The Short Lags of Monetary Policy

G. Buda V. M. Carvalho G. Corsetti J. B. Duarte S. Hansen
A. S. Moura A. Ortiz T. Rodrigo J. V. Rodriguez Mora G. A. Silva

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Long and Variable Lags

"Monetary actions affect economic conditions only after a lag that is both long and variable" (Friedman, 1961).

Short and Variable Lags

"It is true that there are significant lags in monetary policy, but remember these are distributed lags. It's not that nothing happens for a year or 15 months and then suddenly the effect is felt. There is a gradual progression of effects." (Greenspan, 1994).

Current Fed Thinking

"We're, of course, taking into account long and variable lags, and we're thinking about that." (J Powell, 2023).

The consensus view of MP Transmission

Complementing Friedman's dictum, a widespread view in policy circles

1. Stage 1: MP quickly affects asset prices, expectations and financial conditions
2. Stage 2: over time, these drive real variables and inflation with increasing intensity

Friedman dictum + two-stage transmission model:

1. Challenge theoretical models that predict the **largest response of financial and real variables to occur simultaneously on impact**, e.g., the NK model
   - Models typically bridge the gap with empirical evidence including
     - Frictions (e.g. adjustment costs)
     - Behavioral elements (e.g. habit formation)
2. Have been used for identification of monetary policy shocks in empirical studies
   - relying on the idea that some variables are "slow moving"

This paper

- Assembles a novel, high-frequency and comprehensive dataset of measures of economic activity for Spain
- Our rich set of high-frequency economic activity series are obtained
  - Aggregating bank transactions records by Spanish BBVA account holders into proxies for aggregate consumption and investment
  - Leveraging the availability of good administrative data in Spain (VAT **sales** records and employment)
- Study MP transmission relying on Jarociński and Karadi (2020) MP shocks + smooth local projections on seasonally adjusted daily data
- **New in revised version:** two-year horizon, pre-trends test, cumulative multipliers, inventory dynamics, mortgage heterogeneity (1.7M customers), news indicators (GDELT)

Takeaways

1. **Demand adjusts fast; production follows**
   - Consumption and sales—typically regarded as "slow moving"—respond within weeks
   - Aggregate employment (mirrored by the CPI) display smooth declines peaking at long lags
   - Inventories buffer the transition: demand $\downarrow \rightarrow$ inventories accumulate (first retail, then upstream) $\rightarrow$ production cut $\rightarrow$ employment $\downarrow$
   - Mortgagors respond more; interest-rate news spikes within days
2. **Transmission across goods categories, sectors, and by sector "upstreamness"**
   - Durables and luxuries respond faster and by more than other consumption categories
   - Downstream sectors react faster and deeper at short lags
   - Upstream sectors react slightly later (2 month vs 1 month), but more persistent responses
3. **Time Aggregation**
   - Time aggregation to the quarterly frequency alters the identification of monetary transmission
   - Weekly or monthly aggregation preserves daily-frequency results

Plan of Talk

Data and Methodology

Slow vs. Fast Moving Variables in the Transmission of Monetary Policy

Monetary Transmission Across Goods Categories
Upstream vs. Downstream Sectors

Time Aggregation (TA)

Extensions: Credit Conditions, Sentiment, Information, Mortgages

Reconciling short and long lags

Further Extensions and Robustness

1. Data and Methodology

Constructing Novel Daily Data on Consumption and Investment

Bottom up approach: daily transaction level data ⇒ daily aggregates
All series end 31/10/23

- Consumption (starting 01/08/15) Further details
  - Derived by applying National Accounting concepts to granular bank transaction data from 1.8 million BBVA customers in Spain
  - Uses all means of payment (card, cash, one off transfers, direct/recurrent debits)
  - The data's coverage and size allow us to construct consumption disaggregates by COICOP categories
- Investment (starting 01/04/17) Further details
  - Based on 17.4M firm-to-firm transactions (50% reverse factoring) among 1.9M BBVA corporate clients in Spain
  - Key challenge: unlike consumption, firm-to-firm data don't reveal if sales are for *investment* or *intermediate use*
  - Benchmarked against quarterly (from NA) and monthly (from Tax Authority) investment, the correlation of our series is .7 and .95 respectively Plots

Leveraging Daily Administrative Data on Sales and Employment

- Sales (starting 01/07/17) Further details
  - Daily VAT-based sales from large firms (70% coverage) proxy sectoral and aggregate **sales**
  - We interpret total domestic sales—covering consumption, investment, and intermediates—as a proxy for gross output
- Employment (starting 03/08/15) Further details
  - Daily aggregate employment from Social Security data tracks active contracts, covering 99% of employed population
  - Series reflects job stock (net of creation/destruction); includes multiple contracts per person
- Other standard data Data Summary
  - Interest rates and financial markets; housing prices (CIEN)
  - Consumer price indexes; survey-based expectations and confidence
  - GDELT daily interest-rate news coverage and sentiment (starting 01/2017)
  - BBVA mortgage register (1.7M customers, 72M obs)

Methodology: Identification

- We use the monetary policy surprises for the EA from Jarociński and Karadi (2020)
  - High-Frequency Identification of MP shocks
  - Use sign restrictions to address issues in the central bank "information channel"
- Lining up the frequency of shocks and macro series ⇒ avoid issues in time aggregation discussed, e.g., by Ramey (2016)
- 293 ECB policy announcements from 1999 to 2023—63 during our baseline sample (August 2015–October 2023)
- For robustness, we also consider:
  - Observed 1-month OIS changes around policy announcements, controlling for the 'information channel'
  - Policy Target factor by Altavilla et al. (2019)
  - OIS changes at 1-year and 2-year maturities (term structure robustness)

Methodology I: Seasonal Adjustment

- Daily data is highly sensitive to calendar effects.
- **Baseline:** partial out day-of-week and day-of-month effects from raw daily series.
  - Seasonally adjusted data = residual + intercept.
  - NB: no adjustment made to financial data.
- *Previous approach (30-day MA + YoY growth rates) now a robustness exercise.*

Methodology II: Local Projections

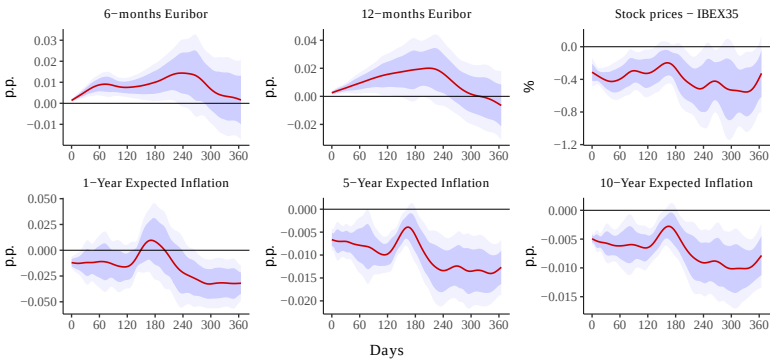
- Estimate the responses of variables to one standard deviation MP shock using local projections
- To deal with COVID-19
  - Include daily cases and stringency index
  - Drop observations between March 14th, 2020 and October 30th, 2020—following Schorfheide and Song (2021) and Lenza and Primiceri (2022)

$$y_{t+h} = \alpha_h + \beta_{h,0} shock_t + \sum_{\ell=1}^{k} \psi_{h,\ell} shock_{t-\ell} + \sum_{\ell=1}^{p} \varphi_{h,\ell} y_{t-\ell} + \theta_h cases_t + \delta_h stringency_t + \varepsilon_{h,t}, \quad (1)$$

- Baseline spec for daily data uses $k = 0$ and $p = 90$
- Key methodological additions:
  - Smooth Local Projections (Barnichon & Brownlees, 2019) Details
  - Pre-Trends Test Details

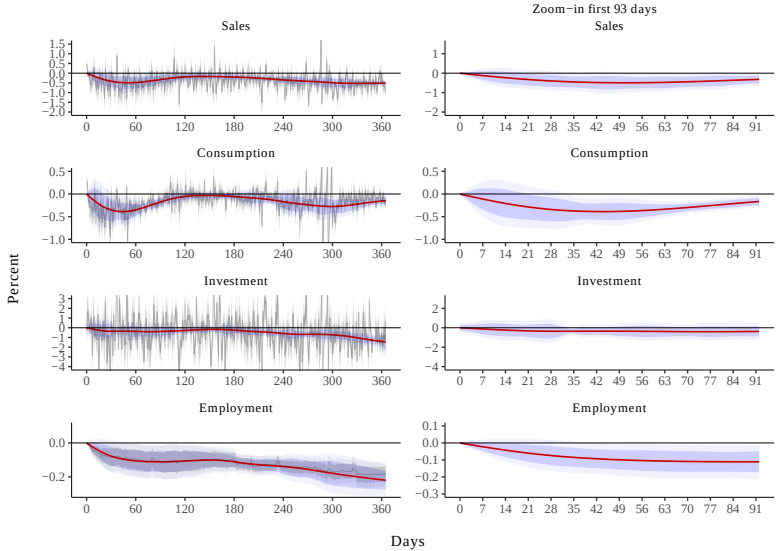
2. Slow vs. Fast Moving Variables in the Transmission of Monetary Policy

Setting the stage: Interest Rates and Inflation Expectations

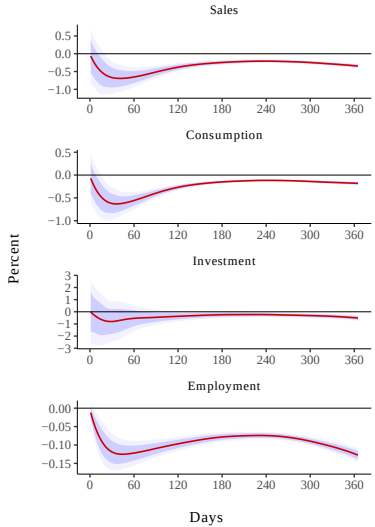


- Euribor rates rise by roughly 1bp within the first 60 days
- Madrid's stock market index drops immediately by about 0.5 pp
- Inflation expectations based on Inf.-linked swaps also decline immediately

Four Key Daily Measures of Economic Activity



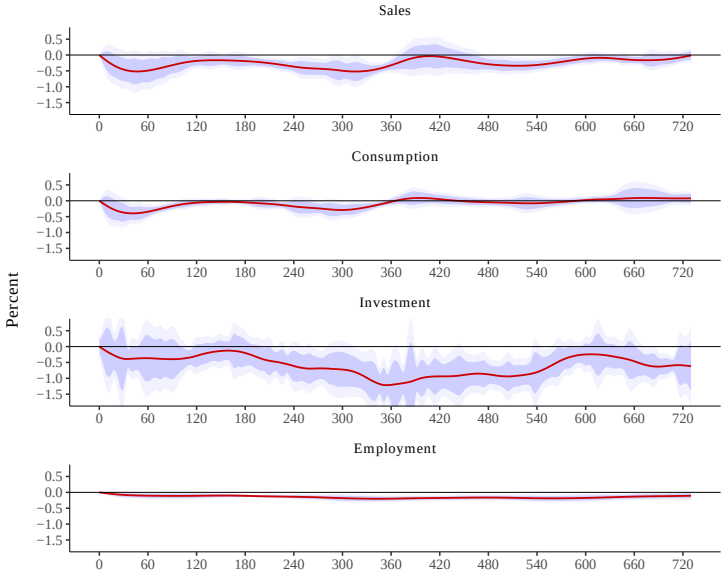
Results in Cumulative Multiplier Terms



Cumulative Response Ratio:

- Ratio of cumulative real activity response to cumulative 12-month Euribor response—similar to fiscal multipliers (Ramey 2016)
- Investment: ≈ -0.5 after one year
- Sales: ≈ -0.3; Consumption: ≈ -0.2
- Employment: ≈ -0.1 (slow adjustment)

Two-Year Horizon: Demand Peaks Early, Production Peaks Late



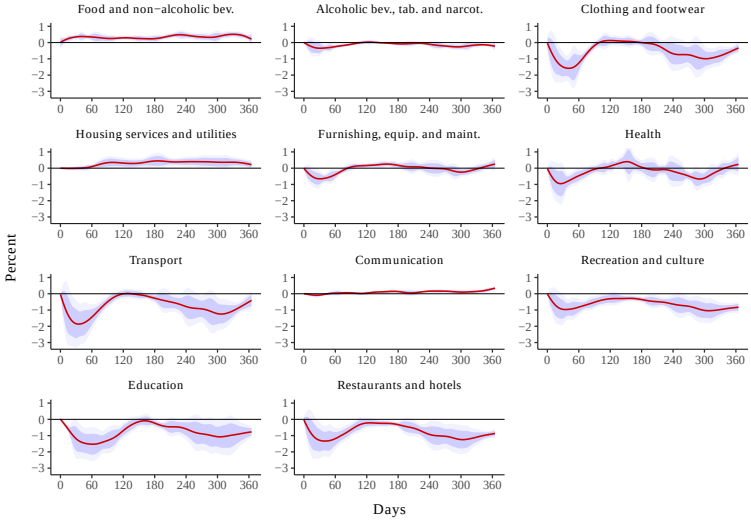
- Sales and consumption trough within first few months, investment at 1 year
- Employment continues to decline, peaks at $\approx$ 10–12 months
- All variables stabilize-revert in second year: no evidence of 2–3 year peak effects (Friedman 1961, Romer & Romer 2004), in line with with Jarociński & Karadi (2020), Miranda-Agrippino & Ricco (2021), Bauer & Swanson (2023)

Taking stock: Demand adjusts fast, production follows

- Evidence casts a different light on a popular classification of slow-moving variables (e.g., consumption) used in identification.
- Evidence for employment—and CPI shown later (monthly data)—aligns with Friedman's dictum: in the aggregate the economy responds at long lags.
- The long lags of monetary policy are not rooted in a generic "slow response of real variables"...
- ...rather, they reflect mechanisms that slow down the transmission of a contraction in demand, already significant at short lags, into employment and inflation.
- **Key narrative:** Demand ↓ fast → Inventories accumulate (shown below) → Production cut → Employment ↓ slow

3. Monetary Transmission Across Goods Categories
Upstream vs. Downstream Sectors

Response Lags Across Consumption Categories



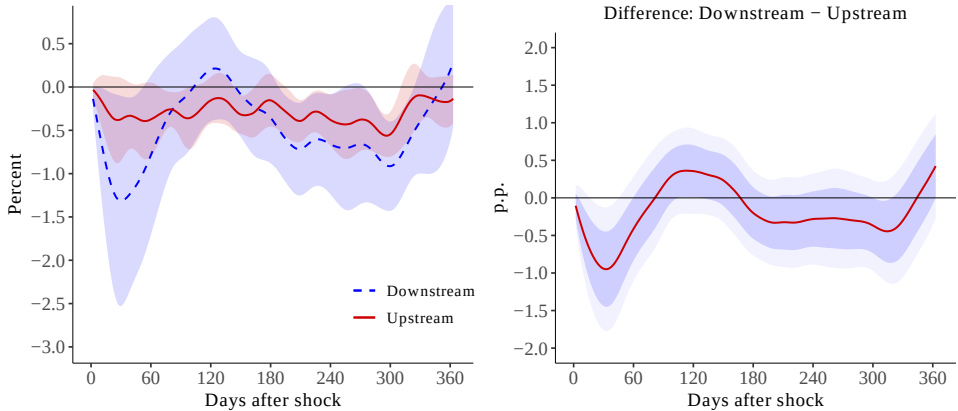
- Stronger adjustments in the final demand for durables, semi-durables and luxuries
- Essential goods (food, utilities) remain subdued

Upstream vs. Downstream Sectors: Methodology

1. We bridge the Spanish Tax Authority sales sectoral classification with the INE Input-Output matrix, and compute an upstreamness indicator following Antràs et al. (2012)
2. Based on the upstreamness indicator, we classify a sector as
   - Upstream if $>$ average of all sectors
   - Downstream if $<$ average of all sectors
3. We then estimate the following panel LP:

$$y_{t+h,s} = \alpha_{h,s} + \sum_{\ell=0}^{k} \beta_{h,\ell} shock_{t-\ell} + \sum_{\ell=0}^{k} \gamma_{h,\ell} shock_{t-\ell} \times up_s + \sum_{\ell=1}^{p} \varphi_{h,\ell} y_{t-\ell,s} + \theta_h cases_t + \delta_h stringency_t + \varepsilon_{h,t}, \quad (2)$$

Upstream vs. downstream sectoral sales to a monetary policy shock

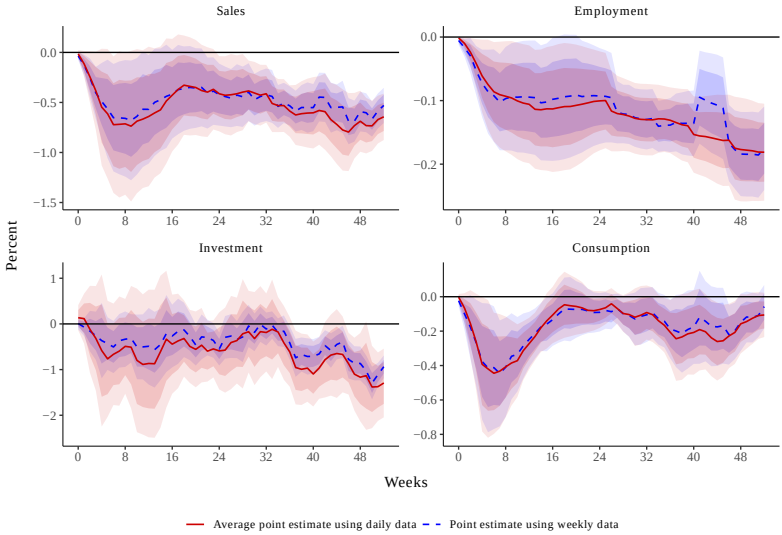


- Downstream sectors respond faster and much more, closely following final consumption demand
- Upstream sectors react a bit more slowly (2 vs. 1 month), but response is persistent.

4. Time Aggregation (TA)

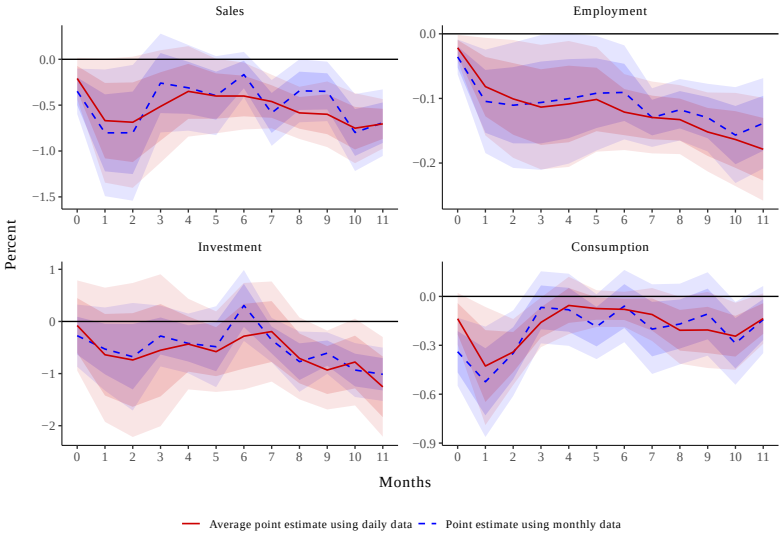
Time Aggregation: Weekly Responses

- To what extent can TA affect empirical results?
- We compare two IRFs:
  1. Time-aggregating daily *LP estimates* at weekly/monthly /quarterly horizons (solid red line)
  2. LPs on time-aggregated *daily data* (dashed blue line)



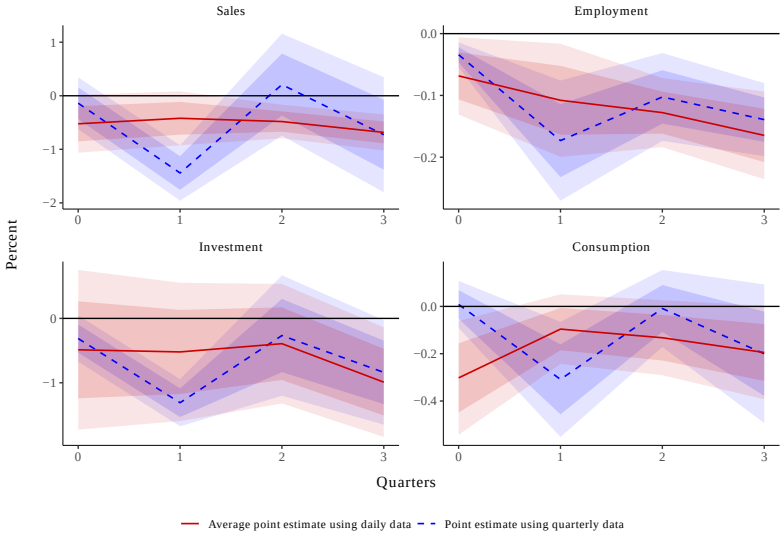
Time Aggregation: Monthly Responses

TA at weekly and monthly frequencies preserve daily-frequency results...



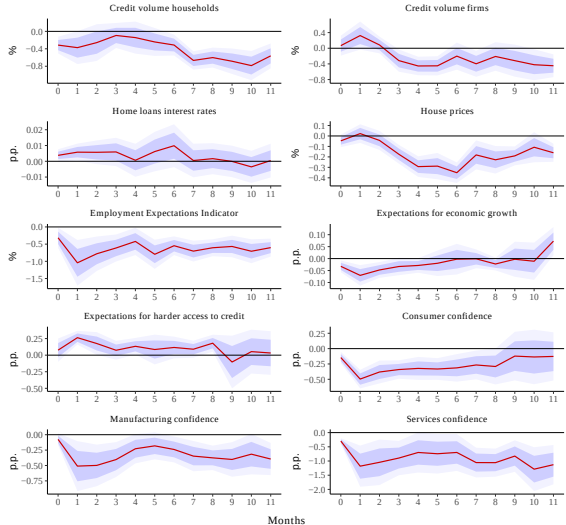
Time Aggregation: Quarterly Responses Blur Short Lags

... but TA at the quarterly frequency alters the identification of MP transmission



5. Extensions: Credit Conditions, Sentiment, Information, Mortgages

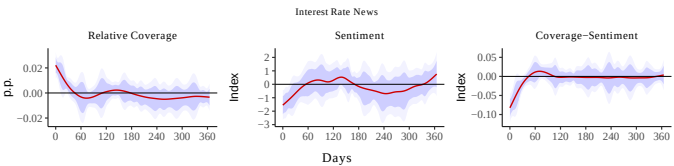
Credit Conditions, Sentiments and Expectations all Respond Fast



Monthly data:

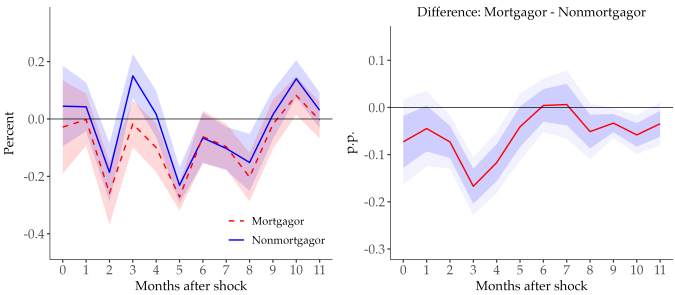
- Credit to households declines $\approx 0.42\%$ in first month
- House (transaction) prices drop from month 3; mortgage rates rise on impact
- All sentiment indicators deteriorate immediately
- Expectations of access to credit worsen on impact

Information on MP: New Indicator of Daily Interest Rate News



- Daily indicators from GDELT database for Spain
- Coverage: share of news tagged `INTEREST_RATE`
- Sentiment: average tone of those articles
- Coverage spikes within days of MP shock
- Sentiment turns sharply negative after contractionary shocks
- Suggests households may update beliefs through media in real time

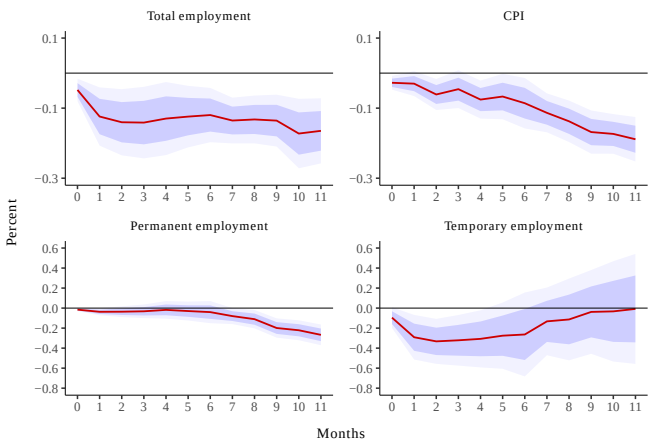
Consumption Response: Mortgagors and Non-Mortgagors



- Merged BBVA credit register with transaction-level consumption data
- **1.7M customers**, 72M customer-month obs (July 2021–May 2025)
- Mortgagors cut spending by additional 0.12–0.15 pp relative to non-mortgagors—Differential peaks at ≈ 3 months. Consistent with Cloyne et al. (2020)
- Non-mortgagors also reduce consumption $\Rightarrow$ channels beyond mortgage exposure matter

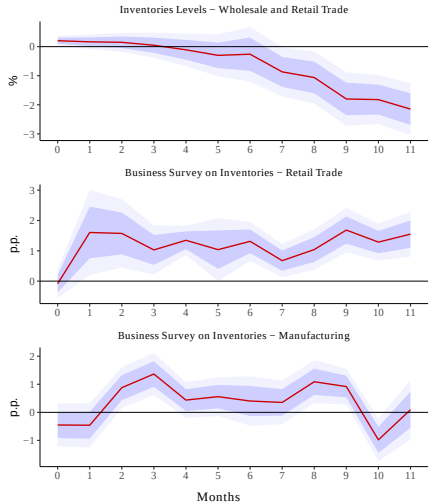
6. Reconciling short and long lags

Long Lags in Employment and Inflation (Monthly Data)



- Similar to employment, the CPI decline is gradual, with a significant but economically small drop in the first semester
- MP ultimately transmits to the real economy by affecting permanent contract employment
- Temporary employment adjusts on impact; permanent employment adjusts slowly

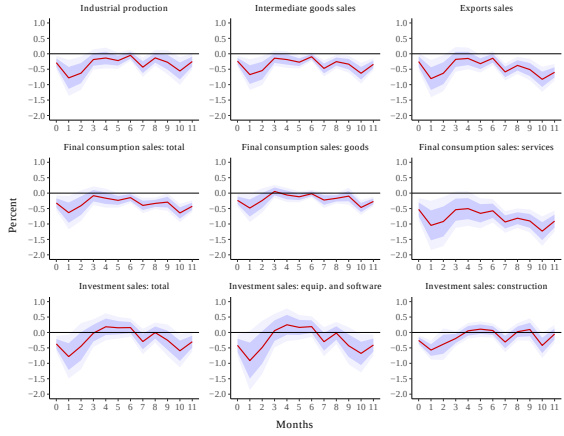
Reconciling Short and Long Lags: Output = Sales + ΔInventories



- As demand falls, Trade inventories first **accumulate**, then decline as production adjusts
- Survey data: downstream firms report excess inventory immediately, manufacturing inventories rise only with a lag
  - Downstream firms adjust first, cutting orders upstream
  - Consistent with production network patterns

7. Further Extensions and Robustness

Short-Lag Dynamics in Industrial Production and Demand



- Monthly IP also contracts at short lags—consistent with Miranda-Agrippino and Ricco (2021) and Bauer and Swanson (2023) for the US
- Monthly VAT-derived consumption and investment series confirm daily baseline findings

Robustness Checks Overview

- **Seasonal Adjustment and Smoothing** Results
  - **New baseline:** Smooth LP on SA (day-of-week/month dummies) raw daily data
  - **Robustness:** 30-day MA + YoY (previous baseline), TBATS, TBATS + SLP
- **Monetary Policy Shock Identification** Results
  - 1-month OIS changes from EA-MPD (with exclusion for info effects)
  - Policy Target factor from Altavilla et al. (2019); 1y and 2y OIS maturities
  - LP-IV check: responses robust to using shocks as instruments
- **COVID-19** Results
  - **Daily:** Re-estimate LPs on pre-2020 sample
  - **Monthly:** 2000–2019 sample shows consistent responses
- **Monte Carlo:** Time aggregation bias confirmed not a small-sample artifact

Conclusion

- **Demand adjusts fast, production follows slowly**
  - Consumption and sales respond within weeks; employment and CPI peak at long lags
  - Inventories buffer the transition from demand to production
- **Mechanisms**
  - Credit conditions deteriorate immediately; mortgagors respond more
  - Interest-rate news disseminates within days
  - Downstream sectors lead, upstream follow through production networks
- **Time aggregation** to quarterly frequency shifts responses to longer horizons—reinterpreting existing quarterly-data evidence
- **Implications**
  - Redirect from mechanisms delaying demand ⇒ mechanisms slowing transmission from demand to production
  - HF data enables structural analysis at frequencies matching central bank decision-making
  - Monthly frequency sufficient to capture short lags ⇒ cross-country replication feasible

Appendix

Smooth Local Projections

Daily IRFs can be volatile across horizons due to finite sample noise.

New baseline: Penalized local projections (Barnichon and Brownlees, 2019):

$$\min_{\beta_h} \sum_{h=0}^{H} \text{RSS}_h(\beta_h) + \lambda \sum_{h=2}^{H} (\beta_h - 2\beta_{h-1} + \beta_{h-2})^2 \tag{3}$$

- Penalty discourages roughness in IRF path across horizons
- Smoothing parameter λ selected via 5-fold cross-validation on horizons 0–90 days
- Optimal λ then applied to full estimation for horizons 0–365 days (and 0–730 for two-year)
- Key advantage: smooths the *IRF*, not the *data* $\Rightarrow$ no distortion of timing

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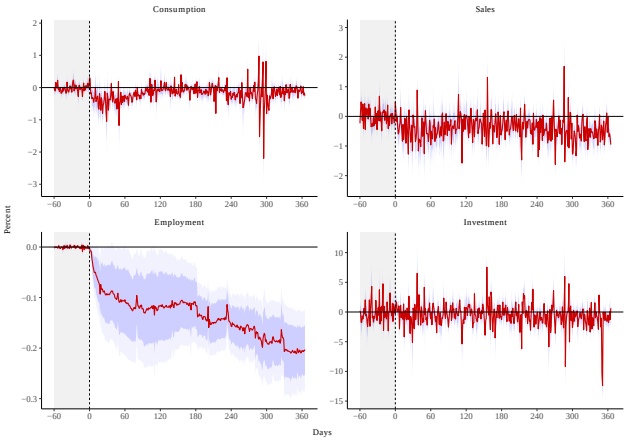
Pre-Trends Test



- Extend LP to negative horizons ($h = -60, \ldots, -1$)
- Tests: does a future shock predict past outcomes?
- Fraction rejecting at 5%: 3–10% $\Rightarrow$ consistent with chance
- Discontinuous break at $h = 0$ supports causal interpretation
- Horizon-by-horizon OLS (not smooth LP) to avoid blending pre/post regions

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Data Overview

Variable	Proxy	Source	Frequency	Start date
Real activity				
Sales	Sales	Spanish Tax Authority	Daily / Monthly	July 1st, 2017 / January 2000
	IP	INE	Monthly	January 2000
Consumption	Private consumption	BBVA	Daily	August 1st, 2015
	Private consumption	Spanish Tax Authority	Monthly	January 2000
Investment	Investment	BBVA	Daily	April 6th, 2017
	Investment	Spanish Tax Authority	Monthly	January 2000
Employment	Employment	Spanish Social Security	Daily	August 3rd, 2015
Financial Markets				
Interest rate	Euribor	European Money Markets Institute	Daily	January 4th, 1999
	Interest rates for housing	Bank of Spain (Statistics Bulletin)	Monthly	January 2003
Stock prices	IBEX35	Bloomberg	Daily	January 3rd, 2005
Prices				
Consumer prices	CPI	INE	Monthly	January 2000
Housing prices	Avg. price per sq. meter	CIEN (notarial records)	Monthly	January 2007
Expectations & News				
Inflation expectations	Inflation-linked swaps	Bloomberg	Daily	June 3rd, 2004
Real activity expectations	Consumer/Business sentiment	EU Commission	Monthly	January 2000
Interest rate news	Coverage & sentiment	GDELT	Daily	January 2017
Mortgage panel				
Consumption by mortgage status	Customer-month panel	BBVA credit register	Monthly	July 2021

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Data: Daily Consumption

- Daily consumption series built from individual bank transactions of 1.8 million Spanish adult retail customers of BBVA Bank in Spain
  - Weighted to provide representative sample of Spanish population
- *All* means of payment (card, cash, one off transfers, direct/recurrent debits)
  - Metadata allows classification of transaction according to National Accounting (NA) principle and construction of COICOP disaggregates
  - Deflated using Spanish CPI (aggregate, disaggregated at COICOP level)
- Daily counterpart of the quarterly version Buda et al. (2022): 0.987 correlation with NA quarterly consumption
- 1st August, 2015 — 31st October, 2023

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Data: Daily Series of Aggregate Investment

- We observe 17.4m firm-to-firm transactions (half of which reverse factoring operations) among 1.9m corporates.
  1. We don't observe the purpose of each sale (investment vs intermediate goods).
  2. The population of BBVA firms may not be representative of Spanish economy.
- We address these problems using official input-output data from INE:
  1. Allocate sales from sector i to sector j to investment in proportion to share of investment sales recorded in IO table.
  2. Re-weight sectors in BBVA to align with aggregate sales totals.
- Transactions recorded at the time of transfer of funds.
- Benchmarked against quarterly (from NA) and monthly (from Tax Authority) investment, the correlation of our series is .7 and .95 respectively.
- 1 April 2017 — 31st October, 2023

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Data: Daily Series of Aggregate Investment

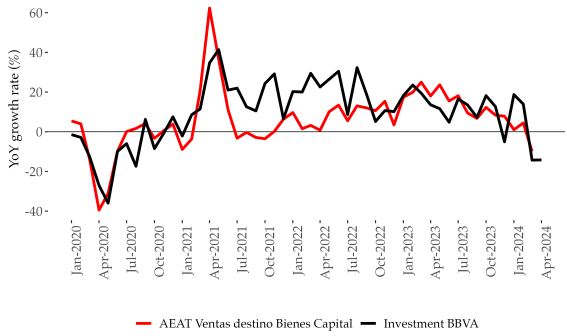

Figure: Monthly TA vs. BBVA investment series

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Data: Daily Series of Aggregate Investment

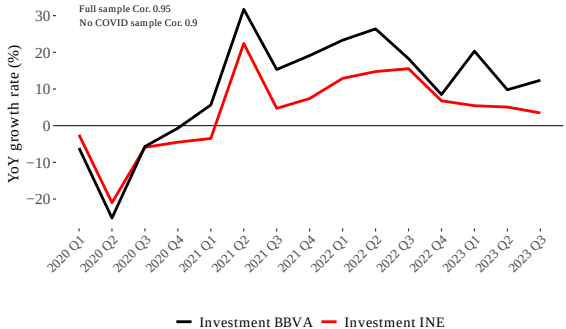

Figure: Quarterly NA vs. BBVA investment series

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Data: Sales

- Spanish Tax Authority compiles daily series from daily VAT declarations by firms
  - 60K large firms accounting for 70% of domestic sales
- Final sales to Spanish Households (and tourists), sales of investment goods, sales of intermediate goods to firms
  - Available with NACE breakdown; deflated with PPI/CPI for each NACE
- 1st July, 2017 — 31st October, 2023
- The authority also produces monthly series of gross output, disaggregated by sector and use. Series start in 2000.

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Data: Aggregate Employment

- Near universe of all labor contracts reported as active on a given day to Spanish Social Security
  - Proxy for employment—a worker may hold more than one contract
- Netting out job destruction (labor contracts ending on the day) from job creation (new labor contracts registered with the social security system)
- 3rd August, 2015 — 31st October, 2023
- At monthly frequency, breakdown into permanent and temporary contracts.

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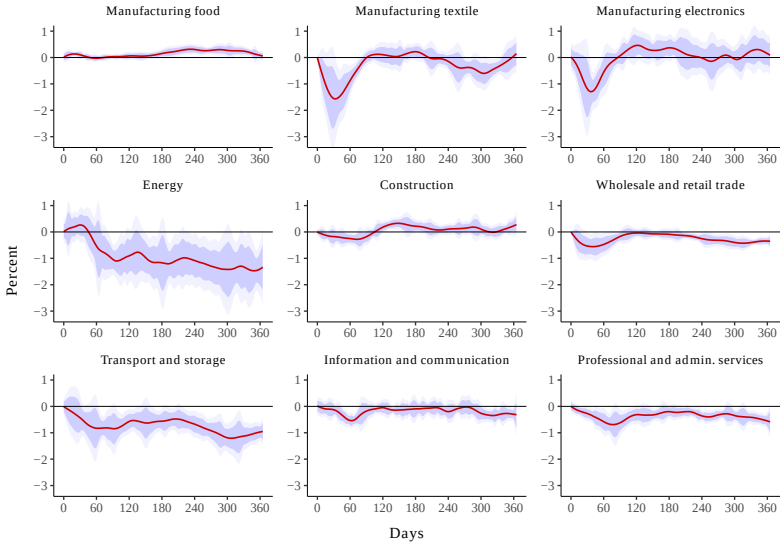
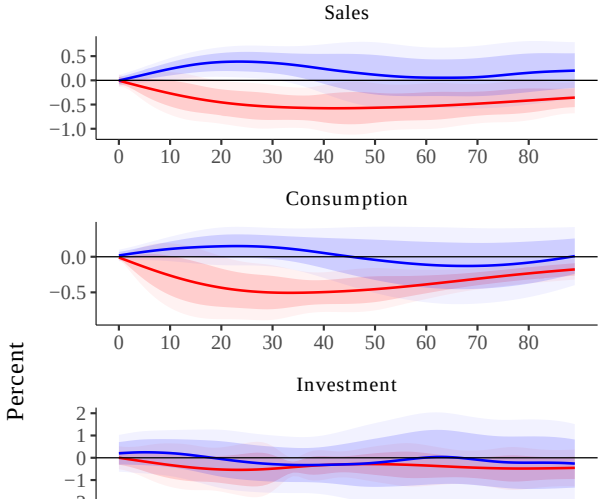
Response Lags Across Sales Categories

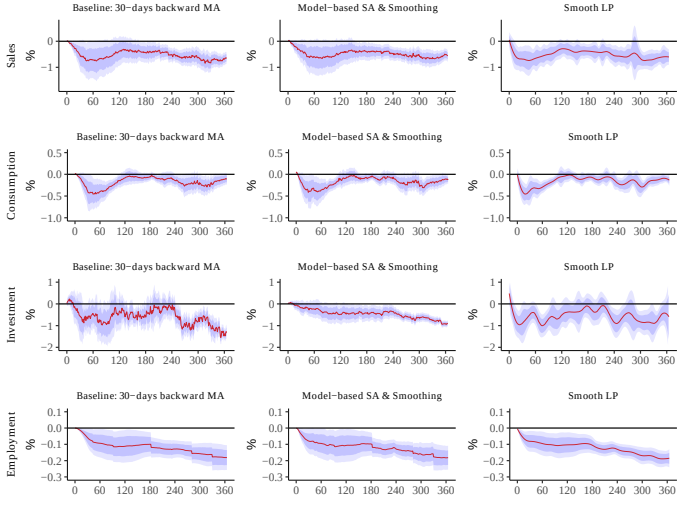


Asymmetric Responses to Contractionary vs. Expansionary Shocks



- 36 contractionary, 27 expansionary shocks
- Restricted to 90 days (imprecision at longer horizons)
- Consumption/sales: contractionary effects stronger than expansionary
- Investment/employment: contractionary significant,

Robustness to Seasonal Adjustment of Daily Series



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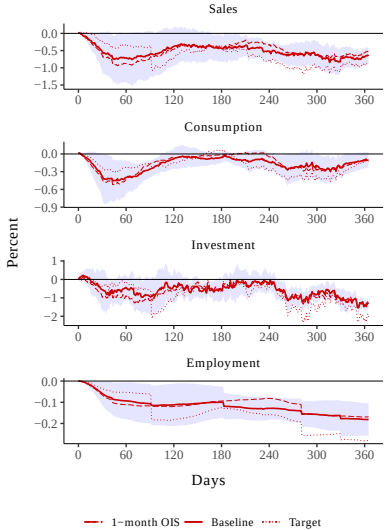
Robustness to Monetary Policy Shocks



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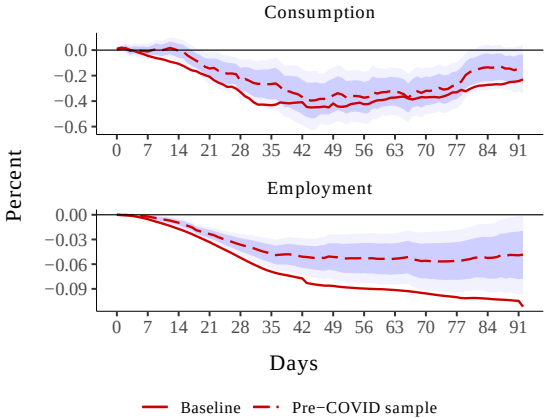
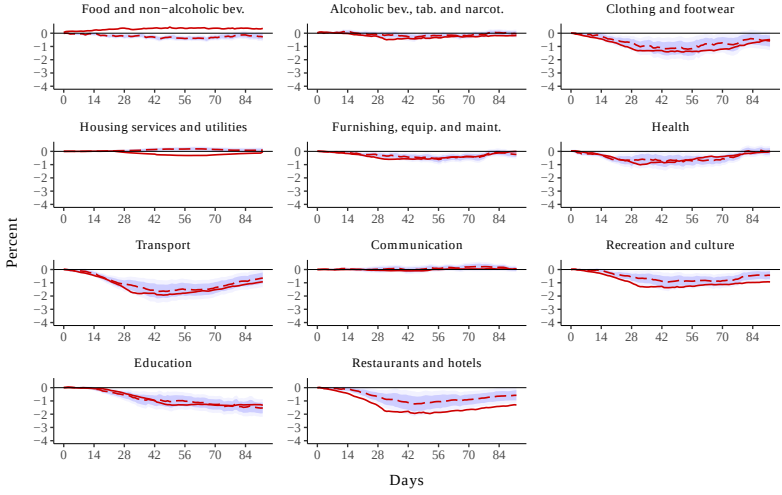
Robustness to COVID-19



Robustness to COVID-19



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