Knowledge Transfers from Multinational to Domestic Firms: Evidence from Worker Mobility

A Replication Study of Poole (*Review of Economics and Statistics*, 2013)

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Data Availability: Data can be used under restrictive conditions. Potential users must apply to the Central Statistics Office, Ireland and to Statistics Norway. A detailed description of the data access and log files can be downloaded at JCRE's data archive (DOI: 10.15456/j1.2023325.1540223821).

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Abstract

This paper replicates Poole (2013) using comprehensive Norwegian and Irish register data. Our results largely confirm the evidence documented in Poole for Brazil which suggests that when workers leave multinationals and are rehired at domestic establishments, the wages of their new coworkers who have already been present in the establishment increase. However, unlike suggested in the original article there is little indication that these spillovers differ in a statistically significant way across various dimensions of heterogeneity for any of the three countries.

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1 Introduction

Beside the direct employment effects foreign direct investment is and has been associated with spillover effects. Compared to the host of papers on horizontal and vertical spillovers between firms[1], the evidence on spillover effects through worker mobility is much more limited: Poole (2013) documents that when workers leave multinationals and are rehired at domestic establishments, continuing workers' wages at these domestic establishments increase in a sample of matched employer-employee data for Brazil. Balsvik (2011) documents that higher shares of workers with multinational experience are associated with higher productivity in non-multinational establishments. More recently, Setzler and Tintelnot (2021) and Alfaro-Ureña et al. (2021) have provided stronger evidence of such spillover effects using instruments for multinational presence.

In this paper we perform a replication study of the robustness-extension type as defined by Clemens (2017) of the analysis in Poole (2013) on comprehensive matched employer-employee data for Norway and Ireland. Hence, we analyse the effects for countries where the gap in potentially transferable skills or knowledge between multinationals and local firms is likely to be smaller than in Brazil, and we therefore expect spillover effects to be potentially smaller. Unlike Poole (2013) who employs a 1% random sample of workers on Brazil we use data covering all workers in the private sector for both Norway and Ireland. Clearly, this is feasible only because Norway and Ireland have much smaller populations. It also implies that we have considerably larger samples making it more likely that the estimated effects are statistically significant. Our results confirm the evidence documented in Poole (2013) which suggests that when workers leave multinationals and are rehired at domestic establishments, the wages of workers who are already in these establishments and remain increase. We also document broadly similar tendencies in terms of heterogeneity. However, the comparisons across subsamples are not significant bar some few exceptions for Ireland. Thus we do not confirm differential effects of wage spillovers for workers in sectors with different levels of unionisation or skill intensity. We also do not confirm significant differences between workers with high versus low job tenure or high versus low waged workers; and likewise between newly hired workers/incumbent workers with high versus low education, occupation and ability.

The remainder of this paper is structured as follows. In Section 2 we describe and compare the datasets; and we set out the methodology and the type of replication performed. In Section 3 we provide summary statistics. In section 4 we present and describe our results. In section 5 we briefly conclude.

2 Data description, methodology, and type of replication

As in Poole's 2013 original paper, we employ matched employer-employee data from Ireland and Norway. Unlike Poole (2013) who employs a 1% sample of formally employed workers in Brazil, we have access to comprehensive registry data for Norway and Ireland.

Figure 1 plots net foreign direct investment inflows as a percentage of GDP for the time periods under consideration for each of the three countries. For Brazil, the share of net FDI flows in

[1] For surveys see e.g. Görg and Greenaway (2004); Keller (forthc.); Smeets (2008).

Figure 1: FDI net inflows (% of GDP)
Source: World Development Indicators

GDP increased by approximately 4 percentage points from 1% in 1995 over the sample period; for Norway the share declined from nearly 5% in 2000 to less than by 2% in 2002 and then gradually recovered to 6% by 2007. In Ireland, a country that has traditionally been attracting more substantial amounts of FDI, the share of net FDI over GDP fluctuated between 10 and 25% between 2005 and 2012, then spiked to 80% in 2015 and has since returned to about 35%. The level of FDI inflows into Ireland has been very high for many years. Much of this is due to the construction of capital assets and the physical movement of physical capital assets to Ireland. However, a large share of the largest inflows are due to the relocation of intellectual property to Ireland as well as the transfer of ownership of capital assets located in other countries to subsidiaries of foreign MNEs in Ireland. The spike in FDI inflows in 2015 was largely due to the relocations of entire balance sheets to Ireland from outside of the EU. This mostly consisted of intellectual property. For the purpose of this paper it is important to note that the spike in 2015 is a monetary phenomenon only and does not translate into a similarly stark increase in the number of foreign-owned firms. Clearly, the fact that we are able to study countries that are different from Brazil in terms of industry structure and the importance of FDI relative to levels of initial development adds interest to this replication exercise.

We next provide, in turn, a description of the data sources, coverage and cleaning for Ireland and Norway. For Ireland and Norway we do our best to follow procedures described and documented in the available code files for the reference paper. The procedures are similar in spirit but necessarily take account of national specificities.

2.1 Norway

We work with three main datasets administered by Statistics Norway. The first data source is the population register. This source has annual files on the population aged between 16 and 74. From this source, we obtain age, gender, years of education and highest level of education, total annual earnings and municipality of residence. These files include an establishment (workplace) identifier for the main employer for people in the labour force, as well as the industry and municipality of the workplace, recorded in November of each year.

The second source of information is income tax files which include both establishment and firm identifiers, allowing us to allocate establishments to firms. Our third data source is the register of foreign ownership interests in Norwegian firms (the SIFON register), which records foreign ownership shares at the firm level. We define a firm as a foreign multinational if the total foreign ownership share is above 50% in the relevant year. We classify establishments as domestic or foreign-owned based on the ownership of the associated firm identifier from the income tax files.

We further merge information from four auxiliary data sources all provided by Statistics Norway to the core datasets above for specific robustness checks: a) Information on the highest level of completed education an individual has completed from the register of highest level of completed education per October 1st each year; b) Information on test scores from a cognitive ability test that all men born between 1950 and 1993 had to take before military service; c) A data file with individual information about claimed tax deductions for labour union membership fees; and d) Detailed import and export data at the firm level from the customs authority (TVINN-files). We add these additional variables at the end of the data preparation process described in the following.

We start by constructing an establishment panel for the years 1996 to 2007 based on the establishment identifiers in the population register and income tax files. From this panel, we drop an establishment if it is not observed in both data sources for more than half of its years in the panel. We also drop establishments that have many years with missing information about location or missing information about industry affiliation. This affects 10% of the initial establishment-year observations. We further drop workplaces in the public sector, which account for 20% of the remaining sample[2]. We also drop very small establishments where all workers are recorded as self-employed or the total wage bill does not exceed 100,000 NOK in 2007 NOK. This affects a further 10% of establishment-year observations[3].

Occupation is available from the population register only for the period 2003-2007 and there are a number of missing observations such that only between 91 and 94 percent of the observations in our sample are covered. Unlike Poole (2013) we use this information for robustness only. Similar to Poole (2013) we group occupations into four dummies: Managers, professionals & technicians and associate professionals into “Professional or managerial occupations”; Clerical support workers and Service and sales workers into “Other white collar occupations”; Skilled agricultural, forestry and fishing workers & Craft and related trades workers into “Skilled blue collar occupations”; and Plant and machine operators and assemblers and Elementary occupations into “Unskilled blue col-

[2]We also drop the very few workplaces that are classified as private households and extraterritorial organisations.

[3]The public sector accounts for around 40% of employment, while the remaining dropped observations account for about 2% of employment.

lar occupations".

To measure wages, we make use of the annual earnings variable from the population register data. This is the sum of earnings that give pension points in the Norwegian pension system. In addition to wages from all employers, the variable also includes payments for maternity leave, unemployment and partial disability. We attribute all these payments to the employer in November of the relevant calendar year.

2.2 Ireland

For Ireland, we work with a combined dataset based on three administrative data sources. Our main dataset is a worker-level panel tracking the universe of formal workers in the Irish economy from 2005 to 2016 from the Irish Central Statistics Office called the SPP35. This dataset is based on tax records filed by employers on behalf of their workers to the Irish Revenue Commissioners (tax authorities). This file includes a unique worker identifier and a unique firm identifier for the main employer. This dataset is first combined with data on additional worker characteristics from the Irish Department of Social Protection Client Record System (CRS) using a unique worker identifier. These characteristics include worker gender, age, nationality and number of weeks worked eligible for social insurance. The CRS information does not vary over time.

The unique firm identifier allows the P35 and CRS data to be merged to the firm level data from the Irish Central Statistics Office (CSO) Business Register. The CSO Business Register covers all firms in the Irish economy and is based on data collected by the Irish Companies Registration Office. All firms in Ireland are required to register with the Companies Registration Office and file an annual return with them. Firms that are incorporated outside Ireland and establish a subsidiary within Ireland must also register an Irish firm with the Companies Registration Office. Firm characteristics includes industry affiliation and geographic location. A firm is considered to be foreign owned if the share of foreign investment is greater than 50%[4].

The worker-level data contains a separate entry for every registered employment position in Ireland in each year from 2005 to 2016. We isolate workers based on their main social welfare category. Some workers are in one or all of the following categories: pensioner, director or employee. We assign workers to the category in which they have the most weeks of employment per year that are liable for social insurance contributions. Where they have 52 of each, we classify them as an employee. If they have 52 weeks as both a pensioner and a director, we classify them as pensioners and drop them. We also exclude workers over 64 and under 16.

Like Poole (2013) we keep private sector firms, and thus exclude workers employed in households and international/external government employers (NACE rev. 2 letters T and U) and workers in the public sector or similar (NACE rev. 2 letters O, P and Q). We further exclude all workers with wages of less than 15,051 euros per year. (EUR 15,051 corresponds to the wage one would earn from working full-time for one year at the national minimum wage in 2011.)

[4]Using information on the ultimate controlling parent we are careful not to classify corporate inversions as Irish.

2.3 Comparison of the datasets

Table 1 summarises the information on data coverage and preparation including the information from the reference paper. Key differences to note are as follows: As already mentioned the reference paper employs a sample of Brazilian formally employed workers, while data for Ireland and Norway cover the (employed) population at the outset. The datasets for Brazil and Norway are at the establishment level, the dataset for Ireland is at the firm level. In the reference paper an establishment is defined as foreign owned in all sample years if any foreign capital stock in the establishment is recorded in the last year of the sample. For both Ireland and Norway, the foreign ownership definition is specific to each year. For Ireland foreign ownership is based on the location of the firm's ultimate owner. For both Ireland and Norway a firm/an establishment is considered to be foreign owned if the share of foreign investment in the establishment is greater than 50%[5]. As we will explain in the methodology section below, the definition of the key explanatory variables, i.e. shares of hires from MNE and domestic firms is cumulative in the reference paper. To ensure greater comparability to the reference paper which covers a time period of six years, we split the 12 year sample for Ireland into two separate sample periods 2005-2010 and 2011-2016.

2.4 Methodology

To get a better sense of the differences in specifications and variables used across the three countries, we briefly recap the methodology set out in Poole (2013). While Poole (2013) starts with a specification with a less demanding set of fixed effects (which we will also replicate), the main specification in her equation (3) is as follows:

$$\ln y_{ijt} = \gamma_M S^M_{jt} + \gamma_D S^D_{jt} + \psi_i + \lambda_{j(i)} + \delta_k t + \delta_r t + \beta_1 X_{it} + \beta_2 Z_{jt} + \epsilon_{ijt}, \tag{1}$$

where i indexes the individual, j the establishment/firm, k industry, r region, t time, and the dependent variable $\ln y_{ijt}$ is individual-level log wages. The model includes individual fixed effects ψ_i to account for unobserved individual-specific ability, establishment fixed effects $\lambda_{j(i)}$ to control for establishment heterogeneity, $\delta_k t$ and $\delta_r t$ are industry-year and region-year fixed effects that account for factors that are specific to the industry-year and region-year. X_{it} are time-varying, individual-specific characteristics and Z_{jt} time-varying, establishment/firm-specific characteristics. Specifically, Poole (2013) includes the following individual characteristics: age, age-squared, tenure at the establishment, education, and the skill intensity of the worker's occupation. The establishment characteristics in her model are: log employment, average tenure of the workforce, share of the establishment female, average education of the workforce, and average occupational skill intensity of the workforce.

This model is estimated on the sample of incumbent workers in domestically owned establishments/firms for the respective sample period(s) for each country[6]. Identification in this model is based on changes over time in the share of former multinational workers within an establishment for each incumbent worker. Standard errors are clustered at the establishment/firm-year level.

[5] Note that in both countries the vast majority of establishments with foreign interests are fully foreign owned.

[6] Note that the restriction to incumbent workers implies that worker fixed effects are identical to worker-establishment/firm fixed effects.

Table 1: Data description - comparison across countries

Item	Brazil (Poole (2013))	Ireland	Norway
Data			
Time period	1996-2001	2005-2016; splits: 2005-2010, 2011-2016	1998-2007
Sources			
- Worker data	Labor Ministry: Relação Anual de Informações Sociais (RAIS)	CSO-matched data from Revenue Commissioners and Department of Social Protection: SPP35	Statistics Norway annual population files for ages 16-74
- Employer data	constructed from worker data using establishment id	constructed from worker data using firm id plus BR information	constructed from worker data using establishment id
- FDI data	Central Bank: Registro Declaratório Eletrônico-Investimentos Externos Diretos (RDE-IED)	CSO Business register (BR)	Statistics Norway: SIFON register
Level of observation	establishment	firm	establishment
Data coverage	formally employed workers: 1% RAIS sample, 5% RAIS sample of males	population of employed workers	population
Sector coverage	workers with private sector contracts, excl. CNAE 95 and 99	private sector (firm level), i.e. excl. NACE rev. 2 letters O, P, Q, T, U (worker level)	private sector (establ. level), i.e. excl. Norwegian SIC (2002)[1] letters P, Q
Definitions			
- Foreign ownership	foreign-owned in all years if establishment has a positive stock of foreign capital in 2001	foreign ownership share > 50%, annual definition	foreign ownership share > 50%, annual definition
- wage measure	annual real wages in reais	annual real wages in Euros (including benefits in kind and pension contributions)	annual earnings in Norwegian Krona: total pensionable earnings, incl. wages and benefits from all employers, plus payments for maternity leave, unemployment, partial disability
Sample restrictions			
- employers	establishments/firms (IRL) with data for at least two periods		
- workers	workers in the sample for at least two years		
	workers aged 15-64	workers aged 16-64	workers aged 16-74
	full-time workers receiving positive wages	workers with salaries > $15,051$EUR and 52 weeks social security contributions per year	establishments with total wage bill > $100,000$ in 2007 NOK

[1] Corresponds to NACE rev. 1.1.

Note that since the publication of the reference paper, the user written STATA command 'reghdfe' has become available to estimate models with high dimensional fixed effects. We use this instead of the 'xtreg' command employed by Poole (2013) to reduce computing time given the larger samples.

The key variables of interest in the equation above are S_{jt}^{M} - the share of the domestically owned establishment's workforce with experience in a multinational establishment - and S_{jt}^{D} - the share of the domestically owned establishment's workforce hired from another such establishment (with no previous experience at a multinational establishment). The idea is that a positive and significant difference in coefficient estimates $\gamma_M - \gamma_D$ is an indication of multinational wage spillovers.

Table 2 shows how the set of control variables employed for the Irish and Norwegian datasets compares to this. For Norway, the available control variables are by and large comparable to those used in the reference paper. One minor difference is that rather than using the share of workers with high-school education, we use the share of workers with at least some high-school education. The main difference is that occupation information for Norway is available only for the last few years of the sample (2003-2007) and there are a number of missing observations such that, depending on the year, only between 91 and 94 percent of the observations in our sample are covered. We use this information only to define the sample splits in Tables 10 and 11. In the case of Ireland, the set of control variables and also the information used to perform sample splits is more limited. Specifically, there is no information on worker's education or occupation available. Note, however, that the estimating equation includes individual fixed effects. Hence, to the extent that, at the individual level, these variables are likely to change only for a small share of workers over the relatively short sample periods, this omission is unlikely to affect the coefficient estimates substantially.

2.5 Classifying our analysis

Given these differences across datasets and coverage, we propose the following assessment of the type of replication exercise performed: Figure 2 reproduces Table 1 from Clemens (2017) proposition for the classification of replication studies.

This study is based on datasets for different countries and time periods to that of the original study. Consequently, the sampling distribution is different, and it falls into the 'Robustness' category. Likewise, we are only able to use the same methodological specification where we have access to the same variables with the same definitions as in the original study. Thus, our analysis most closely aligns with the 'Robustness – Extension' set of categories in Clemens' classification. Note also, that we further perform a small set of additional robustness checks for Ireland and Norway.

3 Summary statistics

Before progressing to the regression results, we provide some summary statistics. Table 3 shows the numbers of establishments/firms and workers in all three countries. As the datasets for Ireland and Norway relate to the population, the number of foreign-owned establishments/firms are naturally much closer to those in the full population than in the case of the 1% sample for Brazil. Note the difference in numbers between Ireland versus Brazil and Norway is to a certain extent due to the Irish data being at firm rather than establishment level. The differences in number of workers

Table 2: Control variable definition & availability - comparison across countries

Item	Brazil (Poole (2013))	Ireland	Norway
Worker controls			
age	yes	yes	omitted[1]
age-squared	yes	omitted[1]	omitted[1]
tenure at establ./firm	yes	yes	omitted[1]
education	3 highest level of education dummies	no	3 highest level of education dummies
skill intensity of occupation	Professional or Managerial, Other White Collar, Skilled Blue Collar, Unskilled Blue Collar	no	robustness 2003-2007: Professional or Managerial, Other White Collar, Skilled Blue Collar, Unskilled Blue Collar
Establishment/workforce controls			
log employment	yes	yes	yes
average tenure	yes	yes	yes, where tenure = age - age at reaching highest recorded level of education
share of females	yes	yes	yes
average education	share of workers with high-school education, share of workers with complete college education	no	share of workers with at least some high-school education, share of workers with complete college education
avg. occupational skill intensity	yes, establ. level shares based on worker occupation	no	robustness 2003-2007, establ. level shares based on worker occupation
share of workers by age group[2]	yes	yes	yes
Fixed effects			
industry (2-digit)	Classificação de atividades econômicas 1995	NACE rev. 2	NACE rev. 1.1
region	27 states	8 NUTS3 regions	160 labour market regions

[1] These variables are available in the data, however, due to near perfect collinearity with age/tenure and the worker fixed effect they yield nonsensical coefficient estimates and are thus excluded.
[2] Brazil & Ireland: 15-17 BRA/16-17 IRL, 18-24, 25-29, 30-39, 40-49, 50-64;
Norway 16-17, 18-24, 25-29, 30-39, 40-49, 50-59, 60-75.

Table 1. A Proposed Standard for Classifying Any Study as a Replication.

	Sampling distribution for parameter estimates	Sufficient conditions for discrepancy	Types	Methods in follow-up study versus methods *reported* in original: Same specification	Same population	Same sample	Examples
Replication	*Same*	*Random chance, error, or fraud*	Verification	**Yes**	**Yes**	**Yes**	*Fix faulty measurement, code, data set*
			Reproduction	**Yes**	**Yes**	*No*	*Remedy sampling error, low power*
Robustness	*Different*	*Sampling distribution has changed*	Reanalysis	*No*	**Yes**	**Yes**/*No*	*Alter specification, recode variables*
			Extension	**Yes**	*No*	*No*	*Alter place or time; drop outliers*

Notes: The "same" specification, population, or sample means the same as *reported* in the original paper, not necessarily what was contained in the code and data used by the original paper. Thus for example if code used in the original paper contains an error such that it does not run exactly the regressions that the original paper said it does, new code that fixes the error is nevertheless using the "same" specifications (as described in the paper).

Figure 2: Classifying replication

Source: Clemens (2017), Table 1

between Brazil versus Ireland and Norway reflect the size of the underlying datasets (1% sample versus populations).

Table 4 shows the number of separations and percentages of subsequent rehires used in the construction of the shares of former MNE and former domestic establishment/firm workers that are the main variables of interest in the regression equation. Unfortunately, it is not possible to distinguish between non-rehired and rehired workers in the Irish or Norwegian data. As a result, the shares of rehired are not directly comparable across the three countries. However, in all three countries the shares rehired in domestic establishments are highest. As a percentage of total for Norway and Ireland and of those rehired for Brazil the share of workers rehired by MNEs is higher in Norway and Ireland than in Brazil, reflecting the larger shares of multinationals present in these countries. Again, the key variables of interest S_{jt}^{M} and S_{jt}^{D} are defined as follows: S_{jt}^{M} is the share of the domes-

Table 3: Samples

Item	Brazil (Poole (2013))[1]	Ireland 2005-10	Ireland 2011-16	Norway
N establishments/firms in sample				
- foreign total	12,401	3,476	2,679	15,738
- foreign in sample	3,814	3,250	2,519	14,791
N workers sample				
- domestic	305,774	1,114,241	974,968	1,636,525
- foreign	12,793	397,459	354,388	552,623

[1] Numbers taken from Poole (2013), p. 396.

Table 4: Separations and rehires, cf. Table 1 in Poole (2013)

	Brazil		Ireland 2005-10		Ireland 2011-16		Norway	
	foreign	dom	foreign	dom	foreign	dom	foreign	dom
N Separations	4,056	180,936	50,195	566,534	147,573	476,429	385,146	1,601,345
Percent of separations								
Not rehired	0.648	0.651	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Rehired	0.365	0.434	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
of which[1]:								
- in same establ./firm	0.051	0.107	0.171	0.112	0.116	0.120	0.093	0.114
- in MNE	0.104	0.012	0.441	0.221	0.450	0.197	0.533	0.248
- in domestic	0.293	0.428	0.507	0.749	0.566	0.771	0.647	0.860

[1] The "of which" categories allow for multiple possibilities, hence they do not sum to 'Rehired' for Brazil or to 1 for Ireland and Norway.

tically owned establishment's workforce with experience in a multinational establishment, S^D_{jt} is the share of the domestically owned establishment's workforce hired from another such establishment (with no previous experience at a multinational establishment). Note that these shares increase mechanically over the sample period.

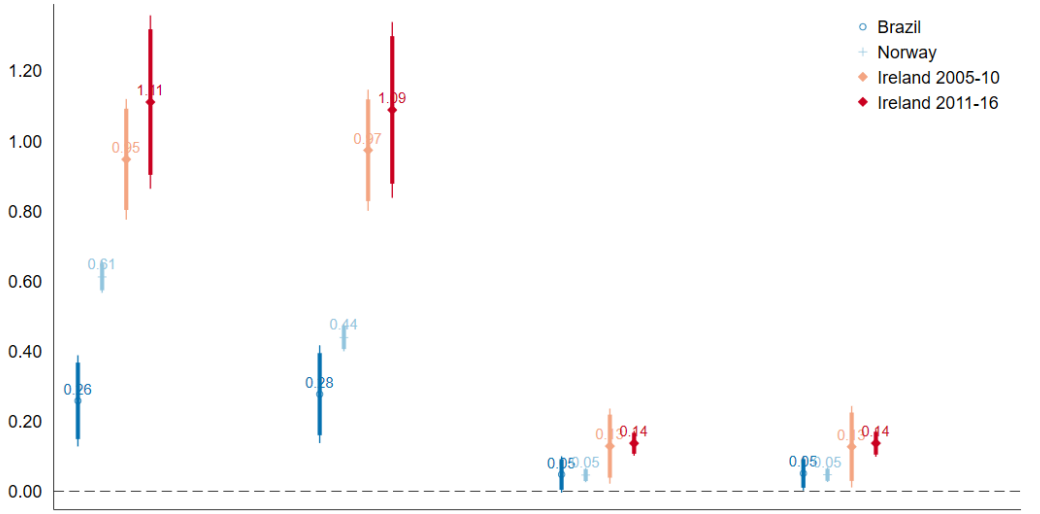
4 Results

The regressions are estimated on the sample of workers in domestic establishments. We follow Poole (2013) in keeping only establishments that have hires from both other domestic establishments/firms and from MNEs. Furthermore, also in line with Poole (2013) we estimate the impact of MNE-switcher workers on the retained workforce in the domestic establishment/firms, defined as the set of workers who have never switched into or out of any domestic establishment, thus creating a balanced panel of the incumbent domestic workforce. Because the sample of workers remains in the same domestic establishment, individual fixed effects (ψ_i) fully absorb the establishment-specific effects ($\lambda_{j(i)}$) (Abowd et al., 1999).

The number of worker-year observations of domestic incumbents in the baseline regressions is 96,560 for Brazil, 1,697,752 for Norway, 1,222,770 for Ireland 2005-2010, and 1,411,776 for Ireland 2011-2016. For ease of exposition we report coefficient plots of the regression coefficients of $\gamma_M - \gamma_D$ together with 99 and 95% confidence intervals for each of the three countries and the two time periods for Ireland. As Poole (2013) reports the F-statistic and its p-value for the estimates for Brazil, we construct confidence intervals for Brazil by using her reported p-value and applying the normal distribution. For Norway and Ireland, the confidence bands are based on the standard errors obtained from using STATA's 'lincom' command.

In the first set of regressions Poole (2013) gradually builds up to the estimating equation reported above using different sets of fixed effects; the results corresponding to her Table 2 are reported in Table/Figure 5 (estimates are reported in Table A2 in the Appendix). The results in column 1 are obtained without the inclusion of fixed effects, in column 2 year dummies are added,

Table/Figure 5: Multinational spillovers, cf. Table 2 in Poole (2013)

Dep Var: log annual wages	(1)	(2)	(3)	(4)
				
Year FE	No	Yes	Yes	Yes
Establ./firm FE	No	No	Yes	Yes
Worker FE	No	No	No	Yes

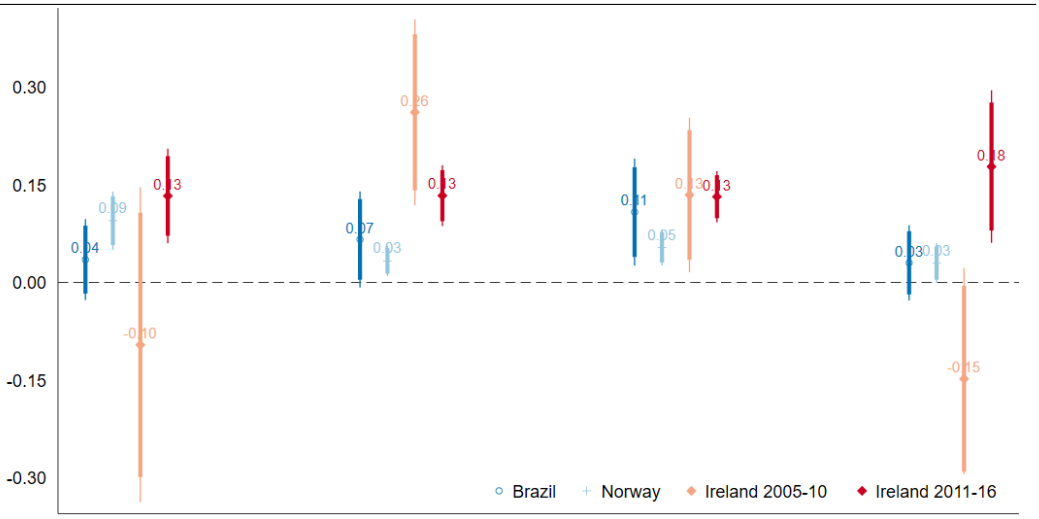
[1] The figure reports $\gamma_M - \gamma_D$ together with 90 (thinner line) and 95% confidence intervals. All regressions include time-varying worker and establ./firm characteristics X_{it} and Z_{jt} as outlined in Table 2.

in column 3 year and establishment/firm fixed effects are included and in column 4 year, establishment/firm fixed and worker fixed effects are included. The coefficient estimates are significantly different from zero in all specifications, indicating the presence of wage spillovers from workers formerly employed in multinational establishments/firms. The coefficients for Norway are more precisely estimated than for Brazil and Ireland. Naturally, the size of the estimates declines as more fixed effects are added, yet in column 4 the estimated effect size for Ireland in both periods is roughly twice that of Brazil and Norway were magnitudes are comparable. Specifically, a 10 percentage point increase in the share of former multinational workers, holding the share of non-MNE switchers constant, increases an incumbent domestic worker's wages by approximately 0.52% for Brazil, by 0.48% for Norway, and by 1.39 and 1.45% for Ireland 2005-10 and 2011-2016.

Table/Figure 6 reports the results comparing workers in high vs low union and high vs low skill sectors corresponding to Table 3 in the reference paper (estimates are reported in Table A3 in the Appendix). For detailed information on the two sample splits in this figure please refer to Table A1 in the Appendix. The first two columns split the sample into low and highly unionised sectors. Poole (2013, p. 400) argues that the structure of the labour market allows to distinguish between two hypotheses based on the premise that worker-level wage spillovers will result when former

Table/Figure 6: Multinational spillovers, by industry characteristics, cf. Table 3 in Poole (2013)

	(1)	(2)	(3)	(4)
Dep Var:		unionisation		skill intensity
log annual wages	high union	low union	high-skill	low-skill



[1] The figure reports $\gamma_M - \gamma_D$ together with 90 (thinner line) and 95% confidence intervals. All regressions include year FE, establ./firm FE, worker FE as well as time-varying worker and establ./firm characteristics X_{it} and Z_{jt} as outlined in Table 2.

MNE workers bring knowledge in the form of physical capital which may enhance the productivity and profitability of the domestically owned establishment. If profits are shared with workers in an imperfectly competitive labor market setting, workers will see improvements in wages. In this case, worker-level wage spillovers occur only because of establishment-level productivity spillovers. Instead, in another hypothesis, the labor market is assumed to be competitive, and multinational workers directly interact and transfer knowledge in line with the social interaction theory. In this case, worker-level wage (productivity) spillovers may lead to firm-level productivity spillovers. As reported in the figure, Poole (2013) finds that for Brazil only the coefficient in the low union sectors is statistically significant. It is also larger than that for the highly unionised sectors pointing towards the second hypothesis. Note, however, that the confidence bands for the two sectors overlap. For Norway, the coefficients for both splits are significantly different from zero. And while the difference goes in the same direction as for Brazil, coefficient sizes are very similar and confidence bands for the two sectors overlap. For Ireland in the early period (2005-10) only the coefficient for the low union sectors is statistically significant. As for Brazil it is larger in the highly unionised sectors, but the confidence bands for the two sectors overlap. In the later period in Ireland (2011-16) the coefficient estimates for the two sectors are nearly identical.

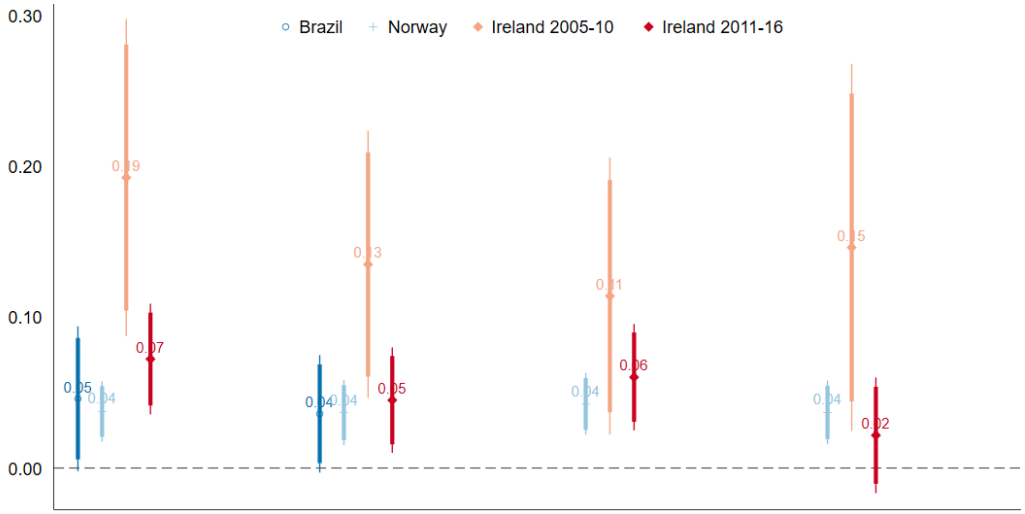
Columns 3 and 4 of Table/Figure 6 examine whether workers in more high-skilled industries experience larger multinational wage spillovers. This is based on the theory of workplace interactions which considers the transfer of information among individuals as an important element. For Brazil, Norway and Ireland in the 2005-11 period coefficient estimates are higher in high-skilled industries and more substantially so in Brazil and Ireland. However, in all four instances, the confidence bands overlap between the two types of industries (bearing in mind that the results are derived from separate regressions).

Based on the argument that skills may be industry specific and that multinational presence may differ across regions affecting reallocation of workers, Poole (2013) replaces the basic year fixed effects from Table/Figure 5 with industry-year and region-year fixed effects. This specification is applied to all further regressions. We replicate these estimates in Table/Figure 7 (cf. Table 4 in the reference paper, (estimates are reported in Table A4 in the Appendix). With the more demanding set of fixed effects, the coefficient estimates remain similar to the specification in column 4 of Table/Figure 5 for Brazil and Norway. The coefficient estimate increases somewhat for Ireland in the earlier period but is reduced to about half in the 2011-16 period. In the case of Brazil the coefficient is less precisely estimated; it is significant only at the 10% level, for Norway and Ireland there is little change in precision. In the second column, the sample is restricted to males only. This allows Poole (2013) to draw a larger (5%) sample of the working population in Brazil — addressing the concern that the overall estimates may be affected by women being potentially less attached to the labour market and more likely to be in part-time working arrangements. These estimates are presented in column 2 of Table/Figure 7. For Norway and Ireland, they refer to all males in the sample. The estimated coefficients are marginally smaller compared to those in the first column suggesting that this is not a big concern. Note, however, that the restriction to workers in domestic establishments/firms who have never switched into or out of any domestic establishments/firms is likely to already restrict the set of workers to those with more traditional stable working arrangements.

We add two further robustness checks here beyond the results presented in the reference paper. First, since foreign multinational experience and experience in other domestic establishments/firms are defined cumulatively in the reference paper, in the third column of Table/Figure 7 we redefine the shares S_{jt}^{M} and S_{jt}^{D} based only on a worker's experience in a foreign multinational or other domestic establishment/firm in the past three years. This also accounts for the sample period for Norway being nearly twice as long relative to the other countries. While the coefficient estimate for Norway is hardly affected, the estimates for Ireland in both periods are smaller compared to those in column 1; in all cases the coefficients are more precisely estimated. In column 4 we add lagged firm growth as an additional control variable. High-growth establishments/firms are likely to also be paying higher wages which if uncontrolled for may be attributed to spillover effects. This check slightly reduces the coefficient estimates relative to column 1; for Ireland in the period 2011-2016 the estimate is no longer statistically significant.

In her Table 5, Poole (2013) checks for omitted variables, specifically for productivity shocks which might cause establishments/firms to seek out former MNE workers or alternatively higher quality workers sorting into higher quality establishments/firms. She uses the export status and future export status of the domestic employers of the incumbent workers as a proxy for such potential productivity shocks. We replicate this analysis in Table/Figure 8 (estimates are reported in Table A5

Table/Figure 7: Multinational spillovers, cf. Table 4 in Poole (2013) plus extensions

Dep Var: log annual wages	(1) change FE	(2) males only	(3) movers in last 3yrs only	(4) add firm growth
				
Establ./firm FE	Yes	Yes	Yes	Yes
Worker FE	Yes	Yes	Yes	Yes
Ind-yr FE	Yes	Yes	Yes	Yes
Reg-yr FE	Yes	Yes	Yes	Yes

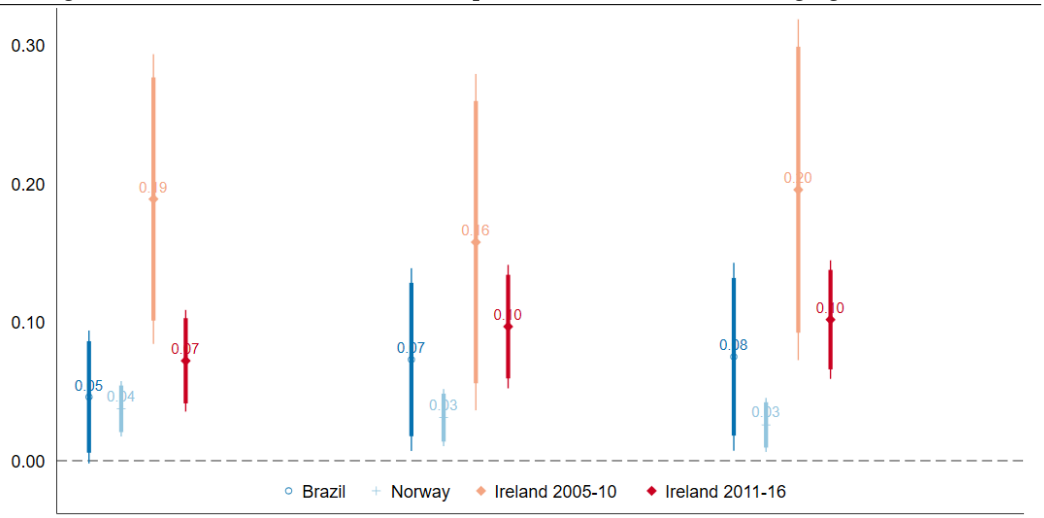
[1] The figure reports $\gamma_M - \gamma_D$ together with 90% (thinner line) and 95% confidence intervals. All regressions include time-varying worker and establ./firm characteristics X_{it} and Z_{jt} as outlined in Table 2.

in the Appendix) in columns 1 - controlling for current export status and 2 - controlling for current export status and export status in period $t+1$. The coefficient estimates remain reasonably stable relative to the baseline specification in column 1 of Table/Figure 7 for all three countries. Note that Poole (2013) includes export status as well as controls for the number of products exported and the number of destinations plus quadratic terms of each to account for nonlinearities for Brazil. We use the same set of covariates for Norway. For Ireland we only have access to information on export status. To capture further that former multinational workers may be better able at distinguishing high-expected wage growth firms, in the last column of Table/Figure 8 future wage growth is added in addition to export status and future export status. Again, the coefficient estimates remain reasonably stable relative to the baseline specification in all three countries.

An alternative explanation to productivity spillovers from multinationals is that multinational establishments/firms may simply be better at screening worker quality than are domestically owned establishments. To test for this, Poole (2013) includes the MNE-switcher worker's tenure at the multinational establishment. Specifically, the main variables of interest, S_{jt}^M and S_{jt}^D, are split into

Table/Figure 8: Multinational spillovers, omitted variables, cf. Table 5 in Poole (2013)

Dep Var: log annual wages	(1) exporters	(2) current & future exporters	(3) current & future exporters & future wage growth



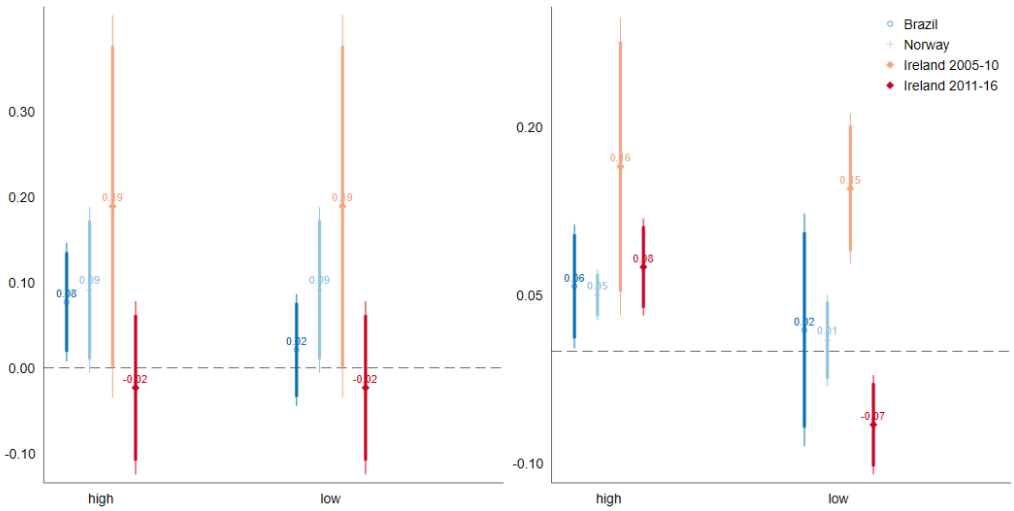
[1] The figure reports $\gamma_M - \gamma_D$ together with 90% (thinner line) and 95% confidence intervals. All regressions include industry-year and region-year FE, establ./firm FE, worker FE as well as time-varying worker and establ./firm characteristics X_{it} and Z_{jt} as outlined in Table 2.

shares with low tenure and shares with high tenure based on the sample's median tenure (which is approximately 2 years in her case). We group workers into the high tenure category if they have at least three years of tenure in the previous establishment. Her results — replicated in column 1 of Table/Figure 9 (estimates are reported in Table A6 in the Appendix) — support the hypothesis that the longer the MNE-switcher worker was employed at the multinational establishment, the better able is the worker to transfer information to the incumbent domestic workforce which results in higher wages for these workers. We obtain similar differences for Norway and Ireland. However, for all countries including Brazil, the confidence bands around the high and low-tenure differences in shares overlap. Poole (2013) is also able to test (her Table 6, column 2) whether spillovers are greater from workers that are laid off versus workers that quit, this information is not available for either Norway or Ireland.

Next Poole (2013) examines whether the basis of the spillovers is that the sending establishment/firm is a multinational or more generally a high-productivity establishment/firms. She employs two proxies to separate multinational and domestic establishments into high- and low-productivity establishments. In the first column multinational workers are split into former MNE exporting workers (high productivity) and former MNE non-exporting workers (low productivity). This split is not available for Norway or Ireland as all multinational firms are also exporters. We

Table/Figure 9: Multinational spillovers, MNE screening and productivity, cf. Tables 6 & 7 in Poole (2013)

	(1)	(2)
Dep Var:		
log annual wages	job tenure	high wages



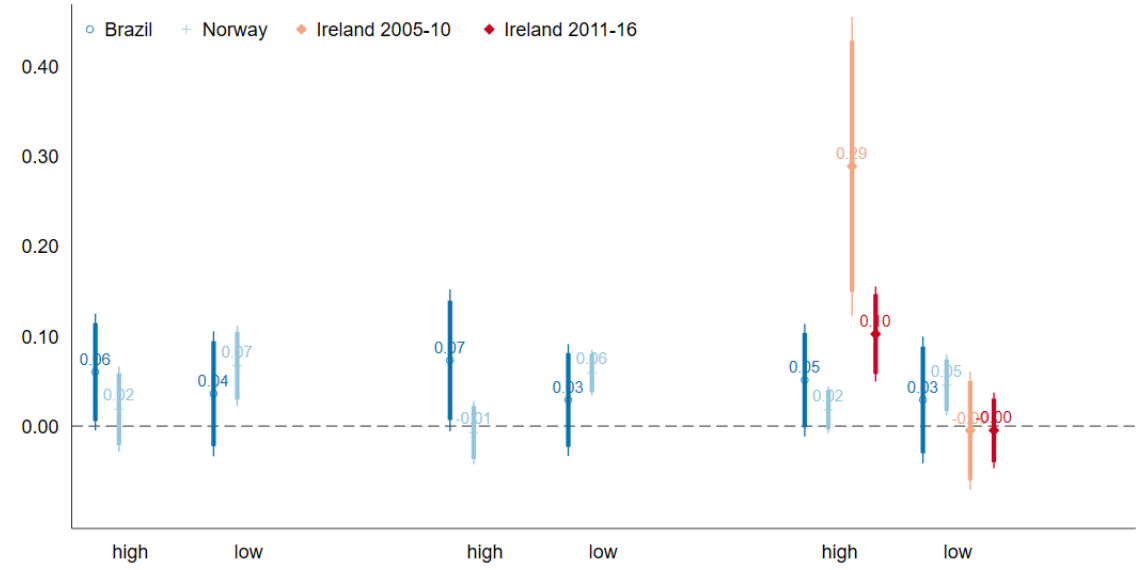
[1] The figure reports $\gamma_M - \gamma_D$ together with 90% (thinner line) and 95% confidence intervals. All regressions include industry-year and region-year FE, establ./firm FE, worker FE as well as time-varying worker and establ./firm characteristics X_{it} and Z_{jt} as outlined in Table 2.

are able to replicate her second exercise where she splits establishments into high-wage and low-wage establishments by the median of the estimated establishment fixed effect obtained from a separate Mincer (1974) wage regression. This separate wage regression includes all the covariates listed in Table 2 and importantly, establishment fixed effects. Based on this, workers are split into former high-wage MNE workers, former low-wage MNE workers, other high-wage other domestic establishment/firm workers, and other low-wage domestic establishment/firm workers. We replicate the results of Poole's 2013 specification in the second column of her Table 7 in column 2 of our Table/Figure 9. Poole interprets her results as suggesting that for Brazil there are significant spillovers only from high-wage establishments. Our results confirm this for Norway and Ireland in the 2011-2016 period. In the 2005-2010 period the coefficient estimates are very similar for both high- and low-wage sending firms in Ireland. Yet, here again, the confidence bands around the high vs low-wage coefficients overlap in all cases except the latter period in Ireland.

The final set of results in the reference paper examines multinational spillovers by worker skill level. This is done by distinguishing first high- and low-skill switchers and second high and low-skill incumbent workers. Poole employs three proxies for skill levels: education, where high education refers to high school and above; occupation where high occupation refers to professional or managerial and other white collar workers; and the worker fixed effects from a separate Mincer (1974)

Table/Figure 10: Multinational spillovers, by switcher skill level, cf. Table 8 in Poole (2013)

	(1)	(2)	(3)
Dep Var: log annual wages	education	occupation	ability



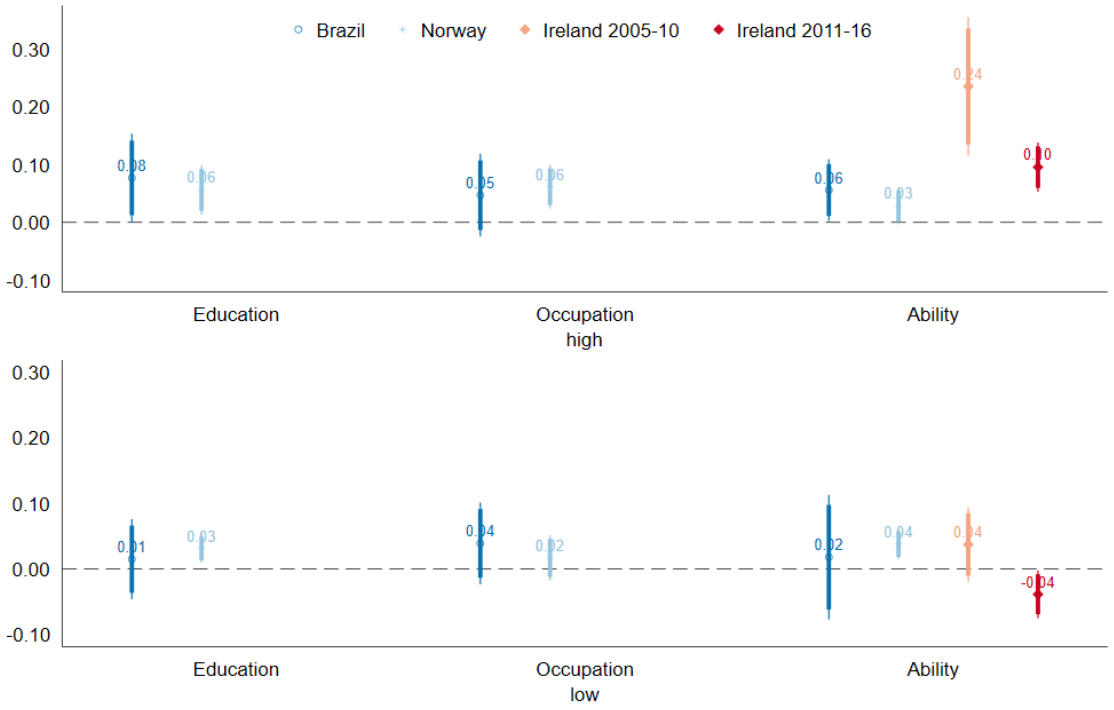
[1] The figure reports $\gamma_M - \gamma_D$ together with 90% (thinner line) and 95% confidence intervals. All regressions include industry-year and region-year FE, establ./firm FE, worker FE as well as time-varying worker and establ./firm characteristics X_{it} and Z_{jt} as outlined in Table 2.

wage regression that includes as above all covariates mentioned so far plus worker fixed effects are used to proxy for ability which is considered to be high if the worker fixed effect is above median. The results for switcher skill level (Poole's 2013 Table 8) are replicated in Table/Figure 10 (estimates are reported in Table A7 in the Appendix). These results indicate for all three countries that wage spillovers tend to be higher from former high-skill MNE workers. Again, the confidence bands on the coefficient estimates for high and low-skill workers overlap for Brazil, Norway, and Ireland in the 2011-2016 period.

The split into high- and low-wage incumbents (cf. Poole (2013), Table 9) is replicated in Table/Figure 11 (estimates are reported in Tables A8 and A9 in the Appendix). Note, here the top and bottom panels are estimated in separate regressions. As in the reference paper, higher incumbent worker skill also does seem to make a greater difference in terms of the size of former multinational worker wage spillovers for all three countries. Also, here the confidence bands around the coefficients are wide enough with the exception of Ireland to call into question whether these differences are significant.

Table/Figure 11: Multinational spillovers, by incumbent skill level, cf. Table 9 in Poole (2013)

	(1)	(2)	(3)
Dep Var: log annual wages			



[1] The figure reports $\gamma_M - \gamma_D$ together with 90% (thinner line) and 95% confidence intervals. All regressions include industry-year and region-year FE, establ./firm FE, worker FE as well as time-varying worker and establ./firm characteristics X_{it} and Z_{jt} as outlined in Table 2.

5 *Discussion and conclusion*

In this paper, we replicate and conduct robustness on the analysis of wage spillovers from former multinational workers to domestic incumbent workers originally performed for Brazil by Poole (2013) for Norway and Ireland. Despite the different nature of the countries, different time periods, and a considerably higher level of FDI interests in Ireland, by and large our results confirm the findings in the reference paper. Crucially, our results however also suggest that the differences between various sample splits such as for workers in sectors with different levels of unionisation or skill intensity, workers with high versus low job tenure or high versus low waged workers, or

in the levels of high- versus low-skill MNE switchers as well incumbent workers highlighted in the reference paper are, with some few exceptions for Ireland, not statistically significant. Moreover, given the endogeneity of worker movement, the question whether these effects truly capture FDI spillovers through worker mobility remains.

References

Abowd, John M., Francis Kramarz, & David N. Margolis (1999). "High Wage Workers and High Wage Firms." *Econometrica*, 67(2), 251–333. DOI: 10.1111/1468-0262.00020.

Alfaro-Ureña, Alonso, Isabela Manelici, & Jose P. Vasquez (2021). "The Effects of Multinationals on Workers: Evidence from Costa Rican Microdata." Working Papers, Princeton University, Department of Economics. PDF: https://jpvasquez-econ.github.io/files/Effects_MNC_Workers.pdf.

Balsvik, Ragnhild (2011). "Is Labor Mobility a Channel for Spillovers from Multinationals? Evidence from Norwegian Manufacturing" *Review of Economics and Statistics*, 93(1), 285–297. DOI: 10.1162/REST_a_00061.

Clemens, Michael A. (2017). "The Meaning of Failed Replications: A Review and Proposal." *Journal of Economic Surveys*, 31(1), 326–342. DOI: 10.1111/joes.12139.

Görg, Holger, & David Greenaway (2004). "Much Ado about Nothing? Do Domestic Firms Really Benefit from Foreign Direct Investment?" *The World Bank Research Observer*, 19(2), 171–197. DOI: 10.1093/wbro/lkh019.

Keller, Wolfgang (forthc.). "Knowledge Spillovers, Trade, and Foreign Direct Investment." *Oxford Research Encyclopedia of Economics and Finance*.

Mincer, Jacob (1974). "Schooling, Experience, and Earnings." New York: Colombia University Press.

Poole, Jennifer P. (2013). "Knowledge Transfers from Multinational to Domestic Firms: Evidence from Worker Mobility." *The Review of Economics and Statistics*, 95(2), 393–406. DOI: 10.1162/REST_a_00258.

Setzler, Bradley, & Felix Tintelnot (2021). "The Effects of Foreign Multinationals on Workers and Firms in the United States" *The Quarterly Journal of Economics*, 136(3), 1943–1991. DOI: 10.1093/qje/qjab015.

Smeets, Roger (2008). "Collecting the Pieces of the FDI Knowledge Spillovers Puzzle." *The World Bank Research Observer*, 23(2), 107–138. DOI: 10.1093/wbro/lkn003.

Appendix

Table A1: Definitions of sample splits in Table/Figure 6 - comparison across countries

Item	Brazil (Poole (2013))	Ireland	Norway
Unionisation	Unionisation status of the establishment's industry is based on Brazil's household survey, Pesquisa Nacional por Amostra de Domicilios, which contains information on the household member's industry of employment and whether the household member belongs to a union. Based on industry-level unionisation rates for each of Brazil's four-digit industries over time, the sample is split into a time-invariant dummy variable equal to 1 if the value of the unionisation measure for the industry is greater than the median value across all industries in 1992 and 0 otherwise.	High vs low union membership is based on splitting NACE letter sector level percentages from the Labour Force survey in 2006 at the median. Source: https://www.cso.ie/en/statistics/labourmarket/labourforcesurveylfstimeseries/	Based on worker-level union membership inferred from tax deductions for union membership. Sample is split into a time-invariant dummy variable equal to 1 if the value of the share of union members in the NACE 3-digit industry is greater than the median value taken over all NACE 3-digit industries in 2002 and 0 otherwise.
High-skill industries	industries above the median value of skill, as defined by the share of the workforce with at least a high school education in 1995.	Based on EU KLEMS, industries with $> 50\%$ of workers classified as 'intermediate' or 'university graduate' in 2002 defined as high-skill. Source https://euklems.eu.	NACE 3-digit industries above the median value of skill, as defined by the share of the workforce with at least a high school education in 2000.

Table A2: Estimates corresponding to Table/Figure 5, cf. Table 2 in Poole (2013)

Dependent variable: Log Annual Wage	(1)	(2)	(3)	(4)
Year FE	No	Yes	Yes	Yes
Establ./Firm FE	No	No	Yes	Yes
Worker FE	No	No	No	Yes
Brazil				
$\gamma_M - \gamma_D$	0.258	0.277	0.048	0.051
F-statistic	35.46	41.32	3.37	4.21
p-value	0.00	0.00	0.07	0.04
γ_M	0.259 (0.043)**	0.279 (0.043)**	0.053 (0.026)*	0.056 (0.025)*
γ_D	0.001 (0.004)	0.003 (0.004)	0.005 (0.002)**	0.006 (0.002)**
N	96,560	96,560	96,560	96,560
R^2	0.5075	0.5101		
Within-R^2			0.3402	0.1792
Ireland (2005-2010)				
$\gamma_M - \gamma_D$	0.947	0.973	0.129	0.127
SE	0.088	0.088	0.055	0.059
p-value	0.000	0.000	0.018	0.032
γ_M	1.337 (0.083)**	1.200 (0.088)**	-0.083 (0.039)*	-0.087 (0.043)*
γ_D	0.391 (0.027)**	0.227 (0.057)**	-0.212 (0.039)**	-0.215 (0.042)**
N	1,212,558	1,212,558	1,212,558	1,212,558
R^2	0.0979	0.1007	0.4027	0.8612
Within-R^2		0.0861	0.0562	0.0717
Ireland (2011-2016)				
$\gamma_M - \gamma_D$	1.110	1.088	0.137	0.137
SE	0.126	0.128	0.018	0.020
p-value	0.000	0.000	0.000	0.000
γ_M	1.610 (0.127)**	1.726 (0.127)**	0.186 (0.017)**	0.185 (0.019)**
γ_D	0.500 (0.045)**	0.638 (0.059)**	0.049 (0.009)**	0.047 (0.010)**
N	1,396,050	1,396,050	1,396,050	1,396,050
R^2	0.1081	0.1089	0.5481	0.9480
Within-R^2		0.1039	0.0594	0.0214
Norway				
$\gamma_M - \gamma_D$	0.611	0.439	0.046	0.047
SE	0.023	0.020	0.010	0.011
p-value	0.000	0.000	0.000	0.000
γ_M	1.022 (0.021)**	0.538 (0.018)**	0.063 (0.009)**	0.061 (0.009)**
γ_D	0.410 (0.008)**	0.100 (0.008)**	0.016 (0.004)**	0.014 (0.004)**
N	1,697,752	1,697,752	1,697,752	1,697,752
R^2	0.3672	0.4073	0.5889	0.8260
Within-R^2		0.3691	0.2279	0.0453

Standard errors clustered at establishment/firm-year level in parentheses. Significant at ** 1%, * 5%, and $^{(*)}$ 10%. All regressions include time-varying worker and establ./firm characteristics X_{it} and Z_{jt} as described in Section 2.4.

Table A3: Estimates corresponding to Table/Figure 6, cf. Table 3 in Poole (2013)

	Unionisation		Skill Intensity	
Dependent Variable:	High	Low	High	Low
Log Annual Wage	Unionised	Unionised	Skill	Skill
Brazil				
$\gamma_M - \gamma_D$	0.035	0.066	0.108	0.030
F-statistic	1.20	3.01	6.13	1.04
p-value	0.27	0.08	0.01	0.31
γ_M	0.038 (0.031)	0.072 (0.038)$^{(*)}$	0.111 (0.044)*	0.036 (0.029)
γ_D	0.003 (0.002)	0.006 (0.002)**	0.003 (0.002)	0.006 (0.002)**
N	52,477	43,371	45,325	51,235
Within-R^2	0.1650	0.2015	0.1817	0.1808
Ireland (2005-2010)				
$\gamma_M - \gamma_D$	-0.096	0.261	0.134	-0.148
SE	0.124	0.073	0.061	0.087
p-value	0.437	0.000	0.027	0.087
γ_M	-0.043 (0.094)	-0.057 (0.050)	-0.096 (0.044)*	-0.064 (0.078)
γ_D	0.053 (0.061)	-0.318 (0.048)**	-0.230 (0.044)**	0.084 (0.050)$^{(*)}$
N	556,803	630,140	1,177,745	34,727
Within-R^2	0.0468	0.0883	0.0732	0.0358
Ireland (2011-2016)				
$\gamma_M - \gamma_D$	0.133	0.133	0.132	0.178
SE	0.037	0.024	0.020	0.060
p-value	0.000	0.000	0.000	0.003
γ_M	0.191 (0.033)**	0.157 (0.022)**	0.177 (0.019)**	0.213 (0.060)**
γ_D	0.059 (0.016)**	0.024 (0.010)*	0.045 (0.010)**	0.035 (0.023)
N	621,447	747,471	1,351,340	44,528
Within-R^2	0.0214	0.0207	0.0218	0.0064
Norway				
$\gamma_M - \gamma_D$	0.095	0.033	0.054	0.030
SE	0.023	0.012	0.014	0.016
p-value	(0.000)	(0.006)	(0.000)	(0.057)
γ_M	0.094 (0.022)**	0.048 (0.011)**	0.062 (0.013)**	0.047 (0.014)**
γ_D	-0.001 (0.008)	0.015 (0.004)**	0.008 (0.006)	0.018 (0.005)**
N	681,800	1,014,330	928,984	766,441
Within-R^2	0.0528	0.0435	0.0469	0.0447

Standard errors clustered at establishment/firm-year level in parentheses. Significant at ** 1%, * 5%, and $^{(*)}$ 10%. All regressions include year FE, establ./firm FE, worker FE as well as time-varying worker and establ./firm characteristics as described in Section 2.4.

Table A4: Estimates corresponding to Table/Figure 7, cf. Table 4 in Poole (2013)

Dependent Variable: Log Annual Wage	(1) change FE	(2) males only	(3) movers in last 3yrs only	(4) add firm growth
Brazil				
$\gamma_M - \gamma_D$	0.046	0.036		
F-statistic	3.57	3.29		
p-value	0.06	0.07		
γ_M	0.050 (0.024)*	0.035 (0.019)$^{(*)}$		
γ_D	0.004 (0.002)*	-0.001 (0.002)		
N	96,560	57,136		
Within-R^2	0.1958	0.1953		
Ireland (2005-2010)				
$\gamma_M - \gamma_D$	0.193	0.135	0.114	0.146
SE	0.054	0.045	0.047	0.062
p-value	0.000	0.003	0.015	0.018
γ_M	-0.042 (0.045)	0.028 (0.040)	−0.054 (0.040)	-0.025 (0.050)
γ_D	-0.235 (0.033)**	−0.107 (0.020)***	−0.168 (0.029)***	-0.171 (0.046)**
N	1,212,558	816,096	1,212,558	808,372
Within-R^2	0.0678	0.0679	0.0668	0.0817
Ireland (2011-2016)				
$\gamma_M - \gamma_D$	0.072	0.045	0.060	0.022
SE	0.019	0.018	0.018	0.020
p-value	0.000	0.011	0.001	0.266
γ_M	0.087 (0.018)**	0.051 (0.017)***	0.060 (0.017)***	-0.001 (0.018)
γ_D	0.015 (0.009)$^{(*)}$	0.006 (0.008)	0.000 (0.007)	-0.023 (0.010)*
N	1,396,050	916,013	1,396,050	930,700
Within-R^2	0.0195	0.0270	0.0193	0.0099
Norway				
$\gamma_M - \gamma_D$	0.038	0.037	0.043	0.037
SE	0.010	0.011	0.010	0.011
p-value	0.000	0.001	0.000	0.001
γ_M	0.048 (0.009)**	0.041 (0.010)***	0.052 (0.010)***	0.041 (0.009)**
γ_D	0.011 (0.004)**	0.004 (0.004)	0.010 (0.004)***	0.005 (0.004)
N	1,697,752	1,165,371	169,7752	1,357,906
Within-R^2	0.0445	0.0417	0.0445	0.0304

Standard errors clustered at establishment/firm-year level in parentheses. Significant at ** 1%, * 5%, and $^{(*)}$ 10%. All regressions include year FE, establ./firm FE, worker FE as well as time-varying worker and establ./firm characteristics as described in Section 2.4.

Table A5: Estimates corresponding to Table/Figure 8, cf. Table 5 in Poole (2013)

Dependent Variable: Log Annual Wage	Exporters	Current & future exporters	Current & future exporters & future wage growth
Brazil			
$\gamma_M - \gamma_D$	0.046	0.073	0.075
F-statistic	3.54	4.77	5.14
p-value	0.06	0.03	0.03
γ_M	0.050 (0.024)*	0.078 (0.033)*	0.080 (0.033)*
γ_D	0.004 (0.002)*	0.005 (0.002)**	0.005 (0.002)*
N	96,560	80,412	79,607
Within-R^2	0.1965	0.1953	0.1876
Ireland (2005-2010)			
$\gamma_M - \gamma_D$	0.189	0.158	0.196
SE	0.053	0.062	0.063
p-value	0.000	0.011	0.002
γ_M	-0.048 (0.044)	-0.133 (0.051)**	-0.110 (0.051)*
γ_D	-0.236 (0.033)**	-0.291 (0.043)**	-0.306 (0.041)**
N	1,212,558	1,010,465	1,010,465
Within-R^2	0.0688	0.0605	0.1367
Ireland (2011-2016)			
$\gamma_M - \gamma_D$	0.072	0.097	0.102
SE	0.019	0.023	0.022
p-value	0.000	0.000	0.000
γ_M	0.087 (0.018)**	0.114 (0.022)**	0.116 (0.021)**
γ_D	0.015 (0.009)(*)	0.017 (0.009)(*)	0.014 (0.009)
N	1,396,050	1,163,375	1,163,375
Within-R^2	0.0195	0.0187	0.0551
Norway			
$\gamma_M - \gamma_D$	0.037	0.031	0.026
SE	0.010	0.010	0.010
p-value	0.000	0.003	0.009
γ_M	0.048 (0.009)**	0.041 (0.009)**	0.030 (0.009)**
γ_D	0.011 (0.004)**	0.010 (0.004)**	0.004 (0.003)
N	1,697,752	1,528,542	1,528,392
Within-R^2	0.0445	0.0409	0.0760

Standard errors clustered at establishment/firm-year level in parentheses. Significant at ** 1%, * 5%, and (*) 10%. All regressions include year FE, establ./firm FE, worker FE as well as time-varying worker and establ./firm characteristics as described in Section 2.4.

Table A6: Estimates corresponding to Table/Figure 9, cf. Tables 6 & 7 in Poole (2013)

Dependent Variable: Log Annual Wage	Job Tenure	High Wage
Brazil		
$\gamma_{M_{low}} - \gamma_{D_{low}}$	0.021	0.019
F-statistic	0.39	0.13
p-value	0.53	0.72
$\gamma_{M_{high}} - \gamma_{D_{high}}$	0.077	0.058
F-statistic	4.78	4.25
p-value	0.03	0.04
N	96,560	96,560
Within-R^2	0.1959	0.1959
Ireland (2005-2010)		
$\gamma_{M_{low}} - \gamma_{D_{low}}$	0.189	0.145
SE	0.114	0.034
p-value	0.098	0.000
$\gamma_{M_{high}} - \gamma_{D_{high}}$	0.190	0.165
SE	0.054	0.068
p-value	0.000	0.015
N	1,212,558	1,212,558
Within-R^2	0.0678	0.0826
Ireland (2011-2016)		
$\gamma_{M_{low}} - \gamma_{D_{low}}$	-0.023	-0.065
SE	0.052	0.023
p-value	0.653	0.004
$\gamma_{M_{high}} - \gamma_{D_{high}}$	0.070	0.075
SE	0.020	0.022
p-value	0.000	0.001
N	1,396,050	1,396,050
Within-R^2	0.0195	0.0205
Norway		
$\gamma_{M_{low}} - \gamma_{D_{low}}$	0.091	0.010
SE	0.049	0.021
p-value	0.065	0.636
$\gamma_{M_{high}} - \gamma_{D_{high}}$	0.036	0.050
SE	0.011	0.012
p-value	0.001	0.000
N	1,697,752	1,697,752
Within-R^2	0.0445	0.0445

Standard errors clustered at establishment/firm-year level in parentheses. Significant at ** 1%, * 5%, and (*) 10%. All regressions include year FE, establ./firm FE, worker FE as well as time-varying worker and establ./firm characteristics as described in Section 2.4.

Table A7: Estimates corresponding to Table/Figure 10, cf. Table 8 in Poole (2013)

Dependent Variable: Log Annual Wage	Education	Occupation	Ability
Brazil			
$\gamma_{M_{low}} - \gamma_{D_{low}}$	0.036	0.029	0.029
F-statistic	1.03	0.85	0.66
p-value	0.31	0.36	0.42
$\gamma_{M_{high}} - \gamma_{D_{high}}$	0.060	0.073	0.051
F-statistic	3.22	3.21	2.63
p-value	0.07	0.07	0.11
N	96,560	96,560	96,560
Within-R^2	0.1958	0.1959	0.1959
Ireland (2005-2010)			
$\gamma_{M_{low}} - \gamma_{D_{low}}$			-0.005
SE			0.034
p-value			0.884
$\gamma_{M_{high}} - \gamma_{D_{high}}$			0.289
SE			0.085
p-value			0.001
N			1,212,558
Within-R^2			0.0904
Ireland (2011-2016)			
$\gamma_{M_{low}} - \gamma_{D_{low}}$			-0.005
SE			0.021
p-value			0.823
$\gamma_{M_{high}} - \gamma_{D_{high}}$			0.102
SE			0.027
p-value			0.000
N			1,396,050
Within-R^2			0.0206
Norway			
$\gamma_{M_{low}} - \gamma_{D_{low}}$	-0.007	0.027	0.045
SE	0.018	0.019	0.017
p-value	0.689	0.154	0.009
$\gamma_{M_{high}} - \gamma_{D_{high}}$	0.059	0.019	0.018
SE	0.013	0.024	0.013
p-value	0.000	0.438	0.172
N	1,697,752	1,697,752	1,697,752
Within-R^2	0.0446	0.0446	0.0446

Standard errors clustered at establishment/firm-year level in parentheses. Significant at ** 1%, * 5%, and (*) 10%. All regressions include year FE, establ./firm FE, worker FE as well as time-varying worker and establ./firm characteristics as described in Section 2.4.

Table A8: Estimates for low-skilled incumbents corresponding to Table/Figure 11, cf. Table 9 in Poole (2013)

	Low-skilled incumbents		
Dependent Variable:			
Log Annual Wage	Education	Occupation	Ability
Brazil			
$\gamma_M - \gamma_D$	0.015	0.039	0.018
F-statistic	0.23	1.48	0.13
p-value	0.63	0.22	0.71
N	58,670	46,275	29,229
Within-R^2	0.1854	0.1913	0.2111
Ireland (2005-2010)			
$\gamma_M - \gamma_D$			0.037
SE			0.029
p-value			0.196
N			335,616
Within-R^2			0.0452
Ireland (2011-2016)			
$\gamma_M - \gamma_D$			-0.038
SE			0.019
p-value			0.038
N			466,620
Within-R^2			0.0100
Norway			
$\gamma_M - \gamma_D$	0.031	0.017	0.038
SE	0.011	0.018	0.012
p-value	0.004	0.335	0.001
N	1,329,938	414,773	1,358,065
Within-R^2	0.0459	0.0189	0.0401

Standard errors clustered at establishment/firm-year level in parentheses. Significant at ** 1%, * 5%, and (*) 10%. All regressions include year FE, establ./firm FE, worker FE as well as time-varying worker and establ./firm characteristics as described in Section 2.4.

Table A9: Estimates for high-skilled incumbents corresponding to Table/Figure 11, cf. Table 9 in Poole (2013)

	High-skilled incumbents		
Dependent Variable:			
Log Annual Wage	Education	Occupation	Ability
Brazil			
$\gamma_M - \gamma_D$	0.077	0.047	0.056
F-statistic	3.82	1.63	4.03
p-value	0.05	0.20	0.04
N	37,890	50,285	67,331
Within-R^2	0.2241	0.2016	0.1990
Ireland (2005-2010)			
$\gamma_M - \gamma_D$			0.236
SE			0.061
p-value			0.000
N			876,942
Within-R^2			0.0793
Ireland (2011-2016)			
$\gamma_M - \gamma_D$			0.096
SE			0.022
p-value			0.000
N			929,430
Within-R^2			0.0231
Norway			
$\gamma_M - \gamma_D$	0.056	0.062	0.028
SE	0.022	0.019	0.016
p-value	0.010	0.001	0.082
N	367,579	401,418	339,626
Within-R^2	0.0328	0.0168	0.0562

Standard errors clustered at establishment/firm-year level in parentheses. Significant at ** 1%, * 5%, and (*) 10%. All regressions include year FE, establ./firm FE, worker FE as well as time-varying worker and establ./firm characteristics as described in Section 2.4.