EUROPEAN CENTRAL BANK

Financing gaps, monetary policy, and investment: Evidence from a new euro-area index

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Motivation

- Financing gap (discrepancy between capital sought and obtained) is a critical obstacle to firm growth and performance
- Accurate measurement difficult: data limitations and absence of widely accepted metrics
- Several approaches: indicators based on financial statements, observed credit outcomes, firms' self-assessments
- The European Central Bank's (ECB) Survey on Access to Finance of Enterprises (SAFE) provides valuable firm-level evidence on perceived financing constraints
- Broader financial and macroeconomic conditions, such as credit market tightness, interest rate dynamics, and shifts in risk appetite, play a crucial role in shaping financing-gap dynamics over time

Goal of this paper

- Novel index of **financing gap** integrating survey-based **firms' perceptions** ($Fin\ Gap_t^{SAFE}$) and **financial market information**
- Use Partial Least Squares (PLS) methods to extract the latent common component ($Fin\ Gap_t^{PLS}$)
- An information-rich indicator for the latent financing conditions underlying firms' reported financing gaps
- Empirical application: the association of the new index with future investment and the impact of monetary policy on firms investment for different levels of financing gap

SAFE financing gap

ECB-EC Survey on Access to Finance of Enterprises (SAFE) survey

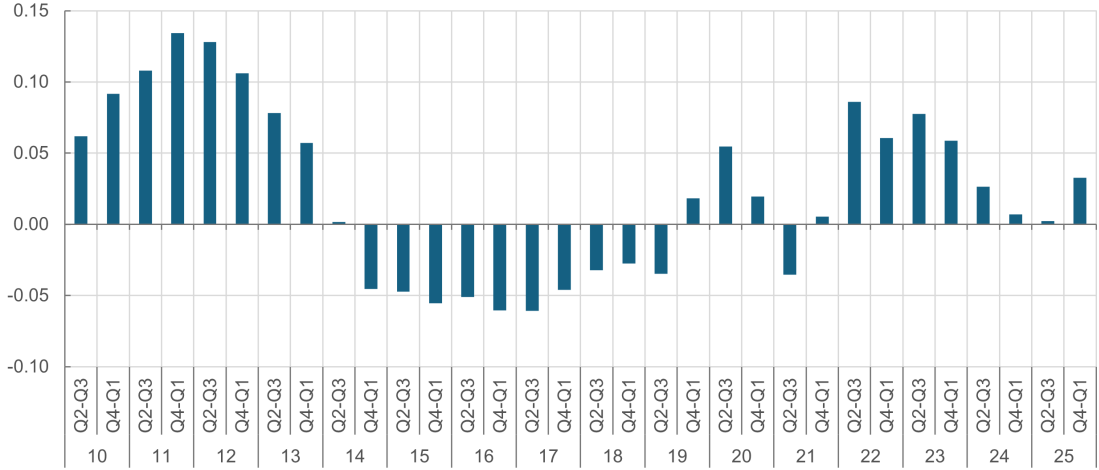
- *"For each of the following types of external financing* — **bank loans, credit lines, trade credit, equity, and debt security issuance** — *please indicate whether your needs (availability) increased, remained unchanged, or decreased during the previous six months"*

For each type of financing:

- **Financing gap indicator** : **1** (-1) if the **need increases** (decreases) and the **availability decreases** (increases). If only a one-sided increase (decrease), the indicator takes the value of 0.5 (-0.5)

- **SAFE financing gap** at firm level: sum of the financing gap indicators for all relevant sources of financing divided by the total number of these sources

SAFE financing gap over time



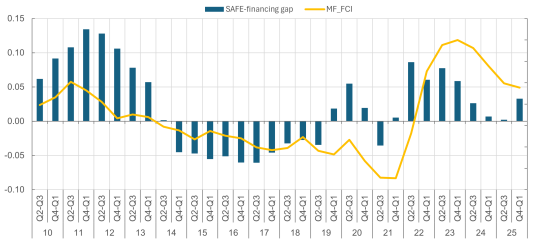
Financial market predictors

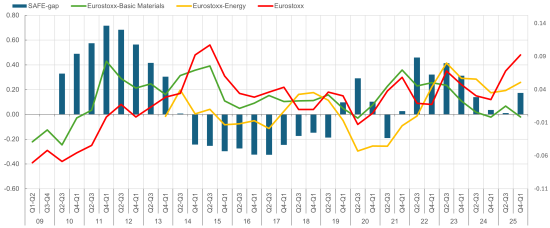
Prior research on financing constraints and credit market conditions highlights both demand-side and supply-side determinants of external financing

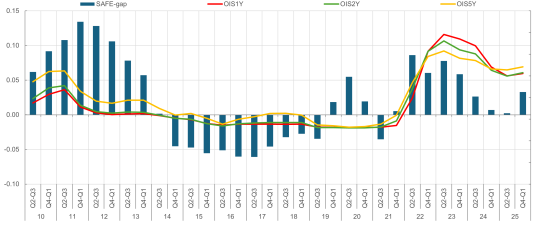
Six categories of financial market indicators:

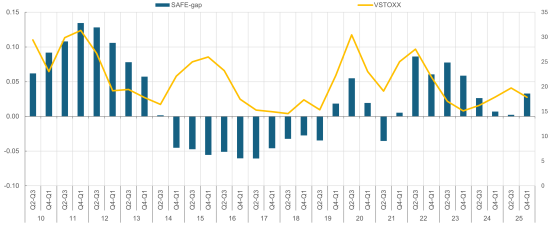
- risk free rates (OIS)
- spreads (NFCHY, NFCIG, sovereign spreads)
- equity (Eurostoxx)
- volatility, FX and commodities (VSTOXX, Vol10yBund, EURUSD, Brent oil)
- financial conditions (MF-FCI,GSFCI)
- valuation and profitability (CAPE, Earnings)

Financing gap and selected financial market indicators over time









Empirical methodology (I)

- Assumption: There is a **latent common factor** underlying financial market variables that also drives the SAFE-financing gap
- Method: We use Partial Least Squares (PLS) to extract a latent factor from macro-financial variables that maximises the covariance with the future SAFE-financing gap
- The latent factor $FinGap_t^{PLS}$ is the new index of financing gap
- PLS allows us to identify and isolate the most informative dimensions of variation
- PLS identifies components that maximise their covariance with the outcome of interest. This ensures that the resulting factors are more directly related to the relationship under study and less likely to capture variation that is orthogonal to the dependent variable

Empirical methodology (II) : calculation at the macro level

Step 1: time-series regressions for each financial market indicator

- We run N time-series regressions

$$x_{i,t-1} = \pi_{i,0} + \pi_i \text{SAFE-gap}_t + \varepsilon_{i,t-1} \tag{1}$$

- $x_{i,t}$: standardized indicator i
- SAFE-gap$_t$: SAFE financing gap (wave level)
- π_i: sensitivity of each $x_{i,t}$ to the latent factor instrumented by the future SAFE gap

Step 2: cross-sectional regressions

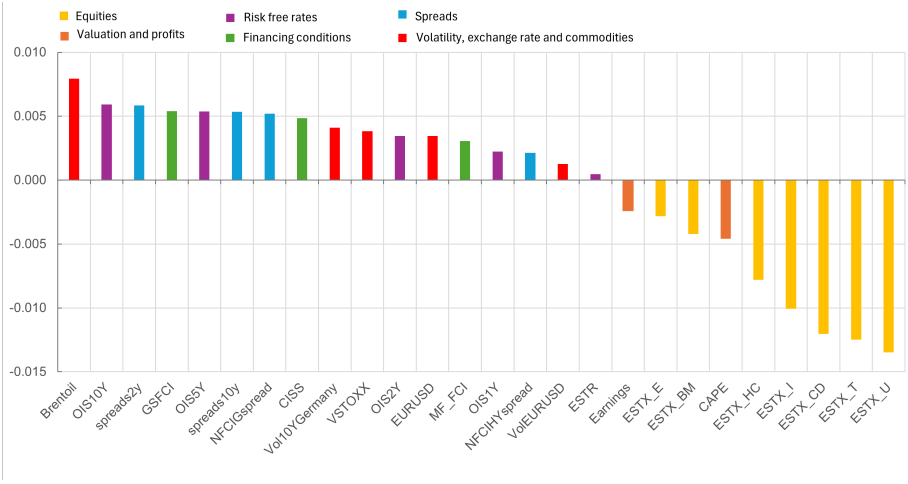
- We run T cross-sectional regressions

$$x_{i,t} = \alpha_{0,t} + \alpha_t \hat{\pi}_i + \varepsilon_{i,t} \tag{2}$$

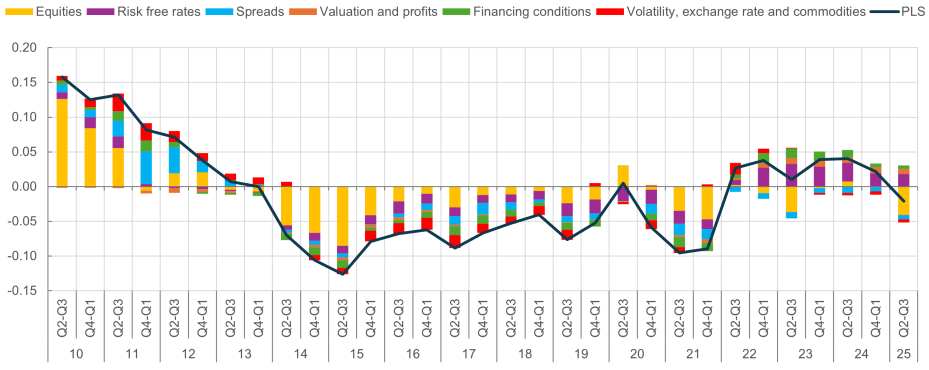
- $\hat{\pi}$ is the first-stage loadings estimated in Eq. 1
- $FinGap_t^{PLS}$: is the coefficient estimated α_t in Eq. 2

Weights of the financial market indicators

The resulting $FinGap_t^{PLS}$ can be expressed as a **linear combination** of the financial market indicators with specific weights

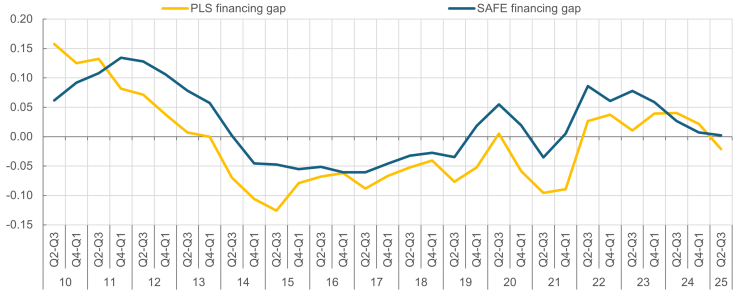


$FinGap_t^{PLS}$ and its decomposition over time



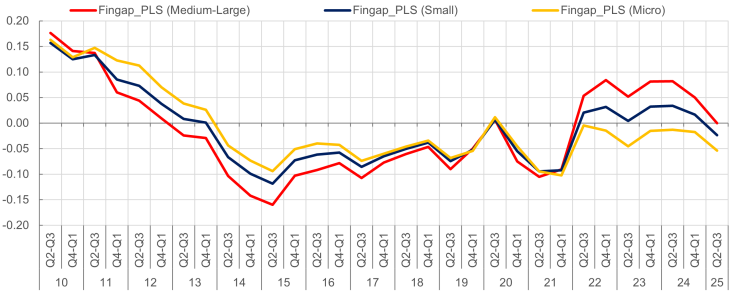
Index validation (I)

- Time series validation: The two measures display a common cyclical pattern



Index validation (II)

- Cross-sectional validation: The PLS index is persistently higher for micro and small firms, as well as for construction and manufacturing Chart



Index validation (III)

- Benchmark validation: Wider financing gaps are associated with greater incidence of financing obstacles; higher rejection and discouragement rates; a greater likelihood that firms report borrowing costs or collateral requirements as binding constraints, and a deterioration in the availability of bank-based finance

	(1) Financially constrained	(2) Access to finance is a problem	(3) Vulnerable	(4) Discouraged borrowers	(5) Applied for loan but rejected	(6) Received limited amount	(7) Loan too costly
Fin Gap^{PLS}	0.103***	0.169***	0.081***	0.039***	0.008	0.026***	0.018***
	(0.015)	(0.022)	(0.012)	(0.011)	(0.006)	(0.007)	(0.005)

Index validation (IV)

- Correlations: Wider financing gaps are associated with lower contemporaneous and future ESI and GDP growth, and with higher unemployment
- The PLS index captures financing conditions that deteriorate in weaker macroeconomic environments and improve during expansions

Variable	Lead	$Fin\ Gap_t^{PLS}$		$Fin\ Gap_t$	
		corr	p-value	corr	p-value
ESI	0	-0.560***	0.001	-0.724***	0.000
	1	-0.573***	0.001	-0.736***	0.000
	2	-0.521***	0.004	-0.591***	0.001
	3	-0.568***	0.002	-0.516***	0.005
	4	-0.594***	0.001	-0.486**	0.010
GDP	0	-0.257	0.171	-0.339*	0.062
	1	-0.216	0.251	-0.278	0.137
	2	-0.110	0.571	-0.081	0.676
	3	-0.207	0.290	-0.030	0.879
	4	-0.209	0.296	-0.049	0.809
UNEMPL	0	0.032	0.868	0.146	0.434
	1	0.165	0.385	0.272	0.147
	2	0.281	0.139	0.348*	0.064
	3	0.405**	0.033	0.406**	0.032
	4	0.506***	0.007	0.462**	0.015

Towards a more disaggregated index

- Macro index is informative but analysis based on firm heterogeneity needs more granular data
- One caveat : Firm-level PLS approach requires long panels; SAFE rotating panel limits this

Our approach:

- Use semi-aggregated index based on *cell-level information* : size $\times$ sector $\times$ country
  - 3 size classes (1-10, 11-49, 50+)
  - 4 sectors (manufacturing, construction, services and trade)
  - 20 countries
  - final number of cells: 213

Financing gaps and future investment

$$Investment_{c,t+1} = \beta_1 \, FinGap_{c,t}^{PLS} + \beta_2 Controls_{c,t} + \alpha_c + \gamma_{st} + \varepsilon_{c,t}$$

- **Hypothesis 1A**: Future investment is inversely related to the scale of the financing gap
- A negative and significant β_1 suggests that wider financing gaps are associated with lower investment

Financing gaps and future investment

	(1)	(2)	(3)	(4)	(5)
Fin Gap^{PLS}	-0.069**	-0.055***	-0.074***	–	-0.078**
	(0.027)	(0.017)	(0.026)	–	(0.030)
Fin Gap^{SAFE}	–	–	–	-0.021	0.011
	–	–	–	(0.028)	(0.035)
Observations	2,768	2,769	2,769	3,237	2,760
R-squared	0.11	0.04	0.11	0.10	0.11
Controls	Yes	Yes	Yes	Yes	Yes
Country FEs	No	Yes	Yes	Yes	Yes
Sector FEs	No	Yes	No	No	No
Sector*Time FEs	No	No	Yes	Yes	Yes
Cell FEs	Yes	No	No	No	No
Time FEs	Yes	No	No	No	No

- Strong negative association between a cell's financing gap and its investment in the subsequent survey round
- A one-standard-deviation increase in financing gap is associated, on average, with about a 1.2 percentage point decrease

Widening and narrowing of the gaps

$$Investment_{c,t+1} = \beta_1 FinGap_{c,t}^{PLS,+} + \beta_2 FinGap_{c,t}^{PLS,-} + \beta_3 Controls_{c,t} + \alpha_c + \gamma_{st} + \varepsilon_{c,t}$$

- **Hypothesis 1B**: Future investment responds asymmetrically to changes in financing gaps.
- We expect β_1 to be negative and statistically significant, while β_2 should be smaller in magnitude or insignificant.

Widening and narrowing of the gaps

	(1)	(2)	(3)
$\Delta FinGap^{PLS,+}$	-0.092^{*}	-0.109^{***}	-0.128^{***}
	(0.046)	(0.035)	(0.034)
$\Delta FinGap^{PLS,-}$	-0.019	-0.061^{**}	-0.051^{*}
	(0.030)	(0.027)	(0.028)
Observations	3,249	3,250	3,250
R-squared	0.070	0.061	0.058
Controls	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Sector $\times$ wave FE	Yes	Yes	Yes

- The coefficient on the widening component of the financing gap is negative and statistically significant, while the coefficient on the narrowing component is economically negligible
- A 0.10 increase in the widening component of the PLS financing gap is associated with about a 0.92 percentage point decline in future investment.

The role of monetary policy

$$Investment_{c,t+1} = \beta_1 FinGap^{PLS}_{c,t} + \beta_2 MP_t + \beta_3 (FinGap^{PLS}_{c,t} \times MP_t) + \beta_4 Controls_{c,t} + \alpha_c + \gamma_{st} + \varepsilon_{c,t}$$

- MP_t: forward guidance surprises aggregated to SAFE wave Chart

- **Hypothesis 2**: Firms with larger financing gaps reduce investment more sharply in response to contractionary monetary policy surprises

- A negative β_3 implies that a larger financing gap amplifies the negative impact of a tightening surprise

Financing gap and the role of monetary policy

	(1)	(2)	(3)
MP	0.000	–	–
	(0.000)	–	–
Fin Gap_t^{PLS}	-0.056***	-0.068***	-0.075***
	(0.009)	(0.014)	(0.015)
MP x Fin Gap_t^{PLS}	-0.003***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)
Observations	2,769	2,769	2,769
R-squared	0.01	0.04	0.09
Cell FE	Yes	Yes	Yes
Wave FE	No	Yes	No
Sector x Wave FE	No	No	Yes

- Under tightening conditions, investment declines even more where financing gaps are larger
  - with a difference of 4.3 % between the bottom and top deciles of financing gap

Robustness tests

- Anticipation of future investment opportunities ▸ Table
- Removing high-leverage firms ▸ Table
- Within-wave heterogeneity of the PLS index ▸ Figure

Conclusion

- We develop a novel financing-gap index ($Fin\ Gap_t^{PLS}$) that accounts for firms perceptions and financial sector developments
  - Moves beyond survey-based measures
  - Extracts latent factors from a large set of financial market indicators
  - Macro level index and also semi-aggregated index

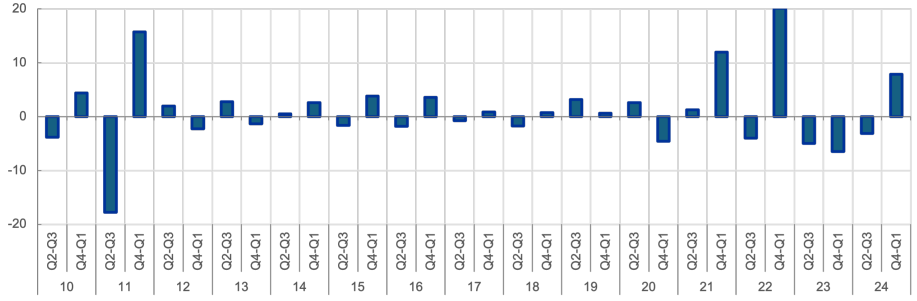
Policy relevance

- Financing gap index as a tool to monitor monetary transmission
- Complements indicators of financial conditions and credit gap
- We provide academics and policymakers with an index that can be used in empirical analyses, both as a dependent and explanatory variable, to examine the role of financing constraints in more detail

Thank you for your attention!

Appendix

Monetary policy surprises



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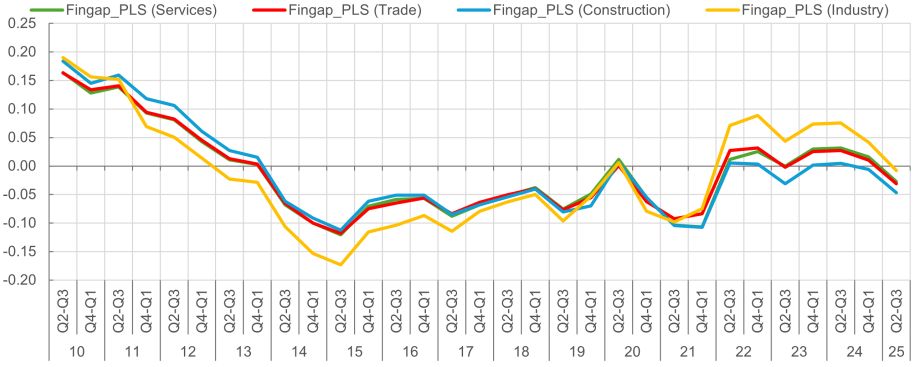
Sectoral decomposition



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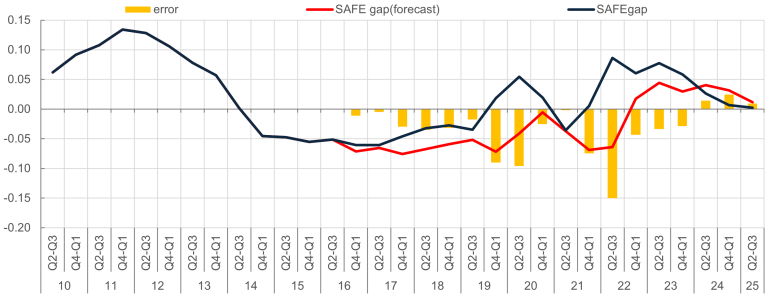
Predicting the SAFE-gap with $Fin\ Gap_t^{PLS}$



- Out of sample forecast of SAFE-gap with increasing training sample
- Bigger discrepancies in COVID period (2020) and energy crisis (end 2021-2022)

Horse race

	(1)	(2)	(3)
Fin Gap^{PLS}	-0.060**	-0.054*	-0.051*
	(0.024)	(0.030)	(0.030)
Fin Gap	-0.067*	–	-0.046
	(0.033)		(0.029)
Pred. Fin. gap	–	-0.099*	-0.054
		(0.053)	(0.056)
Observations	3,501	3,437	3,437
R-squared	0.19	0.20	0.20
Country FEs	Yes	Yes	Yes
Sector*Time FEs	Yes	Yes	Yes

- The PLS-based financing-gap index remains negatively and significantly associated with cell-level investment Slide

Leads and lags

	(1)	(2)	(3)
Lag1 *Fin Gap*^{PLS}	0.001	0.008	0.006
	(0.030)	(0.022)	(0.030)
Lag2 *Fin Gap*^{PLS}	-0.015	-0.045	-0.012
	(0.045)	(0.029)	(0.035)
Fin Gap^{PLS}	-0.066**	-0.049**	-0.056**
	(0.030)	(0.020)	(0.026)
Lead2 *Fin Gap*^{PLS}	-0.008	-0.002	0.005
	(0.048)	(0.029)	(0.043)
Lead3 *Fin Gap*^{PLS}	-0.025	0.010	-0.017
	(0.041)	(0.024)	(0.035)
Observations	2,689	2,690	2,690
R-squared	0.19	0.12	0.14
Country FEs	Yes	No	Yes
Sector FEs	Yes	No	No
Sector×Time FEs	No	No	Yes
Cell FEs	No	Yes	No

- The absence of predictive power in leads beyond the dependent variable's horizon is consistent with financing frictions depressing investment rather than pre-trend confounds Slide

Leverage

	(1)	(2)	(3)
MP (FG)	0.000	–	–
	(0.000)	–	–
Fin Gap^{PLS}	-0.048*	-0.057	-0.071***
	(0.027)	(0.036)	(0.024)
Fin Gap^{PLS} $\times$ *MP*	-0.006*	-0.005	-0.006*
	(0.003)	(0.003)	(0.003)
Controls	Yes	Yes	Yes
Observations	1,905	1,895	1,905
R^2	0.07	0.20	0.13
Sector FEs	Yes	No	No
Sector*Time FEs	No	No	Yes
Cell FEs	No	Yes	No
Time FEs	No	Yes	No

- Removing high-leverage firms leaves the results unchanged

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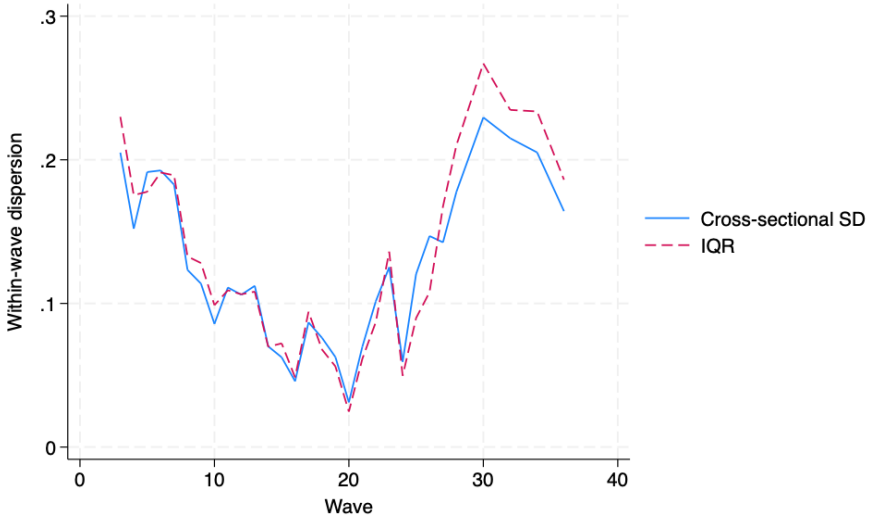
Within-wave dispersion of the cell-level PLS index