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## The Volatility and Cyclicity of Job Flows in German Exporters and Non-Exporters

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# The Volatility and Cyclicalities of Job Flows in German Exporters and Non-Exporters

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## Abstract

This paper exploits the administrative IAB establishment dataset for Germany to investigate the volatility and cyclicalities of job flows within exporters and non-exporters. On average, exporters face a lower employment volatility, which suggests a diversification of sales across markets. A closer look at the export share, however, reveals that the employment volatility is increasing in the export share for small firms, while it is decreasing for large firms. Thus, large firms gain from more diversification of a higher export share, while small firms face more volatility when exporting a higher share. Small exporters with an export share above one third are even more volatile than similar domestic producers.

Although the lion's share of these employment fluctuations is of idiosyncratic nature and aggregate fluctuations play only a minor role, we document heterogeneity between exporters and non-exporters. Controlling for size, exporters are cyclically more sensitive than non-exporters. This result is in line with aggregate exports being highly pro-cyclical and suggest that exporters specialize in the production of goods and services that are more cyclical. The contribution of exporters to the variance of aggregate flows, however, is limited and only about one third, which corresponds approximately to their employment share.

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# 1 Introduction

Firms differ in their engagement in global activities. While the majority of firms is small and produces only for the domestic market, a small fraction of highly productive, mostly large firms, is serving foreign markets as well. This heterogeneity between exporters and non-exporters stimulated recent research and is at the heart of the new new trade theory.<sup>1</sup> A branch of this research is focusing on the impact of globalization on the labor market performance as international trade is a source of aggregate as well as firm-level employment fluctuations.<sup>2</sup> The current study is related to this strand of literature as we focus on employment dynamics in exporters and non-exporters. In particular, we analyze empirically the direction between the export status – and additionally the export share and exporter size – and the plant-level employment volatility. In addition we focus on the cyclical behavior of the job flows of exporters and non-exporters.<sup>3</sup>

Understanding the relation between international trade and employment fluctuations is of crucial importance for an economy such as Germany, which is currently the third biggest exporter in the world and whose labor market is highly dependent on trade.<sup>4</sup> Among others, employment fluctuations, for example, increase the risk of income loss for households and require private and public insurance mechanisms, in particular when markets are incomplete.

Throughout the analysis, the role of size will be taken into account as crucial factor to explain employment fluctuations. It is well known that size is positively correlated with exporters and at the same time, employment volatility is found to be decreasing in size (Davis, Haltiwanger, Jarmin, & Miranda, 2006; Coşar, Guner, & Tybout, 2016). Furthermore, the size of a firm is an important determinant of its cyclical job flows (Moscarini & Postel-Vinay, 2012).

We aim to contribute to the literature in two dimensions. The first part on the analysis of plant-level employment volatility highlights new cross-sectional heterogeneity among exporters, while the second part argues for dynamic differences between exporters and non-exporters.

We provide new facts on the relation between exporters and their employment stability, in particular related to the intensive margin of trade and the exporter size. Theoretically it is ambiguous, whether exporters are more or less volatile in their sales and employment volatility.<sup>5</sup> And more-

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<sup>1</sup>The strand of literature following Melitz (2003) and Eaton and Kortum (2002) aims to explain differences across firms based on their engagement in international activities.

<sup>2</sup>In particular, research focuses on the relation between globalization and unemployment and the rise in inequality (Felbermayr, Prat, & Schmerer, 2011; Helpman & Itskhoki, 2010; Helpman, Itskhoki, & Redding, 2010)

<sup>3</sup>Obviously, there is a relation between the general employment volatility of a firm and its cyclicality. While the cyclicality of job flows is only related to aggregate movements in the economy, the overall employment volatility of a firm is composed of both, idiosyncratic volatility and the aggregate component. In general, aggregate and firm-level volatility can go in opposite directions as shown by Comin and Philippon (2006).

<sup>4</sup>Around 30% of all workers are employed in exporting firms. And estimates show that around 25% of all jobs are directly or indirectly dependent on exports (Yalcin & Zacher, 2011).

<sup>5</sup>The crucial components that determine the volatility are the relative size of shocks in the home and foreign countries and their co-variance. If shocks are not perfectly correlated, firms can decrease their sales volatility by choosing quantities optimally across markets.

over, arguments relating international trade and employment volatility question the homogeneity among exporters and rather suggest additional heterogeneity between exporters themselves, depending on how much and where they export to. Recent theoretical and empirical work has shown the existence of an export share threshold above which exporters are more volatile than domestic firms and below which they are less volatile (Kurz & Senses, 2016; Vannoorenberghe, 2012). Based on this research, exporting is perceived as inherently more volatile. Potential reasons might be shocks to exchange rates, shocks to the political or legal system, or shocks to transport costs. We confirm this non-monotonic relation between export engagement and employment volatility for German exporters. However, we also document that the export share is positively related to the size of plants and once we add plant size to the picture, results change. While it is true that the employment volatility of small firms increases in the export share, the opposite is true for large firms. This finding rises doubts on the fact that any firm can insure by trading internationally and points towards important heterogeneity between small and large exporters. A potential explanation are destination specific fixed costs that small firms cannot cover in every period, while large can and serve all destinations constantly. Therefore, small exporters enter and exit markets more often, which leads to a higher volatility of sales and subsequently employment (Vannoorenberghe, Wang, & Yu, 2014).

Most studies in the international trade literature focus on cross-sectional differences and do not consider heterogeneity in the business cycle behavior dependent on the export status of firms. But exporters are not static objects and in fact exposed to various fluctuations in the domestic and foreign markets. Exporters might be acyclical, because foreign shocks are not necessarily related to the domestic business cycle. At the same time, exporters specialize in the production of durable goods, which are strongly pro-cyclical (Engel & Wang, 2011). Thus, international trade bears the potential to insure against domestic fluctuations or to increase the responsiveness to domestic fluctuations.<sup>6</sup> Closed economy macro studies such as Moscarini and Postel-Vinay (2012) found an important role of firm size in explaining cyclical job flow rates in various countries. They argue that due to poaching of workers, more productive firms are still able to hire when labor markets are tight (Moscarini & Postel-Vinay, 2013). The result is a stronger cyclical sensitivity of more productive (large) compared to less productive (small) firms – in particular in upturns. International trade theories of heterogeneous firms incorporate the self-selection of more productive firms into the export market. Thus, it might well be that the findings are not so much about size,

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<sup>6</sup>We do not focus on the role of international trade on the aggregate volatility of a country. There is an ongoing debate about the effects of international trade on aggregate volatility in a country. In a recent study, Caselli, Koren, Lisicky, and Tenreyro (2015) find that international trade actually lowers the aggregate volatility of GDP in countries. This is in contrast with earlier research such as Newbery and Stiglitz (1984) who argued theoretically that trade can increase the aggregate volatility in a country. Based on industry-level data, di Giovanni and Levchenko (2009) found that international trade is associated with a specialization in sectors which are more volatile and hence increase aggregate volatility. The effect, however, is dampened, because these sectors are less correlated with the rest of the economy.

but about the export activities of firms. So we ask the question if exporters and non-exporters differ in their cyclical job flows in Germany. The findings reveal that the net job creation rate of exporters is cyclically more sensitive. Both, job creation as well as job destruction contribute to this pattern. When decomposing the aggregate volatility, however, the contribution of exporting plants is relatively low and amounts to about one third of aggregate volatility in job flows, which is approximately their employment share in the economy.

The paper is organized as follows. Section 2 discusses the literature and highlights potential mechanisms, while section 3 describes the dataset and the construction of the relevant measures. A first glance at descriptive statistics is included as well. Section 4 presents the empirical methodology for the results in section 5. Section 6 provides robustness of the results, while the last section concludes.

## 2 Related Literature and Mechanisms

### 2.1 Firm-Level Volatility

Empirical work has documented many differences between firms along the export dimension. In general, exporters are found to be larger, more productive, and pay higher wages (Bernard, Jensen, Redding, & Schott, 2012). One of these dimension, which recently gained more attention, is the heterogeneity in firm-level sales volatility as well as employment volatility between exporters and non-exporters.<sup>7</sup> Because better firm-level dataset are available in recent years, the scientific interest grew to investigate the association of firm-level volatility and international trade. The idea that firms can actually stabilize their sales through international trade stems back to at least the seminal work of Hirsch and Lev (1971).<sup>8</sup> Based on the assumption that economic shocks are not perfectly correlated across markets, firms that engage in international trade can choose where to sell their products to exploit international risk sharing of their sales.<sup>9</sup>

Vannoorenberghe (2012) formalizes the idea that firms engage in trade across markets with different volatility. He tests the implications of a partial equilibrium model with market-specific shocks and convex adjustment costs. By doing so, he shows that firms react to shocks in the short run by

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<sup>7</sup>In addition to the volatility that is related to exports there might be fluctuations rooting in the importing of firms, but we abstain from this source due to lack of data in this respect. Nguyen and Schaur (2012) investigate the channel of firm-level import and export linkages and find that domestic sales volatility of Danish exporters as well as importers is significantly higher by 13 and 15 percent.

<sup>8</sup>Testing the hypothesis of international risk sharing through export market diversification, Hirsch and Lev (1971) find a positive correlation between the sales stability and the export diversification for firms in Denmark, the Netherlands, and Israel.

<sup>9</sup>There is also a small branch in the strategic management literature that looks at the potential to stabilize cash flows by insuring through international trade. Campa and Shaver (2002) research Spanish manufacturing firms and find a higher stability of cash flows for exporters. These cash flows are related to subsequent more stable capital investments of exporters compared to non-exporters.

substituting their sales across markets. A negative relation between domestic sales and foreign sales arises and – under the assumption of more volatile export markets – there exist a threshold for which sales of exporters are more volatile than comparable domestic firms. The existence of such a threshold is documented with an empirical analysis of sales in French firms. In a similar style and closest to our research, Kurz and Senses (2016) provide empirical evidence for a non-monotonic relation between international engagement of firms and their employment volatility in the United States. They show that on average trading firms are less volatile than non-trading firms. While the frequency of trading in terms of years is negatively associated to the employment volatility, there are other factors, which lead to a higher volatility. The employment volatility increases, for example, in the export share, suggesting that trade is inherently more volatile. Thus, up to a certain degree firms insure when interacting with international markets, while they cannot insure if they engage too much in trade.<sup>10</sup> For the German economy, Buch, Döpke, and Strotmann (2009) provide evidence that in German manufacturing plants output volatility is reduced due to exporting.<sup>11</sup> They estimate a fixed effect panel regression in which they focus on the relation of output volatility and the export share as well as those firms that enter or exit the export market. Their main finding is a negative association between the selection into exporting and the firm-level output volatility.<sup>12</sup>

Furthermore, the size of exporters plays an important role for firm-level volatility as well. Lawless (2009) shows that larger Irish firms are exporting to more markets than small firms. By doing so, the actual entry and exit into markets is much more volatile than the decision to export itself. This means that many exporters do not constantly serve their destination markets over time. For Chinese firms Vannoorenberghe et al. (2014) find heterogeneity between small and large exporters. Interestingly, the diversification across markets does not hold for small exporters, while it does for large. Small exporters face an increasing volatility in their exports if they sell to a more diversified set of countries. In contrast, large exporters decrease their volatility – as suggested by the portfolio theory argument. A theoretical explanation for the observed pattern is suggested by destination specific fixed costs (Vannoorenberghe et al., 2014). These costs cause small exporters to enter and exit markets more often as they cannot cover the fixed costs, while large exporters serve these markets permanently. This leads to a higher volatility of sales for small compared to large exporters.<sup>13</sup>

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<sup>10</sup>One very obvious explanation that is taken care of by respective controls is based on firm size. Findings of firm-level volatility in the closed economy set-up show a negative relation between firm size and employment volatility (Davis et al., 2006; Comin & Philippon, 2006). Larger firms are closer to their optimal size and do not have to grow much any more.

<sup>11</sup>Compared to our study, they differ in their methodology and investigate only manufacturing plants from the State of Baden Württemberg.

<sup>12</sup>Due to the set-up, they cannot estimate differences between exporters and non-exporters, but only effects of time varying variables.

<sup>13</sup>Note that small and large in this context is related to the firm size. However, it turns out that the export intensity is positively related to the size of a firm.

## 2.2 Cyclicalities of Exporters

While most volatility of plants is of idiosyncratic nature, part of the volatility is related to movements in the aggregate economy. There is only little work on the cyclicalities of exporters. Theoretical work related to the dynamic behavior of exporters in the labor market focuses primarily on the labor market dynamics after trade shocks – i.e. opening up to international trade – and not so much on the business cycle dynamics of exporters. Similarly, the empirical trade literature is focused more on cross-sectional findings than on different dynamics of exporters and non-exporter.<sup>14</sup> One of the exceptions is the work of Engel and Wang (2011). They study the cyclical fluctuations in aggregate exports and verify for OECD countries that exports as well as imports are more volatile than GDP and pro-cyclical. Only net exports are counter-cyclical. Further, they show that a large fraction of exports takes place in durable goods – in Germany 69% of imports and 71% of exports. To explain these findings, the authors construct a model that features trade in investment goods as well as durable consumption goods. When a positive productivity shock hits the home economy, the demand for domestic and foreign investment goods increases in the home economy, leading to an increase in imports. At the same time, the increased supply of the export good lowers its price and leads to increasing exports, because of the higher demand from abroad. The durable consumption sector helps to increase volatility of durable goods, because agents expect higher future income and this wealth effect leads to an increase in the consumption of durable consumption goods. The main argument for the pro-cyclicalities of exports is therefore based on the type of goods that are traded and produced by exporters.<sup>15</sup>

The recent strand of literature on cyclical labor market dynamics of firms generally abstracts from international engagement of firms. Moscarini and Postel-Vinay (2013), for example, emphasize the importance of job-to-job transitions due to labor poaching of more productive firms. Because more productive firms can attract workers through higher wages even when the labor market is very tight, i.e. in booms, more productive firms will be larger on average and more sensitive to the cycle compared to small firms. This is in line with their empirical findings for the United States and some European economies (Moscarini & Postel-Vinay, 2012). Since new-new trade theory is built on a one-to-one relationship between productivity, size, and selection into the export market, the theoretical argument of worker poaching could explain differences between exporters and

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<sup>14</sup>An exception is the literature that focus on the relation between real exchange rate fluctuations and labor market dynamics. The founding articles are written by Gourinchas (1998, 1999). In there, he investigates the labor reallocation after changes in the competitiveness through real exchange rate changes. Klein, Schuh, and Triest (2003) provide further evidence for the United States, while Moser, Urban, and di Mauro (2010) investigate the German economy. They find that real exchange rate changes affect mainly the job creation margin in Germany.

<sup>15</sup>At the same time, di Giovanni, Levchenko, and Mejean (2016) show that exporters are closer linked to the aggregate shocks of their destination country and might therefore transmit shocks to the domestic economy. Because Germany is a very open economy in general, a larger part of the domestic cycle could be actually driven by an international cycle.

non-exporters as well.<sup>16</sup>

In principle, exporters and non-exporters can also differ in their response to a given shock. For example, Lichter, Peichl, and Siegloch (2014) analyze the elasticity of labor demand in German exporters and non-exporters. Their idea is based on the evidence that exporters face destination specific price elasticities of product demand, which are decreasing in per-capita income. Thus, exporters from a rich economy as Germany are facing relatively high elasticities of product demand when trading with poorer countries. The authors use the Hicks-Marshall law of derived demand, which positively relates the elasticity of product demand and the own-wage elasticity of labor demand in a firm, and test for this association. They find that the unconditional own-wage elasticity in German exporters is higher than in non-exporters. This suggests that exporters are more responsive to a given shock, which affects wages. In this case, the cyclical employment volatility should be higher at the firm-level for exporters compared to non-exporters.<sup>17</sup>

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<sup>16</sup>Trade, however, could be not the cause of the cyclical job flows, but rather a coincidence, because more productive firms select themselves into the export market. However, the existence of small exporters does not fit into this picture.

<sup>17</sup>There are also other explanations that are observationally equivalent with a higher cyclical sensitivity of exporters compared to non-exporters. It could well be the case that the domestic business cycle is endogenous and generated – at least partially – by the behavior of exporting firms. Based on the idea of Gabaix (2011) that the law of large numbers does not hold and large firms can actually cause aggregate fluctuations, di Giovanni and Levchenko (2012) show that this mechanism is particularly relevant for exporters as they are the large firms. Using a selection mechanism into trade according to Melitz (2003), they argue that opening up to trade leads to an increase in size of exporters and in turn increases their importance to aggregate fluctuations. For detailed French data they provide evidence that firm-specific components contribute substantially to aggregate fluctuations (di Giovanni, Levchenko, & Mejean, 2014). A similar idea of why large firms might be important for aggregate fluctuations is proposed in a theoretical paper by Acemoglu, Carvalho, Ozdaglar, and Tahbaz-Salehi (2012). They base their argument on a network mechanism in which shocks to the final good producers are transmitted through linkages to the suppliers of intermediate goods. However, this mechanism is only testable with detailed input linkages between firms and a large sample of firms. The data used in the study in hand do not allow for this.



### 3 Data, Measures, and Descriptive Statistics

The main data source is given by the IAB-Establishment Panel, provided by the German Institute for Employment Research (“*Institut für Arbeitsmarkt- und Berufsforschung*”). The dataset contains annual survey information on establishments in East and West Germany, but is unbalanced over time.<sup>18</sup> The unit of observation is therefore given by the establishment.<sup>19</sup> For the construction of the panel, out of the universe of all establishments in Germany with at least one worker subject to social security contributions, establishments are randomly drawn and interviewed according to strata defined over federal state, industry, and size.<sup>20</sup> In this process, large firms are oversampled to ensure that enough respondents of this group are in the sample. To guarantee representativeness, sample weights are computed by comparing the sample of establishments with the population of establishments in the given strata cells.<sup>21</sup> In general, the statistics are representative for about 80% of all employed persons in Germany.<sup>22</sup> Therefore, the panel covers also plants outside the private sector. We decided to drop the plants in public administration to make sure that hiring decisions are driven by motives of the private economy.

The collected data from the personal interviews with plant managers contains information on – among others – total employment, total revenues, share of revenues from abroad (export intensity), industry, total wage bill, and bargaining arrangements. In certain years, the panel includes also answers to questions on institutional features such as short-time work or the credit conditions during the Great Recession.<sup>23</sup>

The sample period in this study is restricted to 1996 to 2012, because prior to 1996 only data for West Germany is available. A further restriction comes from the fact that the export measure is reported for the previous year and therefore information on exports are missing for the most recent

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<sup>18</sup>An overview of the dataset can be found, for example, in Ellguth, Kohaut, and Möller (2014).

<sup>19</sup>The vast majority of establishments are single-establishment firms at the same time, but some belong to multi-establishment firms as well. The dataset does not allow to aggregate information on the firm level, but contains information on whether the establishment is the single-unit of operations or whether there are more establishments in the same firm. We will control for the structure of the firm and check for robustness in section 6.3 by simply constraining on single-plant firms.

<sup>20</sup>The panel is well distributed across regions and industries. Nevertheless, we will include industry and state dummies to guarantee that our results are not driven by the unequal sampling of firms across heterogeneous industries.

<sup>21</sup>An implication is that we cannot test whether the weights are representative in the export dimension as well. Thus, one crucial assumption is that the sample is assumed to be representative with respect to all dimensions used in this paper, in particular the export dimension. This assumption is usually not clearly stated in previous studies on the dataset. Note however that even if problems of representativeness might emerge all results are obviously correct for the actual sample of firms used in this study. Thus, the problem boils down to a potential problem of representativeness.

<sup>22</sup>Excluded categories are mainly civil servants, workers in marginal employment, and family workers.

<sup>23</sup>Unfortunately, the dataset does not include information on the import share. Only in three years there is information on used material from abroad.

year.<sup>24</sup> The number of interviewed establishments is increasing from 8,342 establishments in 1996 to 15,857 in 2012.

The IAB-Establishment panel allows to compute job flows as described later on in section 3.2.<sup>25</sup> When we compute semi-aggregated job flows, the sample shrinks slightly, because only firms that change their employment stock within two subsequent periods are taken into account as required by the definition of these more aggregated job flows.

### 3.1 Size and Export Status

We group firms according to their employment size and export status. Both measures are highly correlated as it is common in the empirical trade literature (Bernard et al., 2012) and explained by the Melitz model. As more productive firms grow larger and at the same time self-select themselves into the export market, large firms are exporters, while small firms stay non-exporters. In reality, the size distribution of exporters and non-exporters is overlapping and only on average, exporters are larger than non-exporters.<sup>26</sup>

Based on their beginning of the period employment, establishments are defined as *Small* (0-50 employees), *Medium* (50-500 employees), and *Large* (>500 employees).<sup>27</sup> Whenever useful we will also use the continuous employment measure, given by the number of employees. The discrete size measure mainly helps to relate to findings in the literature and get stylized facts on small and large plants.

The main variable of interest for us is the export status of an establishment along with its export intensity, i.e. the share of exports in total revenues. The export status is defined according to the reported share of revenues from abroad. Zeros are defined as non-exporters, positive values indicate exporters. In contrast to the size categorization, establishments are classified as exporters

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<sup>24</sup>In principle, we could define exporters also by their beginning of the period export status. However, once we focus on the export share, the previous period export share is not useful to measure current export engagement.

<sup>25</sup>In a previous version of this study, worker flows were analyzed as well. But since the research focus was narrowed down, we decided to drop the analysis of worker flows and leave it for future research. In principal, the IAB-Establishment Panel contains information on worker flows. However, only on accessions and separations in the first half of the year. Instead, worker flows are available as an extension file for the Establishment History Panel (BHP). Since the establishments contained in the IAB-Establishment Panel are a subset of the BHP panel, this extension file can be easily merged with the IAB-Establishment Panel as well. Recently, Baumgarten (2015) analyzed the relation between worker flows and international trade at the plant-level for Germany. He finds unconditional evidence for lower worker flows in trading compared to non-trading establishments. However, once plant fixed effects are taken into account, this relation loses statistical significance.

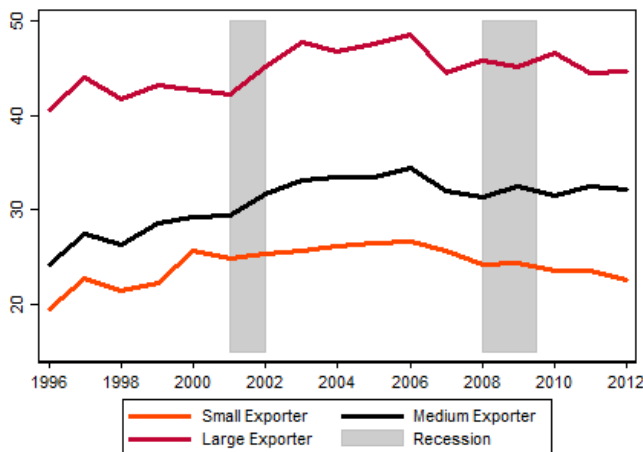
<sup>26</sup>By assuming that productivity is not the only source of heterogeneity, but firms face additionally idiosyncratic export costs, an overlapping size distribution can be generated as shown by Armenter and Koren (2015). Their mechanism leads to an outcome in which some high productive firms face too restrictive export costs and stay non-exporter and some low productive firms get a lucky export cost draw and serve the foreign markets as well.

<sup>27</sup>Thus, when using these size classes we always have in mind the employment stock of a firm. In principle, one could also use similar definitions for firms that export a large share or a small share, but we will use other descriptions for those cases. The classification according to their beginning of period size enables us to overcome the *size distribution fallacy* as discussed by Davis, Haltiwanger, and Schuh (1996, p. 62ff.).

or non-exporters according to their current engagement in international activities.<sup>28</sup> The revenue share from abroad was already used in many other studies on Germany to distinguish between exporters and non-exporters.<sup>29</sup>

As already mentioned above, our measures of size and export status are positively correlated, which is in line with the literature. The discrete measures report a correlation coefficient of 0.34, while the continuous measures report a coefficient of 0.19. It is not only the export status that is correlated with size, but also the export intensity. Figure 1 reveals this interesting pattern. The export share is increasing in the size of exporters. For a dynamic model this suggests that exporters grow more than proportional in the export market.

Figure 1: Weighted Export Share by Size Group



The graph plots the revenue shares from abroad for different size classes of firms, weighted by the relevant strata weights.

Part of the analysis exploits the continuous dimension of the export share. We report the pooled distribution of those establishments with positive export revenues in table 1, which correspond to 29 % of the plants in the overall sample. Conditional on being an exporter, the international engagement of establishments is quite heterogeneous. While many establishments earn only a relatively small fraction of their revenues from abroad, a substantial part of firms report a large export share. 33% of all exporting plants earn 1-10% of their revenues from abroad, while 23 % of exporters export more than 50% of their sales and are strongly dependent on developments in other markets.

<sup>28</sup>Due to this classification, the panel loses one year of observations. But since the actual interest for the cyclical analysis is related to the current performance, the status in the respective period is relevant. For the general volatility measures there is no difference, because only the export status over time divides the sample into non-exporter, part-time exporter, and exporter.

<sup>29</sup>Schank, Schnabel, and Wagner (2007), for instance, used it to analyze wage differences between exporters and non-exporters. Baumgarten (2013) used the variable to research the impact of exporting activity on the risen residual wage inequality in Germany. And we mentioned already the study of Moser et al. (2010) who investigate the role of changing competitiveness due to exchange rate movements on job flows.

Table 1: Distribution of Export Intensity (in percent)

Export Share	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Observations	9019	4134	3034	2596	2211	1808	1490	1275	858	615
Percentage	33%	15%	11%	10%	8%	7%	6%	5%	3%	2%

The table reports the pooled number of establishments that report positive export shares according to their export share for the years 1996 to 2012. Over the whole sample period 29% of plants exported.

Unfortunately, only for few years information on the destinations of the exports is available and therefore cannot be used in a more rigorous analysis. In the questionnaire establishments are also only asked about the destination region. For those years in which data is collected, we can observe some heterogeneity between small and large exporters. We will only focus on the export share to the euro area as a share of overall exports as this corresponds to the region in which neither additional taxes nor exchange rate changes are relevant, i.e. typical trade shocks should be less relevant.<sup>30</sup> In the first two columns, table 2 reports the share of overall exports according to firm size as well as the share of exports, which is shipped to the euro area. In addition, the rightest four columns split the exporters between firms that export above and below 30% or 50% and reports the corresponding fractions that are shipped to the euro area. This helps to better understand potential heterogeneity across exporters not only in terms of size, but also with respect to different export intensities.

The first column underlines again that the export share is increasing in the plant size. While about 32% of the revenues from small exporters stem from abroad, this share increases to 46% for large exporters. But how are these exports distributed across the world? From the second column we can see that on average 60% of the exports are shipped to the euro area. Small exporters export 62% towards the euro area, while 57% of the sales of large plants come from the euro area. As the last four columns show, this difference, however, is driven by compositional effects, i.e. due to a larger mass of small firms with a relatively low overall export share. When comparing the plants that earn more than 30% of their revenues from abroad with the one below we observe a general decrease in the share of the exports that are shipped to the euro area. The average share shipped to the euro area drops from 68% to 54%. For those plants that ship more than half of their products abroad, the share of the exports that stays in the euro area drops even to 48%. Interestingly, we do not observe strong differences between exporters of different size in this respect. When taking into account the mass of exporters, however, we see that the fraction of large exporters that exports more than 50% of the overall exports is higher compared to small exporters (204 out of 425, compared to 131 out of 525). Therefore, the differences between the average small exporter and the average large exporter are of compositional nature. The increase

<sup>30</sup>The panel contains information on exports to the countries of the currency union for the years 1997-2006. The group of countries contain the 10 other founding members of the euro area and from 2000 onwards Greece.

in the overall export share in plant size is in line with the findings of Lawless (2009). She finds a positive relation between the size of a firm and the number of markets it serves.

Table 2: Export Intensity and the Export Share to the Euro Area

	Export Share	Euro Area	Overall Export Share			
			<30%	>30%	<50%	>50%
Small	0.32	0.62	0.69	0.53	0.67	0.49
N	756	525	298	227	394	131
Medium	0.36	0.61	0.68	0.54	0.66	0.46
N	1366	1087	513	574	787	300
Large	0.46	0.57	0.67	0.54	0.64	0.50
N	468	425	104	321	221	204
Overall	0.37	0.60	0.68	0.54	0.66	0.48
N	2590	2037	915	1122	1402	635

The table reports the overall share of exports as well as the shares of exports, which are shipped to the euro area. The complementing share of the latter one is shipped to the rest of the world. The rightmost four columns divide report the export share to the euro area among those plants that export a low and a high share overall. The numbers refer to the average share over time. While the overall export share is available for the entire period between 1996 and 2012, the exports to the euro area are only reported for the years 1997 to 2006.

## 3.2 Job Flows Rates

In the IAB Establishment Panel plants report their stock of employees with respect to the 30th of June in the current as well as the previous year.<sup>31</sup> These information on the employment count will be used to construct two types of measures in the spirit of Davis et al. (1996).<sup>32</sup> The first one is defined on the establishment-level and will correspond to the plant-level net job creation rate. The second measure is a semi-aggregated measure for the six size/exporter groups defined above. While the plant-level variable is used to construct a plant-specific volatility measure as well as for panel regressions, the semi-aggregate measure is exploited for a correlation analysis and the variance decomposition.

The net job creation rate for establishment  $i$  in period  $t$  is given by

<sup>31</sup>Since the panel of establishments is not readily available, but has to be constructed from individual waves, there are slight differences in the reported number of employees. Some establishments report a certain labor force in period  $t-1$  for period  $t-1$ , but report a different labor force in period  $t$  for period  $t-1$ . Different computation procedures were implemented and revealed that all results are robust.

<sup>32</sup>Note that in general the measures of job flows are based on head-counts and neglects the intensive margin, i.e. the adjustment via hours worked. The IAB Establishment Panel does not report information on the hours worked in an establishment. Thus, a problem might arise with the head-count measure during the Great Recession, because most of the adjustment came through the intensive margin compared to the extensive margin. Boeri and Brücker (2011) show that exporting establishments rely more on short time work compared to non-exporting plants. Thus, we would expect less action on the extensive margin for those establishments, i.e. less employment volatility, but also less cyclical sensitivity of exporters.

$$njcr_{i,t} = \frac{E_{i,t} - E_{i,t-1}}{\frac{1}{2}(E_{i,t} + E_{i,t-1})}, \quad (1)$$

where  $E_{i,t}$  corresponds to the number of workers in establishment  $i$  at period  $t$ . The measure is similar to the employment growth rate, just bounded between -2 and 2.

The semi-aggregated measure of job flows classifies establishments either as job creators or as job destroyers, depending on the net employment change in a given period. The semi-aggregated net job creation rate for group  $S$  in time  $t$  is defined as:

$$NJCR_t^S = \underbrace{\frac{\sum_{i \in S^+} \omega_{i,t} \cdot (E_{i,t} - E_{i,t-1})}{\sum_{j \in S} \frac{1}{2}(E_{j,t} + E_{j,t-1}) \cdot \omega_{j,t}}}_{JCR_t^S} - \underbrace{\frac{\sum_{i \in S^-} \omega_{i,t} \cdot (E_{i,t-1} - E_{i,t})}{\sum_{j \in S} \frac{1}{2}(E_{j,t} + E_{j,t-1}) \cdot \omega_{j,t}}}_{JDR_t^S}, \quad (2)$$

where  $S^+$  ( $S^-$ ) defines those subset of plants, belonging to size/export group  $S$ , that on net create (destroy) jobs. The first term sums all created jobs for a group and rescales it by the average employment of this group. During this process of aggregation, we take into account the strata weights  $\omega$  to guarantee representativeness for the overall economy.<sup>33</sup> The second term defines the group-specific job destruction rate and the difference between both terms is defined as the net job creation rate for group  $S$  in period  $t$ .

### 3.3 Business Cycle Measures

To be able to analyze the cyclical role of job flows additional data series for the aggregate fluctuations in Germany are necessary. Therefore, data for aggregate output, exports, and unemployment is merged to the dataset. Data on real GDP for Germany is taken from the Monthly Economic Indicators of the OECD.<sup>34</sup> This time series is aggregated on an annual basis from July of the previous period to June in the current period to assure an overlap with the sample period of the IAB-Establishment panel. Only for illustrative purposes, real exports are included in the plots as well to get an impression on the cyclicity of overall exports. The timing is consistent with the timing of GDP.

The monthly unemployment rate comes from the Federal Employment Agency (BA).<sup>35</sup> The measure is based on the number of dependent employees and is not seasonally adjusted. However, when taking yearly averages a seasonal adjustment is obsolete in the context of this paper.<sup>36</sup> The

<sup>33</sup>As already mentioned above, the panel contains oversampled large establishments that in turn have to be down-weighted in their importance compared to small establishments.

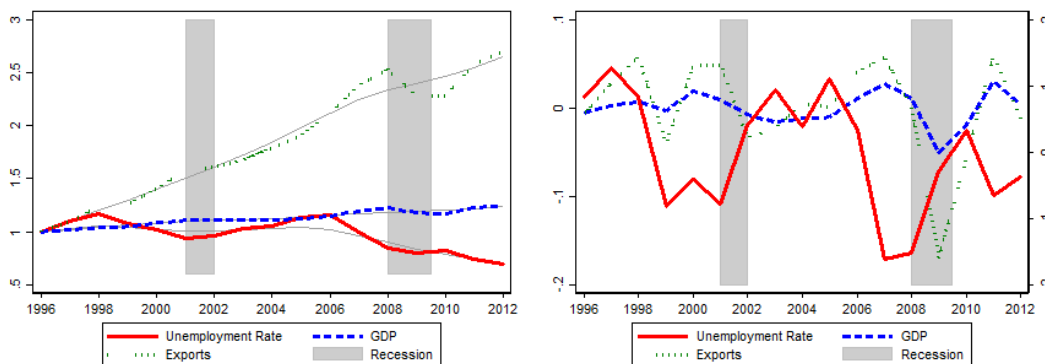
<sup>34</sup>Edition January 2015

<sup>35</sup>Data is taken from table 2.1.2 of “*Arbeitslosigkeit im Zeitverlauf - Januar 2013*”.

<sup>36</sup>Obviously, the average unemployment rate could be lower (higher) in case the seasonal adjustment would lead to decrease (increase) the reported unemployment rate in certain months if there was a time varying pattern between several years in the seasonality. Assuming a constant seasonal pattern over time, the potential mistake due to leaving out seasonal adjustment does not impact changes of the average annual measure over time.

measure is constructed as an average of the unemployment rate between July in the previous period and June in the current period to be consistent with the timing of the job flow rates.

Figure 2: Unemployment, GDP, and Exports over Time



In the left panel, variables are indexed to 1 in 1996. The right panel depicts the demeaned first differences.

Figure 2 plots the aggregate measures over time. In addition to GDP and the unemployment rate, which are the two main aggregate measures used in the further analysis, the real export component of the GDP series is included in the plots. The left panel shows that aggregate exports grew strongly during the period under observation, while unemployment slightly fell.<sup>37</sup> All series underlie business cycle fluctuations, which are depicted in the right panel. For the plot we further demean the first differences of the aggregate measures to make them comparable. The rates highlight a strong pro-cyclicality of exports. During booms and recession periods exports overshoot, meaning that they grow or drop stronger than overall GDP. These findings are in line with Engel and Wang (2011) who found a 2.86 higher standard deviation of real exports compared to GDP. As an explanation they proposed the large fraction of durable goods in overall exports, which they measure to be 71% for German exports. Consumers invest in these durable goods more in booms and postpone purchases of durable goods during recession periods instead. Table 3 reports the contemporaneous correlations<sup>38</sup> (and significance levels) between the three plotted measures and confirms that exports are strongly positive correlated with GDP over the cycle. Moreover, GDP and unemployment are negatively correlated as expected.

<sup>37</sup>Imports, which are not shown in the plots, grew over the period as well, but not as strong. As a result, the net exports are still increasing over this period, but not as dramatically as suggested by our plot. However, what matters for us is the cyclicity and not the trend component of the data series.

<sup>38</sup>Figure 2 shows that unemployment is actually lagging GDP slightly. But when investigating correlations later on, we follow Moscarini and Postel-Vinay (2012) and interpret the correlations with the cyclical unemployment rate as the behavior in later stages of a boom or recession. Moscarini and Postel-Vinay (2012) argue that particularly large firms are more sensitive in later phases of a boom. When the labor market is tight, they manage to hire relatively more compared to small firms.

Table 3: Correlation between Unemployment, GDP and Exports

Unemployment – log GDP		Unemployment – log Exports		log GDP – log Exports	
HP	FD	HP	FD	HP	FD
-0.50**	-0.41	-0.19	-0.08	0.93***	0.90***
(0.04)	(0.11)	(0.45)	(0.77)	(0.00)	(0.00)

The table reports correlation coefficients and p-values for the correlation between the respective variables between 1996 to 2012. The specifications are given by the HP-filtered (parameter 6.25) series, and series in First Differences.

## 4 Specifications and Estimation Method

We are interested in the plant-level volatility and cyclicalities of job flows. First, we want to investigate the plant-level employment volatility across non-exporters and exporters and potential heterogeneity along the intensity of exporting. By doing so, we take into account heterogeneity across establishments of different size. Second, we analyze the cyclicalities of semi-aggregated job flows in exporters and non-exporters. While the first question is mainly based on a standard OLS regression framework, the second question on the cyclicalities is answered with a correlation analysis as well as a variance decomposition.

### 4.1 Plant-Level Employment Volatility

Our dependent variable consists of a time invariant plant-level volatility measure for the period 1996 to 2012. Since our sample is unbalanced, we constrain on establishments with employment information of at least 5 years over this period, i.e. a reported net job creation rate for at least 4 years. The preferred volatility measure is based on the residual approach of Vannoorenberghe (2012); Kurz and Senses (2016). This means that we compute the standard deviations of residuals from a panel regression, which takes into account plant and time specific variation.

In a first step we run the  $njcr_{i,t}$  of establishment  $i$  in period  $t$  on a plant-fixed effect  $\alpha_i$  and a time dummy  $\gamma_t$ . By doing so, we take into account the plant specific average net job creation rate as well as economy-wide time varying fluctuations.

$$njcr_{it} = \alpha_i + \gamma_t + \varepsilon_{it}, \tag{3}$$

The error term  $\varepsilon_{it}$  represents the deviation from the plant-level average as well as from the aggregate shocks at time  $t$ . While the within-plant effects could be taken care of by simply demeaning the net job creation rate, we cannot adequately control for aggregate fluctuations without imposing a balanced panel.<sup>39</sup>

<sup>39</sup>The reason is simple. Imagine two establishments,  $A$  and  $B$ , with identical low volatility that are hit by a severe shock in period  $t$ . The only difference between  $A$  and  $B$  is that  $A$  is observed in period  $t$ , while  $B$  is only



In a second step, we compute our primary time-invariant volatility measure  $\sigma_{njcr}$  as the standard deviation of the residual from the previous panel regression over the time window  $\omega$  as:<sup>40</sup>

$$\sigma_{njcr,i}^{\omega} = \sqrt{\frac{1}{\omega - 1} \sum_{\tau=0}^{\omega} \varepsilon_{i,\tau}^2} \quad (4)$$

To ensure the robustness of the results, we construct a second volatility measure  $\sigma_{njcr_2}$ . It is defined as the standard deviation of the demeaned net job creation rate, but might be blurred by time specific shocks as described above.

$$\sigma_{njcr_2,i}^{\omega} = \sqrt{\frac{1}{\omega - 1} \sum_{\tau=0}^{\omega} (njcr_{i,\tau} - \overline{njcr_{i,\omega}})^2} \quad (5)$$

In addition to the employment volatility measures we will construct a plant-level sales volatility measure based on the residual approach as well.<sup>41</sup> This can help us to investigate the impact of sales volatility on employment volatility and thereby research an actual channel on how international trade might affect employment volatility.

Table 4: Volatility by Size/Export Status

	$\sigma_{njcr}$		$\sigma_{njcr_2}$		$\sigma_{Sales}$	
	NE	E	NE	E	NE	E
Small	0.20	0.17	0.18	0.15	0.23	0.21
Medium	0.15	0.10	0.13	0.09	0.20	0.19
Large	0.13	0.09	0.11	0.07	0.23	0.16
Total	0.19	0.12	0.17	0.10	0.22	0.19

The table reports average standard deviations for the respective groups.  
 "NE" stands for non-exporter, "E" for exporter.

Table 4 gives a brief overview of the averages across size and export groups. On average, exporters report a lower volatility for employment volatility as well as sales volatility, independent of the measure. In addition, the table confirms the finding of Davis et al. (2006) that employment volatility is decreasing in firm size. While small establishments report a standard deviation of 0.17-

observed from  $t + 1$  onwards. By simple demeaning, the aggregate shock would be counted as idiosyncratic shock to  $A$ .

<sup>40</sup>Because we only limit on establishments that report employment in at least 5 years, we still extract plant-specific error components that relate to different time windows. Thus, we take into account the number of observed years when computing the plant-specific standard deviation.

<sup>41</sup>Compared to the head count measure that stems from administrative sources, the sales measure is collected from interviews, which might induce additional biases and lower the data quality. Furthermore, the sales measure is not available for all plants.

0.20 (0.15-0.18) for  $\sigma_{njcr}$ , large plants report a standard deviation of only 0.09-0.13 (0.07-0.11) for the first (second) employment volatility measure.

Table 5: Correlation of Volatility-Measures

	$\sigma_{njcr}$	$\sigma_{njcr2}$	$\sigma_{Sales}$
$\sigma_{njcr}$	1		
$\sigma_{njcr2}$	0.98	1	
$\sigma_{Sales}$	0.27	0.26	1

The table reports the correlation coefficients between the plant-level volatility measures.

Both employment volatility measures are highly correlated as shown in table 5. The correlation coefficient is 0.98 for the measures of employment volatility. However, the correlation between employment volatility and sales volatility is found to be not as high with only around 0.26-0.27. It suggests that sales volatility is not directly mapped one to one into employment volatility.

Table 6: Volatility of Small and Large Exporters and their Export Intensity

	Non-Exporter	Exporter	Export Share			
			<30%	>30%	<50%	>50%
Small	0.20	0.17	0.15	0.19	0.16	0.20
N	6962	756	438	318	575	181
Medium	0.15	0.10	0.10	0.11	0.10	0.10
N	1635	1366	658	708	988	378
Large	0.13	0.09	0.11	0.08	0.10	0.08
N	290	468	117	351	245	223
Overall	0.19	0.12	0.12	0.12	0.12	0.12
N	8887	2590	1213	1377	1808	782

The table reports the standard deviations and underlying number of observations for the respective size and export groups. Exporters are further split with respect to their export intensity.

Table 6 reports once again the employment volatility of exporters and non-exporters broken down by size groups in the first two columns. It further divides exporters according to their export intensity in the right four columns. Analogous to the distinction for the export share in the euro area in table 2, we separate between exporters with an overall export share above and below 30% or 50%. This helps to better understand the heterogeneity between exporters along the export intensity. We have seen from table 4 that the volatility is decreasing in size. Among exporters from 0.17 of small exporters to 0.09 of large exporters. Table 6 reveals additional differences along the export intensity. The volatility of small exporters increases from 0.15/0.16 to 0.19/0.20 when comparing those establishments below and above an export share of 30/50%. This is in line with the

recent findings of Kurz and Senses (2016) on the United States. When looking at large exporters, however, the pattern is flipped. The employment volatility is actually decreasing in the export intensity, from 0.11/0.10 to 0.08/0.08 for plants below and above 30/50%. This difference between the volatility in small and large exporters resembles the evidence provided by Vannoorenberghe et al. (2014) for Chinese exporters. For the overall sample, we do not observe differences in the average plant-level employment volatility above or below the threshold of 30/50%. The average employment volatility for all these groups is given by 0.12, suggesting that compositional effects could play a role for results such as the non-monotonic relationship between exporting and employment volatility (Kurz & Senses, 2016).

Next, we investigate the statistical robustness of this association between the time invariant employment volatility measure,  $\sigma_{njcr}$ , and the different types of plants. We estimate a specification similar to Kurz and Senses (2016), but emphasize the heterogeneity between small and large exporters. Both, in terms of their export status as well as their export intensity.<sup>42</sup> The OLS regression for establishment  $i$  is described by:

$$\begin{aligned} \log(\sigma_{njcr,i}) = & \alpha + \beta_1 \text{Exporter}_i + \beta_2 \text{Exporter}_i \times \text{Medium}_i + \beta_3 \text{Exporter}_i \times \text{Large}_i \\ & + \beta_4 \text{Expshare}_i + \beta_5 \text{Expshare}_i \times \text{Medium}_i + \beta_6 \text{Expshare}_i \times \text{Large}_i + \gamma X_i + \nu_i, \end{aligned} \quad (6)$$

where  $\text{Exporter}_i$  is a dummy variable taking the value of one for exporting establishments and zero otherwise.  $\text{Expshare}_i$  measures the export intensity in percentage points,  $\text{Medium}$  and  $\text{Large}$  are dummies for the respective size group.  $X_i$  is a vector of firm level controls and additional dummies. Due to the construction of the data set, the most obvious control variables are along the dimension of the stratification, i.e. industry, size, and state. We construct industry dummies according to the classification in appendix A.2. The size of establishments is controlled for by the logarithm of the employment stock.<sup>43</sup> Dummies for the 16 German states are included to ensure that the sampling does not bias the results. The logarithm of total sales is included as an additional control for plant size. Furthermore, a measure for the average wage is constructed by dividing the total wage bill by the number of employees. This variable can help to capture the productivity of establishments. Both, sales and the average monthly gross wage are converted into Euro before 2002 and generally deflated with the CPI, downloaded from OECD.Stat. In addition, a dummy controls if a given plant is subject to an industry-wide wage agreement. The structure of the company can be controlled

<sup>42</sup>The main difference in the specification compared to Kurz and Senses (2016) is given by the interaction terms with medium and large plants, i.e.  $\beta_2, \beta_3, \beta_5$  and  $\beta_6$ .

<sup>43</sup>Due to the specification with the interaction terms of size dummies we include the dummies for  $\text{Medium}$  and  $\text{Large}$  as well to make sure that the interaction terms are not driven by the dummy itself. The main reason why we use not only size dummies is that we can control better for size differences between exporters and non-exporters by including a continuous measure, because even within the size groups we observe a slight difference between the exporters and non-exporters.

for by the information on whether the establishment belongs to a single-plant firm, is the place of business, the head office, or the middle-level authority.<sup>44</sup>

## 4.2 Cyclicity of Job Flows and Variance Decomposition

To investigate the cyclicity of job flows we construct semi-aggregated job flows in the spirit of the Business Employment Dynamics (BDS) dataset or the Business Employment Dynamics (BED) for the US. Recent research in the field of macro labor has used such dataset extensively in order to investigate heterogeneous business cycle behavior in the job flows according to size and age.<sup>45</sup>

The cyclical measure is based on linearly detrended or HP-filtered semi-aggregated job flows as defined above.<sup>46</sup>

Then, we compute correlations between the cyclical components of job flows and our aggregate measures. So for example, we can estimate a correlation between GDP growth and the NJCR as:

$$Corr(\log(\widetilde{GDP}_t), \widetilde{NJCR}_t) \quad (7)$$

We report also the associated p-values for the significance level of the correlations.

To judge about the relative importance of cyclical job flow rates of certain groups of firms, the overall variance of job flows is decomposed into individual contributions of size/export classes. Since we have to take into account employment weights we follow the decomposition of Colciago et al. (2016) based on a Taylor expansion of job flows around their trend.<sup>47</sup>

Denoting the deviations from trend with a tilde and the trend itself with a bar, the variance of any aggregate job flow rate  $V(\widetilde{X}_t)$  can be decomposed into individual contributions.

$$V(\widetilde{X}_t) = \sum_{i \in \text{size/exporter}} Cov(\overline{\omega}_{i,t} X_t^i) + Cov(\overline{X}_t^i \widetilde{\omega}_{i,t}), \quad (8)$$

where  $\omega_{i,t}$  refers to the employment weight of group  $i$  in time  $t$ . Size/exporter groups are the six previously defined categories given by small, medium, and large establishments and their further split into non-exporters and exporters.

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<sup>44</sup>For the years before 1998 we adjust the given answers as they were changing order in the survey interview. In principle, one could also control for initial investment and the usage of intermediate inputs. But too few establishments reported values for these variables and the sample size would shrink too much. Therefore, they are not used as control variables.

<sup>45</sup>For instance Moscarini and Postel-Vinay (2012), Fort, Haltiwanger, Jarmin, and Miranda (2013) or Colciago, Lindenthal, and Trigari (2016) research the cyclical role of firm size and age over the business cycle.

<sup>46</sup>However, applying the HP-filter to a short time series might cause problems due to the end points that can bias the results. Therefore, the baseline results will be reported for the linearly detrended job flow rates.

<sup>47</sup>Remember that the overall job flows are employment weighted job flows of individual groups. For example, the net job creation rate of small exporters is given by  $\frac{NJCR_t^{s,e}}{\frac{1}{2}[E_t^{s,e} + E_{t-1}^{s,e}]}$ , while its contribution to the overall net job creation rate is  $\frac{\frac{1}{2}[E_t^{s,e} + E_{t-1}^{s,e}]}{\frac{1}{2}[E_t + E_{t-1}]} \frac{NJCR_t^{s,e}}{\frac{1}{2}[E_t^{s,e} + E_{t-1}^{s,e}]}$ .

By dividing through the variance of the overall job flow rate the individual contributions have to add up to approximately one:

$$1 \approx \sum_{i \in \text{size/exporter}} \frac{\text{Cov}(\widetilde{X}_t, \overline{\widetilde{\omega}_{i,t} X_t^i})}{V(\widetilde{X}_t)} + \frac{\text{Cov}(\widetilde{X}_t, \overline{X_t^i \widetilde{\omega}_{i,t}})}{V(\widetilde{X}_t)} \quad (9)$$

## 5 Results

### 5.1 Employment Volatility

Before estimating the actual model described in equation (6), we proceed step by step and estimate three additional models. Column (1) reports the association of being an exporter and employment volatility, column (2) shows the heterogeneity among exporters in terms of size, column (3) investigates the non-monotonicity between exporting and overall employment volatility, while column (4) is the fully specified model. In the full model we control not only for the size of exporters, but allow for a heterogeneous response of the export intensity across exporters of different size as well. By doing so, we test statistically the descriptive evidence showing an additional heterogeneity across exporters in their export intensity, outlined in table 6 above.

Table 7: Plant-Level Employment Volatility

	$\log(\sigma_{njcr})$			
	(1)	(2)	(3)	(4)
Exporter	-0.095*** (0.00)	-0.001 (0.99)	-0.145*** (0.00)	-0.102** (0.04)
Exporter $\times$ Medium		-0.176*** (0.00)		-0.114 (0.11)
Exporter $\times$ Large		-0.212** (0.02)		0.032 (0.81)
Export Share			0.002** (0.02)	0.003*** (0.00)
Export Share $\times$ Medium				-0.002 (0.18)
Export Share $\times$ Large				-0.007** (0.01)
Medium	-0.109*** (0.00)	-0.062* (0.09)	-0.112*** (0.00)	-0.064* (0.08)

*Continued on next page*

Table 7 – *Continued from previous page*

Large	-0.017 (0.79)	0.066 (0.40)	-0.032 (0.63)	0.079 (0.32)
log(Employment)	-0.045*** (0.01)	-0.050*** (0.00)	-0.043*** (0.01)	-0.046*** (0.00)
<i>njcr</i>	0.291*** (0.00)	0.287*** (0.00)	0.286*** (0.00)	0.281*** (0.00)
log(Sales)	-0.059*** (0.00)	-0.059*** (0.00)	-0.061*** (0.00)	-0.061*** (0.00)
log(Average Wage)	-0.000 (0.99)	-0.003 (0.87)	-0.001 (0.95)	-0.005 (0.79)
Skill Composition	-0.003*** (0.00)	-0.003*** (0.00)	-0.003*** (0.00)	-0.003*** (0.00)
Industry-wide wage agreement	-0.147*** (0.00)	-0.144*** (0.00)	-0.146*** (0.00)	-0.140*** (0.00)
Constant	-0.595*** (0.00)	-0.588*** (0.00)	-0.572*** (0.00)	-0.553*** (0.00)
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Organizational dummies	Yes	Yes	Yes	Yes
Observations	10107	10107	10107	10107
$R^2$	0.121	0.122	0.121	0.123

1,2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

Table 7 reports the results of the baseline specification in which we investigate our preferred volatility measure for the entire sample of plants. The results in column (1) show that exporters face on average a 9.5% lower employment volatility. This underlines the idea that exporters differ from non-exporting plants in the magnitude of shocks they face as well as their frequency and volatility. The negative association is in line with previous findings of Kurz and Senses (2016) for employment volatility as well as Buch et al. (2009); Vannoorenberghe (2012) for sales volatility. Even though, we do not observe the destination markets, the result are in line with the idea that exporters can stabilize their employment stock by diversifying their sales across multiple markets. Column (2) reveals that the lower volatility of exporters is mainly driven by medium and large exporters. Thus, we observe a decrease in the volatility along the size dimension of exporters.<sup>48</sup> This

<sup>48</sup>This decrease is on top of the decrease associated to log employment which we use as control for all plants. The results for log employment confirm the findings of Davis et al. (2006); Coşar et al. (2016) that the employment volatility is decreasing in firm size.

result is also related to the unconditional evidence of table 4 as it shows that only for medium and large plants the difference between exporters and non-exporters is significantly different. However, we have seen from the descriptive statistics that the export share is also correlated to size. So we need to further investigate whether it is really size or the export share that is driving the results. While the two previous regressions only looked at differences related to the export status, column (3) describes results that take into account the intensive margin as well. It shows the non-monotonic relation between the international engagement of firms and the employment volatility, which was already documented by Kurz and Senses (2016) for the United States and in terms of sales volatility for France by Vannoorenberghe (2012). While exporters face a 14.5% lower employment volatility per se, this volatility is increasing in the export share. Each percentage point increase in the export share is associated with an increase of 0.2% in the employment volatility. However, the actual threshold in terms of the export share at which exporters are more volatile than domestic producers is quite high with 72.5%. Keeping in mind the distribution of exporters across their export intensity as documented by table 1, this means that only around 10% of exporters are more volatile compared to domestic producers.

The complete model of column (4) reveals additional heterogeneity among the exporters not only along the size dimension or the export intensity, but shows that exporters of different size have different implications along the export intensity.<sup>49</sup> This heterogeneity is masked in the previous regressions. Either it is attributed to the export status, not even taking into account potential size differences across exporters. Or it is attributed to the heterogeneity in the export intensity that is common to all exporters. In fact, small exporters are on average 10.2% less volatile than non-exporters, but once they have a larger export share than 34% they are overall more volatile than a small non-exporter. Large exporters in contrast are not only on average 10.2% less volatile, but their employment volatility is even decreasing in the export share.<sup>50</sup> A potential explanation for this heterogeneity of small and large exporters in their export intensity could be the higher entry and exit into markets of small exporters as shown by Vannoorenberghe et al. (2014). They show that the sales volatility of small exporters in China increases in the number of destinations they trade with, while the opposite is true for large exporters. The explanation is that small exporters are not able to cover the destination fixed costs in every period and therefore do not serve markets constantly. This entry and exit into different destination markets is associated to a higher volatility.

Furthermore, the regressions show that the employment volatility is generally negatively associated with the size of an establishment as found by Davis et al. (2006). This is true for both measures of establishment size,  $\log(\text{Employment})$  as well as  $\log(\text{Sales})$ . At the same time employment growth

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<sup>49</sup>In appendix D we condition only on exporting plants and verify that the results for the heterogeneity between exporters of different size hold.

<sup>50</sup>The effect of the export intensity is the combined effect of the general export share (0.003) and the export share for large exporter (-0.007), i.e. -0.004.

is positively associated to volatility as expected.<sup>51</sup> The control on the skill composition reveals that plants with a higher skilled labor force have a significantly lower employment volatility. Surprisingly, also the industry-wide wage agreement is negatively associated with the employment volatility. The initial idea for the control was that plants that are subject to an industry-wide wage agreement are less flexible in their wage setting and therefore might react more on the employment margin. But the results show that this is not the case.

## 5.2 Impact of Sales Diversification and Sales Volatility

The idea that firms trade with multiple countries to insure against shocks is mainly centered around the actual sales of firms and not so much on the employment volatility itself. When motivating the effects of trade on employment volatility, for example Kurz and Senses (2016) do not mention a specific transmission from sales to employment and leave it as a black box. Instead, they rather use the same arguments that are used for the relation between firm-level sales volatility and exports. Since the IAB Establishment Panel includes self-reported annual revenues of the establishments we will investigate the relation between sales volatility and employment volatility. We have seen already above in section 4.1 that the correlation between the two measures is only about 0.27, indicating that the volatility of sales is not completely transmitted to employment adjustments.<sup>52</sup> To investigate the sales channel, we will include the measure of sales volatility as additional plant-level control and run the same set of regressions as before.<sup>53</sup> We expect that the measure of sales volatility is positively related to employment volatility. And in case that the transmission goes mainly from sales volatility to employment volatility we expect the coefficient on the sales volatility measure to absorb most of the effect that we have seen before.

The regressions confirm the relation indicated by the positive correlation that we have seen in the descriptive section. More volatile sales map into more volatile employment as shown by table 8. Since we regress the log of sales volatility on the log of employment volatility, the effect of an increase of one percent in the sales volatility is related to an increase in the employment volatility of 0.288 percent.

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<sup>51</sup>The net job creation rate is reported in percent, which magnifies the coefficient. Furthermore, the reader should keep in mind that the net job creation rate is bounded between -2 and 2 with most establishments being very close to 0.

<sup>52</sup>Unfortunately, we cannot measure sales on the firm level which might be more important compared to employment. In general, the sales measure is self-reported and might not capture the actual sales of an establishment. In particular, for establishments that belong to multi-unit firms it might be difficult to report their exact revenues in a given year and there might be further mechanisms to insure within the firm for sales volatility. The head-count employment measure, in contrast, is much easier to identify as it only involves the knowledge of the number of employees in a given location and a given date.

<sup>53</sup>When running the same set of regressions on  $\sigma_{Sales}$  we find additional support for the non-monotonic relation between being an exporter and the export intensity. Plants are on average 9.7% less volatile, but exporters with an export intensity above 24.25% are more volatile than domestic firms. However, we do not find heterogeneity across exporters of different size related to their export intensity. The results are reported in appendix E.



However, the inclusion of sales volatility does not fully offset the negative relation between exporters and their employment volatility. This is not very surprising, because the exporter status does not turn out significant in the regression for sales volatility itself (see appendix E). The results suggest that the positive effect of the export share is offsetting the negative effect of the exporter status. We only find large exporters to be slightly more volatile compared to small and medium size exporters.

Table 8: Plant-Level Employment Volatility with Sales Volatility

	$\log(\sigma_{njcr})$			
	(1)	(2)	(3)	(4)
Exporter	-0.083*** (0.00)	-0.002 (0.96)	-0.090*** (0.01)	-0.048 (0.32)
Exporter $\times$ Medium		-0.153*** (0.00)		-0.108 (0.12)
Exporter $\times$ Large		-0.225** (0.01)		0.006 (0.96)
Export Share			0.000 (0.73)	0.002 (0.12)
Export Share $\times$ Medium				-0.002 (0.32)
Large $\times$ Export Share				-0.006** (0.02)
$\log(\text{Sales Volatility})$	0.288*** (0.00)	0.288*** (0.00)	0.288*** (0.00)	0.287*** (0.00)
$\log(\text{Employment})$	0.013 (0.43)	0.008 (0.63)	0.013 (0.42)	0.010 (0.57)
Medium	-0.126*** (0.00)	-0.085** (0.02)	-0.126*** (0.00)	-0.085** (0.02)
Large	-0.087 (0.19)	0.005 (0.95)	-0.089 (0.18)	0.021 (0.79)
$njcr$	0.313*** (0.00)	0.307*** (0.00)	0.312*** (0.00)	0.305*** (0.00)
$\log(\text{Sales})$	-0.077*** (0.00)	-0.076*** (0.00)	-0.077** (0.00)	-0.076**** (0.00)
$\log(\text{Average Wage})$	-0.004 (0.81)	-0.007 (0.71)	-0.005 (0.81)	-0.008 (0.66)

*Continued on next page*

Table 8 – *Continued from previous page*

Skill Composition	-0.003*** (0.00)	-0.003*** (0.00)	-0.003*** (0.00)	-0.003*** (0.00)
Industry-wide wage agreement	-0.110*** (0.00)	-0.106*** (0.00)	-0.110*** (0.00)	-0.105***
Constant	-0.053 (0.72)	-0.048 (0.75)	-0.050 (0.74)	-0.037 (0.81)
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Organizational dummies	Yes	Yes	Yes	Yes
Observations	9379	9379	9379	9379
$R^2$	0.185	0.186	0.185	0.186

1,2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

The inclusion of the sales volatility weakens the non-monotonic relation for exporters in column (3). Exporters are still less volatile compared to domestic producers, but the former increase in employment volatility due to an increase in the export intensity vanishes. This result, however, seems driven by large exporters and their decrease in employment volatility along the intensive margin of trade as shown in column (4). The results suggest that large exporters are interested in a more stable workforce. Instead of hiring and firing in a similar way as other plants, large exporters are interested in keeping alive their matches with the workers.

Unfortunately, the results can only give some suggestive evidence and further work on firm level data is necessary. Plant-level employment volatility is clearly linked to sales volatility. However, fluctuations in sales cannot completely explain heterogeneity between different types of firms. It might be the case that exporters react differently to a given level of sales volatility, because they face a different frequency of shocks. At the same time, they might prefer to keep their workforce more stable as they often require highly skilled workers for whom it might be too costly to hire and fire them frequently.<sup>54</sup>

### 5.3 Cyclicity of Job Flows

For the analysis of the cyclical sensitivity of job flow rates we will move away from the plant-level and focus on semi-aggregates rates instead.<sup>55</sup> This allows us to relate our findings to relevant

<sup>54</sup>Another interesting question that is not tackled in this set up is the timing of the transmission. Since we constructed time invariant volatility measures we cannot investigate whether the employment of plants directly reacts to changes in sales or whether there is some time lag.

<sup>55</sup>While we focus here on correlations between job flows of specific size/export groups and the aggregate business cycle, we implement a second approach based on a panel estimation in section 6.5. The main reason why we focus

results in the literature such as Moscarini and Postel-Vinay (2012), Fort et al. (2013), or Colciago et al. (2016). Even though we found a negative relation between the employment volatility and the international engagement of plants, this does not imply that exporters have to be less cyclical as well. Fluctuations on the plant-level and on the more aggregated level do not have to move in the same direction, but can be netted out instead. And as shown by Comin and Philippon (2006), trends in firm and aggregate volatility can go in opposite directions. In addition, the share of aggregate fluctuations that explain idiosyncratic volatility is quite low.

We start out by briefly describing the cyclical behavior of the net job creation rate<sup>56</sup> – computed according to equation (2). Then, we move to the analysis of correlations between the aggregate GDP growth rate and differential job flow rates. By doing so, we investigate the heterogeneous behavior of plants of different size as well as export status.<sup>57</sup> The export intensity is not separately taken into account, because the sample size would shrink too much for certain size/export groups.<sup>58</sup> Figure 3 plots the cyclical net job creation rate of the groups of establishments according to their size and export status. In general, the rates exhibit cyclicity as we can see from the individual plots.<sup>59</sup> The cyclical pattern of small and large establishments differs between exporters and non-exporters. In particular, small exporters react much stronger to the recessions compared to small non-exporters, which is in line with a higher volatility and stronger pro-cyclicality found by Engel and Wang (2011) for aggregate exports. For large establishments, the behavior during the recent Great Recession differs strongly. While large non-exporters did not set free much of their labor force, large exporters reacted as in the previous recession with a decrease in their net job creation rate.

As expected from the graphical observations, the contemporaneous correlation patterns between cyclical GDP and the net job creation rate in table 9 is positive for almost all categories. The table reports the correlation coefficients and their significance according to size and export status in the center of the table. The rightest column reports the coefficients according to size only and the bottom row according to export status neglecting size. All correlation coefficients are positive, except for large non-exporters, indicating a pro-cyclical behavior. This means that a boom is

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on the semi-aggregated flows is to relate the analysis to the existing literature.

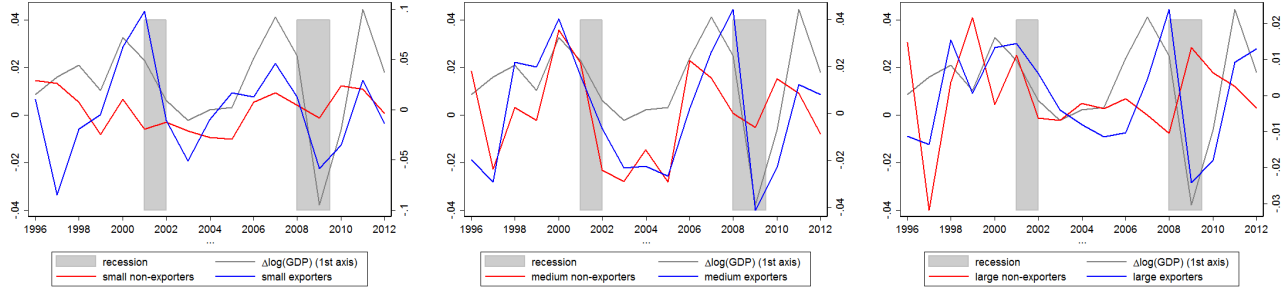
<sup>56</sup>The cyclical behavior of the job creation and job destruction rate can be found in appendix B.

<sup>57</sup>Unfortunately, the amount of establishments for which we know the exact birth year is too little to take into account the age dimension as well.

<sup>58</sup>The construction of the semi-aggregated job flow rates not only require observations for a given size/export category, but observations that change their labor force. The data policy requires that at least 20 observations have to underlie each variable. Therefore, groups cannot be defined too narrow.

<sup>59</sup>We do not report the pure rates in this chapter, but focus only on the cyclical behavior of these rates. They reveal some level differences in the rates across size/export groups. Smaller establishments feature higher net job creation rates compared to larger plants. When comparing exporters and non-exporters, only the category of small establishments bears a level difference – a result that confirms the averages that were reported in the previous section. But as mentioned before, this section is concerned with cyclical differences and not the level differences.

Figure 3: Cyclical Net Job Creation Rate according to Size and Export Status



The plotted net job creation rates are linearly detrended.

accompanied by a rise in employment growth, while a recession sheds labor. Similar patterns can be found for the job creation and job destruction rate in appendix B.

Table 9: Correlation between Net Job Creation Rate and GDP Growth

	Non-Exporters	Exporters	Overall
Small	0.37 (0.15)	0.61** (0.01)	0.32 (0.22)
Medium	0.45* (0.07)	0.76*** (0.00)	0.63** (0.01)
Large	-0.25 (0.33)	0.69*** (0.00)	0.49* (0.05)
Overall	0.44* (0.08)	0.77*** (0.00)	

The table reports the correlation coefficients of the linearly detrended job flow rates and the growth rate of real GDP as well as their respective p-values. 1, 2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

The pattern suggests that exporters are more cyclical as their coefficients are larger and statistical significant. But at the same time, medium and large plants report larger and significant coefficients. Therefore, it is not clear from the table whether size or export status matters more. In general, the table does not allow to judge about the significance of the differences. To understand whether a group of plants is more sensitive to the cycle we compute the differentials and correlate them with the aggregate measure instead, similar to Moscarini and Postel-Vinay (2012). Table 10 reports these correlations.<sup>60</sup> The first three columns report the size differentials, i.e. the job flow rates of large plants minus the one of small plants. The last four columns report the differential between exporters and non-exporters. In addition to the differential of the net job creation rate in the last row, we report differentials for the job creation and job destruction rates in the first and

<sup>60</sup>While we report the correlations of the linearly detrended job flow rates in this section, results for HP-filtered rates are reported in appendix C. Our results are robust to the detrending method.

second row.

Table 10: Correlation of Differential Job Flow Rates and the GDP Growth Rate

	<b>Differential: Large - Small</b>			<b>Differential: Exporter - Non-Exporter</b>			
	Overall	Exporter	Non-Exporter	Overall	Large	Medium	Small
JCR	-0.17 (0.52)	-0.45* (0.07)	-0.36 (0.16)	0.51** (0.04)	0.27 (0.29)	0.18 (0.50)	0.38 (0.13)
JDR	0.28 (0.28)	0.40 (0.11)	0.36 (0.15)	-0.43* (0.09)	-0.73*** (0.00)	-0.66*** (0.00)	-0.39 (0.12)
NJCR	-0.23 (0.38)	-0.46* (0.06)	-0.41 (0.10)	0.49** (0.04)	0.66*** (0.00)	0.49* (0.05)	0.40 (0.11)

The table reports the correlation coefficients of the linearly detrended differential job flows and the growth rate of GDP as well as their respective p-values. 1, 2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

The overall differential of large minus small plants is not significant as shown in the first column. While this is the same for size differentials among the non-exporters in the third column, we find significant heterogeneity between large and small exporters in terms of their job creation rate and their net job creation rate. However, the results reveal a stronger sensitivity of small plants. Even the coefficients that are not significant point towards a stronger sensitivity of small plants. Thus, this finding is in contrast to the findings of Moscarini and Postel-Vinay (2012) who document a stronger sensitivity of large firms for the United States and other countries. But at the same time, Fort et al. (2013) and Colciago et al. (2016) show that this result about firm size is quite weak and in many specifications small firms seem more sensitive.<sup>61</sup>

In contrast to the size differentials, the differentials between exporters and non-exporters give a clear message. The differentials reveal a stronger sensitivity of exporters for all job flow rates in the fourth column. The heterogeneity is significantly pronounced among large and medium size plants, while small firms are missing some statistical power. In addition, the results for the job creation rate conditional on size are not significant. Nevertheless, the coefficients indicate that exporters are more responsive in upturns and downturns compared to non-exporters. The reason might be that exporters and non-exporters simply face different shocks. If the aggregate GDP as well as the job flows of exporters are rather driven by international shocks, then the correlation is an immediate consequence. Another explanation is based on a different response to the same shock, i.e. different labor demand elasticities. Lichter et al. (2014) estimate that exporters face a more elastic product demand elasticity, which maps into a more elastic own-wage labor demand elasticity. The argument is that non-homothetic preferences lead to a situation in which price changes of exports to lower income countries have stronger effects compared to price changes

<sup>61</sup>When adding the age dimension, these studies reveal that it is rather firm age than firm size that is related to heterogeneity among firms.

in higher income countries. Since most destinations of German exporters are countries with a relatively lower income, exporters might adjust their labor stock more in response to aggregate shocks that affect wages.

## 5.4 Relative Contributions to Aggregate Fluctuations

As a last step we estimate the relative contributions of individual groups of plants to aggregate fluctuations in the job flow rates. The variance decomposition in table 11 shows that – with around two thirds of the contribution – the lion’s share of the aggregate variance is explained by non-exporters.<sup>62</sup> In particular, small and medium size non-exporters contribute to fluctuations in all the job flow rates. Large establishments are generally less important. The most obvious difference between exporters and non-exporters consists in the contribution of small establishments. This can be related to the fact that small exporters do not face the usual up or out dynamic that especially small young firms experience. However, the most striking observation is similar to the result of Colciago et al. (2016) who highlight the importance of employment weights. Non-exporters employ roughly two thirds of the workers and therefore it is no big surprise that they contribute around the same magnitude to overall fluctuations.

Exporting plants contribute less to the aggregate volatility in absolute terms, but relatively slightly more compared to their employment share. Among exporters, medium size establishments contribute most to aggregate volatility.

Table 11: Variance Decomposition of Cyclical Job Flows

Definition		Emp	<i>JCR</i>	<i>JDR</i>	<i>NJCR</i>
Small	Total	<b>0.36</b>	<b>0.48</b>	<b>0.36</b>	<b>0.31</b>
Non-	Rate		0.37	0.30	0.32
Exporter	Weight		0.09	0.05	0.00
Medium	Total	<b>0.22</b>	<b>0.15</b>	<b>0.30</b>	<b>0.30</b>
Non-	Rate		0.16	0.28	0.29
Exporter	Weight		-0.02	0.02	0.00
Large	Total	<b>0.08</b>	<b>-0.02</b>	<b>0.02</b>	<b>0.03</b>
Non-	Rate		0.00	0.03	0.03
Exporter	Weight		-0.01	0.00	0.00
		<b>0.66</b>	<b>0.61</b>	<b>0.68</b>	<b>0.64</b>

*Continued on next page*

<sup>62</sup>The contributions of rates and weights do not necessarily add up to the overall contribution as the computation is based on a Taylor approximation around the trend.

Table 11 – *Continued from previous page*

Small Exporter	Total	<b>0.07</b>	<b>0.10</b>	<b>0.05</b>	<b>0.09</b>
	Rate		0.08	0.05	0.08
	Weight		0.02	0.00	0.00
<hr/>					
Medium Exporter	Total	<b>0.16</b>	<b>0.26</b>	<b>0.16</b>	<b>0.18</b>
	Rate		0.23	0.15	0.18
	Weight		0.03	0.01	0.00
<hr/>					
Large Exporter	Total	<b>0.12</b>	<b>0.04</b>	<b>0.12</b>	<b>0.09</b>
	Rate		0.03	0.09	0.09
	Weight		0.00	0.02	0.00
<hr/>					
		<b>0.35</b>	<b>0.40</b>	<b>0.33</b>	<b>0.36</b>
<hr/>					

The table reports the variance decomposition of linearly detrended job flow rates.

## 6 Robustness

In this section we will investigate the robustness of our previous findings on the heterogeneity of employment volatility across firms of different engagement in exporting activities as well as their cyclical properties.<sup>63</sup>

First, we cover a variety of potential problems that could cause biases in the results on the employment volatility. Most important, we check for the robustness of our chosen measure of employment volatility. As our measure was based on the “residual approach” we will consider the volatility of the demeaned net job creation rates instead. Moreover, we will constrain our sample on the manufacturing plants and on single-unit plants.

Second, we check that the stronger cyclicalities of exporters compared to non-exporters also holds for correlations with the unemployment rate and when estimating a panel, in which we investigate the plant-specific cyclicalities.

### 6.1 Alternative Plant-Level Employment Volatility Measure

The results of the baseline regressions reveal a negative association between exporters and employment volatility and heterogeneity among exporters of different size and export intensity. While small exporters face an increasing employment volatility if they export a higher share, large exporters lower their employment volatility further. To verify that this relation is not simply due to the construction of the measure, we take into account the second measure for employment

<sup>63</sup>To save space, we do not report the coefficients for control variables in this section, but they are available on request.

volatility,  $\sigma_{njcr_2}$ , i.e. the employment volatility of the demeaned net job creation rate according to equation (5). In general we decided not to use this measure for the baseline, because the residual measure allows for a better comparison of plant-level volatility for our unbalanced sample. Instead, this second measure might be slightly biased and over- or understate the plant-level volatility depending on the years of observation.

Overall, the point estimates in table 12 are lower, suggesting that the volatility that is controlled for in the residual approach is more relevant for exporters than for non-exporters. Because the treatment of aggregate volatility is the main difference between the two measures, this finding is in line with the higher cyclical sensitivity of the job flow rates in exporters.

Table 12: Plant-Level Employment Volatility – Alternative Employment Volatility Measure

	$\log(\sigma_{njcr_2})$			
	(1)	(2)	(3)	(4)
Exporter	-0.062*** (0.00)	0.015 (0.61)	-0.130*** (0.00)	-0.104*** (0.01)
Exporter $\times$ Medium		-0.153*** (0.00)		-0.093* (0.09)
Exporter $\times$ Large		-0.120* (0.09)		0.144 (0.17)
Export Share			0.002*** (0.00)	0.004*** (0.00)
Export Share $\times$ Medium				-0.002* (0.09)
Export Share $\times$ Large				-0.007*** (0.00)
Controls	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Organizational dummies	Yes	Yes	Yes	Yes
Observations	9678	9678	9678	9678
$R^2$	0.354	0.355	0.355	357

1,2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

Column (1) of table 12 shows that on average exporters have a 6.2% lower employment volatility.



Once again, the result is driven by medium and large exporters as shown in column (2), even though the volatility does not seem to decrease monotonically in size.<sup>64</sup> The negative effect of the exporter status on the employment volatility is further decreasing once the export share is taken into account as shown in column (3). Once again this gives support to a non-monotonic relation between exporters and employment volatility. While exporters exhibit 13% lower employment volatility, the volatility is increasing in the export intensity. As a result, exporters that ship more than 65% of their sales abroad are more volatile compared to domestic plants.

The estimates in the last column (4) support the heterogeneity among exporters of different size in their export intensity. While all exporters are on average 10.4% less volatile, small exporters that export more than 26% are more volatile compared to small domestic producers. Large plants in contrast face a further decrease in employment volatility associated to an increase in the export share. In contrast to the previous findings of the baseline regressions, the volatility of medium size exporters is even lower and also decreasing in the export intensity.

## 6.2 Plant-Level Volatility in the Manufacturing Sector

The results of Kurz and Senses (2016) are estimated on a sample exclusively relying on manufacturing firms, while our baseline estimations are executed on a sample of plants from different sectors, representing the universe of German establishments. Of course, the manufacturing sector plays already a crucial role in our baseline sample, because a large share of establishments is operating in manufacturing. But to investigate which role the individual industries might play, we constrain on manufacturing plants in this section and check for robustness of our previous results. By doing so, we also provide an answer to a potential critique arguing that size classifications should not be the same across sectors. Our classifications could lead to a bias if most of the large plants are in the manufacturing sector and we therefore capture industry specific effects relevant for large plants. Now instead we can compare small and large manufacturing plants directly and estimate the relation between their employment volatility and their international engagement.

As shown in table 13, the results of the baseline regressions are confirmed. The export status is found to be negatively associated to the plant-level employment volatility. Point estimates are close to the baseline scenario. And again we find a difference in the effect of the export share between small and large exporters. While small manufacturing exporters are facing an increase in their employment volatility the larger their export share, the opposite holds true for large exporters.

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<sup>64</sup>The baseline volatility measure instead established a stronger effect on large compared to medium exporters. This indicates that the cyclical sensitivity is not identical across the size groups, but large exporters seem relatively more sensitive compared to medium or small exporters.

Table 13: Plant-Level Employment Volatility - Manufacturing

	$\log(\sigma_{n_jcr})$			
	(1)	(2)	(3)	(4)
Exporter	-0.111*** (0.00)	0.001 (0.98)	-0.161*** (0.00)	-0.119* (0.06)
Exporter $\times$ Medium		-0.181*** (0.01)		-0.111 (0.18)
Exporter $\times$ Large		-0.343*** (0.01)		0.135 (0.36)
Export Share			0.002** (0.03)	0.004*** (0.00)
Export Share $\times$ Medium				-0.003 (0.17)
Export Share $\times$ Large				-0.007*** (0.01)
Controls	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Organizational dummies	Yes	Yes	Yes	Yes
Observations	3320	3320	3320	3320
$R^2$	0.175	0.179	0.177	0.182

1,2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

### 6.3 Plant-Level Volatility for Single Plant Firms

Our level of analysis is based on establishment-level information. Unfortunately, we cannot aggregate information on the firm level as we do not know which establishments form a firm and not all establishments of a given firm might be interviewed. However, we have information whether a firm belongs to a multi-establishment firm or is a single plant firm. Therefore, we check for robustness by constraining our sample on those plants for which we know that they are the only unit of the firm. By doing this, we do not have a difference between the establishment and the firm level. Nevertheless, we will bias our sample towards smaller firms as many of the bigger firms, particularly in manufacturing, are composed of several establishments.

The results confirm a lower volatility of exporters in column (1), but indicates that the large exporter that are left in the sample are not significantly different from large non-exporters. Thus, the

effect of the export status seems to be driven by the medium size exporters. In the third column, we find again a highly significant non-monotonicity of exporters. This effect is a bit weakened, but survives when controlling for size as well in column (4). However, the statistical power for the previously found heterogeneous effect among exporters of different size vanishes. Though, the problem is that constraining on single-plant establishments biases our sample towards smaller firms. Therefore, we cannot fully investigate the heterogeneity among small and large exporters. In spite of insignificance, the point estimate still reveals the same pattern as in the baseline case. It overturns the positive effect on the export share (with -0.007 compared to 0.004).

Table 14: Plant-Level Employment Volatility – Single Plant Firms

	$\log(\sigma_{njcr})$			
	(1)	(2)	(3)	(4)
Exporter	-0.059*	-0.004	-0.135***	-0.103**
	(0.06)	(0.92)	(0.00)	(0.05)
Exporter $\times$ Medium		-0.133**		-0.097
		(0.03)		(0.23)
Exporter $\times$ Large		-0.059		0.167
		(0.71)		(0.47)
Export Share			0.002***	0.004***
			(0.00)	(0.00)
Export Share $\times$ Medium				-0.001
				(0.46)
Export Share $\times$ Large				-0.007
				(0.15)
Controls	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Organizational dummies	Yes	Yes	Yes	Yes
Observations	8404	8404	8404	8404
$R^2$	0.111	0.111	0.111	0.112

1,2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

## 6.4 Job Flow Correlations with Cyclical Unemployment Fluctuations

Instead of correlating the differential job flow rates with GDP growth rate, we use changes in the unemployment rate as measure for the aggregate cycle in this section. Since unemployment and GDP are negatively correlated, it is no surprise that the correlations of the differentials flip signs compared to the previous analysis. In terms of the plant-size we do not observe differences for the overall sample, but slightly significant differences between large and small exporters in terms of their net job creation rate and job creation rate. The export dimension, in contrast, is more important although the results are not as significant as for the correlations with aggregate GDP growth. Exporters are negatively related in their job creation and net job creation rate and contemporaneous unemployment rate changes. This means that in booms – when the unemployment rate is low – exporters have higher rates compared to non-exporters. For the results that condition on the size of establishments we find stronger evidence for small plants. Since the unemployment rate is lagging the cycle, the results can be interpreted as heterogeneous behavior of establishments at later stages of the business cycle, similar to Moscarini and Postel-Vinay (2012). Related to their model and interpretation of the results, one can say that exporters and in particular small exporters still create jobs when the labor market is relatively tight.

Even though the significance is slightly lower for correlations with unemployment the results support the previous findings. Exporters are more sensitive to the aggregate cycle compared to non-exporters.

Table 15: Correlation of Differential Job Flow Rates and Unemployment Fluctuations

	Differential: Large - Small			Differential: Exporter - Non-Exporter			
	Overall	Exporter	Non-Exporter	Overall	Large	Medium	Small
JCR	0.30 (0.24)	0.43* (0.09)	-0.15 (0.57)	-0.54** (0.02)	0.06 (0.81)	-0.42* (0.09)	-0.44* (0.08)
JDR	0.09 (0.74)	-0.39 (0.12)	0.04 (0.88)	0.34 (0.18)	0.41 (0.10)	0.23 (0.37)	0.48* (0.05)
NJCR	0.27 (0.29)	0.44* (0.08)	-0.10 (0.71)	-0.46* (0.06)	-0.23 (0.37)	-0.40 (0.11)	-0.48* (0.05)

The table reports the correlation coefficients of the linearly detrended differential job flows and the growth rate of GDP as well as their respective p-values. 1, 2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

## 6.5 Plant-Level Cyclicity

In this section we implement a plant-level panel regression to study the cyclicity of job flows and verify our results based on correlations of semi-aggregated job flow rates with the business cycle measures. By doing so, we focus only on the plant-level net job creation rate as defined in equation

(1).<sup>65</sup> The main advantage of estimating a panel regression is an increase in the explanatory power, because more data points can be used compared to the correlations on the semi-aggregate level. And the set up allows to control for idiosyncratic differences between plants. However, the plant-level net job creation rate and the semi-aggregated net job creation rate are quite different objects as we have seen already in the construction of the data series in section 3.2. The literature focuses mainly on the cyclical behavior of the semi-aggregated job flow rates. Therefore, we chose this measure as baseline as well.<sup>66</sup>

The general regression framework consists of a fixed-effect panel regression.<sup>67</sup> We regress the net job creation rates on the growth rate of real GDP, interacted with size and exporter dummies according to equation (10). The estimation is based on an unbalanced panel, because the sample of establishment that participated in the interviews increased over time and not many establishments report observations for every year over the sample period. The exact specification is given by:

$$\begin{aligned}
 njcr_{i,t} = & \alpha_i + \beta_1 \Delta \log(GDP_t) + \beta_2 \Delta \log(GDP_t) \times Medium_{i,t} + \beta_3 \Delta \log(GDP_t) \times Large_{i,t} \\
 & + \beta_4 \Delta \log(GDP_t) \times Exporter_i + \beta_5 \Delta \log(GDP_t) \times Exporter_i \times Medium_{i,t} \\
 & + \beta_6 \Delta \log(GDP_t) \times Exporter_i \times Large_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t},
 \end{aligned} \tag{10}$$

where  $\alpha_i$  is the plant-fixed effect and  $\Delta \log(GDP_t)$  is the change in aggregate log GDP, i.e. the GDP growth rate, as measure for the aggregate cycle.  $Medium_t$ , and  $Large_t$  are dummies for the respective size groups while  $Exporter_i$  is a time-invariant dummy for being an exporter.<sup>68</sup>  $X_i$  is a set of controls. Because the plant fixed effects take into account heterogeneity, which is not

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<sup>65</sup>If instead we took into account the job creation and job destruction rates as well, we would not get well defined plant-specific time series as plants might switch back and forth between job creators and destroyers. Take for example two establishments, one increases its employment in three subsequent periods by +2 +4 +2. This means that the establishment is a job creator in all periods and the change in the job creation rate is +2 and -2. The second establishment faces an employment change by +2 -1 +2. So it counts as job creator in two periods and job destroyer in one period. One cannot easily link the change in job creation or job destruction to the aggregate measures in this case, because the establishment should face changes in the job creation rate by -2 and +2 and in the job destruction rate by +1 and -1. Therefore, the analysis abstains from changes in individual rates.

<sup>66</sup>A major shortcoming of the estimation – and obviously also of the baseline correlations – is that we cannot control for productivity. It might well be that productivity of plants is the crucial determinant of the cyclicity and neither size nor export status. As we know from other research that productivity is positively correlated with export status, our findings could simply pick up an effect of productivity.

<sup>67</sup>Estimating the specifications with pooled OLS would likely bias the results, because the error component consists of an unobserved time invariant firm component. It would lead to an endogeneity of the regressors. This time invariant component might be the personal abilities of the managers or the productivity of the establishment, i.e. components that cannot be controlled for. In principle, one could estimate the model also with a panel tobit regression, because the outcome variable is constructed to be bounded between -2 and 2. When looking at the distribution of the outcome variables, however, one can see that there is almost no mass near to the truncation points. Thus, the truncation does not play a role.

<sup>68</sup>We constrained on always exporter or never exporter so that  $Exporter_i$  is fixed over time. As shown in appendix F.2, the results are robust to include the time varying measure of exporter status. Furthermore, the results are robust to include the continuous measure of plant size instead of the size dummies.

time-varying, we will focus mainly on the growth rate of sales to control for idiosyncratic changes over time. We expect a positive association between the net job creation rate and the growth rate of sales as it proxies the overall state of the plant. Furthermore, it is unlikely that the time-varying component of the error term is i.i.d. within plants. To overcome the problem, the standard errors are clustered on the establishment level.

In general,  $\beta_1$  captures the co-movement of plants with the growth in aggregate GDP, i.e. the cyclicity of plants, which is supposedly positive.  $\beta_2$  and  $\beta_3$  capture a potential different cyclical sensitivity of plants of medium or large size. To make sure that the latter effects are not blurred by plants changing their size group over time we include these size dummies as controls as well.  $\beta_4$  captures the different cyclical behavior of plants in terms of their export status and  $\beta_5$  and  $\beta_6$  capture the potential heterogeneous response of exporters of medium and large size. From our findings on the semi-aggregated flows we expect not only  $\beta_1$  to be positive and significant, but also  $\beta_4$  as we found exporters to be cyclically more sensitive.

Table 16: Panel Estimations for Cyclical  $njcr$  in Germany

Dept. Var.: $njcr_t$	Size (1)	Export (2)	Size/Export (3)
$\Delta \log(\text{GDP}_t)$	0.235*** (0.00)	0.183*** (0.00)	0.195*** (0.00)
$\Delta \log(\text{GDP}_t) \times \text{Medium}_t$	0.165** (0.02)		-0.016 (0.86)
$\Delta \log(\text{GDP}_t) \times \text{Large}_t$	0.033 (0.80)		-0.393* (0.09)
$\Delta \log(\text{GDP}_t) \times \text{Exporter}$		0.477*** (0.00)	0.456*** (0.00)
$\Delta \log(\text{GDP}_t) \times \text{Exporter} \times \text{Medium}_t$			0.047 (0.79)
$\Delta \log(\text{GDP}_t) \times \text{Exporter} \times \text{Large}_t$			0.334 (0.28)
$\Delta \log(\text{Sales}_t)$	0.116*** (0.00)	0.116*** (0.00)	0.116*** (0.00)
$\text{Medium}_t$	-0.155*** (0.00)	-0.152*** (0.00)	-0.152*** (0.00)
$\text{Large}_t$	-0.265*** (0.00)	-0.264*** (0.00)	-0.261*** (0.00)

*Continued on next page*

Table 16 – *Continued from previous page*

Constant	0.048*** (0.00)	0.048*** (0.00)	0.048*** (0.00)
Plant fixed effects	Yes	Yes	Yes
Number of clusters	10759	10759	10759
Observations	72542	72542	72542
R <sup>2</sup>	0.205	0.206	0.206

1,2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

The results in table 16 confirm the previous findings from the correlation analysis based on the semi-aggregated job flow rates. We run three different panel regressions to verify the results. In column (1) we only focus on potential cyclical heterogeneity across size groups, in column (2) we do not include interactions with plant size, but only control for the cyclical effect of the export status, and in column (3) we estimate the full specification of equation (10).

The regressions indicate a positive association between the growth rate of aggregate real GDP and the net job creation rate on the plant level for all estimations, i.e. a positive value for our  $\beta_{11}$  coefficient. This confirms the pro-cyclicality of the net job creation rate that we have already seen for the semi-aggregated job flow rates and that are common in the literature. In specification (1) we see that medium size plants are more sensitive to the cycle compared to small and large plants. This is again in contrast to the previous findings of Moscarini and Postel-Vinay (2012) for the United States.<sup>69</sup>

When controlling only for the exporter status interacted with aggregate fluctuations in column (2) we find an even stronger positive relation. This indicates that exporters are more cyclical sensitive than non-exporters. However, this still leaves out the question of size. And since we know that exporters are on average larger, part of the effect might be due to size and not due to the export status.

Therefore, we control for size as well as export status in the regression of column (3). The results confirm the previous results of the correlation analysis. While the net job creation rate is generally positively associated to the aggregate fluctuations, this effect is amplified for exporters. However, large plants are generally found to be less cyclical. Together with the results from appendix F.2 this provides an indication that large exporters might be less cyclical, but the statistical power is relatively low. First of all, the coefficient on the interaction for large establishments is not highly significant and second, the coefficient on the large exporters has almost the same, but positive, magnitude and could offset the effect. But the p-value is too low to be significant on the latter

<sup>69</sup>However, the result could be simply driven by the fact that we investigate the plant-level and not the firm level. As many larger firms are composed of multiple plants, we under-estimate the actual firm size.

coefficient.

## 7 Conclusion

Many differences of firms in terms of size and productivity can be attributed to the distinction between purely domestic producers and exporting firms. With this study we add two further dimensions. On the one hand, we document heterogeneity in employment volatility along the export intensity between exporters of different size. And on the other hand, we provide dynamic differences over the business cycle between exporters and non-exporters.

German establishments that are selling abroad are on average found to be 10% less volatile compared to purely domestic producers. When taking into account the export intensity, however, it is shown that exporting can actually increase the employment volatility if plants are engaged too much in international activities.<sup>70</sup> Interestingly, this is not the case for large exporters. While the employment volatility is increasing in the export intensity for small exporters, it is further decreasing for large exporters. As a result, small exporters that export more than 34% of their sales are more volatile in their employment growth relative to comparable non-exporters.

The exact transmission mechanism, however, is not clear. A potential explanation is related to the work of Vannoorenberghe et al. (2014) and roots in destination specific fixed-costs, which exporters face. The firms that are closer to the threshold of covering these fixed costs, which appear to be small firms, are more often entering and exiting markets. Because of these discrete jumps in sales they face a higher overall volatility. Unfortunately, the our data does not allow to identify the destinations and therefore this channel cannot be tested. Another question is the transmission from sales to employment fluctuations. The IAB Establishment Panel allows to investigate the role of sales volatility too. When controlling for plant-specific sales volatility, previous findings are weakened, but not fully offset. Thus, firms do not fully transmit sales volatility into employment volatility. But further research is needed on firm-level dataset to better identify the exact transmission channel.

The second finding relates to the cyclical sensitivity of job flow rates in exporters and non-exporters, controlling for size. We find that cyclical job flows of exporters are strongly pronounced in Germany and reveal that establishments are creating more jobs in booms and destroy more in recessions. By exporting to foreign economies, these plants are exposed to different shocks, which are potentially orthogonal to the domestic cycle. But at the same time, exporters specialize in the production of certain goods. Often they produce durable goods, which in turn are more cyclical and could explain the stronger cyclical sensitivity in their job flows (Engel & Wang, 2011). Another explanation is a more sensitive reaction to the aggregate shocks, which might be due to competitive

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<sup>70</sup>Note that the results are not based on causal inference, but are only based on estimated associations between the export share and employment volatility on the plant-level.



pressure in foreign markets (Lichter et al., 2014).

Nevertheless, when evaluating the contribution of exporters to aggregate fluctuations in job flows, the findings suggest only a limited role of exporters. Exporters contribute about one third to aggregate fluctuations in the job flow rates, what is slightly more than their share in overall employment.

There are various paths for future related work. In spite of a relatively long discussion starting at least with Hirsch and Lev (1971), there is still little understanding of the exact insurance mechanism of exporting firms. In particular, one could test whether it is true that small exporters enter and exit markets more often and therefore face a higher volatility. Potentially certain destinations are more volatile than others. An interesting question with respect to sales and employment volatility is how firms optimize. Do they prefer a low volatility of sales or are there trade-offs involved so that they accept a higher volatility in return of other gains? Future work could also focus on the analysis of worker flows and in particular job-to-job transitions which might help to understand how exporters recruit their workers. Matches might be more valuable for exporters, which could explain a lower employment volatility.

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# A Dataset

## A.1 Variable Description and Data Source

Table 17: Variable Description and Data Sources

Variable	Definition	Source
GDP	Logarithm of quarterly GDP for Germany in constant prices. Annual values are computed by changing the timing to 3rd quarter of the previous year to 2nd quarter of the current year.	OECD Monthly Economic Indicators - Edition February 2013
Unemployment	Monthly unemployment rate. Annual measures are averaged from July of the previous year to June of the current year.	Arbeitslosigkeit im Zeitverlauf - Januar 2013, table 2.1.2
Small	Dummy equal to 1 if the establishment has less than 50 employees, 0 otherwise	IAB Establishment Panel
Medium	Dummy equal to 1 if the establishment has more than 50 and less than 500 employees, 0 otherwise	IAB Establishment Panel
Large	Dummy equal to 1 if the establishment has more than 500 employees	IAB Establishment Panel, 0 otherwise
Exporter	Dummy equal to 1 if the establishment reports revenues from abroad in all period when included in the panel, 0 otherwise	IAB Establishment Panel
log(Average Wage)	Logarithm of the total wage bill of an establishment divided by the number of employees	IAB Establishment Panel
log(Sales)	Logarithm of annual revenues of an establishment	IAB Establishment Panel
Structure	Distinguishes whether an establishment is (1) single-plant firm, (2) place of business, (3) the head office, or (4) the middle-level authority.	IAB Establishment Panel
Industry-wide wage agreement	Dummy equal to 1 if the establishment is subject to an industry-wide wage agreement, 0 otherwise	IAB Establishment Panel

## A.2 Classification of Industries

Table 18: Correspondence Table of Industrial Classification over Time

Code	Industry	1993-1999	2000-2003	2004-2008	2009	2010-2012
1	Agriculture	1	1	1	1	1
2	Mining and Energy	2	2	2	2	2
3	Manufacturing	4,5	3-6	3-6	3-6	3-6
4	Construction	6	7	7	7	7
5	Retailing	7	8	8	8	8,9
6	Logistics	8	9	9	9	10
7	Banking, insurance	9,10	10	10	12	13
8	Restaurants	11	11	11	11	12
9	Education	12	12	12	14	15
10	Health care	13	13	13	15	16
11	Services	14-15	14-19	14-16	10,13,16-17	11,14,17,18
12	Public administration	16	20	17	18	19

Note that plants in the sector of “public administration” are excluded from the analysis since only private companies are taken into account.

## B Job Creation and Job Destruction Margins

Table 19: Correlation of Job Creation and Destruction Rate with GDP Growth

	JCR			JDR		
	Non-Exporters	Exporters	Overall	Non-Exporters	Exporters	Overall
Small	0.45* (0.07)	0.54** (0.03)	0.24 (0.36)	-0.21 (0.42)	-0.66*** (0.00)	-0.44* (0.08)
Medium	0.58** (0.01)	0.65*** (0.00)	0.68*** (0.00)	-0.17 (0.52)	-0.80*** (0.00)	-0.52** (0.03)
Large	-0.01 (0.98)	0.47* (0.05)	0.38 (0.14)	0.42* (0.09)	-0.73*** (0.00)	-0.46* (0.06)
Overall	0.54** (0.02)	0.71*** (0.00)		-0.19 (0.48)	-0.81*** (0.00)	

The table reports correlation coefficients of the linearly detrended job flows and the growth rate of GDP as well as their respective p-values. 1, 2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

## C Cyclicity of HP-Filtered Job Flow Rates

## D Plant-Level Volatility for Exporters Only

In the baseline set-up of the estimation, we compare non-exporter and exporter even though we mainly focus on the heterogeneity among exporters itself. The baseline estimation is useful to

Table 20: Correlation of Differential Job Flow Rates and HP-Filtered log(GDP)

	Differential: Large - Small			Differential: Exporter - Non-Exporter			
	Overall	Exporter	Non-Exporter	Overall	Large	Medium	Small
JCR	-0.17 (0.52)	-0.13 (0.63)	-0.12 (0.64)	0.51** (0.04)	0.27 (0.29)	0.18 (0.50)	0.38 (0.13)
JDR	0.28 (0.28)	0.30 (0.24)	0.50** (0.04)	-0.43* (0.09)	-0.73*** (0.00)	-0.66*** (0.00)	-0.39 (0.12)
NJCR	-0.23 (0.38)	-0.17 (0.51)	-0.35 (0.17)	0.49** (0.04)	0.66*** (0.00)	0.49* (0.05)	0.40 (0.11)

The table reports correlation coefficients of the HP-filtered (parameter 6.25) differential job flows and HP-filtered log(GDP) as well as their respective p-values. 1, 2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

set the grounds and relate to other studies. Furthermore, it increases the statistical power of the analysis as it is based on a larger number of observations. Nevertheless, we expect to find the heterogeneity between small and large exporters also in a set-up in which we constrain on exporters only.

The results in table 21 indicate that in general the export share is positively associated to the employment volatility. This effect, however, is reversed for large exporters as can be seen in column (4). Nevertheless, only the inclusion of additional size dummies yields the result. This suggests that controlling by log(Employment) is not sufficient, but there is additional heterogeneity among small and large plants. While the volatility for small and medium size exporters is only increasing according to column (4), there is a dampening effect for large exporters. By doing the back-of-the-envelope calculations, it turns out that there is no additional non-monotonicity among exporters.<sup>71</sup>

Table 21: Plant-Level Employment Volatility – Exporters Only

	log( $\sigma_{njcr}$ )		
	(1)	(2)	(3)
Exporter $\times$ Medium	-0.089 (0.15)		-0.063 (0.40)
Exporter $\times$ Large	0.146 (0.20)		0.316** (0.03)
Export Share		0.002**	0.003***

*Continued on next page*

<sup>71</sup>The effect of the export share for large exporters is given by the difference between the standard export share and the additional coefficient for the large plants, i.e.  $0.003 - 0.005 = -0.002$ . Dividing the 0.316 by 0.002 yields an export intensity above 100%.

Table 21 – *Continued from previous page*

		(0.02)	(0.01)
Export Share × Medium			-0.001
			(0.36)
Export Share × Large			-0.05**
			(0.03)
Controls	Yes	Yes	Yes
State dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Organizational dummies	Yes	Yes	Yes
Observations	1656	1656	1656
$R^2$	0.206	0.208	0.211

1,2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

## E Plant-Level Sales Volatility

Table 22: Plant-Level Sales Volatility

	$\log(\sigma_{Sales})$			
	(1)	(2)	(3)	(4)
Exporter	0.031	0.022	-0.097**	-0.115**
	(0.29)	(0.55)	(0.01)	(0.03)
Exporter × Medium		-0.005		0.028
		(0.93)		(0.72)
Exporter × Large		0.166*		0.102
		(0.09)		(0.51)
Export Share			0.004***	0.004***
			(0.00)	(0.00)
Export Share × Medium				-0.001
				(0.45)
Large × Export Share				-0.000
				(0.97)
$\log(\text{Employment})$	-0.197***	-0.195***	-0.193***	-0.192***
	(0.00)	(0.00)	(0.00)	(0.00)

*Continued on next page*



Table 22 – *Continued from previous page*

Medium	0.080** (0.03)	0.084** (0.04)	0.077** (0.04)	0.083** (0.04)
Large	0.351*** (0.00)	0.254*** (0.00)	0.315*** (0.00)	0.249*** (0.01)
<i>njcr</i>	0.093 (0.36)	0.094 (0.36)	0.088 (0.39)	0.088 (0.39)
log(Sales)	0.041*** (0.00)	0.040*** (0.00)	0.039*** (0.00)	0.038*** (0.00)
log(Average Wage)	0.028 (0.15)	0.028 (0.15)	0.028 (0.16)	0.027 (0.17)
Skill Composition	-0.001* (0.06)	-0.001* (0.06)	-0.001* (0.04)	-0.001* (0.04)
Industry-wide wage agreement	-0.120*** (0.00)	-0.123*** (0.00)	-0.120*** (0.00)	-0.122***
Constant	-1.783*** (0.00)	-1.778*** (0.00)	-1.754*** (0.00)	-1.751*** (0.00)
State dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Organizational dummies	Yes	Yes	Yes	Yes
Observations	9379	9379	9379	9379
$R^2$	0.088	0.088	0.093	0.093

1,2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

## F Cyclicalities with Time-Varying Exporters-Status

This section repeats the cyclical analysis, taking into account that plants might change their export-status between different periods. By doing so, we capture the entry and exit in the export market as well.

### F.1 Cyclicalities of Job Flows with Time-Varying Exporter Status

Table 23: Correlation of Differential Job Flow Rates and GDP Growth

	Differential: Large - Small			Differential: Exporter - Non-Exporter			
	Overall	Exporter	Non-Exporter	Overall	Large	Medium	Small
JCR	-0.17 (0.52)	-0.13 (0.63)	-0.12 (0.64)	0.51** (0.04)	0.26 (0.32)	0.11 (0.68)	0.31 (0.22)
JDR	0.28 (0.28)	0.30 (0.24)	0.50** (0.04)	-0.43* (0.09)	-0.64** (0.01)	-0.60 (0.19)	-0.33 (0.19)
NJCR	-0.23 (0.38)	-0.17 (0.51)	-0.35 (0.17)	0.49** (0.04)	0.44* (0.08)	0.40 (0.11)	0.34 (0.18)

The table reports correlation coefficients of the linearly detrended differential job flows and the growth rate of GDP as well as their respective p-values. 1, 2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.

## F.2 Plant-Level Cyclicity with Time-Varying Exporter Status

Table 24: Panel Estimations for Cyclical  $njcr$  in Germany

Dept. Var.: $njcr_t$	Size (1)	Export (2)	Size/Export (3)
$\Delta \log(\text{GDP}_t)$	0.300*** (0.00)	0.230*** (0.00)	0.242*** (0.00)
$\Delta \log(\text{GDP}_t) \times \text{Medium}_t$	0.126* (0.06)		-0.006 (0.95)
$\Delta \log(\text{GDP}_t) \times \text{Large}_t$	-0.018 (0.87)		-0.434** (0.03)
$\Delta \log(\text{GDP}_t) \times \text{Exporter}_t$		0.380*** (0.00)	0.355*** (0.00)
$\Delta \log(\text{GDP}_t) \times \text{Exporter}_t \times \text{Medium}_t$			0.040 (0.78)
$\Delta \log(\text{GDP}_t) \times \text{Exporter}_t \times \text{Large}_t$			0.419* (0.09)
$\Delta \log(\text{Sales}_t)$	0.117*** (0.00)	0.116*** (0.00)	0.116*** (0.00)
$\text{Medium}_t$	-0.151*** (0.00)	-0.149*** (0.00)	-0.149*** (0.00)
$\text{Large}_t$	-0.256***	-0.256***	-0.253***

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Table 24 – *Continued from previous page*

	(0.00)	(0.00)	(0.00)
Exporter <sub>t</sub>	0.011***	0.006	0.006
	(0.00)	(0.10)	(0.11)
Constant	0.047***	0.048***	0.048***
	(0.00)	(0.00)	(0.00)
Plant fixed effects	Yes	Yes	Yes
Number of clusters	13797	13797	13797
Observations	95000	95000	95000
R <sup>2</sup>	0.208	0.208	0.208

1,2, and 3 stars represent the 10%, 5%, and 1% significance level respectively.