CompNet The Competitiveness Research Network

Firm Responsiveness over the Business Cycle

New Evidence From Europe

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How do firms react to unexpected changes to their productivity?

- Firms' **responsiveness** is key to understand aggregate outcomes.
  - *Responsiveness* = firms' ability to adjust in face of unexpected changes.
  - Low flexibility in adjusting prevents resources from flowing to high-productivity firms/sectors: *missalocation* and *dampened growth*.
- MDI: allows unprecedented *cross-country, firm-level* analysis.
- **Key questions:**
  1. How do comparable firms in **different countries** adjust to identical productivity shocks?
  2. How different are firm's ability to adjust in **booms** vs. **recessions**?
  3. How different are their responses to **adverse** vs. **positive** shocks?
- Firm responses in focus:
  - **Employment:** adjusting workforce.
  - **Capital:** investment decisions.

Roadmap

Preview of Results

Preview of Results

1. **Cross-Country Heterogeneity:**
   - Dutch firms show highest responsiveness when they adjust.
   - French firms exhibit the most conservative adjustments.
   - Portuguese firms display strongest responses to extreme shocks.
2. **Business Cycle Effects:**
   - **Labor responses:** During recessions, firms are less likely to hire after positive shocks but more likely to fire after negative shocks.
   - **Capital responses:** During recessions, firms that adjust make significantly smaller smaller investment/divestment adjustments.
3. **Asymmetric Responses:**
   - Firms more likely to react to positive than negative shocks of the same size (i.e. avoid divesting/firing more than investing/hiring).
   - For those who adjust, the larger the shock, the larger the adjustment.

Data and Methodology

Data

Firm-level data. **Micro Data Infrastructure (MDI)**, created under the EU Technical Support Instrument project[1].

- National Statistics Datasets: National Business Registers (BR) and Business Balance Sheet (BS).

- **Manufacturing firms** from the Netherlands, France, Portugal, and Slovenia (2010–2020).

Business cycle data. AMECO: a year with negative real yoy GDP growth in a given country is classified as recession (dummy D_t).

[1] The MDI received funding from the H2020 project grant Microprod, 2019-222, and the EU TSI project, European Commission, Directorate-general for Structural Reform Support under grant agreement No. 101101853 and No. 101140673 (Austria).

Productivity estimation

We are ultimately interested in firms' responses to **innovations to idiosyncratic productivity (TFPR)** ($\eta_{i,t}$).

- *Control function approach*. Production (revenue) functions are estimated at the two-digit manufacturing sector level, following Ackerberg et al. (2015)[2]:

$$\log \text{Revenue}_{i,t} = \alpha \log \text{L}_{i,t} + \beta \log \text{K}_{i,t} + \varepsilon_{i,t}$$

  - TFPR ($\varepsilon_{i,t}$) is assumed to follow an AR(1) process, and $\eta_{i,t}$ is the unexpected component:

$$\varepsilon_{i,t} = \rho \varepsilon_{i,t-1} + \eta_{i,t}, \quad \eta_{i,t} \sim \mathcal{N}(0, \sigma_\eta^2).$$

[2] tool available in MDI

Responsiveness analysis: framework

For each input $j \in \{L, K\}$, we consider a *responsiveness regression* as:

$$y^j_{i,t} = \beta_0 + \beta_1 \eta_{i,t-1} + \beta_2 \eta_{i,t-1} D_t + \beta_3 D_t \\ + \alpha_1 {\eta_{i,t-1}}^2 + \alpha_2 {\eta_{i,t-1}}^2 D_t + \gamma X_{i,t} + \nu_{i,t},$$

D_t is the aggregate state and $X_{i,t}$ hosts a series of firm-level controls.

- *Rich framework*. Accomodates **nonlinearities** in responses, aggregate **state-dependence**, and **interactions** between them.
- *Margins of adjustment.*
  - **Extensive:** whether or not firms adjust$\rightarrow$ $y^j_{i,t} = Pr(\mathbf{1}^{adj}_j = 1)$. $Pr(\mathbf{1}^{adj}_j = 1) = 1$ if a firm's growth rate in input j between t and $t-1$ ($g^j_{i,t}$) exceeds 2.5% in absolute value.
  - **Intensive**: magnitude of adjustment $\rightarrow y^j_{i,t} = g^j_{i,t}$ *Only computed for firms that adjust.*.

Responsiveness analysis: interpretation

- **Expansions**: responsiveness measured as $\beta_1\eta + \alpha_1\eta^2$
- **Recessions**: responsiveness measured as $(\beta_1 + \beta_2)\eta + (\alpha_1 + \alpha_2)\eta^2$

$\Rightarrow$ The same shock hitting the same firm can lead to different responses depending on business cycle.

- **Extensive margin**: *probability of adjusting an input* ***relative*** *to firms of that country-industry peer group not hit by a shock.*
- **Intensive margin**: *growth rate of an input* ***relative*** *to firms of that country-industry peer group not hit by a shock.*

$\Rightarrow$ Responsiveness measures reported in relative terms such that they are comparable cross-countries (ignore β_0).

Results: Labour Adjustment

Hire (fire) or not? Extensive margin during expansions

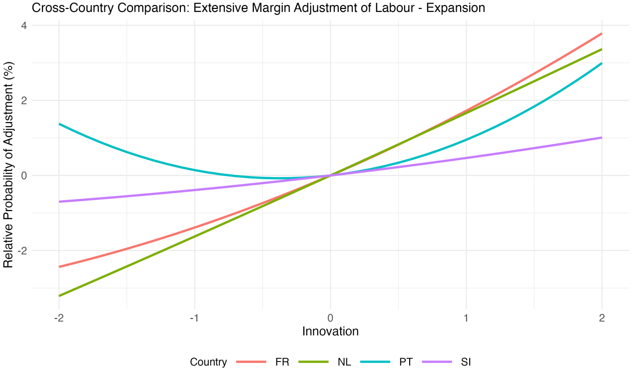
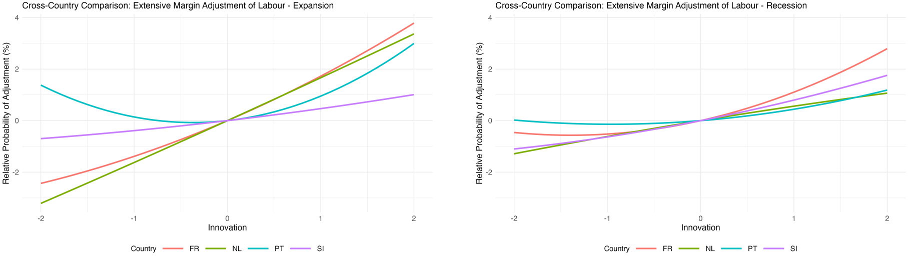


Figure: Labor adjustment probability during expansions

- **Key pattern:** Higher probability of hiring with positive shocks, lower probability of firing with negative shocks.
- **Country heterogeneity:** Portugal shows strongest convexity in responses, especially to negative shocks.

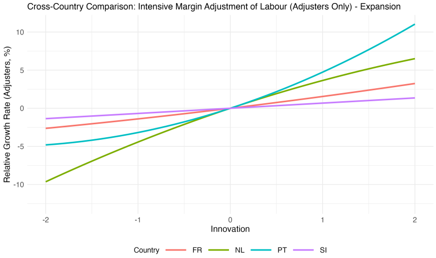
Hire (fire) or not? Extensive margin in expansions *vs* crisis



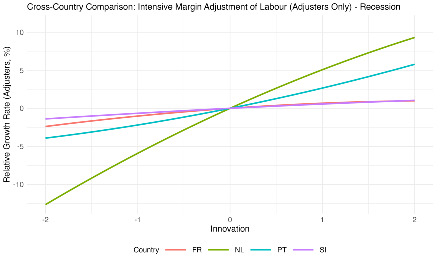
(a) Expansions (b) Recessions

- **Business cycle effect:** Recessions reduce hiring probability for firms with positive shocks while simultaneously increasing the relative probability of workforce reductions when facing negative shocks.

How much to hire/fire? Intensive margin in expansions *vs* crisis



(a) Expansions



(b) Recessions

- **Key pattern:** More linear, upward-sloping relationship than extensive margin.
- **Country heterogeneity:** Throughout the business cycle, NL firms show steepest response slopes, and FR/SI firms demonstrate flattest.

Results: Capital Adjustment

Invest (divest) or not? Extensive margin during expansions

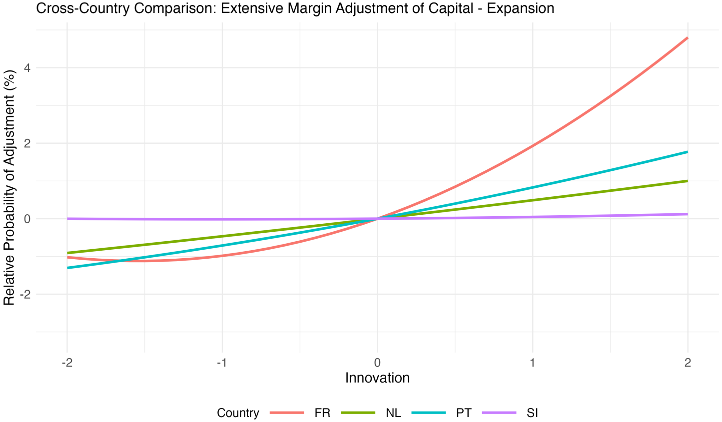
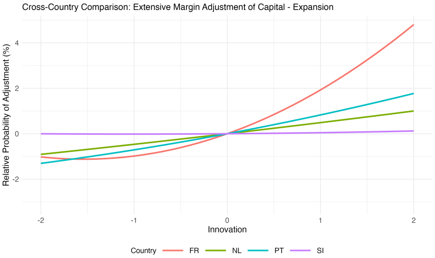


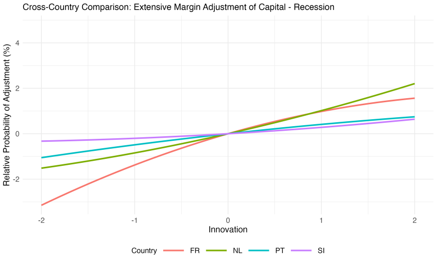
Figure: Capital adjustment probability during expansions

- **Irreversibility:** Firms significantly more likely to invest after positive shocks than to divest after negative shocks.

Invest (divest) or not? Extensive margin in expansions *vs* crisis



(a) Expansions



(b) Recessions

- **Business cycle effect:** Recessions reduce investment probabilities and strengthen capital irreversibility - firms become notably less likely to divest after negative shocks.

How much to invest (divest)? Intensive margin during expansions

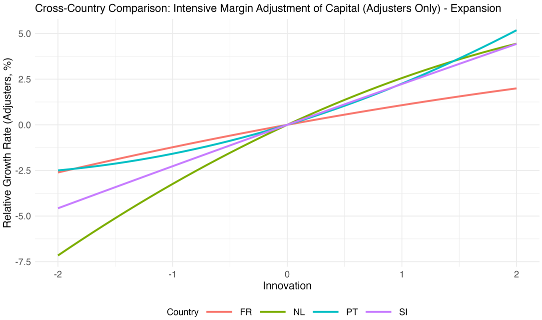
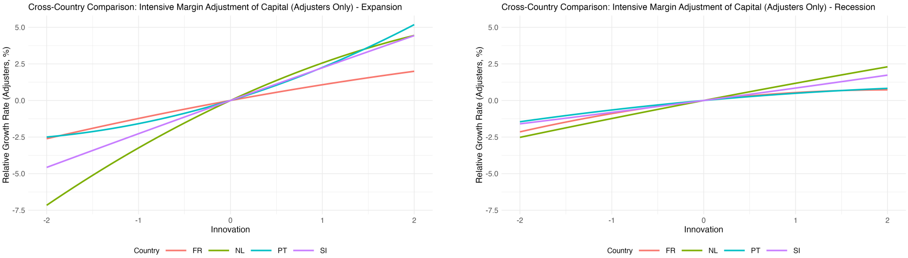


Figure: Capital adjustment magnitude during expansions (adjusters only)

- **Key pattern:** Linear relationship between shock size and adjustment magnitude.
- **Country heterogeneity:** Dutch firms most responsive, French firms least responsive.

How much to invest (divest)? Intensive margin in expansions *vs* crisis



(a) Expansions

(b) Recessions

- **Business cycle effect:** Dramatic flattening of response curves during recessions - firms that do adjust during downturns make much smaller magnitude adjustments.

Key takeaways

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- **Asymmetric responses:**
  - Greater responsiveness to positive than negative shocks (conditional on business cycle).
- **Business cycle effects:** in recessions,
  - Firms less likely to hire but more likely to fire.
  - Firms make significantly smaller investment/divestment adjustments.
- **Cross-Country Heterogeneity:** consistently positioning across both inputs, we find:
  - Dutch firms: Most flexible factor reallocation
  - French firms: Most conservative adjustments

Next Steps:

- Expand to more countries (Finland, Austria, Germany, UK)
- Differentiate tangible vs. intangible capital
- Examine firm heterogeneity by size, age, and export status
- Examine aggregate and productivity effects
- Investigate drivers of cross-country differences

Thank you!

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References

- Ackerberg, D. A., Caves, K., & Frazer, G. (2015). Identification properties of recent production function estimators. *Econometrica*, 83(6), 2411–2451.
- Bartelsman, E., & MDI-Team. (2025). MDI Users Guide. Accessed: February 26, 2025.
- Caballero, R. J., & Engel, E. M. (2003). Lumpy investment in dynamic general equilibrium. *Journal of Political Economy*.
- Cooper, R., & Willis, J. L. (2003). The dynamics of labor demand: Evidence from plant-level observations and aggregate implications. *Research in Economics*.
- Cooper, R., Horn, C.-W., & Indraccolo, L. (2024). Covid and productivity in Europe: A responsiveness perspective. *European Economic Review*, 163, 104655.
- Cooper, R., Haltiwanger, J., & Power, L. (1999). Machine replacement and the business cycle: Lumps and bumps. *American Economic Review*, 89(4), 921–946.
- Cooper, R. W., & Haltiwanger, J. (2006). On the nature of capital adjustment costs. *The Review of Economic Studies*, 73(3), 611–633.
- Decker, R. A., Haltiwanger, J., Jarmin, R. S., & Miranda, J. (2020). Changing business dynamism and productivity: Shocks versus responsiveness. *American Economic Review*, 110(12), 3952–3990.