Online Appendix

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

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A. SOLUTIONS TO THE RESOURCE ALLOCATION PROBLEM

In this mathematical appendix, we present solutions for the firm's initial resource allocation problem and redeployment problem following resource shocks along with additional proofs mentioned in the text.

A.1. Initial Resource Allocation

Absent shocks and future redeployment opportunities, a firm with two potential units solves:

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

$$\begin{aligned} \text{subject to } \; t_1 + t_2 &\leq T \\ t_1 &\geq 0 \\ t_2 &\geq 0 \end{aligned} \tag{A.1}$$

where t_m is resources allocated to unit m (from total resource stock T), p_m are market prices, and γ_m reflects the productivity of the firm's scale-free resources. Assuming fixed costs are sufficiently small, the firm will operate two units, and the resource constraint will hold with equality because the objective function is monotonically increasing in both t_m. Given that the objective function is strictly concave, and the constraint is linear, a stationary point of the Lagrangian solves the problem. Forming the Lagrangian and taking first partial derivatives, we have:

$$L(\boldsymbol{t}, \lambda) = \sum_{m=1}^{2} p_m\, \gamma_m\, t_m^{\alpha} + \lambda \left[T - \sum_{m=1}^{2} t_m \right]$$

$$\frac{\partial L}{\partial t_m} = \alpha\, p_m\, \gamma_m\, t_m^{\alpha-1} - \lambda$$

$$\frac{\partial L}{\partial \lambda} = T - \sum_{m=1}^{M} t_m$$

Then, equating the two partial derivatives for units 1 and 2 we have:

$$\left(\frac{t_1}{t_2}\right)^{\alpha-1} = \frac{p_2\gamma_2}{p_1\gamma_1} \quad \Rightarrow \; t_1^* = \left(\frac{p_2\gamma_2}{p_1\gamma_1}\right)^{\frac{1}{\alpha-1}} \; t_2^*$$

Replacing t_2^* expressed in terms of t_1^* using the resource constraint, leads to:

$$t_1^* = \left(\frac{p_2\gamma_2}{p_1\gamma_1}\right)^{\frac{1}{\alpha-1}} \; (T - t_1^*)$$

Solving for t_1^* gives:

$$t_1^* = \frac{T\left(\frac{p_2\gamma_2}{p_1\gamma_1}\right)^{\frac{1}{\alpha-1}}}{1 + \left(\frac{p_2\gamma_2}{p_1\gamma_1}\right)^{\frac{1}{\alpha-1}}} = \frac{T\,(p_1\gamma_1)^{\frac{1}{1-\alpha}}}{(p_1\gamma_1)^{\frac{1}{1-\alpha}} + (p_2\gamma_2)^{\frac{1}{1-\alpha}}}$$

More generally, t_m^* equals:

$$t_m^* = w_m T \;, \; \text{where } w_m = \frac{(p_m\gamma_m)^{\frac{1}{1-\alpha}}}{\sum_{k=1}^{M}(p_k\gamma_k)^{\frac{1}{1-\alpha}}} \qquad \textbf{(A.2)}$$

The term w_m is a weight representing the share of resources allocated to unit m. Intuitively, profit-maximizing firms allocate more resources to units facing higher prices and those in which they are more productive. Unsurprisingly, if $p_m = p$ and $\gamma_m = \gamma \;\; \forall m$, the firm will allocate the same amount of resources to each unit.

The above analysis, however, assumes the firm operates two units. Another possibility is that fixed costs are large enough that entry is unattractive for one or both units. To determine whether to open two, one, or no units, the firm must compare the two-unit resource allocation above with these alternative allocations. The firms' potentially optimal choices are:

- Open zero units so that $t_1 = t_2 = 0$ and $\Pi(0,0) = 0$.
- Open only unit 1 so that $t_1 = T$, $t_2 = 0$, and $\Pi(T, 0) = p_1\gamma_1 T^{\alpha} - F$.
- Open only unit 2 so that $t_1 = 0$, $t_2 = T$, and $\Pi(0, T) = p_2\gamma_2 T^{\alpha} - F$.
- Open both units so that $t_1 = t_1^*$, $t_2 = t_2^*$, and $\Pi(t_1^*, t_2^*) = p_1\gamma_1 {t_1^*}^{\alpha} + p_2\gamma_2 {t_2^*}^{\alpha} - 2F$.

The firm chooses the allocation that maximizes profit. In the main text, we further discuss the conditions under which the firm will choose to operate a single unit. This happens when resources are below a threshold value that is a function of prices, productivity, and fixed costs; greater fixed costs increase the resource requirements for operating multiple units.

A.2. Resource Shocks and Redeployment

Here, we present the solution to the firm's redeployment problem following shocks to resource endowments in the individual units. Let $\delta = (\delta_1, \delta_2)$ be a vector of positive or negative shocks to each unit's resource stock. Following these shocks, the resources available to unit m equal $\tilde{t}_m = t_m + \delta_m$ and the firm's total stock of resources equals $\tilde{T} = T + \delta_1 + \delta_2$.

Given the per-period fixed costs, shocks to the firm's resource stock can affect both the number of units to operate and the amount of resources to allocate to each unit. Below, we solve the firm's redeployment problem by first assuming it operates two units both before and after the shocks. Then, we analyze the case of a two-unit firm closing a unit following a negative shock. Finally, we consider a single- or two-unit firm opening another unit after a positive shock.

Case 1: Operating two units before and after shock

Absent adjustment costs, the firm's optimal allocation following these shocks is $\tilde{t}_m^* = w_m\tilde{T}$. Assuming, however, that the firm incurs a fixed, symmetric bilateral adjustment cost ($\tau \geq 0$) to redeploy resources and achieve $\tilde{t}_m^*$, it may be optimal to instead accept the post-shock default allocations $\tilde{t}_m$. The decision to redeploy thus hinges on whether the increased profits from redeploying to attain $\widetilde{\Pi}^* = \Pi(\tilde{t}_1^*, \tilde{t}_2^*)$ instead of $\widetilde{\Pi} = \Pi(\tilde{t}_1, \tilde{t}_2)$ exceed τ. The firm redeploys if:

$$\Pi(\tilde{t}_1^*, \tilde{t}_2^*) - \Pi(\tilde{t}_1, \tilde{t}_2) \geq \tau$$

If the firm chooses to redeploy, the quantity of resources redeployed from/into unit m (ρ_m) equals the difference between the post-shock default and post-shock optimal allocations:

$$\rho_m^* = \begin{cases} 0, & \Pi(\tilde{t}_1^*, \tilde{t}_2^*) - \Pi(\tilde{t}_1, \tilde{t}_2) < \tau \\ \tilde{t}_m - \tilde{t}_m^*, & \Pi(\tilde{t}_1^*, t_2^*) - \Pi(\tilde{t}_1, \tilde{t}_2) \geq \tau \end{cases}$$

$$\begin{aligned} \tilde{t}_m - \tilde{t}_m^* &= t_m + \delta_m - w_m \tilde{T} \\ &= t_m + \delta_m - w_m(T + \delta_1 + \delta_2) \\ &= (t_m - w_m T) + \delta_m - w_m(\delta_1 + \delta_2) \end{aligned}$$

where positive values of ρ_m correspond to redeployment away from unit m and negative values the reverse. Assuming the initial, pre-shock resource allocation was optimal ($t_m = t_m^* = w_m T$), the expression for redeployment becomes $\rho_m = \delta_m - w_m(\delta_1 + \delta_2)$. Following a bunch of shocks, each market redeploys outward the value of its shock less its optimal share of aggregate shocks, which is given by its weight, w_m.

While this outcome is clear from the solution to the resource allocation problem given in Section A.1 and the fact adjustment costs are fixed, it can also be derived as the solution to a maximization problem in which the firm chooses how much resources (post-shock) to redeploy from unit 1 to unit 2 ($\rho_1 \geq 0$) and from unit 2 to unit 1 ($\rho_2 \geq 0$):

$$\max_{\{\rho_1, \rho_2\}} p_1 \gamma_1 (t_1 + \delta_1 - \rho_1 + \rho_2)^\alpha + p_2 \gamma_2 (t_2 + \delta_2 + \rho_1 - \rho_2)^\alpha - \tau\, \mathbb{1}(\rho_1 > 0) - \tau\, \mathbb{1}(\rho_2 > 0)$$

$$\begin{aligned} \text{subject to } \; & \rho_1 \leq t_1 + \delta_1 \\ & \rho_2 \leq t_2 + \delta_2 \\ & \rho_1 \geq 0 \\ & \rho_2 \geq 0 \end{aligned}$$

Given positive fixed costs, the solution to this problem requires either $\rho_1^* = 0$ or $\rho_2^* = 0$ or both. To see this, let $r_1 = \rho_1 - \rho_2$ be the net flow from unit 1 to unit 2 and $r_2 = \rho_2 - \rho_1 = -r_1$ be the net flow from unit 2 to unit 1. Writing the profit function above in terms of r_1 and solving for the optimal flow r_1^* shows there are infinite possible values of ρ_1 and ρ_2 that achieve the same net flow r_1^*. Combinations with $\rho_1 > 0$ and $\rho_2 > 0$, however, incur greater adjustment costs (2τ, for redeploying in both directions) than those for which $\rho_1 = 0$ and/or $\rho_2 = 0$ (in other words, the firm will not redeploy into and out of the same unit). Thus, we consider cases where $\rho_1 = 0$ or $\rho_2 = 0$ and compare the profit earned in these cases to the profit when $\rho_1 = \rho_2 = 0$, which is the profit under the default, post-shock allocation: $\Pi(\tilde{t}_1, \tilde{t}_2)$. Re-writing the above problem in terms of the net flow from unit 1 to unit 2 and solving for r^* gives:

$$\max_r p_1\gamma_1(t_1 + \delta_1 - r)^\alpha + p_2\gamma_2(t_2 + \delta_2 + r)^\alpha - \tau\,\mathbb{1}(r \neq 0)$$
$$\text{subject to } \; -(t_2 + \delta_2) \leq r \leq t_1 + \delta_1 \qquad \textbf{(A.3)}$$

Given the discontinuity at $r = 0$ due to adjustment costs, we first solve for a solution ignoring these costs, then compare profits under this solution to $\Pi(\tilde{t}_1, \tilde{t}_2)$. Forming the Lagrangian and taking first partial derivatives, we have:

$$L(r, \lambda_1, \lambda_2) = p_1\gamma_1(t_1 + \delta_1 - r)^\alpha + p_2\gamma_2(t_2 + \delta_2 + r)^\alpha + \lambda_1(t_1 + \delta_1 - r) + \lambda_2(t_2 + \delta_2 + r)$$
$$\frac{\partial L}{\partial r} = -\alpha p_1\gamma_1(t_1 + \delta_1 - r)^{\alpha-1} + p_2\gamma_2(t_2 + \delta_2 + r)^{\alpha-1} - \lambda_1 + \lambda_2$$
$$\frac{\partial L}{\partial \lambda_1} = t_1 + \delta_1 - r$$
$$\frac{\partial L}{\partial \lambda_2} = t_2 + \delta_2 + r$$

When either constraint is binding, the firm closes one or both units. In a trivial case, $\delta_m = -t_m \; \forall m$ and the firm ceases to exist (all resources are wiped out by negative shocks). Alternatively, the firm could close one unit, say $r = t_1 + \delta_1$, and allocate all post-shock resources to unit 2. Absent fixed costs, this cannot be optimal because $\alpha < 1$ and thus $\frac{\partial^2 \Pi}{\partial^2 t_m} < 0$. With a per-period fixed cost, however, it may make sense to close a unit; we analyze this scenario below.

Continuing to assume for now that the firm operates two units, we only consider interior solutions in which neither constraint is binding. Under these conditions, we have:

$$-\alpha p_1 \gamma_1 (t_1 + \delta_1 - r)^{\alpha - 1} + p_2 \gamma_2 (t_2 + \delta_2 + r)^{\alpha - 1} = 0$$

$$\Rightarrow \frac{t_2 + \delta_2 + r}{t_1 + \delta_1 - r} = \left(\frac{p_1 \gamma_1}{p_2 \gamma_2}\right)^{\frac{1}{\alpha - 1}}$$

The right-side equals w_2/w_1 (see Equation (A.2)). Substituting and re-arranging terms, we have:

$$r^* = w_2(t_1 + \delta_1) - w_1(t_2 + \delta_2)$$

which, because $w_1 + w_2 = 1$, can be re-written:

$$r^* = t_1 + \delta_1 - w_1 \tilde{T}$$

$$r^* = (t_1 - w_1 T) + \delta_1 - w_1(\delta_1 + \delta_2)$$

Recall that r represents the net flow of resources from market 1 to market 2; positive values of r represent outward redeployment from market 1 into market 2 and negative values represent outward redeployment from market 2 into market 1. Assuming τ is sufficiently small, taking the first derivative of r^* with respect to the shocks in each market shows how redeployment changes with the magnitude of the shocks:

$$\frac{\partial r^*}{\partial \delta_1} = 1 - w_1 > 0, \qquad \frac{\partial r^*}{\partial \delta_2} = -w_1 < 0$$

If markets are shocked simultaneously (on either the supply- or demand-side, or both), these two effects can partially or fully cancel each other. Thus, net redeployment in a market is a function of supply-side shocks in that market as well as shocks in the firm's other markets (the relative magnitude of the shocks).

Case 2: Closing a unit after shock

Returning to a scenario mentioned above, the firm may respond to a negative shock by closing a unit and redeploying all resources into the remaining unit. Either $r = t_1 + \delta_1$ and all post-shock resources are allocated to unit 2, or $r = -(t_2 + \delta_2)$ and all resources are allocated to unit 1. If the firm closes unit 2 and allocates all resources to unit 1, profit equals:

$$\Pi(\tilde{T}, 0) = p_1\gamma_1\tilde{T}^\alpha - \tau\,\mathbb{1}(t_2 + \delta_2 > 0) - F$$

If the firm alternatively closes unit 1 and allocates all resources to unit 2, profit equals:

$$\Pi(0, \tilde{T}) = p_2\gamma_2\tilde{T}^\alpha - \tau\,\mathbb{1}(t_1 + \delta_1 > 0) - F$$

The firm compares the profit of these two options against the profit of continuing to operating two units, $\Pi(\tilde{t}_1^*, \tilde{t}_2^*)$, and the profit from the default, post-shock allocation, $\Pi(\tilde{t}_1, \tilde{t}_2)$.[1]

Case 3: Opening a unit after shock

Here we consider the possibility of responding to a positive shock by opening a new unit. If the firm initially has a single unit, the firm compares the profit of keeping all resources in the initial unit to the profit of paying the adjustment cost and moving $\tilde{t}_2^*$ of its resources into a new unit. The firm will open the second unit if:

$$\Pi(\tilde{t}_1^*, \tilde{t}_2^*) - \tau \geq \Pi(\tilde{T}, 0)$$

If the firm initially operates two units, and is considering opening a third, the decision is similar but complicated by the need to consider multiple ways to redeploy resources to the new unit. With three units, there are three "redeployment paths" (one between each unit pair) and each

[1] When a shock wipes out all resources in a unit ($\delta_m = -t_m$), then the profit of the default, post-shock allocation will equal the profit of operating a single unit (without the adjustment cost). For example, if $\delta_2 = -t_2$, then $\Pi(\tilde{t}_1, \tilde{t}_2) = \Pi(\tilde{T}, 0) = p_1\gamma_1\tilde{T}^\alpha - F$.

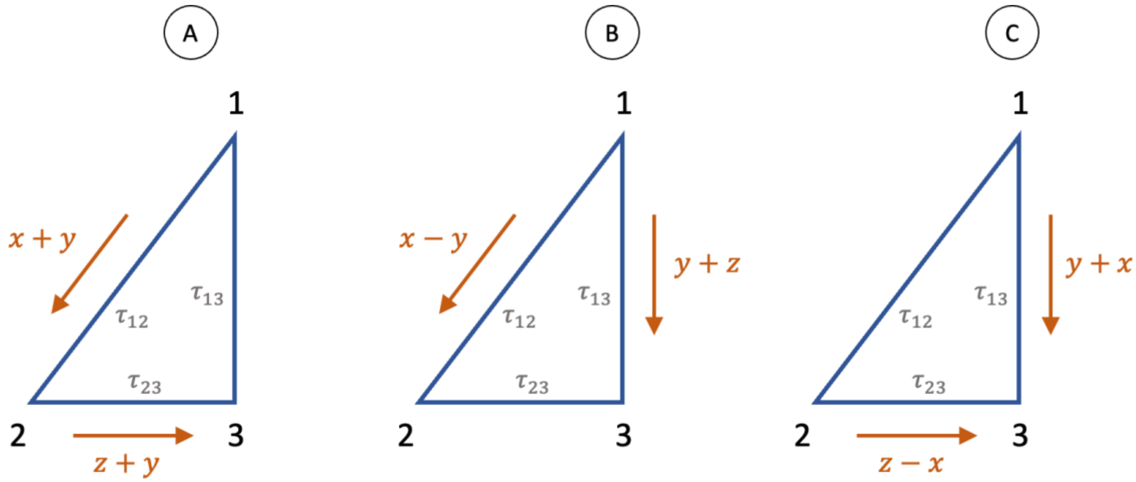

FIGURE A.2. Three Redeployment Plans

A natural constraint to place on resource flows—reflected in Equation (A.3)—is that units cannot redeploy more resources than they initially have. Since unit 3 is new, this means $y \geq 0$ and $z \geq 0$, and for Plan C implies $y + x \geq 0$ and $z - x \geq 0$. Thus, Plan C in Figure A.2 is only feasible if the firm doesn't require units 1 or 2 to be a net recipient of resources, which means:

$$t_1 + \delta_1 \geq w_1 \tilde{T} \;\text{ and }\; t_2 + \delta_2 \geq w_2 \tilde{T} \quad \textbf{(A.4)}$$

When both inequalities hold, units 1 and 2 both receive fewer resources following the shocks and are net suppliers of resources to unit 3 with $z + y = w_3 \tilde{T}$. Plan C will be the preferred way to achieve this allocation when $\tau_{13} + \tau_{23} \leq \tau_{12} + \tau_{i3}$ for $i \in \{1,2\}$. This holds when τ_{12} is the longest side of the triangle (as in the above picture). Conceptually, Plan C is preferable when the new unit is more related (or geographically proximate) to both incumbent units than the incumbent units are to each other. An example would be a firm combining knowledge in two domains to open a new, related business (Miller, Fern, and Cardinal, 2007; Tanriverdi and Venkatraman, 2005).

If either of the inequalities in Equation (A.4) do not hold, then either unit 1 or 2 should be a net recipient of resources and Plan C is not feasible (because unit 3 is new, it has no resources to

Similar expressions can be derived for other redeployment plans that entail operating three rather than two units. When the firm's resource stock exceeds some threshold (the right side of the above inequality), it will open an additional unit rather than confine itself to redeploying between the existing units. Thus, large positive shocks make unit openings more likely, while negative shocks make openings less likely.

Optimal resource allocation when opening a third unit

The above discussion took the final desired resource allocation as given. Here, we show why the allocations used in the above profit functions are optimal. Given multiple possible redeployments, we denote redeployment between units 1 and 2—r in Equation (A.3)—as r_{12}, redeployment between units 1 and 3 as $r_{13} \geq 0$, and redeployment between units 2 and 3 as $r_{23} \geq 0$.[2] As before, we assume each possible redeployment "path" between units i and k has an associated symmetric adjustment cost $\tau_{ik} \geq 0$.

Extending the objective function for redeployment into a new, third unit, the firm solves:

$$\max_{\{r_{12}, r_{13}, r_{23}\}} \begin{array}{c} p_1\gamma_1(t_1 + \delta_1 - r_{12} - r_{13})^\alpha + \\ p_2\gamma_2(t_2 + \delta_2 + r_{12} - r_{23})^\alpha + \\ p_3\gamma_3(r_{13} + r_{23})^\alpha - \\ \tau_{12}\,\mathbb{1}(r_{12} \neq 0) - \tau_{13}\,\mathbb{1}(r_{13} \neq 0) - \tau_{23}\,\mathbb{1}(r_{23} \neq 0) \end{array}$$

$$\text{subject to } \; -(t_2 + \delta_2) \leq r_{12} \leq t_1 + \delta_1 \qquad \textbf{(A.5)}$$

$$0 \leq r_{13} \leq t_1 + \delta_1$$

$$0 \leq r_{23} \leq t_2 + \delta_2$$

As illustrated above, the firm redeploys between at most two pairs of units (at least one of r_{ik}=0) and transfers resources until the marginal profit of resources across units is equalized.

[2] The third unit is new and therefore has no initial resource endowment. Thus, redeployment flows between it and the initial units can only go in one direction: hence, $\eta_{i3} \geq 0 \; \forall \; i$.

First, consider the possibility of staffing unit 3 by redeploying resources from both initial units ($r_{13} > 0,\ r_{23} > 0,\ r_{12} = 0$), which is Plan C above. From the first order conditions for Equation (A.5), equating marginal profit across units, we have:

$$r_{13}^* = t_1 + \delta_1 - w_1(t_1 + \delta_1 + t_2 + \delta_2) = t_1 + \delta_1 - w_1\tilde{T}$$
$$r_{23}^* = t_2 + \delta_2 - w_2(t_1 + \delta_1 + t_2 + \delta_2) = t_2 + \delta_2 - w_2\tilde{T}$$
$$r_{13}^* + r_{23}^* = w_3\tilde{T}$$

where w_i is given by Equation (A.2) and we assume (as discussed earlier) that units 1 and 2 both have "excess" resources to redeploy ($t_i + \delta_i \geq w_i\tilde{T}$). The profit from this redeployment plan is $\Pi(\tilde{t}_1^*, \tilde{t}_2^*, \tilde{t}_3^*) - \tau_{13} - \tau_{23}$.

Next, consider the possibility of redeploying only from unit 1 to unit 3 and leaving unit 2 alone with $t_2 + \delta_2$ resources. Then, the first order conditions for Equation (A.5) imply:

$$r_{13}^* = \frac{w_3}{w_1 + w_3}(t_1 + \delta_1)$$

which amounts to units 1 and 3 splitting unit 1's post shock resources to equalize marginal revenue. Profit in this case equals:

$$\Pi\left(\frac{w_1}{w_1 + w_3}(t_1 + \delta_1), t_2 + \delta_2, \frac{w_3}{w_1 + w_3}(t_1 + \delta_1)\right) - \tau_{13}$$

Next, if the firm redeploys from unit 1 to unit 3 and pays τ_{12} to also redeploy between units 1 and 2 (Plan B above), then the first order conditions for Equation (A.5) imply:

$$r_{13}^* = w_3(t_1 + \delta_1 + t_2 + \delta_2) = w_3\tilde{T}$$

$$r_{12}^* = w_2(t_1 + \delta_1 + t_2 + \delta_2) - (t_2 + \delta_2) = w_2\tilde{T} - t_2 - \delta_2$$

In this case, $t_i = \tilde{t}_i^* = w_i\tilde{T}\ \forall\ i$ and profit equals $\Pi(\tilde{t}_1^*, \tilde{t}_2^*, \tilde{t}_3^*) - \tau_{13} - \tau_{12}$.

This same logic holds if the firm redeploys only from unit 2 to unit 3. In this scenario, unit 2 takes on the role of unit 1 in the above equations and profits are:

are well-suited to estimating treatment effects (Angrist, 2001; Angrist and Pischke, 2009; Wooldridge, 2010). Moreover, they have the advantage of easily accommodating high-dimensional fixed effects. Here, however, we provide estimates of a random effects logit model for redeployment, which is guaranteed to produce predicted probabilities in the $[0,1]$ range (about 35 percent of predicted values in our linear models are outside this range):

$$\text{Logit}\big[\big(P(Redep_{ijt\to t+1} = 1|\boldsymbol{X}_{ijt}\big)\big] = \beta\ Manager\ death_{jt} + \delta'\boldsymbol{X}_{ijt} + \gamma_j + \lambda_t \qquad \textbf{(C.1)}$$

where $Manager\ death_{jt}$ is an indicator for manager death (see Section 4.2.2 of main text) and $\boldsymbol{X}_{ijt}$ is a vector of the same worker-, unit-, and firm-level controls used in the linear probability model (see Equation (9) and Table 2 of the main text). For feasibility of estimation, we replace the establishment fixed effect in our linear model with an establishment random effect, $\alpha_j \sim N(0, \sigma_v^2)$ and replace the industry-year and region-year fixed effects with year indicator variables (λ_t).

Table C.1 presents coefficient estimates of Equation (C.1). The average probability of outward redeployment absent a manager death is 6.6 percent and the average marginal effect of manager death on outward redeployment (Column 1) is -2.6 percentage points (-40 percent) with a standard error of 0.49 ($p < 0.001$). The average probability of inward redeployment absent a manager death is 3.4 percent and the average marginal effect of death on inward redeployment (Column 2) is 0.97 percentage points (28 percent) with a standard error of 0.41 ($p = 0.018$). Thus, like the main results using the linear probability model (Table 2 of text), negative shocks to managerial resources in a unit result in less outward redeployment from that unit and more inward redeployment to that unit.

TABLE C.1. Logit model estimates of resource shocks and manager redeployment

	Outward redeployment	*Inward redeployment*
DV: Redeployment indicator (0/1)	(1)	(2)
Manager death	-0.660	0.319
	(0.154)	(0.122)
Log unit managers	0.085	-1.249
	(0.012)	(0.018)
Log unit employees	0.101	-0.009
	(0.011)	(0.013)
Male	-0.525	0.149
	(0.025)	(0.015)
Log wage	-0.093	-0.223
	(0.008)	(0.013)
Log worker age	0.020	-1.289
	(0.008)	(0.032)
Log firm experience	-0.140	0.396
	(0.016)	(0.008)
Log industry experience	0.093	-0.183
	(0.020)	(0.008)
College degree	-0.207	-0.029
	(0.012)	(0.020)
Log firm managers	0.176	1.207
	(0.016)	(0.017)
Log firm employees	0.340	0.237
	(0.015)	(0.016)
Firm establishments	0.039	-0.016
	(0.002)	(0.002)
Firm industries	-0.090	-0.014
	(0.021)	(0.017)
Labor similarity	0.194	0.627
	(0.057)	(0.059)
Log distance	-0.224	-0.281
	(0.006)	(0.006)
Intercept	-2.308	-0.933
	(0.118)	(0.136)
Year indicators	•	•
σ_ν	1.613	1.229
	(0.014)	(0.013)
ρ	0.442	0.314
	(0.004)	(0.004)
Managers	467,239	441,553
Observations	1,086,171	1,051,514

Notes: Sample includes managers employed in an establishment at year-end. Robust standard errors in parentheses are clustered by establishment.

C.2. Poisson Models of Closings and Openings

In the main text (Table 3), we estimate how manager death affects the probability of firms closing and opening any units using a linear probability model. Here, we estimate the effects of death on the count of unit closings and openings with a Poisson model (Santos Silva and Tenreyro, 2006):

$$\mathrm{E}[N_{ft\rightarrow t+1}|\boldsymbol{C}_{ft}] = \exp\left(\beta\ Firm\ manager\ death_{ft} + \delta'\boldsymbol{C}_{ft} + \gamma_f + \lambda_{k(f)t} + \rho_{m(f)t}\right) \quad \textbf{(C.2)}$$

where $Firm\ manager\ death_{ft}$ is an indicator for manager death (see Section 4.2 of main text) in firm f at time t and $\boldsymbol{C}_{ft}$ is the same vector of and firm-level controls used in the linear probability model of opening and closing (see Equation (10) and Table 3 of the main text). As in that model, we include fixed effects for firm (γ_f), industry-year ($\lambda_{k(f)t}$), and region-year ($\rho_{m(f)t}$).

Results for the Poisson model (Table C.2) are consistent with the main results using the linear probability model (Table 3 of the main text). Estimates in Column 1 indicate that a manager death results in a 19 percent increase in unit closings ($p = 0.06$), while estimates in Column 2 indicate death results in an 8 percent decrease in unit openings ($p = 0.42$).

experienced by j, the lower the positive resource shock experienced by l, and the lower the bilateral adjustment costs between j and l.

In theory, this dyadic prediction of the model could be tested in worker-level data using a conditional logit model (McFadden, 1974), with each firm f choosing whether to redeploy each manager i from j to any of the potential destinations l within the firm. However, in our empirical setting, which features more than 400,000 unique managers and more than 200,000 unique destinations (establishments) that vary across firms, conditional logit models would be difficult to estimate. Guimarães et al. (2003) show that, under typical assumptions, equivalent results to the conditional logit model at the individual level can be obtained via a Poisson model with aggregate counts as the dependent variable. We apply this result and estimate a Poisson model of redeployment at the unit-pair (dyadic) level, where the observations are all pairs of units within a firm and the dependent variable is total outward redeployment from unit j to unit l:[3]

$$TotalRedep_{jlt\rightarrow t+1} = \exp\left(\beta_1 Manager\ death_{jt} + \beta_2 Manager\ death_{lt} + \zeta_1{}'\boldsymbol{K}_{jt} + \zeta_2'\boldsymbol{K}_{lt} + \delta'\boldsymbol{C}_{ft} + ac_{jlt} + \gamma_j + \gamma_l + \lambda_{k(j)t} + \lambda_{k(l)t} + \gamma_{m(j)t} + \gamma_{m(l)t}\right) \quad \textbf{(C.3)}$$

The parameters of interest are the β's, which estimate the effects of shocks to the resource stocks of units j and l, respectively, on total redeployment from j to l. The model includes the same vectors of unit-level and firm-level control variables as Equation (9) of the main text and unit-, industry-year, and region-year fixed effects (for each unit). We also add proxies for bilateral adjustment costs (ac_{jlt}), which are *Labor similarity* and *Log distance* between the units.

[3] The dyads are directed since each member of the dyad may redeploy resources out to the other. In other words, the model includes one observation for $TotalRedep_{jlt\rightarrow t+1}$ and one for $TotalRedep_{ljt\rightarrow t+1}$. However, because outward redeployment from j to l corresponds to inward redeployment to l from j at the dyad-level, we do not separately estimate models of inward and outward redeployment as they are equivalent.

Table E.2 shows that model estimates after removing promotions are like those reported in the main text in terms of both magnitude and statistical significance.

TABLE E.2. Estimates excluding likely promotions

	Outward Redeployment	*Inward Redeployment*
DV: Redeployment indicator (0/1)	(1)	(2)
Recent manager death	-0.015	0.007
	(0.005)	(0.003)
Log managers	0.047	-0.067
	(0.002)	(0.002)
Log employees	0.010	-0.009
	(0.002)	(0.001)
Male	0.006	0.005
	(0.001)	(0.001)
Log wage	-0.001	-0.004
	(0.001)	(0.000)
Log worker age	-0.006	-0.013
	(0.001)	(0.001)
Log firm experience	0.002	0.011
	(0.000)	(0.000)
Log industry experience	0.001	-0.005
	(0.000)	(0.000)
College degree	-0.004	-0.001
	(0.001)	(0.001)
Log firm managers	-0.032	0.058
	(0.001)	(0.001)
Log firm employees	-0.000	0.006
	(0.002)	(0.001)
Firm establishments	-0.000	0.001
	(0.001)	(0.000)
Firm industries	-0.001	-0.001
	(0.002)	(0.001)
Avg. labor similarity	-0.007	-0.001
	(0.004)	(0.002)
Log avg. distance	-0.007	-0.002
	(0.001)	(0.001)
Intercept	0.078	0.050
	(0.010)	(0.006)
Fixed Effects		
Establishment	•	•
Industry-Year	•	•
Region-Year	•	•
Managers	372,322	364,241
Observations	906,448	910,705
R^2	0.316	0.251

Notes: Sample includes managers employed in an establishment at year-end. Robust standard errors in parentheses are clustered by establishment.

F. WAGES AND REDEPLOYMENT

In this appendix, we examine managers' wages around the time of outward redeployment. To do so, we estimate a difference-in-differences model that compares redeployed managers to non-redeployed managers in the same firm:

$$E\left[W_{ijt} | D_{ijt}, X_{it}, Z_{jt}\right] = \exp\left(\beta D_{ijt} + \gamma' X_{it} + \delta' Z_{jt} + \alpha_j + \lambda_t\right) \quad \textbf{(F.1)}$$

where W_{ijt} is manager i's wage in firm j and year t, D_{ijt} is an indicator for whether a manager has been redeployed, X_{it} and Z_{jt} are vectors of worker and establishment/firm characteristics, and α_j and λ_t are firm and year fixed effects. For managers with multiple redeployments, we limit the analysis to the first redeployment. In a second analysis, we estimate a modified, "event-study" version of Equation (F.1) that includes indicator variables for each year pre- and post-redeployment to examine wage dynamics around the time of redeployment.

The coefficient estimates in Table F.1 indicate that managers earn about 7–9 percent more following redeployment. Including a worker fixed effect in the model reduces the estimate of the redeployment effect, suggesting redeployed workers are positively selected on unobservables. Estimates for the event-study model plotted in Figure F.1—which follows the specification in Column 1 of Table F.1—show that redeployed and non-redeployed managers have similar wages prior to the redeployment, and that the wage changes following redeployment are persistent.

Note: Period 0 refers to December 31 immediately prior to redeployment and period 1 is December 31 of the following year (the manager's first year in the destination establishment).

FIGURE F.1 Redeployment and wages

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