

# Production Hierarchies and MNC Expatriates\*

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## Abstract

We study the adjustment of knowledge for an expanding MNC through the lens of a knowledge hierarchy model. In particular, based on the recent evidence that expatriates serve as a means for knowledge transmission from MNCs to their foreign affiliates, we investigate how the use of expatriates changes when foreign affiliates expand or contract. Using data on labor mobility for MNCs headquartered in South Korea, we analyze foreign affiliates that expand with and without changing their organization of hierarchical layers. We find that foreign affiliates who expand by changing their number of organizational layers require more expatriates, especially at the higher layers. When affiliates expand by adding an organizational layer, the new layer mostly comprises expatriates, while the need for expatriates in the layer immediately below declines. Similarly, when affiliates contract by dropping a layer, the need for expatriates in the layer immediately below increases. Additionally, when affiliates grow without adding a layer, the span of control at the upper layer(s) increases. These results are consistent with the predictions of the knowledge hierarchy model.

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# 1 Introduction

The recent economics literature on multinational corporations (MNCs) has documented the use of expatriates as a means of knowledge transmission (Fosfuri et al. (2001); Glass and Saggi (2002); Balsvik (2011); Poole (2013); Gumpert (2018); Astorne-Figari and Lee (2018); Cho (2018)).<sup>1</sup> Astorne-Figari and Lee (2018) and Gumpert (2018) provide evidence on this using data on labor mobility for Korean and German MNCs, respectively. Both studies find that MNCs allocate more expatriates to foreign affiliates located in countries where communication costs with the home country are higher. Astorne-Figari and Lee (2018) also show that the relationship between communication costs and the use of expatriates decreases in sectoral complexity, consistent with the interpretation of expatriates as knowledge repositories rather than monitors. Within this framework, we investigate how the use of expatriates varies as foreign affiliates grow or contract.

The knowledge hierarchy models of Garicano (2000), Garicano and Rossi-Hansberg (2006), and Caliendo and Rossi-Hansberg (2012) characterize production as a problem-solving process requiring labor and knowledge as inputs, where knowledge is required to solve the problems workers encounter during production. In particular, Caliendo and Rossi-Hansberg (2012) and Caliendo et al. (2015) study the case where firms adjust their number of hierarchical layers according to their scale of production, which provides the ideal conceptual framework for our case. In particular, when firms grow or contract, they can choose to do so with or without reorganization (i.e. changing or not changing the number of organizational layers within the firm) in order to minimize production costs. When firms expand without reorganization, they need to hire more workers in each layer and increase the level of knowledge in each layer. On the other hand, when firms expand with reorganization (by adding a layer), they still hire more workers in each layer, but decrease the level of knowledge in all preexisting layers instead. Similar arguments can be made for firms who contract. Using this framework, and considering the role of expatriates as tacit knowledge repositories, we study whether the use of expatriates in each hierarchical layer follows these patterns as foreign affiliates expand or contract.

In our empirical analysis, we examine the use of expatriates in firms that expand and contract, both with and without reorganization, using unpublished panel data on foreign affiliates of MNCs headquartered in South Korea between 2007-2011. One key advantage of our data set is that it distinguishes between South Korean and foreign employees, and classifies the employees of each foreign affiliate into three layers: upper level managers, lower level managers, and production workers. South Korea is ethnically quite homogeneous and differs significantly from other countries in terms of culture and language (Alesina and Wacziarg (2003); Fearon (2003);

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<sup>1</sup>Studies in Management have also recognized expatriates as a channel for knowledge transmission. See (Gong (2003); Belderbos and Heijltjes (2005); Brock et al. (2008); Chang et al. (2012)).

Hofstede et al. (1997); Isphording and Otten (2013)).<sup>2</sup>, generating high communication costs across borders. Moreover, since knowledge includes corporate culture and other entrepreneurial values that can be specific to a particular country’s idiosyncrasy, it could be very costly for foreign workers to be trained in appropriate business protocol.

Our results show that the number of expatriates per layer increases (decreases) when foreign affiliates expand (contract) with reorganization. This increase (decrease) is more pronounced for higher layers. When foreign affiliates expand with reorganization (i.e. by adding an upper-level manager layer), this new layer consists of mostly expatriates and the use of expatriates at the preexisting lower-level manager layer declines. In contrast, for affiliates that contract by dropping the highest layer, the use of expatriates for the remaining managerial layer increases.

Additionally, we look at overall employment trends in all layers. We find that the span of control for all managers (i.e. the number of lower level workers per manager in the layer strictly above) increases (decreases) when affiliates expand (contract) without reorganizing. That is, the magnitude of the change in employees is always greater for lower layers.

We must note that our empirical analysis is not intended to construct causality. It is hard to argue exogeneity when studying the relationship between variables at the disaggregate affiliate level. Rather, our analysis shows that the allocation of expatriates differs across the hierarchical layers of organization in foreign affiliates, and changes in their use depend on whether an affiliate reorganizes or not, as predicted by the knowledge hierarchy model.

## 1.1 Related Literature

Our paper is closely related to Caliendo et al. (2015), who also study the allocation of knowledge across hierarchical layers for firms that expand and contract, based on the knowledge hierarchy model of Caliendo and Rossi-Hansberg (2012). However, Caliendo et al. (2015) study French firms (as opposed to MNCs), taking the average wage as a proxy for knowledge in each layer. Their findings are in line with the predictions of Caliendo and Rossi-Hansberg (2012) as follows. In firms that expand without changing the number of layers, average wages rise in all layers. In firms that expand by adding layers, average wages fall in all preexisting lower layers, while the newly added upper-level managers make the highest wages. Firms alter average wages in a given layer by changing the composition of workers in that layer (instead of changing the wages of current employees). In particular, average wages increase (decrease) when firms hire more (less) experienced workers, particularly at the higher layers, because experience (as opposed to training) provides the knowledge required to solve less frequent problems. While they interpret the extensive margin of hiring more (less) experienced workers as an increase (decrease)

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<sup>2</sup>For example, both Fearon (2003) and Alesina and Wacziarg (2003) rank Korea among the lowest in terms of ethnic, cultural, and linguistic diversity. Isphording and Otten (2013) specifically mention that Korean is a very isolated language.

in knowledge, we interpret the use of expatriates within MNCs as an increase (decrease) in knowledge. Our results are consistent with theirs from the following perspective. Since Korean idiosyncratic values are more likely to be acquired through experience as opposed to formal training, hiring expatriates is consistent with hiring more experienced workers.

Our results are also related with the nascent empirical studies exploring the internal organization of firms. It has been documented that firms have ‘flattened’ as firms expand, i.e. the number of lower level workers per an upper level worker, increases as firms grow. We find a similar pattern of “flattening”, since the span of control of all managers increases when foreign affiliates expand. Rajan and Wulf (2006) use a sample of 300 large U.S. firms for the period 1986 to 1998 to analyze how hierarchies of top-level managers have changed over time. The study shows that the CEO’s span of control has increased while the number of layers between division heads and CEOs has gone down during the sample period. Garicano and Hubbard (2007) study the role of hierarchies as a means of organizing production in law firms. They look at the relationship between the ratio of associate lawyers to a partner lawyer and market size. They argue that uncertainty declines as the size of the market increases and find that the partner lawyer’s span of control increases with the market size. Guadalupe and Wulf (2010) pays attention to causality and presents evidence that increasing competition as a result of 1989 Canada-US FTA leads to flatter hierarchies of U.S. firms.

Finally, we also contribute to the literature on technology diffusion. Foreign direct investment (FDI) is considered an important channel of international knowledge diffusion, through both vertical (e.g. Smarzynska Javorcik (2004)) and horizontal (e.g. Keller and Yeaple (2009)) linkages. Although our work does not directly deal with knowledge diffusion, knowledge spillovers may still occur when allocating knowledge to foreign affiliates through expatriation within a MNC. In Rappoport et al. (2016) and Atalay et al. (2014), the transactions within MNCs or multi-plant firms that share the same ownership become less visible, and the benefit of ownership is not for physical transactions but for efficient intra-firm utilization of knowledge. We propose that MNCs (or multi-plant firms) take advantage of internalization using labor mobility, which does not necessarily involve transactions of physical products. Using the same data set as ours, Cho (2018) shows that there is a positive association between expatriates and labor productivity in foreign affiliates. This correlation is taken as evidence that expatriates are not just more productive than foreign workers, but also transfer knowledge to foreign affiliates.

## 2 Conceptual Framework

In this section, we will briefly review the theoretical framework developed by Caliendo and Rossi-Hansberg (2012) (from now on, CRH) and summarize the predictions of their model that are relevant to our analysis. Then, we will interpret these predictions through a lens of expatriates as knowledge transmitters.

CRH develop a model of production with workers and knowledge as inputs, as in Garicano (2000) and Garicano and Rossi-Hansberg (2006), where workers are organized in hierarchical layers. Knowledge is optimally allocated across layers as follows: production workers (in the lowest layer) learn the knowledge required to solve the most common problems, and managers (in all the above layers) specialize in learning how to solve less frequent problems. The total knowledge in the firm, given by the sum of knowledge in each layer, determines how much the firm can produce.

Aside from choosing the number of employees and the level of knowledge allocated to each layer, firms may also choose to increase or decrease the number of hierarchical layers in order to minimize the cost of production. We say that a firm expands (contracts) without reorganization whenever it increases (decreases) production without changing the number of layers. Similarly, we say that a firm expands (contracts) with reorganization whenever it increases (decreases) production by adding (dropping) a layer. Depending on the magnitude of the expansion, firms will choose to reorganize or not. A firm with a given number of layers produces at minimum cost for a certain range of output, and, if the firm expands past that range of output, it will need to add one layer to continue to produce at minimum cost. The opposite is true if the firm contracts: falling below that range of output will require the firm to drop one layer of organization.<sup>3</sup>

Considering the above, as firms expand (contract), CRH predicts that the number of workers in each layer increases (decreases) regardless of whether or not they reorganize. That is, in order to increase production, the firm must always hire more workers and increase cumulative knowledge. However, the distribution of that cumulative knowledge varies across layers depending on whether or not there is reorganization. Note also that a manager's span of control<sup>4</sup> is fully characterized by the level of knowledge of the workers in the layer immediately below them – the more knowledgeable the workers, the more workers that can report to a single manager.

When firms expand (contract) without reorganization, the number of workers and the knowl-

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<sup>3</sup>Optimal production is chosen to maximize profits in a monopolistically competitive environment, where each firm produces a different variety. Consumers have constant elasticity of substitution preferences for all the varieties produced in the economy, so the profit maximizing quantity depends only on the variety parameter, regardless of whether or not the firm expands by changing the number of layers. For this reason, it suffices to look at cost minimization to gain intuition about reorganization.

<sup>4</sup>The span of control of a manager in a certain layer is defined as the number of workers in the layer immediately below that are “assigned” to her.

edge of workers in all layers increases (decreases). Since knowledge increases (decreases) in all layers, the span of control increases (decreases) for all managerial layers. On the contrary, when firms expand (contract) with reorganization, the number of workers in all layers increases (decreases), but the knowledge in all preexisting layers decreases (increases). Since knowledge decreases (increases) in all preexisting layers, the span of control of managers decreases (increases) as well.

We can now combine the above predictions with our interpretation of expatriates as a proxy for knowledge. As Astorine-Figari and Lee (2018) argue, expatriates serve as a means for knowledge transmission when knowledge has a high tacit component, especially when the host country is culturally very different from the home country. In particular, for an employee to be properly trained to solve problems, she would not only need to learn the home country's language, but also its idiosyncrasies and corporate culture. Since upper layers are more likely to encounter problems that require this tacit knowledge (as opposed to issues arising from the production process itself), we expect the predictions from CRH to be stronger for all layers encompassing managers when using expatriates as a proxy for knowledge.

Therefore, when firms expand (contract) without reorganization, we expect to observe that more expatriate workers are hired in all layers, and that higher layers increase their utilization of expatriate workers more than lower layers. In contrast, when firms expand (contract) with reorganization, we expect to observe that fewer (more) expatriate workers are hired in all preexisting layers, and that higher preexisting layers decrease (increase) their utilization of expatriate workers more than lower layers.

### 3 Data and Descriptive Statistics

In order to examine our hypotheses described in Section 2, we use unpublished data from the South Korean Export-Import (EXIM) Bank on MNCs headquartered in South Korea. Since the year 2000, the EXIM Bank has been pursuing a benchmark survey of South Korean multinational affiliates abroad. Each year, the EXIM Bank has included increasingly more firms in the survey, starting with about 100 parents and their 200 foreign affiliates in the year 2000, and ending with about 2,400 parents and 4,400 affiliates in 2011. Notably, Korea EXIM Bank attempted to survey foreign affiliates that had total accumulated investments of more than 1 million USD and were required by law to submit annual business reports. Therefore, our data consists of a non-random sample that relatively overrepresents large foreign affiliates (in terms of total accumulated investments) and does not include all foreign affiliates belonging to a parent firm.<sup>5</sup>

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<sup>5</sup>Under some circumstances such as a close inspection, Korea EXIM Bank may excuse an affiliate from

Until 2006, the number of firms and affiliates consistently surveyed each year varies too much to make a panel analysis meaningful. For this reason, we restrict our data to the period between 2007 and 2011. During this sample period, we construct a panel dataset based on affiliate code. Since manufacturing exhibits more complete data than other sectors, we concentrate on manufacturing affiliates that report positive number of production workers. In 2011, manufacturing accounted for 60% of foreign affiliates, 51% of affiliate sales, and 84% of affiliate employment. This sector comprises 2,199 parents and 3,455 affiliates.

Our dataset provides general information for foreign affiliates, such as their location, two-digit level industry, sales, and employment numbers. The distinctive feature of this data set is that it provides detailed employee information. It records the number of affiliate employees categorized by whether the employees are Korean or foreign, and which one of four positions they hold in the affiliate: Executive, Manager, Sales, or Production. After dropping affiliates that do not report detailed employee information, we are left with 1,716 parents and 2,453 foreign affiliates for our empirical analysis. Then, we draw year-to-year changes in the number of employees for each affiliate, and drop observations with extremely high annual changes and obvious cases of coding error in the survey.<sup>6</sup> In the end, we use 1,704 parents and 2,432 foreign affiliates for our empirical analysis.

### 3.1 Affiliates by Region

Table 1 provides the mean value of the share of Korean expatriates and other affiliate characteristics, and further decomposes the data by affiliate region. On average, Korean expatriates take only about 4.6% of total employment. When focusing on managerial positions (i.e. Executive and Manager), the share of Korean expatriates increases up to 29%. The last two columns provide the number and share of affiliates that are active in each region. The dominant majority of affiliates – 63% of the total number of foreign affiliates in our sample – is located in China, corresponding to a surge of South Korean multinational activity in China in recent years. Excluding China, the rest of foreign affiliates located in Asia amount to 22%: 10% in Vietnam, 2.7% in India, 2.7% in Indonesia, 2.2% in Thailand, and 1.3% in Malaysia.

The dominant presence of South Korean FDI in Asia is direct evidence of gravity in FDI because, relative to other regions, Asian countries are closer in distance and culture to South Korea. However, when we look at the ratio of Korean expatriates by region, we find that it is lower in Asia relative to other regions, especially to the Americas. Given that FDI in Asia (excluding China) and Central and South America is predominantly vertical and labor-intensive, submitting its annual business report. Korea EXIM Bank also dropped some observations due to reliability issues.

<sup>6</sup>For example, if an affiliate reports  $n$  Executives and 0 Managers at time  $t$ , 0 Executives and  $n$  Managers at time  $t+1$ , and  $n$  Executives and 0 Managers afterwards, we take observation at  $t+1$  as the coding error.

it can be argued that the main difference between these regions is the geographic and cultural distance from South Korea. Based on this argument, the transfer of Korean expatriates is more effective than costly communication for the distant Americas in comparison to Asian countries.

### 3.2 Expatriates as Managers

In the context of the knowledge hierarchy framework outlined in Section 2, and given our central premise that a MNC provides knowledge to foreign affiliates through the transfer of expatriates, we expect that expatriated Korean workers will focus on solving less-frequent problems, i.e. those found at the managerial level rather than the production level.

As Table 1 shows, Koreans occupy more management positions compared to production positions. Further, Table 2 shows the distribution of Koreans versus foreign workers by occupation in more detail. Of all South Korean employees, 85.5% are assigned to management positions (Executive and Manager), while only 14.5% occupy production/sales positions. Conversely, of all foreign workers, about 85% hold production/sales positions, while only 15% take up management roles, with less than 1% occupying upper-level Executive positions. Moreover, the share of South Korean employees increases with the hierarchical level: production/sales positions are filled with only 1.3% South Koreans; lower-level Manager positions are filled with 23.2%; and upper-level Executive positions are 84.3% South Korean. These qualifications, together with the unique characteristics of Korean idiosyncrasy, suggest that South Koreans are more likely to take a role in problem solving rather than production.

### 3.3 Organizational Layers

Based on their occupation, we classify employees into three layers. From now on, we will refer to upper-level managers (or Executives) as “layer 3”, lower-level managers (or Managers) as “layer 2”, and Sales or Production workers as “layer 1”. As Table 3 shows, the majority of foreign affiliates have two or three layers.<sup>7</sup> Also, note that affiliates with three layers are larger than those with two layers in terms of both sales and number of employees. Interestingly, the proportion of expatriates to total number of workers in layer 2 differs significantly for two-layer affiliates compared to three-layer affiliates. For the two-layer affiliates, the proportion of expatriates to total number of workers in layer 2 is 28.5%, while it is 19.1% for the three-layer affiliates. It can be argued that the role of expatriates in layer 2 becomes less important for the three-layer affiliates because knowledge in layer 2 can be substituted by knowledge in layer 3. In other words, if a two-layer affiliate adds a third layer, the number of expatriates in layer 2 is

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<sup>7</sup>There are 60 cases that report zero Manager and positive Executive. We regard them as three layers. Excluding these cases (i.e. focusing on the sample of consecutively ordered layers) do not change the results that follow because these cases comprise only 1% of the total number of observations.



expected to decrease, as predicted in Section 2.

Table 4 reports the distribution of the sample according to the number of layers between periods  $t$  and  $t + 1$  between 2007 and 2011. We have 375 cases that grow or contract with reorganization. In 172 cases, an affiliate grows from 2 to 3 layers, and in 200 cases an affiliate contracts from 3 to 2 layers (the remaining 3 affiliates expand from 1 layer to 2). We use the former to investigate whether the use of expatriates decreases in all preexisting layers, and use the latter to study whether this pattern reverses. Additionally, we have 2,972 cases where affiliates grow without reorganization. Using these 2,972 cases, we investigate how the number of expatriates per layer changes with affiliate expansion or contraction, and whether the extent of these changes is stronger for the higher layers.

### 3.4 Employment and Affiliate Scale

Table 5 shows the average log changes in employment and sales for all affiliates with and without reorganization. On average, South Korean foreign affiliates grow. At the same time, affiliates that grow with reorganization grow fastest, while those that contract with reorganization exhibit the slowest growth in terms of sales and contract in term of employment. This pattern is consistent with the knowledge hierarchy framework, as described in Section 2.

Using the affiliates that grow without reorganization, we plot the relationship between the number of employees per layer (y-axis) and the affiliate’s sales (x-axis) in Figure 1, further distinguishing Korean expatriates and foreign employees in Figure 2. Note that the variables plotted are based on the within affiliate variation.<sup>8</sup> That is, for a given affiliate, the relationship between the number of employees per layer and affiliate sales is not driven by the cross-sectional variation. As expected, the number of employees in each layer increases with the affiliate’s sales, and lower layers show a steeper slope than higher layers. This suggests that the span of control increases for managerial positions, consistent with the ‘flattening’ trend that has been documented in the literature. Further, Figure 2 shows three substantial differences in the number of workers by nationality. First, the scatter plots for expatriates and foreign workers are far apart from each other for the lowest layer and get closer for higher layers. Second, the difference in slope between expatriates and foreign workers decreases with layer hierarchy. Third, the highest layer utilizes more expatriates than foreign workers, as opposed to the first two layers. These observations suggest that the role of expatriates becomes more important relative to foreign workers for the higher layers as the affiliates grow.

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<sup>8</sup>That is, we plot  $x_{it} - \bar{x}_i + \bar{x}$ , where  $x_{it}$  is the observed value of variable  $x$  for affiliate  $i$  at time  $t$ ,  $\bar{x}_i$  is the average value of  $x$  for affiliate  $i$  across time, and  $\bar{x}$  denotes the average value of  $x$  across the whole sample.

## 4 Results and Discussion

We now investigate in more detail the relationship between the use of expatriates and affiliate scale, using expatriates as a means for knowledge transmission. We begin by defining a measure for knowledge as a function of expatriates. Next, we study the adjustment of knowledge when affiliates expand or contract. Finally, we explore the changes in employment resulting from expansion and contraction.

### 4.1 Knowledge and Expatriates

Since knowledge is not directly observable, we proxy a change in knowledge by taking the change in the ratio of expatriates to total employees in a given layer. Intuitively, if more expatriates are hired in a given layer  $\ell$ , we argue that foreign employees in the layer below (i.e.  $\ell - 1$ ) now have more knowledgeable expatriates nearby to help with problem solving – so the level of knowledge in layer  $\ell$  increases. On the other hand, if expatriates from a given layer are removed from that layer, the level of knowledge declines because those knowledgeable employees are not available anymore. Based on this argument, we propose the change in knowledge  $z_{it}^\ell$  in a given layer  $\ell$  of affiliate  $i$  at time  $t$  is given by the following expression.

$$dz_{it}^\ell = d\left(\frac{Expats_{it}^\ell}{N_{it}^\ell}\right) \quad (1)$$

For a given layer  $\ell$  of affiliate  $i$  at time  $t$ ,  $Expats_{it}^\ell$  represents the number of expatriates and  $N_{it}^\ell$  represents the total number of employees. The proportion of expatriates as a proxy for knowledge has been adopted in recent empirical studies by Astorine-Figari and Lee (2018) and Gumpert (2018). Note that this measure of knowledge is also consistent with the average wage change in layer  $\ell$  that is used as a proxy for knowledge change in Caliendo et al. (2015). As long as the wage of expatriates is higher than the wage of foreign workers in a given layer, the increase (decrease) in the proportion of expatriates corresponds to an increase (decrease) in the average wage for that layer.<sup>9</sup>

It is also worth noting that taking yearly differences for all variables controls for affiliate fixed effects. This is important for the following reasons. First, any host country and sector characteristics are controlled. Second, the parent firm characteristics can be controlled. For example, large MNCs that own many foreign affiliates such as the Korean conglomerate *Chaebols* may use human resource strategies that differ from those used by small or medium sized MNCs. In

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<sup>9</sup>Ghemawat (2007) documents that the average costs associated with expatriated workers are two or three times as high as that of hiring foreign workers. In the case of Korea, the Korean Ministry of Foreign Affairs reports the significant costs of expatriating Korean workers to the foreign host country (Rule of Overseas Service Allowance).

this way, we can control for parent company characteristics that affect human resource strategies in all of their foreign affiliates. Third, we can control for any unobserved time-constant affiliate characteristics, such as affiliate specific culture, that may matter for human resource decisions. While previous work has controlled for parent fixed effects, controlling for affiliate level fixed effects is rarely done in the literature on MNCs.

## 4.2 Knowledge in Affiliates that Reorganize

We now investigate human resource strategies in affiliates that grow (contract) with reorganization. As we already showed in Table 5, affiliates that grow with reorganization employ more workers, as predicted by the theory. Our analysis below will further examine the change in employment by layers, focusing on the proportion of expatriates among the newly hired employees.

Using our measure of knowledge change from Expression (1), we explore the adjustment of knowledge as affiliates expand or contract. We compute the average of  $dz_{it}^{\ell}$  for affiliates that grow or contract with reorganization and report the results in Table 6. The first row on the table indicates the number of layers in the initial period and the second row the number of layers in the second period. The third row indicates the layer,  $\ell$ , for which we are calculating the average of  $dz_{it}^{\ell}$ . Two-layer affiliates that grow by adding a third layer reduce knowledge in layer 2, while the newly added layer 3 will be predominantly occupied by expatriated executives, as implied by Table 2.

Our results suggest that, while foreign affiliates that expand with reorganization hire more foreign managers in layer 2, they either send back the expatriated managers in layer 2 and in turn receive upper level executives from the headquarters, or promote expatriated managers in layer 2 to fill the newly added top layer. This finding is consistent with the predictions of the knowledge hierarchy model: when firms add a new top layer, the knowledge required to solve less common problems is reallocated from lower level managers to managers in the newly created layer. In the case of layer 1, we observe a slight though insignificant increase in knowledge, suggesting that knowledge in the top layer may not be substitutable with that of floor production workers.<sup>10</sup> These results reverse for affiliates that contract by dropping the third layer: the number of expatriates increases in layer 2. Again, this finding is consistent with the view that when firms drop the top layer, they make the pre-existing managers know more and handle some of the rare problems that had been dealt with by the top layer managers.

## 4.3 Knowledge in Affiliates that do not Reorganize

We now turn our attention to human resource strategies in affiliates that grow or contract

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<sup>10</sup>We only have 3 observations for affiliates that reorganize from one to two layers.

without reorganization. As in the previous case, the third column of Table 5 shows that affiliates that grow without reorganization do so by increasing overall employment, as predicted by the theory. Below we will analyze the change in employment by layers, with focusing on the proportion of expatriates.

In order to study the relationship between affiliate sales and knowledge for each layer in affiliates that grow (contract) without reorganization, we estimate the following regression equation,

$$dz_{it}^{\ell} = \beta^{\ell} dlnY_{it} + e_{it} \quad (2)$$

where  $dz_{it}^{\ell}$  is our measure of knowledge from Expression (1) for a given layer  $\ell$  of affiliate  $i$  at time  $t$ , and  $dlnY_{it}$  is the log difference in affiliate sales for affiliate  $i$  at time  $t$ . The results from this regression are displayed in Table 7. Unlike the case of affiliates that grow (contract) with reorganization, we do not find any significant relationship between sales and knowledge for the managerial layers in firms who do not reorganize. According to the theory, we would expect these coefficients to be positive, with larger values as the hierarchy goes up. While the coefficient for layer 3 is positive and higher than the corresponding coefficient for layer 2, the difference might not be meaningful, since both coefficients are insignificant. We additionally find that the coefficient for layer 1 is negative and significant, which is not necessarily inconsistent with our assumption that expatriates are problem solvers at the managerial level.

The lack of strong evidence regarding knowledge when firms do not reorganize may reflect potential conflicts between the parent's firm desire to send expatriates and the incentives to accept an international assignment for South Korean employees. That is, while parent companies may attempt to allocate knowledge to foreign affiliates by sending expatriates, employees may turn these assignments down because of dual career concerns, their perception of career advancement opportunities, or other concerns regarding work-life balance. The management literature has recognized this problem between individual and organizational incentives. Both dual career concerns and career advancement concerns constitute barriers to international mobility (Dickmann et al. (2008); Petriglieri (2018)). As Harvey (1995, 1997) documents, having a working spouse affects the willingness to relocate of potential expatriate managers. Moreover, it may also be the case employees are more likely to accept international assignments when affiliates reorganize. Studies show that it is beneficial to accept international assignments at the executive level, both in terms of career advancement (Kraimer et al. (2009)) and monetary compensation (Carpenter et al. (2001)). This last argument may explain why results are stronger for affiliates that reorganize.

#### 4.4 Affiliate Expansion and Employment

In this section, we investigate the changes in overall employment for each layer and study whether these changes vary depending on reorganization. We begin by looking at affiliates that reorganize, and then we examine affiliates that do not reorganize.

Table 8 reports average log changes in employment for affiliates that reorganize. When looking at two-layer affiliates that reorganize by adding a third layer, the value of the coefficient is higher for layer 2 compared to layer 1, although the layer 2 coefficient is not statistically significant. For affiliates that reorganize by dropping the third layer, both coefficients are negative, although only the one corresponding to layer 1 is significant. Thus, when firms reorganize, the change in employment across layers does not present any clear patterns.

Next, we examine the relationship between employment and sales for affiliates that grow (contract) without reorganization. We estimate an equation similar to Equation (2), but using the change in employment  $d \ln N_{it}^{\ell}$  for a given layer  $\ell$  of affiliate  $i$  at time  $t$  as the dependent variable as follows.

$$d \ln N_{it}^{\ell} = \beta^{\ell} d \ln Y_{it} + e_{it} \quad (3)$$

We present our estimates in Table 9. We can clearly see that the coefficients exhibit a pattern consistent with the predictions of the knowledge hierarchy model. Given the number of layers  $L$ , affiliates grow by increasing the number of employees in all layers. Furthermore, the values of  $\beta^{\ell}$  decrease as the hierarchy moves up, indicating that employment increases more at the lower layers as firms expand, and thus the span of control of managers increases. As suggested by Figure 1 earlier, South Korean affiliates become flatter as they grow.

### 5 Concluding Remarks

The aim of this paper is to study the role of expatriates as a means for allocating tacit knowledge in MNCs as foreign affiliates expand or contract. We interpret changes in the use of expatriates as the extensive margin of knowledge change. In general, studying knowledge faces an empirical challenge because of its unobservable nature. We argue that the tacit nature of knowledge and the presence of communication costs across borders make labor mobility play a role in allocating knowledge across countries. The extent to which unobservable knowledge is traced by observable labor mobility is particularly strong for South Korean MNCs due to the high cultural distance between South Korea and other countries.

Using foreign affiliate data from MNC headquartered in South Korea, we investigate how changes in the use of expatriates are associated with foreign affiliate expansion, and interpret

these changes in light of the knowledge hierarchy model. We find strong results when foreign affiliates expand or contract by adding or dropping an organizational layer. When affiliates expand with reorganization, the newly added layer is mostly occupied by Korean expatriates and the number of Korean expatriates at the preexisting managerial layer declines, suggesting the reallocation of knowledge from the preexisting managerial layer to the new upper-level managerial layer. Similarly, when affiliates contract with reorganization by dropping the highest layer, the number of Korean expatriates in the layer immediately below significantly increases. However, we find somewhat weak results for the foreign affiliates that expand or contract without reorganization. A potential explanation is suggested by the management literature on expatriation. While parent companies may attempt to allocate knowledge to foreign affiliates by sending expatriates, employees may turn these assignments down because of dual career concerns or their perception of career advancement opportunities (or lack thereof) by accepting the assignment.

Finally, we investigate the changes in employment associated with affiliate expansion. In particular, when affiliates grow without reorganization, the number of employees increases at all layers. Moreover, changes in employment are larger for lower layers, so the span of control for managerial layers increases as affiliates expand.

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Table 1: Mean value of key variables by region

	$\frac{\text{Korean}}{\text{Total employment}}$	$\frac{\text{Korean managers}}{\text{Managers}}$	$\ln(\text{Employment})$	$\ln(\text{Sales})$	# of affiliates	Share
1. Average	0.046	0.290	4.918	15.779	2402	
2. By Region						
China	0.041	0.274	4.955	15.764	1522	0.633
Asia excluding China	0.043	0.317	5.029	15.421	536	0.223
N. America	0.097	0.333	4.246	16.135	138	0.057
C. and S. America	0.059	0.446	4.953	16.111	49	0.020
Europe	0.052	0.267	4.801	16.713	143	0.060
ROW	0.093	0.256	4.416	16.827	14	0.006

Table 2: The role of Korean expats versus foreign workers

	Executives	Managers	Production/Sales	Total
Korean	31.7%	53.8%	14.5%	100%
Foreign	0.7%	14.4%	84.9%	100%
Korean share	84.3%	23.2%	1.3%	

Table 3: Data description by number of layers

Number of layers	1	2	3
Obs. of affiliate-year	8	1200	5031
$\ln(\text{Employment})$	4.869	4.795	5.043
$\ln(\text{Sales})$	14.198	15.707	16.135
Korean expats share in layer 1	0.033	0.010	0.012
Korean expats share in layer 2	-	0.285	0.191
Korean expats share in layer 3	-	-	0.844

Table 4: Distribution of layers

	Number of layers at t+1			
	1	2	3	0
Number of layers at t	1	0	430	172
	3	0	200	2541

Table 5: Change in affiliate-level outcomes

	All	Layer increase	Layer decrease	No change
dln(Employment)	0.014** (0.007)	0.093*** (0.033)	-0.129*** (0.036)	0.019*** (0.007)
dln(Sales)	0.266*** (0.015)	0.308*** (0.052)	0.256*** (0.070)	0.264*** (0.016)
Observations	3,347	175	200	2,972

This table reports changes in affiliate-level employment and sales between consecutive data points for all affiliates in the first column, for affiliates that reorganize in columns 2 and 3, and for affiliates that do not reorganize in column 4. \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%.

Table 6: Change in knowledge for affiliates that reorganize

# of layers before	2	2	3	3
# of layers after	3	3	2	2
Layer	1	2	1	2
$dz$	0.001	-0.097***	-0.004	0.059***
	(0.001)	(0.025)	(0.003)	(0.022)
Observations	172	168	200	197

This table reports estimates of the average change in knowledge at each layer  $\ell$  among affiliates that reorganize from  $L$  to  $L'$  layers, with  $L \neq L'$ . The term  $dz$  is the average change in the reorganization, estimated as a regression of the change in knowledge in layer  $\ell$  in 2 consecutive data points on a constant. Robust standard errors are reported. \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%.

Table 7: Change in knowledge by sales for affiliates that do not reorganize

Layer	1	2	3
$\beta$	-0.002***	-0.006	0.002
standard error	(0.001)	(0.005)	(0.004)
observations	2,972	2,935	2,541

This table reports the results of regressions of change in knowledge at layer  $\ell$  on its log change in sales, selecting all the affiliates that stay at  $L$  layers across 2 consecutive data points. Robust standard errors are reported. \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%.

Table 8: Change in employment for affiliates that reorganize

# of layers before	2	2	3	3
# of layers after	3	3	2	2
Layer	1	2	1	2
$dlnN$	0.085**	0.106	-0.104***	-0.098
	(0.034)	(0.075)	(0.040)	(0.061)
Observations	172	168	200	197

This table reports estimates of the average log change in employment at each layer  $\ell$  among affiliates that reorganize from  $L$  to  $L'$  layers, with  $L \neq L'$ . The term  $dlnN$  is the average log change in the reorganization, estimated as a regression of the log change in employment in layer  $\ell$  in 2 consecutive data points on a constant. Robust standard errors are reported. \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%.

Table 9: Change in employment by sales for affiliates that do not reorganize

Layer	1	2	3
$\beta$	0.148***	0.092***	0.016*
standard error	(0.016)	(0.016)	(0.009)
Observations	2,972	2,935	2,541

This table reports the results of regressions of log change in employment at layer  $\ell$  on its log change in sales, selecting all the affiliates that stay at  $L$  layers across 2 consecutive data points. Robust standard errors are reported. \* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%.

Figure 1: Affiliates become flatter along with expansion

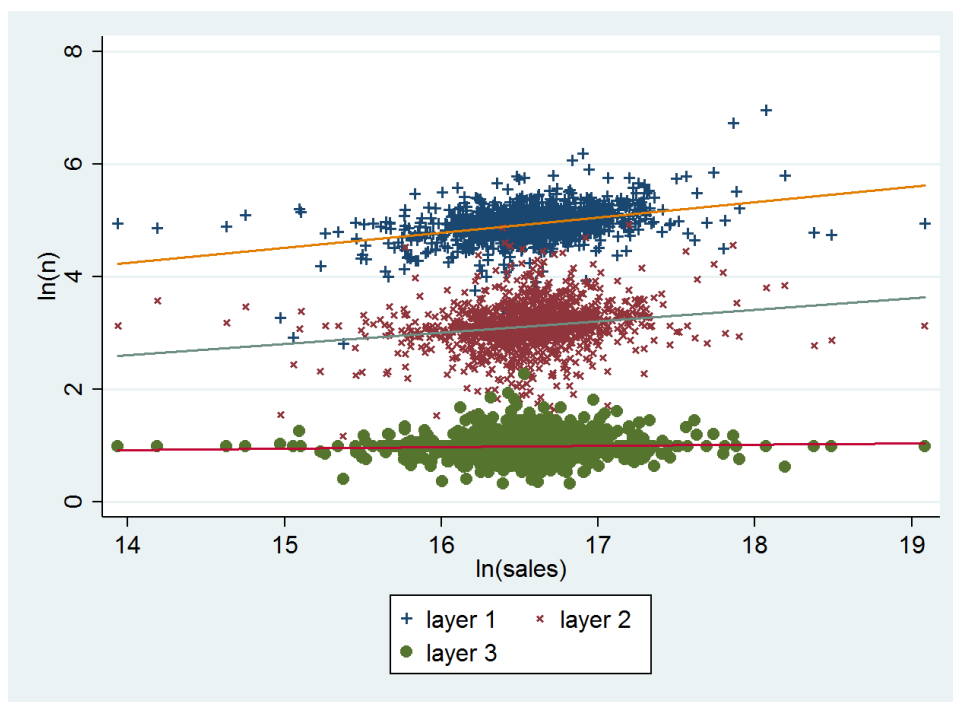


Figure 2: Changes of expatriates vs. foreign workers by layers

