CPB Netherlands Bureau for
Economic Policy Analysis

National Productivity Board 2024 annual report

Labour productivity in the market sector declined by 1.4% in 2023.

Exporters are the most productive firms in the Netherlands, but also their suppliers perform above average.

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Leon Bettendorf &
Michael Polder (Statistics Netherlands)

Preface

Productivity has shifted to the top of the political agenda in the last years. In view of the limitations to a further expansion of the labour supply, productivity growth is the principal way to support our future living standard. Unfortunately, the Netherlands, as all OECD countries, has been struggling with a declining trend in productivity growth during the last decades. We do not yet fully understand the causes of this global productivity slowdown.

CPB is part of a network of independent National Productivity Boards in the EU. The CPB has been a National Productivity Board since 2017. The main NPB tasks are monitoring and analysing productivity developments in the Netherlands. As in previous years, we summarise research on productivity issues in this Annual Report 2024.

We are preparing three publications this year. First, we participate in a multi-country project of the Productivity Institute (UK). The aim of this project is to identify and compare country-specific productivity trends and pro-productivity policies. Second, we will analyse the evidence on changing business dynamics in the Netherlands and the consequences for firm-level productivity and innovation. Finally, we will provide the analysis underlying our projections of long run productivity.

Pieter Hasekamp
Director CPB

Samenvatting

De arbeidsproductiviteit in de marktsector daalde in 2023 met 1,4%. Sinds 2000 is de productiviteit alleen in 2009 nog sterker gedaald. De uitfasering van de gaswinning sinds 2014 heeft de jaarlijkse productiviteitsgroei met gemiddeld 0,3%-punt gedrukt.

We begrijpen nog niet helemaal waarom de productiviteitsgroei is afgenomen. Zoals in alle OESO-landen heeft Nederland last van een vertraging van de productiviteitsgroei. In een literatuuronderzoek vinden we verschillende verklaringen, maar de bijdrage van elke oorzaak is moeilijk te bepalen vanwege de sterke verbanden tussen de oorzaken.

Het productiviteitsverschil tussen de 10% meest productieve bedrijven en minder productieve bedrijven nam in 2021 toe. We stelden in ons vorige rapport (CPB, 2024) vast dat de productiviteitskloof tussen de bedrijven van de top 10% en de bedrijven van de onderste 10% sterk is toegenomen in 2020. Uit een update van deze analyse blijkt dat de kloof in 2021 groot bleef en niet te wijten was aan de bijzondere omstandigheden in 2020. Productiviteitsgroei in de economie kan voortkomen uit productiviteitsgroei binnen bestaande bedrijven of door activiteiten te verschuiven naar productievere bedrijven. De bijdrage van de verschuiving daalde in de verwerkende industrie en de dienstensector in de periode 2011-2019. De bijdrage van de bedrijvendynamiek bleef stabiel in de handel, terwijl deze belangrijker werd voor overige industrieën (bouw, energie, water en afval).

Exporteurs en hun directe toeleveranciers vormen de meest productieve groep bedrijven in Nederland. Uit de literatuur weten we dat exporterende bedrijven productiever zijn dan niet-exporterende bedrijven. We laten met nieuwe netwerkdata een duidelijk patroon zien: exporteurs zijn groter en productiever dan hun toeleveranciers, die op hun beurt beter presteren dan hun eigen toeleveranciers. De productiviteit van exporteurs en hun toeleveranciers wordt versterkt via drie mechanismen: leereffecten, selectie en schaalvoordelen. Beleid dat bedrijfsnetwerken versterkt, kan bijdragen aan productiviteitsgroei.

Summary

Labour productivity in the market sector declined by 1.4% in 2023. Since 2000, only 2009 saw a stronger fall in productivity.. Phasing out gas extraction since 2014 depressed annual productivity growth by 0.3%-point on average.

We do not fully understand why the productivity growth has decreased. As in all OECD countries, the Netherlands is suffering from a slowdown in productivity growth. A survey of the literature provides various explanations, but the contribution of each cause is difficult to determine due to the strong links between the causes.

The productivity difference between frontier firms and non-frontier firms was growing in 2021. We observed that the productivity gap between the top-10% firms and the bottom-10% firms strongly increased in 2020. An update of this analysis shows that the gap remained large in 2021. Productivity growth can originate from growth within existing firms or by reallocating activities to more productive firms. The contribution of reallocation declined in manufacturing and services during the period 2011-2019. The contribution of business dynamics remained stable in trade while it became more important for other industries (construction, energy, wate and waste).

Exporters and their direct suppliers form the most productive group of firms in the Netherlands. From previous research we know that exporting firms are more productive than non-exporting firms. From new network data, a clear pattern emerges: exporters are larger and more productive than their suppliers, who, in turn, outperform their own suppliers. Productivity of exporters and their suppliers benefit through three main channels: learning effects, selection and economies of scale. Policies that strengthen firm networks can contribute to fostering productivity growth.

1 Introduction

This Annual Report summarises research on productivity developments in the Netherlands.[1] It consists of four parts.

In the next section we summarize the unfavourable productivity developments in 2023. We show that phasing out gas extraction since 2014 contributed to the low productivity growth rates in the Netherlands compared to other European countries.

Various explanations are found in the literature why productivity growth is slowing down. No consensus is yet reached on the contribution of each explanation of the slowdown. We discuss the main studies in the third section.

The fourth section, provided by Michael Polder (Statistics Netherlands), updates and extends the evidence on firm-level productivity. He documents productivity differences between firms and shows that the contribution of continuing firms, new firms and closing firms to productivity growth differ across industries, as well as between time periods.

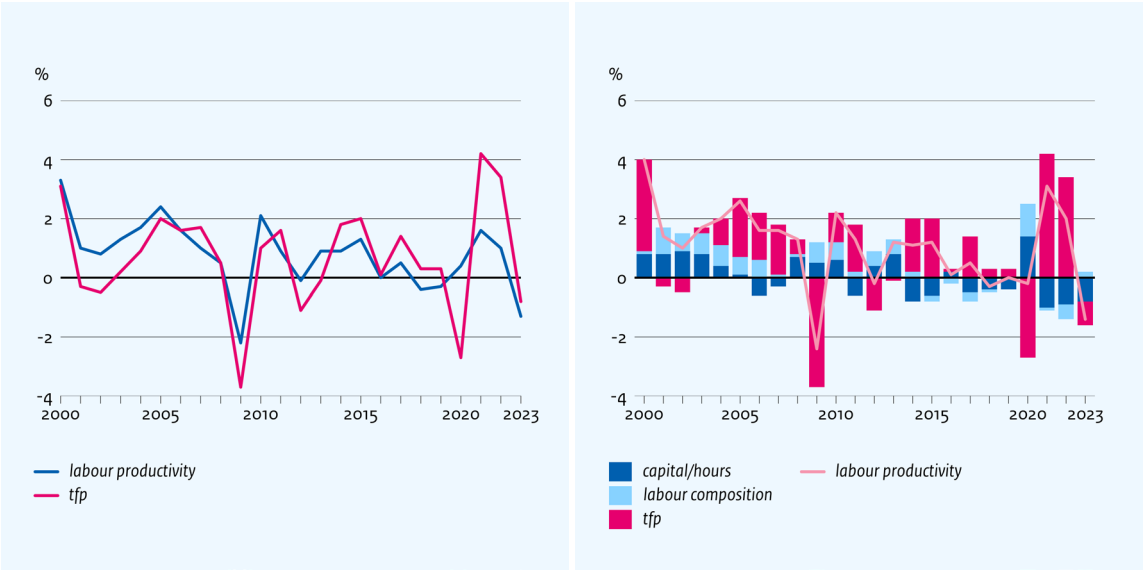
The last section exploits new data on the Dutch production networks.[2] It is well known that exporting firms are more productive than an average firm. This section discusses the impact on productivity of firms that are suppliers to exporting firms.

[1] Our Annual Report of 2023 can be found at annual report 2023. The reports of the other NPBs are collected at this EC-website.
[2] This is a translation of Freeman et al. (2024).

2 Recent productivity developments

Labour productivity in the market sector in 2023 was 1.4% lower than in 2022. Labour productivity is defined as value added per hour worked.[3] Figure 2.1a shows that productivity only declined more (with -2.2%) during the great recession in 2009 (CBS, 2024). The decomposition in figure 2.1b shows that the negative labour productivity growth in 2023 was driven by negative contributions of TFP growth (-0.8%) and capital deepening (-0.8%).[4] The number of working hours has increased, while the capital stock reduced (due to non-ICT capital). The long term decline in capital stock per hour since the mid 2010-s seems to continue at an even faster pace. TFP growth (a measure of the efficiency with which labour and capital are used in the economy) turned negative in 2023. TFP grew fast in 2021 and 2022, in part through recovery from the corona pandemic shock in 2020

Figure 2.1 Labour productivity in de market sector declined in 2023



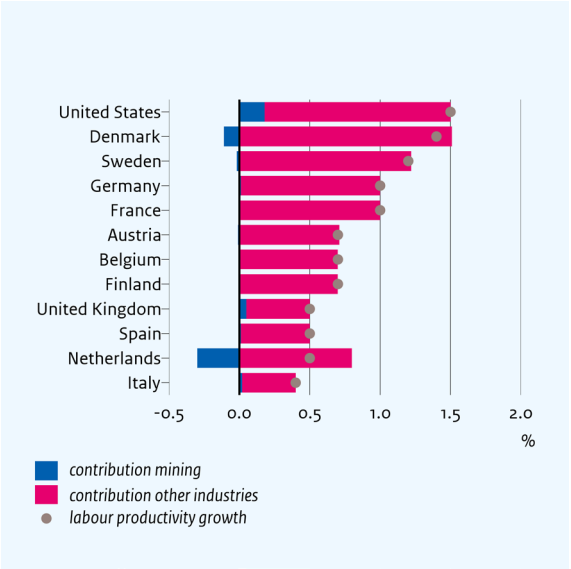
Source: CBS (2024); 2022 & 2023 are preliminary.

Phasing out gas extraction depressed productivity growth, starting in 2014. The mining and quarrying industry is very capital intensive, resulting in a high labour productivity. Labour productivity in this industry grew on average with 0.7% before 2014, while it fell with almost 16% per year after 2014 due to the phasing out of gas extraction (De Vries et al., 2024). Figure 2.2 shows that the average labour productivity growth in the Netherlands was one of the lowest in Europe. However, whereas the average contribution of the mining industry was negligible in most of the countries, it was negative (-0.3%-point) in the Netherlands (and +0.2% in the US). The productivity growth of the market sector excluding mining in the Netherlands was much closer to the average value in Europe. Next to mining, other industries that contributed negatively to productivity growth in 2023 are transport and storage (-0.5%-point) and manufacturing (-0.4%-point).

[3] The market sector includes all sectors, with the exception of the government, education, households and rental & trading of real estate.

[4] We use the identity: $\tilde{Y}_t - \tilde{H}_t = \alpha_t(\tilde{K}_t - \tilde{H}_t) + (1-\alpha_t)\tilde{C}_t + \tilde{A}_t$, where $\tilde{Y}$ is value added growth, $\tilde{H}$ is growth in hours worked, $\tilde{K}$ is capital growth, $\tilde{C}$ is labour composition growth, $\tilde{A}$ is TFP growth and α is the share of capital costs.

Figure 2.2 Average annual growth of labour productivity in the Netherlands was low due to mining (2013-2019)



Source: De Vries et al. (2024), Figure 4.2 & 5.1

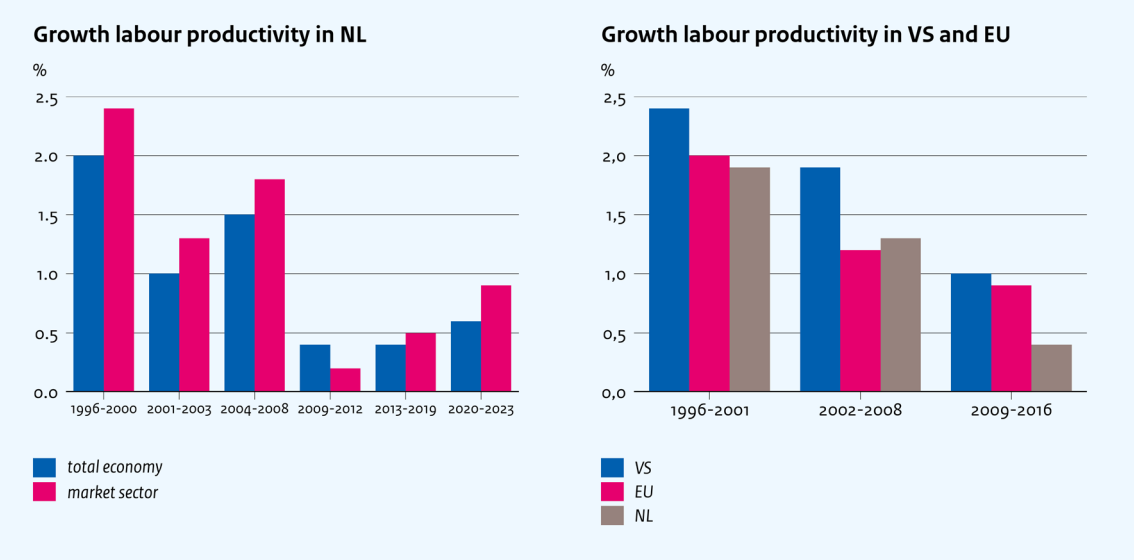
3 Explaining the productivity slowdown: a survey

We do not sufficiently understand current productivity developments, which makes insight into future developments uncertain. As in many other countries, the Netherlands is suffering from a slowdown in productivity growth. In the literature, various explanations are put forward as to why growth has decreased, but the contribution of each cause is difficult to determine due to the strong links between the causes. In addition, it is uncertain whether the outlined trend developments are permanent or temporary. For example, will artificial intelligence really develop into a general purpose technology that will put an end to the weak productivity growth? And, if so, how long will that last?

All OECD countries are experiencing slowdowns in productivity growth. Figure 3.1a shows the annual growth of labour productivity in the Netherlands in the total economy and in the market sector (this is excluding the government). GDP per hour worked grew on average around 2 percent around the turn of the century. This growth has fallen back to below 1 percent after 2009. Figure 3.1b shows the slowdown in other countries. The decline in GDP growth per hour worked started in all countries before the Great Recession (2008-2012). The Great Recession may therefore have exacerbated the slowdown but cannot be the cause (Fernald et al., 2023).

The global slowdown in productivity growth suggests common causes but there is no consensus yet on which cause is the most important and not even on whether the slowdown will be temporary or long-term. This slowdown puzzle contributes to the great uncertainty of projections in the near and distant future. We discuss the most important, global causes one by one, although they are strongly related. [5]

Figure 3.1 Labour productivity growth is falling (value added per hour worked)



Source: De Vries et al. (2024), figure 3.1.; De Bondt et al. (2021), figure 3.1.1.

[5] See the surveys of Moss et al. (2020), Akcigit et al. (2021) and Goldin et al. (2024). For a discussion of specific Dutch causes, such as the large share of self-employed people and low R&D investments, we refer to Roelandt et al. (2019) and de Bondt et al. (2021).

3.1 The diminishing potential of innovative ideas

Technology pessimists are skeptical about innovations that can still significantly increase productivity. Gordon (2016) argues that the number and breadth of innovations was exceptional in the period 1870-1970 and that we have now returned to the normal, structural level. Bloom et al. (2020) argue that the productivity of researchers has fallen sharply because it is becoming increasingly difficult to find new ideas. They express the TFP growth as the product of the number of researchers and their productivity. They observe a strong increase in the effective number of researchers, but the problem is that productivity in research has fallen just as sharply. The best illustration is provided by Moore's Law. The number of transistors in an integrated circuit has doubled every two years, but this required an increasing input of resources.

Jones (2022) lists three reasons why growth in GDP per capita will slow down in the future. Jones analyses economic growth in the US with a model in which TFP growth is determined by a Research & Development (R&D) sector. The first reason for a slowdown in growth is that the three main determinants after 1953, apart from population growth, can hardly grow any further. The contribution of population growth to growth in the past is 20%, while 80% stems from a rising level of education, an improved allocation of production factors and a growing size of the R&D sector (as % of population). The problem is that the last three factors are naturally limited. The second reason is that a slowdown in employment growth in R&D is already observed. The third reason is that natural population growth (excl. migration) is already negative in many developed countries. In the long run, economic growth remains proportional to population growth.

Technology optimists, on the other hand, emphasise the future potential of innovation in ICT; see for example Brynjolfsson and McAfee (2014). As with previous industrial revolutions, they expect that it will take time before the combination and diffusion of multiple new technologies will lead to a revival of productivity growth. Artificial Intelligence (AI) could become a new general purpose technology. AI is expected to have major effects on the economy, and on productivity in particular, because AI not only increases the productivity of the production of products but also the production of innovative ideas (R&D). Initial studies estimate that AI increases macroeconomic productivity by 1%-point per year for 10 years (see the discussion in Aldasoro et al., 2024). However, Acemoglu (2024) is skeptical about the extrapolation of early, simple applications and calculates that TFP growth increases by less than 0.1%-points per year. In addition to the potential of AI, Jones (2022) believes that growth can accelerate in the future because there is still sufficient room for expansion of the R&D sector at the global level.

Philippon (2022) disputes the existence of a structural break in technological progress. He criticizes the standard specification of the TFP growth rate. The literature assumes a constant TFP growth rate (i.e. exponential growth), while Philippon argues that the evidence is more in line with a constant absolute growth rate (additive growth). If absolute growth remains constant, the TFP growth rate will decline in the future. In the US, he finds a structural break in TFP growth around 1930 in the period 1890-2019. Due to catch-up growth, TFP growth in the eurozone and Japan was higher than in the US until 1990. After 1990, absolute growth declined sharply and became smaller than in the US. Assuming additive growth, Philippon finds no evidence of a recent slowdown in technological progress.

3.2 Divergence between high- and low-productivity firms

The OECD found that the difference in productivity between high-productivity firms and low-productivity firms has increased (Berlingieri et al. 2017a). Because knowledge about new production techniques and organizational forms is spread less quickly, low-productivity firms are less able to keep up with the

productivity growth of high-productivity firms. The deterioration in knowledge diffusion might be related to the increasing importance of intangible capital (see section 3.6). The divergent productivity development may explain the slowdown in productivity growth.

In the Netherlands, the productivity difference between the most productive and median firms started to increase around 2015. De Bondt et al. (2021, Table 5.3.2) find that the difference in both labour productivity and TFP increased before 2005 during the period 2000-2015. The divergence in productivity was stronger in industry than in the service sector. Research in van Heuvelen et al. (2018) confirms that the productivity gap between the top 10% firms and the median firms has remained stable in the period 2006-2015. In the next section we show with a new dataset that the top-median gap increased by 0.7% annually from 2015 to 2019. The divergence hypothesis is not a good explanation since the slowdown in productivity growth started much earlier in the Netherlands.

3.3 Increase in market concentration

According to this hypothesis, lower productivity growth is associated with the trend towards less competitive markets. Firms with more market power have fewer incentives to increase their productivity. The emergence of less competitive markets is related to the superstars hypothesis (or winner-takes-all).[6] After superstars have acquired a dominant market position, they shift their activities from innovative investments to strategies to protect their excess profits. De Ridder (2024) argues that the increase in intangible capital explains these developments. Since intangible capital is characterized by a combination of low marginal costs and high fixed costs, this promotes the growth of large firms and a reduction in productivity growth. The increase in market power seems to be a problem mainly in the US.[7] De Loecker et al. (2020) estimate the markup of firms (defined as the ratio of price and marginal costs) as a measure of market power. They find that the average markup in the US nearly tripled from 1980 to 2016.

However, an increase in market concentration can also promote productivity growth. When more productive firms gain market share at the expense of less productive firms, the reallocation contributes to aggregate productivity growth.[8] In Europe, the increase in market concentration does not seem to be associated with more abuse of market power. Bighelli et al. (2023) estimate stable markups in 15 European countries. Van Heuvelen et al. (2021) do not find that markups in the Netherlands increased significantly in the period 2006-2016. The slowdown in productivity growth in the Netherlands therefore does not seem to be explained by the increase in the market power of firms.

3.4 Weakening of business dynamism

Productivity growth has been affected by reduced business dynamism. With healthy business dynamism, old, low-productivity firms are replaced by more productive new firms (principle of creative destruction). Released inputs are put to more productive use, which contributes to a stimulation of productivity growth. Decker et al. (2017) point to the relationship between reduced business dynamism and slowed productivity growth in the US. Freeman et al. (2021) show that business dynamism in the Netherlands is slowing down (after 2006), mainly as a result of a declining share of start-ups. They find that the reduced dynamism has

[6] See e.g. Autor et al. (2020).
[7] See e.g. Eeckhout (2022). This hypothesis is contested by Shapiro et al. (2024).
[8] See the discussion of the distinction between good and bad concentration in Covarrubias et al. (2019).

contributed to lower TFP growth (by 0.2%-points per year), especially in the service sector. The weakening of business dynamism may be a cause, but not the main cause of the slowdown in productivity growth.

3.5 Shifts in sector structure

The shift towards the service sector reduces average productivity growth. The share of the service sector (incl. healthcare) in the economy increases, while the productivity of the service sector grows less than that of industry. De Bondt et al. (2021, section 5.2) confirm that the shift towards the healthcare and service sectors has had a negative effect on productivity growth in the period 1996-2016, but that this shift is not large enough to really explain the slowdown in productivity growth (see an update in De Vries et al., 2024). Most of the productivity growth is found within the industries, while the negative reallocation effect between sectors remains small. Duernecker et al. (2023) compare the strong growth in labour productivity in the period 1970-1985 with the slow growth in 2002-2017 for several high-income countries. They also show that the decline in productivity growth in the Netherlands (2.7%-points) is only partly due to the changed sector structure (0.5%-points).

3.6 Measurement problems

The literature also suggests that the growth slowdown is not a real phenomenon but is a consequence of larger measurement problems of the new economy. Measuring productivity faces classic problems, e.g. the correction for quality improvements in the healthcare sector. But the problems have been exacerbated by the digitalization of the economy.[9] For example, before we could take digital photos, the productivity of developing and printing photos could be calculated. Nowadays, we store and view photos on our phones. How should the productivity of this 'free' service be calculated? However, calculations by Syverson (2021) indicate that measurement problems are probably insufficient to explain the productivity slowdown.

Measurement problems are specifically mentioned in the valuation of the increasing intangible capital stock. Intangibles consist of, for example, R&D, software, human and organizational capital. According to Brynjolfsson et al. (2021), errors in measuring productivity effects of investments in intangibles can be described with a J-curve. At the beginning of the project, productivity is underestimated because inputs are also used for the production of intangibles that are poorly measured. In the course of the project, productivity is overestimated because intangibles are also used for the production of measured tangibles. In the Netherlands, too, intangible investments now exceed tangible investments, making it more difficult to estimate TFP growth.

3.7 Concluding remarks

We conclude that the literature is still very uncertain about the true causes of the slowdown in productivity growth and about the development of trends in the future. It is still unclear what the contribution of each cause is to explaining the slowdown (see the approach in Goldin et al., 2024). And what is the role of links between the causes? The growing importance of intangibles seems to be related to the increasing market power of superstars and the reduced business dynamics. A second question is how permanent are the outlined trend developments? Will the technology pessimists or the optimists be right about the breakthrough of new, substantial innovations? Is the weakening of business dynamics a temporary

[9] See the recent overview by Martin et al. (2024) and also De Bondt et al. (2021, section 6).

or a long-term phenomenon? Given these uncertainties, CPB, as the NPB, will continue to study the low productivity growth.

4 Productivity differences across Dutch firms are large and persistent

Michael Polder (Statistics Netherlands)

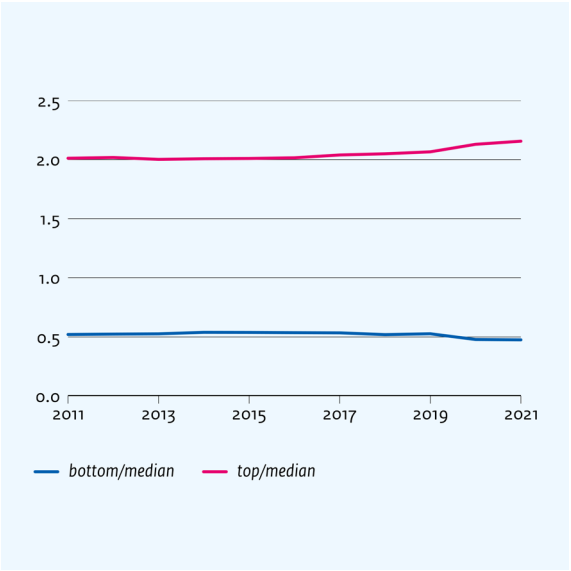
We present an update and extension of evidence on the dynamics of firm-level heterogeneity in labour productivity, and the relation between business dynamics and aggregate (industry-level) productivity. Understanding more about heterogeneity and the role of dynamics is essential for understanding aggregate growth. In particular, statistics about the within-industry dispersion in productivity are informative about whether the performance of firms in a particular industry is similar, or whether there are "winners" and "losers". A stylized fact in the literature is that the latter is the case (e.g. Syverson, 2011): the degree of heterogeneity in productivity is persuasive, even within narrowly defined industries . This is indicative for firm-level differences in things such as production technologies and innovation, as well as market frictions (Bartelsman and Wolf, 2018). In addition, productivity differences are found to be closely linked to differences in renumeration of workers (Cunningham et al. 2023). Finally, macroeconomic growth depends in part on creative destruction, through which the least productive firms are driven out of the market, making way for new innovative and more productive firms, as well as reallocation of market shares towards more productive incumbent firms (Aghion et al. 2021).

Note on data used
We use an experimental dataset on firm-level productivity that is currently being developed at Statistics Netherlands. This dataset is an updated and improved version of that used in the previous edition of the National Productivity Monitor (CPB, 2024). The outcomes presented should be regarded as experimental. In addition, due to differences in delineation of the research population, methodological choices (e.g. outlier exclusion), and variable definitions, these figures may not fully align with official statistics. The dataset currently covers the period 2011-2021 and concerns incorporated enterprises only (legal forms "bv" and "nv") in the business economy (excluding the financial and real estate sectors as well as petroleum). In the indicators we only consider firms with 3 persons (full-time) employed or more.

A decade of productivity dispersion

Frontier firms in the Netherlands are about twice as productive as the median firm, whereas the bottom group is about half as productive as the median. Productivity is measured as value added per hour worked. Dispersion is measured by differences between percentiles of the productivity distribution. In particular, we express in figure 4.1 the labour productivity level of the top decile and the bottom decile relative to the median level. It shows large differences between firms at the top and the bottom of the distribution.

Figure 4.1 Labour productivity, frontier (top-10%) and laggard (bottom-10%) firms compared to median, business economy, 2011-2021



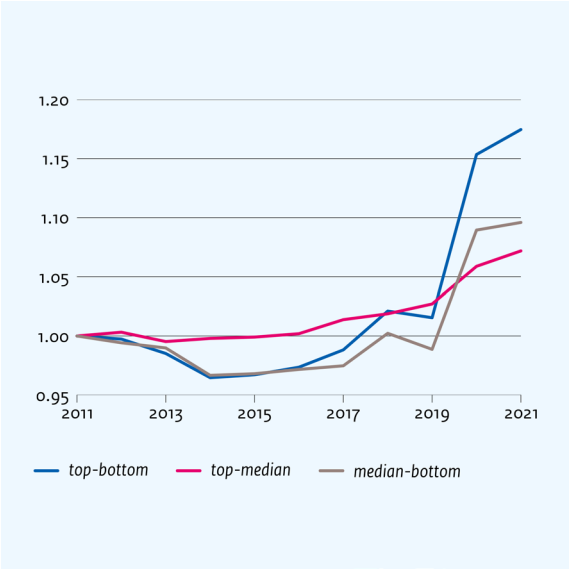
Note: top, median and bottom refer to respectively 90th percentile, median, and 10th percentile of the productivity distribution. Productivity is measured as real value added over persons employed in full-time equivalents. Percentile deviations are calculated within-industry (NACE Rev. 2, two digit) and year. Only enterprises with 3 or more persons employed and legal personality (corporations) have been included, that are part of the Business Economy (NACE Rev. 2 B-N, excl. K, incl. 95; we also exclude 19 and L). Nominal value added is deflated using National Accounts industry-level deflators. For more on the underlying data, see CBS (2022a, Chapter 2).

Growing dispersion in the Netherlands can already be detected before the Covid period. Figure 4.2 shows the change in dispersion relative to the base year 2011. While the figure confirms the stable pattern found in van Heuvelen et al. (2018) for up to 2014/2015, an increase in dispersion can be detected for more recent years. This trend started already before Covid. From 2015 to 2019, the top-bottom gap increased by on average 1.2% annually, composed of a 0.7% increase of the top-median gap and a 0.5% between median and bottom. Growing dispersion has been documented globally (Andrew et al., 2016), but there is variation across countries (Berlingieri et al., 2017) and over time (e.g. in the case of US manufacturing, Cunningham et al., 2023).

The dispersion increased strongly in 2020 and more gradually in 2021. When the economy was hit by the Covid-shock for the first time, this resulted in a substantial decrease in macroeconomic productivity (see figure 2.1).[10] Nevertheless, figure 4.2 shows that this impact has been uneven across the business population, resulting in a productivity spread much higher than in previous years and notably a higher gap for the lowest part of the distribution. Moving further into the Covid period, the dispersion continued to increase. The top-bottom gap grew in 2021 with 1.8%, mainly due to the frontier firms moving away from the median (1.2%).

[10] We note that employment is in full-time equivalents and refers to hours worked according to contract.

Figure 4.2 Labour productivity dispersion, business economy, 2011-2021 (2011 = 1)



Note: Ratios are expressed relative to the value in 2011.

Multinational firms are strongly represented in the frontier group. While the lion share of firms in the frontier group are independent small and medium enterprises (SMEs), their share is substantially lower than in the overall firm population (74.5% of frontier firms versus 83.6% in the population in 2021; table 4.1). Especially foreign multinational enterprises (MNEs) form a relatively large part of the frontier, compared to their population share (16.1% versus 9.3%). The post-2015 increase in dispersion has gone hand in hand with a slight shift within the frontier group, away from Dutch multinationals towards the other groups of firms.

Table 4.1 Composition of the frontier group.

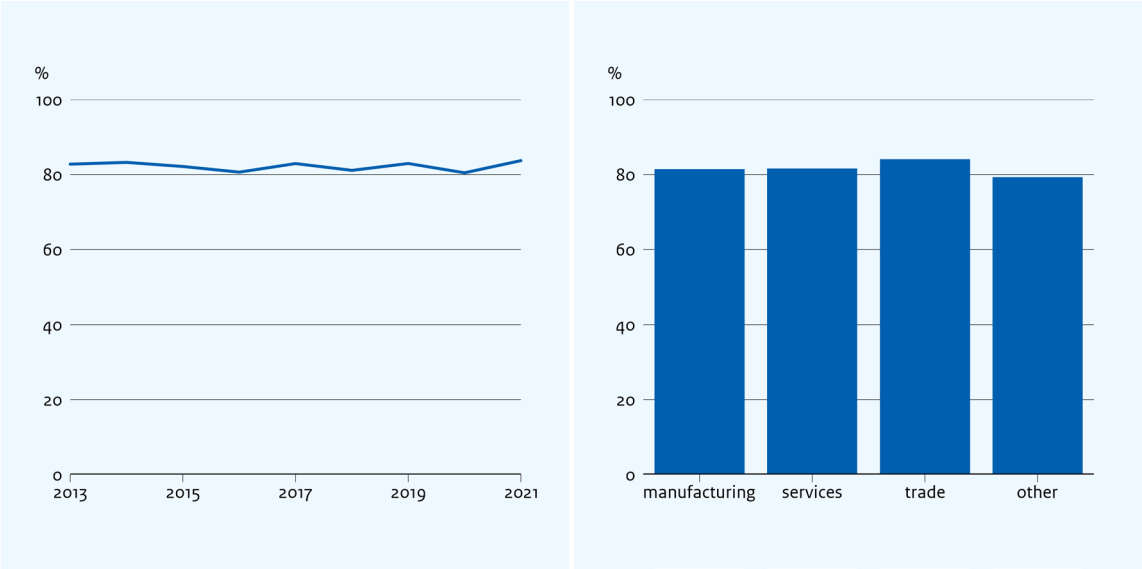
	independent SME	domestic large	Dutch MNE	Foreign MNE
Population				
2015	83.8%	0.5%	7.5%	8.2%
2019	83.6%	0.7%	7.0%	8.8%
2021	83.6%	0.7%	6.4%	9.3%
Frontier				
2015	73.1%	0.4%	10.8%	15.7%
2019	73.5%	0.5%	9.7%	16.3%
2021	74.5%	0.6%	8.7%	16.1%

Note: independent SME not part of a domestic group with 250 persons employed or more, nor part of a multinational; domestic large is a firm with more 250 persons employed or more and not a multinational; Dutch MNE is an enterprise under Dutch ownership (head office and/or affiliates); foreign MNE is an affiliate of a foreign multinational.

We find that persistence at the frontier is substantial. The composition of the frontier group changes each year. The results in figure 4.3 suggest that persistence is rather high with over 80% of firms remaining at the frontier from year to year, or reappearing after a single year.[11] This rate has been rather stable over time and across sectors.

[11] These numbers are lower than in the previous edition due to improvements in the data. It should be noted that we now also include firms reappearing at the frontier after one year as part of persistence. However, also without these additional cases the rates remain

Figure 4.3 Persistence at the productivity frontier (fraction of firms that stays in top decile)



Note: For these calculations, labour productivity was smoothed by taking the average over two consecutive years. When firms return to the frontier after a single year, this has also been counted as persistence. Figure by sector concerns averages across the period 2013-2021. NACE codes manufacturing: 10-33, ex. 19; services: 49-82 + 95, ex. K and L; trade: 45-47; other: 35-43.

Industry productivity growth: the contribution of business dynamics

The productivity growth of industries is composed of the contribution of continuing firms, new firms and closing firms. Figure 4.4 shows a decomposition of sectoral labour productivity growth for the period 2011 to 2021. The contribution of continuing firms is broken down further into a within component (i.e., the contribution of productivity growth within those firms), and a between component (i.e., the gain in aggregate productivity due to changes in the relative size of firms). The contributions of entry and exit are broken down further into those pertaining to actual firm birth or deaths, and those that are due to other reasons (such as M&A, restructuring and split-offs).

There are sectoral differences in the contribution of business dynamics. In manufacturing and in industries grouped under "other" (Construction; Energy; Water; Waste), productivity growth was mainly driven by within-firm productivity growth. In trade, there is an important role for exit of below-average productivity firms. In services, there is a relatively large contribution of newly founded firms achieving above-average productivity levels.[12]

We observe that the role of business dynamics for productivity growth declined in manufacturing and services. We define the contribution of business dynamics as the combined (net) contribution of the entry, exit and between components. Comparing the periods 2011-2015 to 2015-2019 in figure 4.4, we find a decline in the importance of business dynamics in manufacturing (from 3.2 to 1.7 %-point) and services (from 2.4 to 1.0%-point). This corroborates evidence for the US on declining dynamism discussed by Akcigit and Ates (2021) and Decker et al. (2017). However, we note that in services the lower contribution of business dynamics results

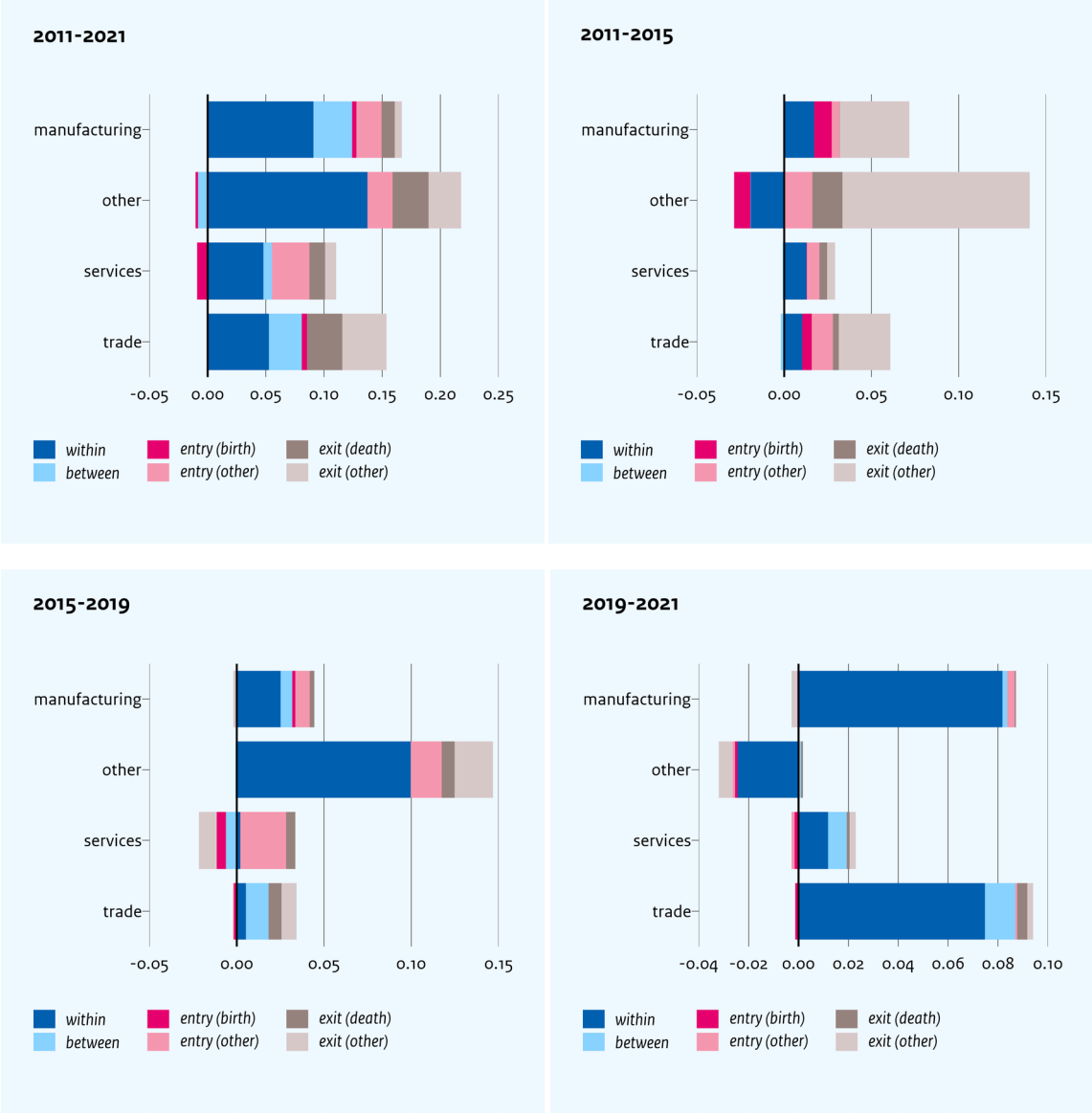
around 80%. With respect to the difference with results in Van Heuvelen et al. (2018) more research is needed. A candidate explanation is that unlike the earlier research, smaller firms (with 2 persons employed and less) have now been excluded. This is a particularly large and highly dynamic group, both in terms of business dynamics and productivity, which dominates the frontier group, and is likely to dominate the degree of dynamics observed as well. Moreover, we have improved the method to follow firms over time.

[12] Of course, considering a period of several years, there is more entry and exit than when looking at annual changes. Therefore, we find that the contributions of entry and exit are relatively large, compared to decompositions of annual changes or to contributions averaged across years.

from a mix of contributions, which does not necessarily indicate less dynamics. In the "other" industries, on the other hand, business dynamics became more important, while in trade it did not change much.

During the Covid crisis business dynamics contributed very little to productivity growth. Nearly all of the productivity growth in the period 2019-2021 was realized through within-firm changes in all sectors. Only in the group of "other" industries this resulted in a productivity decline. The contribution of exit is low. This finding is consistent with existing evidence on low productivity firms having had a higher likelihood of support during the Covid crisis (see e.g. Bettendorf et al., 2021).

Figure 4.4 Decomposition of labour productivity growth by sector



Note: Productivity is measured as real value added over persons employed in full-time equivalents. Percentile deviations are calculated within-industry (NACE Rev. 2, two digit) and year. Only firms with 3 or more persons employed and legal personality have been included, that are part of the Business Economy (NACE Rev. 2 B-N, excl. K, incl. 95; we also exclude 19 and L). Nominal value added is deflated using National Accounts industry-level deflators For more on the underlying data, see CBS (2022a; Chapter 2). Firms in the top and bottom percentile in either the productivity level or growth distributions have been excluded. The decomposition follows the method suggested by Foster et al. (2001).

5 Productivity benefits of export networks

Daan Freeman, Mark van der Plaat and Benjamin Wache (CPB)

5.1 Introduction

International trade remains crucial for the Netherlands. While concepts like strategic autonomy and reshoring have become an integral part of the debate on international trade, the export sector continues to play a vital role in the Dutch economy. Exporting firms are larger and more productive than the average Dutch firm and offer higher wages (CBS, 2022a). According to Statistics Netherlands (CBS), over 30% of gdp is generated through exports (CBS, 2022b). This added value stems not only from the exporting firms themselves but also from their suppliers. Approximately half of the jobs linked to exports are found within these supplier firms (CBS, 2022b). So, we know from previous research that exporting firms are more productive than non-exporting firms. This study extends the analysis to the whole export network.

We examine the productivity of exporters and the firms connected to them through supply networks. By focusing on firms connected to exporters, we gain insights into the broader impact of exports on the Dutch economy. Even firms indirectly involved in international trade may benefit through their connections with exporters. We emphasize productivity because it is a key driver of economic growth and competitiveness for firms and the Netherlands as a whole.

We use a new dataset from CBS that maps the Dutch production network, detailing domestic trade relationships between firms. The highly granular nature of this data allows us to uncover patterns at the firm level, rather than the traditional industry level. This enables us to identify which firms act as suppliers or customers of exporters and which do not. Suppliers to exporters, like exporters themselves, tend to be larger, more productive, and have more customers than firms not directly linked to exporters. This suggests benefits that extend beyond the (additional) revenue from supplying to exporters.

The structure of this section is as follows. Section 3.2 outlines the data sources underpinning our findings. Section 3.3 presents descriptive statistics, followed by results from several regression analyses. Section 3.4 places the findings in an international context and discusses potential explanations. The final section concludes with a summary and briefly highlights areas for future research.

5.2 Data

To map the connections between firms, we use a new dataset from CBS, the *Production Network of Businesses* (PNB). This dataset includes intermediate deliveries of goods and services between firms in the Netherlands, showing which firms trade with each other and the types of products exchanged. Firms combine various goods and services in their production processes, meaning suppliers can come from different industries. For instance, a machinery manufacturer might integrate metal components and construction advice from suppliers across different industries to develop and produce machinery. We focus on the flow of deliveries between firms in this network. This dataset is experimental. While a significant portion of this data

is based on direct observations of transactions between firms, a part is estimated using methods capable of reconstructing networks (Mungo et al., 2024). For a detailed explanation, see Buiten et al. (2021).

The PNB provides an unprecedentedly detailed view of Dutch value chains. Value chains are chains of production stages from raw materials to finished products. In existing literature, both national and international, chains are typically analysed at the industry level, describing for example the amount of agricultural inputs used in the food manufacturing industry (Buiten et al., 2023). CPB has extensively used such data in its research (e.g., van der Wal et al., 2024; Wache et al., 2024). The PNB takes this a step further by focusing on deliveries between individual firms, enabling the identification of differences within industries. This granular approach also allows for the study of dynamics such as spillover effects at the firm level.

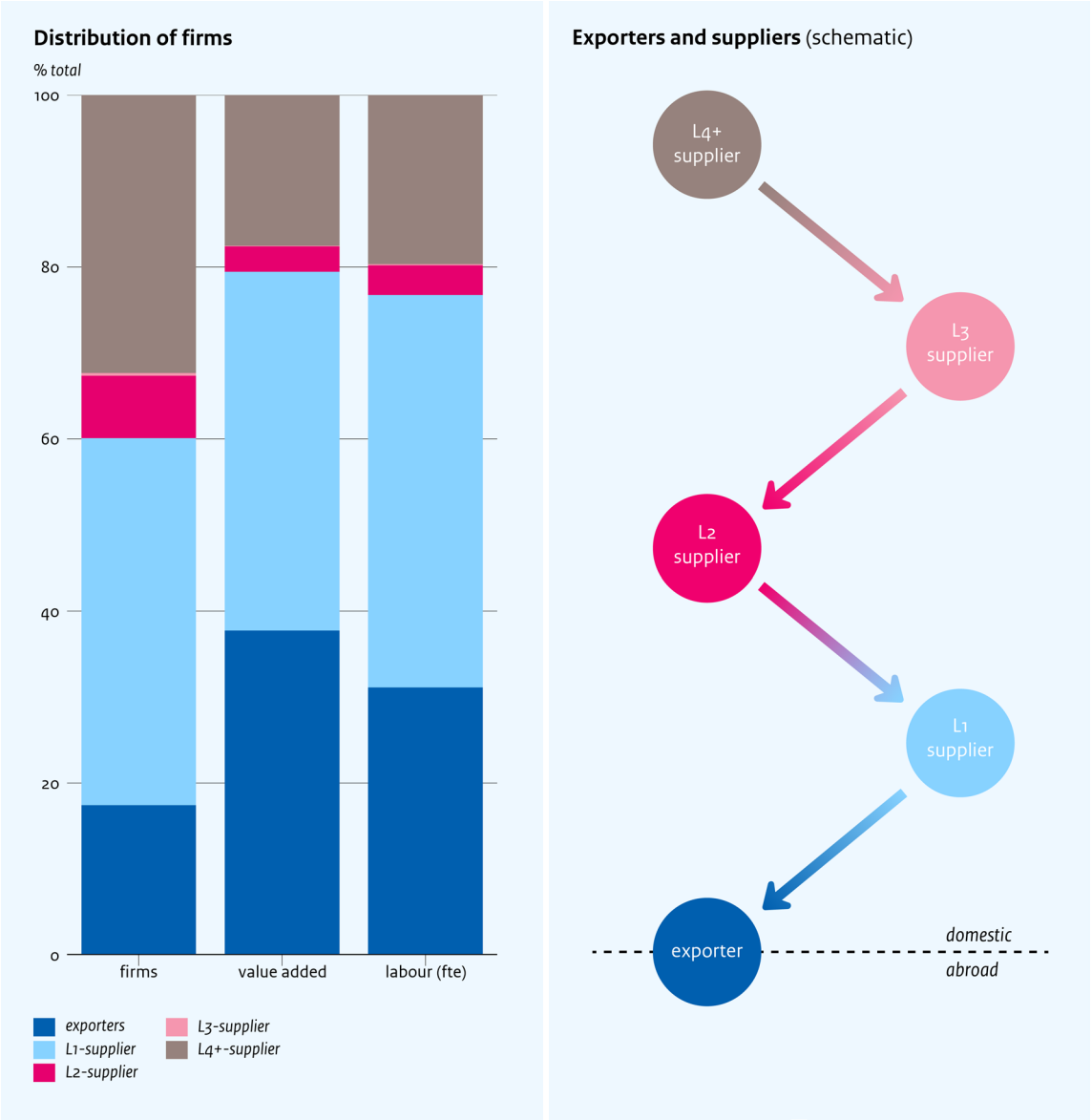
In addition to the network data, we use CBS data on firm-level productivity and international trade in goods. The productivity data includes labour productivity, total factor productivity (TFP), labour, capital, revenue, and value added. The dataset consists of data on corporations, thus excluding self-employed individuals and other non-corporate entities. Based on trade data, we identify exporting firms as explained below.[13] Our analysis is limited to goods exports, as data on international trade in services is unavailable.

The combined dataset includes around 55,000 firms for the analysis year 2018. A firm is classified as an exporter if it was actively exporting goods for at least three years between 2015 and 2018, to exclude one-time exporters.[14] Exporters in the trade and transport industries are excluded, as these often act as intermediaries. Additionally, firms with fewer than five employees are excluded. These criteria result in a higher proportion of exporters (17%) in the dataset compared to the overall firm population (10%) (CBS, 2022b).

Importantly, we identify not only direct suppliers to exporters but also firms supplying these suppliers and beyond. Around 17% of firms in our data set are exporters. So-called L1 suppliers, which supply directly to exporters without exporting themselves, account for over 40% of the total (see Figure 5.1). L2 suppliers, those supplying to L1 firms (but not directly to exporters or exporting themselves) represent a smaller group (7%). Similarly, we identify L3 suppliers, which form an even smaller group (less than 1%). Firms in the L4+ group, which are minimally connected to exporters, comprise about 30% of the total firm population. Together, exporters and L1 suppliers account for around 60% of total number of firms, 80% of the total added value and employment (Figure 5.1).

[13] Re-exports are excluded from our analysis. Firms solely engaged in re-export activities are therefore not classified as exporters.
[14] In the literature, such firms are referred to as *perennial exporters* (see van den Berg et al., 2022).

Figure 5.1 Exporters and their L1 suppliers constitute 60% of the firm population, 2018

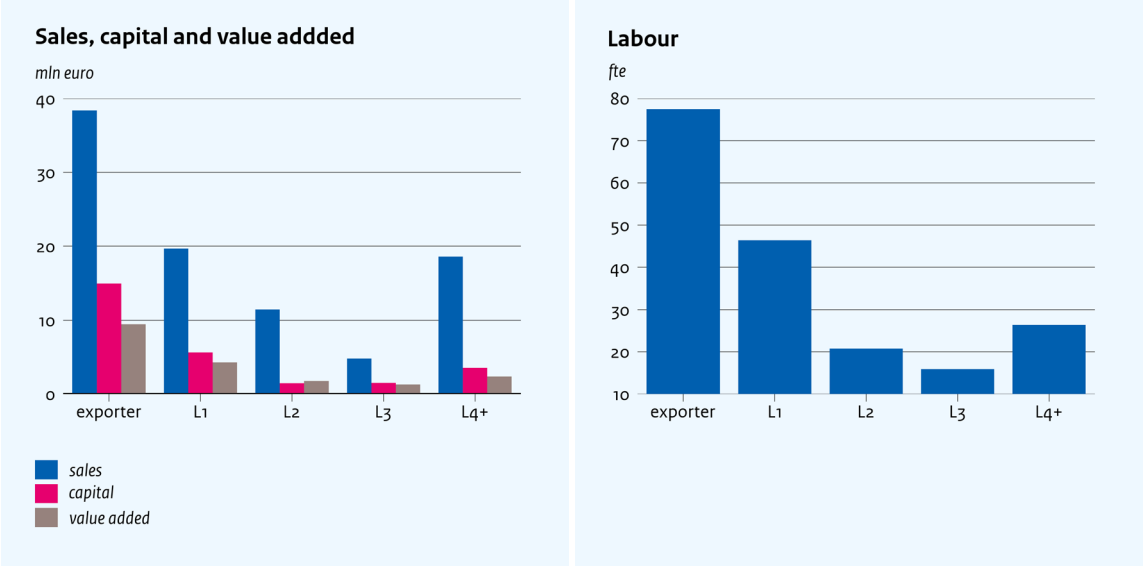


5.3 Results

Exporters are typically larger and more productive than non-exporters. They employ more workers, generate higher revenue, add more value, and maintain larger stocks of capital goods (see Figure 5.2). On average, exporters employ two to three times as many workers as non-exporters, enabling them to generate three to four times more revenue and value added. This higher value added per employee reflects their higher productivity. These findings align with existing literature, such as Bernard and Jensen (1999), which consistently shows that exporters globally tend to have more employees, larger capital stocks, and higher productivity than non-exporting firms. This higher than average productivity level is not so surprising given that exporting to markets beyond your domestic home market typically entails overcoming significant fixed costs due to international trade hurdles such as trade and transport costs, but also information, search and advertising costs.

Direct suppliers to exporters (L1) are also generally larger and more productive than firms that do not supply directly to exporters, although they are still smaller and less productive than exporters themselves. Our new finding is that suppliers to exporters are also larger and more productive than the average firm. L1-suppliers, on average, employ twice as many workers, generate double the revenue, and create two to four times more added value than firms not directly connected to exporters (see Figure 5.2). Their capital stocks are also two to three times larger. However, exporters outperform L1 suppliers across all these dimensions. Together, exporters and L1 suppliers form the most productive group of firms in the Netherlands. Firms further removed from exporters—such as L2 and L3 suppliers—are smaller and less productive than both exporters and L1 suppliers. The L4+ group includes a mix of firms, some of which are large retailers and wholesalers. These larger firms raise the group's average figures for employees and revenue, even though many other L4+ firms are smaller and less productive.

Figure 5.2 Exporters are larger and have more capital than other firms, 2018



Note: Average values per group.

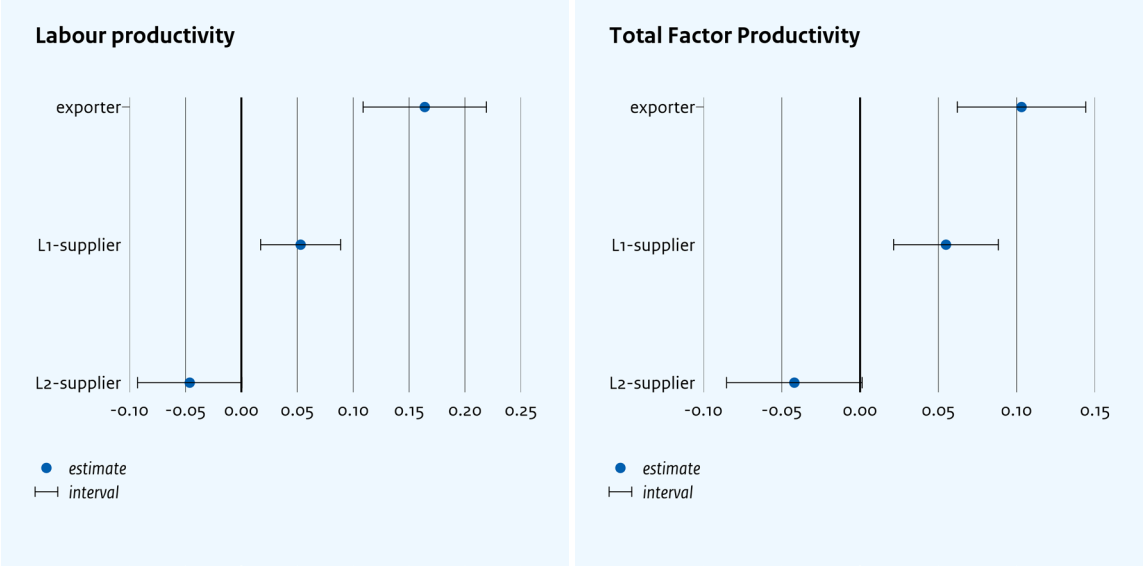
We perform several regression analyses to further examine differences between firms. The above figures compare firms of varying sizes and industry . Regression analysis allows us to control for the number of employees and industry fixed effects, creating a better comparison between groups. This approach ensures that comparisons between supplier groups are not biased by one group having more large firms or firms from specific industries.

Regression analysis enables the comparison of different groups of firms. The coefficients in Figure 5.3 represent the level difference relative to the L3+ supplier group. Given the small number of L3 suppliers, we combine them with the L4+ suppliers into a single group, together called L3+ group. So if we analyse labour productivity and find that the coefficient for exporter status is positive and statistically significant, this indicates that exporters, on average, have higher labour productivity than the L3+ group. The coefficient of each group reflects the percentage difference with the L3+ group. We stress that this analysis does not establish causal relationships.

After adjusting for various firm characteristics, exporters remain the most productive group, followed by their direct suppliers. Figure 5.3 presents the regression results for both labour productivity and TFP, with exporters showing the highest coefficients. On average, exporters are 11% to 18% more productive than the L3+ group. Direct suppliers (L1) are also more productive than other firms, by around 5% on average. Indirect

suppliers (L2), however, do not exhibit higher productivity than other firms. A clear pattern emerges: exporters are the most productive, followed by their suppliers, and then the rest.

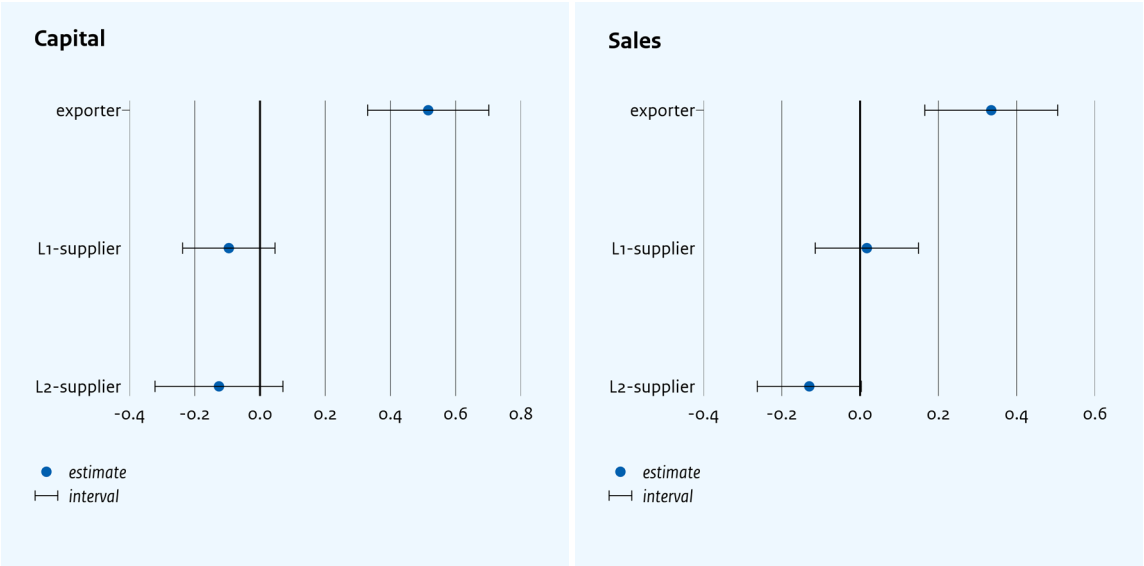
Figure 5.3 Exporters and their suppliers have higher productivity



Note: the whiskers show the 95% confidence interval

Exporters are not only more productive but also generate higher revenue and utilize more capital goods. Figure 5.4 presents the regression results for both sales and capital intensity. Compared to productivity, the patterns for sales and capital differ: exporters achieve the highest sales and have the largest capital stock. On average, exporters use nearly 70% more capital goods and generate 40% more sales than the L3+ group.[15] However, their direct (L1) and indirect (L2) suppliers do not have significantly more capital goods or higher sales. This indicates that exporters use their extensive capital stocks to achieve higher productivity than non-exporters.

Figure 5.4 Exporters are also larger and utilize more capital



Note: the whiskers show the 95% confidence interval

[15] A coefficient of 0.52 implies that capital is around 70% larger ([exp(0.52)-1]*100).

5.4 Explanations

The productivity hierarchy of firms in export networks is not unique to the Netherlands. For example, Dhyne and Rubínová (2016) show that exporters and their suppliers are larger and more productive than other firms in Belgium. There is also a clear hierarchy: exporters are larger and more productive than their suppliers, who, in turn, outperform their own suppliers. Similar trends are reported for Japan (Ito & Saito, 2021). At the industry level, Merlevede and Theodorakopoulos (2021) observe comparable patterns across a broader set of countries.

Selection, economies of scale, and learning effects may explain why exporters tend to be larger and more productive than other firms. Three main drivers of differences between exporters and non-exporters are suggested in the literature. First, according to the *selection effect*, exporters face intense international competition, meaning only highly productive firms can afford to export (Melitz, 2003). Firm size is also critical, as shown by Brakman et al. (2020), who emphasize that firm size significantly impacts the likelihood of starting to export. Second, exporters access larger markets, enabling them to achieve *economies of scale* and lower production costs (Krugman, 1980). Third, by interacting and collaborating with foreign partners, exporters *learn* new techniques or methods, leading to productivity gains (Atkin et al., 2017; CBS, 2022a; De Loecker, 2013). Thus, exporting not only attracts productive firms but also enhances their productivity over time.

Similar factors apply to suppliers of exporters. Productive exporters are likely to invest more in identifying and collaborating with the most productive suppliers, creating a mutually beneficial selection process (Bernard & Moxnes, 2018). Additionally, exporters' economies of scale may benefit their suppliers by increasing the demand for intermediate goods, which boosts suppliers' production efficiency. Lastly, suppliers may adopt new techniques and practices through their partnerships with productive exporters, further improving their own productivity. Empirical studies confirm that exporters often assist suppliers in delivering higher quality and encourage continuous improvement (Alfaro-Ureña et al., 2022).

The relationship between exporters and their suppliers is mutually beneficial. Exporters gain advantages from working with productive suppliers, as highlighted by Bernard et al. (2022) and Bernard and Moxnes (2018). Their model describes how marginal costs of an exporter depend on supplier pricing. Productive suppliers offer lower prices, which keeps costs in the supply chain low. As a result, firms with productive suppliers in their value chains are more competitive than those without such networks. Additionally, productive firms attract more customers and achieve higher sales per customer.

5.5 Conclusion

Exporters play a crucial role in the Dutch economy, extending beyond their function as employers and customers of domestic suppliers. They make a significant contribution in particular to productivity, not only through their own performance, but also possibly by enhancing performance of suppliers. Exporters are the most productive firms in the Netherlands, followed by their suppliers, who also perform above average. The findings suggest that the closer a firm is connected to the export sector, the more it can benefit. Firms gain from exports through various channels, each with distinct policy implications.

The insights from this study are relevant to several policy debates. Policies affecting exports and exporters have broader impacts, influencing not just the export sector but the wider economy. To boost productivity, the

government could, for instance, focus on promoting knowledge diffusion from successful exporters to other firms or facilitating stronger connections between firms. Additionally, stimulating the export sector itself can indirectly drive growth across the broader economy. Effective policy design requires a deeper understanding of productivity spillovers from exporters to their suppliers and beyond. Future research should explore these channels in detail.

Future research will delve further into the differences between exporters and their suppliers, with particular emphasis on the diversity within these groups. First, investigating how suppliers benefit from their relationships with exporters will help design more targeted pro-productivity policies. Second, identifying which firms derive the most advantage from working with exporters—considering factors like firm size, industry, export destinations, or specific products—will clarify the links between (indirect) exporting and productivity. Finally, examining non-export-connected firms will provide insights into their role in the economy. These insights will contribute to the development of more focused policies that support productivity and economic growth in targeted areas of the economy.

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