DISCUSSION PAPER SERIES

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ABSTRACT

Wage Gains from Foreign Ownership: Evidence from Linked Employer–Employee Data

We compare wages in multinational enterprises (MNEs) versus domestic firms, the earnings of domestic firm workers with past, future and no MNE experience, and estimate how the presence of ex-MNE peers affects the earnings of domestic firm employees. The analysis relies on monthly panel data covering half of the Hungarian population and their employers in 2003–2011. We identify the returns to MNE experience from changes of ownership, wages paid by new firms of different ownership, and the movement of workers between enterprises. We find high contemporaneous and lagged returns to MNE experience and significant spillover effects. Foreign acquisition has a moderate wage impact but there is a wide gap between new MNEs and domestic firms. The findings suggest that MNE experience is valued in the high-wage segment of the local economy, connected with the MNEs via worker turnover.

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1. Introduction

We study the direct and indirect wage effects of work experience in multinational enterprises (MNEs) using monthly panel data from Hungary, 2003–2011. The wage premium of MNE workers over similar domestic-sector employees in similar firms is an indisputable gain for the society, especially if it is portable and exerts positive spillover effects. While corporate revenues can easily find their way back home via profit repatriation and transfer pricing, and many MNEs are provided with an initial tax holiday, the wage surplus generated by foreign direct investment predominantly remains and is spent in the host country.

Our benchmark models follow a route paved by Aitken and Harrison (1999), Lipsey and Sjöholm (2004), Barry et al. (2005) and especially Balsvik (2011) and Poole (2013), who used linked employer–employee data similar to ours to study wage spillovers in Norway and Brazil, respectively. We first estimate the foreign-domestic wage gap using a model with both worker and firm fixed effects (2FE henceforth). We then compare domestic firm employees with recent experience in MNEs versus domestic enterprises (other than their current employers) controlling *inter alia* for attributes of the sending and receiving firms and jobs. Finally, we estimate spillover effects for incumbent domestic firm employees, controlling for observed and unobserved worker and firm characteristics. The detailed analysis relates to workers employed in high-skill jobs at least once during their observed careers. We briefly discuss some results on less-skilled workers.

We go beyond replicating the results of Balsvik and Poole by confronting the benchmark models with several points of admittedly justified criticism. The first problem is that the 2FE models identify the foreign-domestic wage gap from observations on a minuscule and non-randomly selected minority of firms undergoing foreign or domestic acquisition. In our sample, 5.3 percent of the observed firms changed majority owner during the period of observation. These companies paid significantly higher wages than "always domestic" firms (when they were domestic) and significantly lower wages than "always foreign" companies (when they were foreign-owned): this is how the 2FE model arrives at a close-to-zero estimate of the ownership-specific wage gap. To learn about the sources of a much wider gap between incumbent firms, we utilize information on newly established and subsequently incumbent MNEs and domestic enterprises.

Second, improvements in model quality also come at the cost of distortions in the sample and a significant loss of observations when we estimate the wage advantage of ex-MNE employees in domestic firms. Only about 7 percent of the person-months in our data make it to the estimation sample of a model in which work histories and characteristics of the sending and receiving firms are adequately controlled. We experiment with a less demanding "overlapping cohorts" model, which treats the current earnings of future MNE workers as a counterfactual for post-MNE earnings, and makes a similar comparison of workers with past and future outside experience in the domestic sector.

Finally, a selection problem also arises when the study of spillover effects is restricted to observations on incumbents—domestic workers with no outside experience at all. In an alternative specification, the identification of within-firm spillovers is ensured using a 2FE model.[1]

Section 2 briefly discusses previous findings on the paper's topic, and prewarns the reader of our own estimates. Section 3 introduces the data and the local context. Section 4 discusses estimation

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[1] When we estimate the model for incumbents, the worker fixed effects absorb the unobserved firm characteristics.

issues and Section 5 presents the results. Section 6 adds supplementary and alternative estimations. Section 7 sums up the results and argues that the empirical findings, taken together, yield support to a 'skills diffusion' scenario in which MNE employees accumulate valuable knowledge that spreads in a segment (but not in entirety) of the local economy through the channels of worker turnover.

2. Previous findings on the foreign-domestic wage gap, lagged returns and spillovers

Estimates of the foreign-domestic wage gap vary in a wide range, with the MNE premium found to be nearly negligible in the most developed market economies. In Norway, the OLS estimate by Balsvik (2011), controlled for worker and plant characteristics amounts to 3 percent, which falls to 0.3 percent once she includes worker fixed effects. An OLS estimate for Sweden by Heyman et al. (2007) is even lower at 2 percent. Andrews et al. (2007) and Malchow-Moller et al. (2007) detect positive gaps in the range of 1 and 3 percent in Germany and Denmark. The OLS estimate of Martins (2004) for Portugal is higher (11 percent), but he finds that the MNE wage premium virtually disappears after controlling for worker selection. These figures compare to 32 percent (pooled OLS for all skill levels) and 13 percent (after adding worker fixed effects) in our sample. Workers moving from domestic to foreign-owned firms are estimated to gain 6 percent in Germany and 8 percent in Norway (Andrews et al. 2007, Balsvik 2011) which compares to 53 percent in the Hungarian sample for all skill levels.[2]

The foreign-domestic gap is much wider in less developed countries: according to raw data presented in Lipsey and Sjöholm (2004), in Indonesian manufacturing, the MNE premium amounts to 47 percent for blue collars and 55 percent for white collars (41 and 73 percent in Hungary). Chen at al. (2017) reports a gap of 40 percent in Chinese manufacturing. An overview of data in OECD (2008a), based on the World Bank Enterprise Survey indicates raw gaps of between 40 and 50 percent in Africa, Asia, the Middle East and combining all these regions and adding Central and Eastern Europe.

A more detailed analysis of the sources of the gaps in Germany, Portugal, the UK and Brazil (OECD 2008b) finds that the marginal effect of takeovers on wages falls short of 3 percent in all of these countries.[3] The effects identified using data on worker mobility are more substantial: the estimates vary between 6 and 8 percent in Germany and the UK, more than 10 percent in Portugal, and 20 percent in Brazil. The authors argue that the discrepancy between the estimates based on takeovers versus worker flows are explained by foreign firms' propensity to share their productivity advantage more extensively with new workers than with workers who do not change firms. We believe that the difference instead roots in the non-random selection of firms to acquisition as will be discussed in more detail later.

To our knowledge, Balsvik's paper is the only one estimating the wage advantage of ex-MNE employees in domestic firms. She identifies a premium of 6.9 percent for workers with three or more years of tenure in an MNE compared to stayers. However, she also detects an advantage of 3.3 percent on the part of workers arriving from local firms, suggesting a net benefit from MNE experience of 3.6 percent (and smaller advantages in case of shorter completed tenure in the

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[2] Note that in the Norwegian case, workers moving from MNEs to domestic firms also acquire a gain of 7 percent, while in our sample they lose 11 percent. The median loss amounts to 26 percent in the case of skilled workers. See Table 3.
[3] Earle and Telegdy (2008) estimate a 7-percent wage gain from foreign acquisition using Hungarian data for a model with firm fixed effects and firm-specific trends.

previous job). We find that domestic firm employees, who left an MNE because of mass dismissals, closure or relocation earn more than their ex-domestic counterparts by 14 percent, while the average difference between the two groups of newcomers amounts to 7 percent.

The empirical evidence on wage and productivity spillovers are mixed. Starting with papers that depict a not too rosy picture of how MNEs affect the rest of the economy, Aitken and Harrison (1999) and Djankov and Hoekman (2000) identify positive direct effect of foreign ownership on productivity in Venezuela and the Czech Republic, but negative spillovers. Results by Konings (2001) suggest that the adverse competition effect is stronger than the positive direct productivity effect of FDI in Bulgaria, Romania and Poland. Barry et al. (2005) found that foreign presence in a sector hurt wages and productivity in domestic exporting firms in the same industry (but has no effect on wages in domestic non-exporters) in Ireland. Fons-Rosen at al. (2017) concludes that in six advanced European countries, positive spillovers are restricted to sectors where domestic enterprises are technologically close to MNEs. Suyanto and Bloch (2014) find the opposite in Indonesia. Keller and Yeaple (2009) detect significant worker-level wage spillovers only in high-skill-intensive industries in US manufacturing.

At the same time, several studies have identified positive spillovers. Using Lithuanian data, Smarzynska-Javorcik (2004) detects positive productivity spillovers from MNEs to local suppliers. Similarly, Gorodnichenko et al. (2014) find that backward linkages have a positive effect on the productivity of domestic firms (while horizontal and forward linkages show no consistent effect) in 17 transition countries. Kosová (2010) demonstrates, using Czech data, that crowding out is short-term: after an initial shock, domestic firm growth accelerates and survival rates improve. Görg and Strobel (2005) show that in Ghana, entrepreneurs with MNE experience start more productive small businesses than others.

One can also find indirect evidence on spillovers, taking into account that MNEs are more productive and more likely to export and engage in R&D. Stoyanov and Zubanov (2012) show that (in Denmark) workers from more productive firms experience productivity gains. Similar results are presented for Hungary by Csáfordi et al. (2018). Mion and Opromolla (2013) show that export experience implies higher export performance and a sizable wage premium for Portuguese managers, who leave for non-exporters. In Finland, Maliranta et al. (2008) identify a positive impact of hiring workers with previous R&D experience to non-R&D jobs.

Importantly, from this paper's point of view, Poole (2013) estimates that the wages of incumbent domestic workers rise by about 0.6 percent if the share of ex-MNE employees increases by 10 percent, while the effect of outside experience in local firms is about ten times weaker than that. While the effect she estimates is not particularly strong, it is statistically significant at conventional levels even after controlling for the observed and unobserved attributes of workers and firms.

3. Data

3.1. Data sources

Our estimation samples have been drawn from a large longitudinal data set covering a randomly chosen 50 percent of Hungary's population aged 5–74 in January 2003. Each person in the sample is followed, on a monthly basis, from January 2003 until December 2011 or exit from the registers for reasons of death or permanent out-migration. The data collect information from records of the

Pension Directorate, the Tax Office, the Health Insurance Fund, the Office of Education and the Public Employment Service. We use information on the highest paying job of a given person in a given month, days in work and amounts earned in that job. The wage figure comprises all payments received during the month in the highest paying job. Throughout the paper, we use daily wages (the monthly figure divided by days in work) normalized for the national average in the given month. Furthermore, we have data on occupation, type of the employment relationship, registration at a labor office, receipt of transfers and several proxies of the person's state of health. We do not observe educational attainment—this is approximated with the highest occupational status the person achieved in 2003–2011.[4] Annual financial data of the employer are available for incorporated firms. We regard a firm as MNE if foreigners' share in subscribed capital exceeds 50 percent.[5]

We restrict the analysis to skilled workers employed with a labor contract at least once in a foreign or domestic private enterprise the employment level of which exceeded the ten workers limit at least once in 2003–2011. We have several reasons to set a size limit. First, foreign firms are nearly absent in the small firm sector.[6] Second, financial data are not available for sole proprietorships and unincorporated small businesses. Third, the financial reports of incorporated small firms are often incomplete and erroneous. Finally, the earnings data of small firms are flawed by the practice of paying "disguised" minimum wages.[7] The inclusion of small firms would also raise the risk of measurement error in the analysis of spillover effects since the probability of not observing an ex-MNE employee in a 50-percent sample is much higher in small establishments. We iteratively removed workers and firms with less than two data points, zero wages and missing covariates.

After these steps of data cleaning, we are left with a sample of 19,961,622 person-months belonging to 344,203 skilled workers and 119,580 firms. 52.6 percent of the workers had at least one spell of employment in the foreign sector of which 21.5 percent worked only in MNEs. We draw special sub-samples from this starting population for the study of lagged returns and spillover effects. Descriptive statistics are presented in Table A1 of the Appendix.

3.2. MNEs in Hungary

In the first decade after the start of the transition, Hungary was the most successful country within the former Soviet bloc in attracting foreign capital. By 2003, the beginning of our period of observation, cumulative FDI inflows exceeded 40 percent of the GDP,[8] multinationals employed 15 percent of the labor force (including self-employment and the public sector into the denominator) and more than 30 percent of private sector employees. They produced 20 percent of the GDP and delivered over two-thirds of the exports (Balatoni and Pitz 2012). Large multinationals, including Audi, General Motors and Suzuki, dominated the motor industry, and

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[4] See Appendix Table A2 for variable definitions.
[5] Setting the limit elsewhere does not affect the results, since 93 percent of the firms with nonzero foreign presence are majority foreign-owned.
[6] In 2014, MNEs had a 4.5 percent employment share in the 1-10 workers category. (Authors' calculation based on the 2014 Q4 wave of the Labor Force Survey).
[7] This term hints at the practice of paying workers the minimum wage (subject to taxation) and the rest of their remuneration in cash. Elek et al. (2012) estimate that in 2006 the share of workers paid in this way amounted to 20 percent in firms employing 5–10 workers, 10 percent in slightly higher firms (11–20 workers) and less than 3 percent in larger enterprises.
[8] UNECE 2001, pp. 190.

foreign presence was already significant in the tobacco, leather, chemical, rubber and electronics industries, with employment shares of between 50 and 80 percent.

Table 1: Foreign ownership in Hungary, 2003

	Fraction employed in MNEs (percent of all person-months in the given industry)		Industrial composition of MNEs (percent of all person-months in the MNE sector)	
	All workers	Skilled workers	All workers	Skilled workers
Agriculture	5.0	6.1	0.8	0.5
Manufacturing	46.5	48.4	59.9	40.5
Construction	7.7	10.6	1.5	1.9
Energy, water, gas	57.5	55.6	3.3	3.1
Wholesale and retail trade	25.9	34.5	16.3	31.5
Finance and insurance	52.7	80.0	11.4	11.5
Services	20.7	24.3	6.8	11.0
Average/Total	34.8	37.6	*100.0*	*100.0*

The data are annual averages observed in the estimation sample in 2003. The number of person-months amount to 8,704,486 (all workers) and 2,068,556 (skilled workers).

Almost three-fourths of the cumulative FDI inflows have arrived in sectors outside of manufacturing. As shown in column 4 of Table 1, nearly 60 percent of the skilled employees within the MNE sector worked in the tertiary sector. Therefore, we do not restrict the analysis to manufacturing, as most papers do in the strand of the literature we follow (see Barry et al. 2005, Görg and Strobl 2005, Lipsey and Sjöholm 2004, Smarzynska-Javorcik 2004 and Balsvik 2011 as opposed to Poole 2013, whose study covers all sectors in Brazil). While FDI typically boosts exports and generates demand for domestic manufacturers producing intermediate goods, its contribution to the quality of retail trade, banking and services can be equally important, especially in the former state socialist countries, which started the transition with critically undeveloped non-tradable sectors.

Table 2: Domestic firms connected with MNEs via worker turnover in 2003-2011

	Domestic employers of		
Fraction connected with MNEs:	Unskilled	Middling workers	Skilled
Unweighted mean (domestic employers=100)	8.1	38.2	37.2
Weighted mean (domestic firm employees =100)	53.0	88.6	69.0

The data cover 156,626 domestic firms. A firm is classified as connected if it employed at least one worker with past MNE experience in 2003-2011. Companies changing majority owner are excluded.

The foreign-owned and domestic parts of the economy are closely connected via labor turnover. In the skilled labor market, 37.2 percent of the domestic firms, employing 69 percent of the domestic labor force, hired at least one ex-MNE worker in 2003–2011 (Table 2). The magnitudes are similar in the case of medium-skilled labor but substantially lower in the case of the unskilled market where 91.9 percent of the firms did not employ ex-MNE workers in the observed period. These firms are typically small as suggested by the contrast between the unweighted and weighted means.

3.3. Descriptive statistics on wages and wage change

Table 3 presents raw statistics on wage levels across ownership categories and wage changes associated with skilled workers' shifts between the categories. The data shows huge differences

between workers in MNEs versus domestic firms, on the one hand, and domestic firm employees hired from MNEs versus workers coming from other domestic enterprises, on the other.

Table 3: Descriptive statistics: Wage levels and wage changes of skilled workers

	Mean	St. dev.	Observations
Wage levels			
Employer = MNE	3.09	2.88	7,937,675[a]
Employer = Domestic firm	1.43	1.61	12,023,947[a]
Wage change upon leaving an MNE for a domestic firm			
- mean	-0.57	1.46	42,479[b]
- median	-0.26	..	42,479[b]
Wage change upon leaving a domestic firm for an MNE			
- mean	0.64	1.26	46,590[b]
- median	0.39	..	46,590[b]
Wages of domestic firm employees with outside experience			
Previous employer = MNE	1.71	1.93	963,075[a]
Previous employer = domestic firm	1.18	1.22	3,557,788[a]

a) The figures relate to person-months observed in 2003-2011. b) The figures relate to persons changing sector and show the change in average earnings in the receiving firm relative to average earnings in the sending firm.

According to the raw data, MNE employees earn more than twice as much as do domestic sector workers. Persons moving from domestic firms to MNEs gain 64 percentage points on average, while individuals who move to the other direction lose 57 points. Measured with the median rather than the mean the gain and the loss amount to 39 and -26 percentage points, respectively.[9] The bottom block suggests a large raw premium for outside experience in foreign-owned enterprises. In the forthcoming sections, we try to disentangle a "pure" ownership-specific effect from differences in composition.

4. Benchmark models

4.1. Estimating the foreign-domestic wage gap

Our first model estimates the foreign-domestic wage gap in the following way:

$$(1) \qquad \ln w_{ijt} = \delta F_{ijt} + [\varphi P_i] + \alpha X_{it} + \beta Y_{ijt} + \gamma V_{jt} + [v_i + f_j] + s_{jt} + \varepsilon_{ijt}$$

where w_{ijt} is the daily average (relative) earnings of person i at firm j and month t, F is a dummy for being employed in a majority foreign-owned firm, P_i and X_{it} are fixed and time varying individual attributes, Y_{ijt} stands for job-specific variables (like occupation and tenure), V_{jt} denotes time varying firm-specific covariates, v_i and f_j are worker and firm fixed effects, respectively, and ε_{ijt} is an error term. We allow for unobserved shocks to productivity by including sector-year interactions s_{jt}. The firm-level variables are size, the capital-labor ratio and a dummy for exporters. Alternatively, we use indicators of investment and productivity. We gradually move from an OLS equation only controlled for s_{jt} to fixed-effects models with all the covariates except for the P_i variables.

When the equation is estimated with OLS, the δ parameter captures the ownership effect, plus the employment-duration weighted average residual *worker* and *firm* effects given personal characteristics P and X (Abowd et al. 2006). The person fixed effects absorb the unobserved time invariant mean "qualities" of workers but the estimated gap is still affected by the employment-duration weighted average of the firm effects for the firms in which the worker was employed.

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[9] See Appendix Figure A2 for a box-and-whiskers plot of wage changes.

When both person and firm fixed effects are included, δ captures a pure ownership effect identified from worker flows between ownership categories, on the one hand, and changes in ownership, on the other.[10] It shows the wage advantage of a foreign firm employee over a domestic worker with similar observable attributes, controlled for their average wages in the entire period of observation and also controlled for average wages of the firms where they worked during the period of observation.

Several methods have been developed in the last ten years (following the pioneering work of Abowd et al. 1999) to deal with two or more high dimensional fixed effects. The iterative methods (Cornelissen 2008, Martins and Opromolla 2009, Guimaraes and Portugal 2010, Carneiro et al. 2012, Mittag 2016) solve the problem by shuffling between the estimation of the slope and the intercept parameters. Balázsi et al (2018) yield an alternative, which presses more on memory but runs faster. Earlier drafts of this paper like Balázsi (2017) experimented with this method. With the size of the final data iterative approaches turned out to be more effective. Therefore we use the method of Guimaraes (2009) implemented in Stata under the name *reg2hdfe*.

4.2. Estimating lagged returns

The identification challenge at this point is that worker mobility is not random. If a worker is fired from her current job, it may be because her marginal product is lower than average. If a new employer attracts a worker, it may be because of a higher-than-average marginal product. We instrument worker mobility with mass layoffs at the sending firm, which are more likely to be exogenous to the productivity of the individual worker.[11]

In Equation (2), we compare workers in domestic firms, who arrived at their employers from MNEs versus other domestic firms. The estimates are controlled for personal characteristics, current and past job attributes, tenure in the last job, months between the two jobs, selected indicators of the sending and receiving firms and sector-year interactions. We retain firms with at least one ex-MNE and one ex-domestic employee and exclude firms undergoing acquisition.

(2) $\ln w_{ijt} = \alpha X_{it} + \beta_1 F\_After_{ijt} + \beta_2 dL_{jt} + \beta_3\big(F\_After_{ijt} \times dL_{jt}\big) + f_j + s_{jt} + \varepsilon_{ijt}$

F_After_{ijt} is a dummy set to 1 for workers, who arrived from foreign firms and 0 for workers arriving from domestic companies. $dL_{jt} = L_{j,t+1}/L_{j,t-1}$ measures the change of employment in the sending firm between year $t-1$ and $t+1$, with t denoting the year when the worker left the firm. The coefficient β_2 measures how wages vary with employment dynamics of the sending domestic firms while the parameter β_3 of the interaction term $F\_After_{ijt} \times dL_{jt}$ captures the impact of dL on workers arriving from foreign employers. The wage advantage of workers arriving from MNEs over workers arriving from domestic firms, conditional on employment dynamics of the sending firm, is given by $\beta_1 + \beta_3 dL_{jt}$. Alternatively, we estimate the equation for three groups distinguished on the basis of dL (lower than 0.5, between 0.5 and 1 and higher than 1), without the size-change and interaction terms.

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[10] The only exception would be observations on firms that, at the same time as changing ownership, would change all of their employees. We do not have such cases in the data.
[11] The dataset provides no direct information on the reason for separation.

Since we are interested in the within-sector and within-firm wage differences between ex-MNE and ex-domestic entrants (rather than how a worker's wage changes upon entering a domestic firm), we include firm fixed effects but not worker fixed effects.

4.3. Estimating spillover effects

We estimate spillover effects for the sample of domestic firm employees with no outside work experience in the observed period. Their wages are regressed on a set of controls and variables measuring the share of workers with previous outside experience within the worker's company and skill category. We deviate from Poole (2013) in that we also study how skilled incumbents' wages respond to the presence of less skilled ex-MNE peers. $Share_{jt}^{MNE,unskilled}$, for instance, measures the ratio of unskilled employees with recent MNE experience.

$$(3) \qquad \ln w_{ijt} = \theta_{F3}Share_{jt}^{MNE,skilled} + \theta_{F2}Share_{jt}^{MNE,middling} + \theta_{F1}Share_{jt}^{MNE,unskilled} +$$
$$\theta_{D3}Share_{jt}^{domestic,skilled} + \theta_{D2}Share_{jt}^{domestic,middling} + \theta_{D1}Share_{jt}^{domestic,unskilled} + \alpha X_{it} +$$
$$\beta Y_{ijt} + \gamma V_{jt} + v_i + s_{jt} + \varepsilon_{ijt}$$

We estimate the model including only worker fixed effects, which also absorb the firm effects since the estimates relate to incumbent workers. The controls are identical to those used in Equation 1. We restrict the time window to 2005–2011 to leave time for the accumulation of an ex-MNE stock. The equations are estimated separately for smaller (11–50) and larger (50+) firms, taking into consideration the higher risk of measurement error in small establishments.

5. Results of the benchmark models

5.1. Wage gap

In Model A of Table 4, which measures the wage advantage of MNE employees relative to domestic firm employees, the estimate falls from 0.745 log points to only 0.718 after controlling for observed worker characteristics. The inclusion of firm size, the capital-labor ratio and exports bring the estimated MNE premium down to 0.437, while adding worker fixed effects reduces it to 0.236. Adding firm fixed effects results in a major drop to only 0.031.

Controlling the worker fixed effect model for TFP or value added per worker instead of the firm fixed effects yield estimates of 0.218 and 0.206, respectively. Including TFP into the set of firm controls in specification (4) results in a coefficient of 0.209. Including investment as well, which controls for the potential coincidence of positive productivity shocks and the hiring of high-quality labor, produces an estimate of 0.216. By contrast, adding firm fixed effects to specification (4) without including worker fixed effects decreases the estimate from 0.437 to 0.036, clearly indicating that selection to acquisition drives the result of the 2FE model.

In Model B of Table 4, the observed person-months are classified by the ownership histories of employers. "Always domestic" (the reference category) and "always foreign" stand for monthly employment spells in firms which did not change majority owner in 2003–2011. "Temporarily foreign" and "temporarily domestic" denote the current majority owner of firms which underwent acquisition. The estimates suggest that firms involved in takeovers and currently operating under domestic ownership pay more than incumbent domestic firms (by 0.113 log points in specification 5 where worker quality is controlled for). Switching firms currently under foreign ownership also pay higher wages than incumbent domestic employers (by 0.166 log points) but lower ones than

always foreign-owned companies (by 0.131 log points). The gap between the coefficients for employment spells under "temporarily foreign" and "temporarily domestic" ownership (0.051 log points) is an alternative measure of how changes of ownership affect the wage. The magnitudes make it clear that switching firms substantially differ from any of the incumbent categories.

Table 4: Estimates of the foreign-domestic wage gap for skilled workers, 2003-2011

Specifications:	(1)	(2)	(3)	(4)	(5)	(6)
Model A						
Foreign-owned	0.745	0.763	0.718	0.437	0.236	0.031
	(2103.9)	(2189.4)	(2179.5)	(1157.4)	(730.2)	(58.0)
aR2/within R2	0.260	0.329	0.417	0.480	0.238	0.917
Model B						
Always foreign-owned	0.794	0.835	0.764	0.474	0.297	..
	(292.9)	(315.8)	(309.2)	(164.8)	(797.9)	..
Temporarily foreign-owned	0.551	0.562	0.510	0.286	0.166	..
	(94.2)	(99.4)	(97.2)	(56.0)	(255.9)	..
Temporarily domestic	0.459	0.469	0.418	0.208	0.113	..
	(73.8)	(77.3)	(73.3)	(39.2)	(166.0)	..
aR2/within R2	0.268	0.327	0.422	0.482	0.242	..
Controls						
Sector × year	Yes	Yes	Yes	Yes	Yes	Yes
Person	No	Yes	Yes	Yes	Yes	Yes
Job	No	No	Yes	Yes	Yes	Yes
Firm	No	No	No	Yes	Yes	Yes
Person FE	No	No	No	No	Yes	Yes
Firm FE	No	No	No	No	No	Yes

All coefficients are significant at 0.001 level, t-values in brackets. The standard errors are adjusted for clustering by persons. *Sample*: 19,961,622 person-months belonging to 344,203 skilled workers in 119,580 firms. *Dependent variable*: log daily wage in the given month relative to the national mean. *Reference categories*: employed in a domestic firm (Model A), employed in an 'always domestic' firm (Model B). *Controls*: person, job and firm characteristics plus sector-year interactions. See Appendix Table A2 for variable definitions. Specifications 5 and 6 include only time-varying covariates and worker and firm fixed effects. *Estimation*: models (1)-(4) were estimated with OLS. Models (5) and (6) were estimated with Stata's *xtreg* and *reg2hdfe* models, respectively.

Appendix Figure A1 compares the estimates of Model A to ones for unskilled and medium-skilled workers. These are very close to each other and amount to about 0.4 log points in the uncontrolled model, less than 0.1 in the panel regression with worker FE and less than 0.02 in the 2FE model. Data available in the Labor Force Survey (Tables A3-A4 of the Appendix) furthermore suggest that a part of the MNE premium compensates unskilled workers for non-wage disamenities. Overtime work, as well as afternoon and night shifts, are about twice as likely to occur among low and medium-skilled MNE employees compared to their domestic counterparts. There is smaller but similarly signed difference concerning work on Saturdays and Sundays. Furthermore, low skilled workers have a higher probability of becoming unemployed in foreign than domestic firms. The data does not indicate ownership-specific differences of this kind among highly skilled workers— this is one of the reasons why we restrict the analysis to them.

5.2. Lagged returns

The upper block of Table 5 shows the results of the models described in section 4.2. The wage advantage of an ex-MNE employee arriving from a firm where staff numbers did not change around the year of the worker's separation (dL=1) amounts to 0.057 log points, while it is

estimated to be 0.074 points in case the sending firm was closed or relocated (dL=0). We added a dummy indicating if the worker had arrived from another domestic firm but had some experience in one or more MNEs before being hired by the current employer. These workers have an advantage of 0.064 log points. Only a part of these gaps results from within-firm advantages, as suggested by the differences between the specifications with and without firm fixed effects.

Table 5: The wage advantage of ex-MNE workers in domestic firms
over coworkers having arrived from other domestic firms – regression estimates

| | Firm fixed effects: | |
	No	Yes
Entire sample		
Sending firm is MNE (F_After)	0.074***	0.056***
	(5.7)	(26.6)
Change of employment in the sending firm (dL)	0.009**	-0.012***
	(2.4)	(18.6)
Interaction term (F_After × dL)	-0.017**	-0.013***
	(2.0)	(9.7)
MNE experience before entry to the sending firm (dummy)	0.064***	0.025***
	(7.4)	(14.8)
Number of observations	797,261	797,261
aR^2 / within R^2	0.474	0.290
Subsamples		
Employment change in the sending firm: $L_{t+1}/L_{t-1} \leq 0.5$		
Sending firm is MNE	0.141***	0.065***
	(5.8)	(11.0)
MNE experience before entry to the sending firm (dummy)	0.076***	0.056***
	(4.1)	(16.0)
Number of observations	160,028	160,028
aR^2 / within R^2	0.489	0.280
Employment change in the sending firm: $0.5 < L_{t+1}/L_{t-1} < 1$		
Sending firm is MNE	0.033***	0.054***
	(2.5)	(24.2)
MNE experience before entry to the sending firm (dummy)	0.054***	0.045***
	(4.0)	(7.1)
Number of observations	336,550	336,550
aR^2 / within R^2	0.484	0.286
Employment change in the sending firm: $L_{t+1}/L_{t-1} \geq 1$		
Sending firm is MNE	0.073***	0.046***
	(5.2)	(19.6)
MNE experience before entry to the sending firm	0.064***	0.027***
	(4.7)	(11.4)
Number of observations	297,587	297,587
aR^2 / within R^2	0.463	0.275

Significance: ***) 0.01 and **) 0.05 level. The standard errors are adjusted for clustering by persons. *Sample*: 797,261 person-months belonging to 96,277 skilled workers in 19,449 domestic firms, who had arrived from MNEs versus other domestic firms. *Estimation*: specifications are pooled OLS and panel regression with firm fixed effects. *Change of employment in the sending firm*: L_{t+1}/L_{t-1}, where indices stand for years and t is the year of separation. *Controls*: person, job and firm characteristics listed in Table A2, except for sector-year interactions. Additional controls are completed tenure in the sending firm, dummy for unobserved tenure, months between the exit from the sending firm and entry to the receiving firm, one-digit sectoral affiliation of the sending and receiving firms and year dummies.

The lower blocks of the table display estimates on sub-samples distinguished along dL. Former MNE workers who lost or left their jobs during mass dismissals (dL<0.5) had substantially higher wage advantages over their ex-domestic counterparts (0.141 log points) than did those ex-MNE workers, who arrived from slightly contracting firms (0.033) or ones with stable or increasing levels of employment (0.073).

Workers who leave well-paying jobs in the MNE sector individually can be either negatively or positively selected. On the one hand, MNE employees fired individually are likely to be less productive than the average. On the other hand, the lucky few who manage to find a well-paid domestic job are predictably over-represented among voluntary quitters. The comparison of group-level estimates suggests that the first effect dominates: workers separating from their firms for reasons other than mass dismissals earn a lower lagged MNE premium on average.

Note that the group-wise estimates controlled for firm fixed effects are much closer to each other than the uncontrolled ones. The outstanding advantage of workers arriving at the domestic sector from shrinking, closing or relocating MNEs seems to result from the propensity (and ability) of high-wage domestic firms to receive them.

Also note that the above results refer to a sample of 797,261 person-months, only 6.6 percent of all monthly spells observed in the domestic sector. The restrictions (such as the exclusion of left-censored employment spells, the need to observe at least two employment spells per worker, the sending firm's level of employment in three consecutive years, the withholding of firms with at least one worker coming from an MNE and one coming from another domestic enterprise) imply a major loss of observations despite a relatively wide time window. Therefore, in Section 6 we will estimate an alternative model based on a much bigger set of observations.

5.3. Results on spillovers

The fixed-effects panel equations summarized in Table 6 regress the log wages of incumbent skilled domestic workers on the share of workers with outside experience within the worker's firm and skill group. The estimated own effect for skilled workers in a medium-sized or large firm (θ_{F3} = 0.074) implies that a one-standard-deviation difference in the share of high skilled ex-MNE employees (0.18) shifts the wages of skilled incumbents up by 1.3 percent. Having more skilled peers with outside experience in the domestic sector has no effect.

Table 6: The effect of coworkers with recent outside work experience on the
wages of skilled incumbents in domestic firms 2005-2011

	Share of coworkers with recent MNE experience within skill groups			Share of coworkers with recent experience in other domestic firms within skill groups		
	Unskilled	Middling	Skilled	Unskilled	Middling	Skilled
Notations in Equation 3:	θ_{F1}	θ_{F2}	θ_{F3}	θ_{D1}	θ_{D2}	θ_{D3}
All firms	0.012*	0.003	0.042***	0.015***	0.01	-0.031***
	(2.0)	(0.4)	(4.9)	(4.3)	(1.9)	(-5.5)
Firms employing >50 workers	0.000	0.02*	0.074***	0.005	0.042***	-0.027**
	(0.0)	(1.9)	(6.0)	(1.0)	(4.3)	(-3.0)

Significant at *) 0.1, **) 0.5, ***) 0.01 level. The t-values are based on standard errors adjusted for clustering by persons. θ_{F3} is significantly larger than θ_{F1}, θ_{F2} and θ_{F3}. *Sample*: 3,737,504 person-months in 122,205 firms in the full sample, 2,478,631 person-months in 81,200 firms in the 50+ sample. *Dependent variable*: log daily wage in the given month relative to the national mean. *Controls*: person, job and firm characteristics, sector-year interactions, and worker fixed-effects.

In evaluating the cross effects, one should take into account the relevant range in the share of ex-MNE workers. While a jump from zero to 50 or 100 percent in the share of ex-foreign workers within the unskilled or medium-skilled workforce is beyond the realm of reality, which renders the spillover effect to be weak, this can easily happen in the high skilled category. Domestic firms employing 50 workers have 7 high skilled workers on average. Hiring two managers or

professionals with foreign sector experience can increase the ex-MNE share from zero to almost 30 percent overnight, which implies a 0.022 log points wage increase for skilled incumbents.

6. Supplementary and alternative estimations

6.1. Exploiting information on new firms

As much as 94.8 percent of the firms in our estimation sample did not change majority owner in the nine-year period covered by the data: 7.3 percent was foreign-owned and 87.5 percent was domestic throughout the observed period. Rather than simply neglecting the huge wage difference between them (as does the 2FE model), we exploit information on newly established and subsequently incumbent foreign and domestic firms. The critical event under examination here is not the takeover of an existing firm, but the birth of an incumbent firm.

The analysis relates to incumbent workers in incumbent firms established after 2003 and staying under majority foreign or domestic control until 2011. We base the definition of a "new firm" on its employment dynamics rather than its date of registration, since the latter is often associated with break-ups, mergers and acquisitions, rather than the birth of a new economic actor. We rely on the fact that a medium-sized or large firm's creation typically begins with hiring a small group of managers who arrange the start-up. This preparatory stage is followed by a "big bang" when rank-and-file employees are hired. We speak of a big bang when a firm's staff jumps from an initial level of $L_{t-1} \leq 5$ to $L_t \geq 50$, or, from $L_{t-1} \leq 50$ to $L_t \geq 300$ within a month. We found 519 such firms with no subsequent change of ownership. Combined employment in these enterprises jumped from 6,728 one year before the big bang to 126,544 one year after the big bang (an estimated growth from 13 to 253 thousand taking into account the 50 percent sampling quota). See Appendix Figure A3 for the evolution of staff numbers in the firms in question.

Table 7: Wages before and after entry to new MNEs and new domestic firms

	Coeff.	t-test	Person-months
Workers of domestic start-ups, before their entry	ref.		115,443
Workers of foreign-owned start-ups, before their entry	0.217***	14.3	146,585
Workers of domestic start-ups, after their entry	-0.018	1.9	84,018
Workers of foreign-owned start-ups, after their entry	0.379***	22.2	125,247
Double difference (point estimate)	0.158	9.1	

Significant at *) 0.1, ***) 0.01 level. The t-values are based on standard errors adjusted for clustering by persons.
OLS regression with dummies standing for the four distinct groups. *Dependent variable*: log daily wage in the given month relative to the national mean. *Sample*: 471,293 person-months belonging to 8,225 skilled workers hired by and staying until December 2011 in 519 newly established firms (366 domestic and 147 foreign-owned). We considered a firm newly established if its staff number jumped from less than 5 to more than 50, or, from less than 50 to more than 300 within a month. Workers employed by new firms before their 'big bang', workers leaving the new firms and firms changing owner after the big bang are excluded. *Controls*: person, job and firm characteristics and sector-year interactions. See Appendix Table A2 for variable definitions.

We estimate a single wage equation with dummies standing for interactions of the ownership of the new firm and the period relative to the date of entry to these firms. Since assignment to the groups compared is person-specific, and the firms do not change owner, we estimate the wage gap with pooled OLS. A large battery of controls guarantees that we compare workers and firms with similar characteristics.

The results in Table 7 indicate a wage gap of 0.397 log points between skilled workers in new MNEs versus new domestic firms—this is fairly close to the 0.437 log points gap estimated with a

fully controlled OLS for all firms in Table 4, specification 4. The workers of new foreign firms also earned more than their domestic counterparts before their entry to the new firms by 0.217 log points on average. Deducting this difference from the post-entry gap suggests that an ownership-specific wage differential of 0.158 log points remains between incumbent workers in incumbent firms. This estimate falls between the individual only and the two fixed-effects parameters, suggesting a significantly larger pure ownership-specific effect than the 2FE model.

6.2. An overlapping cohorts model of lagged returns to MNE experience

We estimate an alternative model to identify the private returns to MNE experience by comparing the wages of domestic firm employees with *past and future* experience in MNEs versus domestic companies other than their current employer. This approach is close in spirit to models that study the wage effect of incarceration by comparing past and future convicts (Grogger 1995, Pettit and Lyons 2009, LaLonde and Cho 2008, Czafit and Köllő 2015) under the assumption that the date of incarceration (mutatis mutandis the dates of entry to and exit from MNEs) can be treated as random.

The sample we work with consists of domestic firm employees in companies employing at least one worker with past or future outside experience and one incumbent worker. We restrict the analysis to 2005–2009 to have sufficient observations on both past and future experience outside the workers' current firms. Even so, the estimates relate to nearly 4 million monthly observations belonging to 153 thousand workers in 18.5 thousand firms.

Table 8: Wage difference between domestic workers with/without outside work experience

	Dependent variable: log daily wage			
	OLS		Firm fixed effects	
Past MNE experience (PF)	0.060***	(11.6)	0.005***	(6.5)
Future MNE experience (FF)	0.012	(1.6)	0.001	(0.6)
Past outside domestic experience (PD)	-0.052***	(12.4)	-0.030***	(47.2)
Future outside domestic experience (FD)	-0.031***	(6.7)	-0.016***	(22.4)
Differences by type of outside experience				
Past MNE – Past domestic	0.112	(21.6)	0.035	(41.4)
Future MNE – Future domestic	0.043	(5.4)	0.017	(11.8)
Double difference	0.069	(7.7)	0.018	(11.5)
F-test of the double difference being zero	58.7	(0.0000)	132.6	(0.0000)
aR2/within R2	0.453		0.342	

Regression estimates. The reported coefficients are significant at the ***) 0.01 level. *Sample*: 3,841,561 person-months belonging to 153,323 persons and 18,510 firms. The sample covers domestic firm employees in firms employing at least one worker with past or future outside experience and one incumbent worker. The coefficients measure wage advantages relative to incumbent workers. Observations for 2005-2009 are used. *Estimation*: OLS and firm fixed effects. The standard errors are adjusted for clustering by persons. *Controls*: person, job and firm controls, and sector-year interactions.

We define a collectively exhaustive classification making a distinction between workers with past MNE experience (PF), workers with future but no past MNE experience (FF), workers with past experience in other domestic firms and no MNE experience (PD) and workers with future domestic sector experience and none of the aforementioned types (FD). Incumbent workers who had no contact with other employers in 2003–2011 constitute the reference category. We regress log wages on the respective dummies and person, job and firm-specific controls plus sector-year interactions.

We measure the effect of foreign sector experience with the double difference $(\beta_{PF} - \beta_{PD}) - (\beta_{FF} - \beta_{FD})$ or equivalently $(\beta_{PF} - \beta_{FF}) - (\beta_{PD} - \beta_{FD})$. The model controls for unobserved differentials in worker quality as long as the wages of workers with future outside experience can be treated

as a counterfactual for the wages of workers with past experience. However, it cannot address the possibly endogenous selection of workers to separation from their previous employers.

The results in Table 8 show that workers with past MNE experience earn more by 0.112 log points than their counterparts with outside domestic experience. This difference overestimates the returns to foreign sector experience since those domestic workers who are on their way to a foreign firm also earn more by 0.043 log points than those who are about to leave for a domestic employer. Using these estimates, we can approximate the return to MNE work experience as the double difference $(\beta_{PF} - \beta_{PD}) - (\beta_{FF} - \beta_{FD})$ equal to 0.069 log points.

The results of the two models aimed at measuring lagged wage effects (Tables 5 and 8) are similar: the first model identified a 0.057 log points advantage on the part of the median skilled worker arriving from a foreign firm with stable employment level (dL=1) over a worker arriving from a similar domestic company (see column 1 of Table 5). A relatively small difference between the two results can partly result from the fact that the second model included more persons working for MNEs over a long period.

In column 2 of Table 8, we reestimate the model by adding firm fixed effects. Similar to the first model, the contrasts fade away: the within-firm wage differentials are much smaller, and the double difference drops to only 0.018 log points, suggesting that the lagged MNE premium predominantly stems from the crowding of past and future MNE employees in high-wage domestic firms.

6.3. Reestimating spillover effects

Incumbents in our data account for only 22 percent of the workers ever employed in the domestic sector and 34 percent of the workers never employed outside the domestic sector. The estimates of spillover effects using their sample may be biased because their exposure to peers with MNE experience differs substantially from that of the average worker. As shown in Table 9, the mean within-firm share of skilled MNE-experienced peers amounts to 9 percent in the case of skilled incumbents as opposed to 14.6 percent in the case of their non-incumbent counterparts. The relative magnitudes are similar for less skilled coworkers—a predictable pattern since incumbents are more likely to be found in firms with low labor turnover.

Table 9: Mean within-firm share of coworkers with past MNE experience (percent)

	Skilled incumbents in domestic firms		Non-incumbent skilled domestic firm employees without MNE experience	
	Share of coworkers with MNE experience	Number of workers	Share of coworkers with MNE experience	Number of workers
Unskilled	7.0	38,355	13.3	73,320
Medium skilled	9.3	53,896	15.4	103,871
Skilled	9.0	55,900	14.6	107,250

Incumbents are workers, who had only a single domestic-owned employer in 2003-2011. The mean within-firm shares are weighted with firm size and relate to 2003-2011.

A higher share of ex-MNE peers increases the likelihood of personal contacts, thereby assisting the diffusion of MNE-based skills within the firm. At the same time, the typical incumbent worker spends more time with the firm, so she has a better chance to absorb the imported knowledge. Because of the potential bias in either direction, we reestimate the spillover model for all domestic

workers, now including firm fixed effects on top of the worker fixed effects in the model to ensure that it identifies within-firm impacts.

Table 10: The effect of coworkers with recent outside work experience on the wages of skilled workers in domestic enterprises 2005-2011

	Share of coworkers with recent MNE experience by their level of skill			Share of coworkers with recent experience in other domestic firms by their level of skill		
	Unskilled	Middling	Skilled	Unskilled	Middling	Skilled
Notations in Equation 3:	θ_{F1}	θ_{F2}	θ_{F3}	θ_{D1}	θ_{D2}	θ_{D3}
All domestic firms	0.007	0.012	0.021*	0.015***	0.022***	-0.040***
	(1.3)	(1.8)	(2.5)	(4.7)	(4.2)	(-6.0)
Domestic firms employing >50 workers	0.006	0.050***	0.058***	0.001	0.057***	-0.024*
	(0.9)	(3.4)	(4.9)	(0.3)	(5.5)	(-2.5)

Significant at *) 0.1, ***) 0.01 level. The t-values are based on standard errors adjusted for clustering by persons. θ_{F3} is significantly bigger than θ_{F1} and θ_{F3}, but not θ_{F2}. θ_{F2} is significantly bigger than θ_{F1}.
Sample: 3,737,504 person-months belonging to skilled workers in 122,205 firms in full sample, 2,478,631 person-months in 81,200 firms in the 50+ sample. *Dependent variable*: log daily wage in the given month relative to the national mean. *Controls*: person, job and firm characteristics, sector-year interactions, worker and firm fixed-effects.

The results for firms with more than 50 workers and all firms are presented in Table 10. Starting with the former: the own effect (0.058) is slightly lower than the estimate for incumbents (0.074 in Table 5). Less skilled ex-MNE workers exert a weak effect—the respective coefficients are only significant at the 10 percent level. Having more peers with recent outside experience in domestic firms do not affect wages at all. The estimates for all firms are much lower and insignificant at 5 percent level. The inward bias is probably explained by the noisy measurement of the F and D ratios in smaller enterprises.

The estimated spillover effect might seem economically insignificant, but it is actually stronger than those we know from the literature. The study of Poole (2013)—which is closest to ours concerning method, sample characteristics and industry coverage—estimated that at the average wage for a typical domestic worker, a 10 percentage points increase in the share of former MNE workers increased incumbents' wages by $23 per year. This amount could buy a little more than one Starbucks solo espresso a month in Rio de Janeiro in 2015. The comparable estimate for skilled incumbents in our sample is $139 a year, which could buy 5.2 cups of Starbucks espresso a month in Budapest at 2015 prices.[12]

6.4. Differences by sectors

Table 11 summarizes estimates of the wage gap, lagged returns and spillover effects from our preferred model specifications for manufacturing and all other sectors labeled "services." The foreign-domestic wage gap is larger in services than manufacturing, and the lagged returns are broadly similar or somewhat larger in services. By contrast, the spillover effects are estimated to be stronger in manufacturing.

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[12]The calculation is based on the estimated own effect (0.074), the mean monthly earnings of skilled domestic firm employees in 2011 (236,078 Ft) and an average exchange rate of 225 Ft/$ in 2011 (National Bank, http://mnbkozeparfolyam.hu/arfolyam-2011.html). We could find Starbucks solo espresso prices for 2015 on the websites of local shops in Rio and Budapest: $1.92 and $1.43, respectively.

Table 11: Selected estimates by sectors

	Manufacturing	Services
Contemporaneous MNE premium		
All firms, worker FE	0.152	0.236
New, incumbent firms, DiD	0.135	0.232
Lagged MNE premium in domestic firms		
Sending firm is MNE, dL<0.5, OLS	0.135	0.133
Sending firm is MNE, dL<0.5, firm FE	0.056	0.044
Overlapping cohorts estimate, DiD	0.027	0.072
Spillover effect, firms L>50 employees		
On incumbents	0.088	0.057
On all workers with no MNE experience	0.069	0.050

*) All coefficients are significant at 0.01 level. The coefficients were estimated separately for the two sectors

7. Discussion

We interpret the coincidence of an MNE premium, substantial wage loss from separation, lagged returns to MNE experience, and wage spillover as a signal of knowledge flows from FDI to domestic firms. In such a scenario, workers acquiring both general and firm-specific knowledge in the modern environment of MNEs are expected to earn more than their domestic counterparts. The specific components in their skills imply that MNE workers lose a part of their wage advantage in case of involuntary separation. The general component in their skills give rise to wage advantages in their new, domestic firm, and tend to exert a positive influence on the productivity of their peers. The simultaneity of these symptoms call into question some alternative explanations, of which we discuss three ones.

First, the existence of a contemporaneous *residual* gap calls into question that the MNE premium results from the crowding of high productivity workers in foreign-owned enterprises.

Second, intense human capital accumulation is admittedly not the only potential source of an MNE premium, with the most important alternative being efficiency wage setting. MNEs may try to prevent leakage of information through labor turnover by paying a premium above the market level (Fosfuri et al. 2001). Their limited knowledge of the local labor market and capital-labor relations may urge them to pay high wages and share a part of their revenues with workers. Furthermore, they may try to compensate their employees for a higher labor demand volatility (Fabri et al. 2003) or a higher plant closure rate (Bernard and Sjoholm 2003). The implications of skills accumulation versus efficiency wages for the foreign-domestic wage gap and the wage loss from separation are observationally identical. However, efficiency wages in MNEs do not imply that ex-MNE employees earn a premium over the receiving domestic firm's going wage rate, and exert influence on the wages of their peers.

Third, a set of findings like this is likely to emerge only if MNE workers accumulate both general and firm-specific knowledge. As outlined in the seminal paper of Becker (1962), in the case of general skills acquired through on-the-job training, productivity and wages move in tandem. Workers accumulating a substantial stock of general skills in one firm are expected to earn higher-than-average wages in other firms and, as far as general skills develop through informal communication between coworkers, their presence also tends to have a spillover effect. However, in this scenario, we do not expect that separation from an MNE induces a wage loss.

If the acquired knowledge is purely firm-specific, and the risk of voluntary separation (motivated by factors other than between-firm wage differentials) is zero, then the firm pays the going market wage before, during and after the period of skills accumulation. These skills lose their value with separation without an impact on wages: pre- and post-separation wages are equal, post-separation wages do not exceed the host firm's average level and do not exert influence on the earnings of coworkers. In the likely case of non-zero risk of voluntary quits, the firm will share in the costs and benefits of training which implies lower wages in the accumulation phase and higher wages afterward as long as the worker stays with her employer. In this case, post-training involuntary separations imply a wage loss, but we continue not to expect lagged returns and spillover effects.

The literature emanating from Becker's benchmark models has been trying to reconcile the theory of on-the-job training with a series of empirical observations inconsistent with the extreme scenarios. A series of empirical findings and ample everyday experience suggest that (i) most skills are general, or at least sector rather than firm-specific (ii) enterprises are willing to pay for general training and (iii) involuntary separations typically imply a loss. Acemoglu and Pischke (1999) demonstrate that in a variety of market settings such as a compressed wage structure, substantial hiring costs, information asymmetry, and other labor market imperfections, general skills are rewarded as if they were partly specific. The "skill-weights" model of Lazear (2009) hypothesizes that skills are predominantly general, but firms attach different weights to their components. A worker who leaves a firm will have a difficult time finding another firm that can make use of all the skills he acquired at the first firm. The limits of transferability impose a cost on mobile workers, so the workers are unwilling to bear the full cost of training, and the costs and benefits will be shared. Such a setting is likely to produce all of the four outcomes observed in our data.

8. Conclusions

We found that high skilled MNE workers earn substantially higher wages than their domestic counterparts. They lose a part of their wage advantage after leaving the foreign-owned sector but, even so, they earn more than their domestic sector colleagues with no MNE experience. Their presence in domestic firms exerts a positive effect on the wages of their peers, who had no contact with foreign-owned firms or had no recent outside work experience at all.

The direct and indirect wage returns to work experience in MNEs are large in Hungary, similar to less developed countries analyzed in the literature. The positive wage effects are not restricted to the manufacturing sector, which is in the focus of attention in the research on FDI.

The estimates suggest that the effect of MNE experience on domestic sector wages is predominantly explained by between-firm variance, that is, the higher-than-average wages of domestic firms connected with the MNEs via labor turnover.

Last but not least, the results draw attention to the difficulties of identifying a 'pure' ownership effect. Identification of the foreign-domestic wage gap from acquisitions is flawed by the non-random selection of firms to buy-outs. In the analysis of lagged returns and spillovers, there is a trade-off between model quality, on the one hand, and unbiasedness of the sample on which the model can be estimated, on the other.

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Appendix 1

Figure A1: Estimates of the foreign-domestic wage gap by skills
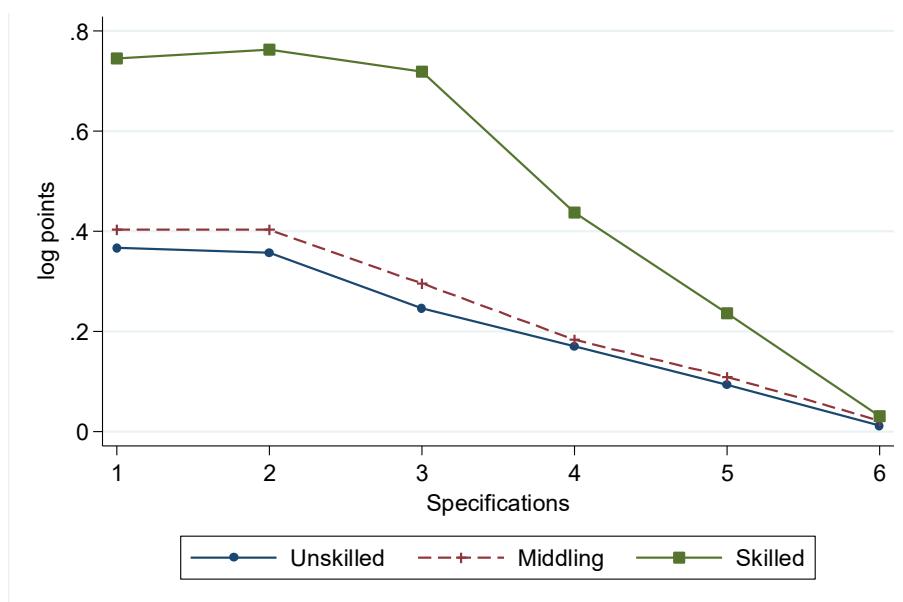
Specifications. 1: Sector-year interactions 2: + person controls 3: + job controls
4: + firm controls 5: + worker fixed effects 6: + firm fixed effects

Figure A2: Shifts between sectors and wage change
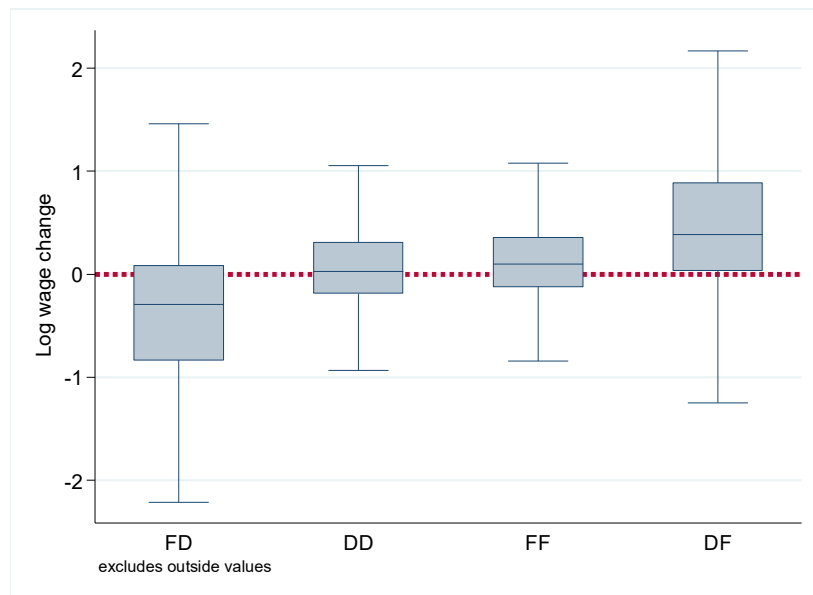
The data relate to 307,874 shifts on the part of skilled workers between ownership sectors in 2003-2011. F and D denote foreign-owned and domestic firms, respectively, in chronological order. The boxes display the interquartile ranges of log wage changes, with a horizontal line within the box indicating the median, and the whiskers showing the highest and lowest adjacent values. Heavy outliers are excluded. Wage change is measured as $\ln(w_1/w_0)$, where w_1 and w_0 are average earnings in the job spells after and before the shift, respectively.

Figure A3: The mean size of firms classified as newly established
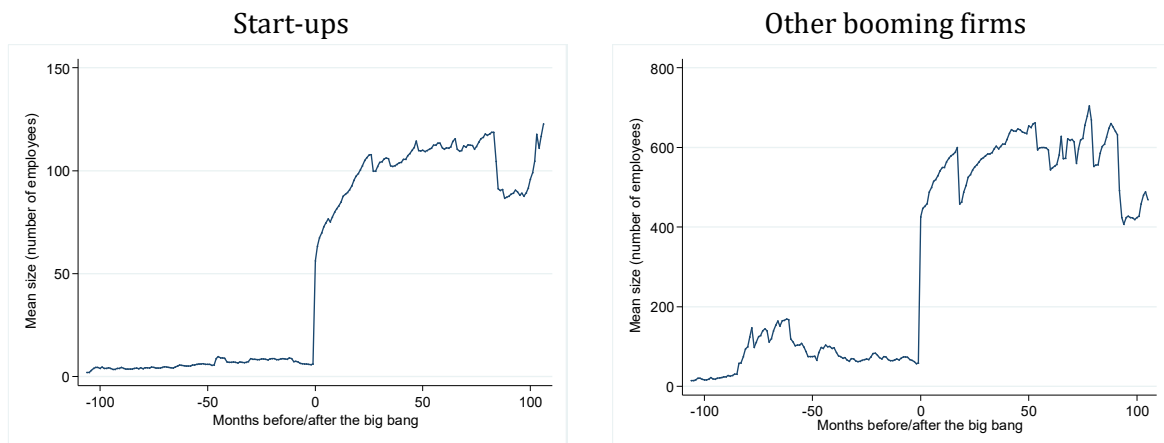
The data relate to 544 firms the size of which jumped from less than 5 to more than 50, or from less than 50 to more than 300 within a month (big bang). Firms changing majority owner are excluded.

Table A1: Descriptive statistics – All skill levels

	Mean	St. dev.	Min	Max
Male	.583		0	1
Age	38.49	11.0	7	82
Low skilled	.147			
Middling	.602		0	1
High skilled	.251		0	1
Months of non-employment in 2003-2011	31.1	29.2	0	108
Log health expenditures/national average wage	-2.08	1.8	-12.08	7.14
Receives disability pension/payment	.013		0	1
Receives care benefit	.012		0	1
Log regional unemployment rate	-2.59	.390	-3.32	-1.73
Central Hungary including Budapest	.307		0	1
Tenure is unobserved	.386		0	1
Tenure (months)	12.87	18.6	0	108
Top manager	.037			
Other manager	.075		0	1
Professional	.073		0	1
Other white collar	.206		0	1
Skilled blue collar	.356		0	1
Assembler, machine operator	.169		0	1
Elementary occupation	.101		0	1
Unspecified occupation	.020		0	1
Agriculture	.044			
Manufacturing	.362		0	1
Construction	.066		0	1
Trade	.188		0	1
Finance	.035		0	1
Energy	.023		0	1
Services	.281		0	1
Foreign	.326			
Domestic	.616		0	1
Public sector	.046		0	1
Other, unspecified	.012		0	1
Firm size (log)	4.94	2.25	-.693	10.88
Fixed assets per worker (log)	7.78	1.86	-5.01	17.59
Share of exports in sales revenues	.212	.349	0	1

Each variable covers 92,663,887 person months. The spells belong to workers employed at least once in a firm, the size of which exceeded the 10 workers limit at least once in 2003-2011.
Note that other samples used in the paper have been drawn from this source file.

Table A2: Pooled OLS results for equation 1, specification 4
Skilled workers, 2003-2011

	Coefficient	t-value
Majority owner[b]		
Foreign	0.437	1157.4
Personal characteristics		
Male	0.154	515.6
Age	0.032	270.9
Age squared/100	-0.033	220.0
Months spent non-employed in 2003-2011	-0.003	446.5
Receipt of disability payment	-0.373	164.7
Receipt of care allowance	-0.207	117.0
Health expenditures (log)	0.002	51.8
Job characteristics[d]		
Tenure if observed	0.001	117.6
Tenure is unobserved	0.138	333.1
Spell lasting for one day	0.354	3.3
Top manager	ref.	
Other managers	-0.062	71.0
Professional	-0.016	18.0
Other white collar	-0.298	335.7
Skilled blue collar	-0.607	679.4
Assembler, machine operator	-0.728	672.7
Laborer in elementary occupation	-0.821	659.2
Regional unemployment rate (log)	-0.063	107.7
Budapest	0.142	371.9
Firm characteristics		
Firm size (log)	0.086	1018.6
Capital-labor ratio (log)	0.041	467.8
Exporter	0.185	540.5
Constant	-1.650	436.0
Adjusted R-squared	0.479	
Number of observations	19,961,622	

Dependent variable: log daily earnings. For the exact definition of the variables see the Data Appendix. The coefficients of 63 sector-year dummies are not shown. The standard errors are adjusted for clustering by persons.

Table A3: Incidence of atypical work schedules in foreign and domestic enterprises
2003-2011, percent

Level of education[a]	Domestic	Foreign	Domestic	Foreign
	Shift work[b]		Overtime work[b]	
Low	27.5	58.2	14.4	32.0
Middling	22.4	41.2	12.0	24.3
High	4.4	4.5	4.0	7.6
	Work in the afternoon[c]		Work in the night[c]	
Low	14.4	29.1	8.1	20.3
Middling	18.6	33.1	9.4	22.1
High	17.7	14.4	7.1	6.6
	Work on Saturdays[c]		Work on Sundays[c]	
Low	26.3	29.3	16.9	17.6
Middling	35.4	36.6	21.2	24.0
High	26.8	18.9	16.7	12.7

a) Low=primary school attainment, High=college or university, Middling=rest
b) Source: Wage Surveys, 2003-2011, private sector. Firms are classified on the basis of their majority owners
The data indicate the percentage share of employees receiving shift pay and overtime pay, respectively. Authors' calculation.
c) Source: Labor Force Surveys, 2003 Q1 – 2011 Q4., excluding public administration, education, health and social services. The data indicate the percentage share of employees working in the respective periods at least occasionally. Authors' calculation.

Table A4: The effect of ownership on the probability of becoming unemployed - Logit odds ratios

	Educational attainment[a]		
	Low	Middling	High
Employer: MNE	1.199***	0.971	1.061
	(2.57)	(0.50)	(0.89)
Female	0.916	1.029	1.149***
	(1.40)	(0.55)	(2.44)
Age	1.012	0.941***	0.919***
	(0.71)	(3.85)	(5.01)
Age squared	0.999**	1.000***	1.000***
	(2.06)	(3.08)	(4.25)
Tenure (years)	0.894***	0.886***	0.895***
	(9.27)	(13.9)	(10.0)
Number of observations	82,638	205,597	227,074
Pseudo R2	0.076	0.067	0.068
Wald chi2 (51)	617.4***	958.0***	763.8***

Significant at the **) 0.5 and ***) 0.01 level.
Discrete time survival model, logit form, following (Jenkins 1985). Estimated for the pool of 28 quarterly waves of the Labor Force Survey in 2003-2009. The estimation excludes the crisis period (2010 and 2011). Sample: employees. Dependent variable: 1 if the person was ILO-OECD unemployed in wave t+1 and 0 otherwise. The coefficients of 19 county dummies and 27 wave dummies are not shown.
a) Low=primary school attainment, High=college or university, Middling=rest

Table A5: On-the-job training: fraction participating among MNE and domestic firm employees
High skilled employees working at least one hour in the reference week = 1

	Foreign	Domestic	Ratio
2003	0.102	0.065	1.57
2004	0.100	0.060	1.67
2005	0.043	0.024	1.80
2006	0.045	0.019	2.41
2007	0.033	0.019	1.73
2008	0.024	0.019	1.30
2009	0.020	0.013	1.59
2010	0.025	0.015	1.59
2011	0.021	0.014	1.61

Source: Authors' calculation using waves 45-80 of the LFS. *Sample*: ILO-OECD employed with college or university background. *Key variables*: participates in training of any kind outside the school system; the employer is majority or minority foreign-owned. Note that the question on participation changed in 2005. Figures above and below the dotted line are not directly comparable.

Data Appendix

Starting sample: 50 percent random sample drawn from Social Security Numbers (SSN, Hungarian TAJ) valid on January 1, 2003. SSN holders aged 5-74 were retained. Data held by the Pension Directorate (ONYF), the Tax Office (NAV), the Health Insurance Fund (OEP), the Office of Education (OH), and the Public Employment Service (NMH) were merged and anonymized by the National Information Service (NISZ). The original data consisted of payment records with start and end dates, a type-of-payment code and amounts received by the person. Employers were identified by ONYF and their annual financial data were provided by NAV. The data was transformed to a fixed format monthly panel data set by the Databank of the Institute of Economics of the Hungarian Academy of Sciences.

Estimation sample: Workers employed with a labor contract at least once in a foreign or domestic private enterprise the maximum employment level of which exceeded the 10 workers limit at least once in 2003-2011. We removed workers and firms with less than two data points, zero wages and missing covariates. 98.5 percent of the workers belong to a single connected group.[13] Special subsamples have been selected for the study of new firms and spillovers.

Data access. Data for the estimation sample and Stata dofiles are available on request. The original data set called Admin2 is available via remote access to the Databank's servers. Write to adatkeres@krtk.mta.hu for requesting access to the data. Note that the size of the original data set ranges between 60 and 120 Gbytes, depending on the amount of information stored in special modules that you want to merge to the base file. The files are in Stata16 format. R and Python codes are allowed.

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[13]'When a group of persons and firms is connected, the group contains all the workers who ever worked for any of the firms in the group and all the firms at which any of the workers were ever employed. In contrast, when a group of persons and firms is not connected to a second group, no firm in the first group has ever employed a person in the second group, nor has any person in the first group ever been employed by a firm in the second group. From an economic perspective, connected groups of workers and firms show the realized mobility network in the economy. From a statistical perspective, connected groups of workers and firms block-diagonalize the normal equations and permit the precise statement of identification restrictions on the person and firm effects.' Abowd, Kramarz and Woodcock (2006)

<div align="center">**Key variables**</div>

Wage. The daily wage figure used in the paper was calculated as monthly earnings divided by the number of days covered by pension insurance ('working days' henceforth) in the given month. Multiple payments made by the same employer to the same person within a month were summed up. Working days belonging to these payments were also summed up but capped at 30 or 31 days. In the case of multiple job holders the wage figure belongs to the highest paying job. We normalized the wage figures by dividing them with the national average wage in the given month, as measured in the starting sample. Source: ONYF.

Foreign-owned firm, MNE: dummy variable set to 1 for firms majority owned by one or more foreign owners. Ownership shares are measured as fractions of subscribed capital. Source: NAV

<div align="center">**Person controls**</div>

Gender, age: Source: ONYF

Skill levels. Skill levels are inferred from the 'highest' occupational status held by the person in 2003-2011. The classification is basedon one-digit occupational codes: 1 Top managers, 2 Other managers, 3 Professionals, 4 Other white collars, 5 Skilled blue collars, 6 Assemblers and machine operators, 7 Elementary occupations. Persons employed in occupations 1-3 at least once are classified as high skilled. Persons never employed outside occupations 6 and 7 are classified as low skilled. Other persons are classified as medium skilled. Source: ONYF

Total time spent non-employed. The number of months out of employment in 2003-2011. Source: ONYF

Disability payment: dummy variable, with 1 standing for any kind of transfer (pension or allowance) received on the basis of permanent disability (*rokkantnyugdíj, rokkantsági járadék*). Monthly data. Source: ONYF.

Care allowance: dummy variable, with 1 standing for any kind of benefit received by the observed person on the basis of raising children (*tgyás, gyed, gyes, gyet*) or taking care of disabled relatives (*ápolási segély*). Monthly data. Source: OEP, ONYF.

Health expenditures. Expenditures and costs registered by the National Health Insurance Fund (OEP). The items include total amount paid for OEP-supported medicine and the costs of OEP-supported services/treatment provided by district doctors, specialists and hospitals. We normalized the nominal figures by dividing them with the national average wage in the given month, as measured in the starting sample. Annual data. Source: OEP

<div align="center">**Job controls**</div>

Tenure. Months elapsed since entry to the firm. Set to zero in the case of left-censored employment spells. A dummy stands for observations from left-censored spells.

Spell lasting for one day. Hungarian firms often pay to individual subcontractors by formally employing them on the day of payment. This practice results in exorbitant 'daily wages' in some cases.

Occupation. One digit ISCO codes.

Regional unemployment rate: seasonally adjusted ILO-OECD unemployment rate in the given month and NUTS-2 region. The worker's region is identified on the basis of his/her zip code in 2003. Source: author's calculation using the Labor Force Survey.

Firm controls

Firm size: average number of employees. Annual data. Source: NAV.

Capital-labor ratio: net value of fixed assets per worker. Annual data. Source: NAV

Exporter: non-zero exports revenues. Annual data. Source: NAV.

Sector: NACE 2. Source: NAV