Adverse Uncertainty, Limited Relief: U.S. Industrial Output under Economic Policy Uncertainty

Lucjan T. Orlowski
Sacred Heart University

Nicholas R. Pusateri
Sacred Heart University

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Using monthly U.S. data from 1985 through 2025, we estimate sign-dependent local projections to study whether industrial production responds asymmetrically to changes in economic policy uncertainty. Rising uncertainty is followed by broad industrial weakness, with the largest relative response in business-equipment output, a category closely tied to deferrable capital spending. At the 24-month horizon, an event-sized EPU increase is followed by a larger decline in business equipment than in total industrial production, manufacturing, or utilities. Measured declines in EPU do not generate equal-and-opposite rebounds. Direct relative-output projections show that business equipment underperforms broader and lower-exposure benchmarks after EPU rises. The evidence points to a timing-sensitive industrial margin in the response to policy uncertainty rather than a symmetric aggregate response.

Keywords: economic policy uncertainty; manufacturing output; industrial production; business equipment; local projections; asymmetry
JEL Codes: E23; E32; L60

Lucjan T. Orlowski is the corresponding author. Email: orlowskiL@sacredheart.edu; Address: Department of Economics, Sacred Heart University West Campus, 3135 Easton Tpke, Fairfield, CT 06825-1081, USA. Nicholas R. Pusateri: pusaterin@sacredheart.edu.

1. Introduction

When economic policy becomes harder to read, firms can shelve equipment orders, cut production runs, and let inventories adjust before the uncertainty clears. Economic policy uncertainty is known to weaken real activity. Less is known about where that decline occurs inside industrial production and whether measured declines in uncertainty restore output as much as rising uncertainty depresses it.

We study these questions with monthly U.S. data from 1985 through 2025. Our sign-dependent local projections show that rising uncertainty is followed by broad industrial weakness, with the clearest relative response in business equipment. At the twenty-four-month horizon, an event-sized increase in policy uncertainty is followed by a 4.6 percent decline in business-equipment output, compared with 2.9 percent for manufacturing, 2.4 percent for total industrial production, and 1.3 percent for utilities. Declines in measured uncertainty do not generate equal-and-opposite rebounds. Direct relative-output projections show that business equipment and manufacturing underperform broader benchmarks after uncertainty rises and do not regain that lost ground symmetrically when measured uncertainty falls.

The sectoral comparison separates industrial margins with different exposure to delay. Business equipment is a durable and investment-linked category where firms can delay purchases, replacement, and production plans when uncertainty rises.[1] Manufacturing provides broader goods-sector evidence. Total industrial production is the broad benchmark, and utilities provide a lower-exposure benchmark inside the same industrial-production system because utility output is less tied to durable-goods and investment timing. Industrial aggregates therefore bundle together sectors with different exposure to delay.

We first build on the literature that measures economic policy uncertainty and links uncertainty to weaker real activity. Baker, Bloom, and Davis (2016) introduce the benchmark EPU index and show that policy uncertainty is associated with lower investment, output, and employment. Classic uncertainty-shock evidence in Bloom (2009) shows how increases in uncertainty can produce sharp but delayed real responses. Al-Thaqeb and Algharabali (2019) survey the large subsequent literature documenting real and financial effects of policy uncertainty. These findings imply that if uncertainty works partly by delaying spending and production plans, durable and investment-linked industrial output should be especially exposed.

[1] The point is not that business equipment is special by construction. It is that a real-options story has a visible quantity margin here: postponed capital spending maps naturally into production of capital goods, while many other delays appear only indirectly in aggregate output.

Recent work shows that the real effects of policy uncertainty need not be symmetric. Using nonlinear ARDL models for the G7, Istiak and Serletis (2018), Bahmani-Oskooee and Mohammadian (2021), and Nusair (2025) find asymmetric effects of economic policy uncertainty on real output and industrial production. Related labor-market evidence in Nusair and Olson (2026) shows that decreases in uncertainty also affect U.S. unemployment.

We build on this literature in three ways. First, we shift the unit of analysis from national aggregates to ex ante industrial margins inside U.S. industrial production: business-equipment output is the high-exposure, investment-linked margin; manufacturing is the broader goods-sector margin; total industrial production is the aggregate benchmark; and utilities output is the lower-exposure industrial benchmark. Second, we estimate direct relative-output projections against total industrial production and utilities, so the evidence does not rest only on separate absolute responses. Third, we use monthly local projections to trace horizon-specific responses rather than relying only on long-run NARDL-type asymmetry. The monthly and relative responses show when and where industrial output weakens after policy uncertainty rises.

Three related strands guide the interpretation and motivate the auxiliary checks. Caggiano, Castelnuovo, and Groshenny (2014) and Caggiano, Castelnuovo, and Figueres (2017) show that uncertainty shocks are more damaging in recessions than in expansions, making recession-state dependence an important comparison. Source-specific uncertainty evidence also cautions against treating broad EPU as a single channel: Müller et al. (2025) construct a topic-specific German uncertainty indicator and find that disaggregated domestic uncertainty shocks have stronger macroeconomic effects than aggregate uncertainty measures. Trade-policy uncertainty provides a narrower channel to test. Caldara et al. (2020) show that trade-policy uncertainty depresses investment and activity in trade-exposed settings, and Bahmani-Oskooee and Harvey (2023) find industry-specific asymmetric effects of U.S. and Mexican policy uncertainty on U.S.-Mexico trade flows. These strands motivate the recession-state and trade-policy-uncertainty comparisons below.

Taken together, the results show that the asymmetry in U.S. industrial output is concentrated in particular industrial margins. Rising uncertainty predicts broad industrial weakness, but the clearest relative response appears in business equipment. Measured declines in uncertainty do not symmetrically restore those industrial margins. Direct benchmark comparisons show business equipment weakening relative to broader industrial production rather than merely moving with it. The auxiliary checks sharpen the comparison with nearby work: the adverse business-equipment response is not confined to recession months, while replacing broad EPU with trade-policy uncertainty produces smaller and more symmetric estimates. This pattern suggests that the paper's contribution is not only another aggregate EPU asymmetry; it identifies a durable, investment-linked industrial margin in the response to broad policy uncertainty.

The next section lays out the data and design. The results section presents the baseline and relative-output estimates, followed by the economic interpretation.

2. Industrial Output: Data and Design

2.1. Data

Our analysis uses monthly U.S. data from January 1985 through December 2025. The uncertainty measure is the Baker-Bloom-Davis economic policy uncertainty index (Baker, Bloom, and Davis 2016). The output outcomes come from the Federal Reserve's industrial production release. Business-equipment output is classified ex ante as the high-exposure margin because it is durable, investment-linked, and tied to planning and replacement decisions. Manufacturing output is the broader goods-sector aggregate. Total industrial production and utilities output serve as benchmarks that separate broad industrial weakness from relative weakness in business equipment and manufacturing. All variable definitions, sources, transformations, and sample windows are recorded in Table A1.

To test sign asymmetry, we first split the uncertainty change into positive and negative components,

$$\Delta epu_t^+ = \max(\Delta epu_t, 0), \qquad \Delta epu_t^- = \max(-\Delta epu_t, 0). \tag{1}$$

Both terms are positive magnitudes. A positive realization is an increase in uncertainty. A negative realization is a decline in uncertainty, recorded as the absolute size of that decline.

We then rescale the signed magnitudes into event-sized units:

$$\widetilde{\Delta epu}_t^+ = \frac{\Delta epu_t^+}{0.25}, \qquad \widetilde{\Delta epu}_t^- = \frac{\Delta epu_t^-}{0.25}. \tag{2}$$

Thus, one unit of the displayed EPU regressor corresponds to an event-sized monthly movement. In this sample, an event-sized movement is a 0.25 log-point change in $\log(1 + \text{EPU})$, close to the 90th percentile of nonzero monthly EPU changes: 0.265 for increases and 0.246 for declines. The rescaling affects only the units of the reported coefficients; fitted values, test statistics, and symmetry-test p-values are unchanged. One-log-point EPU responses can be recovered by multiplying the reported coefficients by four.

These are separate transformations. The sign split defines increases and declines in measured uncertainty. The event-size adjustment changes the reporting unit so the displayed coefficients correspond to a large monthly movement in the index. The signed decomposition reflects the empirical shape of monthly uncertainty changes: increases and declines differ in timing and amplitude rather than appearing as mirror images.[2]

Measured declines in EPU should not be read as structural good-news shocks. The negative-change regressor records the absolute size of declines in the measured index. In this setting, large declines often mark the resolution or fading of earlier uncertainty spikes rather than a new policy-information shock with the opposite sign. If firms postponed production or capital plans while uncertainty was high, output may still be adjusting after the measured index begins to fall.

The interpretation checks use two additional series. The NBER recession indicator enters the state-dependent extension. The trade-policy uncertainty index provides a narrower trade-policy measure for comparison with broad EPU (Caldara et al. 2020). The EPU-innovation checks also use auxiliary macro-financial controls to construct residualized and recursively ordered EPU innovations; those series are listed in Table A1.

2.2. Empirical Strategy

We estimate three sets of responses. First, we estimate sign-dependent output responses for the core outcomes. Second, we estimate relative-output responses against the broad and lower-exposure benchmarks. Third, we use recession-state and trade-policy-uncertainty checks to interpret the baseline pattern.

The three exercises follow an ex ante exposure ranking. Business-equipment output is the a priori high-exposure category because policy uncertainty can delay capital spending, replacement plans, and production of capital goods. Manufacturing is the broader goods-sector category. Utilities output is the lower-exposure industrial benchmark because it is less tied to durable-goods demand and investment timing. The relative-output projections therefore test a pre-specified economic ranking rather than search across industrial categories after observing the estimates.

We begin with Toda and Yamamoto (1995) Granger-causality direction tests as a diagnostic of predictive ordering. Table 1 asks whether lagged policy uncertainty helps predict total industrial production more than lagged total industrial production alone, and whether the reverse predictive content is comparably strong. This test provides diagnostic evidence on predictive ordering rather than structural identification. The results show that lagged

[2] Figures A1 and A3 provide the full-series orientation plots and signed uncertainty changes. Appendix Table A3 reports the corresponding signed-change distribution.

uncertainty changes have significant predictive content for total industrial production, while lagged industrial production does not have comparable predictive content for uncertainty changes. This pattern is consistent with the interpretation that uncertainty changes are a leading indicator of industrial activity, rather than the reverse.

TABLE 1. System-level direction test

Outcome	EPU → output p	Output → EPU p
Total industrial production	0.007	0.250

Notes: Entries are Toda-Yamamoto Wald-test p-values from a monthly augmented-levels VAR estimated over the 1985m1–2025m12 sample. Lag order is selected by SBIC over lags 1–12, and the estimated VAR then adds one extra lag because $d_{\max} = 1$. The effective estimation sample is $N = 489$.

The main empirical specification is a sign-dependent local projection (Jordà 2005).[3] The baseline estimates, reported in Section 3.1, are sign-dependent local projections for horizons $h = 0, 1, \dots, 24$:

$$Y_{t,h} = \alpha_h + \beta_h^+ \widetilde{\Delta epu}_t^+ + \beta_h^- \widetilde{\Delta epu}_t^- + \sum_{j=1}^{12} \gamma_{h,j} \Delta y_{t-j} + \sum_{j=1}^{12} \delta_{h,j} \Delta epu_{t-j} + \varepsilon_{t,h}, \tag{3}$$

where

$$Y_{t,h} = 100 \left[\log(y_{t+h}) - \log(y_{t-1}) \right]. \tag{4}$$

This dependent variable measures cumulative output growth from month $t-1$ to month $t+h$, so Δy_{t-j} denotes lagged monthly log growth rather than a level difference on an undefined object. The coefficients β_h^+ and β_h^- therefore trace the response path to rising uncertainty and measured declines in uncertainty.

The baseline includes a parsimonious control block: a constant, twelve lags of output growth, and twelve lags of aggregate uncertainty changes. The lag block uses lagged aggregate uncertainty changes Δepu_{t-j} rather than lagged signed-change components, so the asymmetry enters through the contemporaneous decomposition of Δepu_t into $\widetilde{\Delta epu}_t^+$ and $\widetilde{\Delta epu}_t^-$. Standard errors are Newey-West (Newey and West 1987) with horizon-specific bandwidth $h + 1$, and the figures report 90 percent confidence bands.

We use local projections rather than a nonlinear ARDL specification for two reasons. First, the monthly response path matters here. The question is not only whether positive and negative uncertainty changes have different long-run cumulative effects, but when the output loss appears and whether it persists over the two-year horizon. Second, local projections let us estimate the same sign-dependent design for absolute output and

[3] All output series enter in logs. For any output series y_t, define monthly log growth as $\Delta y_t = \log(y_t) - \log(y_{t-1})$.

relative-output gaps. That common design makes the benchmark comparisons direct: it shows whether business equipment and manufacturing weaken relative to total industrial production and utilities, rather than only whether their own long-run coefficients differ across signs.

Section 3.2 applies the same local-projection design to relative outcomes. For a core outcome g and a benchmark series b, define

$$r_t^{g,b} = \log(y_t^g) - \log(y_t^b), \tag{5}$$

with monthly relative-output growth

$$\Delta r_t^{g,b} = r_t^{g,b} - r_{t-1}^{g,b}, \tag{6}$$

and estimate

$$R_{t,h}^{g,b} = \mu_h + \phi_h^+ \widetilde{\Delta epu}_t^+ + \phi_h^- \widetilde{\Delta epu}_t^- + \sum_{j=1}^{12} \kappa_{h,j} \Delta r_{t-j}^{g,b} + \sum_{j=1}^{12} \lambda_{h,j} \Delta epu_{t-j} + u_{t,h}, \tag{7}$$

where

$$R_{t,h}^{g,b} = 100 \left[r_{t+h}^{g,b} - r_{t-1}^{g,b} \right]. \tag{8}$$

Negative coefficients in these relative-output projections mean that the core outcome underperforms its benchmark after the corresponding uncertainty move. Here $\Delta r_{t-j}^{g,b}$ denotes lagged monthly growth in the relative log gap. As in the baseline specification, the lag block uses lagged relative-output growth and lagged aggregate uncertainty changes, while the sign split enters only through the contemporaneous signed uncertainty change. The specification measures whether the core outcome weakens relative to the benchmark, rather than merely moving with broader industrial activity.

Finally, in Section 3.3 we turn to interpretation. The recession-state extension interacts the signed uncertainty changes with the NBER recession indicator so the responses to uncertainty increases and declines can differ between expansions and recessions. The trade-policy replacement swaps broad policy uncertainty for trade-policy uncertainty and keeps the rest of the local-projection design fixed.

Throughout, the estimates should be read as reduced-form predictive responses. They are informative about timing, magnitude, and relative exposure, but they do not isolate an exogenous policy shock or identify the specific policy margin driving each episode.

3. Results

Rising uncertainty is followed by broad industrial weakness, and measured declines in uncertainty do not reverse those losses symmetrically. Business equipment shows the clearest relative response, and manufacturing provides broader goods-sector evidence. The interpretation checks show that this ranking is not driven solely by recession months or trade-policy uncertainty.

3.1. Baseline Output Responses

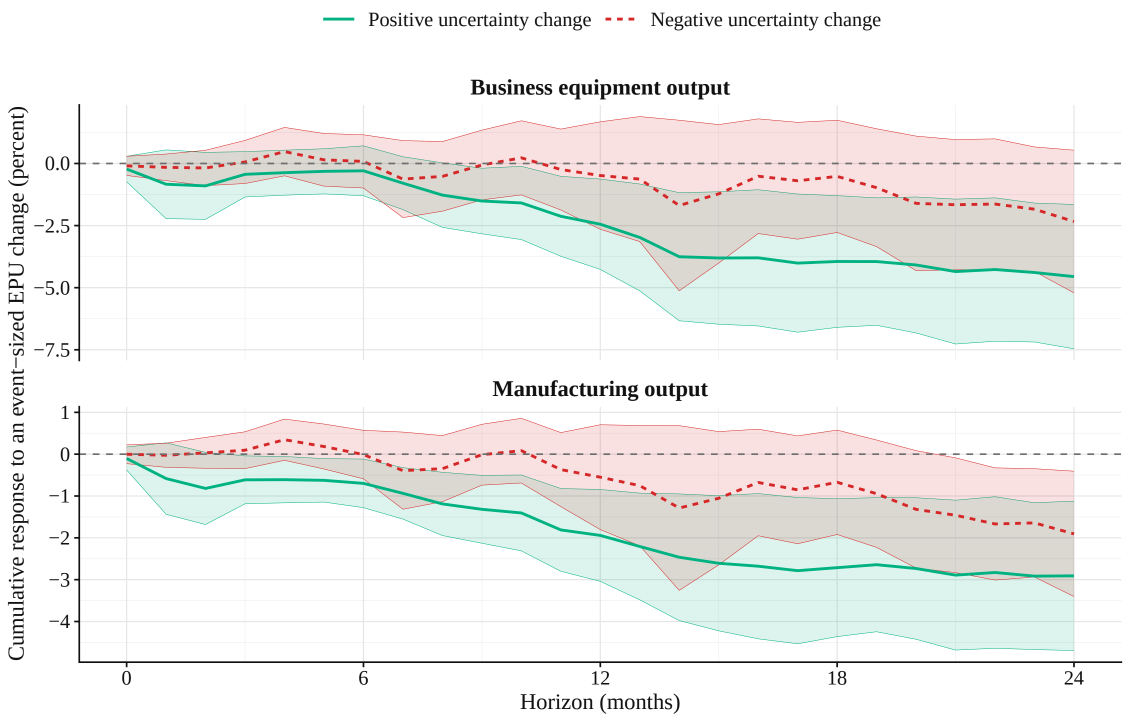

FIGURE 1. Core output responses

Notes: Panels plot cumulative local-projection responses for business-equipment output and manufacturing output over horizons from 0 to 24 months. The EPU change measure is the monthly change in $\log(1 + \text{EPU})$, split into positive changes and the absolute size of negative changes, and reported in event-sized units. Positive-change responses are shown with solid lines; negative-change responses are shown with dashed lines. Outcomes enter in logs, so the vertical axis is read as an approximate cumulative percent change from month $t - 1$ to month $t + h$ after that movement. Each horizon regression uses the 1985m1–2025m12 monthly sample, contemporaneous positive and negative uncertainty changes, 12 lags of output growth, 12 lags of the aggregate uncertainty change, and Newey-West confidence intervals with bandwidth $h + 1$.

Figure 1 and Table 2 show the core result. The figure shows responses to both uncertainty increases, presented with solid green lines, and uncertainty declines, presented with dashed red lines. The displayed units are event-sized changes in the index, as defined in Section 2.1. The plotted path is informative in its own right. For business equipment and manufacturing, the response to an uncertainty increase is modest at short horizons, clearly below zero by the 12-month horizon, and deeper by the 18-month horizon.

At the 24-month horizon, an event-sized increase in uncertainty is followed by statistically significant declines in every reported output series. The declines are not equivalent across categories: business-equipment output is down 4.6 percent [-7.5, -1.6], manufacturing output is down 2.9 percent [-4.7, -1.1], total industrial production is down 2.4 percent [-4.0, -0.8], and utilities are down 1.3 percent [-2.0, -0.5]. At two years, business equipment is the sharpest high-exposure margin, manufacturing also weakens, and utilities fall less.

TABLE 2. Baseline output responses at 24 months

Outcome	EPU increase	EPU decline magnitude	Symmetry p
Business-equipment output	-4.6	-2.3	0.025
	[-7.5, -1.6]	[-5.2, 0.5]	
Manufacturing output	-2.9	-1.9	0.003
	[-4.7, -1.1]	[-3.4, -0.4]	
Total industrial production	-2.4	-1.3	0.023
	[-4.0, -0.8]	[-2.8, 0.2]	
Utilities output	-1.3	-0.3	0.074
	[-2.0, -0.5]	[-1.1, 0.6]	

Notes: Entries are 24-month cumulative responses to an event-sized EPU movement, with positive changes and the absolute size of negative changes entered separately. The line beneath each estimate reports the corresponding 90 percent confidence interval in brackets, based on the same Newey-West inference used in the figures. Outcomes enter in logs, so the coefficients are read as approximate percentage-point changes in cumulative output growth from month $t-1$ to month $t+h$. Every regression uses the monthly sample from 1985m1 through 2025m12, includes contemporaneous positive and negative uncertainty changes, 12 lags of output growth, and 12 lags of the aggregate uncertainty change, and uses Newey-West inference with bandwidth $h+1$. The symmetry test reports the p-value for $H_0 : \beta_h^+ + \beta_h^- = 0$ and is unchanged by the reporting rescale. The effective sample size is $N = 455$ for every reported outcome.

The negative-change estimates do not mirror the adverse side. A negative coefficient in the decline-magnitude column means output continues to weaken as measured uncertainty falls; it is not evidence that lower uncertainty is structurally harmful. The dashed paths in Figure 1 make the same point dynamically: they do not show a corresponding rebound, remaining close to zero through the first year before turning negative at longer horizons. At the 24-month horizon, measured declines in uncertainty do not produce statistically clear output gains in three of the four outcomes; the manufacturing estimate is negative. Taken together, the estimates indicate that the losses from rising uncertainty are not offset by comparable output gains when measured uncertainty falls.

The symmetry tests directly support this non-reversal result. Because the negative-change regressor is recorded as a positive magnitude, equal-and-opposite reversal corresponds to the null that the positive- and negative-change coefficients sum to zero. Rejection of that null indicates non-reversal, not necessarily a positive rebound. The null is rejected for business equipment ($p = 0.025$), manufacturing ($p = 0.003$), total industrial production ($p = 0.023$), and utilities ($p = 0.074$). Declines in measured uncertainty do not restore lost output one-for-one; the adverse-side hit arrives faster, lands harder, and is estimated more precisely than the negative-change side.

Table 3 reports timing and innovation checks for the baseline result. The business-equipment response remains negative when the signed EPU changes are lagged one month, when EPU innovations are residualized on macro-financial controls, and when EPU is ordered after current macro-financial controls. Manufacturing follows the same direction across the same checks. The innovation checks are not a structural identification strategy, but the adverse-side result remains negative under alternative timing and innovation definitions.[4]

TABLE 3. Identification checks at 24 months

Check	EPU increase	EPU decline magnitude	Symmetry p
Business-equipment output			
Baseline	-4.6	-2.3	0.025
	[-7.5, -1.6]	[-5.2, 0.5]	
Lagged signed EPU changes	-4.6	-2.8	0.024
	[-7.6, -1.6]	[-5.7, 0.2]	
Residualized EPU innovations	-6.2	-5.6	0.000
	[-9.2, -3.2]	[-8.4, -2.8]	
Recursively ordered EPU innovations	-5.3	-5.1	0.002
	[-8.4, -2.1]	[-8.2, -2.1]	
Manufacturing output			
Baseline	-2.9	-1.9	0.003
	[-4.7, -1.1]	[-3.4, -0.4]	
Lagged signed EPU changes	-2.9	-1.9	0.005
	[-4.7, -1.1]	[-3.4, -0.5]	
Residualized EPU innovations	-3.7	-3.4	0.001
	[-5.6, -1.8]	[-5.2, -1.6]	
Recursively ordered EPU innovations	-3.0	-2.9	0.002
	[-4.7, -1.2]	[-4.6, -1.2]	

Notes: Entries are 24-month cumulative responses to event-sized EPU movements; bracketed lines are 90 percent Newey-West confidence intervals. The baseline row uses contemporaneous signed EPU changes, 12 lags of output growth, and 12 lags of aggregate EPU changes. The lagged row uses one-month-lagged signed EPU changes and starts the aggregate EPU lag block at month $t - 2$. Residualized innovations come from projecting EPU changes on 12 EPU-change lags and three lags of macro-financial controls. Recursively ordered innovations come from an EPU equation that orders current macro-financial controls before EPU, with three control and EPU-change lags. In the innovation rows, the EPU increase and EPU decline-magnitude columns refer to positive and negative components of the constructed EPU innovation. The symmetry test reports the p-value for $H_0 : \beta_h^+ + \beta_h^- = 0$ and is unchanged by the reporting rescale. Effective samples are $N = 455$ for the baseline and lagged rows and $N = 452$ for the innovation rows.

[4]Appendix Table A2 reports additional robustness checks. The adverse-side response remains visible after adding parsimonious controls, replacing aggregate EPU lags with signed positive and negative EPU lag components, and excluding response windows that overlap COVID or the GFC. The estimates weaken under crisis-window exclusions but remain economically large at the 24-month horizon, especially for business equipment.

3.2. Relative Output Comparisons

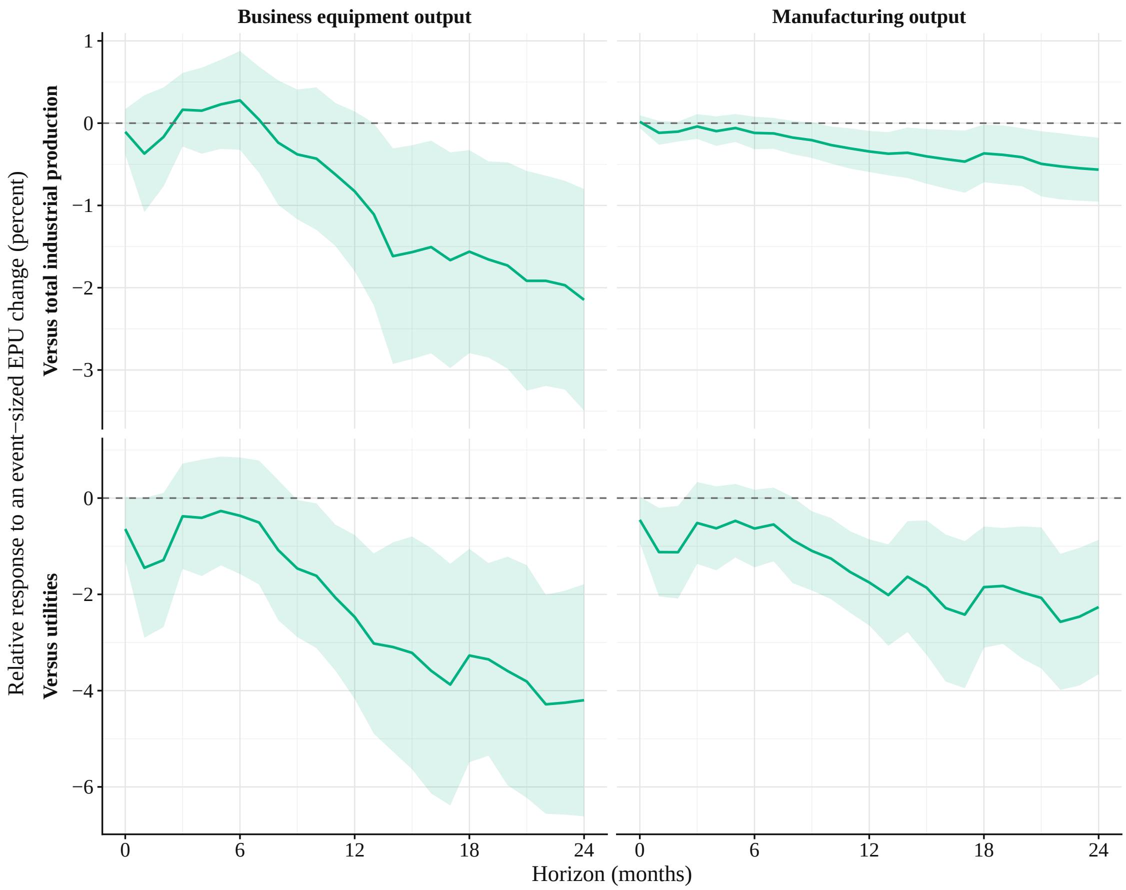

FIGURE 2. Relative output responses for positive EPU changes

Notes: Each panel plots the local-projection response of a log gap: the series named in the column title minus the benchmark named in the row label. Negative values therefore indicate underperformance relative to that benchmark. The EPU change measure is a positive monthly change in log(1 + EPU), reported in event-sized units, and the response variable is cumulative growth in the relative log gap from month $t-1$ to month $t+h$. All panels use the 1985m1–2025m12 monthly sample, contemporaneous positive and negative uncertainty changes, 12 lags of relative-output growth, 12 lags of the aggregate uncertainty change, and 90 percent Newey-West confidence intervals. Table 4 reports the corresponding 24-month responses for both uncertainty increases and uncertainty declines.

The relative-output estimates show where the industrial weakness is concentrated. Figure 2 traces the divergence between the series over the full horizon, and Table 4 reports the 24-month endpoint. The relative-output paths add the sectoral timing: business equipment does not separate much from total industrial production at short horizons, but the gap turns negative around the 12-month horizon and widens through the second year. Against utilities, the separation is larger by the middle horizons, and manufacturing follows the same direction with a smaller gap against total industrial production. At the 24-month horizon, business equipment underperforms total industrial production by 2.2 percentage points [-3.5, -0.8] and utilities by 4.2 percentage points [-6.6, -1.8]. Manufacturing also underperforms, especially against utilities, where the 24-month gap reaches 2.3 percentage points [-3.7, -0.9].

TABLE 4. Relative-output responses at 24 months

Relative outcome	EPU increase	EPU decline magnitude	Symmetry p
Business equipment minus total industrial production	-2.2	-0.9	0.037
	[-3.5, -0.8]	[-2.3, 0.6]	
Business equipment minus utilities	-4.2	-2.6	0.006
	[-6.6, -1.8]	[-5.0, -0.3]	
Manufacturing minus total industrial production	-0.6	-0.7	0.002
	[-1.0, -0.2]	[-1.1, -0.3]	
Manufacturing minus utilities	-2.3	-1.9	0.001
	[-3.7, -0.9]	[-3.2, -0.6]	

Notes: Entries are 24-month cumulative responses to an event-sized EPU movement, with positive changes and the absolute size of negative changes entered separately. The line beneath each estimate reports the corresponding 90 percent confidence interval in brackets, based on the same Newey-West inference used in the figures. Relative outcomes are constructed as the log level of the first series named in each row label minus the log level of the second series named in that row label, so negative coefficients indicate underperformance of the first series relative to the second. Every regression uses the 1985m1–2025m12 monthly sample, contemporaneous positive and negative uncertainty changes, 12 lags of relative-output growth, and 12 lags of the aggregate uncertainty change, and uses Newey-West inference with bandwidth $h + 1$. The symmetry test reports the p-value for $H_0 : \phi_h^+ + \phi_h^- = 0$ and is unchanged by the reporting rescale. The effective sample size is $N = 455$ for every reported comparison.

These relative projections locate the output loss inside the industrial aggregate.[5] Absolute output losses show that rising uncertainty predicts broad industrial weakness. The relative-output results show that the business-equipment margin weakens more than broader and lower-exposure benchmarks after the same uncertainty move. Table 4 also shows why the central pattern is non-reversal rather than a simple rebound. At the 24-month horizon, the negative-change relative-output coefficients are negative in all four rows, so the rejected symmetry tests indicate failed reversal rather than relative rebound by business equipment or manufacturing.

3.3. Interpretation Checks

Recession timing could account for some output responses, so we allow the response to signed EPU changes to differ by NBER recession status. Table 5 reports the adverse-side recession-state results at the twenty-four-month horizon. Outside recessions, an event-sized increase in uncertainty is associated with a decline in business-equipment output

[5] This is the empirical counterpart to asking whether uncertainty changes the composition of industrial production. A common industrial downturn can generate negative absolute responses across sectors; it cannot by itself explain why business equipment loses ground relative to the aggregate or to utilities.

TABLE 5. Recession-state responses at 24 months

Outcome	Expansion EPU increase	Recession EPU increase	State difference p
Business-equipment output	-5.0	-1.7	0.188
	[-9.0, -1.0]	[-3.7, 0.4]	
Manufacturing output	-3.4	-0.7	0.100
	[-5.7, -1.1]	[-2.4, 1.0]	

Notes: Entries report 24-month coefficients from recession-interaction local projections in which the positive monthly change in $\log(1 + \text{EPU})$ is interacted with the NBER recession indicator and reported in event-sized EPU units. 'Expansion' and 'Recession' are the level responses in those two states. The line beneath each estimate reports the corresponding 90 percent confidence interval in brackets, based on the same Newey-West inference used in the figures. 'State difference p' reports the p-value for the recession increment, $H_0 : \beta^{+}_{h,\text{rec}} - \beta^{+}_{h,\text{exp}} = 0$, and is unchanged by the reporting rescale. These regressions use the 1985m1–2025m12 monthly sample, contemporaneous signed uncertainty changes and recession interactions, 12 lags of output growth, and 12 lags of the aggregate uncertainty change. All reported regressions use Newey-West inference with bandwidth $h + 1$ and have effective sample size $N = 455$. Appendix Table A4 reports the full signed results at 12 and 24 months.

of 5.0 percent [-9.0, -1.0] and a decrease in manufacturing output of 3.4 percent [-5.7, -1.1]. The recession-state point estimates are smaller and less precise, and the state-difference tests do not reject equality at conventional levels. This pattern suggests that the adverse response is not confined to recession months.[6]

TABLE 6. Trade-policy-uncertainty replacement at 24 months

Outcome	TPU increase	TPU decline magnitude	Symmetry p
Business-equipment output	-2.5	0.8	0.539
	[-5.1, 0.1]	[-2.4, 3.9]	
Manufacturing output	-1.3	0.7	0.752
	[-2.5, 0.0]	[-1.3, 2.8]	

Notes: Broad policy uncertainty is replaced with the signed monthly change in $\log(1 + \text{TPU})$ while the rest of the baseline local-projection design is held fixed. Entries are 24-month cumulative responses to a one-log-point monthly movement in $\log(1 + \text{TPU})$, with positive changes and the absolute size of negative changes entered separately. In this sample, that movement is roughly event-sized. The line beneath each estimate reports the corresponding 90 percent confidence interval in brackets, based on the same Newey-West inference used in the figures. Each regression uses the 1985m1–2025m12 monthly sample, contemporaneous positive and negative TPU changes, 12 lags of output growth, 12 lags of the aggregate TPU change, and Newey-West inference with bandwidth $h + 1$. The symmetry test reports the p-value for $H_0 : \beta^{+,\text{TPU}}_{h} + \beta^{-,\text{TPU}}_{h} = 0$. The effective sample size is $N = 455$ for both reported outcomes. Appendix Table A5 reports the corresponding 12- and 24-month results in full.

Table 6 reports the key results with trade-policy uncertainty in place of broader economic policy uncertainty. These estimates compare the baseline pattern with a narrower trade-policy measure. That comparison matters because trade-policy uncertainty depresses real

[6]The negative-change side is more uneven. Appendix Table A4 shows that outside recessions, declines in measured uncertainty still do not restore output over the two-year horizon for either outcome, while the recession-state estimates turn positive. The stable adverse response contrasts with a more conditional and weaker negative-change side.

activity, and policy uncertainty has industry-specific asymmetric effects on U.S.-Mexico trade flows; the test here asks whether that narrower channel accounts for the broad EPU response in industrial output (Caldara et al. 2020; Bahmani-Oskooee and Harvey 2023). The TPU replacement is reported in one-log-point changes, which are roughly event-sized in this sample.[7] At the twenty-four-month horizon, the adverse point estimates are 2.5 percent in business equipment and 1.3 percent in manufacturing, while the negative-TPU estimates turn small and positive. The trade-policy estimates are smaller, less precisely estimated, and more symmetric than the broad EPU responses, suggesting that trade-policy uncertainty is one plausible contributing margin rather than the sole source of the broader EPU pattern.

Across these checks, business equipment remains the sharpest timing-sensitive margin, manufacturing supports broader goods-sector weakness, and measured EPU declines do not undo the hit.[8] The next section discusses the economic interpretation of these reduced-form patterns.

4. Discussion

The results point to a timing-sensitive industrial margin. When policy becomes harder to read, firms can delay equipment purchases and production plans where output depends on durable demand and planned capital spending. That interpretation follows the real-options logic of irreversible investment under uncertainty: waiting becomes more valuable when firms can postpone capital commitments (Bernanke 1983; Dixit and Pindyck 1994). It also lines up with uncertainty-shock models in which firms pause investment and hiring until uncertainty recedes (Bloom 2009). Business equipment is the clearest case in our data. The baseline and relative-output evidence in Figures 1 and 2 and Tables 2 and 4 show that business equipment posts the largest absolute decline and the sharpest relative decline after uncertainty rises.

Manufacturing supplies the broader goods-sector evidence. Manufacturing output also falls after positive uncertainty changes and underperforms utilities, but it is a wider aggregate than business equipment. Utilities fall less. The relative-output projections mirror this economic ranking: the durable and investment-linked margin weakens most, the broader goods-sector margin also weakens, and the lower-exposure industrial benchmark moves less.

[7] For TPU, the one-log-point reporting unit is roughly event-sized: the 90th percentiles of nonzero monthly TPU changes are 1.152 for increases and 1.034 for declines.

[8] Appendix Tables A4 and A5 and Figures A4 to A6 report the state-dependence and TPU evidence.

The relief-side estimates fit the same interpretation. The relevant asymmetry is not that EPU increases reduce output while EPU declines raise it. The evidence instead shows that increases in EPU are followed by large and precisely estimated output losses, while measured declines in EPU do not symmetrically restore the affected industrial margins.

The interpretation checks support this reading without making them the paper's main result. The business-equipment response is not confined to recession months, and the trade-policy-uncertainty replacement is smaller and more symmetric than the broad EPU response. That contrast suggests that the main finding is a durable, investment-linked industrial-output margin in broad policy uncertainty, not simply the narrower trade-policy channel emphasized in related work.

5. Conclusion

Increases and decreases in measured economic policy uncertainty do not have symmetric effects on U.S. industrial output. Rising uncertainty predicts broad industrial weakness, and measured declines in uncertainty do not undo those losses on the same scale. The clearest relative response appears in business equipment, including in direct comparisons with total industrial production and utilities output.

Our contribution is to show that EPU-output asymmetry is not only an aggregate phenomenon. In U.S. industrial production, the adverse response to rising uncertainty is concentrated in business equipment, a durable and investment-linked margin closely tied to deferrable capital spending. Measured declines in uncertainty do not restore that margin symmetrically, and this non-reversal remains visible across timing, innovation, and crisis-window checks.

The evidence favors a timing-sensitive industrial response rather than a symmetric aggregate response. When economic policy becomes harder to read, the durable and investment-linked margin takes the hardest hit. When measured uncertainty recedes, output on that same margin does not return on the same scale over the horizons studied here.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work, the authors used GPT-5.4 and GPT-5.5 as assistive tools for brainstorming, code editing, prose refinement, and generating simulated reviewerstyle feedback. After using these tools, the authors reviewed and edited all generated content as needed and take full responsibility for the content of the published article.

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Appendix A. Data Sources and Descriptive Evidence

Appendix Table A1 records the series used in the main text and appendix, along with their sources, transformations, and effective sample windows. Two sample details matter for interpretation. First, the oil-price control begins in January 1986, but the parsimonious-controls row in Appendix Table A2 uses the same effective estimation samples as the baseline at the displayed horizons because common lag-and-horizon trimming is already binding. Second, the residualized and recursive ordered EPU-innovation checks use auxiliary macro-financial controls that enter only in the first-stage innovation construction.

Figures A1 to A3 and Table A3 provide the descriptive evidence behind the uncertainty split. The first figure places policy uncertainty, manufacturing output, and manufacturing employment on the same recession-timed window. The second figure puts normalized trends for those same series on a common scale. The signed-change figure and the table show that positive and negative monthly uncertainty changes differ in timing and amplitude rather than appearing as mirror images.

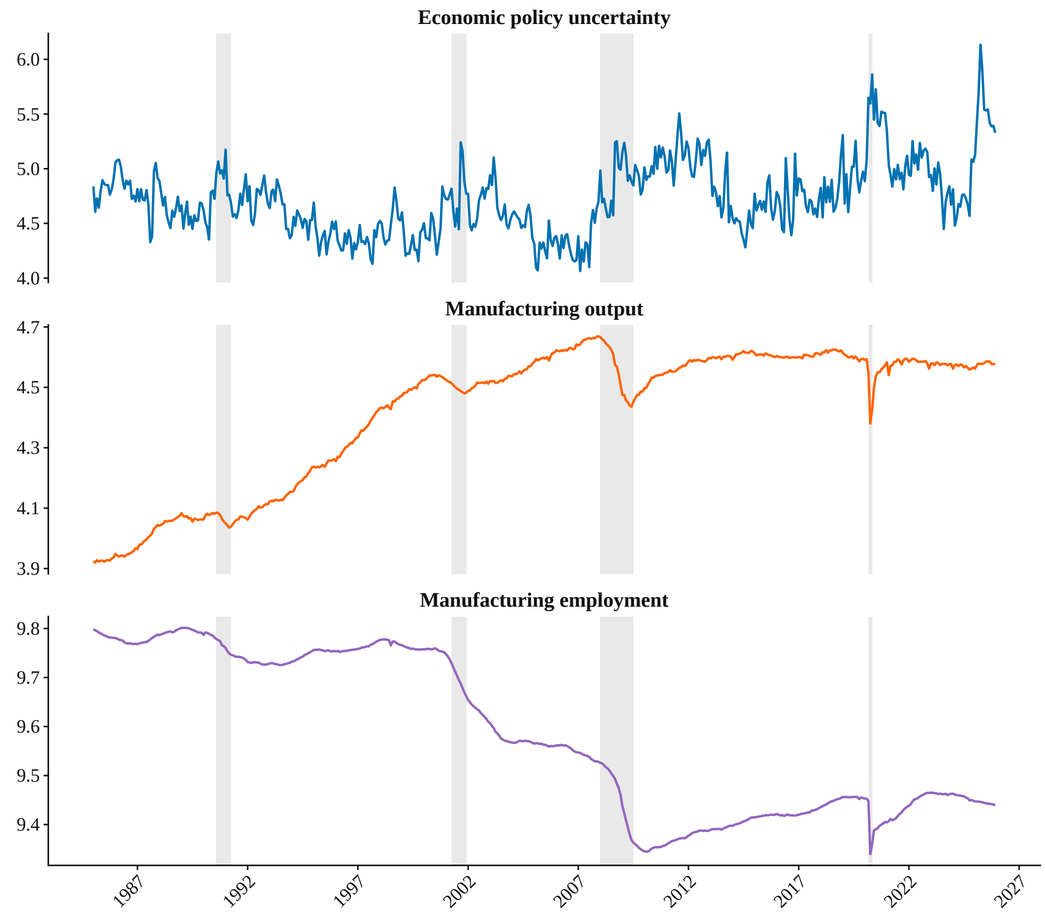

FIGURE A1. Time-series overview

Notes: The top panel plots log(1 + EPU). The middle panel plots the log level of manufacturing industrial production, and the bottom panel plots the log level of manufacturing employment. All three series use the 1985m1–2025m12 monthly sample. Gray vertical bands mark NBER recession months.

TABLE A1. Data sources, roles, and transformations

Series and role	FRED code	Transformation or use	Sample
Uncertainty and state variables			
U.S. economic policy uncertainty (main uncertainty measure)	USEPUINDXM	$\log(1+\text{EPU}_t)$; monthly change split by sign and reported in event-sized units	1985m1–2025m12
Trade-policy uncertainty (channel check)	EPUTRADE	$\log(1+\text{TPU}_t)$; monthly change split by sign and reported in one-log-point units in the replacement exercise	1985m1–2025m12
NBER recession indicator (state interaction)	USREC	Monthly 0/1 recession indicator	1985m1–2025m12
Output outcomes and benchmarks			
Business-equipment output (core high-exposure outcome)	IPBUSEQ	Log level; cumulative future log growth in the local projections	1985m1–2025m12
Manufacturing output (core goods-sector outcome)	IPMAN	Log level; cumulative future log growth in the local projections	1985m1–2025m12
Manufacturing employment (descriptive appendix series)	MANEMP	Log level; plotted in Figure A1	1985m1–2025m12
Total industrial production (broad benchmark)	INDPRO	Log level; comparison and relative-output projections	1985m1–2025m12
Utilities output (lower-exposure benchmark)	IPUTIL	Log level; comparison and relative-output projections	1985m1–2025m12
Robustness and innovation controls			
Federal funds rate (control)	FEDFUNDS	Current monthly change	1985m1–2025m12
Core PCE price index (control)	PCEPILFE	Monthly log inflation	1985m1–2025m12
WTI oil price (control)	MCOILWTICO	Monthly log growth	1986m1–2025m12
Total nonfarm payrolls (innovation control)	PAYEMS	Monthly log growth	1985m1–2025m12
Unemployment rate (innovation control)	UNRATE	Current monthly change	1985m1–2025m12
NASDAQ Composite index (innovation control)	NASDAQCOM	Monthly log return	1985m1–2025m12
Baa–Treasury credit spread (innovation control)	BAA10Y	Monthly average spread	1986m1–2025m12
Treasury term spread (innovation control)	T10Y3M	Monthly average spread	1985m1–2025m12

Notes: In the local projections, uncertainty enters as monthly changes in log-plus-one levels, outcomes enter in logs, and the dependent variable is cumulative future log growth from month $t-1$ to month $t+h$. The EPU response figures and tables use the event-size normalization defined in the introduction; the TPU replacement remains in one-log-point units because that movement is roughly event-sized for TPU. The oil and Baa–Treasury spread series begin in January 1986, but common lag-and-horizon trimming leaves the controls row in Appendix Table A2 with the baseline effective samples at the displayed horizons.

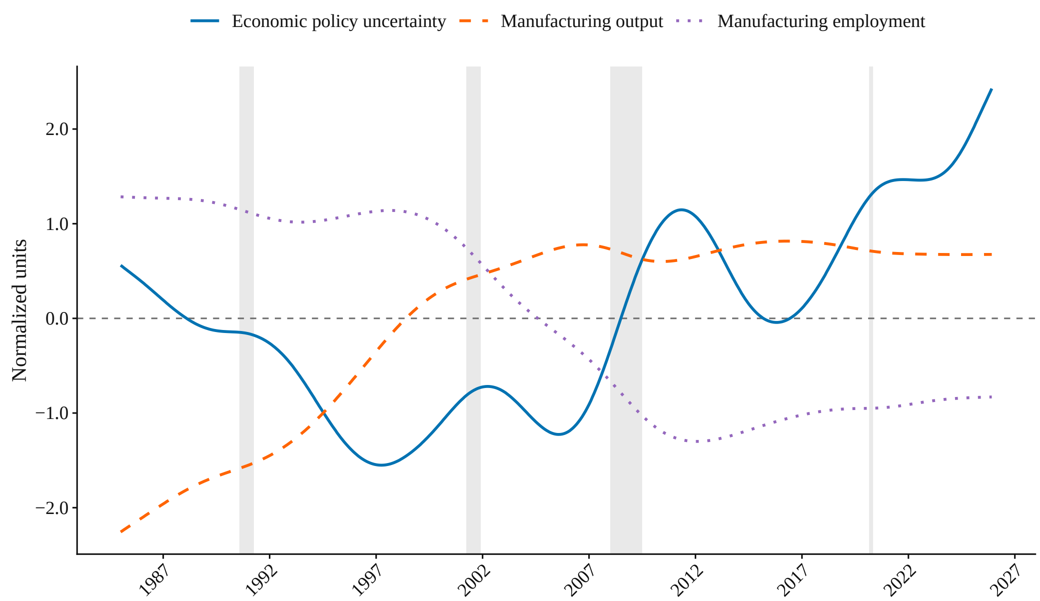

FIGURE A2. Normalized trends

Notes: The figure plots the HP-filtered trend component for log(1 + EPU), the log level of manufacturing industrial production, and the log level of manufacturing employment on one axis. Each trend is computed over the 1985m1–2025m12 monthly sample with smoothing parameter $\lambda = 129{,}600$ and then standardized to have mean zero and standard deviation one. The EPU line is solid, the manufacturing-output line is dashed, and the manufacturing-employment line is dotted. Gray vertical bands mark NBER recession months.

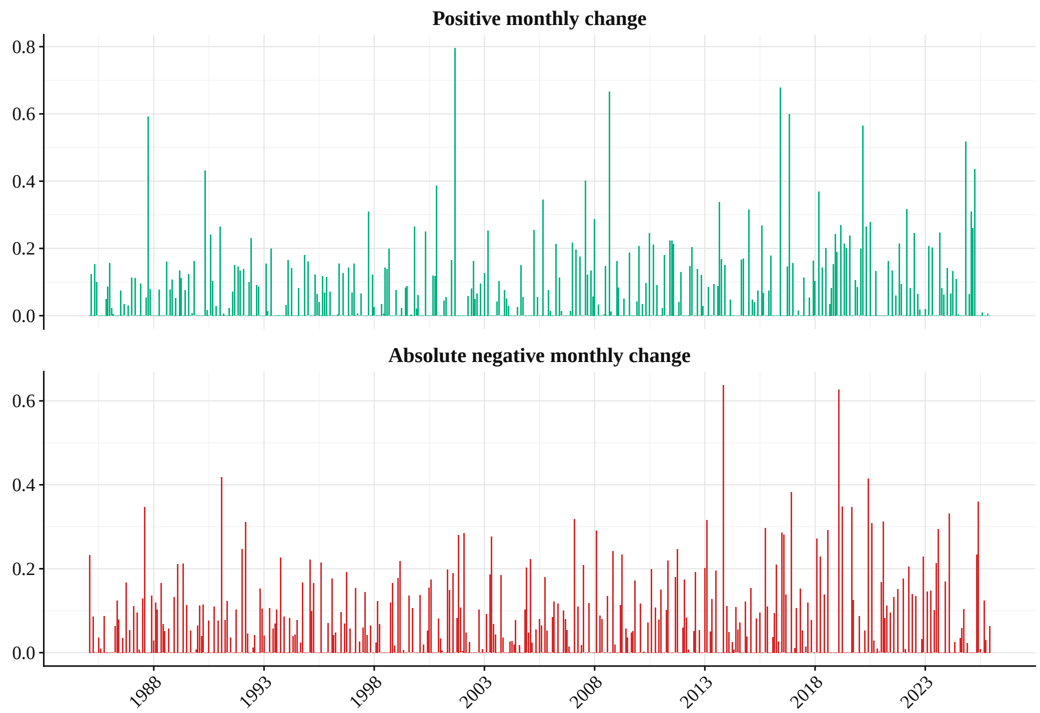

FIGURE A3. Signed uncertainty changes

Notes: The upper panel reports positive monthly changes in log(1 + EPU), and the lower panel reports the absolute size of negative monthly changes in that same transformed uncertainty measure before the event-size display rescaling used in the response tables and figures. The sample is 1985m1–2025m12.

Appendix B. Additional Output Checks

Appendix Tables A2, A4 and A5 and Figures A4 to A6 report additional results. Business-equipment output remains the strongest adverse margin after adding parsimonious controls, using signed EPU lag components, and excluding windows overlapping COVID or the GFC. Manufacturing output points in the same direction across these checks. The recession-state figures show that the adverse response is present in expansions rather than appearing only inside recession months, while the negative-change side remains more mixed. The TPU replacement is smaller and more symmetric than the broader EPU pattern.

TABLE A2. Additional robustness checks

Variant	+EPU (12)	-EPU (12)	Symmetry p (12)	+EPU (24)	-EPU (24)	Symmetry p (24)
Business-equipment output						
Baseline + controls	-2.2	-0.7	0.195	-4.5	-2.5	0.026
	[-4.1, -0.2]	[-3.0, 1.6]		[-7.6, -1.5]	[-5.4, 0.5]	
Signed EPU lag controls	-2.1	-0.1	0.184	-3.9	-1.5	0.023
	[-3.7, -0.6]	[-1.9, 1.7]		[-6.2, -1.7]	[-4.0, 0.9]	
Exclude COVID windows	-2.2	0.7	0.349	-3.7	-0.8	0.090
	[-4.0, -0.5]	[-0.9, 2.2]		[-6.6, -0.8]	[-3.3, 1.6]	
Exclude GFC windows	-1.7	-0.9	0.258	-3.3	-2.4	0.098
	[-3.4, 0.1]	[-3.2, 1.4]		[-6.2, -0.5]	[-5.8, 1.0]	
Manufacturing output						
Baseline + controls	-1.9	-0.7	0.037	-3.1	-2.0	0.002
	[-3.0, -0.8]	[-2.0, 0.7]		[-4.9, -1.4]	[-3.5, -0.5]	
Signed EPU lag controls	-1.7	-0.2	0.018	-2.5	-1.4	0.002
	[-2.6, -0.8]	[-1.2, 0.8]		[-4.0, -1.0]	[-2.7, -0.2]	
Exclude COVID windows	-1.9	0.0	0.033	-2.6	-1.4	0.021
	[-3.0, -0.8]	[-0.9, 0.9]		[-4.7, -0.6]	[-2.7, 0.0]	
Exclude GFC windows	-1.4	-1.0	0.055	-1.9	-2.1	0.024
	[-2.3, -0.4]	[-2.2, 0.2]		[-3.3, -0.4]	[-3.8, -0.4]	

Notes: Rows report cumulative local-projection responses to event-sized EPU movements; bracketed lines are 90 percent Newey-West confidence intervals. Main-text Table 3 reports the baseline, lagged signed-change, residualized-innovation, and recursive-innovation checks at the 24-month horizon, so those rows are not repeated here. Negative-change columns report the absolute magnitude of measured declines. Controls add the current federal funds rate change, core PCE inflation, and oil-price growth. The signed-lag-control row keeps contemporaneous signed EPU changes and replaces the 12 lags of aggregate EPU changes with 12 lags each of positive and negative EPU-change components. COVID and GFC rows exclude observations whose response windows overlap 2020m3–2020m6 and 2007m12–2009m6. The symmetry test reports the p-value for $H_0 : \beta_h^+ + \beta_h^- = 0$ and is unchanged by the reporting rescale. Effective samples at the 12- and 24-month horizons are 467/455 for the controls and signed-lag-control rows, 450/426 for Exclude COVID windows, and 435/411 for Exclude GFC windows.

TABLE A3. Distribution of signed monthly EPU changes

Change type	N	Mean	SD	75th pct.	90th pct.	Max.
Positive EPU change	231	0.138	0.126	0.180	0.265	0.796
Absolute negative EPU change	260	0.121	0.100	0.168	0.246	0.638

Notes: The table summarizes nonzero monthly changes in log(1 + EPU) from 1985m2 through 2025m12. Positive EPU changes are increases in the transformed index. Absolute negative EPU changes are the absolute size of declines in the transformed index. The main text reports EPU coefficients in event-sized units, where one event-sized movement equals 0.25 log points.

TABLE A4. Recession-state responses

Outcome	Horizon	Expansion response	Recession response	State difference p
Panel A. Positive uncertainty changes				
Business-equipment output	12	-2.1	-1.0	0.620
		[-4.4, 0.2]	[-4.2, 2.2]	
Business-equipment output	24	-5.0	-1.7	0.188
		[-9.0, -1.0]	[-3.7, 0.4]	
Manufacturing output	12	-2.0	-0.2	0.252
		[-3.3, -0.7]	[-2.6, 2.2]	
Manufacturing output	24	-3.4	-0.7	0.100
		[-5.7, -1.1]	[-2.4, 1.0]	
Panel B. Negative uncertainty changes				
Business-equipment output	12	-1.0	2.5	0.161
		[-3.4, 1.4]	[-1.3, 6.3]	
Business-equipment output	24	-3.0	0.4	0.165
		[-6.2, 0.3]	[-2.9, 3.6]	
Manufacturing output	12	-1.1	2.5	0.085
		[-2.3, 0.2]	[-0.9, 5.8]	
Manufacturing output	24	-2.4	1.1	0.015
		[-4.0, -0.9]	[-1.2, 3.3]	

Notes: Entries come from recession-interaction local projections estimated on the 1985m1–2025m12 monthly sample and are reported in event-sized EPU units. Panel A reports the state-specific responses to positive uncertainty changes, and Panel B reports the state-specific responses to negative uncertainty changes. The line beneath each estimate reports the corresponding 90 percent confidence interval in brackets, based on Newey-West inference with bandwidth $h + 1$. 'State difference p' reports the p-value for the recession increment, $H_0 : \beta_{h,\mathrm{rec}} - \beta_{h,\mathrm{exp}} = 0$, within the signed-change panel and is unchanged by the reporting rescale. Every regression includes contemporaneous signed uncertainty changes and recession interactions, 12 lags of output growth, and 12 lags of the aggregate uncertainty change. The effective sample size is $N = 467$ at the 12-month horizon and $N = 455$ at the 24-month horizon for both outcomes. Figures A4 and A5 plot the full horizon paths.

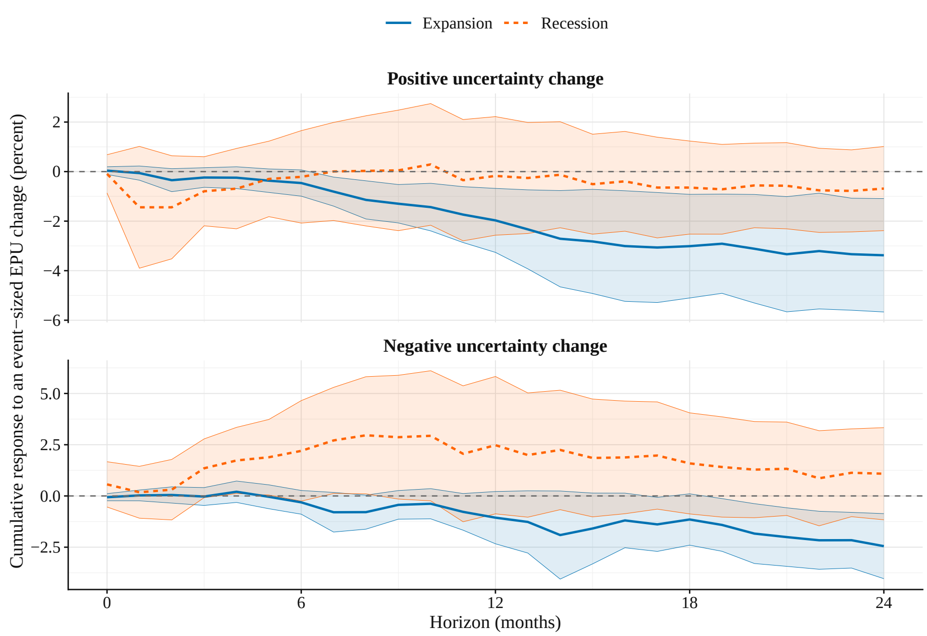

FIGURE A4. Manufacturing recession-state responses

Notes: The upper panel reports manufacturing-output responses to positive uncertainty changes, and the lower panel reports the corresponding responses to negative uncertainty changes. The solid blue line is the expansion-state coefficient and the dashed orange line is the recession-state coefficient from the same recession-interaction local projection. Responses are reported in event-sized EPU units. Each horizon regression uses the 1985m1–2025m12 monthly sample, contemporaneous signed uncertainty changes and recession interactions, 12 lags of output growth, 12 lags of the aggregate uncertainty change, and 90 percent Newey-West confidence intervals.

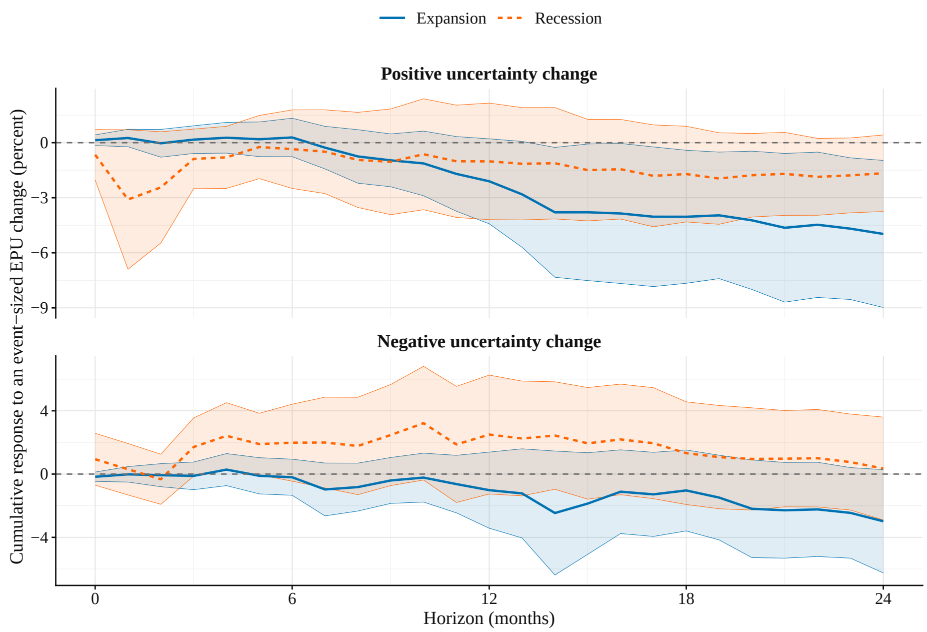

FIGURE A5. Business-equipment recession-state responses

Notes: The upper panel reports business-equipment-output responses to positive uncertainty changes, and the lower panel reports the corresponding responses to negative uncertainty changes. The solid blue line is the expansion-state coefficient and the dashed orange line is the recession-state coefficient from the same recession-interaction local projection. Responses are reported in event-sized EPU units. Each horizon regression uses the 1985m1–2025m12 monthly sample, contemporaneous signed uncertainty changes and recession interactions, 12 lags of output growth, 12 lags of the aggregate uncertainty change, and 90 percent Newey-West confidence intervals.

TABLE A5. Trade-policy-uncertainty replacement

Panel A. 12-month cumulative response

Outcome	TPU increase	TPU decline magnitude	Symmetry *p*
Business-equipment output	-0.5	0.5	0.998
	[-2.4, 1.4]	[-1.5, 2.6]	
Manufacturing output	-0.8	0.6	0.885
	[-1.8, 0.2]	[-0.9, 2.0]	

Panel B. 24-month cumulative response

Outcome	TPU increase	TPU decline magnitude	Symmetry *p*
Business-equipment output	-2.5	0.8	0.539
	[-5.1, 0.1]	[-2.4, 3.9]	
Manufacturing output	-1.3	0.7	0.752
	[-2.5, 0.0]	[-1.3, 2.8]	

Notes: Broad policy uncertainty is replaced with the monthly change in $\log(1 + \text{TPU})$, split into positive changes and the absolute size of negative changes, while the rest of the baseline local-projection design is held fixed. Entries are cumulative responses to a one-log-point monthly movement in $\log(1 + \text{TPU})$, which is roughly event-sized in this sample. The line beneath each estimate reports the corresponding 90 percent confidence interval in brackets, based on the same Newey-West inference used in the figures. Each regression uses the 1985m1–2025m12 monthly sample, contemporaneous positive and negative TPU changes, 12 lags of output growth, 12 lags of the aggregate TPU change, and Newey-West inference with bandwidth $h + 1$. The symmetry test reports the p-value for $H_0 : \beta_h^{+,\text{TPU}} + \beta_h^{-,\text{TPU}} = 0$ in each row. The effective sample size is $N = 467$ at the 12-month horizon and $N = 455$ at the 24-month horizon for both reported outcomes.

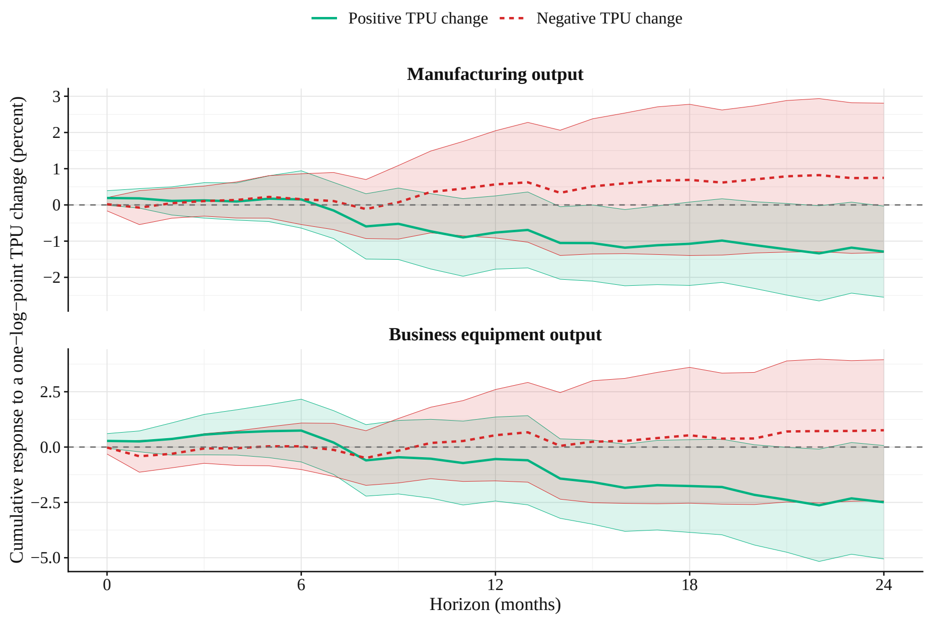

FIGURE A6. Trade-policy-uncertainty replacement

Notes: Panels plot manufacturing-output and business-equipment-output responses when broad policy uncertainty is replaced by the monthly change in $\log(1 + \text{TPU})$, split into positive changes and the absolute size of negative changes. Positive-TPU responses are shown with solid lines; negative-TPU responses are shown with dashed lines. Responses are reported in one-log-point TPU units, which are roughly event-sized in this sample. The local-projection design otherwise matches the baseline output exercise: the 1985m1–2025m12 monthly sample, contemporaneous signed TPU changes, 12 lags of output growth, 12 lags of the aggregate TPU change, and 90 percent Newey-West confidence intervals.