Industry productivity dynamics, ICT intensity and the distribution of firm-level performance: evidence for the Netherlands

Michael Polder, George van Leeuwen en Hugo de Bondt

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Abstract

We determine the degree of entry and exit for the period 2000 to 2010 based on Business Register data and complementary information on the reasons of population changes. Using the typification of firms by entry, exit and continuing firms, data on input and output, and calculating sampling weights, we perform a decomposition analysis of industry level labour productivity growth. We relate industry differences to the variation in the ICT intensity of industries. We find that reallocation and exit contribute positively to productivity growth in ICT intensive industries, whereas in other industries we find indications of misallocation. Moreover, we find that the crisis was particularly cleansing for ICT intensive industries, and that ICT intensity correlates positively with the allocative efficiency in an industry. Finally, we find that ICT intensity associates with several distributional characteristics of firm performance such as market concentration, dispersion, and turbulence.

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1 Statistics Netherlands. Corresponding author: Michael Polder, jpr@cbs.nl. This paper has been written based on research in the ICT and Economic Growth project commissioned and financed by the Dutch Ministry of Economic Affairs. All views expressed in this paper are our own and do not necessarily reflect the policy of the Ministry or Statistics Netherlands. We thank Bert Balk, Eric Bartelsman, Marcel Timmer, and Henry van der Wiel for comments. Errors are our own.
1. Introduction

To give a good representation of the dynamics that lies beneath macro-economic developments, it is necessary to look at changes in the population of firms and changes in the allocation of factors of production between firms. In a flexible and efficient economy, less productive firms are replaced by more productive ones, and factors of production are allocated from the less productive ones to the more productive ones. This notion is backed up by a large empirical literature about the important role in aggregate productivity of entry, exit, and changes in the relative size of firms (Bartelsman and Doms, 2000, Syverson, 2011).

Since ICT is believed to make firms more flexible in the face of economic shocks, and also more efficient in their production process, it is an interesting question whether the dynamic process of reallocation, entry and exit, is faster or better in relatively more ICT-intensive industries compared to less-intensive industries. Syverson (2011), for example, states that the productivity growth in retail trade is primarily due to the substitution of less productive individual stores, by larger, more efficient, and ICT intensive chains (with Walmart being the most prominent example). The impact of ICT can be motivated further by looking at the various roles that it may play in the business process (see e.g. Zand, 2010). Firstly, at a basic level, firms that have automated different tasks that used to be done by workers, are more flexible in responding to shocks, because of lower costs associated with hiring, firing, or hoarding workers. Brynjolfsson et al. (2009) show evidence of increased turbulence and concentration in ICT intensive industries, due to the fact that firms can scale up production relatively easy when a certain business model or concept proves successful. In addition, an important role of ICT is that it allows firms to gather and share information in a timely fashion, and thereby be aware of external and internal developments. For example, enterprise resource planning and supply chain management software allow firms to automatically update information about stocks at customers and suppliers, so that production and the purchase of intermediate goods can be adjusted accordingly. When information systems are linked or integrated between different business processes, possible actions of all processes can be aligned. Finally, ICT also enhances the innovative capacity of firms (Polder et al 2010; Spiezia, 2011) so that in ICT intensive industries firms may be faster to find new ways of producing, organizing processes or develop new products, in order to cope with changing circumstances.

Besides the roles played by ICT in the business process, the specific nature of the nature of the digital economy and information goods also bears on the dynamics and distribution of firm performance. Due to the typical combination of high fixed cost and low marginal cost, the distribution of performance measures becomes increasingly skewed (Shapiro and Varian, 1999; Brynjolfsson and MacAfee, 2013). Some markets which are subject to network effects and where externalities play a big role, may even tend to become “winner-take-all”. This tendency is further reinforced by the fact that digital goods are non-rival, allowing the market to converge to a single standard. This means that revenues or market shares are being divided over a few firms, while a significant amount of competitors are left behind. Thus, markets become more concentrated, while at the same time the spread in performance is increased.

Yet another channel through which ICT may affect the business dynamics is through competition. There is evidence that ICT increases competition due to increased market transparency, lower search cost, increased possibilities of experimentation et cetera (Brynjolfsson and Smith, 2000). Thus, ICT intensive industries may be more competitive than...
other industries. This means that bad performing firms will be driven out of the market sooner, and firms have the incentive to increase their productivity.

In this paper, we perform an empirical analysis of the business dynamics, productivity growth and distributional features of the labour productivity performance of Dutch industries. In addition, we investigate whether differences among industries are related to the ICT intensity of those industries. First we typify firms according to whether they are a continuing firm, an entrant or an exit. This allows us to relate the degree of entry and exit (i.e. turnover of firms) to ICT intensity. Next, we use the typification of the firms to perform a decomposition analysis that divides aggregate changes of productivity into components related to the dynamics, using a linked dataset of Business Register data and data from the Production Statistics. This poses, as we will see below, some challenges in terms of coverage and calculation of productivity. We explore whether there are differences in the contribution of each of the components that may relate to the degree of ICT intensity. Finally, we use the PS data to calculate various distributional characteristics that describe the spread and turbulence of firm performance, and the efficiency of the allocation of inputs. Again, we explore whether differences between industries could be related to ICT.

Our analysis offers a couple of things which we feel are new, improvements, or provide new insights. Firstly, our analysis offers an improved identification of entry and exit for the period 2000 until 2010 for the Netherlands. Moreover, as our decomposition analysis uses the Business Register for sample weighting we obtain results for the decomposition of productivity growth that are more representative than earlier studies. Thirdly, our findings offer new insights on the relation between business dynamics, productivity and ICT, complementing existing insights in the literature on the role of ICT as a driver of economic growth.

The plan of the paper is as follows. We start with a description of the data, including a strategy to align NACE1 and NACE2 aggregates from the EUKLEMS database to obtain consistent time series. Next we describe the typification of firms in continuing firms, entry and exit based on the Business Register, and we discuss productivity calculations at the firm-level, as well as our sample weighting method and outlier correction. We describe the bottom-up productivity calculation in section 4, and section 5 gives the results for the various analysis. Section 6 concludes by summarizing and pointing out where additional work could head.
2. Data

2.1 Business Register and Production Statistics

We use the Business Register (BR) at Statistics Netherlands to determine the population of firms. In accordance to the sampling frame of the Production Statistics we only use firms that are alive in December in a particular year. That is, we analyze yearly changes, from December to December. A firm is defined as a unit of economic activity. The BR contains information on a firm’s industry, size class, and the headcount of workers employed.

Additional information is available in so-called ‘event files’. These files document each change that is registered to a unit, such as a birth, death, merger or acquisition, et cetera. This information is used to determine whether the fact that we observe a firm for the first (last) time in a certain year, is due to the actual birth (exit) of a firm, or that something else is the case. This procedure is described below in section 3. The Business Register was redesigned in 2006, and many units were reassigned. This makes it difficult to analyse the entry and exit in the transition from 2005 to 2006. However, the event information avoids that we wrongly label firms as entry or exit.

The Production Statistics (or Structural Business Statistics) are the source for our productivity analysis. This is an annual survey for a large selection of industries containing information on the outputs and production structure of firms. All firms with more than 20 employees are surveyed, whereas smaller firms are sampled. We use only firms with more than 20 employees in our analysis, because the coverage is too thin to analyse yearly changes for smaller firms. This is a restrictive feature of the productivity analysis, because new firms are likely to start small, and therefore the contribution of these firms to aggregate growth is likely to be underestimated. Moreover, even for larger firms there may be non-response or other reasons for absence of particular firm in the data. To account for this we use sampling weights, as described in section 3.4.

2.2 Deriving consistent NACE1 based time-series from EUKLEMS

While all firms in our microdata are classified according to NACE1.2, we encounter a practical problem for the industry level variables due to the change from NACE1 to NACE2 in 2008. In particular, we need the user cost of ICT capital (and value added) to construct an ICT intensity measure, and deflators for value added and factor inputs to convert nominal into real variables in the productivity calculations. Time series for National Accounts variables are not available in the NACE1 classification for more recent years, and the breakdown by type of user costs are only available in NACE2 from the Dutch Growth Accounts. An alternative is to use the World Input Output Database (WIOD) but also in this case the most recent year is 2009. Moreover, the WIOD does not have a breakdown of capital user cost by type either, which precludes the possibility of deriving an ICT intensity measure from this source.

To get around this problem we decided to use both the old and new version of the EUKLEMS database (www.euklems.net). This database has information on ICT user cost and allow the derivation of deflators for the relevant variables. The first release has information up to 2007, for aggregates based on NACE1. To be able to use a somewhat longer time-series, including...
years from both the period before the crisis and the subsequent recovery period, we also make use of the ‘rolling updates’, which are based on the NACE2 level. To make the classification consistent, we translate the new aggregates to the old ones for 2008 to 2010. To do so, we make use of the fact that in our Business Register firms are coded twice in these years, once according to NACE1 and once according NACE2. Thus, using a key between the old and new EUKLEMS aggregates and respectively NACE1 and NACE2, we can give each firm an old and a new EUKLEMS industry code. Moreover, we know the number of workers employed for these firms.²

The reclassification procedure can then be illustrated by visualizing it in terms of a matrix. Say we put all NACE1 categories in the rows, and all NACE2 categories in the columns. For each cell of the matrix we know the population count and employment from the BR. For a specific variable, the easiest way to determine NACE1 totals from information on NACE2 totals is to construct (column) weights from the employment figures (or from the number of firms), and distribute the NACE2 totals over the according columns using these weights. The implied row totals are estimates of the NACE1 total for the variable being considered. We do this for value added, capital user cost, and labour cost, both in current prices and constant (year t-1) prices. This allows us to calculate the deflators for these variables.

For ICT user cost we follow a somewhat more complicated scheme. The problem with the strategy above is that the change of classification sometimes entailed that one (lower level) industry moves from one aggregate to another. If the sub-industries in aggregates that are being redistributed are heterogeneous in the variable we want to make a time-series of, the strategy above may not be optimal. Suppose two industries are together in the new classification. They are approximately equal in size, but one is low ICT intensive, the other very high, resulting in an on average high ICT intensity. The average is all we can observe. Further, suppose the low ICT intensive industry was in another aggregate in the old situations, in which it was relatively large in terms of employment. In the distribution scheme described above this industry then gets a high weight (based on its size) and a high ICT intensity (because it comes from an ICT intensive aggregate), resulting in an improperly high ICT intensity for the (old) aggregate in the more recent years. We find that examples like these or similar cases exist, leading to occasional jumps in the industry time series.

The alternative we have used is to first make use of the 2007 information on ICT user cost. Moreover, we go down one lower level to two-digit NACE1 and NACE2 to account for the heterogeneity at this level, separating the EUKLEMS aggregates based on persons employed. Again, we construct a matrix with employment weights, and distribute the 2007 ICT user cost from NACE1 two-digit aggregates to NACE2 two-digit aggregates. We then have a matrix with 2007 ICT user cost by NACE1 and NACE2 two-digit combination. Based on this matrix we can determine new weights to distribute the actual 2008 (and further) NACE2 totals over the NACE1 aggregates, which can be aggregated to the level of the EUKLEMS. Summarizing, instead of using employment in 2008 to make the weights, we first estimate NACE2 level ICT user costs, and use these to determine the weights used to distribute NACE2 based ICT user cost to NACE1. While using employment to distribute NACE1 and NACE2 ICT user cost over two digit industries is still not perfect, and the two-digit level may still contain heterogeneity in ICT intensity, the resulting time-series look plausible and consistent, see figure 1.

² We thank Eric Bartelsman for these insights.
Figure 1. ICT intensity (ICT user cost over value added) for NACE1 based EUKLEMS industry classification.
3. Preparatory work

3.1 Typification of firm dynamics

In this section we describe the typification of firms (units of production) into three categories: Continuing firms (C), New firms (N), eXiting firms (X). A relatively new aspect of our analysis is that we distinguish between “real” births and deaths of firms, and entry and exit that are due to other events like mergers, acquisitions, take-overs, or events that are more of a statistical nature. It is not uncommon in the literature that entry and exit is measured by comparing the population in two consecutive time-periods. This, however, does not take into account the variety of reasons why production units are introduced or removed from the statistical population. Ultimately our improved typification will give a better insight into the dynamics of industries and its consequences for aggregate productivity changes.

The population of firms is sourced from the Business Register (BR, Dutch: Algemeen Bedrijvenregister). Information on changes in the population (“events”) are used to derive the typification. This information is available in a supplementary file, which can be linked to the ABR. The following information is available:

- Event action (entering, removal, continuation, correction of a unit)
- Event type (birth, death, mergers et cetera)
- Date of processing

The coding of actions and types are given in the appendix. The event files contain all events for a firm in a particular year. When there are multiple events for one firm, we will consider only the first and the last event, as we are ultimately interested in annual changes only (thus, we use only the information on the youngest and oldest event, using the date of processing). Based on the presence of a firm in year \( t \), combined with its absence or presence in year \( t-1 \), and the event information, firms can be typified. It should be kept in mind that we use December snapshots of the BR, so that (not) present in year \( t \) means (not) present in December of that year.

A continuing firm in year \( t \) is a firm that is present in the BR in year \( t-1 \) and in year \( t \). We distinguish two types of continuing firms based on the event information. Those without any events are “true” continuers. If a continuing firm has any events during a year, it is coded as “continuer with events”; potentially, there may occur drastic events that hamper the comparability over time for these latter units.

A new firm in year \( t \) is a firm that does not occur in year \( t-1 \) and is introduced in year \( t \). We distinguish two types of new firms:

1. a birth (event-type 4 or 14, see appendix)
2. other (other event types)

An exiting firm in year \( t \) is a firm that occurs in year \( t-1 \) but not in year \( t \). Again, we distinguish two types:

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3 Pre-2006 BR files contain only information on the last event in a certain year. This information is not available in a separate file, but in the main BR files.
1. exit due to death (event type 5 or 15)  
2. other (other event types)

3.2 Linking Business Register to Production Statistics

The next step is to link the Business Register (BR), now including the status (C, N or X) for all firms, to the Production Statistics (PS), from which it is possible to derive the productivity numbers. The match between the two sources is not perfect, for a couple of reasons:
- PS are a sample, especially for the smaller firms (size class 40 and lower; 20 employees and less)
- Even for size classes that are surveyed completely, there is the issue of non-response due to non-compliance or mistakes in the sampling frame
- The attrition due to the above two points is amplified, because we are considering changes in productivity (at least for continuing firms), so that information at the firm-level needs to be available in both the current year and in the previous year
- PS do not cover all economic activities, so that some industries cannot be part of the analyses.

Although the PS is a stratified sample for firms with 20 employees or less, it is difficult to include these small firms in our analysis. The reason is that due to the need for current and previous year information, the probability of inclusion in the sample decreases significantly. Moreover, breaking the figures down by firm status (continuing, entry or exit), the coverage becomes rather thin, when also considering a breakdown by industry. Finally, the stratification itself does not take into account the entry/exit behavior, so that we cannot use the standard PS sample weights. In all, we do not think it wise to consider the small firms in our analysis. This is a restriction of our exercise, because it is not unlikely that especially young firms (which often start small) contribute to the dynamics of an industry. By consequence, it should be noted that the contribution of new firms is likely to be underestimated.

Finally, another thing to note is the occurrence of some rare inconsistencies between the PS and the BR. For example, a firm that is new in year t cannot have been included in the PS for year t-1. Likewise, a firm that exited in year t-1 is not expected to respond to the PS for year t (especially as the survey is retrospective and carried out in year t+1). Still, these cases exist in the data. This may be caused by the continuous updating of the Business Register with new information on the firm population, so that the Business Register we are using for this analysis may not fully correspond to the one that was used for the sampling of the PS. As those cases are rare, they will not influence our end results, and we will exclude them from the analysis.

3.3 Firm-level productivity calculations

3.3.1 Labour productivity growth

We calculate labour productivity growth (DLP) based on real value added\(^4\)

\(^4\) Using real value added puts us in the context of ‘revenue-based’ productivity. Lacking firm-level price information or information on quantities, we will use industry-level deflators to transform nominal into real figures. While very common in the literature, it is good to realize that is an approximation. Syverson (2011) notes that due to a negative correlation between prices and quantity-based productivity, the latter tends to exhibit more dispersion than revenue productivity; this is corroborated in the work of e.g. Foster et al (2008).
DLP = LP^1 – LP^0

where 0 is the base period, and 1 is the “comparison” period, and

\[ \text{LP}^1 = \frac{VA^1}{L^1} \]
\[ \text{LP}^0 = \frac{VA^0}{L^0} \]

where VA is value added, L is the number of workers, and the superscripts indicate the respective periods. Period 0 value added is in nominal terms, whereas period 1 value added is in prices of year 0. The value added deflator is sourced from the EUKLEMS database as described in the data section. We analyse the absolute change, rather than the relative one, because it makes the interpretation of the decomposition results easier. However, it is possible to analyze the relative change and proceed in logarithms along the exact same lines.

### 3.3.2 Extension to multifactor productivity growth

Our setup allows a straightforward extension to (multifactor)productivity (mfp) growth. Although we do not present the results for mfp in this paper, we outline the calculation here for later reference. In this case we define the change of productivity as

\[ \text{DMFP} = \text{MFP}^1 – \text{MFP}^0 \]

where 0 is the base period, and 1 is the “comparison” period, and

\[ \text{MFP}^1 = \frac{VA^1}{X^1} \]
\[ \text{MFP}^0 = \frac{VA^0}{X^0} \]

where VA is (real) value added, and X is the (real) cost of inputs, and the superscripts indicate the respective periods.

In the base year total production cost equals the sum the cost of capital and labour:

\[ X^0 = p^0_K K^0 + p^0_L L^0 \]

The user cost of capital, which is the preferred measured of K for productivity calculations, is not available in the microdata. It can be approximated with the cost of depreciation.\(^5\) Labour cost is measured by total payroll.

To derive \(X^1\) one can make use of the quantity indices of capital and labour, given by

\[ Q_k = \frac{p^0_k K^1}{p^0_k K^0} \]
\[ Q_l = \frac{p^0_l L^1}{p^0_l L^0} \]

and using Laspeyres weights leads to an overall input quantity index \(Q_X\) as

\[ Q_X = w_k Q_k + w_l Q_l \]
\[ = w_k (p^0_k K^1 / p^0_k K^0) + w_l (p^0_l L^1 / p^0_l L^0) \]

\(^5\) At the industry-level, it can be verified that depreciation cost is the largest component of the user cost of capital.
where \( w_K = \frac{p_0 K^0}{p_0 K^0 + p_0 L^0} \) and \( w_L = \frac{p_0 L^0}{p_0 K^0 + p_0 L^0} \). Thus, the weights are the cost shares in the base year in prices of the base year. Note that \( w_L = 1 - w_K \). As the numerator of the respective weights cancel against the denominator of the quantity indices, it follows that

\[
Q_x = \frac{p_0 K^1 + p_0 L^1}{p_0 K^0 + p_0 L^0}.
\]

Thus, total real production costs are

\[
X^1 = p_0 Q_x = (p_0 K^1 + p_0 L^1).
\]

In other words, using the Laspeyres weighted quantity index, total real production costs equal the sum of the real capital and labour costs.

### 3.4 Sample weighting

As discussed above, the sample used for analysis is not equal to the population. By way of example, after all calculations and selections have been made, the coverage of our sample in 2007 is as tabulated below.

<table>
<thead>
<tr>
<th>status</th>
<th>sample</th>
<th>population</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>#</td>
<td>12,028</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>85.96</td>
</tr>
<tr>
<td>N</td>
<td>#</td>
<td>1,176</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>8.4</td>
</tr>
<tr>
<td>X</td>
<td>#</td>
<td>789</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>5.64</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>13,993</td>
</tr>
</tbody>
</table>

The percentage below the counts give the shares of C, X, and N in the different samples. The relative coverage of continuing firms is similar to that in the population. The share of exits is underestimated, while the share of entry is overestimated. Therefore we make use of a weighting procedure, to balance the sample totals to the population.

We have opted for a sample-weighting of the results. The observations are categorized by industry, year, size class and status (C, N or X). For each cell we observe the actual population, as represented by the number of firms in the Business Register. Also we know how many firms we observe in the sample used for analysis. To weight our results according to the distribution of firms in the population, we can therefore calculate for each cell the share of firms that is observed with respect to population, which can be interpreted as an “ex-post sampling probability”. The sample weight is then the inverse of this ratio.\(^6\)

\(^6\) An alternative would be to use employment weights, which involves weighting to the total employment rather than the number of firms in each cell. We found that the type of weighting does not affect the results very much, so we abandoned this option, and continued with the frequency weights only.
An issue with the weighting is that some cells that have observations in the population, may have zero observations in the sample when the level of detail becomes more fine-grained. This means that the sample weight cannot be calculated, and that effectively these cells remain empty. Therefore we have chosen to use an industry classification based on 8 industries (the EUKLEMS industry ALT classification). Moreover, we consider four size classes, 20-50, 50-100, 100-200, and more than 200 employees. Together with the breakdown by status (C, N or X), we do not have any empty cells at these levels of aggregations. Alternative weighting schemes, including those at a more detailed level, can be investigated where feasible. Also there are weighting methods that account implicitly for empty cells (e.g. Renssen and Nieuwenbroek, 1997) that could be further investigated.

3.5 Outlier correction

To take care of outliers we use a generic outlier correction, which sets the productivity level of firms in the lower and upper percentile of the productivity distribution to the median value. Thus, we cut off the tails, while instead of throwing the ends away we rather put them to the value of the middle observation. To avoid artificial changes from year to year, we also put the value in the previous year to the median of the current year, thereby implicitly imposing a zero productivity change for these firms, minimizing their influence on the results.

The advantage of using a generic method of treating outliers is that it is fast and not subjective. Of course, this goes at the cost of perhaps overcorrecting, whereby the variance in the productivity distribution is underestimated (we believe that there is no risk of correcting too little with these data, when using the lower and upper percentile as a criterium). However, the share of observations being corrected is quite small, and the influence of overcorrecting will be relatively small compared to the impact of keeping the outliers in the analysis.

Putting the observations to the median values, rather than throwing observations away, has the advantage that the sample weights do not have to be recalculated. If we would exclude the outliers, the number of observations would change, making it necessary to adjust the weights. Thus, the outlier correction can be turned off and on without consequences for the weighting.
4. **Bottom-up calculation of productivity growth**

For calculating the productivity growth by industry we make use of the bottom-up approach, where aggregate productivity growth is a weighted sum of the productivity growth of the underlying units. This approach is discussed at length in Balk (2014). The main issues are how to deal with entry and exit (for which productivity change cannot be calculated), and the choice of weights.

We make use of a familiar decomposition formula that is due to Griliches and Regev (1995). In their approach aggregate productivity growth is composed of four components. In the formulas below we consider changes from period 0 to period 1, as indicated by the subscripts. The variable $P_i$ refers to the productivity level of firm $i$ (either labour productivity, or mfp, or yet another concept); where the subscript $i$ is omitted we refer to the productivity level of the aggregate (hence $P$ is the productivity of firm $i$’s industry). Finally, $\theta_i$ is the share of firm $i$ in the total input in a period, e.g. total employment in the case of labour productivity. The main reason is that this is also the denominator of the productivity term. Therefore it is ensured that when we would calculate productivity growth based on aggregate inputs and outputs, we would end up with the same productivity growth as with the bottom approach. That is, it does not matter if we first add up and then calculate aggregate productivity, or first calculate productivity and then take the weighted sum.

The following components are distinguished:

1. productivity change of continuing firms, weighted by average weights (intra-firm or within effect)
   \[
   \text{within} = \sum_i ((\theta_{ti} + \theta_{0i})/2)(P_{ti} - P_{0i})
   \]

2. average productivity in two periods in deviation from average total productivity, weighted by change in weights (between-firm effect)
   \[
   \text{between} = \sum_i (\theta_{ti} - \theta_{0i}) \left( \frac{P_{ti} + P_{0i}}{2} - \frac{P_{t} + P_{0}}{2} \right)
   \]

3. weighted productivity of new firms in $t = 1$ in deviation from average total productivity in two periods
   \[
   \text{entry} = \sum_i \theta_{ti} (P_{ti} - (P_{t} + P_{0})/2)
   \]

4. weighted productivity of exiting firms in $t = 0$ in deviation from average total productivity in two periods
   \[
   \text{exit} = \sum_i \theta_{0i} (P_{0i} - (P_{t} + P_{0})/2)
   \]
This approach avoids the choice between weights from year $t$ or $t-1$ by taking the (arithmetic) average of the two.\(^7\)

\(^7\) An alternative decomposition that can be employed and compared to the Griliches-Regev approach is the one by Diewert and Fox (2010). The main novelty of the latter is that, instead of comparing the productivity level of entrant and exiters with the average overall productivity in the base and comparison year, it compares the productivity of entrants with the average productivity of the continuers in the year of entry, and similarly the productivity of exiters is compared to the average productivity of the continuers in the year of the exit. In the Griliches-Regev formula as described above one implicitly sets an arbitrary scalar $a$ equal to mean productivity (see Balk, 2014, p. 34). A nice feature of the Diewert-Fox approach is that the relative contribution of the continuers (specifically, the intra-firm effect) with respect to that of entry and exit is not affected by this issue. We leave this for further research.
5. Results

5.1 Demography by industry

Figure 2 shows results regarding the demography of firms in the way we measure it. The figure shows the average percentage of entry, exit and continuing firms for the period 2000-2010, based on the observations that we typified as true entry, exit and continuing firms (see section 3.1).

The percentage of entry and exit is sometimes referred to as the degree of firm turnover (i.e. number entrant plus exiters as a percentage of the total of firms). There is a substantial heterogeneity in this measure of firm dynamics over the various industries, ranging from just over 8% in Real Estate (L) to over 30% in Telecom (64). Another thing to note is that the balance between entry and exit is on average positive, indicating an increasing population of firms, although there is some heterogeneity between industries here as well.

To investigate whether there is a relation between the ICT intensity of an industry and the degree of entry and exit, we regress firm turnover on our ICT intensity measure (ICT user cost over value added). The results are reported in table 2. It turns out that there is a strong correlation between ICT intensity and firm turnover, but once we control for time and industry effects this correlation disappears. Thus, it seems that the degree of entry and exit is not necessarily related to its ICT intensity in the way we measure it, but rather industry specific or related to other industry specific variables.

These figures do not necessarily match official statistics on business demography due to methodological differences. Moreover, the official statistics start in 2007, whereas here we cover the period 2000-2010.
Table 2. Regression of firm turnover (percentage of entry and exit in total) on ICT intensity.

<table>
<thead>
<tr>
<th>ICT intensity</th>
<th>Coefficient</th>
<th>robust se</th>
<th>time/industry dummies</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT intensity</td>
<td>0.699 ***</td>
<td>0.079</td>
<td>no</td>
</tr>
<tr>
<td>ICT intensity</td>
<td>-0.399</td>
<td>0.585</td>
<td>yes</td>
</tr>
</tbody>
</table>

5.2 Decomposition of productivity growth

Figure 3 shows the results of the bottom-up calculation of annual labour productivity growth, according to the Griliches-Regev method in 8 main sectors (according to EUKLEMS alternative hierarchy, see the appendix for underlying industry codes). These figures are somewhat more volatile than the usual official productivity figures at this level of aggregation. Also there appear to be differences in the patterns by industry between these micro-aggregated and the macro-figures. For instance, our micro-data show a dip for Finance and Business in 2009. This dip is much less apparent in the macro-data. However, one should be cautious with direct comparisons here. Our figures do not include smaller firms, for instance. Also, this figure excludes observations where the classification of firms as continuing, entry, or exit is dubious. However, judging from figure 4, including all observations does not change the pattern too much. Finally, a major difference with the National Account figures is of course that those result from confronting the production data with a plurality of other data sources.

Figure 3. Annual labour productivity growth according to the bottom-up approach
(only true classifications)

---

9 See for instance the labour productivity growth figures on StatLine:
http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=81429NED&D1=32&D2=1-4%2c18-21%2c25%2c29-31%2c36%2c41&D3=a&D4=5.15&VW=T.
Figure 4. Annual labour productivity growth according to the bottom-up approach (all observations)

Figure 5. Labour productivity growth decomposition (averages over 2000-2010)
Figure 5 gives the decomposition of labour productivity change, based on the weighted figures (i.e. the sample results have been weighted to resemble population totals). The figure represents averages of the different components by year, over the period from 2001-2010.

The results using only true classifications (panel (a)) show that there are two industries with an average negative growth. Also it is clear that intra-firm productivity change is the most important component. This is consistent with earlier findings (see e.g. Balk and Hoogenboom-Spijker, 2003) based on years before the crisis. However, the between component is non-negligible in most industries, notably in the manufacturing of Finance and Business, where it counterweighs a negative contribution of the intra-firm changes. In Distribution, the opposite is the case: the within component is positive, but the between component is negative. The contribution of exit is also visible in most industries, and mostly as a positive component. This means that exiting firms have below average productivity, which is desirable with respect to the efficient allocation of factors production. From these results, the contribution of entry is quite low, and often negative. It must be emphasized though that our focus on larger size classes is likely to underestimate the contribution of entry.

Panel (b) gives the results using all observations, regardless of whether the typification is true or fake. It shows that both the average growth, as well as the size (and even sometimes the direction) of the contribution of the different component can diverge from that based on using the true classifications only. Thus, it is important to interpret the results carefully when one does not have the opportunity to distinguish true dynamics from those resulting from other reasons.

Finally, we show the pre-crisis average and those for the 2008-2010 period separately in figure 6. Naturally, one can expect labour productivity growth to be higher in the former, but it is striking that in fact only 3 industries show on average negative change in the latter period. Overall, the exit component becomes more important as one may expect. The fact that it is positive is evidence of a cleansing effect, in which bad performing firms are weeded out by the crisis, increasing overall performance. The direction and size of the contributions of the different components varies between the two periods, although the within component remains dominant in most cases. Strikingly however, in Distribution, we find that the between component has a dominant, and negative, effect. Thus, the crisis seems to have shifted the allocation of labour to continuing firms that are performing below average in this industry. Also in the Manufacturing of Investment Goods we find that both the between and exit component are more important than the within component in the crisis. In this industry both these components have a positive contribution.
Figure 6. Pre-crisis (left) and 2008-2010 (right) decompositions by industry

(a) True classifications

(b) All observations
5.3 ICT intensity and dynamics of productivity growth

Using a different classification of industries, it is possible to highlight the role of ICT in the dynamics of productivity growth. We follow Stiroh (2002) in defining three types of industries: those with high ICT intensity, those with low ICT intensity, and a separate category for industries producing ICT goods and/or services. The latter are labelled according to their economic activity (NACE1.2 code 30 to 33, and 64), while for the former two we make use of the ICT user cost over value added as before, and split the sample in low and high according to whether the mean of this ICT intensity variable is above or below the overall median. We then run the decomposition procedure again, resulting in figure 7, which gives the results for again all observations or only true classifications.

Firstly, we find that the low ICT intensive industries show on average a decrease in labour productivity growth over the period considered, where high ICT intensive industries show positive growth, as do the ICT producing industries. (Note that by construction the results for the ICT producing industries are identical to those for Elecom in figure 6.) The negative growth in low ICT intensive industries is mainly caused by a high negative contribution of the between component: this means that resources flow to below average productive firms. If ICT use is related to higher competitive pressure, a tentative interpretation of this result could be that a lack of competition is associated with misallocation in low ICT intensive industries. Although we are likely to underestimate the contribution of entry, the very weak contribution of new firms to overall growth could be a sign that a low degree of competition is reinforced by high entry barriers.

In the ICT intensive group we find that the within component is dominant, but both the between component and exit contribute positively and significantly to the overall growth. Thus, allocation and market selection seem to be more efficient in the ICT intensive group. Entry has a small negative contribution: entrants in ICT intensive industries enter on average at a lower level of productivity. In the ICT producing industries, the within component is much more dominant. Entry has a small positive contribution and the between and exit components are slightly negative. Again, a small contribution of entry could be a sign of entry barriers.

Looking at the results using all observations, we see that the within component again loses much of its dominance, amplifying the role of the other components, which are in the same direction as for the sample restricted to the truly typified firms. Especially the negative effect of entry (now including e.g. splits or mergers and acquisitions) in the low and high intensive industries is now more substantial. In the high intensive industries, the positive contribution of exit (also due to e.g. mergers and acquisitions) is now also larger. Thus, a hypothesis could be that in a rearrangement of business units, the disappearing ones seem to have below average productivity (leading to a positive exit contribution) while the business units in their new constellation still perform below average (negative contribution of new firms). Finally, we note that the moderately negative between component in the ICT producing industry could be a sign that the degree of competition is too mild in these industries as well, although the within component is still dominant and positive, meaning that incumbent perform quite well.
5.4 ICT intensity and the distribution of firm performance

5.4.1 Distributional characteristics
As set out in the introduction, ICT affects the development of firm performance, as well as its distributional characteristics. A large part of an industry’s profits may become more concentrated among a small number of firms, while at the same time the difference between the well and not so well performing firms becomes larger and the performance of a single firm may become more volatile. Moreover, from an aggregate point of view it is interesting to see whether factor inputs are allocated to the best performing firms. To see if we find evidence corroborating these phenomena, we look at whether we can find correlations between several distribution parameters and the intensity of ICT usage.
Concentration of the market
In the literature the role of ICT has been described as increasing competition (Brynjolfsson and Smith 2000; Van Leeuwen 2014). This increased competition should lead to lower prices on the one hand, but can also lead to winner-take-all markets, where the most productive firm takes the largest cut of the pie. Less productive firms see their market-share drop and the market becomes more concentrated. This phenomenon can be measured through a Herfindahl index. The Herfindahl-index is defined as:

\[ \text{HERF}_{jt} = \sum_{i \in j} msh_{it}^2 \]

Where msh represents the market share of gross output, persons employed or value added of industry j. A market with one single firm has a Herfindahl index of 1, while a Herfindahl index close to 0 means that there is a large number of firms with a low market share. The Herfindahl index is sometimes used as a competition measure: a decreasing Herfindahl index means that the concentration in a market is reduced and, since it is inversely related to competition, this is interpreted as a rise in competition. Boone (2008), however, shows that caution is needed in interpreting the measure in this way. In our case, we use it to assess the concentration in a market only, not for competition per se.

Spread in performance
ICT can make a market more risky, increasing the spread of potential outcomes. To assess thus phenomenon, we use two measures here: the standard deviation and interquartile range, denoted respectively as

\[ \sigma_{jt}(\log x) = \sigma(\log x_{it}) \]

where firm \( i \in \) industry j, and

\[ IQR_{jt}(\log x) = Q_3(\log x_{it}) - Q_1(\log x_{it}) \]

where \( x \) is gross output, persons employed, labour productivity or value added of firm \( i \) in year \( t \), and \( Q_1 \) and \( Q_3 \) respectively denote the first and third quartile. The standard deviation takes into account the whole of the distribution of \( x \), including the tails and more extreme observations. Because of the potentially high concentration of certain measures, this may be relevant, but it also makes the standard deviation more sensitive for outliers. We use the log of the variables to mitigate this issue. In addition, we also employ the interquartile range, which is the difference between third and first quartile of the log variable. Because this is the difference between the maximum and minimum value of the middle 50% of the observations, outliers are not likely to play a role here. Given the role of concentration in the tails, however, this measure is likely to be a conservative estimate of the actual spread.

Volatility of performance
ICT is also thought to make markets more volatile. For example, ICT intensive firms may be able to scale up operations more quickly. Thus markets with high intensity should have incumbent firms see their market shares rise and fall faster than less intensive industries. This can be captured by the so-called churn in an industry, defined as the sum of absolute growth in market shares of firms \( i \) in industry \( j \):
Again, we use gross output, persons employed and value added for the market shares.

**- Allocative efficiency**

In a similar vein, ICT may play a role in making markets more efficient, by distributing resources from relatively uncompetitive firms to the more efficient ones by overcoming frictions more easily. Although resource allocation can incur costs for firms, workers and governments (Andrews and Cingano, 2012), for the most part, shifting resources to the most productive firms boosts aggregate productivity. This allocative efficiency can be captured by using the static cross sectional decomposition developed by Olley and Pakes (1996):

\[
CHURN_{jt} = \sum_{i \in j} |msh_{it} - msh_{it-1}|
\]

where \( \sum_{i \in j} \) represents relative size in terms of employment, \( msh_{it} \) is labour productivity of a single firm \( i \) in year \( t \), and a bar represents simple industry averages.

The decomposition uses the covariance between firm productivity and size. A higher covariance means inputs are allocated more efficiently. This latter term in the decomposition is the so-called allocative efficiency:

\[
P_{it} = \sum_{i \in j} \theta_{it} P_{it} = \bar{P}_{jt} + \sum_{i \in j} (\theta_{it} - \bar{\theta}_{jt})(P_{it} - \bar{P}_{jt})
\]

where \( \theta_{it} \) represents relative size in terms of employment, \( P_{it} \) is labour productivity of a single firm \( i \) in year \( t \), and a bar represents simple industry averages.

This measure has been used in other empirical work, e.g. Andrews and Cingano (2012) and Bartelsman et al. (2013) to illustrate the relevance of resource allocation for aggregate productivity, and how allocative efficiency is influenced by for example the institutional setting in a country.

### 5.4.2 Relation of distributional characteristics to ICT intensity

We use the ICT user cost as a percentage of value added per industry. To establish a correlation between ICT on the one hand and the four proposed phenomena we estimate the following regressions:

\[
\text{log HERF}_{jt} = \alpha + \beta \text{log ICT}_{jt} + d_j + d_t + \epsilon_{jt}
\]

\[
\sigma_{jt}(\text{log x})_{jt} = \alpha + \beta \text{log ICT}_{jt} + d_j + d_t + \epsilon_{jt}
\]

\[
IQR_{jt}(\text{log x}) = \alpha + \beta \text{log ICT}_{jt} + d_j + d_t + \epsilon_{jt}
\]

\[
CHURN_{jt} = \alpha + \beta \text{ICT}_{jt} + d_j + d_t + \epsilon_{jt}
\]

\[
AE_{jt} = \alpha + \beta \text{ICT}_{jt} + d_j + d_t + \epsilon_{jt}
\]

All regressions are estimated both in levels and first differences. In the latter case, industry fixed effects are implicitly controlled for, and identification of a possible correlation mainly comes from the time dimension. In the level equations, we control for industry and time specific effects by including dummies \( (d) \) for both effects. Finally, \( \epsilon \) is the error term. Because of skewness, we take the log transformation of the Herfindahl index. We also calculate the
standard deviation and interquartile range on the log of the concerning variable. In these cases, we also take the log of the ICT intensity variable in the regression. The allocative efficiency parameter can take both negative and positive values, making it unsuitable for a log-transformation. The churn variable is based on shares, and therefore there is no need to use the log transform.

The regression results are shown in table 3. We show results for the whole data period, and for the sub-period 2000-2007, which excludes the potentially disturbing effect of the crisis. Turning first to the Herfindahl indices there is a positive and significant correlation between the value added measure and ICT in levels. This provides support for the idea that ICT creates winner take all markets. This effect concerns the cross sectional dimension: more ICT intensive markets show more concentration of value added, but as an industry becomes more ICT intensive it is not necessarily associated with a higher concentration. However, we do not find a relation between concentration and ICT for gross output, nor for employment. The correlations become somewhat stronger when looking only at the pre-crisis period. Possibly the crisis caused firms with low output to exit, thereby increasing concentration if this exit is not matched by subsequent entry of new firms, also in less ICT intensive industries. Thus, in the crisis period markets may have become more concentrated due to a cleansing effect, which occurred independently of its ICT intensity.

Being itself based on first differences of market shares, the churn variable does not have significant correlations with the level of ICT intensity. However, the growth of ICT is positively related to the churning of markets, both in the case of gross output as value added. This provides evidence of an increase in turbulence when markets become more ICT intensive, as described by Brynjolfsson et al. (2009). On the other hand, there is no longer evidence of a churning effect when looking at the pre-crisis years. Thus, it seems that the crisis caused additional turbulence in output-based market shares, especially in ICT intensive industries.

Looking at the regression for the measures of spread, we find evidence that the spread in firm performance in terms of productivity is positively related to ICT intensity, in both periods, when measured by the interquartile range. This is consistent with early empirical findings on this relation by Brynjolfsson and Hitt (2000). However, when looking at the standard deviation no such correlation can be discerned. Possibly, the standard deviation is subject to outliers in the performance measures which are unrelated to the ICT intensity of an industry. In the pre-crisis period there is also a positive correlation of the spread of value added and ICT intensity, although the standard deviation does not show a significant result for gross output. The fact that including the crisis results in a loss of this significance is consistent with the stronger effects found in the pre-crisis period for the Herfindahl index. Again, if firms at the bottom of the distribution exit due to crisis, industries become more concentrated and the spread decreases, regardless of the ICT intensity.

It is striking that in all regressions we do not find any evidence between ICT intensity and the spread, churn or concentration of persons employed. Thus, ICT intensity does not seem to affect the distribution of workers, although it does not seem to relate to output and performance. A worry could be that employment is inflexible due to hiring and firing cost. If firms cannot hire or shed labour easily, this makes the distribution of labour unresponsive to ICT intensity.
Table 3. Regression results for distribution measures on ICT intensity.

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<tbody>
<tr>
<td></td>
<td>level</td>
<td>first differences</td>
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<tr>
<td>Herfindahl index of:</td>
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<tr>
<td>- Gross output</td>
<td>0.16</td>
<td>**</td>
</tr>
<tr>
<td>- Value added</td>
<td>0.75</td>
<td>**</td>
</tr>
<tr>
<td>- Persons employed</td>
<td>-0.05</td>
<td>-0.63</td>
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<tr>
<td>Churn of:</td>
<td></td>
<td></td>
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<tr>
<td>- Gross output</td>
<td>0.10</td>
<td>2.10</td>
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<tr>
<td>- Value added</td>
<td>2.51</td>
<td>3.58</td>
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<td>- Persons employed</td>
<td>-1.25</td>
<td>-0.19</td>
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<td>Standard deviation of:</td>
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<tr>
<td>- Gross output</td>
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<td>0.09</td>
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<tr>
<td>- Value added</td>
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<td>0.16</td>
</tr>
<tr>
<td>- Persons employed</td>
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<td>0.11</td>
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<tr>
<td>- Labour productivity</td>
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<td>0.07</td>
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<tr>
<td>Interquartile range of:</td>
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<td></td>
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<tr>
<td>- Gross output</td>
<td>0.16</td>
<td>0.34</td>
</tr>
<tr>
<td>- Value added</td>
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<td>- Persons employed</td>
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<td>- Labour productivity</td>
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<td>0.24</td>
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<td>Allocative Efficiency</td>
<td>8.24</td>
<td>***</td>
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<td>Year and Industry dummies</td>
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<td>yes</td>
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Table note. Significance: *** p < .01, ** p < 0.05, * p < 0.1.
Our final regressions take away some of this worry as they show that the allocative efficiency is positively and significantly correlated with ICT intensity in the cross sectional dimension. This supports the idea that resources are allocated more efficiently in ICT intensive industries. Comparing the two periods even suggests that the crisis mildly boosted allocative efficiency. This can be interpreted as an example of a stronger cleansing effect for the more ICT intensive industries, because low productive firms become smaller or exit, and workers get reallocated to more productive firms. This finding is consistent with our earlier results from the decomposition analysis of more efficient market selection and reallocation in ICT intensive industries.

Some caveats regarding our results are in order. Firstly, as noted above, the regressions do not establish causal links between ICT intensity and the four different phenomena. They do however provide some hints of the role played by ICT. Important to note is that all significant correlations are in the expected direction, i.e. ICT is positively correlated to concentration, spread, churning and allocative efficiency. Secondly, due to data restrictions, our analysis is at a relatively high level of aggregation. Some of the industries are fairly large and even smaller NACE classifications may from the perspective of an firm not act as a single market. Although not specific to our study, this is a further caution when interpreting the results.
ICT makes firms more flexible and efficient in their production process. This may have consequences for business dynamics and distributional characteristics of firm performance. Using detailed information on entry and exit, we therefore investigate whether the dynamic process of reallocation, entry and exit, is different in ICT-intensive industries compared to less-intensive industries. In this paper, we perform an empirical analysis of the business dynamics, productivity growth and distributional features of the performance of Dutch industries, relating differences among industries to the ICT intensity of those industries. In addition we investigate whether distributional characteristics that describe the spread and turbulence of firm performance, and the efficiency of the allocation of inputs are related to ICT.

Following our typification methodology we find a substantial heterogeneity in entry and exit rates by industry, with the rate of firm turnover (entry plus exit rate) ranging from 8 to 30 percent. The degree of business dynamics does not seem to be related to the ICT intensity, once controlling for industry and year fixed effects. Labour productivity growth calculated with the bottom-up approach is found to be quite volatile, especially in the crisis years, even at higher levels of aggregation. The decomposition of productivity growth over the whole period shows that productivity changes within continuing firms (the within component) explains most of the aggregate change. Exit and reallocation are also important, but the size and direction varies by industry. Entry is relatively unimportant, which could be the consequence of entry barriers, but our restriction to firms with 20 employees or more keeps us from putting too much emphasis on this interpretation. Taking into account whether the typification is true or fake matters for the size (and sometimes the direction) of the components as well, stressing the need to be cautious about conclusions with respect to dynamics when one does not have this information.

The crisis seems to have had a cleansing effect in most industries, with an eye on the sizable and positive contribution of the exit component. In the Distribution sector, however, there is evidence for misallocation, with a large negative reallocation component. Overall, contrary to the other industries, labour productivity growth is negative on average in the low ICT intensive industries. Moreover, there is evidence for misallocation in these industries, following the negative reallocation term. A low level of ICT usage could be associated with lower levels of competition (due to less innovation, market transparency et cetera), which may be the cause of this misallocation. In high ICT intensive industries, the within, reallocation, and exit components all contribute positively to overall labour productivity growth, suggesting that market selection and reallocation work better in such industries, increasing their ability to restructure in response to economic shocks.

Our analysis of the distribution of firm performance provides evidence that the concentration of value added is related to ICT, which is consistent with the idea of lower marginal cost of replication and upscaling together with network effects in ICT intensive industries. As industries become more ICT intensive, the volatility of market shares also increases, in line with the finding that ICT intensive industries are more responsive to shocks. Such industries also show a higher dispersion of firm performance, consistent with the idea that the differences between winners and losers becomes larger in competitive ICT intensive markets. This is true when the dispersion is measured by the interquartile range, but not for the standard deviation however, a measure that might be plagued by outliers. Overall we do not find any effect of ICT intensity on the distributional characteristics of employment, which could point at a high cost of adjustment.
for labour, in response to changes in output. Finally, we find a positive correlation between ICT and the (static) allocative efficiency in the market, that is the covariance of firm size and labour productivity. Moreover, the crisis seems to be associated with a stronger relation of ICT to this efficiency, indicating again a faster or better restructuring in ICT intensive industries.

There are some dimensions that we have left unexplored. Firstly, it is possible to repeat our analysis for multifactor productivity. Moreover, we can look at longer time differences, which will impact the relative contribution of reallocation, entry and exit. Other decomposition methods can be used as well, particularly the Diewert-Fox method. Finally, the use of data on smaller firms, should improve the assessment of the contribution of entry, and is high on our wish list.
References


Appendix

Coding of events in Business Register (in Dutch)

2 EAC_TYPE
Type eventactie
1 Opvoering
2 Afvoering
3 Continuering
4 Correctie

4 EBD_TYPE
Type eventbijdrage
1 Geboorte
2 Kenmerk/koppeling wijziging
3 Combinatie geboorte-sterfte
4 Afsplitsing
5 Uiteenvallen
6 Overname
7 Fusie
8 Herstructurering
9 Sterfte

6 VEV_TYPE
Statistisch event type
1 Lokale Bedrijfseenheid - geboorte
2 Lokale Bedrijfseenheid - sterfte
3 Lokale Bedrijfseenheid - varia
4 Bedrijfseenheid - geboorte
5 Bedrijfseenheid - sterfte
6 Bedrijfseenheid - fusie
7 Bedrijfseenheid - overname
8 Bedrijfseenheid - herstructurering
9 Bedrijfseenheid - afsplitsing
10 Bedrijfseenheid - uiteenvallen
12 Bedrijfseenheid - combinatie geboorte-sterfte
13 Bedrijfseenheid - varia
14 Ondernemingseenheid - geboorte
15 Ondernemingseenheid - sterfte
16 Ondernemingseenheid - fusie
17 Ondernemingseenheid - overname
18 Ondernemingseenheid - herstructurering
19 Ondernemingseenheid - afsplitsing
20 Ondernemingseenheid - uiteenvallen
21 Ondernemingseenheid - combinatie geboorte-sterfte
22 Kenmerk/koppelingwijziging op OG, BE en/of LBE
### EUKLEMS Alternative hierarchy

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
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<td>Other manufacturing; repair and installation of machinery and equipment</td>
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<td>Rubber and plastics products, and other non-metallic mineral products</td>
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<td>Electricity, gas and water supply</td>
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<td>Wholesale and retail trade and repair of motor vehicles and motorcycles</td>
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<tr>
<td>Wholesale trade, except of motor vehicles and motorcycles</td>
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<tr>
<td>Retail trade, except of motor vehicles and motorcycles</td>
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<tr>
<td>Transport and storage</td>
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<td>Postal and courier activities</td>
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<td>FINANCE AND BUSINESS, EXCEPT REAL ESTATE</td>
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<td>Financial and insurance activities</td>
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<td>Professional, scientific, technical, administrative and support service activities</td>
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<td>Other service activities</td>
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<td>Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use</td>
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<td>NON-MARKET SERVICES</td>
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<td>Real estate activities</td>
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<td>Public admin, education and health</td>
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<td>Public administration and defence; compulsory social security</td>
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