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Labor Productivity Growth in the Nordics: The Roles of Frontier Firms and Diffusion

Takuji Komatsuzaki and Théodore Renault

WP/26/178

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Prepared by Takuji Komatsuzaki and Théodore Renault*

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August 2026

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ABSTRACT: This paper investigates the drivers of labor productivity growth in the Nordic countries, using both sectoral and firm-level data over the period 2000–2024. The sectoral analysis documents a broad-based slowdown in labor productivity growth, driven primarily by within-industry developments rather than shifts in the sectoral composition of employment. Firm-level evidence shows that productivity growth is increasingly concentrated among frontier firms—the most productive firms within each industry—while the rest of the firm distribution ("laggards") has experienced weak or stagnant productivity growth. A decomposition of frontier productivity growth reveals that gains among incumbent frontier firms account for most productivity growth at the frontier across countries. The contribution of net firm entry is highly heterogeneous, and is positive mainly in countries where young entering firms exhibit strong productivity momentum upon joining the frontier. The paper finds evidence of productivity diffusion from frontier to laggard firms but shows that the speed of diffusion has declined since the 2010s. The slower diffusion is closely associated with rising persistence at the productivity frontier: when the same firms remain at the frontier for longer periods, opportunities for laggards to catch up are reduced. Overall, the findings highlight that sustaining aggregate productivity growth hinges not only on innovation at the frontier but also on firm dynamism—particularly entry, exit, and turnover at the frontier—to ensure that productivity gains diffuse broadly across the economy.

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WORKING PAPERS

Labor Productivity Growth in the Nordics: The Roles of Frontier Firms and Diffusion

Prepared by Takuji Komatsuzaki and Théodore Renault[1]

[1] The authors would like to thank Alex Pienkowski, Sneha Dattatraya Thube, Konstantīns Benkovskis, Nicolas Sylvain Daniel Gavoille and EUR seminar participants for helpful comments. All remaining errors are ours.

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I. Introduction

Nordic countries remain among the most productive economies in the world, yet their labor productivity growth has decelerated markedly over the last two decades. GDP per hour worked in Denmark, Finland, Norway, and Sweden has expanded at progressively slower rates since 2000: from an average of 1.2 percent per year in the 2000s, labor productivity growth slowed to 0.8 percent in the 2010s and nearly stalled at 0.1 percent after 2020 (Figure 1a). By contrast, labor productivity in the United States grew at 2.3 percent annually between 2000 and 2010 and held at 1.2 percent thereafter. As a result, Nordics' productivity level has declined relative to the United States, particularly since 2017 (Figure 1b). This pattern is not unique to the Nordic region: the broad-based productivity slowdown across European economies is one of the defining economic challenges of the past decade, attracting renewed attention from policymakers (Draghi, 2024; Letta, 2024).

Figure 1. Labor Productivity Developments in the Nordics, Europe and the United States

Figure 1a

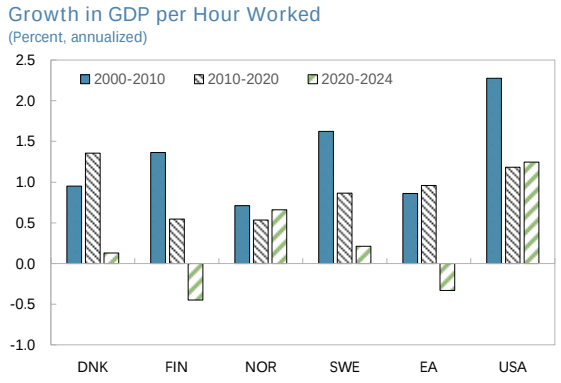
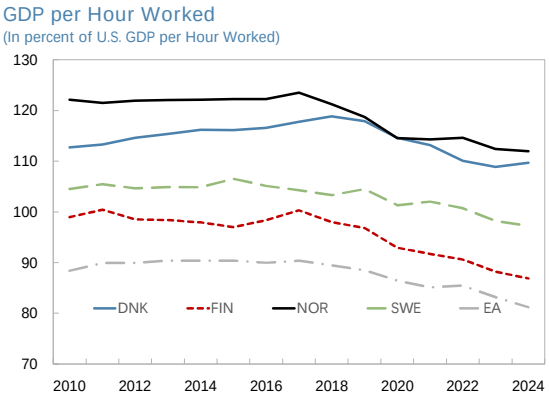


Figure 1b



Source: OECD Productivity Database; and authors' calculations.

Note: Labor productivity is measured by GDP (in US dollars, PPP converted) per hour.

This study draws on two complementary datasets to examine the drivers of aggregate labor productivity growth in the Nordic countries. At the sectoral level, data from Eurostat and the EU KLEMS database are used to analyze productivity trends across industries and identify which sectors have contributed most to the aggregate slowdown. A shift-share decomposition further distinguishes between productivity gains within industries and those arising from the reallocation of labor across sectors. At the firm level, data from the Orbis Bureau Van Dijk (BvD) database are used to examine productivity dynamics within sectors.

The sectoral analysis suggests that the slowdown of labor productivity growth in the Nordic countries is broad based, and mainly due to within-sector developments. Labor productivity growth has decelerated in manufacturing, trade and transport, and ICT services. Moreover, the slowdown has been primarily driven by intra-industry dynamics rather than by inter-sectoral reallocation, hence suggesting that the roots of the slowdown lie within industries, not in the sectoral composition of Nordic countries. This finding is consistent with evidence for a broader set of European economies documented by the European Central Bank (2021).

The firm-level analysis examines the critical role of frontier firms—those leading in productivity within their industries—in driving aggregate productivity growth through innovation and knowledge diffusion. Defined as the most productive firms in each industry, frontier firms matter for aggregate productivity growth through two distinct channels. First, they contribute directly to aggregate productivity growth by innovating. Second, they generate spillovers that allow laggard firms to catch up, as knowledge and best practices diffuse across the productivity distribution (Comin and Mestieri, 2013). The literature has documented a growing dispersion in productivity levels between frontier firms and other firms, referred to here as "laggards". Two mechanisms may account for this trend. The first is that frontier firms have widened their lead over laggards by innovating and scaling faster. The second is that the diffusion of technologies and best practices from the frontier to the broader economy has weakened, slowing the catch-up process. Andrews, Criscuolo, and Gal, (2016) and Akcigit and Ates (2021) consider this second mechanism as a potential driver of the slowdown of the aggregate productivity growth, while Berlingieri et al. (2025) provides recent assessments of the structural and policy determinants of diffusion across OECD economies. André and Gal (2024) takes stock of evidence on both channels. Building on this literature, the firm-level analysis addresses three related questions:

- First, to what extent has labor productivity growth been driven by frontier firms relative to the rest of the distribution?
- Second, within the frontier, how much of productivity growth reflects the performance of incumbent firms versus the entry of new, highly productive firms?
- Third, is there evidence of productivity diffusion from frontier to non-frontier firms, and has its speed changed over time or varied across sectors?

The firm-level analysis yields three main findings. First, frontier firms display substantially higher productivity growth than laggards between 2010 and 2022, with the gap particularly pronounced in non-tech manufacturing and high-tech sectors; Nordic frontier firms also outperform their European peers. Second, a dynamic productivity decomposition following Melitz and Polanec (2015) shows that productivity gains among incumbents are the dominant driver of frontier productivity growth across all countries, while the contribution of net firm entry is highly heterogeneous and depends critically on the age and the productivity performance of the firms entering the frontier. Third, the productivity diffusion mechanism remains operative but has weakened since the 2010s — a slowdown associated with increasing persistence of incumbents at the frontier rather than with the digital intensity of industries. Taken together, the findings highlight the role of business dynamism that enables the entry of high-growth firms into the productivity frontier in shaping aggregate labor productivity growth in the Nordic countries.

The rest of the paper proceeds as follows. Section 2 presents the sectoral analysis. Section 3 presents the firm-level analysis, covering both frontier productivity growth and its decomposition (Section 3.2) and productivity diffusion (Section 3.3). Section 4 concludes with policy implications.

II. Sectoral Analysis

II.1 Sector-Level Productivity Growth

The analysis draws on data from Eurostat and EU KLEMS to characterize the sectoral pattern of the slowdown. Average annualized growth rates are analyzed across three sub-periods: 2000–2010, 2010–2020, and 2020–2024. Four broad sector groupings capture the main structural dimensions of Nordic economies:

manufacturing (NACE Rev. 2, Section C), trade and transport (Sections G–I), information and communication technology services (Section J), and professional, scientific, technical, and administrative activities (Sections M–N). The productivity measure is the gross value added per hour worked, expressed in constant prices and converted to U.S. dollars at PPP-adjusted exchange rates.

Labor productivity growth has decelerated across most major sectors. In manufacturing, productivity growth trended downward in most Nordic countries (Figure 2a): in Finland, Sweden, and Norway, annual growth averaged 3.6 percent in the 2000s, slowed to 2.7 percent in the 2010s, and turned negative at -0.9 percent between 2020 and 2024. Denmark is a notable exception, where the pharmaceutical industry generated an idiosyncratic productivity surge after 2020. Trade and transport experienced a similar, if more modest, deceleration, particularly since 2020 (Figure 2b). ICT services, which had experienced strong productivity growth at 6.0 percent annually in the 2000s, slowed sharply to 3.2 percent in the 2010s and nearly stalled at 0.6 percent after 2020. Professional, scientific, technical, and administrative activities remained weak throughout, with average productivity growth below 1 percent across all three sub-periods.

Figure 2. Real Labor Productivity Growth by Sector

Figure 2a

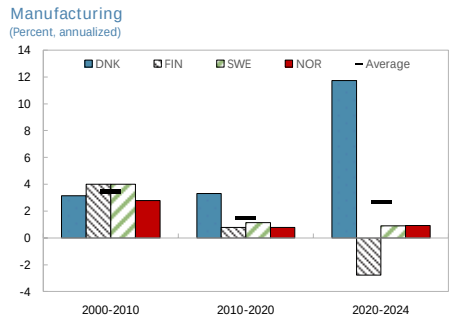


Figure 2b

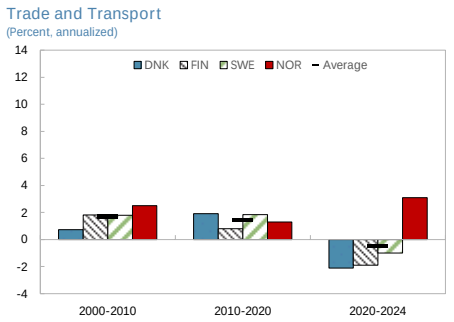


Figure 2c

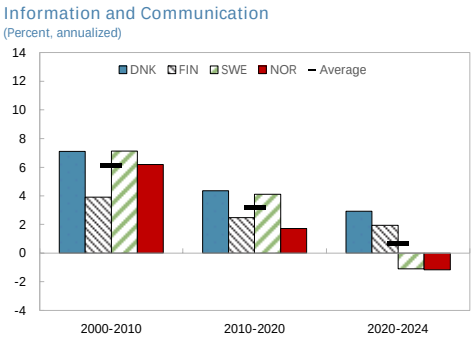
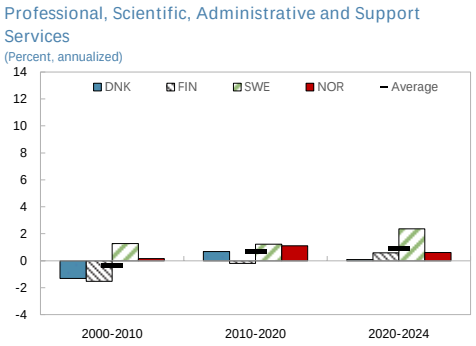


Figure 2d



Sources: Eurostat; and authors' calculations.

Note: simple average across Nordic countries.

II.2 Shift-Share Decomposition

A shift-share decomposition of aggregate labor productivity allows for a distinction between *within*-industry productivity dynamics and the reallocation of labor *between* industries. Following OECD (2018), aggregate labor productivity growth can be decomposed into three components. First, the intra-industry effect

captures productivity growth within each sector, holding employment shares fixed at their base-period levels. Second, the static reallocation effect measures the contribution of shifting employment among industries with different base-period productivity levels. Third, the dynamic reallocation effect reflects the joint covariation of employment shifts and productivity growth and is larger when sectors experiencing faster productivity growth also attract a growing share of employment. Formally, aggregate labor productivity growth between base period 0 and period t is given by:

$$LP_t - LP_0 = \underbrace{\sum_{i=1}^{n}(LP_{it} - LP_{i0})S_{i0}}_{Intra-industry} + \underbrace{\sum_{i=1}^{n}(S_{it} - S_{i0})LP_{i0}}_{Static} + \underbrace{\sum_{i=1}^{n}(LP_{it} - LP_{i0})(S_{it} - S_{i0})}_{Dynamic} \quad (1)$$

Where LP_t and LP_0 denote aggregate labor productivity levels at period t and the base period 0, respectively. Correspondingly, LP_{it} and LP_{i0} represent the labor productivity level in sector i and S_{it} and S_{i0} denote the employment share of sector i.

The productivity slowdown in the Nordic countries is mainly driven by *within*-industry dynamics, with labor reallocation playing a negligible role. The shift-share decomposition is applied over two consecutive periods (2000–2010 and 2010–2020) for the Nordic countries, the European Union, and the United States. The results show that the intra-industry component dominates across all countries: it accounts for the bulk of productivity growth in the 2000s (Figure 3a) and of the subsequent slowdown in the 2010s (Figure 3b). Reallocation effects are comparatively modest. The static reallocation effect turned negative in Europe in the 2010s, suggesting that labor has shifted toward lower-productivity sectors — a pattern not present in the United States, where employment reallocation favored more productive industries over the same period. The dynamic reallocation effect, negative in the 2000s, dissipated in the 2010s across most economies. Taken together, these results point to within-industry productivity dynamics as the primary driver of the slowdown in labor productivity, motivating the turn to firm-level data in the following section.

Figure 3. Shift-Share Decomposition of Labor Productivity Growth

Figure 3a

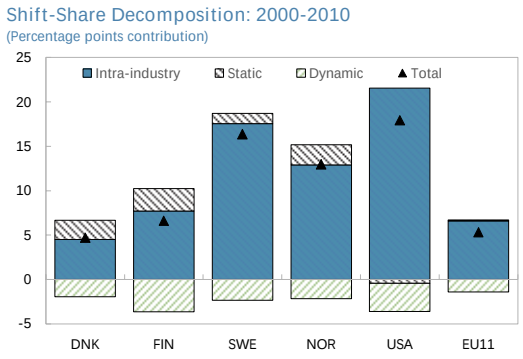
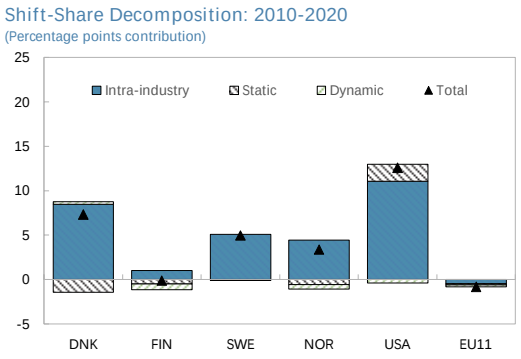


Figure 3b



Sources: Eurostat, EUKLEMS; and authors' calculations.

Note: EU11 includes Austria, Belgium, Czech Republic, Germany, Denmark, Finland, France, Italy, the Netherlands, Spain and Sweden.

III. Firm-Level Analysis

III.1 Frontier vs. Laggards: Definitions and Stylized Facts

The firm-level analysis draws on the Orbis database to examine the within-industry dynamics between frontier and "laggard" firms underlying the aggregate productivity slowdown. The data are sourced from the Orbis Bureau van Dijk (BvD) database as compiled by the IMF's Research Department (Díez et al., 2021). It is the largest cross-country firm-level database, encompassing income statements and balance sheet information of both public and private firms (Gopinath et al., 2017). The sample period runs from 2010 to 2022. Labor productivity is measured as operating turnover divided by the number of employees, expressed in constant 2015 U.S. dollars at PPP.[1] Frontier firms are defined as the top 10 percent of firms within each two-digit NACE industry by labor productivity level, following Andrews, Criscuolo, and Gal (2016); laggard firms comprise the remaining 90 percent. The analysis distinguishes three broad technological categories: non-tech manufacturing, non-tech services, and high-tech sectors — the latter combining high-tech manufacturing and ICT services following the classification in Adilbish et al. (2025).

Table 1. Summary Statistics

		Denmark		Finland		Sweden	
		Frontier	Laggards	Frontier	Laggards	Frontier	Laggards
Employment	Median	69	112	38	40	44	41
	P10	21	28	11	19	15	20
	P90	504	685	225	203	240	188
Age	Median	21	24	19	19	25	24
	P10	7	7	5	5	7	6
	P90	61	59	49	46	64	57

Source: Orbis and authors' calculations.

Note: average between 2010 and 2022.

Frontier firms in the Nordic countries tend to be smaller than laggards but are not systematically younger.[2] In Denmark for example, frontier firms employ fewer workers than laggards: the median frontier firm averaged 69 employees over 2010–2022, compared with 112 for the median laggard. This pattern holds across the employment distribution and is broadly similar in Finland and Sweden (Table 1).[3] By contrast, firm age does not systematically distinguish frontier from laggard firms, with median ages broadly similar across the two groups in all three countries.

Frontier firms are substantially more productive than laggards but account for a small share of total employment. In Denmark, frontier firms are on average eight times more productive than laggards — roughly twice the gap observed in Finland and Sweden, where the ratio stands closer to four, in line with the rest of Europe (Figure 4a). The productivity gap has remained broadly stable over time, pointing to limited catch-up of laggard firms toward the frontier. Despite their higher productivity levels, frontier firms account for less than 10 percent of total employment in Europe (Figure 4b), a reflection the small employment size at the top of the productivity distribution. Economically, because frontier firms employ relatively few workers,

[1] In contrast to gross value added, information on operating turnover is available for a large sample of European countries over time.

[2] Norway is excluded from the firm-level analysis given data limitations in the Orbis database.

[3] Frontier firms have higher operating turnover than laggards, however.

aggregate productivity growth depends less on scaling them up directly and more on diffusing their technologies and practices to the broader population of firms. Absent effective diffusion, strong productivity gains at the frontier translate only weakly into economy-wide labor productivity growth.

Figure 4. Labor Productivity Gap and Employment Share

Figure 4a

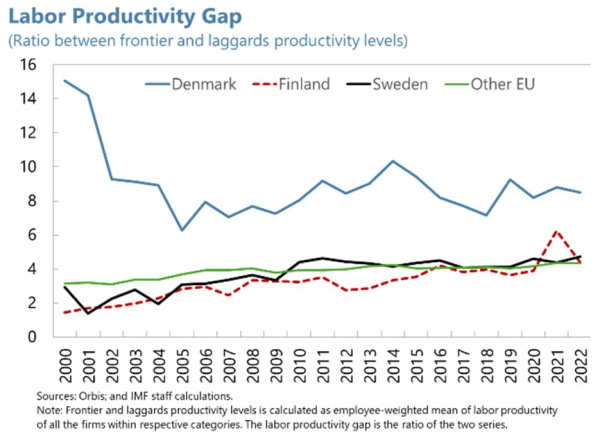
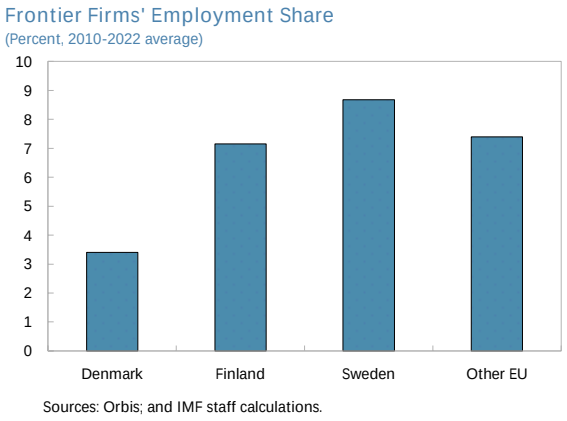


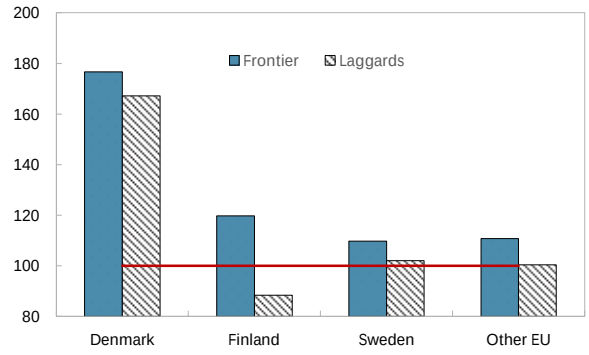
Figure 4b



Sources: Orbis; and authors' calculations.

Frontier firms have recorded substantially higher productivity growth than laggards across all Nordic countries, outperforming their European peers. This productivity gap is most striking in Finland, where cumulative labor productivity growth between 2010 and 2022 reached 20 percent for frontier firms and declined by 12 percent for laggards (Figure 5). In Denmark, both frontier and laggards had strong productivity gains over the period, whereas in Sweden, frontier productivity rose by 10 percent while laggard productivity stagnated. Nordic frontier firms have also outpaced their European counterparts, where cumulative frontier productivity growth averaged around 10 percent and laggard productivity was broadly flat. Frontier's productivity growth has been larger than laggards' across sectors in most countries and the gap has been more pronounced in the non-tech manufacturing and tech sectors (Figure 6).

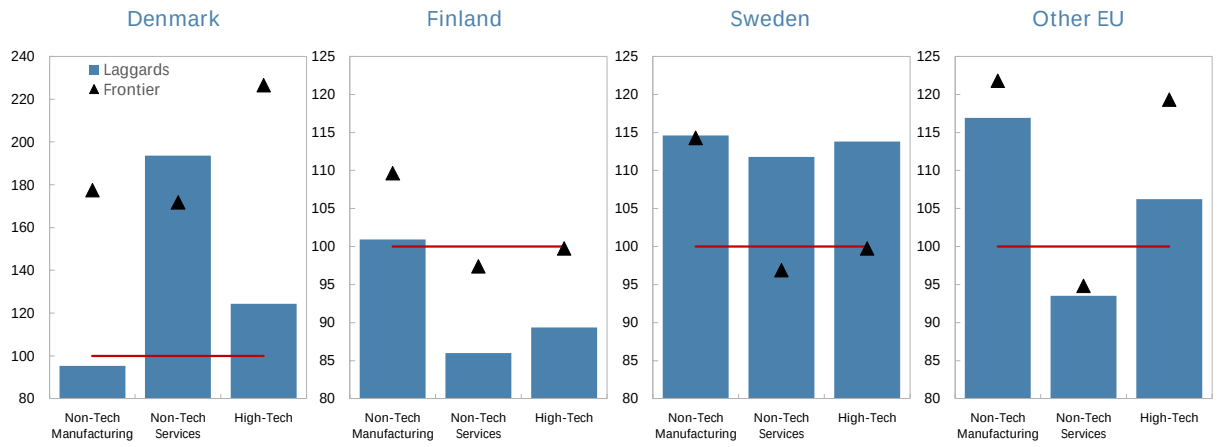
Figure 5. Cumulated Labor Productivity Growth



Sources: Orbis; and authors' calculations.

Figure 6. Cumulated Labor Productivity Growth by Sector

(Index 2010 = 100, 2022)



Sources: Orbis; and authors' calculations.

III.2 The Decomposition of Frontier Productivity Growth

Frontier productivity growth reflects not only the performance of incumbent firms but also the entry and exit of firms at the frontier. To disentangle these contributions, the analysis employs a dynamic Olley-Pakes (OP) decomposition following Melitz and Polanec (2015), which decomposes frontier weighted-average productivity growth into components attributable to "incumbents", "entrants", and "exiters". At time $t-1$, frontier productivity level (in log terms) is a weighted average of incumbents (C) and firms that will subsequently exit the frontier (X), with weights given by their respective employment shares. At time t, frontier productivity is similarly decomposed between incumbents and firms that have newly entered the frontier (E). Denoting s_E and s_X the employment shares of entrants and exiters, the change in frontier productivity between the two periods can then be expressed as:

$$\Delta LP_t = \Delta LP_{C,t} + s_{E,t}\left(LP_{E,t} - LP_{C,t}\right) + s_{X,t-1}\left(LP_{X,t-1} - LP_{C,t-1}\right) \quad (2)$$

The productivity growth of incumbents is further decomposed into two terms. Following Olley and Pakes (1996), the first term in equation (3) captures the change in the unweighted mean productivity, reflecting shifts in the distribution of surviving firms' productivity, while the second captures the change in the covariance between productivity and employment shares, reflecting whether more productive incumbents have gained or lost market share over time. In addition, entrants generate productivity growth if they have higher productivity levels than the incumbents when the entry occurs. Similarly, exiters generate positive productivity gains if they have lower productivity than the surviving firms when exit occurs.

$$\Delta LP_t = \underbrace{\Delta \bar{lp}_C}_{Within} + \underbrace{\Delta\, cov_C}_{Reallocation} + \underbrace{s_{E,t}\left(LP_{E,t} - LP_{C,t}\right) + s_{X,t-1}\left(LP_{C,t-1} - LP_{X,t-1}\right)}_{Net\ entry} \quad (3)$$

Incumbent productivity gains are a common driver of frontier productivity growth across Europe, while the contribution of net entry varies considerably across countries. Over 2010-2022, incumbents

contributed positively to frontier productivity in all European countries (Figure 7a). The contribution of net entry, however, is highly heterogeneous. Within the Nordics, the contribution of net entry also varied over time (Figure 7b-7d). in Finland for instance, it was particularly volatile during the pandemic period, reflecting elevated turnover at the frontier. By contrast, the reallocation of employment shares toward the most productive incumbents made a limited and broadly stable contribution across most European countries.

Figure 7. Decomposition of Frontier Labor Productivity Growth

Figure 7a

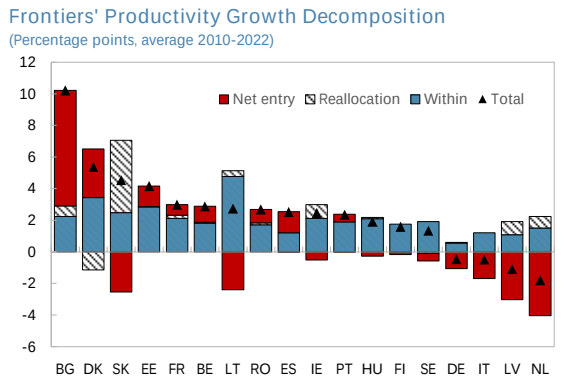


Figure 7b

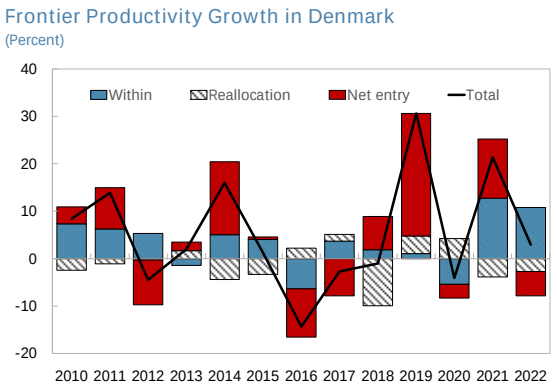


Figure 7c

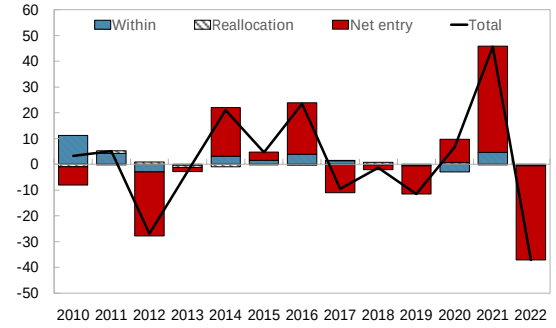
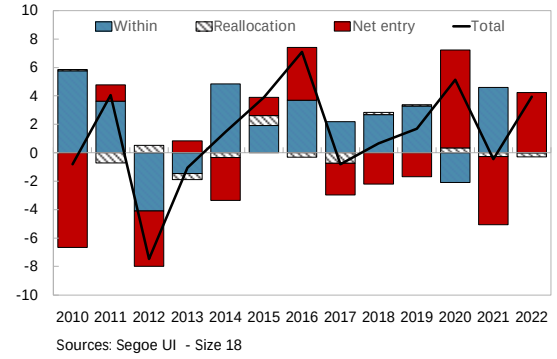


Figure 7d



Sources: Orbis; and authors' calculations.

The heterogeneous contribution of net entry to frontier productivity growth is explained by the productivity performance of entering firms relative to exiters. Entry and exit at the frontier predominantly occurs at the bottom of the frontier distribution, as both entering and exiting firms tend to be less productive than incumbent frontier firms (Figure 8a). Momentum of entering firms is important for the net entry contribution, however. Net entry contributes positively to frontier productivity when entrants are more productive than the firms they displace, and more so when entrants exhibit strong productivity momentum upon joining the frontier (Figure 8b). Cross-country evidence points to firm age as an important determinant of this momentum: countries where entrants display stronger productivity growth upon entering the frontier tend to have younger firms doing so (Figure 8c). By contrast, the productivity growth of entrants does not appear to be systematically related to the sectoral composition of the frontier, as measured by the share of employment in high-tech

industries (Figure 8d), which suggests that the quality of entrants reflects firm-level characteristics rather than the technological intensity of the sectors in which they operate.

Figure 8. Momentum of Net Entry

Figure 8a

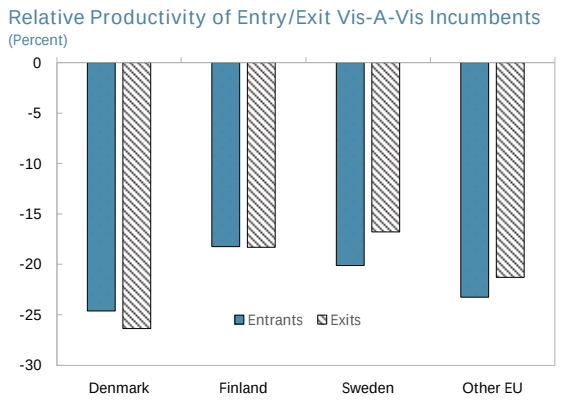


Figure 8b

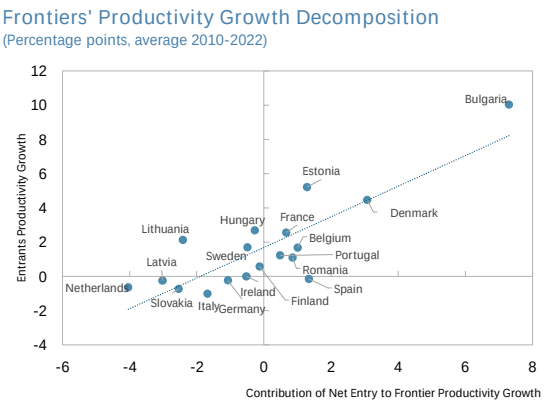


Figure 8c

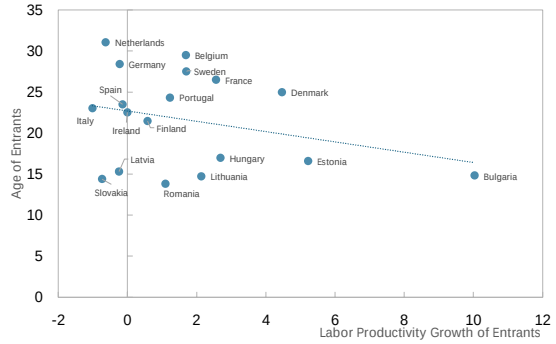
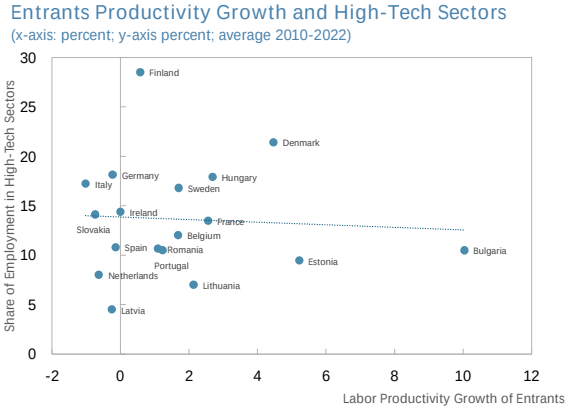


Figure 8d



Sources: Orbis; and authors' calculations.

III.3 Diffusion and the Catch-Up from Laggards to Frontier Firms

Frontier firms contribute to aggregate productivity growth not only directly, but also by diffusing technology, knowledge, and organizational practices to laggard firms. Empirically, this diffusion channel implies that laggard firms should exhibit faster productivity growth when they are further below the frontier — the so-called catch-up or error-correction effect — and when the frontier itself grows faster, generating a contemporaneous co-movement effect. A growing body of evidence confirms that this mechanism, while operative, has weakened over time (Andrews, Criscuolo, and Gal, 2016; Berlingieri et al., 2025), raising concerns about whether productivity gains at the frontier translate into economy-wide welfare improvements.

The diffusion channel is estimated using an error-correction model. Following Andrews, Criscuolo, and Gal (2016) and the theoretical framework of Griffith et al. (2004), the following regression is estimated for each country separately:

$$\Delta LP_{ist} = \delta_1 \Delta LP^F_{st} + \delta_2 (LP^F_{st-1} - LP_{ist-1}) + \sum_j \delta^j_3 X^j_{ist} + \delta_s + \delta_t + \varepsilon_{ist} \quad (4)$$

where LP_{ist} is the labor productivity level (in log terms) of firm i in sector s at time t, LP^F_{st} is the corresponding frontier productivity level in the same sector s, X^j_{ist} are firm-level controls (size and age), and δ_s and δ_t are sector and time fixed effects. The key parameters of interest are δ_1(the contemporaneous elasticity of laggard productivity growth to frontier productivity growth) and δ_2 (the catch-up coefficient measuring the speed of convergence to the frontier). Standard errors are clustered at the sectoral level. The estimates are not interpreted as causal, as identification of the underlying mechanisms would require instruments for frontier productivity growth that lie beyond the scope of this paper.

The diffusion mechanism is operative across all countries in the sample, with catch-up coefficients broadly similar between the Nordics and comparable European countries (Figure 9). Both $\delta_1$and δ_2 are positive and statistically significant at the 1 percent level for all countries. A one percentage point increase in productivity growth at the frontier is associated with a δ_1 percentage point increase in laggards' productivity growth, and the estimates of δ_1 ranges from 0.04 in Denmark and Belgium to around 0.2 in Spain and Italy. The catch-up coefficient δ_2 ranges from approximately 0.08 in Belgium to above 0.35 in Italy, indicating that a 100 percent higher gap from the frontier in the previous period is associated with between 0.08 and 0.35 percentage points of additional productivity growth in the current period. Nordic countries exhibit catch-up coefficients broadly in line with the European average, suggesting that the diffusion mechanism in the Nordics is similar to the rest of Europe. Cross-country comparisons of $\delta_1$and δ_2 should nonetheless be interpreted with caution, as both coefficients are influenced by structural differences across countries: economies with weaker frontier productivity growth tend to exhibit larger contemporaneous elasticities, while those with a smaller gap between frontier and non-frontier firms tend to display higher catch-up coefficients.

Figure 9. Estimates of Diffusion Mechanism

Figure 9a

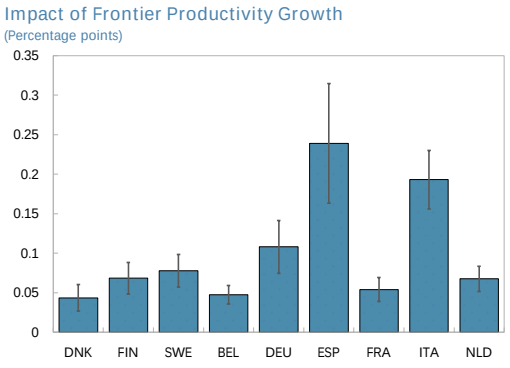
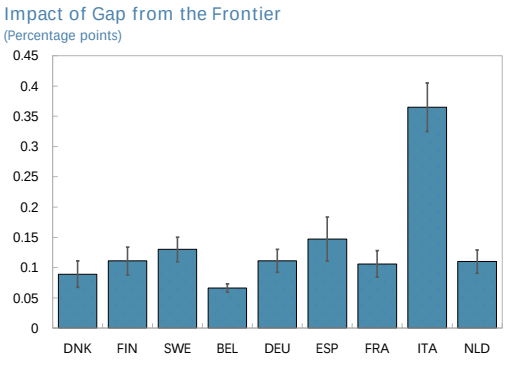


Figure 9b



Sources: Orbis; and authors' calculations.

Note: Error bars represent 95 percent confidence interval.

The baseline specification is extended in two directions to test for general diffusion slowdown and slower diffusion for digital-intensive industries. First, the lagged productivity gap is interacted with period dummy variables (denoted D_t^k, where k refers to 2010–2014, 2015–2019, and 2020–2022, relative to a 2000–2009 baseline) following Andrews, Criscuolo, and Gal (2016), to test whether catch-up speed has changed over time:

$$\Delta LP_{ist} = \delta_1 \Delta LP_{st}^F + \delta_2 (LP_{st-1}^F - LP_{ist-1}) + \sum_k \delta_3^k (LP_{st-1}^F - LP_{ist-1}) * D_t^k + \sum_j \delta_4^j X_{ist}^j + \delta_s + \delta_t + \varepsilon_{ist} \quad (5)$$

Second, the lagged productivity gap is interacted with a dummy variable for digital-intensive sectors (denoted D_s) following Berlingieri et al. (2025), to test whether diffusion is systematically slower in those industries:

$$\Delta LP_{ist} = \delta_1 \Delta LP_{st}^F + \delta_2 (LP_{st-1}^F - LP_{ist-1}) + \delta_3 (LP_{st-1}^F - LP_{ist-1}) * D_s + \sum_j \delta_4^j X_{ist}^j + \delta_s + \delta_t + \varepsilon_{ist} \quad (6)$$

The estimated interaction coefficients confirm a slowdown in the speed of productivity diffusion since the 2000s, but find no evidence that the slowdown is concentrated in digital-intensive sectors. The period interaction coefficients indicate that diffusion speed declined relative to the 2000s in the majority of countries and across most sub-periods (Figure 10a), consistent with the cross-country findings of Andrews, Criscuolo, and Gal (2016) and Berlingieri et al. (2025). However, contrary to the latter study, the interaction of the productivity gap with an indicator for digital intensity is statistically insignificant across all countries in the sample — suggesting that the diffusion slowdown is not disproportionately concentrated in digital-intensive industries (Figure 10b). A potential explanation for this divergence is that Berlingieri et al. (2025) focus on the bottom 40 percent of the productivity distribution, whereas this paper includes the bottom 90 percent as laggards. Together with the well-known bias of the Orbis data (Andrews, Criscuolo, and Gal, 2016), laggard firms in this paper are skewed toward larger and more established firms. This compositional difference may account for the discrepancy.

Figure 10. Diffusion Slowdown and Digital-Intensity

Figure 10a

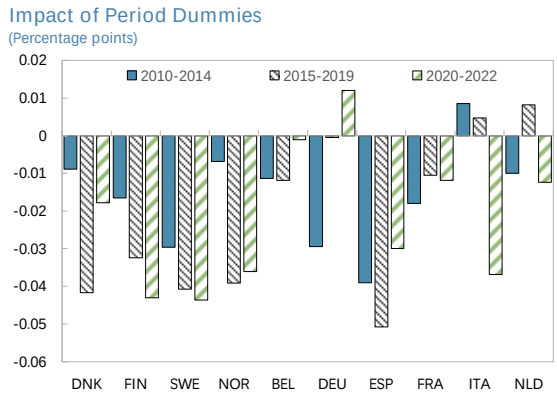
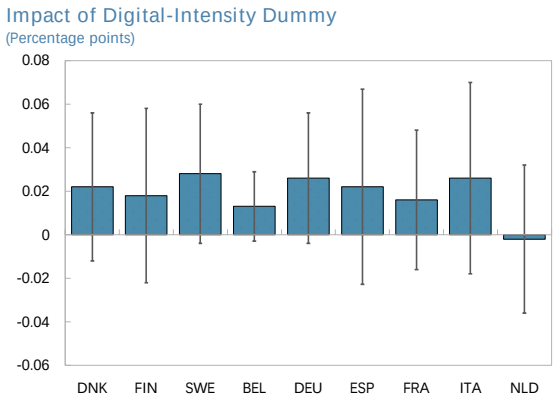


Figure 10b



Sources: Orbis; and authors' calculations.

Note: LHS chart: effect relative to baseline 2000-2009. RHS chart: errors bars represent 95 percent confidence interval.

Figure 11. Persistence at the Frontier and Its Impact on Diffusion

Figure 11a

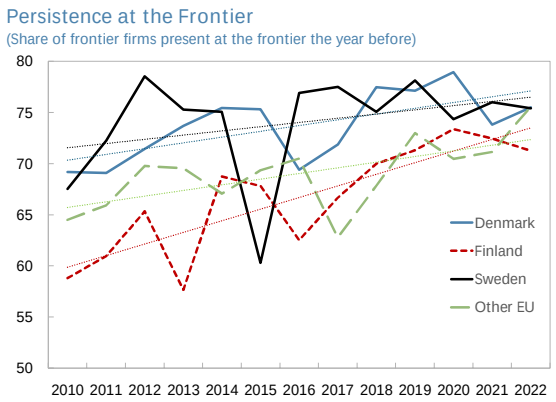
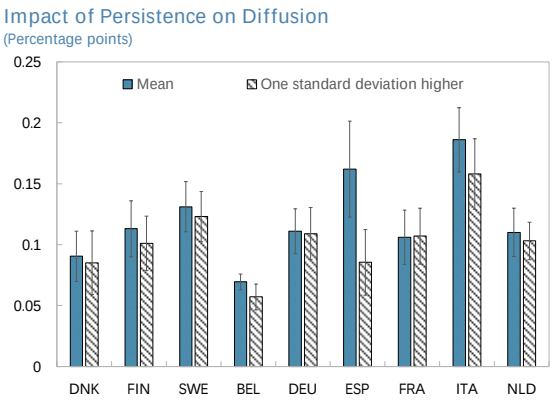


Figure 11b



Sources: Orbis; and authors' calculations.

Note: RHS chart: combined effects of regression coefficients of the productivity gap and the interaction variable of productivity gap and persistence, evaluated at persistence being at mean and one standard deviation higher than mean, respectively.

A potential mechanism behind the diffusion slowdown is an increase in frontier persistence — that is, a declining rate of turnover among the most productive firms. If the same firms remain at the frontier year after year, the opportunities for laggards to observe, imitate, and absorb the practices of newly arrived frontier firms may diminish. Persistence is measured here as the share of frontier firms in year t that were also classified as frontier firms in year $t-1$. This share has increased significantly between 2010 and 2022 across all Nordic countries and the broader EU sample, indicating that frontier composition has become less fluid over time (Figure 11a).

To test whether higher frontier persistence is associated with slower diffusion, the baseline regression is augmented with an interaction between the productivity gap and the persistence ratio:

$$\Delta LP_{ist} = \delta_1 \Delta LP^F_{st} + \delta_2 (LP^F_{st-1} - LP_{ist-1}) + \delta_3 (LP^F_{st-1} - LP_{ist-1}) * P_t + \sum_j \delta_4^j X^j_{ist} + \delta_s + \delta_t + \varepsilon_{ist} \quad (7)$$

where P_t denotes the persistence ratio in year t. To assess the marginal impact of changes in persistence, the combined coefficients for the productivity gap (i.e. $\delta_2 + \delta_3 P_t$) are evaluated at the mean persistence ratio and at one standard deviation above the mean (an increase of approximately 7.6 percentage points on average).

The results confirm that higher frontier persistence is systematically associated with lower catch-up speed. Combined coefficients at higher persistence levels are lower in almost all countries in the sample, by an average of 12 percent, indicating that a less fluid frontier meaningfully dampens the diffusion mechanism (Figure 11b). This finding contributes to a growing body of evidence linking reduced business dynamism to the aggregate productivity slowdown (Decker and others, 2016; Calvino et al, 2020; Akcigit and Ates, 2021). While the existing literature on business dynamism has focused predominantly on entry and exit at the bottom of the

firm distribution, the results here suggest that turnover at the productivity frontier constitutes an additional — and underexplored — margin worth monitoring for productivity policy.

A possible channel is that of slower knowledge diffusion, which can increase the market power of leading firms, weaken competitive pressures, and reduce the ability of followers to catch up, thereby reinforcing persistence at the frontier (Akcigit and Ates (2021, 2023)). André and Gal (2024) identify several potential reasons that slow down knowledge diffusion, including adoption lags, especially in digital technologies; changes in the nature of innovation; potentially anti-competitive uses of intellectual property; widening skills gaps; slower progress in structural reforms; and the growing importance of intangible assets, which are often difficult to imitate or build upon. Taken together, these mechanisms suggest that persistent frontier incumbency may signal structural barriers to diffusion and point to potential gains from policies that strengthen competition, knowledge flows, and firms' absorptive capacity. Weak demand growth may further reinforce both frontier persistence and slow diffusion by reducing incentives to innovate.

Robustness checks indicate evidence consistent with this channel. Equation (7) is augmented with additional firm and industry-level control variables: intangible assets relative to total assets, investment relative to total assets, and lagged sectoral value-added growth. The association between frontier persistence and slower catch-up remains with this augmented specification, but its magnitude declines: a one-standard-deviation increase in the persistence ratio is associated with 9 percent lower diffusion, compared with 12 percent in the baseline specification. The effect is also no longer observed in three of the nine countries. This attenuation suggests that the growing role of intangible investment and industry-level demand conditions partly accounts for the negative association between frontier persistence and diffusion.

IV. Conclusion

This paper combines sectoral and firm-level evidence to study the sources of the labor productivity slowdown in the Nordic countries. Sectoral analysis shows that the slowdown is broad-based across manufacturing, trade and transport, and ICT services, and is driven overwhelmingly by within-industry dynamics rather than labor reallocation.

At the firm level, frontier firms outperform laggards markedly. Incumbent productivity gains drive the bulk of frontier growth across all countries. The contribution of net firm entry is highly heterogeneous and depends critically on the productivity momentum and age of entering cohorts.

Diffusion has slowed, and rising frontier entrenchment is a key driver. The catch-up mechanism from laggard to frontier firms remains operative across all countries, but its speed has declined since the 2010s. However, the slowdown is not concentrated in digital-intensive industries, a result that contrasts with cross-country pooled estimates in the literature (Berlingieri et al., 2025). An important novel finding is that rising persistence in the frontier group is associated with a slower catch-up speed, suggesting that reduced churn at the frontier may be an independent driver of weaker diffusion.

Overall, the findings underscore that labor productivity growth depends not only on innovation by frontier firms, but also on firm dynamics that govern how those gains spread through the economy. Both the heterogeneous contribution of net entry to frontier productivity growth and the role of turnover at the productivity frontier in sustaining diffusion point to the importance of a fluid and competitive firm environment for aggregate productivity growth (IMF 2024).

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