LABOUR REALLOCATION IN RECESSION AND RECOVERY: EVIDENCE FOR EUROPE

Eric Bartelsman,* Paloma Lopez-Garcia, and Giorgio Presidente*****

This paper builds upon Bartelsman, Lopez-Garcia, and Presidente (2018) and provides empirical evidence on the cyclical features of labour reallocation in a sample of European Union (EU) countries over the Great Recession and the slow recovery. The analysis makes use of cross-country micro-aggregated data on firm dynamics and productivity from release 6 of the ECB CompNet database. While productivity-enhancing reallocation generally is counter-cyclical, with a stronger effect providing a silver lining in downturns, it was weaker during the Great Recession in the EU, but reverted back to more normal patters in the most recent years.

Keywords: Great Recession, reallocation, employment.

JEL codes: E24, E32, J63, O4.

Introduction

Factor inputs are reallocated across firms as a reaction to demand and supply shocks that provide a signal to firms to expand or contract, or to enter or exit the market. The process of reallocation is productivity enhancing if factor inputs flow from low to high productive firms. The extent to which productivity enhancing reallocation (PER) can occur depends on frictions and market distortions which prevent instantaneous optimality of resource allocation. These include labour and product regulations, search friction, financial frictions, and entrepreneurial barriers. Productivity-enhancing reallocation has generally been found to be counter-cyclical, with 'cleansing' providing a silver lining to economically painful recessions (Foster *et al*. 2016).

An analysis based on US data (Foster *et al*. 2016), has shown that the Great Recession in the US differed from earlier periods in that labour reallocation was not cleansing. A complementary paper, Bartelsman *et al*. (2018) extends that work in different dimensions using micro-aggregated firm data for six EU countries for the period 2001–12. The paper looks at both capital and labour reallocation and assesses how structural and policy differences affect PER. Also, that paper provides a first look at the cyclical nature of PER and shows that in the early years of the crisis, PER was effectively shut down. In this paper, we explore a different sample of nine countries and analyse the data for the period starting before the crisis through 2015, in order to show how PER evolves.

We find that the sharp drop in exports during the trade collapse provides a partial explanation for the lack of a silver lining. As global demand picks up, we see in particular that the most productive firms increase their market share. We are able to show that the muted cleansing effect was significant only in industries more exposed to the trade collapse, which can be explained by the fact that the latter was an idiosyncratic shock affecting the most productive firms in any given industry.

Our work is based on a 'micro aggregated' database of cross-country and industry information drawn from firm-level datasets from a selection of countries (Lopez-Garcia and di Mauro, 2015). Because the data sources in each EU country are confidential, they cannot be analysed jointly. Instead, our cross-country panel dataset contains a set of 'micro-aggregated' observations within each country, industry and year that are representative of a group of firms, collected in such a manner that they

*Vrije Universiteit Amsterdam; Tinbergen Institute, e-mail: eric.bartelsman@vu.nl; **ECB, e-mail: Paloma.Lopez-Garcia@ecb.europa.eu; ***World Bank, e-mail: g.presidente@worldbank.com. This paper was given at an RES Special Session in 2018: https://www.niesr.ac.uk/events/niesrs-special-sessions-res-2018-conference#131.

disclose confidential information of individual firms and thus can be combined for cross-country analysis.[1]

In past decades, much evidence has been collected for the US, EU and developing countries on resource reallocation. Models to explain such reallocation are based on frictions or distortions that prevent instantaneous optimality of resource allocations. These frictions could result from labour search, product market search, financial frictions, entrepreneurial barriers, or many other causes (Jovanovic, 1982; Mortensen and Pissarides, 1994; Hopenhayn, 1992; Cooper and Haltiwanger, 2006; Bartelsman, Haltiwanger, and Scarpetta, 2013).

The resource allocation process can serve to enhance aggregate productivity, by shifting resources from less to more productive firms, or by having cohorts of entering firms that are more productive than exiting firms. In general, in well functioning economies, resource allocation is productivity enhancing, but that is not always the case. A recent literature explores market distortions that can affect reallocation (Hsieh and Klenow, 2009; Restuccia and Rogerson, 2008; Bartelsman, Haltiwanger, and Scarpetta, 2013; Gopinath *et al*., 2017). Systematic evidence is being collected to compare such reallocation across countries and over time, often supported by multinational organisations such as the OECD,[2] Eurostat[3] and in the CompNet project of the ECB.[4]

When resource allocation patterns during a downturn are productivity enhancing, this is referred to as the cleansing effect which provides a silver lining to economically painful periods (Caballero and Hammour 1994). Different theoretical mechanisms exist which would promote or reduce the cleansing effect. Below, we will provide an overview of the theories that provide context for our cyclical analysis. In all the theories, some underlying mechanism is present that prevents resources from being allocated to their best use at each instant, otherwise there would be no potential cleansing. The interesting research questions are to find out which of the frictions or which components of costs and benefits of reallocation change over time and over cyclical episodes.

The strength of PER will depend on the benefits of moving towards optimal size and the costs of achieving this. Larger shocks can increase potential benefits, as can a steeper relationship between profit and deviation from optimal size. Each of these cost and benefits components can be subject to trends and cycles, for example owing to changes in technology or aggregate demand. In the US, evidence is building up that the magnitude of job reallocation is declining secularly (Hyatt and Spletzer, 2013; Decker *et al*., 2014), although no clear answer is available about the causes of the decline. By contrast, evidence in Bartelsman, Gautier, and de Wind (2016), shows that in the EU reallocation seems to be higher among innovative and ICT intensive firms, likely because the magnitude of the shocks facing these firms is larger.

Reallocation and productivity-enhancing reallocation also may differ over the cycle, as the nature of the shocks changes and as the relationship between benefits and costs are altered. Foster, Grim, and Haltiwanger (2016) review many of the arguments about cyclicality of reallocation, in general finding that it is less costly in downturns, although some distortions may make it more costly. The exact nature of the cyclical changes depends on the factor, labour or capital, but can also differ across recessions, owing to the underlying causes and magnitudes of the shocks. Another issue is whether the costs are associated with changes at continuing firms, or through entry and exit margins. Often through these margins 'scarring' can generate long lasting effects of recessions.

For labour inputs, reduced tightness in the labour market during downturns should reduce search frictions. Krussel *et al*. (2017) present a model of the cyclical properties of gross worker flows, within the search tradition. Policy may also change the incentives for firms to shed workers during downturns. Boeri and Bruecker (2011) study the effects of short-term work programmes and find that they reduce job losses at the onset of the crisis. They further point out that effects may be asymmetric, causing more harm in upturns, and that exact effects depend on interactions with other labour market institutions related to employment protection and wage bargaining regimes.

The next section will describe the CompNet data and refer to underlying documentation of methods and summary statistics. Following this, we discuss the baseline estimate of productivity-enhancing reallocation as provided by Bartelsman *et al*. (2018) and as given for the expanded set of countries and more recent time periods in our sample. In our new empirical exercises, we use the most recent release of CompNet data (v6) to assess the cyclical nature of PER, how it varies over the cycle, and in particular what was different about the Great Recession and the subsequent recovery.

The CompNet dataset

A detailed description of the latest CompNet micro-based database that encompasses a very wide set of indicators related to productivity and competitiveness can be found in Lopez-Garcia and di Mauro (2015), Aglio *et al*. (2018) and Lopez-Garcia (2018).[5]

For our study, we have selected nine countries available in the 6th vintage of the CompNet database that have good coverage of large as well as of small firms (less than 20 employees).[6] Our selection further is predicated on availability of all indicators needed for this paper for the sample period, 2004–15. Our sample includes large and small northern EU countries, southern countries, and accession countries.

The dependent variable used in this paper, namely employment growth, has been collected through the CompNet's 'labour' module. The data have been cross-checked with other sources, and the module has been documented in Fernandez (2016). The main objective of the labour module is to provide cross-country comparable indicators of firm growth. The labour module considers growth from t–3 to t for 3-year moving windows starting in 2004–7 through 2012–15. This setup restricts the analysis to firms that continue in the sample between t–3 and t, i.e. we only see growth at surviving firms, or the intensive margin.

Firm growth will be understood in the remainder of the paper as annual growth in terms of employees of a 'representative firm' within a particular country/industry/year. For each country/industry/year, firms are classified in 25 groups, depending on their size-class transition from a particular size quintile in period t–3 to a quintile in period t. For each cell in the transition matrix, the median annual employment growth, median size of the firms, their median productivity, as well as several financial ratios in the initial period t–3 and final period t are known.

The unit of analysis is therefore a 'representative' firm proxying all the firms in that cell in the transition matrix. To account for differences in the probability of firms to be in a particular cell of the transition matrix, we use total employment in each cell to construct weights to be used in weighted regression, reflecting how likely it is, for example, to observe firms belonging to the lowest quintile to move in three years in the highest one.

There are some caveats attached to the dataset we use for our analysis. To start, we are not able to separate cleanly the effects of firm entry and exit from changes at continuing firms. In many of the countries the firm-level source data are not based upon registers that control well for exit, mergers, and other changes that distinguish new firms from continuing firms. Instead, we use rolling windows of firms that continue for three years to define the transition matrix.

To summarise, the data used in the empirical exercises are available for nine countries, nine macro-sectors or industries (1 digit industry at the 'NACE rev.2' classification system), nine windows (end years 2007–15) and 25 'representative firms' or transition cells. All cell ('firm') characteristics, like size or productivity, are computed at initial period, that is before the growing or shrinking episode takes place. We have considered several possibilities to flag sub-periods in our sample. We analyse the initial downturn and the subsequent European sovereign debt crises separately, with a dummy for the Great Recession (GR) taking a value one for the window ending in 2009, 2010 or 2011, a dummy for the sovereign debt crisis (SDC) taking the value one for the windows ending in 2012, 2013 or 2014, and a dummy for the recovery for the window ending in 2015 (REC).

PER during the Great Recession, sovereign debt crisis and recovery

The main parameter of interest of Bartelsman *et al*. (2018) is the elasticity of factor growth with respect to initial productivity, conditional on the country-sector-specific cyclical shock. Following Bartelsman *et al*. (2018) and Foster, Grim, and Haltiwanger (2016), we estimate the variants of the equation below using 'representative firm' data to explore productivity-enhancing reallocation:

$$\Delta L_{i,c,s,t} = \alpha_1 \Delta \text{cycle}_{c,s,t} + \beta \text{Rel.prod}_{i,c,s,t-3} + \alpha_2 \text{Size}_{i,c,s,t-3} + \gamma \text{FE} + \varepsilon_{i,c,s,t}$$

where the operator Δ gives the annual average growth rate of a variable in time t relative to year t–3, L represents employment, the cycle is proxied by an indicator of industry activity growth from Eurostat, 'Rel. prod' is initial productivity (log TFP) of the representative firm in period t–3 relative to its industry average, Size refers to the initial size of the 'firm' (log of number of employees), FE are fixed effects, and ε represents the error term. The subscript i references our 'representative firm' namely one of the 25 cells in the 3-year employment size-quintile transition matrix, subscript c is for country, s for industry, and t for time. TFP is estimated at the firm-level as the difference between firm's real value added and the predicted one according to technology coefficients estimated at the 2-digit industry level using a semi-parametric approach (e.g. Wooldridge, 2009) to correct simultaneity bias. See Lopez-Garcia and di Mauro (2015) and Aglio *et al*. (2018) for more details.

Table 1. Baseline estimates of productivity-enhancing employment reallocation

Variables	(1) EU 9 country	(2) EU 6 country
Rel. prod$_{-3}$	0.339***	0.815***
	(0.0279)	(0.0845)
Observations	7,502	8,064
Adjusted R-squared	0.346	0.489

Source: (1) Author's calculations, CompNet v6, country sample 2007–15; (2) Bartelsman *et al.* (2018), CompNet v4, 6 country sample.
Note: Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Estimated coefficients for intercept, fixed effects, size and Δcycle are omitted from table.

Unless stated otherwise, each exercise includes the following fixed effects (FE): i) country*industry*initial size quintile; ii) country*year, and iii) industry*year. With this specification the analysis makes use of time variation within a given country/industry/size quintile controlling also for country and industry-specific shocks. To save space in the tables, we do not report on the coefficients of the intercept, the cycle, initial size or any of the FE controls. Finally, all our regressions are weighted with total cell-level employment. This allows adjusting for the fact that the 'representative firms' of the transition matrix vary in size and that the number of firms in each cell varies as well.[7]

Table 1 shows the baseline results for employment growth in our nine-country sample for 2007–15 and the six-country sample from 2004–13 as reported in Bartelsman *et al.* (2018). Conditional on the cyclical shock, growth in labour for each 'representative firm' is significantly correlated to its productivity (relative to all other firms in the industry) in the initial period. Similar to evidence for the US from Foster, Grim, and Haltiwanger (2016), there is significant productivity-enhancing reallocation in both samples of EU countries, although the estimate coefficient from the Bartelsman *et al.* (2018) paper is twice that estimated for our present sample. There might be two reasons for this discrepancy. First, as discussed in Bartelsman *et al.* (2018), the reallocation parameter varies significantly across countries, so differences across different country samples are not surprising. The differences can be related to differences in economic structure, such as industry and size distribution of firms, or to differences in the policy environment, for example employment protection or product market regulation. For the current exercise we do not have complete overlap for the countries used in Bartelsman *et al.* (2018) so we cannot check the importance of this particular factor. Second, and maybe more importantly, for this exercise we have access to the actual employment growth rates of firms of the 'representative' firms whereas in Bartelsman *et al.* (2018) they had to be approximated. Nonetheless, all the qualitative results shown in this paper also hold with the data used in Bartelsman *et al.* (2018).

Indeed, in our sample of nine countries, we find very similar results on the effects of firm-size distribution, market concentration, or of factor or product market regulation, as in Bartelsman *et al.* (2018). In particular, the reallocation coefficient is significantly smaller for large firms, as well as for observations (country, industry, year) with high concentration ratios, high mark-ups, high profit margins, or high employment protection.

We now turn to patterns of reallocation over time. From a theoretical perspective, a deep recession could alter the calculus of costs and benefits to reallocation. If adjustment costs are convex, a sharp downturn is likely to lead to less than expected reallocation, while concave adjustment costs will do the opposite. Further, there may be a relationship between the size of the cyclical shock and the productivity of the firm, for example if exports decline sharply and more productive firms are predominantly exporters, then PER may be reduced. While generally PER is found to be countercyclical, the sharpness, depth and nature of the Great Recession and the European sovereign debt crisis may alter whether or not these episodes generated a silver lining from reallocation.

To address these issues, in table 2 we regress employment growth on the cycle, on initial relative productivity, and their interaction for the full sample period, and for different periods separately: pre-crisis for windows ending in 2007 and 2008, the Great Recession (GR) for the windows ending in 2009, 2010 and 2011, the Sovereign Debt Crisis (SDC) for the windows ending in 2012 through 2014 and the recovery (REC) for the period ending in 2015. The interaction between initial relative productivity and the cycle captures whether PER is enhanced or muted over the cycle. The first column shows that for employment the interaction between cycle and initial productivity is negative for the full period, meaning that normal downturns enhance the PER of labour.[8] However, the sign of the interaction becomes positive during the GR – indicating that over the Great Recession the downturn was less productivity enhancing. The cyclical pattern of cleansing turns negative during the SDC and becomes stronger as the overall economy recovers in the last period. In short, our finding that downturns increase the productivity-enhancing reallocation of employment does not hold

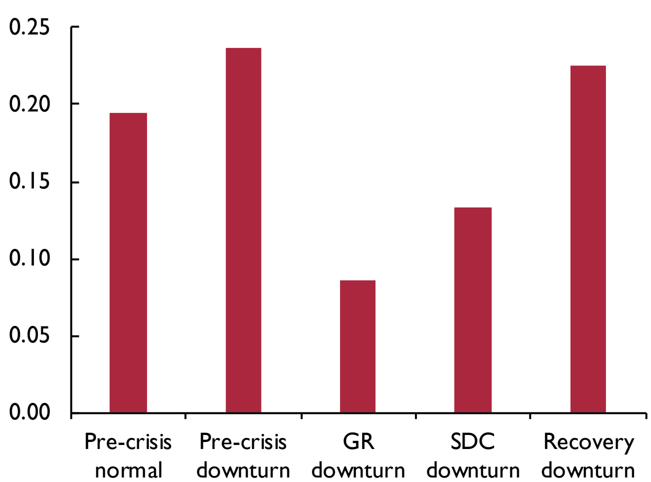
https://doi.org/10.1177/002795011924700113 Published online by Cambridge University Press

Table 2. Productivity-enhancing employment reallocation over the cycle

Variables	(1) Full Sample	(2) Pre-crisis	(3) GR	(4) SDC	(5) REC
$Rel.prod_{-3}$	0.345***	0.381***	0.179***	0.196***	0.275**
	(0.0279)	(0.0708)	(0.0325)	(0.0374)	(0.124)
$Rel.prod_{-3}$ x Δcycle	–0.373***	–1.633**	0.233	–1.288**	–3.303*
	(0.118)	(0.659)	(0.434)	(0.594)	(1.739)
Observations	7,502	1,684	2,504	2,648	666
Adjusted R–squared	0.347	0.434	0.444	0.453	0.324

Source: Authors' calculations using CompNet v6. 9 country sample 2007–15.
Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Estimatd coefficients for intercept, fixed effects, size, and Δcycle are omitted from table. Full sample, 2007 to 2015; pre-crisis 2007, 2008, GR 2009, 2010, 2011; SDC 2012, 2013, 2014; REC 2015.

Figure 1. Predicted employment growth difference: high vs low-productivity firms



true for the Great Recession, when on average PER is rather low and does not vary much according to country and industry specific conditions.

Figure 1 provides a graphical representation for the results by displaying the effect of lagged productivity on employment growth over the cycle in different periods. The figure quantifies the difference in employment growth for firms with initial productivity one standard deviation above and below the average. The first bar shows that in the pre-crisis period, employment in the most productive firms grows 19 per cent more than their unproductive counterparts in normal times. The second column shows that in downturns, productive firms grow over 20 per cent more than the unproductive ones, suggesting that the cycle is 'cleansing' away from less efficient producers.[9] However, the third column shows that during the Great Recession productivity differentials are less important in explaining employment growth, as the difference between the most and least productive firms drops to below 10 per cent. In the next-to-last column referring to the SDC the cycle starts reacquiring its cleansing role. Finally, the cleansing appears strongly in the most recent period.

Changing patterns of PER: the role of the trade collapse

The reduction in countercyclical PER during the Great Recession has also been found for the US (Foster, Grim, and Haltiwanger, 2016). Indeed, our results show that PER was muted during the Great Recession, while it reacquired its cleansing role during the Sovereign Debt Crisis and in the most recent period. There are potentially many explanations for the difference in PER between normal downturns, the GR and the SDC. First, there could be structural differences in industry composition, or differences in the regulatory environment that affect the responsiveness of factor reallocation over the cyclical. Next, the financial stress that occurred during the GR and SDC may have made it more difficult to finance the required reallocation, thus leading to changes in the cyclicality of PER. Finally, a feature common in both the EU and the US was the sharp downturn in global trade that accompanied the onset of the GR.

We start with the last point. The literature has emphasised the positive relationship between exporting status and productivity (Melitz, 2003; Melitz and Ottaviano, 2008). It is plausible that the reduced PER over the GR results from large and productive firms gaining market share during the collapse of international trade relative to less productive firms. If productive firms failed to attract the

https://doi.org/10.1177/002795011924700113 Published online by Cambridge University Press

Table 3. Productivity-enhancing employment reallocation over the cycle

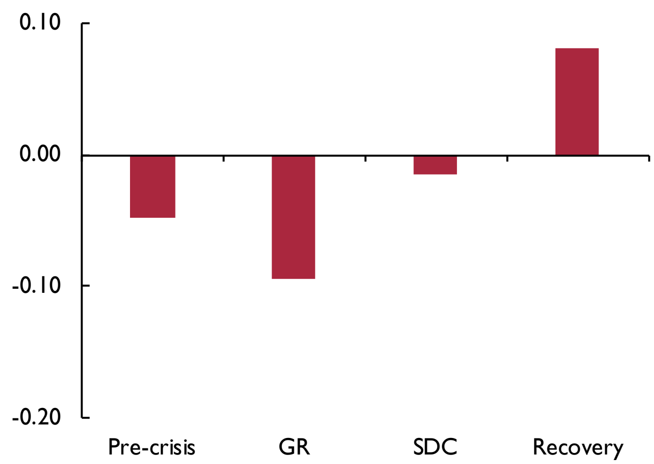
Variables	(1) Pre–crisis	(2) GR	(3) SDC	(4) REC
$Rel.prod_{-3}$	0.395***	0.166***	0.203***	0.279**
	(0.0707)	(0.0319)	(0.0376)	(0.130)
$Rel.prod_{-3} \times \Delta cycle$	–1.758***	–0.168	–1.370*	–3.284*
	(0.659)	(0.804)	(0.756)	(1.900)
$Rel.prod_{-3} \times \Delta cycle \times d_{exp}$	1.859	3.663***	0.560	–3.166
	(1.598)	(1.256)	(0.947)	(3.954)
Observations	1,684	2,504	2,648	666
Adjusted R–squared	0.435	0.451	0.453	0.327

Source: Authors' calculations using CompNet v6. 9 country sample 2007–15.
Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Estimated coefficients for intercept, fixed effects, size, Δcycle, d_{exp}, and Δcycle x d_{exp} are omitted from table. Pre-crisis 2007, 2008; GR 2009, 2010, 2011; SDC 2012, 2013, 2014; REC 2015.

resources they needed to expand, then it should show up in reduced PER. In table 3 we explore whether the lack of silver lining was particularly important in industries more exposed to trade. After splitting the sample into pre-crisis, GR, SDC, and REC, we use a triple interaction between initial productivity, cycle and an industry-specific indicator of the exposure to the trade collapse. This is done with the help of an indicator of industry exposure to trade that is computed from the input-output tables TIVA of the OECD (details are available in Bartelsman *et al.* 2018). This exposure is taken as an average of the few available years and is country-specific. We then multiply that with the actual change in aggregate exports, in each country. We construct a dummy (labelled 'd_{exp}' in the table) that takes the value 1 if the country-industry was more affected by the trade collapse than the country' median in the time period considered and 0 otherwise. The purpose is to explore whether it was particularly in country-industries more exposed to the trade collapse that PER declined. Table 3 shows that indeed, unlike the other periods, during the GR (column 2), country-industries more affected by the trade collapse featured muted employment PER.

Figure 2 shows the employment growth difference between high and low productive firms in country-industries exposed to the trade collapse relative to others. We show the difference in PER during a bust in the pre-crisis period (bar 1), during the GR (bar 2) the SDC (bar 3), and the REC (bar 4). The figure shows that PER over the cycle in country-industries exposed to trade is particularly low relative to the rest of industries during the GR, where small but productive firms might have lost market shares due to the collapse of trade. While trade-exposed country-industries experienced less cleansing over the cycle already in the pre-crisis period

Figure 2. Predicted growth differential high-low productivity firms: industries exposed to trade vs others



(–1 per cent), the difference drops an order of magnitude over the GR. The cleansing property of downturns in exposed country-industries strengthens during the SDC and it becomes higher relative to others during the recovery period.

Next, we consider the credit crisis as a source of a reduction in PER during the GR and the SDC. Theory is less clear about the impact of credit frictions on PER. Mostly, we would expect tightness of credit to prevent firms, particularly those most dependent on bank credit, to grow when fundamental conditions were favourable. If credit constraints showed up in a manner unrelated (or positively related) to productivity, then productive firms might be prevented from growing, thus reducing

PER. In Bartelsman *et al*. (2018) it was found that credit constraints significantly reduced PER of firms reliant on credit during the GR. In our nine-country dataset, we use the same method to explore the role of credit constraints for employment reallocation. Unlike in Bartelsman *et al*. (2018), in this sample we do not find much of a role for credit conditions in changing the cyclicality of PER.

Finally, we consider industry structure and regulatory environment as sources of variation in PER over the cycle. Using a similar methodology, namely a triple interaction between relative initial productivity, a structural or regulatory indicator, and the country-industry specific cyclical shock, we can address the sensitivity of cyclicality to structure or regulation. We see that across firm size classes, there are no differences in patterns of PER in up- or downturns. Nor is there any change in cyclicality of PER under different regulatory regimes even if average PER is significantly affected by regulatory regimes.

In sum, we find evidence that productivity-enhancing reallocation of labour was muted owing to the trade collapse. The effect of credit constraints on changes in the cyclicality of PER of labour, which are not unambiguous theoretically for continuing firms, are found to be statistically insignificant. Further, differences in industry structure or regulatory environment do not seem to have contributed to the lack of silver lining to the GR.

Conclusions

The paper has shown how PER changes over the cycle, and in particular during the Great Recession and the ensuing recovery in a large set of EU countris. We find that the patterns of productivity-enhancing regulation vary over the recent cyclical episodes. In general, we find that PER is counter-cyclical. In other words, in a downturn low productive firms shrink more. However, over the Great Recession, this pattern broke down. Part of this may be attributed to the sharp drop in exports, which harmed the more productive and larger exporting firms and required them to shed labour proportionately more than less productive non-exporting firms. Other potential contributors to the reduction in PER over the Great Recession, namely financial conditions, industry structure or regulatory environment are not seen to have affected significantly the changes in cyclicality of productivity enhancing labour reallocation in our sample.

This paper continues the exploration of firm and industry dynamics that can be conducted using the CompNet data. These data are available to the research community for cross-country policy analysis (https://www.comp-net.org/data/). The breadth of indicators collected and the level of (sub-)industry detail will allow many different types of analyses on a host of issues related to productivity, finance, trade and employment.

NOTES

1 The underlying methodology of distributed micro data analysis is described in Bartelsman, Hagsten, and Polder (2018).
2 Criscuolo, Gal, and Menon (2014).
3 Bartelsman, Hagsten, and Polder (2018).
4 Lopez-Garcia and di Mauro (2015).
5 Detailed meta-data and analysis of cross-country comparability of samples can be found in Altomonte *et al*. (2018). Researchers can apply for access to the most recent version of the CompNet data at https://www.comp-net.org/data/.
6 Belgium (BE), Croatia (HR), Finland (FI), France (FR), Hungary (HU), Italy (IT), Lithuania (LT), Portugal (PT), and Sweden (SE).
7 On average across countries the four smaller quintiles of the size distribution refer to firms with less than ten employees whereas the largest size quintile includes firms with an average size of around 20 employees and contains about 80 per cent of employees.
8 Note that the cyclical indicator varies by country, industry, and year, allowing for both upturns and downturns for any state of the macro economy.
9 In the figure, a downturn is defined as a 5 per cent year-on-year decrease in industry real value added.

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