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Abstract

This study examines the decline in firm dynamism within the Netherlands, potentially linked to the deceleration of productivity growth. We utilise a rich microdata set covering the period 2006-2016, encompassing nearly all Dutch corporations. This dataset facilitates an evaluation of start-ups' and exiting firms' contributions to Total Factor Productivity (TFP) growth across various industries, employing the Melitz and Polanec (2015) decomposition approach. Our findings reveal that in service sectors, the creative destruction hypothesis is substantiated, as start-ups and exiting firms positively impact overall TFP growth. In contrast, TFP growth in manufacturing is primarily driven by incumbent firms. Entry and exit dynamics in this context exert minimal or even negative influence on TFP growth. Although entrants in manufacturing initially display lower productivity than incumbents, their productivity growth outpaces that of incumbents. In services, entrants commence operations with higher initial productivity, a trait that gradually diminishes over time. Generally, entrants with relatively low productivity are predisposed to exit within five years, aligning with the 'up-or-out' pattern.

Keywords: productivity slowdown, firm dynamics, TFP, Netherlands.

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1 Introduction

The Netherlands consistently ranks high in terms of labor productivity, owed to its open economy and strategic position in international trade and investment. The country offers a favorable business climate, strong infrastructure, and a highly educated workforce, which attract foreign companies and encourage cross-border business activities. However, the Dutch productivity growth has encountered a notable slowdown in recent times (Grabska et al., 2017). The causes behind this deceleration remain unclear. In their research, Akcigit and Ates (2021) analyze trends in US business dynamics and present ten key observations on the slowdown. However, several of these findings do not correspond to the Dutch situation, making it a compelling case study. Specifically, rising markup levels seen in the US (De Loecker et al., 2020) seem absent in the Netherlands (Van Heuvelen et al., 2021), where markups remain relatively stable. Furthermore, the gap in productivity between leading and lagging companies in the Netherlands has not significantly widened (Van Heuvelen et al., 2018a), in contrast to other countries (Andrews et al., 2016).

Nonetheless, the evident reduction in firm dynamism in the Netherlands appears to identify a primary driver of the country's productivity deceleration. The churn ratio, a straightforward indicator of business dynamism, measures the total of entering and exiting firms divided by the overall active firms within a year.[1] Since 2009, the Netherlands has witnessed a decline in the churn ratio, mainly due to the entry rate's decrease outweighing the slight rise in the exit rate (see left panel of figure A.1 in the appendix). This trend applies across all firm sizes, from small to large (see right panel), as well as in both manufacturing and service firms (see figure A.2 in the appendix).

Business dynamism, encompassing firm birth, growth, decline, and exit, significantly impacts overall productivity and resource allocation, thus playing a crucial role in economic growth (Decker et al., 2018). Robust dynamism allows resources to shift from low-productivity to high-productivity firms within the economy (Bartelsman and Doms, 2000; Foster et al., 2018). However, both productivity growth and business dynamism are decreasing in multiple countries (Decker et al., 2018; Akcigit and Ates, 2021; Pugsley and Sahin, 2019; Bijnens and Konings, 2020). The relationship between firm dynamics and productivity growth has garnered extensive research, as presented by Ahn (2001). We contribute to this body of work by examining the decline in firm dynamism in the Dutch context and its association with productivity growth, aiming to uncover reasons behind the productivity slowdown.

[1] Entry and exit rates encompass various types: pure entry, mergers and acquisitions, split-offs, and restructures.

We delve into the diminishing firm dynamism from three angles. First, we differentiate between various industries. Second, we distinguish between different modes of firm entry and exit, including mergers and acquisitions (M&As), a distinctive aspect of our dataset, which is a novel feature with respect to the existing literature. Lastly, we concentrate on young firms that are startups and can be tracked during their initial years.

Our primary research query investigates the correlation between diminishing firm dynamism in the Netherlands and the country's productivity growth. Our hypothesis posits that while both service and manufacturing sectors experience decreasing churn, their contributions to productivity growth are different. Typically, the services sector maintains lower productivity levels compared to other productive sectors, with relatively sluggish growth (Maroto-Sanches, 2011). Existing literature outlines several mechanisms to link this aspect. We outline these mechanisms below and then utilize them as potential explanations for the diverse ways in which firm dynamics in service and manufacturing sectors influence productivity growth.

Schumpeter (1934) introduced the "creative destruction" model, connecting firm dynamics and economic growth. In this model, new firms enter the market with new technologies or innovations. Successful innovations lead to heightened competition and the eventual replacement of existing firms, widening the productivity gap between entering and exiting firms. Versions of this model include Aghion (1994) and Caballero (1991). Following this logic, both entry and exit should positively contribute to productivity growth. Business cycles, representing waves of creative destruction and recessions, tend to have a cleansing effect, although the empirical evidence is unclear (Caballero and Hammour, 1991; Foster et al., 2016; Bartelsman et al., 2019).

Later models consider uncertainty, learning, and diffusion effects. Firms grapple with uncertainty as they do not know the demand for new products or which new technologies will succeed. Firms learn by experimenting with different technologies, either passively or actively. Passive learners discern the success of their technologies only after entering, which explains why many entrants exit shortly after their entry and why growth rates of small and young firms vary (Jovanovic, 1982). In the active learning model, firms analyze the market before entering and make informed investment decisions (Ericson and Pakes, 1995). Such models create an 'up-or-out' dynamic, where new firms must either grow or exit the market (Decker et al., 2014; Haltiwanger, 2012).

Other models suggest that successful technologies trigger market growth, leading to numerous new firms entering. As the market matures, survival becomes more challenging; fewer firms enter, and more exit. The product life cycle model by Gort and Klepper (1982) and Agarwal and Gort (1996) follows this trajectory. Notably, entering firms are not necessarily more productive than incumbents.

Recent literature delves into firm dynamics amid increasing industry concentration rates, which measure firm dominance within an industry (De Loecker et al., 2020; Autor et al., 2019). This research emphasizes the emergence of dominant "superstar" firms, driving the rising concentration ratios. These firms, responsible for increased concentration, discourage the entry of smaller firms. Notably, successful young firms are often acquired by these large superstars, curbing their growth potential (Decker et al., 2016).

In general, service firms tend to have lower productivity levels compared to firms in manufacturing or other more traditional sectors (Audretsch et al., 1998). Many service industries rely heavily on human labor and personal interactions, limiting the degree of automation and efficiency that can be achieved compared to manufacturing processes. This is related to the fact that services often involve a wide range of skills and tasks that may be harder to standardize and optimize for productivity improvements. Therefore, many service industries (but not all) have limited potential for achieving economies of scale, unlike manufacturing processes that can benefit from producing larger quantities. Technology-related services (such as software development, consulting, and financial services) can have high productivity due to their ability to leverage technology, standardize processes, and achieve economies of scale. This also relates to specific required investments. In certain industries, substantial upfront investments are necessary, such as manufacturing or service industries like wholesale and trade, reliant on physical capital and infrastructure. In business services, digital infrastructure and technology play a more vital role. Entry and immediate productivity are more achievable when lower investments are required.

The time needed to develop expertise and raise productivity could also contribute to differences between service and manufacturing sectors. Jovanovic (1982) suggests firms learn and invest in enhancing productivity after entering. Such investments might be more common or relevant in manufacturing industries than in many service sectors. Iacovone and Crespi (2010) argue that building technological capabilities at the firm level is crucial for catching up.

Another perspective arises from Melitz and Redding (2021), contending that international trade might influence firm dynamics, particularly in open economies like the Netherlands. Manufacturing is more trade-oriented than many service sectors. Manufacturing firms are more likely to export and thus compete against a broader array of international competitors. Research by Polder et al. (2022) reveals that much of manufacturing growth's firm dynamics is driven by exporters. Hence, manufacturing firms might require greater scale and learning to compete against incumbent and foreign firms on the international front. This might have a lesser impact on new firms and incumbents in the service sector.

The paper continues as follows: in sections 2 and 3 we discuss the dataset and the methodologies used to derive productivity and to decompose productivity growth. Subsequently, we present and discuss the results in section 4, starting with the decomposition results and followed by the regression results that assess the TFP dynamics of firms post-entry. The final section 5 concludes.

2 Data

We merge three datasets to obtain a large representative sample of Dutch firms for which we estimate productivity. The merged dataset contains a total of 401,403 incorporated enterprises, including enterprises that consist of multiple firms.[2] From hereon, we will use the term 'firms' to designate both firms and enterprises. Throughout the paper, we consider three firm size classes: micro firms[3] (<10 employees), small firms (10-49 employees), and large firms (50 or more employees). We distinguish three main industries: manufacturing, services and other (construction and agriculture).

The three datasets are obtained from Statistics Netherlands. Firstly, the ABR (business registry) dataset contains information on important events in the life cycle of the firms and some basic background statistics such as birth date, industry and size. Secondly, the NFO (non-financial firms) dataset contains book value data for the population of firms. Thirdly, we match the Polisbus dataset, which contains employee-level data, to the firm data. Due to changes in definitions in the ABR, we can only consider data in the period 2006 to 2016, yielding an unbalanced panel of 11 years.[4] We calculate productivity for around 144,000 firms per year. Data are available for 52 industries, covering the whole economy excluding public and financial industries (see the list in Table A.3 in the appendix).

We measure labour input by summing employee labour hours for each firm, using the matched firm-employee data. We obtain a good match between the NFO and Polisbus; on average, 82.4% of the firms observations match each year. However, we drop firm-observations when employees are insufficiently matched. For firms with fewer than 20 fte,

[2] In the dataset used in this study, 95.5% of the enterprises consist of only one firm. The majority (77.2%) of the observations where an enterprise consists of multiple firms appear in the 2006-2009 subsample.

[3] Note that, due to data constraints, our data excludes non-employer firms. These firms are therefore not included in our analysis and their contributions to firm dynamics are not considered. Fortunately this is, in terms of value added (< 5%), a relatively small group.

[4] According to the documentation, NFO covers 80% of the large firms and 90% to 95% of the small firms (in terms of the balance sheet total).

10.5% of the observations are lost, while the loss is minimal (3.5%) for other firms.[5] As in Van Heuvelen et al. (2021), we assume labour in the Netherlands to be a flexible input.

The events data is a feature that distinguishes our dataset from many other micro datasets. The information in this dataset lists the reasons for the entry and exit of firms. We can distinguish between three types of entry and exit: pure, M&A, and restructuring. In addition, when we observe entry and exit unlabelled in the events database, we label this "other" entry or exit. Pure entry consists of new firms that have not been previously observed in another form and pure exit consists of firms that leave the dataset completely. This is contrasted by entry and exit through mergers and acquisition (M&A).[6] Entry and exit through restructuring contains firms that are disconnected from the parent firm or that are restructured to such an extent they are registered as a new firm.[7]

Finally, we reduce the effects of outliers (i.e. implausibly small or large TFP values) by trimming the top and bottom 3% of the industry-year TFP distribution. We choose the 3% level because it gives us the best match between aggregated micro data and official productivity growth figures.

3 Methodology

In this section we outline how we derive TFP at the firm level using industry-specific production functions. Following this, we outline the Melitz and Polanec (2015) decomposition method to decompose industry-level productivity growth into different contributors, using the firm-level TFP estimations.

3.1 Measuring TFP

To estimate TFP, we use a Cobb-Douglas production function with Hicks-neutral productivity (lower case denoting logged variables):

$$y_{it} = \beta_k k_{it} + \beta_l l_{it} + \omega_{it} + \epsilon_{it} \tag{1}$$

where value added y is produced with capital k and labour l, productivity ω_{it} (known to the firm) and an unanticipated output shock (ϵ). Since ω_{it} is known to the firm when choosing inputs k_{it} and l_{it} there is an endogeneity problem, resulting in biased OLS estimates.

[5]The results are robust to the sample selection caused by the merge. A detailed discussion of merging outcomes is found in Van Heuvelen et al. (2018b).

[6]Unfortunately, the data does not allow tracing of the parties involved in M&A's or restructuring. This means we can observe firm exit for these reasons as well as firm entry, but not exactly which individual firms merge/restructure into which new individual firms.

[7]We refer the reader to Eurostat for the technical definitions of the entry and exit types.

Several solutions have been proposed to this endogeneity problem, such as using instrumental variables. Olley and Pakes (1996) (OP) have proposed a two stage approach that has been widely taken up and further refined (e.g. Levinsohn and Petrin (2003) (LP) and Ackerberg et al. (2006)). OP derive a valid proxy for ω_{it} entailing investments. LP have adapted this approach using intermediate inputs, such as materials. We follow the approach of LP and use firms' material inputs m_{it}. The approach assumes that a firm chooses its inputs in different periods: capital is chosen at $t-1$ and labour in period t; capital is thus a state variable. Under this timing assumption, the demand for materials inputs can be formulated as a function of productivity ω_{it}, capital k_{it}:

$$m_{it} = f_t(k_{it}, \omega_{it}) \tag{2}$$

with the firm's demand for materials strictly increasing in ω_{it}. To use this approach, several assumptions must be made: (i) the firm's information set at t, I_{it}, includes current and past productivity shocks but does not include future productivity shocks; (ii) productivity ω_{it} evolves according to an endogenous first-order Markov process:

$$\omega_{it} = h(\omega_{it-1}) + \xi_{it} \tag{3}$$

where ξ can be seen as a firm's innovation to its productivity.

Inverting equation (2) and plugging it into the original equation we obtain the following equation:

$$\begin{aligned} y_{it} &= \beta_0 + \beta_k k_{it} + \beta_l l_{it} + f^{-1}(m_{it}, k_{it}) + \varepsilon_{it} \\ &= \beta_l l_{it} + \phi(m_{it}, k_{it}) + \varepsilon_{it} \end{aligned} \tag{4}$$

Because l_{it} and m_{it} are uncorrelated with ε_{it}, β_l and ϕ can be identified; this is the first stage.

The second stage involves the estimation of all coefficients of the production function. As $\omega_{it} \equiv \phi(k_{it}, m_{it})$ - β_0 -$\beta_k k_{it}$, we can obtain the following equation:

$$y_{it} - \hat{\beta}_l l_{it} = \beta_0 + \beta_k k_{it} + h(\hat{\phi}_{it-1} - \beta_0 - \beta_k k_{it-1}) + \xi_{it} + \varepsilon_{it} \tag{5}$$

The estimation of the second stage uses the moment conditions $E\left[(\varepsilon_{it} + \xi_{it})\mathbf{I_{it}}\right] = 0$. The matrix $\mathbf{I_{it}}$ is defined as follows:

$$\mathbf{I_{it}} = \begin{bmatrix} k_{it-1} \\ k_{it} \end{bmatrix} \tag{6}$$

In the first stage, $\hat{\beta}_l$ and $\hat{\phi}$ were estimated, in the second stage, β_0 β_k and f are estimated.[8]

For our estimation we apply the one-step GMM estimator based on Wooldridge (2009) shown below.

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + h(f^{-1}(.)) + \xi_{it} + \varepsilon_{it} \tag{7}$$

We approximate $h(f^{-1}(.))$ with a third order polynomial in all of its elements, except for the year dummies that enter linearly. Finally, using the estimated output elasticities β_l and β_k we back out productivity as a residual.

3.2 Decomposition

Many studies on dynamics and productivity consider some form of decomposition of industry-level productivity index (Foster et al., 2001; Griliches and Regev, 1995; Melitz and Polanec, 2015).[9] The specific decomposition we apply is the Dynamic Olley-Pakes Decomposition (DOPD) developed by Melitz and Polanec (2015). Using this decomposition, we split aggregate productivity growth into the contributions of firm productivity growth and changing shares of firms' value added. The method explicitly separates the contributions of entering and exiting firms. Equation (8) shows the productivity growth decomposition from a period 1 to period 2 (industry subscripts suppressed).

$$\Delta P_{1,2} = \Delta \bar{P}_{S1,2} + \Delta COV_{S1,2} + s_{E2}(P_{E2} - P_{S2}) + s_{X1}(P_{S1} - P_{X1}) \tag{8}$$

where aggregate productivity change that stems from incumbent (S), entering (E), and exiting (X) firms is decomposed into four terms.

The first term of equation (8) is the change of the unweighted industry average productivity for incumbent firms ($\Delta \bar{P}_{S1,2}$).[10] The second term (ΔCOV_S) is induced by market share reallocations between incumbents (i.e. the covariance change between firm-level productivity and value added share). The third and fourth terms of equation (8) are the productivity growth contributions of respectively entrants ($s_{E2}(P_{E2} - P_{S2})$) and exiters ($s_{X1}(P_{S1} - P_{X1})$ with s being the share of value added).

Because there are no observations for the productivity of entrants in period 1 and productivity of exiters in period 2, the method uses the set of incumbent firms as a benchmark

[8] See Olley and Pakes (1996); Levinsohn and Petrin (2003) for a more thorough discussion of the derivations and the assumptions required for this method.

[9] Griliches and Regev and Foster et al., use different methodologies, leading to different outcomes (Baldwin and Gu, 2006).

[10] This is equal to the average firm-level productivity change ($\Delta\Sigma_{P_{et}}$) for all incumbent firms.

to analyse how adding the group of entrants (or exiters) affects the aggregate productivity change. The term for entrants thus compares the weighted average productivity of entrants (P_{E2}) with the weighted average productivity of incumbents in period 2 (P_{S2}). If entrants are more (less) productive than incumbent firms, their entry contributes positively (negatively) to productivity growth. In addition, the degree to which entrants contribute to aggregate productivity growth depends on their share in total industry value added (s_{E2}). The contribution of exiting firms is analogous but uses period 1 as base period. The key feature of this decomposition is that the productivity contributions of entry and exit are defined relative to period 2 and 1, respectively. This is an improvement on many other decompositions, which compare all terms to the same base period and therefore either entry, exit, or both are biased (Melitz and Polanec, 2015).

Our data allows us to observe the reasons for entry and exit, for example mergers & acquisitions or 'pure' entry or exit. Using this information we observe groups of firms that entered or exited in specific ways. We can evaluate the productivity contribution of each of these groups by adding additional entry and exit terms in equation (8).

The next section presents the results of the decomposition and examines the survival and growth of new firms.

4 Results

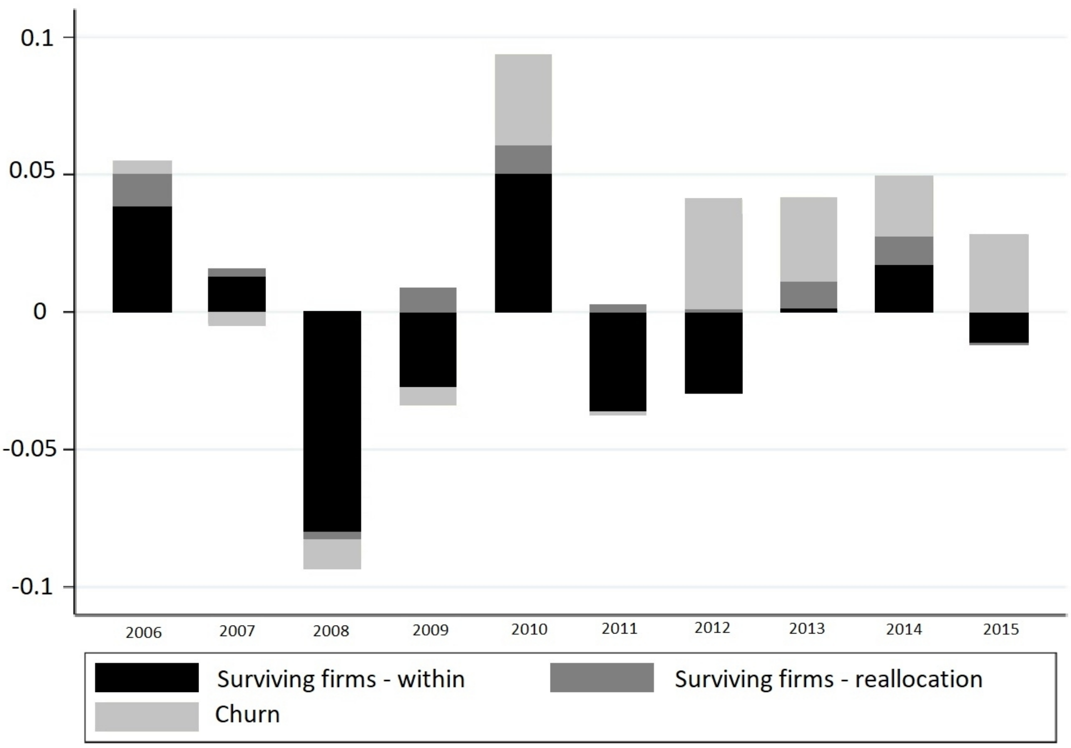
4.1 Productivity Decomposition

In line with the creative destruction model, we expect entry and exit dynamics to contribute positively to productivity growth because firms that enter are expected to be more productive than incumbents, while relatively unproductive incumbent firms are more likely to exit.

4.1.1 Aggregate results

In figure 1, we show the three parts of the aggregate productivity growth (year on year). The contributions of incumbent firms are given by the first two right-hand terms of equation (8). The first term, the unweighted average, indicates how much the average productivity growth within firms contributes to overall productivity growth. The second term is the covariance, which indicates how much the reallocation of market share to incumbent firms has contributed to overall productivity growth. The last part gives the combined contribution of entry and exit to productivity growth, i.e. churn, which is the sum of the final two terms of equation (8).

Figure 1: Contributions to annual productivity growth (in %-points), 2006-2015



We find that average productivity of incumbents has declined and contributed negatively to productivity growth, particularly in 2008-9. The generally positive covariance term (reallocation) indicates small increases in allocative efficiency, with corresponding positive contribution to productivity growth. Finally, churn tends to contribute positively to productivity growth, in line with expectations from theory.[11]

What do these results imply for the link between declining firm dynamism and the slowdown in productivity growth? Churn is found to have contributed on average 1.13%-point to the TFP growth rate, meaning that a decline in churn of 5%-points, not far off from what we observe since 2006, reduces the productivity growth rate with more than 0.25%-points.[12]

[11]These results are driven by pure and M&A churn. The appendix (see figures A.5, and A.6) shows that entry and exit due to other dynamics, such as firm restructuring, contribute less across the board.

[12]A decline in entry and exit of 5%-points is equivalent to a decline in the churn ratio of around 25% (see figure A.1a). If the distribution of entrants and exiters remains the same, this decline translates to a decline in the contribution to productivity growth.

4.1.2 Differences between manufacturing and service industries

The more disaggregated results show a rather striking difference between manufacturing and services with respect to the contributions to productivity growth within incumbents and churn. In the rest of this section, we focus on average annual contributions, as presented in table 1.

Table 1: Average annual contributions to productivity growth (in %-points), 2006-2015

	Total	Manufacturing	Services
Within incumbents	-1.03	0.63	-1.30
Between incumbents	0.37	0.44	0.36
Churn	1.13	0.57	1.23

Manufacturing is defined as ISIC sector C, services as ISIC sectors H through N. The productivity contributions of the underlying 2-digit sectors are aggregated using value added. For more detailed sector results over time, see figures A.3, A.4, A.5, and A.6. The final row shows the total contribution of churn due to all entry and exit types.

Table 1 first shows that the change in the unweighted average productivity within incumbents is the most important for manufacturing industries, while this contribution is negative in service industries. Second, the contribution of reallocation between incumbents is positive in both sectors. Finally, the contribution of churn (of all types) is clearly more positive in services than in manufacturing. Repeating the thought experiment from above, a 5%-point churn decline in services would yield about 0.25%-points lower productivity growth in services, and around 0.1% for manufacturing.

These results show that entry and exit dynamics generate more productivity growth in services than in manufacturing industries. At the same time, incumbent firms constitute a drag on productivity growth in services. In manufacturing, incumbent firms generate productivity growth while churn dynamics contribute relatively little.[13] We find a negative relationship between the contributions of incumbent firms and the contribution of churn at the sub-industry level in manufacturing. In sub-industries where churn dynamics contribute more to productivity growth, the contribution of incumbent firms tends to be lower (see appendix figure A.7).

[13] Other industries (agriculture and construction) fall somewhere in the middle, with positive contributions of churn and ambiguous contributions of incumbents.

4.1.3 Robustness analysis

We report two types of robustness analysis. First, the negative values in table 1 may be explained by the 2008-2010 and 2011-2013 crisis periods when productivity growth turned negative. When we exclude these downturns, the unweighted average across all industries is pushed up, as suggested by the results reported in figure 1. However, the differences between manufacturing and services industries are maintained. See table A.1 for the results.

Second, a change in the value added shares, rather than productivity, may drive the sector-differences in the contribution of churn in table 1. To examine this, we perform a counterfactual decomposition. In this counterfactual, we keep the value added shares of entry and exit at the 2006-level across industries so that the productivity contributions only show the effects of productivity of churn compared to incumbent firms (table A.2). Overall, the average contribution of entry and exits is reduced. Specifically, with constant weights, about two-thirds of the large average contribution of entry and exit in services is due to the productivity contribution of entry and exit. In manufacturing is this only about one-fifth. While this does not explain the difference between sectors, it does highlight that in services productivity growth was driven more by entry and exit dynamics, both in terms of a growing share in value added and productivity. In manufacturing, the productivity of entrants and exiters was much more important than their value added share.

4.2 Productivity growth over the lifespan of firms

The decomposition results have shown that firm dynamics and productivity growth are related across industries. In this section, we focus the analysis on the productivity growth of entrants in the first years of their lifespan. Theory suggests firms follow an 'up-or-out' dynamic; new firms either become more productive in the years after entry or leave the market when their productivity remains relatively low. At the same time, it is possible that high productivity entrants exit the market because they are bought by incumbent competitors. In this case, we would observe a high correlation between productivity and exit through mergers or acquisitions for entrants.

Table 2 shows the characteristics of entrants across industries for their first six years, including firms that exit before reaching that age. It shows for each age cohort their average sales, productivity growth, and the total hours worked by employees. Entrants are smaller, both in terms of sales and employment. We continue by comparing productivity levels of young firms to older firms for each industry. To explore this, we relate firm age to firm productivity-levels: for each industry we run the following regression.

Table 2: Average characteristics of pure entrants as they age, 2006-2015

Age	N	Gross output (euro)	Hours worked	Annual TFP Growth
1	62995	1125	8500	
2	61858	1286	9523	15%
3	50637	1361	10385	15%
4	40505	1566	11234	14%
5	32227	1586	12080	14%
6	24723	1570	13178	13%
older		1811	15206	12%

$$ln(TFP_i) = \beta_0 + \sum_y \beta_y(age_y) + \delta_t + \eta_s + \epsilon_i \tag{9}$$

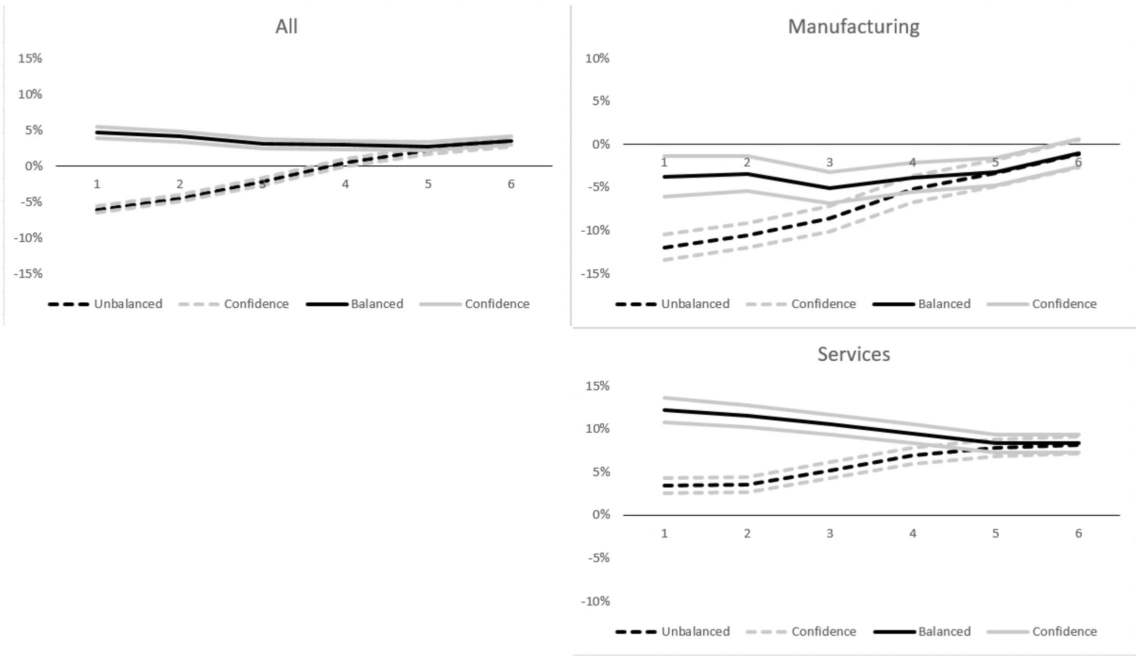
where age_y is a set of dummies indicating firms of ages 1 through 6 years, making firms older than 6 years the reference group in these regressions. δ_t and η_s are time and industry-fixed effects. Because we use logs of TFP in this regression, the coefficients can be interpreted as the %-difference in TFP.

In figure 2 we show the estimated values of the β_y's, for all firms, and for manufacturing and services separately. It shows productivity levels of young firms, up to six years old, compared to average productivity of older incumbents.[14] We do this for two samples: the first is a full sample containing all young firms that entered the market (full lines). The second is a balanced sub-sample, containing only the young firms that make it to at least 6 years of age (dashed lines). The top-left panel shows that the average productivity of all entrants is low compared to older incumbents, however, the entrants surviving to age 6 have, on average, a higher productivity from the start. Therefore, the gap between the two lines illustrates that relatively low productivity entrants are more likely to exit in their initial years.

The relatively small productivity difference between young firms and incumbents at the aggregate level again hides differences between industries. Young firms in services tend to have a *higher* productivity than older incumbents, even those that exit before reaching age 6, see the bottom-right panel. The productivity advantage relative to older incumbents is much greater still for young firms that make it to at least age 6. This advantage declines only very slowly over time, and it is statistically significantly positive

[14] The cut-off age of six years is chosen, given the length of our sample. The age of firms is defined independent of the mode of entry.

Figure 2: Productivity development of entrants compared to incumbents of over six years old, per broad industry category



Estimation results of equation (9) with 95% confidence interval. Table A.4 shows detailed regression results.

for firms aged 6. This is not an *up-or-out* dynamic. Rather, surviving entrants are those firms that appear highly productive right from the start; a *high-or-out* dynamic.

In contrast, young firms in manufacturing tend to have a lower productivity, on average, than older incumbents. Even firms that survive to at least age 6 tend to be less productive when entering the market. However, by age 6, entrants' average productivity is on par with older incumbents. This catching up yields an *up-or-out* dynamic, comprising of two developments. First, similar to services, young firms that exit are on average less productive, see the gap between the unbalanced and balanced panel. See also table A.5 for additional analyses making this point. Second, starting in year 3, the average productivity of young firms that stay in the market starts to converge to the level of older incumbents, being statistically indistinguishable by age 6.

4.3 Discussion on the different contributions to productivity growth

We have observed variations in how firm dynamics impact the growth of Total Factor Productivity (TFP) in different industries. In our introduction, we presented several mechanisms from academic literature to shed light on these differences. In the introduction we put forward the hypothesis centering around economies of scale and low entrance investments as distinguishing factors between the manufacturing and services sectors. The outcomes of our analysis do provide certain indications that support this hypothesis. First, we find that in *services*, the entry of firms contributes most to overall TFP growth. This is in line with the creative destruction hypothesis: entrants in services tend to have a higher than average TFP, while exiting firms have a lower than average TFP. In particular, young entrants show high productivity compared to incumbents, but seem to have no faster productivity growth subsequently.

The dissimilar outcomes observed in the manufacturing and services sectors could potentially be influenced by only a subset of the services. It's important to note that the service sectors encompass a wide range of categories, including accommodation, ICT services, and business services, all falling under this overarching label. Within the category of business services, there's also substantial heterogeneity. To draw meaningful conclusions and ensure that the outcomes related to services aren't solely attributed to particular services within this diverse category, a more detailed investigation is warranted. This serves as a direction for future research.

Second, in *manufacturing*, TFP growth is driven mostly by incumbent firms while entry and exit dynamics contribute relatively little to TFP growth. However, once manufacturing firms have entered the market, their TFP growth tends to be higher than that of incumbents, contributing positively to aggregate TFP growth. This dynamic is in line with models that incorporate learning effects, both passive and active. Passively learning firms discover the success of their technologies only after entry, while actively learning firms analyse the market before entering, selecting successful investments. However, both sectors share a common trait: lower-productivity entrants are more likely to exit during the years following their entry, a characteristic indicative of a well-functioning economy.

An interesting avenue for future research is to explore the dynamics that we document here for other countries. Andrews et al. (2015) show for a wide set of developed countries that firms at the productivity frontier (i.e. with the highest productivity growth), are slightly younger on average than those that lag behind. Van Heuvelen et al. (2018b) document the same for the Netherlands but only for service industries, not for manufacturing. This is in line with our findings that young firms in services tend to be more productive than incumbents on average. This might indicate that the creative destruction dynamics we find for services is more widely applicable in other countries.

Related, compared to other OECD countries, young firms in the Netherlands grow relatively slowly in terms of jobs (Calvino et al., 2016). This might be because manufacturing makes up a larger part of the economies of other countries, and we find that young manufacturing firms experience more rapid growth with respect to productivity. To our knowledge, no previous work has explored the heterogeneity between industries in terms of firm dynamics and productivity in a cross-country setting. Further research in this area will shed more light on whether our results hold more generally, or if these dynamics are specific for the Netherlands.

Our dataset distinguishes between various types of exits and entries. The role these play in explaining firm dynamics and productivity growth may be explored more in-depth, especially when additional data is included on whether young, small highly productive firms are acquired by older, larger and less productive firms. This we also leave for future research.

Finally, our results are highly relevant for the developments in business dynamics related to the Covid-19 pandemic, in which support measures have kept firms afloat, possibly leading to further reductions in firm dynamics (Freeman et al., 2021).[15] This might have implications for productivity growth, particularly in the services sector.[16] Additionally, measures such as lockdowns and social distancing have had very different effects across sectors, again likely significantly altering the firm dynamics with associated productivity growth effects. How these and other developments related to the Covid-19 pandemic (like increased working from home) affect firm productivity and the link between productivity and firm dynamics is a topic of recent research; see e.g. the overview in Muzi et al. (2022).

5 Conclusion

Our results show that the decline in firm dynamics contributed to the slowdown in productivity growth, but the contribution of entrants and exiters relative to incumbent firms differs per industry. Generalising, we find that service firms contribute positively to productivity growth when entering the market, and manufacturing firms after entering the market. In manufacturing, entrants tend to be less productive than incumbent firms but show catch-up behaviour, increasing their productivity much faster than incumbent firms,

[15] Verlhac et al. (2022) document for OECD-members that the Corona pandemic had a substantial heterogenous impact on start-ups and bankruptcies across countries and sectors.

[16] See also Van den Bosch and Vanormelingen (2022) for a broader discussion on this point.

which contributes to productivity growth. In services, entrants start with a higher productivity than incumbent firms and this advantage declines slowly with age. In either case, a declining number of entrants might suppress productivity growth, directly in services and through a reduced number of potential young growing firms in manufacturing.

These differences in how firm dynamics contribute to productivity growth may be explained by economies of scale, how industries are structured, and their production technologies. More research is needed to identify specific explanations for these differences, such as technology (ICT-intensity) or human capital investments. We leave these for future work.

However, some policy recommendations do emerge from our findings. Facilitating firm learning and investing in technical capabilities are important building blocks. Encouraging start-ups to adopt and make use of innovations will be an important building block. Investing in skills, especially ICT, will be important in this regard. Furthermore, our results are highly relevant for policies aimed at keeping firms afloat, like the recent Covid-19 related firms support measures. A downside of this type of policies is the disturbance of creative destruction, which remains an important source for productivity growth, particularly in services.

Declararions

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Appendix

The right panel shows the churn rate per firm size.[17] The rate has fallen for all firm sizes, with the churn rate for large firms falling much earlier. Given their large share in number of firms (81.5% in 2016), micro firms drive the total churn rate.

Figure A.1: The aggregate churn rates, 2006-2015

(a) All firms (b) Firm size types

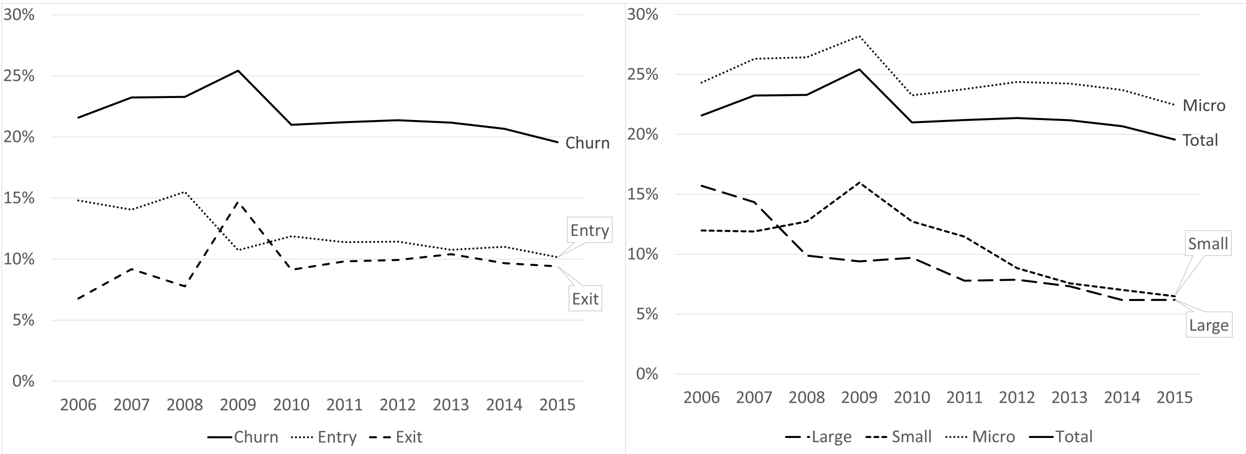


Figure A.2 distinguishes between manufacturing and services industries. It shows that in both manufacturing and services, dynamism has declined. The churn rate is higher in services than in manufacturing (20.7% versus 13.8% in 2015). From a peak in 2009, the churn rate has declined more for manufacturing (32%) than for services (22%).

[17] The total rate is a weighted average of the three components. To facilitate comparison with the total rate, we abstract from firms shifting to another size type. The size types are defined as: micro, with less than 10 FTEs, small, between 10 and 50 FTEs, and medium to large, with more than 50 FTEs.

Figure A.2: The entry, exit and churn rates of manufacturing and services industries, 2006-2015

(a) Manufacturing

(b) Services

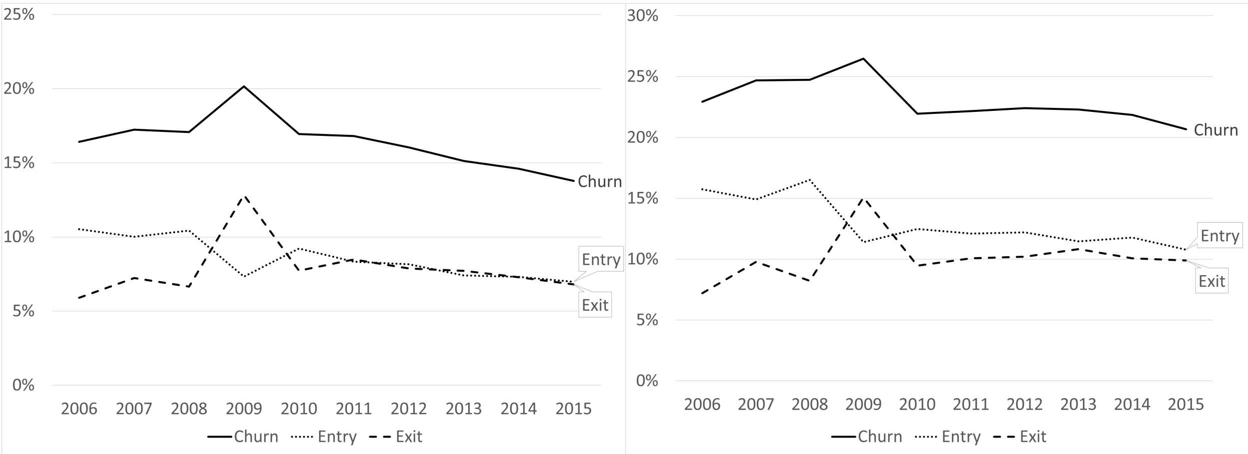


Table A.1: Average annual contributions to productivity growth (in %-points), 2006-2015, excluding crisis years

	Total	Manufacturing	Services
Within incumbents	0.930	2.634	-0.097
Between incumbents	0.626	0.598	0.546
Churn	2.072	0.994	2.351

Manufacturing is defined as ISIC sector C, services as ISIC sectors H through N. The productivity contributions of the underlying 2-digit sectors are aggregated using value added.

Table A.2: Average annual contributions to productivity growth (in %-points), 2006-2015, constant value added share entrants

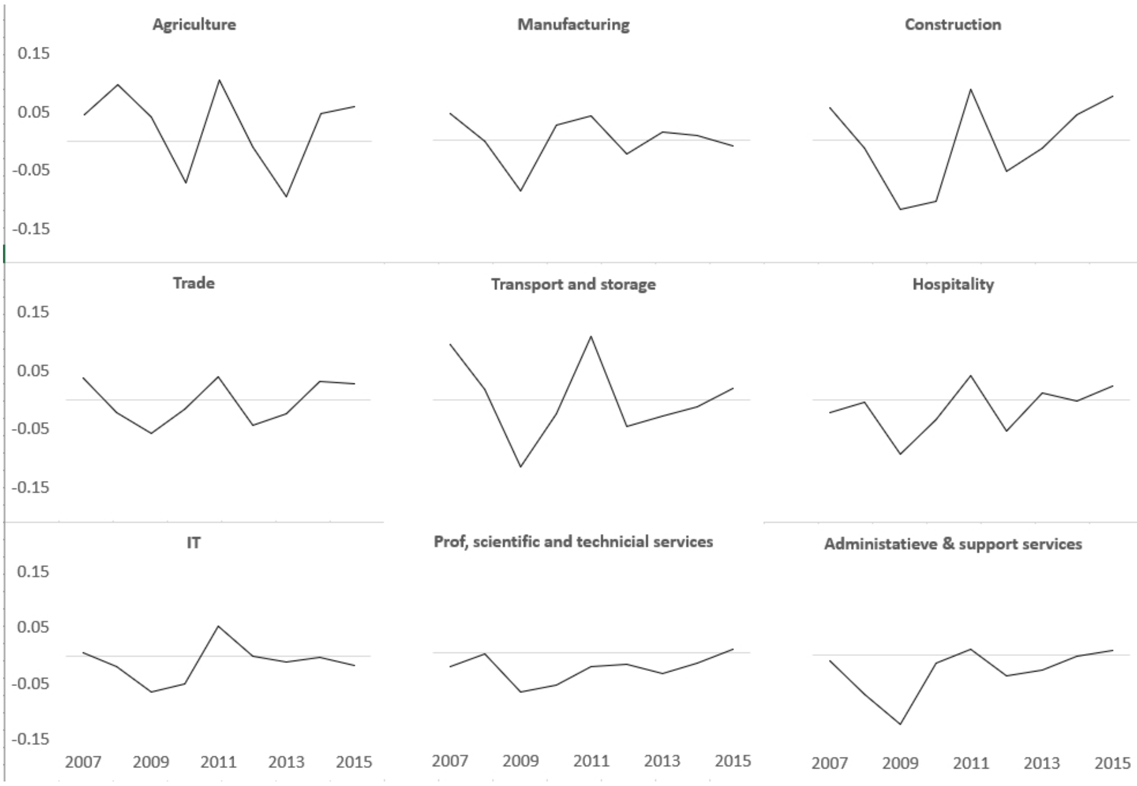
	Total	Manufacturing	Services
Within incumbents	-1.03	0.63	-1.30
Between incumbents	0.37	0.44	0.36
Churn	0.80	0.42	0.87

Manufacturing is defined as ISIC sector C, services as ISIC sectors H through N. The productivity contributions of the underlying 2-digit sectors are aggregated using value added.

Table A.3: List of 2-digit SBI industries

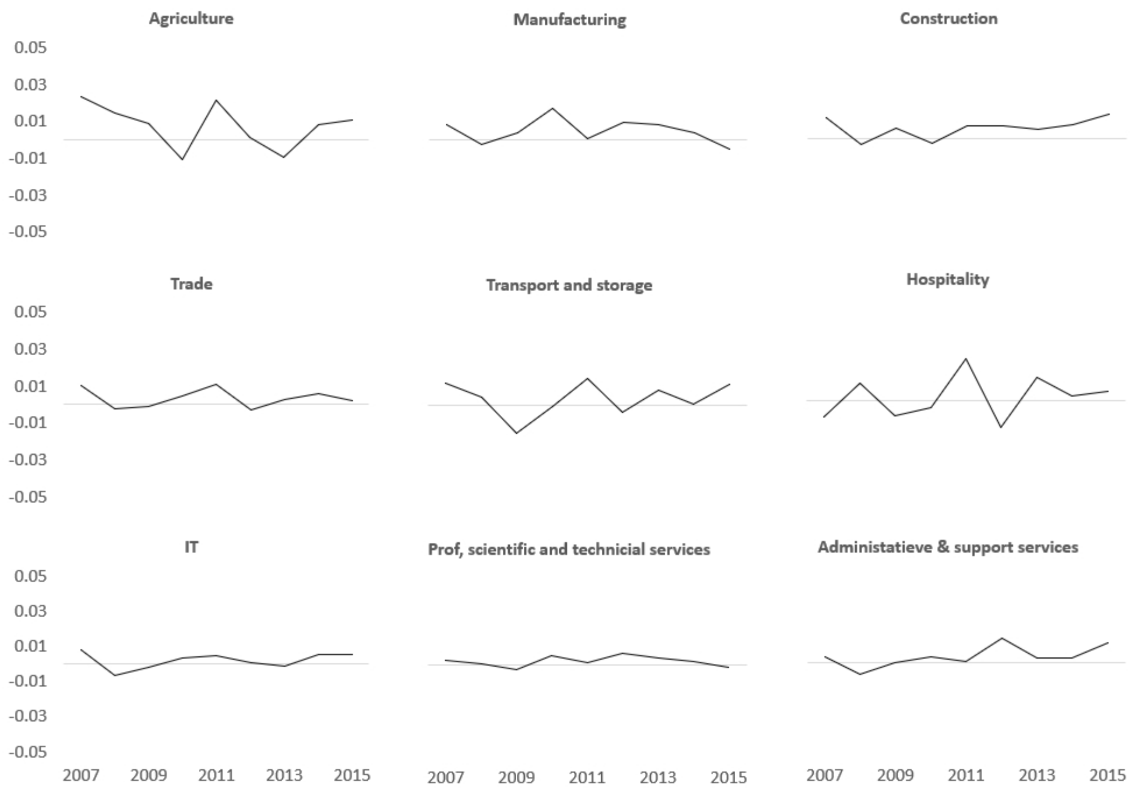
SBI / ISIC	Description
1	Crop and animal production, hunting and related service activities
10	Manufacture of food products
13	Manufacture of textiles
14	Manufacture of wearing apparel
15	Manufacture of leather and related products
16	Manufacture of wood and of products of wood and cork, except furniture; articles of straw and plaiting
17	Manufacture of paper and paper products
18	Printing and reproduction of recorded media
20	Manufacture of chemicals and chemical products
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
22	Manufacture of rubber and plastic products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25	Manufacture of fabricated metal products, except machinery and equipment
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment n.e.c.
29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment
31	Manufacture of furniture
32	Other manufacturing
33	Repair and installation of machinery and equipment
41	Construction of buildings
42	Civil engineering
43	Specialised construction activities
45	Wholesale and retail trade and repair of motor vehicles and motorcycles
46	Wholesale trade, except of motor vehicles and motorcycles
47	Retail trade, except of motor vehicles and motorcycles
49	Land transport and transport via pipelines
50	Water transport
51	Air transport
52	Warehousing and support activities for transportation
53	Postal and courier activities
55	Accommodation
56	Food and beverage service activities
58	Publishing activities
59	Motion picture, video and television programme production, sound recording and music publishing
61	Telecommunications
62	Computer programming, consultancy and related activities
63	Information service activities
69	Legal and accounting activities
70	Activities of head offices; management consultancy activities
71	Architectural and engineering activities; technical testing and analysis
72	Scientific research and development
73	Advertising and market research
74	Other professional, scientific and technical activities
75	Veterinary activities
77	Rental and leasing activities
78	Employment activities
79	Travel agency, tour operator and other reservation service and related activities
80	Security and investigation activities
81	Services to buildings and landscape activities
82	Office administrative, office support and other business support activities

Figure A.3: Changes in unweighted average firm productivity, 2006-2015 for nine broad industries



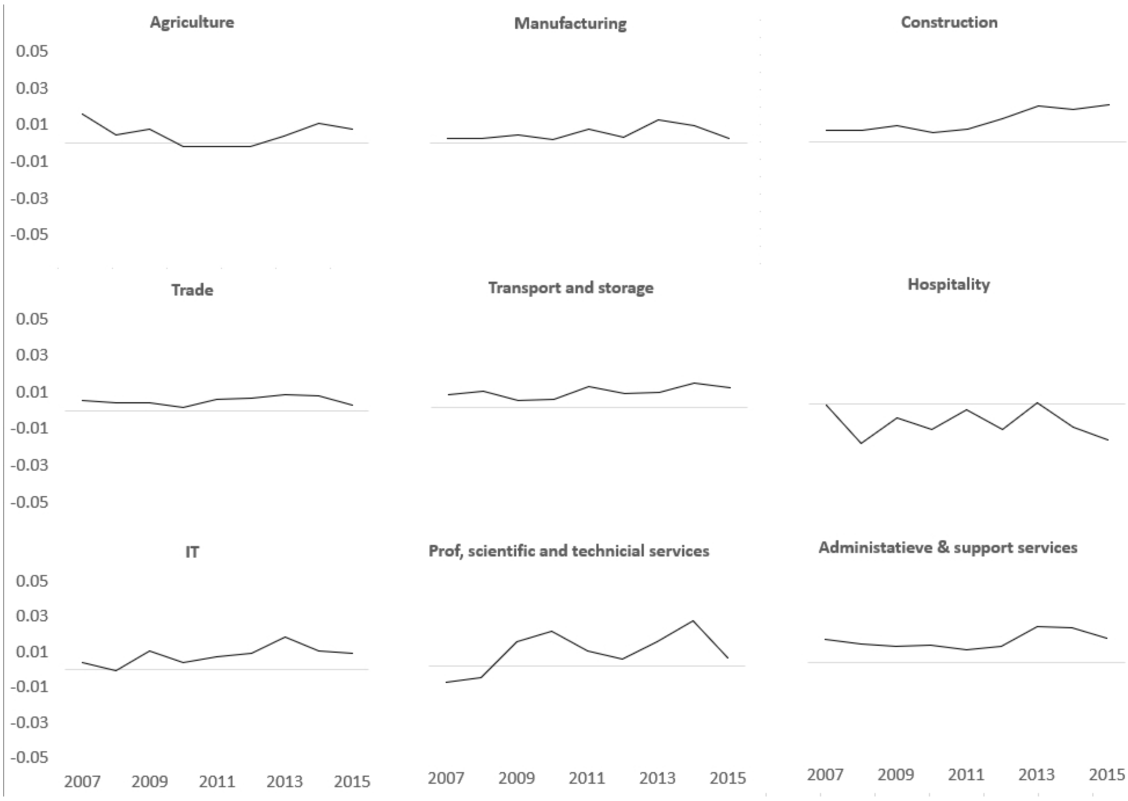
Results based on decomposition using equation (8)

Figure A.4: Changes in productivity growth contribution of reallocation, 2006-2015 for nine broad industries



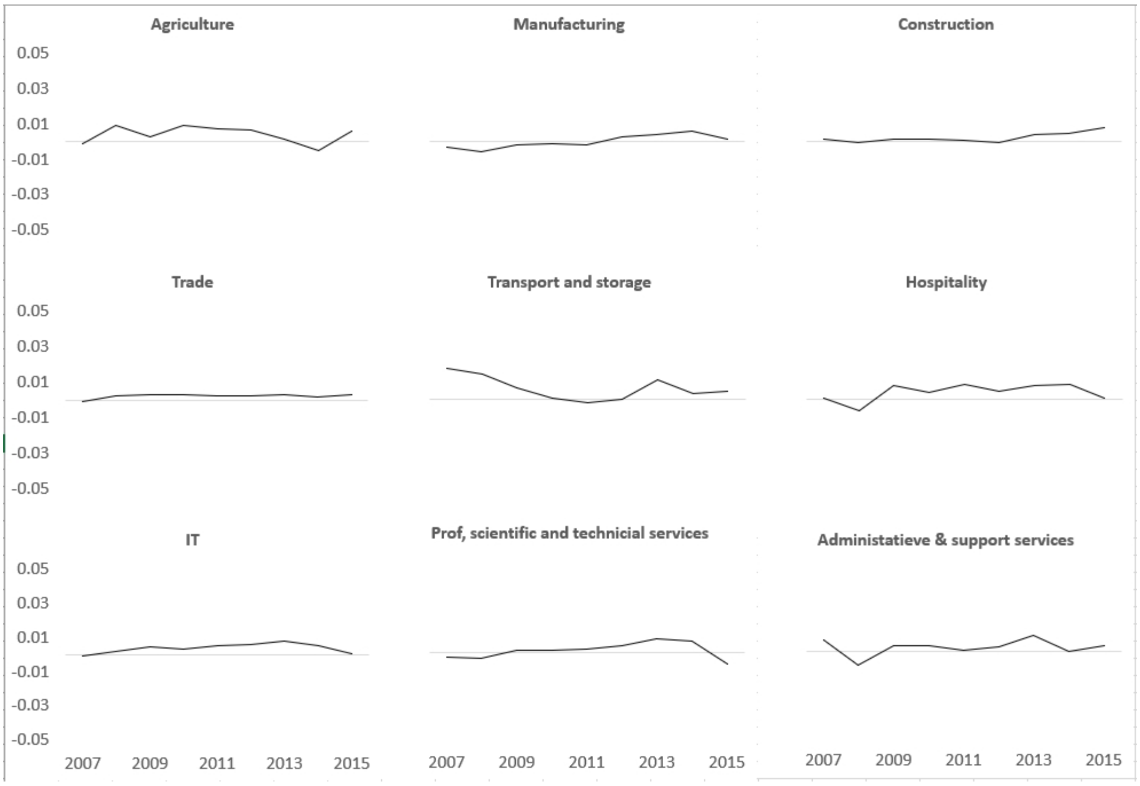
Results based on decomposition using equation (8)

Figure A.5: Changes in productivity growth contribution of pure churn, 2006-2015 for nine broad industries



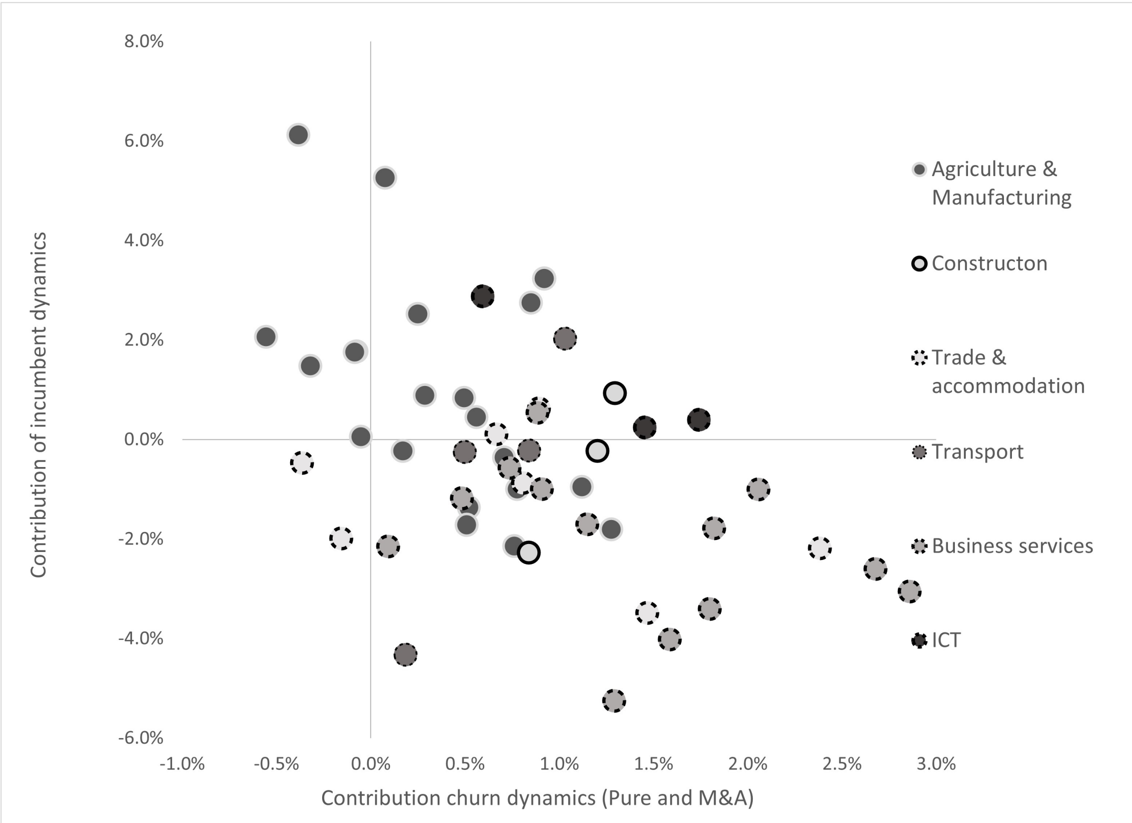
Results based on decomposition using equation (8)

Figure A.6: Changes in productivity growth contribution of M&A churn, 2006-2015 for nine broad industries



Results based on decomposition using equation (8)

Figure A.7: Average annual productivity growth contributions of incumbent firms and churn (in %-points), 2006-2015, per industry



Results based on decomposition using equation (8),

Table A.4: Average TFP of firms ages 1-6 compared to older incumbents

Age	All Firms Balanced Coefficient	SE	Unbalanced Coefficient	SE	Manufacturing Balanced Coefficient	SE	Unbalanced Coefficient	SE
1	0.0456***	(0.0039)	−0.0625***	(0.0027)	−0.0376***	(0.0126)	−0.127***	(0.0086)
2	0.0404***	(0.0035)	−0.0460***	(0.0026)	−0.0347***	(0.0107)	−0.112***	(0.0082)
3	0.0304***	(0.0032)	−0.0221***	(0.0026)	−0.0514***	(0.00973)	−0.0902***	(0.0082)
4	0.0292***	(0.0030)	0.0479*	(0.0027)	−0.0391***	(0.00896)	−0.0532***	(0.0082)
5	0.0272***	(0.0028)	0.0214***	(0.0028)	−0.0322***	(0.00831)	−0.0341***	(0.0081)
6	0.0351***	(0.0027)	0.0327***	(0.0028)	−0.00960	(0.00794)	−0.0108	(0.0081)
Observations	1,236,096		1,425,016		134,589		148, 248	
R-squared	0.3434		0.329		0.292		0.283	

Age	Services Balanced Coefficient	SE	Unbalanced Coefficient	SE
1	0.115***	(0.0064)	0.0339***	(0.0043)
2	0.109***	(0.0057)	0.0352***	(0.0042)
3	0.100***	(0.0053)	0.0512***	(0.0044)
4	0.0908***	(0.0050)	0.0671***	(0.0045)
5	0.0802***	(0.0048)	0.0752***	(0.0047)
6	0.0801***	(0.0047)	0.0787***	(0.0048)
Observations	415,008		498,859	
R-squared	0.366		0.346	

*** p<0.01, ** p<0.05, * p<0.1.

Exit probabilities

Here we show that the faster average productivity growth of young firms is strengthened by unproductive young firms dropping out in all sectors, which is in line with the up-or-out dynamic. To explore this, we use a logit regression for the following log-odds equation.

$$log\frac{P(exit_{iq}=1)}{1-P(exit_{iq}=1)} = \beta_0 + \sum_s \beta_s(AverageTFP_i * Industry_s) + startyear_t + \eta_s + \epsilon_i \quad (10)$$

where the likelihood of exit of type q for firm i occurring sometime between entry and the end of the sample is predicted by the average firm productivity, for each broad industry. We include both industry and time fixed effects. Table A.5 shows the results.

In every industry, less productive entrants are more likely to leave the market through pure exit in the years after entering, indicated by the negative marginal effects in column

Table A.5: Post-entry probability of exit and firm productivity for pure entrants (2006-2015)

	(1) Pure Exit	Exitshare (%)	(2) M&A Exit	Exitshare (%)
Agri & Manuf.	−0.355**	57	−0.0202	12
	(0.148)		(0.0773)	
Accom. & Trade	−0.562***	66	0.0247	11
	(0.0522)		(0.0317)	
Business Services	−0.0448**	68	0.0704***	14
	(0.0188)		(0.0266)	
Construction	−1.034***	66	0.041	12
	(0.135)		(0.119)	
ICT	−0.622***	66	0.178	12
	(0.105)		(0.118)	
Transport	−0.248*	64	0.216***	12
	(0.138)		(0.064)	
Constant	−0.314*		−2.636***	
	(0.176)		(0.285)	
# Observations	82428		82393	
# Exit	17197		4509	

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Exit through restructuring and other entry are rather rare at around 0.5%, those results are therefore excluded here.

1 in table A.5. There is some variation across industries; for example, the coefficient for the business service industry is small, which suggests an 'up-or-out' dynamic for entrants. We can therefore conclude that faster average productivity growth of young firms is both due to faster productivity growth and to unproductive young firms dropping out.

The relation between productivity and exit due to M&A is different. For most industries, the results are insignificant. For Business services and Transport, there is a positive and statistically significant relationship, which indicates that higher than average productivity entrants are more likely to be acquired, or to engage in mergers.

Incumbents might be acquiring high productivity entrants for different reasons: to prevent future competitors or to benefit from their productivity. This is in line with the superstar-firm idea that powerful incumbents defend their market positions by preventing competition, rather than competing (Shapiro, 2019). While we observe that these firms are exiting due to M&A activity, we do not know which new firms are created through

M&A.

The reason that Business Service and Transport industries show these dynamics might be related to the structure of innovation which goes beyond technical innovations (den Butter et al., 2008). In business services, ICT, and to some extent transportation, firms may enter the market with new trade innovations or unique intangible capital, which could be interesting for incumbent firms to acquire. In other industries, intangibles might be less important and innovation might be structured differently. For example, in some industries, incremental innovations may be more important (Crouzet and Eberly, 2019).