Spillovers From Multinationals to Domestic Firms: An Empirical Analysis of the Profitability Effects of Labour Flows

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Abstract

This paper uses linked employer-employee panel data to search for knowledge spillovers from multinationals to domestic firms. Explicit analysis of the profitability effects of labour flows between these firms indicates that hiring workers from foreign multinationals has a positive effect on both productivity and wages in local domestic firms. There is no net effect on profitability growth. More detailed analysis of the labour flows indicates that these effects are driven by hiring of relatively young workers. By contrast, separation of this group of relatively young employees from foreign MNEs leads to a negative profitability effect due to their higher than average influence on productivity and lower than average wages compared to staying workers in these firms. The results indicate that these workers are able to internalize the returns to productivity enhancing knowledge when moving from foreign MNEs to domestic firms.

JEL classification: J62, J24, F23, L25, D62
Keywords: Labour mobility; Multinational enterprises, Knowledge spillovers, Profitability, Linked employer-employee panel data

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1 Introduction

Spillovers from foreign to domestic firms are commonly cited as an argument in favour of policies to promote FDI in both developing and developed countries. These spillovers are expected to arise due to productivity advantages that multinational firms have over domestic firms. Such productivity advantages have been documented in several empirical studies (see Barba Navaretti and Venables, 2004). Theories of multinational firms imply that productivity advantages are due to the fact that these firms require some type of specific advantage to be able to profitably establish themselves in foreign markets (Dunning 1988, Markusen 2002). Such an advantage can arise from superior technological know-how, managerial knowledge, brand names etc. Recent theoretical work on heterogeneous firms also implies that only the most productive firms have the resources to set up their business in foreign countries (Helpman et al. 2004). To the extent that multinational firms are more productive due to knowledge that is implementable within other firms, there is a potential of spillover effects from multinational to domestic firms. If multinational firms are not able to capture the full return to such knowledge, it may be beneficial for the host country to promote FDI.

Potential channels for spillovers from multinational to domestic firms include: 1) backward and forward linkages between foreign owned and domestic firms, 2) demonstration effects and 3) labour mobility (Blomström and Kokko, 1998). Spillovers from foreign owned to domestic firms have mostly been studied by examining the effect of the presence of a multinational company in an industry on the productivity of domestic firms. The channels for these spillovers are more rarely considered, and the evidence on the productivity effects of the presence of a multinational company is not conclusive (Barba Navaretti and Venables, 2004). The studies that do consider the mechanisms through which spillovers occur, focus mainly on backward and forward linkages between firms (e.g. Smarzynska Javorcik, 2004; Aitken and Harrison, 1999). Also in these studies the evidence on productivity spillovers is mixed. Labour mobility as a channel for spillovers has been studied in papers by Görg and Strobl (2005) and Balsvik (2009) using data from Ghana and

Norway respectively. Both find positive productivity effects when employees move from multinational firms to domestic firms in the same industry[1].

This study searches for evidence of spillovers from multinational to domestic firms by examining hiring and separation of employees and the impact these have on firms' performance. It is important to note that the theoretical work on multinationals discussed above does not assume that multinationals are foreign owned, i.e. also domestically owned multinational companies may potentially be a source for spillovers. That is, the important difference is not between foreign and domestic ownership, but rather between multinationals and purely domestic firms, as emphasised e.g. by Bellak (2004). We decompose firm-level productivity change into the effects of hiring from foreign owned multinationals, domestic multinationals and purely domestic firms as well as the effects of separating workers and those who stay at the same firm. This bears a resemblance to the kind of decomposition used frequently to decompose industry level productivity change into the impacts of entry and exit of firms, and productivity growth in continuing firms. These kinds of methods have been popularised by e.g. Foster et al. (2001), but the decomposition we use is more closely related to formulas proposed by Maliranta (1997), Vainiomäki (1999) and Diewert and Fox (2007). A difference between the method we use and the earlier productivity decompositions is that while individual productivity cannot be directly observed, the decomposition forms the basis for an equation from which the relative productivities of the different employee groups can be estimated. A similar decomposition can be made for firm wage growth, and combining the productivity and wage growth decompositions provides us with an equation for firm profitability growth. This is particularly important when analysing knowledge transfer, since any potential externality may be internalised in the labour market. If hired workers are fully compensated for their contribution to productivity, there is no scope for profitability effects.

Our analysis is based on a detailed and comprehensive linked employer-employee panel data set from Statistics Finland. The data set covers basically all firms in all sectors in Finland and all of their employees. We analyse performance changes in the two-year

[1] Görg and Strobl (2005) only consider employees who set up their own firm after leaving the multinational.

intervals 1997-1999, 1999-2001 and 2001-2003. Our approach contributes to the literature on spillovers from foreign owned to domestic firms through labour mobility in a number of ways. Firstly, we utilise data on both the industrial and service sectors and, given the current importance of the service sector, are therefore able to provide a more complete picture of potential spillover effects. Secondly, we explicitly consider how the structure of the workforce is determined by studying both hiring and separation flows. By comparing productivity and wage effects, we are able to assess whether any potential productivity effect is an actual externality or whether spillovers are internalised in the labour market. Balsvik (2009) also studies both productivity and wage effects. However, in that study wage effects are examined at the individual level by comparing recent hires from multinationals to stayers in domestic firms. If the share of workers with experience in multinational firms increases the wage level of incumbent workers as in Poole (2010), the individual level wage premium will not be comparable to the productivity effect at the establishment level and will, therefore, not reveal the extent of the externality.

Our results show that hiring workers from foreign multinationals has a positive effect on both productivity and wages in local domestic firms. These effects cancel each other out, leading to no significant net effect on profitability. More detailed analysis of the labour flows indicates that these effects are driven by hiring of relatively young workers. By contrast, separation of this group of relatively young employees from foreign MNEs leads to a negative profitability effect on these firms due to their higher than average influence on productivity and lower than average wages compared to staying workers. The results indicate that these workers are able to internalise the returns to productivity enhancing knowledge when moving from foreign MNEs to domestic firms. A similar effect is observed for low tenured older workers who move from domestic multinationals to local domestic firms. Hiring of workers from domestic multinationals to foreign multinationals has a negative effect on profitability due to these workers' productivity being lower than that of the existing employees of foreign multinationals. This indicates that there are meaningful differences also between foreign and domestic multinationals.

The next section briefly reviews previous research related to this study, section 3 describes the empirical methodology and section 4 describes the data. Section 5 presents the results of our econometric analysis and section 6 concludes.

2 Previous research

Spillovers through labour mobility between multinational and domestic firms have been explicitly modelled in some recent theoretical contributions, but knowledge transfer related to FDI can also be thought of in the context of models of R&D spillovers.

Fosfuri et al. (2001) and Glass and Saggi (2002) develop models of spillovers from multinationals to domestic firms through labour mobility. The models imply a trade-off between technological and pecuniary spillovers to the local economy. The trade-off arises through the multinational firm's choice between allowing technology transfer and preventing it by paying the worker a premium. Models of R&D spillovers through worker mobility, such as those of Pakes and Nitzan (1983), Gersbach and Schmutzler (2003) and Franco and Filson (2006), are similar in spirit and also provide a framework for thinking of spillovers from foreign owned to domestic firms. These models incorporate the fact that employees gain access to valuable knowledge, which may benefit them later in their career.

The theoretical framework described above is based on workers moving from a firm with better possibilities for knowledge accumulation to firms where this knowledge is not available. If knowledge diffusion actually takes place from domestic to foreign firms, which could be the case e.g. if FDI were technology sourcing[2], workers would be expected to benefit from mobility in this direction.

[2] Driffield and Love (2003) study panel data on UK industries and find that such "reverse spillovers" exist. They do not, however, consider the mechanisms through which these spillovers arise. Ali-Yrkkö (2006) uses Finnish firm level data to study the effect of patents on the likelihood of being acquired by a foreign firm. He finds that owning patents correlates with becoming a target for a foreign firm, implying that technology sourcing also through labour mobility may be relevant.

Empirical evidence on knowledge spillovers from foreign to domestic firms through worker mobility is scarce. Using manufacturing data from Ghana, Görg and Strobl (2005) study productivity of firms run by owners who previously worked at multinational companies. As mentioned above, they find that companies managed by entrepreneurs with experience from a multinational in the same industry are more productive than other domestic companies. In the context of this study, the most relevant piece of prior evidence is provided by Balsvik (2009) who studies Norwegian manufacturing firms, and finds that a higher share of employees with experience in a multinational firm increases total factor productivity. Employees with experience in multinational firms also earn higher wages than their co-workers, but the wage premium received by these employees is lower than the effect that their employment share has on plant level productivity. As noted above, the productivity effect and wage effect in Balsvik (2009) are, however, not completely informative as to the extent of the possible externality. If the share of employees with experience from multinational firms also affects the wages of their co-workers in domestic firms as observed by Poole (2010), the observed contribution to establishment level productivity can be higher than the individual level wage difference even though their impact on the establishment's overall wage level may be closer to the productivity effect.[3] Previous empirical research on productivity spillovers from multinational firms has not included the service sector, which is arguably increasingly important.

In the general context of knowledge transfers, spillovers from foreign owned to domestic firms are also related to R&D spillovers. Empirical evidence on R&D spillovers through labour mobility is provided by, among others, Almeida and Kogut (1999) who study the mobility of patent holders between firms. They find that labour mobility does influence the transfer of knowledge and that the flow of knowledge seems to be embedded in regional labour networks. Møen (2005) studies R&D spillovers empirically in a human capital framework. He shows that workers pay for the possibility to accumulate knowledge in

[3] Poole (2010) studies knowledge spillovers indirectly by examining how wages of incumbent domestic-establishment workers increase as a function of the proportion of workers employed at the domestic establishment with some multinational experience. There are also some recent studies that analyse knowledge spillovers indirectly by looking at the effect of experience in foreign owned firms on individual employees' earnings at subsequent jobs. These are similar to the wage analysis in Balsvik (2009). These studies include Martins (2005) for Portugal, Pesola (2010) for Finland and Malchow- Møller et al. (2007) for Denmark.

R&D intensive firms by accepting lower wages early in their career. The return to these implicit investments is obtained later on, when wage increases reflect the increased value of their knowledge. Maliranta et al. (2009) use a similar decomposition as the current study to track knowledge spillovers through mobility of workers with R&D experience and find that hiring workers previously engaged in R&D into non-R&D activities increases both productivity and profitability.

3 Empirical methodology

In order to estimate the productivity and profitability effects of labour flows between foreign owned and domestic firms, we employ a variant of a micro-level productivity decomposition method, presented by Maliranta (1997), Vainiomäki (1999), Maliranta et al. (2009) as well as Diewert and Fox (2007). These authors have discussed the role of entry and exit of firms for productivity change, whereas Maliranta and Ilmakunnas (2005) and Ilmakunnas and Maliranta (2007) have developed this kind of decomposition to include entry and exit of employees, i.e. labour flows.

Our decomposition of firm level productivity change assumes that a firm's labour force in period 1 can be divided into workers who were employed by the firm in the previous period 0 and are still working at the firm, i.e., stayers (*stay*), and those who were not, i.e., were hired after 0 (*hire*). We assume that the firm's output (value added) in period 1 can be defined as the sum of outputs of staying and hired workers:

$$Y_1 = Y_{1,stay} + Y_{1,hire} \tag{1}$$

The firm's labour productivity is the average of labour productivities of the staying and hired workers, weighted by labour shares:

$$\frac{Y_1}{L_1} = \frac{L_{1,stay}}{L_1}\frac{Y_{1,stay}}{L_{1,stay}} + \frac{L_{1,hire}}{L_1}\frac{Y_{1,hire}}{L_{1,hire}} + \varepsilon_{Y/L,1}, \tag{2}$$

where $L_1 = L_{1,stay} + L_{1,hire}$ and the error term $\varepsilon_{Y/L,1}$ has been included to reflect approximation errors and unobservable factors in our formulation. The group of hired workers can further be divided into subgroups depending on what type of firm they were previously employed by (e.g. multinational/non-multinational). The firm's labour productivity level can then be expressed as follows:

$$\frac{Y_1}{L_1} = \frac{L_{1,stay}}{L_1}\frac{Y_{1,stay}}{L_{1,stay}} + \sum_e \frac{L_{1e,hire}}{L_1}\frac{Y_{1e,hire}}{L_{1e,hire}} + \varepsilon_{Y/L,1} \ , \qquad (3)$$

where *e* denotes type of previous employer. Because the shares of stayers and hired workers add up to one,

$$\frac{L_{1,stay}}{L_1} + \sum_e \frac{L_{1e,hire}}{L_1} = 1,$$

(3) can be written as follows:

$$\frac{Y_1}{L_1} = \frac{Y_{1,stay}}{L_{1,stay}} + \sum_e \frac{L_{1e,hire}}{L_1}\left(\frac{Y_{1e,hire}}{L_{1e,hire}} - \frac{Y_{1,stay}}{L_{1,stay}}\right) + \varepsilon_{Y/L,1}. \qquad (4)$$

Similarly, in period 0 the firm's work force consists of those workers who will stay in the firm at least up to period 1, i.e., stayers, and workers who will leave the firm before period 1 (*sepa).* Of course it holds that

$$L_{0,stay} = L_{1,stay} \ .$$

.

The labour productivity level of the firm in period 0 can then be written in an analogous way:

$$\frac{Y_0}{L_0} = \frac{Y_{0,stay}}{L_{0,stay}} + \frac{L_{0,sepa}}{L_0}\left(\frac{Y_{0,sepa}}{L_{0,sepa}} - \frac{Y_{0,stay}}{L_{0,stay}}\right) + \varepsilon_{Y/L,0}\,. \tag{5}$$

Equation (5) is simpler than (4), since the destination of the separating employees has no influence on productivity. We are interested in labour productivity growth, i.e., the difference in productivity level between periods 0 and 1, i.e.

$$\Delta\frac{Y}{L} = \frac{Y_1}{L_1} - \frac{Y_0}{L_0}\,. \tag{6}$$

Using (4) and (5) we obtain

$$\begin{aligned}&\frac{Y_1}{L_1} - \frac{Y_0}{L_0} = \\ &\frac{Y_{1,stay}}{L_{1,stay}} - \frac{Y_{0,stay}}{L_{0,stay}} + \\ &\sum_e \frac{L_{1e,hire}}{L_1}\left(\frac{Y_{1,e,hire}}{L_{1,e,hire}} - \frac{Y_{1,stay}}{L_{1,stay}}\right) + \\ &\frac{L_{0,sepa}}{L_0}\left(\frac{Y_{0,stay}}{L_{0,stay}} - \frac{Y_{0,sepa}}{L_{0,sepa}}\right) + \varepsilon_{Y/L,1} - \varepsilon_{Y/L,0}\end{aligned} \tag{7}$$

The first term on the right-hand side of the equation shows productivity growth attributable to staying workers. It can be thought of as accumulation of human capital through experience. A firm has a rapid productivity growth when a large proportion of workers have a high productivity growth. These workers may have human capital that enables them to adopt or develop more productive techniques[4].

The second set of terms indicates productivity effects of hiring workers from different types of firms. As can be seen from (7), hiring of workers from type *e* employers has a positive

[4] This effect can be called the Nelson-Phelps effect according to the seminal work by Nelson and Phelps (1966).

impact on productivity when these hired workers have a higher productivity level than the average staying workers. Newly hired workers may be more productive e.g. because they have acquired knowledge or skills when working for their previous employer. Adjustment costs related to hiring are implicitly included in our formulation. The relative productivity of the hired workers should therefore be understood as productivity net of adjustment costs.

Finally, the third term indicates productivity effects of employees that leave the firm between periods 0 and 1. Quite analogously to the hiring effect, separation of workers has a positive effect of productivity change when the average productivity level of these workers is lower than the average productivity level of stayers in period 0.

The terms of (7) can be turned into growth rates by dividing them by the average productivity level in the periods 0 and 1. The growth rate is then a close approximation of a more common log-difference, i.e.,

$$\frac{\Delta(Y/L)}{\overline{(Y/L)}} = \frac{Y_1/L_1 - Y_0/L_0}{0.5(Y_1/L_1 + Y_0/L_0)} \cong \ln\frac{Y_1/L_1}{Y_0/L_0} \qquad (8)$$

Besides labour productivity, we can use a similar decomposition for the average wage level in the firm by just replacing Y in the equations above with W.

In this paper we are particularly interested in profitability effects. Profitability is measured as follows:

$$\Pi = 1 + \frac{OPM}{W(1+a)} = \frac{Y}{W(1+a)} = \frac{Y/L}{(1+a)(W/L)} \qquad (9)$$

where OPM denotes operating margin $OPM=Y-W(1+a)$ where a is the ratio of payroll taxes to wages assumed to be constant over time and across worker groups. The growth rate of profitability is thus simply the difference between the growth rates of productivity and wages, which is approximated by

$$\frac{\Delta\Pi}{\overline{\Pi}} \cong \frac{\Delta(Y/L)}{\overline{(Y/L)}} - \frac{\Delta(W/L)}{\overline{(W/L)}} \quad , \tag{10}$$

where $\overline{(\Pi)} = 0.5[\Pi_0 + \Pi_1]$.

Without the error terms, equations (7) and (8), and corresponding equations for wage growth are in principle identities. We can observe the labour flows, but we do not know the productivities, so the equations cannot be used directly for assessing productivity differences between workers hired from different types of firms. There are some influences, however, that have not been taken into account that allow us to use the equations as a basis for estimating the productivities. First of all, there are likely to be differences across firms in the productivities of different worker groups. If we use (7) as a model for estimating parameters that correspond to the group specific productivities, we will estimate average productivities. Any firm differences will therefore be included in an error term. Secondly, so far we have not taken into account other inputs, especially capital that affect productivity. We will therefore include control variables Z to account for other exogenous influences on firm productivity, wage, and profits. Inclusion of a constant term takes into account productivity growth trend. After these observable influences are taken into account, the error accounts for all unobservables. We obtain the following estimation models:

$$\frac{\Delta(Y/L)}{\overline{(Y/L)}} = \alpha_{Y/L} + \sum\nolimits_e \beta_{(Y/L),e,hire} HR_e + \beta_{(Y/L),sepa} SR + \delta' \mathbf{Z} + \Delta\varepsilon_{Y/L} \tag{11}$$

$$\frac{\Delta(W/L)}{\overline{(W/L)}} = \alpha_{W/L} + \sum\nolimits_e \beta_{(W/L),e,hire} HR_e + \beta_{(W/L),sepa} SR + \delta' \mathbf{Z} + \Delta\varepsilon_{W/L} \tag{12}$$

where $\overline{(Y/L)} = 0.5[(Y_0/L_0) + (Y_1/L_1)]$ and $\overline{(W/L)} = 0.5[(W_0/L_0) + (W_1/L_1)]$

are the average productivity and wage levels, $HR_e = \frac{L_{1e,hire}}{L_1}$ and $SR = \frac{L_{0,sepa}}{L_0}$ are the hiring and separation rates. In the estimations, we use firm panel data, so the equations to be estimated will be indexed with i (firm) and t (period), which are not shown in (11)-(12).

The productivity and wage gaps between workers hired from different types of previous employment can then be interpreted from equations (11) and (12) as being:

$$\beta_{(Y/L),e,hire} = \frac{(Y/L)_{1,e,hire} - (Y/L)_{1,stay}}{\overline{(Y/L)}} \tag{13}$$

and

$$\beta_{(W/L),e,hire} = \frac{(W/L)_{1,e,hire} - (W/L)_{1,stay}}{\overline{(W/L)}} \ , \tag{14}$$

i.e. they measure the relative productivity and wage, respectively, of workers hired from type *e* firms compared to all staying workers. On the separation side, the estimable coefficients have similar interpretations:

$$\beta_{(Y/L),sepa} = \frac{(Y/L)_{0,stay} - (Y/L)_{0,sepa}}{\overline{(Y/L)}} \tag{15}$$

and

$$\beta_{(W/L),sepa} = \frac{(W/L)_{0,stay} - (W/L)_{0,sepa}}{\overline{(W/L)}} \ . \tag{16}$$

The intercept α indicates the growth rate among staying workers.

We also have the profitability change equation

$$\frac{\Delta\Pi}{\overline{\Pi}} = \alpha_{\Pi} + \sum\nolimits_{e} \beta_{(Y/L),e,hire} HR_{ej} + \beta_{(Y/L),sepa} SR + \delta' \mathbf{Z} + \Delta\varepsilon_{\Pi/L} \tag{17}$$

where the following approximations hold

$$\beta_{\Pi,e,hire} \approx \beta_{(Y/L),e,hire} - \beta_{(W/L),e,hire} \text{ and} \tag{18}$$

$$\beta_{\Pi,sepa} \approx \beta_{(Y/L),sepa} - \beta_{(W/L),sepa} \tag{19}$$

Since

$$\beta_{(Y/L),e,hire} = \frac{(Y/L)_{1e,hire} - (Y/L)_{1,stay}}{\overline{(Y/L)}} \approx \ln \frac{(Y/L)_{1e,hire}}{(Y/L)_{1,stay}} \tag{20}$$

and

$$\beta_{(W/L),e,hire} = \frac{(W/L)_{1e,hire} - (W/L)_{1,stay}}{\overline{(W/L)}} \approx \ln \frac{(W/L)_{1e,hire}}{(W/L)_{1,stay}} \tag{21}$$

we can write

$$\begin{aligned} &\beta_{\Pi,e,hire} \approx \ln \frac{(Y/L)_{1e,hire}}{(Y/L)_{1,stay}} - \ln \frac{(W/L)_{1e,hire}}{(W/L)_{1,stay}} = \ln \frac{(Y/W)_{1e,hire}}{(Y/W)_{1,stay}} \\ &\Leftrightarrow \beta_{\Pi,e,hire} \approx \ln \frac{\Pi_{1e,hire}}{\Pi_{1,stay}} \end{aligned} \tag{22}$$

which shows that the parameter of the hiring variable for workers hired from firm type e in the profit equation (17) can be interpreted as a measure of the profitability level of the these workers relative to stayers in period 1.

Analogously we obtain that

$$\beta_{\Pi,sepa} \approx \ln \frac{\Pi_{1,sepa}}{\Pi_{1,stay}}, \tag{23}$$

which provides us a measure of the relative profitability level of the separated workers before they leave.

It is straightforward to show that hired, staying and separating workers can be further divided into various subgroups by worker type. This is of interest when considering productivity and wage gaps not only based on type of previous employer but also on certain individual characteristics such as age and experience. Derivations for estimation equations with worker subgroups are provided in the appendix.

There are possible sources of bias when estimating the above model. First, there can be unobservable firm heterogeneity both in productivity and wage levels, which is correlated with employee characteristics (productivities and shares of different types of employees). For example, new firms often start with a new work force which only slowly evolves over

time (Haltiwanger et al., 1999, 2007). Therefore, firm vintage and worker cohorts tend to be tied together. Since we are using growth rates as the dependent variables, this is not an issue of great concern here. Assume that the error term in the productivity level for firm *i* in period *t* can be written as $\varepsilon_{Y/L,it} = \mu_{Y/L,i} + \nu_{Y/L,it}$, where $\mu_{Y/L,i}$ is the firm-specific, time-invariant unobservable that is correlated with the employee characteristics. When productivity growth is investigated, this component is eliminated in differencing, i.e. $\Delta\varepsilon_{Y/L,it} = \Delta\nu_{Y/L,it}$. A similar argument applies to the wage growth equation. Our approach is related to the use of long differences in fixed effects models (e.g. Griliches & Hausman, 1986). We define the growth rates and labour flows in three different two-year periods and pool them in estimation. We also control for some observable firm characteristics, included in *Z*.

Second, if there are time-varying unobservable firm differences in productivity and wage levels, they will show up in the growth rates. I.e., if the error is $\varepsilon_{Y/L,it} = \mu_{Y/L,it} + \nu_{Y/L,it}$, the unobservables are not eliminated in differencing: $\Delta\varepsilon_{Y/L,it} = \Delta\mu_{Y/L,it} + \Delta\nu_{Y/L,it}$. However, they are eliminated in the analysis of profitability change to the extent that the effects $\Delta\mu$ are equal in the productivity change and wage change equations. It seems reasonable to assume that high productivity growth firms are also high wage growth firms. In this case, $\Delta\varepsilon_{Y/L,it} - \Delta\varepsilon_{W/L,it} = \Delta\mu_{Y/L,it} + \Delta\nu_{Y/L,it} - \Delta\mu_{W/L,it} - \Delta\nu_{W/L,it} = \Delta\nu_{Y/L,it} - \Delta\nu_{W/L,it}$. This is also related to the issue of hiring and separation rates being based on firms' decisions and therefore possibly correlated with the error terms. For example, positive productivity shocks may lead to the hiring of new workers, which then causes an overestimate of their productivity effect (see Olley & Pakes, 1996; Levinsohn & Petrin, 2003). As we are examining hiring flows from different types of firms, shocks that change the propensity to hire new employees in general will not be a problem for interpreting the differences in the impact of hiring flows from various sources. However, if there is a productivity shock that only affects the probability of hiring workers from MNEs, this will bias the difference in the effects of the hiring flows. We have attempted to address this issue by using instrumental variables that take into account exogenous variations in labour supply in the local labour market. To instrument for hiring from foreign MNEs we used job destruction

in foreign MNEs in the area the hiring firm is located in, and similarly for hirings from domestic MNEs and purely domestic firms, we used job destruction in these types of firms in the vicinity of the hiring firm. While the instruments were somewhat correlated with the respective flows, they were very weak and our subsequent estimation results were not significant. It should, therefore, be kept in mind that the results cannot straightforwardly be interpreted as causal effects. In future work we will take the productivity shocks explicitly into account by estimating them using the method suggested by Olley and Pakes (1996). The shocks are in the second step inserted in differenced form as new variables in the models for productivity, wage, and profitability.

Third, there is heterogeneity across workers. This would not be an issue if the firms randomly chose new employees from the pool of applicants or randomly picked those who are laid off. This is not likely to be the case, however, since the firms look to hire the best applicants and lay off poor performers. Our hiring and separation flows may therefore be unrepresentative. However, the selection bias should affect productivity growth and wage growth in the same way if wage setting is based on productivity (see Hellerstein & Neumark, 2007) and therefore be eliminated when we examine their difference, i.e. the productivity wage gaps which directly relate to our measure of firm performance. In addition, as we are primarily interested in potential spillovers, and domestic firms can be expected to poach workers from multinational firms on purpose to gain access to their knowledge, we are not particularly interested in the impact of moving some random worker. Our results on productivity and wage effects should, therefore, not be interpreted as the effects of moving a random worker but can still be interesting in the context of spillovers.

Fourth, there can be productivity differences across firms in the productivity of a certain employee group. This can arise from decreasing returns. For example, extensive use of employees with multinational experience in a firm lowers their marginal productivity. There may also be genuine technological differences between firms or industries. These factors would imply that the coefficients vary across firms. We can still obtain an unbiased

estimate of the mean coefficient and account for the firm differences by correcting standard errors for clustering within firms.

Finally, price differences across firms may cause biases when a common deflator is used for all firms in an industry (see e.g. Foster et al., 2008). For example, the profitability level of a low-price firm will be underestimated and that of a high-price firm underestimated. However, to the extent that there are firm differences in price levels (but not in price growth), they are eliminated when profitability changes are examined.

4 Data

The unique identification codes for persons, companies and plants used in the different registers forms the backbone of the Finnish administrative register network and the Finnish statistical system. This provides an excellent opportunity to construct cross-sectionally and dynamically representative data for various research purposes by linking different administrative data sources (see Abowd & Kramarz, 1999).

The data for this study are drawn from the *Finnish Longitudinal Employer–Employee Data* (FLEED). The data set merges comprehensive administrative records of all labour force members as well as all employers/enterprises (including information also on their establishments) subject to value added tax (VAT). It can be complemented by a range of additional information from both private and public sources. FLEED currently covers the years 1990–2002 with near-perfect traceability of employers and employees across time. The employment statistics, educational statistics, taxation records, business register, financial statement statistics, manufacturing census as well as various surveys are among the original sources of the FLEED variables. To define the labour flows and changes in productivity, wage, and profitability, we use 2-year windows. The flows and changes are defined for the three periods 1997-99, 1999-2001 and 2001-2003. The observation period is restricted by the fact that information on foreign ownership is available from 1994 onwards. However, before this foreign ownership in Finland was scarce in any case due to strict regulations that were not abolished until 1992 (Golub, 2003). We restrict our observation

period to start in 1997 in order to allow for the possibility of some years of work experience in foreign owned firms before the observation period.

The observation unit is a firm. In principle we also have data on establishments, but information on value added, our preferred measure of output, and some other relevant variables, like capital intensity, about establishments are lacking beyond the manufacturing sector. Further, the links between employees and firms are more reliable than those between employees and establishments, especially in multi-unit firms.

Our estimation sample covers the industry sector and service sector. The industry sector consists of mining, manufacturing, public utilities and construction. The service sector comprises retail and wholesale trade, business services and personal services. Real estate and financial intermediation are excluded due to problems in measuring output in a reliable manner.

The dependent variables are defined as follows. Labour productivity growth is measured as a two-year rate of change in value added per employee, average wage growth is correspondingly a two-year rate of change in wage sum per employee, and change in profitability is a two-year relative change in value added per labour costs (wages and social security payments). These variables are measured in nominal terms, and price changes (and other industry-specific effects) are controlled by a set of industry dummies that are interacted with the period dummies.

The labour flows are based on comparisons of employees in the firms in two time periods, *t-1* and *t+1*, where *t* is 1998, 2000 or 2002. In our analysis, the hiring flows will be divided into groups according to the nationality of the hired worker's employer in *t-1*. The groups considered are 1) hires from foreign owned multinationals, 2) hires from domestically owned multinationals, 3) hires from local domestic firms, 4) hires from other employment and 5) hires from non-employment. Foreign owned multinationals are defined as firms that are at least 50 per cent owned by a foreign firm, domestically owned multinationals are Finnish firms that have majority owned subsidiaries abroad and local domestic firms are

firms that are neither foreign owned nor owners of foreign firms. We have excluded firms that experience a change in multinational status between years *t-1* and *t+1*. Appendix Table 1 shows the number of firms that undergo such changes during our observation period. Hires from other employment consist e.g. of employees hired from the public sector, and hires from non-employment include e.g. those hired following full-time studies or unemployment.

The staying and separating employees in a firm are, of course, by definition all related to an employer of the same nationality, but we run the estimations separately for local domestic firms, domestic multinationals and foreign multinationals to see if there are differences in the profitability, productivity and wage effects of different labour flows between different types of firms. We also conduct analyses in which we further split the labour flows according to a combination of age and tenure: 1) age max. 35 in *t-1*, 2) age over 35 in *t-1* and not employed in the same firm in *t-5*, 3) age over 35 in *t-1* and employed in the same firm in *t-5*.

The hiring rate HR_{ejit} for group e*j* is the number of new employees in firm *i* in the group (those in the firm in *t+1*, but not in *t-1*) divided by the number of all employees of the firm in *t+1*. The separation rate SR_{jit} is correspondingly the number of exited employees of firm *i* in group *j* (those in the firm in *t-1*, but no longer in *t+1*), divided by the number of all employees in the firm in *t-1*. When only considering differences amongst workers based on type of previous employment, i.e. when not dividing workers based on individual characteristics, the separation rate is obviously just the total number of exited employees in the firm divided by all employees in the firm in *t-1*. The share of stayers, $STAYSH_{jit}$, is the number of staying employees of firm *i* in group *j* (those in the firm both in *t-1* and *t+1*), divided by all stayers of the firm in *t-1*. The sum of these stayer shares is therefore one, so one of the groups is left out of the estimation. This also implies that when not dividing staying employees into groups, the stayer share is always one and is left out of the estimation.

As controls we use the various characteristics of the plants. We control for the log of capital per employee, which is entered in difference form to be consistent with the form of the dependent variables. The initial levels (in *t-1*) of log of value added per worker and log of average wage account for catching-up effect. We also control for the log of firm age. Finally, we include interacted industry and period dummies (35 industries) to account for, besides price changes, also the effects of idiosyncratic industry shocks, and likewise a set of dummies as controls for regional effects (20 regions).

Before conducting the econometric analysis we leave out some potentially erroneous observations that may distort our results. First, we remove those observations where the number of linked employees differs more than 10 per cent from the number of employees in the company data. This indicates that the linking of the individual and firm data is incomplete. Second, we remove some potentially influential outliers that we detect by using the method proposed by Hadi (1992; 1994). The method is useful for detecting multiple outliers in multivariate data. Identification of outliers is made on the basis of four variables: 1) the productivity growth rate, 2) the growth rate of average wage calculated from the company data, 3) the growth rate of employment according to company data and 4) the growth rate of employment according to individual data (the Employment Statistics). Wage growth is usually correlated with productivity growth, but sometimes they may be very different because of measurement errors in output and/or wages. The last two variables should be highly correlated with each other because they are essentially gauging the same thing, but may sometimes differ due to possible inaccuracies in the links between employees and their employers. The identified outliers (735 out of 17 694 firm-period observations at this stage) are removed from all estimations. In the baseline estimations we include firms that employ at least 20 persons. The main reason for leaving out the smaller firms is that their employment numbers are sometimes imputed on the basis of wages, which could badly distort the analysis in our setting. As discussed above, we conduct the estimations separately for local domestic firms, domestic MNEs and foreign MNEs. Our baseline estimations for domestic firms, domestic MNEs and foreign MNEs include 6350, 1390 and 1279 observations respectively.

5 Empirical analysis

5.1 Basic estimation results

Table 1 shows descriptive statistics for our basic estimation sample split by the type of firm. The total number of observations including domestic firms, domestic MNEs and foreign MNEs is 9019. Average end-year employment is highest in domestic MNEs, which can be related to the fact that foreign MNEs may only have one plant in Finland, whereas domestic MNEs often have several[5]. Both average labour productivity and earnings are highest in foreign multinationals and also higher in domestic multinationals than in local domestic firms. This is in line with previous research. Table 2 shows statistics regarding labour mobility in our estimation sample. We observe just under 5000 new hires by domestic firms from foreign MNEs and approximately 9000 hires by domestic firms from domestic MNEs. The average hiring rate is 29.2 per cent in domestic firms, 22.2 per cent in domestic MNEs and 24.6 per cent in foreign MNEs. As we discuss below, we use employment weights in estimation to account for the fact that small firms will have high flow rates and large firms will have low flow rates. The largest shares of hiring in all three types of firms come from domestic firms and non-employment. Most hires from non-employment are included in the group of young workers which implies that they are likely to be recent graduates. The shares of hiring from foreign and domestic MNEs are highest for foreign MNEs. The average separation rate is 25.5 per cent for domestic firms, 20.8 per cent for domestic MNEs and 23.1 per cent for foreign MNEs[6].

[Table 1 and Table 2 here]

Table 3 shows descriptive statistics separately for domestic firms that hire and do not hire employees from multinational firms. Firms with hiring flows from multinational firms are on average larger and have slightly higher average labour productivity and earnings. The

[5] The 20 person threshold used in the estimations refers to the average of start and end year employment in each period, whereas the figures in Table 1 refer to end year employment. This accounts for the 1st percentile for domestic firms being under 20.

[6] Note that hiring and separation figures underestimate total turnover, since e.g. hiring of an employee after the start of a two-year period and subsequent separation of the same employee before the end of the period is not included in the turnover rates.

differences are, however, much smaller than those shown in Table 1 between domestic firms and multinational firms. For firms that hire from multinationals, the average number of hired workers is 1.3 from foreign MNEs and 2.4 from domestic MNEs. Conditional on positive hiring from foreign MNEs, domestic firms hire on average 2.3 workers from these firms and conditional on positive hiring from domestic MNEs, domestic firms hire on average 3.0 workers from them.

[Table 3 here]

Based on previous literature on spillovers from multinational firms to local firms discussed above, our main interest lies in analysing labour flows from multinationals, both foreign and domestically owned, to local domestic firms. However, there may also be potential for reverse spillovers, e.g. if FDI is technology sourcing, so we conduct the estimations separately for local domestic firms, domestic multinationals and foreign multinationals. We have also done the analysis using pooled data on all the firms with interactions for multinational status. The results are in line with those presented here, and therefore we use the current set up for ease of exposition. All the estimations we analyse here are weighted using firm employment (the average of the initial and the last year's employment). A justification for using weighting comes from the fact that we are interested in the profitability and productivity effects of the employment flows. Unweighted estimation gives equal weight to large firms with low flow rates and small firms that have high flow rates but account for a small share of employment.

Table 4 shows the results for our basic estimations of profitability, productivity and wage equations for local domestic firms. Here we split hiring flows based on type of previous employment, i.e. we do not yet take individual characteristics into account. The results show that employees hired from foreign multinationals are indeed relatively more productive than continuing workers, which is in line with e.g. Balsvik's (2009) previous findings. However, when examining the related wage changes we find that these workers are also paid more than staying workers, and thus explicitly comparing these two results leads to an insignificant difference in their impacts on profitability. When comparing the

coefficients for different types of hiring flows[7], we note that employees hired from foreign MNEs have a statistically significantly higher impact on productivity than e.g. hiring from domestic firms. The difference between the productivity effects of hiring from foreign and domestic MNEs are not significant, with the coefficient on flows from domestic MNEs imprecisely estimated.

[Table 4 here]

The results in Table 4 also show that employees hired from all other types of employment be it in or outside the business sector are paid more than stayers, but their productivity effects are not significant. Higher wages for recruits from other purely domestic firms and outside the business sector with no compensating productivity effect lead to negative effects on profitability. Hires from non-employment, e.g. full-time studies and unemployment have a negative effect on productivity, but these workers also earn lower wages and thus there is no adverse profitability effect. On the separation side we may note that exiting workers have on average higher productivity than stayers, i.e. the productivity effect of them leaving is negative, but these workers were also earning more than the average stayer, so their effect on profitability is not significant.

Table 5 presents the results of the same estimations for domestically owned multinational firms. The signs on different hiring flows are similar to those in local domestic firms, but the effects are not statistically significant. Interestingly, domestic multinationals appear to be able to achieve productivity and profitability gains through separation of workers. Separating workers are on average less productive than stayers and with no wage effect this leads directly to a profitability increase when they leave. We also run our basic estimations separately for foreign MNEs. The results are reported in Table 6 where we can observe indications of the productivity advantages of foreign firms documented in previous literature. Hiring from domestic MNEs has a negative effect on both productivity and profitability of foreign MNEs which would be expected if foreign firms are more productive, i.e. if the advantage is not multinationality, but being foreign owned.

[7] See Appendix Table 2

[Table 5 and Table 6 here]

5.2 Results for disaggregated labour flows

In this section we discuss estimations of profitability, productivity and wage equations where labour flows are further divided based on age and/or tenure of the workers. As discussed in section 4, we split workers into three categories: "Young", i.e. at most 35 years old in *t-1*, "Old with low tenure", i.e. over 35 in *t-1* and not employed by the same firm in *t-5* and "Old with high tenure", i.e. over 35 in *t-1* and employed in the same firm in *t-5*. Tenure is not defined for workers from outside the business sector, i.e. those from "Other employment" and obviously also not available for hires from non-employment. These flows are only divided based on age. Considering the age limit of 35, our labels of "young" and "old" are obviously used purely for convenience. The reference group for staying workers is the group of young workers. As above, hiring flows are also divided based on type of previous employment, and the estimations are run separately for domestic firms, domestic multinationals and foreign multinationals. We present here the results for labour flows in domestic firms, the results for multinationals can be found in the appendix.

Table 7 reports results for estimation of profitability, productivity and wage equations for domestic firms. We can see that the positive productivity and wage effects found in Table 4 for hiring from foreign MNEs are driven by hiring of younger workers. We also see that there is a positive productivity effect accompanied by a similar wage effect for hiring of older employees with relatively short tenure from domestic MNEs. This effect did not show up in our more aggregate results above. However, neither hiring from foreign or domestic MNEs has a net effect on profitability. Hiring of short tenured older workers from other domestic firms and young employees from employment outside the business sector both have a negative effect on profitability, with the first effect driven by low productivity and the latter by high wages relative to stayers. We can also see that the low wage, low productivity hiring flows from non-employment observed in Table 4 are driven by hiring of

young workers, i.e. this effect is most likely due to people moving from full-time studies into employment. The net effect on profitability for these flows is again insignificant.

[Table 7 here]

In line with our more aggregate results in Table 4, separations do not affect profitability. The results show that the negative productivity and wage effects of job leavers arise from young workers leaving, i.e. these workers have higher productivity and higher wages than the average stayer. There are no differences between the contributions of older stayers to profitability and productivity changes as compared to the reference group of young staying workers, and marginally lower wage growth in these groups compared to the reference group.

Results for similar estimations for domestic MNEs and foreign MNEs can be found in the appendix. The results for domestic MNEs are similar to those for domestic firms with most of the differences between the two types of firms apparent already in our more aggregate results above. The negative profitability effects of separation in foreign MNEs observed in Table 6 are driven by highly productive young workers leaving. The difference in their contribution to productivity compared to stayers is significantly higher than the difference in wages between these two groups. This may be indicative of foreign MNEs losing recently trained productive young employees and implies that Balsvik's (2009) finding of future movers to MNEs having lower wages may not reveal the whole picture. Interestingly, as seen in Table 7, domestic firms need to pay young workers hired from foreign MNEs according to their productivity. Thus, if there is knowledge transfer from foreign MNEs to domestic firms taking place through mobility of these young workers, the workers appear able to internalise the returns to this knowledge when changing jobs. These findings could be interpreted in the context of a Loewenstein and Spletzer (1998) type model, where employees do not realise the full return to training until they change jobs.

5.3 Robustness checks

In this section we discuss some robustness checks related to the set-up of our data and empirical specifications. First we consider labour flows split based on educational background instead of age and tenure. This should enable us to gauge whether productivity effects of experience in MNEs are related to skill level. This could be the case if the knowledge being transferred is e.g. related to management practices. New hires are grouped based on multinational status of their previous employer as well as educational level, and staying and separating workers are grouped based on educational level. The education levels considered are comprehensive, intermediate and university level. Otherwise the specifications used in the analysis are the same as those in the previous section.

The results do not indicate significant profitability effects for most labour flows, but there are, however, some findings worth noting[8]. Hiring of highly educated workers from foreign MNEs into purely domestic firms has a positive effect on wages but no corresponding effect on productivity. This leads to a negative profitability effect for hiring of these workers. However, highly educated workers who stay with the firm have a positive and significant effect on productivity. These results are in line with evidence in Maliranta and Asplund (2007), where it is shown that hiring highly educated workers is initially costly to the firm, but that these workers contribute markedly to productivity growth in the long run due to the strong positive effect of the share of staying highly educated workers. This is consistent with the so-called Nelson–Phelps hypothesis mentioned in section 3, i.e. highly educated workers may have human capital that enables them to promote technical change and productivity growth in a firm. Also consistent with the analysis of Maliranta and Asplund (2007), separation of highly educated workers has a positive effect on profitability in domestic firms as well as in both domestic and foreign MNEs.

Secondly, we extend our basic analysis of the previous section to include firms with at least 10 employees instead of the previous 20 person limit. This basically adds to our group of domestic firms, and we find that our previous results of e.g. positive productivity and wage effects of hiring from foreign MNEs are robust to this change. Consistent with the results

[8] Results not shown, available on request.

above, the wage effect offsets the productivity effect leading to no change in profitability growth.

6 Conclusions

This study has searched for evidence of spillovers from multinational to domestic firms by examining hiring and separation of employees and the impact these have on firms' performance. The analysis is based on detailed linked employer-employee panel data which enables explicit comparison of productivity and wage effects. This focus on profitability allows us to assess the extent to which potential knowledge flows from multinational firms are actual spillovers as opposed to being internalised by the labour market. We are also able to distinguish between domestic firms, domestically owned multinationals and foreign owned multinationals and can therefore study whether there are differences based on multinational status and not ownership per se.

The results show that hiring workers from foreign multinationals is related to both higher productivity and higher wages in local domestic firms. These effects cancel each other out, leading to no significant net impact on profitability. More detailed analysis of the labour flows indicates that these findings are driven by hiring of relatively young workers. By contrast, separation of this group of relatively young employees from foreign MNEs is related to a negative profitability effect due to their higher than average influence on productivity and lower than average wages compared to staying workers in these firms. The results indicate that these workers are able to internalise the returns to productivity enhancing knowledge when moving from foreign MNEs to domestic firms. However, due care should be taken when interpreting these results in case there are unobserved productivity shocks that are related to hiring flows from a specific type of firm. Hiring of workers from domestic multinationals to foreign multinationals has a negative effect on profitability due to these workers' productivity being lower than that of the existing employees of foreign multinationals. This indicates that there are meaningful differences also between foreign and domestic multinationals. In future work we will modify the estimation by first estimating the productivity shocks and inserting them as new variables in the models for productivity, wage, and profitability.

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Tables

Table 1 Descriptive statistics

	N	Average	St.Dev	p1	Median	p99
Local domestic firms						
Employment	6350	60	109	18	35	436
Labour productivity	6350	46 468	32 418	16 917	41 097	131 580
Monthly earnings	6350	2 136	572	1 160	2 061	4 039
Profitability growth rate	6350	-0.029	0.196	-0.639	-0.022	0.523
Labour productivity growth rate	6350	0.026	0.238	-0.644	0.031	0.683
Wage growth rate	6350	0.064	0.149	-0.383	0.064	0.488
Log change in capital per labour	6350	0.050	0.555	-1.526	0.010	1.849
Domestic multinationals						
Employment	1390	396	1152	20	124	5348
Labour productivity	1390	63 818	46 308	14 991	52 288	285 795
Monthly earnings	1390	2 624	604	1 492	2 555	4 400
Profitability growth rate	1390	-0.019	0.256	-0.768	-0.020	0.816
Labour productivity growth rate	1390	0.046	0.279	-0.711	0.045	0.887
Wage growth rate	1390	0.072	0.099	-0.209	0.072	0.344
Log change in capital per labour	1390	-0.033	0.484	-1.405	-0.024	1.538
Foreign multinationals						
Employment	1279	178	326	20	73	1703
Labour productivity	1279	74 627	68 671	16 812	61 105	347 184
Monthly earnings	1279	3 035	984	1 460	2 870	6 268
Profitability growth rate	1279	-0.017	0.278	-0.903	-0.010	0.796
Labour productivity growth rate	1279	0.043	0.304	-0.918	0.048	0.928
Wage growth rate	1279	0.070	0.116	-0.298	0.069	0.421
Log change in capital per labour	1279	-0.127	0.630	-2.105	-0.097	2.048

Note: Labour productivity, monthly earnings and employment are end year values

Table 2 Labour mobility

	Local domestic firms			Domestic MNE			Foreign MNE		
	Average share	Average #	Total #	Average share	Average #	Total #	Average share	Average #	Total #
Hire, from For. MNE	0.012	0.77	4 919	0.016	4.59	6 380	0.043	6.49	8 295
Hire, from Dom. MNE	0.021	1.42	9 019	0.043	15.56	21 630	0.033	5.95	7 605
Hire, from Dom.	0.108	6.22	39 489	0.067	20.13	27 984	0.078	12.38	15 828
Hire, from other empl.	0.007	0.40	2 530	0.004	1.07	1 489	0.004	0.60	763
Hire, from non-empl.	0.143	8.68	55 087	0.092	34.51	47 965	0.088	17.09	21 858
Separated	0.255	14.07	89 373	0.208	76.51	106 344	0.231	40.09	51 280

Note: Hired shares are shares of end-year total employment, shares of separated workers are shares of start-year employment. Number of total hires and separations includes flows in all three observation periods: 1997-1999, 1999-2001 and 2001-2003.

Table 3 Descriptive statistics for local domestic firms by type of hiring

	Local domestic firms that hire from multinational firms			Local domestic firms with no hiring from multinational firms		
	Observations	Average	St.dev.	Observations	Average	St.dev.
Employment	3 769	77	138	2 581	35	22
Labour productivity	3 769	48 339	38 928	2 581	43 736	18 987
Monthly earnings	3 769	2 209	625	2 581	2 030	463
Profitability growth rate	3 769	-0.03	0.21	2 581	-0.03	0.18
Labour productivity growth rate	3 769	0.03	0.25	2 581	0.02	0.22
Wage growth rate	3 769	0.07	0.15	2 581	0.06	0.15
Log change in capital per labour	3 769	0.05	0.56	2 581	0.06	0.55
Share of hired, from For. MNE	3 769	0.02	0.03	2 581	0	0
Share of hired, from Dom. MNE	3 769	0.04	0.04	2 581	0	0
Share of hired, from Dom.	3 769	0.12	0.10	2 581	0.09	0.09
Share of hired, from other empl.	3 769	0.01	0.02	2 581	0.01	0.02
Share of hired, from non-empl.	3 769	0.15	0.11	2 581	0.13	0.10
Share of separated	3 769	0.27	0.16	2 581	0.23	0.14
Number of hired, from For. MNE	3 769	1.31	3.20	2 581	0	0
Number of hired, from Dom. MNE	3 769	2.39	5.72	2 581	0	0
Number of hired, from Dom.	3 769	8.48	17.00	2 581	2.92	3.06
Number of hired, from other empl.	3 769	0.50	1.28	2 581	0.24	0.58
Number of hired, from non-empl.	3 769	11.53	25.55	2 581	4.51	4.24
Separated	3 769	18.22	38.29	2 581	8.02	7.08

Note: Hired shares are shares of end-year total employment, shares of separated workers are shares of start-year employment. Labour productivity, monthly earnings and employment are end-year values

Table 4 Profitability, productivity and wage equations for local domestic firms

	Profits	Productivity	Wages
Hire, from For.MNE	-0.152	0.308**	0.424***
	(0.153)	(0.145)	(0.0967)
Hire, from Dom.MNE	0.00137	0.196	0.212***
	(0.105)	(0.127)	(0.0657)
Hire, from Dom.	-0.105***	-0.0267	0.0705**
	(0.0399)	(0.0458)	(0.0274)
Hire, from Other Emp.	-0.324*	-0.108	0.279**
	(0.185)	(0.229)	(0.136)
Hire, from Non-Emp.	0.0324	-0.178***	-0.217***
	(0.0388)	(0.0456)	(0.0304)
Separated	0.0170	-0.0878***	-0.124***
	(0.0364)	(0.0323)	(0.0205)
Observations	6350	6350	6350
R-squared	0.143	0.182	0.236

Notes:

1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2. Other variables include the initial wage and productivity levels (in logs), log change in capital per labor, regional dummies and interactions of industry and period dummies. Employment weighted estimation. Firms with at least 20 employees included.

Table 5 Profitability, productivity and wage equations for domestic MNEs

	Profits	Productivity	Wages
Hire, from For.MNE	-0.147	0.317	0.248
	(0.473)	(0.521)	(0.194)
Hire, from Dom.MNE	0.0871	0.152	0.0822
	(0.224)	(0.264)	(0.0915)
Hire, from Dom.	-0.302	-0.441*	-0.105
	(0.207)	(0.258)	(0.147)
Hire, from Other Emp.	-1.087	-1.852	-0.811
	(1.165)	(1.278)	(0.583)
Hire, from Non-Emp.	-0.312*	-0.582**	-0.247
	(0.176)	(0.269)	(0.158)
Separated	0.296**	0.313**	0.0543
	(0.127)	(0.139)	(0.0413)
Observations	1390	1390	1390
R-squared	0.458	0.436	0.389

Notes:

1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2. Other variables include the initial wage and productivity levels (in logs), log change in capital per labor, regional dummies and interactions of industry and period dummies. Employment weighted estimation. Firms with at least 20 employees included.

Table 6 Profitability, productivity and wage equations for foreign MNEs

	Profits	Productivity	Wages
Hire, from For.MNE	0.214	0.377	0.162
	(0.192)	(0.251)	(0.111)
Hire, from Dom.MNE	-0.481**	-0.624***	-0.0934
	(0.213)	(0.186)	(0.0916)
Hire, from Dom.	0.279	0.309	0.0914
	(0.185)	(0.211)	(0.101)
Hire, from Other Emp.	-1.280	-1.198	0.171
	(1.076)	(1.134)	(0.543)
Hire, from Non-Emp.	-0.151	-0.427**	-0.289***
	(0.176)	(0.213)	(0.104)
Separated	-0.194*	-0.220	-0.0215
	(0.105)	(0.136)	(0.0532)
Observations	1279	1279	1279
R-squared	0.559	0.545	0.223

Notes:

1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2. Other variables include the initial wage and productivity levels (in logs), log change in capital per labor, regional dummies and interactions of industry and period dummies. Employment weighted estimation. Firms with at least 20 employees included.

Table 7 Profitability, productivity and wage equations for local domestic firms: labour flows by age/tenure group

	Profits	Productivity	Wages
Hire, from For.MNE/Young	-0.129	0.462**	0.618***
	(0.183)	(0.225)	(0.143)
Hire, from For.MNE/Old/Low Tenure	-0.408	0.0475	0.333
	(0.329)	(0.327)	(0.222)
Hire, from For.MNE/Old/High Tenure	-0.0124	0.210	0.122
	(0.384)	(0.329)	(0.164)
Hire, from Dom.MNE/Young	-0.0616	0.0191	0.119
	(0.170)	(0.198)	(0.0969)
Hire, from Dom.MNE/Old/Low Tenure	0.176	0.509**	0.301*
	(0.214)	(0.259)	(0.165)
Hire, from Dom.MNE/Old/High Tenure	-0.143	0.229	0.398**
	(0.234)	(0.298)	(0.171)
Hire, from Dom./Young	-0.0646	-0.0601	0.0138
	(0.0564)	(0.0670)	(0.0409)
Hire, from Dom./Old/Low Tenure	-0.255***	-0.158*	0.0753
	(0.0883)	(0.0947)	(0.0646)
Hire, from Dom./Old/High Tenure	-0.0610	0.218*	0.237***
	(0.126)	(0.125)	(0.0756)
Hire, from Other Emp./Young	-0.594*	-0.355	0.374*
	(0.312)	(0.371)	(0.218)
Hire, from Other Emp./Old	-0.0976	0.0647	0.140
	(0.249)	(0.296)	(0.177)
Hire, from Non-Emp./Young	0.0768	-0.199***	-0.263***
	(0.0504)	(0.0580)	(0.0411)
Hire, from Non-Emp./Old	0.00433	-0.0613	-0.107*
	(0.0753)	(0.0928)	(0.0586)
Sep., Young	-0.0189	-0.139***	-0.170***
	(0.0518)	(0.0442)	(0.0283)
Sep., Old/Low Tenure	0.0577	0.0320	-0.0130
	(0.0560)	(0.0609)	(0.0370)
Sep., Old/High Tenure	-0.00709	-0.137	-0.118**
	(0.0685)	(0.0869)	(0.0533)
Stay, Old/Low Tenure	0.0155	-0.0403	-0.0290
	(0.0413)	(0.0259)	(0.0182)
Stay, Old/High Tenure	-0.0230	-0.0325	-0.0115
	(0.0258)	(0.0300)	(0.0159)
Observations	6350	6350	6350
R-squared	0.146	0.184	0.245

1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2. Other variables include the initial wage and productivity levels (in logs), log change in capital per labor, regional dummies and interactions of industry and period dummies. Employment weighted estimation. Firms with at least 20 employees included.

Appendix

Derivation of estimation equations with worker subgroups

When dividing all workers into M different groups j = 1, … , M based on individual characteristics such as age and experience, we obtain the following estimation equations[9]:

$$\frac{\Delta(Y/L)}{\overline{(Y/L)}} = \alpha_{Y/L} + \sum_e \sum_j \beta_{(Y/L),e,j,hire} HR_{ej} + \sum_j \beta_{(Y/L),j,sepa} SR_j + \sum_j^{M-1} \chi_{(Y/L),j,stay} STAYSH_j + \delta' \mathbf{Z} + \varepsilon \quad (24)$$

$$\frac{\Delta(W/L)}{\overline{(W/L)}} = \alpha_{W/L} + \sum_e \sum_j \beta_{(W/L),e,j,hire} HR_{ej} + \sum_j \beta_{(Y/L),j,sepa} SR_j + \sum_j^{M-1} \chi_{(Y/L),j,stay} STAYSH_j + \delta' \mathbf{Z} + \varepsilon \quad (25)$$

where $HR_{ej} = \frac{L_{1ej,hire}}{L_1}$ and $SR_j = \frac{L_{0,j,sepa}}{L_0}$ are the hiring and separation rates in worker groups and $STAYSH_j = \frac{L_{0,j,stay}}{\sum_j L_{0,j,stay}}$ is the share of each group of workers among staying workers.

The coefficients of the hiring and separation rates are now interpreted as labour productivity effects of hiring and separating workers in each group, compared to (all) staying workers:

$$\beta_{(Y/L),e,j,hire} = \frac{(Y/L)_{1,e,j,hire} - (Y/L)_{1,stay}}{\overline{(Y/L)}} \text{ and} \quad (26)$$

$$\beta_{(Y/L),j,sepa} = \frac{(Y/L)_{0,stay} - (Y/L)_{0,j,sepa}}{\overline{(Y/L)}} \ . \quad (27)$$

and the wage equation coefficients are analogous wage effects. Now the intercept α indicates the growth rate in the reference group of stayers and the coefficients of the

[9] For derivations in a model without employer types, see Ilmakunnas and Maliranta (2007).

included $STAYSH_j$ variables (M–1 group variables) indicate differences in the growth rate in the reference group and in group j.

We further obtain the profitability change equation

$$\frac{\Delta(\Pi / L)}{(\Pi / L)} = \alpha + \sum_e \sum_j \beta_{(Y/L),e,j,hire} HR_{ej} + \sum_j \beta_{(Y/L),j,sepa} SR_j + \sum_j^{M-1} \chi_{(Y/L),j,stay} STAYSH_j + \delta' \mathbf{Z} + \varepsilon \quad (28)$$

where the coefficient of a hiring rate is interpreted as the difference of the productivity and wage effects of the worker type in question, and similarly on the separation side.

Appendix Table 1 Firms' ownership status

		Year t			
Status in t-1	**Status in t+1**	**1998**	**2000**	**2002**	**Total**
Domestic	Domestic	4,057	4,638	4,713	13,408
Domestic MNE	Domestic MNE	456	571	664	1,691
Foreign MNE	Foreign MNE	515	589	656	1,760
Domestic	Domestic MNE	102	174	131	407
Domestic	Foreign MNE	47	52	22	121
Domestic MNE	Foreign MNE	15	21	23	59
Domestic MNE	Domestic	51	36	45	132
Foreign MNE	Domestic MNE	63	6	10	79
Foreign MNE	Domestic	40	8	11	59
Total		**5,346**	**6,095**	**6,275**	**17,716**

Appendix Table 2
Comparisons of domestic firms' productivity effects of hiring from different sources

		Comparison to hiring from				
		For. MNE	Dom. MNE	Domestic	Other Empl.	Non-Empl.
Hiring by domestic firms from	For. MNE		0.112	0.335**	0.416	0.486***
			(0.202)	(0.154)	(0.271)	(0.151)
	Dom. MNE	-0.112		0.223	0.304	0.374***
		(0.202)		(0.134)	(0.265)	(0.139)
	Domestic	-0.335**	-0.223		0.082	0.151**
		(0.154)	(0.134)		(0.237)	(0.063)
	Other Empl.	-0.416	-0.304	-0.082		0.07
		(0.271)	(0.265)	(0.237)		(0.236)
	Non-Empl.	-0.486***	-0.374***	-0.151**	-0.07	
		(0.151)	(0.139)	(0.063)	(0.236)	

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table 3 Profitability, productivity and wage equations for domestic MNEs: labour flows by age/tenure group

	Profits	Productivity	Wages
Hire, from For.MNE/Young	-0.142	0.425	0.535
	(0.827)	(0.892)	(0.389)
Hire, from For.MNE/Old/Low Tenure	0.307	0.573	-0.271
	(0.408)	(0.448)	(0.190)
Hire, from For.MNE/Old/High Tenure	-1.250	-0.733	0.562
	(1.722)	(1.927)	(0.479)
Hire, from Dom.MNE/Young	-0.114	-0.311	-0.118
	(0.520)	(0.654)	(0.419)
Hire, from Dom.MNE/Old/Low Tenure	0.563	0.694	0.120
	(0.397)	(0.473)	(0.155)
Hire, from Dom.MNE/Old/High Tenure	-1.106**	-0.689	0.400
	(0.447)	(0.508)	(0.257)
Hire, from Dom./Young	0.322	0.229	0.0235
	(0.325)	(0.388)	(0.212)
Hire, from Dom./Old/Low Tenure	-1.346***	-1.556***	-0.229
	(0.521)	(0.570)	(0.218)
Hire, from Dom./Old/High Tenure	-0.631	-0.871	-0.490
	(0.519)	(0.554)	(0.455)
Hire, from Other Emp./Young	-2.621	-3.765*	-1.372
	(2.040)	(2.122)	(0.860)
Hire, from Other Emp./Old	1.049	-0.114	-1.556
	(1.890)	(2.189)	(1.043)
Hire, from Non-Emp./Young	-0.344	-0.833**	-0.474**
	(0.267)	(0.394)	(0.222)
Hire, from Non-Emp./Old	-0.261	-0.351	-0.0170
	(0.494)	(0.501)	(0.171)
Sep., Young	-0.0151	0.0173	-0.100
	(0.205)	(0.218)	(0.0900)
Sep., Old/Low Tenure	0.709***	0.802***	0.262**
	(0.210)	(0.247)	(0.115)
Sep., Old/High Tenure	0.380	0.276	0.0276
	(0.358)	(0.337)	(0.102)
Stay, Old/Low Tenure	-0.132	-0.217**	-0.137***
	(0.0978)	(0.104)	(0.0370)
Stay, Old/High Tenure	-0.0296	-0.0685	-0.0997***
	(0.0979)	(0.105)	(0.0321)
Observations	1390	1390	1390
R-squared	0.474	0.453	0.415

1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2. Other variables include the initial wage and productivity levels (in logs), log change in capital per labor, regional dummies and interactions of industry and period dummies. Employment weighted estimation. Firms with at least 20 employees included.

Appendix Table 4 Profitability, productivity and wage equations for foreign MNEs: labour flows by age/tenure group

	Profits	Productivity	Wages
Hire, from For.MNE/Young	-0.00856	0.148	0.0976
	(0.365)	(0.401)	(0.193)
Hire, from For.MNE/Old/Low Tenure	0.357	0.742	0.230
	(0.514)	(0.565)	(0.204)
Hire, from For.MNE/Old/High Tenure	0.233	0.0879	0.0275
	(0.501)	(0.569)	(0.224)
Hire, from Dom.MNE/Young	0.102	0.391	0.367*
	(0.354)	(0.409)	(0.220)
Hire, from Dom.MNE/Old/Low Tenure	-0.803	-1.292	-0.209
	(0.592)	(0.807)	(0.344)
Hire, from Dom.MNE/Old/High Tenure	-1.062**	-1.620***	-0.621**
	(0.500)	(0.507)	(0.272)
Hire, from Dom./Young	0.473*	0.545*	0.144
	(0.254)	(0.281)	(0.127)
Hire, from Dom./Old/Low Tenure	-0.113	-0.105	0.147
	(0.665)	(0.665)	(0.188)
Hire, from Dom./Old/High Tenure	-0.104	-0.360	-0.377
	(0.755)	(0.966)	(0.431)
Hire, from Other Emp./Young	-0.391	-2.192	-1.198
	(1.825)	(1.860)	(0.907)
Hire, from Other Emp./Old	-2.025	-1.672	0.308
	(1.547)	(1.667)	(0.664)
Hire, from Non-Emp./Young	-0.224	-0.677***	-0.518***
	(0.235)	(0.257)	(0.110)
Hire, from Non-Emp./Old	0.711	0.700	-0.0139
	(0.518)	(0.548)	(0.244)
Sep., Young	-0.415**	-0.551***	-0.149**
	(0.174)	(0.198)	(0.0758)
Sep., Old/Low Tenure	-0.0374	0.144	0.168**
	(0.233)	(0.254)	(0.0854)
Sep., Old/High Tenure	0.0622	0.0726	0.0626
	(0.217)	(0.288)	(0.108)
Stay, Old/Low Tenure	-0.0956	-0.143	-0.0757*
	(0.0855)	(0.0913)	(0.0386)
Stay, Old/High Tenure	-0.0550	-0.102	-0.0766*
	(0.0815)	(0.0909)	(0.0401)
Observations	1279	1279	1279
R-squared	0.565	0.556	0.261

1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

2. Other variables include the initial wage and productivity levels (in logs), log change in capital per labor, regional dummies and interactions of industry and period dummies. Employment weighted estimation. Firms with at least 20 employees included.