

---

# International Spillovers from Euro Area Monetary Policy to Advanced Small Open Economies: Investment Behavior of Czech Firms

V. Audzei, M. Franta\*

**Second Czech National Bank Workshop on Financial Stability and Macroprudential Policy**

**12 December 2025**

\* Czech National Bank, email: [michal.franta@cnb.cz](mailto:michal.franta@cnb.cz). The views expressed are those of the authors and do not necessarily represent those of the Czech National Bank.

## Aim of the paper

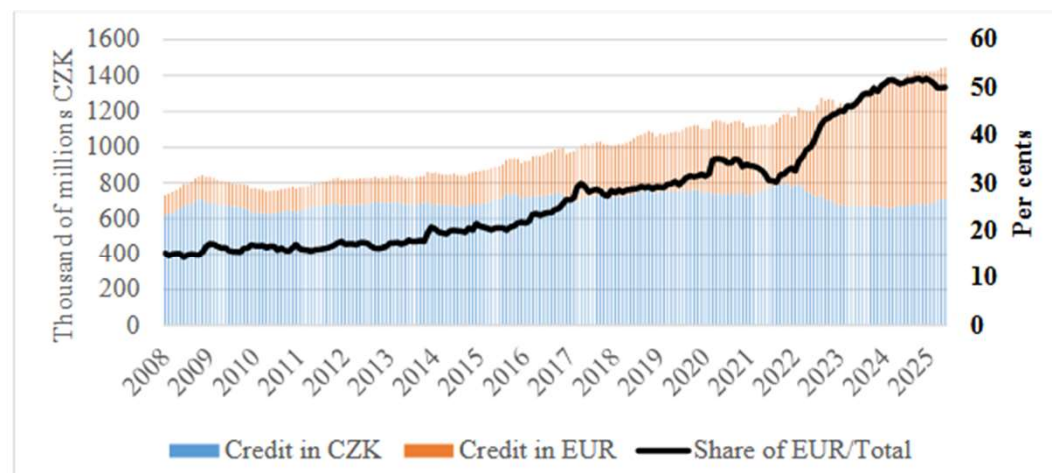
- Examine transmission channels of Euro Area monetary policy spillovers
- Interested in international spillovers to the Czech real economy (investment of firms)

### The Czech case is interesting:

- tight trade links with EA
- credit euroization

=> International spillovers expected via trade and financial channels.

*Figure 2. Composition of Total Loans (Left Axis) and Share of Loans in Euro (Right Axis) to Nonfinancial Institutions vis-a-vis Domestic Banks, Per Cents*



*Note:* The series are from the Czech National Bank ARAD database: Client loans: Monthly, residents - non-financial corporations, total, balance (left axis); share of loans in euro (right axis) is calculated as a share of loans issued in euro to total issued loans, all in CZK million.

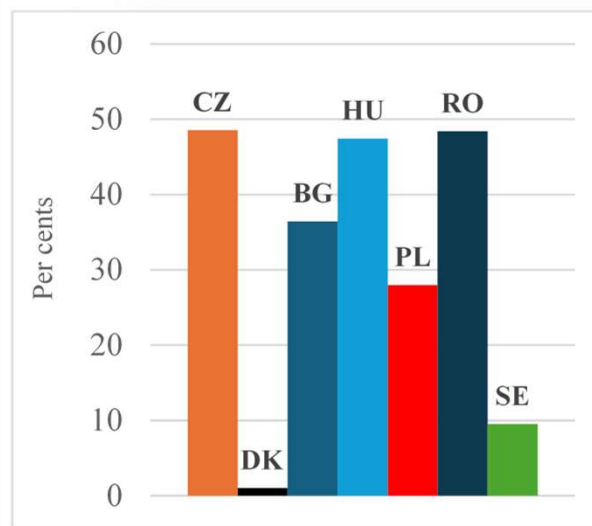
## Aim of the paper

- Examine transmission channels of Euro Area monetary policy spillovers
- Interested in international spillovers to the Czech real economy (investment of firms)

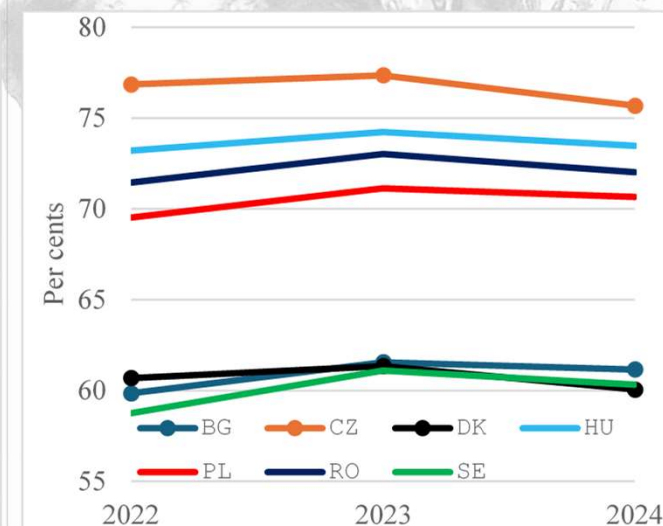
### The Czech case is relevant:

- trade volume and credit euroization similar in HU, RO, PL

*Figure 1. Share of Foreign Currency Loans*



*Figure 2. Share of Trade with EU*



## Literature:

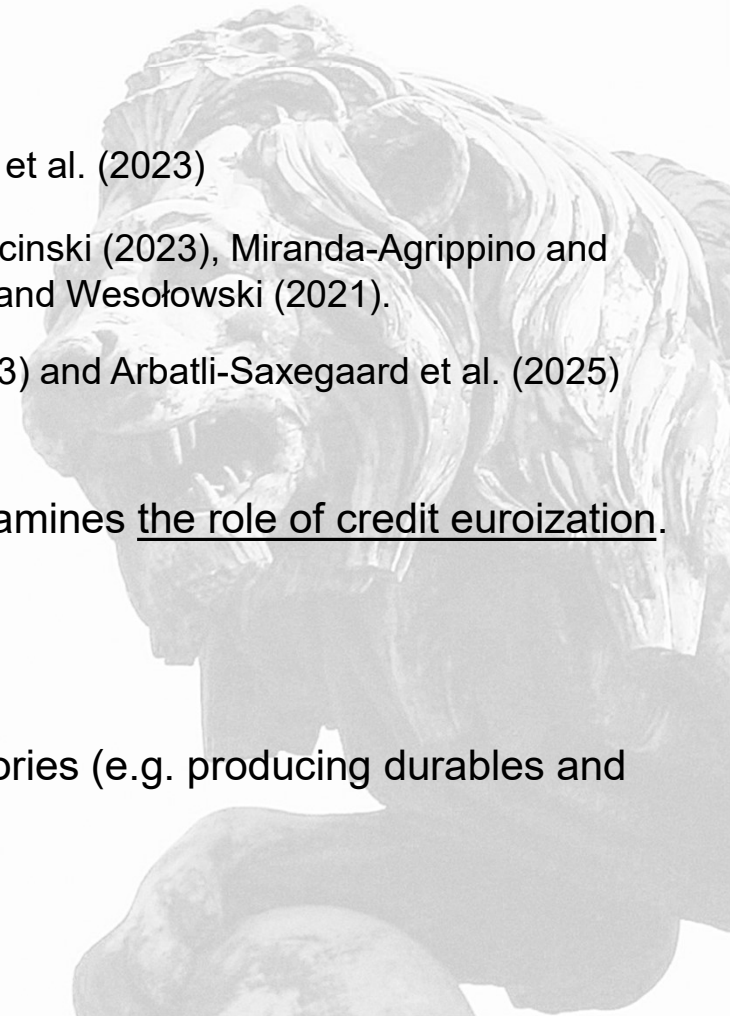
- **Firm-level data to examine MP transmission:** Durante et al. (2022) and Cloyne et al. (2023)
  - **Aggregate data to examine spillovers:** Dedola et al (2017), Georgiadis and Jarocinski (2023), Miranda-Agrippino and Nenova (2022), Ca' Zorzi et al (2020), For EA->CEE: Engler et al (2024) and Walerych and Wesolowski (2021).
- ⇒ **Firm-level data to examine spillovers:** US case - Di Giovanni and Rogers (2023) and Arbatli-Saxegaard et al. (2025)

## Contribution:

The first study that looks at EA MP spillovers based on firm-level data and examines the role of credit euroization.

## Method (Cloyne et al., 2023):

- Panel local projections, high-frequency identified monetary policy shocks
- Differential approach: compare investment behavior of firms in different categories (e.g. producing durables and nondurables, old vs. young,...) after (exogenous) EA MP shock
- Need to be careful with domestic MP and exchange rate,...



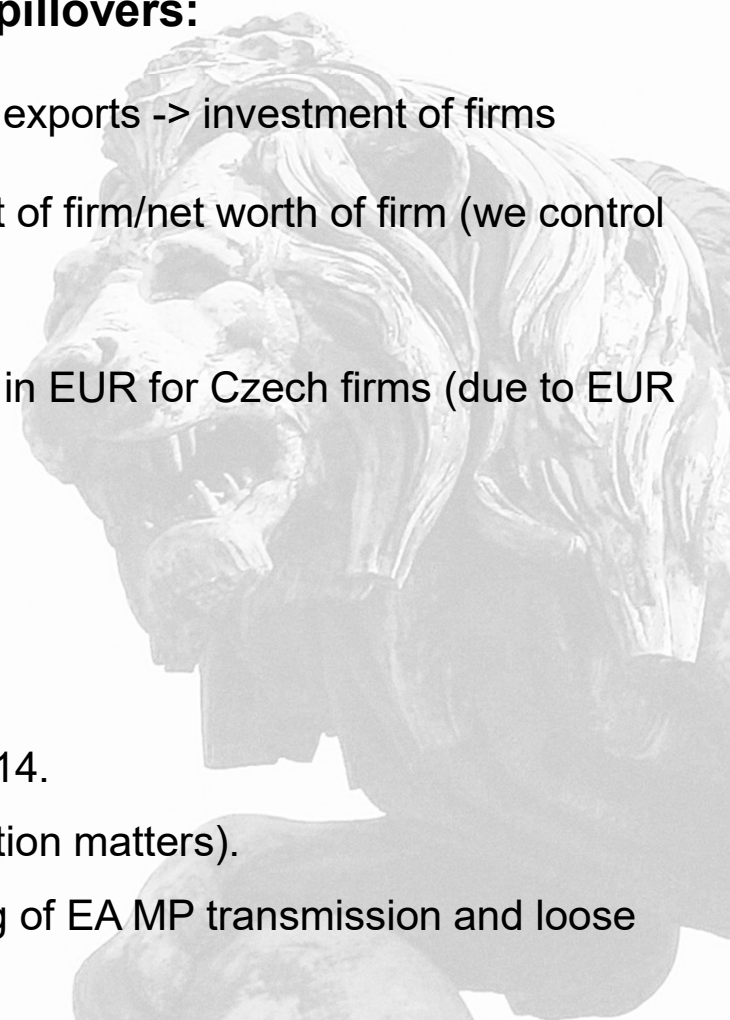
# Channels of spillovers and Findings

## Focus on one real economy and two financial channels of EA MP spillovers:

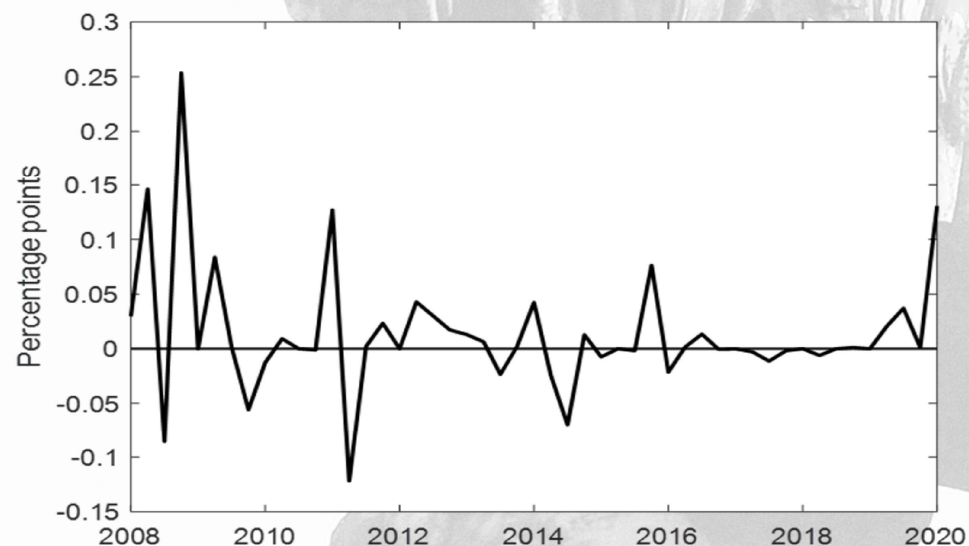
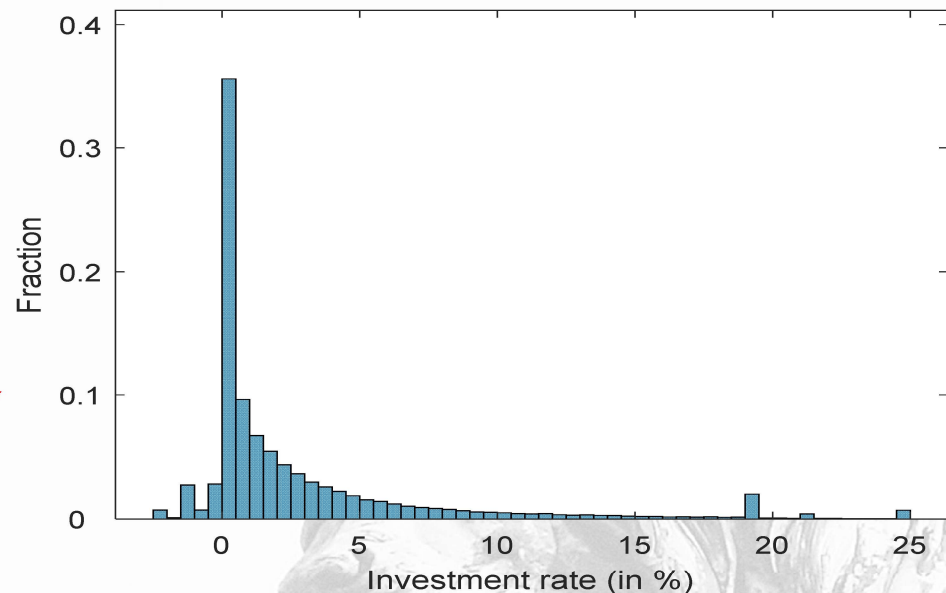
- Export-related trade channel: EA MP shock -> EA demand -> demand for CZ exports -> investment of firms
- Balance sheet channel: EA MP shock -> financial conditions -> balance sheet of firm/net worth of firm (we control for exchange rate) -> investment of firms
- Foreign currency borrowing cost channel: EA MP shock -> cost of borrowing in EUR for Czech firms (due to EUR interest rates and exchange rate) -> investment of firms

## Findings:

- 1) Trade channel is dominant
- 2) Some evidence is found for the balance sheet channel, especially before 2014.
- 3) Foreign currency borrowing cost channel detected after 2014 (credit euroization matters).
- 4) Significant weakening of spillovers after 2014 (consistent with the weakening of EA MP transmission and loose financial conditions)



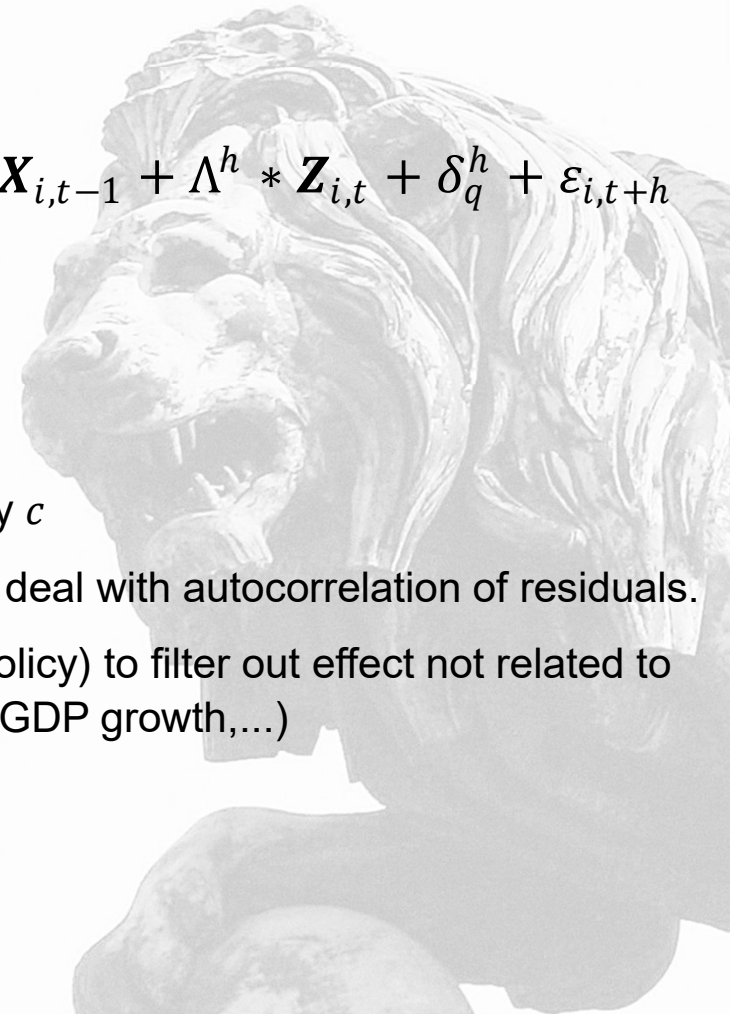
- Quarterly Survey of Financial Indicators (fixed investment, balance sheet data,...) 2008Q1-2020Q1
  - Focus on “normal” times - end of sample 2020Q1
  - Investment rate  $I_t \equiv \frac{FA_t - FA_{t-1}}{FA_{t-1}}$
  - Balance sheet characteristics (net worth, liquidity, leverage,...)
- EA monetary policy shocks (Jarocinski and Karadi, 2020)
- Additional macrovariables:
  - Domestic and foreign macrovars (MP rate, GDP growth, exchange rate, FF rate)
  - Log of VIX, credit spreads



$$\Delta^h I_{i,t-1} = \alpha_i^h + \sum_c \beta_c^h * D_{i,t-1}^c * Shock_t + \sum_c \gamma_c^h * D_{i,t-1}^c + \Gamma^h * \mathbf{X}_{i,t-1} + \Lambda^h * \mathbf{Z}_{i,t} + \delta_q^h + \varepsilon_{i,t+h}$$

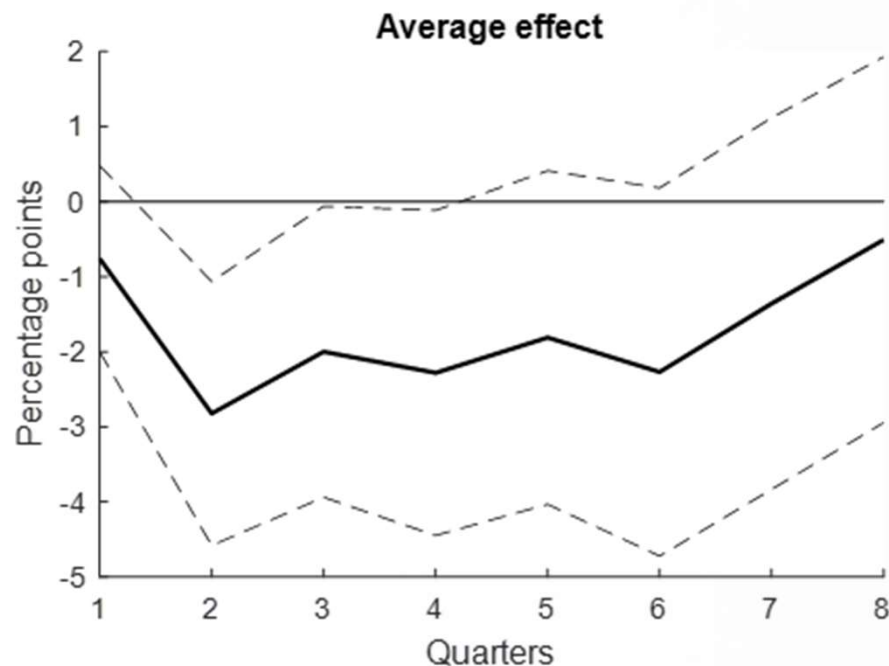
where  $\Delta^h I_{i,t-1} \equiv I_{i,t+h} - I_{i,t-1}$ .

- $\alpha_i^h$  is firm's fixed effect
- $D_{i,t-1}^c$  is dummy variable indicating firm  $i$  at quarter  $t - 1$  belongs to category  $c$
- $\mathbf{X}_{i,t-1}$  includes lagged shock variable and lagged (diff of) investment rate to deal with autocorrelation of residuals.
- $\mathbf{Z}_{i,t}$  includes domestic macrovars (e.g. exchange rate, domestic monetary policy) to filter out effect not related to specific channel, balance sheet characteristics, foreign macrovars (VIX, EA GDP growth,...)
- $\delta_q^h$  quarterly dummies to account for seasonality
- Standard errors are clustered by firm and quarter



## Results: Average effect

$$\Delta^h I_{i,t-1} = \alpha_i^h + \beta^h * Shock_t + \Gamma^h * X_{i,t-1} + \Lambda^h * Z_{i,t} + \delta_q^h + \varepsilon_{i,t+h}$$

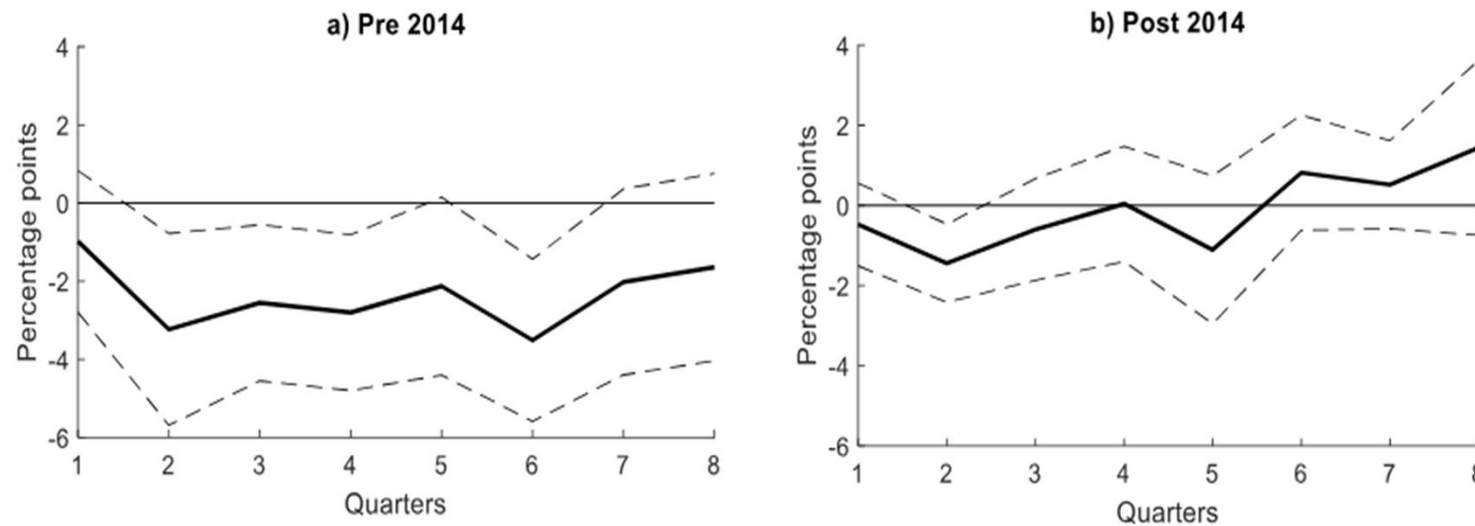


- Usual profile.
- Economically significant effect (median absolute investment rate QoQ change is 1.04).
- Economically intuitive estimates of other parameters. ( $\Rightarrow$ )
- There is substantial heterogeneity behind the average effect.

Average Firm Response of Investment Rate to the Euro Area Contractionary Monetary Policy Shock of Size 1 pp.  
Sample for estimation 2008Q1 - 2020Q1.

## Average effect (subsamples)

*Figure 6. Average Firm Response of Investment Rate to the EA Monetary Policy Contractionary Shock of Size 1 pp before 2014 and after 2014*

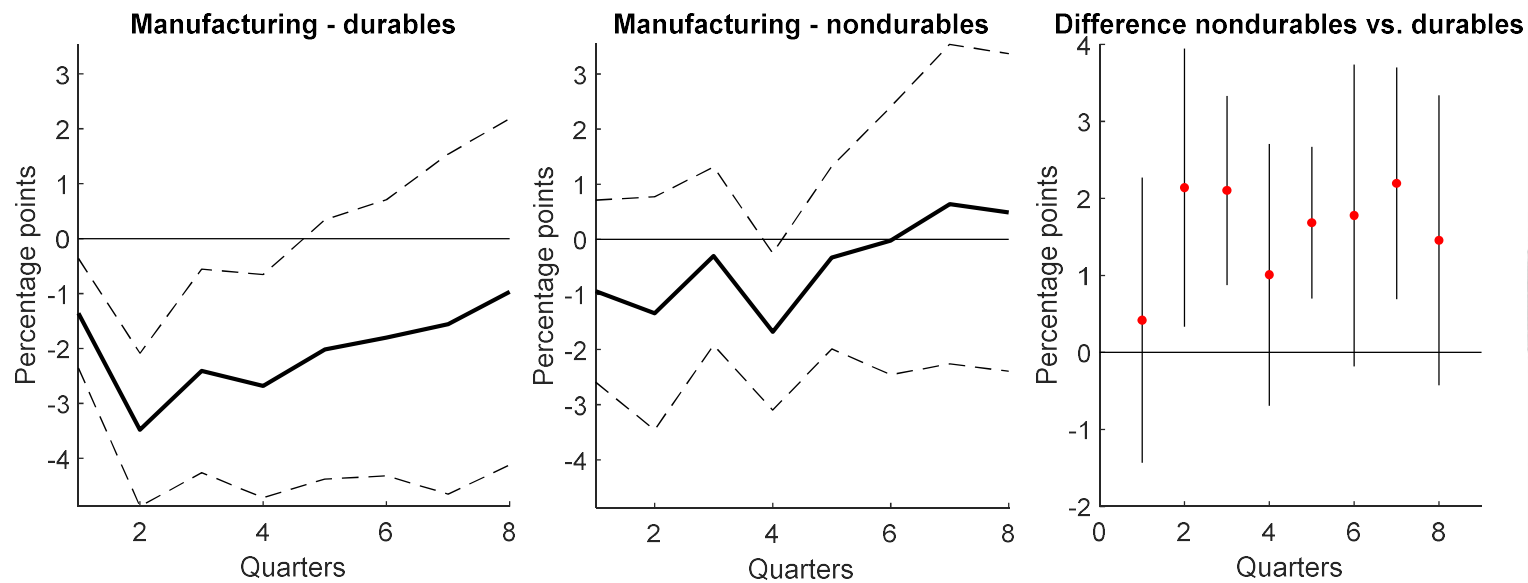


*Note:* Dashed lines indicate 95 % confidence interval. Model estimated on subsamples 2008Q1-2013Q4 (panel a) and 2014Q1-2020Q1 (panel b).

- Important change after 2014.
- The difference is not due to firms (observable and unobservable) characteristics.

# Export-related trade channel

Figure 1. Responses of Investment Rate after 1 pp EA Contractionary Monetary Policy Shock for Firms Producing Durables and Nondurables.



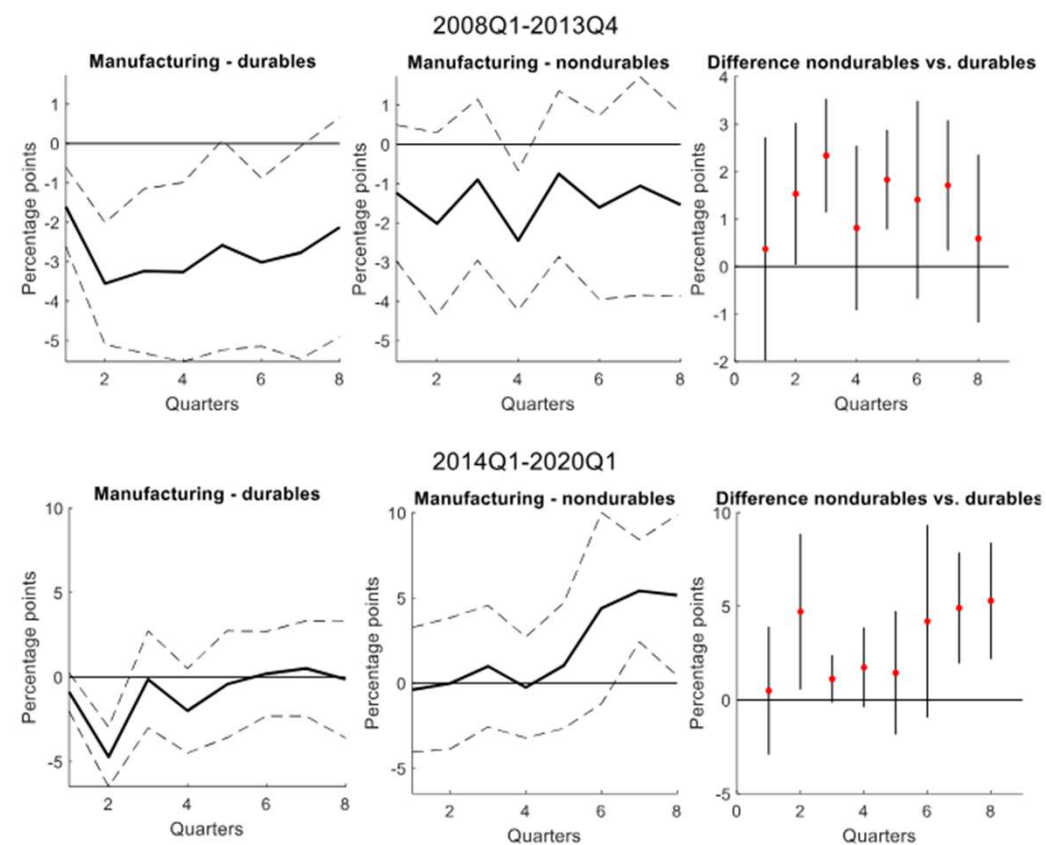
**Note:** Left and central panels show the response of the investment rate, while the right panel shows the difference between the two responses. Dashed lines in left two panels indicate 95 % confidence interval. Vertical lines in the right panel indicate 95 % confidence intervals. Dataset covers 2008Q1-2020Q1.

- Firms producing durables cut investment more (similar with manufacturing vs services =>).
- Demand for durables is more interest rate sensitive than demand for nondurables (Peersman and Smets, 2005)

**=> trade channel is present**

## Evolution of trade channel over time

**Figure 8. Responses of Investment Rate after 1 pp EA Contractionary Monetary Policy Shock for Firms Producing Durables and Nondurables and for Subsamples 2008Q1-2013Q4 and 2014Q1-2020Q1.**

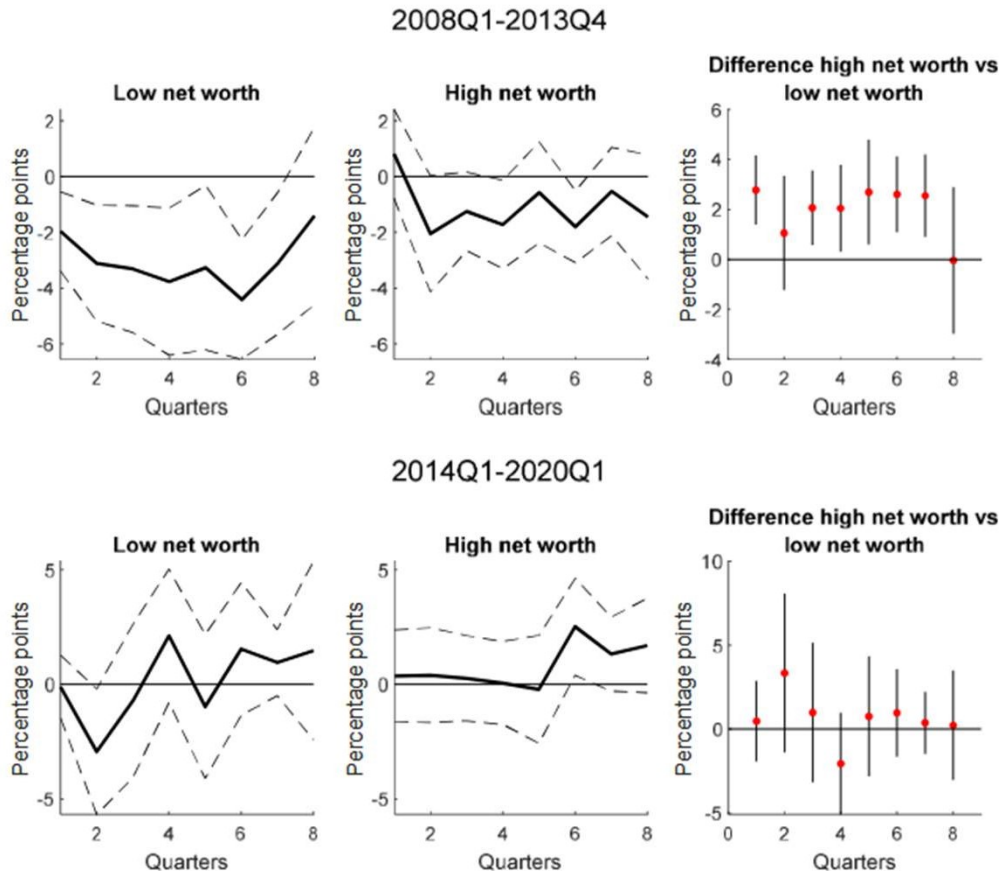


**Note:** Left and central panels show the response of the investment rate, while the right panels shows the difference between the two responses. Dashed lines in left and central panels indicate 95 % confidence interval. Vertical lines in the right panels indicate 95 % confidence intervals.

- The difference between durables and nondurables remains (although uncertainty is higher) => the channel works similarly both before and after 2014.
- The link EA MP -> domestic investment is much weaker.
- Consistent with weaker transmission of EA monetary policy to the EA real economy (EA demand) during the NIRP and QE.

# Balance sheet channel

*Figure 11. Responses of Investment Rate after 1 pp EA Contractionary Monetary Policy Shock for the Firms with Low Net Worth and for the Firms with High Net Worth and for Subsamples 2008Q1-2013Q4 and 2014Q1-2020Q1*



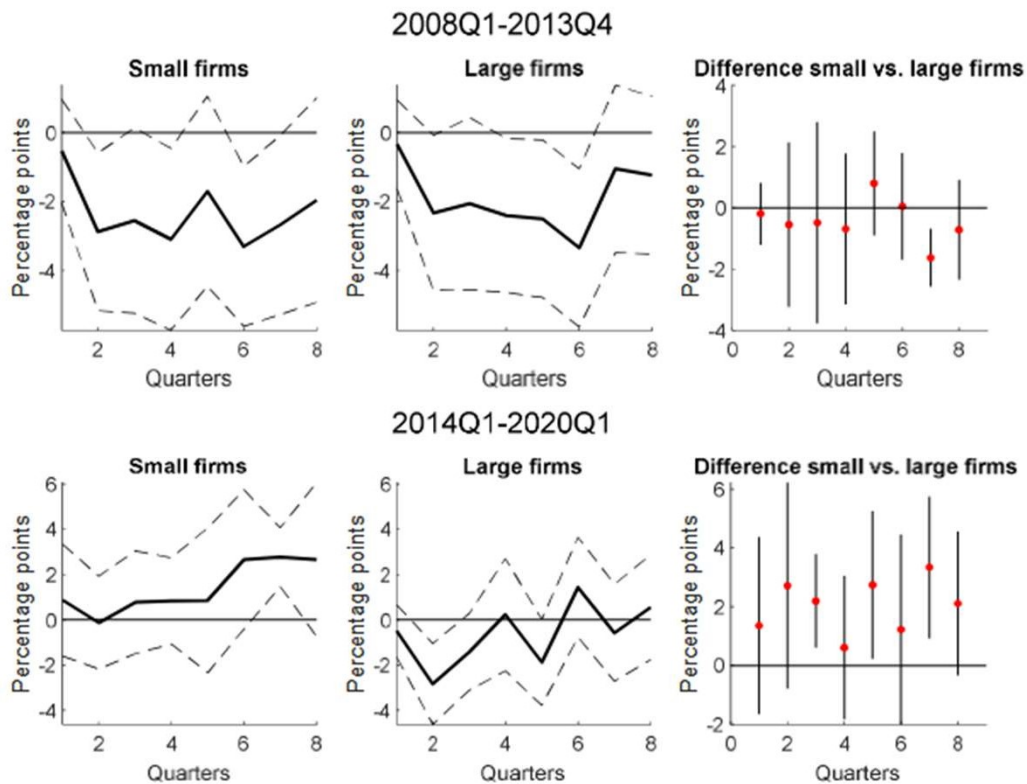
- Compare financially constrained and unconstrained firms
- **Net worth** (= (liquid assets + fixed assets – liquid liabilities)/total assets):
- Low-net-worth firms cut investment more before 2014
- No effects after 2014 - abundant credit, no constraints for investment.

**=> balance sheet channel present before 2014, after 2014 loose financial conditions**

*Note:* Left and central panels show the response of the investment rate, while the right panel shows the difference between the two responses. Dashed lines in left two panels indicate 95 % confidence interval. Vertical lines in the right panel indicate 95 % confidence intervals. Dataset covers 2008Q1-2020Q1.

## Foreign currency borrowing cost channel

*Figure 13. Responses of Investment Rate after 1 pp EA Contractionary Monetary Policy Shock for Small and Large Firms and for Subsamples 2008Q1-2013Q4 and 2014Q1-2020Q1*



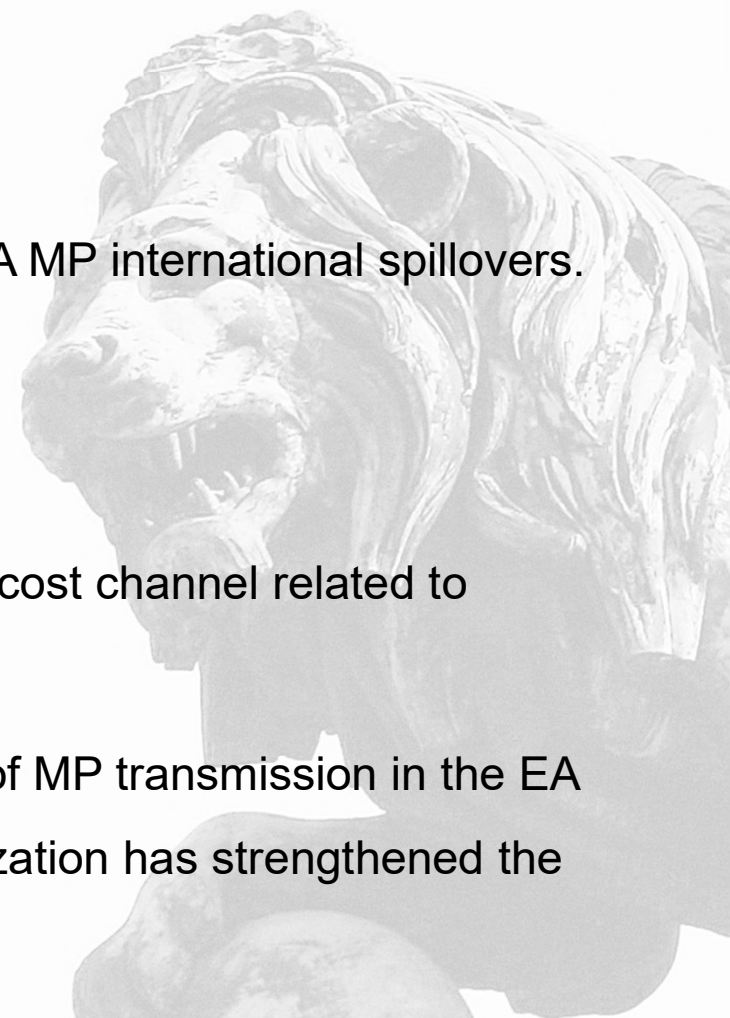
*Note:* Share of credit is calculated relative to the size of firm's balance sheet. Left and central panels show the response of the investment rate, while the right panel shows the difference between the two responses. Dashed lines in left two panels indicate 95 % confidence interval. Vertical lines in the right panel indicate 95 % confidence intervals.

- Differential approach would ideally compare firms with high share of loans in EUR to those with low share.
- No firm-level data => we compare **large and small firms**
  - Empirical evidence that large firms borrow large loans in EUR more (Gric et al., 2025)
  - Theoretical reasoning for the same
  - Size = log of assets
- Control for firm's net worth and VIX and not for the exchange rate to distinguish from the BS channel
- Large firms cut investment more after 2014

**=> Foreign currency borrowing cost channel detected after 2014 (effect of credit euroization)**

## Conclusions

- Firm-level data are used to examine transmission channels of EA MP international spillovers.
- EA MP shock -> investment rate of Czech firms
- Trade channel crucial (always works)
- Financial channels detected as well, foreign currency borrowing cost channel related to credit euroization.
- Spillovers weakened after 2014, consistent with the weakening of MP transmission in the EA during QE and NIRP and loose financial conditions. Credit euroization has strengthened the effect but does not overbalance the overall weakening.



# Back up slides



## Average effect

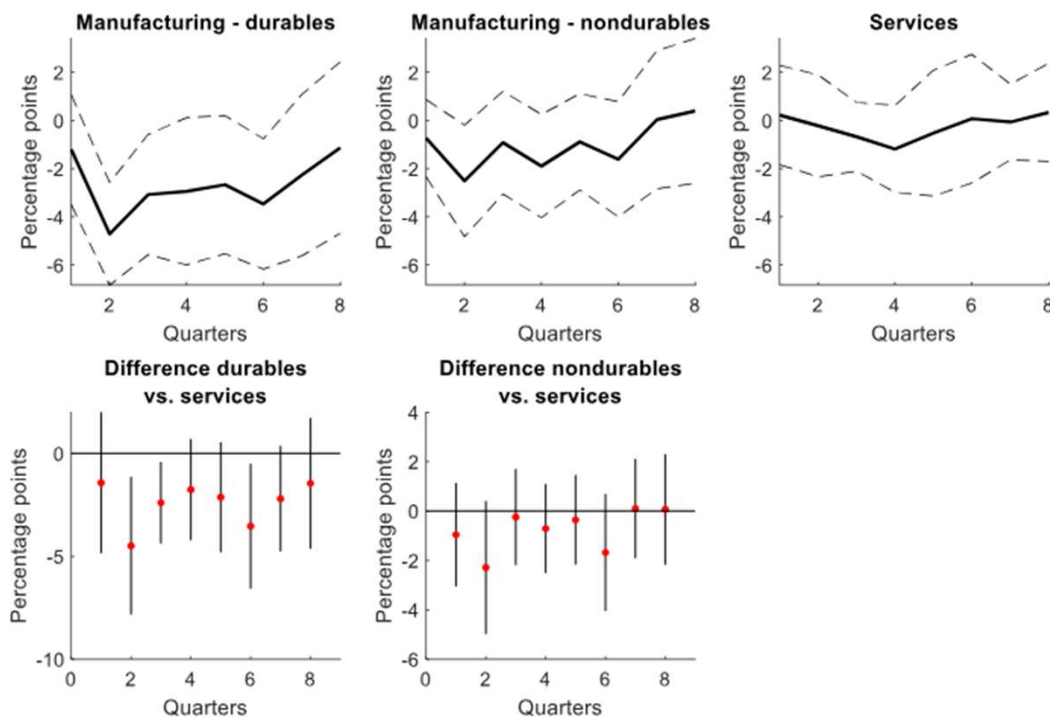
**Table B1: Estimation results based on subsample 2008Q1-2020Q1**

Horizon (Q):	1	2	3	4	5	6	7	8
$Shock_t$	-0.76 (0.63)	-2.82*** (0.9)	-2** (0.99)	-2.28** (1.1)	-1.81 (1.13)	-2.27* (1.25)	-1.36 (1.26)	-0.51 (1.24)
$\delta_1^h$	0.66*** (0.09)	1.71*** (0.1)	-1.03*** (0.09)	0.9*** (0.1)	0.74*** (0.12)	1.75*** (0.14)	-1.06*** (0.12)	0.95*** (0.12)
$\delta_2^h$	1.56*** (0.1)	-0.22** (0.09)	-0.88*** (0.07)	0.83*** (0.08)	1.67*** (0.13)	-0.18* (0.11)	-0.89*** (0.1)	0.85*** (0.11)
$\delta_3^h$	-0.8*** (0.1)	-0.45*** (0.1)	-1.3*** (0.09)	1.33*** (0.1)	-0.64*** (0.11)	-0.38*** (0.12)	-1.34*** (0.11)	1.38*** (0.12)
$Shock_{t-1}$	-2.21** (0.88)	-1.81 (1.16)	-2.84*** (0.95)	-2.42*** (0.74)	-2.93*** (1.09)	-2.54** (1.09)	-1.9* (1.04)	-1.23 (0.95)
$\Delta I_{i,t-2}$	-0.45*** (0.02)	-0.46*** (0.02)	-0.53*** (0.01)	-0.44*** (0.02)	-0.5*** (0.02)	-0.48*** (0.02)	-0.53*** (0.01)	-0.46*** (0.02)
$CZMP_t$	-0.03 (0.03)	-0.11** (0.05)	-0.24*** (0.04)	-0.28*** (0.05)	-0.31*** (0.06)	-0.32*** (0.06)	-0.36*** (0.07)	-0.36*** (0.07)

**Note:** Standard errors in parentheses. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

## Export-related trade channel

**Figure B1. Responses of Investment Rate after 1 pp EA Contractionary Monetary Policy Shock for Firms Producing Durables, Nondurables and Firms in Services**



**Note:** Top panels show the response of the investment rate, while bottom panels show the difference between responses. Dashed lines in the top panels indicate 95 % confidence interval. Vertical lines in the bottom panels indicate 95 % confidence intervals.

