

October 7th 2026

Economics in Real Time & High Definition:
The Short Lags of Monetary Policy

Alvaro Ortiz (BBVA Research)

Keynote Lecture

CEPR European Conference on Household Finance 2026
Swiss National Bank

The lecture draws on three papers

- **National Accounts in a World of Naturally Occurring Data: A Proof of Concept for Consumption**

Buda, Carvalho, Hansen, Ortiz, Rodrigo & Rodríguez Mora

Cambridge, BBVA and CEPR Working Papers

- **The Short Lags of Monetary Policy**

Buda, Carvalho, Corsetti, Duarte, Hansen, Moura, Ortiz, Rodrigo, Rodríguez Mora & Alves da Silva

Cambridge, BBVA and CEPR Working Papers (Revision in JPE)

- **Local News and the Transmission of Monetary Policy**

Duarte, Hansen, Moura, Ortiz & Rodrigo

Forthcoming, NBER-CRIW volume

This lecture: one question, four results

The question: how fast, and how, do different parts of the economy respond to monetary policy shocks (the monetary transmission mechanism)?

- **Result 1 – Short lags:** “slow-moving” aggregates (sales, consumption) respond within days and weeks, not quarters
- **Result 2 – Heterogeneous response:** households’ durables & luxuries and downstream sectors lead; upstream sectors follow, later but more persistently
- **Result 3 – Why quarterly data hide it:** quarterly aggregation hides the short lags (time-aggregation bias); weekly and monthly do not
- **Result 4 – The transmission chain:** news & credit conditions → household demand (mortgagors *and* non-mortgagors) → inventories → production → employment & prices

The method: real-time and high-definition data make it possible to read the response of the economy at the same frequency as the monetary policy shocks.

Ingrained ideas on MTM: Friedman's dictum & the 2-stage view

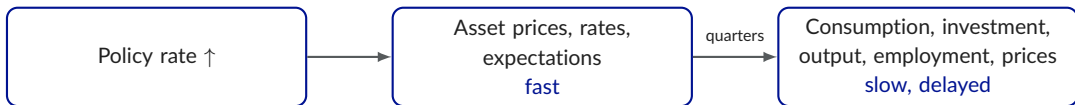
- “Long and Variable Lags” of monetary policy:

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

- A 2-stage view of transmission: a fast financial stage, then a slow real stage
 - **Fast Moving:** Rapid effects on Asset Prices, Expectations and Financial Conditions
 - **Slow Moving:** consumption, employment, industrial production, CPI – the “slow-moving” taxonomy of Bernanke, Boivin & Elias (2005)

Slow demand or slow transmission? Two hypotheses quarterly data cannot distinguish

Hypothesis A: slow demand response (the conventional view)



Hypothesis B: fast demand, slow transmission (this paper)



Both hypotheses deliver Friedman's long lags in employment and prices. They differ in *where* the delay sits, in what a model should build in, and in what a policymaker can observe between two meetings. Telling them apart requires monthly or higher-frequency data, not quarterly.

Real time and high definition

The daily dataset and the empirical design

Real-time economics in Spain: four daily measures of activity

Leveraging micro-data to observe the economy in real-time (Spain, 2015-2023)

Consumption & Investment BBVA Data

1.8M Retail Customers
17.4M Corporate Transactions
(Universe of bank records)

Corporate Sales (Demand) Spanish Tax Authority

~ 60K Large Firms
70% of Domestic Sales
(Daily VAT declarations)

Aggregate Employment Social Security

Near universe of active
labor contracts
(≈99% of employment)

Table A1

High definition: national accounts from naturally occurring data

- **Naturally occurring data:** records generated as a by-product of economic activity, not by a survey: financial transactions, VAT filings, social security registrations, news media
- **National Accounts (ESA) discipline** (Buda et al., 2022): classify every outflow of 1.8M active BBVA retail customers as consumption, saving, investment or taxes following ESA; impute housing services; reweight to the Spanish adult population by gender $\times$ age $\times$ neighbourhood
- **Cross-validation with national accounts (levels, growth & categories):** aggregated to quarters, the series (in levels) is within 1% of official household consumption (q-o-q growth correlation 0.987; matching COICOP shares). The same construction then yields daily series by category (11 COICOP groups), linking merchant category codes (MCC), NACE codes and means of payment to official categories. Real data deflated by own COICOP CPI
- **The same logic for firms:** daily investment from 17.4M invoice payments among 1.9M firms (input-output tables used to scale to national accounts and to separate investment from intermediate consumption); daily corporate sales from VAT filings; daily employment from social security

Daily is exactly the frequency at which monetary policy shocks are identified.

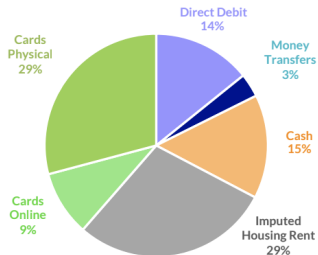
Data details

Consumption is not only about cards... and this matters for real-time measurement and heterogeneous consumers

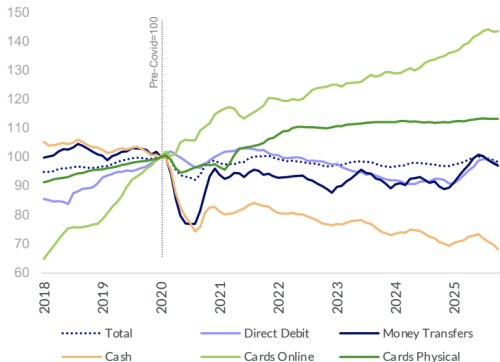


→ 100%
Total Consumption Payments

Spain: Distribution of Payments for Consumption (Cumulative last 12 Months, Nov24-Oct25, % of Total)



Spain: Evolution of Means of Payments (Jan 2020 = 100, Moving Average 6M)



Empirical design: shocks and outcomes at the same frequency through local projections

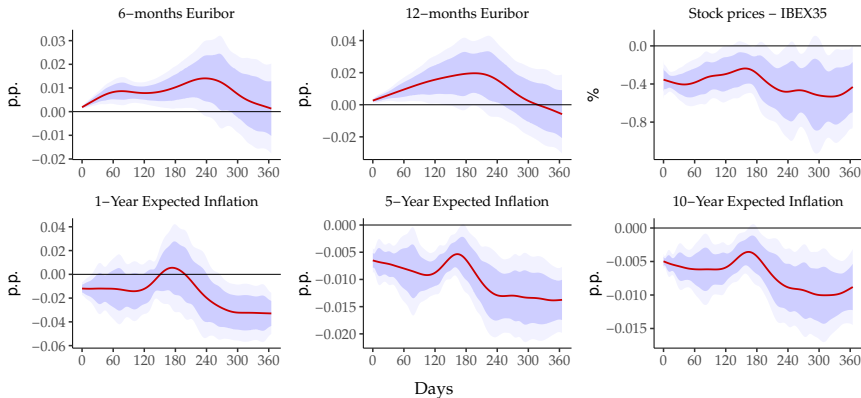
$$y_{t+h} = \alpha_h + \sum_{\ell=0}^k \beta_{h,\ell} \text{shock}_{t-\ell} + \sum_{\ell=1}^p \varphi_{h,\ell} y_{t-\ell} + \theta_h \text{cases}_t + \delta_h \text{stringency}_t + \varepsilon_{h,t}$$

- **Estimation:** smooth local projections (Barnichon & Brownlees, 2019) on daily data; the IRF is the sequence of $\hat{\beta}_{h,0}$, $h = 0, \dots, 364$. $k = 0$, $p = 90$ lags of y , HAC s.e.; COVID window (14 Mar – 30 Oct 2020) dropped; for $h < 365$, $IRF_h = IRF_h^{\text{YoY}}$ (levels)
- **Shocks:** Jarociński & Karadi (2020) euro-area surprises around ECB announcements, purged of the information effect via sign restrictions; 63 announcements (Aug 2015 – Oct 2023); **1 s.d. $\approx$ 3.7bp** (4.1bp in the shorter sales & investment samples); every IRF is for a one-s.d. shock in its own sample
- **Seasonality:** (i) day-of-the-week and day-of-the-month fixed effects on the raw daily series in levels; (ii) year-on-year log growth. No moving average: noise is handled at the estimation stage

Result 1: Real-Time Economics

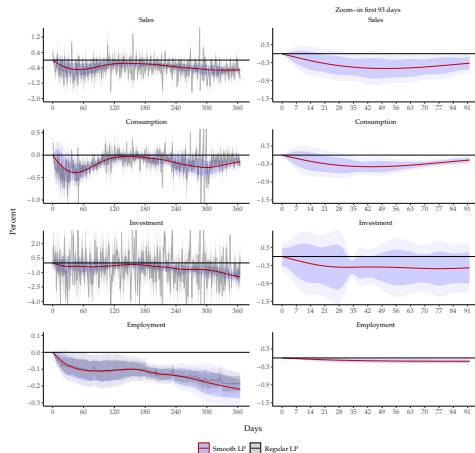
Short lags: demand moves within weeks

Stage one: rates, equities and expectations move on impact



Paper, Figure 1. Smooth LP, one s.d. (3.7bp) contractionary shock, responses in levels; 68% and 90% HAC bands. Financial series are not seasonally adjusted. Sample: Aug 2015 – Oct 2023.

The headline: “slow-moving” aggregates respond within weeks



- **Sales:** significant from day 4 (raw LP), day 20 (smooth LP); local trough -0.50% at day 51
- **Consumption:** significant in week 1 (raw LP), $\sim$ day 21 (smooth LP); trough -0.39% at day 44
- **Investment:** noisier; short-run trough -0.36% at day 34
- **Employment:** much slower; -0.11% at 3 months, largest at **day 365** (-0.22%)

Smoothing does not drive it: the raw LP (grey) already shows the short-lag fall.

Days, not Quarters

Impulse responses to a 1-s.d. shock (Figure 2)

4 days

sales fall detectable (raw LP)

44 days

cons. trough -0.39%

51 days

sales local trough -0.50%

365 days

employment -0.22%

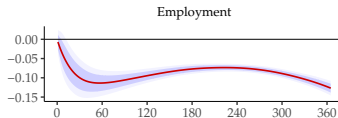
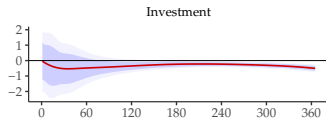
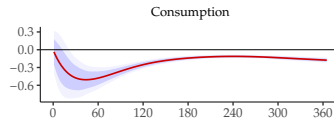
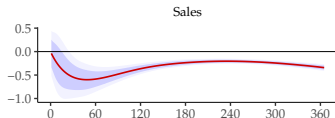
Cumulative monetary multipliers

Multipliers

Pre-trends

Two-year

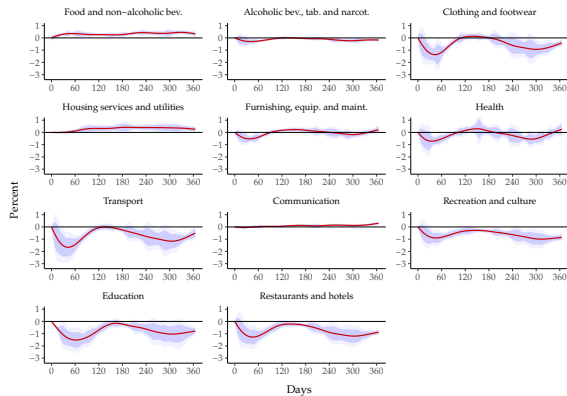
cumulative response / cumulative 12-month Euribor response; at one year: investment -0.5 , sales -0.3 , consumption -0.2 , employment -0.1



Result 2: High-Definition (HD) Economics

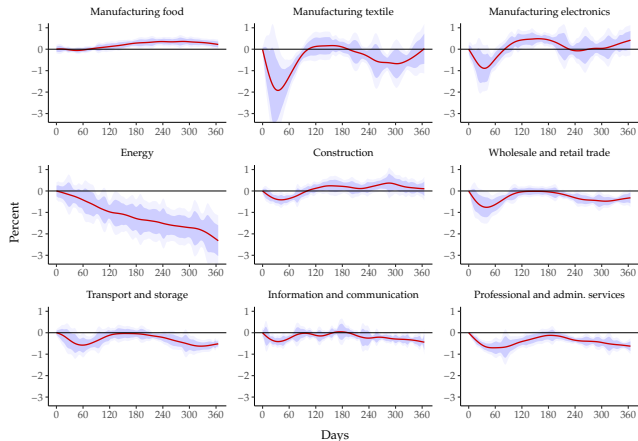
Heterogeneous responses by goods, sectors and the supply chain

Households cut where theory says they should: durables and luxuries, fast



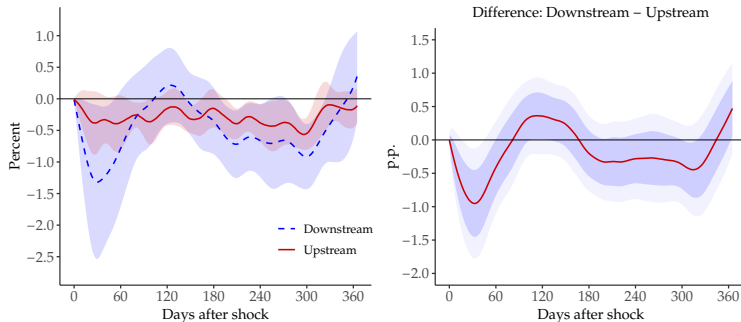
- **Durables, semi-durables and luxuries contract sharply at very short lags:** on average -1% to -2% within the first 60 days (clothing, transport, recreation, restaurants & hotels, health, education)
- **Necessities stay subdued** at all horizons within the first year (0 to 0.25%): food & non-alcoholic beverages, housing & utilities, communication; food at home even rises slightly (away from restaurants)
- **Summing up:** high-frequency analysis confirms that the consumption response is mainly driven by durables, semi-durables and luxuries — and that it is very fast

The same picture in firms' books: sectoral sales



- **Rapid reaction by “Downstream” sectors:** Activities closer to final demand by households show a short-lag faster response
- **Short-run fall where durables weigh most** (marked in textiles; noisier in electronics and construction), while **food manufacturing and information & communication barely move** (consistent with the consumption categories)
- **Responses of upstream sectors** (providing general inputs for production) **may be different from downstream...**

Downstream first, upstream later: gradual transmission along the production network



Downstream: significant within ~ 1 month, trough almost $3\times$ deeper.

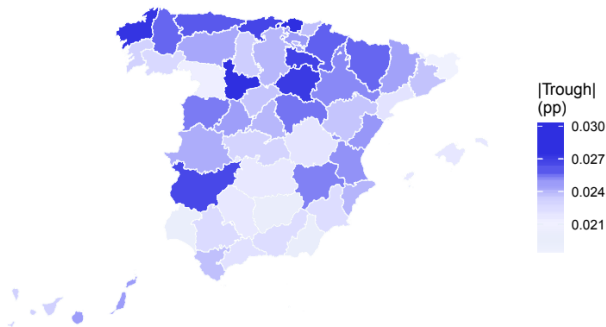
Upstream: significant only after ~ 60 days.

[Click Here for Methodology](#)

Further advantages of real-time & high-definition data: monetary policy impact by provinces, cities...

Consumption response to a monetary policy shock by province

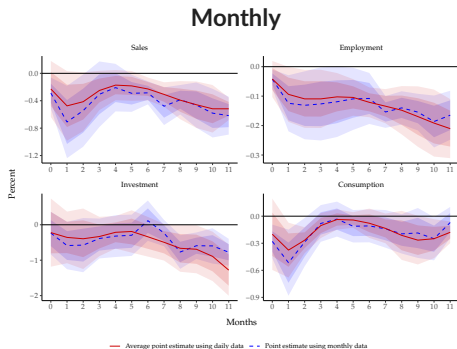
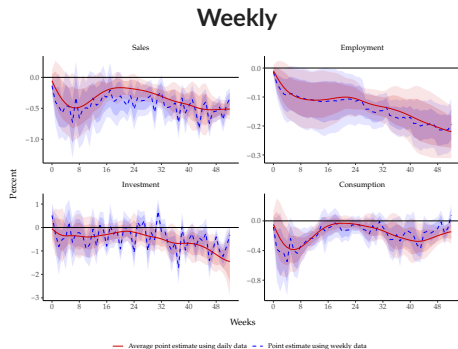
(|trough|, province-level smooth LP, 1-s.d. shock)



Result 3: Time Aggregation Bias

Why quarterly data hide it: time aggregation bias

Time aggregation: weekly and monthly aggregation preserve the daily pattern

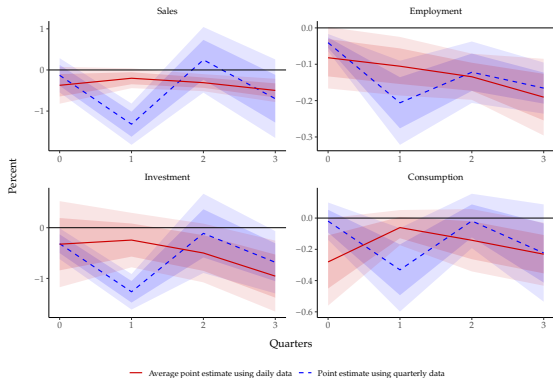


Red (reality): the true daily response, estimated day by day and averaged within each week, month or quarter.

Blue (availability): what a researcher with only aggregated data would estimate, using a standard LP on data and shocks summed to that frequency.

Quarterly aggregation shifts the response to later horizons: the optical illusion

Monte Carlo



Red (reality): the true daily response, estimated day by day and averaged within each quarter.

Blue (availability): what a researcher with only aggregated data would estimate, using a standard LP on data and shocks summed to quarters.

Result 4: The Sequence

The transmission of monetary policy

The transmission chain: two questions

1.

How does a monetary policy shock reach Spanish households within days?

News, credit conditions & asset prices, expectations (complementary channels) → spending (mortgagors and non-mortgagors)

2.

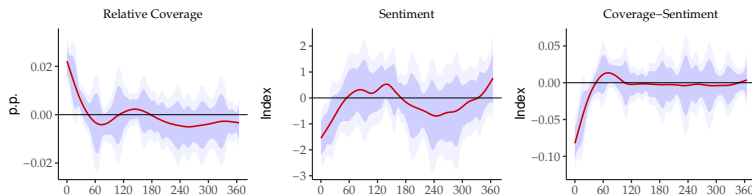
If demand falls this fast, what slows the transmission?
(using monthly analysis)

Inventories → upstream production → employment (permanent vs. temporary) → prices

Step 1: households learn about the shock within days

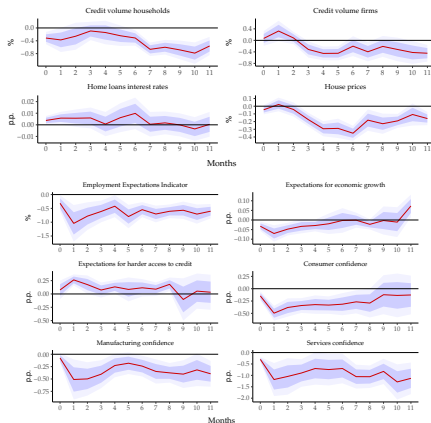
Information reaches households almost immediately

- Traditional view: Households are inattentive.
- **Our finding (GDEL, 419 Spanish media outlets):** Media coverage of interest rates spikes on impact ($\approx 3\%$ of its daily mean, elevated for ~ 30 days) and its tone becomes markedly negative within *days* of an ECB shock.



Fast signal $\rightarrow$ *Fast deterioration of expectations* $\rightarrow$ *Fast contraction in demand*

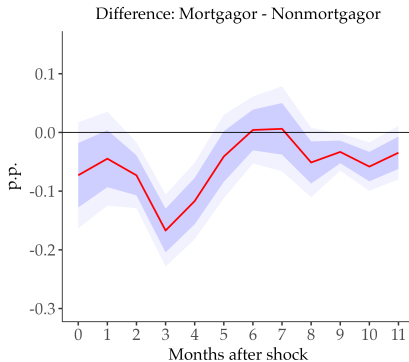
Step 2: household credit and expectations deteriorate within a month



Paper, Figures 10–11. Shock s.d.: 4.2bp (3.6bp for growth and credit-access expectations, from Apr 2020).

- **Credit: Larger and faster response by Households than Firms:** -0.37% in month 1, -0.79% at 10 months; firms only from the 2nd quarter
- **Housing Market:**
 - Mortgage rates respond on impact (peak +1bp) and stay elevated for six months
 - House prices (notarial transaction prices) drop significantly from month 3, trough -0.35% at month 6
- **Expectations & Confidence:** employment and growth expectations fall on impact; confidence drops within a month, *before* employment and activity contract in the data.

Step 3: non-mortgagors cut spending too; mortgagors cut more



BBVA consumption merged with BBVA's credit register (1.7M customers, July 2021 – May 2025): **mortgagors** cut spending by an extra 0.12 p.p. (peak at 3 months), as in Cloyne, Ferreira & Surico (2020); non-mortgagors also cut (App. F.1). Descriptive, not causal.

Table 2

Step 4: inventories buffer the gap between fast sales and slow production

If demand falls in weeks, why does employment take a year to hit bottom?

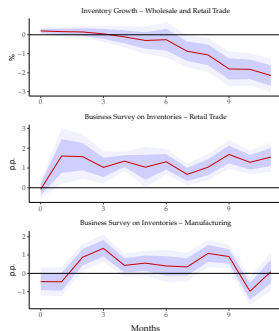
$$\text{Output} = \text{Sales} + \Delta \text{Inventories}$$

Sales fall within weeks; production cannot follow,
so unsold stocks pile up

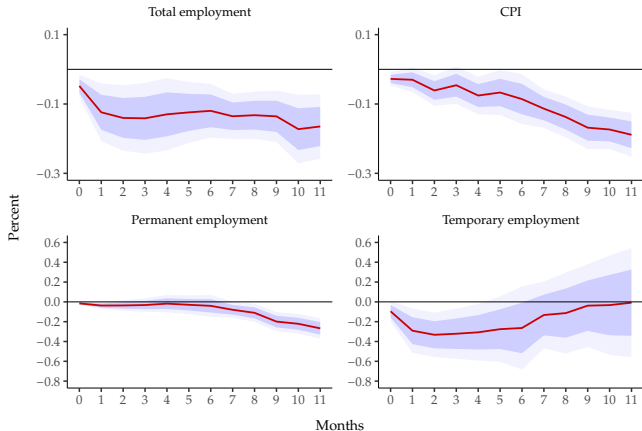
The sequence:

- **Retailers (downstream):** excess stocks in month 1
- **Manufacturers (upstream):** only around month 3, once retailers cut orders
- **Then** production is cut and inventories run down ($\approx -2\%$ by year-end)

Consistent with **Production Network effects**: downstream first, upstream later, the same sequence as in sales



Step 5: employment and prices — Friedman's long lags



- The monthly response of Employment is similar to the daily one
- Different dynamics for Permanent & Temporary labor contracts: Permanent (no fixed term, 84% of total) only responsive at the end of the 1st year. Temporary (fixed term) adjust on impact, for 5–6 months
- The CPI response decline is gradual: significant on impact (no price puzzle) but economically small, deepening after month 6; lowest point within the year: -0.2 pp at month 11 (still falling beyond it, App. C.3). 9 of 11 COICOP price categories do not respond at short lags

The transmission sequence, day by day



Demand responds within weeks; the long lags are lags of transmission through inventories, the production network and the labour market.

Taking stock

Policy implications, conclusion

Implications: models, identification, policy, household finance

- **For models:** DSGE models calibrated on quarterly data build in a delayed demand response (habits, adjustment costs), which may misrepresent the sequencing. What is needed: fast demand, then gradual transmission to production, employment and prices
- **For identification:** calling consumption and sales “slow-moving” may be an artefact of data frequency. The same caution applies to annual administrative records
- **For policy:** demand responds within weeks, and heterogeneously across goods, sectors and households. Transaction-level microdata allow better structural models at the frequency of policy decisions: a timely, granular assessment of policy effects between successive meetings
- **For household finance:** transaction data merged with credit registers show heterogeneity within months, not years. Here we observe only mortgage status, not leverage or liquidity across banks. Next: richer heterogeneity, other countries

Friedman refined, not overturned

- Monetary policy **does** affect employment and prices only with long lags
- But our evidence **suggests** those lags **primarily reflect a rapid contraction in demand that propagates only gradually** through inventories, the production network and the labour market, rather than a slow response of demand itself
- **Seeing this requires observing the economy at high frequency** (monthly or higher, not quarterly): in real time and in high definition

Thank you

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Appendix

Appendix: Is this Spain, the sample, or the method?

- **Public monthly data tell the same story:** Spanish industrial production falls 0.30% on impact and 0.72% at one month; the Tax Authority's own monthly VAT consumption and investment mirror the daily baseline; monthly series back to 2000 agree
- **Magnitudes are in line with the literature** once rescaled to our shock: IP trough -0.72% , between Bauer & Swanson (2023, US: -0.89%) and Altavilla et al. (2025, euro area: -0.53%); same-month IP responses in Jarociński-Karadi and Miranda-Agrippino-Ricco
- **Other countries, other data:** fast and sizable credit-card spending responses in Germany (Grigoli & Sandri, 2026, EER), suggesting the short lags are not sample- or country-specific
- **Robust to** alternative seasonal adjustment and smoothing (30-day MA + standard LP, TBATS, FAM, and their full grid; only investment somewhat sensitive), alternative shocks (1-month OIS with the “poor man's” exclusion; Policy Target factor; both also as instruments in LP-IV), and the pre-COVID sample for consumption and employment (24 shocks, horizons up to 93 days)

Appendix: Data overview (Table A1 of the paper)

Variable	Proxy	Source	Frequency	Start date
Real activity				
Sales & output	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
Inventories	Stock index, total trade	INE	Monthly	January 2013
	Survey balance, retail (Q2)	EU Commission	Monthly	January 2000
	Survey balance, manufacturing (Q4)	EU Commission	Monthly	January 2000
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	Average price per square meter	CIEN	Monthly	January 2007
Expectations				
Inflation expectations	Inflation-linked swaps	Bloomberg	Daily	June 3rd, 2004
Real activity expectations	Consumer sentiment indicators	EU Commission	Monthly	January 2000
	Business sentiment indicators	EU Commission	Monthly	January 2000
	Consumer expectations	ECB	Monthly	April 2020
Financial markets expectations	Consumer expectations	ECB	Monthly	April 2020

Appendix: Daily Corporate Sales from Public Registries

- Daily Value Added Tax (VAT) by firms to Spanish Tax Authority
 - Final sales to Spanish Households (residents and not resident as tourists)
 - Sales of investment goods to Spanish firms
 - Sales of intermediate goods to firms
 - Near 60K large firms accounting for 70% of domestic sales
- A proxy for gross output up to inventory changes: $\text{Output} = \text{Sales} + \Delta \text{Inventories} \Rightarrow$ we read it as a measure of demand
- Disaggregated by NACE sector (20 sectors)
- Real: Deflated appropriately with PPI/CPI/SPI for each NACE
- Time Period: 1st July, 2017 to end October, 2023

Appendix: Daily Consumption from Bank Financial Transactions

- **Daily transactions from individuals from a Private Spanish Bank in Spain (BBVA)**
 - 1.8 million active retail customers (self-employed excluded)
 - National: Weighted to provide representative sample of Spanish population
- **Total Consumption:** all account outflows, classified as in Buda et al. (2022)
 - Cards, cash withdrawals (treated as consumption), direct debits & transfers
 - Imputed housing services; imputed rents and monthly bills spread evenly over the month
- **Disaggregated:** Metadata allows Consistency with official categories (COICOP)
- **Real:** Deflated using Spanish CPI (aggregate, disaggregated at COICOP level)
- **Time Period:** 1st August, 2015 – October 2023
- **Validation (Buda et al., 2022):** within 1% of official quarterly consumption; q-o-q growth correlation 0.987

Appendix: Daily Aggregate Investment

- **Daily Investment proxy calculated using transaction data from BBVA**
 - Around 17.4 million transactions (corporate transfers and reverse factoring, roughly evenly split) among 1.9 million firms
- **Corporate transfers and Confirming BBVA operations** Some restrictions:
 - Payment transactions (i.e. invoice) + both parties identified
 - Not included: financial sector firms, public sector and non-profit foundations
 - Not included: transactions between firms of the same ownership group
- **Corrections: Sample Biases and Investment vs Intermediate consumption**
 - **Population Biases:** We apply sector IO weights to align with national IO data sector
 - **Investment vs Intermediate Consumption:** Using IO tables to find investment goods sales as % share of total output & apply shares to all BBVA transactions where firms in the sector are sellers
- **Real Investment:** Deflated by implicit deflator from monthly investment by Spanish Tax Authority.
- **Time Period:** 6th April, 2017 – October 2023 (corr. with quarterly NA investment: 0.95)

Appendix: Daily Aggregate Employment

- Near universe of all labor contracts reported as active on a given day to Spanish Social Security (Mandatory; $\approx 99\%$ of employment)
- **Labor Contracts:** Job Creation (new labor contracts registered with the SS system) netting out Job Destruction (labor contracts ending on the day)
- **Temporary vs Permanent:** Monthly SS breakdown between Permanent (no fixed term, $\approx 84\%$ of contracts) and Temporary (fixed-term) contracts
- **Time Period:** August 2015 – October 2023

Appendix: Empirical design — smoothing, COVID, pre-trends

- **Noise handled at the estimation stage, not by pre-smoothing the data:** Smooth Local Projections (Barnichon & Brownlees, 2019): $\beta_{h,0}$ as B-splines with a roughness penalty λ (5-fold blocked cross-validation); unsmoothed LP overlaid in Fig. 2 and App. D.2
- **Other frequencies:** shock lags $k = 0$ daily & weekly; $k = 6$ monthly; $k = 2$ quarterly
- **IRFs in levels from yoy growth rates:** $IRF_h = IRF_h^{YoY}$ for $h < 365$; beyond one year, recursively $IRF_h = IRF_h^{YoY} + IRF_{h-365}$
- **COVID-19:** drop 14 March – 30 October 2020 (Schorfheide & Song, 2024) and control for $cases_t$ and $stringency_t$; consumption and employment results hold in the pre-COVID sample
- **No pre-trends:** the projection at negative horizons ($h = -60, \dots, -1$) shows no predictability; the response emerges discontinuously at day 0
- **Robustness:** 30-day MA + standard LP (earlier version of the paper), model-based SA (TBATS, FAM)

Appendix: Identification of Monetary Policy Shocks

- **Baseline: High-Frequency monetary policy surprises for the EA from 1999 to 2023 borrowed from Jarociński and Karadi (2020)**
 - EA high-frequency changes in financial assets around ECB policy announcements as Gürkaynak, Sack and Swanson (2005); 63 announcements between Aug 2015 and Oct 2023 (55 in the LP sample from Aug 2016, Table B1)
 - Controlling by central bank “information channel” potentially polluting monetary policy shocks: Standard High Frequency Identification + Bayesian VAR Sign Restrictions (Jarociński & Karadi, 2020).
 - One Standard Deviation Shock = 3.7bp (consumption & employment samples) & 4.1bp (shorter sales & investment samples)
 - No pre-trends: LP at negative horizons ($h = -60, \dots, -1$) shows no predictability of the shock
- **Alternative I:** 1-month OIS change around policy decisions from the Euro Area Monetary Policy Event-Study Database (EA-MPD, Altavilla et al., 2019), with the “poor man’s” exclusion of same-sign rate/stock moves
- **Alternative II:** Policy Target factor (Altavilla et al., 2019). Both alternatives also used as instruments (LP-IV): similar results

Bringing and aligning with several distinct literatures (1/2)

- **High Frequency identification of Monetary Policy Shocks**

Kuttner (2001), Gürkaynak et al (2005), Altavilla et al (2019), Jarociński & Karadi (2020), Bauer & Swanson (2023)

- **High-Frequency Economic Activity Indicators and transaction data**

Eraslan and Götz (2021), Buda et al (2022), Baumeister, Leiva-León and Sims (2021), Lewis et al. (2022), Diebold (2022), Rua and Lourenço (2020), Andersen et al. (2021, 2022), Bounie et al. (2020), Chetty et al. (2020), Ganong and Noel (2019), Grigoli and Sandri (2026, EER)

- **Consequences of time aggregation**

Amemiya & Wu (1972), Sims (1971), Geweke (1978), Marcet (1991), Christiano & Eichenbaum (1987), Stock (1987), Jacobson, Matthes & Walker (2026, JPE Macro)

- **Household attention and the information channel**

Carroll (2003), Lewis, Makridis & Mertens (2019), Lamla & Vinogradov (2019), Coibion, Gorodnichenko & Weber (2022)

Bringing and aligning with several distinct literatures (2/2)

- **Mortgage cash-flow channel**

Di Maggio et al. (2017), Cloyne, Ferreira & Surico (2020), Flodén et al. (2021), Calza, Monacelli & Stracca (2013), Corsetti, Duarte & Mann (2022)

- **Inventories as buffers**

Blinder & Maccini (1991), Bernanke & Gertler (1995), Ramey & West (1999), Bils & Kahn (2000), Wen (2011)

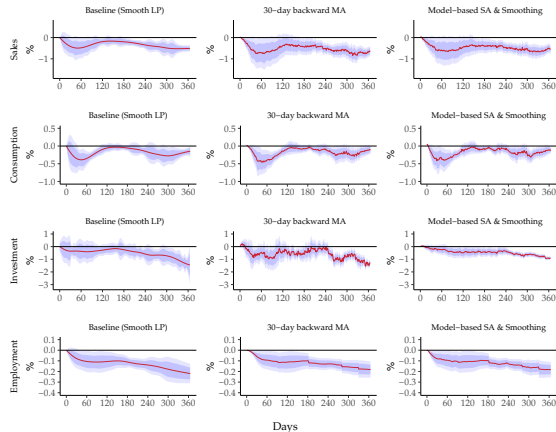
- **Production Networks and Monetary Policy Transmission**

Basu (1995), Carvalho (2006), Nakamura & Steinsson (2010), Pasten, Schoenle & Weber (2020); empirics: Ozdagli & Weber (2017), Ghassibe (2021)

Appendix: Seasonal Adjustment

- **Seasonally Adjusting Daily Series is Challenging!!** within-year/quarter/month/week variation; pervasive noise
- **Baseline (two steps + smoothing at the estimation stage):**
 - Day-of-the-week and day-of-the-month fixed effects (within-week and within-month patterns, e.g. weekends, paydays)
 - Year-on-year log growth rates of the adjusted series
 - Smooth Local Projections (Barnichon & Brownlees, 2019), λ by blocked 5-fold CV; unsmoothed LP overlaid in Fig. 2 and App. D.2
- **Robustness: Alternative Methods (Appendix G.2, G.5)**
 - 30-day backward MA + standard LP (earlier version of the paper); model-based SA (TBATS; Fractional Airline Model)
 - Full grid of smoothing (none, 7/30/90-day MA, exponential) $\times$ SA (none, TBATS, FAM): baseline closely tracked in most of the 15 cases (no smoothing / 7-day MA noisy; 90-day MA blurs short lags)

Appendix: Daily Response to Alternative SA Procedures



- **Baseline (Smooth LP):** calendar fixed effects, yoy growth, Smooth LP
- **30-day backward MA:** yoy growth of a 30-day MA + standard LP (earlier version of the paper)
- **Model-based SA & Smoothing:** unobserved components (TBATS) + regular LP
- Sales, consumption and employment similar across all three; only investment somewhat sensitive

Appendix: Alternative Monetary Policy Shocks

Table B1: MP descriptive statistics

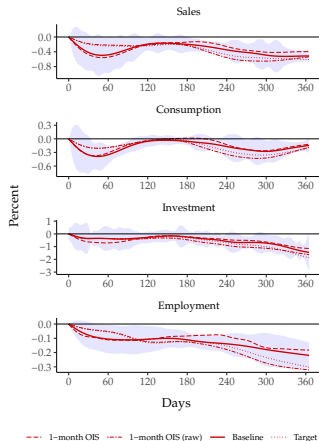
MP shock	N	Mean	Median	SD	Min	Max
Baseline sample						
JK (baseline)	55	0.90	0.31	3.74	-5.38	18.76
Target	55	0.55	-0.30	3.58	-4.96	21.13
1-month OIS	24	0.76	0.03	2.86	-4.45	10.57
Full sample						
JK (baseline)	224	0.51	0.20	3.29	-8.53	18.76

Table B2: MP cross-correlation in the Baseline sample

	1-month OIS	Target	JK (baseline)
1-month OIS	1.00	0.51	0.75
Target	0.51	1.00	0.52
JK (baseline)	0.75	0.52	1.00

Notes: The baseline sample starts in August 1st, 2016 and ends in October 30th, 2023, while the full sample starts in January 1st, 2002 and ends in the same day as the baseline sample.

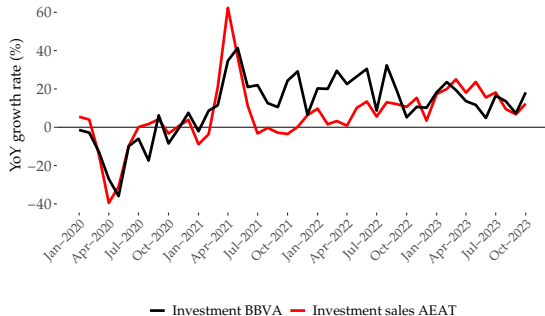
Appendix: Daily Response to Alternative Policy Shocks



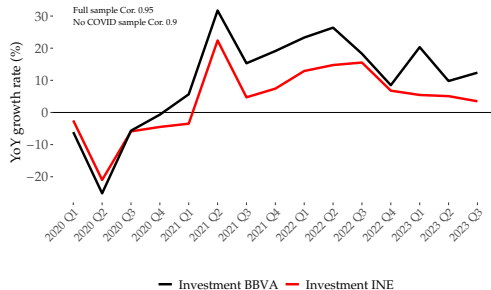
- **Baseline:** Jarociński & Karadi (2020) High Frequency Identification : Gürkaynak, Sack and Swanson (2005) + BVAR sign restriction to control by central bank “information channel”
- **Alternative I: 1-month OIS + “poor man’s” exclusion:** 1-month OIS around policy decisions (EA-MPD, Altavilla et al 2019); days on which OIS and Euro Stoxx 50 move in the same direction are excluded (the raw OIS series is also shown)
- **Alternative II: Policy Target factor** (factor applied to changes in the yield curve) proposed by Altavilla et al. (2019), used raw (no information-channel adjustment)
- Responses within the baseline confidence bands; LP-IV with both series as instruments gives similar estimates. Surprises further out the term structure transmit more slowly (Grigoli & Sandri 2026)

Appendix: Investment cross validation

Monthly: BBVA vs. Tax Authority (AEAT)
yoy growth, corr. 0.70 (paper, Figure A1)



Quarterly: BBVA vs. national accounts (INE)
yoy growth, corr. 0.95 (paper, Figure A2c)

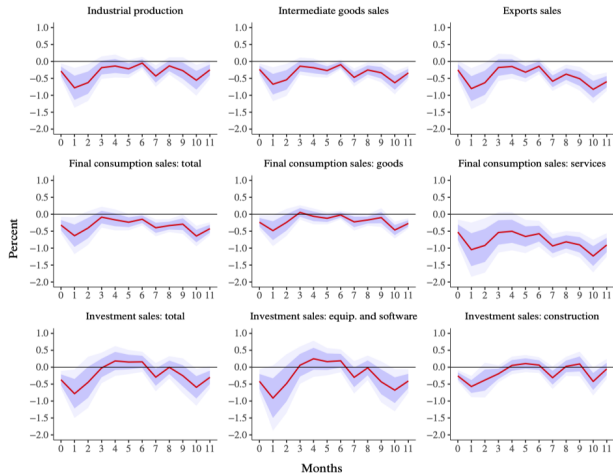


Appendix: Upstream & Downstream Classification

Industry	In Sales Data?	Upstreamness	Upstream
Residential care services; social work services without accommodation	No	1.01	0
Public administration and defense services; compulsory social security	No	1.06	0
Human health services	No	1.20	0
Education services	No	1.20	0
Other personal services	No	1.24	0
I. Hospitality	Yes	1.28	0
Creative, arts and entertainment services; libraries, archives, museums	No	1.42	0
Fish and other fishing products; aquaculture products	No	1.45	0
C21. Pharmaceutical Products Manufacturing	Yes	1.55	0
F. Construction	Yes	1.56	0
Sporting services and amusement and recreation activities	No	1.57	0
Real estate services	No	1.58	0
Services furnished by membership organizations	No	1.76	0
G. Wholesale Trade and Trade Intermediaries, Sale and Repair of Motor Vehicles and Motorcycles and Retail Trade, except Motor Vehicles and Motorcycles	Yes	1.86	0
Insurance, reinsurance, and pension funding services, except compulsory social security	No	1.89	0
Repair services of computers and personal and household goods	No	1.89	0
C13 + C14 + C15. Textile Industry, Apparel, and Footwear Manufacturing	Yes	2.02	0
C26 + C27. Manufacturing of IT, Electronic and Optical Products; Manufacturing of Electrical Equipment	Yes	2.09	0
C29. Manufacturing of Motor Vehicles, Trailers, and Semi-Trailers	Yes	2.16	0
Manufacturing of machinery and equipment n.e.c.; other transport equipment manufacturing; repair and installation of machinery and equipment	No	2.17	0
Natural water; water treatment and supply services	No	2.18	0
C16 + C31. Wood and Cork Industry; Furniture Manufacturing	Yes	2.19	0
J. Information and Communications	Yes	2.20	0
C10 + C11 + C12. Food Industry, Beverage and Tobacco Manufacturing	Yes	2.27	1
Services auxiliary to financial services and insurance	No	2.39	1
Financial services, except insurance and pension funding	No	2.58	1
C19 + C32. Coke Ovens and Oil Refining; Other Manufacturing Industries	Yes	2.65	1
Products of agriculture, hunting, and related services	No	2.76	1
M+N. Professional and Administrative Activities	Yes	2.78	1
H. Transport and Storage	Yes	3.09	1
Sewerage services; sewage sludge; waste collection and disposal services	No	3.11	1
D. Electricity, Gas, Steam, and Air Conditioning Supply	Yes	3.28	1
C22 + C23. Rubber and Plastic Products Manufacturing; Other Non-Metallic Mineral Products Manufacturing	Yes	3.31	1
Products of forestry, logging, and related services	No	3.33	1
C24 + C25. Metallurgy; Manufacturing of Metal Products, except Machinery and Equipment	Yes	3.53	1
C17 + C18. Paper Industry; Graphic Arts	Yes	3.55	1
Chemical industry	No	3.60	1
Mining and quarrying	No	3.87	1

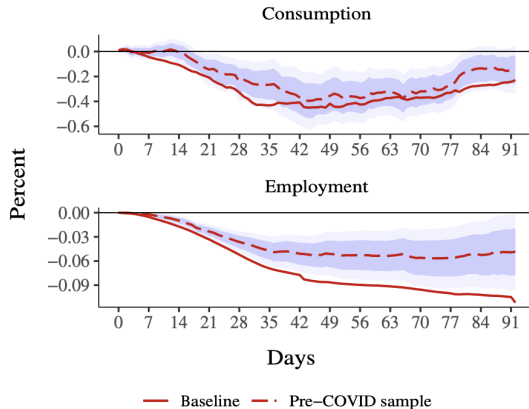
- Measure of upstreamness by Antràs et al. (2012) (paper, Table D3)
- Upstreamness: average distance of an industry from the final consumption of its products capturing its role in the early or intermediate stages of the supply chain.
- Based on two primary methodologies:
Recursive Input-Output + Equations Approach
- Upstream = upstreamness above the average (2.20); downstream = below (results robust to top vs. bottom quartile)

Appendix: Monthly IRFs of Industrial Production and Sales



- **Industrial production contracts at short lags** (-0.30% on impact, -0.72% at one month; once rescaled, between Bauer & Swanson 2023 for the US, -0.89% , and Altavilla et al. 2025 for the EA, -0.53%) with a similar pattern in intermediate-goods and export sales
- **Goods vs. services:** services sales bear the brunt of the fall in final consumption sales
- **Investment by asset:** immediate fall in equipment & software (less noisy than the daily series); a more muted response in construction.

Appendix: Pre-COVID Sample (ending December 2019)



24 shocks, horizons up to 93 days: consumption and employment responses qualitatively similar to the baseline, only slightly attenuated. Monthly series back to 2000 tell the same story.

Appendix: Monte Carlo on time-aggregation bias

- **Monte Carlo** calibrated to the estimated daily consumption IRF and the actual ECB meeting calendar (1,000 replications); standard LP on the quarterly aggregates

Sample	IRF	Shocks / Q	Q0			Q1		
			Bias	68%	90%	Bias	68%	90%
<i>IRF in DGP (Consumption): Q0 = -0.281, Q1 = -0.061</i>								
Baseline	Cons	Two	+0.167	10.2	23.8	-0.124	19.7	36.0
Extended	Cons	Two	+0.153	0.4	1.7	-0.134	0.1	0.7
Extended	Cons	One (First-day)	-0.006	61.9	83.7	-0.001	65.3	87.6
Extended	Cons	One (Early)	+0.056	23.5	43.4	-0.051	26.2	47.3
Extended	Cons	One (Late)	+0.246	0.0	0.0	-0.221	0.0	0.0
<i>IRF in DGP (Employment): Q0 = -0.082, Q1 = -0.105</i>								
Baseline	Emp	Two	+0.059	38.3	61.8	+0.004	64.9	84.8
Baseline	Emp	One (First-day)	+0.001	61.4	84.1	+0.001	60.5	80.8

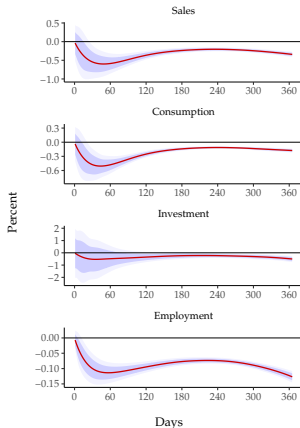
- Q0 bias +0.167 (true -0.281), 68% coverage 10%; Q1 overstated: trough displaced by one quarter. A longer sample (108 quarters) does **not** help: coverage 0.4%
- Shock on day 1 of the quarter: bias ≈ 0 . Shock ~ 20 days before quarter-end (2nd ECB meeting): impact ≈ 0 , zero coverage
- Not specific to the IRF shape: with the slow, monotonic employment IRF the Q0 bias is +0.059 (true -0.082), larger in % terms; it again disappears with a day-1 shock

Appendix: Mortgagors vs. Non-Mortgagors (paper, Table 2)

	Horizon (months)						
	0	1	2	3	6	9	11
Difference	-0.060* (0.053)	-0.043 (0.045)	-0.043* (0.034)	-0.122** (0.037)	-0.024 (0.033)	-0.035** (0.015)	-0.021 (0.024)
Observations (000s)	72130	72130	72130	72130	72130	66957	63516
Customers (000s)	1725	1725	1725	1725	1725	1722	1718
Customer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Controls: 3 lag(s) consumption</i>							

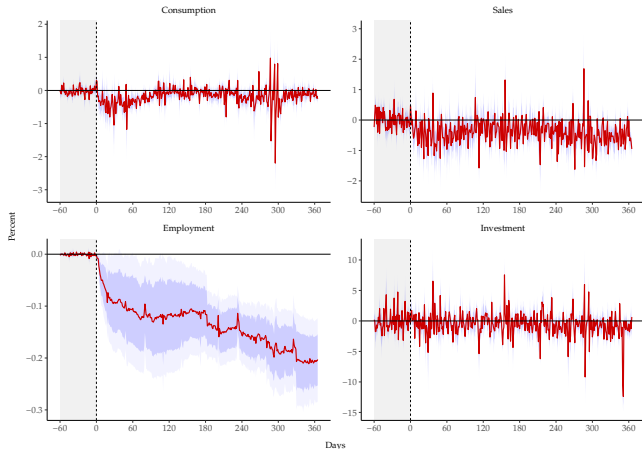
LP estimates of the differential consumption response (mortgagors minus non-mortgagors) to a one s.d. shock; dependent variable: 12-month log change in consumption (p.p.). Customer and time fixed effects (time FE absorb the main shock effect). Driscoll–Kraay SEs; *, **: 68% and 90% CI. Sample: July 2021 – May 2025; shock s.d. 2.9bp.

Appendix: Cumulative Monetary Multipliers



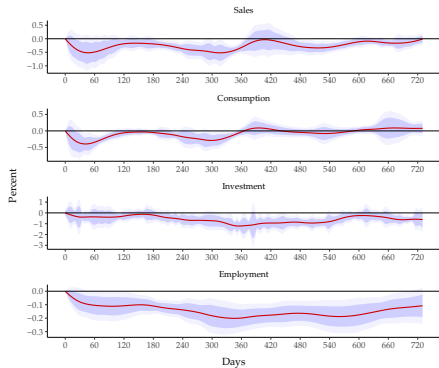
- **Definition:** ratio of the cumulative response of each real-activity variable to the cumulative response of the 12-month Euribor (monetary analogue of the cumulative fiscal multipliers of Mountford & Uhlig 2009 and Ramey 2016; see also Barnichon & Mesters 2024)
- **Short horizons:** large multiplier in magnitude, since demand contracts immediately while rates are still rising gradually; temporary flattening as policy rates reach their peak
- **One year out:** investment ≈ -0.5 , sales ≈ -0.3 , consumption ≈ -0.2 , employment ≈ -0.1 (small but persistent, still building at $h = 365$)
- The multiplier measures potency, not speed: the speed distinction is visible in the IRFs

Appendix: No Pre-trends (LP at Negative Horizons)

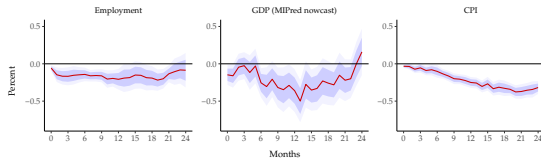


- Necessary condition for lead-lag exogeneity (Stock & Watson 2018; Jordà & Taylor 2025): the shock should not predict outcomes already realised
- Baseline LP (same controls) extended to $h = -60, \dots, -1$, horizon-by-horizon OLS
- Pre-shock coefficients centred on zero, no drift; rejections at 5% between 3% and 10% of horizons, consistent with the nominal size
- The response emerges discontinuously at $h = 0$

Appendix: Beyond One Year — Layered Lags (exploratory)



Daily, two-year horizon



Monthly: employment, GDP nowcast (AIReF MIPred), CPI

- Sales and consumption trough within the first year and stay modestly negative
- Employment (and, noisily, investment) trough around 11–12 months, broadly in line with Friedman's (1961) 16-month average lag; GDP nowcast (short sample) $\approx -0.5\%$ near month 13; CPI around month 20
- New: the speed of the demand response. Where the long-lag peak in employment and prices lies (1, 1–2 or 2–3 years) our short sample cannot settle

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