the opposite direction. That is a ratio of two measured changes, not an estimate of how much of a cost saving firms pass on, and it does not show how much is measurement error, a point the caveat below returns to.

Exhibit 6: About a fifth between industries over long windows

Slope of relative price change on relative productivity growth measured over the same window, by window length in quarters, on three summaries



Source: QILP and BLS producer price indexes via FRED, retrieved 1 October 2026; SAM calculations. Industry trends retained: both changes relative to the cross-industry mean in each quarter, each industry's own average kept, because over long windows the differences between industries are the object; slope through 50 equal-sized bins, or fitted directly to the windows. Industry trends removed: productivity growth net of industry and quarter averages, binned. Horizons are drawn at log spacing. All overlapping windows that avoid 2018Q1; their number falls from 3,958 at one quarter to 1,096 at seven years. Descriptive summaries.

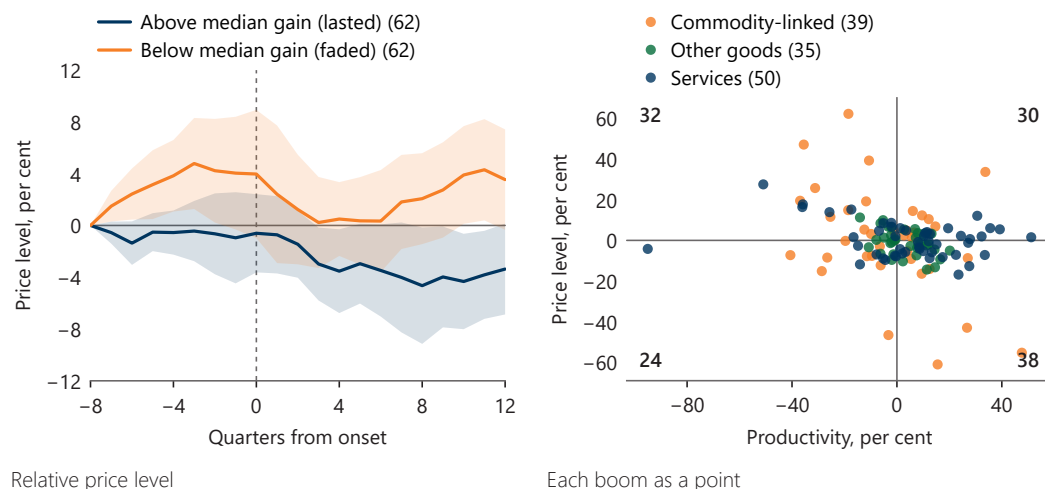
7. The strongest objection to reading the average this way is that it mixes real technological episodes with noise. The booms that would matter for artificial intelligence are the lasting ones, the objection runs, and averaging them with temporary blips hides a real effect. Split the booms at the median of their lasting productivity gain and the objection is half right ([Exhibit 7](#)). The 62 booms whose gain lasted ended three years after onset with productivity 15.9 per cent above its level two years before onset and, on average, a relative price level 3.4 per cent below it, with a standard error of 1.8. The 62 whose gain faded ended with productivity 12.4 per cent below and prices 3.5 per cent above. In 56 of the 124 booms with a complete record, productivity three years on was no higher than it had been two years before onset.

On average, prices did stay lower after the lasting booms, by about a fifth of the gain, 3.4 per cent against 15.9, although the band at three years, like the fading half's, includes zero. Measured from onset the proportion is about the same: the lasting half gained 13.3 per cent and its prices fell 2.8. It depends on the endpoint, at about 0.31 at two years, and on which industries are in the sample: dropping any one industry moves it between 0.16 and 0.30. The fading half moved the other way in a somewhat larger proportion, 3.5 against 12.4. The averages hide wide variation, which the right-hand panel shows boom by boom: of the 68 booms that ended with higher productivity, 38 ended with lower prices and 30 did not, and of the 56 without a lasting gain, 24 still ended with lower prices. Commodity episodes spread widely; service episodes sit close to zero price change. The sort uses measured productivity, which is built with the same price indexes, so it is not fully independent of prices, and its upper half is episodes with lasting measured gains, not necessarily technological ones. Read this way, the split is a check that lasting gains did not come with one-for-one price declines, not a separate

measurement.

Exhibit 7: On average, prices ended lower after the booms whose gain lasted

Left: relative price level for booms split at the median lasting productivity gain. Right: every boom three years after onset. Per cent (100 times the log), measured from two years before onset

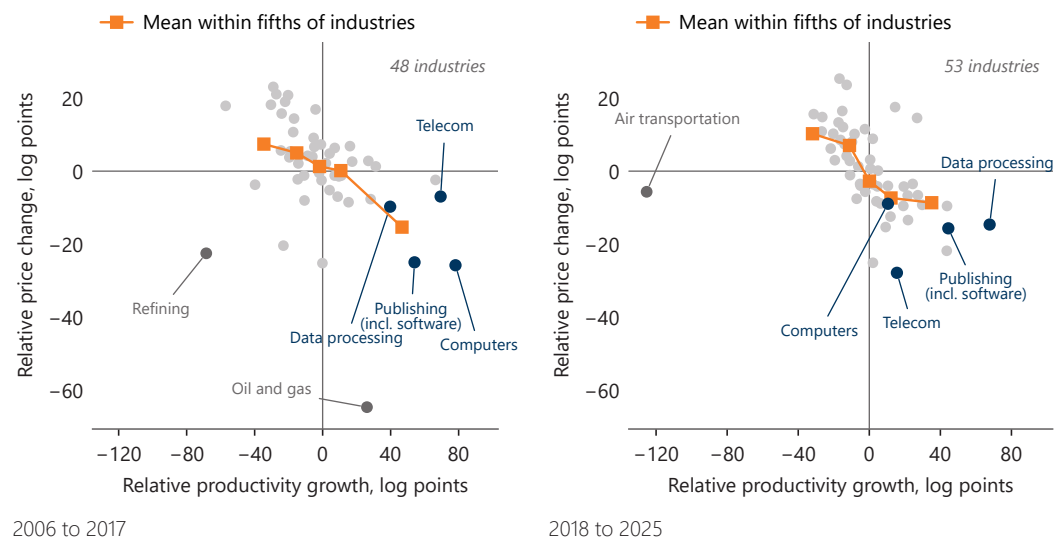


Source: QILP and BLS producer price indexes via FRED, retrieved 1 October 2026; SAM calculations. The 124 booms of [Exhibit 2](#). Left: split at the median productivity level three years after onset relative to two years before (3.0 per cent), 62 at or above (gain lasted) and 62 below (gain faded, including 6 with small gains under the median); bands are two standard errors of the episode mean. Right: one point per boom, productivity measured as in [Exhibit 3](#); the corner numbers count booms in each quadrant, split at zero rather than at the median; nothing is clipped and no line is fitted.

8. The long-run record shows the same proportion across industries ([Exhibit 8](#)). Across 48 industries from 2006 to 2017, those whose productivity rose faster than the average saw their prices rise more slowly, by about 0.22 points for each point of productivity; across 53 industries from 2018 to 2025, by about 0.20. The relation is loose, with a correlation near -0.4 in both windows, but its direction holds. The information technology industries sit in the tail, with wide variation around the fifth. From 2006 to 2017 computers and electronics gained 78 log points of productivity relative to the average while their relative prices fell 26; publishing including software, 54 and 25, though only its price index is specific to software; data processing and other information services, 40 and 10; telecommunications and broadcasting, 69 and only 7. In the later window data processing leads, at 68 and 15. That window's slope is sensitive to one industry: air transportation, whose measured productivity fell 125 log points relative to the average with almost no relative price change. Without it, the 2018 to 2025 slope is -0.37 .

Exhibit 8: Over long windows, faster productivity growth came with slower price growth

Change in labor productivity (horizontal) and producer prices (vertical) over each window, log points (100 times the log change), each relative to the cross-industry mean



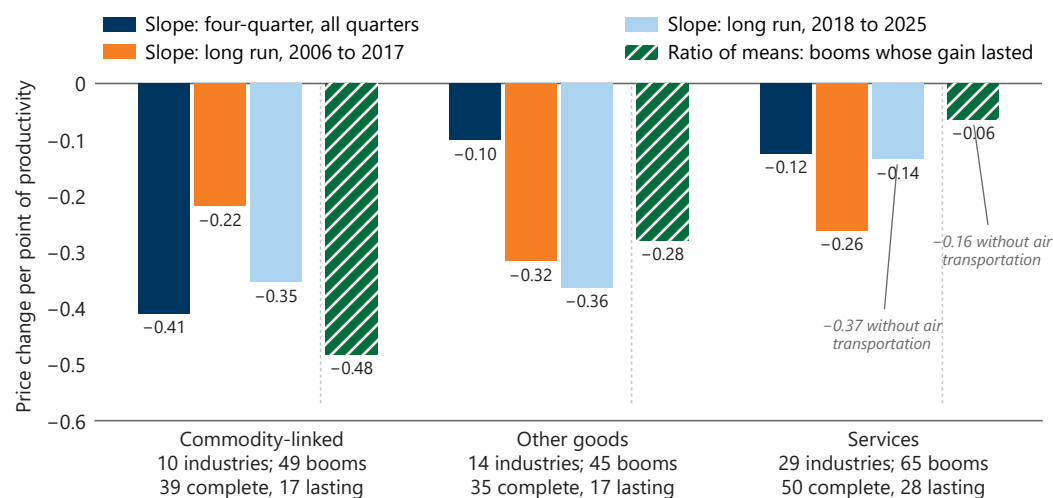
Source: QILP and BLS producer price indexes via FRED, retrieved 1 October 2026; SAM calculations. One point per industry with both series at both ends of the window: 2006Q2 to 2017Q4 (48) and 2018Q1 to 2025Q2 (53); neither window crosses the 2018Q1 change in industry definitions. Squares are the means within fifths of industries ranked by productivity growth; no line is fitted. The slopes quoted in the text are least-squares slopes through the points, descriptive. Nothing is clipped; air transportation (2018 to 2025) and oil and gas and refining (2006 to 2017) are labelled because they dominate the frame. Publishing's productivity series covers publishing industries except internet, including software; data processing's covers internet publishing and other information services.

9. The pooled fifth hides differences by industry group (Exhibit 9). The quarterly relation is steepest in ten commodity-linked industries: oil and gas, other mining and its support activities, utilities, logging, wood, paper, refining, chemicals and primary metals. There the slope is -0.41 ; in other manufacturing it is -0.10 , and in services -0.12 , or -0.06 fitted directly. Over long windows services show a negative relation too: -0.26 from 2006 to 2017, between the other two groups, and -0.14 from 2018 to 2025, which becomes -0.37 without air transportation, in line with the other groups.

The lasting booms look different by group, but on few industries. Among the booms whose gain lasted, relative prices fell by about half the gain in commodity-linked industries, at -7.2 per cent against 14.9 with a standard error of 6.1 ; by about a quarter in other manufacturing, -3.0 against 10.8 ; and by almost nothing in services, -1.3 against 19.7 . That services figure is largely one industry. Air transportation supplies 7 of the 28 lasting service booms, with productivity up 34.0 per cent and relative prices up 2.0 on average; without it, service prices fell 2.4 per cent against 15.0 , about a sixth, with a standard error of 1.4 . The other ratios move as much when a single industry is dropped, from 0.05 to 0.36 in other manufacturing and from 0.32 to 0.55 in commodities, so they describe a few dozen episodes and should be read that way. Air transportation is also the industry that moves the long-run services slope. Set it aside and services fall within the range of the other groups on both measures. For commodities, one possible explanation besides cost savings is that their prices are set in world markets and their output moves with capacity cycles; a descriptive note cannot separate the two.

Exhibit 9: Steepest in commodities by quarter, broad in the long run; the lasting-boom ratios rest on few industries

Points of relative price change per point of relative productivity, by industry group: four-quarter slope, long-run slopes, and the ratio for booms whose gain lasted



Source: QILP and BLS producer price indexes via FRED, retrieved 1 October 2026; SAM calculations. Groups were fixed from industry definitions before any group result was computed. Four-quarter slope: the zero-shift binned slope of Exhibit 5 over all industry-quarters in the group. Long run: least-squares slope through the group's points in Exhibit 8; services rest on 24 points in 2006 to 2017 and 29 in 2018 to 2025, and the annotations give the services 2018 to 2025 slope and lasting-boom ratio without air transportation. Lasting-boom ratio (hatched): a ratio of group means, not a slope; mean price change over mean productivity change, two years before onset to three years after, for the group's booms in the lasting half of Exhibit 7; the commodity price mean has a standard error of 6.1. Booms are counted as total onsets, complete-window episodes and lasting episodes. Descriptive summaries on few points.

10. One caution applies to every exhibit. Real output in these data is value added, deflated by price indexes built largely from the same producer prices that sit on the other axis. An error in an industry's price index therefore moves its measured productivity and its measured inflation in opposite directions at once, and produces a negative relation with no economics behind it. The long-run comparison is less exposed to a temporary error in an index than the quarterly ones, but no better protected against a persistent bias, and nothing here measures how much of the fifth is mechanical. The test that would address it, productivity measured without the industry's own price, cannot be built from these data. Double deflation can produce odd results in the source itself: the securities industry's productivity index in the Chicago Fed workbook is negative from 2006 to 2008 while its nominal value added is positive.

Other limits are plainer. Every number is relative to the cross-industry average, which moves with monetary policy and demand; nothing here speaks to aggregate inflation. Some industries central to discussion of artificial intelligence have no producer price index at all: computer systems design is not among the 53 industries here. And the booms are selected on four-quarter windows; a technology that diffuses over a decade is a different object.

11. For artificial intelligence the record supports a conditional, and a looser one than a single number suggests. If AI produces lasting productivity gains concentrated in

some industries, the historical pattern here is for relative prices to fall by a fraction of such gains. In goods industries, the long-run slopes and lasting-boom ratios in these exhibits run from about a fifth to about a half, the half imprecise. In services, the long-run comparison shows a fifth or more once one outlier is set aside, and the lasting-boom ratio, about a sixth without that industry, rests on too few episodes to set services apart. On this record a quarter or two of fast productivity growth in an exposed industry says little until it has lasted, and a boom that begins from a slump has more often been a recovery than a gain; those are interpretations of the exhibits, not something they show directly. Industry productivity data arrive quarterly and are revised, as the Chicago Fed workbook's own version notes record, so the distinction will take several releases to draw.

12. Three results would change the view. Lasting booms followed by price declines close to one-for-one with their gains would break the fifth ([Exhibit 7](#)). Relative inflation that kept falling in the year after a boom would be consistent with prices lagging productivity rather than moving with it ([Exhibit 5](#)). A long-run services relation near zero once single outliers are set aside, or lasting service booms with no price decline even without air transportation, would cut the bridge from this evidence to service industries ([Exhibit 9](#)).

Methodology and Disclosures

Authorship

This note was produced by SAM, a semi-autonomous research system, under human direction. Data were retrieved from the public sources named below and charted without further adjustment except where stated. The analysis is descriptive: it reports what the series show and does not claim to identify a causal effect.

Data

Labor productivity is the Federal Reserve Bank of Chicago's Quarterly Industry-Level Labor Productivity data (Hobijn, Mestieri, Werquin and Zhang, *Economic Perspectives* 2025, no. 1): real value added per hour, version of 7 October 2025, 2006Q2 to 2025Q2. Prices are BLS producer price indexes by industry, 72 series retrieved from FRED on 1 October 2026, averaged to complete quarters. The starting point is Marto and McCollum, "Do Productivity Booms Push Down Prices?", Federal Reserve Bank of St. Louis *On the Economy*, 24 September 2026. Source, retrieval time, span and a checksum of every input are in `data_vintage.json`; nothing was re-fetched after the cutoff.

Industries

The 53 most detailed industries in the productivity data that can be matched to a producer price index: 31 with one index of the same scope, 22 with an equal-weight average of component indexes or one component covering part of the industry (`code/00_packages.py`). Twelve detailed industries have no index and are excluded. Ten quarters of the securities industry, where the productivity index is negative (workbook sheets Labor Productivity and Nominal Output), are dropped.

Construction

Windows, transformations, groups and both splits were fixed in `research_plan.md` after a scratch rebuild of the published result and before the prose that uses them; nine amendments, recorded there, cover every later change, including the services ratio, the start-position split, the replaced exhibits and the unclipped eighth exhibit. Relative means relative to the unweighted mean across industries reporting in that quarter. Episode dating follows the published analysis. The 2018Q1 change in industry definitions is excluded from growth and counts as zero when growth is cumulated into a level. Levels are 100 times the natural log, written as per cent; the large long-run changes in the eighth exhibit are given in log points.

Slopes are descriptive

No specification is estimated. Each slope is a least-squares slope through bin means or through points, reported to summarize a chart and to compare with the published figure; none is an estimated effect, and no line is drawn on any chart. Binned and direct slopes differ at short horizons and agree from three years on (sixth exhibit). Standard errors treat episodes as independent; they overlap in time, so the bands are narrower than they would be otherwise.

Checks

Each check re-splits its own sample at its own median. The lasting and fading halves end 3.7 per cent lower and 2.4 higher with each industry's own price trend also removed; 3.5 lower and 3.8 higher without the 33 onsets of 2020 and 2021; 3.2 lower and 6.2 higher in the 31 exactly matched industries, where the four-quarter slope is -0.27 and the 2006 to 2017 slope -0.24 . The services lasting-boom ratio is -0.06 in exactly matched industries and -0.05 without the 2020 and 2021 onsets, but -0.16 without air transportation (-0.19 in exactly matched industries); dropping any one industry moves the pooled lasting ratio between -0.16 and -0.30 .

Replication

The pipeline, the plotted values behind every exhibit and the data vintage record are in `code/`, `exhibits/` and `data_vintage.json`. `REPLICATION.md` gives the run order; `review_pipeline/` holds the referee reports, revision plan and reply. The class, brand and chart style were copied into the note's directory, which preserves its design but does not pin fonts, the typesetting distribution or the plotting library.

Disclaimer

This note is published for research and educational purposes. It is not investment advice, not an offer or solicitation, and not a recommendation to buy or sell any security. Past performance does not indicate future results.