Managing Innovation in a Multi-Divisional Firm:

When Does Mobility across Divisions Improve R&D Managers' Performance?

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ABSTRACT

Multi-divisional firms often seek to achieve cross-divisional synergies by transferring their R&D managers through a variety of assignments in different divisions, yet the implications for managers' ability to contribute to innovation are largely unexplored. To examine these implications, we introduce the concept of an "assignment portfolio", which refers to the set of assignments an R&D manager has undertaken across divisions. We argue that R&D managers with assignment portfolios characterized by greater coherence across divisions and greater concentration within the current division will perform more effectively, but that these benefits will depend on the extent to which the context of their current division favors exploitation versus exploration. We test our arguments using detailed survey and archival data from 241 R&D managers in a Fortune 500 technology-intensive multinational corporation.

INTRODUCTION

"At times, innovation happens on the fringes between different divisions. A lot of innovation comes from redefining the space you play in, and often it's at the intersection of different divisions that you have a very rich space for innovation."

– Extract from an interview with an R&D manager

As this quote illustrates, multi-divisional firms have great potential to benefit from cross-divisional synergies in their innovation activities (Rosenkopf & Nerkar, 2001), but how can they realize this potential? Achieving such synergies is a central challenge for the management of innovation in multi-divisional firms (Van de Ven, 1986). Scholars have emphasized that a key source of competitive advantage for such firms is the ability to benefit from sharing knowledge across divisions (Kogut & Zander, 1992), scaling up new products and processes to a wide range of markets (Burgelman & Grove, 2007), transferring innovation-related capabilities between divisions over time (Helfat & Eisenhardt, 2004), and pursuing initiatives that span divisions (Gawer, 2014; Tushman & Scanlan, 1981). Researchers have highlighted the importance of cross-divisional linkages in facilitating these processes (Lawrence & Lorsch, 1967), with emphasis on the role of networks between business units (Hansen, 1999; Tortoriello & Krackhardt, 2010; Tsai, 2001). Beyond this, however, we have limited insight into how the individual employees who carry out the firm's innovation activities can help their firms to benefit from cross-divisional synergies. Developing such insight is important for furthering our understanding of the micro-foundations of innovation in multi-divisional firms (Foss & Pedersen, 2016), as well as for addressing the critical managerial challenge of achieving cross-divisional synergies in these firms.

A common approach that many multi-divisional firms use to achieve such synergies and develop managerial talent for their innovation activities is to rotate their current and prospective

R&D managers through a variety of assignments in different divisions, often transferring them every few years (Allen, 1977; Katz & Tushman, 1981; Ortega, 2001). Working in different divisions can give employees exposure to different products, markets, technologies, and value chains, as well as different organizational assets, capabilities, and processes, and also serve as a means of socialization (Edström & Galbraith, 1977). As a result, cross-divisional mobility is often viewed as necessary for career advancement (cf. Stahl, Miller, & Tung, 2002). Yet these transfers tend to involve considerable personal adjustment challenges, as well as substantial investments by the firm (Bhaskar-Shrinivas, Harrison, Shaffer, & Luk, 2005; Shay & Baack, 2004). Moreover, while such costs of intra-firm mobility are widely recognized, the benefits of working in different divisions for an R&D manager's performance are far from clear.

In particular, two key questions arise for R&D managers who undertake cross-divisional assignments, beyond the initial question of whether to move at all. The first question is *where* to move. Will managers stand to gain greater performance benefits from undertaking assignments in divisions that are more similar or more different? The second question is *when* to move. How should managers balance time spent in a particular division with time spent in other divisions? Prior research on mobility and innovation has not addressed these questions, as it has focused primarily on R&D scientists rather than R&D managers, on inter-firm rather than on intra-firm mobility, and on comparing outcomes for mobile versus non-mobile individuals rather than examining different decisions about where and when to move (e.g. Almeida & Kogut, 1999; Corredoira & Rosenkopf, 2010; Hoisl, 2007). Yet R&D managers often move between divisions inside large firms, and decisions about where and when to move are potentially important for their performance. Moreover, prior research has not considered the possibility that the performance implications of different mobility patterns may be contextually contingent – that is, the benefits for an R&D manager's current performance may depend on the characteristics of the context in which the manager currently works.

To address these research gaps and gain insight into the relationship between cross-divisional mobility and the performance of R&D managers, we take a portfolio perspective on managerial mobility. We introduce the concept of an "assignment portfolio" to refer to the set of assignments that a mobile manager has undertaken in different divisions within the firm. In developing our arguments, we start by describing two core managerial responsibilities that are central to the R&D manager's role: strategic overview and operational oversight. We then draw on prior theories of learning from mobility, and organizational learning more generally (e.g. March, 1991; Schulz, 2001; Song, Almeida, & Wu, 2003), to argue that different assignment portfolios have different learning benefits for R&D managers, with different implications for how well they are able to perform their role in a particular division within the firm.

We focus on two key characteristics of an R&D manager's assignment portfolio in particular: its coherence across divisions, which refers to the extent to which the manager has worked in divisions that are similar to each other, and its concentration in the current division, which refers to the extent to which the manager has spent time in this division versus other divisions. These two characteristics reflect decisions about where and when to move across divisions. We argue that greater levels of coherence and concentration of R&D managers' assignment portfolios will be associated with higher managerial performance. However, these benefits are contextual, depending on whether the current division favors exploitation versus exploration (Gibson & Birkinshaw, 2004; Gupta, Smith, & Shalley, 2006; Katila & Ahuja, 2002). Contexts that favor exploration are usually characterized by higher environmental uncertainty and more slack resources than those that favor exploitation (Voss, Sirdeshmukh, &

Voss, 2008). We therefore argue that the levels of uncertainty and slack in an R&D manager's division will affect the extent to which managers can realize the benefits of their learning from a more coherent or concentrated assignment portfolio in that division.

We test our hypotheses using hand-collected data on R&D managers working at Artemis, a pseudonym for a Fortune 500 multi-divisional firm with extensive R&D operations. We combine insights from our field interviews with data from proprietary surveys, human resource records, and the corporate website. Our core dataset includes data on the assignment portfolios of 241 R&D managers who had worked in 25 different divisions within the firm, supplemented with data on their contexts from two separate surveys of R&D directors and R&D technologists.

Our findings offer three contributions to scholarly understanding of innovation management and employee mobility within firms. First, while there is extensive research on R&D scientists and inventors (e.g. Almeida & Kogut, 1999; Corredoira & Rosenkopf, 2010), the work of R&D managers has received little attention. Yet R&D managers play distinctive roles that are critical for successful innovation in firms (Van de Ven, 1986), making greater understanding of the factors that enable them to perform effectively valuable both for organizations conducting innovation and for researchers studying innovation management. Second, we offer insight into the micro-foundations of innovation within multi-divisional firms (Foss & Pedersen, 2016) by examining how individual employees' assignments across divisions enable them to perform more effectively in their innovation activities. Our findings show that the performance benefits for R&D managers vary with the coherence and concentration of their assignment portfolios. Third, we contribute to the literatures on mobility and careers (e.g. Bidwell, 2011; Choudhury, 2017) by offering a portfolio perspective that highlights not only the characteristics of the assignments undertaken by mobile managers, but also their value for managerial performance in particular contexts. Our findings reveal that the benefits of different mobility patterns depend on the extent to which an R&D manager's current division favors exploitation versus exploration, indicating that greater attention to the contingent value of mobility is warranted.

ASSIGNMENT PORTFOLIOS AND MANAGERIAL PERFORMANCE

The Role of R&D Managers

Research on the role of individuals in developing technological innovations inside large firms has focused primarily on technical R&D professionals such as inventors, engineers, and scientists, and on how their technical knowledge – gained through in-house research, mobility, or boundary-spanning networks – affects their ability to contribute to the firm's innovation outcomes (e.g. Almeida & Kogut, 1999; Choudhury, 2017; Corredoira & Rosenkopf, 2010; Dahlander, O'Mahony, & Gann, 2015; Hoisl, 2007; Tortoriello & Krackhardt, 2010). Although there has been some research on innovation among general managers (Gibson & Birkinshaw, 2004; Jansen, Van Den Bosch, & Volberda, 2006), little consideration has been given to how R&D managers help their firms achieve innovation goals. This is surprising given the critical role that R&D managers play in the conception, execution, and delivery of innovation projects and programs (Van de Ven, 1986).

R&D managers typically start their careers in a firm as technical specialists, with extensive training and experience in science and technology. As technical specialists become more senior, some choose to avoid managerial responsibilities and continue to focus on discovery and development, but others transition into a managerial role and take on new responsibilities that differ substantially from those of their technical counterparts (Cardador, 2017; Hoffmann, Hoegl, Muethel, & Weiss, 2016; Katz, Tushman, & Allen, 1995). Those who pursue the manager pathway are responsible for ensuring that innovation efforts are aligned with key strategic market and financial objectives, and that innovation projects meet time and budget constraints (Blau & Scott, 1962). Fundamentally, R&D managers are charged with improving the firm's profitability by directing the R&D activities of their teams towards the realization of innovations that generate increased revenues or cost savings for the firm, while keeping R&D costs under control and projects on target. We distinguish two core aspects of the R&D manager role that help them achieve these outcomes: strategic overview and operational oversight.

First, R&D managers are responsible for strategic overview of the firm's innovation efforts: that is, for ensuring that innovation efforts are aligned with the strategic goals of their division and of the broader organization. Because the innovation process often involves multiple functions, resources, and disciplines that each risk losing sight of the overall effort (Melero & Palomeras, 2015; Van de Ven, 1986), R&D managers are tasked with supervising the entire innovation initiative and coordinating the inputs involved, both within and across divisions. The strategic overview function also demands skill and flexibility in linking technologies and markets (Dougherty, 1992). Although R&D efforts may be initiated with a specific application in mind, unexpected technical developments or changing market conditions may shift the areas that a new technology is able to address, requiring R&D managers to rethink the focus of their innovation efforts (Gruber, MacMillan, & Thompson, 2008; Smith & Tushman, 2005). R&D managers often need to act as boundary-spanners within the firm, going beyond their own division to access complementary resources, expertise, or capabilities from other divisions (Ancona & Caldwell, 1992; Hargadon & Sutton, 1997). Relatedly, they may lead cross-divisional initiatives, for example by facilitating projects that combine competences from multiple divisions (Kogut, 1996; Van de Ven, 1986). Additionally, R&D managers must champion R&D projects with senior decision makers (Howell & Higgins, 1990), making the case for committing resources and providing support in light of their potential importance to the firm (Mueller, Melwani, Loewenstein, & Deal, 2018). Together, these strategic overview duties are central to guiding the firm's innovation efforts and enabling the design and delivery of innovation projects and programs.

Second, R&D managers are responsible for operational oversight of R&D efforts: that is, they are accountable for the delivery of specific innovation projects on time and within budget, as well as for the achievement of broader innovation targets (Benner & Tushman, 2003; Thompson, 1965; Van de Ven, 1986). As a central part of this role, R&D managers are typically tasked with monitoring project milestones and ensuring project delivery, requiring them to identify problems as they arise and reallocate resources away from failing projects (Cooper, 2008; Keum & See, 2017). They must recognize and tackle problems that often beset innovative projects, such as escalating commitment to current ideas, under-estimation of developments costs, or excessive flexibility in the meeting of project milestones (Schilling, 2016), while at the same time maintaining the courage and confidence to support pursuit of promising and even 'foolish' ideas (Kanter, 2000; March, 2006). Operational oversight also involves directly managing R&D staff, including allocating individuals with appropriate skills to specific projects (Brown & Eisenhardt, 1995), deciding how much autonomy to grant them (Bailyn, 1985), creating a climate of 'psychological safety' that supports them in undertaking risky initiatives (Edmondson, 1999), and facilitating their personal development by, for example, finding funds or time for them to attend conferences, conduct small-scale trials, or work on pre-research projects (Augsdorfer, 2005; Criscuolo, Salter, & Ter Wal, 2014). These operational oversight duties are critical for ensuring that innovation efforts are carried out efficiently and do not exceed time or budget constraints.

Cross-Divisional Mobility and R&D Managers' Performance

Many large multi-divisional firms expect managers to spend time working in different divisions of the firm to help develop their managerial capabilities. For R&D managers in particular, working in different divisions provides a way to build the strategic overview and operational oversight capabilities that are critical for effectively managing innovation projects and programs. The expectation that cross-divisional mobility can offer learning benefits is consistent with prior research that shows that mobility between firms enables R&D workers to transfer learning from one setting to another (Almeida & Kogut, 1999; Groysberg, Lee, & Nanda, 2008; Song et al., 2003). Within a firm, however, these learning benefits are likely to vary with decisions about which divisions to work in and how long to work in them, as well as with the context in which the manager is currently working. In developing our hypotheses below, we focus first on two main characteristics of an R&D manager's assignment portfolio that reflect where the manager has worked and for how long: its coherence across divisions and its concentration in the current division. We then consider how the relationships between these two portfolio characteristics and managerial performance may be moderated by the context of the manager's current division.

Portfolio Coherence. The coherence of an R&D manager's assignment portfolio is greater if the manager has worked in divisions that are more similar to each other. For example, a portfolio is more coherent if the manager has worked in three different divisions with highly related underlying scientific or technological disciplines, such as material science, biochemistry, and polymer science, than if the manager has worked in three different divisions with quite unrelated underlying disciplines, such as electrical engineering, toxicology and bioinformatics.

When an R&D manager's assignment portfolio is more coherent, the benefits of having worked in different divisions for that manager's performance are likely to be greater, because the knowledge, insights, and experiences gained through these assignments are more mutually relevant (Schulz, 2001). Related variety promotes the development of abstract principles or schema that aid the acquisition of related skills or knowledge sets and facilitate learning (Schilling, Vidal, Ployhart, & Marangoni, 2003). Assignments that are more mutually relevant thus increase the manager's absorptive capacity for learning from related areas, and for applying that learning to adjacent areas (Cohen & Levinthal, 1990). As a result, the manager is more likely to be able to identify relevant approaches or opportunities for generating new revenues or cost savings for the firm, or for keeping R&D projects within budget and on target, that can usefully be imported to their current division. For example, the manager might learn about technological advances that could be applicable in their current division, such as a new type of environmentally-friendly packaging for which customers are willing to pay more, or about transferable approaches to reducing costs, such as transferring the risks of developing a key component to trusted suppliers. The manager is also more likely to undertake innovation initiatives that span related divisions, such as joint development of a new technology platform that can be used in both divisions' products, or outsourcing of specific project elements to other divisions that can complete them more efficiently (Gawer, 2014). Accordingly, a manager's strategic overview and operational oversight capabilities can benefit more from mobility across divisions if that manager has worked in a more similar or related set of divisions. Hence, we predict:

H1: Greater coherence of an R&D manager's assignment portfolio across divisions will be positively associated with managerial performance.

Portfolio Concentration. The concentration of an R&D manager's assignment portfolio is greater if the manager has spent more time in the current division compared to other divisions. For example, a portfolio is more concentrated if a manager who has been with the firm for a total of nine years and has worked in a total of three divisions has spent five years in the current division and two years each in two other divisions than if the manager has spent three years in the current division and three years in each of the other divisions.

An R&D manager with a more concentrated assignment portfolio has greater depth of experience in the current division compared to other divisions. Accordingly, this manager has a deeper understanding of how knowledge, insights, and ideas gained from other divisions may or may not address needs and opportunities in their current division (see Gounopoulos & Pham, 2018 for a similar argument on CEOs). For example, this manager may identify a promising market-technology linkage based on their experience in another division – but then recognize that this linkage would not in fact fit with the needs of the current division. In contrast, an R&D manager with a less concentrated assignment portfolio has less depth of experience in the current division compared to other divisions. This manager might identify the same market-technology linkage without recognizing the risks and drawbacks of trying to import it to the current division, due to their more superficial understanding of this division. Similarly, this manager might struggle to successfully implement cross-divisional revenue-generating projects or cost-saving initiatives due to insufficient understanding of the distinctive constraints, culture, politics, or priorities of their current division. Thus, a manager's strategic overview and operational oversight capabilities can benefit more from mobility across divisions if that manager has spent more time in their current division compared to other divisions. Hence, we predict:

H2: Greater concentration of an R&D manager's assignment portfolio within the current division will be positively associated with managerial performance.

While we expect coherence and concentration to be positively related to an R&D manager's performance overall, we argue that the divisional context matters. Building on theories of organization learning, we suggest that the value of coherence and concentration depends on the extent to which the context of the current division favors exploration versus exploitation (March, 1991). All R&D activities are focused on innovation, but within large multi-divisional firms much innovation is exploitation-oriented, while some is more exploration-oriented (Anderson & Tushman, 1990; Danneels, 2002; Gibson & Birkinshaw, 2004; Gupta et al., 2006). Exploitation involves refining and extending existing competences, technologies, and paradigms in order to generate incremental advances, while exploration involves experimenting and taking big risks with new alternatives in order to generate radical breakthroughs (March, 1991; Voss et al., 2008). Contexts that favor exploration tend to be characterized by higher environmental uncertainty and more slack resources (e.g. Voss et al., 2008). While environmental uncertainty requires divisions to emphasize exploration, slack resources enable them to pursue exploration. Accordingly, we focus on how these two features of R&D managers' current contexts may affect the relationships between the coherence and concentration of their assignment portfolios and their performance.

Moderating Effects of Divisional Uncertainty. In innovation-focused settings, environmental uncertainty typically takes the form of uncertainty related to markets or to technologies, due for example to rapidly changing customer preferences (Markides, 1997) or fast-moving technical frontiers (Suarez & Lanzolla, 2007). Prior research has found that in settings characterized by uncertainty, learning from more distant or unrelated areas can be more beneficial than learning from more proximate or closely related areas (Rosenkopf & Nerkar, 2001). Learning from more distant areas facilitates recombination of previously disconnected knowledge, which can be particularly important for exploration-oriented innovation (Danneels & Sethi, 2011; Fleming & Sorenson, 2001; Gruber, Harhoff, & Hoisl, 2013). Thus, R&D managers in divisions with greater uncertainty typically need to monitor a more diverse array of market trends and technological advances, and supervise more divergent innovation efforts, in order to effectively carry out their strategic overview and operational oversight responsibilities. These requirements can reduce the benefits of a coherent or concentrated assignment portfolio.

First, the benefits of a more coherent assignment portfolio will be reduced because R&D managers who have worked in a set of divisions that are more similar to each other will have less ability to identify ideas from distant divisions that might potentially be valuable for their current division (Custodio, Ferreira, & Matos, 2017; Gruber et al., 2013). Such managers might lack breadth in their knowledge and networks and thus be less able and motivated to identify, undertake, and oversee revenue-generating or cost-saving initiatives that span distantly related divisions, undermining their ability to meet the current division's needs for exploration (Wu, Levitas, & Priem, 2005). In contrast, R&D managers who have worked in a set of divisions that are less similar to each other are likely to have developed more diverse knowledge and understanding of more distant markets and technologies, as well as a wider-ranging set of network contacts on whom they can draw to identify potential new ideas for generating revenues or saving costs within their current division. The more diverse experiences of these managers may also enable them to oversee complex and varied innovation efforts that span more distant divisions (cf. Melero & Palomeras, 2015). Thus, we predict:

H3: The relationship between the coherence of an R&D manager's assignment portfolio and their managerial performance will be less positive in divisions with greater environmental uncertainty.

Second, the benefits of a more concentrated assignment portfolio will be also reduced in divisions with greater uncertainty, because R&D managers who have spent more of their time with the firm in the current division are more likely to fall prey to strategic myopia and reliance on established ways of approaching markets and technologies, which is particularly damaging when markets or technologies are uncertain (Levinthal & March, 1993). Having spent relatively little time outside their current division, they may struggle to fully understand and appreciate the potential of ideas from other divisions, to align their initiatives across divisions, or to muster the support from other divisions needed to successfully champion their innovations (Mom, Fourné, & Jansen, 2015). These limitations will be particularly consequential in contexts with higher uncertainty, where incorporating new and different approaches is important for exploration (March, 1991). Conversely, R&D managers who have spent more of their time in other divisions are likely to be better able to sense changing customer needs or new technical trends, and to align their initiatives with other divisions. Additionally, these managers may be better positioned to champion novel ideas by drawing on their greater exposure to other divisions to inform the selling of such ideas within their current division and to generate support for approaches that deviate from the status quo from other divisions (Howell & Higgins, 1990). Hence, we predict:

H4: The relationship between the concentration of an R&D manager's assignment portfolio and their managerial performance will be less positive in divisions with greater environmental uncertainty.

Moderating Effects of Divisional Slack. Contexts that favor exploration also tend to have more slack resources, which can buffer the work setting from short-term pressures and allow for more experimentation and risk-taking (Levinthal & March, 1981). The concept of "slack" refers to a cushion of resources beyond those required for regular activities (Cyert & March, 1963). For example, a particularly valuable resource in innovation-focused settings is time for experimentation, both on a short-term basis (e.g. because daily work is not too pressured) and on a longer-term basis (e.g. because project timeframes are more extended) (Levinthal & March, 1981; Miron-Spektor, Ingram, Keller, Smith, & Lewis, 2018; Voss et al., 2008). Such "slack time" gives teams and individuals more latitude to gather information, generate ideas, consider alternatives, and play them out (e.g. Haas, 2006; Okhuysen & Eisenhardt, 2002; Perlow, 1999). This can reduce the benefits of both portfolio coherence and portfolio concentration for an R&D manager's performance.

First, the benefits of a more coherent assignment portfolio will be greater in divisions with little slack than in divisions with greater slack. For example, where there is little time to engage in experimentation, R&D managers will find it more efficient to draw on more closely related knowledge, insights, and experience when importing new approaches to revenue generation or cost control from other divisions (Baer & Oldham, 2006). Such local inputs are likely to be easier to align and incorporate into the current division, and more quickly accepted by its employees. However, in divisions where daily work is less pressured or project timeframes are more extended, the value of such efficiencies is reduced. R&D managers will have more time to experiment with drawing on analogies or searching for knowledge from distant domains in order to generate new revenue streams or cost savings for the firm (Laursen, 2012). They will also have more opportunity to try out ideas for managing the R&D process itself that are quite different from those used in the current division. Such learning is especially valuable for more exploratory activities (Levinthal & March, 1993), which not only require more divergent approaches and ideas but also tend to run over time and budget. Thus, we predict:

H5: The relationship between the coherence of an R&D manager's assignment portfolio and their innovation performance will be less positive in divisions with more slack resources.

Second, the benefits of a more concentrated assignment portfolio will also be greater in divisions with little slack than in those with greater slack. For example, an R&D manager who is more familiar with the current division is likely to be more efficient at carrying out their strategic overview and operational oversight responsibilities within that division because they can more quickly identify revenue generation and cost saving opportunities or address potential cost control problems inside the division (Cohen & Levinthal, 1990). While such efficiency is valuable when daily work is pressured or project timeframes are tight, it is less valuable when there is more slack (Voss et al., 2008). Moreover, the potential benefits of greater familiarity with other divisions are also higher when there is more slack, because R&D managers have more time to experiment with novel ideas and approaches that draw on the deeper knowledge gained through their time in other divisions (Baer & Oldham, 2006). They also have more time to reach out to the networks of contacts they have built in these other divisions in order to access new ideas and information, and to solicit their support for risky innovation initiatives (Tortoriello & Krackhardt, 2010; Tortoriello, Reagans, & McEvily, 2012). Since a more concentrated portfolio has fewer advantages under such conditions, we predict:

H6: The relationship between the concentration of an R&D manager's assignment portfolio and their innovation performance will be less positive in divisions with more slack resources.

METHOD

Data and Research Design

This study is based on survey data from R&D managers in Artemis, supplemented with archival data and qualitative interviews. Artemis is a pseudonym for a Fortune 500 technology-intensive company with extensive R&D operations across its divisions. The company operates a dual career ladder structure, where R&D employees with approximately ten years of experience in the R&D organization face the choice of progressing their careers along either a management pathway or a technical pathway, to become either R&D managers or R&D technologists. Artemis' R&D employees tend to stay with the company for the long-term; most have limited work experience outside Artemis and remain with the company for their entire careers.[1]

Employees who choose the managerial career path are expected to undertake assignments in different divisions of the firm. Artemis' formal organizational structure includes 25 large divisions responsible for different product categories, with varying technical needs and customer

[1] On average, the R&D employees in our sample had only 2.7 years of work experience outside Artemis; 46% had never worked outside Artemis; and only 10% had more than 10 years of work experience outside Artemis.

segments. Artemis believes that cross-divisional mobility is critical for R&D managers, to help them develop a better understanding of the organization as a whole and greater awareness of innovation opportunities across divisions. There is also a strong belief that moving across divisions helps R&D managers to avoid becoming trapped in established ways of thinking. As one manager explained: *"If [you] stick within a certain area for way too long, [you] tend to be, 'I've been there, I've done that', and you have a little box and you shut yourself off of new ideas because you've been there way too long."* This emphasis on internal mobility is common for R&D managers in large multi-divisional organizations.[2] At Artemis, promotions typically happen after R&D managers have proved themselves in a new division, rather than when they move divisions, but there is still a strong belief that moving across divisions helps accelerate career advancement.[3] Despite the general sense that such moves are both beneficial for R&D managers' performance and important for their career advancement, senior managers and HR professionals in Artemis voiced concerns about whether mobility across divisions is always as helpful as it might be, and whether some types of mobility might be more helpful than others.

To address these questions, we first conducted interviews with 30 R&D managers at Artemis, to understand their role in the innovation process and their mobility across divisions within the company. These interviews provided insights into the role of R&D managers in providing strategic overview and operational oversight for the firm's innovation processes. For example, in describing their strategic overview responsibilities, one manager explained: *"My role [as an R&D manager] is to make sure I understand what the business needs from us in order to win, and that the science we're working on should have relevance to the business*

[2] It is generally less common for technical R&D staff, both at Artemis and at other similar organizations, since their specialist knowledge is often highly specific to a particular division.
[3] Both our interview and survey data indicated that moves across divisions were not typically associated with promotions at Artemis. In the survey dataset, approximately one-sixth of such moves also involved a promotion.

proposition that we're trying to achieve." Another manager described their operational oversight responsibilities as follows: "*What the manager is bringing to the party is an understanding of the various types of risk… the manager will be thinking, well, if I've got two technical routes and one is going to be a real problem for cost and one will be a problem for timing… actually I can deal with the timing question, the business can afford to delay the initiative, but I know that [there's a] cost constraint because of what the competition can do."*

In addition to the R&D managers, we also interviewed 40 R&D technologists, who worked closely with them, and five R&D directors, who supervised them, to more fully understand the context of their work. Together, these interviews informed the design of our survey instruments, the framing of the survey questions, and the construction of measures with contextual validity in the company. We administered surveys to the full populations of R&D managers (n≈900), R&D technologists (n≈600), and R&D directors (n≈80) in the firm, which was supplemented with HR information on performance ratings. All surveys were administered anonymously in mid-2015, following invitations from Artemis' Chief Technology Officer. The survey response rates were 43% for R&D managers, 61% for R&D technologists, and 46% for R&D directors. We found no statistically significant differences between respondents and non-respondents for any variables with full-population data, including performance ratings, seniority level, tenure, location, or division, nor between early and late respondents on the key variables of interest in this study. After excluding 27 R&D managers' surveys due to missing data, our dataset included 343 R&D managers, of whom 241 (70%) had worked in more than one division. To test our hypotheses, our main analyses focus on these 241 managers, but we also account for possible endogeneity due to self-selection into cross-divisional mobility by using the full sample of 343 managers to estimate a two-stage selection model (Wooldridge, 2010).

Dependent Variable

Managerial performance. We measure R&D managers' performance using end-of-year performance ratings from 2015 obtained from Artemis' corporate HR records. The rating system assessed managers' performance relative to peers within the same division on an annual basis. All R&D managers were required to fill in a form which asked them to summarize their contributions to the firm's innovation efforts, including specific details on how their own work and the work of the employees they managed had produced innovation-related outcomes that led to either increased revenues or cost savings aligned with the business objectives of their division. This focus on increased revenues or cost savings was viewed as central to a manager's contributions to innovation at Artemis. R&D managers were also judged on their ability to deliver projects on time and budget, and they were asked to back their claims with hard data whenever possible. The completed forms were assessed by a committee of managers of higher rank than the focal manager. Any disagreements or disputes were resolved by managers two levels up, to ensure objectivity and fairness of peer comparisons within divisions. These ratings were the most important form of performance assessment at Artemis, and were utilized in the awarding of salary increases, bonuses, and promotions.

We coded the dependent variable as 1 if the manager received a top performance rating or 0 otherwise. While managers were rated on a five-point scale, our interviews revealed that a top rating was the most meaningful and important indicator of strong managerial performance at Artemis, and that comparing top-rated managers to all other managers provided the best insight into superior performance. In our sample, 30% of the R&D managers received the top performance rating, consistent with the full population of R&D managers in Artemis.[4]

Independent Variables: Portfolio Characteristics

We obtained information on R&D managers' assignment portfolios from the survey, where we asked respondents to specify the division, location, seniority level, and start year of their current position and up to three previous positions. Since our focus is on cross-divisional assignments, we define an assignment here as a period of time spent working in a given division.[5] Of the R&D managers in our sample, 50% reported on two assignments, 37% reported on three assignments, and 13% reported on four assignments. The total duration of their reported assignments was 13.6 years on average, and the average length of an assignment was 4.9 years.

Coherence. The coherence of an R&D manager's assignment portfolio measures the similarity between the divisions in which a manager had worked, including their current assignment as well as their past assignments. We consider two divisions to be more similar (or dissimilar) to each other if they had greater (or smaller) overlap in terms of their core scientific areas. We obtained information on the scientific and technological disciplines underpinning each of Artemis' 25 divisions from a section in the company's website that aims to attract new hires for its worldwide R&D operations. This list included broad domains, such as inorganic chemistry and statistical analysis, as well as specific areas, such as nutrition and packaging. We constructed binary vectors of 66 different disciplines indicating the relevance (1) or non-relevance (0) of each discipline for each division, and then calculated pairwise Jaccard similarity scores between all

[4] In our sample, 31% received a performance rating of 2, 36% received a rating of 3, only 2% received a rating of 4; and no managers received a rating of 5 (the lowest possible). In robustness checks, we excluded managers with a rating of 4, and also managers with a rating of 3 or 4, and found results consistent with our main findings.

[5] If the manager reported two positions in the same division, for example, we coded this as one divisional assignment. We captured the manager's most recent assignments, which can be expected to more strongly affect their current managerial performance than assignments that preceded them. Reporting on additional positions was considered too burdensome for the respondents. We conducted several robustness tests (reported later) to examine whether our results were affected by capping the number of assignments that could be reported in the survey.

combinations of unique divisions in each manager's portfolio and divided by the number of unique combinations. The coherence of a manager's assignments thus is measured as the average pairwise similarity between all unique pairs of divisions in their portfolio (see Appendix for an illustration).

Concentration. To capture the extent to which an R&D manager had spent time in the current division versus other divisions, we first calculated the total number of years each manager had spent in their current division during both their current assignment and any of their previous reported assignments. On average, managers had spent a total of 5.4 years in their current division. We then divided this numerator by the total length of their assignment history reported in the survey. The concentration variable thus captures the share of a manager's total reported assignment portfolio that was spent in the current division (see Appendix for an illustration).

Moderator Variables: Division Characteristics

Environmental uncertainty. We constructed two variables to capture the level of environmental uncertainty facing a manager's current division: *technological uncertainty* and *market uncertainty*, using responses from the R&D directors' survey. Our interviews indicated that directors were ideally suited to assess the uncertainty facing a manager's division because directors typically head divisions at Artemis and are responsible for strategic decision-making at the division level. When multiple directors from the same division responded to the survey, we averaged their responses.[6] We used two four-item scales developed by Jaworksi and Kolhi (1993) and adapted by DeLuca and Atuahene-Gima (2007) to measure technological uncertainty

[6] Of the 25 divisions in which R&D managers in our sample reported working, we received responses from one R&D director for eight divisions and from more than one R&D director for another eight divisions. The level of inter-rater agreement for these divisions was well above the recommended threshold of 0.7 (a_{wg}=0.894 for technological uncertainty, a_{wg}=0.848 for market uncertainty scale) (Brown & Hauenstein, 2005). The 9 divisions for which we did not receive at least one response were relatively small; only 24 managers in our sample worked in them. For these, we used uncertainty measures derived at a higher level of aggregation. Specifically, Artemis classifies its divisions into five industries; we used industry-level technological and market uncertainty for the divisions on which we did have directors' responses. Excluding managers working in these divisions produced results consistent with reported here.

(Cronbach's α=0.80) and market uncertainty (Cronbach's α=0.74).

Slack resources. We use two variables to capture the level of slack in the form of time available for exploration in a manager's current division: *daily slack*, based on informal daily time pressure, and *project slack*, based on formal project timeframes. Our interviews indicated that division-level slack was best captured by combining the views of R&D managers and R&D technologists, since they worked closely together on innovation projects and their experiences of daily and project slack were highly interdependent. Therefore, to measure daily slack at the division level, we reverse-coded a five-item scale capturing informal time pressure (Andrews and Smith 1996 - Cronbach's α=0.71), and then averaged the responses of managers and technologists within the same division. To measure project slack at the division level, we used a survey question in which respondents were asked, for up to five main projects on their work plan, when they expected their work to reach the market or be implemented, with four answer options ranging from less than 1 year to more than 5 years. We calculated the share of a respondent's projects that were due to reach the market or be implemented in more than one year, and then averaged this share for managers and technologists in the same division.[7]

Control Variables

We included five sets of control variables in our models. First, we controlled for additional assignment portfolio characteristics besides our main variables of coherence and concentration. To capture portfolio size, we controlled for the *total number of moves* the manager reported between divisions within Artemis. For example, a manager who worked in Division A followed by Division B followed by Division C reported two moves between divisions. This variable thus

[7] Analysis of variance for the two slack variables indicated that both are valid division-level attributes, since their variance is significantly smaller within divisions than between divisions (*daily slack*: mean squares=1.07 versus 1.35; Bartlett's test=19.14, p-value=0.744; *project slack*: mean squares=0.22 versus 0.37; Bartlett's test= 24.02, p-value= 0.402). Robustness tests using measures derived from managers' answers only generated consistent results.

controls for a manager's overall level of cross-divisional mobility.[8] Although the majority of moves across divisions required changing location too, managers sometimes changed divisions without changing location; conversely, they sometimes changed locations while staying within the same division. To account for the potential impact of such moves, we also included two variables that count the *number of moves across divisions only* and the *number of moves across locations only*. Additionally, we controlled for the *total duration of assignments* reported by the manager (in years), and for whether there were *repeated assignments* to the same division within a manager's portfolio of assignments (coded 1 if yes or 0 if no).

Second, to control for possible quality differences among the R&D managers in our sample, we included a variable for *speed of promotion*, coded as the number of years more or less than the average that the manager took to achieve their current seniority level. The average speed of promotion was calculated using information from the company HR records on all R&D managers' year of entry in Artemis and year of attainment of their current seniority level. Since most R&D managers joined Artemis soon after graduation and promotion from within was the norm, their speed of promotion is a reliable proxy of unobserved managerial quality.

Third, we controlled for several other characteristics of a manager's career history in the firm. We included a *seniority level* dummy variable coded 1 for more senior managers and 0 for less senior managers. We included both *tenure* and *tenure squared*, in years, to account for the possibility that innovative performance may increase with tenure up to a point, but then peak and decline (Ng & Feldman, 2013). We also captured whether a manager had *changed career ladder* (coded 1 if yes or 0 if no), since although R&D employees usually chose the managers' career ladder after ten years at Artemis, there were some who initially chose the technologists' career

[8] We found no evidence of a curvilinear effect using the squared term of the number of moves.

ladder but then switched later. Additionally, we included a variable for whether a manager was *from an acquired company*, coded 1 if yes or 0 if no, since such managers might experience post-acquisition adjustment costs that could affect their performance.

Fourth, we controlled for other attributes that could affect a manager's performance ratings, including *gender*, coded 1 for female and 0 for male (Cardador, 2017), and *intrinsic motivation*, using a 4-item scale developed by Rynes et al. (2004) (Cronbach's α=0.63).

Fifth, we controlled for current responsibilities that could influence managerial performance ratings. Managers who worked for Artemis' largest product lines were responsible for providing the R&D input for products with very high annual sales, and might have faced more resistance to innovation due to the risk of cannibalizing the value of existing assets (Chandy & Tellis, 1998). Other managers did not work for a specific product line, but were instead responsible for supporting the R&D activities of multiple product lines. We therefore included two dummy variables for *largest product line responsibility* (coded 1 if yes, or 0 otherwise) and *non-product line responsibility* (coded 1 if yes, or 0 otherwise). We also controlled for the manager's *number of direct and indirect reports*, measured using categories from 1 to 6 which reflected six size bands ranging from zero full-time employees to 100 or more. Finally, we included fixed effects for the *division* in which a manager currently worked, to control for other division characteristics that were not captured by our moderator variables.[9]

Empirical Approach

Before conducting our main analyses, we consider two possible sources of endogeneity due to self-selection bias in our data.

[9] Specifically, we included 10 division dummies using the higher level industry classification used by Artemis for the divisions with a small number of observations. This avoided identifying specific individuals in our sample and ensured sufficient degrees of freedom in our estimations. We also estimated our models using five industry dummies instead of division dummies and found results consistent with those reported here.

Movers versus non-movers. First, while our main analyses focus only on R&D managers who have worked in more than one division (N=241), there may be unobserved systematic differences between these managers and those who have worked in only one division (N=102). For example, although Artemis strongly encouraged its R&D employees to undertake assignments in different divisions to develop their managerial capabilities, higher-performing individuals might have been more likely to take on this challenge than lower-performing individuals (or vice versa). To address this possibility, we first compared managers who worked in more than one division versus only one division on both their average speed to promotion and the proportion with a top performance rating. We found no statistically significant differences, indicating no clear quality differences using these metrics (t=-0.004, p=0.99; Z=-.369, p=0.69).

Second, we also estimated models based on nearest neighbor matching estimators (Abadie, Drukker, Herr, & Imbens, 2004), to further test for unobserved heterogeneity between movers and non-movers. As exact-matching variables we used gender, seniority, tenure, number of direct and indirect reports, and division. These models enabled us to calculate the average treatment effect for the treated subgroup (ATT), i.e. the impact of moving for those managers who changed division (Abadie et al., 2004). We found no significant impact of moving division on either promotion speed or performance rating either using one match or two matches.

Third, we formally tested for selection bias by estimating a two-stage selection model (Wooldridge, 2010), as shown in Table 1. In the first stage, we predicted the likelihood that a manager moved across divisions at least once (*moved division*, coded 1 if yes or 0 if no). We included three exclusion restrictions suggested by our interviews. First, we included the size of the manager's division in 2010, as measured by the total number of managers in the division (*division size*), because individuals who worked in larger divisions might have been less likely to move to other divisions since they had more opportunities to take on different roles within their division without moving. Second, we included the *proportion of senior managers* (out of total managers) in a division in 2015, to further capture future opportunities for promotion while remaining in the same division. Managers in top-heavy divisions might have been less likely to move but this should not have affected their ability to achieve a higher performance rating in a given year. Third, we included the *number of divisions in R&D site* in 2015, because managers might have been less likely to move division if this required them to move location.[10] As shown in Model 1 in Table 1, all three variables are strongly negative and significant predictors of the probability of moving division, supporting their validity as exclusion restrictions. From this first-stage probit model, we then derived the Inverse Mills' Ratio, which we included in the second-stage probit model predicting managerial performance. Model 2 shows that all three variables do not predict managerial performance, further supporting the choice of these variables as exclusion restrictions. Since the coefficient of the Inverse Mills' Ratio is also not significant in Model 2, we concluded that our main results are not affected by selection bias. We therefore proceeded to test our hypotheses without including the Inverse Mills' Ratio in our main models.

----- Insert Table 1 about here -----

Among movers. Within our sample of movers, there might also be a potential concern of self-selection into particular assignment portfolios, if certain types of managers might have systematically sorted themselves into certain types of assignments. However, our interviews at Artemis indicated that R&D employees who moved divisions had little control over where and when they moved. Although they could express a preference about whether they wanted to

[10] We only have information on the proportion of senior managers and the number of divisions in each R&D site for 2015. Because Artemis underwent an organizational restructuring between 2010 and 2015, we expect these variables to be lower-bound estimates of the impact of these factors in explaining the likelihood of moving.

change division, ultimately decisions about where and when they moved were made by a committee of senior managers based on the needs of the division and their assessment of what experiences, capabilities and skills would benefit a manager. Managers could refuse to accept a new assignment, especially if it involved moving to a new R&D site, but they had to provide compelling reasons. Our qualitative data thus indicated that the possibility of self-selection into particular types of assignments was highly constrained. Still, we further probed the possibility that certain types of managers preferred certain types of assignments by examining two quantitative indicators – whether a manager had worked in companies other than Artemis or not, and whether the manager had received a university degree from their country of birth or elsewhere – on the premise that those who had changed companies or ventured abroad to study might have been inclined to take on more diverse assignments and spend less time in the same division. We found no statistically significant difference in the mean values of coherence and concentration across these two samples of managers, further reducing potential concerns about such self-selection bias.

RESULTS

Table 2 provides descriptive statistics and correlations for the variables in our main models. Table 3 reports the tests of our hypotheses, using logit models with errors clustered by seniority to account for potential correlation in the error terms due to the fact that performance ratings were assigned within each seniority level. Model 1 includes only the control variables. Models 2-4 add the two main independent variables. Models 5-12 include the moderation effects individually. The Variable Inflation Factors in these models are all below 2. Model 13 is the full model.

----- Insert Tables 2 and 3 about here -----

Model 1 shows that among the control variables, promotion speed, intrinsic motivation, and number of reports are each positively and significantly related to managerial performance, while being more senior, from an acquired company, female, and responsible for the largest product line in a division are each negatively and significantly related to managerial performance.

H1 predicted that R&D managers' performance will be stronger if their portfolio of assignments is more coherent. We find support for this hypothesis: the coefficient for coherence is positive and significant in Models 2 and 4 (β=1.267, $p<0.001$; β=0.962, $p<0.05$). H2 predicted that R&D managers' performance will be stronger if their assignment portfolio is more concentrated in the current division. The positive and significant coefficient of the concentration variable in Models 3 and 4 (β=3.067, $p<0.001$; β=2.952, $p<0.001$) supports this hypothesis too. Since it is possible that both coherence and concentration might have curvilinear rather than linear relationships with managerial performance, we also tested for such relationships by including squared terms for these variables in our models, but found no statistically significant evidence of curvilinear effects. Additionally, we examined whether there was a performance premium from having a portfolio that is both coherent and concentrated by including an interaction term between these two variables, but we found no evidence of such an interaction.

H3 predicted that the relationship between portfolio coherence and managerial performance will be less positive in divisions with greater uncertainty. Models 5 and 6 show that the interaction between coherence and technological uncertainty is significant (β=-4.629, $p<0.01$), but the interaction between coherence and market uncertainty is not. Since we use a non-linear model to estimate these moderation effects, we graph them following best practice (Hoetker, 2007).[11] Figure 1A shows how the predicted probability of achieving a top performance rating is related to an increase in technological uncertainty (from one standard

[11] Although not shown, we derived the confidence intervals of the difference between the predicted probability of a top performance rating when the moderator variable is "high" and "low" for each of the graphs in Figures 1 and 2, and found that the marginal effects are all statistically significant for the entire range of the moderated variables.

deviation below to one standard deviation above the mean, while keeping continuous variables at their mean values). As illustrated in Figure 1A, the likelihood of obtaining a top performance rating strongly increases with the level of coherence if technological uncertainty is low, whereas this positive relationship is weaker if technological uncertainty is high. Thus, we find mixed support for H3: the performance benefit of a more coherent portfolio is smaller in divisions with greater technological uncertainty, though not in divisions with greater market uncertainty.

H4 predicted that the relationship between portfolio concentration and managerial performance will be less positive in divisions with greater uncertainty. Models 7 and 8 show that the interaction terms between the concentration variable and our measures of technological uncertainty and market uncertainty are both significant ($\beta=-2.706$, $p<0.01$; $\beta=-4.079$, $p<0.01$). As shown in Figures 2A and 2B, we find that the performance benefits of greater concentration in the current division are lower at higher levels of technological and market uncertainty.

H5 predicted that the relationship between portfolio coherence and managerial performance will be less positive in divisions with more slack resources. The results shown in Models 9 and 10 support this hypothesis: the interactions of portfolio coherence with both daily slack and project slack are negative and significant ($\beta=-12.87$, $p<0.01$; $\beta=-32.41$, $p<0.05$). Figures 1B and 1C show that the positive association between portfolio coherence and managerial performance is weaker when slack resources are high relative to when they are low.

H6 predicted that the relationship between portfolio concentration and managerial performance will be less positive in divisions with more slack resources. Models 11 and 12 reveal mixed support for the hypothesis: the interaction term for daily slack is negative and statistically significant ($\beta=-4.953$, $p<0.05$), while the interaction term for project slack is not significant. Figure 2C shows that the positive association between portfolio concentration and managerial performance is weaker if the division is characterized by higher daily slack.

----- Insert Figures 1 and 2 about here -----

Model 12 reports the full model. All but one of the interaction terms that are statistically significant in the partial models are still significant; the weakened coefficient for the interaction between coherence and daily slack is likely due to multicollinearity arising from the inclusion of multiple interactions with coherence and concentration, as evidenced in a VIF of well over 10.

Robustness Tests

We performed three sets of robustness tests on our findings. To facilitate presentation of these results, Table 4 shows the partial models using each alternative specification in a single vertical column; each partial model includes the full set of control variables (not shown).

----- Insert Table 4 -----

We considered several alternative operationalizations of our main portfolio variables (see Appendix for illustrations). First, the concentration and coherence variables in our main models did not take into consideration how long ago each assignment took place, so we constructed alternative measures that applied a discount to past assignments based on when they were completed, using an annual discount rate of three percent. Second, our coherence measure also did not take account for the duration of the assignments in each of the divisions, so we constructed a weighted version where the Jaccard similarity measure for each pair of divisions is weighted by the share of total time spent in these two divisions over the total duration of an R&D manager's reported assignment history. Third, our coherence measure did not consider the sequence or order of the different divisions an R&D manager had worked in, so we constructed the reverse of the erraticism measure proposed by Leung (2014), by summing the Jaccard similarity indices of consecutive divisions in a manager's portfolio of assignments. Each of these alternative operationalizations produced similar results to our main findings, as shown in Models 1-3 of Table 4. Notably, however, the previously non-significant interaction between coherence and market uncertainty is significant and negative when using both the discounted measure and the weighted measure of coherence, as predicted by H3 (β=-0.284, $p<0.01$; β=-1.250, $p<0.01$).

Next, we tested for the impact of outliers, by excluding those managers who reported working in four divisions or those with a total assignment duration of more than one standard deviation above the mean. The results were fully consistent with our main models, as shown in Models 4 and 5, except that the previously non-significant interaction between concentration and project slack is significant and negative in Model 5 (β=-6.305, $p<0.01$), as predicted by H6.

Finally, we assessed whether our findings are robust if we exclude those R&D managers whose reported assignment history in our survey did not cover their full time as a manager at Artemis, by excluding those for whom more than ten years of work history were not captured. This reduced sample produced results largely consistent with our main findings, as shown in Model 6.

DISCUSSION

Many multi-divisional firms view moving their employees across divisions as a potentially valuable way to promote cross-divisional synergies and develop managerial talent, yet we know little about the performance implications of such intra-firm mobility for these employees. Our study of mobility across divisions within a Fortune 500 firm reveals relationships between an R&D manager’s portfolio of assignments across divisions and the manager’s performance that depend on the characteristics of those assignments (i.e., their concentration and coherence) and also on the context of the manager’s current division (i.e., its environmental uncertainty and slack resources). These findings have implications for our understanding of R&D management and the micro-foundations of innovation within firms, as well as for research on mobility and careers.

Management of Innovation in Multi-Divisional Firms

Much of the literature on strategic innovation management has highlighted macro-level structures and processes that can facilitate innovation in multi-divisional firms, including ambidextrous formal structures (Gibson & Birkinshaw, 2004; He & Wong, 2004; Tushman & O'Reilly, 1996), decentralization of R&D (Argyres & Silverman, 2004), open innovation (Chesbrough, 2003), dedicated units for exploration (Benner & Tushman, 2003), alliances or mergers and acquisitions (Ahuja & Katila, 2001), and inter-division knowledge networks (Tsai, 2001). However, with the exception of some research suggesting that managers may be able to achieve better innovation outcomes if they balance exploration and exploitation (Smith & Tushman, 2005), little attention has been paid to micro-level factors that may affect the abilities of R&D managers – rather than inventors, engineers, or scientists – to contribute to innovation in such firms.

In this study, we focus attention on the distinctive roles of R&D managers, whose activities are understudied yet central to managing the innovation process within such firms (Van de Ven, 1986). In particular, our study highlights the managerial responsibilities of strategic overview and operational oversight, and illuminates the assignment experiences that enable R&D managers to carry out these responsibilities more effectively and thus drive innovation for their firms. This focus on R&D managers complements the much more extensive literature on R&D inventors, engineers, and scientists, helping to advance research on the management of innovation.

We also illuminate the particular patterns of cross-divisional assignments that may increase (or decrease) the effectiveness of R&D managers in their innovation roles. By offering insight into how different configurations of assignments relate to managerial performance, our study of R&D managers' performance at Artemis sheds light on the micro-foundations of innovation within a large multi-divisional firm (Foss & Pedersen, 2016). Our findings show that different decisions about where and when to move between divisions within a firm are associated with different performance outcomes for the firm's R&D managers.

The Contingent Value of Mobility

For a multi-divisional firm, transferring employees across divisions is one way to address the challenge of integrating its differentiated units (Lawrence & Lorsch, 1967). It helps the firm to realize the potential synergies of holding multiple divisions within a single organizational entity by facilitating learning across the firm's divisions (Kogut & Zander, 1992). The benefits of such learning are particularly valuable for current and future managers. Yet mobility across divisions can also be costly for the firm as well as for its employees (Bhaskar-Shrinivas et al., 2005). Consequently, both firms and their employees can benefit from greater understanding of how decisions about where and when to move can affect managerial performance.

While the foundations of much research on mobility within firms lie in theories of internal labor markets and intra-firm vacancy chains (e.g. Althauser, 1989), prior studies of intra-firm mobility usually focus on single moves rather than multiple assignments (e.g. Bidwell, 2011), a feature shared by international business research on expatriate assignments (e.g. Shay & Baack, 2004). This research also usually focuses on career-related outcomes such as hiring or promotions rather than on the performance implications of intra-firm mobility. By taking a portfolio perspective on mobility within firms, our study shows that the characteristics of a manager's set of assignments affect their performance, beyond simply whether they moved at all or how many times they moved. R&D managers at Artemis performed more effectively if their assignments were characterized by greater coherence across divisions and by greater concentration in the current division. These findings suggest that future research on intra-firm mobility can benefit from a portfolio view that considers the nature and duration of the assignments that individuals undertake and their implications for performance.

Some research in the careers literature has gone beyond the effects of single moves to examine the benefits of overall career specialization or generalization for outcomes such as hiring (e.g. Kacperczyk & Younkin, 2017; Leung, 2014). Our study extends this research by focusing on within-firm mobility, and its implications for job performance (see Carpenter, Sanders, & Gregersen, 2001; Choudhury, 2017; Ferguson & Hasan, 2013; Wu et al., 2005). Moreover, we draw attention to the performance implications of the fit between an individual's assignment experiences within a firm and the context in which the individual is currently working. Our findings from Artemis show that portfolio coherence and concentration did not have curvilinear relationships with managerial performance as main effects, indicating that it was not the case that high levels of coherence and concentration were generally negative. Instead, the positive main effects of coherence and concentration were contextually dependent: a more coherent or concentrated portfolio was more beneficial for managerial performance in divisions that favored exploitation than in those that favored exploration. Thus, examining contextual effects was more informative than focusing on curvilinear effects of mobility in this setting. These findings reveal the contingent value of mobility, and indicate that research on mobility and careers can be advanced by paying greater attention to the contingent effects of different mobility patterns for different outcomes in different contexts, rather than assuming that some patterns are always better than others.

Limitations and Future Directions

While our study advances understanding of mobility and innovation within firms, the empirical design of the study has several limitations which suggest directions for future research. First, as explained earlier, our survey respondents could only report on assignments in up to four different divisions of the firm, given the excessive burden that a longer survey would have imposed. We conducted several robustness checks to ensure that this limitation did not substantially affect our results, but future research could usefully collect data on individuals' complete sets of assignments within a firm or, potentially, across their entire working careers. Second, while our study did not reveal curvilinear main effects of either coherence or concentration at Artemis, it is possible that very high levels of coherence or concentration might be negative in other settings, particularly those where lack of sufficient experience in different contexts could be really detrimental to managerial performance. Third, our dependent variable measured R&D managers' performance using ratings derived from an intensive firm-specific evaluation process, which Artemis utilized extensively and relied on heavily in determining a manager's pay and promotion prospects. Nevertheless, other measures that focus on specific components of R&D managers' performance could usefully be examined in future studies. Fourth, we treated Artemis' divisions and the differences between them as fixed in our study, yet these divisions may have changed over time, leading to a realignment of intra-organizational knowledge (Karim & Kaul, 2015), and divisions may also differ in their willingness to share knowledge with each other (Tsai, 2002). While we are unable to assess how such factors may shape the benefits of prior divisional experience for R&D managers' performance in this study, these issues could be tackled in future studies. Finally, our study was conducted within a single, very large, multi-divisional firm. We would expect our findings to be replicable in other large multi-divisional firms, as well as in smaller firms where managers rotate between different departments or areas, but this should be confirmed in future research.

Conclusion

This study has aimed to shed light on how intra-firm mobility affects the performance of R&D managers in a multi-divisional firm. Our findings show that managers whose assignment portfolios were more coherent across divisions or more concentrated in their current division performed better. However, the benefits of a more coherent or more concentrated portfolio were reduced if the current division's context favored exploration over exploitation. Together, these findings demonstrate the contingent value of intra-firm mobility, and advance understanding of the conditions that enable R&D managers to perform their innovation roles successfully.

Table 1. Testing for sample selection bias

	DV=Moved division	DV=Managerial performance
Division size	-0.00744***	-0.00171
	(0.00)	(0.00)
Proportion of senior managerial positions	-2.620***	0.928
	(0.71)	(4.24)
Number of divisions on site	-0.0390***	-0.00836
	(0.00)	(0.01)
Inverse Mills' ratio		0.63
		(2.19)
Coherence		0.516***
		(0.09)
Concentration		1.701***
		(0.02)
Technology uncertainty	-0.563***	-0.84
	(0.21)	(0.93)
Market uncertainty	0.898***	1.013
	(0.29)	(1.24)
Daily slack	-1.831**	-0.937***
	(0.90)	(0.04)
Project slack	2.465	-0.472
	(2.28)	(1.23)
Total number of moves [a]		0.344
		(0.24)
Moves across divisions only [a]		-0.113
		(0.19)
Moves across locations only	-0.613***	-0.25
	(0.03)	(0.51)
Total duration of assignments	-0.0105	-0.0171
	(0.02)	(0.03)
Repeated assignments [a]		-0.698
		(0.56)
Speed of promotion	0.00935*	0.0630***
	(0.00)	(0.02)
Senior manager	0.0364	-0.769***
	(0.03)	(0.03)
Tenure	0.0403	0.107**
	(0.08)	(0.05)
Tenure squared	-0.00045	-0.00275***
	(0.00)	(0.00)
Changed career track	-0.324***	-0.123
	(0.04)	(0.39)
From acquired company	-1.521***	-2.210*
	(0.37)	(1.25)
Gender	-0.00234	-0.145***
	(0.02)	(0.05)
Intrinsic motivation	0.0262***	0.0836*
	(0.00)	(0.05)
Largest product line responsibility	-0.274*	-0.663***
	(0.16)	(0.07)
Non-product line responsibility	-0.334	-0.833***
	(0.39)	(0.17)
Number of direct & indirect reports	0.1	0.477***
	(0.06)	(0.10)
Constant	1.197***	-3.180***
	(0.01)	(0.12)
Division FEs	Yes	Yes
N	343	241
Ll	-160.9	-124.8

Note: * Significant at p< .10; ** Significant at p< .05; *** Significant at p< .01.
Robust standard errors clustered by rank
[a] This variable could not be included in the first stage model because of simultaneity issues, e.g. total number of moves variable is always 1 for managers who never moved divisions.

Table 2. Descriptive statistics and correlation matrix

		Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	Managerial performance	0.3	0.46	0	1																					
2	Coherence	0.4	0.24	0	0.97	0.02																				
3	Concentration	0.4	0.21	0	0.9	0.08	0.17																			
4	Technology uncertainty	2.68	0.62	1.67	3.83	-0.07	0.15	0.07																		
5	Market uncertainty	3.38	0.68	2	4.38	0.09	-0.13	0.06	0.06																	
6	Daily slack	1.08	0.2	0.47	1.53	0.02	-0.06	-0.01	-0.21	0.24																
7	Project slack	0.7	0.07	0.47	0.85	0.02	0.13	0.05	-0.21	0.01	0.42															
8	Total number of moves	1.63	0.7	1	3	0.02	-0.11	-0.21	0.08	0.04	-0.06	-0.09														
9	Moves across divisions only	0.65	0.73	0	3	-0.03	0.14	-0.04	0.02	0.10	0.14	0.03	0.38													
10	Moves across locations only	0.36	0.55	0	2	-0.07	-0.09	-0.02	0.01	-0.05	0.04	0.03	-0.28	-0.19												
11	Total assignment duration	13.64	4.74	5	31	-0.07	-0.10	-0.05	-0.10	0.03	-0.09	-0.09	0.07	-0.07	0.08											
12	Repeated assignments	0.16	0.37	0	1	-0.01	0.00	0.31	0.09	0.09	-0.01	0.01	0.47	0.27	-0.16	-0.04										
13	Speed of promotion	-0.02	4.13	-14	11	0.13	0.02	-0.14	-0.05	0.00	0.15	0.09	0.10	0.04	-0.05	-0.21	0.05									
14	Senior manager	0.22	0.42	0	1	0.01	-0.07	-0.04	0.00	-0.02	0.11	0.08	0.03	-0.04	0.08	0.03	-0.01	0.11								
15	Tenure	20.12	5.8	7	38	-0.10	-0.15	0.02	-0.07	-0.04	-0.07	-0.08	0.05	-0.02	0.10	0.53	0.01	-0.44	0.22							
16	Changed career track	0.02	0.13	0	1	-0.02	-0.11	0.00	-0.11	0.06	-0.02	0.04	0.07	0.02	0.03	0.00	0.12	0.02	-0.07	0.06						
17	From acquired company	0.03	0.17	0	1	-0.06	-0.09	0.01	-0.09	0.04	0.11	0.05	-0.05	0.02	-0.02	-0.03	-0.08	0.19	-0.03	-0.10	-0.02					
18	Gender	0.37	0.48	0	1	-0.04	-0.05	0.08	0.08	-0.07	-0.20	-0.11	-0.03	-0.04	-0.04	0.02	-0.03	-0.09	-0.09	-0.11	-0.03	-0.03				
19	Intrinsic motivation	0.03	0.97	-3.59	1.73	0.07	0.01	0.02	0.02	-0.09	0.06	0.11	-0.05	0.00	0.02	-0.03	0.03	0.07	0.11	0.02	-0.05	0.03	0.02			
20	Largest product line resp.	0.69	0.46	0	1	-0.03	0.10	0.12	0.03	-0.13	0.03	0.15	-0.02	0.05	0.04	-0.16	-0.03	0.15	0.06	-0.25	0.02	0.01	0.01	-0.02		
21	Non-product line resp.	0.12	0.33	0	1	-0.05	-0.21	-0.07	0.02	0.14	0.09	0.01	0.11	0.07	0.01	0.13	0.09	-0.09	-0.02	0.17	-0.05	-0.06	-0.02	0.01	-0.56	
22	No. of direct & indirect reports	3.7	1.12	1	6	0.14	-0.02	-0.06	0.06	-0.02	0.11	-0.04	0.08	0.02	-0.03	-0.10	0.06	0.20	0.62	-0.04	-0.14	0.07	-0.04	0.07	0.10	-0.03

Table 3. Logit model predicting managerial performance (N=241)

	1	2	3	4	5	6	7	8	9	10	11	12	13
Total number of moves	0.103	0.136	0.536	0.542	0.588*	0.542	0.512	0.682	0.57	0.451	0.54	0.553	0.651
	(0.34)	(0.37)	(0.42)	(0.41)	(0.36)	(0.41)	(0.41)	(0.47)	(0.38)	(0.47)	(0.42)	(0.45)	(0.43)
Moves across divisions only	-0.161	-0.22	-0.173	-0.218	-0.255	-0.214	-0.199	-0.288	-0.231	-0.211	-0.19	-0.221	-0.204
	(0.27)	(0.29)	(0.24)	(0.24)	(0.26)	(0.23)	(0.21)	(0.27)	(0.22)	(0.27)	(0.22)	(0.25)	(0.19)
Moves across locations only	-0.225	-0.181	-0.171	-0.14	-0.208	-0.141	-0.142	-0.174	-0.18	-0.157	-0.167	-0.153	-0.25
	(0.18)	(0.22)	(0.16)	(0.20)	(0.30)	(0.21)	(0.15)	(0.16)	(0.22)	(0.21)	(0.20)	(0.21)	(0.19)
Total assignment duration	-0.0171	-0.0197	-0.0132	-0.016	-0.0392	-0.0149	-0.0222	-0.0296	-0.0221	-0.0226	-0.0149	-0.0166	-0.0493
	(0.04)	(0.04)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.02)	(0.03)	(0.03)	(0.03)
Repeated assignments	-0.333	-0.309	-1.274	-1.2	-1.224	-1.207	-1.204	-1.338	-1.116	-1.045	-1.216	-1.199	-1.364
	(0.87)	(0.89)	(0.96)	(0.96)	(1.04)	(0.98)	(1.04)	(1.00)	(1.03)	(1.05)	(1.04)	(1.01)	(1.19)
Speed of promotion	0.0825***	0.0818**	0.114***	0.111***	0.103***	0.112***	0.123***	0.116***	0.111***	0.110***	0.113***	0.116***	0.125***
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.02)	(0.02)	(0.02)	(0.01)	(0.03)
Senior manager	-1.132***	-1.118***	-1.292***	-1.280***	-1.241***	-1.287***	-1.360***	-1.483***	-1.302***	-1.232***	-1.266***	-1.297***	-1.564***
	(0.03)	(0.03)	(0.08)	(0.07)	(0.11)	(0.08)	(0.09)	(0.01)	(0.07)	(0.06)	(0.09)	(0.13)	(0.03)
Tenure	0.114	0.123*	0.146**	0.149**	0.191**	0.149**	0.183**	0.128**	0.159**	0.180**	0.146*	0.143**	0.205***
	(0.08)	(0.07)	(0.07)	(0.07)	(0.09)	(0.07)	(0.07)	(0.06)	(0.07)	(0.08)	(0.08)	(0.06)	(0.07)
Tenure squared	-0.00325	-0.00334	-0.00420**	-0.00418**	-0.00511**	-0.00418**	-0.00488**	-0.00360*	-0.00438**	-0.00490**	-0.00415*	-0.00399**	-0.00537**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Changed career track	-0.218	-0.115	-0.0703	-0.0158	0.343	0.00492	-0.247	-0.508*	-0.293	-0.235	0.0804	0.02	-0.497
	(0.25)	(0.30)	(0.22)	(0.23)	(0.50)	(0.28)	(0.36)	(0.26)	(0.46)	(0.23)	(0.34)	(0.33)	(1.07)
From acquired company	-2.666***	-2.659***	-3.088***	-3.059***	-2.850***	-3.066***	-3.435***	-3.410***	-3.330***	-3.364***	-2.920***	-2.998***	-3.797***
	(0.32)	(0.26)	(0.57)	(0.48)	(0.10)	(0.50)	(0.67)	(0.37)	(0.86)	(1.04)	(0.32)	(0.30)	(0.45)
Gender	-0.212***	-0.151***	-0.299***	-0.246***	-0.187**	-0.248***	-0.217***	-0.185	-0.255***	-0.178***	-0.314**	-0.269**	-0.106
	(0.01)	(0.04)	(0.03)	(0.07)	(0.09)	(0.08)	(0.07)	(0.13)	(0.06)	(0.07)	(0.13)	(0.13)	(0.18)
Intrinsic motivation	0.172**	0.168	0.150**	0.147	0.239**	0.147	0.197*	0.217*	0.149	0.228**	0.172*	0.141*	0.404***
	(0.08)	(0.11)	(0.07)	(0.09)	(0.10)	(0.09)	(0.10)	(0.12)	(0.11)	(0.09)	(0.09)	(0.09)	(0.12)
Largest product line resp.	-0.723*	-0.698	-1.048**	-1.009**	-1.151***	-1.012**	-1.066***	-1.376***	-1.103***	-0.939**	-1.025**	-1.036**	-1.573***
	(0.42)	(0.43)	(0.42)	(0.41)	(0.34)	(0.42)	(0.39)	(0.50)	(0.36)	(0.41)	(0.44)	(0.45)	(0.29)
Non-product line resp.	-1.106	-1.093	-1.340**	-1.310**	-1.307**	-1.311**	-1.367**	-1.582*	-1.350**	-1.090**	-1.355**	-1.333**	-1.475**
	(0.69)	(0.67)	(0.68)	(0.65)	(0.53)	(0.65)	(0.69)	(0.91)	(0.60)	(0.48)	(0.65)	(0.67)	(0.59)
No. direct & indirect reports	0.684***	0.687***	0.805***	0.799***	0.748***	0.803***	0.785***	0.871***	0.810***	0.759***	0.808***	0.807***	0.807***
	(0.00)	(0.00)	(0.03)	(0.02)	(0.05)	(0.03)	(0.06)	(0.04)	(0.04)	(0.03)	(0.04)	(0.05)	(0.09)

	1	2	3	4	5	6	7	8	9	10	11	12	13
Technology uncertainty	-0.960***	-1.033***	-1.100***	-1.161***	-0.266	-1.164***	-0.147	-1.256***	-1.152***	-1.085***	-1.089***	-1.170***	0.647
	(0.33)	(0.33)	(0.25)	(0.21)	(0.18)	(0.21)	(0.27)	(0.21)	(0.19)	(0.15)	(0.18)	(0.22)	(0.65)
Market uncertainty	0.837***	0.933***	1.187***	1.246***	1.333***	1.213***	1.350***	3.176***	1.371***	1.575***	1.256***	1.246***	3.198***
	(0.14)	(0.16)	(0.16)	(0.20)	(0.23)	(0.29)	(0.05)	(0.17)	(0.31)	(0.04)	(0.19)	(0.24)	(0.57)
Daily slack	-1.764*	-1.951*	-1.580***	-1.733***	-1.562***	-1.730***	-1.653	-1.825***	0.587	-3.005***	-0.371***	-1.604***	-0.0432
	(0.92)	(1.01)	(0.47)	(0.45)	(0.30)	(0.44)	(1.01)	(0.51)	(0.67)	(0.97)	(0.12)	(0.10)	(2.27)
Project slack	1.593***	1.769***	1.569***	1.674***	1.435**	1.650***	2.550***	1.532***	2.118***	11.93***	2.095***	3.797	10.04
	(0.38)	(0.24)	(0.13)	(0.13)	(0.66)	(0.19)	(0.61)	(0.22)	(0.49)	(4.60)	(0.61)	(4.32)	(7.25)
Coherence		1.267***		0.962**	14.16***	0.436	1.168***	0.438	14.51***	23.87**	1.074***	1.004***	28.38***
		(0.07)		(0.40)	(1.23)	(1.73)	(0.19)	(0.41)	(4.03)	(9.67)	(0.29)	(0.28)	(4.27)
Concentration			3.067***	2.952***	3.082***	2.979***	10.09***	17.34***	3.192***	2.957***	8.180***	8.468	29.16***
			(0.23)	(0.13)	(0.31)	(0.18)	(0.13)	(0.06)	(0.10)	(0.39)	(2.45)	(11.52)	(5.14)
Coherence x Technology uncertainty					-4.629***								-3.287***
					(0.48)								(0.07)
Coherence x Market uncertainty						0.159							1.6
						(0.40)							(1.32)
Concentration x Technology uncertainty							-2.706***						-2.970***
							(0.02)						(1.00)
Concentration x Market uncertainty								-4.079***					-3.917***
								(0.07)					(0.42)
Coherence x Daily slack									-12.87***				-6.536
									(3.76)				(7.47)
Coherence x Project slack										-32.41**			-23.74**
										(13.83)			(11.18)
Concentration x Daily slack											-4.953**		-3.201***
											(2.15)		(1.01)
Concentration x Project slack												-7.817	-0.534
												(16.05)	(11.12)
Constant	-2.237***	-2.823***	-5.248***	-5.505***	-8.334***	-5.401***	-9.393***	-11.53***	-8.789***	-12.72***	-7.470***	-7.098**	-25.13***
	(0.49)	(0.45)	(0.26)	(0.52)	(0.45)	(0.80)	(0.08)	(0.39)	(1.21)	(3.13)	(0.67)	(2.99)	(0.64)
Division FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Log-Likelihood	-131.30	-130.34	-126.12	-125.59	-121.77	-125.58	-123.72	-119.57	-123.24	-123.08	-124.90	-125.43	-112.43
McKelvey & Zavoina's R^2	0.24	0.25	0.31	0.32	0.36	0.32	0.34	0.40	0.35	0.33	0.33	0.32	0.47
LR ratio test (degree of freedom)		1.93(1)*	10.37(1)***	11.42(2)***	7.64(1)***	0.01(1)	3.74(1)**	12.04(1)***	4.70(1)**	5.01(1)**	1.39(1)	0.33(1)	26.32(8)***

Note: *p< .10; **p< .05; *** p< .01. Robust standard errors clustered by rank; LR ratio test compares M2-4 to M1 and M5-12 to M4

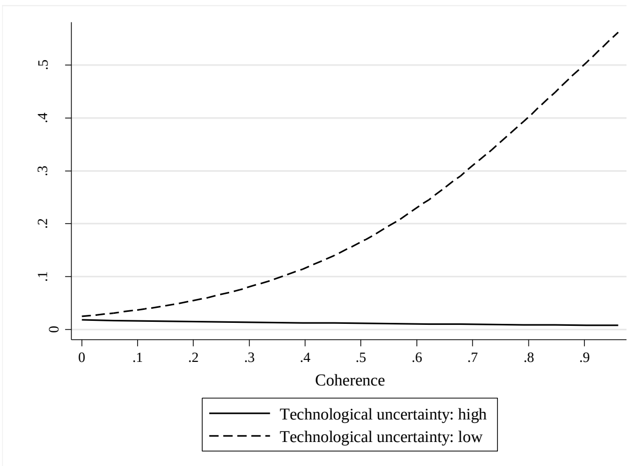
Table 4. Robustness tests (DV = Managerial performance)

	Discounted measures	Weighted coherence	Reversed erratic moves	2 or 3 asgs only	Excl. with earliest asgs	Excl. with short asgs
	1	2	3	4	5	6
Technological uncertainty	0.0233	-0.135	-0.249	-0.408***	-0.24	-0.162
	(0.31)	(0.30)	(0.15)	(0.07)	(0.37)	(0.37)
Market uncertainty	1.440***	1.266***	1.342***	2.130***	2.363***	0.968
	(0.16)	(0.06)	(0.26)	(0.28)	(0.03)	(0.74)
Daily slack	-1.697**	-1.435*	-1.548	-2.391	-4.671***	-2.409**
	(0.79)	(0.86)	(0.94)	(1.77)	(1.13)	(1.03)
Project slack	2.522***	2.192***	2.128*	0.79	6.247	4.211
	(0.21)	(0.26)	(1.20)	(2.35)	(4.12)	(4.31)
Coherence	1.943***	1.419***	2.368	0.801*	1.089***	0.798*
	(0.01)	(0.34)	(1.83)	(0.42)	(0.22)	(0.44)
Concentration	11.30***	9.834***	10.11***	10.12***	9.368***	7.052***
	(0.17)	(0.06)	(0.73)	(0.23)	(0.41)	(1.00)
Coherence x Technological uncertainty	-3.934***	-3.756***	-1.561***	-5.602***	-6.027***	-5.224***
	(1.25)	(0.34)	(0.57)	(0.08)	(1.94)	(1.07)
Coherence x Market uncertainty	-0.284***	-1.250***	-0.00557	-0.379	-0.5	-0.14
	(0.08)	(0.41)	(0.33)	(0.44)	(0.48)	(0.57)
Concentration x Technological uncertainty	-3.191***	-2.699***	-2.705***	-2.805***	-2.771***	-1.832***
	(0.11)	(0.06)	(0.28)	(0.05)	(0.01)	(0.66)
Concentration x Market uncertainty	-4.406***	-4.043***	-4.043***	-4.659***	-4.863***	-3.476***
	(0.41)	(0.04)	(0.03)	(0.49)	(0.60)	(0.43)
Coherence x Daily slack	-9.765***	-11.69***	-8.062*	-13.71***	-12.20***	-14.32
	(2.24)	(0.54)	(4.76)	(4.41)	(4.19)	(9.56)
Coherence x Project slack	-25.32***	-56.39***	-18.38	-67.06***	-29.30***	-28.33*
	(6.03)	(14.67)	(15.03)	(9.00)	(5.24)	(16.91)
Concentration x Daily slack	-5.486**	-4.894**	-4.906**	-7.324*	-5.209*	-4.794**
	(2.41)	(2.09)	(2.16)	(3.75)	(2.77)	(2.13)
Concentration x Project slack	-8.939	-8.652	-9.059	-21.2	-6.305***	-6.393
	(17.82)	(16.29)	(15.78)	(17.92)	(1.63)	(7.35)
Division FEs	yes	yes	yes	yes	yes	Yes
N	241	241	241	210	208	189

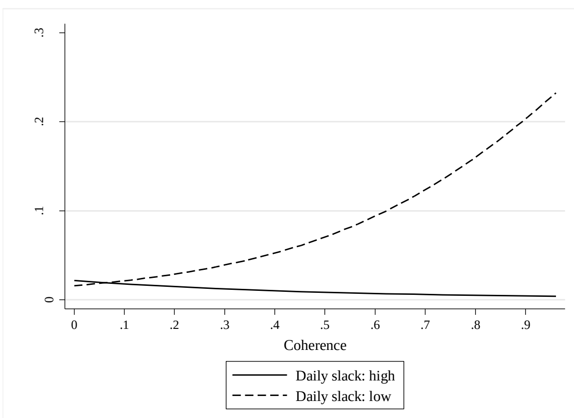
Note:* Significant at p< .10; ** Significant at p< .05; *** Significant at p< .01.Robust standard errors clustered by rank.
Each column reports the coefficient estimates of the interaction terms found in the partial Models 5-12 of Table 3. All models included full set of controls.

Figure 1. Moderating effects of environmental uncertainty and slack resources on the relationship between assignment portfolio coherence and managerial performance

1A



1B



1C

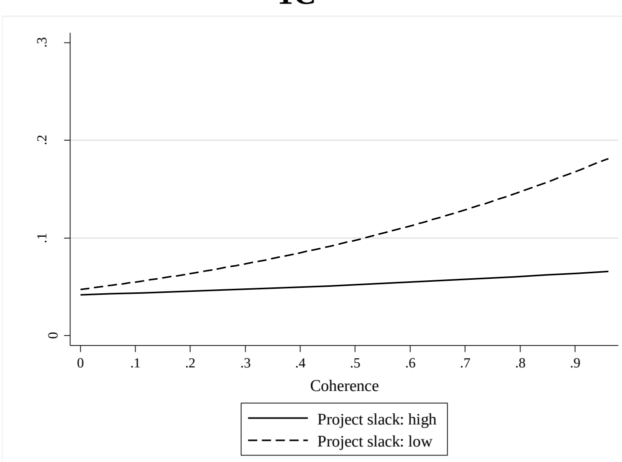
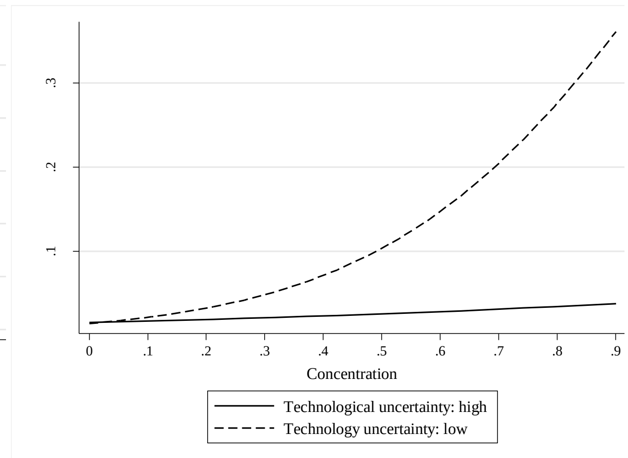
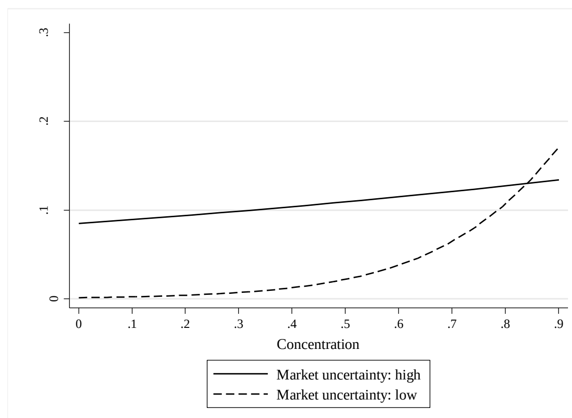


Figure 2. Moderating effects of environmental uncertainty and slack resources on the relationship between assignment portfolio concentration and managerial performance

2A



2B



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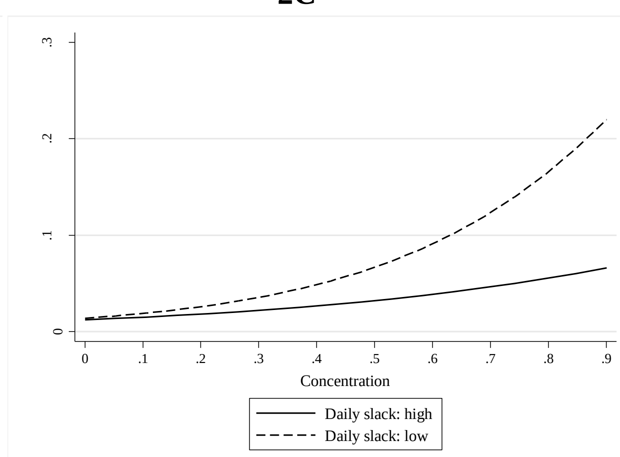

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APPENDIX

Alternative operationalizations of portfolio concentration and portfolio coherence

Manager	Assignments	Year started	Year ended	Assignment duration	Total duration	Concentration measures	Coherence measures
M1	Division A	2005	2009	4	10	Concentration: 3/10 Discounted: 3/10	Coherence: (Jacc AB+JaccAC+JaccBC)/3 Discounted: [JaccAB*(0.97^(2015-2009)+JaccAC*0. 97^(2015-2009)+ JaccBC*0.97^(2015-2012)]/3 Weighted: /JaccAB*[(4+3)/10]+JaccAC*[(4+3)/10]+JaccBC*[(3+3)/10]}/3 Reversed Erraticism: (JaccAB+JaccBC)/2
M1	Division B	2009	2012	3			
M1	Division C	2012	2015	3			
M2	Division A	1999	2005	6	16	Concentration: (2+6)/16 Discounted: [2+6^*(0.97^(2015-2005)]/16	Coherence: (Jacc AB+JaccAC+JaccBC)/3 Discounted: [JaccAB*(0.97^(2015-2005)+JaccAC*0. 97^(2015-2005)+ JaccBC*0.97^(2015-2010)+JaccAA*0.97^(2015-2005)]/4 Weighted: /JaccAB*[(6+5)/16]+JaccAC*[(6+3)/16]+JaccBC*[(5+3)/16]+ JaccAA*[(2+6)/16}}/4 Reversed Erraticism: (JaccAB+JaccBC+JaccCA)/3
M2	Division B	2005	2010	5			
M2	Division C	2010	2013	3			
M2	Division A	2013	2015	2			