Volatile Multinationals?
Evidence from the Labor Demand of German Firms*

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Abstract

Does more FDI make the world a riskier place for workers? We analyze whether increased activities of multinational firms are associated with increased firm-level employment volatility. We use a firm-level dataset for Germany which allows distinguishing purely domestic firms, domestic multinationals, their foreign affiliates, and foreign firms that are active in Germany. We decompose the volatility of firms into their reaction and their exposure to aggregate developments. Generally, we find no above-average wage and output elasticities and thus no differences in reactions for multinational firms. German multinationals in services industries even have a lower elasticity of labor demand.

Keywords: employment volatility, labor-demand, multinational firms

JEL classification: F23, J23

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1 Introduction

Does more FDI make the world a riskier place for workers? Survey evidence suggests that a greater presence of multinational firms in an industry increases workers' perceived insecurity (Scheve and Slaughter 2004). There are also good theoretical reasons to believe that labor market volatility increases as firms become more active across borders. Firms in comparative advantage industries are likely to experience higher job turnover rates than firms in industries without comparative advantage (Bernard et al. 2004), outsourcing affects the volatility of employment at home and abroad (Bergin et al. 2006), firms can move volatile production to locations where labor markets are flexible (Cunat and Melitz 2006), and greater familiarity with foreign countries may increase the elasticity of labor demand (Rauch and Trindade 2003).

In this paper, we study the link between FDI and the volatility of employment empirically. We start from the hypothesis that multinational firms have higher elasticities of labor demand and thus react more to a given shock than domestic firms (Rodrik 1997, Scheve and Slaughter 2001). Since macroeconomic volatility has declined over the past decades in industrialized countries, changes in the reaction to aggregate developments could be a factor behind a – potentially – increased volatility of employment at the firm-level. Our focus is thus on the impact of internationalization on the *response* of firms to changes in wages and output. We test whether the response differs across firms that operate domestically and multinational firms, and we distinguish the response to domestic and foreign value added.

Using firm-level data on German firms, we follow earlier literature by estimating labor demand elasticities at the firm-level. We go beyond earlier literature in three main ways. First, we distinguish the exposure from the reaction of firms to industry-level aggregates. Second, we use a finer distinction of different groups of firms by distinguishing different types of MNEs as well as exporters and non-exporters. Third, we compute the determinants of firm-level dispersion as a measure of uncertainty. One advantage of this measure of uncertainty over standard volatility measures is that it can be computed even for firms with short strings of time series observations.

Our data come from two sources. The first is the firm-level database Micro-Database Direct Investment (*MiDi*) on foreign direct investment (FDI) of German firms abroad and on FDI of foreign firms in Germany, provided by the Deutsche Bundesbank. We use these data to obtain information on the importance of multinational firms across industries and the exposure of

German multinationals to foreign industry-level value added. The second data source is the firm-level database *Dafne*, which has information on the balance sheets and income statements of firms that are active in Germany, provided by Bureau van Dijk. This database also contains information on the ownership structure of firms.

Our research is related to three strands of empirical literature:

A first strand of literature is concerned with the estimation of labor demand elasticities and with differences between domestic and foreign firms. Using industry-level data, Slaughter (2001) finds no significant impact of openness on labor demand elasticities. Evidence using firm-level data is mixed. Using data for European firms, Barba Navaretti, Checchi, and Turrini (2003) find that MNEs adjust their labor demand faster than national firms but that wage elasticities are smaller than for domestic firms. Using data for the UK, Fabbri, Haskel, and Slaughter (2003) show that the elasticity of labor demand is higher for multinational than for national firms.

A second strand of literature studies patterns in firm-level volatility. To date, literature remains somewhat inconclusive with regard to the evolution of firm-level volatility over time. Comin and Philippon (2005) document diverging patterns in firm-level and aggregated output volatility for the US. While firm-level output volatility has increased, aggregated output volatility has decreased. Comin et al. (2006) support these general patterns and show that output and employment volatility display similar trends. Empirical evidence for France also supports an upward trend in firm-level volatility (Thesmar and Koenig 2004). For Germany, it is difficult to detect a clear trend in firm-level volatility though. Patterns are similar to those found in aggregated data, and there is little evidence for an increase in volatility (Buch et al. 2006). Davis et al. (2006) show that, also for the US, the finding of an increase in firm-level volatility depends on the sample of firms chosen. According to their results, the increase in firm-level volatility documented by Comin and Phillipon (2005) is a feature of the large, publicly traded firms. Using information on privately-owned firms as well, Davis et al. (2006) find a downward trend in firm-level volatility for the US. The impact of openness on firm-level volatility has hardly been studied. Bergin et al. (2006) find that outsourcing industries in the US and Mexico have higher volatilities than the industry average, but their data are at the industry-level. Buch et al. (2006) find that export openness of German firms and output volatility are negatively correlated.

A third strand of literature studies the impact of openness on employment security in Germany, but the set up of their empirical models differs from ours. Becker and Mündler (2006) use a linked employer-employee dataset to show that expanding multinational

enterprises retain more domestic jobs than competitors without foreign expansions. The foreign expansion is the dominant explanatory factor for reduced worker separation rates. Results by Geishecker (2006) suggest that greater openness increases insecurity instead. He uses data from the German socio-economic panel and finds that international outsourcing at the industry-level significantly lowers individual employment security.

In the following Second Part, we decompose the effect of openness on employment volatility into the exposure and the reaction to shocks. We describe our empirical approach with regard to estimating the elasticity of labor demand and measuring employment volatility and dispersion. In Part Three, we describe our data and present descriptive statistics. Part Four has the regression results and robustness tests, and Part Five summarizes our findings. Generally, we find no evidence for above-average wage and output elasticities of multinational firms. German multinationals in services industries tend to have a lower elasticity of labor demand than the rest of the sample.

2 Decomposing Employment Volatility: Theory and Measurement

The volatility of employment can differ between domestic and multinational firms for two main reasons: firms can have different exposures to shocks and firms can react differently to these shocks. To set the stage for our empirical analysis below, the following section presents a partial-equilibrium model of a multinational firm, which disentangles these effects. We then describe how we measure the exposure and the reaction of firms to firm- and industry-level developments.

2.1 Theoretical Background [1]

Assume that domestic firm *i* produces output Y_i, using domestic labor L_i and capital K_i under a standard CES production function: $Y_i = \left(\alpha L_i^{\rho_i} + (1-\alpha) K_i^{\rho_i}\right)^{1/\rho_i}$ where $0 < \alpha < 1$ denotes the labor share and $1 \geq \rho_i \geq -\infty$. We model the degree of internationalization in a very simple way by assuming that the firm owns foreign affiliates through which it sells a share m_i of its output on the foreign market. The firm does not produce abroad. Correspondingly, a share $(1-m_i)$ of output is sold on the domestic market, and total output can be decomposed into $Y_i = Y_i^H + Y_i^F = m_i Y_i + (1-m_i) Y_i$. The parameter m_i captures the degree of multinationality of the firm. In the short run, the firm takes all prices and the capital stock as given

[1] For a similar argument see Barba-Navaretti and Venables (2004).

($K_{it} = \bar{K}_{it} = 1$).[2] It chooses the optimal labor input and the degree of multinationality according to the following first-order conditions:

$$\begin{aligned} &\left[p\left(1-m_i\right)+\left(p^*-c_i\right)m_i \right]\cdot\alpha\left(\frac{Y_i}{L_i}\right)^{1-\rho_i} = w_i \\ &p = p^*-c_i \end{aligned} \tag{1}$$

where c_i is a per-unit cost of exporting and p (p*) denote domestic (foreign) prices. Solving for L_i yields the labor demand function:

$$L_i^D = \left[\frac{\alpha}{w}\left(p\left(1-m_i\right)+\left(p^*-c_i\right)m_i\right)\right]^{\frac{1}{1-\rho_i}}\cdot Y_i = \left(\frac{x_i\alpha}{w}\right)^{-\eta_i^D}\cdot Y_i \tag{2}$$

where $\eta_i^D = -1/(1-\rho_i)$ is the labor demand elasticity, and $x_i = p(1-m_i)+(p^*-c_i)m_i$ is a weighted average of demand conditions on the home and on the foreign market. Note that the elasticity of labor demand may be firm-specific, depending on the market in which firms are active and the degree of multinationality: $\eta_i^D = \eta_i^D(m_i)$. Multinationals can, for instance, shift production more easily between different affiliates than domestic firms, and they are exposed to greater competition on foreign markets. The percentage change in employment for firm *i* is given by:

$$\hat{L} = \frac{dL}{L} = \frac{\eta^S\eta_i^D}{\eta^S+\eta_i^D}\hat{x}_i = \Phi_i\hat{x}_i \tag{3}$$

where $\hat{x}_i$ captures firm-specific domestic and foreign demand developments, and $\Phi_i = \frac{\eta^S\eta_i^D}{\eta^S+\eta_i^D}$ summarizes labor demand and supply elasticities. The volatility of employment is given by:

$$\sigma^2(\hat{L}) = \Phi_i^2\sigma^2(\hat{x}_i). \tag{4}$$

Equation 4 shows that there are three factors affecting the volatility of employment. First, domestic and multinational firms might *react* differently to changes in demand because their elasticities of labor demand and supply differ. Second, multinational firms are *exposed* to domestic and foreign demand developments. Domestic firms, by contrast, are exposed only to changes in domestic demand. Third, the correlation between domestic and foreign demand shocks affects the exposure to shocks and, thus, the volatility of employment. If shocks are imperfectly correlated across countries, multinational firms benefit from a *diversification* effect, which dampens the volatility of employment.

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[2] Endogenizing the capital stock would not change the qualitative argument made below.

In sum, openness affects firm-level volatility through the reaction and the exposure of firms to aggregated developments. We analyze the reaction by estimating the wage and output elasticities of different types of firms. We also distinguish the reaction of firms to changes in its own output from changes in (domestic and foreign) output at the industry-level. Next, we describe how we measure the reaction and the exposure of firms to shocks as well as firm-level volatilities.

2.2 Measuring the Elasticity of Labor Demand and Volatility

2.2.1 Elasticity of Labor Demand

Understanding how internationalization affects the elasticity of labor demand requires decomposing this elasticity into its components. Hamermesh (1992) shows that a firm's own-price labor-demand elasticity (η_{LL}) depends on the labor share in total revenues, the constant-output elasticity of substitution between labor and other factors of production, and the product-demand elasticity facing firm i in the output market: $\eta_{LL} = -(1-s)\,\sigma_{LK} - s\eta < 0$ where $s = wL/Y$ is the labor share, σ_{LK} is the elasticity of substitution between capital and labor, and η is the product demand elasticity. In assessing the impact of increased multinational activity on factor demand, three effects can be distinguished:

- Substitution effect: How much, for a given level of output, does the firm substitute labor away from other factors of production?
- Scale effect: How much of the change in labor demand is due to a change in the level of output?
- Scope effect: To what extent does the firm change the composition of its output? Firms may, for instance, become more specialized in R&D or management as they become MNEs (Hanson et al. 2003).

Our data are not sufficiently detailed to allow separating the scope effect. However, the substitution and the scale effect can be distinguished by estimating the constant-output demand for labor as a function of wages, interest rates, and output using the following linear model Hamermesh (1992):

$$l_{it}^{d} = c + \eta'_{LL}\, w_{it} + \eta'_{LK}\, r_{it} + \eta y_{it} + \varepsilon_{it}$$

where η' denotes the constant-output labor demand elasticities. Including the level of output captures the fact that markets become more competitive and that consumers find it easier to substitute between different varieties in more integrated markets. We follow Slaughter (2001) in assuming that labor supply faced by the individual firm is perfectly elastic. In this case,

changes in the labor supply schedule, which we measure through changes in wages, allow observing changes in labor demand, and we can interpret our coefficient estimates as labor demand elasticities.

One application of this framework to an international setting is a paper by Barba Navaretti et al. (2003) who estimate labor demand functions for a panel of European firms taken from the *Amadeus* database. They include a dummy variable which indicates whether a firm is owned by a foreign MNE, and they interact this variable with wages to test whether domestic and multinational firms have a different elasticity of labor demand. Their empirical specification also includes a lagged term which allows modeling partial adjustment processes and estimating the persistence of labor demand. They find that MNEs adjust their labor demand faster than national firms. However, long-run wage and output elasticities of labor demand are higher for national than for multinational firms. There are no systematic differences with regard to the short-run elasticities. Results for Germany are similar to those for the other countries in the sample.

2.2.2 Exposure to Industry-Level Value Added

In contrast to earlier empirical work studying the elasticities of labor demand, we disentangle the reaction and the exposure of firms to aggregate developments. We also distinguish the response of firms to idiosyncratic developments at the firm-level and to changes in output at the industry-level.

For all firms in the sample, we include German industry-level value added in constant prices as a regressor. For domestic multinationals, we additionally include a measure of industry-level value added abroad. To construct this measure of the exposure of German multinationals to foreign aggregate developments, we use the firm-level database on foreign direct investment (*MiDi*), provided by the *Deutsche Bundesbank*. From this database, we calculate the employment (*emp*) and sales weights ω_{ij} of each partner country *j* in total foreign activities for each German MNE *i*:

$$\omega_{ij} = \frac{emp_{ij}}{\sum_{j=1}^{n} emp_{ij}} \text{ or } \omega_{ij} = \frac{sales_{ij}}{\sum_{j=1}^{n} sales_{ij}}$$

Results using the different weighting schemes differ very little. These weights are then used to calculate a firm-specific foreign value-added aggregate at the industry-level. Firms are classified by the industry of the German parent.[3]

2.2.3 Volatility and Dispersion

Ideally, we would compute firm-level volatilities. It has become relatively standard in the literature to compute volatility over the growth rates as the variance in growth rates over a moving 5-year window. (See, e.g., Comin et al. (2006) for a study using data for the US.) However, for many firms in our sample, we lack sufficient time series information to calculate this volatility measure. Therefore, our volatilities are based on industry-level data. Figure 1 thus shows the standard deviation of percentage changes γ in employment in industry *i* over a rolling five-year period. We use this volatility measure to provide descriptive statistics only.

To obtain a firm-level measure of the variability of business outcomes, which we can also use for a regression analysis, we follow Davis et al. (2006) and compute the cross-sectional standard deviation of firms' growth rates as a dispersion measure. Let firm *i*'s growth rate be given by: $\gamma_{it} = (x_{it} - x_{it-1}) / x_{it-1}$. Then, the cross-sectional dispersion of growth rates is given by: $d_{it} = \gamma_{it}^2 - \bar{\gamma}_t^2$ where $\bar{\gamma}_t$ is the period-average growth rate of all firms in the sample. This dispersion measure reflects the year-to-year variation in growth rates between firms whereas volatility measures reflect the year-to-year within-firm variations in growth rates. Although these measures capture different aspects of the variation in growth rates over time and across firms, Davis et al. (2006) show, for the US, that dispersion and volatility measures have co-moved over recent years.

3 Data and Descriptive Statistics

3.1 The Data

Our data come from two sources. (See the Appendix for details on the data definitions and sources.) The main data source is *Dafne*, a commercial database providing financial information for 60,000 German companies. We use this database as it provides information on a large panel of firms that are active in Germany. The second data source is the firm-level

[3] In principle, we could use the same methodology to construct measures of the exposure of foreign multinationals in Germany to foreign industry-level value added. However, we lack information on further host countries for foreign multinationals and their activities there.

database on multinational firms *MiDi* provided by the *Deutsche Bundesbank* (Lipponer 2006). From this database, we obtain information on the countries in which firms are active and the volume of their activity abroad.

Using *Dafne*, we can distinguish German firms which hold more than 10% of the equity capital in foreign firms, from foreign firms which hold more than 10% of the equity capital in German firms, and from firms which, both, own foreign affiliates and are owned by foreigners. Moreover, we can distinguish German firms that export from those that do not.[4] We thus create five groups of firms:

- Purely domestic German firms, i.e. firms which are not owned by a foreign parent and which do not hold affiliates abroad ('Domestic Firms') (1,696 firms),
- Domestic firms that export ('Domestic Exporters') (288 firms),
- German firms with foreign affiliates ('German MNEs') (309 firms),
- Foreign firms that are active in Germany ('Foreign Firms') (50 firms), and
- Foreign firms in Germany which are owned by foreign firms *and* which own affiliates abroad ('Two-Way MNEs') (139 firms).

Ownership and export information is for the most recent year, i.e. we have no time-varying ownership and export information in *Dafne*. Where available, dynamic ownership information has been implemented using *MiDi* data.

To eliminate outliers and to clean the sample, we start from the full *Dafne* dataset and drop firms with less than 10 employees and with negative values for sales. Data for very small firms are often patchy and unreliable, and negative sales might be an indication of miss-reporting. Imposing the additional restriction that firms should have entries for at least three consecutive years for employment, sales, and wages further reduces the sample. Since we do not have information on mergers among the firms in the sample, we correct for possible merger-induced outliers by dropping observations with large changes of sales, employment, and wages.[5] This outlier correction results in a further reduction of observations. The final dataset used for the regressions contains some 8,600 firm-year observations. These represent data from about 2,500 firms in 8 years, of which 2,000 are domestic enterprises (NEs), and 500 are multinationals (MNEs).

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[4] In principle, similar information could be obtained from *MiDi*. Due to lacking information in *MiDi* on German parent firms as well as parents' and affiliates' foreign trade, we use *Dafne* data as a starting point.

[5] More specifically, we drop firms that report more than doubling or halving sales, wages or employment on a year-on-year basis, and that report wages exceeding three times the mean.

To check whether the reduced sample is roughly representative for German industry as a whole, Table 1a compares the final structure of our sample in terms of sales, employment, and number of firms to aggregate data for Germany. The biggest discrepancies are for manufacturing, which is over-weighted in our sample (49% of sales) compared to the German aggregate (36% of sales). Our sample under-weights the wholesale and retail trade industries (12 versus 32% of sales). The shares of the remaining industries are, by and large, similar to those in the aggregated data. We address the potential selection bias by including industry-time fixed effects in all regressions, by including dummies for firms of different size, and by estimating our main regressions separately for firms of different size and from different industries.

Table 1b shows the allocation of employment by industry and ownership type for the data used in the regressions. Overall, 40% of the employment in our sample is in Domestic Firms. The second largest group are the Two-Way MNEs (26%), followed by German MNEs (22%), Domestic Exporters (10%), and Foreign Firms. Across the industries, the allocation of employment differs though. Two-Way MNEs, for instance, are particularly important in agriculture, manufacturing, construction, hotels and restaurants, and transport and communication. Domestic Firms, in contrast, prevail in industries such as mining and quarrying, electricity, financial intermediation, public administration, education as well as health and social work.

In *Dafne*, company reports typically include balance sheet information and profit and loss information. We can, therefore, compute a firm-level measure of wages by dividing the total wage bill by the number of employees. Comparing the average wage bill per worker in our data to industry-level data shows that the average wage bill of the *Dafne* firms is about 160% of the average wage bill in the respective industry. This reflects that *Dafne* contains data on firms' total personnel expenditure including social security contributions rather than just workers' gross wages.

From the Bundesbank's *MiDi* database, we obtain information on the names and the number of countries in which firms are active. This information is used to construct weights for foreign industry level aggregates described above (Section 2.2.2) as well as a count variable indicating the number of countries in which firms are active. This variable will be used as a regressor in our labor demand equations below, and it is intended to capture the diversification effect of multinational activity (Section 2.1). We also use data on stocks of FDI taken from *MiDi* as a measure of industry-level openness.

3.2 Descriptive Statistics: Volatility and Dispersion

Figure 1 shows scatter plots for volatilities and the share of FDI relative to the total capital stock (i.e. gross fixed capital formation) by industry. We plot the volatility of employment, of wages, and of output. We also distinguish inward from outward FDI.

Eye-balling Figure 1 does not suggest strong links between our volatility measures and FDI. If anything, there is a slight negative correlation between FDI and employment and wage volatilities and a positive correlation between FDI and output volatility. At the same time, there is also a large degree of heterogeneity across industries. Manufacturing has a high share of outward FDI relative to its domestic capital stock; the retail and wholesale trade industries have a high share of inward FDI. Both industries have a low- to medium-level volatility. Agriculture, fishing, and mining are the most volatile industries. These industries, in turn, have a very low degree of internationalization.

A recent model by Cunat and Melitz (2006) suggests that multinationals might not only have a volatility of employment that differs from national firms, but they may also endogenously respond to changes in industry-level volatility. Cunat and Melitz analyze trade between countries with different labor market institutions – a flexible and a rigid economy. Countries with flexible institutions enjoy a comparative advantage in the production of highly volatile industries. This generates industry-level differences in relative productivities across countries. Cunat and Melitz find empirical support for their model testing it on cross-country industry-level data. Germany as a country with relatively rigid labor markets could be expected to specialize in the production of industries with relatively low volatility and/or to produce relatively capital intensive. Hence, following the model, we should find a positive correlation between volatility at the industry-level and the intensity of outward FDI and a negative correlation between volatility at the industry-level and inward FDI. However, in unreported regressions, we find no significant linkages between FDI and employment volatility at the industry-level. The only significant effect we find is a positive impact of inward and outward FDI on output volatility.

We can also compare our results to the stylized facts reported in Bergin et al. (2006), who report an average output volatility for US aggregate manufacturing of 1.4% for the period 1996-2005. For outsourcing industries,[6] they report an average volatility of 2.5%. Hence, output volatility in the outsourcing industries is higher than for the US as a whole. In terms of the magnitudes of the volatilities, our numbers are in a similar range (see Figure 1 c).

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[6] These are the industries apparel, transport equipment, electrical machinery, and electronics.

Next, we turn from industry-based volatilities to our firm-level dispersion measures. Comparing these dispersion measures across different types of firms, we find no clear differences. For the full sample, the dispersion of employment growth over the cross-section of firms is 1.8% (standard deviation of 6.1%). These values are very similar for Domestic Exporters, German MNEs, and the Two-Way MNEs. The employment dispersion measure is higher for the Foreign Firms (3.3%) but the standard deviation across these – relatively few – firms is also large (12.6%). Hence, prima facie, there are no strong indications that the volatility or the dispersion of employment growth differs significantly according to firms' MNE status.

4 Regression Results: Firm-Level Labor Demand Elasticities

One reason for differences in the employment volatilities across industries could be that the relative importance of multinational firms differs and that, in addition, multinational firms react differently to changes in wages and in output. Next, we thus estimate output and wage elasticities for different firms that are active on the German market.

4.1 The Model

Our baseline model for labor demand elasticities is based on Hamermesh (1992) and is specified similar to Barba Navaretti et al. (2003):[7]

$$\begin{aligned} l_{ijt} = {} & \alpha_o + \beta_1 l_{ijt-1} + \beta_2 D_{MNE} l_{ijt-1} + \beta_3 y_{ijt} + \beta_4 D_{MNE} y_{ijt} + \beta_5 w_{ijt} \\ & + \beta_6 D_{MNE} w_{ijt} + \beta_7 y_{jt} + \beta_8 y^*_{jt} + D_{size} + D_{jt} + \varepsilon_{jit} \end{aligned} \tag{5}$$

where l_{ijt} is employment in firm i in industry j at time t, D_{MNE} is a vector of dummies for Domestic Exporters, German MNEs, Foreign Firms, and Two-Way MNEs, y_{ijt} are total firm-level sales, $y_{jt}\left(\ y^*_{jt}\right)$ is domestic (weighted foreign) industry-level value added, w_{ijt} are firms' average wages, D_{size} is a vector of size dummies according to firms' total employment,[8] D_{jt} are time-industry fixed effects, and ε_{ijt} is the error term. We include lagged employment to account for the fact that costs of hiring and firing may cause employment persistence. All variables are specified in logs, and we can therefore interpret the coefficients as elasticities.

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[7] Descriptive statistics for the variables used in the regressions are given in Table 1d.

[8] See Table 1c for the size distribution of the *Dafne* data and our regression sample.

Since we lack price data at the industry-level for some industries, in particular services industries, we use nominal values. The time-industry fixed effects capture price changes and other developments at the industry-level such as the cost of capital, for which we do not have reliable estimates at the firm-level. They also capture the possible selection bias which is due to differences in the structure of our sample compared to the Germany economy (see Table 1a).

We go beyond earlier work in three main regards. First, we not only include a firm's own output but also domestic and foreign output at the industry level. Hence, we distinguish how firms react to changes in domestic and foreign industry-level value added. The reaction of labor demand to a firm's own output captures the response to changes in the relative demand for its product. Second, as regards the ownership dummy D_{MNE}, Barba Navaretti et al. (2003) distinguish domestic firms and affiliates of multinational firms. We can additionally distinguish German MNEs, Foreign Firms, and Two-Way MNEs as well as Domestic Exporters. Third, we use a system GMM instead of a difference GMM estimator to model the dynamics of firms' labor demand.

Before turning to the specifics of the model, note that, using equation (5), we can assess how quickly firms adjust to changes in external conditions. This speed of adjustment is given by $1-\beta_1$ for domestic and $1-\beta_1-\beta_2$ for the different groups of multinational firms. We can also compute the short-run output elasticities for domestic firms (β_3) and multinational firms ($\beta_3+\beta_4$) as well as the long-run output elasticities for domestic firms $\beta_3/(1-\beta_1)$ and multinational firms $(\beta_3+\beta_4)/(1-\beta_1-\beta_2)$. Similarly, we can read off the short- and the long-run wage elasticities of domestic and multinational firms.

Our main interest is the elasticities of labor demand with respect to output and wages. We expect a positive sign on the output elasticity and a negative sign on the wage elasticity. If multinational firms were *more* responsive to output and wages, β_4 should be positive and β_6 should be negative. Our maintained assumption is that the individual firm faced a perfectly elastic supply schedule and that we can therefore interpret the coefficients on wages and output as labor *demand* elasticities.

Equation (5) assumes that employment adjusts with a lag. In our empirical specifications reported below, the first lag of the endogenous variable is indeed highly significant. Since the residuals are correlated with the endogenous variables, simple fixed effects estimates would be biased. The difference GMM proposed by Arellano and Bond (1991) or the system GMM proposed by Blundell and Bond (1998) allow estimating unbiased coefficient in dynamic panel models. The main difference between the two is that system GMM adds the level

equations to the regression and augments the number of instruments of order *T*. Adding the level equation to the regression in the system GMM gives more efficient estimates by increasing the number of instruments. As a general rule, the number of instruments used should be significantly smaller than the number of groups used for the regressions. This condition is met throughout, as the number of instruments does not exceed 10-20% of the number of groups. Hence, adding more instruments through system GMM should be plain sailing.

The system GMM should be preferred over the difference GMM if the dependent variable (in our case: employment) is close to a random walk, i.e. if it is stationary.[9] In this case, the difference GMM performs poorly by using past levels as instruments which carry little information about future changes.

Due to the unbalance nature of our panel and the short time series dimension, we cannot apply standard panel unit root tests to check whether employment is stationary. Note that our panel is of a standard "Large N, small T"-type. The cross-section dimension (N = 2,482 firms) clearly dominates the time series dimension (maximum T = 8 years per cross-section) and thus drives the asymptotics. Hence, we use two indirect methods of assessing the appropriateness of choosing system over difference GMM.

First, we estimate equation (5) using a naïve OLS- and a within-panel model. This gives us a range for the lagged coefficient term to lie between 0.97 and 0.28 (Roodman 2006). All our estimates reported below give point estimates within this range. Estimating the model using the Arellano-Bond (1991) difference GMM gives a point estimate of 0.37 (standard error of 0.06) whereas the Blundell-Bond (1998) system GMM gives a point estimate of 0.85 (standard error of 0.02). (See columns (1) and (4) of Table 5.) Hence, the lagged employment in the system GMM lies more comfortably within the above range.

Second, finding a significant value for the Sargan-test statistics would be an indication that the stationarity assumption could be violated. Since the Sargan test never turns out being significant, this gives further support to making system GMM our preferred choice.

Moving from difference to system GMM has two main implications for our results. First, the point estimate on the lagged endogenous variable increases. This is not uncommon in

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[9] Intuitively, stationarity implies that the economy is in the steady state and that fast-growing firms are not systematically closer to or further away from their steady state than slow-growing firms. During the convergence process, employment in smaller (larger) firms would tend to increase (decrease). Using lagged employment changes as instruments in a system GMM model would then be inappropriate since the instruments would be correlated with the fixed effects.

empirical applications similar to ours. (See, e.g., the labor demand functions estimated in Roodman (2006).). Second, the coefficient on wages becomes smaller. We interpret this as evidence for the endogeneity of firm-level wages. Endogeneity of wages implies that changes in firm-level wages are a mirror-image of changes in firm-level employment. This effect is partly picked up by the lagged endogenous variable in the system GMM.

Following Roodman (2006), we make two further specification choices:

First, since the maximum string of firm-level observations is less than 10 years, we use the one-step instead of the – more data-intensive – two-step estimator. We invoke the *robust*-option in all specifications. This yields an estimator for the one-step standard errors that is based on the estimation of the covariance matrix from the one-step residuals. It is robust to heteroscedasticity and to arbitrary patterns of autocorrelation within individuals. Moreover a full set of time-industry fixed effects is included to account for contemporaneous correlation across the residuals.

Second, using firm-level and, to a lesser extent, industry-level explanatory variables as regressors creates endogeneity problems. At the same time, finding truly exogenous instruments is extremely difficult, and we essentially have to generate our instruments from within the dataset. The Blundell-Bond system GMM allows distinguishing endogenous from predetermined and exogenous variables. We treat firm-level variables such as sales and wages as endogenous,[10] and we use lags two and earlier to instrument for these. German industry-level value added is treated as pre-determined. We use lags one and earlier of the instrument variable for the transformed equation. Only dummies and foreign industry-level variables are treated as exogenous and are included in the set of IV- rather than GMM-type instruments.

For each regression, we report the number of instruments[11] and groups. As a rule of thumb, the number of instruments used should be strictly smaller than the number of groups. This is indeed the case. Moreover, our estimation results are consistent if we use appropriate instruments for our lagged endogenous variable and if there is no second-order autocorrelation. Tests on first and second order serial correlations and the Sargan-Hansen test on over-identifying restrictions do not allow rejecting the validity of our specification and instruments.

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[10] Treating wages as endogenous rather than exogenous or predetermined renders the interaction term between Domestic MNEs and sales and wages insignificant. Unreported regressions with exogenous or predetermined wages show significantly lower elasticities for the Domestic MNEs.

[11] We report the degrees of freedom of the Sargan/Hansen tests, i.e. the number of instruments minus the number of regressors.

4.2 Regression Results

In our baseline estimations (Table 2), we have a total of 6,099 firm-year observations. We present five specifications. Column (1) has the baseline specification, in which we regress employment on lagged employment, firm-level sales, wages, and industry-time fixed effects. In Column (2), we add interaction terms between all variables and the three types of MNE-ownership dummies. In Column (3), we add a size dummy. The (unreported) dummy for large firms has the expected positive sign. In Column (4), we additionally include interaction terms between the explanatory variables and exporter dummies. In Column (5), we add proxies for domestic and foreign industry-level value added.

In the baseline specification, we find a positive and significant coefficient on the lagged dependent variable and on firm-level sales as well as a negative coefficient on firm-level wages. The wage elasticity is smaller than the one found in earlier studies (-0.25 versus -0.5). (See Barba Navaretti et al. (2003) or Slaughter 2001.) Our interpretation of these differences is that the system GMM estimator provides superior instruments to control for the endogeneity of wages.

Adding interaction terms hardly changes the baseline results. The coefficient estimates for the output elasticities are similar across specifications (around 0.1 and -0.25). Our estimates for the lagged endogenous variable (0.85) are a bit higher than earlier estimates (0.68) and suggest a greater persistence of employment.

Next, we turn to the key interest in this paper – the interaction terms between multinational status, on the one hand, and sales and wages, on the other hand. Generally, the interaction terms are insignificant. There are no significant differences between domestic and multinational firms with regard to their reaction to firm-level output and wages. In terms of the persistence of employment, there are no significant differences between firms as well.

Results presented in Table 2 do not allow reading off long-run elasticities as well as the total wage and output elasticities for the different types of firms. Table 3 thus shows the estimates and significance levels for these elasticities. From Table 2 we know that MNEs do not behave significantly different from the rest of the sample. Table 3 partly confirms that result. The persistence of employment and the short- and long-run elasticities of output are quite similar for the different groups of firms. As for the wage elasticities, the point estimates are still negative for all firms but smaller in absolute terms than for the control group of domestic firms. The total wage elasticities for German and Foreign MNEs are now not significantly different from zero. Hence, if anything, we can infer that jobs in these MNEs are less risky than jobs in other firms.

In sum, results so far do not lend strong support to the hypothesis that multinational firms as a group have more volatile employment because of a higher wage or output elasticity of labor demand. MNEs do not differ significantly from domestic firms with regard to their output and wage elasticities. Our results are thus at odds with the conventional wisdom that employment with foreign firms exposes workers to higher risk than employment in domestically-owned firms.

4.3 Robustness Tests

Columns (4) and (5) of Table 2 and Tables 4 and 5 provide robustness tests for our baseline model. We account for the impact of trade, we split firms by size and by industry, and we change the specification of the model dynamics. We run the robustness tests in tables 4 and 5 on a specification which does not include the proxies for macroeconomic developments.

Impact of trade: So far, we have attributed the effects of international openness to the ownership of firms. We have not accounted for the fact whether firms are exposed to foreign market developments because they export some of their output. In Column (4) of Table 2, we therefore present specifications including interaction terms between a 0/1 dummy indicating whether a domestic firm is an exporter, on the one hand, and firm-level sales and wages, on the other hand. Our main results are not affected, and the trade interaction terms are insignificant.

Size effects: Datasets such as ours suffer from a selection bias resulting from incomplete reporting of employment, in particular for the smaller and domestic firms. Although our final sample has a higher share of small and mid-sized firms than the full *Dafne* dataset (see Table 1c), these firms are likely to have a below-average representation in our original database. Hence, we re-estimate our above model for the larger firms in the sample. Results are given in Column (4) of Table 4. In terms of the persistence of employment, we obtain a similar coefficient for the large firms as for the full sample. In contrast to estimates for the full sample, the coefficient on firm-level wages is now insignificant. One explanation for this could be that larger firms have a wider range of possibilities to adjust to changes in wages than smaller firms.

Production versus services: Earlier research on the labor demand of multinational firms such as the work by Barba Navaretti et al. (2003) is based on data for manufacturing firms only. To check whether differences between ours and their findings are do to the fact that we also have data on services firms, we re-run our baseline model for firms in the production and in the services industries separately. We also distinguish industries producing tradables from the rest

of the sample. Results are reported in Columns (1)-(3) of Table 4. In terms of persistence, results for the different groups of firms are very similar.

Results for the production industries and the industries producing tradables are very similar to those for the full sample. They do, most importantly, not reveal any differences between the multinational firms and exporters compared to the rest of the sample. For the services industries, we find some significant interaction terms. The interaction terms between firm-level sales, on the one hand, and Domestic Exporters and German MNEs are negative and significant. The corresponding interaction terms for firm-level wages are positive and significant. Hence, these two groups of firms have *lower* elasticities than their national counterparts.

To check whether individual industries drive this result, we estimate the full model but exclude observations for each industry one-by-one. In unreported regressions, we find that dropping industries does not change the main qualitative results in most cases. There are two exceptions. First, the interaction terms between sales (wages) and Domestic Exporter status turn significantly positive (negative) when excluding industry K (real estate, renting, and business activities). Hence, without industry K, Domestic Exporters have higher wage and output elasticities than the rest of the firms. Second, the findings reported above that Domestic Exporters and German MNEs in services industries respond less to wages and output than other firms is a feature of the sample excluding industry D (manufacturing). In samples excluding sectors C and E (Mining and Electricity), German MNEs are less sensitive to changes in output and wages than other firms.

Model dynamics and estimation technique: Table 5 presents results for the same specification as in Table 4, but we now check the sensitivity of our results with regard to the choice of estimation technique and the model dynamics. In Column (1) of Table 5, we re-report Column (4) of Table 2 as a reference specification. In Column (2), we choose the standard set of instruments, but we add lagged wages and lagged sales as regressors. In Column (3) we introduce an estimation of the model in first differences. Column (4) gives the results of a difference GMM estimation. Overall, the main results are unaffected but there are also some differences across the specifications.

Results using additional lags also show some short-run dynamics in the response of firms to changes in sales and wages. Firms tend to overshoot with regard to the long-run adjustment, as the lagged terms are negative and positive, respectively, and significant. Again, there is no evidence that MNEs show a more volatile response to sales and wages. Estimating the model using first differences of all variables, as is done in column (3) shows a significantly negative

lagged dependent variable, a positive output elasticity, and a negative wage elasticity. The coefficient on sales is around 0.35 the coefficient on wages is -0.7. However, estimating the model in first differences by construction creates problems of second order autocorrelation, as indicated by the deterioration of the autocorrelation tests in comparison with Column (1).

Diversification effects: In unreported regressions we have also accounted for the fact that firms can reduce their exposure to changes in domestic conditions by diversifying activities across several host countries by including a dummy variable. This variable is set equal to one for German multinationals that are active in more than 10 host countries. Yet, it is insignificant, and it measures only the impact of the degree of diversification on the level of employment. Since only 40 out 300 firms are active in more than 10 countries, we also test the impact of diversification effects by including a continuous measure of 'diversification', i.e. the number of countries in which German multinationals are active, which turns out to be insignificant, too. In further regressions (unreported), we also use interaction terms of the diversification dummy, dropping the interaction terms with the dummy for German multinationals at the same time. We find no indications that more diversified multinationals react differently to sales or wages than the remaining firms.

4.4 Determinants of Firm-Level Employment Dispersion

In a final step, we analyze whether differences in the response of firms to output and wages affect the firm-level dispersion of employment. We use firm-level dispersion as a measure of uncertainty instead of firm-level volatility since the time-series dimension of our data is short for many firms (see Section 2.2.3). Our baseline specification uses the dispersion of employment as the dependent variable. Explanatory variables are the dispersion of sales or, alternatively, wages, firm size (log sales and a dummy for firms with more than 500 employees), and a set of interaction terms with the MNE status and exporter dummies. We also split the sample into production and services industries.

Table 6 shows that both, a higher dispersion of sales growth rates and a higher dispersion of wage growth rates, are positively correlated with dispersion in employment growth rates. Typically, firm size has no significant impact on employment dispersion. Interaction terms between dummies for exporter and MNE status generally confirm our earlier findings. Combining the coefficients appropriately shows that for Domestic Exporters, a higher dispersion of sales or wages has no significant effect on dispersion of employment. For German MNEs the same holds true for the effect of sales dispersion.

However, for Foreign Firms, there is some evidence for a greater effect of sales or wage dispersion on employment dispersion for firms in production industries. Note that this result may be driven by only a few firms since the number of firms in this category is relatively small while the standard deviation of employment dispersion is relatively large. For firms in services, the interaction with the Foreign Firms' dummy is insignificant or even weakly negative. Finally, the effect of wage dispersion on employment dispersion for Two-Way MNEs in services is significantly higher than for the rest of the sample.

In sum, Table 6 provides an alternative test of differences in employment uncertainty across multinational and domestic firms, which can be applied to firm-level datasets with a short time dimension. It generally supports the findings of our empirical results based on estimates of labor demand elasticities.

5 Summary of Findings

Does multinational activity make the world a riskier place for workers? Our short answer to this question is: No. More specifically, we address this question using a firm-level dataset on German firms. In contrast to earlier work, we distinguish different types of multinational firms, and we study their exposure to industry-level value added. Hence, we disentangle whether differences in the volatility of employment across different types of firms are due to different reactions or due to different exposures to industry-level developments.

Our main results are based on estimates of firm-level labor demand functions, which give the response of different types of firms active in Germany to firm-level and aggregated wage and output developments. Results can be summarized as follows:

- Employment in German firms is relatively persistent, it increases in response to firm-level sales, and it falls if wages increase.
- Multinational firms do not respond systemically more to wages and output than firms that are active only on the domestic market. Also, the persistence of employment is very similar across the different types of firms.
- Multinationals in production industries do not behave differently from the remaining firms. Domestic Exporters and German multinationals in services industries tend to react less to firm-level output and wages than the rest of the sample.
- We also use employment dispersion a measure of firm-level uncertainty. Estimates of the determinants of employment growth dispersion by-and-large support the findings of our labor demand estimations.

- Accounting for differences in firms' exposures to industry-level developments has little impact on our results. Our data allow constructing a firm-level measure of exposure to foreign aggregate output changes. This variable is insignificant though. Differences in employment volatilities across firms resulting from different reactions to changes in output and wages thus have a large idiosyncratic component.

Overall, our results do not lend to support the hypothesis that an increasing integration into international markets generally increases the elasticity of labor demand. In view of the large degree of heterogeneity across different types of multinationals, across different industries, and across firms of different size, it would be difficult to devise policy measures directly geared towards the reduction in employment risk in specific types of firms or industries. Instead, policies should aim at increasing the flexibility of firms and workers to adjust to changes in the external environment.

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7 Data Appendix

Variable	Definition	Source
Firm-level data		
Employment	Number of employees	Bureau van Dijk (*Dafne*)
Sales	Turnover in €1,000	Bureau van Dijk (*Dafne*)
Wages	Personnel expenditure per employee in €1,000	Bureau van Dijk (*Dafne*)
Domestic Exporter	0/1 dummy for domestic exports as of 2006	Bureau van Dijk (*Dafne*)
German MNE	0/1 dummy for German firm with foreign affiliates as of 2006, dynamic ownership information from *MiDi*	Bureau van Dijk (*Dafne*), Deutsche Bundesbank (*MiDi*)
Foreign MNE	0/1 dummy for affiliates of foreign firms in Germany as of 2006	Bureau van Dijk (*Dafne*)
Two-Way MNE	0/1 dummy for affiliates of foreign firms in Germany which own affiliates abroad as of 2006	Bureau van Dijk (*Dafne*)
Production	0/1 dummy (1 for industries C-F) (Note that 'manufacturing' comprises industry D only.)	Bureau van Dijk (*Dafne*)
Services	0/1 dummy (1 for industries G-P)	Bureau van Dijk (*Dafne*)
Tradables	0/1 dummy (1 for industries A-E, I, J)	Bureau van Dijk (*Dafne*)
Employment- and sales-based weights for foreign value added	Employment (sales) per country over total employment (sales) abroad	Deutsche Bundesbank (*MiDi*)
Diversification dummy	0/1 dummy if a firm has affiliates in more than 10 countries	Deutsche Bundesbank (*MiDi*)
Size dummies	small:10-100 employees, medium:101-500 employees, large: > 500 employees	Bureau van Dijk (*Dafne*)
Industry-level data		
Germany		
Domestic employment	Number of employees, yearly average	Federal Statistical Office Series 18
Gross value added by industry	In current Euro	Federal Statistical Office Series 18
Gross fixed capital formation	In current Euro, at replacement costs	Federal Statistical Office Series 18
Inward and outward FDI	Primary direct investment stocks, in €1,000	Deutsche Bundesbank (*MiDi*)
Other countries		
Foreign value added	Value added by industry (OECD countries only) Index (2000 = 100).	OECD Annual National Accounts

8 Graphs and Tables

Table 1: Descriptive Statistics

(a) Industry Distribution of Sales and Employment (2004)

This Table compares the structure of the data used in the regression sample for the combined *Dafne* / *MiDi* data after search for consecutive chains and outlier analysis. Aggregated data for sales and employment come from the Federal Statistical Office; aggregated data for the number of firms come from the VAT statistics. All data are in %. The industry classification is based on WZ 2003. – = Industries are not included in the respective statistics.

Industry		Aggregated data (%)			Regression sample (%)			
		Sales	Employ-ment	Number of firms	Sales	Employ-ment	Number of firms	Number of firms (absolute)
A	Agriculture, hunting and forestry	0.6	2.2	2.51	0.04	0.06	0.50	10
B	Fishing	0.0	0.0	0.03	0.00	0.00	0.00	0
C	Mining and quarrying	0.6	0.2	0.09	0.52	0.81	0.79	16
D	Manufacturing	35.6	19.6	9.37	49.36	42.11	30.89	623
E	Electricity, gas, and water supply	4.4	0.8	0.47	7.40	3.75	9.72	196
F	Construction	3.7	5.8	10.42	0.46	0.65	2.03	41
G	Wholesale and retail trade, repairs	32.3	15.3	23.75	12.31	6.30	15.12	305
H	Hotels and restaurants	1.2	4.5	8.28	0.10	0.37	0.50	10
I	Transport, storage, and communication	5.7	5.4	4.25	11.62	19.40	6.45	130
J	Financial intermediation	0.9	3.2	0.52	0.29	0.14	0.45	9
K	Real estate, renting, and business activities	11.7	13.0	27.84	15.98	21.40	23.65	477
L	Public administration, defense, social security	–	6.9	1.03	0.02	0.03	0.30	6
M	Education	0.2	5.8	–	0.01	0.13	0.20	4
N	Health and social work	1.0	10.2	1.52	0.75	3.43	5.55	112
O	Other community, social and personal services	2.2	5.3	9.92	1.27	1.43	3.87	78
P	Private households with employed persons	–	1.7	–	0.00	0.00	0.00	0
A-P	Total	100	100	100	100.00	100.00	100	2,017

(b) Industry Distribution of Employment by MNE type (2004)

All figures in %. Data for the industries B ('Fishing') and P ('Private households with employed persons') are excluded because we have no observations in our sample.

	All	Domestic firms	Domestic Exporters	German MNEs	Foreign Firms	Two-Way MNEs
Agriculture, hunting and forestry	100.00	41.78	15.09	0.00	0.00	43.13
Mining and quarrying	100.00	88.98	0.87	10.16	0.00	0.00
Manufacturing	100.00	13.86	21.78	25.38	3.10	35.88
Electricity, gas, and water supply	100.00	93.91	0.00	6.09	0.00	0.00
Construction	100.00	39.22	2.62	4.68	1.22	52.26
Wholesale and retail trade, repairs	100.00	66.29	4.33	23.49	2.14	3.74
Hotels and restaurants	100.00	26.17	0.00	19.00	0.00	54.83
Transport, storage, and communication	100.00	19.03	0.05	33.60	0.00	47.32
Financial intermediation	100.00	88.08	0.00	11.92	0.00	0.00
Real estate, renting, and business activities	100.00	77.32	4.39	13.21	1.01	4.07
Public administration, defense, social security	100.00	100.00	0.00	0.00	0.00	0.00
Education	100.00	100.00	0.00	0.00	0.00	0.00
Health and social work	100.00	95.60	0.00	4.40	0.00	0.00
Other community, social and personal services	100.00	78.54	1.57	2.02	9.62	8.24
Total	100.00	39.54	10.45	22.12	1.80	26.08

(c) Size Distribution (2004)

This table gives the size distribution of firms by total employment in our sample and in the full *Dafne* dataset.

Size (by number of employees)	Regression sample (number)	Regression sample (in %)	*Dafne* (in %)
Small (10-100)	432	21.4	8.9
Medium (101-500)	884	43.8	6.8
Large (>500)	701	34.8	84.3
All	2,017	100.0	100.0

(d) Descriptive Statistics (2004)

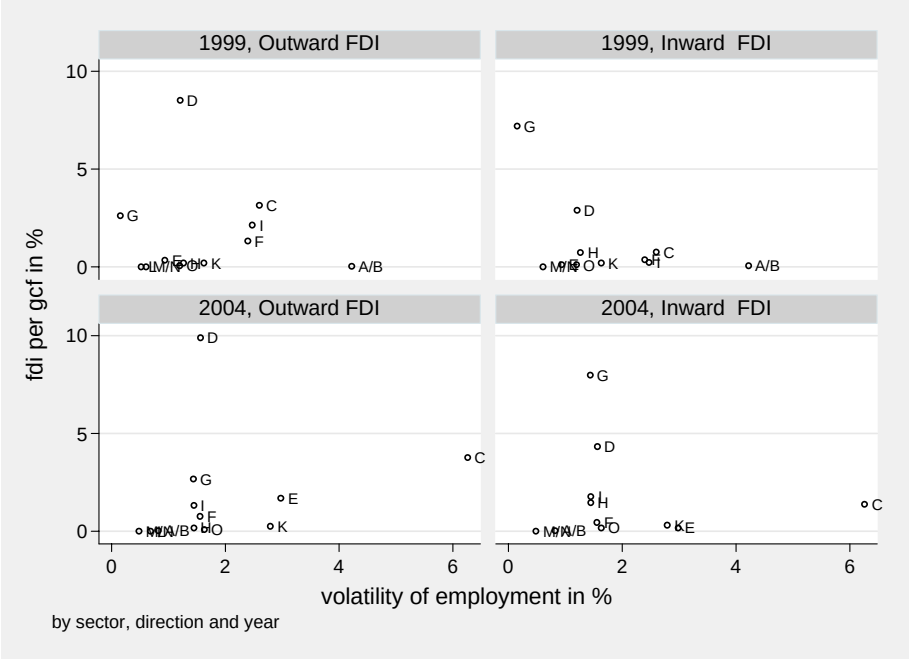
Wages = mean personnel expenditure per employee

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Employment	2,017	1,294	7,628	10	208,199
Sales	2,017	384,726	2,150,382	187	56,100,000
Wages	2,017	53.67	19.97	9	208.96
Weighted industry-level value added (foreign)	2,017	11.10	31.95	0.00	152.55
Industry-level value added (domestic)	2,017	104.88	5.98	74.88	115.88

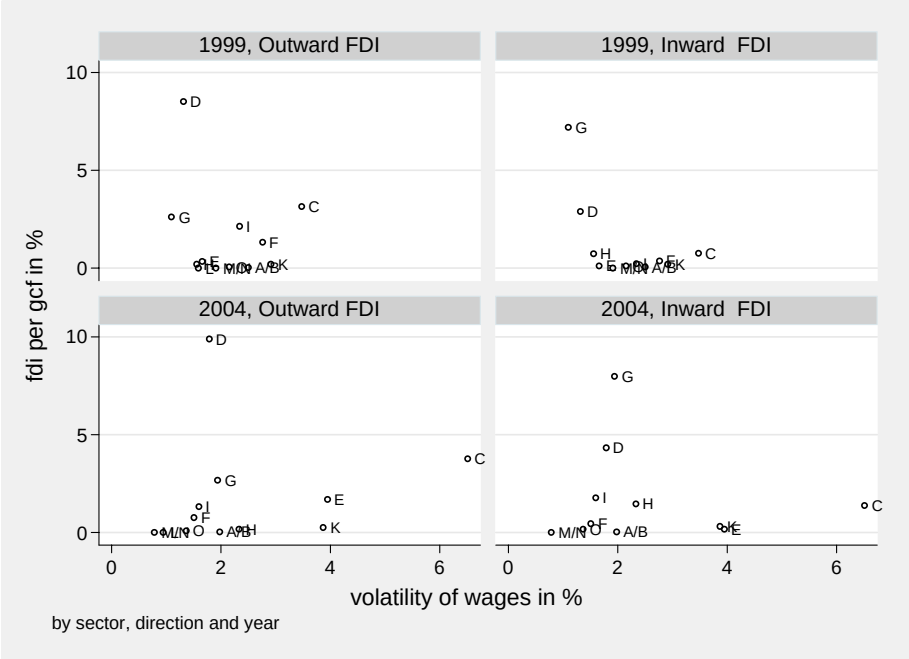
Figure 1: FDI and Industry-Level Volatility

A = agriculture, B = fishing, C = mining and quarrying, D = manufacturing, E = energy and water supply, F = construction, G = retail and wholesale trade, H = hotels and restaurants, I = transport and telecommunications K = real estate, L = public administration, M = education, N = health, O = other services, P = private household services. Note that industry J = financial intermediation and insurance is not included in the graphs. gcf = gross fixed capital formation. Volatility = standard deviation of the growth rate of employment, wages, or output over a 5-year period * 100.

(a) Employment volatility



(b) Wage volatility



(c) Output volatility

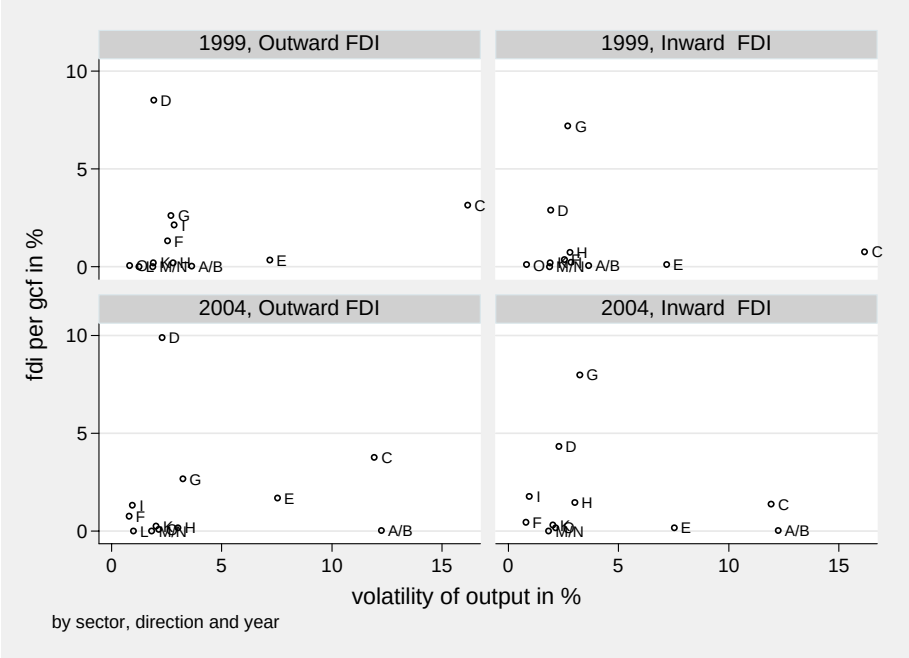


Table 2: Labor Demand Regressions

This Table presents results of labor demand regressions using data for firms taken from the combined *Dafne-MiDi* database. The dependent variable is the level of employment. For each explanatory variable (lagged employment, sales, wages), we report the coefficient estimate as well as the coefficients of interaction terms with 0/1-ownership / exporter dummies. All variables are entered in log levels. Results are based on system GMM estimations. Robust standard errors are reported in parentheses. *, **, *** significant at the 10%, 5%, 1% level.

	(1)	(2)	(3)	(4)	(5)
Employment (*t*-1)	0.833***	0.872***	0.877***	0.877***	0.883***
	(0.034)	(0.023)	(0.024)	(0.023)	(0.023)
Domestic Exporter				0.00105	-0.000934
				(0.0064)	(0.0061)
German MNEs (K3)		0.00509	0.00675	0.00514	-0.000697
		(0.0044)	(0.0046)	(0.0046)	(0.0024)
Foreign Firms (K4)		-0.00115	-0.00201	-0.00291	-0.00721
		(0.0056)	(0.0056)	(0.0066)	(0.0055)
Two-Way MNEs (K34)		0.00741	0.00613	0.00542	0.00265
		(0.0070)	(0.0071)	(0.0071)	(0.0035)
Sales	0.186***	0.117***	0.112***	0.111***	0.0989***
	(0.031)	(0.022)	(0.022)	(0.022)	(0.019)
Domestic Exporter				-0.00543	-0.00203
				(0.022)	(0.020)
German MNEs (K3)		-0.0389	-0.0367	-0.0448	-0.0289
		(0.033)	(0.035)	(0.030)	(0.023)
Foreign Firms (K4)		0.000704	-0.0280	-0.0228	-0.00561
		(0.043)	(0.044)	(0.047)	(0.035)
Two-Way MNEs (K34)		-0.0143	-0.0126	-0.0152	-0.00675
		(0.028)	(0.028)	(0.029)	(0.019)
Wages	-0.368***	-0.245***	-0.254***	-0.255***	-0.224***
	(0.13)	(0.082)	(0.082)	(0.081)	(0.067)
Domestic Exporter				0.0175	0.00964
				(0.062)	(0.056)
German MNEs (K3)		0.106	0.100	0.127	0.0821
		(0.096)	(0.100)	(0.087)	(0.082)
Foreign Firms (K4)		0.00926	0.0920	0.0801	0.0718
		(0.13)	(0.13)	(0.14)	(0.15)
Two-Way MNEs (K34)		0.0369	0.0311	0.0399	-0.0592
		(0.083)	(0.084)	(0.086)	(0.091)
Aggregated variables					
Employment-weighted foreign industry value added					0.000151
					(0.00027)
Industry-level gross value added (Germany)					0.00268
					(0.0017)
Industry-level gross value added (Germany, K3)					0.000165
					(0.0033)
Industry-level gross value added (Germany, K4)					-0.00138
					(0.0053)
Industry-level gross value added (Germany, K34)					0.00309
					(0.0033)
Constant	0.349	0.396	0.452	0.460	0.174
	(0.44)	(0.30)	(0.32)	(0.29)	(0.35)
Size dummy (large)	no	no	yes	yes	yes
Time * industry - dummies	yes	yes	yes	yes	yes
Observations	6099	6099	6099	6099	6099
Number of firms	2482	2482	2482	2482	2482
Sargan test statistic	61.98	159.0	158.0	189.3	274.3
Degrees of freedom (Sargan test)	68	189	189	239	315
Sargan (p-value)	0.682	0.945	0.951	0.992	0.952
AR1 (p-value)	0.000	0.000	0.000	0.000	0.00
AR2 (p-value)	0.834	0.826	0.790	0.808	0.886

Table 3: Speed of Adjustment, Short- and Long-Run Elasticities

This Table gives results of tests on linear combinations of the coefficient estimates for the regressions reported in Table 2, Column (3), (4), and (5). *, **, *** significant at the 10%, 5%, 1% level.

	With FDI	With trade	With domestic and foreign aggregate variables
Speed of adjustment			
All	0.123***	0.123***	0.117***
Domestic Exporter		0.122***	0.118***
German MNE (K3)	0.116***	0.118***	0.118***
Foreign MNE (K4)	0.125***	0.126***	0.124***
Two-Way MNE (K34)	0.117***	0.118***	0.115***
Outward FDI (K3 + K34)	0.110***	0.113***	0.115***
Inward FDI (K4 + K34)	0.119***	0.121***	0.122***
Short-run output elasticity			
All	0.112***	0.111***	0.099***
Domestic Exporter		0.106***	0.097***
German MNE (K3)	0.075**	0.066***	0.070***
Foreign MNE (K4)	0.084*	0.088*	0.093**
Two-Way MNE (K34)	0.099***	0.096***	0.092***
Short-run wage elasticity			
All	-0.254***	-0.255***	-0.224***
Domestic Exporter		-0.238***	-0.215***
German MNE (K3)	-0.154	-0.128	-0.142*
Foreign MNE (K4)	-0.162	-0.175	-0.152
Two-Way MNE (K34)	-0.223***	-0.215***	-0.283***
Long-run output elasticity			
All	0.907***	0.902***	0.843***
Domestic Exporter		0.865***	0.819***
German MNE (K3)	0.644***	0.562***	0.593***
Foreign MNE (K4)	0.669*	0.747*	0.791***
Two-Way MNE (K34)	0.847***	0.814***	0.804***
Long-run wage elasticity			
All	-2.068***	-2.069***	-1.912***
Domestic Exporter		-1.944***	-1.816***
German MNE (K3)	-1.325	-1.086	-1.205**
Foreign MNE (K4)	-1.299	-1.387	-1.225
Two-Way MNE (K34)	-1.910***	-1.826***	-2.473***

Table 4: Robustness Tests – Sample Splits

This Table presents results of labor demand regressions using data for firms taken from the combined *Dafne-MiDi* database. The dependent variable is the change in the level of employment. For each explanatory variable (lagged employment, sales, wages), we report the coefficient estimate as well as the coefficients of interaction terms with 0/1-ownership / exporter dummies. All variables are entered in log levels. Production = industries C-F (see Table 1a), services = industries G-P, tradables = industries A-E, I, J. Large firms = firms with more than 500 employees. Results are based on system GMM estimations. Robust standard errors are reported in parentheses. *, **, *** significant at the 10%, 5%, 1% level.

	(1) Production	(2) Services	(3) Tradables	(4) Large Firms
Employment (*t*-1)	0.846***	0.911***	0.856***	0.831***
	(0.028)	(0.026)	(0.024)	(0.036)
Domestic Exporter	0.000952	0.0152	0.00173	0.00146
	(0.0083)	(0.011)	(0.0082)	(0.0061)
German MNEs (K3)	-0.00187	0.00553	0.000965	0.00164
	(0.0066)	(0.0073)	(0.0067)	(0.0044)
Foreign Firms (K4)	-0.00466	-0.0119	-0.00933	-0.000483
	(0.011)	(0.0090)	(0.011)	(0.0052)
Two-Way MNEs (K34)	0.00337	0.00259	0.000510	-0.000745
	(0.0082)	(0.0082)	(0.0086)	(0.0080)
Sales	0.0852***	0.0852***	0.0694***	0.118***
	(0.026)	(0.023)	(0.022)	(0.030)
Domestic Exporter	0.0244	-0.0658***	0.0347	0.00135
	(0.026)	(0.023)	(0.023)	(0.028)
German MNEs (K3)	0.0525	-0.0479**	0.0458	-0.00582
	(0.036)	(0.024)	(0.036)	(0.027)
Foreign Firms (K4)	-0.000566	0.0371	-0.0239	0.0425
	(0.040)	(0.039)	(0.038)	(0.049)
Two-Way MNEs (K34)	0.0161	-0.00149	0.0424	0.0297
	(0.026)	(0.027)	(0.027)	(0.027)
Wages	-0.171**	-0.174*	-0.161**	-0.116
	(0.070)	(0.099)	(0.070)	(0.079)
Domestic Exporter	-0.0694	0.176***	-0.0994	-0.00942
	(0.068)	(0.063)	(0.063)	(0.085)
German MNEs (K3)	-0.147	0.127*	-0.132	0.00742
	(0.098)	(0.068)	(0.099)	(0.083)
Foreign Firms (K4)	0.0277	-0.0921	0.101	-0.130
	(0.12)	(0.11)	(0.11)	(0.14)
Two-Way MNEs (K34)	-0.0418	0.0108	-0.116	-0.0950
	(0.079)	(0.073)	(0.083)	(0.080)
Constant	0.539**	0.237	0.585**	0.237
	(0.24)	(0.34)	(0.27)	(0.29)
Size dummy (large)	yes	yes	yes	no
Time * industry - dummies	yes	yes	yes	yes
Observations	2868	3212	3173	2143
Number of firms	1122	1350	1240	856
Sargan test statistic	182.3	131.7	197.4	151.3
Degrees of freedom (Sargan)	229	169	229	197
Sargan (p-value)	0.990	0.985	0.936	0.993
AR1 (p-value)	0.000	0.000	0.000	0.000
AR2 (p-value)	0.420	0.147	0.875	0.202

Table 5: Robustness Tests – Different Dynamic Specifications

This Table presents results of labor demand regressions using data for firms taken from the combined *Dafne-MiDi* database. The dependent variable is the change in the level of employment. For each explanatory variable (lagged employment, sales, wages), we report the coefficient estimate as well as the coefficients of interaction terms with 0/1-ownership / exporter dummies. Column (1) shows the baseline specifications, which is equivalent to Column (4) of Table 2. Column (2) adds additional lagged regressors, which are reported in Column (2b). Column (3) reports results of an estimation of the model equation in first differences. Column (4) gives the results of a difference GMM estimation. All variables are entered in log levels. Robust standard errors are reported in parentheses. *, **, *** significant at the 10%, 5%, 1% level.

	(1)	(2a)	(2b) Lags (t-1)	(3) all in Δ	(4)
Employment (*t*-1)	0.877***	0.920***	–	0.00194	0.372***
	(0.023)	(0.020)	–	(0.11)	(0.056)
Domestic Exporter	0.00105	-0.0795	–	0.0383**	-0.00365
	(0.0064)	(0.066)	–	(0.019)	(0.0099)
German MNEs (K3)	0.00514	-0.0150	–	0.0233	0.000260
	(0.0046)	(0.042)	–	(0.015)	(0.0054)
Foreign Firms (K4)	-0.00291	-0.0183	–	-0.0180***	-0.00966
	(0.0066)	(0.058)	–	(0.0048)	(0.0082)
Two-Way MNEs (K34)	0.00542	0.119	–	0.00738	-0.00528
	(0.0071)	(0.080)	–	(0.015)	(0.0094)
Sales	0.111***	0.357***	-0.287***	0.349***	0.239***
	(0.022)	(0.057)	(0.060)	(0.13)	(0.074)
Domestic Exporter	-0.00543	-0.00825	0.0857	0.133	0.0129
	(0.022)	(0.028)	(0.061)	(0.15)	(0.069)
German MNEs (K3)	-0.0448	-0.0524**	0.0182	0.0167	-0.00587
	(0.030)	(0.023)	(0.034)	(0.063)	(0.033)
Foreign Firms (K4)	-0.0228	-0.0582	0.0520	-0.353	-0.0928
	(0.047)	(0.062)	(0.082)	(0.27)	(0.058)
Two-Way MNEs (K34)	-0.0152	-0.0342	-0.0556	0.0246	0.0231
	(0.029)	(0.047)	(0.061)	(0.075)	(0.039)
Wages	-0.255***	-0.695***	0.540***	-0.749***	-0.660***
	(0.081)	(0.097)	(0.074)	(0.16)	(0.13)
Domestic Exporter	0.0175	0.0219	-0.120	-0.407	-0.0177
	(0.062)	(0.082)	(0.091)	(0.45)	(0.20)
German MNEs (K3)	0.127	0.153**	-0.0272	-0.0356	0.0286
	(0.087)	(0.066)	(0.045)	(0.16)	(0.100)
Foreign Firms (K4)	0.0801	0.181	-0.132	0.955	0.264
	(0.14)	(0.19)	(0.17)	(0.71)	(0.17)
Two-Way MNEs (K34)	0.0399	0.0823	-0.0110	-0.0331	-0.0773
	(0.086)	(0.13)	(0.074)	(0.19)	(0.11)
Constant	0.460	0.300	–	0.0260	–
	(0.29)	(0.23)	–	(0.027)	–
Size dummy (large)	yes	yes		yes	yes
Time * industry - dummies	yes	yes		yes	yes
Observations	6099	6099		3617	3617
Number of firms	2482	2482		2266	2266
Sargan test statistic	189.3	196.9		48.42	109.7
Degrees of Freedom (Sargan)	239	260		83	165
Sargan (p-value)	0.992	0.999		0.999	1.000
AR1 (p-value)	0.000	0.000		0.000	0.000
AR2 (p-value)	0.808	0.233		0.219	0.816

Table 6: Determinants of Firm-Level Employment Dispersion

This Table shows results from panel fixed effects regressions of the combined *Dafne-MiDi* database. The dependent variable in this Table is the dispersion of employment as defined in the text (Section 2.2.3).

	(1)	(2)	(3)	(4)	(5)	(6)
	All firms		Production		Services	
Sales (dispersion)	0.233***		0.234***		0.235***	
	(0.050)		(0.085)		(0.061)	
Domestic Exporter	-0.205***		-0.179*		-0.339***	
	(0.071)		(0.10)		(0.12)	
German MNEs (K3)	-0.224**		-0.244**		-0.192	
	(0.091)		(0.12)		(0.16)	
Foreign Firms (K4)	1.407*		2.242***		-0.197*	
	(0.79)		(0.35)		(0.10)	
Two-Way MNEs (K34)	-0.126		-0.123		-0.141	
	(0.080)		(0.10)		(0.13)	
Wages (dispersion)		0.312***		0.495***		0.249***
		(0.053)		(0.17)		(0.039)
Domestic Exporter		-0.323		-0.646***		1.400
		(0.25)		(0.25)		(0.88)
German MNEs (K3)		0.0983		-0.318		1.047*
		(0.19)		(0.20)		(0.58)
Foreign Firms (K4)		2.409***		3.469***		0.369
		(0.89)		(1.04)		(0.27)
Two-Way MNEs (K34)		0.790		1.106		0.426**
		(0.56)		(1.02)		(0.22)
Sales (log of level)	-0.0160	0.000260	-0.0203	-0.00561	-0.0132	0.0114
	(0.011)	(0.012)	(0.013)	(0.013)	(0.017)	(0.019)
Size dummy (large)	0.0256	0.0290**	0.0383	0.0281	0.0149	0.0233
	(0.016)	(0.014)	(0.030)	(0.020)	(0.014)	(0.017)
Constant	0.183	-0.0000801	0.229	0.0642	0.156	-0.119
	(0.12)	(0.13)	(0.15)	(0.15)	(0.19)	(0.21)
Time * industry - dummies	no	no	no	no	no	no
R^2	0.08	0.10	0.12	0.17	0.06	0.10
Observations	6128	6128	2883	2883	3226	3226
Number of firms	2482	2482	1122	1122	1350	1350