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).

Long 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).

Long and Variable Lags

"We're, of course, taking into account long and variable lags, and we're thinking about that." (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
- Relying on Jarociński and Karadi (2020) MP shocks + local projections, studies monetary transmission to daily demand and output
- 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 sale records for gross output, and employment)

Takeaways

1. **Slow vs. fast moving variables**
   - Consumption and gross output respond within weeks—typically regarded as ”slow moving”
   - Aggregate employment (mirrored by the CPI) display smooth declines peaking at long lags
2. **Transmission across good 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 display 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

1. Data and Methodology
2. Slow vs. Fast Moving Variables in the Transmission of Monetary Policy
3. Monetary Transmission Across Goods Categories and Sectors
4. Time aggregation
5. Extensions and Robustness

Plan of Talk

1. Data and Methodology
   - Daily Economic Activity Data Assembly
   - Seasonal Adjustment and Smoothing of Daily Series
   - Identification of Monetary Policy Shocks
   - Local Projections for Estimating Monetary Transmission
2. Slow vs. Fast Moving Variables in the Transmission of Monetary Policy
3. Monetary Transmission Across Goods Categories and Sectors
4. Time aggregation
5. Extensions and Robustness

1. Data and Methodology

Constructing Novel Daily Data on Consumption and Investment

Bottom up approach: daily transaction level data ⇒ daily aggregates

- Consumption 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 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 Further details
  - Daily VAT-based sales from large firms (70% coverage) proxy sectoral and aggregate gross output
  - We interpret total domestic sales—covering consumption, investment, and intermediates—as a proxy for gross output
- Employment 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
  - Financial markets
  - Housing prices
  - Consumer price indexes, both aggregate and by consumption category
  - Variety of expectations' data and confidence indicators

Methodology: Identification

- We use the monetary policy surprises for the EA of 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)
- The updated version of the shocks database includes 293 ECB policy announcements from 1999 to 2023—63 during our baseline sample from August 2015 to October 2023
- For robustness, we also consider:
  - Observed 1-month Overnight Indexed Swap (OIS) changes around policy announcements, controlling for the 'information channel'
  - Policy Target factor by Altavilla et al. (2019)

Methodology: Seasonal Adjustment and Smoothing of Daily Series

- Main hurdles:
  1. Daily data is highly sensitive to calendar effects, such as the different number of working days or moving holidays.
  2. One needs to purge not only the within-year, but also the within-month and within-week variation.
  3. Daily series tend to be noisier—irregular variation is not time-averaged away, and measurement errors may be heightened.
- Baseline data treatment of all but financial variables: Two-step approach
  1. Apply the 30-day backward-looking MA
  2. Compute year-on-year growth rates
- Baseline data treatment approach yields similar adjustment to more sophisticated methods

Methodology: Local Projections

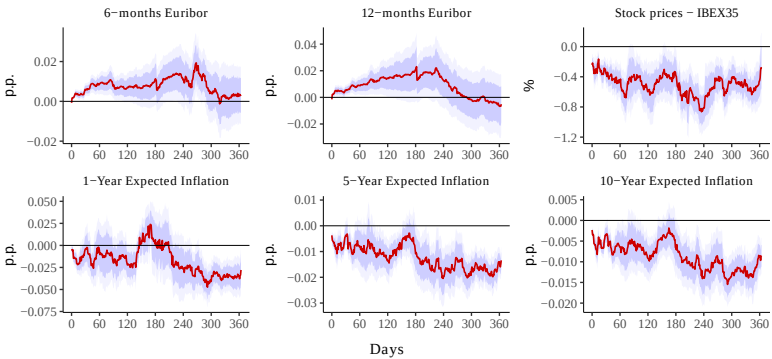
- Estimate the responses of variables to one standard deviation MP shock (3.7bp) using local projections
- To deal with COVID-19
  - Include daily cases and stringency index
  - Drop observations between March 14th, 2020 and October 30th, 2020—following Schorfheide and Song (2021) and Lenza and Primiceri (2022)

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

- Horizon-h LP-IRFs are obtained from OLS estimates of $\hat{\beta}_{h,0}$
- Baseline spec for daily data uses and $k = 0$ and $p = 90$

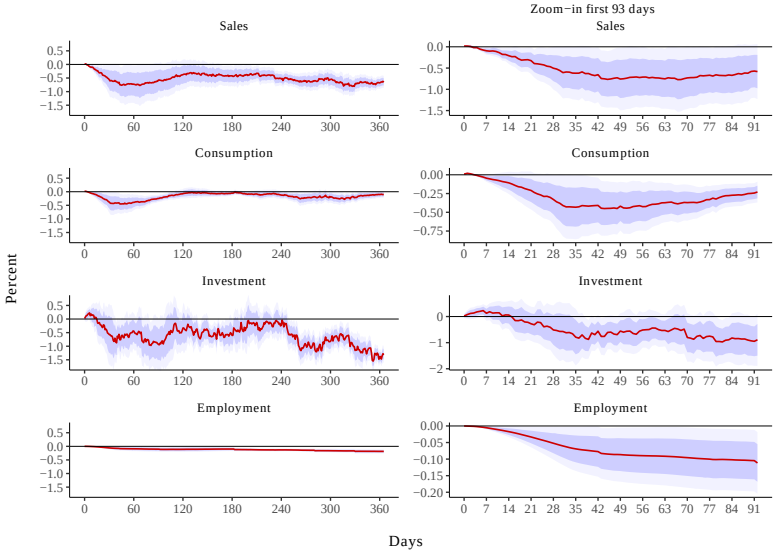
2. Slow vs. Fast Moving Variables in the Transmission of Monetary Policy

Setting the stage: Interest Rates and Inflation Expectations



- Euribor rates rise by roughly 1bp within the first 60 day
- Madrid's stock market index drops immediately by about 0.4 pp, remaining around that level for the rest of the year
- Inflation expectations based on Inf.-linked swaps for Spain also decline immediately

Four Key Daily Measures of Economic Activity

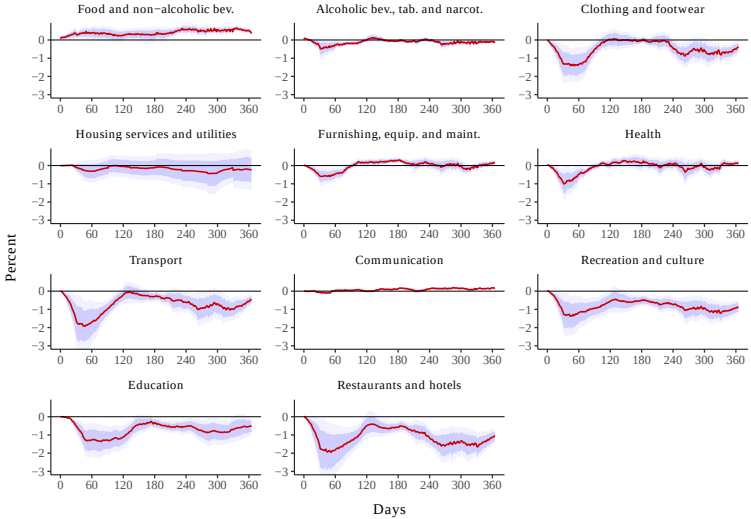


Taking stock: slow-moving variables vs. slow transmission

- 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 the Friedman dictum.
- 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 and gross output, already significant at short lags, into employment and inflation.

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

Response Lags Across Consumption Categories



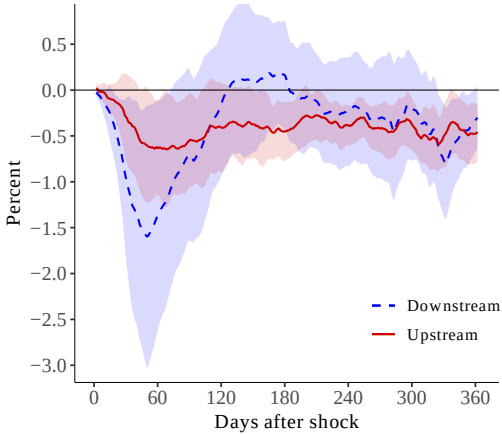
- Stronger adjustments in the final demand for durables, semi-durables and luxuries

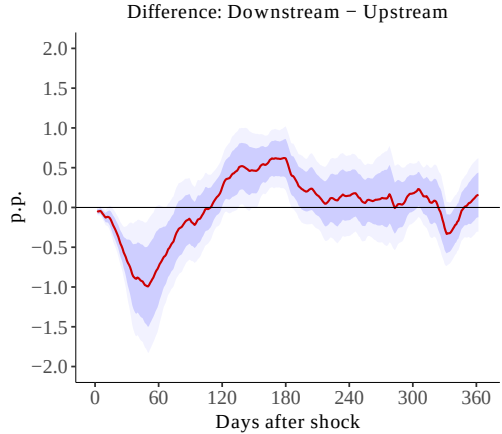
Upstream vs. Downstream Sectors: Methodology

1. We bridge the Spanish Tax Authority sales sectoral classification with the INE Input-Ouput 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

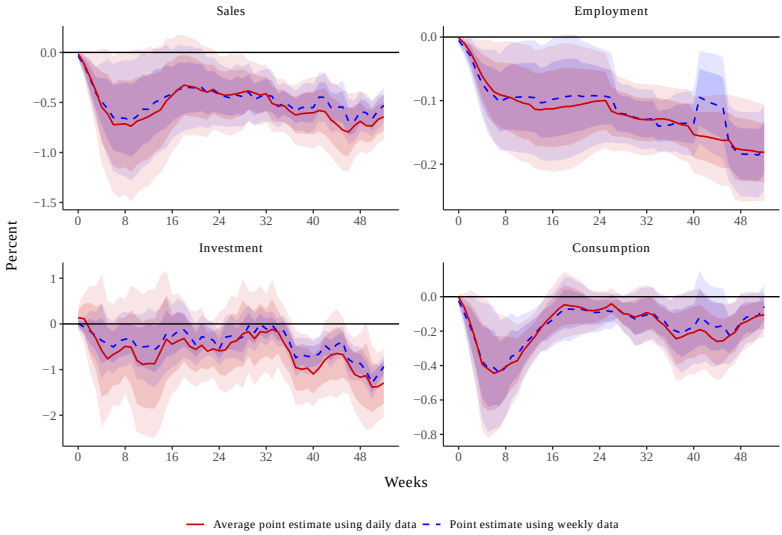




- Downstream sectors respond faster and much more, closely following final consumption demand
- Upstream sectors react a bit more slowly (2 vs. 1 month), but response is persistent.

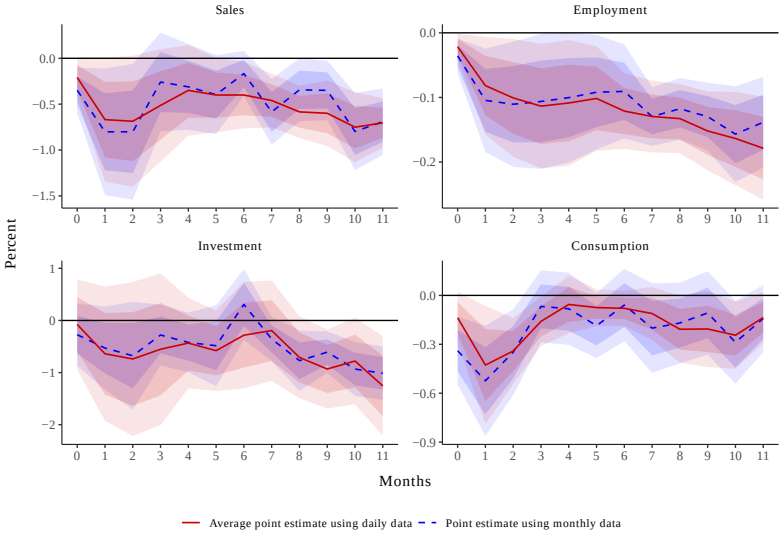
Time Aggregation: Weekly Responses

- To what extend can TA affect empirical results?
- We compare two IRFs:
  1. by time-aggregating (i.e., averaging) our daily *local projection estimates* at the weekly, monthly and quarterly horizons. (solid red line)
  2. by LPs on time-aggregated *daily data*—at weekly, monthly and quarterly frequency. (dashed blue line)



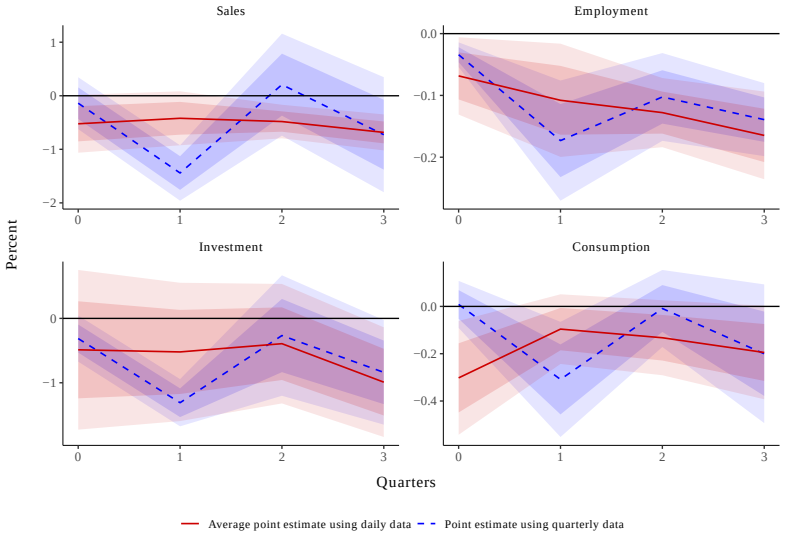
Time Aggregation: Monthly Responses

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



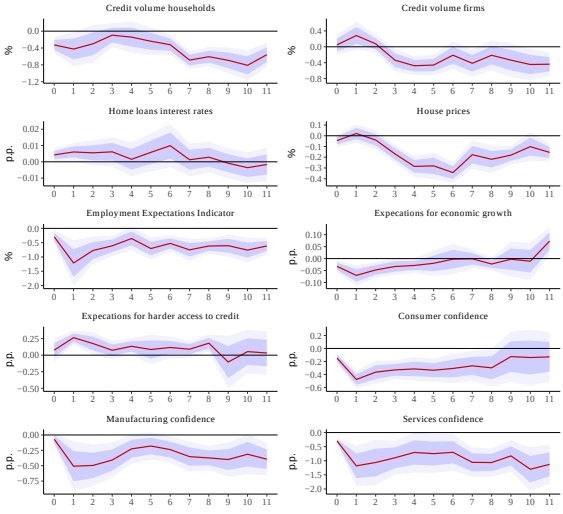
Time Aggregation: Quarterly Responses Blur Short Lags

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



4. Extensions and Robustness

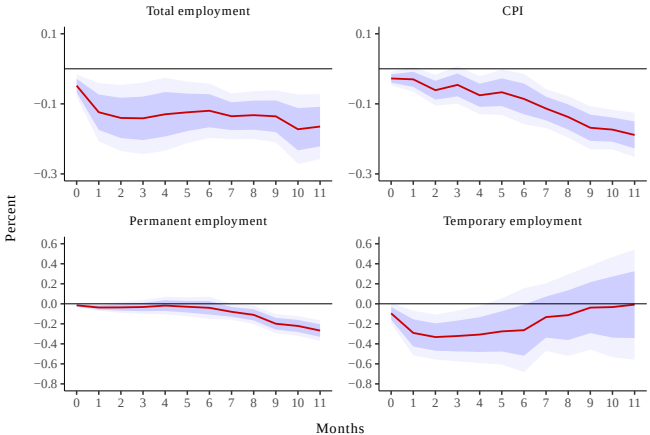
What else responds fast?



- Credit Conditions, Sentiments and Expectations (Monthly frequency)
- Industrial production. (also found in Jarociński and Karadi (2020) and Miranda-Agrippino and Ricco (2021)

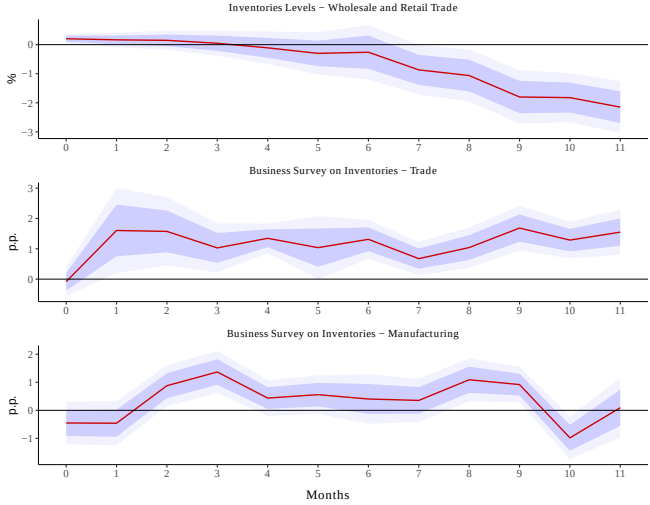
Results on IP and other monthly series

The 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
- Monetary policy ultimately transmits on the real economy by affecting permanent contract employment

Reconciling Fast and Slow Adjustments: Inventories



- As demand falls, inventories in Trade first accumulate, then decline in line with sharper drops in employment and prices
- Survey data (2nd and 3rd rows) confirms pattern
  - Downstream firms adjust first, cutting orders to upstream suppliers as inventories build
  - Trade firms report excess inventory immediately; manufacturing responds with a lag

Robustness Checks Overview

- **Seasonal Adjustment and Smoothing**
  - **Model-based (TBATS):** Seasonal and irregular components removed
  - **TBATS + SLP:** Seasonal adjustment with Smooth Local Projections (penalized B-splines). Alternative SA + Smoothing
  - **Further variations:**
    - No adjustment vs. econometric adjustments
    - No smoothing, different moving average windows, exponential smoothing

- **Monetary Policy Shock Identification** Results with alternative shocks
  - **Alternative 1:** 1-month OIS changes from EA-MPD (with exclusion for info effects).
  - **Alternative 2:** Policy Target factor from Altavilla et al. (2019)
    - **LP-IV check:** Responses robust to using shock series as instruments

- **COVID-19** Pre-COVID-19 sample results
  - **Daily (Pre-COVID):** Re-estimate LPs on pre-2020 sample (consumption and employment)
  - **Disaggregated:** COICOP category responses remain stable in pre-COVID sample
  - **Monthly data:** 2000–2019 sample shows consistent responses in real activity variables

Conclusion

- Our findings suggest future research would benefit from redirecting focus:
  - from mechanisms that delay the transmission of shocks and financial variables to aggregate demand
  - $\Rightarrow$ those that slow the transmission of rapid demand and output responses to adjustments in labor, upstream intermediate inputs, and prices
- Both transaction-level and administrative microdata offer promising avenues for empirically investigating these transmission mechanisms
- Our time aggregation results are relevant to a large empirical literature
  1. that aggregates MP shocks to quarterly or yearly frequencies $\Rightarrow$ may significantly impair the identification of monetary transmission mechanisms
  2. that aggregates MP shocks to monthly frequency $\Rightarrow$ our validation facilitates the replication of our findings across different countries

Appendix

Data Overview

Variable	Proxy	Source	Frequency	Start date
Real activity				
Gross 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
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

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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 (Classification of Individual Consumption by Purpose) 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

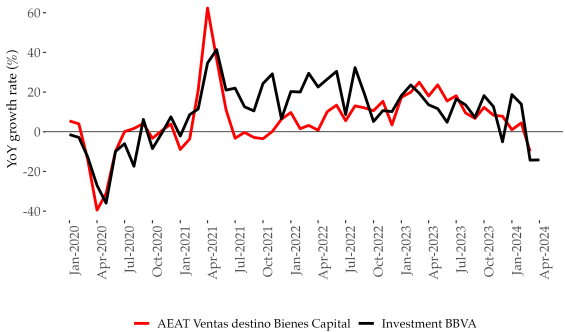

Figure: Monthly TA vs. BBVA investment series

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Data: Daily Series of Aggregate Investment

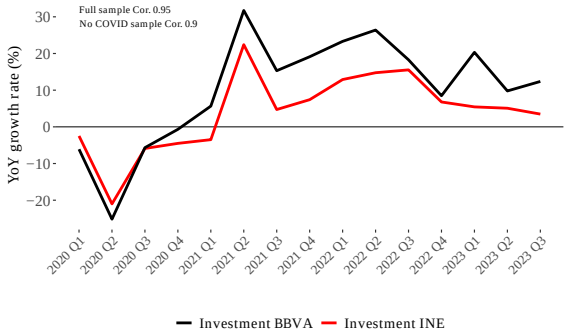

Figure: Quarterly NA vs. BBVA investment series

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Data: Gross Output

- Spanish Tax Authority compiles daily series from daily Value Added Tax (VAT) declarations by firms
  - 60K large firms accounting for 70% of domestic sales
- Final sales to Spanish Households (and tourists), Sales of investment goods to Spanish firms and households, Sales of intermediate goods to firms
  - Available with Nomenclature of Economic Activities NACE breakdown
  - Deflate appropriately with PPI/CPI for each NACE
- 1st July, 2017 — 31st October, 2023
- The authority also produces monthly series of gross output, series disaggregated by sector and use (consumption, investment, intermediate input and exports). 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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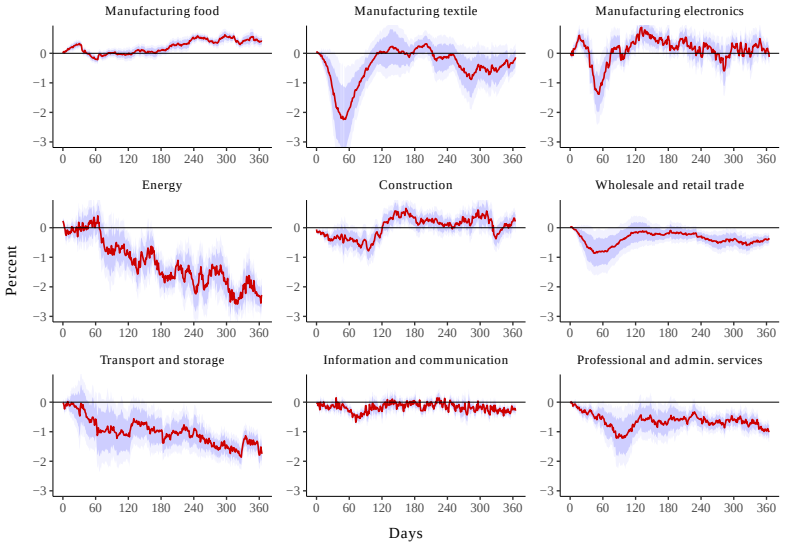
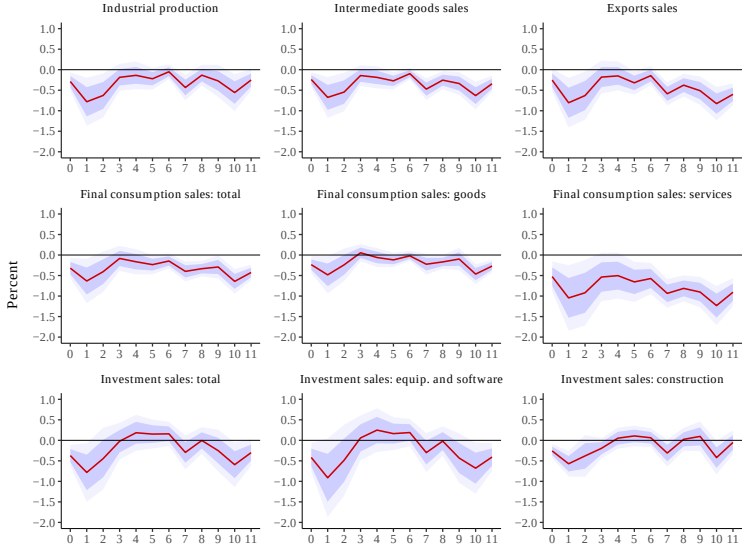
Response Lags Across Sales Categories



Short-Lag Dynamics in Industrial Production and Demand



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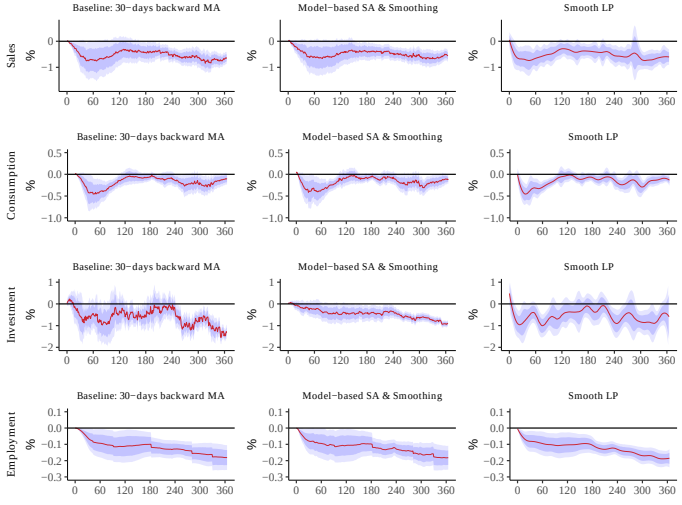
Robustness to Seasonal Adjustment of Daily Series



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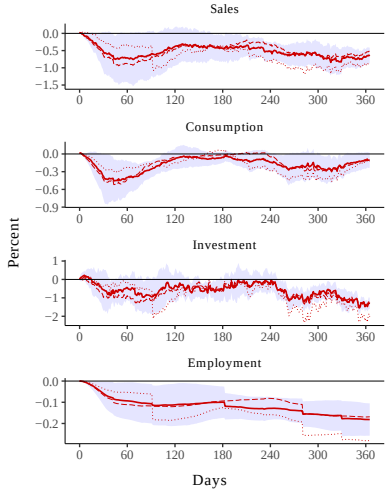
Robustness to Monetary Policy Shocks



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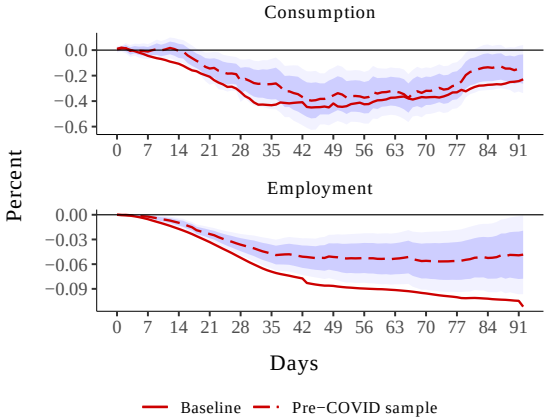
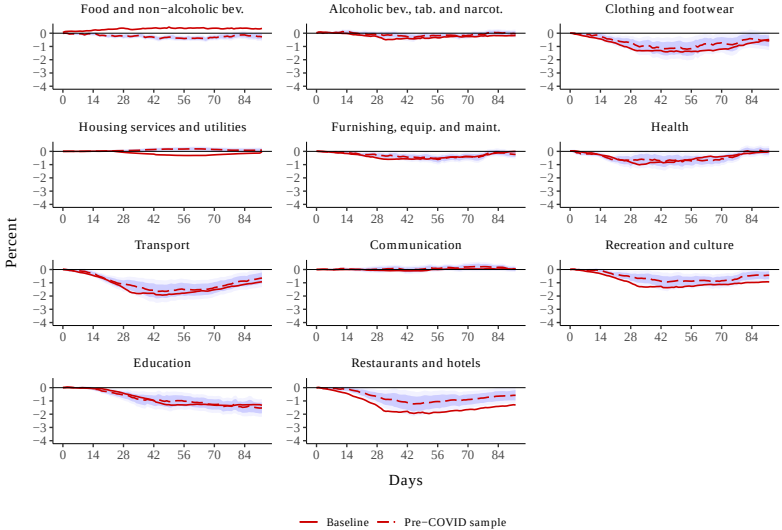
Robustness to COVID-19



Robustness to COVID-19



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