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Labour demand adjustment: Does foreign ownership matter?

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Abstract

This paper examines whether multinational companies differ in their employment adjustment from domestic firms, on the basis of a panel of Belgian firms for the period 1997-2007. We focus on incumbent firms as, in general, they account for the largest fraction of net employment creation, especially among multinational firms (MNFs). We obtain structural estimates of adjustment cost parameters for blue-collar workers and white-collar workers, domestic firms, and MNFs. We find evidence of convex, asymmetric (in the sense that it is more expensive to downsize than to upsize) and cross adjustment costs (indicating costly substitution between workers). To adjust white-collar employment seems to be around half as costly for MNFs as for domestic firms. There is no difference between Belgian MNFs and foreign MNFs. A small fraction of the gap between the adjustment costs of MNFs and domestic firms may be explained by the use of fixed-term contracts and early retirement. Controlling for firm size does not yield robust conclusions; the cost advantage of MNFs may diminish, vanish or turn into a disadvantage.

The views in this paper are those of the authors and do not necessarily reflect the views of the National Bank of Belgium. All remaining errors are the authors' responsibility. We would like to thank Michel Dumont, Holger Görg and Gianmarco Ottaviano for useful comments on previous drafts.

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1 Introduction

Multinational firms (hereafter MNFs) have played a growing role in the world economy over the last decades. Many governments devote substantial efforts to attracting foreign direct investment (hereafter FDI) to their country[1] on the grounds that foreign MNFs are important employment providers. Belgium is no exception to this. This small country has long been very open to MNFs. In terms of inward FDI flows, expressed as a percentage of gross capital formation, Belgium (64%) ranks at the top among European Union countries (16%), and far above the United States (6%) (UNCTAD, 2009). Between 2003 and 2008, around 10,000 jobs were directly created each year by FDI in Belgium (IBM, 2009). MNFs, which are typically larger, may make a sizeable contribution to employment creation. However, the other side of the coin is that they can abruptly leave the local market and consequently destroy a substantial number of jobs. For example, the closure of the Belgian assembly line of a large car manufacturer in the nineties caused the destruction of about 3,000 jobs.[2] Actually, MNFs may have broader (international) scope than domestic firms in that respect. They may have an incentive to relocate their activities to another country where labour costs are lower, productivity is higher and/or local demand is increasing strongly. Low barriers to mobility facilitate the international relocation of the MNFs' activities. In all, MNFs are commonly viewed as "footloose" or at least as having great flexibility in terms of international employment and plant management.

The closure of firms by multinationals may be crucial for policy, especially for evaluating the relevance of government expenditure on attracting FDI. This explains the extensive literature focusing on the footloose nature of multinationals, or on ascertaining whether MNFs have a higher propensity to close plants and exit the domestic market than national firms (see, for example, Alvarez and Görg, 2009, Bernard and Jensen, 2007, Bernard and Sjöholm, 2003, Görg and Strobl 2003, and, for Belgium, Van Beveren, 2007). Two main findings can be drawn from this literature: (i) a simple frequency analysis indicates that MNFs exit less frequently than domestic firms; but (ii) the survival (exit) probability of MNFs is lower (greater) than that of domestic firms when one controls for various characteristics such as size, age, sector and productivity.

The aim of this paper is to go beyond these views by assessing the main features of labour adjustment of MNFs in a small open economy. Employment adjustment is a more general process than plant closure or massive restructuring, as it also covers "business as usual" hiring and firing decisions of firms. The total impact of MNFs on employment growth must be viewed as the

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[1] This may include fiscal stabilisation measures such as rulings. Also, multinationals' financial centres, known as coordination centres, received favourable tax treatment, up to 2010. In addition, government investment in infrastructure as a complement to inward FDI, and subsidies (Haskel *et al.*, 2007, report examples of subsidies in the US and the United Kingdom) may represent significant incentives for foreign investors. Also, in Belgium, governments have set up public agencies devoted to inward and outward FDI (see invest.belgium.be and the websites of the regional authorities www.investinbrussels.com, www.investinflanders.be and www.investinwallonia.be).

[2] After the closure of this assembly line, a new law was passed obliging firms with 20 or more employees to inform their employees if they are planning mass redundancies or a plant closure. During the consultation period, the workers (or their representatives) can make counter-proposals or negotiate accompanying measures (training programmes, early retirement, redundancy pay). While such a law has little impact on the footloose nature of multinationals, it does prevent them from arranging unexpected international relocations.

outcome of two processes. Job creation and job destruction arise respectively when a firm is created or closed down. But incumbent firms also adjust their labour force in response to changes in demand and business conditions.

To assess the relative importance of job destruction caused by the closure of firms and employment adjustment by incumbent firms in total net job creation, we analyse net job creation along the lines of Davis *et al.* (1996). We conduct a first breakdown across incumbents and exiting firms and a second across domestic firms[3] and MNFs, distinguishing between Belgian and foreign MNFs. Overall, we find that incumbent firms contribute substantially to net job variations. This result is still valid by type of firms. However, incumbent foreign MNFs make a bigger contribution to net employment flows than domestic firms. This suggests that there might be differences in labour adjustment costs between the two types of firms.

We therefore focus on employment adjustment by incumbent firms. More precisely, we investigate the difference in employment adjustment costs across MNFs and domestic firms. On the assumption that MNFs are potentially more flexible in their workforce management, we test whether the adjustment costs are lower for MNFs than for domestic firms.

Only very few papers have considered the distinction between the employment adjustment of MNFs and that of domestic companies. Navaretti *et al.* (2003) estimate a partial adjustment model of labour demand based on an unbalanced panel covering more than ten thousand companies located in eleven European countries, and observed over the period 1993-2000. They find that multinational companies adjust employment much faster than domestic firms, which may suggest lower adjustment costs for MNFs.

Why might labour adjustment be less costly for MNFs than for domestic firms? First, multinationals are typically large, and economies of scale in human resources management may decrease their adjustment costs and minimise labour indivisibility issues compared to smaller domestic firms. In this context, they may be more inclined to use more flexible forms of employment, such as fixed-term contracts and procedures that reduce downsizing costs. In Belgium, early retirement is a legal procedure that reduces restructuring costs compared to (collective) redundancies. Note that this applies to both domestic and foreign MNFs. Second, as shown by Haskel *et al.* (2007) on the basis of some typical examples, MNFs may have bargaining power with respect to (national or local) governments and unions, which may allow them to obtain temporary exceptions in regard to hiring and firing costs and practices. Third, national firms (domestic or multinational) may face additional constraints on their ability to severely downsize their labour force, such as special relationships with governmental authorities or consumer anger. Fourth, the (international) multi-plant nature of their activities allows MNFs to reallocate employment within an internal labour market across countries without formally firing employees and hiring new workers. Fifth, the structure of the workforce may also affect total adjustment costs. These are expected to be greater for highly skilled workers than for low skilled workers, and MNFs typically employ a larger percentage of highly skilled workers than domestic firms (Markusen, 2002).

Following the literature on labour adjustment costs, we estimate a dynamic labour demand equation from structural Euler equations. We estimate adjustment costs separately for blue-collar

[3] We define domestic firms as companies with no foreign affiliates.

(or the equivalent non clerical) workers and white-collar (clerical) workers, to eliminate compositional effects when examining differences between MNFs and domestic firms. A flexible specification of adjustment costs is introduced, based on a polynomial approach initially proposed by Alonso-Borrego (1998). The adjustment cost function used allows for concave or convex adjustment costs and for asymmetries between upsizing and downsizing costs. We also allow for cross adjustment costs, i.e. adjustment costs related to one type of workers depending on adjustment of the other type of workers.

We then explore the role of various factors that may affect adjustment cost parameters, and in particular the difference between MNFs and domestic firms. We consider the nationality of the owner firm in order to capture differences in the constraints and bargaining power of foreign and national MNFs. Three proxies are introduced to take into account the scope of employment management. First, we consider a dummy for union representation, based on a minimum number of employees.[4] It is expected to increase adjustment costs but possibly to a lesser extent for MNFs. Second, the share of fixed-term contracts, in either the labour force or staff turnover, is used as a measure of the firm's ability to apply flexible employment practices. Third, the use of early retirement procedures is considered as another proxy of flexible adjustment practices. The scope of the internal labour market of MNFs could be considered as an additional relevant factor. However, we cannot investigate this dimension because it would require data on the international network of foreign MNFs. Finally, we also control more directly for firm size by using a proportional cost model that is a generalisation of Meghir *et al.* (1996).

The dynamic labour *d*emand equations are estimated by System-GMM methods which yield consistent parameter estimates and deal with the weak instrument problem. To conduct our econometric analysis, we use firm-level panel data from the Belgian Foreign Direct Investment Survey matched with firms' annual and social reports over the period 1997-2007, and with firm-level data of employment and remuneration by type of worker, from the Social Security Data Warehouse.

Our results suggest that, for both types of workers and both types of firms, adjustment costs are convex and asymmetric in the sense that it is more expensive to downsize than to upsize. Furthermore, labour adjustment is less costly when adjustment is undertaken by changing the number of both blue-collar and white-collar workers in the same direction, but substitution between the two types of workers increases adjustment costs.

MNFs face lower adjustment costs than domestic firms. More precisely, for non-clerical workers, the gap between downsizing costs and upsizing costs is equal to zero for MNFs and is positive for domestic firms. For clerical workers, adjustment costs are around half as much for MNFs as for domestic firms.

Our results also indicate that when account is taken of the use of legal procedures to increase labour flexibility, i.e. the use of fixed term contracts and early retirement, the difference in adjustment costs of white-collar workers between MNFs and domestic firms still exists even though it is reduced. Conversely, we do not verify that - compared to domestic firms - MNFs have any

4 In Belgium, union representation is compulsory for firms with 50 employees and more. It also implies union participation in works councils, where consultation and negotiation between employers' and employees' representatives take place.

particular additional bargaining power *vis-à-vis* unions. Finally, there are no differences in adjustment costs between Belgian and foreign MNFs.

Regarding the impact of firm size, our results are less clear-cut. While controlling for this dimension reduces and in some cases offsets the adjustment cost advantage of MNFs, it actually becomes an adjustment cost disadvantage in some specifications. This clearly shows the limits of a variable that proxies for several (opposing) effects.

The rest of the paper is organised as follows. Section 2 describes the dataset. Section 3 reports evidence on net job creation, focusing on the relative contribution of incumbent firms and firm closures to employment flows. In Section 4, we derive Euler equations for labour inputs. We then report estimates of production function coefficients. We present estimates of labour adjustment costs. Finally, we investigate several explanations for the difference in adjustment costs between MNFs and domestic firms. Our main conclusions are summarised in Section 5.

2 Construction of the dataset and variables

To conduct the various empirical analyses presented in the following section, we use a sample of multinational and domestic firms observed over the period 1997-2007. Our sample is obtained by merging three sources of information. The first is the Survey on Foreign Direct Investment, conducted by the National Bank of Belgium and covering the period 1997-2007. The second is the annual accounts of firms, collected for (nearly) all companies located in Belgium by the Central Balance Sheet Office of the National Bank of Belgium. The third is the Social Security Data Warehouse, from which we obtain data on worker flows and workers' remuneration, by worker type (blue and white-collar workers), for firms having at least 10 employees over the same period. We briefly present the construction of the dataset in this section. A detailed description is provided in Appendix A.

We restrict our analysis to firms with at least 10 employees that filed their annual accounts using the most detailed (full) format for at least one year during the period considered.[5] We focus on manufacturing industries, construction, trade, market services and financial intermediation sectors (i.e. two-digit 2003 NACE-bel codes between 15 and 73). We exclude the sector "other business activities" (NACE code 74), which includes temporary employment agencies, because that could seriously bias the job flow estimates. We also restrict our sample to "profit maximising" firms, defined according to their legal form, e.g. we exclude non profit associations and public utilities.

We construct variables based on the main balance sheet items such as total assets, value added, and the capital stock (measured as the book value of tangible fixed assets). We use the two-digit NACE sector-level price indexes for value added and investment as deflators.

We obtain firm-level wage data by type of employee from the Social Security Data Warehouse. For confidentiality reasons, our dataset reports annual averages per firm (instead of per individual worker) for annual remuneration and premia by type of workers,[6] and number of employees per

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5 This is motivated by the fact that 95% of the companies identified as multinationals in the Survey on Foreign Direct Investment file their annual accounts in Belgium using the full format.

6 For cases that involve only one worker, we do not obtain the exact amount of wages and premia but the mean figure of the remuneration (or premium) class, defined in bands of EUR 500.

category. In this paper we focus on blue-collar workers and white-collar workers. Appendix A describes the trimming and adjustment method used to ensure consistency between the Social Security database and the annual accounts.[7]

Taking into account all these criteria, our base sample contains 115,706 observations for 13,932 firms, of which 2,929 are MNFs (812 are Belgian MNFs and 2,117 are foreign MNFs). According to the Survey on Foreign Direct Investment, foreign-owned firms are, in most cases, owned by a single foreign company, via direct participation; the average number of foreign owners is 1.14. On average, foreign participation amounts to 90% of the firm's equity: 69% direct participation and 21% indirect participation.

3 Net Employment flows

We first provide a global evaluation of the contribution of multinational firms to employment growth, through a net job creation analysis on the lines of Davis *et al.* (1996). We produce separate breakdowns for domestic firms (firms with no outward FDI and less than 50% in foreign ownership), subsidiaries of foreign multinationals (firms at least 50% owned by a foreign company), and Belgian MNFs (firms which have outward FDI and in which no foreign company owns at least 50%). We also distinguish between entrants, incumbents and exiting firms. Entry and exit are defined as follows: (i) a firm is considered as an entrant in the year it officially started; (ii) a firm is considered as exiting in the year in which its total assets are recorded for the last time before 2006.[8] Note that, as firms are identified on the basis of their value added tax (VAT) identification number, a firm exit may not necessarily indicate a close-down; it may equally indicate a take-over. Detailed figures of net job creation for entrants, incumbents and exiting firms, by type of firm, as well as separate figures for blue-collar workers and white-collar workers, are reported in Tables B.1 to B.3 in Appendix B.

The information presented in Table 1 highlights three main features of employment patterns.

First, net job creation is mainly due to domestic firms. In fact the relatively low figures for employment adjustments in MNFs mask contrasting patterns for Belgian and foreign MNFs. In our sample, foreign MNFs are, on several occasions, responsible for a substantial part of net employment growth, while Belgian MNFs make a negative contribution in almost every period. Between 1998 and 2005, Belgian MNFs destroyed 16,428 jobs, while the two other types of firms increased the number of jobs (+57,537 for domestic firms and +5,902 for foreign MNFs).

Second, incumbent firms often account for the largest share of net employment flows every year. This feature is confirmed for MNFs, where incumbents are the largest contributors to net job flows. This result is another reason for focusing on the employment adjustment behaviour of incumbent firms. These features translate to blue-collar workers and white-collar workers, as

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7 To give an indication of the representativeness of our sample, firms in our sample account for one half of value added, as reported in National Accounts statistics for the same sectors of economic activity. Due to differences in firm size, our sample represents 83% of value added in manufacturing industries, and 30% in services, as reported in National Accounts statistics.

8 In Belgium, nearly all companies have to file annual accounts. Nevertheless, a very small number of companies may be absent from the annual accounts database if they are late in filing their accounts. For this reason, we identify exiting firms by their absence from the sample for at least two consecutive years. Therefore, the exit dummy is defined over the 1996-2005 period on the basis of the annual accounts for 2006 and 2007.

shown in Tables B.2 and B.3 in Appendix B. However, there are some exceptions to this general pattern. For Belgian MNFs, 9.2 thousand jobs were destroyed in 2000, but that was due mainly to the closure of the major national airline. In 2003, the exiting firm that represents the largest employment reduction among foreign MNFs was actually taken over by another foreign MNF, so that the total impact on employment was mitigated.

Table 1 - Net employment flows

	1998	1999	2000	2001	2002	2003	2004	2005
Total								
Net creation[1]	23.1	13.8	21.4	0.9	-13.6	-1.1	7.7	-5.2
Incumbent firms	*27.7*	*21.8*	*37.2*	*9.0*	*-9.2*	*9.1*	*12.5*	*5.5*
Firm exit	*-8.2*	*-11.3*	*-19.0*	*-11.3*	*-8.5*	*-11.4*	*-6.2*	*-11.2*
Average net creation[2]	2.1	1.2	1.9	0.1	-1.3	-0.1	0.7	-0.5
Domestic firm								
Net creation[1]	16.7	15.4	19.7	3.1	0.4	-1.0	6.1	-2.8
Incumbent firms	*20.0*	*22.3*	*25.0*	*8.5*	*4.2*	*5.6*	*8.6*	*5.5*
Firm exit	*-6.8*	*-10.2*	*-8.5*	*-8.6*	*-8.0*	*-7.3*	*-4.0*	*-8.6*
Average net creation[2]	1.7	1.6	2.0	0.3	0.0	-0.1	0.7	-0.3
MNFs								
Net creation[1]	6.4	-1.6	1.7	-2.2	-14.0	-0.1	1.7	-2.4
Incumbent firms	*7.8*	*-0.6*	*12.2*	*0.5*	*-13.5*	*3.5*	*3.8*	*0.0*
Firm exit	*-1.4*	*-1.1*	*-10.5*	*-2.7*	*-0.5*	*-4.1*	*-2.2*	*-2.6*
Average net creation[2]	*4.8*	*-1.2*	*1.2*	*-1.3*	*-7.7*	*-0.1*	*0.9*	*-1.5*
Belgian MNFs								
Net creation[1]	0.3	-2.3	-7.6	-2.9	-4.1	3.7	-2.4	-1.2
Incumbent firms	*0.6*	*-2.1*	*2.2*	*-1.3*	*-4.0*	*3.7*	*-1.7*	*-0.7*
Firm exit	*-0.3*	*-0.2*	*-9.8*	*-1.6*	*-0.1*	*0.0*	*-0.7*	*-0.5*
Average net creation[2]	0.9	-6.6	-22.3	-6.7	-9.5	8.9	-5.9	-3.5
Foreign MNFs								
Net creation[1]	6.1	0.7	9.3	0.7	-9.9	-3.8	4.0	-1.2
Incumbent firms	*7.1*	*1.6*	*10.0*	*1.8*	*-9.4*	*-0.2*	*5.5*	*0.7*
Firm exit	*-1.1*	*-0.9*	*-0.7*	*-1.1*	*-0.5*	*-4.0*	*-1.5*	*-2.1*
Average net creation[2]	6.2	0.8	8.8	0.5	-7.1	-2.6	2.9	-0.9

Note: The decomposition exercise is performed only up to 2005 as firm exits are defined only over the 1997-2005 period. Average net creation is defined as net employment creation over the number of firms.
[1] in thousands.
[2] in units.

Third, at the individual level, foreign MNFs appear to have the largest net employment growth. This is the motive underlying government efforts to attract and retain foreign multinationals.[9] However, the exit of a foreign MNF implies on average the destruction of 117.4 jobs, while the exit of a Belgian-owned firm only destroys 54.2 jobs. Even though only 13 of the 186 exiting firms are foreign MNFs, such a difference in job destruction between foreign MNFs and Belgian-owned firms fuels the fear of massive job losses due to the footloose nature of foreign multinationals, as they tend to set up large plants and may be less rooted in the national economy.

To summarise the findings of this section, one important feature is that net employment flows are attributable largely to incumbent firms, especially in the case of foreign MNFs. This pattern

9 In our sample, domestic firms outnumber MNFs by more than four to one. This explains why domestic firms make the largest overall contribution to total employment growth.

holds for the employment of both white-collar and blue-collar workers. This implies that to understand labour adjustment flows, one should focus on firms conducting "business as usual" rather than on the creation or exit of firms. Analysis of the risk of MNF plant closure or relocation, although an important issue *per se*, may neglect the other key aspect of employment adjustment. Moreover, the descriptive statistical analysis shows that incumbent foreign MNFs undertake larger employment adjustments than incumbent domestic firms. This provides a first valuable indication of the validity of the hypothesis that adjustment costs are lower for foreign MNFs than for domestic firms.

4 Estimation of labour adjustment costs

Differences in labour demand adjustment between foreign multinationals and domestic firms may be explained by the fact that MNFs employ a larger proportion of white-collar workers (e.g. Navaretti *et al.*, 2003). According to the skill level of the workforce, there are differences in recruitment/training costs associated with hiring, differences in wage levels which induce differences in redundancy payments, as well as differences between blue-collar workers and white-collar workers in regard to legislation on dismissal.[10] To control for this composition effect, we distinguish between blue-collar workers and white-collar workers in our estimates of adjustment costs across firms (Bresson *et al.*, 1992; Kramarz and Michaud, 2010). Another distinguishing feature of MNFs may be that, due to their ability to transfer production to alternative locations, MNFs may have more bargaining power than domestic firms with respect to government and/or unions, which may soften constraints imposed by labour market regulations. Additionally, they have an internal labour market where employment can be adjusted by shifting employees from one subsidiary to another.

We allow for differences in downsizing costs and upsizing costs by adopting an asymmetric functional form for net employment adjustment costs. This follows previous empirical estimates of adjustment costs. Our specification of adjustment costs is based on a cubic function,[11] allowing for asymmetric costs of firing/downsizing and hiring/upsizing. Alternative adjustment cost functions have been proposed in the literature to account for asymmetry (for a survey, see Hamermesch and Pfann, 1996).

The specification used by Navaretti *et al.* (2003) is an approximation of quadratic and symmetric adjustment costs (Hamermesch, 1993). Using micro-data, the literature clearly shows that the adjustment costs have a more complex structure (Hamermesh, 1993; Hamermesh and Pfann, 1996). Even though the structure of adjustment costs may vary across specifications, two main features emerge from empirical analyses. First, adjustment costs are asymmetric, in the sense that termination costs differ from hiring costs. For example, in Europe, the former exceed the latter (Goux *et al.*, 2001; Lundgren and Sjöstrom, 2001; Mathieu and Nicolas, 2006) while termination seems less costly than hiring in the case of the United States (Hamermesch, 1993). Second, adjustment costs may vary according to worker characteristics, especially the level of skill.

[10] When the termination decision is taken by the firm, blue-collar workers are given notice ranging from 28 days, if the worker has less than 20 years' service, to 56 days otherwise. White-collar workers are given notice ranging from 3 to 18 months according to the employee's length of service.

[11] This can be viewed as a Taylor approximation of a more general adjustment cost function.

Hiring and termination costs seem higher for skilled workers than for unskilled workers (Bresson *et al.*, 1992; Abowd and Kramarz, 2003; Kramarz and Michaud, 2010). Third, a part of the literature on adjustment costs has devoted substantial effort to testing for the presence of non convex adjustment costs, essentially modelled by a fixed adjustment cost. However, the results are not clear-cut.[12] Note that one important motivation for non convex adjustment costs is to reproduce lumpy employment adjustment as observed in microeconomic data. Based on our dataset, episodes of no employment adjustment are seldom observed, at least compared to previous studies (only 9.2% of the observations in our dataset compared to 37% in Ejarque and Nilsen, 2008, and 57% in Lapatinas, 2009). Thus, we do not allow for the presence of lump-sum adjustment costs in our specification.

4.1 Dynamic labour demand under asymmetric adjustment costs

We assume that firms operating within the same sector of activity share a common production function technology. The functional form of adjustment costs is identical for all companies and workers, but we allow for differences in adjustment costs between multinational and domestic firms, and between blue-collar workers and white-collar workers.

To derive our Euler equations, we assume that prices are defined at the sector level, using:

$$P_{st} = P(Q_{st}) \tag{1}$$

where Q_{st} stands for the production of sector *s* at time *t*.

We also assume a Cobb-Douglas production function for firm *i* in period [*t*,*t*+1].

$$Q_{it} = A_{it}\widetilde{L_{it}^{B}}^{\alpha_B}\widetilde{L_{it}^{W}}^{\alpha_W}K_{it}{}^{\alpha_K} \tag{2}$$

where A_{it} represents the productivity shock observed at the beginning of the [*t*,*t*+1] period, $\widetilde{L_{it}^{B}}$ the stock of blue-collar workers, $\widetilde{L_{it}^{W}}$ the stock of white-collar workers, and K_{it} the capital stock, all during the [*t*,*t*+1[period.

The capital stock at the beginning of the year depends on past capital minus depreciation at rate δ plus investment I_{it-1}:

$$K_{it} = (1-\delta)K_{it-1} + I_{it-1} \tag{3}$$

The stock of white-collar workers available at the end of period [*t*,*t*+1[is given by L_{it}^{B}. Net employment flows result from hirings H_{it}^{B}, firings F_{it}^{B}, and natural quits Q_{it}^{B} that occur at the beginning of period [*t*,*t*+1[. The same holds for white-collar workers.

$$\Delta L_{it}^{B} = H_{it}^{B} - F_{it}^{B} - Q_{it}^{B} \tag{4a}$$

[12] Abowd and Kramarz (2003) find evidence of high fixed costs, particularly termination costs, while Kramarz and Michaud (2010) report much lower fixed costs, once account is taken of the panel dimension of the data, and significant quadratic costs. Ejarque and Nilsen (2008) estimate substantial quadratic adjustment costs, linear costs, and low but significant fixed costs for Portugal.

$$\Delta L_{it}^{W} = H_{it}^{W} - F_{it}^{W} - Q_{it}^{W} \quad (4b)$$

As hiring and firing decisions generate costs, we assume that net employment creation or destruction is costly for the firm. To be consistent with the assumption of imperfect substitution between inputs, our adjustment cost function introduces cross adjustment effects between the two types of labour input[13]. Specifically, our adjustment cost function is:

$$AC(\Delta L_{it}^{B}, \Delta L_{it}^{W}) = \frac{a^{B}}{2}(\Delta L_{it}^{B})^{2} + \frac{a^{W}}{2}(\Delta L_{it}^{W})^{2} + \frac{d^{B}}{3}(\Delta L_{it}^{B})^{3} + \frac{d^{W}}{3}(\Delta L_{it}^{W})^{3} + g\Delta L_{it}^{B}\Delta L_{it}^{W} \quad (5)$$

For negative d^{j}, downsizing costs exceed upsizing costs.[14] For negative g, it is less costly to adjust blue-collar (white-collar) employment when one simultaneously adjusts the number of white-collar (blue-collar) workers in the same direction. Under this assumption, however, substitution between the two labour inputs is costly in the sense that increasing the number of one type of workers while reducing the other type of workers increases total adjustment costs. Our specification encompasses the standard quadratic adjustment cost function, for $d^{B} = d^{W} = g = 0$.

As we assume differences between domestic firms and MNFs in employment adjustment costs, we consider that

$$a^{j} = a_{0}^{j} + a_{MNF}^{j} D_{it}^{MNF} \quad (6a)$$

$$d^{j} = d_{0}^{j} + d_{MNF}^{j} D_{it}^{MNF} \quad (6b)$$

and

$$g = g_{0} + g_{MNF} D_{it}^{MNF} \quad (6c)$$

Considering the firm's decision on the number of blue-collar workers and the number of white-collar workers, the value of the intertemporal objective function of the firm may be written, disregarding the capital adjustment costs, as

$$V_{it} = E_{t}\left[\sum_{k=t}^{\infty} \beta^{k}\left(P_{st}Q_{it} - W_{it}^{B}L_{it}^{B} - W_{it}^{W}L_{it}^{W} - r_{it}K_{it} - AC(L_{it}^{B}, L_{it}^{W})\right)\right] \quad (7)$$

with β the discount rate and r_{it} the user cost of capital.

The first order condition for the demand of type *j* workers is given by:

$$\frac{\partial V_{it}}{\partial L_{it}^{j}} = P_{st}\frac{\partial Q_{it}}{\partial L_{it}^{j}} + \frac{\partial P_{st}}{\partial Q_{st}}\frac{\partial Q_{st}}{\partial Q_{it}}\frac{\partial Q_{it}}{\partial L_{it}^{j}}Q_{it} - W_{it}^{j} - \frac{\partial AC_{it}}{\partial L_{it}^{j}} - \beta E_{t}\left[\frac{\partial AC_{it+1}}{\partial L_{it}^{j}}\right] = 0 \quad (8)$$

13 We also estimate an extended model with interactions inside the adjustment cost function between labour inputs and capital. As these crossed terms were estimated to be insignificant, we do not report them in the paper.

14 Omitting this parameter may bias the estimate of a^{j} If downsizing costs exceed upsizing costs, an hypothesis supported by evidence of higher firing costs compared to hiring costs, a^{j} may be biased upward if most of observed employment changes are related to labour force reductions, and vice versa.

The last term is due to the fact that hiring and firing decisions affect the stock of type *j* employment for both the current and next periods. The first two terms of equation (8) may be rewritten, using the Lerner condition, as a function of the mark-up, μ_{it}, simplifying the marginal product of type *j* labour thanks to the Cobb-Douglas specification, and under the Cournot assumption (zero conjectural variations), as:

$$\frac{\partial V_{it}}{\partial L_{it}^{j}} = P_{st}\left(\frac{1}{\mu_{it}}\right)\alpha^{j}\frac{Q_{it}}{L_{it}^{j}} - W_{it}^{j} - \frac{\partial AC_{it}}{\partial L_{it}^{j}} - \beta E_t\left[\frac{\partial AC_{it+1}}{\partial L_{it}^{j}}\right] = 0 \quad (9)$$

From (5) and (9), the Euler equation for type *j* workers may be written as:

$$P_{st}\left(\frac{1}{\mu_{it}}\right)\alpha^{j}\frac{Q_{it}}{L_{it}^{j}} - W_{it}^{j} = a^{j}\Delta L_{it}^{j} + d^{j}\Delta L_{it}^{j\,2} + g\Delta L_{it}^{k} - \beta E_t[a^{j}\Delta L_{it+1}^{j} + d^{j}\Delta L_{it+1}^{j\,2} + g\Delta L_{it+1}^{k}] \quad (10)$$

where *k≠j.* Note that the Euler equations depend on the production function coefficient of labour, which varies across worker skill types, as well as on the firm's market power, and the discount factor, β, in addition to adjustment costs. The production function coefficients and the firm's market power are estimated from our sample of Belgian firms and foreign MNFs. As explained in the next section. β, is fixed at 0.97; but we examine the robustness of our results with respect to alternative values.

4.2 Estimation of production functions

In order to estimate production function coefficients, as well as adjustment cost coefficients, we restrict our sample to firms with sufficient observations, and trim for outliers. Trimming for outliers is performed along the following lines. We exclude the 99th percentile of gross employment flows of blue-collar workers and of white-collar workers, which may capture takeover events. We focus on observations where reported employment exits are consistent with the sum of reported exits due to lay-offs, those due to retirement, those due to early retirement, and those due to other reasons. In order to estimate production function coefficients, we retain only firm-year observations where firms employ both blue-collar and white-collar workers,[15] and where the value of capital is above EUR 100[16] and intermediate consumption is positive. We finally remove outliers by keeping observations where the log of apparent labour productivity, the log of the ratio of real average wage bill over apparent labour productivity, and the log of the capital-labour ratio lie within the range defined by the median minus or plus three times the inter-quartile range. This criterion is applied by year and NACE two-digit level sectors. Lastly, we focus on firms with at least two consecutive observations.

Taking into account all these criteria, our base sample contains 58,594 observations, 8,688 firms, over the period 1997-2007, of which 504 are Belgian MNFs and 1,158 are foreign MNFs.

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[15] This criterion is needed to estimate the production function allowing for both blue-collar and white-collar labour inputs.

[16] This is intended to avoid downward bias in estimated production function coefficients.

Table A.1 in Appendix A reports some basic descriptive statistics, such as the mean and median of employment, wages, productivity and capital intensity, for domestic firms, Belgian MNFs and foreign MNFs. The figures confirm previous findings in the literature. Multinational companies, especially foreign ones, are larger; they employ a bigger share of white-collar workers, and are more capital intensive. Furthermore, MNFs, in particular foreign MNFs, offer higher wages, though this mainly holds for white-collar workers. Lastly, foreign multinationals have higher productivity while purely domestic firms lie at the opposite end of the scale. For all figures, Belgian MNFs lie between domestic and foreign MNFs, but are closer to foreign MNFs.

To estimate the labour production coefficients for non-clerical workers and clerical workers, we rely on the method recently proposed by Ackerberg *et al.* (2006). The method extends the procedures initially proposed by Olley and Pakes (1996) and Levinsohn and Petrin (2003) which correct for the simultaneity bias between factor demand and productivity shocks by assuming, for identification, that productivity shocks depend on capital (quasi-fixed factor) and on a proxy that must be strictly positive. The proxy is either investment, in the case of Olley and Pakes (1996), or intermediate inputs, in the case of Levinsohn and Petrin (2003). Following the latter, we consider intermediate inputs as proxy.

In line with the theoretical assumptions made in the model used to derive adjustment costs, we consider a Cobb-Douglas production function composed of two labour inputs - blue-collar workers and white-collar workers - in addition to capital at the beginning of the current period. The identification of production coefficients is based, in our application, on the following assumptions. The stock of capital accumulated until the end of period [t-1, t[was built up by investment in period [t-1, t[and is therefore orthogonal to the productivity shock that occurs at the beginning of period [t, t+1[. The identification of labour coefficients is based on the assumption that labour does not adjust immediately to productivity shocks; that is consistent with the presence of employment adjustment costs. This motivates our use of the Ackerberg *et al.* (2006) estimator that allows for the presence of a correlation between productivity shock and current labour inputs.

As discussed in Griliches and Mairesse (1995), if we consider the case where firms have some degree of market power, and charge prices that differ from the sector-level prices, this has two important consequences for the estimation of production function parameters. First, the estimated parameters are the input coefficients divided by the firm's mark-up; in our case, α^B/μ and α^w/μ. Second, when output measures are deflated by sector-level price indices rather than by firm-level prices, due to the lack of the relevant data, this introduces aggregate demand shifts and industry price levels in the estimated production function (Foster *et al.*, 2008; Katayama *et al.*, 2003; Klette and Griliches, 1996). Therefore, our production function estimates include time dummies that vary across sectors, in order to overcome this issue.

We estimate input coefficients at the NACE one-digit sector level to capture the differences in technology across sectors and to preserve the accuracy of the estimates by keeping sample size within a reasonable range (see Table C.1 in Appendix C), Table 2 reports estimated production function coefficients from the Ackerberg *et al.* (2006) method together with their bootstrap standard errors.[17]

Table 2 - Estimation of the production function, by sector

Sector	α^K/μ	α^B/μ	α^W/μ
Food and textiles	0.178	0.424	0.388
	(0.011)	(0.015)	(0.016)
Wood, paper, chemicals, metal and non-metal	0.161	0.358	0.437
products, machinery	(0.006)	(0.009)	(0.009)
Equipment and recycling	0.138	0.354	0.433
	(0.011)	(0.013)	(0.018)
Energy and construction	0.106	0.502	0.338
	(0.007)	(0.007)	(0.006)
Trade and hotels and restaurants	0.126	0.176	0.561
	(0.005)	(0.005)	(0.008)
Communication and financial intermediation	0.163	0.268	0.361
	(0.005)	(0.006)	(0.007)
Real estate and business activities	0.179	0.071	0.612
	(0.013)	(0.018)	(0.034)

Note: Estimates based on the 1997-2005 period; 58,594 observations and 8,688 firms.
Point estimates of the production parameters are obtained from a genetic algorithm that makes it possible to minimise equation (25) in Ackerberg *et al.* (2006). At the first step, a 3rd order polynomial is used to approximate the productivity shock function. The values reported in Table 2 are the mean values and the standard errors (in brackets) obtained by bootstrap of this estimation procedure (1000 replications).

4.3 Estimation of adjustment costs

We use the set of estimated production function parameters and assume a discount rate, β, equal to 0.97 to construct the left-hand side variable of equation (10). We jointly estimate the adjustment cost parameters of blue-collar and white-collar workers. We use SGMM techniques (Arellano. and Bover, 1995, Blundell and Bond, 1998) in order to account for rational expectations that firms are assumed to form about their future level of employment.

Our baseline results are given in Table 3. Column (1) reports the estimates of adjustment costs for the entire sample; column (2) tests differences between MNFs and domestic firms. The point estimates reported in Table 3 are used to compute the average and marginal adjustment costs for various cases of employment adjustment, displayed in Table 4. Results for the entire sample highlight four main features of employment adjustment costs.

First, adjustment costs are convex, as the estimates of a^B and a^W in Table 3 are significant and larger than the estimates of d^B and d^W. For instance, the marginal adjustment cost of blue-collar workers rises from EUR 227 to EUR 449 when ΔL_{it}^B increases from one to two.[18]

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[17] For comparison, Tables B.2.a and B.2.b in Appendix B report production function coefficients estimated using the Ackerberg *et al.* methodology, making some alternative assumptions on labour flexibility (i.e. when blue-collar employment is flexible, or when both blue-collar and white-collar employment are fully flexible) or the Olley-Pakes and Levinsohn-Petrin methodologies.

[18] At first sight, our estimates of the average or marginal costs of adjustment may look low. The reason is that we analyse net employment flows, which also include voluntary departures, retirement and the expiry of temporary contracts. In our sample, workers who have been laid off account for 25% of worker outflows, on average.

Table 3: Estimates of adjustment costs for blue-collar and white-collar workers

	(1)	(2)
a^B	228.75***	291.84***
	(34.05)	(61.43)
a^B_{MNF}		-93.67
		(96.47)
d^B	-2.22**	-7.99**
	(1.12)	(3.21)
d^B_{MNF}		7.98**
		(3.20)
a^W	835.20***	1,191.58***
	(--99.13)	(217.80)
a^W_{MNF}		-692.26***
		(259.00)
d^W	-8.36***	-20.98**
	(2.60)	(8.59)
d^W_{MNF}		14.40
		(9.34)
g	-216.40***	-283.13***
	(54.79)	(74.89)
g_{MNF}		185.13
		(115.90)
Wald, H$_0$:$a^B = a^W$	34.38	15.96
Wald, H$_0$:$d^B = d^W$	4.82*	2.03***
Wald, H$_0$: $a^B + a^B_{\mathrm{MNF}} = 0$		11.20
Wald, H$_0$: $a^W + a^W_{\mathrm{MNF}} = 0$		18.07
Wald, H$_0$: $d^B + d^B_{\mathrm{MNF}} = 0$		0.00***
Wald, H$_0$: $d^W + d^W_{\mathrm{MNF}} = 0$		7.76
Wald, H$_0$:$g + g_{\mathrm{MNF}} = 0$		1.50***
Sargan	19.15*	30.41

Notes: 37,553 observations and 5,544 firms over 1998-2006, standard errors in brackets. All equations include year and sector dummies.

*** significant at the 1% level, ** at the 5% level, * at the 10% level.

Instruments for the level equation: stacked values of $\Delta[\Delta L^x_{it-1} - \beta\,\Delta L^x_{it}]$, $\Delta[\Delta L^x_{it-2} - \beta\,\Delta L^x_{it-1}]$, $\Delta[\Delta L^{2x}_{it-1} - \beta\,\Delta L^{2x}_{it}]$ and $\Delta[\Delta L^{2x}_{it-2} - \beta\,\Delta L^{2x}_{it-1}]$, $\Delta[\Delta L^z_{it-1} - \beta\,\Delta L^z_{it}]$ and $\Delta[\Delta L^z_{it-2} - \beta\,\Delta L^z_{it-1}]$, where x=B and z=W for the blue-collar equation, x=W and z=B for the white-collar equation, and interactions with *MNF,* a dummy equal to one for MNF, in column (2).

Instruments for the difference equation: stacked values of $\Delta L^x_{it-2} - \beta\,\Delta L^x_{it-1}$, $\Delta L^x_{it-3} - \beta\,\Delta L^x_{it-2}$, $[\Delta L^{2x}_{it-2} - \beta\,\Delta L^{2x}_{it-1}]$, $[\Delta L^{2x}_{it-3} - \beta\,\Delta L^{2x}_{it-2}]$, $[\Delta L^z_{it-1} - \beta\,\Delta L^z_{it}]$ and $[\Delta L^z_{it-2} - \beta\,\Delta L^z_{it-1}]$, where x=B and z=W for the blue-collar equation, x=W and z=B for the white-collar equation, and interactions with *MNF,* a dummy equal to one for MNF, in column (2).

Second, adjustment costs are asymmetric in the sense that firing costs are greater than hiring costs, as suggested by the negative and significant estimated value of d^B and d^W. For example, reducing the number of white-collar workers by five costs an average of EUR 140 more than increasing the white-collar workforce by five.

Third, the estimated g is significantly negative, which indicates that adjusting one type of labour is less costly when the other type is adjusted in the same direction. By contrast, substituting one type of worker for the other increases the cost of adjustment. To illustrate these points, consider the base case of increasing white-collar employment by five; this induces an average adjustment cost of EUR 2,018. If the number of clerical workers is now raised by four and the number of non-clerical workers by one, the average adjustment cost falls to EUR 1,150. By contrast, reducing the number of blue-collar workers by one and increasing the number of white-collar workers by six, raises the average adjustment cost to EUR 3,169.

Table 4: Amounts of average and marginal adjustment costs

ΔL^B	ΔL^W	average adj. cost	marginal cost of ΔL^B	marginal cost of ΔL^W
1	0	114	227	
-1	0	115	-231	
2	0	226	449	
-2	0	232	-466	
5	0	553	1,088	
-5	0	590	-1,199	
0	1	415		827
0	-1	420		-844
0	2	824		1,637
0	-2	846		-1,704
0	5	2,018		3,967
0	-5	2,158		-4,385
5	0	553	1,088	-1,082
4	1	266	663	-39
6	-1	1,135	1,509	-2,142
0	5	2,018	-1,082	3,967
1	4	1,150	-639	2,991
-1	6	3,169	-1,529	4,927

Fourth, results reported in Table 4 show that average and marginal adjustment costs are more than three times higher for white-collar workers than for blue collar-workers. This may be explained by the fact that blue-collar workers develop less firm-specific human capital and are therefore more easily replaced. It is also due to less stringent legislation on dismissal, as explained above. The result is consistent with the estimates of Alonso-Borrego (1998), for Spain, based on an Euler equation model with a comparable adjustment cost function. It is also in line with Abowd and Kramarz (2003) and Kramarz and Michaud (2010), who find that termination costs are much greater for higher-skilled workers than for lower-skilled workers in France.

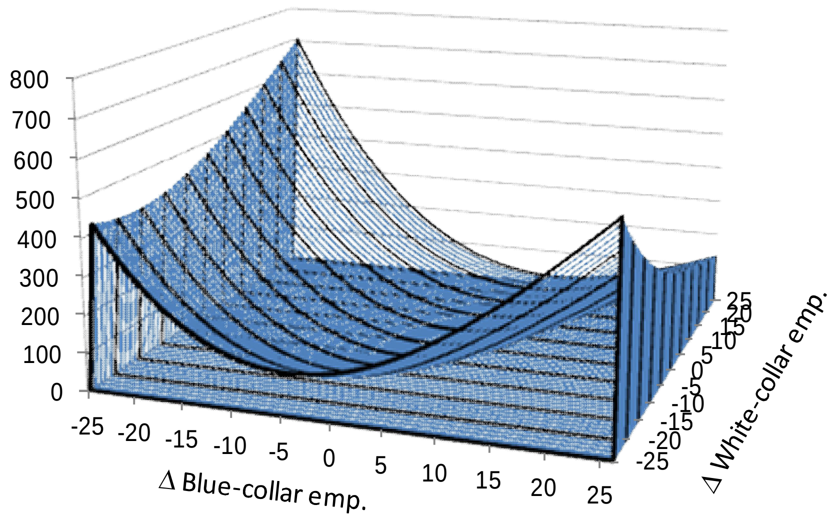
In all, we find evidence of convex, asymmetric and cross adjustment costs. For a given amount of employment change, total adjustment costs are higher for white-collar workers than for blue-collar workers.

Next, we examine differences across domestic firms and multinationals. The major difference is that the adjustment costs are lower for the latter than for the former. The gap is much larger in the case of white-collar workers. Marginal and average adjustment costs of MNFs are only half those of domestic firms for white-collar workers. The difference is around 25% for blue-collar workers.

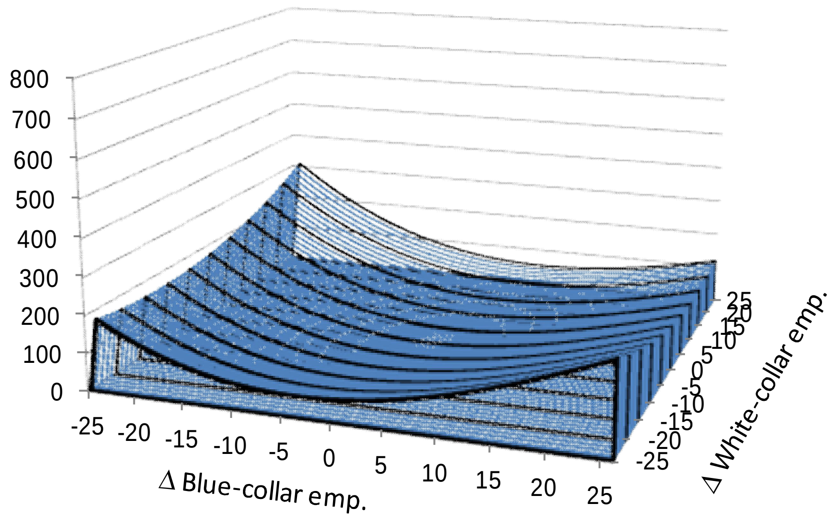
Differences between the two types of firms also concern adjustment cost asymmetry. As illustrated by Figures 1.a-1.b, adjustment costs for non-clerical workers are strongly asymmetric for domestic firms, which face larger downsizing costs than upsizing costs. This is consistent with the estimated value of d^B in column (2) of Tables 3. Such asymmetry is absent in multinationals, as evidenced by the Wald tests for the hypothesis that $d^B + d^B_{\text{MNF}} = 0$. For white-collar workers, the results are less clear-cut. Indeed, the difference in asymmetry coefficients between domestic firms and MNFs is positive but not significant.[19]

Figure 1 - Total adjustment costs (in EUR thousands)

a. Domestic firms



b. MNFs



4.4 What may justify differences in adjustment costs?

Several explanations may be put forward to justify the differences in adjustment costs between domestic and multinational companies. First, it has been argued that domestic firms may be more deeply rooted in the local economy, and may try harder to avoid job losses. Other explanations are

[19] To test the robustness of our results, we repeat these estimations using alternative estimates of production function coefficients, using the Ackerberg *et al.* (2006) procedure with alternative assumptions on labour flexibility, and the Olley and Pakes (1996) methodology or the Levinsohn and Petrin (2003) procedures, controlling for firm survival. We also perform robustness tests considering a discount rate of 0.95 and 0.99, instead of the 0.97 rate considered above. Our results are robust to those alternative specifications. These results are available on request.

related to the larger scale of MNFs compared to domestic firms. Labour indivisibilities make labour adjustment more costly, as it may be more damaging for the organisation of production to reduce employment by one unit in a "10 employees" firm than in a "100 employees" company. They may also have a more developed Human Resources Department. Lastly, they may have stronger bargaining power with respect to unions, e.g. because of their footloose nature and because their employment decisions affect a large number of workers.

We start our analysis with the origin of firms. The argument that national firms may be more reluctant to undertake massive job losses (reluctance effect) holds for Belgian domestic firms and potentially for Belgian multinationals. The latter may be less inclined to close production plants at home than abroad, in the case of negative shocks. To take into account the presence of a potential reluctance effect, we have introduced a dummy variable for Belgian MNFs that interacts with the parameters of the adjustment cost function. As shown in column (2) of Table 4, none of the coefficients which interacted with the dummy for Belgian MNFs is significant, and the estimates of other coefficients are of the same order of magnitude as in column (1).[20] Consequently, there is no reluctance effect that would create differences in labour adjustment between Belgian MNFs and foreign MNFs.

In column (3), we examine the consequence of the union effect on the difference in adjustment costs between domestic firms and MNFs. On the one hand, the presence of unions in a firm may increase adjustment costs. On the other hand, the union effect may be dampened in MNFs, as their bargaining power *vis-à-vis* unions may be greater than that of domestic firms. To capture the union effect, we introduce a dummy variable associated with a threshold value (more than 50 employees) beyond which union representation is compulsory. Again, this dummy variable interacts with the adjustment cost parameters. However, this proxy may also capture a labour indivisibility effect. Unions and indivisibility must have opposite effects on adjustment costs. If the union effect dominates, it should increase adjustment costs. Furthermore, if MNFs have more bargaining power with respect to unions than domestic firms, adjustment costs of MNFs would remain lower even after controlling for the union effect, i.e. a^{j}_{MNF} would remain significantly negative. Our estimates suggest that the firms above the threshold have lower adjustment costs. This is true for blue-collar and white-collar employees, as a^{B}_{proxy} and a^{W}_{proxy} are both negative. Consequently, the indivisibility effect, that reduces the adjustment costs for large firms, dominates over the union effect. Furthermore, the a^{j}_{MNF} parameters of the adjustment cost function are now smaller and non significant. This suggests that MNFs do not seem to have any particular ability in the management of their relationships with unions.[21]

[20] To test the assumption that European MNFs could adopt behaviour similar to that of domestic Belgian firms, we decompose foreign MNFs into those that belong to the EU and those that do not. The estimates show that there is no significant difference between MNFs according to their nationality.

[21] Note that this result may also be viewed as a preliminary indication that firm size potentially explains the difference between MNFs and domestic firms. We explore this issue in more detail below.

Table 5: Estimates of adjustment costs as a function of firm characteristics

	(1)	(2) Belgian MNF	(3) threshold	(4) %ftc	(5) turnftc	(6) early ret.
a^B	291.84***	295.12***	563.97***	299.18***	295.37***	624.03***
	(61.43)	(64.27)	(80.14)	(62.08)	(58.28)	(130.10)
a^B_{MNF}	-93.67	-96.21	-30.81	-57.10	-12.17	48.54
	(96.47)	(96.36)	(104.60)	(94.23)	(82.39)	(85.40)
a^B_{proxy}		-24.72	-337.67***	-620.59**	-166.34*	-456.12***
		(140.50)	(100.50)	(259.70)	(90.99)	(138.20)
d^B	-7.99**	-8.28**	-10.18***	-7.36**	-6.34**	-21.78***
	(3.21)	(3.44)	(2.38)	(3.05)	(2.62)	(6.75)
d^B_{MNF}	7.98**	7.85**	8.76***	6.94**	4.91	4.53*
	(3.20)	(3.68)	(3.32)	(3.12)	(3.39)	(2.55)
d^B_{proxy}		0.36	1.60	3.73	2.37	17.13***
		(1.18)	(3.25)	(6.57)	(2.93)	(6.72)
a^W	1,191.58***	1205.64***	1,881.63***	1,223.91***	1,377.40***	1,269.59***
	(217.80)	(231.40)	(230.40)	(176.30)	(212.40)	(171.80)
a^W_{MNF}	-692.26***	-704.23***	-388.59	-807.46***	-691.98***	-564.39**
	(259.00)	(261.00)	(265.30)	(206.60)	(227.90)	(271.00)
a^W_{proxy}		285.21	-994.36***	1,448.41	-518.61**	-179.24
		(346.20)	(313.00)	(1474.10)	(266.50)	(253.40)
d^W	-20.98**	-19.77***	-52.53***	-26.31***	-22.43***	-19.81**
	(8.59)	(8.78)	(9.68)	(9.84)	(8.72)	(7.95)
d^W_{MNF}	14.40	12.07	5.67	16.85*	14.95*	7.76
	(9.34)	(9.46)	(7.90)	(9.84)	(8.48)	(10.48)
d^W_{proxy}		-8.30	40.26***	77.71*	5.79	5.23
		(11.81)	(11.27)	(43.76)	(8.31)	(8.34)
g	-283.13***	-288.55***	-305.55*	-249.18***	-236.01***	-255.08*
	(74.89)	(75.41)	(174.70)	(76.53)	(90.36)	(141.90)
g_{MNF}	185.13	159.24	194.87*	161.03	223.70**	257.46**
	(115.90)	(118.60)	(110.80)	(112.30)	(115.80)	(115.80)
g_{proxy}		166.12	23.00	-674.55	-276.51	-55.03
		(194.00)	(183.20)	(649.10)	(191.50)	(154.10)
Sargan	30.41	34.77	39.43	38.34	38.12	42.26

Notes: 37,553 observations and 5,544 firms over 1998-2006, standard errors in brackets. All equations include year and sector dummies. *Belgian MNF* is a dummy equal to one for Belgian MNFs, *threshold* is a dummy equal to 1 for firms with 50 employees or more at the beginning of the period; *%ftc* the firm percentage of workers under fixed-term contracts in the total workforce at the beginning of the period; *turnftc* is the firm average turnover rate of fixed-term contract workers at the beginning of the period, computed as $(in^{ftc} + out^{ftc})/(in + out)$ where *in* refers to the number of worker inflows, *out* is the number of worker outflows and *ftc* denotes workers under fixed-term contracts; *early ret* is a dummy equal to one if there is early retirement in the firm at least once over the period.

*** significant at the 1% level, ** at the 5% level, * at the 10% level.

Instruments for the level equation: stacked values of $\Delta[\Delta L^x_{it-1} - \beta\,\Delta L^x_{it}]$, $\Delta[\Delta L^x_{it-2} - \beta\,\Delta L^x_{it-1}]$, $\Delta[\Delta L^{2x}_{it-1} - \beta\,\Delta L^{2x}_{it}]$ and $\Delta[\Delta L^{2x}_{it-2} - \beta\,\Delta L^{2x}_{it-1}]$, $\Delta[\Delta L^z_{it-1} - \beta\,\Delta L^z_{it}]$ and $\Delta[\Delta L^z_{it-2} - \beta\,\Delta L^z_{it-1}]$, and interactions with proxies in columns (2) to (6). x=B and z=W for the blue-collar equation, x=W and z=B for the white-collar equation,

Instruments for the difference equation: stacked values of $\Delta L^x_{it-2} - \beta\,\Delta L^x_{it-1}$, $\Delta L^x_{it-3} - \beta\,\Delta L^x_{it-2}$, $[\Delta L^{2x}_{it-2} - \beta\,\Delta L^{2x}_{it-1}]$, $[\Delta L^{2x}_{it-3} - \beta\,\Delta L^{2x}_{it-2}]$, $[\Delta L^z_{it-1} - \beta\,\Delta L^z_{it}]$ and $[\Delta L^z_{it-2} - \beta\,\Delta L^z_{it-1}]$, and interactions with dummies in columns (2) to (6). x=B and z=W for the blue-collar equation, x=W and z=B for the white-collar equation.

The type of employment contract may be relevant to explain the differences in adjustment costs between domestic firms and MNFs. Several papers have highlighted the role of fixed-term contracts to permit flexible labour management and reduce labour adjustment cost (Dhyne and Mahy, 2009, Goux *et al.*, 2001, among others). Early retirement procedures have been pointed out by companies as a cost-reducing strategy in a couple of countries including Belgium (Babecky *et* *al.*, 2009). From these previous results, we investigate whether MNFs are better able to use the legal procedures that improve flexibility in employment management. We consider two measures of fixed-term contracts. The first is the firm average fraction of the workforce hired under fixed-term contracts over the period. The second is the firm average turnover of fixed-term contract workers over the period.[22] To control for early retirement, we consider a dummy equal to one if the firm resorts to early retirement at least once over the period.

Introducing both proxies for fixed-term contracts in our model, a^B_{proxy} is significantly negative, confirming that using this type of contracts decreases adjustment costs. But, the parameter a^B_{MNF} is still not significantly different from zero (see columns (4) and (5)). By contrast, MNFs still experience lower a^W than domestic firms after controlling for the use of fixed-term contracts. Using estimates in column (5) to compute the average adjustment costs shows that reducing the number of white-collar workers by two generates an average cost of EUR 2,815 for a domestic firm and EUR 1,391 for a multinational. Note that in the baseline case, without controlling for fixed-term contracts, these costs were of EUR 2,439 and EUR 904, respectively. The introduction of the dummy variable relating to early retirement provides similar qualitative results (see column (6)). Again, MNFs continue to have lower adjustment costs for white-collar workers than domestic firms. For a reduction of white-collar workers by two, a multinational bears an average adjustment cost of EUR 1,153 while for a domestic firm the cost is EUR 2,592. Even though the difference between average adjustment costs is reduced by the introduction of proxies for fixed-term contracts and early retirement, it remains sizeable. Our results suggest that MNFs maintain an employment adjustment cost advantage over domestic firms in the case of white-collar workers. Consequently, we cannot reject the assumption that MNFs are better at managing the legal procedures in favour of a greater flexibility of employment.

4.5 MNFs' labour adjustment costs and size effect

The results presented above suggest that part of the differences in labour adjustment costs between MNFs and domestic firms is due to several factors (union representation, use of flexible labour contracts, early retirement). Firm size is often suspected as the reason for heterogeneity in labour adjustment costs. The fact that MNFs seem to face lower adjustment costs compared to domestic firms may simply reflect the fact that MNFs are typically larger than domestic firms.[23] Their larger scale may make it easier to adjust employment, as it may allow them to circumvent labour indivisibility issues, for instance. As mentioned above, they may have a more developed Human Resources Department, improving their ability to manage employment changes.

Therefore, it is important to control for size to properly evaluate whether MNFs have an advantage in labour adjustment over domestic firms. This was done to some extent in the previous section, as the various explanatory factors considered above are largely related to firm size. Union representation is typically associated with size, and the use of flexible contracts or early retirement is more common in larger firms. To take proper account of the fact that firm size may partly affect

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22 It is defined as $(in^{ftc} + out^{ftc})/(in + out)$ where *in* refers to the number of worker inflows, *out* is the number of worker outflows and *ftc* denotes workers under fixed-term contracts.

23 The average workforce of MNFs amounts to 212 employees, while the figure for domestic firms is only 67, as shown in Table A.1. in Appendix A.

our results, we introduce a flexible specification of the adjustment cost function that directly includes a size effect.

$$AC\left(\Delta L_{it}^{B}, \Delta L_{it}^{W}, L_{i,t-1}\right) = \frac{a^B}{2}\Delta L_{it}^{B\,2} L_{i,t-1}^{\theta} + \frac{a^W}{2}\Delta L_{it}^{W\,2} L_{i,t-1}^{\theta} + \frac{d^B}{3}\Delta L_{it}^{B\,3} L_{i,t-1}^{2\theta} + \frac{d^W}{3}\Delta L_{it}^{W\,3} L_{i,t-1}^{2\theta} + g\Delta L_{it}^{B}\Delta L_{it}^{W} L_{i,t-1}^{\theta} \quad (11)$$

Under this specification, the Euler equation for type *j* workers may be written as:

$$P_{st}\left(\frac{1}{\mu_{it}}\right)\alpha^j \frac{Q_{it}}{L_{it}^j} - W_{it}^j = a^j \Delta L_{it}^j L_{i,t-1}^{\theta} + d^j \Delta L_{it}^{j\,2} L_{i,t-1}^{2\theta} + \gamma \Delta L_{it}^k L_{i,t-1}^{\theta} - E_t\left\{a^j\left[\Delta L_{i,t+1}^j L_{it}^{\theta} - \frac{\theta}{2}\left(\Delta L_{i,t+1}^j\right)^2 L_{it}^{\theta-1}\right] + d^j\left[\left(\Delta L_{it+1}^j\right)^2 L_{i,t-1}^{2\theta} - \frac{2\theta}{3}\left(\Delta L_{it+1}^j\right)^3 L_{it}^{2\theta-1}\right] + g\left[\Delta L_{it+1}^k L_{it}^{\theta} - \theta \Delta L_{it+1}^j \Delta L_{it+1}^k L_{it}^{\theta-1}\right]\right\} \quad (12)$$

where *k≠j*

This specification encompasses our baseline specification and a specification on the lines of Meghir *et al.* (1996) as special cases where the θ parameter respectively equals 0 and -1. Values of θ between 0 and -1 induce a smaller size effect than the value stipulated in the specification according to Meghir *et al.* (1996), while a parameter below -1 implies a stronger size effect. Considering several values for the θ parameter, we estimate our baseline model to see how size affects the differences in the adjustment cost parameters between MNFs and domestic firms. The results are summarised in Table 6.

Table 6 - The impact of size on the MNF coefficients

	θ = 0[(1)]	θ = -0.5	θ = -0.6	θ = -0.8	θ = -1[(2)]	θ = -1.2
a_{MNF}^{B}	-93.67	457.60	3,494.44	18,598**	62,345***	201,126***
	(96.47)	(1,648.2)	(3,141.3)	(9,073)	(24,737)	(72,014)
d_{MNF}^{B}	7.98**	280.81	-265.30	-6,537*	-50,170*	-347,951***
	(3.20)	(250.6)	(590.3)	(3,475)	(27,065)	(137,916)
a_{MNF}^{W}	-692.26***	-3,809.59*	-3,545.10	6,327	40,434	137,725**
	(259.00)	(2,175.4)	(3,547.0)	(10,050)	(29,578)	(70,547)
d_{MNF}^{W}	14.40	-33.14	-1,622.74	-32,028**	-235,198*	-1,365,632**
	(9.34)	(728.7)	(2,034.4)	(16,356)	(144,116)	(672,282)
g_{MNF}	185.13	621.80	996.59	2,715	5,994	1,552
	(115.90)	(1,665.7)	(2,821.4)	(7,993)	(20,793)	(48,403)
Sargan	30.41	36.48	35.41	35.24	35.87	34.26

Notes: 37,553 observations and 5,544 firms over 1998-2006, standard errors in brackets. All equations include year and sector dummies. MNF is a dummy equal to one for MNF.

(1) no size effect, (2) specification according to Meghir *et al.* (1996)

*** significant at the 1% level, ** at the 5% level, * at the 10% level.

Instruments for the level equation: stacked values of $\Delta[\Delta L_{it-1}^{x} - \beta\,\Delta L_{it}^{x}]$, $\Delta[\Delta L_{it-2}^{x} - \beta\,\Delta L_{it-1}^{x}]$, $\Delta[\Delta L^{2}{}_{it-1}^{x} - \beta\,\Delta L^{2}{}_{it}^{x}]$ and $\Delta[\Delta L^{2}{}_{it-2}^{x} - \beta\,\Delta L^{2}{}_{it-1}^{x}]$, $\Delta[\Delta L_{it-1}^{z} - \beta\,\Delta L_{it}^{z}]$ and $\Delta[\Delta L_{it-2}^{z} - \beta\,\Delta L_{it-1}^{z}]$, where x=B and z=W for the blue-collar equation, x=W and z=B for the white-collar equation, and interactions with firm type dummies.

Instruments for the difference equation: stacked values of $\Delta L_{it-2}^{x} - \beta\,\Delta L_{it-1}^{x}$, $\Delta L_{it-3}^{x} - \beta\,\Delta L_{it-2}^{x}$, $[\Delta L^{2}{}_{it-2}^{x} - \beta\,\Delta L^{2}{}_{it-1}^{x}]$, $[\Delta L^{2}{}_{it-3}^{x} - \beta\,\Delta L^{2}{}_{it-2}^{x}]$, $[\Delta L_{it-1}^{z} - \beta\,\Delta L_{it}^{z}]$ and $[\Delta L_{it-2}^{z} - \beta\,\Delta L_{it-1}^{z}]$, where x=B and z=W for the blue-collar equation, x=W and z=B for the white-collar equation, and interactions with firm type dummies.

Introducing size effects in the specification has a varying impact on the adjustment cost differentials between MNFs and domestic firms. For instance, if θ equals -0.6, which represents a less than proportional size effect, we find no significant differences in labour adjustment costs between MNFs and domestic firms. However, considering a specification according to Meghir *et al.* (1996) (θ = -1.) or a specification with stronger size effects (θ = -1.2), we observe that, in contrast to the results with no firm effect, MNFs might suffer from adjustment cost disadvantages for both blue-collar and white-collar employment (the a^{B}_{MNF} and a^{W}_{MNF} become significantly positive) and their adjustment cost structure might become more asymmetric, implying larger downsizing costs relative to upsizing costs (the d^{B}_{MNF} and d^{W}_{MNF} become significantly negative).

Controlling for size leads to opposing conclusions about the difference in adjustment costs between MNFs and domestic firms. We therefore consider it hazardous to draw definite conclusions about the impact of firm size on the potential advantages or disadvantages in labour adjustment costs of MNFs compared to domestic firms.

5 Conclusion

Our empirical estimates of adjustment cost parameters point to a significant difference between multinationals and domestic firms. MNFs face lower adjustment costs for clerical employees than domestic firms. The difference in adjustment costs is much smaller for non-clerical employment. Together, these results indicate that, for a given negative shock, MNFs may more easily downsize employment than domestic firms, and more especially that white-collar employment volatility is greater in MNFs than in domestic firms.

To explain this difference, three main arguments can be raised. First, foreign MNFs may be less deeply rooted in the national economy than Belgian MNFs. We show that this explanation is not validated empirically; Belgian MNFs share the same adjustment cost parameters as foreign MNFs. Second, MNFs may be better able to use the legal procedures in favour of greater flexibility on the local labour market. We find that taking account of the importance of fixed-term contracts or early retirement slightly reduces the difference in adjustment costs between MNFs and domestic firms, but the difference remains very large.

Third, MNFs could have more bargaining power vis-à-vis unions. When controlling for the 50-employees threshold, above which union representation is compulsory, the difference in adjustment costs between MNFs and domestic firms disappears. However, this threshold may also capture labour indivisibility effects, i.e. employment adjustment is easier the larger the firm.

Behind these three arguments lies the more general issue of the firm's size. Görg and Strobl (2003) find that MNFs are as footloose as domestic firms when one controls for size. The estimate of a flexible specification of the adjustment cost function controlling for size clearly shows that the impact of size is very sensitive to the weight of firm size. The role of firm size and what specification is the most appropriate to take size into account are clear avenues for further research.

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Appendix A - construction of the dataset

In order to obtain a sample of multinationals and domestic firms, we focus on firms that report full annual accounts[24] over the period 1997-2007. More precisely, we restrict our attention to firms that have filed at least one complete set of annual accounts, have employed at least 10 employees over the period considered, have positive value added and nominal fixed assets over EUR 100.

This choice is motivated by the aim to obtain a sample of domestic firms with characteristics comparable to multinationals. Over the period 1997-2005, 95% of the companies identified as multinationals from the Survey on Foreign Direct Investment file full annual accounts. Therefore, in order to compare multinationals with a sample of comparable domestic firms, we consider the set of firms that file complete annual accounts. Since the Survey on Foreign Direct Investment is not exhaustive, we are aware that multinational firms which have not participated in the FDI survey may be seen as domestic firms,. We presume that this concerns a minority of cases.

We focus on manufacturing industries, construction and trade, market services and financial intermediation (i.e. two-digit 2003 NACE codes between 15 and 74). (i.e. two-digit NACE rev1.1 codes between 15 and 73). We exclude the sector "other business activities" (NACE code 74), which includes temporary employment agencies, because this could seriously bias our job flow estimates. We also restrict our sample to "profit maximising" firms, defined according to their legal form, e.g. we exclude non profit associations and public utilities.

We used annual and social reports, to construct data on the main balance sheet items such as total assets, value added, the capital stock (measured as the book value of tangible fixed assets) as well as gross employment flows by type of workers and by reason for leaving,

Adjustment of NACE codes and annual accounts

We use the 60 branches sector-level price indexes for value added and investment as deflators. We take the two-digit NACE rev1.1 codes provided in the annual accounts dataset. These are defined according to the main activity of the firm. Some firms may change their main activity during the period considered. We corrected temporary NACE codes to avoid discontinuity, and possible exclusion of firms for some estimation procedures. We use the following rule: firms that have two, three or four different NACE codes over the period 1996-2007 take a single NACE code over the entire period if the most frequently observed code is reported for at least 8 periods and the least observed ones for at most 2 periods. In this case, firms are given the most frequently observed NACE code for the entire period.[25]

In the majority of cases, firms in our sample file annual accounts that cover a period of 12 months from January to December. However, in some cases, their annual accounts overlap two (or

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[24] According to Belgian accounting legislation, a company falls within this category, in 2007, either when the yearly average of its workforce is at least 100 *or* when at least two of the following thresholds are exceeded: (1) yearly average of workforce is 50, (2) turnover (excluding VAT) amounts to at least EUR 7,300,000, (3) total assets exceed EUR 3,650,000. In general, the latter two thresholds are altered every four years in order to take account of inflation.
Less than 10% of the companies in Belgium report full annual accounts, but these represent most of the value added and employment.

[25] To have an idea of the importance of these corrections, in our sample of 31,341 firms, 20% firms have at least two different NACE codes before adjustment (5,703 have two NACE code, 482 have three, and 17 have four different NACE codes). After NACE code adjustment, 95% of firms have only one code, 1,364 firms have two NACE codes and 90 firms have three NACE codes.

more) calendar years. In order to obtain comparable series across firms and over time, use the appropriate yearly deflators, and ensure consistency when merging annual accounts data with other firm information such as FDI or foreign trade information, we annualise the annual accounts. Flows are adjusted by taking a weighted average of *t* and *t*-1 flows. Stocks are adjusted by adding to the current year's stocks the weighted change in stocks between the current year and the next year. The procedure attributes a missing value when there is not enough information to cover the entire year, for example when information about the first or last months of a given year is missing. This does not apply for the last year in which the firm is observed and for flows in the first year in which the firm is covered.[26]

Before annualising flow and stock variables in annual accounts, we perform a small set of corrections on the dataset. These involve some corrections to the date and year of the annual accounts,[27] in cases where the number of months covered by the annual account appears incorrect.[28]

Lastly, we extrapolate missing values by taking the average difference between the previous year and the next year. We allow up to two consecutive missing values.

We also extrapolate missing participation rates of inward and outward FDI. Missing observations may be due to a temporary drop below the reporting threshold, or to non-reporting. Given the highly stable participation rates, extrapolation is really a correction of the dataset and does not involve any significant assumptions.

Social Security Wage data

We obtain firm-level wage data by type of employee from the Social Security Data Warehouse. For confidentiality reasons, we ask for firm-year averages of annual remuneration and premia by type of workers, and number of employees per category. For cases that involve only one worker, we will not obtain the exact amount of wages and premia but the mean of the remuneration (or premium) class, defined in bands of EUR 500. These data are used to obtain our measures of wages (wages of blue-collar workers, wages of white-collar workers), as well as the number of employees by category of worker.

Consistency between the Social Security database and the annual accounts is not perfect because the former refers to the gross labour compensation received by the employee, while the latter is related to the employers' labour costs. Since our estimates refer to labour costs, we correct the wage measures obtained from social security by a proportionality factor.

We compute the ratio of total labour costs (account 62) and wage bill (account 620) using the data in the annual accounts and we use this ratio to convert the average wage received by the employee to the average wage paid by the firm. As we do not have a measure of total labour costs

[26] To have an idea of the importance of this phenomenon, note that in our sample of 31,430 firms over the 1996-2007 period, 16,694 always closed their annual accounts in December (31/12/xx), 2,554 always closed their annual accounts every 12 months but not in December, the remaining 12,182 firms followed an irregular pattern (for instance some or their accounts cover an accounting period other than 12 months). Therefore, the annual accounts of 47% of the firms in our sample have to be adjusted.

[27] For example, when the end date was 2 January 2005, we change it to 31 December 2004. By doing this we attribute the values reported in the annual accounts to the year 2004 instead of 2005.

[28] A limited number (48 observations) of errors in the number of months were identified based on inconsistency between flow variables and the number of months reported, or auditor reports. They may be due to encoding errors.

and direct labour costs by type of workers, the correction factor is the same for blue-collar and white-collar workers.

Trimming for outliers

Our base sample, used in Section 3 of the paper, is constructed as follows. First, we avoid major inconsistency between annual accounts and Social Security data by considering only firm-year observations where the ratio of the total wage bill reported in the annual accounts and that constructed from Social Security data lies between 0.532 and 1.114.[29] Second, in order to correct Social Security wages by the discrepancy between the wage bill and labour costs, we concentrate on firm-year observations where the ratio of total labour cost to the wage bill, as given in the annual accounts, is greater than one but smaller than 2.

Our trimmed sample, used in Section 4, further restricts the base sample in order to estimate production function coefficients as well as adjustment cost coefficients. Trimming for outliers is performed along the following lines. We exclude the 99th percentile of gross employment flows of blue-collar workers and of white-collar workers, which may capture takeover events. We drop the sector "other business activities", which includes temporary employment agencies, because this could seriously bias job flow estimates. We focus on observations where reported employment exits are consistent with the sum of reported exits due to lay-offs, those due to retirement, those due to early retirement, and those due to other reasons.

In order to estimate production function coefficients, we retain only firm-year observations where firms employ both blue-collar and white-collar workers, where the value of capital is above EUR 100 and intermediate consumption is positive. We finally eliminate outliers by keeping observations where the log of apparent labour productivity, the log of the ratio of real average wage bill over apparent labour productivity and the log of the capital-labour ratio, lie within the range defined by the median minus or plus three times the inter-quartile range. This criterion is applied by year and NACE 2 digit sectors. Lastly, we focus on firms with at least two consecutive observations.

Table A.1 reports the mean and median of employment, wages, productivity and capital intensity, for domestic firms, and MNFs comprising both Belgian and foreign MNFs. The last four columns of Table A.1 report the estimated difference and t-statistic with respect to purely domestic firms, controlling for size, $size_{it}$ measured by employment, sector and year. Specifically, we perform the following regressions[30]

$$x_{it} = a + b_B D_{it}^{MNF} + b_L size_{it} + \delta_s + \delta_t + \varepsilon_{it} \qquad \text{(a.1)}$$

and

$$x_{it} = a + b_B D_{it}^{Belgian\ MNF} + b_F D_{it}^{foreign\ MNF} + b_L size_{it} + \delta_s + \delta_t + \varepsilon_{it} \qquad \text{(a.2)}$$

[29] These thresholds represent the 2.5 and 97.5 percentile of the distribution of the ratio of the wage bill reported in the annual accounts and that constructed from the Social Security data.

[30] $size_{it}$ is omitted when x_{it} stands for employment.

Table A.1 - Descriptive statistics

	Unconditional		Conditional difference wrt domestic	
	Mean	Median	coef.	t-stat
number of employees				
Domestic	66.91	46.00		
MNF	212.27	141.00	139.96	108.39
Belgian MNF	201.70	123.00	126.43	53.62
Foreign MNF	216.00	147.00	144.76	98.56
percentage of white-collar workers				
Domestic	0.39	0.32		
MNF	0.48	0.42	0.13	43.40
Belgian MNF	0.44	0.37	0.11	21.18
Foreign MNF	0.49	0.44	0.14	41.08
average wage				
Domestic	38,014	37,221		
MNF	47,031	45,029	7,901	69.96
Belgian MNF	42,486	41,273	3,930	20.49
Foreign MNF	48,635	46,721	9,355	74.28
blue-collar wage				
Domestic	31,376	31,031		
MNF	35,647	34,569	2,305	26.29
Belgian MNF	33,064	32,432	22	0.15
Foreign MNF	36,559	35,322	3,141	32.05
white-collar wage				
Domestic	48,616	47,477		
MNF	59,023	57,434	7,862	50.15
Belgian MNF	54,340	52,843	3,359	12.59
Foreign MNF	60,676	59,123	9,512	54.31
apparent labour productivity				
Domestic	58,909	51,336		
MNF	84,071	69,200	26,707	54.56
Belgian MNF	73,202	62,981	16,853	20.20
Foreign MNF	87,907	72,478	30,318	55.34
TFP				
Domestic	42,836	38,259		
MNF	51,891	41,388	13,069	39.74
Belgian MNF	45,468	35,651	8,404	14.98
Foreign MNF	54,158	43,510	14,780	40.11
percentage of fixed-term contracts				
Domestic	0.032	0		
MNF	0.038	0.016	0.00	-1.95
Belgian MNF	0.032	0.010	-0.01	-4.20
Foreign MNF	0.041	0.019	0.00	-0.04
percentage of outflows due to early retirement				
Domestic	0.028	0		
MNF	0.059	0	0.02	11.70
Belgian MNF	0.051	0	0.01	3.76
Foreign MNF	0.062	0	0.02	12.17

Note: final sample trimmed for outliers as explained in Appendix, 58,594 observations and 8,688 firms over 1997-2007; 'conditional difference' reports the conditional difference and t-stat, controlling for firm employment, sector and year. The TFP figures are computed using the Ackerberg *et al.* (2006) procedure.

Appendix B

Table B.1 - Net employment flows

a. Total employment flows (in thousands)

	1998	1999	2000	2001	2002	2003	2004	2005
Total	23.1	13.8	21.4	0.9	-13.6	-1.1	7.7	-5.2
Firm entry	*3.6*	*3.3*	*3.3*	*3.2*	*4.2*	*1.1*	*1.4*	*0.5*
Ongoing firms	*27.7*	*21.8*	*37.2*	*9.0*	*-9.2*	*9.1*	*12.5*	*5.5*
Firm exit	*-8.2*	*-11.3*	*-19.0*	*-11.3*	*-8.5*	*-11.4*	*-6.2*	*-11.2*
Domestic firm	16.7	15.4	19.7	3.1	0.4	-1.0	6.1	-2.8
Firm entry	*3.6*	*3.2*	*3.3*	*3.2*	*4.2*	*0.7*	*1.4*	*0.3*
Ongoing firms	*20.0*	*22.3*	*25.0*	*8.5*	*4.2*	*5.6*	*8.6*	*5.5*
Firm exit	*-6.8*	*-10.2*	*-8.5*	*-8.6*	*-8.0*	*-7.3*	*-4.0*	*-8.6*
Belgian MNF	0.3	-2.3	-7.6	-2.9	-4.1	3.7	-2.4	-1.2
Firm entry								
Ongoing firms	*0.6*	*-2.1*	*2.2*	*-1.3*	*-4.0*	*3.7*	*-1.7*	*-0.7*
Firm exit	*-0.3*	*-0.2*	*-9.8*	*-1.6*	*-0.1*	*0.0*	*-0.7*	*-0.5*
Foreign MNF	6.1	0.7	9.3	0.7	-9.9	-3.8	4.0	-1.2
Firm entry	*0.0*	*0.1*	*0.0*	*0.0*		*0.4*		*0.2*
Ongoing firms	*7.1*	*1.6*	*10.0*	*1.8*	*-9.4*	*-0.2*	*5.5*	*0.7*
Firm exit	*-1.1*	*-0.9*	*-0.7*	*-1.1*	*-0.5*	*-4.0*	*-1.5*	*-2.1*

b. Average net employment flows (in units)

	1998	1999	2000	2001	2002	2003	2004	2005
All firms	2.1	1.2	1.9	0.1	-1.3	-0.1	0.7	-0.5
New firm	*37.4*	*45.3*	*43.1*	*46.2*	*97.1*	*48.5*	*90.6*	*47.3*
Ongoing firm	*2.5*	*2.0*	*3.4*	*0.8*	*-0.9*	*0.9*	*1.2*	*0.5*
Closing firm	*-56.9*	*-60.6*	*-101.8*	*-50.6*	*-42.2*	*-66.4*	*-38.9*	*-51.9*
Domestic firm	1.7	1.6	2.0	0.3	0.0	-0.1	0.7	-0.3
New firm	*37.5*	*44.9*	*43.5*	*46.4*	*97.1*	*35.0*	*90.6*	*30.9*
Ongoing firm	*2.1*	*2.3*	*2.6*	*0.9*	*0.5*	*0.6*	*1.0*	*0.6*
Closing firm	*-51.1*	*-58.9*	*-48.5*	*-42.5*	*-42.3*	*-48.3*	*-28.0*	*-44.7*
Belgian MNF	0.9	-6.6	-22.3	-6.7	-9.5	8.9	-5.9	-3.5
New firm								
Ongoing firm	*1.8*	*-6.2*	*6.5*	*-3.0*	*-9.4*	*9.1*	*-4.1*	*-2.1*
Closing firm	*-109.0*	*-78.5*	*-2438.3*	*-233.1*	*-33.5*	*-23.5*	*-352.5*	*-122.0*
Foreign MNF	6.2	0.8	8.8	0.5	-7.1	-2.6	2.9	-0.9
New firm	*29.0*	*72.0*	*17.0*	*26.0*		*138.7*		*195.0*
Ongoing firm	*7.4*	*1.6*	*9.6*	*1.3*	*-6.8*	*-0.2*	*3.9*	*0.6*
Closing firm	*-132.5*	*-83.5*	*-105.7*	*-78.1*	*-42.1*	*-223.1*	*-112.0*	*-111.2*

Note: The decomposition exercise is performed only up to 2005 as firm exits are defined only over the 1997-2005 period..

Table B.2 - Net employment flows of blue-collar workers

a. Total employment flows (in thousands)

	1998	1999	2000	2001	2002	2003	2004	2005
Total	9.7	3.0	15.0	-6.3	-10.0	0.4	4.2	-5.7
Firm entry	*2.1*	*1.7*	*1.8*	*0.5*	*1.9*	*0.7*	*0.5*	*0.3*
Ongoing firms	*11.7*	*7.4*	*19.5*	*-0.7*	*-7.8*	*5.6*	*6.5*	*-0.7*
Firm exit	*-4.1*	*-6.0*	*-6.3*	*-6.1*	*-4.1*	*-5.9*	*-2.8*	*-5.4*
Domestic firm	7.6	5.0	10.5	-1.1	-2.4	0.4	2.4	-2.1
Firm entry	*2.1*	*1.6*	*1.8*	*0.5*	*1.9*	*0.4*	*0.5*	*0.1*
Ongoing firms	*9.1*	*9.0*	*12.5*	*3.0*	*-0.5*	*3.9*	*3.6*	*1.9*
Firm exit	*-3.7*	*-5.7*	*-3.7*	*-4.6*	*-3.8*	*-3.8*	*-1.7*	*-4.2*
Belgian MNF	-0.4	-0.7	-1.1	-1.7	-0.2	1.1	-1.7	-1.3
Firm entry								
Ongoing firms	*-0.1*	*-0.6*	*1.3*	*-0.5*	*-0.2*	*1.1*	*-1.1*	*-1.0*
Firm exit	*-0.2*	*-0.1*	*-2.4*	*-1.2*	*0.0*	*0.0*	*-0.6*	*-0.3*
Foreign MNF	2.5	-1.2	5.5	-3.4	-7.3	-1.2	3.5	-2.3
Firm entry	*0.0*	*0.1*	*0.0*	*0.0*		*0.3*		*0.1*
Ongoing firms	*2.6*	*-1.0*	*5.7*	*-3.1*	*-7.1*	*0.6*	*4.0*	*-1.6*
Firm exit	*-0.2*	*-0.3*	*-0.2*	*-0.3*	*-0.2*	*-2.1*	*-0.6*	*-0.9*

b. Average net employment flows (in units)

	1998	1999	2000	2001	2002	2003	2004	2005
All firms	0.9	0.3	1.3	-0.6	-0.9	0.0	0.4	-0.6
New firm	*21.8*	*22.8*	*23.2*	*7.7*	*43.9*	*28.7*	*33.2*	*27.4*
Ongoing firm	*1.1*	*0.7*	*1.8*	*-0.1*	*-0.7*	*0.5*	*0.6*	*-0.1*
Closing firm	*-28.1*	*-32.4*	*-33.8*	*-27.4*	*-20.1*	*-34.6*	*-17.4*	*-24.8*
Domestic firm	0.8	0.5	1.1	-0.1	-0.3	0.0	0.3	-0.2
New firm	*21.9*	*22.3*	*23.3*	*7.5*	*43.9*	*18.2*	*33.2*	*15.7*
Ongoing firm	*1.0*	*0.9*	*1.3*	*0.3*	*-0.1*	*0.4*	*0.4*	*0.2*
Closing firm	*-27.5*	*-32.7*	*-21.2*	*-22.6*	*-20.3*	*-25.3*	*-11.5*	*-21.8*
Belgian MNF	-1.0	-2.1	-3.2	-4.0	-0.5	2.6	-4.2	-3.7
New firm								
Ongoing firm	*-0.3*	*-1.8*	*3.8*	*-1.2*	*-0.5*	*2.7*	*-2.8*	*-3.0*
Closing firm	*-80.7*	*-54.5*	*-589.3*	*-175.3*	*-5.0*	*-15.0*	*-278.0*	*-70.8*
Foreign MNF	2.6	-1.2	5.3	-2.6	-5.3	-0.8	2.5	-1.8
New firm	*8.0*	*56.0*	*14.0*	*17.0*		*99.0*		*133.0*
Ongoing firm	*2.7*	*-1.0*	*5.5*	*-2.4*	*-5.2*	*0.4*	*2.9*	*-1.2*
Closing firm	*-19.4*	*-23.3*	*-32.1*	*-22.4*	*-19.2*	*-114.8*	*-42.9*	*-45.8*

.

Table B.3 - Net employment flows of white-collar workers

a. Total employment flows (in thousands)

	1998	1999	2000	2001	2002	2003	2004	2005
Total	13.4	10.8	6.5	7.1	-3.6	-1.5	3.5	0.5
Firm entry	*1.5*	*1.6*	*1.5*	*2.7*	*2.3*	*0.5*	*0.9*	*0.2*
Ongoing firms	*16.1*	*14.4*	*17.7*	*9.6*	*-1.5*	*3.5*	*6.0*	*6.2*
Firm exit	*-4.1*	*-5.2*	*-12.7*	*-5.2*	*-4.5*	*-5.4*	*-3.4*	*-5.9*
Domestic firm	9.2	10.4	9.2	4.1	2.8	-1.4	3.6	-0.7
Firm entry	*1.5*	*1.6*	*1.5*	*2.7*	*2.3*	*0.3*	*0.9*	*0.1*
Ongoing firms	*10.8*	*13.3*	*12.5*	*5.5*	*4.7*	*1.7*	*5.1*	*3.6*
Firm exit	*-3.1*	*-4.5*	*-4.8*	*-4.0*	*-4.2*	*-3.5*	*-2.4*	*-4.4*
Belgian MNF	0.7	-1.6	-6.5	-1.2	-3.9	2.6	-0.7	0.1
Firm entry								
Ongoing firms	*0.8*	*-1.5*	*0.9*	*-0.7*	*-3.8*	*2.6*	*-0.5*	*0.3*
Firm exit	*-0.1*	*0.0*	*-7.4*	*-0.4*	*-0.1*	*0.0*	*-0.1*	*-0.2*
Foreign MNF	3.6	1.9	3.7	4.1	-2.6	-2.7	0.5	1.1
Firm entry	*0.0*	*0.0*	*0.0*	*0.0*		*0.1*		*0.1*
Ongoing firms	*4.5*	*2.6*	*4.2*	*4.9*	*-2.3*	*-0.8*	*1.4*	*2.3*
Firm exit	*-0.9*	*-0.7*	*-0.5*	*-0.8*	*-0.3*	*-1.9*	*-0.9*	*-1.2*

b. Average net employment flows (in units)

	1998	1999	2000	2001	2002	2003	2004	2005
All firms	1.2	1.0	0.6	0.6	-0.3	-0.1	0.3	0.0
New firm	*15.7*	*22.5*	*20.0*	*38.5*	*53.2*	*19.8*	*57.4*	*19.9*
Ongoing firm	*1.5*	*1.3*	*1.6*	*0.9*	*-0.1*	*0.3*	*0.6*	*0.6*
Closing firm	*-28.7*	*-28.2*	*-68.0*	*-23.3*	*-22.1*	*-31.8*	*-21.5*	*-27.2*
Domestic firm	0.9	1.1	0.9	0.4	0.3	-0.2	0.4	-0.1
New firm	*15.6*	*22.6*	*20.2*	*38.9*	*53.2*	*16.8*	*57.4*	*15.2*
Ongoing firm	*1.1*	*1.4*	*1.3*	*0.6*	*0.5*	*0.2*	*0.6*	*0.4*
Closing firm	*-23.7*	*-26.2*	*-27.3*	*-19.8*	*-22.0*	*-23.0*	*-16.4*	*-22.9*
Belgian MNF	1.9	-4.5	-19.1	-2.7	-9.0	6.3	-1.7	0.2
New firm								
Ongoing firm	*2.1*	*-4.4*	*2.7*	*-1.8*	*-8.9*	*6.3*	*-1.3*	*0.8*
Closing firm	*-28.3*	*-24.0*	*-1849.0*	*-57.9*	*-28.5*	*-8.5*	*-74.5*	*-51.3*
Foreign MNF	3.7	2.0	3.6	3.1	-1.9	-1.8	0.4	0.9
New firm	*21.0*	*16.0*	*3.0*	*9.0*		*39.7*		*62.0*
Ongoing firm	*4.6*	*2.7*	*4.1*	*3.7*	*-1.7*	*-0.6*	*1.0*	*1.8*
Closing firm	*-113.1*	*-60.2*	*-73.6*	*-55.7*	*-22.9*	*-108.2*	*-69.1*	*-65.4*

Appendix C. Estimates of production function coefficients

Estimates are based on the trimmed sample as explained in Appendix A. Table C.1 reports the number of observations and firms in the sample used to estimate production function coefficients. Table C.2 and C.3. report estimates of production coefficients, based on alternative procedures. Table C.2 reports estimates using the Ackerberg *et al.* (2006) procedure with alternative assumptions on labour flexibility. The first column reports our preferred specification. The estimates are based on the assumption that labour inputs do not fully adjust to current productivity shocks, consistently with our assumption of labour adjustment costs. The second column partly relaxes this assumption, allowing for blue-collar workers to adjust to current productivity shocks. The third column allows the employment of both blue-collar workers and white-collar workers to be flexible. We estimate standard errors using a bootstrap procedure.

Table C.3 compares our preferred estimates based on the Ackerberg *et al.* (2006) procedure, with those obtained using the Olley and Pakes (1996) and Levinsohn and Petrin (2003) methods. In the Olley-Pakes (1996) procedure a polynomial function of investment and capital is used to proxy for productivity. In the Levinsohn and Petrin (2003) approach, intermediate inputs are used in place of investment. In both cases, we control for survival bias, along the lines of Olley and Pakes (1996), and include year dummies.

Table C.1. Number of observations and firms in the base sample

Sector	# of obs.	# of firms
(1) Food and textiles	6449	918
(2) Wood, paper, chemicals, metal and non-metal products, machinery	14316	2013
(3) Equipment and recycling	3750	554
(4) Energy and construction	5913	871
(5) Trade and hotels and restaurants	20985	3254
(6) Communication and financial intermediation	5341	876
(7) Real estate and business activities	1840	308

Note: Final sample on 1997-2005; 58594 observations and 8688 firms.

Table C.2. Estimates of production coefficients using alternative procedures

	ACF			**ACF**			**ACF**		
	K, L^B and L^W fixed			K and L^W fixed, L^B flexible			K fixed, L^B and L^W flexible		
sector	α^K	α^B	α^W	α^K	α^B	α^W	α^K	α^B	α^W
1	0.178	0.424	0.388	0.120	0.664	0.350	0.138	0.569	0.351
	0.011	0.015	0.016	0.033	0.168	0.037	0.053	0.249	0.246
2	0.161	0.358	0.437	0.154	0.387	0.431	0.166	0.367	0.257
	0.006	0.009	0.009	0.009	0.040	0.012	0.024	0.080	0.243
3	0.138	0.354	0.433	0.102	0.637	0.406	0.119	0.643	0.242
	0.011	0.013	0.018	0.040	0.243	0.061	0.037	0.225	0.160
4	0.106	0.502	0.338	0.097	0.532	0.331	0.089	0.592	0.305
	0.007	0.007	0.006	0.010	0.056	0.017	0.015	0.203	0.145
5	0.126	0.176	0.561	0.120	0.208	0.560	0.138	0.167	0.422
	0.005	0.005	0.008	0.009	0.042	0.009	0.037	0.083	0.264
6	0.163	0.268	0.361	0.159	0.257	0.356	0.164	0.238	0.272
	0.005	0.006	0.007	0.012	0.170	0.024	0.018	0.078	0.153
7	0.179	0.071	0.612	0.173	0.101	0.618	0.188	0.105	0.408
	0.013	0.018	0.034	0.016	0.052	0.039	0.047	0.089	0.261

Note: Final sample on 1997-2005; 58594 observations and 8688 firms, standard errors in bracket.

K stands for the capital stock, L^B for the number of blue-collar workers, L^W for the number of white-collar workers.

ACF stands for Ackerberg *et al.* (2006), mean values and standard errors of the bootstrap estimates

Table C.3. Estimates of production coefficients using alternative procedures

	ACF			OP			LP		
sector	α^K	α^B	α^W	α^K	α^B	α^W	α^K	α^B	α^W
1	0.178	0.424	0.388	0.130	0.341	0.282	0.114	0.344	0.279
	0.011	0.015	0.016	0.020	0.007	0.007	0.018	0.007	0.007
2	0.161	0.358	0.437	0.077	0.310	0.312	0.083	0.319	0.315
	0.006	0.009	0.009	0.012	0.004	0.004	0.011	0.004	0.004
3	0.138	0.354	0.433	0.110	0.333	0.347	0.115	0.346	0.358
	0.011	0.013	0.018	0.026	0.009	0.008	0.019	0.008	0.008
4	0.106	0.502	0.338	0.048	0.428	0.274	0.051	0.430	0.267
	0.007	0.007	0.006	0.015	0.006	0.006	0.011	0.006	0.006
5	0.126	0.176	0.561	0.059	0.145	0.437	0.077	0.149	0.439
	0.005	0.005	0.008	0.012	0.003	0.004	0.009	0.003	0.004
6	0.163	0.268	0.361	0.091	0.224	0.323	0.099	0.235	0.314
	0.005	0.006	0.007	0.021	0.007	0.008	0.017	0.006	0.007
7	0.179	0.071	0.612	0.089	0.030	0.426	0.109	0.044	0.432
	0.013	0.018	0.034	0.032	0.011	0.015	0.027	0.010	0.014

Note: Final sample on 1997-2005; 58594 observations and 8688 firms, standard errors in bracket.
K stands for the capital stock, L^B for the number of blue-collar workers, L^W for the number of white-collar workers.
ACF stands for Ackerberg *et al.* (2006), OP for Olley and Pakes (1996) and LP for Levinsohn and Petrin (2003). For the ACF procedure, the table reports the mean values and the standard errors of the bootstrap estimates, assuming K, L^B and L^W fixed.

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