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## Firm growth in Europe: an overview based on the CompNet labour module

CompNet The Competitiveness Research Network

**Competitiveness Research Network**

This paper presents research conducted within the Competitiveness Research Network (CompNet). CompNet is a research network founded in 2012 to foster the debate on competitiveness and productivity issues among partner institutions and researchers. It aims at providing a robust theoretical and empirical link between drivers of competitiveness and macroeconomic performance for research and policy analysis purposes.

Originally founded by the European System of Central Banks (ESCB), CompNet now includes as partner institutions the European Central Bank (ECB), the European Commission (EC), the Leibniz Institute for Economic Research of Halle (IWH), the European Bank of Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Tinbergen Institute and several national central banks.

CompNet-related research is conducted in two main work streams:

1) Productivity growth drivers and efficiency of resource allocation
2) International trade, euro area rebalancing and global value chains

The views expressed in this paper are the ones of the author(s) and do not necessarily reflect those of the ECB, the ESCB, and any of the other organisations associated with the Network.

**Abstract**

This paper illustrates the main features of the Labour Module of the CompNet dataset which provides indicators of firm growth over the period 1995-2012 across 17 EU (13 euro area) countries and 9 macro-sectors. It also includes information on a large set of micro-aggregated characteristics of firms growing at different speed such as their financial position and labour and total factor productivity. The paper shows that during the Great Recession the share of shrinking firms sharply increased in countries under stress, while firm growth slowed down in non-stressed countries. In the former, the construction sector suffered the most, while in the latter manufacturing and services related to transportation and storage were mainly affected, possibly as a result of the trade collapse. While we find that, all else equal, more productive firms had a higher probability of growing, the process of productivity-enhancing reallocation was muted during the Great Recession.

**Non-technical summary**

The availability of firm-level data has unveiled the importance of firm heterogeneity for a number of macroeconomic dimensions, such as employment, productivity and innovation. Accounting for firm heterogeneity has also important policy implications, as resource allocation at the micro-level is a key channel to boost aggregate productivity and potential output, and increase the resilience of an economy in the face of adverse shocks. Until recent years, however, empirical research has been constrained by the lack of pooled harmonised cross-country firm-level data.

In this regard, the micro-based cross-country dataset developed by the Competitiveness Research Network (CompNet) is an important step forward. In particular, the Labour Module of the CompNet dataset provides a wide range of indicators related to firm growth, with comparable data produced for 17 EU (13 euro area) countries and 9 macro-sectors over the period 1995-2012. In addition, the CompNet data provides information on a large set of covariates – including, among others, the financial position of the firm, labour and total factor productivity, unit labour costs or investment – enabling researchers to investigate the drivers of employment growth. Finally, such a cross-country multi-sector dataset can be potentially very useful to identify possible implications of economic policies for firm growth.

The aim of this paper is twofold. First, it provides a detailed description of the CompNet Labour Module as a methodological reference for future studies. It clarifies in particular the rationale behind the three different approaches to measuring firm growth, highlighting advantages and possible pitfalls of each.

Second, it presents a new set of stylized facts on patterns of firm growth across selected EU countries and macro-sectors, placing particular emphasis on the impact of the Great Recession. In particular, we show that, prior to the crisis, the share of firms growing was larger, across the board, than that of firms shrinking, with the new Member States generally more dynamic on this front than the old Member States. Data also indicate that there is not much cross-sector variation, at least in the pre-crisis period. The Great Recession came with a sharp increase in the share of firms shrinking in stressed countries and with a decline in share of growing firms in the non-stressed countries. In the former, the construction sector suffered the most, while in the latter

manufacturing and services related to transportation and storage were mainly affected, possibly reflecting trade collapse that affected external sectors of non-stressed countries.

Our results also confirm previous findings in the literature on firm growth, as well as support intuition on firm dynamics during the crisis. In particular, data show that more productive firms have, all else equal, a higher probability of growing than less productive ones. At the same time, we find that the process of productivity-enhancing reallocation was muted during the crisis. Capital-intensive firms are more likely to grow, while larger firms are less likely to expand. Finally, we find that a higher investment ratio and profitability (in the pre-crisis period) have a positive impact on firm growth.

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# 1.    Introduction

There is now a general understanding that the analysis of macroeconomic dynamics, whether pertaining to employment, productivity or innovation, needs to take firm heterogeneity into account. Indeed, moving beyond a representative-firm framework has unveiled patterns that were not evident in macro studies, with important policy implications. While there is an extensive theoretical and empirical literature on within-country firm distributions of key variables, such as employment and productivity (Cabral and Mata 2003, Bottazzi and Secchi 2006), much less evidence is available with a cross-country perspective due to the difficulty of harmonising firm-level data. In this context, the new micro-based cross-country dataset developed by the Competitiveness Research Network (CompNet) is an important step forward.

The importance of having comparable data for cross-country analysis can hardly be overstated, especially in a monetary union. First, competitiveness, whether driven by costs or non-cost factors, is a relative concept. Second, cross-country analysis in the context of the euro area has important implications for the conduct of monetary policy. On the one hand, the evolution of cost and price variables bears an impact on inflation, guiding monetary policy decisions. On the other hand, the possibility of analysing, for example, employment or trade dynamics adds to the evaluation of business cycle synchronization in the currency union, allowing for an assessment of the optimality of the single monetary policy. Furthermore, cross-country comparable data is necessary for benchmarking analysis, i.e. looking for best practices in peer countries, which is widely used by international institutions such as the World Bank, the OECD, the European Commission and also the ECB. More importantly, cross-country regressions have allowed researchers to better understand the impact of the regulatory framework and institutions, which vary across countries, on micro and macro developments. They are also useful to investigate the impact of similar shocks on different economies based on their specific economic institutions and market structures.

Following the format of other papers documenting the different modules developed in the framework of CompNet, e.g. those covering trade and financial variables, this paper presents basic stylised facts on labour costs, productivity and employment across countries by exploiting the richness of a new firm-level dataset. The paper should be considered as a methodological

reference for future studies, complementing the information on the general CompNet database provided in the User guide (CompNet, 2016) and in Lopez-Garcia et al. (2015).

More specifically, data available under the so-called Labour Module allow to analyse firms' movements along the distribution of size (defined in terms of number of employees), productivity and unit labour costs in 17 EU countries (13 in the Euro Area), 9 macro-sectors (defined roughly at the 1-digit industry level of the NACE rev. 2 sector classification) and 17 years (from 1995 to 2012, unbalanced panel).[1] The dataset looks at employment growth over three-year windows using three approaches. First, it records the share of firms in five different growth categories, including high-growth firms. Second, it considers the share of firms in each country and sector moving (or not) from one size class to another. Third, it considers firms moving (or not) across quintiles of the size, productivity or unit labour costs distribution. Transition matrices can be constructed in the case of firms moving from one size class to another and from one quintile to another.

Our approach is similar to what has been done within the framework of the OECD *DynEmp* project, making it therefore possible to compare results. Nevertheless, the two datasets differ in a number of aspects.[2] CompNet provides wider country coverage within the EU[3] and, most importantly, includes information on a large set of covariates for firms in each cell of the transition matrices – including, among others, the financial position of the firm, labour and total factor productivity, unit labour costs or investment – enabling researchers to deepen the analysis of the drivers of employment, productivity and unit labour costs growth. Third, the availability of cross-country multi-sector information allows identifying the effect of policies or framework conditions on firm growth. On the downside, in most countries entry into and exit from the

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[1] At the time of releasing this paper for publication, a new round of data compilation just finished. The updated dataset includes now the year 2013 and three new countries: Denmark, Latvia and the Czech Republic although Austria, Slovenia and Lithuania had not updated their data at the time of writing this paper.

[2] The *DynEmp* database collects harmonized micro-aggregated firm-level data from business registers for 17 OECD countries (9 in the euro area) and Brazil, giving account of employment transition for groups of firms classified on the basis of size, age, broad sector, country and time (Criscuolo et al. 2014).

[3] Note, however, that the country coverage in CompNet varies depending on the sample of firms analysed – firms with at least one employee or firms with more than 20 employees – due to the existence of different exclusion rules across countries. France, Slovakia and Poland, for example, provide information only of firms with at least 20 employees whereas Portugal has data only from 2006 onwards and Hungary did not provide data for the full sample of firms. For these reasons the bulk of the analysis is done with the full sample covering firms with at least one employee in 12 countries: Austria, Belgium, Croatia, Estonia, Finland, Germany, Italy, Lithuania, Malta, Romania, Slovenia and Spain.

market cannot be inferred from entry and exit in the CompNet sample. Moreover, the year of creation of the firm is an item provided only by six countries. Therefore, at present one cannot compute entry and exit rates, nor split firms according to their age, thereby limiting the potential for analysing firm "churning" dynamics. For this reason, throughout the paper the discussion will focus on the intensive margin, i.e. on the expansion or contraction of *existing* firms.

The paper is organised as follows. Section 2 (together with Annexes 1 to 3) discusses the main features of the dataset and validates the data against other sources. Section 3 presents some stylized facts on patterns of firm growth across countries and sectors. Section 4 shows some descriptive and parametric evidence on potential drivers of firms' growth. Finally, section 5 concludes and discusses avenues for future research.

## 2.    The CompNet database: the Labour Module

The CompNet database encompasses a wide set of indicators related to competitiveness.[4] Data sources vary across countries, although most of them consist of administrative data (firm registries) or surveys carried out by national central banks. Despite this heterogeneity in terms of sources, target populations are defined in the same way across countries, aiming at private sector non-financial corporations with at least one employee.[5] In order to improve the cross-country comparability of the data while preserving the confidentiality of firm-level information, a "distributed micro-data approach"[6] was followed. In particular, a common protocol in the form of a STATA do-file was developed to extract and aggregate relevant firm-level information. This do-file was then sent to (and run independently by) each of the participating country teams. The common methodology was developed with the aim of harmonizing – to the highest possible extent – sampling procedures, variable definitions and estimation methodologies.

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[4] Detailed information on the general database can be found in Lopez-Garcia et al. (2015). Some of that information, to the extent that it is relevant for this paper, will be reproduced here for convenience.

[5] This definition corresponds to the category S11 in the European System of Accounts (i.e. excluding sole proprietors). Note that firms operating in the mining and agriculture, refine of coke and petroleum, and utilities have been excluded for technical reasons.

[6] Bartelsman et al. (2004).

As detailed in Annex 1, data coverage and exclusion rules vary across countries. In some cases, the sample does not include very small firms[7]; in others, only firms fulfilling certain criteria, such as obtaining a credit rating, are sampled.[8] In order to deal with such differences, CompNet collects all indicators for two different samples of firms: those with at least one employee (the *full sample*), and those with at least twenty employees (the *20E sample*). [9] Although the 20E sample is preferable in terms of cross-country comparability, the full sample is still representative of the population of firms in a large set of countries, namely Belgium, Croatia, Estonia, Finland, Italy, Lithuania, Portugal, Romania, Slovenia and Spain.

The Labour Module is an add-on to the general CompNet do-file, which analyses cross-country indicators of firms' employment growth.[10] For each country and macro-sector we compute employment change between years $t$ and $t+3$, for a total of 14 three-year rolling windows; the first three-year window is 1995-1998 and the last one is 2009-2012. These three-year windows are used to correct for one-off expansions, and to reduce volatility in the data by smoothing over years. In the literature, most studies calculate growth rates over a time horizon of a few years (Coad 2014). Earlier papers, based on the Longitudinal Research Database of the Census Bureau of the USA, used 5-year windows to explore productivity dynamics (see for example Baily et al. 1992) given that the census of manufacturing is conducted every five years in the US. More recent papers use different lengths of windows.[11] We chose three-year windows to make our results readily comparable with other recent work, such as the OECD DynEmp (Criscuolo et al. 2014), Bravo-Biosca (2011) or Bartelsman et al. (2005).

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[7] Poland has information only on firms with more than 9 employees; Slovakia samples firms with at least 20 employees or, if smaller, with a turnover larger than 5 million euros; France gets information only on firms with turnover larger than 750.000 euros. No information on firms below 5 employees is provided for Malta.

[8] That is the case of Germany and Austria. For more information on cross-country comparability refer to CompNet (2016), Lopez-Garcia, di Mauro et al. (2015), as well as to the companion report on data quality (Benati et al. 2014).

[9] The 20E sample is only available from 2001 onwards and is population weighted so it is representative of the population of firms in terms of macro-sector and size class.

[10] Employees are defined at the firm level as average number of employees, over the year, measured in full time equivalents. However there are deviations to this common definition in some countries. For details, see Annex 2.

[11] Three- or four-year periods are used in most studies on high growth firms, although some studies have used shorter as well as longer periods.

The Labour Module produces a total of six output files, generated at either the aggregate or the macro-sector level[12]: three databases, which differ in the definition of firm's employment growth, plus three additional databases describing firms' transitions along the labour productivity, total factor productivity and the unit labour cost distributions.

Focusing on the data files recording employment growth, the first database – called *percentage growth dataset* – classifies firms in five groups, depending on their cumulative percentage employment growth over each three-year period: (1) decline (negative growth larger than -3.03%); (2) broadly unchanged (growth between -3.03% and +3.03%); (3) moderate growth (between 3.03% and 33.1%); (4) high growth (between 33.1% and 72.8%) and (5) very high-growth (over 72.8%).[13] The cross-country harmonisation in terms of definitions of growth categories and availability of a rich set of information on firms in each of those categories, as it will be explained below, makes this dataset the most appropriate to analyse differences in terms of prevalence rates or drivers of firm growth. Box 4, for example, exploits this dataset to explore the characteristics of very high-growth firms in Europe.

The second dataset – called *size-class dataset* – defines employment growth as a change of size class between year *t* and *t+3*. In each year, firms are assigned to one of five different size classes, depending on their employment level: (1) firms with 1 to 9 employees; (2) firms with 10 to 19 employees; (3) firms with 20 to 49 employees; (4) firms with 50 to 249 employees; (5) firms with 250 employees or more. Then, within each three-year window, a firm is classified as *growing* when it moves to *any* of the higher size classes, remaining *equal* when no change in class size occurs, or *declining* when moving to *any* size class below. Table 1 shows the average firm size within each of the size classes in each country, taking the average of all rolling windows. The data suggest that much of the cross-country variation in firm size concerns the largest firms, namely those with more than 50 employees.

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[12] So there are in total 12 data files, six at the country level and six at the country/macro-sector level. See Annex 1 for sector details.

[13] The thresholds, 3.03%, 33.1% and 72.8% are equivalent to an average annual growth of 1%, 10% and 20%. For this reason, the last group is labelled high-growth firms. The OECD defines them as firms with an average annual growth over 20% in 3 consecutive years, with a minimum size at the beginning of the period of 10 employees. See for example Henrekson and Johansson (2010).

**Table 1: Average firm size by size-class**

| | FULL SAMPLE AVERAGE FIRM SIZE, BY SIZE CLASS | | | | |
|---|---|---|---|---|---|
| | 1-9 employees | 10-19 employees | 20-49 employees | 50-249 employees | more than 250 employees |
| AUSTRIA | 4 | 14 | 34 | 124 | 861 |
| BELGIUM | 3 | 14 | 31 | 102 | 987 |
| CROATIA | 3 | 13 | 30 | 104 | 730 |
| ESTONIA | 4 | 13 | 30 | 95 | 587 |
| FINLAND | 3 | 14 | 30 | 102 | 911 |
| GERMANY | 5 | 14 | 33 | 114 | 1134 |
| ITALY | 5 | 14 | 31 | 96 | 965 |
| LITHUANIA | 4 | 14 | 30 | 99 | 716 |
| MALTA | 5 | 14 | 32 | 101 | 562 |
| PORTUGAL | 3 | 13 | 30 | 97 | 814 |
| ROMANIA | 3 | 13 | 30 | 103 | 765 |
| SLOVENIA | 3 | 13 | 31 | 107 | 764 |
| SPAIN | 4 | 14 | 30 | 94 | 1892 |
| AVERAGE | 4 | 14 | 31 | 103 | 899 |

Note: Full sample, average over the period 1995-2012. Data for Poland, Slovakia, France and Hungary are only available for the 20E sample and are shown in Annex 6. Please refer to Table A1 in Annex 1 for information on years available in each country.

Finally, the *quintile dataset* measures employment growth in terms of change of quintile, within the firm size distribution of the sector of reference, between *t* and *t+3*. Each quintile, by definition, includes 20% of the number of firms in the sector so that the relative magnitude of each segment is the same. In this case, the dataset records not only whether a firm grows or declines (as in the size-class dataset) but also to which quintile of the employment distribution it is moving within each 3-year window. Table 2 below shows, for each country, the average firm size within each quintile, suggesting that in all countries (except Austria and Germany, featuring samples biased towards large firms) the production structure is largely populated by very small firms, with 80% of firms concentrated in the smallest dimensional size class (up to 9 employees) or slightly above it (as in the case of Italy and Lithuania).[14] Therefore, studying quintile

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[14] The size distribution of each sample is analysed in the context of data validation (Annex 3).

transitions in this context implies that in most countries one will be actually looking at firm growth from one to two or at most four employees. Also, for the 20E dataset quintile transitions will mostly refer to firms between 20 and 50 employees (see Annex 6 for details).

**Table 2: Average firm size by quintile, 1995-2012**

| | FULL SAMPLE AVERAGE FIRM SIZE, BY QUINTILE | | | | |
|---|---|---|---|---|---|
| | 1 quintile (0-20%) | 2 quintile (21-40%) | 3 quintile (41-60%) | 4 quintile (61-80%) | 5 quintile (81-100%) |
| AUSTRIA | 7 | 28 | 65 | 142 | 758 |
| BELGIUM | 1 | 2 | 3 | 6 | 65 |
| CROATIA | 1 | 2 | 3 | 7 | 65 |
| ESTONIA | 1 | 3 | 4 | 8 | 50 |
| FINLAND[1] | 0.4 | 1 | 2 | 5 | 52 |
| GERMANY | 13 | 29 | 55 | 112 | 816 |
| ITALY | 2 | 4 | 7 | 12 | 82 |
| LITHUANIA | 2 | 4 | 7 | 13 | 92 |
| MALTA | 3 | 6 | 10 | 22 | 139 |
| PORTUGAL | 1 | 2 | 4 | 7 | 43 |
| ROMANIA | 1 | 2 | 3 | 5 | 53 |
| SLOVENIA | 1 | 2 | 3 | 6 | 75 |
| SPAIN | 1 | 2 | 4 | 8 | 54 |
| AVERAGE | 3 | 7 | 13 | 27 | 180 |

[1]Firm size refers to the average number of employees in a given year. Although CompNet drops all firms with 0 employees, it does not drop firms with e.g. 0.5 employees on average over the year. This explains the very low numbers for Finland.

Note: Full sample. Data for Poland, Slovakia, France and Hungary are only available for the 20E sample and are shown in Annex 6. Please refer to Table A1 in Annex 1 for information of years available for each country.

The size-class and the quintile datasets, which record the initial and final size of firms, are then used to construct transition matrices, providing the share of firms in a given size-class or quintile in year *t* moving to another specific quintile in *t+3*.[15] Table 3a-b shows such transition matrices computed from the size-class and quintile dataset, averaging over countries, sectors and years.[16]

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[15] A similar approach is adopted in other studies like the Dynemp of the OECD (Criscuolo et al. 2014). Transition matrices have also been widely used in analyses of productivity dynamics like in Baily et al. (1992).

[16] For a more detailed analysis of the transition matrices by country and period, please refer to Annex 4.

Firm size appears highly persistent (panel a) especially among the smallest firms, as on average less than 10% of firms classified as micro-firms in year *t* were able to grow into a higher size category over a three-year period. Only one third of firms in the first quintile of the size distribution (with average firm size of 3 employees)[17] were able to jump to a higher one (mainly to the adjacent quantile, corresponding to an average size of 7 employees).

**Table 3. Transition matrix**

| a) Size-class | | | | b) Quintile | | | | | |
|---|---|---|---|---|---|---|---|---|---|

**a) Size-class**

| size class at t/size class at t+3 | Decline | Equal | growth |
|---|---|---|---|
| 1-9 employees | - | **91%** | 9% |
| 10-19 employees | 22% | **61%** | 17% |
| 20-49 employees | 19% | **70%** | 11% |
| 50-249 employees | 16% | **81%** | 3% |
| More than 249 employees | 15% | 86% | - |

**b) Quintile**

| | | Quintile at t+3 | | | | |
|---|---|---|---|---|---|---|
| | quintile at t/ quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
| **Quintile at t** | 0-20% | **66%** | 22% | 8% | 3% | 1% |
| | 21-40% | 21% | **45%** | 26% | 7% | 2% |
| | 41-60% | 8% | 17% | **48%** | 26% | 3% |
| | 61-80% | 3% | 4% | 14% | **60%** | 20% |
| | 81-100% | 1% | 1% | 2% | 9% | **87%** |

Note: Numbers refer to the full sample and are unweighted averages of transitions in Austria, Belgium, Croatia, Estonia, Finland, Germany, Italy, Lithuania, Malta, Portugal, Romania, Slovenia and Spain over 1995-2012. Please refer to Annex 1 for details on the years available for each country and to Annex 4 for a more disaggregated analysis of the employment transitions.

Similarly to firms' size, transition matrixes were also computed to analyse firms' movement along the productivity and the unit labour cost distributions. More specifically, for firms belonging to a given quantile of the (labour productivity, total factor productivity or unit labour cost) distribution, the transition matrix enables to identify whether three years later these firms still belong to the same quintile, or shifted to an upper or lower one; evidence on the share of firms experiencing changes in labour productivity is presented in Box 1.

Besides containing information on the share of firms expanding or downsizing, all datasets collect information on the characteristics of each group of firm, defined in terms of cumulative growth rate, or transition from one size class (or quintile) to another between t and t+1. Such characteristics – ranging from the financial status to productivity and allocative efficiency, to trade – are provided at the beginning of each three-year period together with the moments of the respective distribution. Table 4 shows the complete list of characteristics and the related statistics

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[17] See Table 2 above.

(mean, standard deviation, full distribution etc.) available in each dataset. This information enriches the dataset, allowing researchers to test for the impact of possible determinants of firm growth.

For all datasets, some important caveats apply. First, the year of creation of the firm, required to compute firm's age, is an item provided in the balance sheet of only six of the participating countries[18] and, therefore, not yet incorporated in the labour module. This implies that we are not able to identify young firms, which is a clear drawback when it comes to analysing firm growth. We are able, however, to identify high-growth firms which are, to a large extent, young firms. Second, the labour module analyses the dynamics of a subsample composed of *surviving* firms, as they are required to be in the database at both *t* and *t+3*.

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[18] Estonia (2009-2012), France (2000-2012), Italy (2001-2012), Portugal (2006-2012), Slovenia (2000-2012) and Spain (2000-2012).

**Table 4: Set of firm-level characteristics computed for each type of firm**

| Indicators | Mean | Standard deviation | Skewness | Median | Interquantile range | Distribution deciles* |
|---|---|---|---|---|---|---|
| Cash flow ratio | P. Q. S | P. Q. S | P. Q. S | P. Q. S | P. Q. S | |
| Cash ratio | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Fixed capital ratio | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Debt burden | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | |
| Capital depreciation | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | |
| Dividend ratio | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | |
| Equity_Debt | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Equity ratio | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | |
| Financial gap | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Implicit rate | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | |
| Investment to turnover | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | |
| Investment ratio | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Capital productivity | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Labour | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Labour cost | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Labour cost per employee | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Leverage | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Labour productivity | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Turnover productivity | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Marginal product capital | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Marginal product labour | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Profit margin | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | |
| Fixed assets | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Fixed assets per employee | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| ROA | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Total sales net of VAT | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Real value added | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| TFP | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Trade credit | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | |
| Trade debt | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | |
| Unit labour cost | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |
| Wageshare | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, Q, S | P, S |

Notes: P: percentage growth dataset, Q: quintile dataset, S: size class dataset; * p10,p20,p30,p40,p60,p70,80,p90,p99.

Data from the labour module have been validated against other sources, namely the EU Labour Force Survey (EU-LFS) and the OECD Dynemp. While the details of the validation exercise are documented in Annex 3, the main results are summarised here for convenience. First, the panel structure required to follow firms from *t* to *t+3*, which implies considering only growth of surviving firms, does not bias systematically employment growth rates. Second, compared to the EU-LFS, CompNet performs well in terms of employment growth and employment sector distribution in all countries, with the exception of Malta, Germany and Austria. In Malta there is

an exclusion rule of firms with less than 5 employees, whereas in Germany and Austria there is a severe bias towards large firms. These features result in an overrepresentation of employment in manufacturing and large firms in those countries. Hence the analysis of these three countries, in terms of firm growth, warrants caution. Finally, for those countries where information from both CompNet and Dynemp is available, the distribution of employment by firm size appears rather similar, with the exception of Italy where very small firms (from 0 to 9 employees) are under-represented.[19]

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**Box 1. Productivity transition matrices**

The Labour Module contains information on firm's dynamics not only in terms of employment but also in terms of productivity and unit labour cost. Firms are divided into quantiles (each containing 20% of firms) according to their level of productivity and unit labour costs in each year. As in the case of employment transitions, for each country, sector and year, the module provides the characteristics – reported at time $t$ – of firms moving from quantile $q_i$ to quantile $q_j$ over a three-year period.

Table B1.1 shows the labour productivity transition matrices for four different country groups (economies under stress, non-stressed countries, new EU members and Germany) before the crisis, which is defined as the rolling windows up to and including the window 2005-2008. Each cell shows the percentage of firms in a given quintile of the productivity distribution at $t$ shifting (or not) to another quintile of the distribution in a three-year time.

The figure shows quite similar patterns across country groups: although there is high persistency in terms of labour productivity (as in the case of employment), a relatively large number of firms saw their productivity grow or decline over a three-year window. Actually, in all country groups, the sum of firms changing, up or down, their productivity level is often larger than the share of firms staying in the same productivity quintile over time. In this respect, it is interesting that during the pre-crisis period the new EU members were relatively more dynamic, i.e. the share of firms in the diagonal of the matrix is always lower than in the rest of countries. This is consistent with the fact that they are still catching-up economies.

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[19] Both Dynemp and CompNet share the same data source in many of the countries, which explains the exact match in terms of employment distribution in some instances.

**Table B1.1: Productivity transition matrices by group of countries, pre-crisis period (windows up to and including 2005-2008).**

Countries under stress — Quintile at t+3

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **68%** | 25% | 6% | 2% | 0% |
| 21-40% | 15% | **50%** | 28% | 6% | 1% |
| 41-60% | 4% | 18% | **47%** | 28% | 4% |
| 61-80% | 2% | 4% | 19% | **53%** | 23% |
| 81-100% | 1% | 1% | 3% | 16% | **80%** |

Non-stressed countries — Quintile at t+3

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **71%** | 21% | 6% | 2% | 1% |
| 21-40% | 16% | **48%** | 27% | 7% | 1% |
| 41-60% | 4% | 17% | **48%** | 26% | 4% |
| 61-80% | 1% | 3% | 19% | **56%** | 21% |
| 81-100% | 0% | 1% | 2% | 13% | **83%** |

New EU countries — Quintile at t+3

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **49%** | 34% | 12% | 6% | 2% |
| 21-40% | 14% | **39%** | 33% | 14% | 3% |
| 41-60% | 4% | 18% | **40%** | 34% | 9% |
| 61-80% | 2% | 5% | 18% | **48%** | 29% |
| 81-100% | 1% | 2% | 4% | 19% | **77%** |

Germany — Quintile at t+3

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **63%** | 24% | 7% | 4% | 2% |
| 21-40% | 15% | **42%** | 29% | 10% | 4% |
| 41-60% | 5% | 16% | **40%** | 30% | 8% |
| 61-80% | 3% | 6% | 19% | **44%** | 27% |
| 81-100% | 2% | 3% | 6% | 19% | **70%** |

Note: Quintile dataset, 20E sample. Average over the rolling windows 2000-2003 to 2005-2008. The groups of countries are as follows: stressed countries (Spain, Italy and Slovenia), non-stressed countries (Austria, Finland, Belgium) and new EU countries (Romania, Malta, Lithuania, Estonia and Croatia; firm dynamics in Germany are rather different from those in the other groups, and therefore is shown separately.

During the crisis (defined as the windows 2006-2009 to 2009-2012), productivity transitions diverged across country groups. Table B1.2 shows the change in the transition matrices during the crisis, i.e. the difference, in percentage points, in the share of firms in each cell of the productivity transition matrix between the crisis and the pre-crisis period. We show in red the cells where the share of firms declined and in green those where the share of firms increased.

The most striking fact emerging from this exercise is that in countries under stress, the share of firms with decreasing productivity (under the diagonal) did not change during the crisis, while the share of firms with increasing productivity dropped and the share of firms remaining in the same quintile increased. The dynamics were different in the remaining groups of countries: in new EU members the share of firms with declining productivity increased during the crisis (and the share of firms increasing productivity barely changed) whereas in Germany the share of firms with declining productivity dropped. In the remaining non-stressed countries the picture is mixed.

The reasons behind these different dynamics are not entirely clear. One possible factor behind the drop in the share of firms increasing their productivity in stressed countries could be tighter financial constraints, which prevented investment in human capital and technology adoption even by productive firms. Figure 6 in the text shows that fast growth firms were affected disproportionally by credit constraints during the

crisis, which could be regarded as descriptive evidence supporting this possibility. This finding would deserve, however, further research.

**Table B1.2: Change in the share of firms in each cell of the matrices, crisis vs. pre-crisis**

Countries under stress — Quintile at t+3

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | 1% | -2% | 1% | 1% | 0% |
| 21-40% | 6% | -1% | -5% | 0% | 0% |
| 41-60% | 2% | 5% | -1% | -6% | -1% |
| 61-80% | 1% | 3% | 4% | -3% | -6% |
| 81-100% | 0% | 1% | 1% | 3% | -6% |

Non-stressed countries — Quintile at t+3

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | 3% | -2% | -2% | 0% | 0% |
| 21-40% | 8% | 3% | -7% | -4% | 0% |
| 41-60% | 2% | 7% | -1% | -7% | -1% |
| 61-80% | 2% | 3% | 4% | -4% | -5% |
| 81-100% | 0% | 0% | 2% | 7% | -10% |

New EU countries — Quintile at t+3

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | 13% | -9% | -4% | 0% | 0% |
| 21-40% | 14% | 0% | -13% | -3% | 0% |
| 41-60% | 8% | 9% | -6% | -11% | -1% |
| 61-80% | 2% | 4% | 6% | -9% | -3% |
| 81-100% | 1% | 0% | 2% | 2% | -7% |

Germany — Quintile at t+3

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | 5% | -3% | -1% | -1% | 0% |
| 21-40% | 5% | 6% | -6% | -4% | -2% |
| 41-60% | 1% | 8% | 1% | -7% | -3% |
| 61-80% | 0% | 1% | 5% | 1% | -7% |
| 81-100% | -1% | -1% | 0% | 1% | 1% |

Note: Quintile dataset, 20E sample. The groups of countries are as follows: stressed countries (Spain, Italy and Slovenia), non-stressed countries (Austria, Finland, Belgium) and new EU countries (Romania, Malta, Lithuania, Estonia and Croatia; firm dynamics in Germany are rather different from those in the other groups, and therefore is shown separately.

# 3. Firm growth across countries and sectors: some stylised facts

This section presents some evidence on firm dynamics emerging from the Labour Module, with a special focus on the impact of the Great Recession. More specifically, the section starts with a cross-country analysis, pooling all firms across all sectors together and averaging over the pre-crisis (or "normal") years. We then look at whether the general patterns identified are similar across all sectors of activities and whether they changed, and in which way, during the economic and financial crisis starting in 2008. We adopt the convention of clustering countries in three groups – namely, *stressed countries* (Spain, Italy and Slovenia), *non-stressed countries* (Austria, Finland, Belgium) and *new EU countries* (Romania, Malta, Lithuania, Estonia and Croatia); firm

dynamics in Germany are rather different from those in the other groups, and therefore will be shown separately.[20]

In the following, unless stated otherwise, we refer to the "percentage growth" database and the full dataset of CompNet, thereby keeping micro-firms in the analysis.[21] Moreover, as shown in the previous section, there are some country differences in terms of coverage of this dataset which might affect comparisons (the different dynamics of Germany might be partly due to the sample bias, partly to the different phase of the cycle). For this reason, and to be able to include countries reporting results only with the 20E dataset, Annex 6 replicates all charts shown in this section but using the more comparable 20E samples. Lastly, in what follows the crisis period starts with the 2006-2009 window.

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[20] Portugal should belong to the group of economies under stress; data for this country are, however, available only from 2006 onwards, therefore it will be included only in some of the charts. France is not shown as the sample does not include firms with less than 20 employees.

[21] This means that France, Poland, Slovakia and Hungary will not be included in the main set of figures and tables of this section.

**Figure 1: Proportion of firms by growth category, pre-crisis**
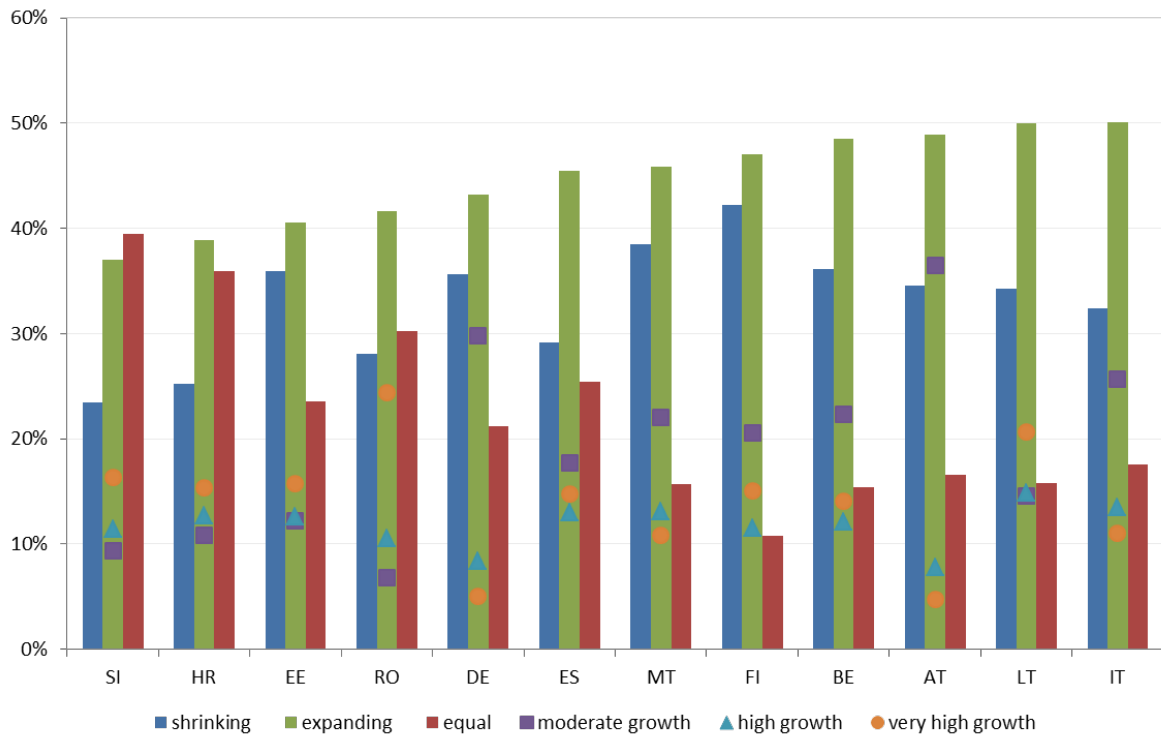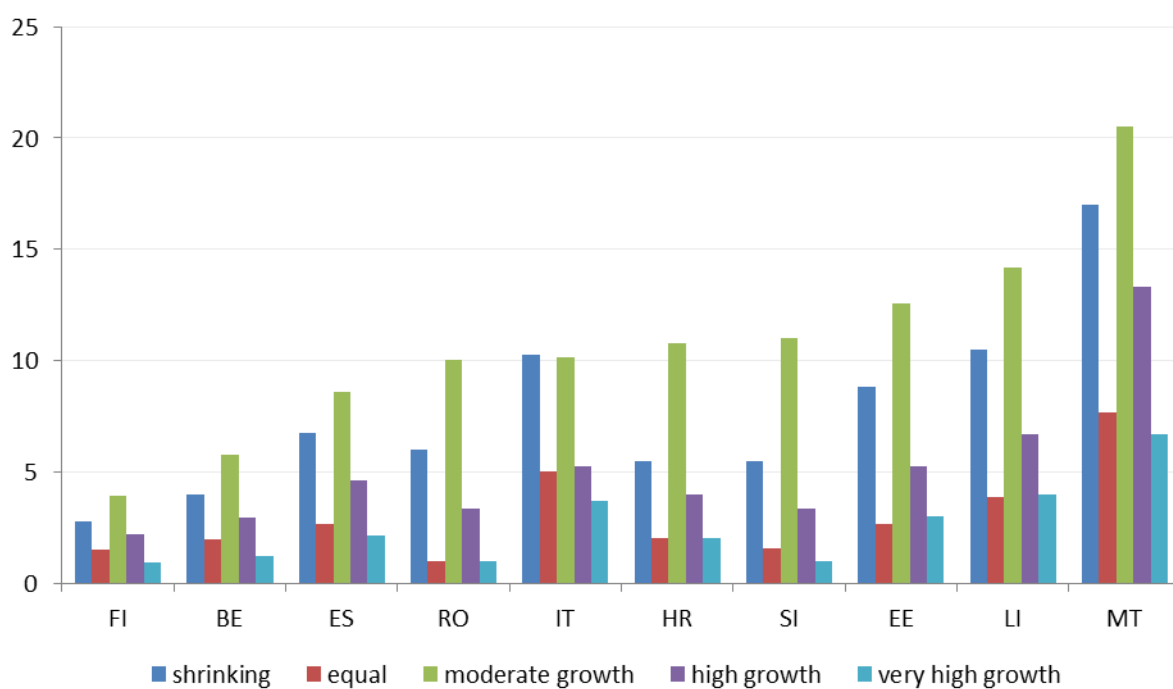


Note: Percentage growth dataset (full sample), country detail. Average over the windows 2000-2003 to 2005-2008. Note that Germany and Austria have the highest proportion of firms growing moderately in Figure 1. This is related to their samples, biased towards large firms. Indeed, as Figure 2 shows, the average size of slow growing firms is larger than the average size of firms in the rest of growing categories.

Figure 1 shows the average proportion of firms shrinking (decreasing by more than 3% over three years), the proportion of firms keeping their level of employment broadly unchanged (i.e. within an employment growth between -3% and 3%) and the proportion of firms expanding (i.e. increasing more than 3% over three years) in the pre-crisis period. The latter (green bar) is the sum of the proportion of firms growing at different rates: moderate growth (between 3.03% and 33.1%), high growth (between 33.1% and 72.8%) and very high-growth (over 72.8% or annual average of 20%) over the pre-crisis windows. Firm dynamics differ markedly across countries. However, there are some common patterns worth highlighting. First, during the pre-crisis period the share of firms expanding was larger than that of firms downsizing in all countries. Second, in all Central and Eastern European (CEE) economies the share of firms with high or very high-growth exceeded that with moderate growth whereas in non-CEE economies most of the firms

with positive employment growth grew very moderately (between 1 and 10% in average per year, in a 3-year window) which points to higher dynamism in the CEE countries.[22]

Moreover, amongst growing firms there is a negative correlation between speed of growth and size (Figure 2). The higher employment growth of small firms, and the fact that large firms are the ones with the highest probability of downsizing, is partially an artefact of the regression to the mean bias and partially an economic grounded phenomenon whereby small and, above all, young firms are the most dynamic and feature higher churning rates (see for example Lotti et al. 2003, Gómez-Salvador et al. 2004, Neumark et al. 2011 and Haltiwanger et al. 2013).[23,24]

**Figure 2: Median firm size by growth category, pre-crisis**



Note: Percentage growth dataset (full sample), country detail. Average over the windows 2000-2003 to 2005-2008. Germany, Austria and Malta are not shown due to the bias in their full samples.
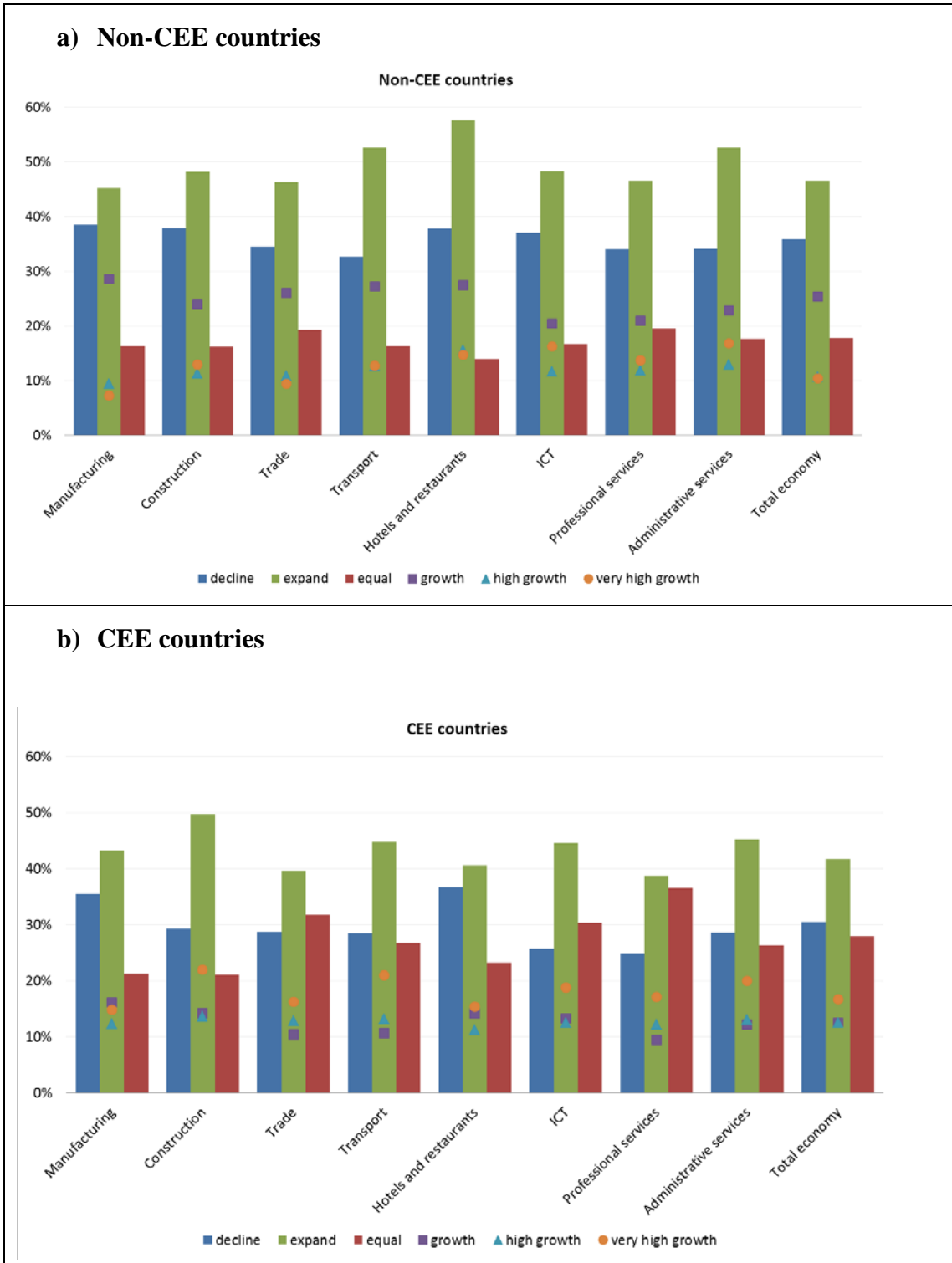
[22] There is a broad literature studying firm productivity and employment dynamics in transition economies. It has been now documented that during the first phase of the transition period, in early 90s, job destruction, above all in large state-owned companies, exceeded job creation. In subsequent years, the growth of a new private sector and improvement of institutions facilitated the process of catching up with strong entry (and exit) of firms and firm growth. See for example Mitra et al. (2014), Faggio and Konings (2003), and Konings et al. (1996).

[23] Since Birch (1979) a number of studies have provided evidence in support of the argument that small businesses are the primary engines of job growth. This view, however, has been subject to controversy, as a number of subsequent empirical studies (e.g. Davis et al. 1996) have highlighted statistical and measurement problems underlying this perception.

[24] Coad et al. (2014) emphasize that whether growth is measured in relative or absolute terms does make a difference. Growing firms defined by relative growth, as done in this analysis, tend to be smaller than those that are fast growing in absolute terms, i.e. measures of absolute (relative) growth are biased toward larger (smaller firms).

Zooming into the sector detail, Figure 3 shows the share of firms in each growth category by macro-sector. Given the differences observed in Figure 1 between CEE and non-CEE countries, we show the cross-country unweighted average in each sector and for each of those country groups. Interestingly, the data reveals that the growth pattern of firms observed in Figure 1 holds roughly across all sectors, particularly among non-CEE economies. In the latter group of countries, the sector relatively more dynamic, i.e. with the lowest share of firms with moderate growth and largest share of firms with extreme growth, is ICT. Among CEE economies the more dynamic sectors are, instead, construction and transport and storage.

**Figure 3: Proportion of firms by growth category. Sector detail, pre-crisis average**

### a) Non-CEE countries



Non-CEE countries

Legend: ■ decline ■ expand ■ equal ■ growth ▲ high growth ● very high growth

### b) CEE countries



CEE countries

Legend: ■ decline ■ expand ■ equal ■ growth ▲ high growth ● very high growth

Source: CompNet's Labour Module, percentage growth dataset (full sample ).

Before turning to the impact of the crisis, Box 2 uses the size-class and quintile datasets to explore the patterns of firm growth controlling for initial size, indeed an important determinant as it will be discussed in section 4.

**Box 2: Firm growth when controlling for the initial size.**

All the results we have presented up to now are based on the *percentage growth dataset*. This dataset has the advantage of splitting firms according to their relative growth. However, it has the disadvantage of not allowing the researcher to control for the initial size of the firm. For this reason CompNet has also constructed the *size-class* and the *quintile datasets*. As we pointed out in section 2, the *size-class dataset* groups firms in five categories (1-9, 10-19, 20-49, 50-249, and above 250 employees) while the *quintile dataset* groups firms according to the employment quintile they belong to. Firm growth is defined in this context as the jump to a higher or lower size class or quintile (differently from the percentage growth dataset, hence results are not directly comparable), i.e. the share of firms expanding (shrinking) in the *size-class dataset* will be defined as the share of firms in a given size class at time *t* jumping to a larger (smaller) size-class at *t+3*. These jumps might require large employment growth rates (much larger than the 3% threshold used in the *percentage growth database*).

Using the *size-class dataset*, we show the proportion of firms that expand and shrink during the pre-crisis period in Figure B2.1.[1] Four facts emerge: First, within a given size-class, the proportion of firms expanding is always lower than the proportion of firms shrinking. This is actually a statistical artefact resulting from the fact that most firms are concentrated in the lower size classes, i.e. the number of firms in the bottom size class is always larger than the number of firms in the top size class (of firms with 249 employees or more). This implies that if a given number of firms expand from a lower size-class to a higher one and the same number of firms shrink from the higher size-class to the lower one, the shrinking firms will always represent a larger proportion of the firms in the size-class of origin than the expanding firms. Second, the numbers here are much lower than the ones shown in Figure 1. On average only 10% of the firms expand while 15 % of the firms shrink compared to the 40% and 30% we obtained exploiting the *percentage growth dataset*. This comes as no surprise given that "expansion" or "downsizing" is much more demanding in this dataset.

**Figure B2.1: Proportion of firms expanding (left panel) and shrinking (right panel) by size-class (SZC). Pre-crisis period.**
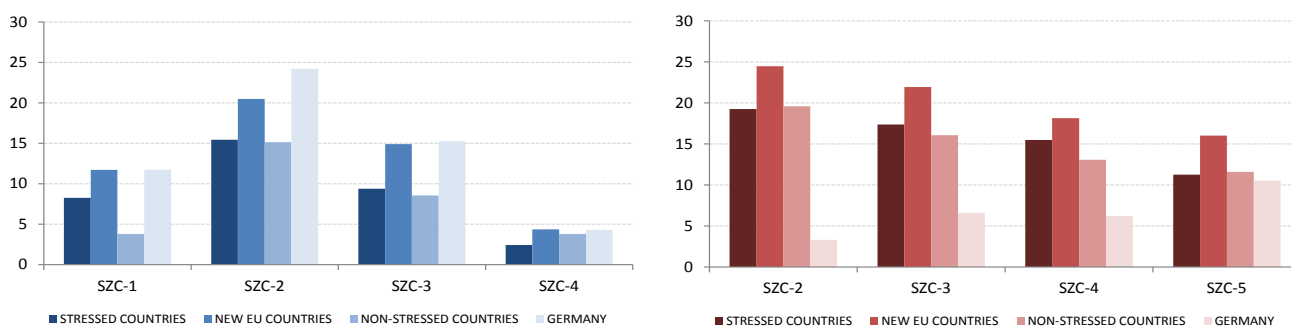


Note**:** Size-class dataset (full sample). SZC-1 refers to firms with 1-9 employees, SZC-2 refers to firms with 10-19 employees, SZC-3 refers to firms with 20-49 employees, SZC-4 refers to firms with 50-249 employees while SZC-5 refers to firms with and above 250 employees. Average over the pre-crisis windows 2000-2003 to 2005-2008.

Third, Figure B2.1 shows that, in line with the literature, (Gomez-Salvador et al 2004 and Neumark et al 2011), the proportion of small firms growing, especially those between 10-19 employees, is higher than the proportion of large firms growing. Lastly, the probability of shrinking is much higher for small firms, which is also a stylized finding in the literature given that young firms start small and exit or shrink after learning about their true productivity (see for example Jovanovic 1982).

[1] Note that the message from Figure B2.1 could differ from the one obtained in Figure 1 because the definition of firm growth is different. In Figure 1 any firm growing above a 3% in 3 years was considered as expanding and any firm reducing its workforce more than 3% was considered to be a shrinking firm. However, in the size-class dataset a firm is defined as expanding or shrinking if it jumps to another size-class.

By collapsing all categories of positive employment growth into one category of "expanding firms", Figure 4 shows how the share of shrinking and expanding firms evolved over time in each country group.[25] During the pre-crisis period, firm dynamics appears fairly stable, with the proportion of both expanding and shrinking firms broadly constant up to 2008; a notable exception is Germany, where job creation rocketed from 2002 onwards (possibly as a result of the Hartz Reforms implemented between 2002 and 2005). As expected, in most countries this pattern changes dramatically during the Great Recession, with economies under stress experiencing a marked increase in the proportion of shrinking firms, from 32% on average before the crisis to 50% during the crisis period. A similar development was observed in new EU Member States, where job destruction occurred in 40% of firms, compared to 28% in the previous period. The dramatic increase in the proportion of shrinking firms was at the cost of a strong reduction in the proportion of expanding firms. This is in line with the finding in Elsby et al. (2013) according to which unemployment variation in continental Europe is explained almost evenly by both the increase in rates of inflow to and outflow from unemployment.

[25] Regarding the impact of the crisis, a further clarification on the nature of the data is warranted. The share of shrinking and expanding firms is computed as the percentage of surviving firms, out of the total number of firms active in t and in t+3, with employment growth below or above -3% and 3% respectively. However, the number of firms in each of the three-year window may not be necessarily the same, as it will depend on the number of entries and exits between two different rolling windows. In the analysis above, we considered only the pre-crisis period during which the number of firms in each rolling window did not change substantially, so this was not a major issue. However, the comparison between the crisis and pre-crisis period could be affected by this feature of the data. The reason is that negative net entry will decrease the population of surviving firms (the denominator used to compute the share) relative to the pre-crisis period so the change in the share of shrinking and expanding firms will be overstated in the countries with massive exit (and/or drop of entry) of firms during the crisis.

**Figure 4: Share of firms that expand, shrink or remain of equal size over time**
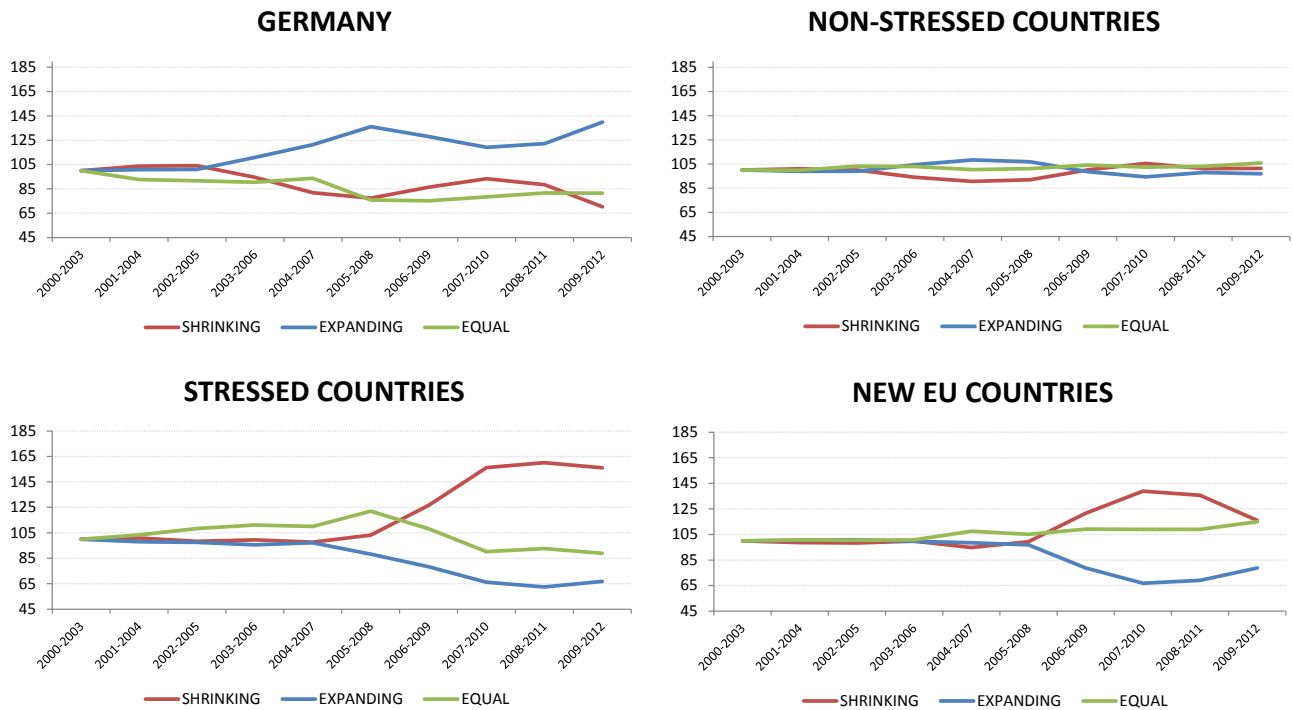


Note: Percentage growth dataset (full sample). Each chart shows the unweighted average of the included countries. Year 2000=100.

Importantly, whereas in new EU countries firm dynamics started already reverting in 2012, in stressed countries we do not observe any evidence of a recovery with a possible exception of Spain, where the share of shrinking firms started declining already over the last window of observations.[26]

Box 3 below provides more evidence on job creation and destruction over the cycle in the European countries.

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**Box 3: Dynamics of job creation and job destruction over the cycle**

There is a large strand of literature, initiated in the US by Davis and Haltiwanger in the early 1990s (see, for instance, Davis and Haltiwanger 1996), analysing gross job flows, i.e. jobs created and destroyed by firms at a given time. The reason is that gross job flows, rather than net
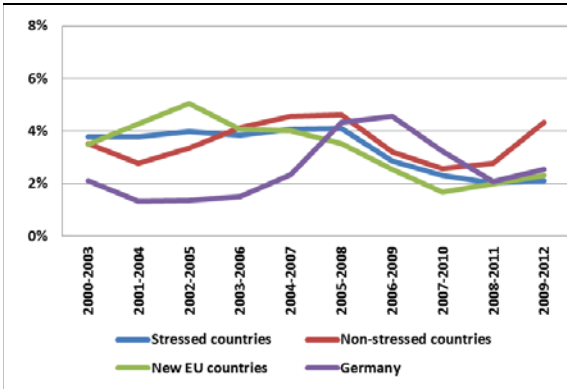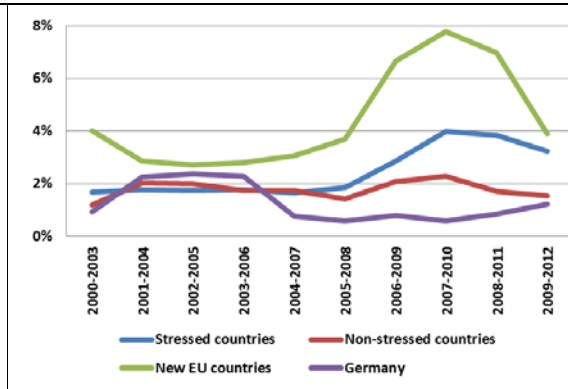
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[26] See country specific graphs in Annex5. Still, the drop in the share of shrinking firms observed over the last window (2009-2012) in Spain could actually be resulting from the massive exit of firms, which decreased the number of firms in the last rolling window relative to that in the previous one (2008-2011).

employment growth of firms, give an idea of the ability of an economy to reallocate resources of production across firms. The study of such reallocation, resulting from the entry and expansion, and exit and contraction of firms, over the cycle informs policy-makers about the margin of adjustment of an economy to aggregate shocks. Furthermore, we know now that the reallocation of resources from low to high productive firms in a given sector is an important driver of aggregate productivity growth (see Bartelsman et al. 2013).

Although gross job flows at the firm level are not computed in CompNet as yet, they can be approximated for every country, macro-sector and time window. The analysis of these flows, jointly with the other information provided by the labour module of CompNet, in a cross-country set up gives researchers a unique opportunity to identify the role of institutions and policies in preventing or fostering resource reallocation (see for example Bartelsman et al. 2017). The purpose of this box is to provide the reader with the tools required to construct job creation and destruction rates from the data in the CompNet labour module. Next, to illustrate the possible use of such flow data, we analyse whether reallocation is procyclical in Europe, as it is in the US, and whether the Great Recession was any different from earlier cycles in that respect.

*Measuring job creation and job destruction with CompNet data*

As it was detailed in section 2 of this paper, the quintile dataset provides information on the characteristics of firms in a given cell of a transition matrix. In each of those transition matrices we have 25 cells which can be identified as $q_{i,t}$-$q_{i,t+3}$, where $i$ is the quintile of the size distribution and $t$ is the initial year of the rolling window considered; i.e. $q_{1,t}$-$q_{2,t+3}$ would be the cell recording the number of firms in the first quintile (lowest) of the size distribution at $t$ able to move to the second quintile after three years. If we assume that the median firm in such a cell is a representative firm, we would know its initial size (and several other characteristics, as detailed in Table 4). With this information along with the information on the median size of (all) firms in $q_{i,t+3}$ we can approximate the employment growth of each of the 25 representative firms, in a given country, macro-sector and rolling window. Note that this is only an approximation because we use the median size of all firms, coming from different quintiles, at t+3 to compute the employment growth of firms in a given cell. Future vintages of CompNet data will include the median employment growth rate of firms in each cell of the transition matrices so there will be no need to approximate it. Job creation rates would be the weighted average employment growth rate of all representative firms with positive employment growth, where the weight is the share of the cell in the country/macro-sector and window employment. Similarly, job destruction rates would be the weighted average employment growth rate of all firms without positive employment growth. Figures B3.1 a-b shows the job creation and destruction rates by group of countries (stressed, non-stressed, new EU Member States and Germany).

| **Figure B3.1a: Job creation rates by country** | **Figure B3.1b: Job destruction rates by country** |
|---|---|
|  |  |
| Sources: Own calculation from the labour module of CompNet (full sample) | Sources: Own calculation from the labour module of CompNet (full sample) |
| Notes: The country aggregate job creation and destruction rate has been computed as the weighted average of sector – specific job flows, where the weight is the sector share in total value added. The country group average is than computed as an unweighted average across countries. | Notes: The country aggregate job creation and destruction rate has been computed as the weighted average of sector –specific job flows, where the weight is the sector share in total value added. The country group average is than computed as an unweighted average across countries. |

Figure B3.1 shows that, on average, job creation and destruction rates are about 4%, which is quite low, although one should remember that we have information only on incumbent firms, and only on net flows at the firm level. Focusing on the dynamics, while job creation flows moved quite similarly over time in all countries (with the exception of Germany), job destruction rates show marked differences. At the onset of the Great Recession, job destruction rates increased steeply in the new EU Member States and stressed euro area countries, whereas they were almost flat in non-stressed countries. This larger sensitivity of the job destruction margin to the cycle during the crisis, which was very different for these four groups of countries, is something well established in the literature (see for example Mortensen and Pissarides 1994) and is what drives the observed procyclicality of job reallocation (defined as the sum of job creation and destruction rates).[27]

*The dynamics of job flows over the Great Recession*

Interestingly, recent work in the US has uncovered that job reallocation, as defined above, has dropped over the Great Recession, relative to other cycles, resulting from a relatively larger drop

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[27] Elsby et al. (2013) find that fluctuations in both inflow and outflow rates contribute substantially to unemployment variation within countries. Anglo-Saxon economies exhibit approximately a 15:85 inflow-outflow split to unemployment variation, while continental European and Nordic countries display closer to a 45:55 split. According to Elsby et al. (2013), in all economies, increases in inflows lead increases in unemployment, whereas outflows lag a ramp-up in unemployment. The recent rise in unemployment has been associated more with rises in unemployment inflows in Continental European economies, and with declines in rates of outflow in Anglo-Saxon countries.

of job creation. Using the job flows from CompNet, we test whether this has been also the case in Europe by regressing the country-sector job creation and destruction rates, as well as their sum (the job reallocation), against an indicator of the sector-specific cyclical position (the inverse of the change in sector real value added, so an increase is an indicator of a bust) and its interaction with a Great Recession dummy (taking the value 1 in the window 2006-2009 and onwards). Results are shown in Table B3.1.

**Table B3.1: Job flows over the cycle**

|  | (1) | (2) | (3) |
|---|---|---|---|
| VARIABLES | JCR | JDR | REALL |
|  |  |  |  |
| cycle | -0.0735*** | 0.1721** | 0.0965 |
|  | (0.0276) | (0.0724) | (0.0684) |
| cycle*GR | 0.0042 | 0.1866* | 0.1869* |
|  | (0.0391) | (0.1011) | (0.0971) |
| Constant | 0.0182*** | 0.0234*** | 0.0415*** |
|  | (0.0021) | (0.0031) | (0.0034) |
|  |  |  |  |
| Observations | 14,652 | 14,671 | 14,620 |
| R-squared | 0.6395 | 0.7629 | 0.6937 |
| r2_a | 0.638 | 0.762 | 0.692 |

Robust standard errors in parentheses

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

Note: OLS pooled regression including country, sector, country*sector and year fixed effects

This very simple regression exercise shows that the job destruction rate is indeed more sensitive to the cycle, as suggested by Figure B3.1, resulting in marginally significant procyclical reallocation (the t-statistics is 1.41, which results in a p-value of 0.16). During the Great Recession, contrary to what has been found in the US, the job creation margin did not behave differently from previous busts whereas job destruction over-reacted compared to previous cycles. Hence reallocation of resources turned more procyclical during the Great Recession, contrary to what has been found in the US.
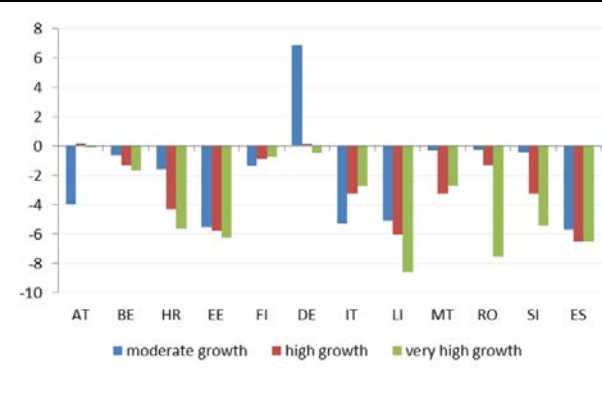
Some caution is needed when drawing conclusions from the results, though. First, more reallocation does not necessarily imply more cleansing. This only happens when reallocation goes from the low to the high productive firms, an aspect which is analysed in detail in Bartelsman et al. (2017). Second, we cannot assess whether the Great Recession is fundamentally different from earlier major recessions due to the relatively short time span, although the cycle indicator used in the regression is sector-specific and so it captures more booms and busts than what would be implied by aggregate data.

Figure 5 shows that the drop in the share of expanding firms during the crisis was not equal across all growth categories, which include moderate, high and very high growth firms. In most countries, the share of firms experiencing high growth rates dropped more than those growing moderately. There are some exceptions, namely Italy and Finland. While the analysis of the causes behind the very large drop of fast growing firms during the crisis is beyond the scope of this paper, Figure 6 suggests that they might be related to the extent to which credit constraints have been binding across growth categories.[28] The negative correlation between the change in credit constraints and the change in the share of firms in each growth category would indicate that the credit crunch may have affected fast growing firms to a larger extent. This could be due to the fact that these firms are the most innovative (in a broad sense, i.e. technological or managerial), risky and young. This is in line with the evidence shown in Haltiwanger et al. (2014) on the more than proportional impact of the crisis on job flows of young firms. Similarly, Gertler and Gilchrist (1994) and Sharpe (1994) have shown that small firms (more prevalent in the high growth classes) respond more to financial and monetary policy shocks.[29]

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[28] The share of credit constrained firms in each of the growth categories has been calculated in CompNet using a similar methodology as in the White-Wu indicator. Very roughly, it predicts the probability one particular firm will be credit constrained given its financial position using the elasticities estimated after merging data from the firms sampled by the ECB SAFE survey and AMADEUS (Bureau van Dijk). A summary of the methodology can be found in Annex 7. For more detailed information, please refer to Ferrando et al. (2015).
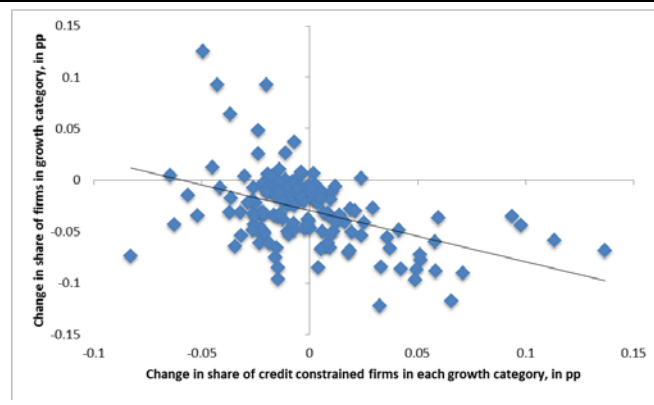
[29] However, some controversy prevails in this area. Moscarini and Postel-Vinay (2012) study the contribution of large and small businesses to job creation in times of high and low unemployment. Exploiting data for the US, Canada, Denmark and France, they document a negative correlation between the net job creation rate of large employers and the level of aggregate unemployment that is much stronger than for small employers. The results are not only due to entry and exit patterns of small and large employers, but hold also for continuing establishments.

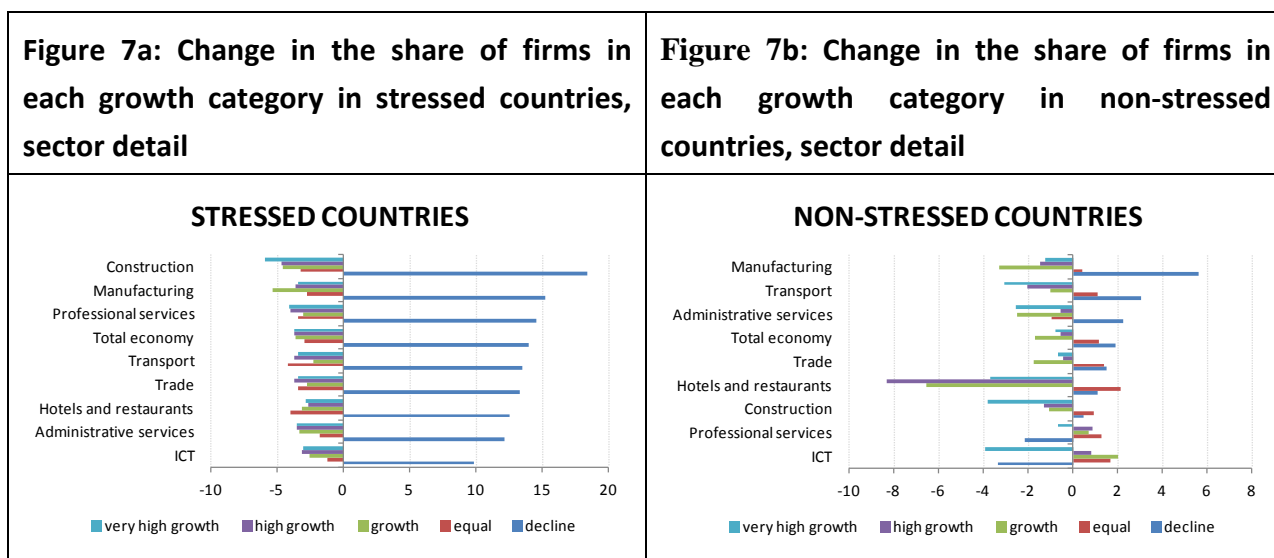| **Figure 5: Change of share of firms in different growth categories, crisis vs. pre-crisis (in pp)** | **Figure 6: Correlation between the change in share of firms and change in mean credit constraints in each growth category** |
| --- | --- |
|  |  |
| Note**:** Percentage growth dataset (full sample), country detail. | Note: Percentage growth dataset (full sample), with macro-sector information. The mean exposure to credit constraints is measured by the CompNet Indicator of Credit Constraints (see Ferrando et al. 2015 and Annex 7 for more details), which is available for each country/macro-sector/window and growth category. |

Figure 7 (panels a-b) explores the sector-specific impact of the Great Recession. The figure displays the difference (in percentage points) in the share of firms growing at different paces during the crisis period relative to the pre-crisis period. In economies under stress the proportion of shrinking firms raised by more than 10pp in almost all sectors, particularly in construction and manufacturing. Conversely, information and communication turned out to be the least affected by the crisis.[30] The impact of the crisis was more heterogeneous in non-stressed countries, where the hardest hit sectors were manufacturing and transportation and storage. While the proportion of firms with high and very high growth experienced a sharp fall in the accommodation and food industry, the share of shrinking firms did not change as much.

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[30] It should be noted, however, that the labour module of the CompNet dataset does not allow capturing firm exit, which might bias the picture.

| Figure 7a: Change in the share of firms in each growth category in stressed countries, sector detail | Figure 7b: Change in the share of firms in each growth category in non-stressed countries, sector detail |
|---|---|



Source: CompNet's Labour Module, percentage growth dataset (full sample)

## 4. Possible drivers of firms' growth: a preliminary overview

### 4.1 Which firms expand? A brief glance at the literature and some descriptives

The previous sections have shown that countries' aggregate employment performance is a result of largely heterogeneous dynamics across firms with different initial size and sector, among others. This section goes a step further, presenting selected stylized facts based on the relationship between firms' growth and a number of key variables which the literature has indicated as affecting firm dynamics. Among them, productivity has been found to be an important driver of firm expansion. The issue is studied, amongst others, in the cross-country study by OECD (2009), which uses firm-level data for a sample of countries including Belgium, Denmark, France, Italy, Japan, Poland, Spain, Sweden, the UK and the USA over 2000-2006. The evidence therein suggests that less productive firms appear to destroy jobs and that more productive firms create jobs in essentially all countries for which data are available. Labour reallocation appears thus to contribute positively to productivity growth. Another feature documented in OECD (2009) is that labour and capital adjustments go hand-in-hand: employment growth (or firm expansion) tends to be larger in firms that are investing in new capital equipment. Apart from investment, other financial factors ranging from liquidity constraints to access to external finance and foreign markets have been found to bear an impact on firms' capacity to grow. Well-functioning financial markets can mitigate problems of moral

hazard and adverse selection by reducing the costs of raising money from outsiders (Beck and Demirguc-Kunt 2006). This is particularly relevant for small firms that can rely less on internal resources. For example, Fazzari et al. (1988) and Gilchrist and Himmelberg (1995) argue that small and young firms are generally more sensitive to liquidity constraints than others. Aghion et al. (2007) use harmonized firm-level data for sixteen industrialized and emerging countries to show that availability of credit is important for entry by small firms and their subsequent expansion. Bartelsman et al. (2005) also find that post-entry growth is importantly affected by country-specific environmental factors such as access to finance on top of broad regulatory frameworks and labour market institutions.

Consistent with this literature, this section explores whether productivity, unit labour cost, investment and other indicators of the financial position of the firm are associated with firms' growth, with particular emphasis on their role during the crisis. The CompNet database is a promising source of information in this respect (covering also high-growth firms, see Box 4); as already mentioned, it provides information on the median value of those characteristics for all firms in a country, sector and growth category (of the percentage growth dataset) at the beginning of each of the three-year window considered. Hence, throughout this section, employment growth is defined according to the criteria set out in section 2 above, i.e. in terms of cumulative percentage growth over three-year periods.

Figure 8 shows the median values of selected characteristics at time *t* (that is, before the recorded growth episode) for manufacturing firms that expanded or shrunk in terms of employment over the following three years.[31] It emerges that, compared to shrinking firms, expanding firms are relatively more productive, which in turn explains their relatively lower unit labour costs and higher profit margins. Furthermore, firms expanding were, on average, investing the most (although in countries under stress investment contracted sharply in both growing and shrinking firms). This evidence is consistent with OECD (2009) as well as with Bartelsman et al. (2017), showing that across all countries firm employment growth is positively correlated with the initial productivity of the firm.

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[31] We show manufacturing firms in the descriptive evidence because not all sectors are equally well covered in CompNet and, without controlling for that, it could bias the unconditional charts. However, in the regression analysis of the next sub-section, which includes appropriate controls, all non-financial sectors will be considered.

**Figure 8: Characteristics of expanding and shrinking firms: Manufacturing sector.**

Non-stressed EA countries                    Stressed EA countries
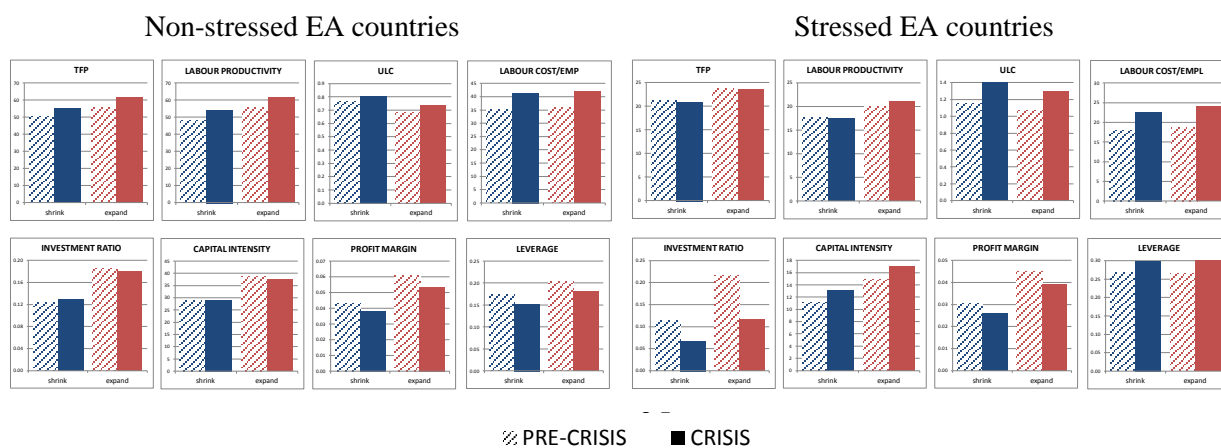


☒ PRE-CRISIS   ■ CRISIS

Note: Percentage growth dataset, full sample. Medians weighted by the number of firms within each country, equal weights applied to countries. Pre-crisis period refers to transitions from 2000-2003 until 2005-2008 and crisis period covers 2008-2011 and 2009-2012. Information on financial variables is missing for several countries: leverage (AT, ES), profit margin (AT), investment ratio (AT, IT).

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**Box 4.1: A descriptive analysis of high-growth firms in Europe**

**Table B4.1: Share of high-growth firms**

It has been documented in the literature that most new jobs are created by a small number of high-growth firms (henceforth, HGFs). However, the lack of a harmonised definition across studies in different countries, or of sufficient information on these firms' characteristics, explains how little we know about them, at least in Europe. For this reason, the growth categories in the CompNet percentage growth dataset include the very high growth category, defined as firms with average annual employment growth above 20%, for a period of 3 years, similar to the definition adopted by the OECD.

Note, however, that the OECD requires firms to have at least 10 employees at the beginning of the growing period, whereas, given that we use the 20E sample for the exercise in this box, we require firms to have at least 20 employees.

According to the CompNet database, before the crisis the share of HGFs ranged from 2.6% in Austria to

12.8% in Romania (Table B4.1). The share of HGFs was the highest among new EU member states, which is consistent with the evidence shown before, with a weighted average of 9.6%, while mature euro area economies showed both lower prevalence rate, with a weighted average of 4.1%, and lower cross-country variation. The share of HGFs declined in all countries during the crisis, although at a more pronounced rate in the new EU member states. As a result, the difference between the new and old EU member states largely disappeared during the crisis (averaging to 4.9% and 3.2%, respectively).[32] HGFs are present in all the three major sectors with the highest share among service firms, in line with the evidence in Henreksson and Johansson (2010). Table B4.2 allows comparing the characteristics of HGFs with firms that shrunk or expand at a lower rate. In particular, it provides relative values with respect to the category of firms whose size remained unchanged, before and during the crisis. The main message emerging from section 4.1 holds – i.e. firms that are more likely to expand than to shrink are those with higher initial productivity, lower ULC, and a higher investment ratio.

Table B4.2 shows that whereas in non-stressed euro area countries HGFs are substantially more productive compared to the rest of firms, in countries under stress the initial level of labour productivity does not seem to play such an important role in determining the ability of firms to become HGFs, suggesting potential distortions in the allocation of resources. This result holds for all the main sectors over the entire period. On the other hand, HGFs in stressed countries have higher TFP than other firms, although the difference is not as high as in non-stressed countries.

Note that HGFs have substantially higher initial labour costs per employee than the remaining growing firms in non-stressed countries, while the opposite is true in the stressed countries. This could suggest, on average, different growth pattern of firms in stressed and non-stressed countries based on lower labour costs in the former and on better compensated employees with higher human capital and productivity in the latter. Despite higher labour costs in non-stressed countries, HGFs have the lowest initial ULC among the groups of firms considered even though the difference with respect to the remaining growing firms is small in some cases. Investment ratios of HGFs are substantially higher than in the remaining growing firms which might explain the lower profit margin of HGFs.

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[32] Table B4.1 also shows the shares of HGFs reported by Hoffman and Junge (2006). The numbers reported by Hoffman and Junge (2006) are much lower than those obtained in the CompNet dataset. This could be related to differences in the dataset, definition and time coverage. In particular, Hoffman and Junge (2006) define HGFs as firms with 15-200 employees increasing their employment by more than 60% over two years with a minimum annual growth of 20%. This is more restrictive than the CompNet definition. Moreover, the coverage of the dataset used in Hoffman and Junge (2006) varies substantially across countries (and years) and it appears to be skewed towards larger companies. Finally, Hoffman and Junge (2006) consider the following two-year periods: 1999-2001, 2000-2002 and 2001-2003.

Despite figures in Hoffman and Junge (2006) being much lower than those resulting from the Labour Module, some common patterns emerge in terms of countries' relative position. Using the same definition as Hoffman and Junge (2006) but administrative balance sheet data for Spain, Lopez-García and Puente (2012) find a higher share of HGFs for Spain (3.2%) which appears to be just between the CompNet figure and the estimate by Hoffman and Junge (2006).

**Table B4.2: Characteristics of high-growth firms**

| | Non-stressed euro area countries | | | | Stressed euro area countries | | | |
|---|---|---|---|---|---|---|---|---|
| | shrink | same | expand | HGFs | shrink | same | expand | HGFs |
| **Pre-crisis (2000-2005)** | | | | | | | | |
| Labour productivity | 0.939 | 1 | 1.042 | 1.233 | 0.913 | 1 | 1.042 | 1.056 |
| TFP | 1.031 | 1 | 1.025 | 1.133 | 0.993 | 1 | 1.012 | 1.059 |
| Unit labour costs | 1.064 | 1 | 0.987 | 0.928 | 1.032 | 1 | 0.946 | 0.887 |
| Labour cost / empl. | 1.000 | 1 | 1.046 | 1.142 | 0.941 | 1 | 1.004 | 0.977 |
| Investment ratio | 0.974 | 1 | 1.195 | 1.651 | 0.909 | 1 | 1.181 | 1.703 |
| Capital-labour ratio | 0.913 | 1 | 0.855 | 1.020 | 0.846 | 1 | 0.992 | 1.340 |
| Profit margin | 0.672 | 1 | 1.081 | 0.919 | 0.659 | 1 | 1.145 | 0.989 |
| Leverage | 1.037 | 1 | 1.010 | 0.951 | 1.042 | 1 | 1.040 | 1.041 |
| No. of employees | 1.263 | 1 | 0.812 | 0.574 | 0.973 | 1 | 0.747 | 0.573 |
| | | | | | | | | |
| **Crisis (2008-2009)** | | | | | | | | |
| Labour productivity | 0.981 | 1 | 1.046 | 1.152 | 0.890 | 1 | 1.012 | 0.987 |
| TFP | 0.997 | 1 | 1.019 | 1.148 | 0.983 | 1 | 1.007 | 1.026 |
| Unit labour costs | 1.052 | 1 | 0.985 | 0.920 | 1.090 | 1 | 1.001 | 0.948 |
| Labour cost / empl. | 1.007 | 1 | 1.019 | 1.177 | 0.950 | 1 | 0.984 | 0.918 |
| Investment ratio | 0.990 | 1 | 1.165 | 1.576 | 0.992 | 1 | 1.158 | 1.474 |
| Capital-labour ratio | 0.725 | 1 | 0.844 | 1.455 | 0.913 | 1 | 0.984 | 0.924 |
| Profit margin | 0.700 | 1 | 1.062 | 0.958 | 0.616 | 1 | 1.020 | 0.781 |
| Leverage | 1.013 | 1 | 1.003 | 0.969 | 1.055 | 1 | 1.054 | 1.028 |
| No. of employees | 1.158 | 1 | 0.856 | 0.538 | 1.139 | 1 | 0.953 | 0.681 |

Notes: Percentage growth dataset, firms with 20 and more employees. Averages weighted by the number of firms within each country, equal weights applied to countries. Rescaled TFP to ensure cross-country comparability. Leverage is not available for Spain. Pre-crisis period refers to transitions from 2000-2003 until 2005-2008 and crisis period covers 2008-2011 and 2009-2012. Non-stressed euro area countries include Austria, Belgium, Finland, France and Germany. Stressed euro area countries are Italy, Spain and Slovenia.

## 4.2 Determinants of firm growth: an econometric analysis

In this section we explore parametrically the link between the probability of firm growth and the set of explanatory variables discussed above. Note that we do not claim any causality given that endogeneity issues might be at play (between growth and productivity, for example) for which a more thorough analysis would be needed. That being said, the correlations shown appear rather promising and suggestive of further avenues for research.

Based on the full sample of firms with at least one employee, we construct a panel of 11 countries,[33] 9 macro-sectors covering the whole non-financial private economy, excluding utilities and mining and agriculture,[34] and 10 rolling windows.[35] Although section 2 showed that coverage of this sample varies across countries – warranting some caution in the interpretation of results - the inclusion of controls in the regression reduces the possible biases. Our dependent variable $y_{it}$ is equal to 1 if firm $i$ expanded employment between $t$ and $t+3$, and zero if it shrunk. While using the percentage growth dataset, we define expanding firms as those whose average annual employment growth over the three year period exceeded 1%. Formally,

$$y_{it} = \begin{cases} 1 & if\ E_{it+3} > 1.03E_i \\ 0 & if\ E_{it+3} < 0.97E_i \end{cases} \tag{1}$$

We denote the unobserved propensity of firms to grow by $y^*$ and estimate the following probit model

$$y_{it}^* = \alpha + \beta_1 x_{it1} + \ ... + \beta_k x_{itk} + \varepsilon_{it} \tag{2}$$
$$y_{it} = \begin{cases} 1 & if\ y_{it}^* > 0 \\ 0 & otherwise \end{cases}$$

where $x_{itk}$ is the $k^{th}$ explanatory variable and the errors $\varepsilon_{it}$ are normally distributed.

The econometric exercise is structured in two steps. We first estimate a simplified probit specification, in which the probability of growing is regressed on basic variables considered in the literature as important drivers of firm growth: the initial relative total factor productivity (relative to the sector-country-year average), initial labour costs per employee (again in relative terms), initial firm's size and initial relative capital-labour ratio to control for country, sector (and time) differences in capital intensity as job creation depends on choices concerning how to produce. We also include sector-specific real value added growth to control for differences in the business cycle across sectors and countries, a crisis dummy (equal to 1 for the window 2006-2009 and onwards) and a full set of country and sector dummies.[36] In the second step, the specification is enriched by adding a set of financial variables which, according to the literature, might play a particularly important role in explaining firm growth, namely initial profit margin, investment and leverage. Initial profit margin (profit or loss over turnover) is included as a proxy

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[33] Austria, Belgium, Finland, Germany, Italy, Portugal, Spain, Estonia, Lithuania, Romania and Slovenia.

[34] Manufacturing, construction, wholesale and retail trade, hotels and restaurants, ICT, transport and storage, real state, professional activities and administrative and support services.

[35] The first rolling window starts in 2000 and the last one ends in 2012. We exclude data prior to 2000 due to the uneven data availability across countries.

[36] The percentage growth dataset does not allow us to control for the initial age of the firm.

for the availability of internal finance and a determinant of access to external finance. Leverage (measured as debt over total assets) can hamper employment growth as highly leveraged firms might find it hard to attract external finance (Öztürk and Mrkaic 2014). Finally, the initial investment ratio (defined as the relative increase in the capital stock) controls for the link between investment and employment growth (OECD 2009).[37]

Table 5 shows the results of the baseline specification estimated for non-stressed euro area countries, all euro area countries and all countries in the sample (i.e. euro area plus Romania and Lithuania).[38] Columns 1-3 show the baseline specification whereas columns 4-6 interact the continuous explanatory variables of the model with the crisis dummy to explore whether these correlations changed during the crisis.

As suggested by Figure 8 above, firms' growth is positively and significantly correlated with initial productivity even after controlling for capital intensity and other factors. This positive link is significant in all country groups, which suggests that although the institutional framework of a country might have an effect on the magnitude of the elasticity of employment growth to initial productivity, reallocation is likely to be productivity-enhancing. This consistency across countries is also found in Bartelsman et al. (2017).[39]

Table 5 also shows that larger firms are less likely to grow, *all else equal*. This finding is in line with the results presented in section 3 as well as with most of the findings in the literature and is possibly related to obvious material constraints to expansion. Moreover, it appears that capital intensive firms are *ceteris paribus* more likely to grow. The negative crisis dummies in columns (1) to (3) suggest that, *all else equal*, firms were less likely to expand during the Great Recession.

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[37] For more details on the definition of the financial indicators, please refer to Ferrando et al. (2015). The financial variables and size do not enter relative to the sector-country-year average (unlike productivity, labour costs per worker and capital-labour ratio) because models with this specification did not converge.

[38] Note that the dataset goes until 2012 when Lithuania was not a member of the euro area yet. Furthermore, we do not report separate models for stressed countries or new EU member states because these models often did not converge, possibly due to heterogeneity among the countries covered.

[39] In addition, Bartelsman et al. (2017) consider explicitly the role of selected labour and product market institutions in hampering or fostering the efficient allocation of labour across firms. They find that markets more exposed to stringent regulations feature on average a weaker (although still significant) link between firms' employment growth and productivity. The reason is that when product regulation is very restrictive, unproductive firms have larger probabilities of surviving (or not shrinking), which means that they hold on to productive resources. At the same time, when labour regulation is strict, productive firms might find difficulties in attracting production resources to expand. It could also be the case that in markets heavily regulated productive firms prefer to stay small (or in any case below the threshold after which regulation applies), as shown by Garicano et al (2013) in their analysis for France or by Marzinotto and Wintr (2016) using the CompNet dataset.

Interestingly, the effect of productivity on firm growth became weaker during the crisis suggesting that the process of productivity-enhancing reallocation was muted in these countries, even though the effect is statistically significant only for non-stressed euro area countries. The muted reallocation during the crisis is consistent with the findings of Foster et al. (2014) for the US and Bartelsman et al. (2017) for the euro area.[40] Both papers find that in contrast to previous recessions, the intensity of productivity enhancing reallocation fell during the Great Recession relatively to previous busts. This could be related to distortions to reallocation dynamics specific to the Great Recession, such as impairments to credit markets.

**Table 5: Probit model without financial variables, marginal effects at means**

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
|  |  |  | Non- |  |  | Non- |
|  | ALL | EA | stressed EA | ALL | EA | stressed EA |
| ln (relative TFP) | 9.40** | 9.24** | 7.41** | 12.06** | 11.70** | 15.35** |
|  | (2.230) | (2.363) | (2.228) | (1.824) | (1.648) | (2.384) |
| Crisis * ln (rel. TFP) |  |  |  | -3.14 | -2.81 | -10.57** |
|  |  |  |  | (3.084) | (3.426) | (3.547) |
| ln (relative LC/L) | 3.39* | 3.90* | 7.39** | 6.41** | 6.70** | 31.07** |
|  | (1.370) | (1.569) | (2.427) | (2.281) | (2.498) | (5.830) |
| Crisis * ln (rel. LC/L) |  |  |  | -5.67* | -5.23+ | -25.13** |
|  |  |  |  | (2.670) | (2.867) | (6.039) |
| ln (rel. K/L) | 2.50** | 2.47** | 3.85** | 3.65** | 3.75** | 5.67** |
|  | (0.887) | (0.883) | (0.821) | (0.789) | (0.835) | (1.450) |
| Crisis* ln (rel. K/L) |  |  |  | -2.02** | -2.18** | 0.28 |
|  |  |  |  | (0.554) | (0.583) | (1.456) |
| VA growth | 0.04 | 0.04 | 0.03 | -0.04 | -0.06 | 0.04 |
|  | (0.028) | (0.029) | (0.029) | (0.048) | (0.047) | (0.100) |
| Crisis * VA growth |  |  |  | 0.13 | 0.18+ | 0.08 |
|  |  |  |  | (0.084) | (0.093) | (0.120) |
| ln (Size) | -1.84** | -1.80** | -1.86** | -2.29** | -2.30** | -3.18** |
|  | (0.255) | (0.262) | (0.377) | (0.258) | (0.263) | (0.494) |
| Crisis * ln (Size) |  |  |  | 0.07 | 0.06 | 0.13* |
|  |  |  |  | (0.056) | (0.053) | (0.059) |
| Crisis | -0.24** | -0.20* | -0.20+ | -0.08 | 0.10 | -0.25 |
|  | (0.083) | (0.083) | (0.102) | (0.234) | (0.256) | (0.402) |
| Country dummies | YES | YES | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES | YES | YES |
| Observations | 997 | 883 | 495 | 997 | 883 | 495 |
| Pseudo $R^2$ | 0.89 | 0.89 | 0.90 | 0.91 | 0.90 | 0.94 |

Note: ** p<0.01, * p<0.05, + p<0.1. Standard errors in parentheses Percentage growth dataset, full sample. "Non-stressed euro area countries" include Austria, Belgium, Estonia, Finland and Germany. Euro area countries (EA) include non-stressed EA countries and Italy, Portugal, Slovenia and Spain. All countries also include Lithuania and Romania.

[40] It should be noted that our result compare the Great Recession with the pre-crisis period while the literature compares the Great Recession with previous recessions.

In Table 6 we extend the baseline model with additional regressors from the financial module of the CompNet dataset – namely the profit margin, the investment ratio and firm leverage. Results appear broadly consistent with those reported in Table 5. Caution is warranted in interpreting the coefficients due to the reduced number of observations (the sample now excludes Austria and Romania for which financial variables are not available). As expected, results suggest that, *all else equal*, a higher investment ratio increases the subsequent likelihood of firms' growth. The effect is significantly weaker during the crisis, even though it remains positive. In the pre-crisis period higher initial profitability *ceteris paribus* increases the likelihood of firms' growth as these firms might be less dependent on external finance. However, initial profitability has no significant impact on growth during the crisis. Finally, changes in leverage do not have a significant impact on the probability of firm growth. This could be related to the non-linear effects of leverage: debt financing supports growth when leverage is low (typically in the new member states) but it can be detrimental among over indebted firms (see for example Rajan and Zingales 1996, Barlevy 2000). [41]

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[41] We have run several robustness checks which confirm that the qualitative results are robust across a range of specifications.The qualitative results presented in Tables 5 and 6 are robust to exclusion of individual countries and observations, to various restrictions on the sample period, using labour productivity instead of TFP, including interactions between the country, sector and year dummies and some non-linear specifications.

**Table 6: Probit model with financial variables, marginal effects at means**

| | (1) ALL | (2) EA | (3) ALL | (4) EA |
|---|---|---|---|---|
| ln (relative TFP) | 8.36* | 7.72* | 33.94** | 27.73** |
| | (3.535) | (3.380) | (4.700) | (8.731) |
| Crisis * ln (rel. TFP) | | | -25.90** | -22.43** |
| | | | (3.605) | (6.512) |
| ln (relative LC/L) | 3.06* | 3.19** | 10.89** | 5.05+ |
| | (1.347) | (1.178) | (3.591) | (2.842) |
| Crisis * ln (rel. LC/L) | | | -7.09+ | 1.25 |
| | | | (4.151) | (4.751) |
| ln (rel. K/L) | 2.42** | 2.29** | 10.63** | 7.16** |
| | (0.893) | (0.846) | (2.044) | (2.749) |
| Crisis* ln (rel. K/L) | | | -8.44** | -5.19* |
| | | | (1.970) | (2.502) |
| VA growth | 0.09* | 0.11** | -0.64** | -0.53* |
| | (0.040) | (0.038) | (0.173) | (0.250) |
| Crisis * VA growth | | | 0.84** | 0.82* |
| | | | (0.236) | (0.356) |
| ln (Size) | -1.95** | -1.97** | -4.45** | -3.75** |
| | (0.283) | (0.282) | (0.826) | (1.287) |
| Crisis * ln (Size) | | | 0.40 | 0.39* |
| | | | (0.329) | (0.183) |
| ln (Profit margin) | 0.22 | 0.22 | 4.29** | 3.56** |
| | (0.142) | (0.174) | (0.597) | (1.133) |
| Crisis * ln (Profit m.) | | | -4.43** | -3.60** |
| | | | (0.667) | (1.307) |
| ln (Investment ratio) | 0.77** | 1.05** | 2.64** | 3.46** |
| | (0.132) | (0.165) | (0.407) | (1.049) |
| Crisis * ln (Investment r.) | | | -1.75** | -2.21** |
| | | | (0.344) | (0.742) |
| ln (Leverage) | 0.07 | 0.02 | -0.02 | 0.03 |
| | (0.161) | (0.179) | (0.672) | (0.356) |
| Crisis * ln (Leverage) | | | -0.00 | -0.08 |
| | | | (0.639) | (0.315) |
| Crisis | -0.11 | 0.01 | -15.56** | -13.38** |
| | (0.110) | (0.114) | (2.901) | (4.534) |
| Country dummies | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES |
| Observations | 678 | 643 | 678 | 643 |
| Pseudo $R^2$ | 0.91 | 0.91 | 0.95 | 0.95 |

Note: ** p<0.01, * p<0.05, + p<0.1. Standard errors in parentheses Percentage growth dataset, full sample. Euro area countries in the sample include Belgium, Estonia, Finland, Germany, Italy, Portugal, Slovenia and Spain. "All" countries include euro area countries and Lithuania.

# 5. Conclusions and avenues for future research

The availability of firm-level data has enhanced the understanding of many issues related to e.g. macroeconomic dynamics, employment, productivity or innovation, but to some extent empirical research has been constrained by the lack of pooled harmonised cross-country micro-based data. The Labour Module of the CompNet dataset provides comparable data on firm growth dynamics in 17 EU (13 euro area) countries and 9 macro-sectors over 1995-2012, thereby representing a valuable source of information for researchers interested in advancing the analysis of the impact of the Great Recession on firms' employment and productivity performance.

To summarise, the CompNet Labour Module offers the following value added. First, it contains information on transitions of firms from one size class to another over a three-year period. This set of indicators is suited for assessing threshold effects in firm growth, as, for example, in the case of countries that have size-contingent employment protection legislation that is binding only for some size classes.[42] Second, it defines transition as a move from one size quintile to another, bypassing one of the weaknesses of the size-class dataset, namely the fact that some size classes are in fact relatively large, with the result that firm dynamics are easily underestimated. The quintile dataset is more suitable to study the determinants of growth in small and medium-sized firms as well as in countries where the proportion of micro and small firms is largest. Third, it offers data on the relative growth of firms, which is defined in line with common practice as growth rates within certain intervals. The percentage growth dataset is suitable for instance to study the performance of high-growth firms.

The stylised facts that emerge from the analysis of data from the Labour Module provide information on patterns and determinants of firm growth before and during the Great Recession. Main findings can be summarised as follows. Prior to the crisis, the share of growing firms was larger, across the board, than that of shrinking firms, [43] with the new Member States being generally more dynamic on this front than the old Member States. The data also indicate that there is not much cross-sector variation, at least in the pre-crisis period. The Great Recession came with a sharp increase in the share of firms shrinking in stressed countries and with a slowdown in firm growth in the non-stressed countries. In the former,

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[42] The issue is being studied in Marzinotto and Wintr (forthcoming).

[43] Still, this result might be biased by the fact that CompNet dataset does not capture firm destruction and creation.

the construction sector has suffered the most, while in the latter it was mainly manufacturing and services related to transportation and storage, possibly reflecting the Great Trade Collapse that affected external sectors of non-stressed countries.

Results from the analysis of the determinants of firm growth are comforting in that they are largely in line with expectations and with the existing literature. We found that, all else equal, more productive firms have a higher probability of growing than less productive ones. At the same time, we find that the process of productivity-enhancing reallocation was muted during the crisis. Capital intensive firms are more likely to grow, while larger firms are less likely to expand, which may reflect material constraints to expansion after reaching a certain size. Finally, the data indicate that a higher investment ratio and profitability (in the pre-crisis period) have a positive impact on firm growth, a result that alludes to the fact that being less dependent on external finance increases the probability that a firm can hire additional employees.

Future research avenues include issues such as whether the traded sector's firm size distribution relative to that of the non-traded sector affects the rebalancing process and in what direction; whether not only labour market regulation but also product market regulation in interaction with hiring and firing costs play a role in the process of job creation and destruction; whether access to finance is alternative or complementary to adjustment via the labour market over the cycle, etc. Additionally, there is room for exploiting synergies with other datasets. Data from the Labour Module have been merged with the ECB Wage Dynamics Network (WDN) survey data to determine whether the type and degree of collective bargaining centralization bear an impact on firm dynamics. The WDN contains additional information that could open up additional avenues for research, including the impact of recent structural reforms on job reallocation and the factors conditioning the choice between adjusting prices rather than quantities, especially during the crisis.

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## Annex 1: CompNet data coverage and sector detail

The first column of Table A.1.1 below provides information on the possible existence of any selection criterion in the sampling of firms which could bias the sample. The second column shows the coverage, in terms of number of firms and employment, of each sample vis-à-vis the population of firms (of legal firms with employees, operating in the same sectors and years as in CompNet). The third column shows the coverage of the total economy, comparing the micro-based aggregates of value added and employment with those of the National Accounts. Finally, the last column of the table shows the specific sectors excluded in each country. The default is that countries cover all non-financial business industries, with the exception – for technical reasons – of mining and agriculture, manufacture of petroleum and coke and utilities (Table A.1.2 below shows the list of 2-digit and 1-digit industries covered by CompNet). In some countries, two-digit industries are not covered due to confidentiality reasons.

**Table A1.1: Coverage of CompNet data**[44]

| Country | Is there any selection criterion to include firms in the sample? | Coverage vis-a-vis population of firms [1/] | | Coverage vis-a-vis National Accounts [2/] | | Time and sector coverage | |
|---|---|---|---|---|---|---|---|
| | | No. of firms | Employment | VA | Employment | Sample period | Sectors excluded (deviations from default) |
| Austria | firms obliged to report to the OeNB [3/] | 1% | 29% | 20% | - | 2000-2012 | 12, 50, 53, 60, 75, 80 |
| Belgium | none | 31% | 76% | 49% | 39% | 1996-2010 | none |
| Croatia | none | 32% | 36% | - | 46% | 2002-2012 | 12 |
| Estonia | none | 73% | 95% | 25% | 56% | 1995-2012 | 12 |
| Finland | none | 48% | 96% | - | 45% | 1999-2012 | 12, 68 |
| France | turnover >750,000€ | 7% | 58% | 42% | 34% | 1995-2012 | 12 |
| Germany | firms applying for a rating[3/] | 3% | 41% | 32% | 20% | 1997-2012 | 12, 55, 56, 63, 68, 75, 77-82 |
| Hungary | none | 44% | 88% | 20% | 50% | 2003-2012 | 12 |
| Italy | LLCs with employees | 10% | 53% | 27% | 30% | 2001-2012 | none |
| Lithuania | Excluded a few very large firms for confidentiality reasons | 27% | 43% | 20% | 46% | 2000-2012 | 12 |
| Malta | Only firms with more than 5 employees included | - | - | 7% | 24% | 2003-2011 | 12, 13, 15, 24, 29, 30, 45-47, 49-53, 63, 68, 75 |
| Poland [4/] | Only firms with more than 9 employees included | 77% | 80% | 15% | 24% | 2005-2012 | 75 |
| Portugal | none | 30% | 80% | 40% | 45% | 2006-2012 | none |
| Romania | none | 70% | 47% | 29% | 37% | 2003-2012 | 53 |
| Slovakia [4/] | Only firms with more than 19 employees, or total assets>5M.€ | 91% | 95% | - | 29% | 2001-2011 | 12, 50, 51, 53, 59, 60, 65 |
| Slovenia | none | 31% | 85% | - | 46% | 1995-2012 | 12 |
| Spain | none | 19% | 47% | 25% | 32% | 1995-2012 | none |

1/ Source of reference: OECD – Structural Business Statistics; averages over 2004-2007, except for Latvia (2005-2007) and Portugal (2006-2007).
2/ Source of reference: Eurostat – National Accounts Series; coverage computed for 2005, except for Portugal (2006).
3/ See details in Annex 1 of Lopez-Garcia et al. (2015). In both cases this selection results in a significant overrepresentation of large firms for a variety of reasons.
4/ Coverage computed over the population of firms with 20 or more employees.

There are three countries with important exclusion rules, based on firm size (Poland), turnover (France) or a combination of both. Hence, those three countries are included only in the 20E sample that is, in the database covering only firms with at least 20 employees.[45] On top of that, Malta dropped from the sample firms with less than 5 employees so its full

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[44] Data coverage computed after treating and cleaning CompNet data.

[45] Note that reported coverage in Table A1 for those 3 countries refer to the population of firms with at least 20 employees.

sample results should be interpreted with care. With the exception of Germany and Austria, where firms are sampled according to certain criteria which result in an overrepresentation in both countries of large and industrial firms, the rest of samples are reasonably representative of the underlying population of firms, covering about two-thirds, in average, of employment in the private non-financial sector. For more details in the country-specific raw data, as well as data sources, please refer to the paper documenting the CompNet database (Lopez-Garcia et al. 2015).

**Table A1.2: Sector classification (NACE rev. 2)**

| Code | Description | Code | Description |
|------|-------------|------|-------------|
| | | 10 | Manufacture of food products |
| | | 11 | Manufacture of beverages |
| | | 12 | Manufacture of tobacco 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 |
| | | 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 |
| **C** | Manufacturing | 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 |
| | | 29 | Manufacture of motor vehicles, trailers and semitrailers |
| | | 30 | Manufacture of other transport equipment |
| | | 31 | Manufacture of furniture |
| | | 32 | Other manufacturing |
| | | 33 | Repair and installation of machinery and equipment |
| **F** | Construction | 41 | Construction of buildings |
| | | 42 | Civil engineering |
| | | 43 | Specialised construction activities |
| | Wholesale and retail trade; repair of motor vehicles and motorcycles | 45 | Wholesale and retail trade and repair of motor vehicles and motorcycles |
| **G** | | 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 |
| **H** | Transportation and storage | 51 | Air transport |
| | | 52 | Warehousing and support activities for transportation |
| | | 53 | Postal and courier activities |
| | Accommodation and food service activities | 55 | Accommodation |
| **I** | | 56 | Food and beverage service activities |
| | | 58 | Publishing activities |
| | | 59 | Motion picture, video and television programme production, sound recording and music publishing |
| **J** | Information and communication | 60 | Programming and broadcasting activities |
| | | 61 | Telecommunications |
| | | 62 | Computer programming, consultancy and related activities |
| | | 63 | Information service activities |
| **L** | Real estate activities | 68 | Real estate activities |
| | | 69 | Legal and accounting activities |

| | | 70 | Activities of head offices; management consultancy activities |
|---|---|---|---|
| **M** | Professional, scientific and technical 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 |
| **N** | Administrative and support service 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 |

## Annex 2: Deviations from the country definitions of employment

**Table A2: Common definition of firm size**: number of employees in FTE, average of the year

| Country | Employment: country specific definitions when different from common |
|---|---|
| Croatia | Average number of employees based on hours worked |
| Finland | Full-time equivalent number of employees, yearly average, paid employees only |
| France | Number of employees |
| Germany | Total full- and part-time employment |
| Italy | Total employment, full-time and part-time |
| Malta | Total employment, full-time and part-time |
| Poland | Total employment at the end of the year |
| Portugal | Average number of employees in the months of the year during which the enterprise was active |
| Romania | Total employment, including full-time and part-time. Average of monthly total employment |
| Slovakia | Average number of employees |
| Spain | Full-Time Equivalent average in the case of large firms. Average total employment in the case of SMEs |

**Annex 3: Data validation**

This Annex compares general statistics extracted from the CompNet labour module with those from widely-used data sources, such as the EU-Labour Force Survey or the OECD *Dynemp*. We consider aggregate employment growth as well as the distribution of firms and employment by sector and size class. If general trends and cross-country aggregate statistics provided by this novel database are reasonably similar to those provided by other well-known sources, one can be confident on the soundness of the database and, therefore, on the results that are based on the data.

Moreover, a feature of the labour module that renders this validation exercise particularly important is that it is the only place in the whole CompNet micro-based cross-country exercise where the longitudinal dimension is exploited and firms are followed over time. As a consequence, firms in the labour module are required to be in the sample both in year $t$ and $t+3$. This selection of surviving firms may bias the sample across countries; hence the validation exercise includes an analysis of the effect of this requirement on aggregate employment growth figures.

Figure A3.1 starts by comparing, country by country, aggregate year-on-year employment growth in the CompNet data (that is, without demanding that firms are survivors between years $t$ and $t+3$) with that provided by the EU-Labour Force Survey (EU-LFS). The figures refer to the full economy. In Figures A3.2 and A3.3 we compare employment growth considering only manufacturing and wholesale and retail trade firms, respectively.

The figure includes also the change in the number of firms in CompNet samples, cleansed from cyclical variation.[46] The reason to include this piece of information is that in the late 90s many countries improved their data collection methods resulting in a steady increase in the number of firms reporting information to the firm registries. Similarly, the last year of information, 2012, is not complete in many countries given that not all firms had filed the information when the data were collected. Hence employment growth divergences between CompNet and the EU-LFS could be driven in some years by those phenomena. Note also that the EU-LFS figures refer to employment growth across all sectors of the economy, including the financial and public sectors, which are excluded from the CompNet data.

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[46] That is, the line "number of firms" is the residual from a regression of the change in the number of firms on the change in GDP in each country.

Despite these differences, employment dynamics shown in CompNet and the EU Labour Force Survey are quite similar in most countries, with some exceptions like Austria, Germany and Malta. Those 3 countries are the ones featuring the most biased samples due to the exclusion of some service sectors (see Table A1.1), exclusion rules (in Malta firms with less than 5 employees have been dropped) or to reporting standards (voluntary reporting in Germany and selected reporting in Austria). Hence the divergence with the aggregate figures comes as no surprise. In some other countries, developments over the Great Recession seem to be more pronounced in CompNet than in the EU-LFS. In Austria, Slovenia and Spain the number of firms, cleansed from cyclical variation, dropped clearly over the last year indicating that the number of firms in the sample is well below what we would expect given economic activity, most probably due to incomplete reporting.

**Figure A3.1: Employment growth in the business economy; CompNet and the EU-LFS**
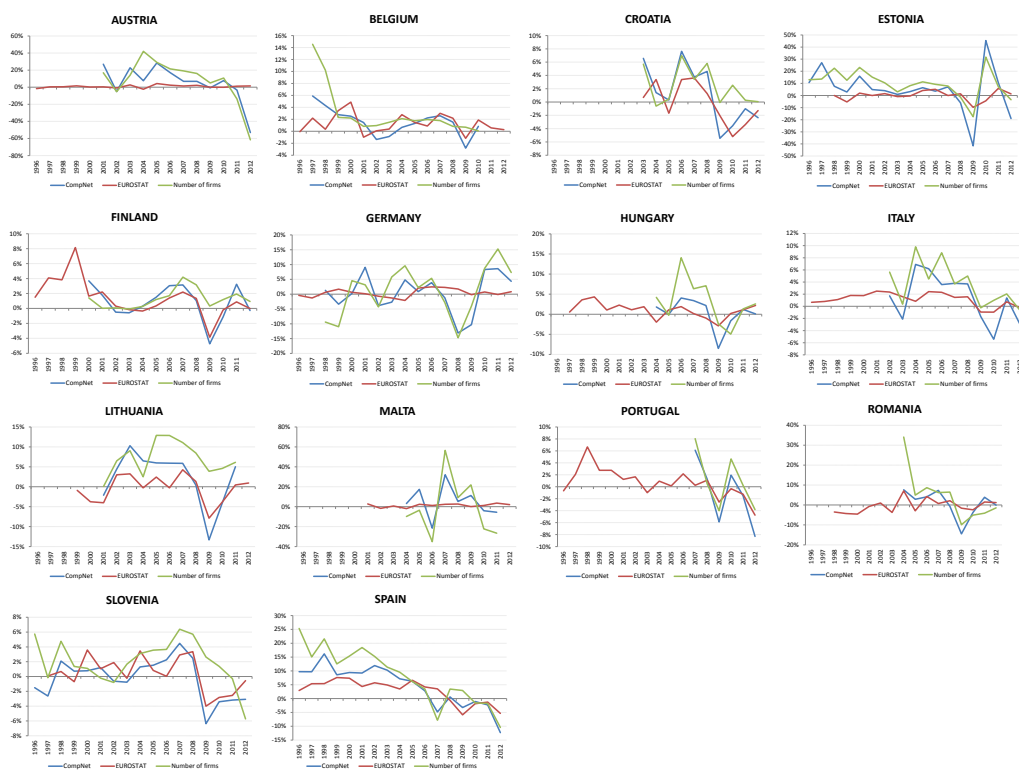
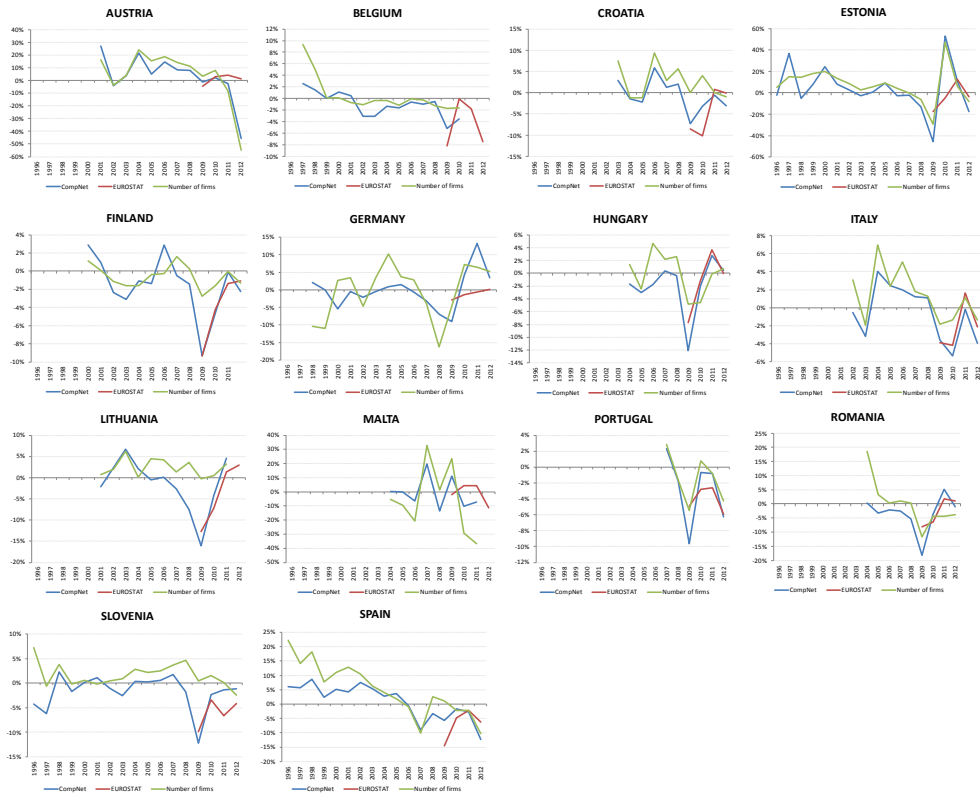**Figure A3.2: Employment growth in the manufacturing sector; CompNet and EU-LFS**

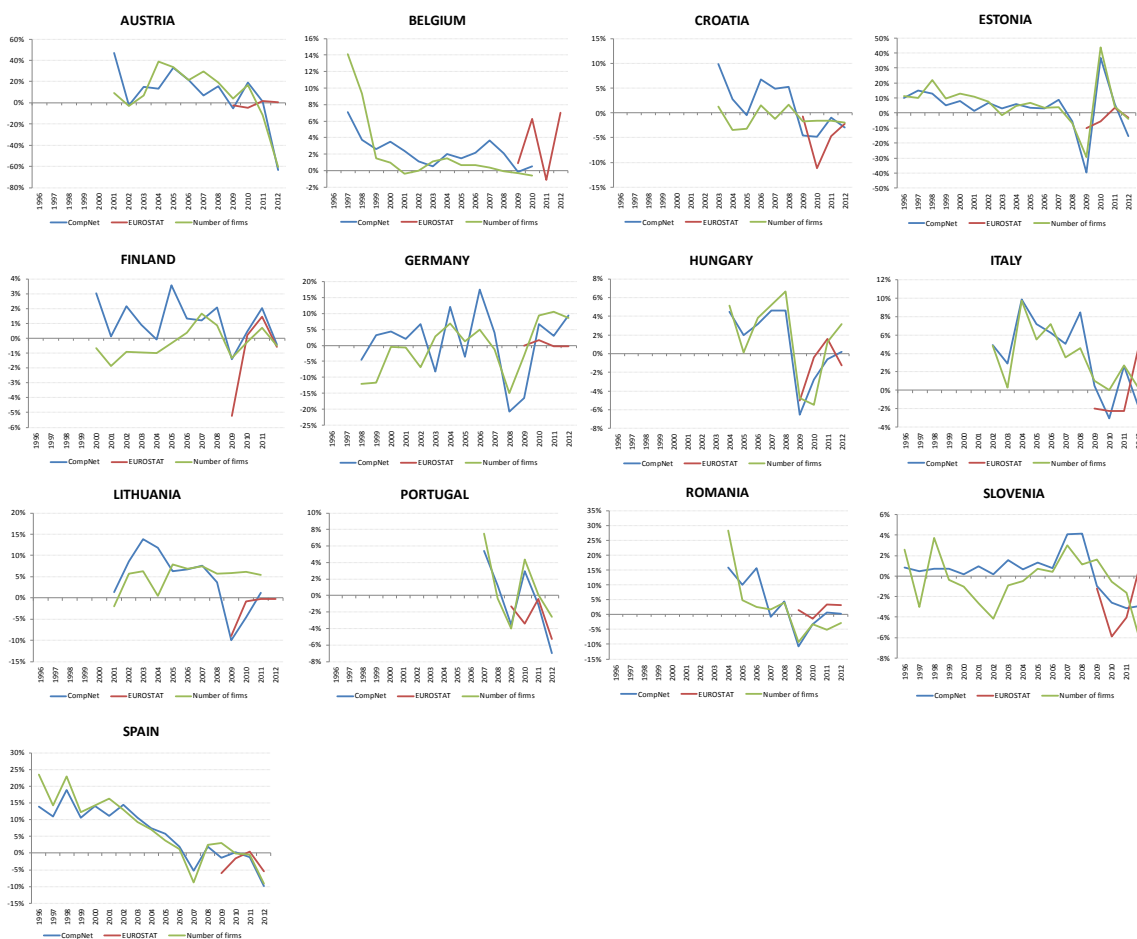**Figure A3.3: Employment growth in wholesale and retail sector; CompNet and EU-LFS**



Figure A3.4 turns to the possible bias introduced in the CompNet labour module by the requirement that firms stay in the sample over a period of 3 years. The figure shows y-o-y employment growth in the CompNet database (with no survivor bias) with that in the CompNet labour module (featuring only surviving firms from year *t* to year *t+3*). The survivor bias in the CompNet labour module seems to be quite small.

## Figure A3.4: Survivor bias of the CompNet labour module
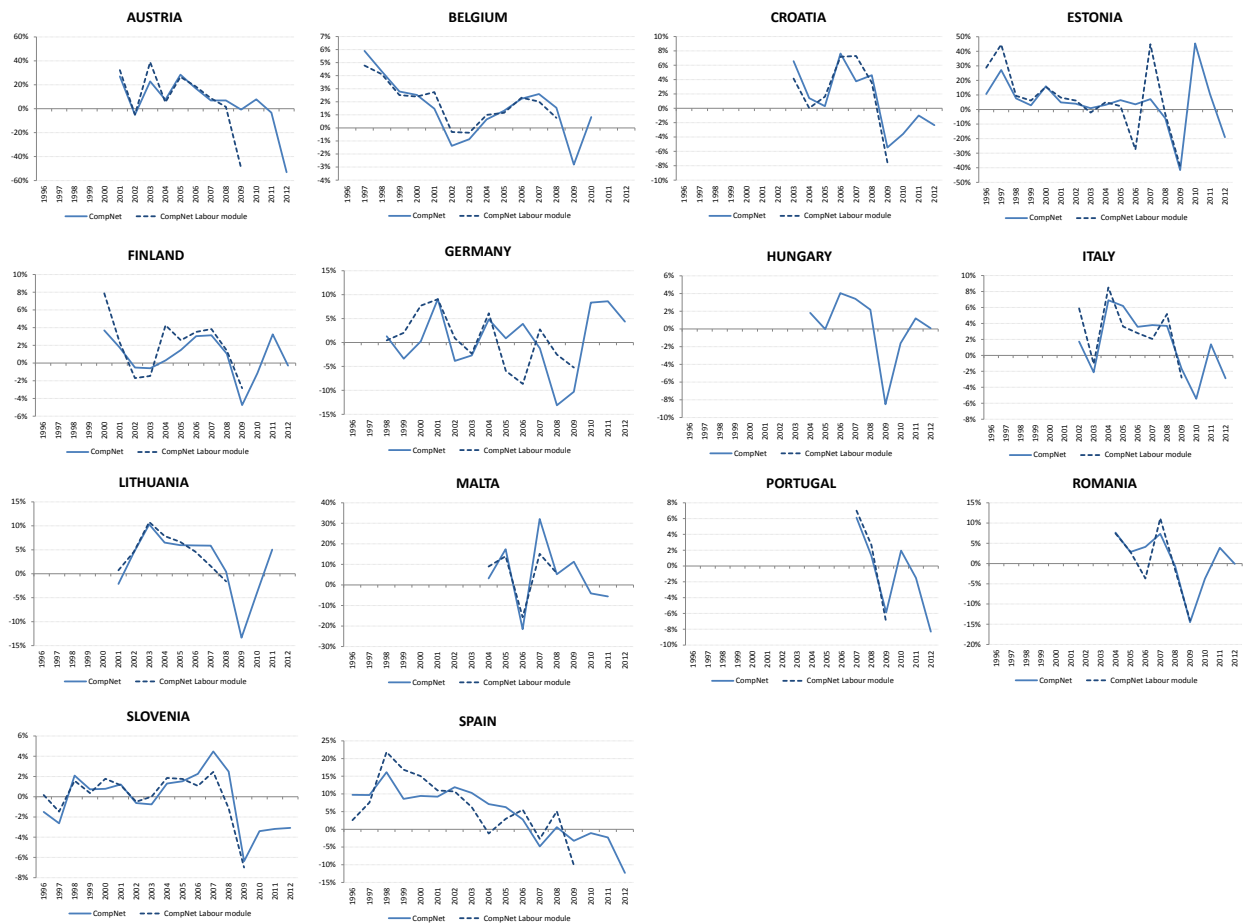


Turning now to the distribution of firms in terms of size or sector in CompNet, vs. other sources, Figure A3.5 below shows the share of employment by broad sector in CompNet's labour module and the EU-LFS, country by country. As expected, after inspection of Table A1.1 above, there is an over-representation of manufacturing firms (in terms of employment) in Germany and Austria. Malta has no information on retail and also features a CompNet sample somewhat biased towards manufacturing. The rest of the countries show a sector distribution in CompNet very similar to that provided by EU-LFS.[47]

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[47] Note that France does not provide information in CompNet for firms with less than 20 employees.

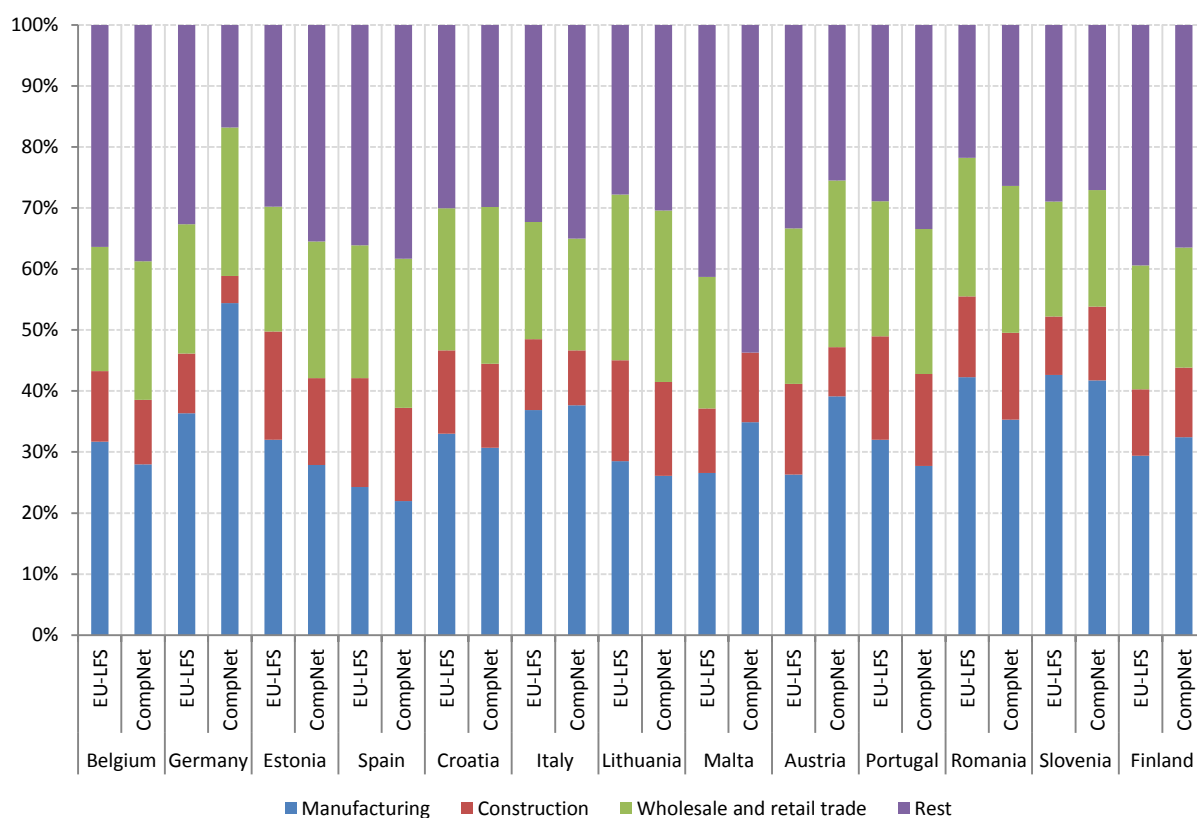**Figure A3.5: Employment by broad sector: CompNet's labour module and the EU-LFS**



Figure A3.6 compares the employment distribution by firm size of the CompNet Labour Module with that of the OECD *Dynemp*. The information is only shown for the countries included in both datasets. Countries show very similar patterns across CompNet and *Dynemp*.[48] The exception is Italy, a country sample which, despite featuring a sector distribution similar to the one shown by the EU-LFS, suffers from an under-representation of employment in very small firms (less than 9 employees). Figure A3.7 shows the comparison of the distribution of firms (rather than employment) by size in the CompNet Labour Module and *Dynemp*. The patterns unveiled in terms of employment distribution (in Figure A3.3) turn out to be quite similar to the ones shown when the distribution of firms by size class is analysed instead.

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[48] For some countries this is not surprising as the OECD DynEmp uses the same data source as CompNet.

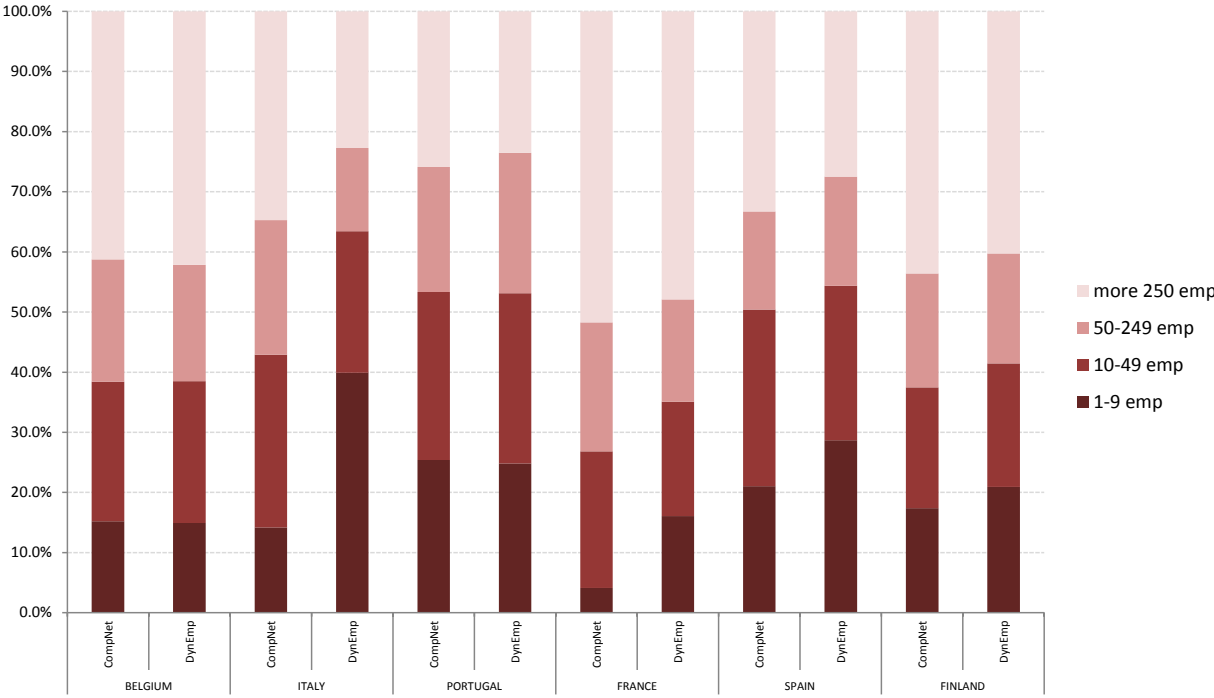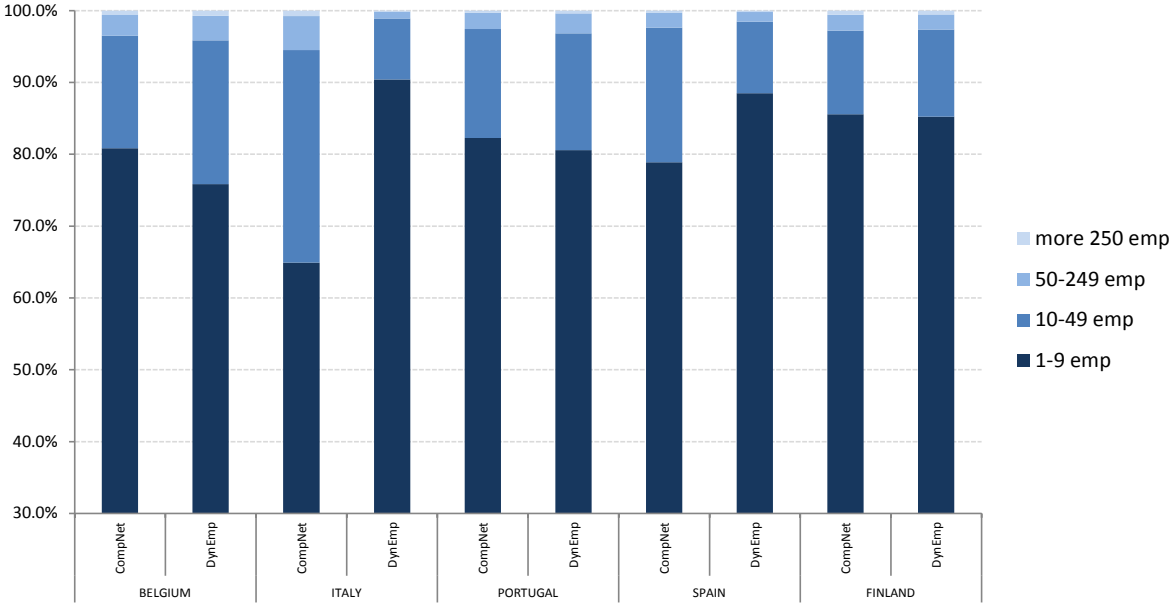**Figure A3.6: Employment by firm size; CompNet's labour module and the OECD Dynemp**



**Figure A3.7: Firm distribution by size class; Full economy; CompNet (labour module) and Dynemp**

## Annex 4: Transition matrices by group of countries and period: full sample

Figure A4.1. shows the transition matrices for each group of countries (stressed, non-stressed, new EU countries and Germany) over the pre-crisis period using the full sample. Figure A4.2 does the same exercise using the 20E sample. The very large persistency of firms, in terms of size, is a feature of each group of countries (and sample). The only difference to be noted is the somehow lower persistency (lower numbers in the diagonal) in the new EU countries and the higher in Germany. The former is related to the fact that new EU countries are catching-up economies and therefore more dynamic. The latter is related to the sample-specific bias of Germany as can be seen by the fact that diagonal numbers in Germany are much more similar (although still a bit higher) than those in other countries when the 20E sample is used instead.

.

## Figure A.4.1. Transition matrices by group of countries, pre-crisis

Stressed countries

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **64%** | 22% | 9% | 3% | 1% |
| 21-40% | 19% | **46%** | 26% | 8% | 1% |
| 41-60% | 6% | 16% | **48%** | 27% | 3% |
| 61-80% | 2% | 3% | 14% | **60%** | 20% |
| 81-100% | 1% | 1% | 1% | 8% | **89%** |

Non-stressed countries

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **67%** | 23% | 8% | 2% | 1% |
| 21-40% | 18% | **45%** | 31% | 5% | 1% |
| 41-60% | 7% | 13% | **53%** | 29% | 2% |
| 61-80% | 2% | 2% | 12% | **66%** | 20% |
| 81-100% | 1% | 1% | 1% | 7% | **91%** |

New EU countries

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **59%** | 24% | 11% | 6% | 2% |
| 21-40% | 24% | **36%** | 27% | 11% | 3% |
| 41-60% | 10% | 17% | **39%** | 29% | 6% |
| 61-80% | 4% | 5% | 16% | **52%** | 24% |
| 81-100% | 2% | 1% | 2% | 11% | **85%** |

Germany

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **81%** | 16% | 2% | 0% | 0% |
| 21-40% | 12% | **70%** | 16% | 2% | 0% |
| 41-60% | 1% | 15% | **70%** | 14% | 1% |
| 61-80% | 0% | 1% | 14% | **75%** | 10% |
| 81-100% | 0% | 0% | 1% | 9% | **90%** |

Note: Quintile dataset, full sample. Average over the rolling windows 2000-2003 to 2005-2008. The groups of countries are as follows: stressed countries (Spain, Italy and Slovenia), non-stressed countries (Austria, Finland, Belgium) and new EU countries (Romania, Malta, Lithuania, Estonia and Croatia; firm dynamics in Germany are rather different from those in the other groups, and therefore is shown separately.

**Figure A.4.2. Transition matrices by group of countries, pre-crisis. 20E sample**

Countries under stress

| quintile at t/quintile at t+3 | Quintile at t+3 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **50%** | 32% | 13% | 4% | 1% |
| 21-40% | 19% | **43%** | 29% | 8% | 1% |
| 41-60% | 5% | 17% | **51%** | 25% | 3% |
| 61-80% | 2% | 3% | 14% | **67%** | 14% |
| 81-100% | 0% | 1% | 1% | 9% | **89%** |

Non-stressed countries

| quintile at t/quintile at t+3 | Quintile at t+3 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **50%** | 35% | 11% | 3% | 1% |
| 21-40% | 20% | **47%** | 27% | 6% | 1% |
| 41-60% | 4% | 17% | **54%** | 23% | 2% |
| 61-80% | 1% | 3% | 14% | **68%** | 14% |
| 81-100% | 0% | 0% | 1% | 8% | **91%** |

New EU countries

| quintile at t/quintile at t+3 | Quintile at t+3 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **42%** | 30% | 19% | 7% | 2% |
| 21-40% | 21% | **33%** | 32% | 12% | 3% |
| 41-60% | 7% | 16% | **42%** | 30% | 5% |
| 61-80% | 2% | 4% | 16% | **55%** | 23% |
| 81-100% | 1% | 1% | 2% | 11% | **86%** |

Germany

| quintile at t/quintile at t+3 | Quintile at t+3 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **58%** | 27% | 7% | 6% | 1% |
| 21-40% | 15% | **52%** | 21% | 11% | 1% |
| 41-60% | 3% | 16% | **48%** | 31% | 2% |
| 61-80% | 1% | 2% | 8% | **77%** | 12% |
| 81-100% | 0% | 0% | 0% | 7% | **92%** |

Figure A4.3. shows the changes over the crisis in the transition matrices; i.e. we show the pp difference in the share of firms in each cell of the matrix between the crisis and the pre-crisis period, for each group of countries. Figure A4.4 shows the same analysis but using the 20E sample. We show in red the cells where the share of firms has decreased in the crisis and in green those where it has increased. In stressed and new EU countries the numbers above the diagonal are all red, meaning that there is a general decrease in the share of firms expanding, whereas numbers below the diagonal are green pointing to increasing shares of firms declining. In non-stressed countries the picture is mixed while in Germany is the opposite: there is a general increase in share of firms expanding, although very moderately. This difference between Germany and the other countries remains, although weaker, when the 20E sample is used instead.

## Figure A.4.3. Change in the share of firms in each cell, crisis vs. pre-crisis, by group of countries. Full sample

**Countries under stress**

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **2.0%** | -0.7% | -0.7% | -0.4% | -0.1% |
| 21-40% | 3.8% | **-0.6%** | -1.6% | -1.4% | -0.2% |
| 41-60% | 1.7% | 1.9% | **-2.9%** | 0.1% | -0.8% |
| 61-80% | 0.3% | 0.8% | 0.7% | **1.4%** | -3.1% |
| 81-100% | 0.0% | 0.1% | 0.4% | 2.0% | **-2.6%** |

**Non-strressed countries**

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **6.7%** | -3.5% | -0.3% | 0.2% | 0.0% |
| 21-40% | 5.3% | **3.2%** | -7.2% | -1.3% | 0.0% |
| 41-60% | -0.4% | 5.2% | **0.0%** | -6.4% | -0.1% |
| 61-80% | 0.2% | 0.0% | 3.0% | **0.1%** | -4.1% |
| 81-100% | 0.1% | 0.0% | 0.1% | 2.5% | **-2.6%** |

**new EU countries**

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **10.5%** | -3.0% | -2.9% | -1.6% | -0.4% |
| 21-40% | 6.2% | **4.7%** | -2.8% | -3.4% | -1.0% |
| 41-60% | 2.8% | 5.7% | **-0.3%** | -5.0% | -1.9% |
| 61-80% | 2.1% | 2.6% | 3.7% | **-2.8%** | -4.8% |
| 81-100% | 0.7% | 0.6% | 0.5% | 1.3% | **-2.7%** |

**Germany**

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **-22.9%** | 20.4% | 1.4% | 0.6% | 0.4% |
| 21-40% | -7.8% | **-14.1%** | 20.4% | 1.2% | 0.3% |
| 41-60% | -0.3% | -6.6% | **-12.6%** | 19.2% | 0.3% |
| 61-80% | -0.1% | -0.2% | -4.9% | **-4.9%** | 10.2% |
| 81-100% | 0.0% | 0.0% | 0.0% | -2.6% | **2.5%** |

Note: Quintile dataset, full sample. Difference in percentage points between the crisis (windows starting in 2006-2009) and the pre-crisis period (windows ranging from 2000-2003 to 2005-2008). The groups of countries are as follows: stressed countries (Spain, Italy and Slovenia), non-stressed countries (Austria, Finland, Belgium) and new EU countries (Romania, Malta, Lithuania, Estonia and Croatia; firm dynamics in Germany are rather different from those in the other groups, and therefore is shown separately.

## Figure A.4.4. Change in the share of firms in each cell, crisis vs. pre-crisis, by group of countries. 20E sample

**Countries under stress** — Quintile at t+3

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **8%** | **-4%** | **-3%** | **-1%** | **0%** |
| 21-40% | **9%** | **4%** | **-9%** | **-3%** | **0%** |
| 41-60% | **4%** | **10%** | **-3%** | **-10%** | **-1%** |
| 61-80% | **1%** | **2%** | **6%** | **-4%** | **-4%** |
| 81-100% | **0%** | **0%** | **1%** | **4%** | **-5%** |

**Non-stressed countries** — Quintile at t+3

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **2%** | **-1%** | **-2%** | **1%** | **0%** |
| 21-40% | **2%** | **1%** | **-2%** | **0%** | **0%** |
| 41-60% | **1%** | **2%** | **-1%** | **-2%** | **0%** |
| 61-80% | **0%** | **1%** | **2%** | **-1%** | **-2%** |
| 81-100% | **0%** | **0%** | **0%** | **1%** | **-2%** |

**New EU countries** — Quintile at t+3

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **15%** | **-2%** | **-9%** | **-3%** | **-1%** |
| 21-40% | **12%** | **6%** | **-10%** | **-7%** | **-1%** |
| 41-60% | **5%** | **9%** | **3%** | **-14%** | **-3%** |
| 61-80% | **1%** | **3%** | **7%** | **1%** | **-12%** |
| 81-100% | **0%** | **0%** | **1%** | **6%** | **-8%** |

**Germany** — Quintile at t+3

| quintile at t/quintile at t+3 | 0-20% | 21-40% | 41-60% | 61-80% | 81-100% |
|---|---|---|---|---|---|
| 0-20% | **1%** | **1%** | **-1%** | **-1%** | **0%** |
| 21-40% | **-3%** | **1%** | **2%** | **0%** | **0%** |
| 41-60% | **-1%** | **-3%** | **2%** | **2%** | **0%** |
| 61-80% | **0%** | **-1%** | **-1%** | **2%** | **0%** |
| 81-100% | **0%** | **0%** | **0%** | **-1%** | **1%** |

## Annex 5: Country graphs

### Figure A5.1: Proportion of firms that expand, shrink or remain of equal size across years

**ROMANIA**

**SLOVENIA**

**SPAIN**
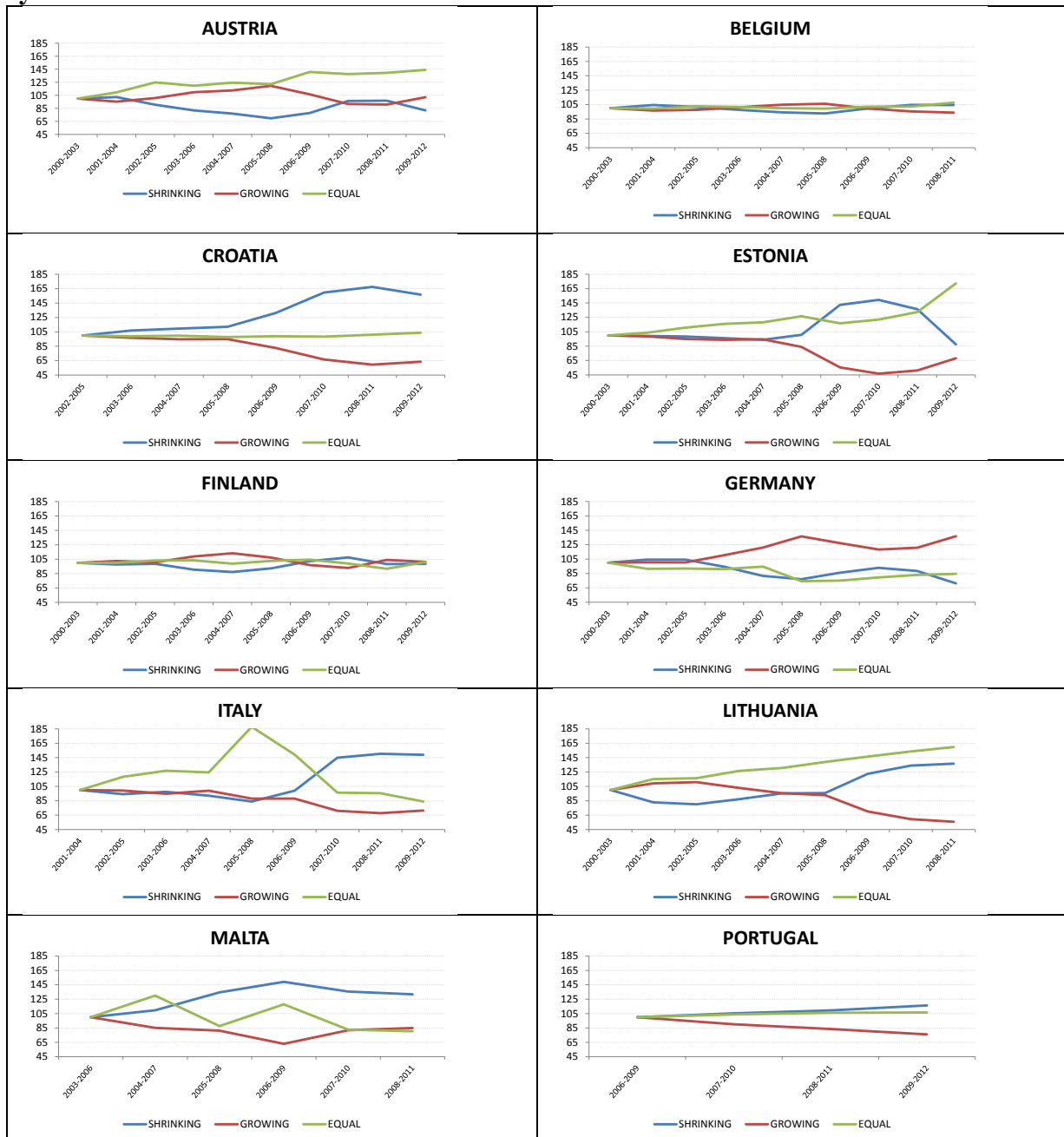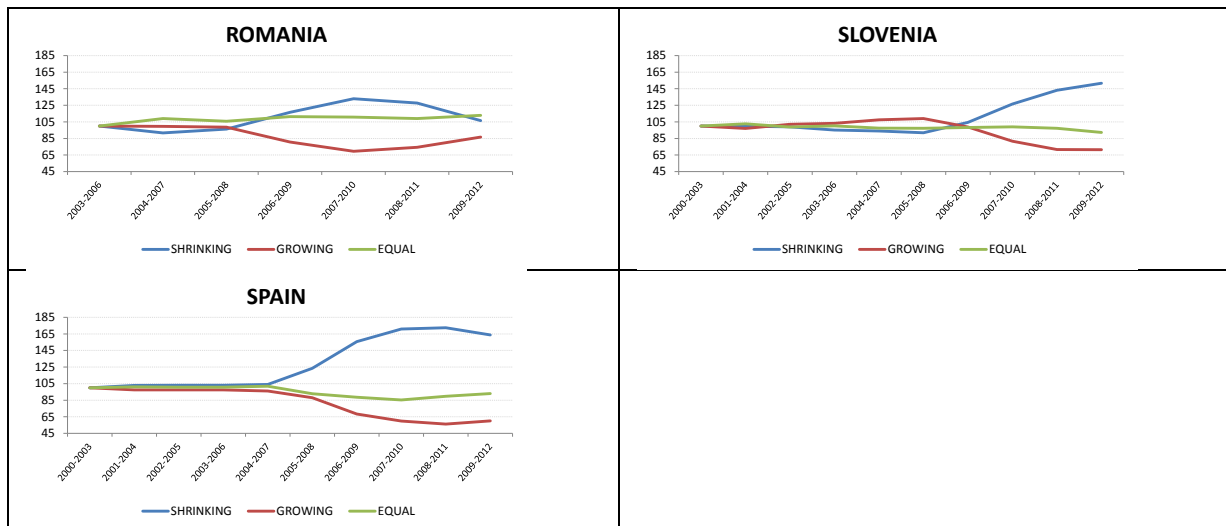
Source**:** CompNet's Labour Module and own calculations

Note: Period 2000-2012 (Year 2000=100). Full sample of firms. Percentage growth dataset.

## Annex 6: Main features of the 20E sample

### Table A.6.1:  Average firm size per size class

| | 20E SAMPLE AVERAGE NUMBER OF EMPLOYEES BY SIZE | | |
|---|---|---|---|
| | 20-49 employees | 50-249 employees | More than 250 employees |
| Austria | 35 | 122 | 898 |
| Belgium | 32 | 103 | 926 |
| Croatia | 32 | 105 | 715 |
| Estonia | 32 | 97 | 594 |
| Finland | 31 | 102 | 914 |
| France | 33 | 105 | 1063 |
| Germany | 33 | 115 | 1117 |
| Hungary | 32 | 101 | 890 |
| Italy | 32 | 97 | 963 |
| Lithuania | 32 | 100 | 721 |
| Malta | 34 | 104 | 490 |
| Poland | 33 | 108 | 785 |
| Portugal | 31 | 97 | 822 |
| Romania | 32 | 105 | 765 |
| Slovakia | 35 | 106 | 853 |
| Slovenia | 34 | 107 | 740 |
| Spain | 31 | 95 | 1892 |
| Average | 33 | 104 | 891 |

Source: CompNet's Labour Module and own calculations

Notes: 20E sample; average 1995-2012

**Table A6.2: Average firm size by quintile**

| | 20E SAMPLE AVERAGE NUMBER OF EMPLOYEES BY QUINTILES | | | | |
| --- | --- | --- | --- | --- | --- |
| | 1 quintile (0-20% of size distribution) | 2 quintile (21-40%) | 3 quintile (41-60%) | 4 quintile (61-80%) | 5 quintile (81-100%) |
| Austria | 24 | 32 | 42 | 70 | 401 |
| Belgium | 22 | 28 | 37 | 56 | 335 |
| Croatia | 22 | 29 | 40 | 68 | 365 |
| Estonia | 22 | 28 | 38 | 60 | 226 |
| Finland | 22.3 | 28.3 | 38.8 | 64.9 | 443.9 |
| France | 23 | 30 | 40 | 61 | 431 |
| Germany | 23 | 31 | 42 | 74 | 508 |
| Hungary | 22 | 28 | 39 | 62 | 371 |
| Italy | 22 | 27 | 36 | 53 | 303 |
| Lithuania | 22 | 29 | 39 | 64 | 276 |
| Malta | 24 | 32 | 45 | 78 | 291 |
| Poland | 23 | 32 | 46 | 81 | 398 |
| Portugal | 22 | 27 | 36 | 55 | 278 |
| Romania | 22 | 29 | 41 | 68 | 353 |
| Slovakia | 26 | 36 | 53 | 92 | 504 |
| Slovenia | 25 | 34 | 47 | 85 | 432 |
| Spain | 22 | 26 | 34 | 49 | 521 |
| Average | 23 | 30 | 41 | 67 | 379 |

Source: CompNet's Labour Module and own calculations

Notes: 20E sample; average 1995-2012

**Figure A6.1: Proportion of firms in different growth categories by country**
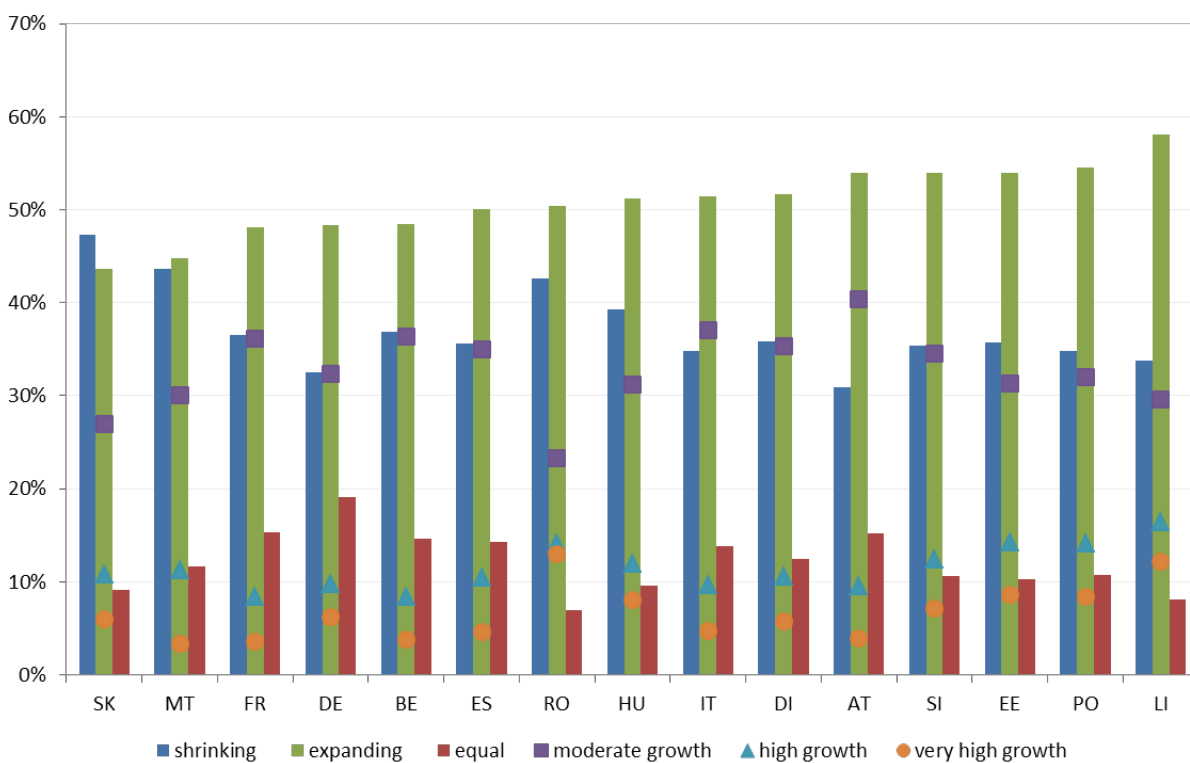


Source**:** CompNet's Labour Module and own calculations

Notes: Average across windows starting 2000-2005. 20E sample. Percentage growth dataset.

**Figure A6.2: Proportion of firms that expand, shrink or remain of equal size over years**
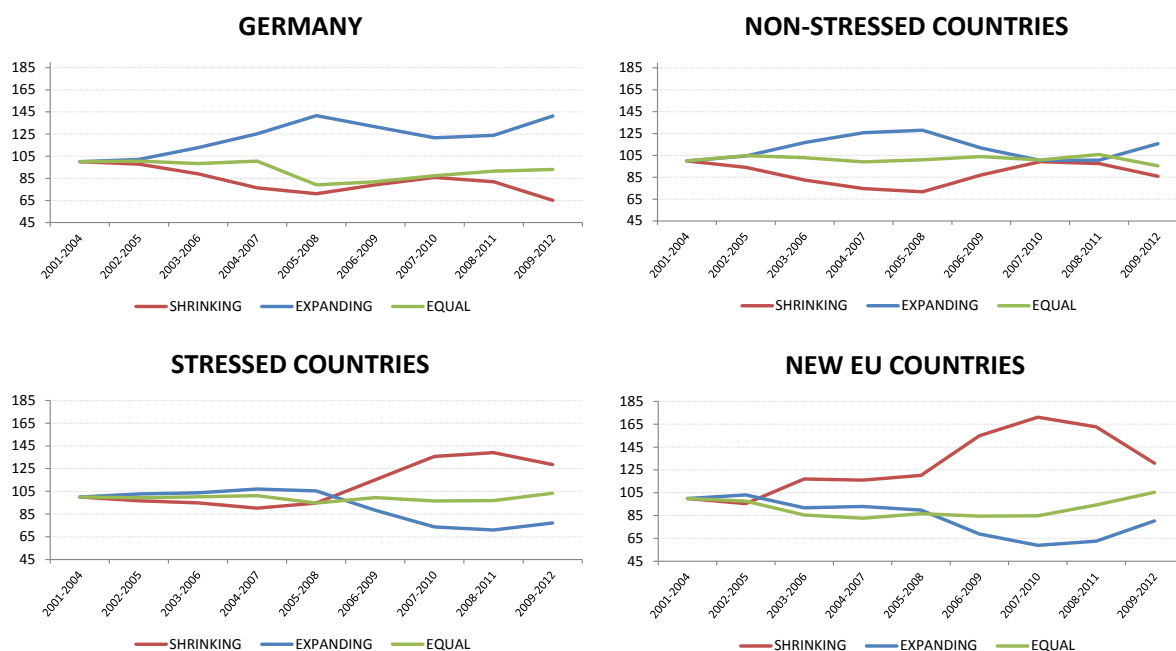


Source**:** CompNet's Labour Module and own calculations

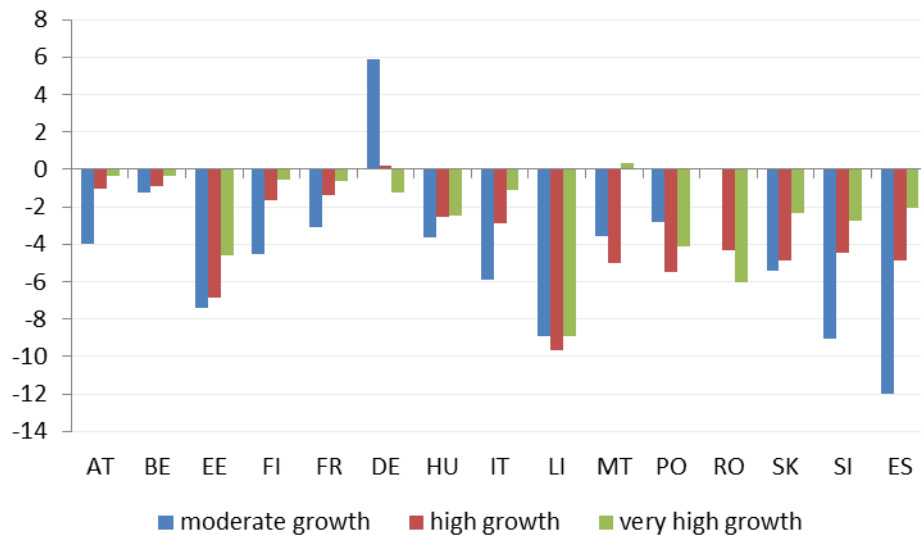Notes: 2000-2012. 20E sample. Percentage growth dataset. (Year 2000=100)

**Figure A6.3: Proportion of firms that expand, shrink or remain of equal size over years**
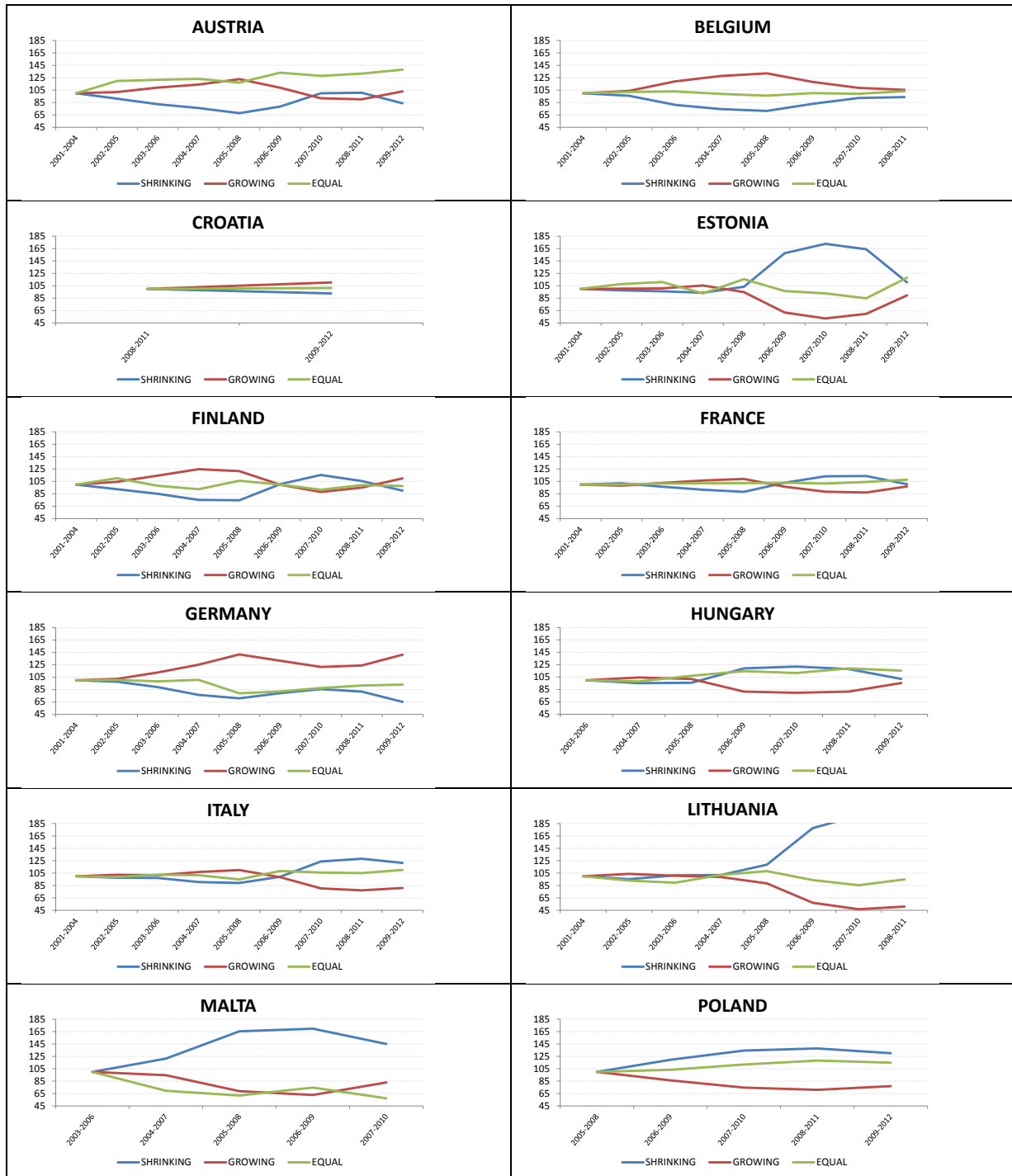
**Figure A6.3 (cont): Proportion of firms that expand, shrink or remain of equal size across years**
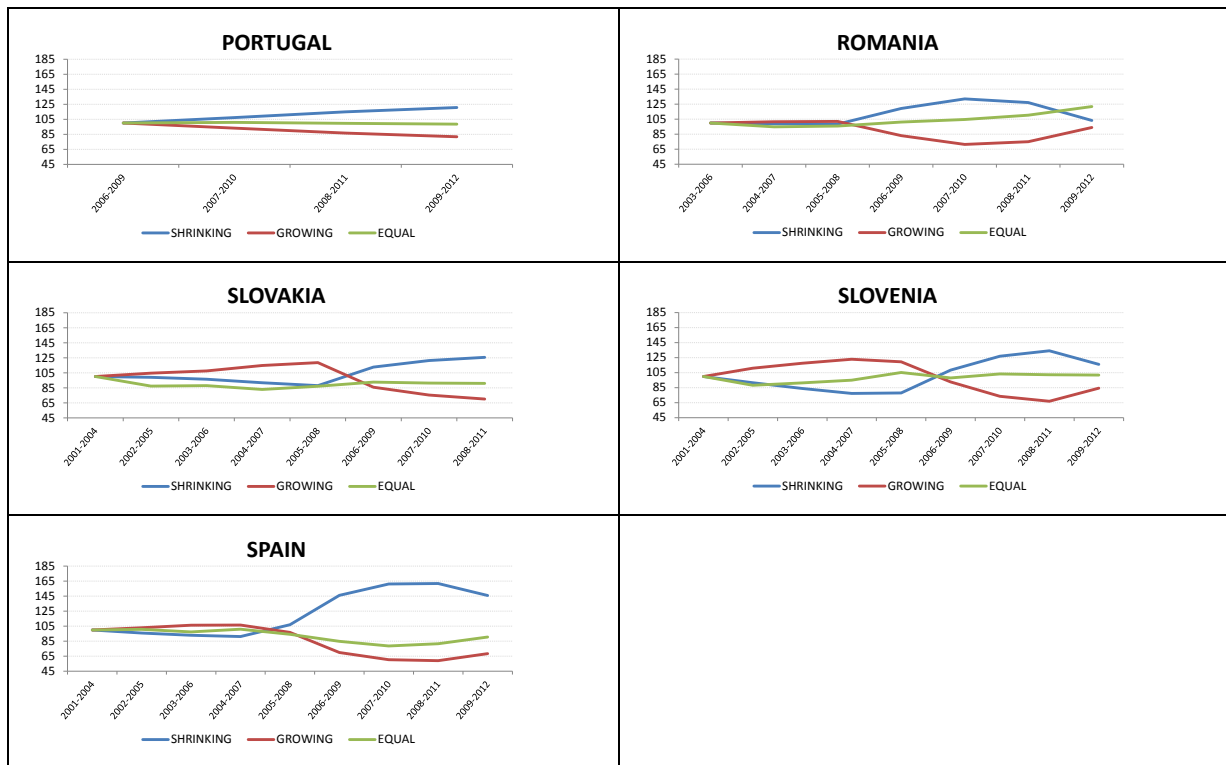
Source**:** CompNet's Labour Module and own calculations

Notes: 2000-2012. 20E sample. Percentage growth dataset. (Year 2000=100)

**Figure A6.4: Average firms size of firm sin different growth categories, pre-crisis**
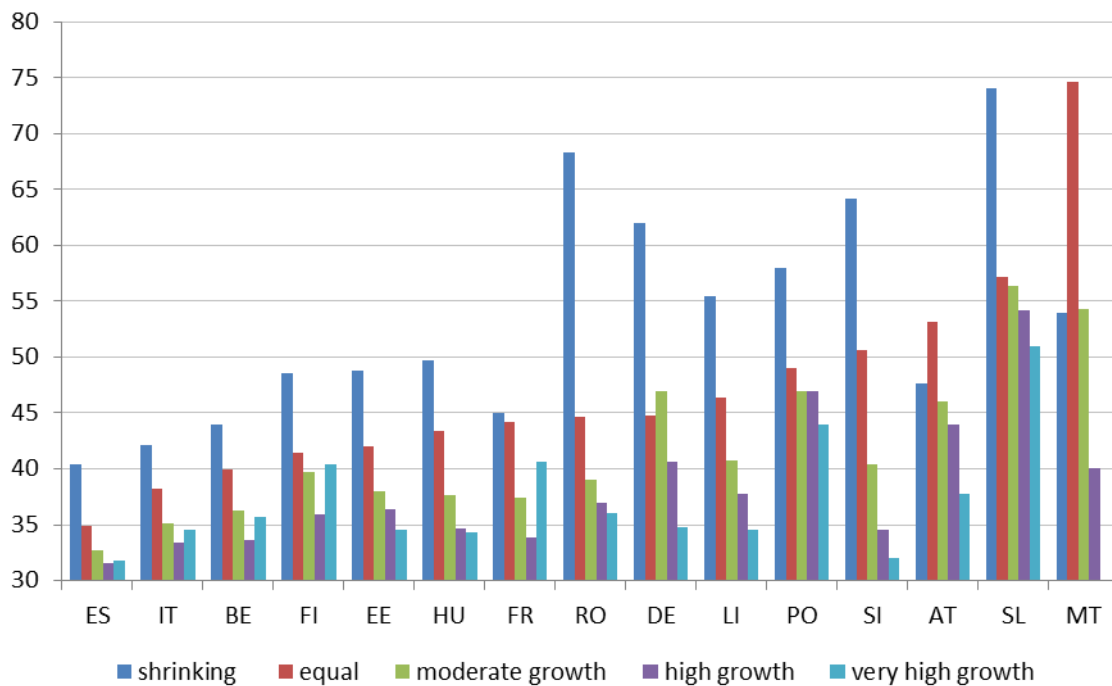


Source**:** CompNet's Labour Module and own calculations

Notes: 20E sample. Percentage growth dataset.

**Figure A6.5: Change in share of firms in different growth categories, crisis vs. pre-crisis**

Notes: 20E sample, percentage growth dataset. Only positive growth categories included.

**Figure A6.7: Change in the share of firms in each growth category. Pre-crisis vs. crisis (in pp.) Sector detail. 20E sample.**
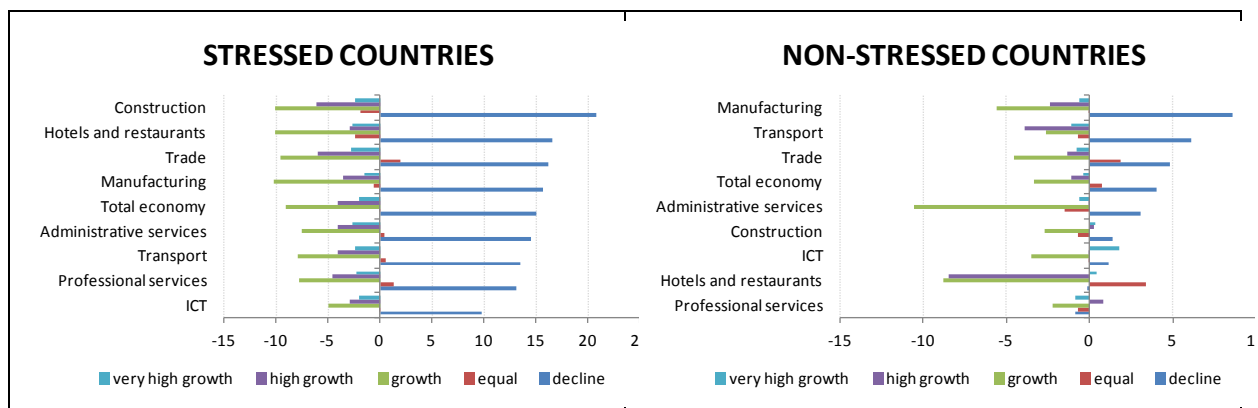
## Annex 7: CompNet's Indicator of Credit Constraints

The Indicator of Credit Constraints (ICC) of CompNet is computed drawing from the Survey on Access to Finance of Enterprises (SAFE), which is conducted by the ECB jointly with the European Commission twice per year. The survey intends to assess the financial condition of firms in the euro area. It defines a firm as credit constrained when:

- The firm reports loan applications which were rejected;
- The firm reports loan applications for which only a limited amount was granted;
- The firm reports loan applications which were rejected by the firms because the borrowing costs were too high;
- The firm did not apply for a loan for fear of rejection (i.e. discouraged borrowers).

Next, the financial balance sheet data of the firms undertaking the SAFE survey in each country are retrieved from AMADEUS (Bureau van Dijk). The probability of being credit constrained of each of the firms is then modelled as a function of different indicators of its financial position (leverage, financial pressure, profit margin, collateral, cash holdings), size proxied by total assets and a full set of controls. The estimated elasticities are then used to estimate a "SAFE score" for each of the firms sampled in CompNet, according to their financial position, size, country and sector of activity:

$$SAFE_{\text{score,i}} = -1.88 + 0.71 \cdot finlev_i + 0.28 \cdot ifp_i - 0.51 \cdot pm_i - 0.21 \cdot coll_i - 1.2 \cdot cashH_i - 0.05 \ln(TA_i),$$

where *finlev* is the financial leverage, *ifp* is the index of financial pressure, *pm* is profit margin, *coll* is collateral, cashH is cash holding and *TA* are the total assets for firm i.

From the fitted regression values we obtain the distribution of the SAFE score estimates. The SAFE survey provides as well information on the share of firms that are credit constrained for a given country and year. Next, we fix a threshold of the fitted SAFE score for each country such that the resulting share of firms above this threshold is the same as reported in the SAFE survey as being credit constrained. This threshold is then used to estimate the share of credit constrained firms in each sector, size class, or growth category.

For more information on this index, as well as a collection of results and comparisons with other indicators of credit constraints, please refer to Ferrando et al. (2015).

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