Received: 13 November 2020 | Revised: 18 August 2021 | Accepted: 21 September 2021

DOI: 10.1111/twec.13203

ORIGINAL ARTICLE

The World Economy WILEY

# Patterns of employment, skills, and tasks within MNEs associated with offshoring

**Kent Eliasson**[1,2] | **Pär Hansson**[3,4] | **Markus Lindvert**[1]

[1]Growth Analysis, Östersund, Sweden

[2]Department of Economics, Umeå University, Umeå, Sweden

[3]Growth Analysis, Stockholm, Sweden

[4]Örebro University School of Business, Örebro, Sweden

**Correspondence**
Pär Hansson, Growth Analysis, Box 574, SE-101 31 Stockholm, Sweden.
Email: par.hansson@oru.se

**Funding information**
Swedish Research Council for Health, Woking Life and Welfare, Grant/Award Number: 2012-00859

## Abstract

We examine the relationship between relative demands for skills, non-routine, and non-offshorable tasks in Swedish MNE parents (onshore) and their employment shares in affiliates abroad (offshore). Our estimations suggest that increased employment shares in affiliates abroad (offshore) result in higher relative demand for skills and larger shares of non-routine tasks performed by employed that are highly educated in the parents at home (onshore). However, we do not find any evidence for that the share of non-offshorable tasks rises in the parents of Swedish MNEs when employment shares increase in their affiliates overseas. Furthermore, we estimate the relationships between absolute employment onshore (skilled and less-skilled labour) and employment in affiliates offshore (high- and low-income countries). Increased employment in affiliates in low-income countries relates negatively to the employment of less-skilled workers in manufacturing MNE parents (*substitute*), whereas increased employment in affiliates in high-income countries correlates positively with the employment of skilled workers in service MNE parents (*complement*).

**KEYWORDS**

multinational enterprises, non-routine and offshorable tasks, offshoring, relative labour demand, skill upgrading

# 1 | INTRODUCTION

Declining costs for transportation and for information and communication, together with lower barriers to international trade and investment, have led to the increased fragmentation of production within global value chains.[1] Multinational enterprises (MNEs) are highly instrumental in such processes. Within MNEs, some production stages of the value chains have been relocated to affiliates offshore (or outsourced to independent suppliers abroad), whereas others have been retained or even expanded in the parents at home (onshore).

The purpose of this paper is to examine which activities Swedish MNEs – Swedish-owned enterprise groups with employees abroad —keep in the parents onshore when their affiliates overseas are expanding. In other words, we aim to investigate the relationship between outward foreign direct investment (FDI) and the onshore employment composition of Swedish MNEs. Previous studies, such as Head and Ries (2002) and Hansson (2005), have focused solely on skills measured, e.g. in terms of educational attainment of the employees. We also analyse the skill composition, but in addition, as in Becker et al. (2013), we study the impact of offshoring on the non-routine task content in the MNE parents.

Routine tasks are activities accomplished by following a set of specific, well-defined rules, whereas non-routine tasks are more complicated activities, such as problem-solving and decision-making. Accordingly, several non-routine tasks may be too complex to be fully communicated to production teams in another country. Routine tasks are thus more easily fragmented geographically than non-routine tasks because they can be simply translated into instructions for the offshore producers. Hence, we expect the share of non-routine tasks to increase in the parents at home when MNEs are expanding their activities abroad.

We use two commonly employed measures of the non-routineness of occupations to investigate the relationship between increased offshore activities in the affiliates of Swedish MNEs and the share of non-routine tasks in their onshore MNE parents. The first one, recently put to extensive use[2] but to our knowledge not in this context, is a routine task index of different jobs consisting of three aggregates: manual, routine, and abstract tasks. The second one, proposed and employed by Becker et al. (2013), is based on survey questions concerning whether the respondent workers use a listed workplace tool. A crucial difference between these two measures is that the former acknowledges that in certain middle skilled occupations the element of routine tasks is substantial, e.g. office clerks, and that in some low-skilled occupations the content of non-routine tasks is considerable, e.g. drivers. Both measures are significantly correlated —especially the second one —with the share of skilled labour (skill intensity) on occupational level.

Non-routineness is one factor that can determine the offshorability of a task. Another factor is the extent to which a task requires face-to-face contact with people other than fellow workers with no loss of quality. Blinder and Krueger (2013) define offshorability as: "the ability to perform one's work duties (for the same employer and customers) in a foreign country but still supply the good or service to the home market". This implies that also a variety of tasks carried out by highly skilled workers can possibly be offshored via telecommunication devices, e.g. computer

[1]The authors gratefully acknowledge financial support from Swedish Research Council for Health, Working Life and Welfare. We have benefited from comments from an anonymous referee and in seminars at European Trade Study Group in Florence, Nordic International Trade Seminars in Stockholm, Swedish Network for European Studies in Economics and Business in Malmö, and at Örebro University.

[2]See, e.g., Autor and Dorn (2013), Goos et al. (2014), and Autor et al. (2015).

programming.[3] Blinder and Kreuger (2013) assigned professional coders to consider these aspects to assess the degree of offshorability in different occupations. Interestingly, we notice that the share of non-offshorable tasks and the skill intensity on occupational level is uncorrelated. To what extent offshorable tasks really are offshored is an empirical question. Therefore, compared to previous studies, we exploit the Blinder and Kreuger measure of offshorability to examine whether the shares of non-offshorable tasks increase in Swedish MNE parents in connection with higher offshore employment shares in their affiliates.

In contrast to former studies, the observation period in our study is quite lengthy, i.e. 2001–2013.[4] This is important because we can investigate effects over a longer term and during a period when foreign direct investment has grown substantially in low-income countries, such as in China.

We employ a commonly applied cost function approach originating from Berman et al. (1994) to examine the relationship within Swedish MNEs between relative demands for skills, non-routine, and non-offshorable tasks in the MNE parents (onshore) and their employment shares in affiliates abroad (offshore).

In manufacturing MNEs and service MNEs, the share of skilled labour has been growing at a similar rate (and faster than in non-MNEs). In manufacturing MNEs, however, this growth is due to a heavy decrease in the employment of less-skilled labour, whereas in service MNEs, it is a result of a substantial boost in the employment of skilled labour. To investigate these developments and reasons behind them in more detail, besides relative demand, we examine the relationships between offshore affiliate employment in high- and low-income countries and the absolute employment of skilled and less-skilled labour onshore separately.[5] The results from such estimations indicate whether employment in offshore affiliates in high- and low-income countries complements or substitutes the employment of different skills in MNE parents onshore.

To preview our results, we find that expansions within Swedish MNEs of their offshore employment are associated with increased relative demand for skills and larger shares of non-routine tasks conducted by skilled workers in the parents in Sweden (onshore). However, we do not find any indications that the share of non-offshorable tasks rises in the parents when employment shares increase in affiliates overseas.

From the estimations of the absolute employment of skilled and less-skilled labour onshore, we note that increased employment in low-income countries relates negatively to the employment of less-skilled labour in manufacturing MNE parents in Sweden (*substitute*). This is consistent with one of the motives put forward in the FDI literature, namely resource-seeking (vertical

[3]Blinder (2006) envisages that we, with continued improvements in information and communication technology (ICT), will experience even more offshoring of what he describes as "impersonal services", i.e., services that can be delivered electronically over long distances. Furthermore, we note that the largest Swedish MNEs perform more than half of the R&D in their affiliates abroad (Tillväxtanalys 2019; Table 1).

[4]In Becker et al. (2013), the observation period is 1998 to 2001 and studies using data that are more recent are sparse. In another study referred to, Elia et al. (2009), the time span is 1996–2002. Other prominent analyses of the effects on labor markets of offshoring, e.g., Harrison and McMillan (2011) and Ebenstein et al. (2014), end at approximately the year 2000. Hummels et al. (2014), employ matched worker-firm data to study wage effects of offshoring 1995–2006 in Denmark.

[5]In this regard, we follow partly the approach in Elia et al. (2009). They allow for different impacts of FDI on high- and low-skilled labor and distinguish between investments in high- and low-income countries. However, their study differs in the sense that it only includes manufacturing, and that the unit of analysis is not just MNE parents but the parent companies' "industrial region", i.e., they aim to capture both direct (on MNE parents) and indirect (on the parent's relevant business environment) employment effects of outward FDI.

FDI). Vertical FDI may lead to a relocation of less-skilled activities from Sweden to countries where less-skilled workers are cheaper.

Another motive for FDI is market-seeking (horizontal FDI). Unlike vertical FDI, horizontal FDI has positive employment effects in the home countries; an expansion abroad requires expanded headquarters activities in the parents (coordination and development). In contrast to manufacturing, our results for services show that increased employment in affiliates in high-income countries associates positively to the employment of skilled in service MNE parents in Sweden (*complement*).

The structure of the remainder of the paper is as follows. In Section 2.1, we present the Swedish microdata we employ. Section 2.2 describes Swedish MNE employment at home and abroad. Section 2.3 discusses the measures of non-routine and non-offshorable tasks in different occupations. Section 3 contains the econometric analysis. Section 3.1 sets out the econometric specification. Section 3.2 shows results from estimations of relative demand for skills and tasks and Section 3.3 presents results from estimations of the relationships between offshore employment in high- and low-income countries and onshore absolute employment of skilled and less-skilled labour. Section 4 summarizes and concludes.

## 2 | DATA AND DESCRIPTION

### 2.1 | Data sources

To construct our dataset, we connect data from a range of microdata sources. The unique identification numbers of the firms enable us to link information on financial accounts, R&D expenditure, and register-based labour statistics (in our case, the education levels of employees and their occupations). The unit of analysis is Swedish controlled enterprise groups with employees abroad, i.e. Swedish MNEs. We identify firms within the same enterprise groups by means of Koncernregistret (the Business Group Register).

The basic variables in our study, aside from employment, are of individuals' educational attainment and occupations, which we derive from annual registers of the Swedish population compiled by Statistics Sweden (SCB). The education register has remained since 1985 and a complete register on occupations has existed between 2001 and 2013. Unfortunately, due to an introduction of a new classification of occupations in 2014, the register is again incomplete. This is the reason to why we constrain our analysis to the period 2001–2013. Wage incomes[6] are from register-based labour market statistics (RAMS) and variables derived from balance sheets and income statements, such as value added and capital, are from the Structural Business Statistics (SBS). Both RAMS and SBS are also register data collected by SCB. Employment in Swedish MNEs, in their Swedish parents, and in their affiliates abroad at country level are from the MNEs annual accounts compiled by the Swedish Agency for Growth Policy Analysis (Growth Analysis).

### 2.2 | Swedish MNE employment at home and abroad

Better opportunities to exploit efficiency gains of global value chains, due to lower barrier to international trade and investments, have led to shifts in employment within Swedish MNEs from

[6]More precisely, wage incomes are gross annual earnings.

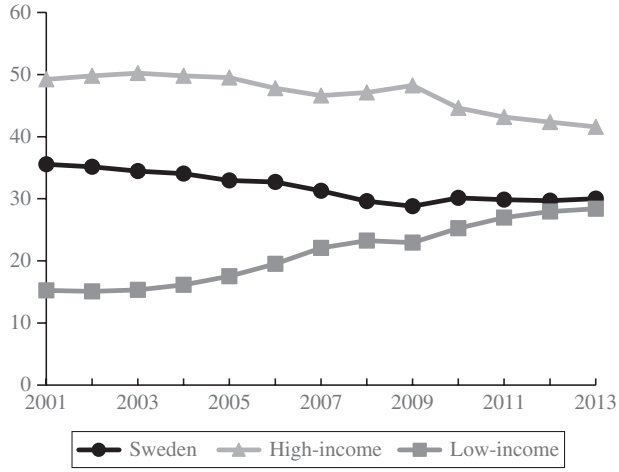


**FIGURE 1** Employment shares of Swedish MNEs in Sweden and in high- and low-income countries (%). Notes: High-income countries are the "old" OECD countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Switzerland, the United Kingdom, and the United States. Table A1 in Appendix shows the low-income countries included in the analysis

the parent in Sweden to affiliates abroad. Furthermore, the transition from plan to market in neighbouring countries in Central and Eastern Europe and China's entry into the world market have involved shifts in employment from affiliates in high-income countries to affiliates in low-income countries.

We illustrate this, in Figure 1, by describing the development of the distribution of employment in Swedish MNEs between the parents in Sweden and affiliates in high- and low-income countries during the studied period 2001 to 2013. In addition, Table 1 presents changes in employment between 2001 and 2013 in the 10 most important host high- and low-income countries of Swedish MNEs in 2013.

The relative importance of Sweden as a location for Swedish MNEs has decreased. In Sweden, the proportion of total employment in Swedish MNEs has fallen from 35% in 2001 to 30% in 2013. The drop is largest in the beginning of the 2000s and flattens out from 2008. In affiliates in high-income countries, the proportion at the outset starts out at 50%, begin to fall in 2005, and is 42% in 2013. In low-income countries, the employment share has a distinctly rising trend from 15% in 2001 to more than 28% in 2013. Here, we can see, in Table 1, that the employment growth in affiliates in China stands out; in absolute terms, the employment increases with 65,245 employees and in percentage terms with 535 percent. Also, we notice considerable employment shares and growth in foreign affiliates in some small Baltic countries and in Poland. The affiliates' employment share is largest, but declining, in the United States and is high in other Nordic countries.

One of the main purposes of this study is to examine the relationship between changes in offshore employment in affiliates abroad and the skill composition in the parent companies at home. It may therefore be of interest to compare the development of the share of skilled labour in the parents of Swedish MNEs with the development in non-MNEs in Sweden. We show this in Figure 2 and define skilled labour as employees with three years or more of post-secondary education.

We find that, in both Swedish MNEs and non-MNEs, skill intensity grew substantially between 2001 and 2013. The reason behind these trends is most likely a sizeable increase in the

**TABLE 1** Employment in affiliates of Swedish MNEs in high- and low-income countries

| High-income countries | | | | Low-income countries | | | |
|---|---|---|---|---|---|---|---|
| | | Employment | | | | Employment | |
| Country | Place | 2013 | Δ13-01 | Country | Place | 2013 | Δ13-01 |
| United States | 1 | 170,865 (15.5) | −47,758 (−21.8) | China | 3 | 77,432 (7.0) | 65,245 (535.4) |
| Germany | 2 | 91,494 (8.3) | 4245 (4.9) | Poland | 7 | 47,511 (4.3) | 17,992 (61.0) |
| United Kingdom | 4 | 64,596 (5.8) | 7844 (13.8) | India | 10 | 34,124 (3.1) | 16,799 (97.0) |
| France | 5 | 55,528 (5.0) | −13,618 (−19.7) | Brazil | 12 | 26,208 (2.4) | 13,920 (113.3) |
| Norway | 6 | 48,255 (4.4) | 6678 (16.1) | Argentina | 14 | 19,880 (1.8) | 13,408 (207.2) |
| Denmark | 8 | 40,231 (3.6) | −7763 (−16.2) | Mexico | 16 | 17,253 (1.6) | 4,159 (31.8) |
| Finland | 9 | 38,033 (3.4) | −3772 (−9.0) | Czech Republic | 19 | 16,162 (1.5) | 2,251 (16.2) |
| Spain | 11 | 32,275 (2.9) | 5589 (20.9) | Estonia | 20 | 15,140 (1.5) | 4,350 (40.3) |
| Netherlands | 13 | 22,915 (2.1) | 7379 (47.5) | Lithuania | 21 | 13,611 (1.2) | 10,430 (327.9) |
| Belgium | 15 | 17,445 (1.6) | 636 (3.8) | Turkey | 22 | 12,936 (1.2) | 11,965 (1232.2) |

*Notes:* Within parentheses are employment shares in total employment overseas and employment change in percent.

*Source*: Growth Analysis, Swedish Enterprise Groups with Affiliates Abroad.

supply of skilled labour in Sweden during this period.[7] However, of greater interest is that the increase in the skill intensity in Swedish MNEs is larger than in non-MNEs; the skill intensity in Swedish MNEs grew by 8.2 percentage points, whereas the rise in non-MNEs is 5.4 percentage points. One possible explanation is that, unlike non-MNEs, MNEs have opportunities to move activities between plants located in different countries. Relocating less-skilled activities from Sweden by MNEs, while retaining and expanding skilled activities at home, leads to a greater increase in skill intensity in Swedish MNEs than in non-MNEs in Sweden. Moreover, we notice in Figure 2 that the skill intensity is clearly higher in Swedish MNEs than in non-MNEs; in 2013, the share of skilled labour is 23.5% in Swedish MNEs compared to 15.3% in non-MNEs.

[7]The number of university degrees from educations that are three years or longer relative to the cohort of the population aged 20–29 year has increased from 2.5% in 2001 to 4.0% in 2013. Moreover, the educational attainment among retiring employees compared with the average employee are lower.

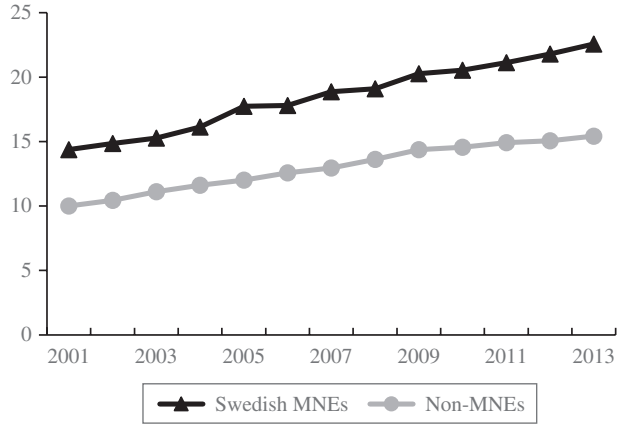


**FIGURE 2** Share of skilled labor in Swedish MNEs and in non-MNEs (%)
Note: Statistics Sweden, Register-based Labor Market Statistics (RAMS).

**TABLE 2** Employment in Swedish MNEs in manufacturing and services. Skilled, less-skilled labour, and share of skilled labour in the parents in Sweden

| | Skilled | | | Less skilled | | | Skill share | | |
|---|---|---|---|---|---|---|---|---|---|
| **Swedish MNEs** | **2001** | **2013** | **Δ** | **2001** | **2013** | **Δ** | **2001** | **2013** | **Δ** |
| Manufacturing | 28.9 | 35.7 | 6.8<br>23% | 198.2 | 128.0 | −70.2<br>−35% | 8.9 | 21.8 | 12.9 |
| Services | 42.4 | 70.6 | 28.2<br>67% | 204.7 | 220.8 | 16.1<br>8% | 10.0 | 24.2 | 14.2 |

*Note:* Skilled and less-skilled employment in thousands and skill share in percent.

*Source*: Statistics Sweden, Register-based labour market statistics (RAMS).

In Table 2, we distinguish between parent employment in manufacturing MNEs and in service MNEs and we can see that the change in skill intensity between 2001 and 2013 is similar. In manufacturing MNEs, the share of skilled labour rose 12.9 percentage points and in service MNEs, the increase is 14.2 percentage points. In 2013, the skill intensity in service MNEs is higher than in manufacturing MNEs, 24.2% in service MNEs and 21.8% in manufacturing MNEs.

However, if we instead, in Table 2, focus on the changes in absolute employment of skilled and less-skilled labour, we observe a different pattern in manufacturing than in services. Although the employment of skilled labour in manufacturing MNEs grew significantly between 1997 and 2013 (+23%), the increase in service MNEs is more substantial (+67%). Regarding less-skilled labour, we find that a sharp decline in the employment in manufacturing MNEs (−35%), while the employment in service MNEs increased (+8%). In other words, in manufacturing MNEs, the rising skill share is due to a heavy decrease in less-skilled labour, whereas in service MNEs, the higher skill intensity is largely the result of a considerable increase in the employment of skilled labour.

Let us then, in Table 3, take a closer look at the overseas activities in manufacturing and service MNEs. Do their patterns of localization differ, and have they developed differently?

**TABLE 3** Employment and foreign affiliates in Swedish manufacturing and service MNEs

| | Sweden | | | High income | | | Low income | | |
|---|---|---|---|---|---|---|---|---|---|
| **Swedish MNEs** | **2001** | **2013** | **Δ** | **2001** | **2013** | **Δ** | **2001** | **2013** | **Δ** |
| Employment (thousands) | | | | | | | | | |
| Manufacturing | 249 | 166 | −83 | 380 | 277 | −103 | 138 | 290 | 152 |
| Share (%) | 32.5 | 22.6 | −9.9 | 49.6 | 37.8 | −11.7 | 18.0 | 39.6 | 21.6 |
| Services | 237 | 297 | 60 | 322 | 402 | 80 | 51 | 180 | 129 |
| Share (%) | 38.9 | 33.8 | −5.1 | 52.8 | 45.7 | −7.1 | 8.3 | 20.5 | 12.2 |
| **Foreign affiliates** | | | | | | | | | |
| a) Number of affiliates abroad | | | | | | | | | |
| Manufacturing | 1,341 | 1,182 | −159 | 751 | 1,210 | 459 | | | |
| Share (%) | 64.1 | 49.2 | −14.9 | 35.9 | 57.8 | 21.9 | | | |
| Services | 1,197 | 1,645 | 448 | 414 | 740 | 326 | | | |
| Share (%) | 74.3 | 69.0 | −4.3 | 25.7 | 31.0 | 5.3 | | | |
| b) Mean/median | | | | | | | | | |
| Manufacturing | 5/3 | 3/1 | −2/−2 | 4/1 | 3/1 | −1/0 | | | |
| Services | 3/2 | 2/1 | −1/−1 | 2/1 | 2/1 | 0/0 | | | |
| c) Maximum/minimum | | | | | | | | | |
| Manufacturing | 21/1 | 22/1 | 1/0 | 82/1 | 81/1 | −1/0 | | | |
| Services | 17/1 | 20/1 | 3/0 | 20/1 | 42/1 | 22/0 | | | |

*Notes:* Foreign affiliates are the number of affiliates in different countries a Swedish MNE has overseas. This means that even if an MNE have many affiliates in the same country abroad that is counted as one foreign affiliate. Accordingly, our measure of foreign affiliates indicates to what extent an MNE is established in various countries abroad.

*Source*: Growth Analysis, Swedish Enterprise Groups with Affiliates Abroad.

First, we note that manufacturing MNEs have relatively more activities abroad than service MNEs. In 2013, the offshore employment share is larger in manufacturing MNEs than in service MNEs, 77% in manufacturing MNEs and 66% in service MNEs. However, in absolute terms the employment in service MNEs abroad is larger, in 2013, 582,000 in service MNEs compared to 567,000 in manufacturing MNEs. This means that not only manufacturing MNEs, but also service MNEs, carry out significant and growing parts of their activities in affiliates abroad.

Second, the overseas operations in service MNEs are more concentrated to high-income countries, while manufacturing MNEs have largely, compared to service MNEs, shifted to, and increased their activities in low-income countries. We observe, in Table 3, that the offshore employment and the offshore employment share in high-income countries is higher in service MNEs (402,000 and 46%) than in manufacturing MNEs (277,000 and 38%) and that, over the studied period, the offshore employment share in high-income countries has declined more in manufacturing MNEs (12 percentage points) than in service MNEs (7 percentage points). In service MNEs in high-income countries, the employment has increased between 2001 and 2013 (+80,000), whereas it has fallen in manufacturing MNEs (−103,000). Service MNEs grow absolutely in employment and in number of affiliates both in high- and low-income countries; in number of affiliates, the expansion in high-income countries is even larger than in low-income countries.

Moreover, the offshore employment shares in low-income countries in manufacturing MNEs have trended heavily upwards, from 18% in 2001 to 40% in 2013, compared with from 8% to 20% in service MNEs over the same period, in absolute terms +152,000 in manufacturing MNEs and +129,000 in service MNEs. Notable in Table 3 is that, in 2013, the offshore employment share in low-income and high-income countries in manufacturing MNEs is about the same (38%–39%); in service MNEs, the share is more than twice as large in high-income countries.

We detect a similar pattern if we instead of employment overseas look at the number of affiliates a Swedish MNE has in different countries abroad. Interestingly, Table 3 indicates that manufacturing MNEs, on average, have more overseas affiliates in different countries than service MNEs; the means of foreign affiliates are higher in manufacturing MNEs than in service MNEs. Not surprisingly, the distribution of the number of overseas affiliates among Swedish MNEs appears to be skewed, with a few MNEs having affiliates in several countries and quite many MNEs having affiliates only in a few countries; in general, the means of foreign affiliates are higher than the medians.[8]

In sum, we discern from the figures in Section 2.2 that, at the same time, as we see a substantial increase in the employment share in affiliates of Swedish MNEs abroad, the proportion of skilled labour has risen more rapidly in Swedish MNEs than in non-MNEs in Sweden. This observation is consistent with Swedish MNEs retaining and expanding skilled activities onshore, while moving less-skilled activities offshore.

Remarkably, the offshore employment shares in low-income countries have driven the development towards higher employment shares abroad. Lately, in manufacturing MNEs, the offshore employment share has grown in low-income countries to be about the same as in high-income countries. In contrast to manufacturing MNEs, service MNEs still focus their activities overseas mainly to high-income countries.

However, to obtain more direct and reliable evidence regarding the impact of changes in offshore employment on the onshore skill (and task) composition within Swedish MNEs requires econometric analyses. Before we present the results of such analyses, we discuss the different task measures we employed, which might cover other characteristics of importance for the propensity to offshore an activity than skill (level of education).

## 2.3 | Construction of task measures

In the econometric analysis in Section 3, we utilize three different task intensity measures recently used in the literature to characterize various occupations. First, we present two measures of the elements of non-routineness in an occupation, and second, an index of the degree of non-offshorability in an occupation. We take these classifications of occupations regarding non-routine and offshorability at face value. By employing these "off the shelf" measures of non-routineness and non-offshorability as above, instead of constructing our own measures, enables us to achieve better comparability among similar studies.[9]

[8]Table 3 shows that, between 2001 and 2013, the average number of affiliates in different countries abroad decrease both in manufacturing MNEs and in service MNEs. One explanation could be that several smaller Swedish enterprises became MNEs during the period and these new MNEs have only a few affiliates abroad (see Table A2 in Appendix and footnote 20).

[9]This is a recommendation by Autor (2013).

The first measure of the content of routine tasks in different occupations is based on a typology proposed by Acemoglu and Autor (2011). Their measure distinguishes between four types of tasks: non-routine cognitive, routine cognitive, routine manual, and non-routine manual. *Non-routine cognitive tasks* can be analytical or interpersonal. The former requires abstract thinking, creativity, and problem-solving – tasks common among engineers, IT specialists, and designers —whereas the latter demand strong communication skills – prevalent among managers. *Routine cognitive tasks* are structured, repetitive intellectual activities that require accuracy and being exact – often performed by office clerks, administrative workers, and cashiers. *Routine manual tasks* are repetitive physical activities that also require accuracy and meticulousness, and *non-routine manual tasks* necessitate manual dexterity, response to the environment and spatial orientation. An example of routine manual occupations is production workers, such as machine operators and assemblers, and examples of non-routine manual occupations are drivers, construction workers, and waiters.

A measure that has operationalized the typology above into an index is the Routine Task Intensity (*RTI*) index, used by, for example, Autor and Dorn (2013). In turn, Goos et al. (2014) normalize the *RTI* index to have zero mean and unit standard deviation and then map it onto the two-digit ISCO88 occupational code.[10] The *RTI* index consists of three task aggregates: manual, routine, and abstract tasks, combined to create the summary measure *RTI* by occupations *s*, which increases with the importance of routine tasks in each occupation and declines with the importance of manual and abstract tasks. To map the *RTI* values in Goos et al. (2014) onto a variable *RTI* that assumes values between 0 and 100, we use the cumulative normal distribution with a mean of 0 and a standard deviation of 1. From $RTI_s$, we obtain the non-routine task intensity of occupation *s*, $NRTI1_s = 1 - RTI_s$. Table 4 presents the share of non-routine tasks *NRTI*for various occupations *s*, $NRTI1_s$, which can be interpreted as the percentage of non-routine tasks in occupation *s* ($\delta_s^{nr1}$).

The second measure of the non-routine intensity of an occupation, proposed by Becker et al. (2013), is based on survey questions regarding whether the respondent workers use a listed of workplace tool.[11] Each of the 81 tools identified is assumed to indicate whether a worker performs non-routine tasks.[12] Because the respondents of the survey also state their occupation, the average number of non-routine tasks in an occupation *s*, $T_s$, and the maximum number of non-routine tasks in any occupation, *MaxT*, can be calculated. The measure of the non-routine intensity of an occupation *s*, $NRTI2_s$, is then generated by dividing $T_s$ with *MaxT*, which gives a continuous task intensity measure ranging between 0 and 1, where 1 denotes maximum intensity. To enable linkage between our Swedish data on occupations at individual level and $NRTI2_s$, the more detailed German two-digit occupation in Becker et al. (2013) is translated into the more limited two-digit international standard classification ISCO88. Table 4 shows *NRTI2* for different occupations $sNRTI2_s$, which indicate the percentage of non-routine tasks ($\delta_s^{nr2}$).

We derive our measure of the degree non-offshorability in an occupation *s*, $NOFFI_s$, from the offshorability measure *OFF* in Blinder and Kreuger (2013). *OFF* draws on professional coders'

[10]A caveat is that the mapping from the US occupational code to the international ISCO88 code means that we are left with a crude occupational classification of only 21 occupations.

[11]The survey is the German Qualification and Career Survey 1998/99 (BIBB-IAB).

[12]The 81 workplace-tools range from hand tools to machinery and diagnostic devices to computers and means of transport. For a complete list of the workplace tools included in the survey along with whether they indicate performance of non-routine tasks, see Becker et al. (2013) Table A1.

**TABLE 4** The share of non-routine and non-offshorable tasks and skill intensity in different occupations (%)

| ISCO 88 | Occupation | Non-routine 1 $NRTI1\delta_s^{nr1}$ | Non-routine 2 $NRTI2\delta_s^{nr2}$ | Non-off shorable $NOFFI\delta_s^{noff}$ | Skill-intensity *SKILL* | Employment 2013 |
|---|---|---|---|---|---|---|
| 11 | Legislators and senior officials | n/a | 54.4 | n/a | 62.5 | 4,833 (0.1) |
| 12 | Corporate managers | 77.3 | 78.4 | 62.6 | 40.8 | 188,239 (4.3) |
| 13 | Managers of small enterprises | 93.6 | 46.6 | 73.6 | 21.0 | 79,041 (1.8) |
| 21 | Physical, mathematical, and engineering science professionals | 79.4 | 100.0 | 14.7 | 57.2 | 206,146 (4.7) |
| 22 | Life science and health professionals | 90.4 | 84.1 | 77.6 | 50.5 | 94,484 (2.2) |
| 23 | Teaching professionals | n/a | 61.2 | n/a | 80.4 | 214,851 (4.9) |
| 24 | Other professionals | 76.7 | 63.0 | 41.7 | 61.0 | 311,621 (7.1) |
| 31 | Physical and engineering science associate professionals | 65.5 | 79.7 | 54.8 | 23.7 | 209,176 (4.8) |
| 32 | Life science and health associate professionals | 62.9 | 56.3 | 77.3 | 65.8 | 132,554 (3.0) |
| 33 | Teaching associate professionals | n/a | 36.1 | n/a | 43.9 | 99,713 (2.3) |
| 34 | Other associate professionals | 67.0 | 52.7 | 46.0 | 24.9 | 411,100 (9.4) |
| 41 | Office clerks | 1.3 | 52.1 | 34.5 | 11.3 | 262,620 (6.0) |
| 42 | Customer services clerks | 7.9 | 27.1 | 59.9 | 11.0 | 71,096 (1.6) |
| 51 | Personal and protective services workers | 72.6 | 32.0 | 82.6 | 6.4 | 677,186 (15.5) |
| 52 | Models, salespersons, and demonstrators | 48.0 | 8.1 | 81.3 | 6.5 | 225,312 (5.2) |
| 61,62 | Market-oriented skilled agricultural and fishery workers | n/a | 10.8 | n/a | 7.3 | 91,448 (2.1) |
| 71 | Extraction and building trades workers | 57.5 | 21.4 | 82.4 | 2.0 | 260,910 (6.0) |
| 72 | Metal, machinery, and related trades workers | 32.3 | 41.6 | 67.4 | 1.7 | 129,472 (3.0) |

(Continues)

**TABLE 4** (Continued)

| ISCO 88 | Occupation | Non-routine 1 $NRTI1\delta_s^{nr1}$ | Non-routine 2 $NRTI2\delta_s^{nr2}$ | Non-off shorable $NOFFI\delta_s^{noff}$ | Skill-intensity *SKILL* | Employment 2013 |
|---|---|---|---|---|---|---|
| 73 | Precision, handicraft, printing, and related trades workers | 5.6 | 39.8 | 4.8 | 8.4 | 11,724 (0.3) |
| 74 | Other craft and related trades workers | 10.7 | 17.7 | 12.5 | 4.9 | 18,388 (0.4) |
| 81 | Stationary-plant and related operators | 37.4 | 43.6 | 5.6 | 2.9 | 52,850 (1.2) |
| 82 | Machine operators and assemblers | 31.2 | 18.8 | 0.9 | 2.9 | 183,917 (4.2) |
| 83 | Drivers and mobile plant operators | 93.3 | 6.3 | 84.1 | 3.4 | 167,284 (3.8) |
| 91 | Sales and services elementary occupations | 48.8 | 0.0 | 79.1 | 5.9 | 210,283 (4.8) |
| 92 | Agricultural, fishery and related labourers | n/a | 0.9 | n/a | 7.0 | 3,831 (0.1) |
| 93 | Labourers in mining, construction, manufacturing, and transport | 32.6 | 2.5 | 74.5 | 3.9 | 48,676 (1.1) |

*Source*: Non-routine 1: Goos et al. (2014) Table 1, non-routine 2: Hakkala Nilsson et al. (2014) Table 1, non-offshorable: Goos et al. (2014) Table 1, skill intensity and employment: Statistics Sweden, register-based labour market statistics (RAMS).

**TABLE 5** Correlations of occupational non-routine intensity, non-offshorable intensity and skill intensity

| | *NRTI1* | *NRTI2* | *NOFFI* | *SKILL* |
|---|---|---|---|---|
| *NRTI1* | n/a | n/a | n/a | n/a |
| *NRTI2* | 0.38* | n/a | n/a | n/a |
| *NOFFI* | 0.47** | −0.20 | n/a | n/a |
| *SKILL* | 0.51*** | 0.77** | 0.03 | n/a |

*Note:* ***, **, and * indicate significance at the 1, 5, and 10 percent levels, respectively.

assessment of the ease with which an occupation could potentially be offshored. This measurement is normalized to have zero mean and unit standard deviation and is converted to the two-digit ISCO88. As we did with *RTI* above, we map these values onto a variable *OFFI* that assumes values between 0 and 100 by using the cumulative normal distribution. We obtain our non-offshorability index of occupation $s$, $NOFFI_s = 1 - OFFI_s$. Table 4 shows *NOFFI* for different occupations $s$ ($\delta_s^{noff}$) that signifies the share of non-offshorable tasks.

Not surprisingly, we can see in Table 4 that employees working in occupations where the content of non-routine cognitive tasks is high (analytical ISCO 21 Engineers or interpersonal ISCO 13 Small enterprises managers) tend to be well educated. In contrast, those having an occupation carrying out mainly routine manual tasks (ISCO 82 Assemblers) are considerably less educated. However, in occupations where routine cognitive tasks are significant (ISCO 41 Office clerks), there are often middle-skilled workers, and in occupations performing non-routine manual tasks (ISCO 83 Drivers), the skill intensity is low. These findings explain why the correlation in Table 5 between the occupational non-routine intensity *NRTI1* and the occupational skill intensity *SKILL* – share of employees in an occupation $s$ that have a post-secondary education more than three years – is indeed positive (0.51) but far from perfectly correlated.

According to Table 5, the correlation between *NRTI2* and *SKILL* is substantially larger (0.77). The explanation is that *NRTI2* is low in low-skilled occupations doing non-routine manual tasks, for instance drivers, and higher in mid-skilled occupations with a large content of routine cognitive tasks, such as office clerks. In other words, *NRTI2* appear to be unable to discern routine cognitive tasks and non-routine manuals tasks (cf. *NRTI1*).

From Table 5, we thus infer that those performing non-routine tasks are often individuals with a high level of education (skilled workers), in particular, if we use *NRTI2* to measure the non-routine content in an occupation. An interesting question is to what extent skilled workers also carry out non-offshorable tasks. In contrast to non-routine tasks, there is no relationship between those who having occupations with high non-offshorable task intensity and their skill level; the correlation between *NOFFI* and *SKILL* is insignificant.[13] If we, in Table 4, take a closer look at *NOFFI*, we observe that *NOFFI*, as well as *NRTI1*, are high in low-skilled, non-routine manual occupations. Furthermore, *NOFFI* indicates that engineers – a high-skilled occupation – carry out potentially highly offshorable tasks. The motive is that certain complex, non-routine tasks performed by skilled labour can be offshored via telecommunication devices. Overall, this seems to explain the non-existent correlation between *NOFFI* and *SKILL*.

[13]The latter differ slightly from the findings in Blinder and Kreuger (2013), where educated workers appear to hold somewhat more offshorable jobs.

In sum, we conclude that skilled individuals largely tend to perform non-routine tasks. Although the non-routine task measures and the measure of skill clearly overlap for different occupations, the mapping is far from one to one. This applies not least to *NRTI1*, where employed in some occupations in which the share of non-routine tasks is high according to *NRTI1* also have low level of education. The *NRTI1* measure appears to be a more elaborated measure than *NRTI2* and captures more dimensions of non-routineness than just the relation to skills. As regards to the non-offshorable task measure, it seems that both skilled and less-skilled workers perform such tasks.

Given the correlations between tasks and skill content in occupations presented above, it would be intriguing to investigate whether it is routine tasks or activities conducted by less-skilled workers that are offshored when Swedish multinationals expand their employment abroad, or rather, if it is relocations of offshorable tasks overseas. In the econometric analysis in the following section, we examine the relationship between relative demand for skills and for different types of tasks in the parents of Swedish multinationals and changes in employment in their affiliates abroad.

# 3 | ECONOMETRIC ANALYSIS

## 3.1 | Econometric specification

In our econometric analyses, we use enterprise groups as the unit of analysis. We prefer that, instead of MNE plants, as in Becker et al. (2013), because this is the level at which decisions be taken about initiating production abroad, relocations, and other structural changes within MNEs. Moreover, potential problems with plants arise, when MNEs relocate low-skilled activities from their home country to other countries by closing plants at home and reopening them abroad. With plants as the unit of analysis, the observations disappear from the sample. With enterprise groups, on the other hand, the proportion of skilled labour increases at home, while the offshore employment share becomes higher.

As a measure of relative demand for task $i$ in MNE parent of enterprise group $j$ in Sweden at time $t$, we use the wage bill share:

$$WS^{i}_{jt} = \frac{\sum_s \delta^{i}_{s} W_{sjt}}{W_{jt}}, \tag{1}$$

where $W_{sjt}$ is the sum of wages of workers in occupation $s$ in MNE parent $j$ at time $t$, $\delta^{i}_{s}$ is the share of job task $i$ in occupation $s$ (see Table 4), and $W_{jt}$ is the total wage bill in MNE parent $j$ at time $t$. The wage bill share in equation (1) picks up both a higher share of task $i$ and larger compensation for task $i$ in MNE parent $j$.

Our corresponding measure of relative demand for skills is the wage bill share of workers with three or more years of post-secondary education.[14] This measure captures both an increased share of skilled employment in MNE parent $j$ and higher compensation for skills.

[14]Such a measure implies that we focus on highly skilled labor. As a check of robustness, we have estimated our specifications using a broader definition of skilled labor, namely employees with some post-secondary education. In 2013, the wage bill share of skilled labor defined broadly in Swedish MNEs is 43%, which is compared with 26% for highly skilled. When we use this broader definition of skilled labor and estimate the same specifications as in Tables 7, 9–12, we find that the results do not differ much, neither qualitatively nor quantitatively. See the Supplementary Appendix that provide estimates from various robustness tests.

To analyse the link between the relative demand for work type $i$ (skill, non-routine or non-offshorable tasks) at the parent of MNE $j$ in Sweden and the offshore employment at foreign location $k$, we employ an approach that has become standard in such analyses:[15]

$$WS^{i}_{jnt} = \sum_{k} \gamma_k OES_{jkt} + \beta_M \left(\frac{M}{Q}\right)_{jt} + \beta_K \ln\left(\frac{K}{Y}\right)_{jt} + \beta_Y \ln Y_{jt} + \beta_W \ln\left(\frac{w^i}{w^{-i}}\right)_{nt} + + \beta_R \left(\frac{RD}{Y}\right)_{nt} + \beta_I \left(\frac{ICT}{Y}\right)_{nt} + \alpha_j + \alpha_t + \varepsilon^{i}_{jnt}. \quad (2)$$

$WS^{i}_{jnt}$ is the wage bill share of work type $i$ at parent $j$ in industry $n$ at time $t$. The variable of particular interest is the offshore employment share $OES_{jkt}$, defined as the ratio of the employment in foreign affiliates of MNE $j$ in location $k$ to total (onshore and offshore) employment in MNE $j$ at time $t$. This is a measure of MNE $j$'s offshore activities in location $k$ at time $t$. The estimate $\gamma_k$ tells us about the relationship between changes in offshore employment shares and relative demand for skills, non-routine, or non-offshorable tasks within Swedish MNEs.

As an alternative to carry out offshoring activities within the MNE by relocating activities to its affiliates overseas, an MNE can offshore activities outside the MNE to stand alone firms abroad (arms-length), so-called international outsourcing.[16] One would expect that within MNE offshoring and international outsourcing are related; increased international outsourcing can be a substitute for within MNE offshoring. Therefore, not consider the extent of international outsourcing in an MNE may bias the results. As a control for that, we add to our specification the value of imports of goods and services to sales on enterprise level $(M/Q)_{jt}$.[17]

Other basic variables originating from the cost function assumptions behind this approach are the parent-level capital/output ratio $ln(K/Y)_{jt}$ – which indicates whether capital deepening affects relative demand for skills and tasks —and the parent-level real value added $lnY_{jt}$. The relative wage regressor $ln\left(w^i/w^{-i}\right)_{nt}$ accounts for changes in the wage bill share due to substitution away from a more expensive factor. In our estimations, however, we follow the practice of many other similar studies and omit the relative wage regressor.

We expect technological change, computerization, and automation to have positive impact on the demand for skills and the share of non-routine tasks because routine tasks are easier to automate or replace by computers.[18] To control for the impact of technology on the relative demand for skills and non-routine tasks, we add to our econometric specification variables such as R&D expenditures and ICT capital as a share of value added in industry $n$ of the MNE parent, $(RD/Y)_{nt}$ and $(ICT/Y)_{nt}$. Finally, in equation (2), $\alpha_j$ is an MNE-specific fixed effect, $\alpha_t$ a year effect, and $\varepsilon_{njt}$ is an error term.

[15]See, e.g., Head and Ries (2002), Hansson (2005) and Becker et al. (2013).

[16]This was pointed out by an anonymous referee.

[17]We obtain the variable by summing imports and sales for the firms included in an MNE. One problem is that we cannot distinguish between intra-MNE import and import from outside the MNE. Other studies, e.g., Becker et al. (2013) use, as in Feenstra and Hanson (1999), industry variables on ratios of intermediate imports to output as control variables. A similar variable to ours to examine the effect of international outsourcing on relative demand for skills on firm level has been employed by Andersson et al. (2017) and on workers' wages on firm level by Hummels et al. (2014).

[18]Machin and Van Reenen (1998), Autor, Levy and Murnane (2003) and Autor and Dorn (2013).

**TABLE 6** Panel characteristics

| Years in the panel | Number of MNEs | Cumulative share | Number of observations | Cumulative share | Employment mean (*SD*) |
|---|---|---|---|---|---|
| 13 | 186 | 5.8 | 2,418 | 16.7 | 1,171 (2,904) |
| 12 | 56 | 7.5 | 672 | 21.4 | 931 (2,909) |
| 11 | 41 | 8.8 | 451 | 24.5 | 495 (1,779) |
| 10 | 59 | 10.6 | 590 | 28.6 | 226 (358) |
| 9 | 133 | 14.8 | 1,197 | 36.9 | 213 (739) |
| 8 | 136 | 19.0 | 1,088 | 44.4 | 277 (2,030) |
| 7 | 149 | 23.6 | 1,043 | 51.6 | 261 (1,076) |
| 6 | 224 | 30.6 | 1,344 | 60.9 | 141 (381) |
| 5 | 273 | 39.1 | 1,365 | 70.4 | 177 (519) |
| 4 | 347 | 49.8 | 1,388 | 80.0 | 198 (804) |
| 3 | 374 | 61.5 | 1,122 | 87.8 | 165 (460) |
| 2 | 525 | 77.8 | 1,050 | 95.0 | 146 (845) |
| 1 | 715 | 100.0 | 715 | 100.0 | 106 (294) |
| Total | 3,218 | | 14,443 | | |

## 3.2 | Estimations of relative demand in Swedish MNE parents

We estimate the model in equation (2) on an unbalanced panel of Swedish MNEs between 2001 and 2013. If we include all observed Swedish MNEs during the studied period, we have 3,218 MNEs and 14,443 observations. This implies that several MNEs entry and exit between 2001 and 2013. Moreover, there has been an upward trend in the number of Swedish MNEs over the period.[19] Table 6 presents some panel characteristics. How many Swedish MNEs are in the panel $x$ years, where is $x$ is between 1 and 13 years? What is the average employment in MNEs that are in the panel $x$ years?

From Table 6, we realize that only 6 percent of the MNEs and 17 percent of the observations are in the balanced panel, i.e. are in the panel all 13 years and we notice that MNEs that stay longer in the panel, on average, have larger employment. The high entry and exit rate among MNEs in the panel might significantly affect the estimation results and we acknowledge that potentially this is a problem. On the other hand, an advantage with our dataset is that we have the possibility to follow MNEs under quite a long-time span[20] and during a period of a considerable expansion in overseas affiliates in low-income countries (Table 3). There are many reasons to why Swedish MNEs entry (and exit) the panel: they begin (stop) having employees abroad, become Swedish-owned (become foreign-owned), or enterprises undergo large organizational changes that means that they obtain other id-numbers.

Below, we present estimations based on an unbalanced panel of Swedish MNEs between 2001 and 2013 with all observations included. However, in the Supplementary Appendix we

[19]According to Table A2 in Appendix, which shows the number of Swedish MNEs each year in the panel, they have almost doubled between 2001 and 2013. This is because more Swedish enterprises have, over time, become MNEs, but it is also due to improved methods to detect Swedish MNEs.

[20]In Becker et al. (2013), the period is only four years, 1998 to 2001, and they analyze a balanced panel of plants.

**TABLE 7** Offshore employment and onshore skill upgrading, non-routine and non-offshorable task intensities. Manufacturing and services together

| | Skill upgrading | Non-routine 1 | Non-routine 2 | Non-offshorable |
|---|---|---|---|---|
| *OES* | 1.562 | 0.432 | 1.448 | −0.122 |
| | (2.25) | (1.03) | (3.41) | (−0.32) |
| *M/Q* | 0.021 | $-2.2 \times 10^{-5}$ | −0.012 | −0.007 |
| | (0.72) | (−0.10) | (−1.08) | (−2.31) |
| $ln\,(K/Y)$ | −0.421 | −0.340 | −0.344 | −0.162 |
| | (−2.22) | (−2.25) | (−2.75) | (−1.38) |
| ln*Y* | −1.348 | −1.173 | −0.790 | −0.580 |
| | (−3.51) | (−4.48) | (−3.06) | (−2.57) |
| *RD/Y* | 0.472 | −0.331 | 0.526 | 0.150 |
| | (0.66) | (−1.20) | (1.29) | (0.38) |
| *ICT/Y* | −9.842 | −7.533 | −5.029 | −1.747 |
| | (−1.76) | (−1.82) | (−1.08) | (−0.55) |
| $R^2$(overall) | 0.029 | 0.048 | 0.028 | 0.013 |
| Observations | 14,443 | 14,443 | 14,443 | 14,443 |
| Groups | 3,218 | 3,218 | 3,218 | 3,218 |

*Note:* We estimate the model with MNE-specific fixed effects and add time dummies in all specifications. The reported *t*-values in parentheses are based on robust standard errors, clustered at the MNE group level.

**TABLE 8** Assessment of the economic relevance of within MNE offshoring on onshore workforce composition

| | Coefficient estimate | Change in *OES* | Predicted $\Delta WS^i$ | Observed $\Delta WS^i$ | Contribution to $\Delta WS^i$ |
|---|---|---|---|---|---|
| Skill upgrading | | | | | |
| All MNEs | 1.562 | 0.052 | 0.081 | 12.56 | 0.6% |
| Years ≥8 | 3.129 | 0.076 | 0.238 | 14.43 | 1.6% |
| Non-routine 2 | | | | | |
| All MNEs | 1.448 | 0.052 | 0.075 | 2.00 | 3.8% |
| Years ≥8 | 2.761 | 0.076 | 0.210 | 3.68 | 5.7% |

show, as a robustness check, how the results are affected if we impose restrictions on how long an MNE must be observed to be included in the analysis. We find that, qualitatively, the results are relatively stable using the different panels, possibly apart from the balanced panel. Quantitatively, harder restrictions on observation time tend to give larger estimated coefficients.

We estimate equation (2) for each of the work types: skilled, non-routine, and non-offshorable, and present the results in Tables 7, 9 and 10. Table 7 includes OLS estimates for manufacturing and services together.

For our key variable in Table 7, the offshore employment share *OES*, the estimates are positive and significant for skill upgrading and non-routine 2 tasks, whereas the coefficients are

**TABLE 9** Offshore employment and onshore skill upgrading, non-routine and non-offshorable task intensities. Manufacturing and services

| | Skill upgrading | | Non-routine 1 | | Non-routine 2 | | Non-offshorable | |
|---|---|---|---|---|---|---|---|---|
| | **Manufacturing** | **Services** | **Manufacturing** | **Services** | **Manufacturing** | **Services** | **Manufacturing** | **Services** |
| *OES* | 0.420 | 1.979 | 0.802 | −0.015 | 1.792 | 1.290 | 0.635 | −0.399 |
| | (0.55) | (2.38) | (1.61) | (−0.03) | (3.20) | (2.34) | (0.82) | (−0.94) |
| *M/Q* | $-1.00 \times 10^{-5}$ | −0.994 | −0.001 | 0.310 | −0.006 | 0.327 | −0.007 | 0.021 |
| | (−0.04) | (−1.21) | (−0.85) | (0.48) | (−3.13) | (0.58) | (−2.77) | (0.05) |
| $R^2$(overall) | 0.017 | 0.037 | 0.029 | 0.016 | 0.033 | 0.107 | 0.045 | 0.055 |
| Observations | 4,892 | 9,551 | 4,892 | 9,551 | 4,892 | 9,551 | 4,892 | 9,551 |
| Groups | 1,021 | 2,357 | 1,021 | 2,357 | 1,021 | 2,357 | 1,021 | 2,357 |

*Note:* The specifications in the table include capital/output, value added, R&D and ICT intensities. We estimate the model with MNE-specific fixed effects and add time dummies in all specifications. The reported *t*-values in parentheses are based on robust standard errors, clustered at the MNE group level.

insignificant for non-routine 1 and non-offshorable tasks. Hence, within Swedish MNEs, expansions in affiliates abroad relate positively with relative demand for skilled labour and for non-routine tasks performed by skilled at home. By contrast, there are no associations between offshoring within Swedish MNEs and relative demand for non-routine tasks in general and for non-offshorable tasks. The correlations indicate that increased employment shares in the affiliates abroad seem to have positive impact on the relative demand in the parents for skills and non-routine tasks to the extent that such tasks are carried out by skilled labour.

To assess the economic relevance of offshoring on skill upgrading and task intensities in Swedish MNE parents, in Table 8, we perform some calculation of the explanatory power of offshore employment for wage bill shares of skilled labour and non-routine 2 tasks.[22] We multiply the within offshoring MNE coefficient estimates in Table 7 (column 1) by the changes in offshoring *OES* between 2001 and 2013 (column 2), which gives us in-sample predictions of the changes in wage bill shares (column 3). By relating that to the observed onshore change in the wage bill shares (column 4), we obtain an estimate of the contribution of offshoring to the onshore change in wage bill shares (column 5).[23]

We notice from our robustness test that if we restrict the dataset to MNEs that are observed eight years or more between 2001 and 2013, we observe a substantial increase (doubling) of the estimated coefficients on *OES*. As a sensitivity test, we also include these estimates into the assessment.

From the assessment of the economic relevance of offshoring on the workforce composition onshore, we find that within MNE offshoring "explains" only 1%–2% of the overall skill upgrading and 4%–6% of the increased non-routine 2 intensity in Swedish MNE parents.[24]

One reason to the very modest role within MNE offshoring appears to have played might be that heavily increased supply of skilled labour in Sweden during the period of study explains the bulk of skill upgrading we observed in Figure 2 both in Swedish MNEs and in non-MNEs. On the other hand, within MNE offshoring seems to have contributed to the faster growing skill intensity we have seen in Swedish MNEs compared to in non-MNEs.

Our variable presumed to capture to what extent international outsourcing occur in an MNE, $M/Q$, are in most cases unrelated to relative demand for skills or tasks in the MNE parents in Sweden (or sometimes the coefficient on the variable is even significant with non-expected sign). These are result we also observe in other specifications further ahead, which could indicate that the value of goods and service imports to sales is not an appropriate measure of international outsourcing in MNEs.[25] In addition, we find that the inclusion of $M/Q$ into our estimated model has very little impact on the coefficients on within MNE offshoring.

[22]We focus on skill upgrading and non-routine 2 intensity because in Table 7, the estimates of *OES* on the non-routine 1 intensity and the non-offshorable intensity are insignificant.

[23]Cf. Becker et al. (2013) Table 10.

[24]This is considerably less than in Becker et al. (2013) for German MNEs (almost 12% for highly educated and 10% for non-routine tasks), and in Hansson (2005) for skill upgrading in Swedish manufacturing MNEs in the beginning of the 1990s (15%).

[25]For instance, if an MNE outsource assembling activities arms-length abroad, we do not expect to see large imports back to the parent of final products, especially if the home country of the parent is a small country. Moreover, we notice that, in Becker et al. (2013), their controls for international outsourcing on industry level are unrelated to skill upgrading and relative demand for non-routine tasks in MNE plants at home, and in Andersson et al. (2017), only imports of service in non-MNEs have a positive impact on relative demand for skills.

**TABLE 10** Offshore employment and onshore skill upgrading, non-routine and offshorable task intensities. High- and low-income countries

| | Skill upgrading | Non-routine 1 | Non-routine 2 | Non-offshorable |
|---|---|---|---|---|
| *OES* | 1.545 | −0.069 | 0.756 | −0.467 |
| high-income | (2.40) | (−0.17) | (1.72) | (−1.14) |
| *OES* | 1.598 | 1.505 | 2.933 | 0.618 |
| low-income | (1.35) | (1.80) | (3.76) | (0.80) |
| *M/Q* | 0.021 | −0.001 | −0.012 | −0.008 |
| | (0.72) | (−0.27) | (−1.17) | (−2.30) |
| $R^2$(overall) | 0.029 | 0.044 | 0.020 | 0.011 |
| Observations | 14,443 | 14,443 | 14,443 | 14,443 |
| Groups | 3,218 | 3,218 | 3,218 | 3,218 |

*Note:* See Table 9.

If we then focus on the control variables in Table 7, we find that value added in the Swedish parts of the MNEs seems to correlate negatively with skill upgrading, and with higher intensities of non-routine and non-offshorable tasks. An interpretation might be that less production in Sweden involves concentration of the remaining parts in the MNE parents to more skilled activities and more non-routine or non-offshorable tasks.

Additionally, there appears be to a negative relationship between capital deepening and skill upgrading and the wage bill shares of non-routine tasks. This implies that our results provide no support for either capital-skill complementarity or for complementarity between capital and non-routine tasks.

Finally, somewhat surprisingly in the light of the results from previous studies (older as well as more recent) regarding the effects of technological change and computerization on skills and non-routine task intensities, we obtain no significant positive coefficients on R&D and ICT intensities.

Offshoring may have a different impact on the onshore composition of skills and tasks in manufacturing or services MNEs or whether offshoring takes place in low- or high-income countries. Table 9 shows separate estimates on manufacturing MNEs and services MNEs, whereas Table 10 presents results where we allow for different impacts of offshoring in high- and low-income countries.

The picture that stands out in the tables is not clear-cut. In Table 9, the estimates are positive and significant for *OES* in services for skill upgrading and for non-routine task 2. This suggests that an expansion abroad in service MNEs may lead to increased relative demand for skilled labour and non-routine tasks carried out by labour that is more educated. The coefficient for non-routine task 2 intensity is positive and significant for manufacturing MNEs as well.

In Section 2.2, we saw that over the studied period the expansion in Swedish MNEs abroad took place in low-income countries. However, if we, in Table 10, allow for different relationships between relative demand for skills and tasks at home and increased employment overseas in high- and low-income countries, we hardly find any significant differences (except for non-routine tasks 2).

**TABLE 11** Offshore and onshore employment: total, skilled, and less-skilled employment. Manufacturing and service MNEs together

| | Total | Skilled | Less-skilled |
|---|---|---|---|
| Manufacturing and services | | | |
| Offshore employment | 0.057 | 0.017 | 0.040 |
| High-income $OE_{high}$ | (1.26) | (1.53) | (0.99) |
| Offshore employment | −0.016 | 0.009 | −0.024 |
| Low-income $OE_{low}$ | (−0.44) | (1.09) | (−0.74) |
| Import sales ratio | −0.031 | −0.187 | 0.155 |
| $M/Q$ | (−0.03) | (−1.02) | (0.18) |
| Capital/output | 33.71 | 5.500 | 28.21 |
| $ln\,(K/Y)$ | (3.25) | (2.51) | (3.19) |
| Value added | 207.1 | 28.31 | 178.8 |
| $ln\,(Y)$ | (5.03) | (4.81) | (4.78) |
| $RD/Y$ | 25.66 | 4.976 | 20.68 |
| | (0.40) | (0.33) | (0.41) |
| $ICT/Y$ | 1339 | 301.5 | 1037 |
| | (1.36) | (1.72) | (1.26) |
| $R^2$(overall) | 0.311 | 0.175 | 0.302 |
| Observations | 14,443 | 14,443 | 14,443 |
| Groups | 3,218 | 3,218 | 3,218 |

*Note:* We estimate the model with MNE-specific fixed effects and add time dummies in all specifications. The reported *t*-values in parentheses are based on robust standard errors, clustered at the MNE group level.

## 3.3 | Relationship between offshore and onshore employment

In the previous section, the estimations of relative demand for skills indicate that increased offshore employment shares *OES* lead to larger wage bill shares of skilled labour $WS^{skill}$ −skill upgrading −in the MNE parents at home. Table 2 suggests that the driving forces behind skill upgrading differ between manufacturing and services. In manufacturing, the higher share of skilled labour onshore is a result of decreased employment of less-skilled workers, whereas in services, the skill upgrading is due to increased employment of skilled labour.

We examine the relationship between changes in offshore employment in high- and low-income countries and onshore employment of skilled and less-skilled labour in absolute terms in manufacturing and services. This means that we replace the dependent variable in equation (2), the wage bill share of skilled labour $WS^{skill}_{jnt}$ with the employment of work type $i$ (skilled or less-skilled) in the Swedish MNE parent $j$ in industry $n$ at time $t$, $L^i_{jnt}$. Equation (3) shows the new specification:

$$L^i_{jnt} = \sum_k \gamma_k OE_{jkt} + \beta_M \left(\frac{M}{Q}\right)_{jt} + \beta_K \ln\left(\frac{K}{Y}\right)_{jt} + \beta_Y \ln Y_{jt} + \\ + \beta_R \left(\frac{RD}{Y}\right)_{nt} + \beta_I \left(\frac{ICT}{Y}\right)_{nt} + \alpha_j + \alpha_t + \varepsilon^i_{jnt}. \tag{3}$$

**TABLE 12** Offshore and onshore employment: total, skilled, and less-skilled employment. Manufacturing and service MNEs separately

| | Total | Skilled | Less skilled |
|---|---|---|---|
| Manufacturing | | | |
| Offshore employment | 0.060 | 0.010 | 0.050 |
| High-income $OE_{high}$ | (1.10) | (0.64) | (1.14) |
| Offshore employment | −0.092 | 0.017 | −0.109 |
| Low-income $OE_{low}$ | (−3.07) | (0.72) | (−6.24) |
| Import sales ratio | 0.611 | −0.329 | 0.941 |
| *M/Q* | (0.99) | (−0.82) | (2.63) |
| $R^2$(overall) | 0.231 | 0.444 | 0.139 |
| Observations | 4892 | 4892 | 4892 |
| Groups | 1021 | 1021 | 1021 |
| Services | | | |
| Offshore employment | 0.056 | 0.027 | 0.029 |
| High-income $OE_{high}$ | (1.01) | (2.50) | (0.59) |
| Offshore employment | 0.017 | 0.006 | 0.011 |
| Low-income $OE_{low}$ | (0.51) | (1.42) | (0.37) |
| Import sales ratio | 49.97 | 2.798 | 47.18 |
| *M/Q* | (0.96) | (0.35) | (1.02) |
| $R^2$(overall) | 0.270 | 0.114 | 0.258 |
| Observations | 9,551 | 9,551 | 9,551 |
| Groups | 2,357 | 2,357 | 2,357 |

*Note:* The specifications in the table include capital/output, value added, R&D and ICT intensities. We estimate the model with MNE-specific fixed effects and add time dummies in all specifications. The reported *t*-values in parentheses are based on robust standard errors, clustered at the MNE group level.

Essentially, the explanatory variables are the same in equation (3) as in equation (2) except for $OE_{jkt}$, that is, employment in affiliates of MNE *j* in country group *k* (high- or low-income countries) at time *t*. We estimate equation (3) for total parent employment, as well as for parent employment of skilled and less skilled.

Table 11 presents OLS estimates at the outset for manufacturing and services MNEs together and then, in Table 12, for manufacturing MNEs and services MNEs separately.

In all our specifications in Table 11, we control for onshore output changes, and as expected, increased value added in the MNE parents correlates positively with larger onshore employment. If we then look at the variable of main interest —employment changes abroad —we find that, given output changes onshore, no relationship exists between employment changes in affiliates abroad, neither in low-income, nor in high-income countries, and employment changes in the parent companies at home.

Generally, a higher capital/output ratio in the parents relates positively to employment changes onshore. In addition, the proportion of ICT capital or R&D expenditure to value added

at home in the industry of the MNE parent is unrelated with onshore employment, except perhaps for skilled labour in industries that invest heavily in ICT (significant on 10 percent level).

However, in Table 12, the outcome become more interesting when we estimate the model in equation (3) separately for manufacturing MNEs and service MNEs. The results imply that, within manufacturing MNEs, increases in offshore employment in low-income countries relate negatively to onshore employment, particularly of less-skilled labour. This suggests that employment in affiliates in low-income countries *substitutes* for less-skilled employees onshore. Accordingly, an explanation to the falling employment of less-skilled labour we observe in Table 2 is that, within Swedish manufacturing MNEs, low-skilled activities relocate from the parents in Sweden to affiliates in low-income countries abroad. In other words, resource-seeking FDI seems to be important in manufacturing.[26]

Moreover, within service MNEs, the estimates indicate that increases in employment in affiliates in high-income countries affect the onshore employment of skilled positively. This suggests that employment in affiliates in high-income countries *complements* onshore employment.[27] This might reflect that market-seeking motives for FDI are more prevalent in the service sector because in many service industries, producers and consumers must locate in the same place.[28] To the extent that we find skill upgrading in service MNE parents of offshoring that could be explained by increased skill employment. An expansion abroad requires, e.g. more headquarter service at home, which is by and large more skill intensive.[29]

## 4 | CONCLUDING REMARKS

The paper examines the relationship between within MNE offshoring and the onshore workforce composition in Swedish MNEs between 2001 and 2013. In many respects, the results correspond with previous studies. However, by employing some new task measures we can provide a richer picture of the association between within MNE offshoring and the composition of skills and tasks in the MNE parent.

As in Becker et al. (2013), we find that within MNE offshoring correlates with increased relative demand for skills and non-routine tasks carried out by skilled labour in the MNE parents. Interestingly, when we use two other newly developed task measures – a more elaborated one on non-routine tasks and another explicitly designed trying to capture offshorability, and both less associated with workers skill (educational attainment) – the relative demand for such tasks in MNE parents is unrelated to within MNE offshoring. Taken together, this indicates that MNEs' expansions in affiliates abroad entail that largely routine activity performed by low-skilled labour in the parents is relocated abroad or that they retain and expand non-routine tasks carried out by skilled labour at home.

[26]This result corresponds with the findings in Elia et al. (2009).

[27]Hijzen et al. (2011) find that service sector outward FDI in high-income countries is associated with positive employment effects. In contrast, in Elia et al. (2009), outward FDI to high-income countries relates negatively to employment in the parents' "industrial region". However, they do not include the service sector.

[28]Francois and Hoekman (2010) have termed that the "proximity burden".

[29]Remember that we, in Table 9, find that, within service MNEs, a higher employment share offshore relates positively to skill upgrading and to increased relative demand for non-routine tasks such that are performed by more educated labor onshore.

In contrast to other similar studies, we can show that the drivers behind the rising skill shares in manufacturing and in service MNEs differ; in manufacturing MNEs, it is reduced employment of less-skilled labour, while in service MNEs, it is mainly due to substantially increased employment of skilled labour. The estimations of the relationship between employment offshore and onshore within Swedish MNEs suggest that increased employment in affiliates in low-income countries affects the employment of less-skilled workers in manufacturing MNE parents negatively. Notable in this context is that, in manufacturing MNEs during the studied period, we have seen considerable expansions in employment and number of affiliates overseas in low-income countries. In services MNEs, on the other hand, foreign operations have been growing both in high and low income, and the number of affiliates even more in high-income countries (Table 3). We conclude, therefore, that offshoring within Swedish MNEs seems to have contributed to the general contraction in manufacturing employment and expansion of service employment observed in the Swedish business sector.

The economic relevance of MNE offshoring for the ongoing skill upgrading in Swedish MNEs appears to be small, even less than in previous studies. Heavily increased supply of skilled labour in Sweden during the period of study has led to a considerable general skill upgrading in both Swedish MNEs and non-MNEs. However, the faster growing skill intensity in Swedish MNEs than in non-MNEs (Figure 2), and most likely because of that also higher productivity, might be an outcome of within MNE offshoring.

Offshoring within MNEs and international outsourcing are different ways to offshore activities, and this should thus be considered in the analysis. The results in the paper indicate that international outsourcing in MNEs is unrelated to parent skill upgrading. However, we believe that the variable commonly used in analyses of the impact of international outsourcing on firm-level, the value of imports to sales, is less appropriate for MNEs than for non-MNEs and here there is room for improvements in future research.[30]

## ORCID


*Pär Hansson* https://orcid.org/0000-0003-2575-6114

## REFERENCES

Acemoglu, D., & Autor, D. (2011). Skills, tasks and technologies: Implications for employment and earnings. In D. Card & O. Aschenfelter (Eds.), *Handbook of labor economics*. Vol. *4b*, (pp. 1043–1171). Amsterdam: North-Holland.

Andersson, L., Karpaty, P., & Savsin, S. (2017). Labor demand, offshoring and inshoring: Evidence from Swedish firm data. *World Economy*, *40*(2), 240–274.

Antràs, P. (2016). *Global production: Firms, contracts, and trade structure*. Princeton: Princeton University Press.

Autor, D. (2013). The "task approach" to labor markets: an overview. *Journal of Labor Market Research*, *46*(3), 185–199. https://doi.org/10.1007/s12651-013-0128-z

Autor, D., & Dorn, D. (2013). The growth of low-skill service jobs and the polarization of the US market. *American Economic Review*, *103*(5), 1553–1597.

Autor, D., Dorn, D., & Hanson, G. (2015). Untangling trade and technology: Evidence from local labour markets. *Economic Journal*, *125*, 621–646. https://doi.org/10.1111/ecoj.12245

Autor, D., Levy, F., & Murnane, R. (2003). The skill content of recent technological change: An empirical exploration. *Quarterly Journal of Economics*, *118*(4), 1279–1333. https://doi.org/10.1162/003355303322552801

[30]Fruitful avenues to pursue might be to consult recently developed theoretical models on the importance of contractual frictions in the international system of production, which provide insights on how such frictions influence the choice between offshoring within MNEs and international offshoring, and for the empirical analysis, try to get access to data on intra-MNE trade (at present not available in Sweden). See Antràs (2016).

Becker, S., Ekholm, K., & Muendler, M.-A. (2013). Offshoring and the onshore composition of tasks and skills. *Journal of International Economics*, *90*, 91–106. https://doi.org/10.1016/j.jinteco.2012.10.005

Berman, E., Bound, J., & Griliches, Z. (1994). Changes in the demand for skilled labor within US manufacturing: Evidence from annual survey of manufactures. *Quarterly Journal of Economics*, *109*(2), 367–398.

Blinder, A. (2006). Offshoring: The next industrial revolution? *Foreign Affairs*, *85*(2), 113–128. https://doi.org/10.2307/20031915

Blinder, A., & Krueger, A. (2013). Alternative measures of offshorability: A survey approach. *Journal of Labor Economics*, *31*(2), S97–S128. https://doi.org/10.1086/669061

Ebenstein, A., Harrison, A., McMillan, M., & Phillips, S. (2014). Estimating the impact of trade and offshoring on American workers using the current population surveys. *Review of Economics and Statistics*, *96*(4), 582–595. https://doi.org/10.1162/REST_a_00400

Elia, S., Mariotti, I., & Piscitello, L. (2009). The impact of outward FDI on the home country's labour demand and skill composition. *International Business Review*, *18*, 357–372. https://doi.org/10.1016/j.ibusrev.2009.04.001

Feenstra, R., & Hanson, G. (1999). The impact of outsourcing and high-technology capital on wages: Estimates for the United States, 1979–1990. *Quarterly Journal of Economics*, *114*(3), 907–940. https://doi.org/10.1162/003355399556179

Francois, J., & Hoekman, B. (2010). Services trade and policy. *Journal of Economic Literature*, *48*(3), 642–692. https://doi.org/10.1257/jel.48.3.642

Goos, M., Manning, A., & Salomons, A. (2014). Explaining job polarization: Routine-biased technological change and offshoring. *American Economic Review*, *104*(8), 2509–2526. https://doi.org/10.1257/aer.104.8.2509

Hakkala Nilsson, K., Heyman, F., & Sjöholm, F. (2014). Multinational firms, acquisitions and job tasks. *European Economic Review*, *66*, 248–265. https://doi.org/10.1016/j.euroecorev.2013.12.003

Hansson, P. (2005). Skill upgrading and production transfer within Swedish multinationals. *Scandinavian Journal of Economics*, *107*(4), 673–692. https://doi.org/10.1111/j.1467-9442.2005.00428.x

Harrison, A., & McMillan, M. (2011). Offshoring jobs? Multinationals and U.S. manufacturing employment. *Review of Economics and Statistics*, *93*(3), 857–875. https://doi.org/10.1162/REST_a_00085

Head, K., & Ries, J. (2002). Offshore production and skill upgrading by Japanese manufacturing firms. *Journal of International Economics*, *58*(1), 81–105. https://doi.org/10.1016/S0022-1996(01)00161-1

Hijzen, A., Jean, S., & Mayer, T. (2011). The effects at home of initiating production abroad: Evidence from matched French firms. *Review of World Economics*, *147*(3), 457–483. https://doi.org/10.1007/s10290-011-0094-x

Hummels, D., Jørgensen, R., Munch, J., & Xiang, C. (2014). The wage effects of offshoring: Evidence from Danish matched worker-firm data. *American Economic Review*, *104*(6), 1597–1629. https://doi.org/10.1257/aer.104.6.1597

Machin, S., & Van Reenen, J. (1998). Technology and changes in skill structure: Evidence from seven OECD countries. *Quarterly Journal of Economics*, *113*(4), 1215–1244. https://doi.org/10.1162/003355398555883

Tillväxtanalys (2019). Forskning och utveckling internationella företag 2017. (Research and development in international firms 2017). *Statistik*, *2019*, 2.

## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

**How to cite this article:** Eliasson, K., Hansson, P., & Lindvert, M. (2021). Patterns of employment, skills, and tasks within MNEs associated with offshoring. *The World Economy*, 00, 1–27. https://doi.org/10.1111/twec.13203

## APPENDIX 1

**TABLE A1** High- and low-income countries included in the panel

| High-income | Low-income | | |
|---|---|---|---|
| Australia | Afghanistan | Greenland | Nigeria |
| Austria | Algeria | Guatemala | Oman |
| Belgium | Angola | Honduras | Pakistan |
| Canada | Argentina | Hong Kong | Panama |
| Denmark | Armenia | Hungary | Paraguay |
| Finland | Azerbaijan | India | Peru |
| France | Bahrain | Indonesia | Poland |
| Germany | Bangladesh | Iran | Puerto Rico |
| Greece | Barbados | Iraq | Qatar |
| Iceland | Belarus | Isle of Man | Romania |
| Ireland | Belize | Israel | Rwanda |
| Italy | Benin | Ivory Coast | Russia |
| Japan | Bermuda | Jamaica | Philippines |
| Luxembourg | Bhutan | Jordan | Saint Kitts and Nevis |
| Netherlands | Bolivia | Kazakhstan | Saudi Arabia |
| New Zealand | Bosnia and Herzegovina | Kenya | Senegal |
| Norway | Botswana | Dem Rep of Kongo | Serbia |
| Portugal | Brazil | Rep of Kongo | Singapore |
| Spain | Bulgaria | Kuwait | Slovenia |
| Switzerland | Burkina Faso | Laos | Sri Lanka |
| United Kingdom | Cambodia | Latvia | Sudan |
| United States | Cameroon | Lebanon | Swaziland |
| | Chile | Libya | South Africa |
| | China | Lithuania | South Korea |
| | Colombia | Macau | Syria |
| | Costa Rica | Macedonia | Tajikistan |
| | Croatia | Malaysia | Taiwan |
| | Czech Republic | Mali | Tanzania |
| | Cyprus | Malta | Thailand |
| | Dominican Republic | Mauritius | Togo |
| | Ecuador | Mexico | Trinidad and Tobago |
| | Egypt | Moldavia | Tunisia |
| | El Salvador | Mongolia | Uganda |
| | Estonia | Montenegro | Ukraine |

**TABLE A1** (Continued)

| High-income | Low-income | | |
|---|---|---|---|
| | Ethiopia | Morocco | United Arab Emirates |
| | Falkland Islands | Mozambique | Uruguay |
| | Faroe Islands | Myanmar | Uzbekistan |
| | Fiji | Namibia | Yugoslavia (former) |
| | Gabon | Nepal | Venezuela |
| | Georgia | Nicaragua | Vietnam |
| | Ghana | Niger | |

**TABLE A2** Number of MNEs each year in the panel

| Year | Number | Year | Number |
|---|---|---|---|
| 2001 | 751 | 2008 | 1,232 |
| 2002 | 754 | 2009 | 1,317 |
| 2003 | 752 | 2010 | 1,341 |
| 2004 | 771 | 2011 | 1,413 |
| 2005 | 992 | 2012 | 1,448 |
| 2006 | 1,075 | 2013 | 1,481 |
| 2007 | 1,116 | | |