



## RESEARCH ARTICLE



WILEY

# When suppliers shift my boundaries: Supplier employee mobility and its impact on buyer firms' sourcing strategy

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**Funding information**

Novak Druce center for professional service firms - Saïd Business School; Spanish Ministry of Economy and Competitiveness, Grant/Award Number: PGC2018-098610-B-I00

**Abstract**

**Research summary:** Buyer firms respond to supplier employee mobility by reshuffling work among suppliers. However, the extant literature has not considered plural-sourcing firms which can bring work back in-house. In this paper, we develop a governance framework in which buyers engage in a comparative assessment of the costs associated with different sourcing modes following supplier employee mobility. Due to the imperfect transferability of social capital and associated uncertainty, buyers face increased contracting costs when supplier employees move. This prompts plural-sourcing buyers to increase their reliance on insourcing when the costs of adjusting in-house capacity are relatively low and when the costs of switching to alternative suppliers are relatively high. The analysis of data on patent prosecution activities and patent attorney mobility provides support to our theory.

**Managerial summary:** This study provides a decision framework for buyer firms when their suppliers experience employee departures. Buyers may choose to (a) stay with the suppliers suffering employee losses or (b) follow mobile employees to their new suppliers. However, in both cases contracting becomes more

difficult due to the disruption in supplier relationships or the need to work with new suppliers. There is a third option (c) though which is to bring work in-house. We explain that buyers opt for option (c) when it is easy to expand in-house capacity and when the costs of switching to alternative suppliers already in use are relatively high. Thus, supplier employee mobility may lead buyer firms to adjust their reliance on outsourcing even when there are no buyer employee departures.

#### KEYWORDS

employee mobility, firm boundary, patent prosecution, plural sourcing, social capital

## 1 | INTRODUCTION

What happens to supplier relationships when employees move? This is an important question, especially for knowledge-intensive firms where employees constitute a central, if not the only, part of their contracting strategy (Coff, 1997; Dyer & Singh, 1998). The extant literature addresses this question by focusing on human and social capital and their effect on work allocation among different suppliers (Dokko & Rosenkopf, 2010; Wezel, Cattani, & Pennings, 2006). In particular, buyer firms tend to follow employees when they move from one supplier to another (Broschak, 2004; Carnahan & Somaya, 2013; Somaya, Williamson, & Lorinkova, 2008), but different employee or exchange characteristics mitigate the adverse effect of employee departures on trading ties (Bermiss & Greenbaum, 2016; Briscoe & Rogan, 2016; Broschak & Block, 2014; Raffiee, 2017; Rogan, 2014).

While this line of research has yielded important insights, it upholds an assumption that firm boundary is fixed. This assumption implies that work can be reallocated among external suppliers only. However, this is not always the case. Firms often engage in plural sourcing, that is, carry out part of the work in-house (Bradach, 1997; Dutta, Bergen, Heide, & John, 1995; Parmigiani, 2007; Puranam, Gulati, & Bhattacharya, 2013). Plural-sourcing firms may respond to supplier employee mobility either by reshuffling work among suppliers or by changing their relative reliance on making versus buying. But under what circumstances would firms choose the latter, thus redrawing their boundaries?

We answer this question by developing a framework in which buyer firms engage in a comparative assessment of the costs associated with different sourcing modes following supplier employee mobility. First, supplier employee losses increase buyers' costs of contracting with suppliers due to the imperfect transferability of employee social capital. As boundary spanners, employees develop "external" social capital (Nahapiet & Ghoshal, 1998; Somaya et al., 2008) and contribute towards establishing "relational capital" between firms (Kale, Singh, & Perlmutter, 2000). However, employees' external social capital is complementary to firm-level relational capital (Perrone, Zaheer, & McEvily, 2003; Zaheer, McEvily, & Perrone, 1998; Zaheer & Venkatraman, 1995). Hence, employees' ability to use their external social capital diminishes when they move from one supplier to another.

Moreover, employees develop "internal" social capital that allows them to access intra-organizational networks and mobilize firm resources (Adler & Kwon, 2002; Leana & Pil, 2006).

When supplier employees move, their access to intra-firm networks is disrupted and their ability to use their internal social capital diminishes (Shaw, Duffy, Johnson, & Lockhart, 2005). Thus, buyer firms face uncertainty regarding existing suppliers' and mobile employees' ability to deliver the expected level of service (Raffiee, 2017). Buyers, if they were to follow mobile employees, also face uncertainty over the willingness of suppliers gaining employees to invest in relation-specific assets (Dyer, 1997; Dyer & Singh, 1998).

The imperfect transferability of employee social capital and associated uncertainty therefore increase the costs of contracting with suppliers experiencing employee losses and encourage insourcing (Sako, Chondrakis, & Vaaler, 2016). However, buyers need to balance increases in costs of contracting with the costs of adjusting in-house production and the costs of switching to alternative suppliers already in use. We suggest that supplier employee mobility prompts insourcing when the adjustment costs of bringing work in-house are relatively low and when the costs of switching to suppliers already in use that do not suffer employee losses are relatively high.

We test our theory using data on the patent filing activities of *Fortune* 500 companies and records of patent attorney mobility. We chose a professional services context because employees are critical carriers of social capital, and because plural sourcing is prevalent in this particular setting (Moeen, Somaya, & Mahoney, 2013; Somaya et al., 2008). We find that supplier employee losses increase insourcing; increases in insourcing are larger when the buyer firm's insourcing capacity is greater, and when the activities performed by the focal buyer and by the suppliers experiencing employee losses are more similar. Finally, we demonstrate that the shift to insourcing is less pronounced when employees move to other suppliers that also trade with the focal buyer and when the activities performed by suppliers experiencing employee losses and by other suppliers in the buyer firm's portfolio are similar.

This study makes three contributions. First, we contribute to research on firm boundaries and plural sourcing by linking the human and social capital literatures underpinning the study of employee mobility with the contracting literature at the heart of theorizing about inter-organizational relationships. In particular, we identify an additional parameter—supplier employee mobility—that influences plural sourcing strategies. Importantly, this paper demonstrates how the mobility of employees between *suppliers* affects *buyers'* boundary decisions, thus establishing a novel link between theories of the firm and employee mobility.

Second, our paper contributes to theories of vertical scope and governance. Much of the recent literature highlights the need to adopt a holistic view of the different activities firms undertake when they set their boundaries (Argyres, Felin, Foss, & Zenger, 2012; Argyres & Liebskind, 1999; Lee & Kapoor, 2017). We build on this approach by demonstrating how in-house adjustment costs and supplier switching costs impact firm boundary decisions. These are important frictions that can limit changes in sourcing modes, and lead to heterogeneous sourcing strategies. Hence, our work is part of an emergent literature that explores the configuration of supplier relationships and their impact on contracting and governance (Argyres, Bercovitz, & Zanarone, 2020; Chatterji, Cunningham, & Joseph, 2019; Mawdsley & Somaya, 2018; Moeen et al., 2013; Sako et al., 2016).

Third, this paper consolidates our knowledge of the frictions that employees face when moving across different organizations (Campbell, Kryscynski, & Olson, 2017; Starr, Ganco, & Campbell, 2018). In particular, we highlight the imperfect transferability of employees' social capital and examine how this influences the ease of contracting and the resulting work allocation to suppliers. This study then helps explicate the heterogeneous effects of employee mobility by adding contracting costs to other firm and employee characteristics that moderate the relationship between employee mobility and supplier selection (Broschak, 2004; Carnahan & Somaya, 2013; Mawdsley & Somaya, 2015; Rogan, 2014).

## 2 | THEORY AND HYPOTHESES

The causes and consequences of employee mobility have received much attention recently (Campbell, Ganco, Franco, & Agarwal, 2012; Carnahan, Agarwal, & Campbell, 2012; Ganco, Ziedonis, & Agarwal, 2015; Mawdsley & Somaya, 2015; Palomeras & Melero, 2010). Among the studies about consequences, there is a great deal of interest in the portability of human capital across firm boundaries and in how mobility affects the performance of individual employees (Grohsjean, Kober, & Zucchini, 2016; Groysberg, Lee, & Nanda, 2008). At the firm level, studies examine how mobility shapes inter-firm networks (Broschak, 2004). These studies emphasize social capital and its role in facilitating exchange, especially in knowledge-intensive services.

Social capital is commonly defined as the sum of the actual and potential resources embedded within, available through, and derived from, the network of relationships possessed by an individual or social unit (Nahapiet & Ghoshal, 1998, p. 243). Following this logic, Somaya et al. (2008) and Dokko and Rosenkopf (2010) show that employee departures have significant competitive implications as mobile employees reshuffle the social capital available to firms. Employees take client work with them when they move to competitors, while employee mobility between buyers and suppliers increases exchange between them irrespective of the direction of mobility. The adverse effects of employee departures on trading ties are mitigated by multiplexity (Raffiee, 2017; Rogan, 2014), by supplier intra-firm network cohesion and knowledge homogeneity (Briscoe & Rogan, 2016), or when employee departures take place at suppliers but not buyer firms (Broschak & Block, 2014).

### 2.1 | Plural sourcing and contracting costs

A limitation of the literature reviewed above is that it does not consider the buyer firm's sourcing options in their entirety. Following supplier employee mobility, work is reallocated among external suppliers only. But this assumption in effect ignores the possibility that buyers could reallocate work to in-house departments. Firms often rely on both internal and external suppliers simultaneously, engaging in plural sourcing. They do so for a variety of reasons including demand uncertainty (Adelman, 1949), technological volatility (Jacobides & Billinger, 2006; Krzeminska, Hoetker, & Mellewigt, 2013), bargaining and monitoring (Dutta et al., 1995; Harrigan, 1986), or complementarity in knowledge and incentives (Parmigiani, 2007; Puranam et al., 2013).

But why would buyer firms change their make-and-buy balance in response to supplier employee mobility? After all, employees move from one supplier to another and the buyer firm can simply follow the mobile employee. We suggest that our understanding of supplier employees as carriers of social capital needs to be coupled with a more holistic consideration of the buyer firm's sourcing strategy and its portfolio of supplier relationships. By explicitly recognizing the buyer's choice over making-and-buying, we aim to provide a more complete picture of the effects of employee mobility on firm boundary decisions.

Our framework considers plural-sourcing buyer firms that design their supplier portfolio with a view to managing relationships with suppliers as well as setting their make-and-buy balance (Sako et al., 2016). A range of sourcing strategies may be located on a continuum. At one extreme, the buyer may aim to increase its bargaining power vis-à-vis suppliers by reducing commitment, dependence, and switching costs (Inkpen & Beamish, 1997; Pfeffer &

Salancik, 1978). At the other extreme, the buyer may opt to build committed, high trust relationships with suppliers (Baker, Gibbons, & Murphy, 2002; Sako, 1992).

Each sourcing strategy has its upsides and downsides. A bargaining-based strategy gives firms flexibility to hire and fire suppliers. But it comes with higher costs of contracting arising from opportunism, haggling, and the need to establish transactional interfaces (Baldwin & Clark, 2003; Langlois, 1992, 2006; Williamson, 1985). Consequently, buyer firms rely more on making than buying. By contrast, a relationship-based strategy “locks-in” buyers to specific suppliers. But such lock-in lowers contracting costs due to shared trust and relation-specific investments made by the buyer-supplier pair (Dyer, 1997; Dyer & Singh, 1998). This tilts the balance in favor of buying in plural sourcing (Sako et al., 2016).

Hence, economic efficiency considerations prompt plural-sourcing firms to change their make-and-buy balance in response to shifts in the costs associated with different sourcing modes.<sup>1</sup> In the next sections, we specify how supplier employee mobility increases plural-sourcing firms’ costs of contracting and the conditions under which the higher costs of contracting result in more insourcing.

## 2.2 | Supplier employee mobility, social capital, and make-and-buy balance

We start by considering mobile employees as carriers of human and social capital. Human capital is typically defined as the productive knowledge, skills and capabilities that are embedded in employees—“what” you know—while social capital refers to the productive possibilities embedded in relationships—“who” you know (Nahapiet & Ghoshal, 1998; Somaya et al., 2008). Social capital is important in facilitating or impeding the deployment of human capital across different contexts and the two interact to determine the productive possibilities available to firms or individuals (Byun, Frake, & Agarwal, 2018; Mawdsley & Somaya, 2015). Human capital can be imperfectly transferrable (Becker, 1964; Coff, 1997). But we focus on settings where human capital is general and can be deployed across different contexts, for example, knowledge-intensive services (Groysberg & Lee, 2009; Hitt, Bierman, Shimizu, & Kochhar, 2001). This allows us to identify social capital as a key driver of changes in contracting costs.

Social capital may be understood as the “goodwill available to individuals...(whose) source lies in the structure and content of the actor’s social relations” (Adler & Kwon, 2002, p. 18). Note that this is a narrower definition of social capital compared to organizational social capital, and excludes the norms and routines that are institutionalized for a collection of individuals (Putnam, 2000). Here, we describe the position of employees as boundary spanners between buyers and suppliers. Such ties generate “bridging” forms of *external* social capital and facilitate exchange. At the same time, employees develop “bonding” ties within the firm and *internal* social capital. This allows them to gain access to resources and information through intra-firm networks (Adler & Kwon, 2002; Leana & Pil, 2006).

Trust is a key component of employee external social capital. As explained by Nahapiet and Ghoshal (1998), the relational dimension of social capital is based on trust and norms of reciprocity that create “expectations that bind.” However, trust works at both the interpersonal and

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<sup>1</sup>Legitimacy concerns could also influence the design of plural sourcing strategies (Jia, 2018). However, our framework primarily applies to settings where economic efficiency considerations take precedence.

interorganizational level (Zaheer et al., 1998). When aggregated, the external social capital of employees gives rise to interorganizational relational capital which represents the mutual trust between two firms (Kale et al., 2000). Relational capital is not reducible to individual employees. Rather, supplier firms can use it across multiple transactions (Chatain & Zemsky, 2007; Mawdsley & Somaya, 2018).

When a supplier employee moves, she may attempt to take the entirety of her external social capital to a different supplier firm. In practice, however, employee social capital is imperfectly transferrable as it is embedded within a specific organizational context (Adler & Kwon, 2002; Broschak & Block, 2014) and develops important complementarities with relational capital. Research on trust provides ample evidence of the complementarity between personal and organizational trust. Zaheer et al. (1998) find that trust between individuals does not facilitate exchange performance directly, but rather through its institutionalizing effects on inter-organizational trust. The effects of interpersonal and interorganizational trust are mutually reinforcing, and the social context and organizational rules that constrain and orient its members play an important role in the level of trust ascribed to individual boundary spanners (Perrone et al., 2003; Zaheer et al., 1998).

This complementarity implies that employee external social capital is more valuable in the presence of inter-firm relational capital and vice versa. Employees develop external social capital as individuals as well as representatives of their firms and rely on relational capital to provide services to their clients (Seabright, Levinthal, & Fichman, 1992; Sorenson & Rogan, 2014). When employees depart from suppliers, the relational capital shared between buyers and their portfolio of suppliers declines. This results in buyers facing higher costs of contracting. Contracting costs derive from different sources, including Williamsonian costs related to holdup (Williamson, 1985), “mundane” costs of searching and creating transactional interfaces (Baldwin, 2008; Langlois, 2006), and “dynamic” costs of redefining transactional interfaces in response to economic change (Langlois, 1992). Relational capital develops over time to reduce these contracting costs by building trust (Dyer, 1997; Elfenbein & Zenger, 2014; Sako & Helper, 1998), and by facilitating coordination and learning (Mayer & Argyres, 2004; Vanneste & Puranam, 2010). But supplier employee mobility can increase holdup concerns or coordination problems, resulting in higher costs of contracting.

Likewise, employee internal social capital is imperfectly transferable. Employees rely on their coworkers to access resources or information and their position in intra-firm networks confers important advantages (Burt, 2000). When supplier employees move, their ability to use their internal social capital is reduced as mobility disrupts intra-firm ties (Brymer & Sirmon, 2018; Shaw et al., 2005). Consequently, buyers face uncertainty, first as to whether existing suppliers could deliver the expected level of service following employee losses, and second, as to whether mobile supplier employees could replicate the same level of service in a new context (Moran, 2005; Raffiee, 2017). Uncertainty is further compounded by the lack of relation-specific assets and transactional interfaces at new suppliers, as these involve setup costs and inseparabilities (Argyres & Liebskind, 1999; Mayer & Argyres, 2004).

Taken together, the imperfect transferability of social capital results in higher costs of contracting for buyer firms. Uncertainty over mobile employees' and suppliers' performance together with the reduced levels of relational capital shared with suppliers give rise to holdup concerns. Buyers also face increased costs of establishing transactional interfaces and coordinating with suppliers due to the disruption of intra-firm ties at supplier firms. While higher costs of contracting favor insourcing (Sako et al., 2016), this link is not obvious. Firms engage in a comparative assessment of the costs associated with different sourcing options and the costs of



shifting to different sources of supply feature in firms' decisions (Williamson, 1985). Buyers consider both the costs of expanding in-house production, what we term *in-house adjustment costs*, and the costs of employing alternative suppliers already in use, which we call *supplier switching costs*.

Hence, faced with supplier employee losses, buyers will update their sourcing strategy by comparing increases in the costs of contracting with in-house adjustment costs and supplier switching costs. Buyers will prefer insourcing when in-house adjustment costs are relatively low and supplier switching costs are relatively high. This leads to our first hypothesis:

**Hypothesis (H1).** *When in-house adjustment costs are relatively low and supplier switching costs relatively high, supplier employee losses lead the focal plural-sourcing buyer firm to rely more on insourcing.*

## 2.3 | Supplier employee mobility and buyers' in-house adjustment costs

We have so far described the conditions under which supplier employee losses lead to more buyer firm insourcing. Next, we explore these conditions in more detail by focusing on the determinants of buyers' in-house adjustment costs.

Adjustment costs are related to scale (Knudsen, Levinthal, & Winter, 2014). It is well-known that firms' growth potential is constrained by their existing pool of resources and is limited by their ability to incorporate new human capital (Harrison & Carroll, 2006; Penrose, 1959; Winter & Szulanski, 2001). Applying this logic to our setting, we can see that firms with a relatively small internal department will face difficulties in rapidly expanding in-house capacity. Small departments face substantial adjustment costs, in part due to indivisibilities and the lack of scale economies (Caves & Porter, 1977). By contrast, large departments with a track record of insourcing face lower adjustment costs as they enjoy scale economies and have set procedures and channels for recruiting new talent. Hence, buyers with a relatively large insourcing capacity will face lower costs of bringing additional work in-house. And, as a result, they are more likely to increase insourcing due to supplier employee losses.

**Hypothesis (H2).** *The positive effect of supplier employee losses on insourcing is stronger when the focal plural-sourcing buyer firm's insourcing capacity is higher.*

Of course, scale alone is not enough in order to assess in-house adjustment costs. The buyer should also have access to the necessary capabilities. By definition, plurally sourced inputs entail very similar production technologies and processes. These are not necessarily identical though (Azoulay, 2004). The plurally sourced inputs are characterized by different levels of similarity that capture the degree of substitutability of the production investments made for these inputs (Krzeminska et al., 2013; Parmigiani, 2007). High similarity between the plurally sourced inputs suggests that the production investments made for one can be easily used for another, thus facilitating shifts between making and buying (He & Nickerson, 2006; Parmigiani & Mitchell, 2009). In contrast, low similarity entails some adjustment costs in order to produce the plurally sourced inputs.

Hence, the buyer firm's costs of bringing work in-house following supplier employee mobility will depend on the degree of similarity between the activities performed by the in-house

department and the suppliers experiencing employee losses. When similarity is high, the in-house department will be able to undertake the additional work with minimal adjustment costs. In contrast, the in-house department will face higher adjustment costs when trying to bring dissimilar work in-house. The increased contracting costs resulting from supplier employee mobility are therefore more likely to encourage insourcing when the inputs produced by the in-house department and suppliers are similar.

**Hypothesis (H3).** *The positive effect of supplier employee losses on insourcing is stronger when there is greater similarity between the inputs produced by the suppliers experiencing employee losses and the inputs produced by the focal plural-sourcing buyer firm.*

## 2.4 | Supplier employee mobility and supplier switching costs

As suggested before, buyer firms can avoid increases in insourcing by relying on alternative suppliers that do not suffer employee losses. But this depends on supplier switching costs, which can be seen as part of the overall costs of contracting. When supplier switching costs are low, supplier employee mobility is less likely to increase overall costs of contracting, and consequently, insourcing. Here, we explore the determinants of supplier switching costs.

We start by looking into the destination of mobile employees and in particular consider cases where employees move between suppliers both of which trade with the focal buyer. Given pre-existing contractual relationships, the new supplier is likely to have developed trust with the buyer firm (Poppo, Zhou, & Ryu, 2008). This will facilitate the transfer of employee external social capital by preserving (at least some of) the complementarity between employee external social capital and firm relational capital. Since individual trust requires interorganizational trust to be effective (Perrone et al., 2003; Zaheer et al., 1998), a move to another trusted supplier will reduce holdup concerns. In contrast, a new supplier with no history of trading with the focal buyer firm shares no relational capital with the buyer and the effectiveness of the mobile employee's external social capital is reduced.

Moreover, buyer firms would need to invest substantially in developing coordination mechanisms and relationship governance systems with a new supplier. As explained before, investments in relation-specific assets are not guaranteed and the resulting uncertainty will be high. There are also substantial set-up costs for establishing new transactional interfaces (Dyer & Singh, 1998; Mayer & Argyres, 2004). But these additional costs are—at least partly—avoided in the case of suppliers that already trade with the buyer firm. Thus, increases in the focal buyer's contracting costs will be lower when supplier employee losses are to destinations within its supplier portfolio. Our fourth hypothesis is therefore:

**Hypothesis (H4).** *The positive effect of supplier employee losses on insourcing is attenuated when the departing employees move to other suppliers that are also used by the focal buyer firm.*

Lastly, we look into alternative suppliers in the buyer's portfolio that do not suffer employee losses. Buyer firms have already developed relational capital with these suppliers so they could shift work to them, in this way avoiding any increases in insourcing. The extent to which this is possible depends on the level of supplier switching costs. As argued above, the degree of similarity between the activities performed by suppliers is relevant here.



Let's consider the case where a buyer has two suppliers, the first of which suffers employee losses. Contracting costs with the first supplier increase and the buyer considers giving additional work to the second supplier. When the two suppliers perform very similar activities, the buyer can easily shift the tasks from one to the other with little effort spent on coordinating and explaining the work (Langlois, 1992; Vanneste & Puranam, 2010). The second supplier would also face lower costs of adjusting production processes. When the two suppliers' activities are not similar, however, switching costs are higher. The buyer will need to explain the task at hand and the second supplier will need to undertake some changes in the production process. These translate into higher costs of contracting. Moreover, there can be disagreement over who should cover the switching costs, resulting in further contractual difficulties (Monteverde & Teece, 1982; Walker & Poppo, 1991). Taken together, the arguments above suggest that buyers are more likely to switch to other suppliers already in use when there is greater similarity between the activities performed by the suppliers suffering employee losses and remaining suppliers. Hence, our final hypothesis is:

**Hypothesis (H5).** *The positive effect of supplier employee losses on insourcing is weaker when there is greater similarity between the inputs produced by the suppliers experiencing employee losses and the inputs produced by the remaining suppliers in the focal plural-sourcing buyer firm's portfolio.*

### 3 | DATA AND METHODS

To test our hypotheses, we focus on patent prosecution in the United States, consisting of the process of drafting and filing patents at the U.S. Patent and Trademark Office (USPTO). This type of work is undertaken by patent attorneys (or agents) and requires specialized professional qualifications. While patent prosecution itself is not very costly, it is of great strategic importance as errors or omissions during patent filing can challenge patent validity and lead to expensive litigation. Also, an advantage of this setting is that patent filing involves little task heterogeneity and teamwork, two factors that may interfere with the effects of mobility (Briscoe & Rogan, 2016). Patent prosecution requires very standardized tools and processes undertaken by a single attorney and these do not vary across transactions. At the same time, differences in the patentable subject matter allow us to explore the degree of similarity in tasks undertaken by law firms and in-house departments.

Moreover, patent attorneys' human capital is primarily general, making their legal expertise perfectly portable across different law firms; so, an alternative explanation based on the transferability of human capital is less relevant in our setting. Patenting companies also regularly use in-house attorneys along with external law firms, engaging in plural sourcing (Moeen et al., 2013; Sako et al., 2016). Finally, mobility events are recorded by the USPTO, which requires all patent attorneys to register with its Office of Enrollment and Discipline (OED) and to update their contact information following changes in employment.

We start from the 2002 list of *Fortune* 500 firms and track their patenting activity, including that of their subsidiaries (using Capital IQ), from 2002 to 2013. The dataset we create contains information on patent filings using the NBER and PatentsView databases as well as the patent application (or PAIR) data from the USPTO (Hall, Jaffe, & Trajtenberg, 2001). We take advantage of information in the "Attorney/Agent" field in the application documents where the

lawyer responsible for filing the patent is listed. This allows us to identify patents filed by different law firms on behalf of their clients and those filed using in-house attorneys. Subsequently, we match buyer firms with financial data from Compustat and collect information on the mobility of patent attorneys using PatentBuddy. This tracks the work history of all registered patent attorneys from 2002 onwards relying on the records of the USPTO's OED. This process is facilitated by the unique registration number assigned to each attorney, eliminating any problems related to name disambiguation.

Our final sample consists of 98 buyer firms that applied for at least five patents during the 2006–2013 period. We do so to ensure that the firms included in our analysis file patents on a regular basis and thus face the tradeoffs associated with developing a plural sourcing strategy. The first 4 years of our dataset are not included in our analysis to allow for the construction of different variables included in our analysis.

### 3.1 | Dependent variable

We use *Insourcing ratio* as the dependent variable. This is the percentage of patent applications filed using an in-house attorney by buyer  $i$  in year  $t$ . This measure is based on 160,012 patent applications filed by buyer firms in our sample, 88,596 of which were outsourced to law firms. We relied on the “Attorney/Agent” field of the application document. For cases where this was missing, we relied on the granted patent. Roughly 1% of patents did not list attorney information in both documents and were thus excluded from our sample. Using a semimanual approach, we were able to account for inconsistent reporting and identify and standardize law firm names. An additional concern arose when the name of an individual patent attorney was listed. In these cases, the patent attorney is usually, but not always, an in-house lawyer (see Moeen et al. (2013)). To distinguish between these cases, we checked the address of the attorney listed to identify mismatches with corporate addresses.

### 3.2 | Independent variables

#### 3.2.1 | Supplier employee losses

This measure is based on the number of patent attorneys that left the law firms used by buyer firm  $i$  in year  $t - 1$  (Carnahan & Somaya, 2013; Somaya et al., 2008). Given that we look into the focal buyer's supplier portfolio as a whole, we calculate a weighted average based on the strength of the relationship with each law firm in the portfolio. This measure better reflects the impact of supplier employee losses on the buyer's overall costs of contracting. Evidently, employee losses at a key supplier are more consequential than those at a supplier that is rarely used by the focal buyer firm. The weights are calculated based on the average share of the focal buyer's outsourced patents prosecuted by each law firm over the past 3 years, that is,  $t - 1$  to  $t - 3$ .

#### 3.2.2 | Buyer insourcing capacity

This measure is calculated as the natural log of one plus the average number of patent attorneys working at buyer firm  $i$  in years  $t - 1$  and  $t - 2$ .

### 3.2.3 | Buyer–supplier input similarity

We isolate all patents filed in year  $t - 1$  on behalf of buyer firm  $i$  by law firms that suffered employee losses in year  $t - 1$  and then create a list of all primary patent classes. Then we calculate the percentage of those classes that were also listed as primary patent class in patents prosecuted by in-house attorneys during years  $t - 1$  to  $t - 3$ . High similarity suggests that the in-house department can relatively easily internalize the outsourced work as in-house attorneys have previously worked in the same technology areas and do not need to familiarize themselves with the prior art. In contrast, low similarity means that in-house attorneys have little experience in filing patents in those areas where law firms suffering employee losses are used. When there are no supplier employee losses (42 observations or 6% of the total), this variable is set to missing.

### 3.2.4 | Within-portfolio supplier employee losses ratio

For this measure, we isolate supplier employee losses inside the buyer's portfolio—that is, patent attorneys that left the law firms used by buyer firm  $i$  to join other competing law firms that were also used by buyer firm  $i$  in year  $t - 1$ . Then we calculate the weighted average of the within portfolio losses—the weights used are the same as above—and divide that with the weighted average of all supplier employee losses. When there are no supplier employee losses, this variable is set to missing.

### 3.2.5 | Supplier input similarity

We generate the list of primary patent classes for patents filed by law firms with employee losses in year  $t - 1$  and then calculate the percentage of those patent classes that were also listed as primary patent classes in patents prosecuted by the remaining law firms used in the same year (i.e., those not experiencing employee losses) during years  $t - 1$  to  $t - 3$ . This measure is high when other law firms in the buyer's portfolio file patents in technology areas similar to those of law firms with employee losses. In such cases, it will be easier for the buyer to switch to alternative suppliers given that they are already working in the same technology areas for the buyer firm. When there are no supplier employee losses, this variable is set to missing.

## 3.3 | Control variables

First, we calculate *Supplier departing employee tenure* to control for the amount of social capital that the mobile employees have developed prior to their departure. This is calculated based on the number of years the mobile employees spent in the law firms used by buyer  $i$  in year  $t - 1$ . We look into the three years prior to their departure, that is,  $t - 2$  to  $t - 4$ , and then calculate a weighted average of the tenure of departing attorneys based on the same weights described above for each individual law firm. Next, we calculate *Supplier concentration and stability*, a measure of concentration, but modified to account for continuity in supplier relationships. This captures the extent to which buyers enjoy lower costs of contracting (Sako et al., 2016). We calculate the nonbiased Herfindahl index of the distribution of

outsourced patents across the law firms used by buyers. But the relative share of each law firm is calculated as the average over the past 3 years and year  $t$ . In this way, we capture the intensity of repeated interactions between the buyer and law firms, which proxies relational capital.

We also control for mobility between buyer  $i$  and law firms in its portfolio by counting the number of patent attorneys that moved from law firms to the buyer and from the buyer to law firms in year  $t - 1$  (Somaya et al., 2008). We also add a number of variables to help us account for changes in human capital. These are the average experience of buyer patent attorneys as well as counts of new hires and losses for the buyer in year  $t - 1$ . Similarly, for law firms in the buyer's portfolio we calculate the weighted averages of attorney count, average experience, and new hires in year  $t - 1$ .

Subsequently, we add the number (log) of successful patent applications for buyer firm  $i$  in year  $t$  to control for scale effects as well as the standardized difference between patent applications in years  $t$  and  $t - 1$  to control for demand variability (Adelman, 1949). We also include variables to control for heterogeneity in the patenting output of the buyer firm. We compute the average number of citations received by buyer firm patents adjusted for truncation to account for patent quality (Hall et al., 2001) and the nonbiased measure of technological concentration of the patents applied across patent classes to control for the diversity of patenting output. We also include the average number of claims listed, the average measures of generality and originality—see Trajtenberg, Henderson, and Jaffe (1997)—and the average number of citations made to other patents.

Control variables also include the percentage of patents applied that cite a previously litigated patent (based on the LitAlert database). Next, we control for the technological distance between patents applied and the buyer firm's patent stock using Jaffe's (1986) measure of proximity. *Self cites* is the percentage of citations to other patents owned by the buyer firm averaged for all patents applied and controls for the degree of buyer-specific knowledge in filling a patent (Moeen et al., 2013). Finally, we include controls for past outsourcing, that is the average number of outsourced patents in years  $t - 1$  to  $t - 3$  averaged across patent classes (Mayer, Somaya, & Williamson, 2012), focal buyer R&D intensity, sales (log), profitability, debt, advertising intensity and employee count (log). Table S1 lists all variable descriptions while Table 1 presents descriptive statistics.

### 3.4 | Econometric specifications

The dependent variable in our hypotheses, *Insourcing ratio*, is bound between zero and one so a Tobit estimator would be appropriate. However, parameter estimates are inconsistent for Tobit fixed effects models (Greene, 2004). We therefore use a fixed effects OLS estimator as our preferred specification. Standard errors can be clustered at the buyer firm level and the interpretation of interaction effects is more straightforward in linear models (Hoetker, 2007). We perform robustness checks using the random effects Tobit estimator.

## 4 | ANALYSIS AND RESULTS

The first thing to note in our analysis is the prevalence of plural sourcing in the context of patent prosecution. Among the buyer firms in our sample only 14 outsource all of their patent

TABLE 1 Descriptive statistics and pairwise correlations (N = 697, for a N = 655)

Variable	Pair-wise correlations																																						
	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)			
(1) Insourcing ratio	0.38	0.36	1.00																																				
(2) Supplier employee losses	3.47	3.69	-0.03	1.00																																			
(3) Buyer insourcing capacity	2.30	1.56	0.32	-0.04	1.00																																		
(4) Buyer-supplier input similarity <sup>a</sup>	0.47	0.37	0.62	-0.01	0.53	1.00																																	
(5) Within-portfolio losses ratio <sup>a</sup>	0.10	0.17	-0.14	0.01	0.17	0.01	1.00																																
(6) Supplier input similarity <sup>a</sup>	0.54	0.32	-0.14	-0.28	0.37	0.29	0.19	1.00																															
(7) Supplier departing employee tenure	1.12	0.76	-0.11	0.54	-0.09	-0.11	0.02	-0.30	1.00																														
(8) Supplier concentration and stability	0.34	0.26	-0.33	0.11	-0.38	-0.44	-0.17	-0.35	0.19	1.00																													
(9) Buyer-supplier mobility (log)	0.02	0.14	0.10	0.02	0.24	0.15	0.02	0.07	-0.01	-0.13	1.00																												
(10) Supplier-buyer mobility (log)	0.05	0.20	-0.01	-0.01	0.26	0.10	0.09	0.14	0.01	-0.13	0.22	1.00																											
(11) Buyer experience (log)	2.22	1.07	0.16	-0.10	0.68	0.30	0.13	0.33	-0.12	-0.31	0.06	0.10	1.00																										
(12) Buyer new hires (log)	0.72	0.83	0.28	-0.01	0.77	0.44	0.13	0.26	-0.01	-0.30	0.28	0.36	0.38	1.00																									
(13) Buyer employee losses (log)	0.54	0.77	0.23	-0.05	0.72	0.35	0.10	0.26	-0.04	-0.21	0.31	0.25	0.31	0.67	1.00																								
(14) Supplier size (log)	3.67	0.94	-0.14	0.63	-0.02	-0.04	-0.02	-0.29	0.56	0.03	0.05	0.01	-0.03	-0.08	-0.01	0.03	0.60	1.00																					
(15) Supplier experience (log)	2.38	0.45	-0.12	0.16	-0.03	0.00	0.03	-0.14	0.30	-0.05	0.01	-0.03	-0.08	-0.01	0.03	0.60	1.00																						
(16) Supplier new hires (log)	1.77	0.74	-0.07	0.65	0.02	0.00	-0.01	-0.22	0.47	0.01	0.06	0.01	-0.02	0.06	0.01	0.86	0.38	1.00																					
(17) Patents applied (log)	4.49	1.44	0.22	-0.06	0.66	0.57	0.26	0.50	-0.07	-0.46	0.16	0.27	0.40	0.54	0.43	0.00	0.05	-0.01	1.00																				
(18) Diff in patents applied	-0.09	0.49	0.00	0.00	0.04	0.00	0.11	0.04	0.02	-0.04	-0.06	-0.01	0.01	0.02	0.02	-0.02	-0.04	-0.01	0.24	1.00																			
(19) Citations received	6.72	5.12	-0.04	0.17	-0.14	0.02	-0.05	0.01	0.08	-0.04	0.00	0.03	-0.18	0.00	-0.08	0.14	-0.10	0.23	-0.05	0.04	1.00																		
(20) Tech concentration	0.21	0.19	-0.25	0.06	-0.18	-0.24	0.02	-0.08	0.02	0.24	-0.08	-0.07	-0.10	-0.17	-0.18	-0.03	-0.03	-0.05	-0.32	-0.23	-0.10	1.00																	
(21) Claims	17.87	3.09	-0.36	0.12	-0.23	-0.17	0.09	0.06	0.05	0.05	-0.09	-0.02	-0.13	-0.13	-0.21	0.12	-0.06	0.12	-0.09	0.10	0.33	0.15	1.00																
(22) Generality	0.24	0.12	0.03	0.18	-0.12	0.03	-0.07	-0.08	0.13	-0.01	0.02	0.01	-0.17	0.00	-0.04	0.14	-0.09	0.23	-0.11	0.00	0.60	-0.24	0.20	1.00															
(23) Originality	0.55	0.11	0.00	0.21	-0.20	-0.20	-0.08	-0.34	0.25	0.19	-0.08	-0.12	-0.16	-0.13	-0.10	0.19	0.12	0.19	-0.37	-0.01	0.05	-0.02	-0.06	0.24	1.00														
(24) Citations made	30.64	31.86	-0.16	0.13	-0.04	-0.16	0.05	-0.05	0.15	0.10	-0.05	-0.03	-0.07	0.02	0.01	0.15	0.04	0.16	-0.20	0.08	0.27	0.12	0.25	0.14	0.39	1.00													
(25) Litigation	0.01	0.02	0.09	-0.06	0.22	0.15	0.01	0.18	-0.07	-0.10	0.03	0.07	0.09	0.19	0.19	0.03	-0.05	0.00	0.16	0.01	0.10	-0.02	0.00	0.02	-0.19	0.06	1.00												
(26) Past outsourcing	41.16	109.3	-0.19	-0.04	0.24	0.09	0.19	0.30	-0.06	-0.10	0.04	0.27	0.13	0.22	0.07	-0.01	-0.01	-0.02	0.42	-0.01	-0.06	0.24	0.11	-0.14	-0.29	-0.09	0.05	1.00											

TABLE 1 (Continued)

Variable	Pair-wise correlations																																			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)		
(27) Jaffe tech proximity	0.82	0.18	0.01	0.03	0.38	0.30	0.18	0.43	-0.05	-0.15	0.08	0.12	0.27	0.31	0.25	-0.01	-0.02	0.00	0.57	0.11	0.08	-0.18	0.03	-0.02	-0.28	-0.06	0.21	0.21	1.00							
(28) Self cites	0.13	0.09	0.28	-0.01	0.50	0.43	0.05	0.22	-0.03	-0.14	0.08	0.12	0.35	0.30	0.30	0.01	0.03	-0.01	0.48	0.01	-0.09	-0.04	-0.27	-0.13	-0.08	-0.08	0.26	0.19	0.40	1.00						
(29) R&D intensity	0.05	0.06	0.08	-0.09	0.49	0.29	0.04	0.36	-0.15	-0.20	0.14	0.14	0.22	0.42	0.41	0.01	0.09	-0.01	0.40	-0.01	0.03	-0.10	-0.14	-0.10	-0.44	-0.05	0.31	0.28	0.28	0.32	1.00					
(30) Sales (log)	9.67	1.03	0.12	0.12	0.45	0.33	0.19	0.22	0.09	-0.19	0.14	0.20	0.17	0.44	0.37	0.10	0.03	0.11	0.48	0.10	0.00	-0.05	-0.04	0.05	-0.02	-0.05	0.09	0.22	0.27	0.18	0.03	1.00				
(31) Profitability	0.18	0.10	0.07	0.03	0.43	0.19	0.14	0.20	0.08	-0.11	0.16	0.19	0.22	0.43	0.33	0.09	0.00	0.06	0.33	0.06	-0.01	-0.01	0.00	-0.09	-0.19	0.08	0.31	0.26	0.28	0.25	0.38	0.31	1.00			
(32) Debt	0.04	0.06	0.18	0.03	0.00	0.11	-0.03	-0.09	0.04	-0.03	-0.01	0.05	-0.09	0.04	0.06	0.05	0.06	0.03	0.04	-0.03	-0.01	-0.05	-0.18	0.06	0.19	-0.02	-0.03	-0.06	-0.08	-0.05	-0.07	0.21	0.06	1.00		
(33) Advertising intensity	0.02	0.03	0.01	-0.17	0.08	-0.08	0.03	0.10	-0.06	0.00	0.05	0.07	0.07	0.07	0.09	-0.11	-0.06	-0.14	0.00	0.03	0.03	0.04	0.00	-0.03	0.03	0.00	0.12	0.01	0.11	-0.01	0.04	0.14	0.22	0.14	1.00	
(34) Employees (log)	3.76	0.96	0.02	0.00	0.38	0.25	0.20	0.28	0.04	-0.23	0.13	0.18	0.20	0.36	0.31	0.04	0.05	0.03	0.52	0.09	-0.06	-0.16	-0.08	-0.03	-0.04	-0.06	0.02	0.19	0.35	0.17	-0.02	0.80	0.23	0.18	0.10	1.00



applications while none insources all applications. Mean insourcing ratio is 38% but there is substantial variation across firms.

Interestingly, the correlation between *Insourcing ratio* and *Supplier employee losses* is negative. This is not surprising as supplier employee losses are weighted based on the strength of the relationship between the buyer firm and the supplier experiencing employee losses. *Supplier employee losses* are low when buyer firms avoid building strong relationships with suppliers (the weights used to calculate *Supplier employee losses* are based on the amount of work assigned to each supplier by the buyer firm—in this case low). In contrast, *Supplier employee losses* tend to be higher when buyer firms use relational suppliers. But strong supplier relationships are also associated with lower costs of contracting and, as a result, reduced levels of insourcing (Sako et al., 2016). This can be seen in the strong, negative correlation between *Supplier concentration and stability*, a proxy for relational suppliers, and *Insourcing ratio*. Hence, the negative correlation between *Insourcing ratio* and *Supplier employee losses* likely captures the negative effect of a relationship-based supplier portfolio on insourcing. Conditional on *Supplier concentration and stability*, the correlation between *Insourcing ratio* and *Supplier employee losses* turns positive.

Table 2 presents results of the regression analysis. In model (1) we include all the control variables and *Supplier employee losses*. We find a positive effect as expected by with a  $p$  value of .03. This suggests that, on average, firms in our sample increase insourcing as a result of supplier employee mobility. This could be attributed to relatively low in-house adjustment costs or relatively high supplier switching costs. Given that all firms in our sample are large, established firms, it is plausible that they face less constraints in expanding in-house capacity. The coefficient estimate suggests substantial increases in insourcing. A one standard deviation increase in *Supplier employee losses* increases insourcing by 3.9%. The average firm insources 38% of its patents in a year so this amounts to roughly a 10% increase in insourcing.

In model (2) we test . To do so we interact *Supplier employee losses* with *Buyer insourcing capacity*. Both variables are centered around the mean in order to facilitate interpretation. We find a positive effect with a  $p$  value of .08. This provides reasonable support to suggesting that supplier employee losses are more likely to increase insourcing when buyers have a relatively high insourcing capacity. Figure 1a graphically illustrates the moderating effect of *Buyer insourcing capacity*. Increases in insourcing are much larger for in-house departments with a high number of attorneys. For example, an increase of one standard deviation in *Supplier employee losses* results in a 5.5% increase in insourcing when *Buyer insourcing capacity* is one standard deviation above the mean. This compares to a much smaller increase of 2.6% in insourcing when *Buyer insourcing capacity* is one standard deviation below the mean.

posits that increases in insourcing will be more pronounced when input similarity between the buyer firm and suppliers experiencing employee losses is high. Model (3) provides support to this as the interaction terms between *Supplier employee losses* and *Buyer-supplier input similarity* (both mean centered) is positive with a  $p$  value of .00. In Figure 1b we can see sharp increases in insourcing for high levels of *Buyer-supplier input similarity*. Insourcing increases by 6.4% in response to a one standard deviation increase in *Supplier employee losses* when *Buyer-supplier input similarity* is one standard deviation above the mean. The equivalent increase is lower, at 2.2%, when *Buyer-supplier input similarity* is one standard deviation below the mean.

Next, we move to (H4), suggesting that increases in insourcing will be attenuated when employees move to suppliers within the buyer's portfolio. In Model (4) we see that the interaction term between *Supplier employee losses* and *Within-portfolio supplier employee losses ratio* (both mean centered) is negative with a  $p$ -value of 0.01. This provides support to (H4). In Figure 1c we can see

**TABLE 2** Panel data regression models of patent applications insourcing, 2006–2013

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Supplier employee losses	0.011 (.04)	0.011 (.00)	0.011 (.00)	0.011 (.00)	0.007 (.06)	0.007 (.00)
Buyer insourcing capacity		0.042 (.17)				0.048 (.11)
Supplier employee losses $\times$ buyer insourcing capacity		0.003 (.08)				0.003 (.08)
Buyer–supplier input similarity			0.068 (.00)			0.058 (.02)
Supplier employee losses $\times$ buyer–supplier input similarity			0.015 (.00)			0.010 (.07)
Within-portfolio supplier employee losses ratio				−0.069 (.02)		−0.052 (.08)
Supplier employee losses $\times$ within-portfolio supplier employee losses ratio				−0.023 (.01)		−0.013 (.17)
Supplier input similarity					−0.054 (.03)	−0.057 (.01)
Supplier employee losses $\times$ supplier input similarity					−0.017 (.03)	−0.017 (.00)
Supplier departing employee tenure	−0.002 (.81)	−0.006 (.53)	−0.005 (.55)	−0.004 (.65)	−0.002 (.82)	−0.006 (.50)
Supplier concentration and stability	−0.176 (.00)	−0.230 (.00)	−0.227 (.00)	−0.242 (.00)	−0.237 (.00)	−0.254 (.00)
Buyer–supplier mobility (log)	−0.002 (.96)	−0.017 (.60)	−0.010 (.75)	−0.009 (.78)	−0.007 (.78)	−0.016 (.61)
Supplier–buyer mobility (log)	−0.019 (.47)	−0.025 (.29)	−0.021 (.37)	−0.019 (.42)	−0.021 (.45)	−0.021 (.37)
Buyer experience (log)	−0.015 (.18)	−0.022 (.15)	−0.010 (.44)	−0.010 (.45)	−0.016 (.20)	−0.024 (.10)
Buyer new hires (log)	0.005 (.58)	0.002 (.87)	0.004 (.67)	0.002 (.86)	0.005 (.60)	−0.000 (1.00)
Buyer employee losses (log)	−0.014 (.16)	−0.015 (.18)	−0.013 (.23)	−0.017 (.11)	−0.013 (.19)	−0.013 (.22)
Supplier size (log)	−0.037 (.06)	−0.022 (.25)	−0.025 (.18)	−0.023 (.22)	−0.016 (.44)	−0.021 (.26)
Supplier experience (log)	0.014 (.66)	−0.002 (.94)	−0.014 (.63)	−0.018 (.55)	−0.028 (.56)	−0.008 (.78)

**TABLE 2** (Continued)

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Supplier new hires (log)	0.016 (.19)	0.010 (.51)	0.011 (.46)	0.015 (.33)	0.011 (.40)	0.014 (.35)
Patents applied (log)	−0.066 (.01)	−0.077 (.00)	−0.071 (.00)	−0.069 (.00)	−0.073 (.01)	−0.072 (.00)
Dif in patents applied	0.016 (.13)	0.023 (.06)	0.023 (.05)	0.022 (.06)	0.023 (.04)	0.028 (.02)
Citations received	0.000 (.88)	−0.001 (.53)	−0.000 (.74)	−0.001 (.43)	−0.001 (.66)	0.000 (1.00)
Tech concentration	−0.136 (.01)	−0.165 (.00)	−0.135 (.01)	−0.147 (.00)	−0.140 (.01)	−0.132 (.01)
Claims	−0.000 (.97)	−0.001 (.83)	−0.001 (.69)	−0.001 (.82)	−0.001 (.82)	−0.000 (.89)
Generality	−0.064 (.40)	−0.072 (.21)	−0.051 (.37)	−0.049 (.40)	−0.043 (.59)	−0.062 (.28)
Originality	−0.052 (.65)	−0.215 (.03)	−0.176 (.07)	−0.190 (.05)	−0.173 (.11)	−0.198 (.05)
Citations made	0.000 (.64)	0.000 (.66)	0.000 (.56)	0.000 (.52)	0.000 (.60)	0.000 (.46)
Litigation	0.167 (.49)	0.191 (.54)	0.121 (.70)	0.176 (.57)	0.161 (.50)	0.150 (.62)
Past outsourcing	−0.000 (.70)	−0.000 (.76)	−0.000 (.54)	−0.000 (.55)	−0.000 (.76)	−0.000 (.68)
Jaffe tech proximity	−0.101 (.06)	−0.029 (.52)	−0.029 (.51)	−0.008 (.87)	−0.022 (.66)	−0.028 (.53)
Self cites	0.383 (.02)	0.308 (.03)	0.289 (.04)	0.317 (.02)	0.345 (.05)	0.294 (.03)
R&D intensity	−0.171 (.58)	−0.261 (.46)	−0.245 (.48)	−0.233 (.51)	−0.275 (.27)	−0.280 (.42)
Sales (log)	0.120 (.02)	0.099 (.01)	0.102 (.01)	0.117 (.00)	0.105 (.03)	0.091 (.02)
Profitability	−0.165 (.39)	−0.115 (.46)	−0.127 (.41)	−0.089 (.56)	−0.127 (.49)	−0.074 (.62)
Debt	0.234 (.12)	0.202 (.09)	0.181 (.13)	0.198 (.10)	0.202 (.20)	0.141 (.23)
Advertising intensity	−1.430 (.03)	−1.238 (.05)	−1.172 (.06)	−1.034 (.10)	−1.153 (.05)	−1.149 (.06)
Employees (log)	−0.059 (.13)	−0.039 (.26)	−0.044 (.19)	−0.057 (.10)	−0.049 (.18)	−0.040 (.24)

TABLE 2 (Continued)

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Constant	0.044 (.91)	0.367 (.23)	0.304 (.30)	0.181 (.54)	0.300 (.45)	0.407 (.17)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Technology area dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i> (number of firms)	697 (98)	697 (98)	655 (95)	655 (95)	655 (95)	655 (95)
<i>R</i> <sup>2</sup>	0.209	0.236	0.251	0.240	0.243	0.282

Note: All models use a fixed effects OLS estimator with standard errors clustered at the firm level and Insourcing ratio as the dependent variable. *p* values are reported in parentheses.

that insourcing increases less when employees move to law firms within the buyer firm's portfolio. An increase of one standard deviation in *Supplier employee losses* results in a 4.9% increase in insourcing when the *Within-portfolio supplier employee losses ratio* is set at 0. The increase is much lower, at 2.7%, when *Within-portfolio supplier employee losses ratio* is one standard deviation above the mean.

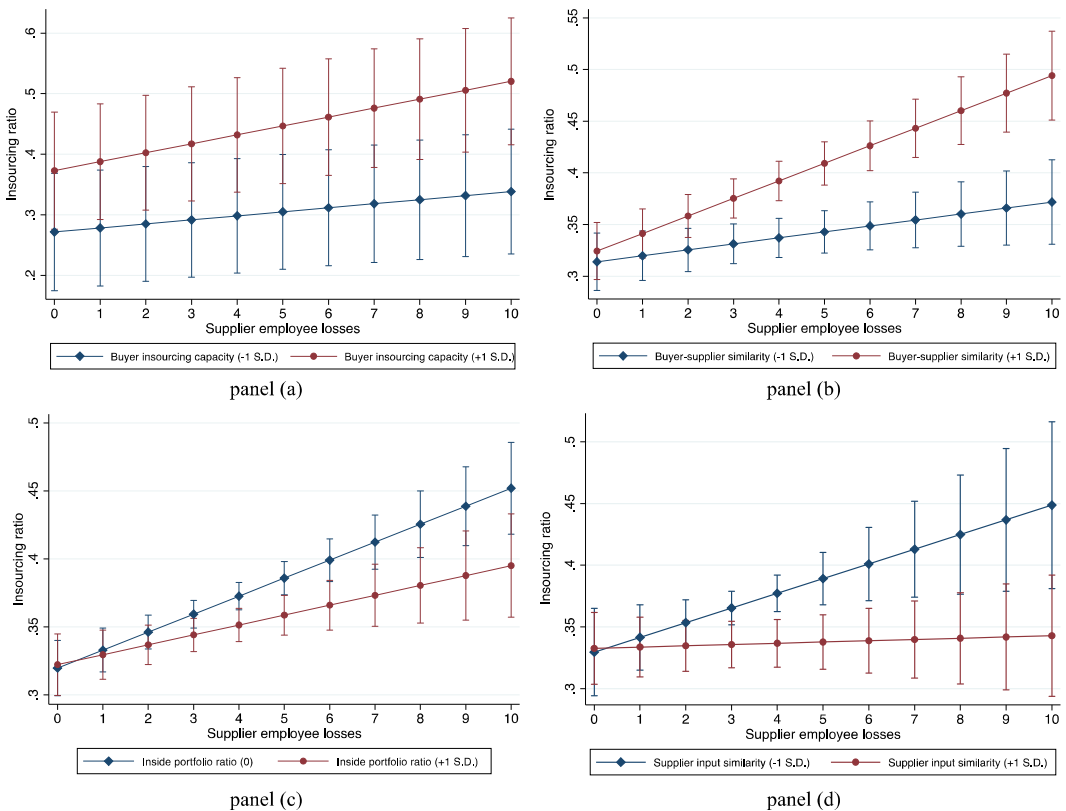
The last hypothesis explores the degree of input similarity between suppliers experiencing employee losses and other suppliers. In Model (5) we can see that the interaction term between *Supplier employee losses* and *Supplier input similarity* (both mean centered) is negative with a *p* value of .03. This suggests that buyer firms increase insourcing following supplier employee losses when the inputs undertaken by the suppliers experiencing losses are dissimilar from those of remaining suppliers. For high levels of *Supplier input similarity*, we can see in Figure 1d that insourcing barely increases following supplier employee losses. In contrast, a one standard deviation increases in *Supplier employee losses* when *Supplier input similarity* is one standard deviation below the mean leads to a 4.6% increase in insourcing.

In Model (6), we include all interaction terms and continue to find support for our hypotheses. It is important to note though that the *p* value of the interaction term testing (H4) is higher in the fully specified model at 0.17. This could be attributed to collinearity due to the high number of interaction terms. Still, we should be cautious and acknowledge only limited support for (H4).

#### 4.1 | Additional analysis

We perform additional analyses in order to test the robustness of our results and consider alternative explanations.<sup>2</sup> First, we estimate all our models using a random effects Tobit estimator. Results remain unchanged. Second, we considered alternative ways of calculating our key independent variable. In particular, we used different time periods to calculate the weights for

<sup>2</sup>All unreported results in this section are available in Data S1 in the on-line appendix.



**FIGURE 1** Moderating effects on the relationship between Supplier employee losses and Insourcing ration. All graphs are generated using models in Table 3 with the key independent variables uncentered. With the exception of the variables included in the graphs, the remaining ones are set at their mean. % confidence intervals are drawn around the point estimates

*Supplier employee losses* by accounting for the relative share of outsourced patents to law firms for 1 year ( $t - 1$ ) only, or for 2 years prior to departure. We also counted only losses to competing law firms, thus excluding losses of other sorts, for example due to retirement or career change. Our results hold.

Next, we look into the calculation of *Buyer-supplier input similarity*, *Within-portfolio supplier employee losses ratio*, and *Supplier input similarity*. As explained before, these variables are missing for the small number of cases where there are no supplier employee departures. Alternatively, we calculate different measures of *Supplier employee losses* based on the median of these variables and compare the coefficients. For example, we calculate separate measures of *Supplier employee losses* when *Supplier input similarity* is above the median and when it is below or equal to the median and test whether the coefficient of *Supplier employee losses* (*Supplier input similarity above median*) is higher than that of *Supplier employee losses* (*Supplier input similarity below/equal to median*). We find robust support to our hypotheses using this approach.

We also look into the possibility of reverse causality driving the relationship between insourcing and supplier employee losses. Given that we do not have data on the motivation of employee moves, we essentially assume that these are exogenous to the level of insourcing and to patterns of work allocation to suppliers. Nevertheless, we can imagine a situation where

supplier employees leave because work is brought in-house. Quite simply, patent attorneys could be responding to changes in buyer firms' sourcing policy. Even though mobility variables are lagged, attorneys have regular contact with buyer firm scientists and could predict such changes. According to this logic, work does not follow employees as we posit but employees follow work.

This possibility is difficult to rule out, but we present additional evidence here that alleviate such concerns. We employ three tests. First, we look into the overall amount of work allocated to law firms and differentiate between two types of law firms: (a) those with an increasing or stable amount of work allocated to them and (b) those with a decreasing amount of work allocated to them. The logic for this is that moves away from law firms that are experiencing decreasing performance are more likely driven by lawyers following work rather than other career concerns. Hence, we look into supplier employee losses only for law firms with increasing performance in a particular year. This allows us to more closely identify departures that are not directly driven by patterns of work allocation to the law firms. In Table 3 panel (a), we find that *Supplier employee losses* from law firms with an increasing trend in work allocated to them increase insourcing ( $p$  value is .03) while controlling for *Supplier employee losses* at law firms with a decreasing trend in work allocated to them.

The second test relies on the status differential of the law firms involved in the mobility events. Status is of great importance to law firms and an important consideration in attorney career choices (Phillips, Turco, & Zuckerman, 2013). Normally, attorneys are inclined to join law firms of similar or higher status as pay and career advancement hinge on such moves. In contrast, moves to law firms of lower status could be an indication of lower workload at the law firm they work for, possibly due to increases in insourcing by their core corporate clients. Hence, we differentiate between moves to similar or higher status law firms and those to lower status law firms and recalculate separate measures of *Supplier employee losses*.

Data on law firm status were taken from Chambers and Partners' annual nationwide rankings of U.S. law firms in the area of intellectual property, which includes patent prosecution services.<sup>3</sup> This ranking is one of the most recognized directories in the legal profession and has been used extensively to measure differences in firm status (Chatain & Mindruta, 2017). On average, 30 law firms are included which are divided into four bands. Unranked law firms were treated as a lower status fifth band. Given that status is only available for law firms, we focus on losses to law firms and recalculate measures of *Supplier employee losses* either to higher/same status competitors or to lower status competitors.

In Table 3 panel (b), we find evidence consistent with the mechanism we put forward as *Supplier employee losses* to similar/higher status law firms increase insourcing ( $p$  value of .02). The impact of a one standard deviation increase in supplier employee losses to law firms of lower status is more than double than that of a one standard deviation increase in supplier employee losses to law firms of similar/higher status (3.6% vs. 1.6% increase in insourcing, respectively). This could indicate reverse causality, consistent with resource dependence theory (Pfeffer & Salancik, 1978): law firms rely on their clients for work and attorney layoffs (resulting from increases in client firm insourcing) could force them to move to lower status firms. It is important therefore to acknowledge that these results could suggest both mechanisms are likely at play. So, we provide a third test in order to ensure that our interpretation of a causal effect of supplier employee losses on insourcing is supported.

<sup>3</sup>Chambers started offering nationwide rankings from 2007 onwards. For 2005–2006 we rely on the state rankings of five key states: CA, DC, IL, NY, and OH.



**TABLE 3** Regression analyses—tests for reverse causality

<b>Panel (a)</b>				
<b>Model (1) employs a random effects Tobit estimator while model (2) uses a fixed effects OLS estimator with standard errors clustered at the firm level. Both models use <i>Insourcing ratio</i> as the dependent variable. Control variables are the same as the ones included in Table 2.</b>				
	<b>(1) RE Tobit</b>		<b>(2) FE OLS</b>	
	<b>Coeff.</b>	<b>p value</b>	<b>Coeff.</b>	<b>p value</b>
Supplier employee losses (positive trend)	0.009	(.00)	0.009	(.03)
Supplier employee losses (negative trend)	0.011	(.00)	0.011	(.05)
Controls	Yes		Yes	
Firm fixed effects	Yes		Yes	
Technology area dummies	Yes		Yes	
Year dummies	Yes		Yes	
N (number of firms)	697 (98)		697 (98)	
Wald $\chi^2$ ( $R^2$ )	186.84		(0.22)	
<b>Panel (b)</b>				
<b>Model (1) employs a random effects Tobit estimator while model (2) uses a fixed effects OLS estimator with standard errors clustered at the firm level. Both models use <i>Insourcing ratio</i> as the dependent variable. Control variables are the same as the ones included in Table 2.</b>				
	<b>(1) RE Tobit</b>		<b>(2) FE OLS</b>	
	<b>Coeff.</b>	<b>p value</b>	<b>Coeff.</b>	<b>p value</b>
Supplier employee losses (increase status)	0.007	(.02)	0.007	(.02)
Supplier employee losses (decrease status)	0.027	(.00)	0.025	(.07)
Controls	Yes		Yes	
Firm fixed effects	Yes		Yes	
Technology area dummies	Yes		Yes	
Year dummies	Yes		Yes	
N (number of firms)	697 (98)		697 (98)	
Wald $\chi^2$ ( $R^2$ )	197.98		(0.21)	
<b>Panel (c)</b>				
<b>Model (1) uses <i>Supplier employee losses</i> as the dependent variable while Model (2) uses <i>Insourcing ratio</i> as the dependent variable. A fixed effects OLS estimator with standard errors clustered at the firm level is used. Control variables are the same as the ones included in Table 2.</b>				
	<b>(1) 1st stage</b>		<b>(2) 2nd stage</b>	
	<b>Coeff.</b>	<b>p value</b>	<b>Coeff.</b>	<b>p value</b>
Supplier employees in 9th year	0.228	(.00)		

TABLE 3 (Continued)

Panel (c)

Model (1) uses *Supplier employee losses* as the dependent variable while Model (2) uses *Insourcing ratio* as the dependent variable. A fixed effects OLS estimator with standard errors clustered at the firm level is used. Control variables are the same as the ones included in Table 2.

	(1) 1st stage		(2) 2nd stage	
	Coeff.	<i>p</i> value	Coeff.	<i>p</i> value
Supplier employee losses			0.028	(.06)
Controls	Yes		Yes	
Firm fixed effects	Yes		Yes	
Technology area dummies	Yes		Yes	
Year dummies	Yes		Yes	
<i>N</i> (number of firms)	697 (98)		697 (98)	
<i>R</i> <sup>2</sup>	0.36		0.16	

The third test addresses endogeneity by employing an instrumental variables approach. The challenge here is to identify a variable that influences insourcing only through its effect on *Supplier employee losses*. To this end, we take advantage of the up-or-out system of promotion in U.S. law firms. This is a key feature of professional services firms and requires attorneys to either become partners or leave the law firm after a certain number of years (Greenwood & Empson, 2003). While there are certainly deviations from this, the use of up-or-out system of promotion is widespread among U.S. law firms during our study period.

Our instrument is the weighted average number of patent attorneys in their ninth year of working experience<sup>4</sup> for law firms in the buyer firm's portfolio in year  $t - 1$ . We chose the ninth year of attorney tenure as this is the most likely year to face up-or-out decisions during our study period (Galanter & Henderson, 2008). To assess the appropriateness of our instrument we need to establish that this is correlated with *Insourcing ratio* only through its effect on *Supplier employee losses*. First, it is easy to see that a higher number of attorneys facing up-or-out evaluations is likely to increase *Supplier employee losses*. Failure to achieve partner status normally implies change of employment. This is also evident in Table 3 panel (c) that presents the first stage regression results. The coefficient of *Supplier employees in 9th year* is positive and the *p* value is .00. The instrument relevance can be seen from the partial *F*-statistic for the addition of the instrument in the first stage regression. In our case, we find an *F*-statistic of 18.80—much above the Stock–Yogo (2002) critical values. However, the Kleibergen–Paap rk Wald *F*-statistic is preferable when using cluster-robust standard errors. We find this to be 9.21, almost at the

<sup>4</sup>PatentBuddy only starts tracking the work history of patent attorneys from year 2002 onwards but the date of registration for each individual attorney is included. This date reflects the time when attorneys first registered with the USPTO and started practicing. This allows us to identify attorneys on their ninth year of working experience assuming that attorneys did not quit and return to the profession for years where we are unable to observe their work history and that pre-evaluation mobility does not affect the timing of up-or-out decisions.

threshold of 10 that is considered to suggest that weak identification is not a problem (Baum, Schaffer, & Stillman, 2007).

Second, we do not have any theoretical reasons to believe that our instrument has a direct effect on *Insourcing ratio*. The number of attorneys in the ninth year of their tenure increases employee losses due to the structural characteristics of the legal profession but does not capture any characteristics that could influence buyer firms' make-and-buy balance that are not already controlled for. Given that our chosen instrument is appropriate, the second stage estimates in Table 3 panel (c) provide additional confidence in our results. *Supplier employee losses* have a positive effect on *Insourcing ratio* with a  $p$  value of .06.

## 5 | DISCUSSION

This study explores the effects of supplier employee mobility in a knowledge-intensive sector where social capital is crucial for supplier selection. Its main aim was to shed light on a hitherto neglected factor in the plural sourcing and governance literatures, namely supplier employee mobility and its impact on make-and-buy decisions. In doing so, we also point to a gap in the employee mobility literature which has neglected the existence of internal suppliers at buyer firms. We develop a governance framework in which buyers compare the costs associated with different sourcing modes following supplier employee losses. We find robust evidence that supplier employee losses increase the amount of work insourced when the costs of adjusting in-house capacity are relatively low and when the costs of switching to alternative suppliers are relatively high.

In our empirical context of patent prosecution work, we find that attorney departures from law firms lead client firms to increase their reliance on insourcing. Our theory suggests that this is due to the imperfect transferability of employee social capital and resulting increases in the costs of contracting. To probe this mechanism further, we conducted ten unstructured interviews with general counsels, in-house and external patent attorneys, and R&D staff from large, technology-intensive firms. Our interviewees confirmed that attorney mobility can be disruptive for corporate clients. For example, an IP counsel explained:

“Moving can be a concern...I had a go-to patent attorney who was handling a good part of my business and he moved to another law firm. We did follow him and gave him most of the work he was doing but then he left to form a new law firm...So, there was certainly disruption to our firm, we had to transfer files, change names, update docketing information. The law firms also need to do a lot of filing and admin.”

Similarly, a patent attorney working for a large law firm noted that there are important “set-up” costs when working with a new law firm:

“It's very important to be familiar with the technology so working with an attorney over time makes sense. They need to know the area specifications and the prior art so they can narrow down the claims. But when attorneys move you have 'set-up' costs as you have to negotiate rates, set up agreements. Law firms usually require approval by the GC office, and this also takes time.”

We also invited our interviewees to reflect on how patent attorney mobility could influence corporate clients' sourcing decisions. Most of our interviewees thought a move towards insourcing is plausible and happens in practice while some provided specific examples where this took place. According to a patent litigation lawyer:

“With changing financial pressures...client relationships have become increasingly brittle because of the pricing pressure. Even in a deeply established relationship, when lawyers doing patent prosecution change, that's enough to fracture the whole relationship and precipitate a re-examination of the profitability of outsourcing the work, and instead of following the lawyer, it results in taking the work in-house.”

Along the same lines, a former general counsel gave specific examples:

“It's always very disruptive when your lawyer is moving. They move to a new law firm and you don't know them or how they work. We rarely followed the lawyer; we tried to stay with the (law) firm that we knew and trusted. But when this happens it makes you re-evaluate the whole value chain. You think everything over and you come to the conclusion that some parts are better done in-house. When I was the GC, we certainly did that and I often decided it was best to do the work internally rather than follow the lawyer or stay with the law firm.”

Interestingly, one corporate interviewee never considered increasing insourcing despite acknowledging the disruption caused by attorney mobility. He explained that the vast majority of patent prosecution work was done by law firms, so it would be difficult to bring work in-house. This underlines the importance of considering the costs of employing alternative sourcing options, as suggested by our theory.

## 5.1 | Theoretical implications

Our key theoretical contribution lies in identifying an important, novel link between firm boundary and employee mobility. Different theories of the firm have alluded to the role of human capital in the form of knowledge and capabilities (Demsetz, 1988; Grant, 1996; Richardson, 1972). Williamson (1981) also addressed human asset specificity and its effect on governance choices. However, much of the focus there is on human assets within the focal firm's boundary. Our focus, the impact of *supplier* employee mobility on the *buyer's* firm boundary, is less intuitive. Here, we develop a theory that explains why employee mobility outside the focal firm's boundary affects its vertical scope.

In addition, we contribute to theories of vertical integration and governance by moving beyond a dyadic, buyer–supplier analysis and focusing instead on the buyer and its portfolio of suppliers. The literature has moved beyond an analysis of individual transactions, to appreciate the interdependence of governance choices (Argyres et al., 2012; Argyres & Liebskind, 1999; Lee & Kapoor, 2017). Here, we complement these approaches by highlighting the role of in-house adjustment costs and supplier switching costs. Moreover, our framework accounts for differences in supplier portfolio design which in turn influence boundary choices. For example, we show that patterns of work allocation to suppliers can impact their interchangeability and, as a result, the costs of contracting. Our results then help explicate heterogeneous sourcing

strategies and demonstrate how the configuration of supplier relationships impacts contracting and governance (Argyres et al., 2020; Chatterji et al., 2019; Mawdsley & Somaya, 2018; Moeen et al., 2013; Sako et al., 2016).

Lastly, our paper sheds light on the heterogeneous effects of employee mobility. The extant literature has made important strides in uncovering individual or firm characteristics that influence work allocation to suppliers following employee losses (Bermiss & Greenbaum, 2016; Briscoe & Rogan, 2016; Broschak & Block, 2014; Raffiee, 2017; Rogan, 2014). Here, we highlight the imperfect transferability of employee social capital as an important moderating factor. Hence, our paper contributes towards a better understanding of firm heterogeneity arising from frictions in the mobility of employees (Mahoney & Qian, 2013; Starr et al., 2018).

## 5.2 | Implications for practice

In recent years, lawyers increasingly move from law firm to law firm as “lateral hires” proliferate. In this context, our study provides important insights for corporate clients and law firms. To a frequently posed question “Do you hire a lawyer or a law firm?”, the answer arising from our research is “a lawyer” when there is little relational capital. Our study also shows that corporate clients are more likely to follow lawyers to a new law firm if the firm is already working with the same clients. Lastly, law firms can create hurdles against mobile lawyers taking clients with them by investing in relational capital, reinforcing the role of law firm reputation beyond the personal trust clients may entertain with individual lawyers.

## 5.3 | Limitations and future research

Our study has a few limitations we wish to highlight. First, our sample consists of large, established firms. While we are confident about the applicability of our framework to other firms with similar characteristics, we are more cautious to generalize for smaller or younger firms with limited internal legal expertise. Second, our framework focuses on plurally sourced inputs. This is not always the case, so the applicability of our hypotheses is not universal. We contend, however, that the same logic we describe could be useful for cases where firms choose between making or buying. Our main argument is that supplier employee mobility makes market contracting comparatively costlier, hence, certain firms could foreseeably opt for vertical integration instead. Additional work could test this conjecture.

Third, like other studies of patent prosecution work, we do not always observe the name of the individual attorney filing the patent. For outsourced patents, the name of the law firm is usually listed. The degree of interaction between the buyer and mobile employee is therefore imperfectly observed. We are confident though that our results are not affected in any systematic way. Future work could rely on additional data and explore the differential effects of employee mobility based on the degree of employee interaction. Fourth, we do not know the motives of mobile employees, so it is difficult to definitively rule out reverse causality. The additional analyses we provide help alleviate such concerns. Future work could seek more detailed data or rely on other sources of exogenous variation.

## 6 | CONCLUSION

Firm boundary decisions are central to firm strategy and require a holistic view of the different activities undertaken by firms to be understood. Notwithstanding the limitations discussed above, our study highlights the importance of employee mobility outside the focal firm's boundary as a predictor of contracting costs and ensuing boundary decisions. Moreover, we demonstrate how different supplier portfolio configurations can lead to heterogeneous sourcing strategies. Hence, our paper is part of a growing literature that highlights the complex interactions between firms and their suppliers in order to explain decisions of vertical scope. Additional work can help further improve and consolidate existing theories of the firm.

## ACKNOWLEDGEMENTS

We are grateful to Martin Ganco and two anonymous *SMJ* reviewers for their extremely helpful guidance and suggestions throughout the review process. We also thank Matt Amengual, Rosa Ferrer, Michael Gill, Greg Kolocouris, Harris Kyriakou, Tom Lawrence, Sally Maitlis, Akshay Mangla, Eduardo Melero, Geert Mesters, Andrea Polo, Paul Vaaler and Filippo Wezel for useful comments and suggestions as well as seminar audiences at the 2017 SMS special conference in Milan, the 2017 Sumantra Ghoshal conference at London Business School, the 2017 DRUID conference, Carlos III University, ESADE Business School, IESE Business School, INSEAD, Ludwig Maximilian University, Universitat Pompeu Fabra, University of Minnesota, and University of Oxford. We gratefully acknowledge financial support for this research from the Novak Druce Center for Professional Service Firms at the University of Oxford and the Spanish Ministry of Economy and Competitiveness (Grant PGC2018-098610-B-I00).

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

**How to cite this article:** Chondrakakis G, Sako M. When suppliers shift my boundaries: Supplier employee mobility and its impact on buyer firms' sourcing strategy. *Strat Mgmt J*. 2020;1–30. <https://doi.org/10.1002/smj.3154>