CPB Netherlands Bureau for
Economic Policy Analysis

Dynamics, Productivity, and Innovation in the Dutch Economy

Creative destruction is the process in which the replacement of old ideas by new ones drives economic growth. Various indicators of economic dynamism suggest a weakening of this process in the Netherlands, consistent with international trends.

Business and job dynamics have declined between 2007 and 2023. Overall productivity growth slows, and productivity differences between firms increase. Innovation activities are increasingly concentrated among larger and older companies.

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1 Introduction

A decline in economic dynamism has become a growing concern across OECD countries. Fewer firms are being founded, while the rate of firm exits is falling or stable. Additionally, both job creation and job destruction have slowed. The weakening of business and job dynamism might distort the efficient (re)allocation of resources across firms, thereby slowing down the Schumpeterian process of creative destruction. Various indicators point to a weakening of this process, and adverse trends in these indicators appear to be interconnected (Akcigit and Ates, 2021; Haltiwanger, 2015). A notable example is the potential link between the weakening of business dynamism and the slowdown in productivity growth.

A Schumpeterian growth model with two types of sectors can account for many of the empirical trends of business dynamism and productivity that we document here. Schumpeterian growth models specify how growth is generated by new innovations replacing old technologies (Aghion et al., 2014). A model with two types of sectors, one that features firms with similar productivity levels, and the other with productivity leaders and laggers, can account for many empirical trends of firm dynamics and productivity (Akcigit and Ates, 2021). In so-called *levelled* sectors, firms produce at similar productivity levels. These neck-and-neck firms compete strongly and innovate to escape competition, which stimulates growth. The resulting reallocation of resources among incumbents, as well as from incumbents to new entrants, is a major source of productivity growth in levelled sectors. This process of creative destruction is vital for levelled sectors, which are often at the technology frontier. In contrast, *unlevelled* sectors feature firms with diverse productivity levels; as a consequence, the most productive firms often dominate the market in these sectors, and laggard firms and potential entrants have weaker incentives to innovate when bridging the productivity gap becomes increasingly challenging. The implication for the design of growth policies is that they should differ between levelled and unlevelled sectors.

This paper studies indicators of the key mechanisms of the creative destructive process in the Netherlands. We use microdata on Dutch firms and employees between 2007 and 2023. We contribute to descriptive analysis of firm entry and exit, job reallocation, and productivity and innovation at the firm-level. We present results for several groups of firms in the economy (size class, age, sector, export-status), and apply shift-share and dynamic Olley-Pakes decompositions to aggregate and sectoral productivity growth.

Taken together, the evidence we find points to a growing divergence between firms in the Dutch market sector. We find a widening productivity gap between high- and low-productivity firms in the Netherlands. Incumbent firms are the primary contributors to productivity and innovation growth, while the contributions of entrants and exiting firms remain limited. Relatively fewer new firms are being established, and a smaller proportion of the workforce is employed by young firms. A divergence is also evident between exporting and non-exporting firms. While business dynamism is declining among firms that operate exclusively in the domestic market, it remains relatively stable for internationally active firms. Although the number of hours an average firm dedicates to innovation is increasing, R&D efforts are increasingly concentrated in large, established firms. We structure our findings on indicators in three sections: business and job dynamics; productivity dynamics, and innovation activity dynamics.

We find a decline in business and job dynamism in the Netherlands. Business dynamics is slowing down, resulting mainly from a falling entry rate after 2008. Job dynamics, measured by the job reallocation rate, is also falling. These results are in line with results for the US (e.g. Decker et al., 2016) and other European countries (Biondi et al., 2025). Worker dynamics, defined as the sum of workers hired and separated, does not show a strong trend, as in the US (Haltiwanger, 2015; Hyatt, 2015). We observe a similar decline in dynamism in most sectors, size- and age classes, with only some exceptions (as in Biondi et al., 2025). Finally, the aggregate

fall in job reallocation is driven by a decrease within size classes and sectors, rather than reallocation between them.

We observe various signs of weakening productivity dynamics within the Dutch market sector since 2015. Aggregate productivity growth is primarily driven by productivity gains within incumbent firms. At the same time, we see a deterioration in allocative efficiency, as resources shifted toward low productivity firms. While highly productive firms typically grow faster, low productivity firms collectively gain employment share. Furthermore, the productivity gap between high and low productivity firms is large and increasing. Relatedly, we see more stable firm-level productivity rankings. Our key findings on productivity growth align with research for many other developed countries (see the references in section 4).

We observe a concentration of the innovative activities of Dutch firms. To measure innovation, we use firm-level labour hours registered under the Dutch R&D Promotion Act (WBSO) scheme. We summarise three main findings. First, WBSO-hours are increasingly concentrated among larger and older firms. This trend raises concerns, as research (Akcigit & Kerr, 2018; Klenow & Li, 2021) suggests that small firms often use R&D resources more efficiently and are more likely to generate breakthrough innovations. Second, the upward trend in overall WBSO-hours per FTE is primarily driven by incumbent firms, while the contributions by firm entry and exit remain limited. The average innovation intensity among incumbent firms falls, while reallocation has a positive contribution, consistent with the increased concentration among large firms. Finally, we find no clear evidence that employees move from less to more innovative firms in the market sector. After 2015, net employee flows between non-WBSO and WBSO-firms in the market sector are close to zero.

The relationship between weakened business dynamism and productivity growth is theoretically ambiguous. Interpreting a decline in economic dynamics is challenging. Job dynamics can boost productivity growth if it involves a reallocation to more productive jobs. However, excessive dynamics can harm productivity if it reduces incentives for employers and employees to invest in firm-specific human capital (Belot et al., 2007). Similarly, higher market concentration can be bad or good for productivity growth (Covarrubias et al., 2020; Syverson, 2019). When fewer firms enter a market, existing firms have more room to grow. The increased market power can reduce incentives for innovation and productivity improvements (Akcigit and Ates, 2021). De Ridder (2024) attributes rising market concentration to the strong scale economies inherent in intangible capital. The remaining dominant firms then leverage their profits to eliminate competitors and discourage potential entrants. In contrast, an increase in concentration can also result from replacing less productive firms by more productive ones. Bighelli et al. (2023) argue that the increase in concentration in Europe has actually contributed to improved allocative efficiency.

The structure of the rest of the paper is as follows. We start with a concise overview of the micro-datasets that are employed throughout the analysis. In Section 3, we examine business, job and worker dynamics. Sections 4 and 5 explore the relationship with productivity and innovation dynamics, respectively. We conclude with a summary of the findings and a discussion of key policy implications.

2 Data

In this chapter we outline the datasets used in this publication. The chapter is divided up into two sections according to the level of observation; firm-level or worker-level. The firm-level datasets are: Firm registry (ABR), firm demographics (BDK), the productivity data, trade data, and the innovation data (WBSO). The person-level datasets are Person registry (GBA) and the employee data (SPOLIS). We combine all these datasets using firm/employee identifiers; this yields a rich dataset on firms, employees, and the matches between them.

All datasets used are compiled and made available by Statistics Netherlands (CBS). These are confidential data, access to which is restricted to research institutions. The final dataset features a time span of 2007 to 2023 and focuses on the market sector, unless otherwise stated.[1] Several analyses use fewer years, due to the different data availability of some variables.

2.1 Firm-level data

We construct our firm-level database from several different datasets. Each of these datasets is linked through unique firm-level identifiers that allow us to keep track of firms across the different datasets as well as over time. Note that our analyses are all done at the business unit level, as opposed to the more aggregate organisation level, or the more detailed plant level. The business unit level yields the richest dataset with the largest availability of the indicators we use at the most detailed level.

2.1.1 ABR

The General Business Register (ABR) forms the basis for our firm-level dataset. It contains basic information on all active firms in the Netherlands, like sector, size in number of workers, and age. The data are based on trade registry data and curated by the CBS. The dataset contains roughly 1.3 million firm-records in 2007 and grows to about 2.5 million records in 2023. A large part of this increase is made up of the self-employed. These people often are registered as firms but operate as freelancers. Excluding firms with one worker or less, the number of firms was roughly 426 thousand in 2007, growing to just over 448 thousand in 2023.

The ABR features an events database to identify mergers, acquisitions, and other firm events. For some of our analyses, we explore firm entry and exit. To do this consistently, we need to know the reasons why firms enter and exit the market. Firms might be removed from the data for several different reasons. These include actual firm birth and death, but also other events like mergers, acquisitions, splitting off or up. Furthermore, we use these data to keep track of firms across events like mergers. More on this below.

All our analyses are at the firm business-unit level (*bedrijfseenheid* in Dutch). The CBS distinguishes between several levels of firm organisation: plant-level, business unit level and the business group level. These are partially analogous and partially nested concepts. As such, a business group contains one or multiple business units, which in turn contain one or multiple plants. Of these three, the ABR contains data for the business-unit and -group levels. We focus here on the business unit, since the other data sources we are using

[1] The market sector is defined following https://www.cbs.nl/nl-nl/onze-diensten/methoden/begrippen/marktsector, additionally excluding the financial sector due to data constraints. This means the sectors K, L, O, P, Q, T, and U are excluded. Other industries may be excluded in specific analyses due to data constraints for certain industries.

usually also report data at this level. Whenever we use the term 'firm', we are therefore talking about a business unit.

2.1.2 BDK

The Business Demographic Framework (BDK, *Bedrijfsdemografisch Kader* in Dutch) is a more refined version of the ABR. This dataset combines businesses that, due to administrative renumbering, are registered as separate companies even though they are the same entity. For example, due to changing accounting rules or adjustments in a firm's status, it might be that a single firm is registered in the ABR as multiple different firms in the same year. This is especially salient in 2009-2010, when a structural break in the data occurs due to a changing definition of what constitutes a firm. The BDK allows us to track and correct for such administrative changes in the data.

We combine the BDK and ABR events to follow firms over time. By combining the BDK correction for administrative changes and the ABR events data, which documents actual changes to firm status like M&A activity, we can track firms and jobs over time better than we would have been able otherwise. An illustrative example is the case of a merger between two firms. We code such a case as follows: the two previously existing firms cease to exist in the data, and a new firm emerges. However, in all three cases, we code this not as 'true entry'/'true exit', but as 'other entry'/'other exit'. At the same time, we assume that the jobs at the initially existing firms likely don't change. When tracking the number of jobs at these firms, we want to avoid overstating the job dynamics. Specifically, when two firms merge, we don't want to see two firms lose all their jobs (and exit), while a new firm instantly grows to their combined size. Instead, we want to make sure the stable jobs in a merger are accounted for as such. How we accomplish this exactly is described in appendix 7.1.

2.1.3 Productivity

The productivity dataset features information on productivity, along with its constituent parts. These include labour (in FTEs), capital stocks, revenue and value added. All variables are available both in nominal prices and deflated versions to correct for price developments. The dataset contains only corporations with more than two employees. This includes most large firms in the Netherlands and covers roughly 65% of revenue of all firms and 35% of all persons employed. The data is available from 2010 until 2022.

The main variables we use from this dataset are labour productivity and TFP. Labour productivity is a simple measure of value added per FTE (full-time employee). TFP is a productivity residual estimated using a control function approach in line with Ackerberg et al. (2015). This method specifies a value-added production function featuring labour and capital to estimate TFP as a residual.[2]

2.1.4 IHG & international status

The international trade in goods (IHG) contains trade data at the firm level. We use these data to identify exporters and importers. The data covers the period 2009-2022 and contains for all firms that import or export the traded values by product and origin/destination country. For any given year we consider a firm to be an exporter only if it engaged in exports for at least three of the previous 4 years, if available.

We use supplementary data to identify Multinationals (MNEs). This dataset is based on firm ownership information and contains dummies on whether firms are part of a multinational firm. This includes whether a firm is part of a Dutch or Foreign MNE. We use these data together with the data on exporters and importers to create groups of non-internationalised firms (neither exporter nor MNE), exporters & importers, and MNEs, the most internationalised firms.

[2] This database was made available by Statistics Netherlands (CBS). Extra documentation available from CBS upon request.

2.1.5 WBSO

The WBSO data contains information on hours and money spent on R&D activities. These data are constructed from tax information on firms that take part in the eponymous '*wet bevordering speur en ontwikkelwerk*' (WBSO) scheme, a tax-exemption programme for R&D expenditure.[3] This program allows firms to deduct R&D expenditures and wage costs of researchers for tax purposes.

The WBSO is available to almost all firms. As such, we assume that all firms engaged in innovative activities are using the WBSO. The coverage, however, does not appear to be 100% as there are few limitations facing firms wanting to take part in the WBSO, despite engaging in innovative activities. Brouwer et al. (2025) estimate that 64% of firms engaged in R&D use the WBSO, therefore our measurement error here is limited and likely contained to smaller firms. In total, the data contain about 10 thousand firms actively engaged in R&D, who cover around 20% of all workers in the economy.

In our analyses we focus on the number of hours associated with R&D activities. While the data contains information on R&D expenditures, this information is less readily usable due to structural breaks arising from changes in the WBSO deduction rules. The information on hours associated with R&D does not face this issue and therefore allows us to employ a wider timespan. For more information about this data, see the evaluations carried out on behalf of the Dutch Ministry of Economics (Brouwer et al., 2025; De Boer et al., 2019; Verhoeven et al., 2012).

2.2 Employee-level data

The SPOLISBUS dataset contains data on all employee jobs in the Netherlands. We track the job history of every employee, irrespective of age, across all sectors, including the public sector, for the quarterly periods from 2007 to 2024. For employees holding multiple jobs within a given quarter, the dominant job is selected. The dominant job is defined as the one with the highest average monthly wage over its duration.

We define job-spells as consecutive quarters of dominant job observations at the same firm. Recalls with an employment discontinuity of more than 31 days are considered separate job-spells. We define the hiring and separation quarters as the first and last quarter of a dominant job-spell, respectively.

We differentiate between three types of worker transitions/flows. Employment-to-employment transitions occur when employees change their dominant employer between quarters and the duration between the last day of their previous job-spell and the first day of their new job-spell is no longer than 31 days. Hires from non-employment occur when employees start a job-spell and were not previously employed in the 31 days prior. Separations to non-employment occur at the end of a job-spell when employees do not start a new job-spell within the subsequent 31 days.

[3] Note that the WBSO scheme does not cover all R&D expenditures. This is because the definition used by the scheme, *speur en ontwikkelingswerk*, does not 1:1 translate to the concept of R&D (Brouwer et al., 2025).

3 Business, job, and worker dynamism

This chapter describes the results on firm and worker dynamics in the Netherlands and compares them to results reported in the literature for other countries. The decline in dynamism is studied in the literature using several concepts. First, business dynamics is measured by entry and exit rates, which are defined as the number of entering and exiting firms divided by the total number of active firms, respectively.[4] Second, job dynamics is measured by the job reallocation rate, which is defined as the sum of created and destroyed jobs, scaled by the average employment over two periods. In other words, the rate measures the expansion or shrinking of employment in firms. Third, worker dynamics is measured by worker flows, the sum of workers hired and fired, scaled by the average employment over two periods. The difference between worker and job dynamics is called worker churn. Worker churn measures worker mobility, people changing jobs, without changing the total number of jobs at the firms.

In this study we use a standard shift-share analysis to explore the contribution of reallocating resources between different firm classes.[5] We decompose aggregate growth into changes that occur within groups, like sectors, and between groups. The former describes the average growth of firms within a group, while the latter tallies the contribution of shifting weights, like market share changes, to the aggregate growth. Specifically, consider the growth of variable y, averaged over the firm classes j, into three terms:

$$\sum_j s_{jt'}\, lny_{jt'} - \sum_j s_{jt}\, lny_{jt} = \sum_j s_{jt}\, \Delta lny_j + \sum_j \Delta s_j lny_{jt} + \sum_j \Delta s_j \Delta lny_j$$

where Δ denotes the change from period t to t', and s the share in employment of the firm class. The first term gives the within-effect, as the growth rates of y are weighted with the shares of the starting period. The second term presents the static shift effect, or the effect of reallocating employment between firm classes with a different, initial level of y. The last term, interacting both changes, gives the dynamic effect of shifting employment between firm classes with a different growth rate of y.

After describing dynamics for the total economy, we focus on differences in dynamics between firm classes. We begin in the next section with a discussion of aggregate business and job dynamics using annual firm-level data. Next, we elaborate on job and worker dynamics by switching to quarterly data. In sections 3.2 to 3.5 we document the contributions of different firm classes: sector, size, age and international orientation, respectively. Each section starts with a brief overview of results from other countries, before we present results for the Netherlands.

3.1 Dynamics in the market economy

3.1.1 Business dynamics

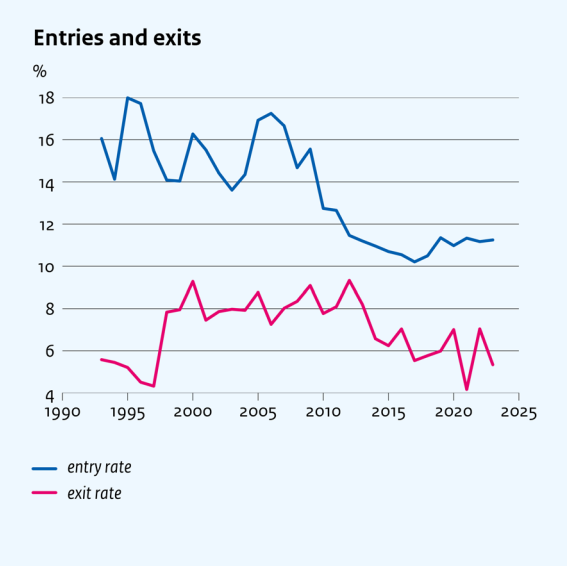
A decline in business dynamics is observed in most OECD countries. Decker et al. (2016b) show a strong secular decline in the firm entry rate in the US, whereas the exit rate remains rather stable (1979-2011).

[4] Decker et al. (2016b), followed by Bijnens and Konings (2020), measure business dynamics alternatively by changes in the shape of the employment growth rate distribution. Declines in dispersion and skewness in firm growth rates indicate weaker business dynamics.
[5] See similar applications in e.g. Biondi et al. (2025) and Duernecker and Sanchez-Martinez (2023).

Therefore, the rate of net entry has turned negative since 2008.[6] Calvino et al. (2020) document the same combination of falling entry rates and stable exit rates for 18 OECD countries (2000-2015). In contrast, Biondi et al. (2025, Fig. C1) present a large variation in entry and exit rates within and across 19 European countries. Finally, CMA (2024) finds that both entry and exit rates have fallen slightly in the UK after 2004. According to the report, the observation that the entry rate exceeds the exit rate since 2012 might indicate the survival of non-viable firms.

Business dynamism in the Netherlands is also slowing down, resulting mainly from a falling entry rate after 2008. Figure 3.1 shows a decline of the entry rate after the Great Recession, while the exit rate declined less. The exit rate remained remarkably low during the COVID crisis due to the government support measures.[7] Freeman et al. (2021) used a sample of non-financial corporations (2006-2015), showing that a decreasing trend in the entry rate dominated the slightly increasing trend in the exit rate after 2010 (see also CBS, 2022).

Figure 3.1 Decline in business dynamism



Note: Figure shows the ratio of firm entries and firm exits relative to all firms in a year. Authors calculations based on CBS statistics.

3.1.2 Job dynamics

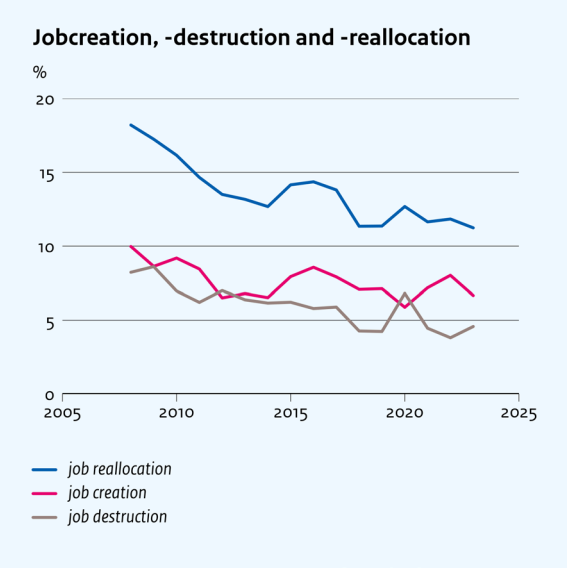
The job reallocation rate has fallen in most countries. The decline in the trend of the job reallocation rate, i.e., the sum of the job creation and destruction rates, was first observed in the US. Both job creation and destruction exhibit a general downward trend in the period 1980-2011, being particularly pronounced post-2000 (Decker et al., 2014). Using harmonized data for 19 European countries (without the Netherlands), Biondi et al. (2025) document a considerable fall in reallocation rates in all countries.[8] The average decline (-21%) is similar to the decline in the US (-24%) with a comparable dataset. Calvino et al. (2020) also find the trend decline for 18 OECD countries (2000-2015). CMA (2024) report that the declining trend for the UK resulted from both lower job creation and destruction rates (2004-2021). The fall in job creation is due to both a lower entry rate of new firms and a decline in the job creation rate by incumbents, while the decline in the job destruction rate is mainly caused by fewer firms ceasing activity. Bijnens and Konings (2020) present a decline in job creation and destruction rates in Belgium (1998-2007).

[6] Decker and Haltiwanger (2023) observed that the firm entry rate and the associated job creation rose sharply during the second half of 2020 and remained high through mid-2023.
[7] Bettendorf et al. (2021) find that in 2020 the exit rate was much lower for supported firms than for unsupported firms (i.e. non-financial corporations).
[8] Biondi et al. (2025) select firms with at least 20 employees in the years 1997 to 2021.

Job dynamics is also weakening in the Netherlands. Figure 3.2 measures the job reallocation rate entirely with firm-level employment data. It shows that the rate fell from 17% in 2007 to 11% in 2023. The rate dropped strongly after the Great Recession. A decline in both job creation and destruction rates contributed to the lower reallocation rate.

The hypothesis that the decline in firm and job dynamism is due to changes in the nature of productivity shocks is rejected in the literature. When productivity shocks become smaller or shorter-lived, firms need to adjust employment less. Decker et al. (2020) show that the decline in job dynamism in the United States can hardly be attributed to the shock hypothesis, implying that firms have responded less to given productivity shocks. Biondi et al. (2025) estimate that nearly 60% of the decline in job dynamism in German industry is explained by changing shock dynamics. Davies et al. (2023) conclude that the reduced job dynamism among UK firms did not reflect a change in the shocks hitting the economy. We will not further investigate the shock hypothesis for the Dutch economy.

Figure 3.2 Job creation, destruction, and reallocation



Note: Figure shows the creation and destruction of jobs in each year as a ratio of the for the average total jobs in that year. Job reallocation is the sum of creation and destruction. Authors calculations based on CBS statistics.

3.1.3 Worker dynamics

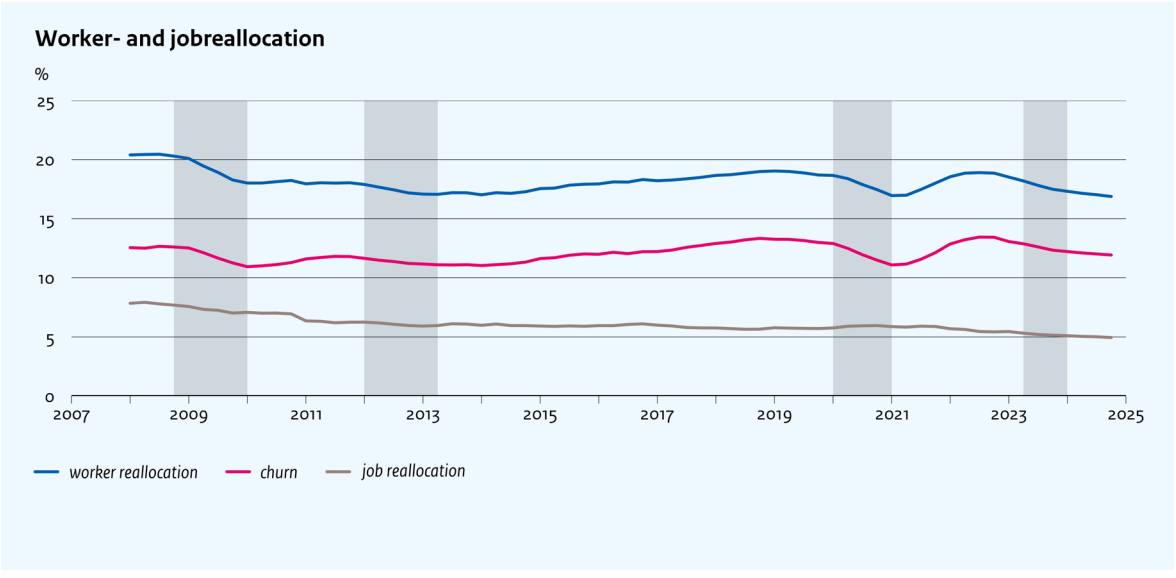
Worker dynamics has declined in the US. Worker dynamics consists of job dynamics and churn. Where churn consists of all job changes to and from existing jobs, without jobs being created or destroyed. Worker dynamics is about twice the size of job dynamics in the US (Haltiwanger, 2015). Similar to job dynamics, worker dynamics and churn declined sharply in the post-2000 period. Hyatt (2015) discusses the reasons for the decline in the job-to-job flow rate. Shifts in the labour force—such as an aging population, higher education levels, and declining entrepreneurship—offer only a partial explanation for the decline, with its underlying causes still largely unresolved. Akcigit and Ates (2023) argue that production technologies have become more complex and jobs more specialized, making it less easy to find and train new workers, which caused less churn. The authors argue that the persistent decline in worker dynamics in the US in turn contributed to a decline in knowledge diffusion and spillovers.

Worker dynamics was stable in Germany. Bachmann et al. (2021) show that job and worker dynamics are substantially larger in the US than in West Germany.[9] In contrast to the US, West-Germany did not experience a secular decline in the components of worker and job dynamics (period 1992-2014). Worker churn is shown to be procyclical in both Germany and the US (Bachmann et al., 2021; Haltiwanger et al., 2025; Moscarini & Postel-Vinay, 2018).

Job dynamics is one third of worker dynamics in the Netherlands. We now report observations based on quarterly flows of primary jobs (see the discussion in section 2.2). The previous section used firm-level employment data of the market sector. This section uses employee data of the total economy (including the government sector). Figure 3.3 shows worker reallocation as the sum of job reallocation and worker churn. The grey regions show quarters with a negative year-to-year GDP growth, which clearly identify the Great Recession, the debt crisis, and the COVID crisis. Switching to quarterly employee-level data only affects the level but not the declining trend of job reallocation that we have already discussed. The job dynamics rate is shown to fall from 7.8% in 2008 to 5.0% in 2024.

Worker dynamics does not show a strong trend, but seems to be associated with business cycles. Since worker churn is the larger component of worker dynamics, it drives the overall worker dynamics trend. Our evidence that worker dynamics has not experienced a persistent decline weakens the plausibility of the proposed link between worker dynamics and knowledge diffusion. During the Great Recession and debt crisis, worker dynamics decreased. In the subsequent expansion years (2014-2019), we see a gradual recovery of worker mobility, followed by a sharp decline during the Covid crisis in 2020. After a recovery, the dynamics has declined again following the increasing labour market tightness in recent years (2023-2024). To understand the procyclical worker dynamics, we look more at its components.

Figure 3.3 Worker reallocation versus job reallocation



Note: Worker reallocation consists of all job changes. It is divided into churn, the job changes between existing jobs, and job reallocation, the job changes paired with job creation or destruction, corresponding to Figure 3.2. All flows scaled by average employment in quarter t and t-1. Seasonally corrected by moving average over 4 quarters. The grey regions show quarters with a negative year-to-year GDP growth.

Worker dynamics can be further subdivided into job-to-job flows or flows to/from non-employment. Newly recruited workers can come directly from another firm, job-to-job mover, or they can come from non-

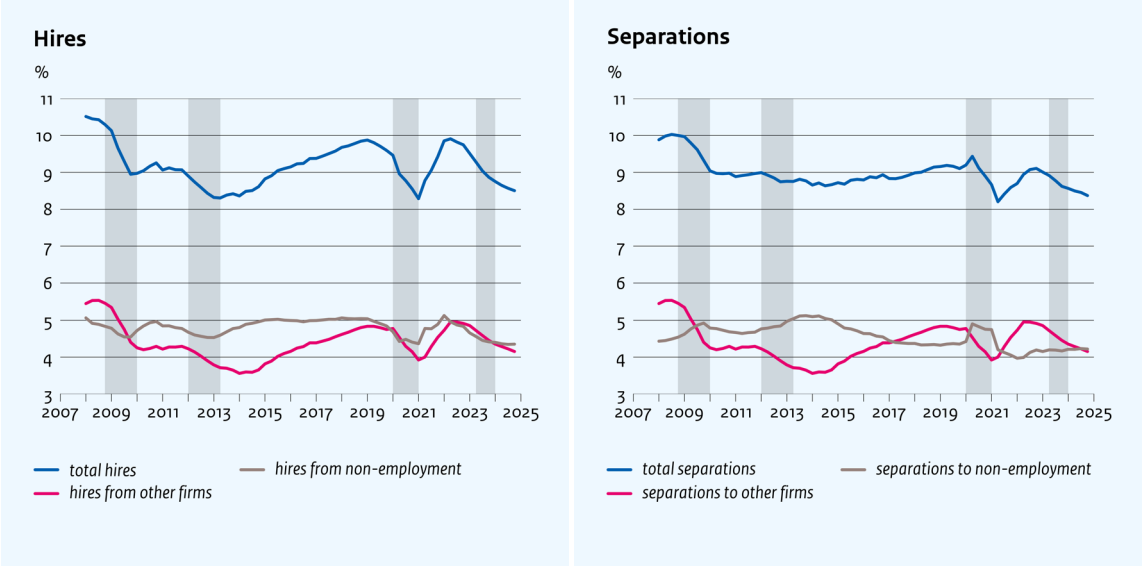
[9] We stress the caveat that comparing rates across countries remains difficult because studies make different selections of years, workers, and firms.

employment, like unemployment, self-employment or migration. Workers who leave can either start directly at another firm or leave employment. Figure 3.4 shows the sources of hires and the destinations of separations.

The procyclical pattern of worker dynamics is driven by job-to-job flows. Job-to-job movers (orange lines) fluctuate more than flows to/from non-employment (blue lines). In line with findings for other countries, job-to-job flows are procyclical, while flows to/from non-employment show less cyclical fluctuations (Bachmann et al., 2021; Moscarini & Postel-Vinay, 2018). During booms, more workers succeed in finding a more preferred job at another firm than during busts. We elaborate on the procyclicality of job-to-job flows in the next chapter, where we examine whether workers move from low productivity to higher productivity firms.

Smaller job-to-job flows also contribute to the sharp decline in worker dynamics in 2023 and 2024. In addition to the reduced flow from non-employment, the decline in worker dynamics is driven by reduced job-to-job flows. It seems that due to the tightness of the labour market, firms hoard labour, making poaching more difficult for other firms. Based on a survey of the European Commission, 11% of Dutch firms engaged in labour hoarding in 2023 and 2024 (Gayer et al., 2024).

Figure 3.4 Hires and Separations

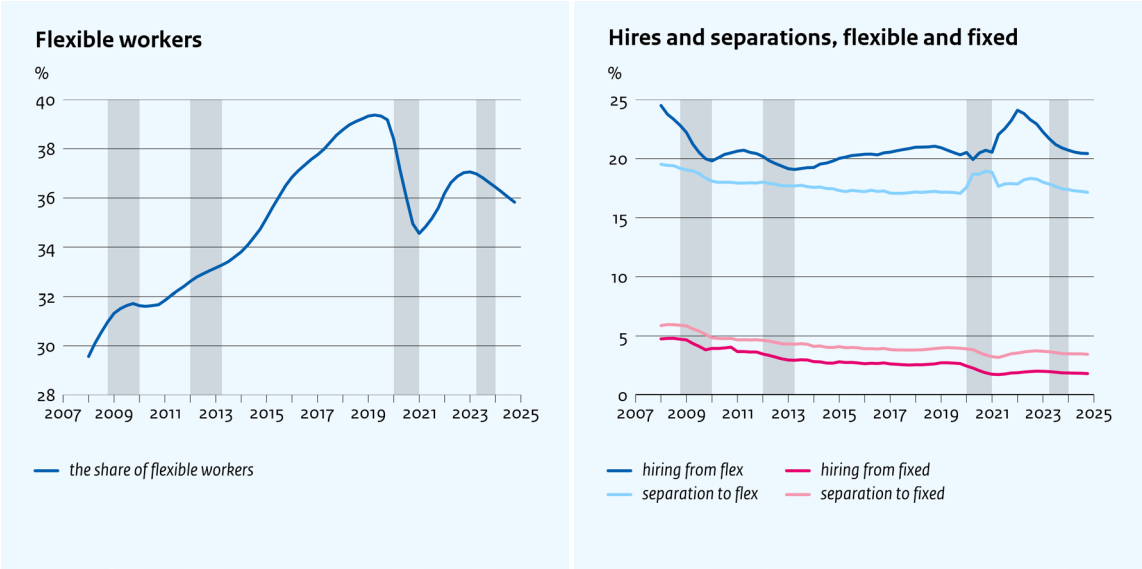


Note: Total hires and separations of workers, each scaled by average employment in quarter *t* and *t*-1. Seasonally corrected by moving average over 4 quarters.

Worker dynamics are stable, despite the increase in flexible workers (see Figure 3.5). We define flexible workers as on-call and agency workers and workers with a temporary contract. After a strong increase until 2019, and a decline during COVID, the share of flexible workers fluctuated around 36%.[10] Flexible workers are by definition more mobile, and the flows into and out of a flexible employment relationship are higher than the flows into and out of permanent employment.[11] The between effect on worker dynamics is positive (up to 2019), as employment is shifted to the group with more mobile workers. We also observe that the within effect is negative, as the shares of inflows and outflows for both permanent and flexible workers are lower in 2024 than in 2008 (see right figure). Therefore, the stable worker dynamics results for the combination of a negative within effect and a positive between effect.

[10] CBS (2024) shows that the number of agency workers is decreasing due to the increasing tightness on the labour market.
[11] Note that employees who switch between a permanent and a flexible contract with the same employer are included in the left figure but not in the right figure.

Figure 3.5 Mobility of flexible versus permanent workers



Note: Left figure shows the share of flexible workers, defined as the sum of on-call and agency workers and workers with a temporary contract, scaled by number of workers in quarter t. Right figure shows flows scaled by average number of workers (permanent or flexible) in quarter *t* and *t*-1. Seasonal adjustment: backward-looking moving average over 4 quarters.

3.2 Dynamics in sectors

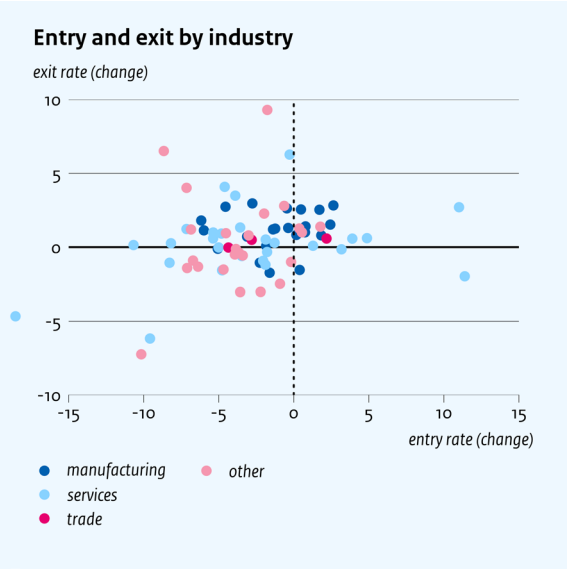
3.2.1 Business dynamics in sectors

Declines in the dispersion in employment growth rates indicate weaker business dynamics in most sectors. Decker et al. (2016b) discuss sector-specific patterns in business dynamics in the US, measured by the employment growth differences between fast and slow growing firms (the 90th and the 10th percentile, respectively). This differential declined faster in the services and the retail sectors than in manufacturing over the whole period (1983-2011), while it fell in the information sector after 2000. Bijnens and Konings (2020) apply the same measure to compare dynamics between sectors in Belgium. Whereas dynamics declined slowly in non-ICT-intensive sectors since 1985, it strongly increased in ICT-intensive sectors till the mid-1990s, followed by an even stronger decrease.

Entry rates decreased in most sectors. Calvino et al. (2020) conclude that the aggregate decline in entry rates originates from trends within (and not between) 2-digit industries. Entry rates decline faster in sectors with a high intangible and digital intensity, than in other sectors. Slightly falling trends in entry and exit rates are found in all UK sectors by CMA (2024), except for two sectors; transport and storage and wholesale and retail trade experienced rising trends.

We find that the development of business dynamics is not identical across sectors. Figure 3.6 is a scatter plot of changes in the entry and exit rate for 2-digit sectors from 2007 to 2023. The lower-left quadrant includes the sectors for which both the entry and the exit rate fell. In line with the aggregate outcomes, the number of sectors with a decreasing entry rate exceeds the fraction of sectors with a decreasing exit rate. Some industries that stand out in the figure are ICT services with the largest decline in entry and telecom with the second largest decline of the exit rate. On the other extreme, security and 'other services' show relatively large increases in entry rates and industries utility (power) and TV-broadcasting have increased exit rates.

Figure 3.6 Business dynamics differ across sectors (changes from 2007 to 2023)



Note: Figure shows the 2007-2023 change of the ratio of firm entries and firm exits as a percentage of all firms in a year for each industry at the 2-digit level. Authors calculations based on CBS statistics.

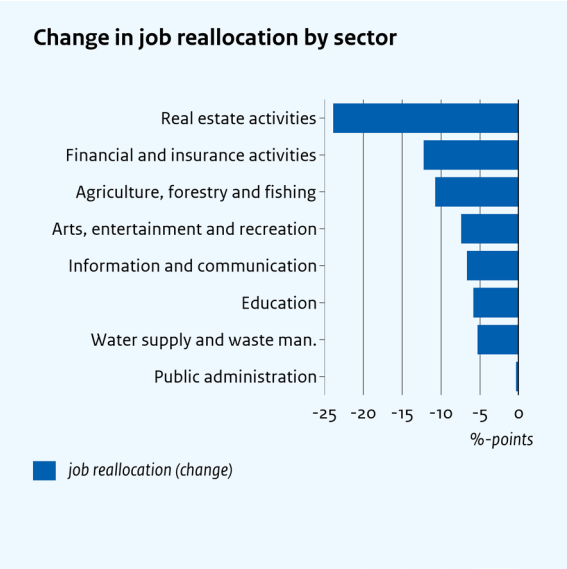
3.2.2 Job dynamics in key sectors

Job reallocation declines in most sectors. Biondi et al. (2025) document that the reallocation rate decreased in most sectors in all European countries. The decline is most pronounced in the two largest sectors in Europe: manufacturing and trade. An exception is the transportation and storage sector in some countries. In addition, Biondi et al. (2025) and Calvino et al. (2020) show that the aggregate decline in all countries is mainly explained by within-sector reductions and not by changes in sectoral composition.[12] CMA (2024) finds the same for the UK, including the non-decreasing trend in transportation and storage. Bijnens and Konings (2020) find a positive between effect for Belgium (1998-2007), implying that the drop in the job reallocation rate with 2.7%-point would have been 0.5%-point higher if jobs were not shifted between sectors.

The job reallocation rate decreased in all sectors in the Netherlands. Figure 3.7 shows the job reallocation rate decreased the most for the sectors supply of electricity and gas (D) and real estate activities (L), while it remained rather stable in the sectors accommodation and food services (I) and public administration and defence (O). A shift-share analysis shows that the aggregate reduction in job reallocation can be fully attributed to changes within sectors.

[12] They obtain similar findings when using microdata of German manufacturing (1996-2017).

Figure 3.7 The job reallocation rate decreased in all sectors from 2007 to 2023



Note: Job reallocation is the sum of job creation and destruction rates. The figure shows 2007-2023 change in job reallocation for firms grouped by selected sectors. Authors calculations based on CBS statistics.

3.3 Dynamics in size classes

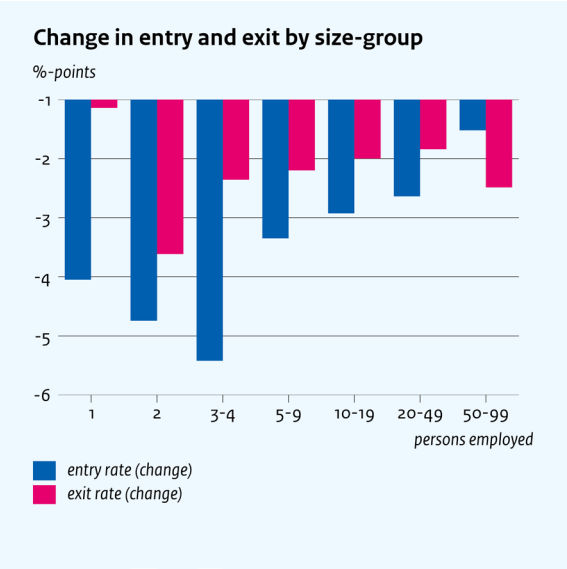
3.3.1 Business dynamics in size classes

Business dynamics for different size classes is analysed by employment shares. Haltiwanger (2015) reports the employment share of SMEs (employment smaller than 500 FTEs) and large firms (>500) in the US over the period 1981-2012. SMEs, mainly younger than 5 years, lost employment share (-10%-points) to large firms. Decker et al. (2016b) focus on the employment share of the group of high growth firms in the US (having employment growth rates in the top decile in 1973). They show that the share of employment accounted for by high growth firms declined in all size classes after 2000, in particular for firms with more than 50 employees. Findings by Bijnens and Konings (2020) support the pattern of declining shares of high growth firms in Belgium post-2000, but the smallest high growth firms (between 8 and 50 employees) experienced the fastest decreases.[13]

The entry and exit rates have declined for all size classes in the Netherlands, except for the exit rate of single employee firms (see Figure 3.8). Starting in 2007, we find that the entry rate declined most for small firms with fewer than five employees. A stable exit rate for firms with one employee compensates for the decreases in rates for the other size classes, yielding a relatively stable aggregate exit rate. Freeman et al. (2021) conclude that micro firms (with less than 10 employees) drive the business dynamics, given its large share in number of corporations (81.5% in 2016).

[13] They define high growth and firm size at time *t*-3.

Figure 3.8 Entry and exit rates across size classes (2007-2023)



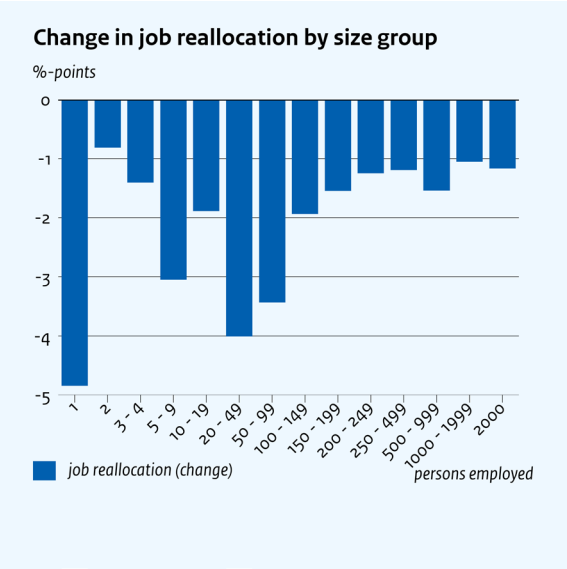
Note: Figure shows the 2007-2023 change of the ratio of firm entries and firm exits as a percentage of all firms in a year for firm size-groups in persons employed. Authors calculations based on CBS statistics.

3.3.2 Job dynamics in size classes

Internationally, the fall in the job reallocation rate is observed in all firm size classes. Biondi et al. (2025) find that increases are rare for all size classes in European countries. They also show the aggregate fall in each country is hardly affected by changing shares between three size classes. The minor impact of changes in the size composition is supported by results for Belgium from Bijnens and Konings (2020). ONS (2020) examines the fall in job reallocation in the UK between the pre- and post- 2008 economic downturn periods. The largest negative contributions are found for job destruction by closing micro businesses (one to nine employees) and large businesses (more than 250). Job creation by new large businesses is another important contributor.

The job reallocation rate decreased in all size classes in the Netherlands. Figure 3.9 presents the largest decreases in the rate for single employee firms and medium-sized firms with 20-99 employees. Smaller declines are found for large firms. The aggregate fall of -5.1% in total job reallocation is driven by the decrease within size classes, while the contribution of changing shares is small effectively zero.

Figure 3.9 The change in the job reallocation rate across size classes in the Netherlands (2007-2023)



Note: Job reallocation is the sum of job creation and destruction rates. 2007-2023 change in job reallocation for firms grouped by size according to persons employed. Authors calculations based on CBS statistics.

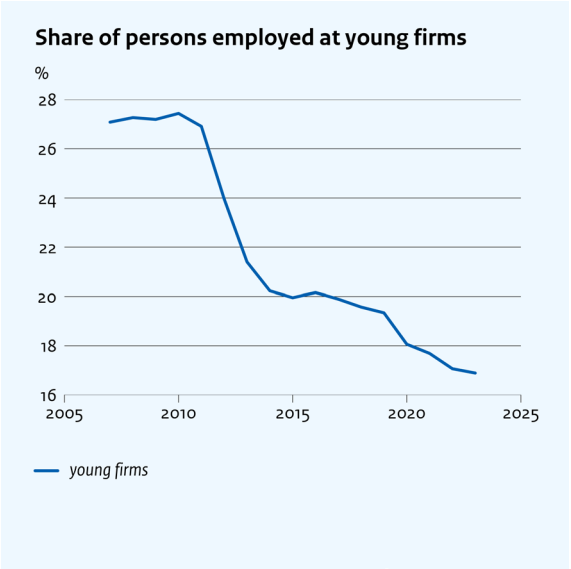
3.4 Dynamics in age classes

3.4.1 Business dynamics in age classes

The employment share of young firms is declining in many countries. In addition to the falling entry rate, Decker et al. (2016b) show a secular decline in the share of employment at new firms in the US (1983-2011). The share of employment of exiting young firms (aged five or below) increased after 2003. The share of young firms among firms with the 10% highest employment growth rates fell strongly after 2000. Calvino et al. (2020) document that the employment share of young firms in OECD countries is on average more than 8%-points lower in 2015 than in 2000. CMA (2024) reports that young firms in the UK account for a smaller share of turnover and employment in the last two decades. Bijnens and Konings (2020) find for Belgium that the 90-10 differential between employment growth rates is stable for young firms (max. 5 years old) after 2000, while it declines for older firms.

Our analysis confirms that a declining share of employees works at young firms in the Netherlands (Figure 3.10). The decline was particularly strong between 2010 and 2015.

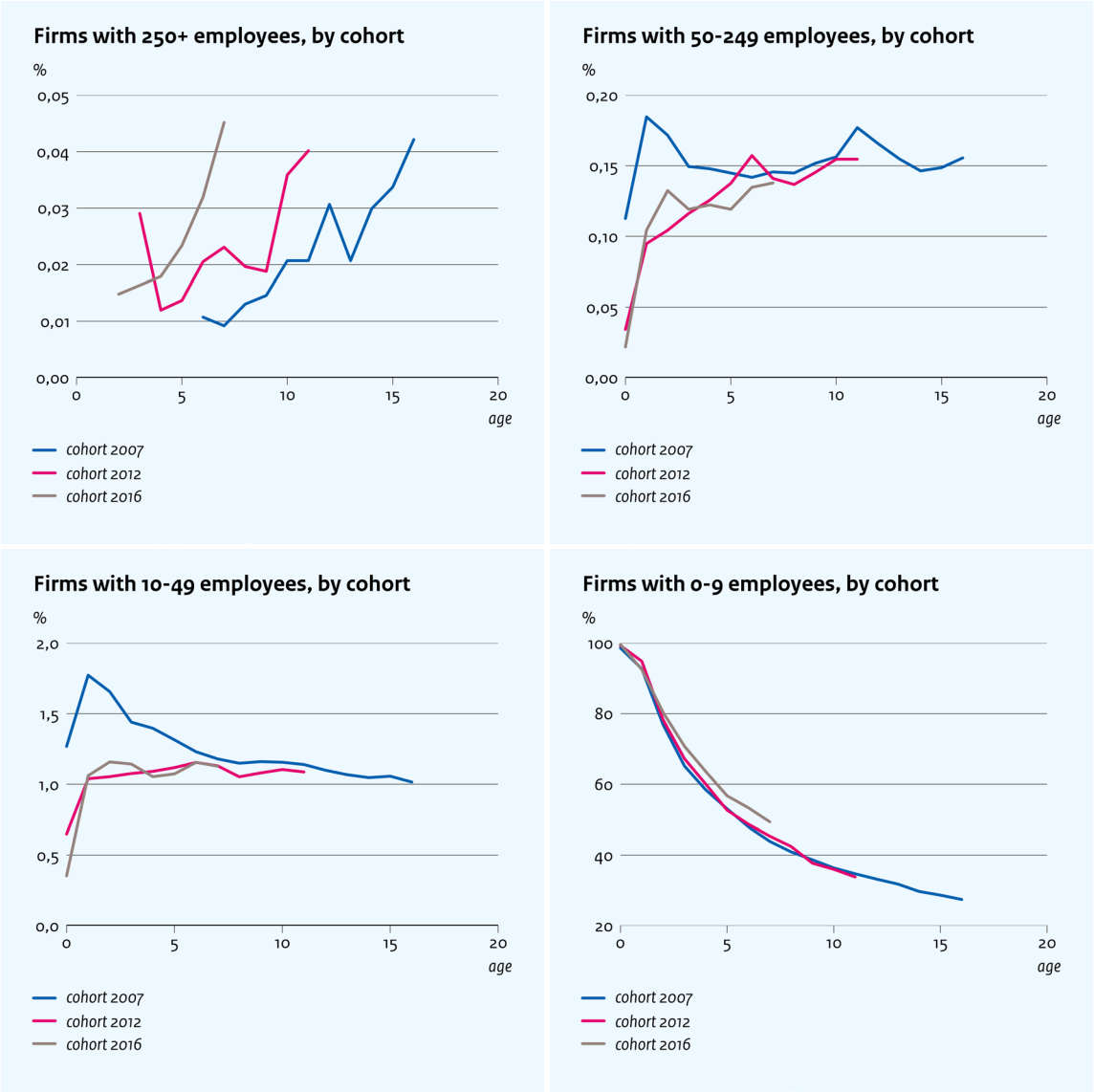
Figure 3.10 Employment share of young firms declines



Note: Figure shows the share of persons employed at firms under the age of 6.

The growth trajectories of young firms have become more polarized over time: relatively more end up either very small or very large, and fewer mature into mid-sized enterprises. Figure 3.11 follows all firms founded in 2007, 2012 or 2016 and asks: after a given number of years, what share employ at least 250 workers (top left panel) and what share employ 10–49 workers (bottom left panel)? A larger fraction of the 2016 start-up cohort reaches either very large scale (250+ employees) or remains very small (0–9 employees, bottom right panel) compared with the 2007 and 2012 cohorts. Conversely, at any firm age, a smaller fraction of the 2016 cohort attains mid-sized status. In short, young firms increasingly diverge: a larger share scales to very large size or persists as very small firms, while fewer grow into the mid-sized range.

Figure 3.11 The growth process of young firms has become more extreme



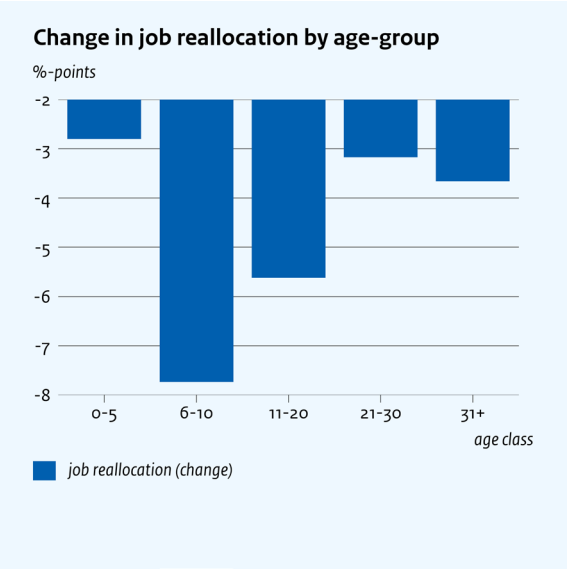
Source: CBS Statistics Netherlands and own calculations
Note: The figure tracks all firms founded in a given year over time. The top left panel shows the share of cohort firms that, at a given age, employ 250 or more workers. The other panel show the same firms attain a size of 50-249 (top right), 10-49 (bottom right), 0-9 (bottom left)

3.4.2 Job dynamics in age classes

The international literature finds that the decline in the job reallocation rate is concentrated in older firms. Biondi et al. (2025) document that the share of employment in young firms (not older than 5 years) is declining in Europe. The average job reallocation rate in Europe falls for older firms, while it rises for young firms. Shifting jobs to older, less dynamic firms accounts for an average of 18% of the decline in job reallocation across the countries. The fraction of age composition effects is the same (19%) for Belgium in Bijnens and Konings (2020). Decker et al. (2016b) show that high-growth young firms played critical roles in job and productivity growth of the US in the 1980s and 1990s. However, their contribution declined post-2000. The implied shift toward more mature firms accounts for about 26% of the decline in job reallocation rates (1979-2011).

The job reallocation rate falls for all age classes in the Netherlands. The rate declines the most for middle-aged (6-20 years) firms (Figure 3.12). The decline for young firms (< 6) is similar to the decline for older firms (>20). A shift-share analysis shows that around 60% of the decline can be explained by changes within age groups, and the remaining 40% by changes in the size of age groups.

Figure 3.12 The job reallocation rate declines in all age classes (2007-2023)



Note: Job reallocation is the sum of job creation and destruction rates. 2007-2023 change in job reallocation for firms grouped by age. Authors calculations based on CBS statistics.

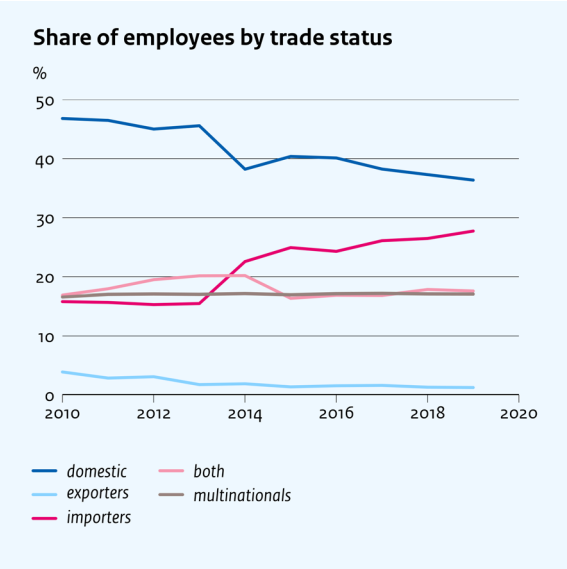
3.5 Dynamics and international orientation

3.5.1 Business dynamics and international orientation

The contribution of trade openness to weaker business dynamics is still uncertain. Calvino et al. (2020, Sec. 4.2.3) examine whether more open OECD economies have become more or less dynamic by considering different measures of globalization and Global Value Chains. They estimate a negative effect of import penetration (within manufacturing) on the entry rate, which is explained by the higher competition on domestic markets. Export intensity has an insignificant negative effect, as exports are concentrated at large, mature firms that are less dynamic. Backward integration, referring to importing intermediate inputs from foreign firms in value chains, depresses entry rates, which might again result from a competition effect. In contrast, forward integration, measured by exports of intermediate inputs, is associated with higher entry rates, possibly by stimulating production networks and knowledge spillovers. Bijnens and Konings (2020, Fig. 14) split the Belgian sample between sectors with a low and high MNE presence, based on the share of employment at firms with foreign ownership. The 90-10 dispersion of employment growth rates is larger in the group with a low MNE presence, while its falling trend is steeper starting in the mid-1990s.

The employment share of 'international' firms is increasing at the expense of 'domestic' firms in the Netherlands. In Figure 3.13 we consider four groups of international firms: importers, exporters, exporters that also import, and firms that are part of a domestic (neither import nor export) or foreign multinational. The declining share of domestic firms is driven by an increase in the share of firms that import, but don't export. The shares of exporters, also importers or not, and the share of multinationals have remained relatively stable. The declining employment shares of domestic firms might result from a decline in the net-entry or in the net-job creation by domestic firms (see next section).

Figure 3.13 Employment share of 'international' firms (2010-2023)



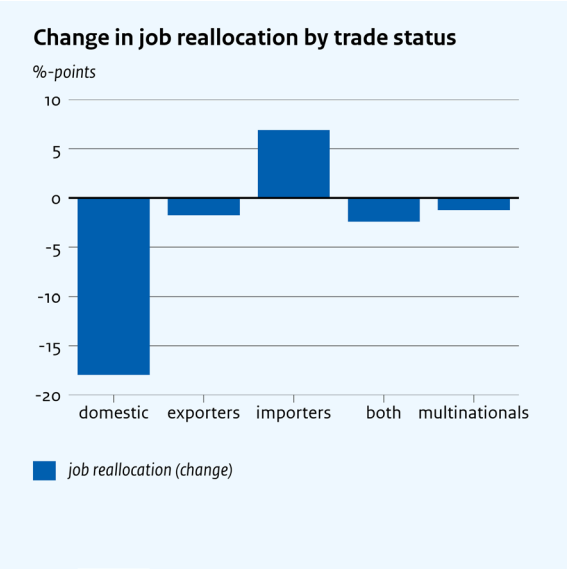
Note: Domestic firms engage in neither exports nor imports. Exporters and importers are firms that export or import, respectively, but are not part of a multinational firm. Both refers to firms engaging in both imports and exports, but are not part of a multinational.

3.5.2 Job dynamics and international orientation

The evidence on the role of firms with international activities in job dynamics is scarce in the literature. In line with the discussed effects on entry rates, Calvino et al. (2020) report significant negative effects of import penetration and export intensity on job reallocation, while forward linkages improve job dynamics. This is possibly due to competitive effects. Firm faced with competition from international markets might be less able to afford going on e.g. hiring sprees. At the same time, benefitting from additional demand from abroad, might have the opposite effect on firms with high enough productivity (see e.g. Melitz, 2003).

The aggregate decline in the job reallocation rate is driven by domestic firms in the Netherlands. Figure 3.14 shows that the job reallocation rate strongly falls for firms without any international activities and increases for importing firms, it remains stable for the other groups. This reflects the decline of the employment share of domestic firms and its increase for importers.

Figure 3.14 The job reallocation rate declines the most for domestic firms (2010 – 2023)



Note: Job reallocation is the sum of job creation and destruction rates. 2010-2023 change in job reallocation for firms grouped by international status. Exporters and importers are firms that export or import, respectively, but that are not part of a multinational firm. Both refers to firms engaging in both imports and exports, but are not part of a multinational. Authors calculations based on CBS statistics.

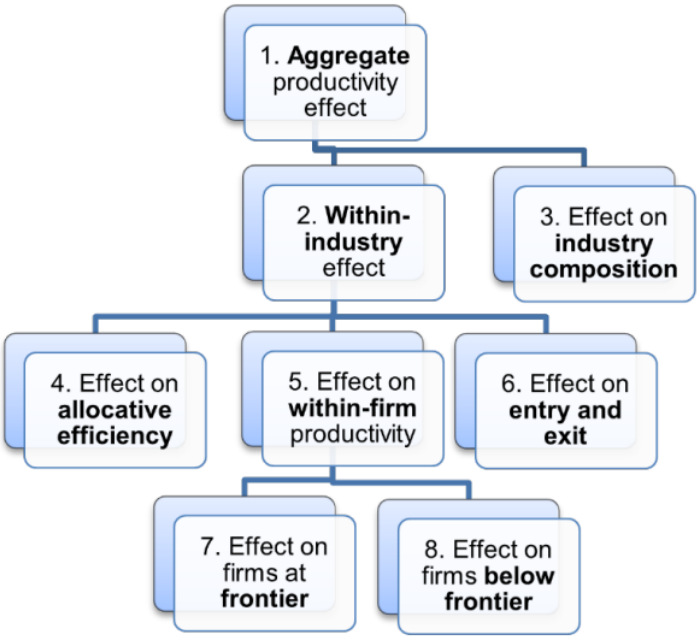
4 Productivity dynamics

In this chapter we examine the link between business and job dynamics and productivity dynamics. Akcigit and Ates (2021) link the slowdown of productivity growth to stylized facts of business dynamics. We describe different aspects of productivity dynamics related to the observations on dynamics in the previous section.

We focus on labour productivity of the market sector. Labour productivity is measured as real value added over persons employed in full-time equivalents. In view of the quality of the productivity data, we only include corporations with 3 or more persons employed. We restrict the analysis to firms in the market sector, which excludes primary sectors, mining, finance, real estate, government, education, health care and the cultural sector.

Aggregate productivity growth can in general fall due to lower productivity growth of firms or due to unfavourable compositional changes (within or between sectors). The outline of this chapter follows the scheme in Figure 4.1 that is proposed by André and Gal (2024). We start in section 4.1 with a discussion of within-sectors versus between-sectors effect on productivity growth. In section 4.2 we focus on the dispersion of firm productivity within sectors. We describe how productivity differs between firms with different characteristics, including differences between firms at and off the frontier. We complete the analysis in section 4.3 by assessing the contribution of reallocating activities between existing firms and the contribution of entry and exit. In section 4.4 we elaborate on changes in the fractions of firms that become less or more productive, or have to leave the market. In the final section we examine the relationship between worker dynamics and firm productivity by checking whether workers flow to more productive firms.

Figure 4.1 Decomposition of aggregate productivity growth



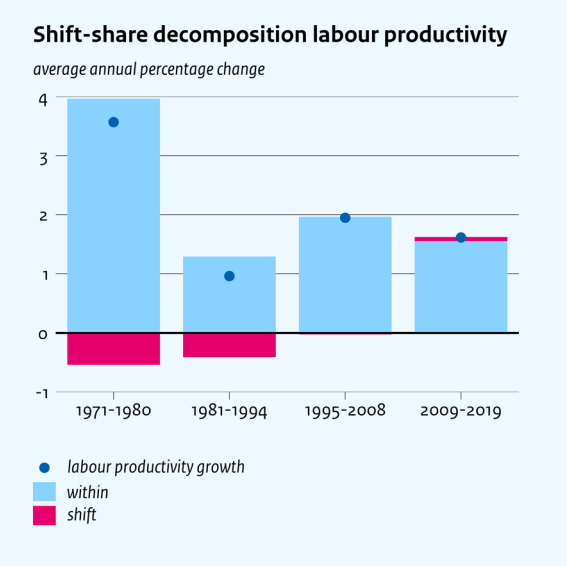
Note: Source: André and Gal (2024)

4.1 Productivity growth and sector structure

Changes within sectors are the main drivers of aggregate productivity growth. The share in GDP of service sectors is increasing at the expense of agriculture and manufacturing. This implies that economic activity is reallocated from sectors with high productivity growth to sectors with lower productivity growth, in line with Baumol's law. Duernecker and Sanchez-Martinez (2023, Tab. 3) present the results of a shift share analysis of labour productivity growth in the period 1970-2017. They show a decomposition of the average productivity growth in EU14[14] into a within-effect of 2.3%-point and a between-effect of -0.3%-points. Results for the Netherlands are very similar, 2.3% and -0.4%, respectively.[15] The average growth in the US was lower (1.4%) than in EU14, but the contribution of reallocation was similar at -0.4%-point. The analysis in OECD (2025, Fig. 1.4) supports the finding of a minimal role of reallocation in the period 1995-2019 in the US and the Euro area.

The reallocation effect is also small in the market sector in the Netherlands. De Vries and Van Leeuwen (2024) confirm that most of the productivity growth in the Netherlands is found within the sectors.[16] Whereas Duernecker and Sanchez-Martinez (2023) considered the total economy, we restrict the analysis to the market sector and distinguish four subperiods (Van der Plaat et al., 2025). [17] Figure 4.2 shows that in each period, the productivity growth of the market sector mainly arises from productivity improvements within sectors, and less from shifts between sectors. The low growth rates in the last decades are therefore not due to unfavourable shifts to low productive sectors. In the next sections we focus on the reallocation between firms in the same sector.

Figure 4.2 Reallocation effect on productivity growth is small in market sector



Note: Based on EUKLEMS sector-level data. See Van der Plaat et al. (2025) for details.

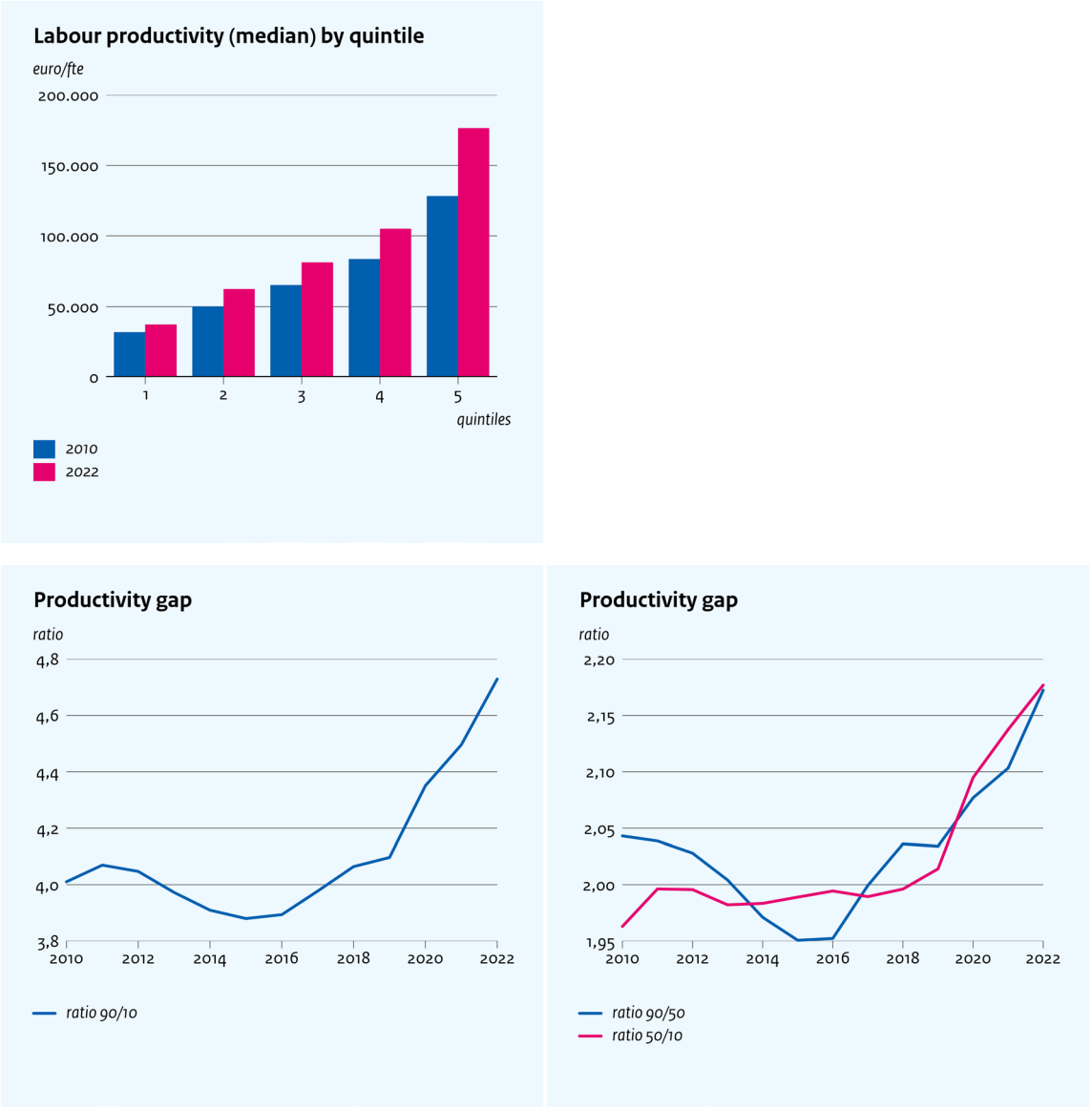
[14] These are the old member states without the UK.
[15] Kotera (2025, Fig. 2) reports that around 80% of the productivity growth of the Dutch economy from 2019–2023 can be attributed to within-sector growth.
[16] They exclude three sectors: education, government and real estate activities.
[17] Van der Plaat et al. (2025, Fig. 2.4) use an alternative definition of the market sector.

4.2 Dispersion of firm-level productivity

Differences between firm productivity within sectors increased in many countries. A growing dispersion of the productivity distribution indicates weakening business dynamics, as less productive firms struggle to adopt the best practices of more productive firms. Decker et al. (2020) document a rising within-industry dispersion of various productivity measures in the US. Berlingieri et al. (2024) calculate the gap between the 90th, 50th and 10% percentiles of the labour productivity distribution across 12 countries from 2001 to 2012. They find that the 90th/10th ratio widened by 14%, with the divergence being strongest between the 50th and 10th percentiles. Akcigit and Ates (2021) attribute the increasing gap to the decline in knowledge diffusion between frontier and laggard firms. The rise of intangible capital might also have contributed to less diffusion due to the large returns to scale of some intangibles (see e.g. Berlingieri et al., 2024). AI technologies, which are adopted faster by large firms (OECD, 2025), might widen the productivity gap further. Bloom (2020) discusses the relation between business cycles and productivity dispersion, showing it to be strongly counter-cyclical.

The gap between the most and the least productive firms has also increased in the Netherlands. We split firms into five equally sized productivity quintiles, per sector and year. Figure 4.3 (top-left) shows that the firms in the top quintile are about twice as productive as median firms, whereas firms in the bottom quintile are about half as productive as median firms. Figure 4.3 (bottom two) displays productivity gaps from 2010 to 2022, measured by the ratio of the top and the bottom quintile (bottom left), the top and the middle quintile and the middle and bottom quintile (bottom-right), respectively. Divergence between the top-and bottom quintile started around 2015 and accelerated after 2019. The top-medium gap remained stable until 2019, while the median-bottom gap even decreased until 2015 (see also Bettendorf and Polder, 2025). Productivity dispersion is also used as a measure of the misallocation of labour and capital, since high productive firms can use inputs more efficiently than low productive firms (Hsieh and Klenow, 2009). Bun and De Winter (2022) find increasing misallocation for capital after 2001 and for labour after 2013, in the Netherlands. While the increasing gap could be related to business cycles, its stability until 2014 and subsequent consistent rise continuing through to 2022, means this is likely not the only reason.

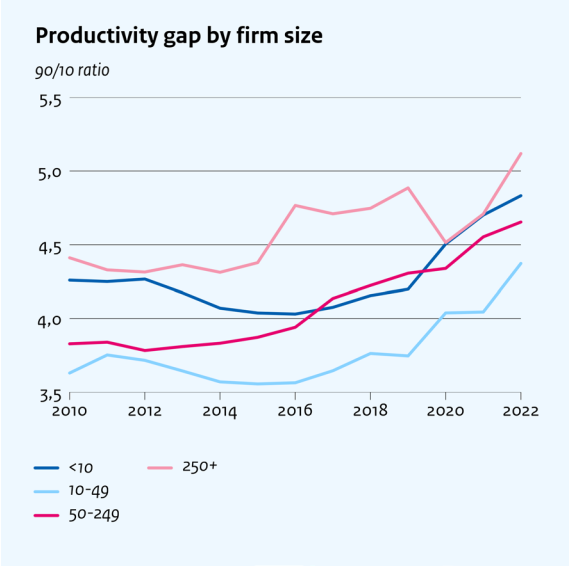
Figure 4.3 Dispersion between high and low productive firms is large and increasing



Note: Top figure shows the median labour productivity values for each of the five quintiles. These correspond to the 10th, 30th, 50th, 70th, and 90th percentiles. To two bottom figures show ratios between the 90th and 10th (left) and 90th & 50th and 50th & 10th percentiles (right).

Divergence is found for all size classes. Figure 4.4 presents the 90/10 gap for four size classes, based on firm employment. We observe a growing dispersion for all size classes, in particular after 2019.[18]

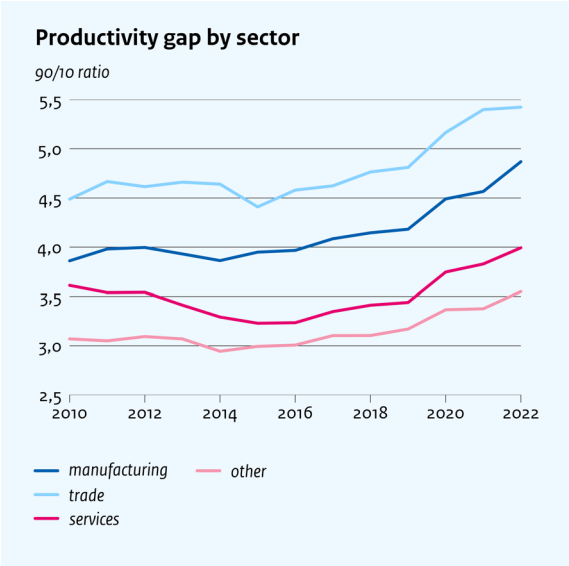
Figure 4.4 The top-bottom gap of labour productivity per size class



Note: Figure shows ratios between the 90th and 10th productivity percentiles. Lines show different size groups of firms by persons employed.

Divergence is observed in all main sectors. Figure 4.5 shows that the dispersion in trade and manufacturing is larger than in services and other sectors. The top-bottom gap is increasing in all sectors since 2015.

Figure 4.5 The top-bottom gap of labour productivity per sector

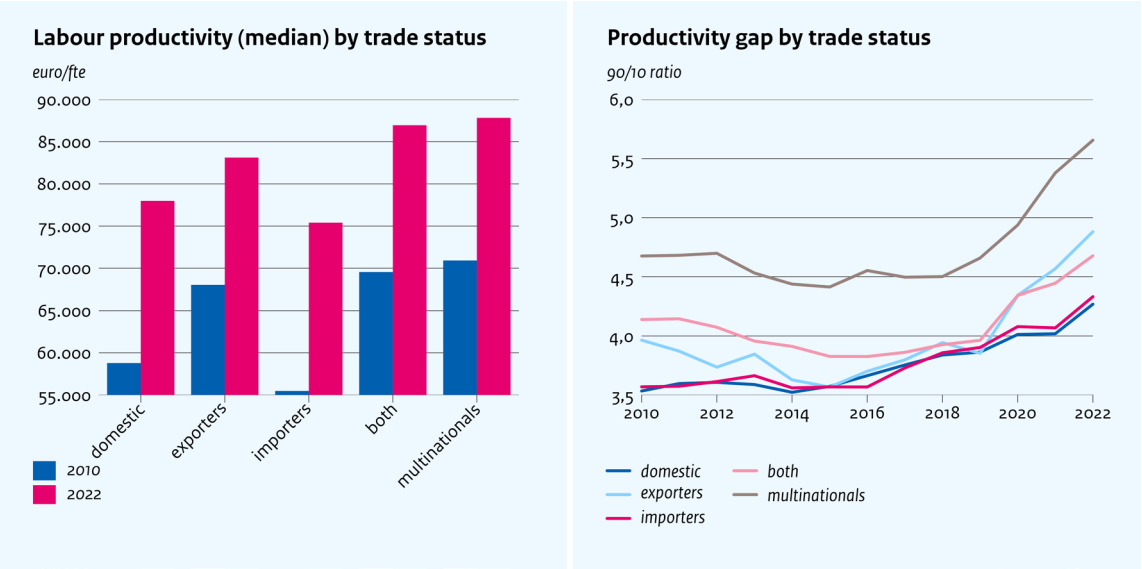


Note: Figure shows ratios between the 90th and 10th productivity percentiles. Lines show different size groups of firms by sectors.

[18] Kotera (2025) shows that the average growth rate of large firms (more than 250 FTEs), which have higher productivities in general, has been lower than of smaller firms in the period 2010-2021. OECD (2025) concludes that productivity differences by firm size are substantial in 2023 in all OECD countries.

Dispersion is increasing for 'domestic' and 'international' firms. We label firms without exporting transactions as domestic firms. We consider four groups of international firms; exporters, importers, exporters that also import, and firms that are part of a domestic or foreign multinational. Figure 4.6 illustrates a stylised fact: exporters are on average more productive than non-exporters, firms part of a multinational are most productive (Bernard & Jensen, 1999; CBS, 2022). Not only the median level, but also the productivity dispersion is larger for 'international' firms than for 'domestic' firms. However, dispersion is strongly increasing for all groups of firms.

Figure 4.6 International firms are more productive and dispersion is increasing for all groups



Note: Figure (left) shows the median labour productivity for firm by internationalization status. Figure (right) shows ratios between the 90th and 10th productivity percentiles. Lines show different size groups of firms by internationalization status.

4.3 The contribution of business dynamics to productivity growth

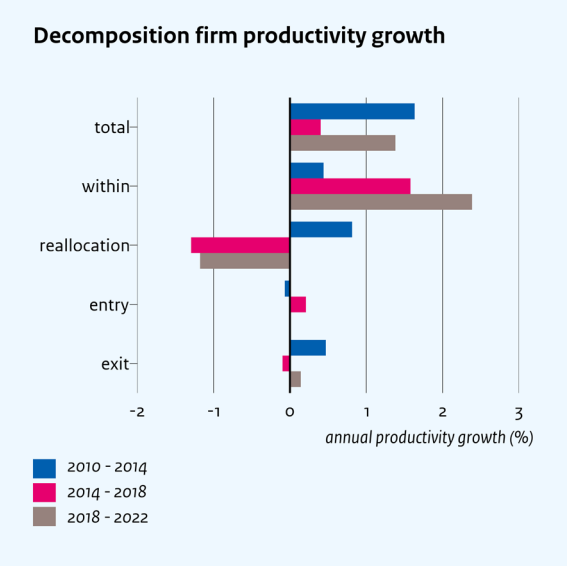
Productivity growth of the market sector is composed of productivity growth of continuing firms, new firms and exiting firms. We apply the dynamic Olley-Pakes decomposition (DOPD) to assess the contribution of business dynamics to productivity growth (Melitz & Polanec, 2015). The equation shows the decomposition of productivity growth from year t to year t' into four terms:

$$\Delta \mathrm{P} = \Delta \bar{\mathrm{P}}_C + \Delta \mathrm{cov}_C(\mathrm{s}, \mathrm{P}) + \mathrm{s}_{Et'}(P_{Et'} - P_{Ct'}) + \mathrm{s}_{Xt}(P_{Ct} - P_{Xt})$$

where P denotes productivity and s the share in hours worked. The subscripts C, E and X denote the group of continuing, entering and exiting firms, respectively. The contribution of continuing firms is split into two terms. The first term equals the unweighted average of productivity growth of continuing firms. The second term is the change in covariance between market share and productivity, which represents the change in allocative efficiency among continuing firms. A positive second term means that market shares are reallocated to high productive firms or that large firms growth their productivity faster. The contribution of new firms is positive when they enter the market with a productivity that is higher than the weighted average productivity of continuing firms. We distinguish between 'pure' firm births and entries due to other reasons (such as M&A, restructuring and split-offs). The last term shows that when below average productivity firms exit, this contributes positively to productivity growth. 'Pure' firm deaths are distinguished from other exits.

Productivity growth in the Netherlands is mainly driven by developments among continuing firms. Figure 4.7 shows the decomposition for three subperiods.[19] The first period 2010-2014 includes the fallout of the financial crisis, with an average GDP growth of 0.7% and an average productivity growth (in the market sector) of almost 1.4%. The second period 2014-2018 combines a higher GDP growth of 2.5% with a low productivity growth. The last period 2018-2022 includes the COVID crisis and the energy crisis. We first observe that the largest part of the productivity growth can be attributed to continuing firms in all periods and limited contributions of entering and exiting firms. Next, when comparing periods, we observe that the reallocation between continuing firms switches from the largest positive contribution in the first period to the largest negative one in the second and third period. This indicates an unfavourable shift of market shares toward low productive firms.

Figure 4.7 Decomposition of productivity growth in the market sector



Note: Figure shows the results from a dynamic Olley-Pakes decomposition of market sector labour productivity. Within and reallocation terms show an unweighted average and covariance term for surviving firms. Entry and exit refer to firms that are newly founded and definitively exit the market. Entry and exit (other) include additional dynamics such as firm mergers and acquisitions.

Decomposition results are sensitive to the decomposition method. The sign and size of the terms vary over the selected years and applied methods. CBS (2022) applies the DOP decomposition of TFP growth from 2012 to 2018 for the manufacturing and trade sectors.[20] The average TFP growth of 11% is mainly attributed to continuing firms, divided into a within effect of 4%-points and a reallocation effect of 5%-points. The large reallocation effect fully stems from the machine and electronic industries. The total contribution of the entry and exit dynamics is 2%-points. Finally, the decomposition results largely vary between sectors. Bettendorf and Polder (2025) use the Balk (2003) (eq. 51) decomposition and discuss sectoral differences in the period 2011-2021. Comparison with our results is complicated because of the different decomposition method along with some different underlying data choices[21]. The switch to a negative contribution of reallocation is found for both manufacturing and business services.

[19] This study updates the analysis for the period 2006-2015 by Freeman et al. (2021).
[20] Data cover corporations with more than one employee.
[21] Bettendorf and Polder (2025) use an imputation method to estimate missing labour productivity, which we do not do here. Furthermore, they employ a different deflation method, which is not available to us.

Decelerating allocative efficiency accounts for most of the decline in productivity growth in the US from 1997 to 2013. Decker et al. (2017) find that the within contribution is negative and stable in this period, while the contribution of reallocating between continuing firms is positive but declining. The contribution of net entry remains small.[22]

4.4 Transitions among productivity classes

Firms tend not to shift much within the productivity distribution over time. We measure how much movement there is by looking at how many firms change their position in the productivity ranking. To do this, firms are grouped into productivity deciles by sector in the starting year. Then we track where each firm ends up five years later—or whether it has exited the market.

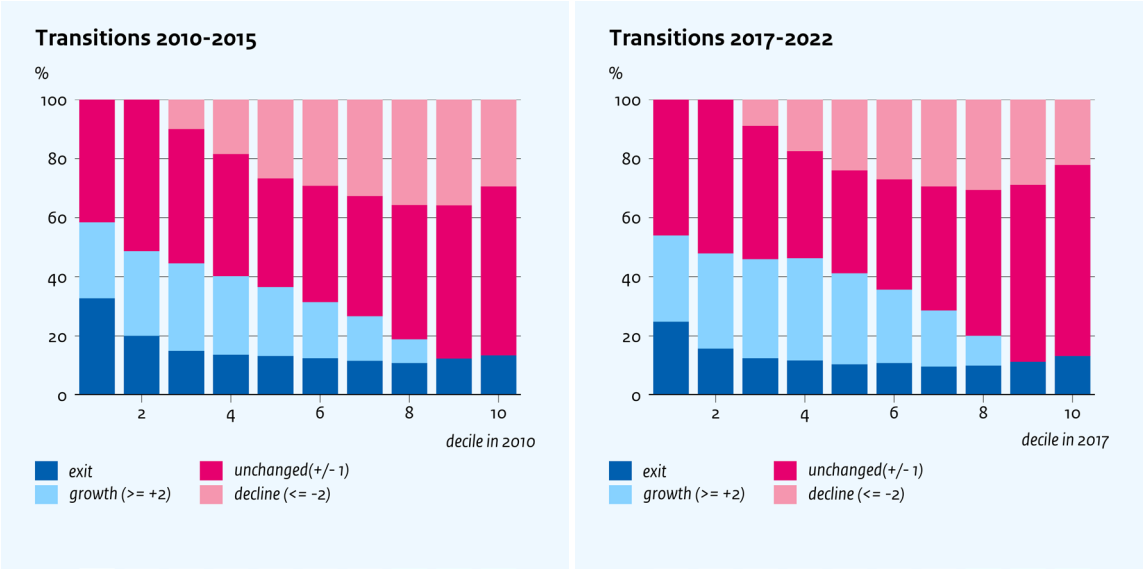
We show the firm transitions for two time periods. Figure 4.8 reveals that around 40% of the firms originally in the middle deciles moved maximal one decile after five years, while 50% moved more than one decile. Firms that started in the top two deciles were the most stable: more than 50% of them stayed in the same decile or moved one decile up- or downwards.[23] In contrast, firms in the bottom decile had the highest exit rate—they were more likely to leave the market entirely.

The least and the most productive firms became less mobile in 2017-2022. The productivity ranking in the middle deciles remained rather stable between both periods. A larger fraction of firms remained in the lowest deciles, whereas relatively fewer firms in these deciles exited. In the upper deciles more firms managed to stay at the top and fewer firms dropped in the ranking or exited the market.

The literature shows that firm-level productivity is persistent. Decker et al. (2020) show that the high persistence of revenue TFP in the US has declined only modestly (see also Foster et al., 2008). Davies et al. (2023) conclude that the productivity ranking of firms in the UK has become more stable, meaning that leaders are more likely to stay leaders and laggards to stay as laggards over time.

[22] They also apply the Foster, Haltiwanger, and Krizan (FHK) decomposition. Whereas the first term in the DOP decomposition equals the unweighted average, this alternative decomposition uses the weighted average to reflect the interaction between allocative efficiency effects and within-firm productivity change.
[23] This is in line with the finding in Bettendorf and Polder (2025) that 80% of the firms in the top decile remain at the frontier from year to year, or reappear after a single year.

Figure 4.8 Slow transitions between productivity deciles



Note: Figures show the transition of firms between productivity deciles between 2010-2015 (left) and 2017-2022 (right).

4.5 Worker flows between productivity classes

Employment develops differently over the business cycle between low and high productivity firms. In section 3.1.3 we showed the pro-cyclical pattern of worker dynamics. By analysing the origin and destination of worker flows per productivity quintile, we elaborate on the drivers of this pattern. For each firm in the market sector we decompose the quarterly growth of employment into job-to-job flows from or to other firms in the market and non-market sectors and into flows in and out non-employment (such as unemployment, self-employment and migration). Firms are grouped into five quintiles, based on average labour productivity over the firm's lifetime (to avoid the impact of large annual variations) and weighted by firm employment.[24] In Figure 4.9 we show the average net growth (scaled by average employment in the current and previous quarter) separately for the period 2011-2015 (with low GDP growth) and the period 2016-2019 (with higher GDP growth).

High productivity firms grow more than low productivity firms in both periods. Net job-to-job flows, referred to as poaching, are negative for low productivity firms and positive for high productivity firms, suggesting that workers move upwards on the job ladder. The job ladder describes that workers try to move slowly to more preferred jobs through job-to-job flows. Negative shocks might force workers down the ladder or even to unemployment (Moscarini & Postel-Vinay, 2018). Net poaching in the Netherlands is relatively limited compared to the US, likely due to the more compressed wage distribution. Job ladders are documented for the US in Haltiwanger et al. (2025) [25] and for Denmark in Bertheau and Vejlin (2025).[26]

[24] We face the problem that productivity data are not available for roughly 50% of job flows. This is due to productivity being unavailable for some, mostly small, firms. For these firms we impute productivity using percentiles of average (log) hourly wages. The results are similar when imputed firms are excluded.
[25] This study covers the quarters in 1998-2015. Productivity is measured by revenue per worker. High-productivity firms are in the top 2 quantiles, low-productivity firms in the lowest 3 quantiles.
[26] Bertheau and Vejlin (2025) use quarterly data from 1992-2013. They prefer the TFP-measure in the base case. High TFP firms are in the top two quintiles and low TFP firms are in the bottom quintile. They find that high productivity firms in Denmark grow on average by 0.52% (per quarter), where more than half (0.28%) results from net poaching. In comparison, employment of low productive firms falls on average (-0.39%), because they lose workers to other firms (-0.47%).

We find that net poaching is minimal for firms in the second to fourth productivity quintiles. As a result, these firms mainly grow by hiring workers from nonemployment in the second period, while worker flows are negligible during the first period. Therefore, we focus our discussion on firms in the first (lowest) and fifth (highest) quintiles.

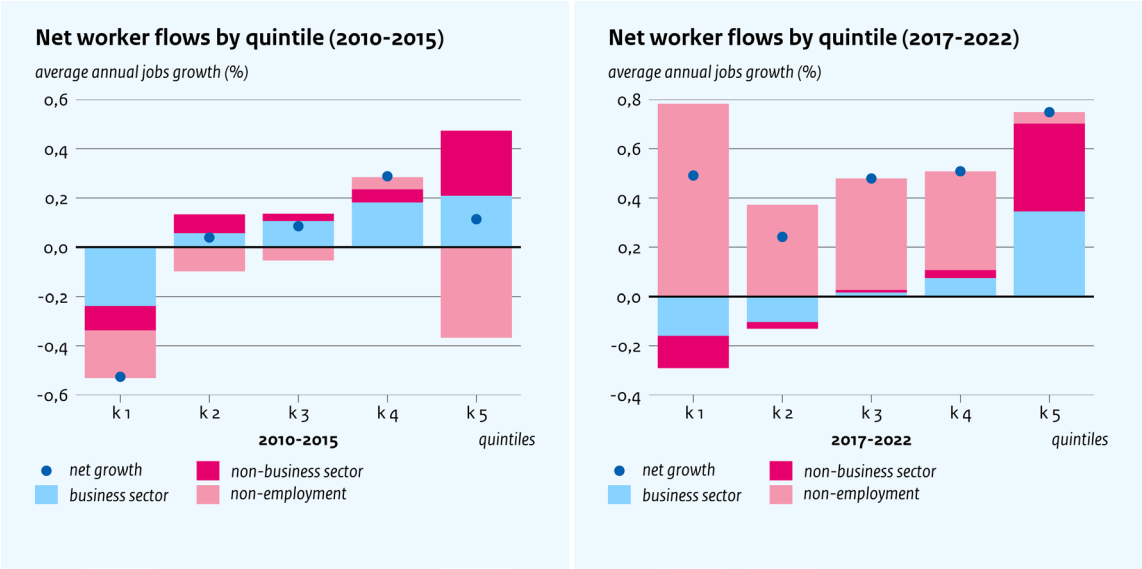
On average, low productivity firms attract workers from non-employment, and lose workers to other firms. This holds for both periods. We find that low productivity firms reduce employment in the first period more than high productivity firms. Net flows from non-employment are much smaller in the first period than in the second period, or firms lose workers in the first period by hiring fewer, and losing more workers to non-employment. These results illustrate the cleansing effect of recessions by reallocating resources towards more productive firms. Foster et al. (2016) find that in the US employment is reallocated towards more productive firms in downturns, but less so during the Great Recession. Bartelsman et al. (2018) find the same pattern in six European countries (without the Netherlands). Our results are in line with the findings for Denmark in Bertheau and Vejlin (2025).

Net poaching from the market and non-market sectors contributes to the employment growth of the most productive firms. We find that job-to-job flows are positive in the first period, but are smaller than in the second period. The reason is that poaching workers from other firms becomes more difficult during recessions. In addition, most productive firms reduce employment in the first period by losing workers to non-employment. The sullying effect works against the cleansing effect: lower job mobility harms productivity growth during downturns. Haltiwanger et al. (2025) find empirical evidence of both cleansing and sullying effects of recessions in the US. Bertheau and Vejlin (2025) present evidence on sullying effects in Denmark.

In sum, our results indicate that less productive firms grow by attracting workers from non-employment, while more productive firms grow by job-to-job flows. The job ladder works well in both periods, as workers move to more productive firms.[27] Unfortunately, the timespan of our data is too short to conclude whether the job ladder has improved or not. We do not have sufficient observations in downturns to isolate structural effects from cyclical effects.[28]

[27] We leave the wage ladder for future research. Bertheau and Vejlin (2025) conclude that the job ladder measured by productivity is better than measured by wages for two reasons. First, the difference in growth rates between high and low productive firms is larger than between high and low wage firms. Second, net poaching is larger using productivity as a ranking compared to wages.
[28] Using the same data but covering the years 1999 to 2013, Abolhassani (2024) estimates the effect of job mobility on productivity. The study finds a positive association between hiring from more productive firms and productivity gain one year after hiring. The effect is larger when workers move within the same sector than across sectors, suggesting a link with knowledge diffusion. Since a single coefficient is estimated for all years, the study does not deal with changes in productivity spillovers.

Figure 4.9 Net worker flows per productivity quintile



Note: Figure shows for business sector firms in each productivity quintile, the net worker flows with three categories: business sector, flows to and from other business sector firms (of any quintile); non- business sector, flows to and from other firms; non-employment, flow to and from other sources, like unemployment, migration, retiring.

5 Innovation activities

In this chapter we analyse trends in innovation activities of Dutch firms between 2007 - 2023. The main data source for this is firm-level data on uptake of an R&D tax benefit scheme by the Dutch government, called "WBSO" (*Wet Bevordering Speur- en Ontwikkelingswerk*). This scheme gives tax benefits to firms in the Netherlands for both labour and capital expenditures related to R&D. In 2024, the Dutch government spent roughly 1.3 bln euros on the WBSO scheme.[29]

The main findings are as follows: i) the share of firms engaged in innovation activities has been stable since 2017, and the share of employees working at innovative firms, firms engaged in innovation activities, has been stable since 2010, ii) the total number of WBSO hours across the Dutch economy continues to rise, iii) innovation activity has shifted towards older, and larger firms between 2015 – 2023, iv) the distribution of innovation activities across sectors is broadly stable since 2012, with the notable exception of the significant growth of the machine industry (C28) since 2016, v) the innovation intensity of the Dutch economy (WBSO hours per FTE) is growing moderately, and this is explained mostly by a reallocation effect towards large firms (even counteracting a strong and negative within-firm effect), and not significantly affected by firm entry and exit, vi) we find no evidence in favour of the existence of an innovation activity employment ladder. In sum, our evidence points towards a neutral to slightly increasing trend in overall innovation of the Dutch economy, as well as increasing concentration of innovation activities in older and larger firms.

These trends are in line with our findings in previous chapters. The finding that innovation activities are increasingly concentrated in older firms connects well with the earlier found decrease in business dynamism. A shift towards large firms may also be explained as a consequence of falling business dynamism, although we do find a relatively low (but positive) correlation between firm age and size in our data.

There is a lively debate in the academic literature on the potential drivers and consequences of increasing market concentration and its connection with innovation. Authors have posited that increased market concentration can be explained with falling firm dynamism (Decker et al., 2016a), the rise of multi-product firms with low overhead costs (Aghion et al., 2023), intangible capital (De Ridder, 2024), falling knowledge diffusion (Akcigit & Ates, 2023), decreasing effectiveness of research in translating to growth (Bloom et al., 2020; Fort et al., 2025), demographics (Peters & Walsh, 2024), and interest rates (Liu et al., 2022).

Whether rising concentration of innovative activities benefits future productivity growth also remains an open debate. Akcigit and Kerr (2018) and others argue that small firms have higher incentives for innovation than large firms, specifically for external innovation (i.e. new products rather than improvements of existing ones). Klenow and Li (2021) show that in the US, young and small firms both have a disproportionate contribution to aggregate growth compared to their share of total employment. However, Berlingieri et al. (2025) have recently shown that product innovation intensity in a panel of French firms is highly linear in firm size. Another possible way of interpreting this result is through the lens of knowledge diffusion: if knowledge is spread less through the economy, firms may lack the basic knowledge necessary to engage in R&D investments and innovation, limiting future productivity growth (Akcigit & Ates, 2023). However, there may be positive aspects to concentration, e.g., due to higher efficiency of scale (Aghion et al., 2023). Also, if knowledge is shared quickly between firms, the outcomes of R&D efforts even by a small share of firms might in theory spread quickly through the economy. Finally, Berlingieri et al. (2025) argue that firm size may play less of a role for innovation and innovation policy than previously thought.

[29] Another large R&D subsidy is the 'Innovatiebox' scheme, on which the Dutch government spent around 2.2 bln euros in 2024.

5.1 Data

The main data source we use in this analysis covers firm-by-year information on the uptake of R&D subsidies. This source contains administrative information on the total hours of labour registered by firms under the 'WBSO' scheme by the Dutch government. The dataset also covers other related variables, such as total firm-level WBSO-related expenditures, and total tax benefit received. The WBSO data cover the years 2007 – 2023. For our analysis, we select firms that are active in the market sector (see above), and that have at least three employees. Our sample contains WBSO information for around 10,000 firms (in 2023), and we assume that firms without any reported WBSO information did not partake in the scheme.

Our main measure of innovation activities at the firm-year level is the labour hours a firm has registered under the WBSO scheme. We acknowledge that labour costs are only a part of total WBSO-related costs.[30] However, the WBSO scheme and related laws have undergone several changes over the years.[31] This means that labour hours registered under the WBSO scheme are the only available measure that can be observed consistently across firms and time. We also acknowledge that the WBSO is targeted towards only a part of all R&D expenditures; see e.g. Brouwer et al. (2025) for the difference between S&O [32] and R&D and how this changed over time. However, we argue that WBSO hours at the firm level provide the best available data for studying broad developments of innovation activities in the Dutch economy over time.

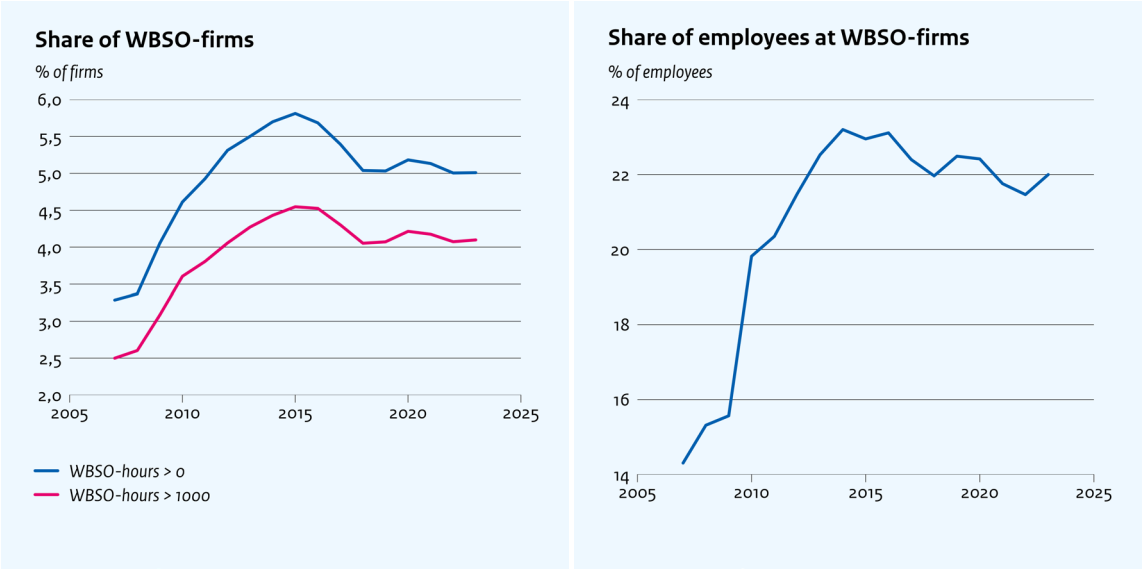
5.2 Descriptive Results

Approximately 5% of all companies in the dataset (or about 10,000) reported WBSO-supported innovation activities in 2023. See Figure 5.1 (left). A slightly lower share of around 4% of firms report more than 1,000 WBSO hours per year. However, these two groups show very similar developments over time. The share of firms with any WBSO hours has grown strongly after 2007, before peaking in 2015, and subsequently stabilizing at its current level since around 2017.

We note that WBSO usage by firms has increased from around 3.5% of all firms in our sample in 2007, to around 5-6% after 2015. Particularly the initial increase between 2007 – 2012 coincides with several significant changes in the composition of WBSO hours (see below). We interpret the period 2007 – 2012 as a time of expansion in the use of WBSO in the economy, potentially being more reflective of changes in the WBSO and its uptake, rather than innovative activity itself. We hence put more weight in our interpretation of WBSO as a measure of innovation in the Dutch economy during the time period following roughly 2012.

[30] Between 2016 – 2023, wage costs make up a very stable share of roughly 75% of total WBSO costs across all firms in the sample. The correlation of WBSO wage costs and total WBSO costs is roughly 0.86 for the same period.
[31] Most notably, up until 2016, the WBSO scheme pertained only to labour costs related to R&D activities. In 2012, the RDA scheme was introduced to account for capital expenditures related to R&D. In 2016, the two schemes were combined under the WBSO.
[32] In Dutch: *speur- en ontwikkelingswerk*. The concept of innovation using in WBSO is a more narrow concept of innovation activities.

Figure 5.1 Share of WBSO-firms and employees at WBSO firms



Note: This figure shows shares of firms engaged in WBSO (left) and the share of all employees working at a WBSO-firm(right).

5.3 Composition of WBSO Hours by Groups

In this section, we examine the composition of total annual WBSO hours over time and for different groups of firms. In all subsequent analyses, we start our analysis from total annual WBSO hours in a given year, and then apportion those hours according to one of several firm characteristics, such as size, sector, and age.

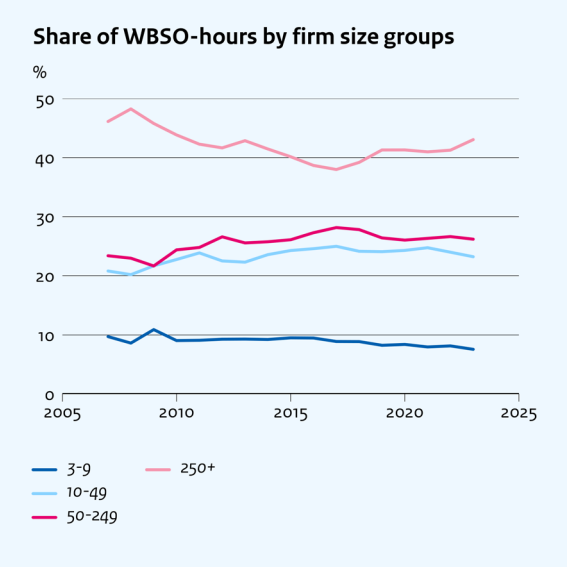
5.3.1 Composition of WBSO Hours by Company Size

Mid-sized companies (10 – 249 employees) are collectively responsible for around half of total WBSO hours, while large companies (250+ employees) are responsible for around 40%, and small companies (3 – 9 employees) make up the remaining 10% of all WBSO hours in our sample. Figure 5.2 shows these numbers. The ranking across these groups is broadly stable since around 2012.

However, since 2017, the largest firms have collectively grown by around 5% of total WBSO hours. This growth of the largest firms is mirrored by small losses in the shares of the groups of smaller firms. Particularly the group of very small firms (3 – 9 employees) is on a slow, but marked downward trend since 2017. These results on increasing concentration of R&D efforts in large firms mirrors results found by TNO (2024) and CBS (2023).

The growing share of the largest firms in WBSO hours is mostly due to a particularly strong growth in hours of these firms. Figure 7.2 in the appendix shows that the initial drop in the share of the largest firms between 2007 and 2017 can be explained by a relatively stronger growth in hours at mid-sized firms during that period. The figures further imply that the growth in hours of the largest firms is not due to an increase in the number of large firms, but rather a growth in WBSO hours/firm; this figure also suggests that at least some of the growth in share and hours of firms with 50 – 249 employees is explained by a growth in the number of such firms.

Figure 5.2 Share of WBSO hours by Size Class

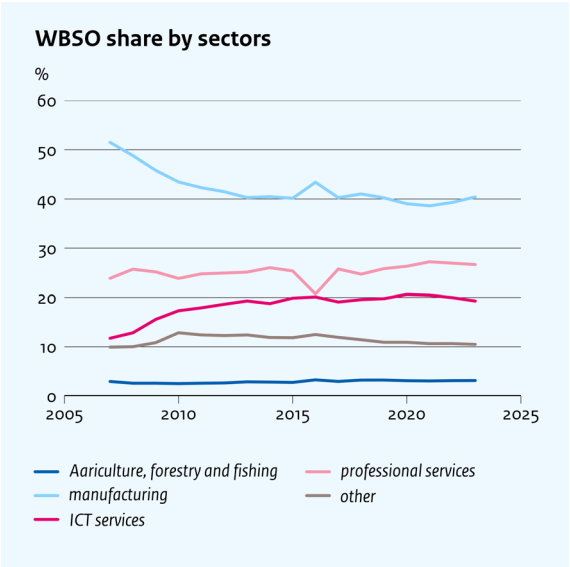


Note: Figure shows shares of total WBSO divided over firm groups. Lines show different size groups of firms by persons employed.

5.3.2 Composition of WBSO Hours by Sector & Two-Digit Industry

The sectors responsible for the most WBSO hours are manufacturing (C), consultancy & research (M), and ICT (J), see Figure 5.3.[33] The distribution across sectors is broadly stable since the early 2010s. An analysis of the top two-digit industries in Figure 5.4**Error! Reference source not found.** reveals that the machine sector (28) has increased its share by around 5% of total WBSO hours between 2016 and 2023, while the overall manufacturing sector's share has remained constant. The other striking industry from this figure is the IT industry (62), which showed strong growth between 2007 and 2015.

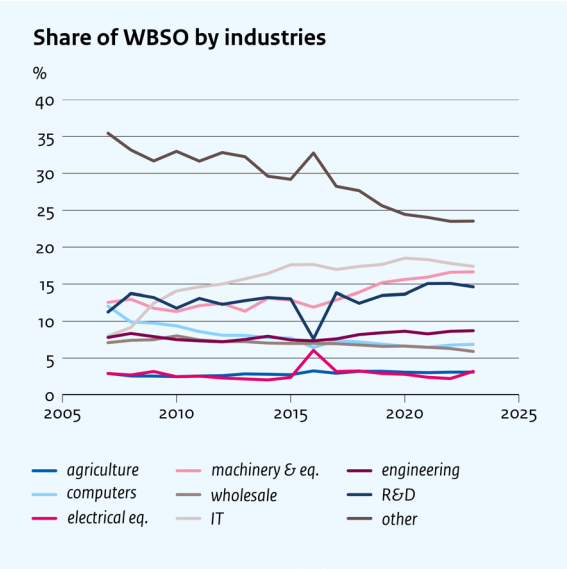
Figure 5.3 Share of WBSO Hours by Sector



Note: Figure shows shares of total WBSO divided over firm groups. Lines show different sectors.

[33] Note that sector financial services (F), which has been identified as a large WBSO sector by Brouwer et al. (2025), is not part of our sample due to our selection of firms in the market sector.

Figure 5.4 Share of WBSO hours per two-digit industry



Note: Figure shows shares of total WBSO divided over firm groups. Lines show different detailed (2-digit) sectors.

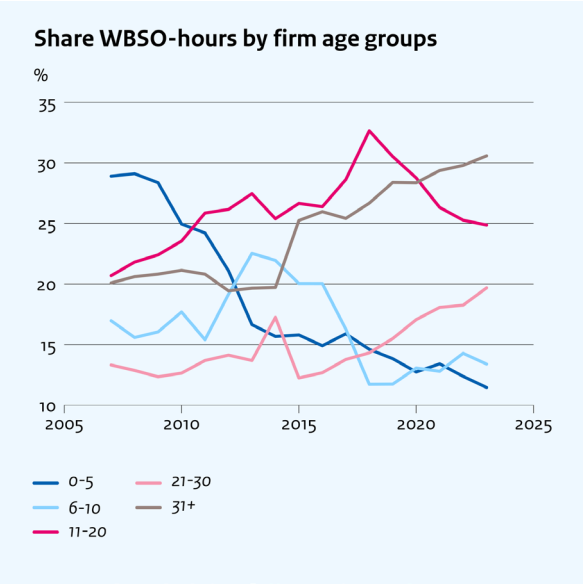
5.3.3 Composition of WBSO Hours by Company Age

We observe a significant shift in WBSO hours towards the oldest companies (31+ years), from 20% in 2007, towards 30% by the end of the sample period. See Figure 5.5. Firms aged 21 – 30 years have also increased their collective share, from ~13% to around 20%. Conversely, the youngest companies, aged 0 – 5 years, saw their share of innovation activities drop markedly, from approximately 30% down to 12%.

We note that the steepest drop in the share of young firms (2009 - 2013) roughly coincides with the overall increase in the share of firms that use WBSO, and may hence be partially an artefact of that. However, the share of these firms continued to fall almost every year since 2013, while the share of the oldest firms has increased at the same time.

The drop in the share of young firms is driven by an overall drop in the WBSO hours of young firms, as well as a drop in the number of firms engaging in WBSO. See Figure 7.3 in the appendix. The growth in the share of the oldest firms, on the other hand, is exclusively driven by an increase in the ratio of WBSO hours per firm.

Figure 5.5 Share of WBSO Hours by Age Class

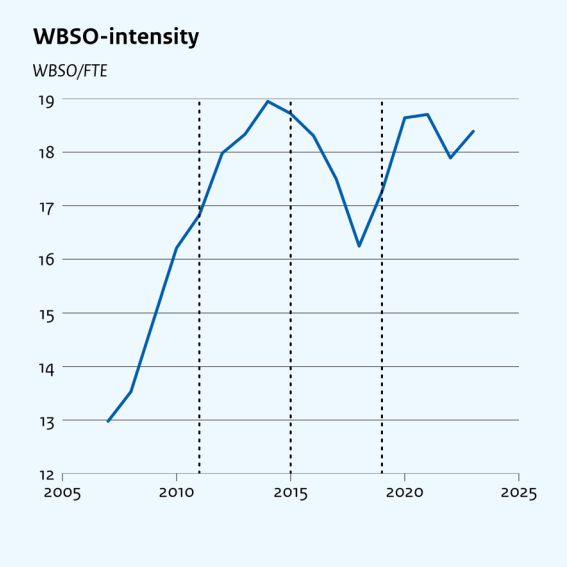


Note: Figure shows shares of total WBSO divided over firm groups. Lines show different groups of firms by age (in years) categories.

5.4 Dynamic Olley-Pakes Decomposition

In this section we perform the dynamic Olley-Pakes decomposition (as explained in Section Error! Reference source not found.) **of the change in total WBSO intensity of the economy, i.e. the number of total WBSO hours divided by the number of total FTEs.** see Figure 5.6. We split the time period from 2007 to 2023 into four sub-periods, with cutoffs in 2011, 2015, and 2019. The total WBSO intensity increased in all sub-periods except for 2015-2019. We decompose overall changes in the innovation intensity of the economy, into a within firm component, a reallocation between firms component, as well as firm entry, firm exit, as well as other forms of firm entry and exit (e.g. mergers and acquisitions).

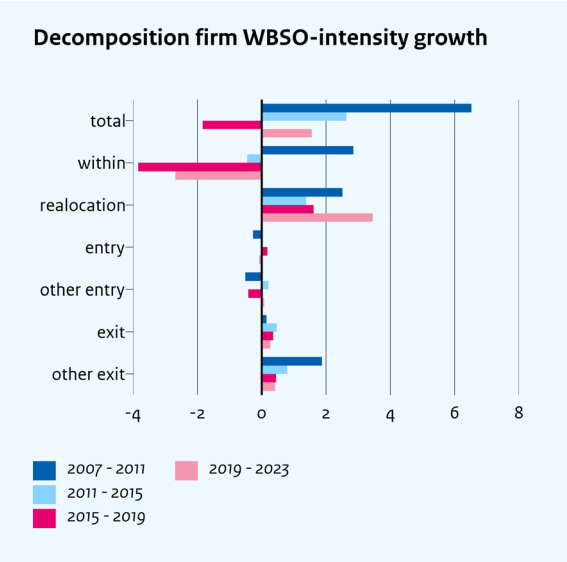
Figure 5.6 Total Innovation Intensity of the Economy



Note: Figure shows WBSO-hours intensity, measured by WBSO-hours/FTE in the total economy.

The decomposition analysis shown in Figure 5.7 reveals that the positive change in WBSO intensity is mostly due to a positive reallocation effect. This positive reallocation effect means that the correlation between firm size (measured by FTE) and WBSO intensity has increased over time. Conversely, the decomposition reveals mostly negative within-effects. Technically, this is due to a decrease in the average WBSO intensity of surviving firms for that time period. Relative to the within- and the reallocation-effects, (true) entry and exit of firms had only a small influence on overall innovation intensity. Other entry and exit (capturing e.g. M&A activity), has a sizeable, and positive effect throughout.

Figure 5.7 DOPD Decomposition



Note: Figure shows a DOP-decomposition (see section 4.3) for the WBSO intensity in different periods.

5.5 Innovation Employment Ladder

We explore employee mobility between firms taking part in WBSO and firms that do not. Following the same methodology as the productivity ladder in Section **Error! Reference source not found.**, we examine the net employee flows of firms in the market sector to and from (1) other firms in the market sector, (2) firms in the non-market sector, and (3) non-employment (e.g. unemployment, self-employment, or migration). Figure 5.8 compares these two groups in terms of their total net job growth. For both groups of firms, we observe similar patterns in annual growth rates, albeit with a higher variance for non-WBSO firms. These firms experience stronger declines in employment during economic downturns, but tend to grow somewhat faster in times of recovery. WBSO firms, on the other hand, seem to not shrink, or shrink only very little, even during a recession.

Figure 5.8 Annual growth of WBSO firms and non-WBSO firms

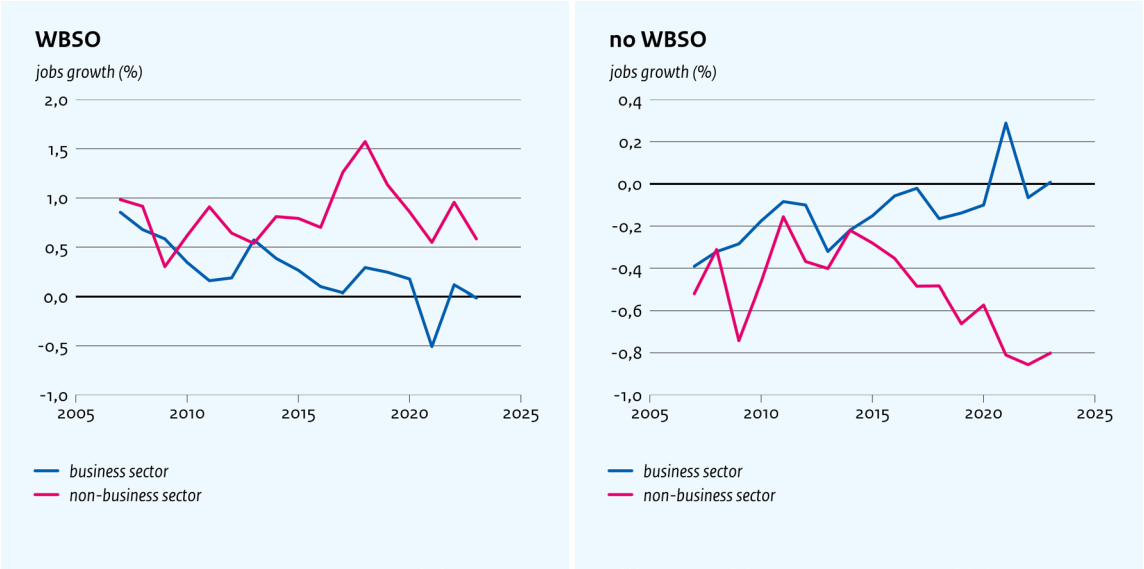
Note: Figure shows the total net job growth in each quarter of WBSO-firms and non-WBSO-firms, as a percentage of total average jobs in each quarter.

We do not find firm evidence for the innovation ladder in the market sector. In contrast with the productivity ladder, we do not find that WBSO firms tend to grow by attracting workers from non-WBSO firms in the market sector during 2016-2023. Figure 5.9 illustrates this by showing two sources of employment growth[34] for WBSO firms (left) and non-WBSO firms (right). The figure shows that employee flows from market sector firms are close to zero for both groups, indicating no innovation ladder is present in the market sector.

WBSO and non-WBSO firms grow in different ways. Figure 5.9 (right) indicates that non-WBSO firms tend to grow neither through hiring from market sector nor non-market sector firms; instead, their growth comes from non-employment.[35] In contrast, WBSO firms grow by hiring workers from the non-market sector. One reason might be that WBSO firms expand by attracting relatively innovative workers from the financial sector or the public sector, which include education, defence, and other public knowledge sectors.

[34] The third and final being non-employment, omitted in Figure 5.9, but shown in the appendix Figure 7.1.
[35] Due to the significant distributional changes before 2016, we refrain from reading too much into the results before 2016

Figure 5.9 Innovation Ladder on the Labour Market



Note: Figure shows the net job growth in each quarter of WBSO-firms and non-WBSO-firms, as a percentage of total average jobs in each quarter. The sources of growth depicted are from hiring from the business sector and hiring from the non-business sector. Hiring from non-employment (the residual category) is omitted.

6 Conclusions

This study has documented a growing divergence between firms within the Dutch market sector. The system seems increasingly divided between a small cohort of highly productive, innovative frontier firms and a large, stagnating group of laggards characterized by weakening economic dynamism with potentially adverse consequences for productivity and innovation. Our analysis reveals three interconnected developments to indicate this: declining dynamism, deteriorating resource allocation, and concentrated innovation. Together these suggest a move towards a higher prevalence of unlevelled dynamism as discussed by Aghion et al. (2014) and a slowdown of the process of creative destruction

Business and job dynamism are declining. The observed fall in firm entry rates means fewer new firms are entering to challenge incumbents. Simultaneously, lower job reallocation rates indicate that labour is becoming less mobile between firms. This growing inertia creates an environment where inefficient firms face less pressure to improve or exit, allowing them to persist and trap resources.

The productivity gap is widening and allocative efficiency deteriorating. While frontier firms continue to push forwards, the knowledge and practices they develop appear to diffuse less effectively to the rest of the economy. This explains why the productivity rankings of firms have become more static. Leaders are more likely to stay leaders, and laggards are more likely to stay laggards, creating a situation of entrenchment. At the same time, we observe a decline in allocative efficiency as laggard firms appear to have increased their share of total (labour) resources.

Innovation is increasingly concentrated within large, established firms. While aggregate R&D spending may be rising, its consolidation within a few firms limits the diversity of successful innovative approaches. This could create a negative feedback loop: as innovation becomes more concentrated, the competitive advantage of incumbents grows, increasing barriers to challenge them.

Several findings in this study show nuance, suggesting that not all aspects of dynamism are in decline. Notably, while business and job dynamism show a clear decline, worker dynamism does not. Instead, it remains procyclical, driven primarily by job-to-job flows. This persistence of worker mobility challenges the notion that knowledge diffusion through this channel has uniformly stalled. Furthermore, our analysis of the productivity job ladder shows that parts of reallocation continue to function. Specifically, workers, on average, still move from low- to high-productivity firms. Finally, while innovative activity has become more concentrated, the aggregate WBSO-intensity of the economy has trended slightly upwards. Taken together, these observations suggest that while we document a clear decline in dynamism, it is not complete, and certain channels for growth and reallocation are resilient.

Several policy options are available to shore up the process of creative destruction. The following policy directions are direct responses to the challenges identified in this study.

Business dynamism can be promoted by improving insolvency and regulatory frameworks. The insolvency framework in the Netherlands is more rigid than in most European countries (OECD, 2025). Increasing its efficiency will facilitate faster and less costly exit of non-viable firms. Additionally, reducing the regulatory burden, in particular of small firms, might stimulate business creation (Kotera, 2025).

Improving knowledge diffusion can narrow the gap between low- and high-productivity firms. Investments in education, such as in foundational skills and lifelong learning, strengthen human capital,

stimulate innovation, and increase productivity. Well-educated employees are more productive and can adopt new technologies more readily.

Reducing financial barriers can promote the creation and growth of innovative firms. Adilbish et al. (2025) attribute weak productivity growth in Europe to credit constraints: large, publicly listed companies lack market-based financing, whereas young, fast-growing firms require more risk capital. The *IBO bedrijfsfinanciering* (2024) specifies that while the Dutch ecosystem is conducive to startups, later-stage companies face difficulties in attracting venture capital. In general, adjustments to innovation policy could be considered in light of a new reality. Specifically, scale has become more important with the advent of AI (Draghi, 2024), making access to significant growth capital all the more critical for challenging incumbents and revitalizing innovation across the economy.

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7 Appendix

7.1 Data

7.1.1 Ensuring Firm-Level Time-Series Consistency

This appendix outlines the methodology used to create a consistent time-series dataset of firms. Following individual firms over time is challenging due to several data and conceptual issues. This document explains the problems encountered and the steps taken to address them.

Challenges in Tracking Firms Over Time

Several issues complicate the longitudinal analysis of firm data. In descending order of severity, these are:

Administrative ID Changes: A significant number of firms have their administrative ID at CBS Statistics Netherlands changed for reasons unrelated to any actual change in the firm's structure. A major instance of this occurred in 2010 due to a redefinition of what constitutes a 'firm', leading to widespread ID changes without any underlying organizational shift. From 2009 to 2010, more than 10% of firms are subject to this in one way or another.

Combined Firm Entry and Exit Events: The ABR events database registers instances where one firm exits and another firm with similar characteristics (industry, employee count) enters simultaneously. While some of these are administrative ID changes, others may have underlying business reasons. However, these registered events do not include specific "doorstart" (restarts after bankruptcy) scenarios.

Firm Status Changes from Corporate Events: Events such as mergers, acquisitions, and spin-offs (also listed in the ABR events database) result in changes to firm IDs. While these changes have clear underlying causes, they can create analytical challenges. For example, a firm might split and then merge back into its original structure within the same year.

Proposed Solutions

While one might ignore these issues or exclude affected firms, both approaches potentially introduce significant bias, especially given the concentration of these events in specific years (e.g., the 2010 structural break), and the long timeframe we are considering here. Our proposed solution is to create a consistent firm history by linking records across these changes. This involves several steps:

Utilizing the CBS BDK Dataset

Instead of the standard ABR dataset, we use the CBS BDK dataset. The BDK is specifically designed to address administrative ID changes by creating linking tables (*koppeltabellen*) that connect firms over time. For each firm ID (beid) and year, the BDK provides the ID at the start of the year (begin_beid) and the ID at the end of the year (eind_beid). For most firms, these three IDs are identical. However, for a firm undergoing an ID change, the begin_beid or eind_beid will differ from their beid.

As an example, consider a firm with beid “1” that exists from 2005 to 2015. In 2010, its ID changes to “2” due to some administrative reason. In the ABR, this appears as two separate firms: Firm “1” (2005-2010) and Firm “2” (2010-2015), with both firms appearing in 2010. In the BDK, for the year 2010:

The record for the original firm (beid 1) shows: begin_beid=1, beid=1, eind_beid=2.

The record for the new firm (beid 2) shows: begin_beid=1, beid=2, eind_beid=2.

This clearly shows that both records originated from begin_beid 1 and concluded as eind_beid 2. This allows us to aggregate the two 2010 records into a single, consistent entity for that year. This adjustment alone corrects for ID changes affecting between 2% and 11% of all firms annually between 2007 and 2023. Furthermore, this adjustment allows us to continue following the firm post-2010, with the knowledge that these records belong to the same firm.

Chaining Links Through Time

Firms can experience multiple ID changes or corporate events over their lifespan. To create a complete history, we "chain" these year-on-year links, outlined above, together. To achieve this, we match the eind_beid of a firm in one period to its begin_beid in the subsequent period. This process creates a continuous chain, allowing us to track a firm across multiple events and years. We can then identify a consistent firm entity by its original begin_beid at the start of the analysis period and its final eind_beid at the end. The information of firms part of this begin_beid - eind_beid entity can be aggregated into one temporally consistent record.

Building a Custom Linking Table from ABR Events Data

To account for legitimate corporate events (mergers, acquisitions, spin-offs), we expand on the BDK's linking methodology. To do this, we process the ABR events database, which details antecedent and successor firms for each event, to create our own BDK-style linking table.

Consider the following example: Two firms with beid “3” and beid “4” merge to form a new firm with beid “5” in a given year. We generate linking tables where the eind_beid for 3 and 4 are set to 5, indicating they became firm 5. This allows us to follow the continuity from the two original firms to the single successor firm. We can do this for all different types of events listed in the ABR events database. This step captures an additional 1-2% of firms that undergo changes each year.

Why Addressing These Issues Matters

Ignoring these data inconsistencies can lead to misinterpretations of firm dynamics and biased analytical results. We discuss several relevant examples:

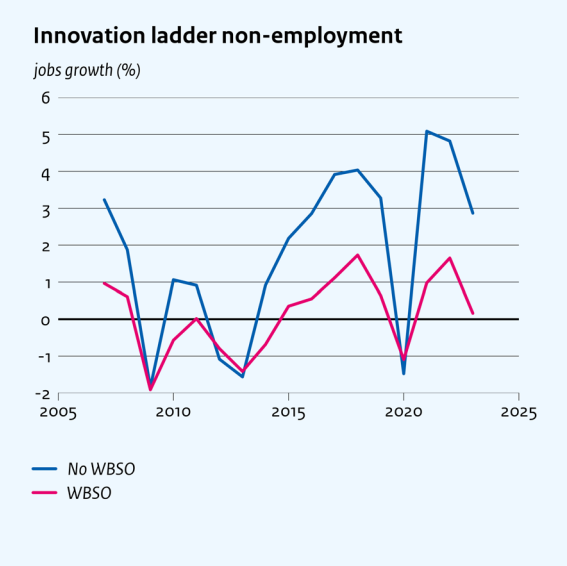
Analysing Job Growth: If a merger of two firms into one new entity is not accounted for, it might be incorrectly recorded as two firms losing all their employees and a new firm gaining them. A more conceptually sound approach would be to compare the combined employment of the original firms with the new, merged entity.

Tracking Policy Effects: When evaluating the impact of a policy (e.g., COVID-19 support), a simple analysis might lose track of treated firms if their IDs change after receiving support. Similarly, if a treated firm splits, the resulting new entities, which originate from the treated firm, might be incorrectly excluded from the treated firms pool.

Other types of analyses following firms over time might call for different specific approaches, but will be possible using the BDK and/or ABR Koppeltabellen.

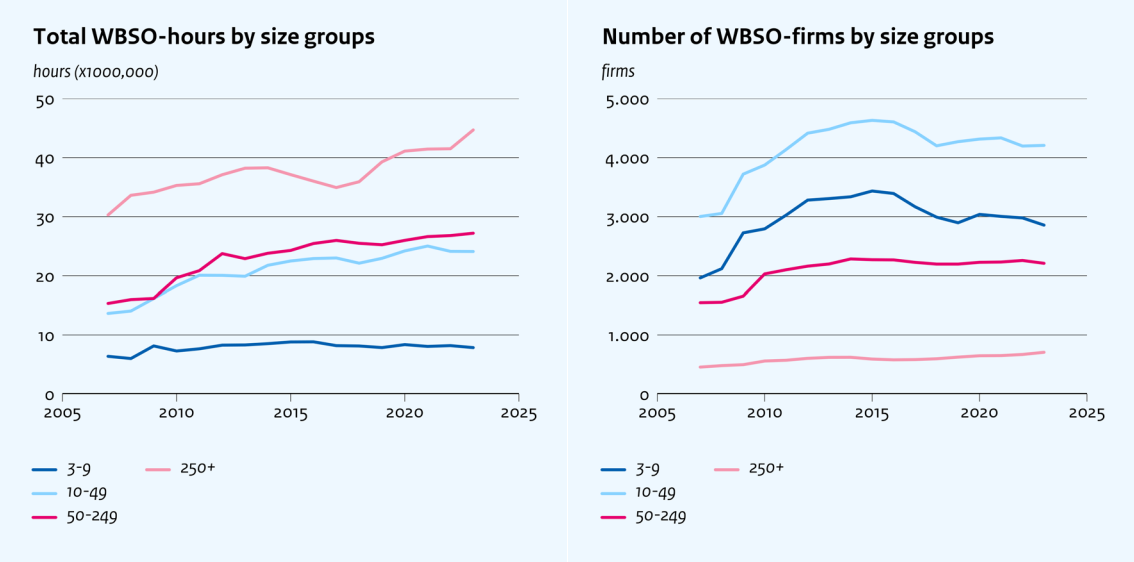
7.2 Supplementary figures

Figure 7.1 – Innovation ladder net flows with non-employment



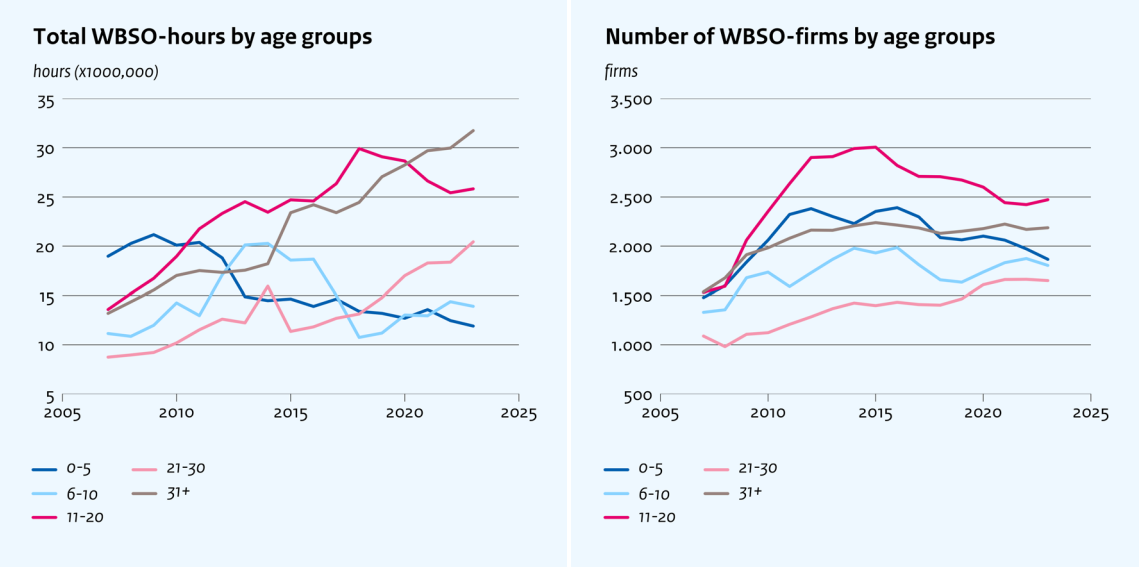
Note: Figure shows the net employment flow with non-employment of WBSO and non-WBSO firms

Figure 7.2 – WBSO-hours (left) and -firms (right) by size class



Note: Figure shows the total number of WBSO hours performed at firms in four size-groups.

Figure 7.3 – WBSO-hours (left) and -firms (right) per age class



Note: Figure shows the total number of firms and WBSO hours performed at firms in five age-groups.