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Supply-Side Inducements and Resource Redeployment in Multi-Unit Firms

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Abstract: We examine to what extent and when multi-unit firms internally redeploy managers between units. While theory has emphasized how changes in demand conditions affect redeployment, we argue that optimal internal resource allocation involves consideration of both demand and each unit's resource supply. We formalize this argument, showing how redeployment arises from "supply-side inducements"—return advantages in new over existing resource uses resulting from changes in resource supply. Empirical tests using manager deaths as an exogenous, supply-side shock to firms' resource stocks support our arguments, showing that firms frequently redeploy resources away from better-endowed and toward negatively affected units. Incorporating supply-side inducements into redeployment theory implies additional value-creation opportunities from redeployment and carries novel predictions for the direction of intra-firm resource flows.

Keywords: resource allocation, redeployment, inducements, human capital, firm growth

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1 INTRODUCTION

Research has long maintained that firms exist to internally allocate resources that are costly to transact in external markets (Coase, 1937; Teece, 1982). Because firms' resource needs evolve, internal allocation is dynamic and a central question is how firms redeploy resources as they grow and contract (Folta, Helfat, & Karim 2016; Karim & Capron, 2016). Recent theory proposes that the internal allocation of capacity-constrained resources proceeds on the basis of opportunity cost (Levinthal & Wu, 2010, 2022) and entails considerations of inducements—defined as return advantages in new over existing resource uses—and adjustment costs, which are the costs of transferring and adapting resources (Helfat & Eisenhardt, 2004; Sakhartov & Folta, 2014, 2015). A common finding is that firms tend to withdraw resources from declining, maturing, or technologically obsolete products and industries and use them to enter more promising markets (Anand, 2004; Anand & Singh, 1997; Giarratana & Santaló, 2020; Miller & Yang, 2016; Wu, 2013).

Studies of redeployment provide important insights into how demand conditions influence firms' resource allocation decisions. Surprisingly, the effects of supply-side conditions on redeployment have not been formally examined. Building on Levinthal & Wu (2010), we develop a formal model that includes both demand and supply conditions and analyze how changes in each affect opportunity cost and redeployment. Our model yields several insights. First, it formally shows how changes in resource stocks affect opportunity cost and create "supply-side inducements" that can trigger value-creating redeployment even absent changes in demand conditions. Second, it reveals that supply- and demand-side inducements lead to distinct patterns of redeployment. Specifically, the model predicts redeployment *toward* units experiencing negative shocks to their resource stocks and redeployment *away from* units experience positive shocks. These predictions are the opposite of the pattern that typically follows demand-side shocks; consistent with prior theory, the model predicts that negative (positive) demand-side shocks encourage redeployment away from (toward) the affected units. Finally, echoing Penrose's (1959) theory of growth, our model shows how shocks to firms' resource stocks affect the likelihood of unit openings and closings; however, we identify redeployment rather than resource-sharing as a key mechanism in that relationship.

We then test our model's predictions by examining worker redeployment using an employer-employee matched census from Brazil. We examine the accumulation, depletion, and redeployment of managerial human capital in a large, cross-industry sample of multi-unit firms. To provide causal estimates, we study the impact of sudden, non-work-related deaths of managers, a plausibly exogenous shock to units' managerial resource stocks (Carnahan, 2017; Jäger & Heining, 2022). Results show that these shocks lead to redeployment patterns that are consistent with the model's predictions. Firms are more (less) likely to redeploy managers into (out of) units after these suffer a negative shock to their stock of managerial human capital. We also find that shocks to firms' managerial resource stocks affect firm growth. Firms that suffer a negative shock become more likely to close units and less likely to open units. Finally, we present direct evidence that unit openings and closings trigger redeployment, consistent with both prior research and our model's predictions.

This paper's main contribution is to extend redeployment theory (e.g., Helfat & Eisenhardt, 2004; Levinthal & Wu, 2010; Sakhartov & Folta, 2014, 2015) by offering a formal analysis of how demand-side and supply-side shocks affect the internal opportunity cost of resources and contribute to inducements that drive redeployment. Introducing supply-side inducements into the literature is important because they imply that changes in demand conditions, while sufficient, are not necessary for redeployment. Changes in relative resource supply, which can arise from various factors that differentially affect resource stock accumulation across firm units, can also prompt redeployment. This insight broadens our understanding of the scope of the theory and implies that redeployment can create value not only in diversified firms, which have been the focus of empirical studies of redeployment (e.g., Belenzon & Tsolmon, 2016; Chang & Matsumoto, 2022; Dickler et al., 2022; Dickler & Folta, 2020; Giarratana, Pasquini, & Santaló, 2021; Lieberman et al., 2017; Sabel & Sasson, 2023; Sohl & Folta, 2021), but also in non-diversified, multi-unit firms. We also extend theory by illuminating the distinct patterns of intra-firm resource flows that result from different sources of inducements. In doing so, we identify value-creation opportunities from the redeployment of resources away from units where resource supply is relatively abundant to less-well-endowed units, and we illustrate how firms can use redeployment to engage in "resource spreading" that mitigates the effects of supply-side shocks on individual units.

Finally, we offer rare empirical evidence linking managerial resource accumulation to firm growth (Helfat, 2021). While theory frequently emphasizes the importance of experienced managers, empirical evidence is scant. Our data allow us to offer causal evidence of managers' effect on unit openings and closings that supports the predictions of our model while also revealing insights into the magnitude and patterns of their redeployment across a large sample of firms.

2 THEORY AND HYPOTHESES

2.1 Theoretical background

In this section, we discuss optimal within-firm allocation of scarce resources, i.e., productive inputs that cannot be readily acquired in external markets due to market frictions or firm-specificity and therefore must be accumulated (Barney, 1991; Dierickx & Cool, 1989). Resource redeployment—the act of partially or fully withdrawing resources from one use and reallocating them to another within a firm—is pertinent when scarce resources are applicable across uses but are non-scale free and thus cannot be shared, such as human capital (Anand, Kim, & Lu, 2016; Levinthal & Wu, 2010). In an influential article, Levinthal & Wu (2010) propose that such resources are optimally allocated within firms based on their opportunity cost and model how changes in a firm's demand environment affect resource allocation. We extend this work by developing a model that considers how supply-side factors—specifically, changes to units' resource stocks—affect intra-firm resource allocation even absent changes in demand. Our model yields three novel insights. First, like demand-side shocks, supply-side shocks to resource stocks can create inducements and trigger value-creating resource redeployment. Second, unlike adverse demand-side shocks, adverse supply-side shocks often lead to redeployment *toward* negatively impacted units. Finally, while adverse demand-side shocks tend to increase the likelihood of business exit and simultaneous entry, adverse supply-side shocks increase exit but make unit openings *less* likely.

2.2 A model of resource redeployment with shocks to resource stocks

Consider a firm deciding how to allocate its stock of non-scale-free resources ($T > 0$) across two units, which may represent the firm's activities in distinct industries or geographic locations. Production in both units is described by:

$$Q_m = \gamma_m t_m^{\alpha}, \qquad 0 < \alpha < 1 \tag{1}$$

where t_m is the amount of resources allocated to unit m (from total resource stock T) and $\gamma_m > 0$ are the firm's scale-free resources. Scale-free resources entail no opportunity cost, but their applicability may differ across units.

[1] This description of production resembles Levinthal & Wu's (2010) but specifies that the production technology exhibits decreasing returns to scale. This is a common assumption in the firm diversification literature (e.g., Gomes & Livdan, 2004; Maksimovic & Phillips, 2002), but it is not essential for the argument. Other constraints that limit expansion in a market, such as downward-sloping demand or a second input with increasing marginal cost (e.g., limits on factory size), are also sufficient for the results. Finally, we assume firms are price takers facing $p_m > 0$ in each market and have a per period fixed cost of operating each unit, $F \geq 0$. Initially, we discuss the case in which fixed costs are sufficiently low that the firm chooses to operate both units ($t_1 > 0, t_2 > 0$) and generate hypotheses regarding redeployment between them. Later, we consider when firms will open or close units and the implications for redeployment.[2] The firm's profit is given by:

$$\Pi(t_1, t_2) = p_1\, \gamma_1\, t_1^{\alpha} + p_2\, \gamma_2\, t_2^{\alpha} - \sum_{m=1}^{2} F\, \mathbb{1}(t_m > 0)\,, \qquad t_1 + t_2 \leq T \tag{2}$$

While Levinthal and Wu (2010) assume the firm's resource stock (T) is fixed, we note that this stock may change over time due to gradual processes of resource accumulation and depletion or sudden shocks to accumulated resource stocks (Dierickx & Cool, 1989).[3] Consider a firm that experiences resource shocks $\delta = (\delta_1, \delta_2)$ so that the firm's total stock equals $\tilde{T} = T + \delta_1 + \delta_2$ and each unit has $\tilde{t}_m = t_m + \delta_m$ resources. The default, post-shock allocation is not necessarily profit-maximizing; thus, the firm may wish to redeploy resources following the shocks. Assume the firm must pay a fixed, symmetric adjustment cost $\tau \geq 0$ to redeploy resources between units

[1] Allowing the applicability of the firm's scale-free resources to differ across units also subsumes the possibility of potential differences in efficiency or technology across units in a firm.
[2] In the online appendix, we present the model while simultaneously considering both the number of units to operate and whether to redeploy resources between them.
[3] By "shock" we mean changes in resource stocks that are not deliberately decided on by the firm.

(Helfat & Eisenhardt, 2004). In the online appendix, we show that the profit-maximizing resource allocation before considering adjustment and fixed costs is:

$$\tilde{t}_m^* = w_m \tilde{T}, \text{ where } w_m = \frac{(p_m \gamma_m)^{\frac{1}{1-\alpha}}}{\sum_{k=1}^{M} (p_k \gamma_k)^{\frac{1}{1-\alpha}}} < 1 \quad (3)$$

Intuitively, Equation (3) implies that firms want to allocate more of their resource stock to units that are more productive and enjoy higher prices. Following the shocks, firms will redeploy resources to achieve this allocation when the return difference between it and the default allocation that ensues post-shocks exceeds adjustment costs. The firm redeploys if:

$$\underbrace{\Pi(\tilde{t}_1^*, \tilde{t}_2^*) - \Pi(t_1 + \delta_1, t_2 + \delta_2)}_{\text{Return difference (Inducement)}} \geq \underbrace{\tau}_{\text{Adjustment costs}} \quad (4)$$

Equation (4) shows that, like demand-side shocks, supply-side shocks can create inducements—i.e., return advantages in new over existing resource uses. Firms redeploy resources when the inducements are sufficiently large and adjustment costs are sufficiently low.[4] Supply-side shocks, however, yield novel predictions regarding the *direction* of redeployment. When the inequality in Equation (4) holds, the amount of resources redeployed to achieve the allocation $(\tilde{t}_1^*, \tilde{t}_2^*)$ equals:

$$r^* = (t_1 + \delta_1 - \tilde{t}_1^*) = (t_1 - w_1 T) + \delta_1 - w_1(\delta_1 + \delta_2) \quad (5)$$

with positive values of r corresponding to outward redeployment from unit 1 to unit 2 and negative values inward redeployment to unit 1 from unit 2.[5]

Focusing on unit 1, Equation (5) shows that holding demand and unit productivity constant, it is more likely to redeploy resources out to unit 2 $(r^* > 0)$ after it experiences a positive resource shock $(\delta_1 > 0)$ and more likely to redeploy resources in from unit 2 $(r^* < 0)$ after it experiences

[4] The inducement is always non-negative because $\Pi(\tilde{t}_1^*, \tilde{t}_2^*)$ is a global maximum of the profit function.
[5] Given positive adjustment costs, a firm will not send resources back and forth between two markets. The redeployment decision can thus be represented with a single variable. We show this formally in the online appendix.

a negative shock ($\delta_1 < 0$).[6] These effects are increasing in the magnitude of the supply-side resource shock ($|\delta_1|$). Equation (5) thus shows how firms can use redeployment to mitigate the effects of supply-side shocks on individual units and optimally spread their resources. A unit that is hit hard by a negative shock ($\delta_1 < 0$) can receive help from other units, while units enjoying positive shocks ($\delta_1 > 0$) can share their bounty with other units by spreading the additional resources across the firm until the marginal returns across units are equalized (and the allocation in Equation (3) is achieved).

These patterns of redeployment following supply-side shocks differ starkly from those that follow demand-side shocks. Holding supply conditions constant, a negative demand-side shock to a unit (such as an industry downturn) would lead to *outward* redeployment from that unit to escape the now relatively underperforming business (Anand, 2004; Anand & Singh, 1997; Wu, 2013). Meanwhile, a positive demand-side shock would lead to *inward* redeployment. These effects of demand-side shocks can also be inferred from Equations (3) and (5) by noticing that under stable supply conditions, $\frac{\partial r^*}{\partial p_1} < 0$. These differences in predictions, however, can be rationalized by noticing that supply- and demand-side shocks create inducements via different underlying mechanisms. Typical sources of demand-side inducements (such as price increases) arise from changes in marginal revenue, which create differences in resource returns across businesses. Meanwhile, the supply-side inducements we describe above arise from changes in the *marginal product* of a resource across units. When positive supply-side shocks rapidly increase a unit's resource stock, all else equal, the marginal product of resources falls (Wu, 2013). Both mechanisms, however, are contained within the logic of opportunity cost (Levinthal & Wu, 2010,

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[6] Focusing on unit 1 is without loss of generality; outward/inward flows from unit 2's perspective are the reverse of those for unit 1. The predicted directions of redeployment follow from the first derivative of Equation (5) with respect to the shock in unit 1: $\frac{\partial r^*}{\partial \delta_1} = 1 - w_1 > 0$.

2022). Whether inducements are created by supply- or demand-side changes (or both), redeployment entails moving resources to where their opportunity cost is lowest and foregoing some return in the origin unit in search of a higher return in the destination.

Although the discussion of non-scale-free resources above is general, we focus our empirical analyses on stocks of managerial resources for three reasons. First, advantages from internal redeployment are most relevant for resources subject to frictions and failures in external markets (Capron, Dussauge, & Mitchell, 1998; Mahoney & Qian, 2013; Teece, 1982). Managerial labor markets tend to exhibit frictions, not only because some valuable aspects of managerial human capital are firm-specific (Becker, 1964; Penrose, 1959) but because even general managerial human capital tends to exhibit inelastic supply (Campbell, Coff, & Kryscynski, 2012; Chadwick, 2017; Mackey, Molloy, & Morris, 2014). Second, managerial talent is highly relevant for firm performance and constitutes an important source of competitive advantage (Barney, 1991; Castanias & Helfat, 1991; Peteraf, 1993). Finally, several recent empirical studies of redeployment have also focused on managerial and professional talent, which allows us to relate our findings to this emerging literature (Belenzon & Tsolmon, 2016; Chang, Kim, & Park, 2023; Karim & Williams, 2012; Stadler, Helfat, & Verona, 2022).

Focusing on managerial human capital, Equations (4)–(5) predict that units that suffer a negative shock to their managerial resource stocks, holding demand constant, will be less likely to redeploy managerial resources out to other units and more likely to receive resources from other units. While shocks to resource stocks could also be positive, we focus on negative shocks for reasons of empirical identification (see Section 3). We hypothesize:

Hypothesis 1a (H1a). *Conditional on a unit remaining open, the probability that a manager will be redeployed out of a focal unit decreases after the unit experiences a negative shock to its stock of managerial resources.*

Hypothesis 1b (H1b). *Conditional on a unit remaining open, the probability that a manager will be redeployed into a focal unit increases after the unit experiences a negative shock to its stock of managerial resources.*

2.3 Resource accumulation, redeployment, and unit openings and closings

We now consider how shocks to resource stocks affect not only redeployment between ongoing units (H1a–H1b), but also firms' unit opening and closing decisions. As before, consider a two-unit firm that is initially endowed with resource stock T and experiences resource shocks $\delta = (\delta_1, \delta_2)$ so that the firm's final resource stock equals $\tilde{T} = t_1 + t_2 + \delta_1 + \delta_2$. Following the shocks, the firm decides whether to continue to operate two units, or whether to close or open a unit. If the firm closes one unit, it earns $p_1\gamma_1\tilde{T}^{\alpha} - F - \tau$.[7] If the firm continues to operate two units and redeployment is profitable (see Equations (4)–(5)), it earns $\Pi(\tilde{t}_1^*, \tilde{t}_2^*) - \tau$ where $\tilde{t}_m^* = w_m\tilde{T}$ (see Equation (3)). Comparing profits across these alternatives, the firm will close a unit when:

$$p_1\gamma_1\tilde{T}^{\alpha} - F - \tau > p_1\gamma_1\, \tilde{t}_1^{*\alpha} + p_2\gamma_2\, \tilde{t}_2^{*\alpha} - 2F - \tau \tag{6}$$

The values of the resource stock for which the firm will close a unit are:

$$\tilde{T} < \left(\frac{F}{p_1\gamma_1[w_1^{\alpha} - 1] + p_2\gamma_2 w_2^{\alpha}}\right)^{1/\alpha} \tag{7}$$

[7] Without loss of generality, we assume that unit 1 is the more profitable one (so that if a firm operates only one unit, it is unit 1) and that operating one unit yields greater profit than operating no units. We assume the firm redeploys resources from unit 2 to unit 1 upon closing and thus incurs cost τ.

In other words, if accumulated resource stocks fall below a certain threshold and adjustment costs are not too large, a firm will close a unit (Helfat & Lieberman, 2002; Wu, 2013). Thus, negative shocks to resource stocks ($\delta_1 < 0, \delta_2 < 0$) reduce $\tilde{T}$ and make the firm more likely to close a unit.

A firm may also want to open a unit following shocks to its resource stock. When doing so, Equations (3) and (5) imply that it will redeploy resources from its existing unit(s) to the new unit. If the firm is already multi-unit, it has the option of redeploying from one or from multiple existing units. Here, we illustrate the key result with the case of a two-unit firm following a positive shock deciding whether to open a unit and redeploy resources from both the existing businesses.[8] Let τ_C be the adjustment cost of redeploying from the existing units into the new unit, and τ_{12} the adjustment cost of redeploying between units 1 and 2. The firm opens the new unit when:

$$\tilde{T} \geq \frac{F + 2\tau_C - \tau_{12}}{\sum_i^2 p_i \gamma_i \left[w_i^\alpha - \left(\frac{w_i}{w_1 + w_2} \right)^\alpha \right] + p_3 \gamma_3 w_3^\alpha} \tag{8}$$

This shows that firms open new units when their resource stock ($\tilde{T}$) rises above a threshold value. Positive shocks ($\delta_1 > 0, \delta_2 > 0$) increase $\tilde{T}$ and the likelihood of unit openings while negative shocks decrease $\tilde{T}$ and make openings less likely. After opening, the firm redeploys resources to the new unit until the marginal return across units is equalized (see online appendix, section A.2).

The tendency of negative supply-side shocks to increase the likelihood of closing units and decrease the likelihood of opening units described above again differs from the effects of demand-side shocks. Redeployment theory suggests that, holding supply constant, a negative demand-side shock to a focal industry frees up resources that can be redeployed to new, better-performing industries (Helfat & Eisenhardt, 2004). Thus, negative demand-side shocks increase the likelihood

[8] This represents the case where the new unit is equally related to each of the firm's existing units, as might happen when a firm combines knowledge from two businesses to diversify into a third (Miller, Fern, & Cardinal, 2007; Tanriverdi & Venkatraman, 2005). We evaluate the other options in the online appendix.

of closings and *simultaneous* openings (Miller & Yang, 2016). Again, however, the logic of opportunity cost rationalizes the different patterns of redeployment following demand- and supply-side shocks. Negative demand-side shocks increase the likelihood of openings because they make the revenue potential of new businesses relatively more attractive. Negative supply-side shocks, however, decrease the likelihood of openings because they reduce the firm's resource stock, thus raising the marginal product of remaining resources in their current use. For empirical reasons explained in Section 3, we focus on the predicted effects of negative resource shocks and hypothesize that:

Hypothesis 2a (H2a). *All else equal, the probability that a firm closes a unit increases after it experiences a negative shock to its stock of managerial resources.*

Hypothesis 2b (H2b). *All else equal, the probability that a firm opens a new unit decreases after it experiences a negative shock to its stock of managerial resources.*

The model also implies several patterns of redeployment following openings and closings. After opening a new unit, the firm redeploys resources from the initial to the new market until the condition in Equation (3) is satisfied. Hence, we expect that unit openings trigger outward redeployment from ongoing units. After closing a unit, the model implies that firms redeploy the closed unit's resources to other units. Hence, we expect that closings trigger inward redeployment to ongoing units.[9] These predictions are consistent with existing theory (Levinthal & Wu, 2010; Lieberman et al., 2017) and do not help distinguish alternative mechanisms driving redeployment. Therefore, we do not present formal hypotheses for these predictions and instead explore descriptively whether empirical patterns in the data are consistent with them in Section 5.3.

[9] See the online appendix for proofs and further details about redeployment after openings and closings.

3 EMPIRICAL APPROACH

3.1 Empirical approach

Estimating the effects of changes in units' resource stocks on redeployment is challenging because firms strategically decide whether to accumulate or divest resources as they respond to market opportunities and threats. For example, a firm may lay off managers to downsize in a shrinking market. This would reduce a unit's managerial resource stock but would not be followed by redeployment toward the unit. Similarly, a firm may hire more managers in response to favorable demand conditions. This would increase a unit's resource stock but would not be followed by outward redeployment. Because resource accumulation is endogenous to unobserved factors, naïve models that regress redeployment on changes in units' resource stocks can offer descriptive evidence but suffer from omitted variable bias and are unlikely to yield causal estimates of the effects of interest.

An ideal experiment in our context would randomly shock a unit's managerial resource stock and observe subsequent redeployment. We approximate this ideal by using unexpected deaths of managers. The key idea is that the death of a manager in a unit creates an exogenous, negative shock to a unit's managerial resource stock that is unlikely to be correlated with other determinants of a firm's resource allocation decisions (e.g., changes in demand, unit productivity, etc.). This strategy therefore allows us to recover causal estimates of the effects of changes in managerial resource stocks on inward and outward redeployment in ongoing units (H1a, H1b) and the likelihood of unit openings and closings (H2a and H2b). The identification strategy is most similar to the approaches of Carnahan (2017)—who uses unexpected deaths of solo-practicing attorneys to estimate the effects of competitive shocks on new firm foundings—and Jäger & Heining (2022), who study the impact of worker deaths on the retention and wages of coworkers.[10]

3.2 Empirical models

H1a and H1b predict that manager redeployment in ongoing units (those not opening or closing) will be sensitive to shocks to the resource stock in the manager's unit. Specifically, they predict that conditional on a unit remaining open, a manager is less likely to be redeployed out to other units (H1a) and more likely to be redeployed in from other units (H1b) after the focal unit suffers a negative shock to its stock of managerial resources. Corresponding with this resource-level outcome, we test these predictions in individual-level data, where each observation is a manager, and estimate models of the following form:

$$Redep_{ijt\rightarrow t+1} = \beta\ Manager\ death_{jt} + \psi'\boldsymbol{Z}_{it} + \zeta'\boldsymbol{K}_{jt} + \boldsymbol{\delta}'\boldsymbol{C}_{ft} + \gamma_j + \lambda_{k(j)t} + \rho_{m(j)t} + \varepsilon_{ijt} \quad (9)$$

where $Redep_{ijt\rightarrow t+1}$ is an indicator variable denoting that manger i in unit j was redeployed from year-end t to year-end $t+1$.[11] We estimate separate models of outward redeployment from unit j and inward redeployment to unit j. Our model predicts that β, which represents the effect of an exogenous shock to a unit's stock of managerial resources on the probability that a manager is redeployed, is negative for models of outward redeployment and positive for models of inward redeployment. Because we expect *Manager death* is correlated with unit size,[12] the vector $\boldsymbol{K}$ includes controls for unit size and other unit-level variables described in Section 4.2.3.

Our model predicts that resource allocation and redeployment decisions also respond to output prices and unit productivity. To control for these determinants, Equation (9) includes an

[10] Researchers have used similar identification strategies to study how the deaths of star scientists and inventors affect the productivity of their collaborators (Azoulay, Zivin, & Wang, 2010; Jaravel, Petkova, & Bell, 2018; Oettl, 2012).
[11] We present individual level models of redeployment as our main approach, but also report results of establishment-level and establishment-pair (dyadic) models in Section 6.1.3; these approaches yield similar conclusions.
[12] The probability a unit experiences at least one manager death mechanically increases in the number of managers.

industry-year fixed effect $\lambda_{k(j)t}$ (which controls for industry-wide price changes) and a region-year fixed effect $\rho_{m(j)t}$ (which controls for local price changes). Further, the model includes a unit-fixed effect (γ_j) to absorb stable, unobserved unit characteristics, such as persistent productivity differences across units. Because redeployment is sensitive to alternative resource uses in the firm (e.g., the resource stocks of other units), the vector $\boldsymbol{C}$ includes time-varying, firm-level variables that proxy for resource returns elsewhere in the firm. Finally, vector $\boldsymbol{Z}$ controls for worker-level characteristics, such as sex and age, that may affect redeployment.

H2a and H2b predict that shocks to a firm's managerial resource stock affect the likelihood that a firm closes or opens a unit. Corresponding with this firm-level decision, we test H2a and H2b in a firm-level data using the following model:

$$Y_{ft\rightarrow t+1} = \beta\ Firm\ manager\ death_{ft} + \delta'\boldsymbol{C}_{ft} + \gamma_f + \lambda_{k(f)t} + \rho_{m(f)t} + \varepsilon_{ft} \qquad (10)$$

where $Y_{ft\rightarrow t+1}$is an indicator variable for any unit closing (H2a) or opening (H2b) in firm f between year-end t and year-end $t+1$.[13] The coefficient of primary interest is β , which represents the effect of a shock to the firm's stock of managerial resources on the probability that the firm subsequently opens or closes a unit. The model also includes vector $\boldsymbol{C}$ with the same firm-level variables as Equation (9) and a firm fixed effect (γ_f). As in Equation (9), we include industry-year ($\lambda_{k(f)t}$) and region-year ($\rho_{m(f)t}$) fixed effects. Because firms can be active in multiple industries and regions, we follow standard practice (e.g., Balasubramanian & Lieberman, 2010) and associate each firm with the industry and region that accounts for the largest share of its employment.

[13] Results are similar using the count of closings and openings as the dependent variable (online appendix Table C.2).

4 DATA AND MEASUREMENT

4.1 Data sources

We study the redeployment of managerial resources using a rich employer-employee matched dataset from Brazil, the *Relacao Anual de Informacoes Sociais* (RAIS). RAIS is a mandatory, annual census of all formal-sector employers and their employees collected by the Ministry of Labor and Employment to support worker payments under several social insurance programs. A key advantage of the empirical setting is that the data contain high-quality information on the employment spells, occupation, wages, and demographics of millions of workers, and allow us to measure redeployment and shocks to managerial resource stocks due to worker deaths. A second advantage is that high-quality management is relatively scarce in emerging economies like Brazil (Bloom & Reenen, 2010), which makes questions about its optimal internal allocation pertinent.

4.1.1 Firm sample

We start with the population of firms that employed a manager and operated more than one establishment in at least one year between 2003 and 2014 ("multi-unit firms") and thus had the option to redeploy managers.[14] We then exclude state-owned enterprises, cooperatives, holding companies, and sole proprietorships, as well as firms in the public administration and education sectors. Finally, we limit our main sample to firms with no more than 250 employees. This restriction is motivated by our identification strategy, which relies on manager deaths; the effect of a single death might be difficult to detect in large firms. Such size restrictions are common in studies that use deaths for identification. For example, Jäger & Heining (2022) restrict their analysis to firms with fewer than 30 employees, and Hartog & Neffke (2017) use establishments

[14] Each establishment is identified in RAIS with a unique 14-digit *Cadastro Nacional da Pessoa Jurídica* (CNPJ) tax ID number. The first eight digits of the CNPJ identify the firm and the subsequent six digits the establishment within the firm (Muendler, Rauch, & Tocoian, 2012). We use the terms "establishment" and "unit" interchangeably.

with fewer than 200 employees. We test the robustness of our results to other size restrictions in Section 6. Our final sample includes more than 81,000 firms and more than 400,000 managers.

4.2 Measurement

4.2.1 Dependent variables

RAIS provides unique identifiers for each worker, their workplace (establishment), and firm. These allow us to link workers to establishments and establishments to firms, and to observe workers moving between establishments over time. We measure redeployment at the worker-year level as an indicator variable for workers who switch employment between establishments of the same firm between the end of one year and the end of the following year.[15] A worker switching employment between establishments (which are discrete places of business) matches the notion of a resource being redeployed between units in our theoretical model. We refer to a worker leaving an establishment as *Outward redeployment* and a worker joining an establishment as *Inward redeployment*; each inward redeployment necessarily has a matching outward redeployment. One potential concern with our measurement of redeployment is that workers may relocate across establishments of the same firm when they are promoted or due to employees' own decisions to relocate, movements that are distinct from the firm-driven redeployment that our theory focuses on. In Section 6.2, we discuss robustness of our results and examine alternative mechanisms.

At the firm level, we define *Any opening* as an indicator variable for a firm having opened at least one establishment in a year.[16] An establishment is identified as new in the first year it

[15] In a small number of cases, workers simultaneously hold more than one position. In these cases, we use the highest-paying observation, a practice consistent with prior research (Cornwell, Schmutte, & Scur, 2021; Helpman et al., 2017). In our sample of workers, only 0.7 percent of observations hold multiple jobs.
[16] In most cases (78 percent), conditional on opening at least one establishment, the firms in our sample open exactly one. Online appendix (Table C.2) shows that results are similar using the count of new and closed establishments as the dependent variable in a Poisson model.

appears in RAIS, which is also the first year it has any employees.[17] We identify *Any closing* as an indicator variable for a firm having closed at least one establishment in a year. An establishment is identified as closed in the last year in which it has employees.

4.2.2 Managers and deaths

RAIS contains a detailed occupation code for each worker. Following prior studies (e.g., Cornwell et al., 2021; Helpman et al., 2017), we use the first digit of the occupation code to identify managers. We identify manager deaths via a code specifying the reason for the termination of an employment relationship.[18] To limit our analysis to unexpected deaths, we follow prior literature and only consider the deaths of managers aged 65 or less who died of non-work-related causes.[19] We also only count deaths of managers not hired in the year of death (those with experience at the firm). This procedure identifies 1,030 unexpected manager deaths in our sample.[20] The average deceased manager is 45 years old and has 6 years of experience in the firm. The average (median) number of managers in units that experience these deaths is 6 (3). Therefore, the death of a manager represents a 17 percent (33 percent) reduction in the average (median) unit's managerial resource stock. We create an indicator variable, *Manager death*, for instances in which a unit lost a manager to unexpected death.[21] We also create a firm-level variable—*Firm manager death*—indicating

[17] Establishments are unlikely to appear and disappear from the data for reasons other than opening and closing. The reasons an establishment can change tax identifier are very limited (Muendler et al., 2012). Nevertheless, in the online appendix, we describe additional steps to identify potential misclassification of new establishment openings. Tests reported in Section 6.1.5 show that excluding these observations does not meaningfully affect the reported results.
[18] RAIS includes a variable denoting more than twenty different reasons for the termination of a contract (such as dismissed with cause, retirement, etc.). Among the reasons are death, which has separate codes for non-work and work-related death. We use only non-work-related deaths in our measure because work-related deaths may correlate with unobserved unit characteristics that affect redeployment (e.g., productivity).
[19] Examples include Acemoglu, He, & le Maire (2022), Carnahan (2017), and Jäger & Heining (2022), who use deaths before age 65. Azoulay et al. (2010) use a slightly higher cutoff—67 years—and explore sensitivity around it.
[20] Conditional on having a manager death in a year, 99.7 percent of establishment-years have one death.
[21] Because we measure redeployment as of December year-over-year (t to $t + 1$), we construct our indicator to equal 1 if a manager dies in either year t or year $t + 1$.

firms that lose a manager to unexpected death in any unit. These indicators represent exogenous shocks to units' resource stocks (δ_i in our theoretical model).

4.2.3 Control variables

We measure each unit's stock of managerial resources as the natural log of the number of managers at year-end (*Log managers*). We measure *Log firm managers* analogously as the total number of managers across all firm units. These variables correspond to the stocks of resources—t_i and T, respectively—in our theoretical model. Additionally, we control for the count of non-managerial workers with *Log employees* and *Log firm employees*. At the firm level, we control for the count of establishments (*Establishments*) and unique industries (*Industries*) because diversification is likely to affect redeployment activity (Bodner, 2022; Miller & Yang, 2016).

To account for adjustment costs, we create two unit-level measures. First, we measure *Avg. labor similarity* as the average cosine similarity between the occupation profiles of a unit's industry and the industries of other firm units (Farjoun, 1994; Sakhartov & Folta, 2015). This measure reflects the ease with which employees can transfer their skills within the firm.[22] Second, we measure *Log avg. distance* as the average geographic distance between a unit and all other firm units; distance is likely to increase the costs of redeploying managers.[23]

At the worker level, we control for several characteristics that may affect the probability of redeployment independent of a unit's resource stocks. We measure *Log wage* as the log of a worker's average monthly salary in real terms deflated to year 2008 reais using IBGE's National Consumer Price Index (INPC). The longitudinal nature of the data and the stability of worker identifiers across years allow us to calculate workers' prior experience. We measure *Log firm*

[22] We provide a detailed explanation of this measure along with mathematical formulas in the online appendix.
[23] Distance is measured as the shortest path between the administrative centers (*sedes municipais*) of each municipality (using the *geodist* package in Stata). Intra-municipality distance is estimated using municipality area.

experience as the total months a worker was active in a firm across all years of data (1995–2014).[24] Similarly, *Log industry experience* is the worker's total experience in the establishment's five-digit CNAE industry, whether with the focal firm or other firms. Finally, we control for gender (*Male*), age (*Log age*), and educational attainment (*College degree*).

4.3 Descriptive statistics

Table 1 provides descriptive statistics for managers, units, and firms in our sample. Panel A shows that 5 percent of managers are redeployed each year. Sample establishments (Panel B) have an average of 24 employees, 2 of which on average are managers. About 0.1 percent of establishments experience the death of a manager each year. While rare at the unit level, these deaths affect about 0.66 percent of all managers (larger units are more likely to experience at least one death, thus a larger share of managers than units experience a death at their establishment). Panel C of Table 1 reports firm-level summary statistics. The average sample firm has 2.3 establishments and is active in 1.2 industries (16.5 percent of firms are multi-industry).

[INSERT TABLE 1 ABOUT HERE]

5 RESULTS

5.1 Shocks to resource stocks and redeployment

Table 2 tests H1a and H1b in our sample of ongoing units. In Column 1, we exclude the manager death variable and estimate the relationship between the (endogenous) accumulation of managerial resources in an establishment and the probability of outward redeployment. Results imply that having an additional manager in an average-size establishment is associated with an increase in

[24] Because the data begin in 1995, we cannot observe the complete work history of all employees (the maximum history is 20 years). This censoring, however, only affects about 4.5 percent of worker-firm pairs.

the probability of outward redeployment of about 2 percentage points (40 percent).[25] Column 2 adds the indicator for recent manager death—our exogenous, negative shock to managerial resource stocks—to the model. Consistent with H1a, managers who experience the death of a managerial colleague are 1.5 percentage points (30 percent) less likely to be redeployed over the following year ($p = 0.001$).

[INSERT TABLE 2 ABOUT HERE]

Columns 3–4 of Table 2 provide supportive evidence for H1b using parallel models for inward redeployment. Estimates in Column 3 imply that having an additional manager in an average-size establishment is associated with a decrease in the probability of inward redeployment of about 2.6 percentage points (52 percent), an estimate that is similar in magnitude but opposite in sign to the one for outward redeployment (Column 1). Results in Column 4 show that the probability that a manager is redeployed into an establishment (conditional on the establishment not closing) is 0.8 percentage points higher ($p = 0.013$) after the death of a managerial colleague, which corresponds to a 16 percent increase over the 5 percent probability of inward redeployment for all managers. These results corroborate the prediction of H1b.

5.2 Shocks to resource stocks and firm growth

[INSERT TABLE 3 ABOUT HERE]

Table 3 examines the relationship between a firm's stock of managerial resources and firm extensive margin growth via unit closings and openings (H2a and H2b). Column 1 presents a descriptive model of closings and (endogenous) changes in the stock of managerial resources. A one standard deviation increase in the number of managers (4.7 managers) at an average-size firm is associated with a 0.5 percentage point increase in the probability of closing an establishment (an

[25] The change in redeployment probability is $\beta \ln(1 + \Delta x/\bar{x}) = 0.049 \ln(1 + 1/2) = 0.0198$.

increase of 4 percent over a firm with an average number of managers).[26] This pattern is inconsistent with firms closing units because they suffer from low stocks of managerial resources, although the effect size is small. It might reflect lower exit thresholds in more resource-endowed firms, which potentially have more opportunities to productively redeploy resources (Lieberman et al., 2017; Santamaria, 2022). Column 2 examines the effect of manager death on unit closings. Manager deaths lead to a 1.9 percentage point (16 percent) increase in the probability of closing a unit ($p = 0.011$), which is consistent with H2a.

Columns 3–4 of Table 3 present parallel models for unit openings. Estimates in Column 3 indicate that a one standard deviation increase in the number of managers is associated with a 1 percentage point increase in the likelihood of opening an establishment (an increase of 7.5 percent over a firm with an average number of managers). Results in Column 4 examining the effect of manager death imply that death results in a 1.1 percentage point decrease in the probability of opening a unit. This pattern is directionally consistent with H2b, but the coefficient estimate is not statistically significant at common thresholds ($p = 0.156$).

5.3 Patterns of redeployment following entry and exit

Our model has implications for redeployment patterns following the opening or closing of a unit. We do not present hypotheses related to these implications as the predictions are consistent with multiple mechanisms (e.g., demand-side and supply-side inducements). However, given the relative scarcity of empirical evidence on intra-firm redeployment, we present descriptive patterns of managerial redeployment following unit openings and closings.

[INSERT TABLE 4 ABOUT HERE]

[26] The average firm has 3 managers. The increase in the probability of any closing given a one standard deviation increase in the number of managers is therefore $0.005 \ln(1 + 4.7/3)) = 0.0047$, or about 0.5 percentage points.

Table 4 reports the mean percentage of managers who are redeployed in multi-unit firms for ongoing, opening, and closing units. On average, 22 percent of managers in new units are employees redeployed from elsewhere in the firm, and when firms close units, 23 percent of their managers are redeployed to other units. Both percentages are much higher than the inward and outward redeployment rates at units that are neither opening nor closing. These magnitudes are consistent with similar facts documented in U.S. establishments by Tate & Yang (2015) and French establishments by Cestone et al. (2023), and are suggestive of sizable frictions in external markets for managers and of firm-specificity in human capital.

Figure 1 shows redeployment patterns for workers employed at incumbent establishments around the time firms open and close units. Our theory maintains that a unit closing triggers inward redeployment from the closing unit toward ongoing units. Conversely, opening triggers the outward redeployment of resources from incumbent units toward the new unit. Figure 1 is consistent with these predictions. Upon closing a unit (Figure 1a), firm's non-closing units see a sudden, temporary increase in inward redeployment of managers as the closing unit's resources are reabsorbed into the firm. In the years following the closing, inward redeployment is much lower as the loss of a unit reduces subsequent opportunities for redeployment. Upon opening a unit (Figure 1b), there is an immediate increase in outward redeployment of managers from incumbent units. Outward redeployment remains elevated in subsequent years as the creation of a new unit creates additional opportunities for redeployment.

[INSERT FIGURE 1 ABOUT HERE]

6 ROBUSTNESS TESTS AND ALTERNATIVE EXPLANATIONS

We conduct several robustness tests and examine several alternative explanations for our results, which are summarized in Table 5 and discussed in detail below.

[INSERT TABLE 5 ABOUT HERE]

6.1 Robustness tests

6.1.1 Firm size restriction

Our main sample is restricted to firms with no more than 250 employees (see Section 4.1.1). We expect shocks to resource stocks, and especially unexpected deaths of managers, to be more salient in smaller firms. However, our theoretical predictions regarding shocks to in resource stocks and redeployment generalize to firms of any size. Figure 2 presents coefficient estimates of the effects of manager death on redeployment in ongoing establishments after re-estimating the models in Tables 2–3 under alternative firm size restrictions, ranging from 100 to 1,000 employees. As expected, results for outward redeployment in Figure 2(a) attenuate with firm size but remain statistically different from zero. Results for inward redeployment suggest that manager deaths increase the probability of inward redeployment at all but the smallest firms.

[INSERT FIGURE 2 ABOUT HERE]

Results for unit opening and closing in Figure 2(b) show that manager deaths tend to increase the likelihood of closing and decrease the likelihood of opening, and that this effect is not sensitive to the firm size threshold. As in Table 3, however, the negative effect of death on opening is not statistically significant for any threshold. Together, the results in Figure 2 show our conclusions are not sensitive to the choice of firm size threshold.

6.1.2 Model specification

Redeployment measured at the employee level is a binary variable. We replicate the analysis of Table 2 using a logit rather than a linear probability model (LPM) and report the results in the online appendix (Table C.1). Estimates of the effect of manager death on redeployment using the logit model are statistically significant and slightly larger in magnitude than those from the LPM.

For similar reasons, we replicate the analysis of closing and opening (Table 3) using a Poisson model for the count of unit openings and closings (Table C.2). As with the analysis of redeployment, the results have similar implications as those from the LPM.

6.1.3 Sensitivity to level of analysis

Our main analyses are performed at the level of the redeployed resource (a manager). An advantage of a worker-level model is the ability to control for worker-level characteristics that may affect redeployment (such as gender, age, etc.). An alternative approach to test the predictions of our theory is modeling redeployment at the establishment-level or between each potential pair (dyad) of establishments within the firm. One unique advantage of dyadic models is that they can include bilateral measures of adjustment costs, which feature in our theory and have been shown to affect the extent of worker redeployment (e.g., Sabel & Sasson, 2023). In the online appendix, we present estimates from both establishment-level (Table C.3) and dyad-level models (Table C.4) for the count of total inward and outward redeployments.[27] The results of both analyses are consistent with the main results and similar in magnitude, showing that manager death leads to less outward redeployment (H1a) and more inward redeployment (H2a).

6.1.4 Placebo analysis

Two potential concerns with our study design are that (a) the relationship between unit manager death and redeployment is a mechanical result of redeployment and death randomly co-occurring in units with more managers, and (b) units experiencing manager death were more likely to redeploy anyway—i.e., that trends in redeployment among units experiencing deaths and other units differ. We are careful to avoid spurious correlation between redeployment and death by

[27] A dyadic discrete choice model at the worker-level is not computationally feasible given the large number of dyads in our data (all pairs of managers and potential destinations in their firms). However, Guimarães, Figueirdo, & Woodward (2003) show that a Poisson model of total redeployment at the establishment level mechanically yields the same estimates as a conditional logit model at the individual level.

excluding managers who die from the sample of potential redeployments and by lagging variables that could themselves be outcomes of redeployment or death. However, to further assess potential biases, we conduct a placebo test that randomly re-assigns manager deaths to other managers in a unit during the pre-death period. We repeat this randomization 200 times and re-estimate the models in Table 2 for each placebo death event. The results, presented in the online appendix (Figure D.1) along with further details, show that placebo deaths do not correlate with either inward or outward redeployment. This supports our identification strategy of using manager deaths as an exogenous shock to resource stocks.

6.1.5 Measurement of unit openings and closings

We measure establishment openings using the appearance of a new CNPJ tax identifier in a firm. While these identifiers are meant to be permanent, there are limited situations in which establishments may change their CNPJ (Muendler et al., 2012), which could lead us to overestimate openings. Although this measurement error would likely attenuate our results, we evaluate this potential bias by re-analyzing openings and closings after applying several criteria to identify possible CNPJ changes. Results are relatively unchanged when we exclude these cases from our sample and they continue to support H2a–H2b (online appendix Table E.1).

6.2 Alternative explanations

6.2.1 Knowledge transfer

Our theory focuses on the permanent redeployment of managers to where they are relatively scarce and their marginal product is high. However, the internal transfer of managers can also be used specifically to transfer knowledge (e.g., Grant, 1996; Kogut & Zander, 1992; Nonaka & Takeuchi, 1995) and several empirical redeployment studies find evidence of this mechanism (Chang et al., 2023; Karim & Williams, 2012; Stadler et al., 2022). Knowledge-transfer is complementary to our arguments because it raises the marginal product of a manager in a destination and can contribute to creating supply-side inducements. However, it is not necessary for supply-side inducements to exist.[28] Knowledge transfer also implies that a worker's marginal product falls rapidly after knowledge is transferred and hence, would frequently lead to return redeployments. However, only 5 percent of inward redeployments in our sample represent managers returning to their origin establishment and among return redeployments, the average (median) time until returning is 3 (2) years. Knowledge transfer is also less consistent with our finding that manager deaths lead to more inward and less outward redeployment even among incumbent establishments.

6.2.2 Job rotation

In addition to knowledge transfer, intra-firm employee mobility may be used as a mechanism of knowledge augmentation. Studies show that firms use job rotation and expatriation to develop managers (Edstrom & Galbraith, 1977; Ondrack, 1985).[29] In such programs, high-potential employees move every few years to develop new skills, enhance their understanding of the firm's businesses, and expand their interpersonal networks (Chattopadhyay & Choudhury, 2017; Choudhury, 2020; Podolny & Baron, 1997). In the job rotation mechanism, we should observe repeat movements and simultaneous movement into and out of establishments, since rotation implies that outgoing managers are replaced by incoming managers (Edström & Gaibraith, 1977).[30] Neither of these features describe a large share of redeployment in our data. 84 percent of manager redeployments are the employee's first move, and 85 percent of redeployed managers

[28] For example, a firm may face an inducement to redeploy a worker (e.g., an experienced welder) because their human capital is scarce and its marginal product in a unit is high, even if that worker will not transfer any knowledge.
[29] This literature typically focuses on multinational enterprises, but our sample is limited to Brazilian establishments. We examine these explanations, however, because the motivations for employee mobility contemplated in this literature (e.g., human capital development) could also explain domestic geographic mobility in our sample.
[30] In contrast, redeployment is permanent in that there is no intention at the time the resource is redeployed to return it to its original use (Helfat & Eisenhardt, 2004).

have only a single redeployment during the ten-year sample period. Conditional on engaging in redeployment, units' inward and outward redeployments are negatively correlated ($\rho = -0.17$), 83 percent of inward redeployments have no accompanying outward redeployment in the same year, and conditional on having both, balance in only 8.8 percent of establishment-years.

6.2.3 Promotions

While firms may redeploy workers to fill resource needs, they may also move workers between establishments as a reward or promotion (Bidwell & Keller, 2014; Doeringer & Piore, 1971). To ensure that such "person-push" (Bidwell, 2020) promotions do not drive our results, we perform the main analyses excluding redeployments that resemble promotions.[31] To identify promotions, we use the first digit of the occupation code (see Section 4.2.2) to identify managers who were not managers in the prior year. Approximately 35 percent of inward redeployments resemble promotions, compared to 15 percent of manager observations not associated with redeployment. This suggests that manager mobility across units is positively associated with promotion, even if promotion does not account for the majority of redeployments. In the online appendix, we show that excluding likely promotions from our analysis does not affect the main results—coefficients in this restricted sample are similar in both magnitude and statistical significance (Table E.2).

6.2.4 Employee preferences for locations

Resource redeployment research emphasizes firm' decisions to shift resources within the firm. Research on employee mobility emphasizes employees' own decisions to move within or between firms for reasons unrelated to changes in the firm's opportunity cost of resources. Employees may relocate in response to wage or amenity differences among labor markets (Roback, 1982) or

[31] This test is conservative as redeployment is not inconsistent with promotion *per se*. Firms may promote workers concurrent with redeployment to motivate them to move. However, in this test, we exclude all promotions because it is difficult to empirically distinguish those motivated by resource needs versus employee rewards.

preferences for living near family and friends (Dahl & Sorenson, 2010, 2012). The theory of "equalizing differences" predicts that, all else equal, a worker would be willing to accept *lower* wages to move to places with better amenities or proximity to family (Rosen, 1986). In additional analyses in the online appendix, we show that redeployed managers tend to earn *higher* wages after redeployment (Table F.1). These wage increases occur regardless of where employees relocate.[32] This pattern is more consistent with workers capturing part of the surplus created from redeployment, rather than mobility driven by personal preferences.[33] To probe the relevance of preferences for living near family and friends, we examine how often redeployed workers move to their region of birth.[34] We find that only 4 percent of manager redeployments are workers moving to their region of birth from another region. If redeployments were random within firms, we would expect about 11 percent of movements to follow this pattern.

7 DISCUSSION AND CONCLUSION

We examine how changes to units' managerial resource stocks affect the dynamics of intra-firm manager redeployment. Focusing on the unexpected deaths of managers as an exogenous shock to such stocks, we find that the probability a firm redeploys a manager out of an ongoing unit decreases by 30 percent when the unit experiences an unexpected manager death. Conversely the probability that a firm redeploys a manager into the unit from elsewhere in the firm increases by

[32] The median wage increase in the year of redeployment is about 12 percent (versus 4.6 percent for managers who are not redeployed). These statistics are similar for workers relocating across and within narrowly defined micro-regions (roughly the size of commuting zones), which further suggests workers are not earning a compensating differential in exchange for moving to less desirable geographic locations. We do not argue that compensating differentials do not exist, but that the subset of mobility we term redeployment is unlikely to be an artifact of workers moving across locations due to differing amenities.

[33] Moreover, 73 percent of redeployments in our sample consist of managers remaining within the same Brazilian microregion, an area similar in size to a U.S. commuting zone.

[34] This analysis is necessarily coarse because birthplaces are divided into only nine regions. The ninth digit of a Brazilian social security number corresponds to the fiscal region responsible for issuing it. We use this digit as a proxy for workers' regions of birth, a likely location of family.

16 percent. These results are consistent with our prediction that firms use redeployment to reallocate resources in response to shocks to resource stocks across units. We also predict that negative shocks to resource stocks limit firm growth by reducing the amount of resources available for redeployment to support new units. Our analysis finds only weak evidence that firms are less likely to open units following negative shocks to their managerial resource stocks. We do find, however, that firms are 16 percent more likely to close a unit following these shocks. Descriptive evidence shows that unit openings and closings trigger sharp spikes in managerial redeployment.

Our findings contribute to a growing literature on intra-firm resource allocation and the theory of resource redeployment by illuminating how supply-side shocks affect the internal opportunity cost of resources and contribute to previously underexplored sources of inducements. Prior research has extensively explored inducements arising from market maturity, product obsolescence, government regulation, and competitive dynamics (Anand, 2004; Anand & Singh, 1997; Giarratana & Santaló, 2020; Miller & Yang, 2016; Morandi Stagni, Santaló, & Giarratana, 2020; Natividad & Sorenson, 2015; Wu, 2013). While varied, these factors typically affect firms' demand conditions, and thus constitute sources of "demand-side inducements." We extend theory by instead analyzing "supply-side inducements" that can arise even under stable demand conditions.

While redeployment decisions necessarily depend on the balance of demand and supply conditions, distinguishing demand-side and supply-side inducements offers insights for both scholars and business managers. First, as detailed in Section 2.2, it is important for understanding the *direction* of intra-firm resource flows. Second, the distinction is crucial for recognizing the *contexts* in which redeployment is valuable. Demand-side inducements suggest that redeployment options are particularly valuable in related-diversified firms because such firms face imperfectly correlated demand shocks that create inducements, while relatedness keeps adjustments costs low (Rumelt, 1982; Sakhartov, 2017; Sakhartov & Folta, 2014). Supply-side inducements show how firms can create value by shifting resources across units in the *same* industry, and imply that redeployment options are thus valuable in single-business firms. In such contexts, inducements can arise from imperfectly correlated supply-side shocks, and adjustment costs are likely even lower than for related industries. Third, supply-side inducements enhance our understanding of *when* redeployment is likely to occur. While prior work has focused on redeployment following demand shocks, our work implies that supply-side shocks, for example, the sudden departure of employees or the depletion of physical capital from a natural disaster can also trigger redeployment.

This article further contributes to research on firm growth by offering causal evidence that links the accumulation of managerial resources to growth outcomes. Managerial resources are seen as a key source of competitive advantage (Barney, 1991; Castanias & Helfat, 1991), but causal evidence of their effect on firm outcomes is scant (Bloom et al., 2013). Drawing on managerial deaths for identification, we provide some evidence that the unexpected loss of a manager reduces the likelihood that firms open new units, and strong evidence that deaths increase the likelihood of closing units, thus limiting growth. These findings support Penrose's (1959) arguments regarding the importance of managerial resource accumulation for firm growth. While prior research has examined this relationship through the lens of resource-sharing (synergies) (e.g., Montgomery & Wernerfelt, 1988; Panzar & Willig, 1981; Teece, 1980), we show that unit openings and closings trigger significant redeployment (Helfat & Eisenhardt, 2004). Results reveal that managerial redeployment to firms' new establishments is sizable: internally redeployed managers account for 22 percent of managers in firms' new establishments, on average. This finding implies a potentially important role of internal labor markets in helping firms open new establishments and take advantage of growth opportunities, especially in contexts where external labor markets exhibit significant frictions (Cestone et al., 2023; Chauvin, Inoue, & Poliquin, 2022).

7.1 Limitations

We acknowledge three main limitations of our study. First, our theoretical discussion assumes that resources are not available in external markets and that internal frictions from agency problems, information asymmetries, and social comparison do not constrain redeployment (e.g., Bower, 1970; Feldman, Gartenberg, & Wulf, 2018; Scharfstein & Stein, 2000). In practice, such frictions likely drive a wedge between optimal and actual resource allocation. For example, division managers who are evaluated on local performance may hoard talent (Haegele, 2022), making redeployment less responsive to changes in resource returns. Assessing the role of internal frictions for intra-firm resource allocation presents significant opportunity for future research.

Second, we emphasize a single source of supply-side inducements: differential changes in resource stocks across firm units. To obtain causal tests of theory, we also limit our empirical analyses to a specific shock to firms' resource stocks: managerial deaths. These are rare events and not necessarily the most prominent source of supply-side inducements. Significant opportunity exists for future work to identify other sources of supply-side inducements and study how they affect redeployment. Natural disasters and physical climate risks are increasingly relevant for many firms (e.g., Li, 2022); future work could investigate how firms use redeployment to boost resilience in the face of shocks to individual units.

Finally, our analysis is confined to Brazil, a country where institutional voids in external markets for human capital and regulatory frictions could affect the value and prevalence of worker redeployment (Belenzon & Tsolmon, 2016; Khanna & Palepu, 2000). If such factors significantly contribute to the use of redeployment in Brazil, then our findings may not generalize to other contexts. The growing accessibility of administrative datasets from different countries allows for comparison of worker redeployment practices across different contexts. Future work can enhance our understanding of how differences in institutional and regulatory environments across countries (e.g., Berry, Guillén, & Zhou, 2010) and differences in the efficiency of external markets affect the prevalence and use of internal redeployment.

7.2 Conclusion

Despite these limitations, our study significantly enhances understanding of how firms allocate their arguably most important resource: human capital. We identify the theoretical tradeoffs involved in human capital allocation within multi-unit firms and offer causal evidence demonstrating the influence of supply-side inducements in the lateral redeployment of experienced managers. Our results indicate that redeployment plays an important role in mitigating supply-side resource shocks and in optimally allocating resources as firms grow and contract. From a managerial perspective, these findings imply that honing redeployment capabilities—such as the ability to recognize redeployment opportunities, to reduce adjustment costs involved in the redeployment process, and to coordinate redeployment among units as the needs arise—can offer performance advantages for both diversified and non-diversified firms.

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TABLES

TABLE 1. Summary statistics and correlations

A. Worker-level variables

	Variable	Mean	SD	Correlations (2)	(3)	(4)	(5)	(6)	(7)	(8)
(1)	Outward redeployment†	0.05	0.21	0.11	-0.01	-0.02	-0.04	-0.03	-0.02	-0.02
(2)	Inward redeployment†	0.05	0.21		-0.01	-0.02	-0.05	0.06	0.02	-0.04
(3)	Male†	0.62	0.48			0.20	0.16	0.05	0.05	0.03
(4)	Log wage	1.25	0.95				0.36	0.16	0.13	0.54
(5)	Log age	3.58	0.28					0.30	0.30	0.17
(6)	Log firm experience	1.05	1.15						0.73	-0.04
(7)	Log industry experience	1.23	1.07							-0.08
(8)	College degree†	0.31	0.46							

B. Unit-level variables

	Variable	Mean	SD	(2)	(3)	(4)	(5)
(1)	Manager death†	0.001	0.035	0.04	0.03	0.00	0.01
(2)	Log managers	0.40	0.63		0.45	-0.03	0.10
(3)	Log employees	2.42	1.21			-0.07	0.11
(4)	Avg. labor similarity	0.90	0.23				-0.02
(5)	Log avg. distance	4.09	1.60				

C. Firm-level variables

	Variable	Mean	SD	(2)	(3)	(4)	(5)	(6)	(7)
(1)	Firm manager death†	0.002	0.047	-0.01	0.00	0.05	0.03	0.02	0.01
(2)	Any opening†	0.17	0.38		0.08	0.06	0.02	0.23	0.09
(3)	Any closing†	0.12	0.32			0.02	-0.02	0.18	0.09
(4)	Log firm managers	0.71	0.80				0.51	0.38	0.12
(5)	Log firm employees	3.07	1.23					0.34	0.16
(6)	Establishments	2.30	2.01						0.24
(7)	Industries	1.18	0.44						

†Indicator variable

Notes: Wage is expressed in real terms in thousands of reais (deflated to year 2008 reais). Age and experience variables are measured in years. Unit-level and firm-level employees measures exclude managers. Avg. labor similarity represents the average cosine similarity between the occupation profiles of a unit's industry and the industries of other firm units. Avg. distance represents the average distance to other firm units in kilometers.

TABLE 2. Resource shocks and manager redeployment

	Outward redeployment		*Inward redeployment*	
DV: Redeployment indicator (0/1)	(1)	(2)	(3)	(4)
Manager death		-0.015		0.008
		(0.005)		(0.003)
Log managers	0.049	0.049	-0.064	-0.064
	(0.002)	(0.002)	(0.002)	(0.002)
Log employees	0.010	0.010	-0.018	-0.018
	(0.002)	(0.002)	(0.001)	(0.001)
Male	0.007	0.007	0.008	0.008
	(0.001)	(0.001)	(0.001)	(0.001)
Log wage	-0.001	-0.001	-0.012	-0.012
	(0.001)	(0.001)	(0.001)	(0.001)
Log age	-0.008	-0.008	-0.021	-0.021
	(0.001)	(0.001)	(0.001)	(0.001)
Log firm experience	0.002	0.002	0.013	0.013
	(0.000)	(0.000)	(0.000)	(0.000)
Log industry experience	0.001	0.001	-0.006	-0.006
	(0.000)	(0.000)	(0.000)	(0.000)
College degree	-0.004	-0.004	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Log firm managers	-0.033	-0.033	0.052	0.052
	(0.001)	(0.001)	(0.002)	(0.002)
Log firm employees	0.000	0.000	0.018	0.018
	(0.002)	(0.002)	(0.001)	(0.001)
Establishments	-0.000	-0.000	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)
Industries	-0.002	-0.002	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Avg. labor similarity	-0.007	-0.007	-0.003	-0.003
	(0.004)	(0.004)	(0.002)	(0.002)
Log avg. distance	-0.007	-0.007	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Intercept	0.085	0.085	0.087	0.087
	(0.009)	(0.009)	(0.006)	(0.006)
Fixed Effects				
Establishment	•	•	•	•
Industry-Year	•	•	•	•
Region-Year	•	•	•	•
Managers	431,992	431,992	412,693	412,693
Observations	1,042,747	1,042,747	1,017,303	1,017,303
R^2	0.31	0.31	0.26	0.26

Notes: Sample includes managers employed in an establishment at year-end. Robust standard errors in parentheses, clustered by establishment. The number of observations differs across models due to dropping singletons, missing data, and the year-over-year nature of the redeployment measure (see Sections 3 and 4.2.1).

TABLE 3. Resource shocks and firm growth

	Any closing		*Any opening*	
DV: Any closing/opening indicator (0/1)	(1)	(2)	(3)	(4)
Firm manager death		0.019		-0.011
		(0.007)		(0.008)
Log firm managers	0.005	0.005	0.010	0.010
	(0.001)	(0.001)	(0.001)	(0.001)
Log firm employees	0.005	0.005	0.020	0.020
	(0.001)	(0.001)	(0.002)	(0.002)
Establishments	0.047	0.047	-0.058	-0.058
	(0.001)	(0.001)	(0.002)	(0.002)
Industries	0.030	0.030	-0.046	-0.046
	(0.002)	(0.002)	(0.002)	(0.002)
Intercept	-0.045	-0.045	0.245	0.245
	(0.004)	(0.004)	(0.005)	(0.005)
Fixed Effects				
Firm	•	•	•	•
Industry-Year	•	•	•	•
Region-Year	•	•	•	•
Firms	81,418	81,418	81,418	81,418
Observations	448,229	448,229	448,229	448,229
R^2	0.337	0.337	0.282	0.282

Notes: Sample includes multi-unit firms with 250 or fewer employees. For the industry-year and region-year fixed effects, firms active in multiple industries and/or regions are assigned the industry and region representing the largest share of their employment. Robust standard errors in parentheses, clustered by firm.

TABLE 4. Share of managers redeployed

	Ongoing Units		Opening Units		Closing Units	
Measure	Mean	SD	Mean	SD	Mean	SD
Inward Redeployment	5.3%	20.7	22.1%	40.1	9.9%	28.6
Outward Redeployment	4.2%	18.3	8.1%	26.0	22.7%	40.7

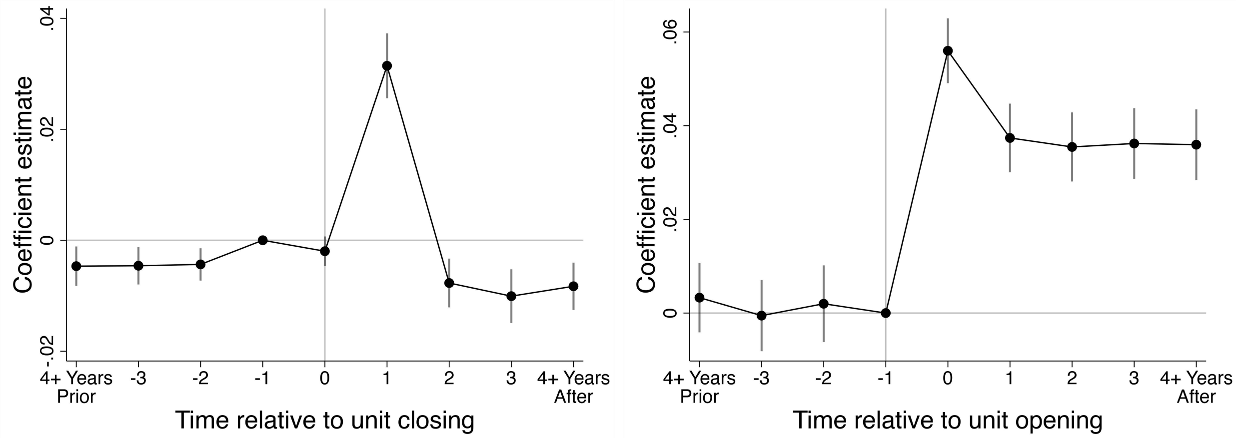
Notes: Sample consists of establishments in multi-unit firms with 250 or fewer employees and at least one manager. Cells report percentages of managers annually redeployed inward or outward for ongoing (non-closing and non-opening), opening, and closing units. Columns do not sum to 100 percent because most managers are not redeployed.

TABLE 5. Summary of robustness tests

Issue	Test	Result	Location
Robustness Tests			
Sensitivity to firm size cutoff	Examine alternative cutoffs	Results similar, even in larger firms	Figure 2
Functional form	Logit model of manager redeployment	Results and effect sizes similar	Table C.1†
	Poisson model of opening and closing	Results directionally consistent	Table C.2†
Sensitivity to level of analysis	Estimate establishment-level models of redeployment	Results consistent	Table C.3†
	Estimate dyadic (unit pair level) models of redeployment	Results consistent	Table C.4†
Identification strategy using deaths	Perform placebo analysis	Placebo deaths do not predict redeployment	Figure D.1†
Openings may be mismeasured	Exclude potentially mismeasured "openings"	Results consistent	Table E.1†
Alternative Explanations			
Knowledge transfer drives redeployment	Examine repeat and return redeployments	Few redeployments entail return to original unit	Section 6.2.1
Job rotation drives redeployment	Examine repeat and simultaneous incoming/outgoing redeployment	Repeat redeployment rare, units rarely receive and send managers simultaneously	Section 6.2.2
Redeployment is a promotion	Check occupation code changes at redeployment	Results similar after excluding likely promotions	Table E.2†
Employee location preferences explain redeployment	Examine wage changes, desirable cities, and return to employees' birth regions	Wages increase at redeployment, which is often within microregion, and is not driven by movement to employees' birth regions	Section 6.2.4 Table F.1† Figure F.1†

† Reported in online appendix.

FIGURES

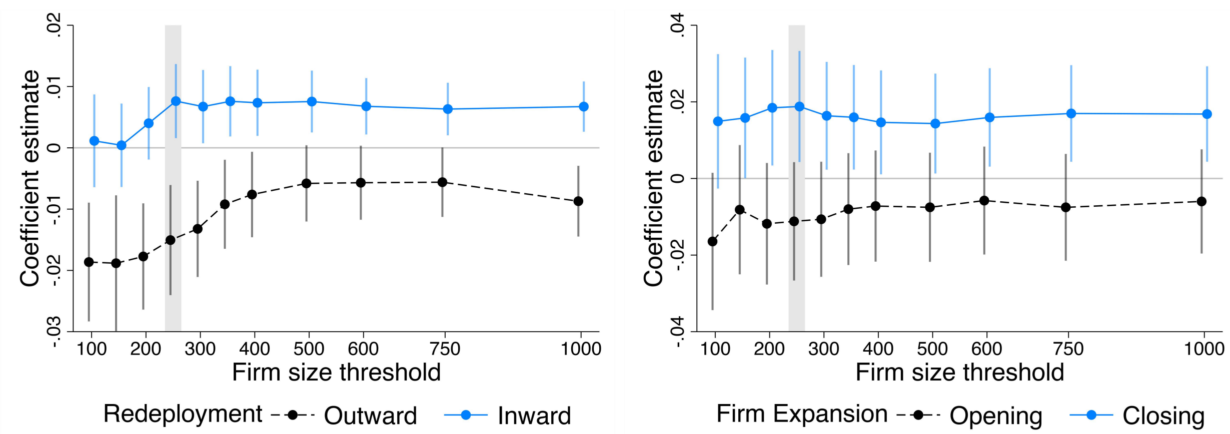


(a) Inward redeployment to incumbent units relative to a closing in the firm

(b) Outward redeployment from incumbent units relative to an opening in the firm

Notes: Coefficient estimates reflect the change in the probability of manager *Inward redeployment* (a) and *Outward redeployment* (b) in incumbent units (excluding the closing and opening establishment) conditional on the control variables in Table 2. Sample is limited to managers employed in the period around each firm's first unit closing or opening. Vertical lines represent 95 percent confidence intervals.

FIGURE 1. Redeployment at time of unit opening and closing



(a) Effects on Redeployment

(b) Effects on Opening and Closing

FIGURE 2. Effects of manager death under alternative firm size restrictions

Notes: Coefficient estimates represent the marginal effect of *Manager death* on *Outward redeployment* and *Inward redeployment* (a) and of *Firm manager death* on *Any closing* and *Any opening* (b) estimated via Equations (9) and (10). Estimates in the shaded regions coincide with those in Tables 2–3. Values along the x-axis are jittered to limit overlap of the vertical lines, which represent 95 percent confidence intervals.