The Short Lags of Monetary Policy

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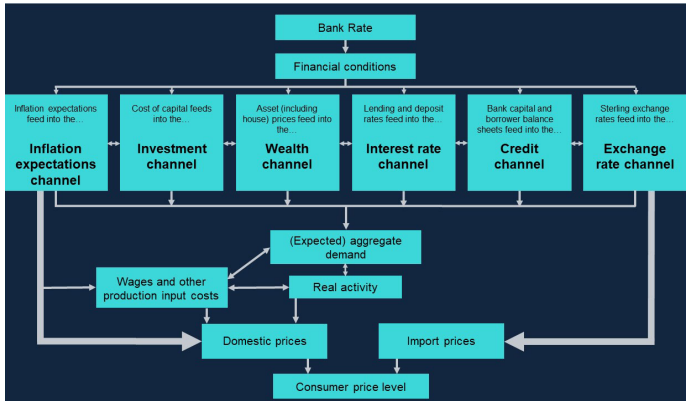
Long and Variable Lags

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

Long and Variable Lags

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

Two-stage view of monetary policy 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

The consensus view of MP Transmission

Together, the Friedman dictum and the two-stage model of transmission challenge theoretical monetary models that predicts the **largest response of financial and real variables to occur simultaneously on impact**, e.g. NK model.

- Models typically bridge the gap with empirical evidence including
  - Frictions (e.g. adjustment costs)
  - Behavioral elements (e.g. habit formation)
- Identification in empirical studies typicall relies on the idea that some variables are "slow moving"

This paper

- We assemble a novel, high-frequency and comprehensive dataset for Spain and reassess the received wisdom on the short lags of monetary policy.
- Relying on series of policy shocks obtained by applying high-frequency identification and local projections, we study the response of measures of daily demand and output in the days, weeks and months following monetary policy disturbances, at aggregate and disaggregated levels, up to a yearly horizon.
- Our rich set of high-frequency series are obtained
  - aggregating bank transactions records by Spanish BVVA 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** — ChaMP WS2 transmission via the real economy
   - Variables typically regarded as ”slow moving”, such as consumption and output, respond within weeks.
   - Aggregate employment (mirrored by the CPI) display smooth declines peaking at long lags

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   - Aggregate employment (mirrored by the CPI) display smooth declines peaking at long lags
2. **Transmission across good categories, sectors, and by sector "upstreamness"** — ChaMP WS2 transmission via production networks
   - Some final consumption categories respond faster and more: durable and luxuries.
   - Downstream sectors tied to final consumption and investment react faster and much deeper at short lags—follow the pattern of final demand.
   - Upstream sectors displayed slightly delayed (2 month vs 1 month), but more persistent responses. All sectors aligning at longer lags.

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3. **Time Aggregation**
   - Time aggregation to the quarterly frequency alters the identification of monetary policy transmission, shifting significant responses to longer lags

Literature

- High frequency identification of monetary shocks:
  Kuttner (2001) and Gürkaynak, Sack and Swanson (2005); Jarocínski and Karadi (2020), Gertler and Karadi (2015), Almgren et al. (2022), Cloyne, Ferreira and Surico (2020) and Holm, Paul and Tischbirek (2021),Miranda-Agrippino and Ricco (2021), Bernanke, Boivin and Eliasz (2005), Gürkaynak, Sack and Swanson, 2005 and Swanson, 2021; Gorea, Kryvtsov and Kudlyak, 2022), Lewis, Makridis and Mertens (2019)
- High frequency indicators of economic activity
  Eraslan and Götz (2021), Baumeister, Leiva-León and Sims (2021), Lewis et al. (2022), Diebold (2020) and Rua and Lourenço (2020). Andersen et al. (2021), Andersen et al. (2022), Bounie et al. (2020), Chetty et al. (2020) and Ganong and Noel (2019)). Grigoli and Sandri (2023)

Literature

- Production networks
  Basu (1995) Carvalho (2006) and Nakamura and Steinsson (2010) Pasten, Schoenle and Weber (2020) – Ozdagli and Weber (2017) and Ghassibe (2021) Ozdagli and Weber (2017) Ozdagli and Weber (2017)
- Foundational work on time aggregation
  Amemiya and Wu (1972), Sims (1971) and Geweke (1978). Marcet (1991) Christiano and Eichenbaum (1987) and Stock (1987) Jacobson, Matthes and Walker (2022),

Plan of Talk

1. Data and Methodology
2. Slow vs. Fast Moving Variables in the Transmission of Monetary Policy:
   Consumption Investment Gross Output and Employment
3. Monetary Transmission Across Goods Categories and Sectors
   Upstream vs. Downstream
4. Time aggregation
   Daily Weekly Quarterly
5. Extensions and Robustness
   Credit conditions, confidence and expectations
   Inflation and Employment
   Robustness

1. Data and Methodology

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

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.

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

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

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.

Methodology: Identification

- The monetary policy shocks series we use in our baseline is the series of monetary policy surprises for the EA of Jarociński and Karadi (2020).
- Shocks are constructed from EA high-frequency changes in financial assets around ECB policy announcements along the lines of Gürkaynak, Sack and Swanson (2005), using sign restrictions to address issues in the central bank "information channel".
- Lining up the frequency of shocks and macro/financial series allows us to avoid issues in time aggregation discussed, e.g., by Ramey (2011).
- The updated version of the shocks database by Jarociński and Karadi (2020) includes 293 ECB policy announcements from 1999 to 2023—63 during our baseline sample from August 2015 to October 2023.

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. Noise is pervasive in daily series—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
- We show that our poor man's approach yields similar adjustment to more sophisticated methods: fractional airline model or TBATS model (Box-Cox Transformation, ARMA innovations, Trend and Seasonality).

Methodology: Local Projections

- Estimate local projections of series on monetary policy surprises.
  We include controls for COVID-19, while removing the influence of COVID observations (March 14th, 2020 to October 31st, 2020) from the estimation procedure following Lenza and Primiceri (2022) and Schorfheide and Song (2021)

$$y_{t+h} = \alpha_h + \beta_h shock_t + \sum_{\ell=1}^{k} \psi_{h,\ell} shock_{t-\ell} + \sum_{\ell=1}^{p} \varphi_{h,\ell} y_{t-\ell} + \theta_h cases_t + \delta_h stringency_t + \varepsilon_{h,t}, \tag{1}$$

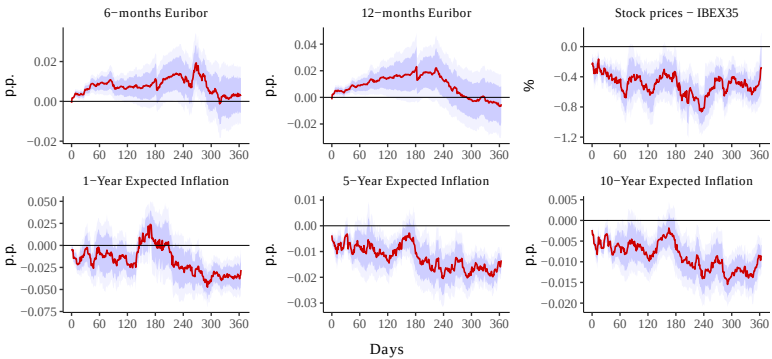
- Horizon-h LP-IRFs are obtained from OLS estimates of $\hat{\beta}_{h,0}$

Reduced-Form Evidence Methodology: Baseline Specs

- MP shock size: 1 standard deviation (3.7bp in baseline sample)
- Confidence intervals
  - 68% and 90%
- Lagged endogenous variable lags (p)
  - 90 for daily frequency
  - 3 for monthly frequency
  - 1 for quarterly frequency
- Lagged monetary policy surprises lags (k)
  - 0 for daily frequency
  - 6 for monthly frequency
  - 2 for quarterly frequency

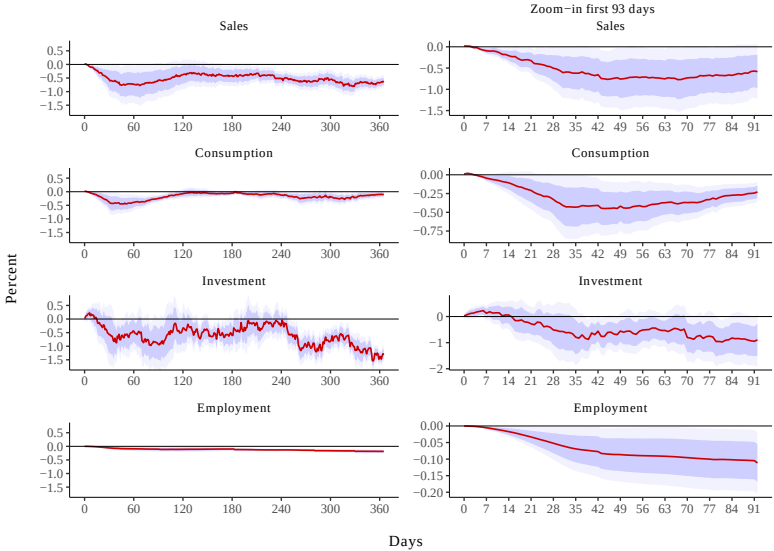
2. Slow vs. Fast Moving Variables in the Transmission of Monetary Policy

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

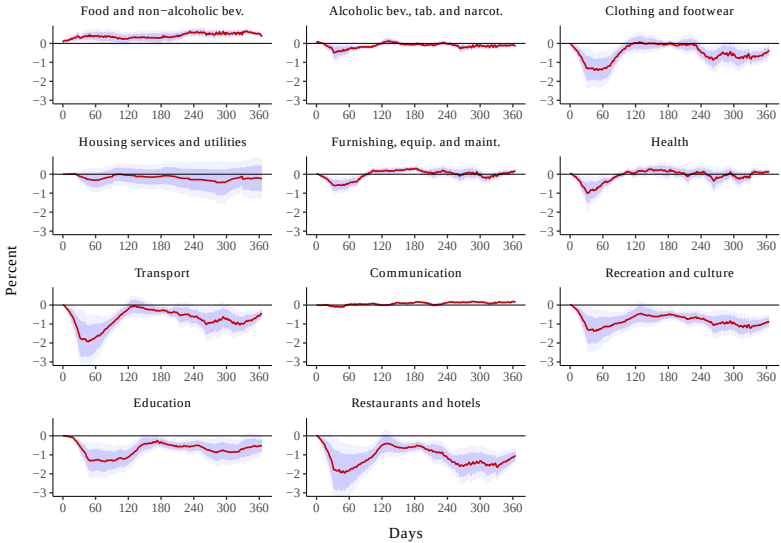


Taking stock: slow-moving variables vs. slow transmission

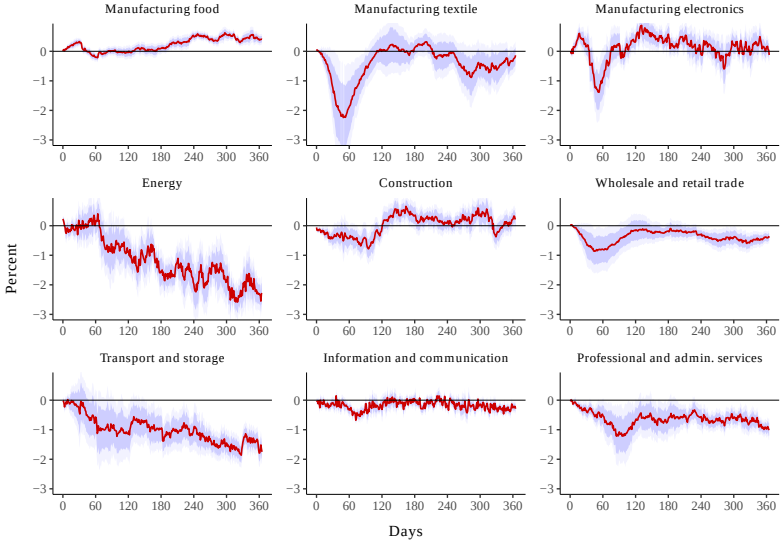
- Monetary policy has economically and statistically significant effects on key aggregate indicators of real economic activity already within weeks.
- Evidence casts a different light on a popular classification of slow-moving variables (e.g., consumption) used in identification.
- By no means this evidence contradicts the Friedman dictum.
  - Employment responds smoothly and becomes economically significant at long lags.
  - Same applies to the CPI (only available at monthly frequency, shown below).
- One natural conclusion prompted by this is that 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



Response Lags Across Sales Categories



Upstream vs. Downstream Sectors

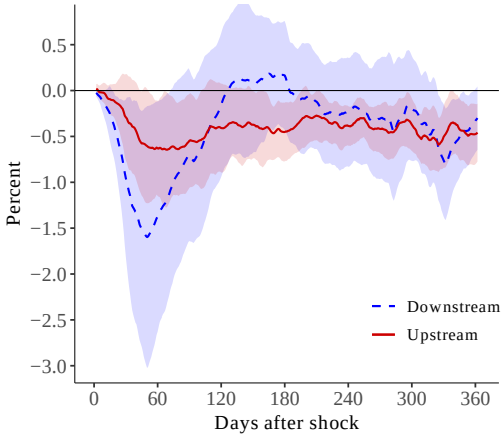
- Stronger adjustments in the final demand for durables, semi-durables and luxuries.
- Downstream sectors' sales (closer to final demand) appear to react more and faster than upstream sectors'.
- Next we test whether the sales responses of upstream sectors, providing general purpose inputs for the production of goods and services, is different from downstream sectors.

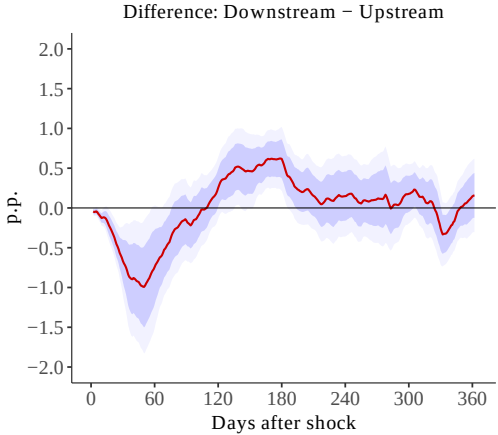
Upstream vs. Downstream Sectors: Methodology

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 this indicator, we classify a sector as upstream or downstream depending on whether it scores above or below the indicator average for 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





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.
- The two series only align over the longer lags, longer than 6 months

4. Time Aggregation

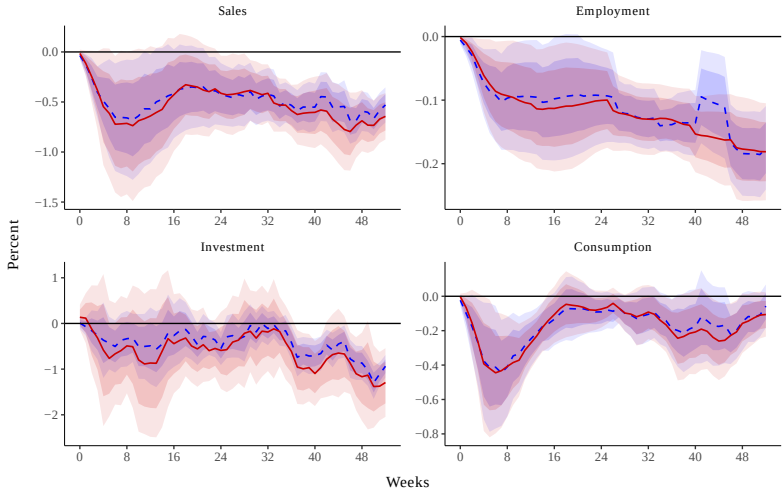
Time aggregation

To what extend can TA affect empirical results? We contribute empirical evidence on this issue by comparing two sets of estimates.

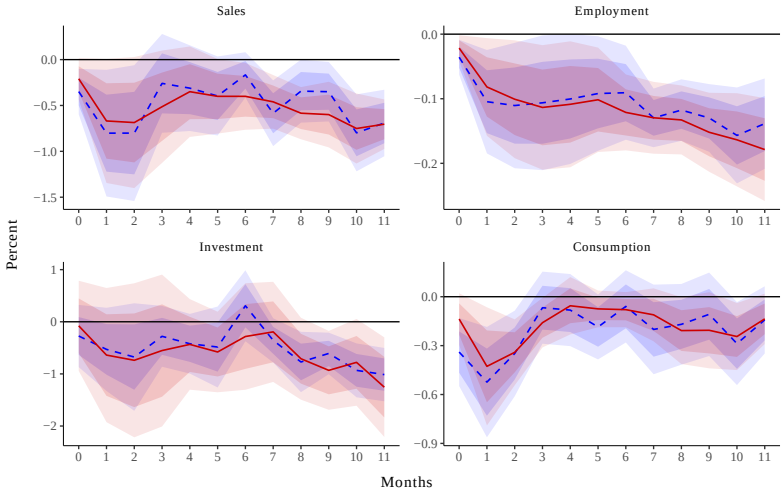
We compare IR series obtained:

1. by time-aggregating (i.e., averaging) our daily *local projection estimates* at the weekly, monthly and quarterly horizons.
2. based on time-aggregated versions of our *daily data*—at weekly, monthly and quarterly frequency.

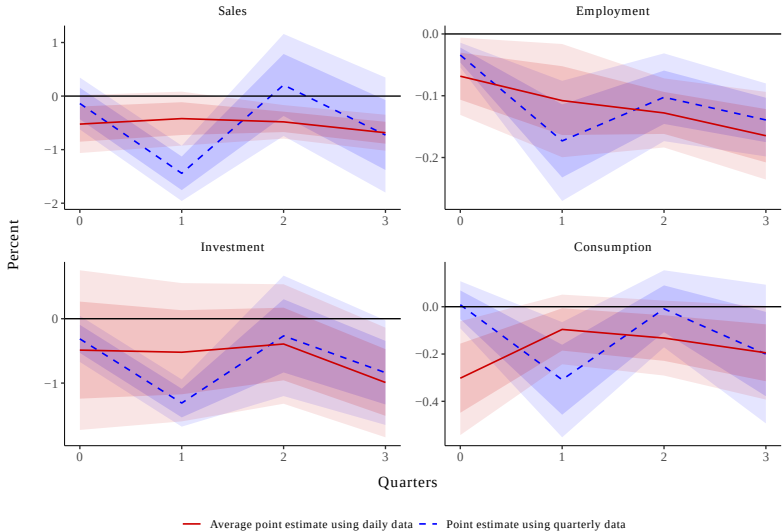
Time Aggregation: Weekly Responses



Time Aggregation: Monthly Responses

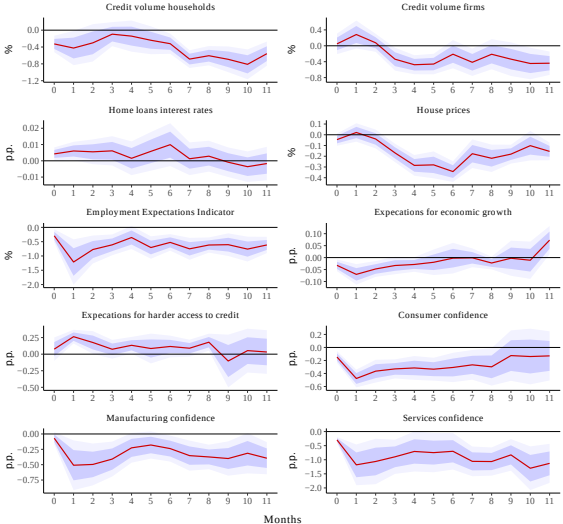


Time Aggregation: Quarterly Responses Blur Short Lags



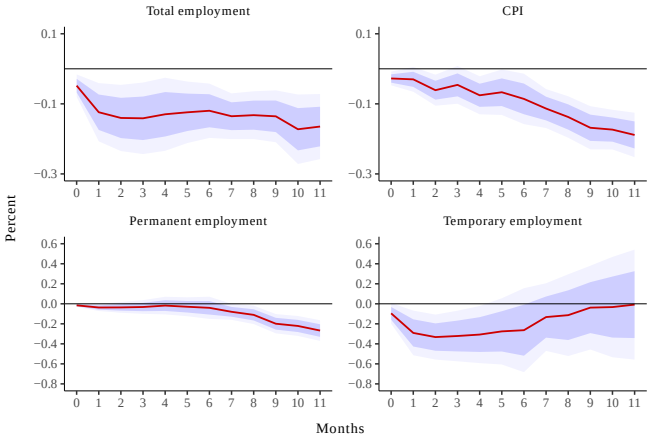
5. Extensions and Robustness

What else responds fast?



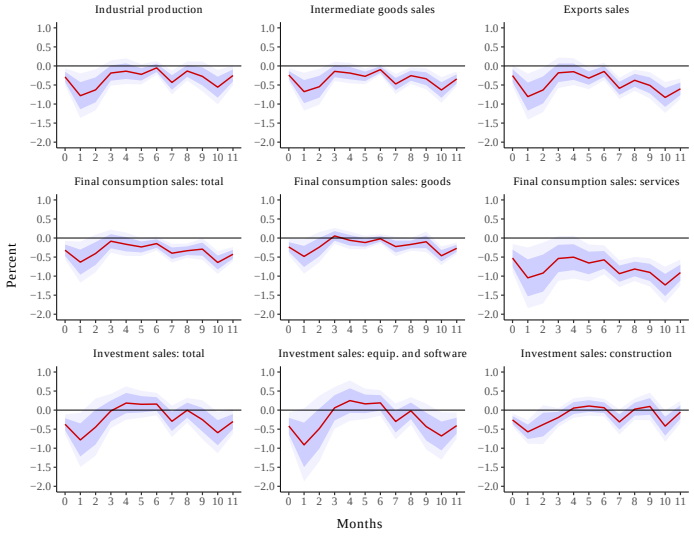
- Credit Conditions, Sentiments and Expectations (Monthly frequency)

The Long Lags in Employment and Inflation—Monthly Data



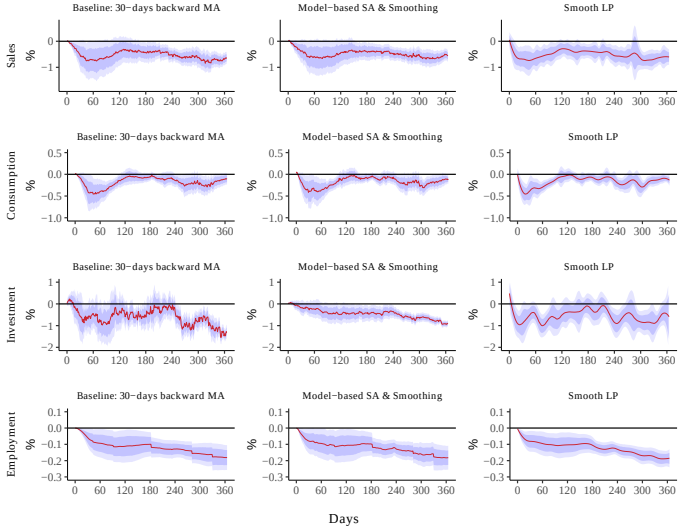
- Similar to employment, the CPI decline is gradual, with a significant but economically small drop in the first semester
- Monetary policy ultimately transmits on the real economy by affecting permanent contract employment.

Short-Lag Dynamics in Industrial Production and Demand

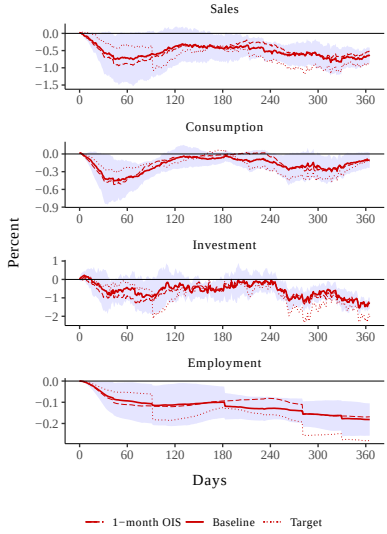


- Same month response of industrial production. (also found in Jarociński and Karadi (2020) and Miranda-Agrippino and Ricco (2021))

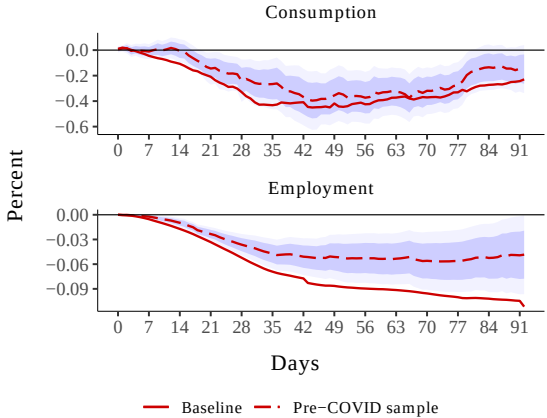
Robustness to Seasonal Adjustment of Daily Series



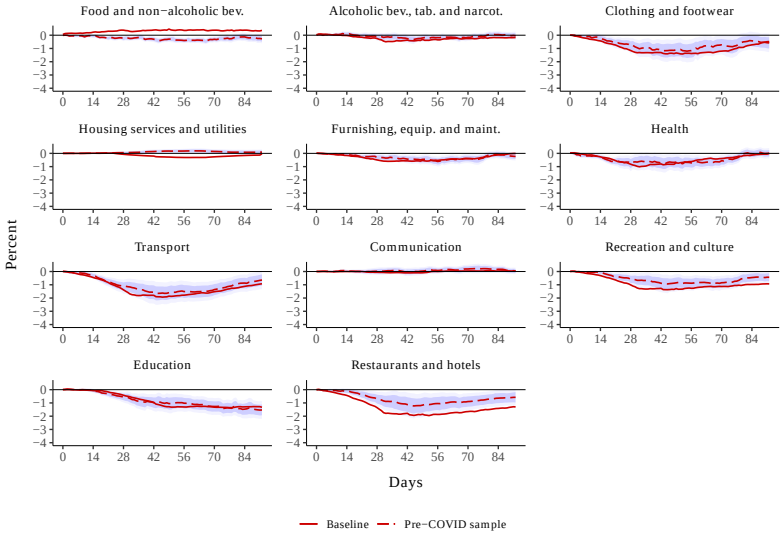
Robustness to Monetary Policy Shocks



Robustness to COVID-19



Robustness to COVID-19



Conclusion

- We have provided evidence on the effects of monetary policy at short lags, assembling a high-quality high-frequency dataset on a large set of variables spanning demand, output, asset prices, expectations and confidence, from different sources. Variables that are traditionally considered slow-moving respond fast.
- Our findings suggest that future research, both theoretical and empirical, would benefit from redirecting focus from mechanisms that delay the transmission of shocks and financial variables to aggregate demand, toward 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.

Conclusion

- Our analysis also shows that the time aggregation of economic activity and monetary policy shocks may distort the identification of monetary policy transmission, shifting the empirical response to longer lags. The issues in time aggregation we document in our paper are therefore relevant to a large empirical literature that routinely aggregates identified monetary policy shocks around policy announcements to quarterly or yearly frequencies: temporal aggregation at these lower frequencies may significantly impair the identification of monetary transmission mechanisms.
- However, our findings also suggest that monthly frequency data provide sufficient granularity to capture the short transmission lags of monetary policy. This is particularly relevant given the increasing availability of monthly aggregate measurements which should, in turn, facilitate the replication of our findings across different countries.