The Firm as a Cultivator of Internal Relationships: How Rotation Supports Favor Exchanges in Organizations

Nicholas Argyres
Olin School of Business
Washington University in St. Louis

and

Giorgio Zanarone
HEC Lausanne
University of Lausanne
and CEPR

October 2026

Abstract

In a multidivisional firm, units must frequently transfer resources to each other to address unforeseen contingencies. Yet, the organization typically lacks the information to enforce unscheduled resource transfers, and divisions lack the budgetary discretion to pay for them. We model interdivisional cooperation as a "favor-exchange" agreement in which a division's manager may transfer resources to another division in the hope of being a receiver in the future. We show that by reassigning managers to roles over time, the organization can facilitate internal favor-exchange agreements. We derive conditions under which role rotation makes the promise of interdivisional favor exchanges more credible by increasing the managers' future rewards from cooperation (rotation across divisions) or the punishment they suffer after defection (rotation in and out of superior positions). We discuss empirical implications of the model, as well as applications to other kinds of organizations such as government agencies, buyer-supplier relationships, and strategic alliances.

Keywords: Management Rotation; Favors; Relational Contracts; Multidivisional Organizations

We thank Bard Harstad, Bob Gibbons, Fabrice Lumineau, Hideo Owan, Wenqian Wang, Christian Zehnder, and audiences at HEC Lausanne, IESE, the 2026 Workshop on Relational Contract, the 2026 Strategy Science and SIOE Conferences, the 2026 Strategic Contracting Workshop, and the 2026 Ohlstadt Organizational Economics Symposium, for helpful comments.

1 Introduction

Organizational economists and strategy scholars have studied several related governance mechanisms through which a firm can enforce or incentivize cooperation between its units. These mechanisms include hierarchical fiat (Williamson 1985, 1991); various forms of financial incentives, such as transfer pricing (Holmstrom & Tirole 1991; Edlin & Reichelstein 1995; Shelanski 2004) and subjective bonuses (Baker, Gibbons & Murphy 2002); and formal contracts between divisions (Magelssen, Rich & Mayer 2022).

These centrally determined mechanisms are thought to work well for routine interdivisional cooperation, such as timely and consistent input delivery from an upstream unit to a downstream one, or the provision of R&D and legal services from centralized functional departments to product divisions. However, the need for resource transfers between firm units often arises suddenly, in response to non-routine local problems that are difficult for the central hierarchy to anticipate, monitor and incentivize (Williamson 1975; Jensen & Meckling 1992). Decentralized financial incentive mechanisms are also poorly suited to govern such unforeseen cooperation needs because previously set divisional budgets and transfer pricing rules make it difficult or impossible for divisional managers to make spontaneous discretionary payments to each other.

Divisions therefore often cooperate through an exchange of "favors". For example, consulting firms including Accenture and PwC temporarily assign consultants to their foreign units to help with projects that are struggling, and the flow is often reversed (Meister & Davenport 2005; PwC 2025). Construction companies often need to move equipment abruptly between sites run by different business units when equipment breakdowns occur, or

when unforeseen geological problems are encountered.[1] Rolls Royce's aerospace division temporarily assigned engineers to the company's marine and nuclear divisions in order to help develop those businesses, assignments that likely could only have been partially planned in advance (CIPD 2015). Divisions often send researchers to other divisions' R&D centers in order to assist with, or learn from, research projects (Kang & Eklund 2025). Such visits are sometimes arranged on short notice and can be costly to the sending or receiving division in terms of researcher time.

In this paper, we ask how a multidivisional firm can encourage its divisions to exchange favors that can neither be centrally enforced nor compensated or incentivized financially. Our formal model shows that by systematically alternating managers across divisions and roles over time, the firm can increase their future gains from providing favors to each other, and their losses from failing to do so, thus creating a basis for the development of internal relational contracts. Our paper therefore motivates a new perspective on the hierarchy's role in a firm: not as central enforcer/coordinator, but as broker of internal relationships between divisional managers.

Following the economics literature (e.g., Kandori 1992; Mobius 2001), we model favor exchanges as equilibria of a repeated game in which a divisional manager is motivated to perform favors for another division manager because she expects to receive favors from her in the future, and is concerned about permanently forfeiting such favors if she defects. We depart from this literature, however, in a crucial respect; while existing models of favor exchanges take the alternation of giver and receiver roles as given, we assume that in an organization those roles are endogenous because the organization chooses which manager is

[1] https://www.constructiondive.com/spons/the-benefits-of-sharing-resources-across-multiple-offices/648249/#:~:text=The%20best%20way%20to%20get,employee%20availability%20in%20each%20location.

assigned to which position at a given point in time. We show that by rotating managers across positions with optimal frequency, an organization can make promises of favor exchanges between divisions more credible.

We explore two complementary mechanisms through which manager rotation facilitates favor exchange agreements between divisions: (1) enhancing the managers' rewards from cooperation and (2) increasing their losses from defection (punishment). To analyze the reward mechanism, we model an organization containing pairs of divisions or units that are naturally pre-disposed to cooperate with each other. Examples of such pairs are a purchasing and a supplying division, or business units that are co-located or have fungible assets or employees.

To demonstrate the reward mechanism, we show that alternating a pair of managers horizontally across divisions replaces the continuation payoffs those managers would receive when their roles are fixed with a convex combination of them. Intertemporal discounting implies that more frequent such rotation raises the continuation payoff of the manager currently assigned to the unit that gives favors more often, while decreasing the payoff of the unit manager who more often receives favors. A well-designed rotation policy therefore uses the high continuation value of the unit that is more frequently the receiver to "subsidize" the low continuation value of the unit that is more frequently the giver, such that both units' managers are willing to honor a promise to exchange favors.

Academic studies and practitioner reports have found that job rotation is common among managers in a variety of industries (Campion, Cheraskin & Stevens 1994; Bidwell & Keller 2014; Bidwell & Mollick 2015; CRANET 2023; SHRM 2025; Ray et al. 2026). Our model was inspired by an interview with a senior manager of a large, multidivisional Chinese

construction company,[2] a context where horizontal rotation is especially common (Nyallu, Deng & Melckzedeck 2025).[3] In explaining why there are few contractual disputes between the firm's main contractor division and its subcontracting subsidiaries, this manager said:[4]

> *"In internal group management, the execution of internal contracts can also affect some management careers. I might be here today, there tomorrow, and then I could be in a leadership position that I need to serve on the side of the current projects. Their roles change every two to three years. […] Adjusting leadership roles appropriately while ensuring professionalism is beneficial for executing internal contracts because you might become my Party A, and I could become your Party B."*

To analyze the punishment mechanism through which rotation facilitates favor exchanges, we allow a manager to rotate into a position of authority over their previous position. What call this "vertical rotation". We show that rotating the manager of a favor-receiving division vertically in this way can make the promise of favors credible because it enables the victim of a defection (today's favor-receiving manager) to punish the favor-giving manager after moving into a position of authority. This punishment mechanism is not available with fixed roles because the superior cannot easily monitor favor exchanges between division managers. Our model provides a novel explanation for the leadership rotation practices observed in universities and in political organizations such as the EU or the Swiss government, as well as the rotating membership in promotion and compensation committees of consulting and law firms.

Finally, we extend our two-unit model to consider settings where a single giver division provides favors to multiple receiver divisions. Such settings might include

[2] The interview was conducted by Wenqiang Wang (Hong Kong Baptist U.) and Ying Gao (Tianjin U).
[3] These companies are important, accounting for seven of the eight largest construction companies in the world in 2025. Chinese construction companies' 2025 share of international mega-projects over $1 billion in value is estimated to be 25-30% (https://dialogue.earth/en/energy/the-belt-and-road-boomed-in-2025).
[4] As in other Chinese state-owned construction companies, the company in question used internal contracts between its main contracting division and its subcontracting subsidiaries. Magelssen et al. (2022) analyze the economic functions of such internal contracts.

organizations in which a functional unit provides services to other divisions (e.g., R&D), or in which one division provides inputs to other divisions. Aside from confirming the insight that rotation facilitates internal favor-exchange agreements between managers (relative to a policy of fixed roles), this extension shows that the specific direction and pattern of rotation matter and that their optimal design is organization-specific. In particular, the optimal rotation policy depends on which directions of rotation are feasible given the organization's characteristics, and whether a manager's incentive to give favors is increased more by being moved to the unit that receives most favors, or being moved away from the favor-giving unit.

The rest of this paper is organized as follows. In the next section, we discuss how our model relates to the literature. We then present the basic model of favor exchanges within pairs of organizational units (Section 3), followed by our analysis of manager rotation across units (Section 4) and in and out of superior positions (Section 5). In Section 6, we extend the baseline model to the case of multiple favor-receiving units. We conclude by discussing additional examples, applications and empirical implications of our model in Section 7.

2 Literature Review

Our paper connects three literatures –those on internal organization, relational contracts, and job rotation. A central claim of transaction cost economics is that adaptation to unforeseen contingencies is less costly in internal transactions between divisions or units than in transactions between buyers and independent suppliers (Williamson 1985). There are relatively few studies, however, of how internal transactions are managed to achieve such adaptation. Williamson (1991) asserts that hierarchical fiat and the obligation to submit intrafirm disputes to the upper management rather than courts are the key mechanisms to enforce cooperation between divisions. Organizational economics models study conditions

under which centralized authority facilitates communication and coordination between divisions (Cremer, Garicano & Prat 2007; Alonso, Dessein & Matouschek 2008). A few papers focus on transfer pricing as a coordination and motivation device, and study the tradeoff between centralized and decentralized transfer pricing systems (Holmstrom & Tirole 1991; Shelanski 1994; Edlin & Reichelstein 1996). More recently, Magelssen et al. (2022) document the use of formal, court-enforceable contracts between a firm's subsidiaries.

Our paper contributes to this literature on intra-firm governance by studying how spontaneous internal transactions can be efficiently governed when centralized authority, transfer pricing, and written contracts are ineffective. This is an important phenomenon because the need for interdivisional transfers of goods is often unscheduled, and managing such transfers requires information the firm's central management does not possess (Williamson 1975; Jensen & Meckling 1992). Moreover, transfer pricing rules cannot be effectively used to coordinate and incentivize unscheduled transactions between units because divisional budgets cannot be renegotiated quickly.

Our paper also contributes to the economic literature on relational contracts, conceptualized as informal agreements that are enforced by the parties' desire to preserve valuable future interactions (Klein 1996; Baker et al. 1994, 2002; Levin 2003).[5] Most relational contracting models study how a principal (an employer or a buyer) can enter a self-enforcing agreement with one or multiple agents (employees, suppliers) by appropriately selecting monetary incentives (Halac 2012; Li & Matouschek 2013), the number of agents with whom to deal (Levin 2002; Argyres, Bercovitz & Zanarone 2020), and formal

[5] The existence of relational contracts is supported by empirical evidence (e.g., Gil & Marion 2013; Barron et al. 2020; Gil, Kim & Zanarone 2022; Macchiavello & Morjaria 2015, 2021).

contractual and governance provisions (Klein & Murphy 1988; Baker et al. 1994, 2011).

Unlike our paper, none of these models studies how a principal can facilitate relational contracts of which she is not herself a party. By modeling relational contracts between managers in the absence of monetary incentives, our model also relates to repeated-game models of "favor exchanges," in which current favors are sustained by the fear of losing future ones (Kandori 1992; Mobius 2001; Hauser & Hopenhayn 2005; Abdulkadiroglu & Bagwell 2013; Ali & Miller 2016; Li & Powell 2020). However, while these models – and most of the relational contracting literature – assume the players' roles as favor giver/receiver or principal/agent are exogenously fixed, we explore how the reallocation of roles across players facilitates relational contracts between them.

A third stream of research to which our paper contributes is the literature on job rotation. Ouchi (1981)'s study of Japanese corporation was perhaps the first to emphasize the value of employee rotation, explaining that by enhancing their knowledge of each other's tasks, employees are better able, and more willing, to cooperate with each other.[6] Subsequent literature has emphasized the learning and information transmission effects more than the motivation to cooperate. Rotation has been shown to foster employees' learning of new skills (e.g., Meyer 1994; Campion et al. 1994; Cosgel & Miceli 1999; Bidwell & Keller 2025) and the employer's ability to learn about those skills (Ortega 2001; Eriksson & Ortega 2006); to prevent clients' poaching of a firm's employees by limiting those employees' acquisition of client-specific skills (Battiston, Espinosa & Liu 2025); to weaken future supervisors' ability to infer employees' skills from past performance, thus softening the ratchet effect (Ickes & Samuelson 1987) and enhancing career-concern incentives (Hanekes & Katolnik 2017); to

[6] Ouchi (1981) argued that rotation motivates cooperation through the development of trust and group spirit. Our model is based on rational choice.

enable employers to obtain accurate information from employees (Hirao 1993; Mittendorf 2004; Hertzberg, Liberti & Paravisini 2010); and to prevent employees from gaining access to private information (Prescott & Townsend 2006). A few papers have emphasized alternate benefits of rotation, such as motivating employees via boredom-reduction (Campion et al. 1994; Eriksson & Ortega 2006), as well as potential costs of job rotation policies in terms of reduced specialization, additional training, organizational instability, stress, and loss of social cohesion (Cosgel & Micheli 1999; Eriksson & Ortega 2006; Casad 2012; Foroutan, Safavi & Bouzari 2021).

We contribute to this literature by modeling a novel, non-informational mechanism rotation can improve organizational performance; namely, facilitating the sustainability of interdivisional favor-exchange agreements. Indeed, our model's primary application is to senior managers who may have already become well-informed about the firm's operations, and whose skills are better known to their superiors. In this case, the learning and monitoring functions of rotation emphasized in the literature may be less important, and the optimal pattern of rotation may be more affected by the need to facilitate interdivisional cooperation.

Finally, by showing that rotation enables the manager of a favor-giving unit to share the benefits that flow to favor-receiving units over time, our model highlights a novel mechanism by which firms can initiate trusting relationships between employees, stimulate the formation of social capital, and establish communities of practice. These functions of firms have been argued to explain their existence as institutions (Nahapiet & Ghoshal 1998; Brown & Duguid 2001), and have been attributed to sociological mechanisms such as norms of reciprocity and friendship-based trust. Our paper assumes instead calculative trust (Williamson 1993; Poppo, Zheng & Ryu 2008) and shows that intertemporal payoff sharing

can increase managers' future gains from cooperation and discourage defection. However, the payoff-sharing function of rotation uncovered by our model could also activate non-economic drivers of trust and community building, such as employees' preference for fairness and distributive justice. In particular, our model implies that if managers are "Rawlsian" individuals motivated by distributive justice (and de-motivated by its lack), a rotation policy that gives each manager an equal share of all units' payoffs should make that manager more willing to exchange favors with the managers of other units.

3 Model

3.1 Preliminaries

In our baseline model we analyze an organization with two units, 1 and 2. The organization is managed by a principal, whereas the units are managed by two identical agents, each of whom is assigned to a unit. All players are risk-neutral, live forever, and discount next-period payoffs at the rate $\delta \in (0,1)$. Time evolves in discrete periods ($t = 1,2, \ldots$).

Without loss of generality, we assume that at the outset of the game, the principal randomly assigns agents to units for period 1. To determine agent assignments in subsequent periods, the principal announces and commits to a *rotation policy*. Here and in the following Section 4 we focus on "horizontal" rotation: at the beginning of any period $t > 1$, the agents switch units with probability $\rho \in [0,1]$, and stay at the same unit as in period $t - 1$ with probability $1 - \rho$. We consider "vertical" rotation – whereby unit agents periodically switch roles with the principal – in Section 5.

The principal's problem is to simultaneously incentivize the agents to run their own unit efficiently (*routine effort*) while cooperating with the other unit when needed (*favors*). Formally, the timeline of events in each period is as follows.

1. Contracting: First, the principal and the agent in charge of a given unit $i \in \{1,2\}$ negotiate an incentive contract $w_i = s_i + \beta_{ii} y_i + \beta_{ij} y_j$, where s_i is a fixed payment (which could be negative), y_i and y_j are the total profits of units i and $j \neq i$, to be defined momentarily, and $\beta_{ii} \in [0,1]$ and $\beta_{ij} \in [0,1]$ are the shares of the two units' profits that the contract assigns to agent i. The principal's share of unit i's profit is therefore $1 - \beta_{ii} - \beta_{ji}$.
2. Routine efforts: If the negotiation is unsuccessful, each party collects her outside option, which we normalize to zero for simplicity. If the negotiation is successful, the agent in charge of unit i chooses how much productive effort $a_i \in \mathbb{R}^+$ to exert on the unit's routine activities. This effort generates a private cost $k_i = \frac{{a_i}^2}{2}$ for the agent, and contributes $v_i \equiv f_i a_i$ to the unit's profit.[7]
3. Need for inter-unit favors: After the routine efforts are sunk, with some probability one of the two units needs the other to take an unscheduled, non-routine cooperative action, which we label "favor". For instance, the two units may operate at different stages of the vertical chain of production, and the downstream (manufacturing) unit may need the upstream one to expedite component deliveries due to a demand spike. Alternatively, the two units may be responsible for different but related products or locations, and one unit may need know-how from the other on short notice. The probability that unit 2 needs a

[7] We assume explicit functional forms for v_i and k_i for expositional simplicity and transparency. None of the model's results depends on these assumptions.

favor from unit 1 is p_1, the probability that unit 1 needs a favor from unit 2 is p_2, and the probability that neither unit needs a favor is $1 - p_1 - p_2$ (we rule out simultaneous favors for simplicity). Without loss of generality, we assume that unit 1 is the more frequent favor-giver, and unit 2 the more frequent favor-receiver: $p_1 \geq p_2$. For example, a newly-formed business unit may fail to anticipate the full range of human and capital resources it needs to initiate its business, and therefore may call on resources from an established unit more frequently than vice versa.

4. Favor decisions: If a favor is needed from unit i, its agent chooses whether to do the favor (decision $d_i = 1$) or not (decision $d_i = 0$). If the agent chooses $d_i = 1$, unit i incurs a cost c, and the other unit receives a profit $b > c$. We assume for simplicity that while favors consume unit resources, they do not require effort, and hence the agents do not bear private costs for giving them.
5. Payoffs: After favor decisions are made, the units' profits are realized and each player receives and consumes her current period's payoff, that is:

$$u_P \equiv y_1 + y_2 - w_1 - w_2 \text{ for the principal, and} \quad (1)$$

$$u_i \equiv w_i - k_i \text{ for the agent at unit } i \in \{1,2\}, \quad (2)$$

where $y_i \equiv \pi_i + v_i + \varepsilon_i$ is the total realized profit of unit i. A unit's profit consists of three components: (a) the favor component $\pi_i \equiv \sigma_j d_j b - d_i c$, where $\sigma_j \in \{0,1\}$ is an indicator for whether unit i needs a favor from unit $j \neq i$ ($\sigma_j = 1$) or not ($\sigma_j = 0$); (b) the routine-effort component v_i; and (c) a random component ε_i, which we assume to have zero mean.

Consistent with the delegation of authority in multidivisional firms (Chandler 1962; Williamson 1975; Aghion & Tirole 1997) and the unscheduled and idiosyncratic nature of

inter-unit cooperation, we assume the principal cannot monitor the agents and directly contract for routine efforts and favors.[8] Formally, neither the principal nor a court can observe the agents' routine efforts (a_i), whether a favor is needed and from which unit (σ_i), whether a needed favor has been given (d_i), and the distinctive contributions of favors, routine efforts and noise to unit profits (π_i, v_i and ε_i). Thus, the principal cannot elicit the desired efforts and favors through simple "forcing contracts" (formal salaries conditional on the agents' actions) or "relational incentive contracts" (discretionary bonuses conditional on those actions, as in Bull 1987, or Levin 2003). Since profits are noisy, the principal is also unable to infer whether a favor has been given from the units' total realized profits, which makes it difficult to use clever non-linear contracts (including budget breaking mechanisms a la Holmstrom 1982) to incentivize favor giving. Given these limitations, we assume the principal must use the compensation contract (w_i) linking the agents' pay to the unit's contractible total profit (y_i) in order to simultaneously incentivize routine efforts and favors.

While incentivizing routine efforts requires that each agent be the residual claimant of her unit's profit, incentivizing favors requires such profit to be shared with the other unit's agent.[9] The principal therefore faces a team production problem where each unit's profit depends on the actions of both its own manager (routine effort) and the other unit's manager (favors), and must choose which of the two activities to target with the profit sharing contract (Holmstrom 1982, 1999).

[8] Reducing top management's span of control and economizing on headquarter resources and monitoring costs is a major rationale for delegating authority to divisions in the first place (Chandler 1962; Williamson 1975). Additionally, companies often commit themselves not to interfere with unit operations in order to stimulate initiative and innovation (Aghion & Tirole 1997) and reduce politicking and strategic communication (Milgrom & Roberts 1988; Dessein 2002).

[9] The agent at unit i is willing to give a favor to the other unit if and only if her profit under favor-giving is higher than her profit without it, that is, if $\beta_{ij}b - \beta_{ii}c \geq 0$, or $\beta_{ij} \geq \frac{\beta_{ii}c}{b}$.

In the rest of the paper we ask whether the principal can achieve the first best by using (1) the profit sharing contracts to directly incentivize efficient routine efforts and (2) the rotation policy ρ to indirectly encourage self-enforcing favor-exchange agreements between the agents. In the first best equilibrium, each agent exerts the effort that equates marginal cost to marginal product, $a_i = f_i$, generating profit contribution $v_i^* \equiv {f_i}^2$ and effort cost $k_i^* \equiv \frac{f_i^2}{2}$. Moreover, each agent chooses the efficient favor schedule $d_i = \sigma_i$ (that is, gives a favor if and only if the other unit needs it), generating expected profit contribution $\pi_i^* \equiv p_j b - p_i c$.

To investigate whether a first best equilibrium exists, we assume the principal makes the agents full residual claimants of unit profits by setting $\beta_{11} = \beta_{22} = 1$ and $\beta_{12} = \beta_{21} = 0$. In response to this contract, each agent chooses her routine effort to equate the marginal cost a to the private marginal benefit $\beta_{ii} f_i$, which for $\beta_{ii} = 1$ coincides with the marginal product for the firm. We assume the principal captures part of the units' surplus by stipulating an appropriate fixed payment $s_i^* < 0$.[10]

Having ensured that profit-sharing contracts induce the agents to exert efficient routine efforts, we now turn to the paper's central question – how reshuffling the agents across units over time (through the rotation policy ρ) encourages them to exchange favors.

3.2 Two benchmark solutions

3.2.1 Monetary payments between units

[10] The exact amount of the fixed payment depends on the principal's and the agent's relative bargaining power. If the principal has all the bargaining power and makes agent i a take-it-or-leave-it offer, she can appropriate the unit's entire net expected surplus by offering $s_i^* = k_i^* - v_i^* - \pi_i^*$. At the other extreme, if the agent has all the bargaining power, she can offer $s_i^* = 0$ and extract all the surplus. Intermediate payments are of course also possible. For instance, the Nash Bargaining Solution would imply $s_i^* = -\frac{1}{2}(k_i^* - v_i^* - \pi_i^*)$.

In this section, we follow canonical economic models of relational contracts (Baker *et al*., 1994, 2002; Levin, 2003) and assume that the agents can use informal monetary incentives and transfers to elicit mutual favors. Specifically, we assume that in every period, a relational contract requires the agent in charge of a unit (say, unit 2) to make a fixed upfront transfer τ (which could be negative) to the agent in charge of the other unit. Additionally, in the event that a favor is needed from unit $i \in \{1,2\}$, the relational contract requires the agent in charge of that unit to give the favor, and the other unit's agent to pay her a bonus B_i if and only if the favor request is honored. We make the standard assumption that if either agent deviates by failing to give a requested favor or make a prescribed payment, the relationship terminates and all parties revert to the static Nash equilibrium in which there are no favors and no discretionary payments between units forever after.

Our relational contract is self-enforcing if it is a subgame perfect equilibrium of the repeated game between the agents. Below we apply Levin's (2003) seminal model to show that an equilibrium in which both agents perform the required favors exists, provided that the present discounted value of the two units' joint surplus from favors, $\frac{\delta}{1-\delta}(\pi_1^* + \pi_2^*)$, outweighs the present cost c of giving a favor. In other words, the profit of unit 2, which receives favors more frequently than it gives them, can be used to "subsidize" unit 1, which is usually the favor giver.

We also extend Levin (2003) to show that the organization cannot relax this condition by rotating the agents across units (i.e., by switching from $\rho = 0$ to $\rho > 0$). In other words, when the agents can condition mutual monetary payments on favors, a rotation policy does not increase cooperation between units.

Proposition 1: Suppose that monetary payments between the agents are feasible. Then an optimal relational contract prescribes that each unit's agent either does a favor in every period in which it is asked to do so or never does. Moreover, the optimal contract can be implemented without rotation ($\rho = 0$), and it prescribes favor-giving if and only if the discounted value of the two units' joint per period surplus offsets the present cost of a favor:

$$\frac{\delta}{1-\delta}[\pi_1^* + \pi_2^* = (p_1 + p_2)(b - c)] \geq c. \quad (3)$$

Proof: See Appendix.

This result is explained as follows. Rearranging condition (3) implies that favor-giving can be implemented through a relational incentive contract if and only if the agents are patient enough:

$$\delta \geq \delta^{MI} \equiv \frac{c}{\pi_1^* + \pi_2^* + c}, \quad (4)$$

where δ^{MI} is the minimum discount rate required to implement favors in equilibrium using monetary incentives (*MI)*.

While unit 2 (the more frequent favor receiver) has higher expected profits than unit 1, so long as their joint surplus stream, $\frac{\delta}{1-\delta}(\pi_1^* + \pi_2^*)$, is large enough, it is possible to incentivize either unit's agent to give favors via bonuses, while using fixed transfers to allocate the future joint surplus stream to the other unit's agent -- who will then also be incentivized to cooperate by giving favors or paying bonuses, depending on the realized state. Moreover, because the joint surplus does not depend on how agents are assigned to units over time, switching from fixed assignments ($\rho = 0$) to a policy of rotation ($\rho > 0$) cannot make favors between units easier to sustain.

While enforcing inter-unit cooperation through monetary incentives is appealing, it requires the agent in charge of one unit to have the discretion to make monetary payments to the other. In many cases, however, this condition, is unlikely to hold. As noted above,

divisional profit centers within decentralized, multidivisional firms generally cannot use company cash to pay for unplanned interdivisional resource transfers except in extraordinary circumstances (Datar & Rajan 2021, ch. 16, 22). Divisional budgets and transfer prices are approved in advance; payments for spontaneous transfers are not permitted without a lengthy re-approval process. This is in part because allowing division managers to make large, non-budgeted discretionary payments to each other could open up opportunities for them to game the accounting system for self-serving purposes, or engage in other kinds of financial misappropriations.

3.2.2 Favor-exchange agreements with fixed roles

Absent the possibility of using monetary incentives, relational contracts for interunit cooperation must take the form of pure favor exchanges: the agent in one unit is motivated to give favors to the agent in another unit by the fear of losing the latter's future favors upon termination of the relationship between the two agents.

Formally, we define a favor-exchange agreement as a subgame-perfect equilibrium of the infinitely repeated game described above, where in any given period t: (a) the agent in charge of the unit called upon to give a favor to the other unit does so, and (b) if the agent deviates, no further favors are exchanged from period $t + 1$ and thereafter.

In this section, we analyze favor exchanges in the absence of rotation, that is, when the agents are permanently assigned to a unit ($\rho = 0$). This is the standard setting in economic models of favor exchanges (e.g., Kandori 1992; Mobius 2001). Under fixed roles, the agent at the favor-giving unit will honor a favor request if and only if *her own individual* continuation payoff – that is, the present value of receiving the expected equilibrium utility from running her unit in each future period – exceeds the present cost of doing a favor, plus

the post-defection payoff – that is, the present value of receiving the expected utility from running her unit her unit without favor exchanges. For the agent at unit 1, this condition is:

$$\frac{\delta}{1-\delta}(u_1^* = \pi_1^* + s_1^* + v_1^* - k_1^*) \geq c + \frac{\delta}{1-\delta}(s_1^* + v_1^* - k_1^*),$$

where s_1^* is the fixed payment stipulated in the agent's contract with the principal, as defined above, and $v_1^* \equiv f_1^2$ and $k_1^* \equiv \frac{f_1^2}{2}$ are, respectively, the expected profit from routine activities and the agent's private effort cost given the effort induced by such a contract. Notice that because divisional managers have no power to fire each other or modify each other's compensation contract, only the extra profit from favors is lost upon defection, whereas the agent continues to receive the other components of her utility function. Thus, the agent's incentive constraint can be rewritten as

$$V_1^{FR} = \frac{\delta}{1-\delta}(\pi_1^* = p_2 b - p_1 c) \geq c. \quad (5)$$

For identical reasons, the favor-giving condition for the agent at unit 2 is:

$$V_2^{FR} = \frac{\delta}{1-\delta}(\pi_2^* = p_1 b - p_2 c) \geq c, \quad (6)$$

where *FR* indicates fixed roles.

For the favor-exchange agreement to be an equilibrium, both incentive constraints must be satisfied. Let $\delta_1^{FR} \equiv \frac{c}{\pi_1^* + c}$ and $\delta_2^{FR} \equiv \frac{c}{\pi_2^* + c}$ be the minimum values of the discount factor δ that satisfy incentive constraints (5) and (6), respectively. Since unit 1 is the usual favor-giver and unit 2 is the usual favor-receiver ($p_1 \geq p_2$), constraint (5) is at least as stringent as (6), that is, $\delta_1^{FR} \geq \delta_2^{FR}$. Thus, (5) is the relevant condition for mutual favor exchanges to be sustainable. Notice that if (5) is violated, not only it is impossible to sustain mutual favors – it is also impossible to sustain unilateral favors from unit 2 in the event that

(6) is satisfied: if only unit 2 is required to do favors, the continuation payoff of the agent at unit 2 drops from π_2^* to $-p_2 c \leq 0$. Our second proposition follows from these observations:

> **Proposition 2**: Suppose each agent is permanently assigned to a unit and that monetary incentives between units are infeasible. Then, a favor-exchange agreement prescribes that each unit's agent either does a favor in every period in which they are asked to do so or never does. Moreover, the optimal agreement prescribes mutual favor-giving if and only if the discount rate of the agent at the usual favor-giving unit exceeds their cost of doing a favor, such that:
>
> $$\delta \geq \delta_1^{FR}. \quad (7)$$

Note that $\delta_1^{FR} > \delta^{MI}$: there is a range of discount factors (namely, $\delta \in [\delta^{MI}, \delta_1^{FR})$) where favors can be implemented through interdivisional monetary incentives but not through a favor-exchange agreement with fixed roles. Intuitively, because there are no monetary transfers in the favor-exchange agreement, it is not possible to use the favor-receiving unit's high future expected payoff to "subsidize" the favor-giving unit's low payoff. This constrains the agents' ability to sustain cooperation.

4 Horizontal rotation

Our key point so far is that when the organization cannot directly enforce favor exchanges between its units, it is difficult for those units to sustain such exchanges through decentralized relationships between their managers. In this section we show that by systematically and predictably rotating managers horizontally across units over time through the policy variable ρ, the organization can increase the managers' gains from favor exchanges and thus facilitate the development of relational contracts between them. In other words, the organization can serve as a cultivator of, or platform for, internal relationships, rather than an enforcer of them.

Recall that ρ, announced by the organization at the outset, is the probability with which at any time t, the two agents expect to switch units at time $t+1$. Fixed roles is thus a limiting case where the organization selects $\rho = 0$. Let $V_1^R(\rho)$ and $V_2^R(\rho)$ be the equilibrium continuation payoffs (from time $t+1$ onwards) of the agents assigned to units 1 and 2 at time t respectively. Similarly, let $V_1^D(\rho)$ and $V_2^D(\rho)$ be the agents' continuation payoffs following defection and the perpetual suspension of favor exchanges between them (where "*D*" stands for "defection"). Favor exchanges can be sustained under policy ρ if and only if the continuation payoff of the agent at the favor-giving unit outweighs the favor's cost in every stage, that is:

$V_1^R(\rho) \geq c + V_1^D(\rho)$ when unit 1 must give the favor, and (8)

$V_2^R(\rho) \geq c + V_2^D(\rho)$ when unit 2 must give the favor. (9)

To analyze the conditions under which these incentive constraints hold, we must first describe the equilibrium and post-defection continuation payoffs. For the agent at unit 1, we can write these payoffs, respectively, as follows:

$V_1^R(\rho) \equiv \rho\delta\left(u_2^* + V_2^R(\rho)\right) + (1-\rho)\delta\left(u_1^* + V_1^R(\rho)\right)$, and

$V_1^D(\rho) = \rho\delta\left(u_2^* - \pi_2^* + V_2^D(\rho)\right) + (1-\rho)\delta\left(u_1^* - \pi_1^* + V_1^D(\rho)\right)$.

These equations say that when an agent is currently assigned to unit 1 and rotation occurs, her continuation payoff from period $t+1$ onwards is equal to the utility she will receive when reassigned to unit 2, plus the continuation payoff of the agent at unit 2. When rotation does not occur, that payoff is equal to the utility from remaining at unit 1, plus the corresponding continuation payoff. However, while the equilibrium continuation payoff includes the favor-exchange profit component π_i, the post-defection payoff does not.

The equilibrium and post-defection continuation payoffs of the agent currently assigned to unit 2 are defined in the same way:

$V_2^R(\rho) = \rho\delta\left(u_1^* + V_1^R(\rho)\right) + (1-\rho)\delta\left(u_2^* + V_2^R(\rho)\right)$, and

$V_2^D(\rho) = \rho\delta\left(u_1^* - \pi_1^* + V_1^D(\rho)\right) + (1-\rho)\delta\left(u_2^* - \pi_2^* + V_2^D(\rho)\right)$.

After solving the equilibrium payoff system and the punishment payoff system, we obtain the following formulas:

$$V_1^R(\rho) = \frac{\delta}{1-\delta}\left((1-\omega)u_1^* + \omega u_2^*\right),$$

$$V_2^R(\rho) = \frac{\delta}{1-\delta}(\omega u_1^* + (1-\omega)u_2^*) \text{ in equilibrium, and} \quad (10)$$

$$V_1^D(\rho) = \frac{\delta}{1-\delta}\left((1-\omega)(u_1^* - \pi_1^*) + \omega(u_2^* - \pi_2^*)\right),$$

$$V_2^D(\rho) = \frac{\delta}{1-\delta}\left(\omega(u_1^* - \pi_1^*) + (1-\omega)(u_2^* - \pi_2^*)\right) \text{ after defection,} \quad (11)$$

where $\omega = \frac{\rho}{1-\delta(1-2\rho)}$ is a weight, with $\omega \in [0,1]$.

Therefore, the continuation payoffs under rotation are convex combinations of the continuation payoffs under fixed roles: the agent currently at unit 1 gets a share ω of the future utility stream from running unit 2, and a share $1-\omega$ of the utility stream from running unit 1, and vice versa for the other agent. Moreover, rotation determines how the utilities from running the two units are split among the agents. Because the agents discount future income ($\delta < 1$), the payoff of the unit an agent will be assigned to at time $t+1$ carries more weight than the payoffs of units where the agent will be in subsequent periods. Thus, by increasing the probability that the agents will switch units at time $t+1$, an increase in ρ increases ω, the weight of the other unit in an agent's continuation payoff. This implies that

relative to fixed roles, more frequent rotation raises the future stake in unit 2 for the agent currently assigned to unit 1, and vice versa for the agent currently assigned to unit 2.[11]

We can now ask under what conditions a rotation policy that implements mutual favor-giving exists; that is, one that satisfies both (8) and (9). After substituting from the continuation payoff formulas (10) and (11) and simplifying, we can rewrite the incentive constraints as:

$(1-\omega)V_1^{FR} + \omega V_2^{FR} \geq c$ for constraint (8), and

$(1-\omega)V_2^{FR} + \omega V_1^{FR} \geq c$ for constraint (9),

where $V_i^{FR} = \frac{\delta}{1-\delta}\pi_i^*$ is a unit's discounted stream of favor profits under fixed roles, as defined in Section 3.2. As already noted there, the sustainability of favor exchanges only depends on the favor components of each agent's unit-level utility (π_i^*) because the agents cannot modify each other's contract with the principal and thereby receive utility from routine activities ($s_i^* + v_i^* - k_i^*$) -- both in equilibrium and following a defection from favor-giving. We return on this point below when discussing the model's empirical implications.

To determine the conditions for favor exchanges, we first compute the minimum rotation frequency ρ^* that satisfies (8). We then verify that ρ^* also satisfies (9). This policy is given by:

$\frac{\delta}{1-\delta}\left((1-\omega)\pi_1^* + \omega\pi_2^*\right) = c,$

which after substituting $\omega = \frac{\rho}{1-\delta(1-2\rho)}$ becomes

[11] The larger the discount factor δ, the smaller the effect of rotation on the agents' continuation payoffs. At the limit, in the case of no discounting ($\delta = 1$), $\omega = 0.5$ for all $\rho > 0$: any positive rotation probability gives each agent an equal expected stake in both units. Increasing ρ does not change the agents' shares in this scenario because any increase (decrease) in an agent's payoff at time $t+1$ due to the higher probability of switching units is offset by an equal decrease (increase) in the payoff at time $t+2$ due to the higher probability of switching back.

$$\rho^* = \frac{(1-\delta)(c-V_1^{FR})}{V_2^{FR}-V_1^{FR}-2\delta(c-V_1^{FR})}, \quad (12)$$

This rotation policy satisfies the unit-2 agent's incentive constraint, (9), if and only if

$$V_2^{FR} - c \geq c - V_1^{FR}, \text{ or} \quad (13)$$

$$\delta \geq \frac{2c}{\pi_1^*+\pi_2^*+2c} = \frac{2c}{(p_1+p_2)(b-c)+2c} \equiv \delta^R.$$

It is easy to check that if condition (13) holds, $\rho^* \in [0,1]$ and thus a rotation policy that implements bilateral favor giving exists. If instead condition (13) is violated, there is no rotation policy that induces the agents at both units to give favors when needed. To understand condition (13), notice that in the absence of rotation, the agents' incentive constraints under rotation, (8) and (9), coincide with the corresponding constraints under fixed roles, (5) and (6). By redistributing future favor profits from the agent currently assigned to unit 2 (the more frequent favor receiver) to the agent currently assigned to unit 1 (the more frequent favor giver), an increase in rotation relaxes the incentive constraint of the latter, while tightening the constraint of the former. Thus, so long as the slack in the unit-2 constraint under fixed roles, $V_2^{FR} - c$, is at least as large as the gap in the unit-1 constraint, $c - V_1^{FR}$, an appropriate rotation frequency implements favor exchanges in every state.

Notice that $\delta^R \in (\delta_2^{FR}, \delta_1^{FR})$, that is, the critical discount factor for both agents to be willing to exchange favors under rotation lies between the agents' individual critical discount factors under fixed roles. Combined with the fact that only the unit-1 agent's incentive constraint binds under fixed roles (Proposition 2), this implies that mutual favor exchanges cannot be sustained under any policy (fixed roles or rotation) when $\delta < \delta^R$. Such exchanges can be sustained only under positive rotation when $\delta^R \leq \delta < \delta_1^{FR}$, and can be sustained under both fixed roles and rotation when $\delta \geq \delta_1^{FR}$. Intuitively, rotation cannot implement

favor exchanges when even the agent at unit 2, the usual favor receiver, is unwilling to give favors under fixed roles ($\delta < \delta_2^{FR}$). If both units' continuation values, V_1^{FR} and V_2^{FR}, are lower than the cost of a favor, their convex combination will also be lower than this cost. If the agent at unit 2 is willing to give favors under fixed roles whereas the agent at unit 1 is not ($\delta_2^{FR} < \delta < \delta_1^{FR}$), replacing the fixed roles payoffs with their convex combination via rotation can help, provided the excess "relational capital" coming from unit 2 is large enough ($\delta \geq \delta^R$). Lastly, if both agents are willing to give favors under fixed roles ($\delta \geq \delta_1^{FR}$), rotation can implement favor exchanges, but it is not necessary for that purpose.

The results of this analysis are summarized below.

> **Proposition 3**: There exist cutoffs δ^R and δ_1^{FR}, with $\delta^R < \delta_1^{FR}$, such that mutual favor exchanges between divisions: (1) cannot be implemented under either fixed role or rotation if the parties are highly impatient ($\delta < \delta^R$), (2) can be implemented through some rotation policy $\rho \geq \rho^* > 0$, but not under fixed roles, if the parties are moderately patient ($\delta^R \leq \delta < \delta_1^{FR}$), and (3) can be implemented under both fixed roles and rotation if the parties are highly patient ($\delta \geq \delta_1^{FR}$).

To derive sharp predictions from Proposition 3 on when horizontal rotation will be observed, we take the view that all else equal, the organization prefers less rotation to more. This is a natural assumption given that the literature has highlighted costs of rotation in terms of reduced specialization, organizational instability, social cohesion, and stress from which our model abstracts (Cosgel & Micheli 1999; Eriksson & Ortega 2006; Casad 2012; Foroutan, Safavi & Bouzari 2021). Given this assumption, Proposition 3 implies that rotation should only be observed when it is strictly better than fixed roles – that is, when the agents are moderately patient ($\delta^R \leq \delta < \delta_1^{FR}$). Moreover, the optimal rotation policy in this region

is given precisely by ρ^*, the minimum rotation rate that implements mutual favor exchanges.[12]

A second implication of our analysis is that rotation should only be observed when the two units differ in the extent to which they need favors from one another ($p_1 > p_2$). To see this point, suppose to the contrary that the units benefit equally from favors ($p_1 = p_2$). In such a scenario, expressions (10) and (11) imply that the agents' continuation payoffs are the same ($V_1^R(\rho) = V_2^R(\rho) = V_1^{FR} = V_2^{FR}$) under fixed roles and any rotation rule, and thus favors can either be implemented under both fixed roles and rotation or under neither of these two policies. Importantly, only asymmetries between units in the likelihood of giving and receiving favors affect the optimal rotation policy.

In contrast, any asymmetries that do not originate from inter-unit favors – that is, differences in the profitability of the units' routine activities – have no effect on rotation. Suppose, for instance, that running unit 1 is much more attractive than running unit 2 because of the profits from routine activities ($v_1^* \gg v_2^*$, such that $u_1^* > u_2^*$), and yet unit 2 is the one that benefits more often from favors ($\pi_2^* > \pi_1^*$). Proposition 3 implies that in such a scenario, rotation can be an optimal policy for promoting favor exchanges. Empirically, this implies that rotation can be valuable in the common scenario in which the usual favor-receiving unit is a new venture that is not yet profitable.

A final observation, which follows from the comparison of the δ^R and δ^{MI} thresholds, is that while rotation can be a second-best policy in the absence of monetary incentives between units, it is still not as good as those incentives: $\delta^R > \delta^{MI}$. In other words, there is a

[12] We do not model the costs of rotation in this paper. In a richer model, those costs would help determine whether, and how often, managerial rotation occurs.

region in which rotation cannot implement favors, but monetary incentives can implement them.

5 Vertical Rotation

While our analysis so far has focused on the horizontal rotation of managers across favor-exchanging units, multi-unit organizations sometimes rotate lower-level agents into and out of higher-level positions; that is, vertical rotation. As mentioned above, there are important examples of these kinds of rotations in political organizations such as the Swiss federal government, in which the President position rotates across ministers, and the Council of the European Union (a legislative body composed of ministers from the member countries' national governments), whose presidency rotates every six months across member states.[13] University professors often rotate in and out of Department Chair and Dean positions. Vertical rotation is also occasionally observed in firms' top management teams (Eichenberger & Frey 2024), and in professional partnerships. For instance, members of McKinsey's Shareholders' Council, which controls consulting partner admissions and equity allocations, are elected to fixed 3-year (more recently 6-year) terms. A similar practice is used by many large law firms. Vertical rotation is also frequently used in self-managed teams and nonprofit community organizations (Chrislip & Carlson 1994).

In this section we show that, like rotation across units at the same organizational level, rotation into the principal's position can also help sustain favor exchanges between units. The mechanism, however, is very different. While rotation between favor-giving and

[13] While the Swiss President and the state holding the Council of the European Union's Presidency lack the power to rule unilaterally or to appoint and remove ministers, they have more subtle powers that can importantly shape and constrain decision making. For instance, the Swiss President has a tie-breaking vote in the Swiss Federal Government, and the President of the Council of the European Union can decide which issues have priority in the Council's agenda.

favor-receiving units increases the value of cooperation to managers, rotation into the principal's position enables the victim of a defection to punish the defector by unfavorably modifying her employment contract – something that only the principal has the authority to do. This second kind of rotation therefore potentially mitigates the principal's informational problem that prevents centralized enforcement of favors.

To formalize this insight in the clearest and simplest way, we study an extension of our baseline model in which unit 1 is the sole favor giver ($p_2 = 0$). Examples of this setting are a headquarters office that is periodically asked to share employees with a regional office, or an upstream division that is asked to provide a downstream unit with expedited delivery during unanticipated demand spikes. We assume that at the end of any period t, the agent at unit 2 (the favor-receiving unit) expects to switch roles with the principal in period $t + 1$ with probability $\rho \in [0,1]$, and to stay in unit 2 with probability $1 - \rho$. We then study conditions under which such periodic rotation of the unit-2 agent into a superior position incentivizes the unit-1 agent to give her favors (we only consider rotation of the unit-2 agent because the unit-2 agent does not herself need any favor-giving incentives).

In an equilibrium where favors are given whenever requested, the net per period expected payoff of the agent at unit 1 (who needs to be incentivized to give favors but cannot be rotated) is:

$$u_1^* = \pi_1^* + s_1^* + v_1^* - k_1^* = s_1^* + v_1^* - k_1^* - p_1 c. \tag{18}$$

Under fixed roles ($\rho = 0$), a relational contract whereby the agent at unit 1 satisfies favor requests from unit 2 can be sustained as a subgame perfect equilibrium if and only if

$$\frac{\delta}{1-\delta}\pi_1^* \geq c. \tag{19}$$

This incentive constraint is similar to (5), the fixed-roles incentive constraint in Section 4, except that (19) is violated regardless of the discount factor δ because unit 1 never receives favors, and thus its agent has no future benefits to look forward to in exchange for current cooperation.

We now construct a subgame perfect equilibrium (SPE) featuring rotation of the unit-2 agent into the principal's position ($\rho > 0$), which induces the unit-1 agent to give favors to the unit-2 one. Formally, consider the following set of strategies.

On the equilibrium path. (1) In period $t = 1$ the principal makes a take-it-or-leave-it (TIOLI) offer to the agents specifying output shares $\beta_{11} = \beta_{22} = 1$, and fixed payments s_1^* and s_2^* such that $u_1^* > 0$ and $u_2^* = 0$. The agents accept. (2) In any period $t > 1$, the principal offers the same contracts that were offered at time $t - 1$ (by her or her predecessor). The agents accept. (3) The unit-1 agent honors favor requests from unit 2.

Off the equilibrium path. (1) If the unit-1 fails to honor a favor request at time t: (a) the unit-1 agent continues not to give favors in period $t + 1$ and thereafter; (b) the player who was unit-2 agent at time t offers payments s_1^D and s_2^D, which leave zero utility to both agents, in every period $h > t$ in which she is principal (the output shares are the same as on the equilibrium path); (c) the player who was principal at time t offers the same contracts that were offered at time $h - 1$ (by her or her predecessor) in every period $h > t$ in which she is principal. (2) If the principal offers contracts other than the prescribed ones at time t: (a) she goes on to offer payments s_1^D and s_2^D in every period $h > t$ in which she is principal (the output shares are the same as on the equilibrium path); and (b) the unit-1 agent gives no favors in period t and thereafter.

Notice that the principal has no temptation to deviate on the unit-2 agent's contract offers (both on and off the equilibrium path) and on the unit-1 agent's off-path contract offer because those contracts allocate the unit's entire surplus to the principal. Notice also that the unit-1 agent has no temptation to deviate on her own off-path favor strategies. Following a deviation, the agent's utility is u_1^* per period until the unit-2 agent becomes principal, and $u_1^* - s_1^* + s_1^D$ afterwards, regardless of whether she gives favors or not, implying that the agent is better off terminating favors in perpetuity.

For the above strategies to be a SPE, we therefore only need to check that the unit-1 agent has no incentive to deviate on equilibrium favor-giving, and that the principal has no incentive to deviate on the equilibrium contract offer to the unit-1 agent. We begin by evaluating the agent's incentive constraint. Here, notice that if the agent deviates at time t and the other agent is rotated into the principal's position in the next period, which occurs with probability ρ, then the deviating agent receives zero utility in perpetuity: the victim of the agent's time-t defection punishes her by offering a zero-utility contract in period $t+1$ and in any other period in which she is principal, and the time-t principal, who does not observe the defection, does the same because she is prescribed to replicate her predecessor's contract offer. If instead the deviation's victim is not rotated into the superior position in the next period, the deviating agent will receive the equilibrium payoff minus the expected cost of giving favors in period $t+1$, and her post-deviation continuation payoff afterwards. Given these observations, we can write the discounted post-deviation payoff as follows:

$$V_1^D(\rho) \equiv \delta(1-\rho)[s_1^* + v_1^* - k_1^* + V_1^D(\rho)],$$

where the "*D*" superscript stands for "defection". After straightforward algebra, this can be rewritten as:

$$V_1^D(\rho) = \frac{(1-\rho)\delta(s_1^* + v_1^* - k_1^*)}{1-\delta(1-\rho)}, \quad (20)$$

which decreases in the probability of vertical rotation because the sooner rotation occurs, the sooner the agent's defection is punished. Then, the unit-1 agent's non-deviation constraint is:

$$-c + \frac{\delta}{1-\delta} u_1^* \geq V_1^D(\rho),$$

which after substituting from (20) and rearranging becomes

$$\frac{\delta}{1-\delta}[\pi_1^* + \alpha(s_1^* + v_1^* - k_1^*)] \geq c. \quad (21)$$

The term $(s_1^* + v_1^* - k_1^*)$ is the non-favor component of the agent's per period equilibrium utility, and $\alpha \equiv \frac{\rho}{1-\delta(1-\rho)} \in [0,1]$ is the discounted share of such utility that the agent expects to lose upon being punished by the principal. Because punishment only occurs when the agent who suffered from the defection becomes principal and modifies the defector's contract, α increases in the rotation frequency ρ, ranging from zero (for $\rho = 0$) to one ($\rho = 1$). The punishment probability also increases in δ. If the parties are infinitely patient ($\delta = 1$), rotation will eventually occur given the infinite time horizon, so $\alpha = 1$. As δ tends to zero, the probability of punishment tends to coincide with the next-period rotation probability, $\alpha = \rho$.

Clearly, incentive constraint (21) is less stringent than the constraint without vertical rotation, (19), because now the unit-1 agent expects to lose a portion α of her per period utility following defection. Before we conclude that our strategies constitute a SPE, and thus vertical rotation implements favor exchanges, we must check that the principal is better off not deviating on the equilibrium contract offer to the unit-1 agent.

To evaluate the principal's incentive constraint, notice that her optimal deviation is to offer payments s_1^D and s_2^D that leave both agents with zero utility. Since the unit-1 agent responds to a deviation by immediately terminating favors, the principal's per period utility following a deviation is $u_P^D = v_2^* - k_2^* + v_1^* - k_1^*$. Because rotation switches the roles of the principal and of the agent assigned to unit 2, and taking into account that the agent in charge of unit 2 obtains zero utility both on and off the equilibrium path, the mathematical steps from Section 4 can be applied to obtain the principal's equilibrium and post-deviation continuation payoffs:

$V_P^{LR}(\rho) \equiv \frac{\delta}{1-\delta}(1-\omega)u_P^*$ in equilibrium, and

$V_P^D(\rho) \equiv \frac{\delta}{1-\delta}(1-\omega)u_P^D$ after defection,

where $\omega = \frac{\rho}{1-\delta(1-2\rho)}$ is the usual weight, and $u_P^* = v_2^* + \pi_2^* - k_2^* - s_1^*$ is the principal's per period equilibrium payoff. The principal's incentive constraint then implies that she must prefer to honor the promised payments and receive the equilibrium continuation payoff over appropriating the two units' entire surplus, giving up the profits from favors, and receiving the post-deviation payoff:

$u_P^* + V_P^{LR}(\rho) \geq u_P^D + V_P^D(\rho)$,

which after substituting and rearranging can be written as

$$\frac{\delta}{1-\delta}(1-\omega)(u_P^* - u_P^D) \geq u_P^D - u_P^*. \tag{22}$$

For condition (22) to hold, it must be that $u_P^* \geq u_P^D$, that is, $s_1^* \leq \pi_2^* - (v_1^* - k_1^*)$. Then, since increasing s_1^* relaxes the agent's constraint, (21), the proposed strategies constitute a SPE if and only if condition (21) holds for $s_1^* = \pi_2^* - (v_1^* - k_1^*)$, that is:

$$\frac{\delta}{1-\delta}(\pi_1^* + \alpha\pi_2^*) \geq c. \tag{23}$$

Condition (23) is violated in the absence of vertical rotation ($\rho = 0$) and becomes less stringent as the frequency of rotation grows until for $\rho = 1$, it coincides with (3), the equilibrium condition when monetary bonuses can be used to incentivize favors (see Section 3.2.1). Then, the intermediate value theorem guarantees that if favors can be sustained in an ideal world with monetary incentives ($\delta \geq \delta^{MI}$), they can also be sustained in the absence of such incentives under frequent enough vertical rotation ($\rho \geq \rho^* \in (0,1)$). These arguments prove our next result.

> **Proposition 4**: Suppose there is a giver unit and a receiver unit. Then, if monetary incentives can implement favors in every period ($\delta \geq \delta^{MI}$), there exist vertical rotation policies ($\rho \geq \rho^* \in (0,1)$) that replicate the same outcome.

Our analysis has several implications. First, it suggests that periodically rotating managers into superior positions (i.e., positions whose holder has authority over agents in their previous roles) can help an organization sustain cooperation between units. Notice that vertical rotation is radically different from permanently promoting a well-performing employee into a superior position – a policy that has received much more attention in the literature. It is precisely the temporary character of vertical rotation that makes it useful as a tool to sustain favor exchanges over time. If the receiver unit's agent were promoted to a superior position indefinitely, this promotion would not motivate any subsequent favors from unit 1 to unit 2 because the new manager of unit 2 would face little or no prospect of advancing to a superior position in the future, and hence the agent at unit 1 would expect defections on favors to go unpunished.

Second, our model implies that a policy that rotates the managers of favor-receiving units can provide incentives to the managers in favor-giving units. The reason for this seemingly counterintuitive result is that vertical rotation incentivizes inter-unit cooperation

by reducing the agent's post-deviation payoff (via empowerment of the agent suffering from the defection).

Lastly, our model suggests that vertical rotation can mimic a relational incentive contract backed by discretionary monetary payments. This occurs because such rotation effectively solves the principal's monitoring problem that prevents monetary incentives in our model. As in Levin (2003), the principal can use the fixed payment s_1^* to allocate the total expected surplus from favors to the unit-1 agent ($u_1^* = \pi_1^* + \pi_2^*$). Under high-enough ρ, the agent expects to lose this rent because the victim of her defection (the receiver unit's agent) will soon enough become principal and punish her, and this threat deters the agent's defection. While this result calls for vertical rotation to be used more frequently, it is important to stress that it strongly depends on the assumption that a unit manager can rotate into a superior position at low cost. This assumption may be reasonable in some settings but not in others. When it is unreasonable, vertical rotation is unlikely to be an optimal policy.

More generally, our model of vertical rotation is deliberately elemental and could be enriched and extended in several directions. First, one could consider an organization with bilateral favor exchanges ($p_2 > 0$), as in the baseline model from Section 4. In this extension, incentivizing favor exchanges would require rotating both agents into superior positions with positive probabilities ρ_1 and ρ_2. Since $\rho_1 + \rho_2 \leq 1$, a tradeoff may then arise between incentivizing the unit-1 agent (through high ρ_2, as in the current model) and incentivizing the unit-2 agent (through high ρ_1). While we would expect vertical rotation to continue to increase efficiency in this model, we would also expect it to be less asymmetric (i.e., there may be regions in which $min\{\rho_1, \rho_2\} > 0$) and less powerful (i.e., it may not fully

replicate monetary incentives) than in the model with only one giver unit. We leave a full development of this extension for future research.

A second way in which the model could be extended is by considering $N > 1$ receiver units. We consider this extension in Section 6.2 below.

6 Favor Exchanges and Rotation with Multiple Units

So far we have assumed that favors only occur within a pair of units. While within-pair favors may be relevant in many cases (e.g., a supplier division co-located with an assembler division, or two divisions producing similar products), there are also settings in which several units may be involved in favor exchanges. When this occurs, there are potentially a multitude of rotational patterns that the firm can consider.

In this section, we illustrate this point by modeling a multi-unit version of the type of organization we considered in Section 5: a central giver unit g that may give favors to N receiver units $1, \dots n$, each unit being managed by one of $N + 1$ identical agents. All previous assumptions regarding production, agents' preferences, information and contracting continue to apply, except that now in any given period, each receiver unit $i \in \{1, \dots, n\}$ needs a favor from the giver unit with probability p_i, and the probability that no favors are needed is $1 - \sum_{j=1}^{n} p_j$, with $\sum_{j=1}^{n} p_j \leq 1$. Receiver units may differ in the extent to which they need favors, and without loss of generality, we assume $p_1 \geq p_2 \geq p_3 \geq \cdots \geq p_n$. In an equilibrium where favors are given whenever requested, the per period expected utilities of the agent in charge of the giver unit and of the agent in charge of a typical receiver unit are, respectively,

$$u_g^* \equiv \pi_g^* + s_g^* + v_g^* - k_g^*, \text{ and} \tag{14}$$

$$u_i^* \equiv \pi_i^* + s_i^* + v_i^* - k_i^*, \text{ for } i \in \{1, \dots, n\}. \tag{15}$$

Where $\pi_g^* \equiv -c\sum_{j=1}^{n} p_j$ and $\pi_i^* \equiv p_i b$ are the receivers' expected profit from favors. Straightforward extension of the analysis in Section 4 implies that regardless which receiver unit needs the favor, the giver-unit agent's incentive constraint under fixed roles is:

$$V_g^{FR} \equiv \frac{\delta}{1-\delta}\pi_g^* \geq c.$$

Since $\pi_g < 0$, no relational contract involving favors can be sustained under fixed roles, regardless of the discount factor δ. However, our baseline model suggests that a policy of rotating the organization's manager, either across units (Section 4) or in and out of the principal's role (Section 5) may enable self-enforcing favor-exchange agreements. The question we now address is what that policy would be in a setting with many receivers.

6.1 Horizontal rotation

For concreteness, we focus on the case in which each agent can rotate horizontally between the giver unit and one receiver unit but not across different receiver units. This case might be relevant if the giver unit requires general management skills whereas the receiver units require product or market specialization. In this case, a rotation policy specifies the probability $\rho_i \in [0,1]$ with which at the end of any period t, the agent at receiver unit i expects to switch units with the agent at the giver unit in period $t+1$ (implying that with probability $1-\rho_i$, the agent stays at unit i). The giver unit's agent is therefore rotated to some receiver unit with probability $\sum_{j=1}^{n}\rho_j$, and stays in the giving unit with probability $1-\sum_{j=1}^{n}\rho_j$.[14]

[14] If rotation among receiver units were also possible, the set of possible optimal rotation patterns may become even richer than modeled above. For instance, it may sometimes be optimal to adopt a "sequential rotation" policy in which the agent initially assigned to the giver unit rotates first to receiver 1, then to receiver 2, and so on until she reaches receiver n, at which point she rotates back into the giver unit.

The equilibrium continuation payoffs of the agents at the giver and receiver units are, respectively:

$$V_g^R(\boldsymbol{\rho}) = \delta\left[\sum_{i=1}^n \rho_i\left(u_i^* + V_i^R(\boldsymbol{\rho})\right) + (1-\sum_{i=1}^n \rho_i)\left(u_g^* + V_g^R(\boldsymbol{\rho})\right)\right], \text{ and}$$

$$V_i^R(\boldsymbol{\rho}) = \delta\left[\rho_i\left(u_g^* + V_g^R(\boldsymbol{\rho})\right) + (1-\rho_i)\left(u_i^* + V_i^R(\boldsymbol{\rho})\right)\right], \text{ for all } i \in \{1,\dots,n\},$$

where $\boldsymbol{\rho} = [\rho_1,\dots,\rho_n]$ is the vector of rotation probabilities (the interpretation of the payoff expressions is similar to the baseline model). After solving this system of $N+1$ equations, we obtain the following formula for the equilibrium continuation payoff of the giver unit's agent (i.e., the agent who must be incentivized to give favors):

$$V_g^R(\boldsymbol{\rho}) = \sum_{j=1}^n \omega_j u_j^* + \left(1-\sum_{j=1}^n \omega_j\right)u_g^*, \qquad (16)$$

where $\omega_j = \frac{x_j}{1+\delta\sum_{i=1}^n x_i} \in [0,1]$, $j \in \{1,\dots,n\}$, are weights, and $x_j = \frac{\rho_j}{1-\delta(1-\rho_j)}$.

In words, the continuation payoff of the giver unit's agent is a convex combination of *all* the N receiver units' payoffs (first term in (16)) and the giver unit's payoff (second term) under fixed roles. Notice that the weight assigned to each receiver unit increases in the probability of rotation into that unit but does so at a decreasing rate.

We are now ready to define the conditions under which favor-giving can be sustained through inter-unit rotation. As usual, we look for subgame-perfect equilibria of the repeated game where in any period t, the agent in charge of the giving unit does a favor for the receiver unit if requested. While this equilibrium behavior is similarly to the baseline model, off-the-equilibrium actions following a deviation by the giver unit's agent are slightly more complicated because there are now N receiver-unit agents, each of whom must decide whether to punish the deviator if and when she switches units with her.

We focus on the case in which the agents are bound by a strong norm of multilateral enforcement: if the agent in charge of the giver unit at time t defects, she will never receive or give favors in the future regardless of whether the agent she is supposed to exchange favors with the agent who suffered the defection. This is a natural case to model because (1) multilateral enforcement is generally efficient (Levin, 2002) and (2) the agents belong to the same organization and thus may easily coordinate on the multilateral enforcement norm.[15]

Given multilateral enforcement, a straightforward extension of the baseline model's analysis implies the giver unit's agent will honor *any* receiver unit's request under rotation policy $\boldsymbol{\rho}$ if and only if the following unique incentive constraint holds:

$$\sum_{j=1}^{n} \omega_j V_j^{FR} + \left(1 - \sum_{j=1}^{n} \omega_j\right) V_g^{FR} \geq c, \tag{17}$$

where $V_j^{FR} \equiv \frac{\delta}{1-\delta}\pi_j^*$ is the per period profit from receiving favors at unit $j \in \{1, \ldots, n\}$ under fixed roles. As in Section 4, the relevant continuation payoff on left-hand side of (17) depends only on the units' profits from favors, and not on the profits from routine activities or on the payments stipulated in the agents' contracts with the principal. It is clear from (17) that there exists a rotation policy that makes favor exchanges easier to sustain than under fixed roles. To see this, suppose there is no rotation at the outset, and raise the probability of rotation of some receiver $j \in \{1, \ldots, n\}$ by an arbitrary amount $d\rho_j > 0$, while leaving the other receivers' rotation probabilities at zero. This switch from fixed roles to rotation changes the giver-unit agent's continuation payoff on the left-hand side of (17) by

[15] Multilateral enforcement assumes that being colleagues, all agents can observe past defections on favor exchanges. When monitoring among peers is imperfect, one may need to incentivize the victim of defection to report it to other receivers, and that may require the use of less severe punishments than perpetual termination of favors (Ali & Miller 2016). Alternatively, enforcement may be bilateral, in which case only the defection's victim suspends future favors upon rotation. We do not model these alternative enforcement mechanisms due to space limitations.

$$\left[\frac{\partial \omega_j}{\partial \rho_j} V_j^{FR} + \sum_{i \neq j} \frac{\partial \omega_i}{\partial \rho_j} V_i^{FR} - \left(\frac{\partial \omega_j}{\partial \rho_j} + \sum_{i \neq j} \frac{\partial \omega_i}{\partial \rho_j}\right) V_g^{FR}\right] d\rho_j = \left[\frac{\partial \omega_j}{\partial \rho_j} V_j^{FR} - \frac{\partial \omega_j}{\partial \rho_j} V_g^{FR}\right] d\rho_j,$$

where the second term in the above equality comes from the fact that $\frac{\partial \omega_i}{\partial \rho_j} = 0$ at $\rho_i = 0$, for all i. This variation in the giving-unit agent's payoff is positive because the weights of all receiver units increase in rotation ($\frac{\partial \omega_j}{\partial \rho_j} > 0$), and the fixed-role payoff is positive for receiver units ($V_j^{FR} > 0$), and negative for the giver unit ($V_g^{FR} < 0$). Thus, switching from no rotation to some rotation relaxes incentive constraint (17).

Which specific rotation policy is optimal, however, is not obvious a priori and depends on the relative importance of the favor-receiver units as well as on the value of favors. Suppose, for instance, that all receiver units are in similar need of favors ($p_1 = p_2 = \cdots = p_n = p > 0$). Then, we can rewrite incentive constraint (17) as

$$V^{FR} \sum_{j=1}^{n} \omega_j + \left(1 - \sum_{j=1}^{n} \omega_j\right) V_g^{FR} \geq c,$$

and the optimal rotation policy simply minimizes the weight of the (negative) favor profit of the giver unit. It is easy to check that $\sum_{j=1}^{n} \omega_j$ increases in the probability of being rotated into each receiver unit (due to intertemporal discounting, which magnifies the value of next-period payoffs) but does so at a decreasing rate (due to the higher probability of switching back to the giver unit in subsequent periods). Thus, at the optimum, rotation must occur with certainty ($\sum_{j=1}^{n} \rho_j = 1$) and the rotation probability should be the same for all receiver units ($\rho_1 = \rho_2 = \cdots = \rho_n = \frac{1}{N}$).[16] This implies that in an organization with one

[16] To formally see why the rotation probabilities must be equal across units, suppose to the contrary that $\rho_i > \rho_j$ for some pair of receiver units, $i \neq j$. Consider a change in the rotation policy that decreases ρ_i and increases ρ_j by the same small amount. Simple algebra reveals that the effect of this change in policy on $\sum_{j=1}^{n} \omega_j$ equals $\frac{\frac{1-\delta}{1-\delta(1-\rho_j)} - \frac{1-\delta}{1-\delta(1-\rho_i)}}{\left(1+\delta \sum_{k=1}^{n} x_k\right)^2}$, which is positive for $\rho_i > \rho_j$.

favor-giver unit and many similar receivers, a rotation policy that aims to facilitate favor exchanges should: (1) rotate the agent at the giver unit in every period, and (2) split such rotation evenly across all receivers.

At the opposite extreme, suppose that one unit is overwhelmingly more likely to need favors than the others ($p_1 > p_2 = \cdots = p_n = 0$), such that the incentive constraint becomes

$$\omega_1 V_1^{FR} + \left(1 - \sum_{j=1}^{n} \omega_j\right) V_g^{FR} \geq c.$$

In this case, it is easy to check that if a favor's benefit is large enough relative to its cost ($b \gg c$), such that increasing the current favor giver's chances to become a favor receiver is much more valuable, from an incentive provision perspective, than minimizing her chances to remain the favor giver, then the optimal rotation policy is asymmetric and fully concentrates into the favor-receiving unit: $\rho_1 = 1$, and $\rho_2 = \rho_2 = \cdots = \rho_n = 0$.

In sum, our analysis indicates that when several units are involved in favor exchanges, there is not a one-size-fits-all optimal rotation policy. Instead, the rotation policy should be adapted to the nature and structure of the organization, particularly to how the need for unscheduled cooperation is distributed across units.

6.2 Vertical rotation

We now turn to vertical rotation in the single giver, N receivers setting. In this extension, ρ_i denotes the probability that the agent at receiver unit i switches roles with the principal in the next period. We construct a SPE similar to the one described in Section 5, such that the unit g honors all receivers' favor requests given the organization's vertical rotation policy. We continue to focus on the multilateral enforcement case: if the giver unit denies a favor at time t, all agents in charge of a receiver unit at time t will punish her in subsequent periods. The giver unit's payoff after deviating on *any* receiver is then

$$V_g^D(\boldsymbol{\rho}) \equiv \delta\left(1 - \sum_{j=1}^{n} \rho_j\right)\left[s_g^* + v_g^* - k_g^* + V_g^D(\rho)\right].$$

Straightforward extension of the analysis in Section 5 implies that the incentive constraints are

$\frac{\delta}{1-\delta}\left[\pi_g^* + \tilde{\alpha}\left(s_g^* + v_g^* - k_g^*\right)\right] \geq c$ for the agent, and

$\frac{\delta}{1-\delta}(1 - \tilde{\alpha})(u_P^* - u_P^D) \geq u_P^D - u_P^*$ for the principal,

where $\tilde{\alpha} \equiv \frac{\sum_{j=1}^{n} \rho_j}{1-\delta\left(1-\sum_{j=1}^{n} \rho_j\right)}$ is the discounted probability of punishment. After substituting the maximum salary that is incentive-compatible for the principal into the agent's constraint, it turns out that vertical rotation implements favor exchanges as part of a SPE if and only if

$$\frac{\delta}{1-\delta}\left[\pi_g^* + \tilde{\alpha} \sum_{j=1}^{n} \pi_j^*\right] \geq c.$$

This constraint is analytically identical to condition (23) in the model with one receiver unit, implying that Proposition 4 continues to hold: if the total surplus from favor exchanges is large enough, such that a multilateral agreement with monetary incentives can sustain cooperation, then policies that rotate the receiver-unit agents into superior positions with high-enough frequency also implement cooperation. Moreover, so long as the total rotation probability $\sum_{j=1}^{n} \rho_j$ is high enough, it does not matter how often each individual receiver-unit agent rotates: a policy where all agents rotate with equal frequency is as good as one where only one agent rotates.[17]

[17] If punishments were bilateral rather than multilateral -- that is, if favor denial to one receiver only triggered punishment by that receiver once she switches roles with the principal --, vertical rotation would continue to improve over fixed roles, but it may no longer replicate the monetary incentive equilibrium. The reason is that the giver unit would now face an incentive constraint for each single receiver unit. Given that the sum of the rotation probabilities cannot exceed one, relaxing the constraint on receiver i (by increasing the frequency with which its agent switches roles with the principal) may make the constraints on the other receivers more stringent, and the organization may need to choose which favors to incentivize via vertical rotation.

7 Discussion and Conclusion

Our game-theoretic model shows that rotating a firm's managers across divisions and into superior positions creates incentives for interdivisional cooperation by making managers' favor-exchange promises credible. This is an important phenomenon because of the many instances in which unplanned cooperation between divisions cannot be easily monitored by top management or incentivized through interdivisional payments. In tackling this phenomenon, our theory builds a bridge between repeated game models of favor exchanges and models of relational contracting. Like ours, models of favor exchanges emphasize cooperation among peers in the absence of monetary incentives; however, these models assume that roles are exogenous and hence are ill suited to study organization design and management practices. Relational contracting models (Baker et al. 1994, 2002; Levin 2003) highlight the role of endogenous governance choices (e.g., formal decision rights, asset ownership) in sustaining self-enforcing agreements but largely ignore role rotation, perhaps because of their emphasis on monetary incentives and transfers that make such rotation irrelevant. Moreover, in relational contracting models a principal chooses governance to facilitate her own relationship with one or more agents, rather than to develop collaborative relationships between the agents themselves. Our model therefore contributes to both literatures by combining favor exchange with endogenous governance.

A limitation of our model is that we do not incorporate costs of rotation that could be incurred by the rotated managers and/or by the organization as a whole. Future research could enrich our model by adding these costs. However, we believe that including such costs would only serve reduce or eliminate the value of rotation for favor exchanges, without

changing our novel result that rotation dominates fixed roles with sufficiently high discount factors, assuming low rotation costs.

A first prediction of our model is that the value of interdivisional rotation increases in the asymmetry in the demand for favors by each division, whereas it does not depend on differences in the divisions' profitability that are unrelated to favors. If demand for favors is symmetric, the two units generate the same expected gains from cooperation and thus the agents' incentives to cooperate are the same under every possible rotation policy. Rotation does not dominate fixed roles in this case. The larger the asymmetry between divisions, the larger the region in which rotation dominates fixed roles.

One setting in which demands for favors are likely to be asymmetric is when divisions are vertically related to each other: a supplying division regularly provides inputs to a buying division, whereas the reverse is less frequently the case. A transfer pricing mechanism might exist to compensate the supply division for providing these inputs, but the buying division might often need favors that cannot be foreseen at the beginning of a divisional budget cycle. Such favors might include expedited delivery, late changes to input specifications or input quantity, and the like. If this assumption holds, our model predicts that rotation will be more often observed among vertically related units than among horizontally related ones, all else equal. The same prediction applies to the many organizations in which centralized units provide key services to divisions or operating units within them. For example, leaders of centralized R&D or sales divisions may rotate in and out of decentralized product or geographic divisions.

Another setting in which asymmetric needs for favors may be important is in corporations with new venture units. Large U.S. companies have long experimented with

programs in which new venture units or divisions experiment different management practices than those applied to established divisions. Many of these programs have been assessed as failures, often because established divisions did not cooperate with the new venture sufficiently (e.g., Fast 1978; Burgelman & Sayles 1985; Brass 2010). Others are seen as successes, however, such as Lockheed's skunkworks (Rich 1996), and Amazon.com's units that produced Amazon Web Services, Kindle and Alexa (Stone 2021). New venture units are initially less profitable than established ones, and they often need to borrow managerial skills and resources from those in order to succeed, such as in engineering, sales and marketing, distribution, etc. Moreover, some of these needs may not be fully foreseeable. For these cases, our model predicts that companies with rotation policies involving new ventures and established divisions are more likely to find success with their new venture programs than those that lack such policies. Moreover, our model implies that rotation should prioritize the newer venture units that are more in need of favors, even if they are the least profitable ones.

A second prediction of our model is that there is a non-monotonic relationship between the value of rotation and the likelihood and value of future interactions between agents within the organization (measured by the intertemporal discount factor δ): rotation fails to elicit interdivisional favors when δ is too low to support relational contracting, it becomes decisive at some point as δ grows, and it becomes redundant as δ grows so large that relational contracts can be sustained even under fixed roles.

At least three empirical implications follow from this second result. First, rotation is less likely to be observed in industries in which employee mobility across firms is high. The reason is that in this case, managers anticipate that they are likely to leave the firm in the short or medium term, so the rate at which they discount the future value of cooperation with

current colleagues is high. Second, when employee mobility is very low, managers value future cooperation so highly that rotation is unnecessary to incentivize their cooperation. This condition might apply to organizations that face little competition, such as regulated utilities or government bureaucracies. Third, the complementarity between rotation and the shadow of future interactions implies that rotation as a mechanism to support favor exchanges is likely to be observed in organizations with policies aimed at lengthening managers' expected career horizons within the organization, such as promotion from within, aggressive retention efforts, and efficiency wages and/or non-wage benefits.

An advantage of our model is that the favor exchange rationale for management rotation it uncovers applies quite broadly, including to settings where the better understood benefits of rotation – most notably, learning – are tenuous. For example, by the time an employee reaches senior roles, the organization may have learned about her talents and skills and thus the "employer learning" motive for rotation (Ortega 2001) may be less important. Moreover, when there is scope for skill transfers, learning theories imply that rotation should improve the performance of junior and inexperienced managers while having no major effects on the performance of senior managers, who have had numerous opportunities to learn about the firm's products and markets. In contrast, our model implies that rotation can improve performance even if it involves senior managers and divisions selling similar products because the need for cooperation between units and tasks – the benefit of rotation according to our model – does not fade away with, and may even be magnified by, employees' seniority and the similarity of two divisions' products or markets.

While our analysis has mostly focused on favor exchanges between divisions of a firm, government is another setting in which it may apply. For example, government agencies

must often address social problems that span agency boundaries (e.g., Linden 2003; Goldsmith & Eggers 2004). Rotation of managers across such agencies may be important in incentivizing the kind of favor-giving required to address these problems effectively. An example is the successful joint effort by the U.S. Department of Veteran Affairs (V.A.) and the Department of Housing and Urban Development (H.U.D.) to reduce veteran homelessness (e.g., Rosenheck et al. 2003; O'Connell & Rosenheck 2019). This objective was not included in either department's original mission set by Congress, and neither department had authority over the other. Moreover, financial incentives were not legally allowed to incentivize cooperation. Cooperation was therefore mostly voluntary, and initiated by senior government executives. Several of these executives served together on interagency council, and one, Gordon Mansfield, served as Assistant Secretary at H.U.D. before becoming Deputy Secretary of the V.A.[18] These roles likely fostered favor exchanges across executives in the two agencies. Consistent with this example, the U.S.'s Office of Personnel Management (OPM) requires some candidates for promotion to the Senior Executive Service to spend at least four months in a rotation program with another federal government agency (OPM, 5 CFR 412.302).

While our model focuses on intra-organizational cooperation, favor exchanges and some form of role rotation could also operate in buyer-supplier relationships. For example, industrial buyers sometimes rotate suppliers of a given component (Lu, Huang & Shen 2011). Thus, Boeing may allocate one set of parts for an aircraft variant (say, the 787-8) to Supplier A, and a corresponding set for a different variant (say, 787-9) to Supplier B. When an aircraft undergoes a minor design change, Boeing may swap these allocations between the two

[18] https://en.wikipedia.org/wiki/Gordon_H._Mansfield

suppliers in order to maintain suppliers' technical capabilities and reduce points of failure.[19] The two suppliers must cooperate in this process, because swapping the allocation often requires coordinating data and tooling exchanges, and transferring tacit production knowledge. Anticipating future rotations could motivate both suppliers to engage in this kind of cooperation.

A form of rotation may also support favor exchanges in strategic alliances in which mutual transfers of knowledge approach the levels of such transfers within a firm. This rotation is unlikely to be direct: the literature in strategy has emphasized the wide range of methods firms use to restrict employee mobility across firm boundaries in order to prevent the leakage of proprietary information and internal disruption (e.g., Liebeskind 1996; Coff 1997; Agarwal, Ganco & Ziedonis 2009). However, firms in an alliance may rotate roles indirectly by periodically changing who takes the lead on the alliance's projects. For example, Davis and Eisenhardt (2011) studied four technological collaborations between pairs of independent firms in which decision rights in the collaboration alternated between employees of each partner firm. Such alternation achieves a similar effect to the kind of rotation we model within organizations, in the sense that even though managers do not rotate across firms, the firm that is today's main favor giver (the one without decision rights, who may be asked to cooperate by the leading firm) may be tomorrow's favor receiver, and *vice versa*. Davis and Eisenhardt (2001) found that decision rights alternation stimulated innovation by better leveraging each firm's technological capabilities, as compared to collaborations that did not feature such alternation.

[19] https://www.eplaneai.com/news/boeing-strengthens-supplier-oversight-to-reduce-defects-in-aircraft-production

While our model's leading application is cooperation between divisional managers, it can be applied to lower-level workers as well. For example, a worker on a production team may be responsible for a task or job that benefits from favors from another worker when an unanticipated contingency arises. The other worker's task may benefit less from a favor. Rotating the two team members through the more favor-sensitive task may better support the favor exchanges needed to complete the project efficiently and effectively. Rotation to support favor exchanges is a different incentive mechanism for stimulating cooperation or "helping" on teams than those in the economics literature, such as evaluation and compensation schemes (e.g., Demski & Sappington 1984; Itoh 1991; Holmstrom 1982), and mutual monitoring and peer pressure (Kandel & Lazear 1992; Bandiera, Barankay & Rasul 2010). It is also different than psychological mechanisms motivating cooperation such as altruism and well-being (e.g., Fehr & Fischbacher 2003; Hui 2022).

Finally, while our analysis focuses on cases in which favor exchanges benefit the organization, there may be circumstances in which they do not. For example, both horizontal and vertical rotation may enable managers to cooperate with each other to hide, and benefit from, theft from the organization. In addition, rotation (especially the vertical form) may facilitate collusion between an agent and her supervisor to the detriment of the organization. For instance, Italian judges and prosecutors periodically elect some of their peers onto a joint Council that evaluates their performance and decides on their careers and promotions.[20] After finishing their term on the Council, the elected representatives return to their ordinary positions. This rotation mechanism has been criticized for encouraging judges to favor the prosecution in cases before them for fear of being punished by prosecutors after they rotate

[20] The official name of this Body is Superior Council of the Magistrature. It is regulated by articles 104-107 of the Italian Constitution.

onto the Council. Future research should investigate when managerial rotation benefits the organization, and when it facilitates collusion that undermines its goals. We encourage scholars to examine this issue, as well as to pursue the empirical implications of our model.

References

Abdulkadiroglu, A., and K. Bagwell. 2013. Trust, reciprocity, and favors in cooperative relationships. *American Economic Journal: Microeconomics*, 5: 213-259.

Agarwal, R., M. Ganco and R. Ziedonis. 2009. Reputations for toughness in patent enforcement. *Academy of Management Journal*, 50: 446-467.

Aghion, P., and J. Tirole. 1997. Formal and real authority in organizations. *Journal of Political Economy*, 105: 1-29.

Akerlof, G. 1982. Labor contracts as partial gift exchange. *Quarterly Journal of Economics*, 4: 543-579.

Akerlof, G. 1984. Gift exchange and efficiency-wage theory: Four views. *American Economic Review*, 74: 79-83.

Ali, S., and D. Miller. 2016. Ostracism and forgiveness. *American Economic Review*, 106: 2329-2348.

Argyres, N., J. Bercovitz, and G. Zanarone. 2020. The role of relationship scope in sustaining relational contracts in interfirm networks. *Strategic Management Journal*, 41: 222–245.

Baker, G., R. Gibbons, and K.J. Murphy. 1994. Subjective performance measures in optimal incentive contracts. *Quarterly Journal of Economics* 109: 1125-1156.

Baker, G., R. Gibbons, and K.J. Murphy. 2002. Relational contracts and the theory of the firm. *Quarterly Journal of Economics* 117: 39-84.

Bandiera, O., I. Barankay, and I. Rasul. 2010. Social incentives in the workplace. *Review of Economic Studies* 77: 417-458.

Battiston, D., M. Espinosa, and S. Liu. 2025. Talent poaching and job rotation. *Management Science,* 71: 2975-2992.

Barron, D., R. Gibbons, R. Gil, and K. J. Murphy. 2020. Relational adaptation under reel authority. *Management Science*, 66: 1868–1889.

Bernheim, D., and M. Whinston. 1990. Multimarket contact and collusive behavior. *RAND Journal of Economics*, 1-26.

Bidwell, M. and E. Mollick. 2015. Shifts and ladders: Comparing the role of internal and external mobility in managerial careers. *Organization Science*, 26: 1629-1649.

Bidwell, M. and J.R. Keller. 2014. Within or without? How firms combine internal and external labor markets to fill jobs. *Academy of Management Journal*, 57: 1035-1055.

Bidwell, M. and J.R. Keller. 2025. Stepping sideways to step up: Lateral mobility and career advancement inside organizations. *Management Science*, 71: 240-261.

Brass, D. 2010. Microsoft's creative destruction. *New York Times*, Section A, p. 27.

Brown, J.S. and P. Duguid. 2001. Organizational learning and communities of practice: Toward a unified view of working, learning and innovating. *Organization Science*, 2: 40-57.

Bull, C. 1987. The existence of self-enforcing implicit contracts. *Quarterly Journal of Economics*, 102: 147-159.

Burgelman, R. and L. Sayles. 2005. *Inside Corporate Innovation: Strategy, Structure and Managerial Skills*, New York: The Free Press.

Campion, M., L. Cheraskin, and M. Stevens 1994. Career-related antecedents and outcomes of job rotation. *Academy of Management Journal*, 37: 1518-1542.

Carmichael, H., and B. MacLeod. (1997). Gift giving and the evolution of cooperation. *International Economic Review*, 38: 485-509.

Casad, S. 2012. Implications of the job rotation literature for performance improvement practitioners. *Performance Improvement Quarterly*, 25: 27-41.

CIPD. 2015. *Learning and Development.* London: Chartered Institute of Personnel and Development.

Cremer, J., L. Garicano and A. Prat. 2007. Language and the theory of the firm. *Quarterly Journal of Economics,* 122: 373-407

Coff, R. 1997. Human assets and management dilemmas: Coping with hazards on the road to resource-based theory. *Academy of Management Review*, 22: 374-402.

Cosgel, M. and T. Miceli. 1999. Job rotation: Costs, benefits and stylized facts. *Journal of Institutional and Theoretical Economics*, 155: 301-320.

Crislip, D. and C. Larson. 1994. *Collaborative Leadership: How Citizens and Civic Leaders Can Make a Difference*, San Francisco: Josey-Bass.

Datar, S. and M. Rajan. 2021. *Horngren's Cost Accounting: A Managerial Emphasis,* 17th edition. Hoboken, NJ: Pearson.

Davis, J. and K. Eisenhardt. 2011. Rotating leadership and collaborative innovation: Recombination processes in symbiotic relationships. *Administrative Science Quarterly,* 56: 159-201.

Demski, J. and D. Sappington. 1984. Optimal incentive contracts with multiple agents. *Journal of Economic Theory*, 33: 152-172.

Dessein, W. 2002. Authority and communication in organizations. *Review of Economic Studies*, 69: 811-838.

Edlin, A. and S. Reichelstein. 1995. Specific reliance investment under negotiated transfer pricing: An efficiency result. *Accounting Review*, 70: 275-291.

Eichenberger, R. and B. Frey. 2024. Permanently rotate the winning team. *Journal of the Knowledge Economy*, 16: 11198-11213.

Fehr, E. and U. Fischbacher. 2003. The nature of human altruism. *Nature*, 425: 785-791.

Eriksson, S., and J. Ortega. 2006. The adoption of job rotation: Testing the theories. *Industrial and Labor Relations Review,* 59: 653-666.

Fast, N. 1978. *The Rise and Fall of Corporate New Venture Divisions*, Ann Arbor, MI: UMI Research Press.

Foroutan, T., H. Safavi and M. Bouzari. 2021. The ugly side of job rotation. *International Journal of Hospitality Management*, 95: 1-10.

Gibbons, R. 2005. Four formal(izable) theories of the firm? *Journal of Economic Behavior and Organization*, 58: 200-245.

Gil, R., and J. Marion. 2013. Self-enforcing agreements and relational contracts: Evidence from California highway procurement. *Journal of Law, Economics and Organization,* 29: 239-77.

Gil, R., M. Kim, and G. Zanarone. 2022. Relationships under stress: Relational outsourcing in the US airline industry after the 2008 financial crisis. *Management Science*, 68: 1256–1277.

Goldsmith, S. and W. Eggers. 2005. *Governing by Network: The New Shape of the Public Sector*. Washington, DC: Brookings Institution Press.

Hakenes, H. and S. Katolnik. 2017. On the incentive effects of job rotation. *European Economic Review*, 98: 424-441.

Halac, M. 2012. Relational contracts and the value of relationships. *American Economic Review*, 102: 750–779.

Hauser, C., and H. Hopenhayn. 2008. Trading favors: Optimal exchange and forgiveness. *Carlo Alberto Notebooks*, *88*: 864.

Hertzberg, A., J. M. Liberti, and D. Paravisini. 2010. Information and incentives inside the firm: Evidence from loan officer rotation. *Journal of Finance* 65: 795-828.

Hirao, Y. 1993. Task assignment and agency structures. *Journal of Economics and Management Strategy*, 2: 299-323.

Holmstrom, B. 1982. Moral hazard in teams. *Bell Journal of Economics,* 13: 324-340.

Holmstrom, B. 1999. The firm as a subeconomy. *Journal of Law Economics and Organization*, 15: 74-102.

Holmstrom, B. and P. Milgrom. 1991. Multitask principal-agent analyses: Incentive contracts, asset ownership, and job design. *Journal of Law Economics and Organization*, 7: 24-53.

Hui, B. 2022. Prosocial behavior and well-being: Shifting from 'chicken and egg' to positive feedback loop. *Current Opinion in Psychology*, 44: 231-236.

Ickes, B., and L. Samuelson. 1987. Job transfers and incentives in complex organizations: Thwarting the ratchet effect. *RAND Journal of Economics* 18: 275–286.

Itoh, H. 1991. Incentives to help in multi-agent situations. *Econometrica*, 59: 611-637.

Jensen, M. and W. Meckling. 1992. Specific and General Knowledge, and Organization Structure, in L. Werin and H. Wijkander (eds.) *Contract Economics*, Oxford: Blackwell.

Kandel, E. and E. Lazear. 1992. Peer pressure and partnerships. *Journal of Political Economy*, 100: 801-818.

Kandori, M. 1992. Social norms and community enforcement. *Review of Economic Studies*, 59: 63-80.

Kang, H. and J. Eklund. 2025. Fast friends: The impact of short-term visits on innovation outcomes. *Organization Science*, 36: 1154-1176.

Klein, B. 1996. Why hold-ups occur: The self-enforcing range of contractual relationships. *Economic Inquiry*, 34: 444–463.

Klein, B. and K.M. Murphy. 1988. Vertical restraints as contract enforcement mechanisms. *Journal of Law and Economics,* 31: 265-297.

Levin, J. 2002. Multilateral contracting and the employment relationship. *Quarterly Journal of Economics*, *117*: 1075-1103.

Levin, J. 2003. Relational incentive contracts. *American Economic Review,* 93: 835-857.

Li, J., and N. Matouschek. 2013. Managing conflicts in relational contracts. *American Economic Review*, 103: 2328–2351.

Li, J., and M. Powell. 2020. Multilateral interactions improve cooperation under random fluctuations. *Games and Economic Behavior*, 119: 358-382.

Liebeskind, J. 1996. Knowledge, strategy, and the theory of the firm. *Strategic Management Journal*, 17: 93-107.

Linden, R. 2003. *Working Across Boundaries: Making Collaboration Work in Government and Nonprofit Organizations*. San Francisco: Jossey-Bass.

Lu, M., Huang, S. and Z. Shen. 2011. Product substitution and dual sourcing under random supply failures. *Transportation Research Part B: Methodological*, 45: 1251-1265.

Magelssen, C., B. Rich and K. Mayer. 2022. The contractual governance of transactions within firms. *Organization Science*, 33: 2226-2349.

Macchiavello, R., and A. Morjaria. 2015. The value of relationships: Evidence from a supply shock to Kenyan rose exports. *American Economic Review*, 105: 2911–2945.

Macchiavello, R., and A. Morjaria. 2021. Competition and relational contracts in the Rwanda coffee chain. *Quarterly Journal of Economics*, 1089–1143.

Meister, D. and T. Davenport. 2005. *Knowledge Management at Accenture*, Harvard Business School Case Study 905E18.

Meyer, M. 1994. The dynamics of learning with team production: Implications for task assignment. *Quarterly Journal of Economics*, 109: 1157-1184.

Milgrom, P., and J. Roberts. 1988. An economic approach to influence activities in organizations. *American Journal of sociology*, 94: S154-S179.

Mittendorf, B. 2004. Information revelation, incentives and the value of a real option. *Management Science*, 50: 1615-1761.

Möbius, M. 2001. Trading Favors. Unpublished manuscript.

Nahapiet, J. and S. Ghoshal. 1998. Social capital, intellectual capital, and organizational advantage. *Academy of Management Review*, 23:242-266.

Nyallu, B., X. Deng and M. Melckzedeck. 2025. The influence of internal work locus of control on knowledge loss and organizational performance: Role of job rotation in Chinese construction firms. *Engineering Management and Architectural Management*, 32: 7236-7265.

OECD 1999. *Employment Outlook,* Cedex, France: OECD Publications.

Ortega, J. 2001. Job rotation as a learning mechanism. *Management Science*, 47: 1361-1370.

Ouchi, W. 1981. *Theory Z*. New York: Avon Books.

Poppo, L., K. Zheng, K. and S. Ryu. 2008. Alternative origins to organizational trust: An interdependence perspective on the shadow of the past and the shadow of the future. *Organization Science*, 19: 39-55.

Prescott, E., and R. Townsend. 2006. Private information and intertemporal job assignments. *Review of Economic Studies*, 73: 531-548.

PwC. 2025. *Global Annual Review*, https://www.pwc.com/gx/en/about/global-annual-review.html

Ray, C., A. Nyberg, M. Maltarich, and G. Reilly. 2026. On the move: The impact of internal mobility and internal comobility on unit- and organization-level outcomes. *The Academy of Management Journal*, 69: 76-98.

Rich, B. 1996. *Skunk Works: A Personal Memoir of My Years at Lockheed,* New York: Little, Brown

Rosenheck, R., W. Kasprow, L. Frisman, and W. Liu-Mares. 2003. Cost-effectiveness of supported housing for homeless persons with mental illness. *Arch Gen Psychiatry,* 60: 940-951.

Rosenheck, R. and M. O'Connell. 2019. Supported housing: Twenty-five years of the Housing and Urban Development-Veterans Affairs Supported Housing (HUH-VASH) program. In J. Tsai (ed.), *Homelessness Among U.S. Veterans: Critical Perspectives*, pp. 77-107, Oxford University Press.

Shapiro, C., and J. Stiglitz. 1984. Equilibrium unemployment as a worker discipline device. *American Economic Review*, 74: 433-444.

Shelanski, H. 2004. Transaction-level determinants of transfer-pricing policy: Evidence from the high technology sector. *Industrial and Corporate Change*, 13: 953-966.

SHRM. 2025. *State of the Workplace*. https://www.shrm.org/content/dam/en/shrm/topics-tools/research/2025-shrm-state-of-the-workplace-research-report.pdf

Stone, B. (2021). *Amazon Unbound: Jeff Bezos and the Invention of a Global Empire*, New York: Simon & Schuster.

Williamson, OE. 1975. *Markets and Hierarchies: Analysis and Anti-trust Implications.* New York: The Free Press.

Williamson, OE. 1985. *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. New York: The Free Press.

Williamson, O.E. 1991. Comparative economic organization: The analysis of discrete structural alternative. *Administrative Science Quarterly*, 36: 269-296.

Williamson, O.E. 1993. Calculativeness, trust and economic organization. *The Journal of Law and Economics*, 36: 453-486.

Appendix: Proof of Proposition 1

Consider a relational incentive contract that prescribes favors to be given whenever requested as well as the following monetary payments: (1) at the beginning of each period, the agent at unit 2 must make a transfer τ to the agent at unit 1 (which could be negative); (2) if unit $i \in \{1,2\}$ is called upon to give a favor, the agent at unit i must be paid a bonus B_i by the agent at the other unit if and only if she does the requested favor. If at any point in time an agent deviates (by not making or accepting a prescribed payment or by not doing a prescribed favor), both agents revert to the static Nash equilibrium with no favors forever after.

In any given period t, the agents' expected payoffs under this contract are:

$\tilde{u}_1 \equiv u_1^* + \tau + p_1 B_1 - p_2 B_2$ for the agent at unit 1, and

$\tilde{u}_2 \equiv u_2^* - \tau - (p_1 B_1 - p_2 B_2)$ for the agent at unit 2,

where $u_i^* = \pi_i^* + s_i^* + v_i^* - k_i^*$, as defined in Section 3.2.2, and $\tilde{u}_1 + \tilde{u}_2 = u_1^* + u_2^*$ because the payments are zero-sum transfers.

We prove Proposition 1 in two steps. We first show that assuming the agents are permanently assigned to units ($\rho = 0$), condition (3) is necessary and sufficient for the above contract to be a subgame perfect equilibrium of the repeated game. We then show that condition (3) continues to be necessary in the presence of rotation ($\rho > 0$), implying that when monetary incentives and payments are feasible, rotation cannot improve interunit favors.

Step 1: optimal relational contract without rotation

In order to be part of a subgame perfect equilibrium of the repeated game, the proposed relational contract must be individually rational for both agents:

$\tilde{u}_1 \geq u_1^* - \pi_1^*$ for the agent at unit 1, and (A1)

$\tilde{u}_2 \geq u_2^* - \pi_2^*$ for the agent at unit 2. (A2)

Additionally, complying with the relational contract must be incentive compatible for both agents in every state of the world. If the realized state is one where unit 1 must give the favor, the incentive constraints are:

$-c + B_1 + \frac{\delta}{1-\delta}\tilde{u}_1 \geq \frac{\delta}{1-\delta}(u_1^* - \pi_1^*)$ for the agent at unit 1, and (A3)

$-B_1 + \frac{\delta}{1-\delta}\tilde{u}_2 \geq \frac{\delta}{1-\delta}(u_2^* - \pi_2^*)$ for the agent at unit 2. (A4)

In words, the favor-giving agent must prefer to do the prescribed favor and receive the bonus today, while continuing to receive her equilibrium payoff in subsequent periods, over saving the favor's cost and forgoing the bonus today, while receiving no favors in subsequent periods.

Similarly, if the realized state is one where unit 2 must give the favor, the incentive constraints are:

$-c + B_2 + \frac{\delta}{1-\delta}\tilde{u}_2 \geq \frac{\delta}{1-\delta}(u_2^* - \pi_2^*)$ for the agent at unit 2, and (A5)

$-B_2 + \frac{\delta}{1-\delta}\tilde{u}_1 \geq \frac{\delta}{1-\delta}(u_1^* - \pi_1^*)$ for the agent at unit 1. (A6)

Given that a favor costs the same regardless who gives it, and monetary payments are a mere transfer of utility between the agents, the sum of the first state's incentive constraints, (A3) and (A4), is identical to the sum of the second state's constraints, (A5) and (A6), and coincides with condition (3) from Proposition 1:

$\frac{\delta}{1-\delta}(\pi_1^* + \pi_2^*) \geq c.$

This condition is necessary for all the incentive constraints to be satisfied, and hence for the relational contract to be self-enforcing. Additionally, this condition is also

sufficient in the sense that provided it holds, there exist payments (for instance, $B_1 = 0$, $B_2 = c$, and $\tau = \pi_2^* + p_2 c$) that satisfy (A1) through (A6).

Notice that within the class of stationary contracts (i.e., contracts with the same actions and payments in every period, conditional on the realized state), the proposed relational contract (in which both agents give favors when requested) is optimal: if the parties entered an asymmetric agreement in which only one agent gives favors when requested while the other never does, the equilibrium surplus would be lower and the aggregate incentive constraint (condition (3)) would be more stringent.

Lastly, recall that by Theorem 2 in Levin (2003), in a repeated game (like ours) with symmetric information and unrestrained monetary payments, stationary contracts are optimal in the sense that for any optimal (surplus-maximizing) relational contract, there is a stationary contract that is optimal. We can therefore conclude that the optimal relational contract is one where both agents always do favors when requested if condition (3) holds, and one where favors are never exchanged if condition (3) does not hold.

Step 2: rotation cannot increase cooperation

Suppose the organization wants to implement the contract above under a rotation policy: at any given time t, the agents expect to switch units at time $t + 1$ with probability $\rho > 0$. Then, at time t, the equilibrium continuation payoffs of the agent at unit 1 and the agent at unit 2 are, respectively:

$$V_1^{MI}(\rho) = \rho\delta\left(\tilde{u}_2 + V_2^{MI}(\rho)\right) + (1-\rho)\delta\left(\tilde{u}_1 + V_1^{MI}(\rho)\right), \text{ and}$$

$$V_2^{MI}(\rho) = \rho\delta\left(\tilde{u}_1 + V_1^{MI}(\rho)\right) + (1-\rho)\delta\left(\tilde{u}_2 + V_2^{MI}(\rho)\right).$$

Similarly, the agents' continuation payoffs after a deviation (i.e., after an agent fails to give a due favor or pay a due bonus) are:

$V_1^{MID}(\rho) = \rho\delta\left(u_2^* - \pi_2^* + V_2^{MID}(\rho)\right) + (1-\rho)\delta\left(u_1^* - \pi_1^* + V_1^{MID}(\rho)\right)$, and

$V_2^{MID}(\rho) = \rho\delta\left(u_1^* - \pi_1^* + V_1^{MID}(\rho)\right) + (1-\rho)\delta\left(u_2^* - \pi_2^* + V_2^{MID}(\rho)\right)$.

After solving the above systems, we can rewrite each agent's equilibrium and post-deviation payoff as a convex combination of the payoffs they would receive if they were permanently running unit 1 and unit 2:

$V_1^{MI}(\rho) = \frac{\delta}{1-\delta}[(1-\omega)\tilde{u}_1 + \omega\tilde{u}_2]$,

$V_2^{MI}(\rho) = \frac{\delta}{1-\delta}[\omega\tilde{u}_1 + (1-\omega)\tilde{u}_2]$ in equilibrium, and

$V_1^{MID}(\rho) = \frac{\delta}{1-\delta}[(1-\omega)(u_1^* - \pi_1^*) + \omega(u_2^* - \pi_2^*)]$,

$V_2^{MID}(\rho) = \frac{\delta}{1-\delta}[\omega(u_1^* - \pi_1^*) + (1-\omega)(u_2^* - \pi_2^*)]$ after a deviation,

where $\omega = \frac{\rho}{1-\delta(1-2\rho)} \in [0,1]$.

In order to be part of a subgame perfect equilibrium of the repeated game, the relational contract must satisfy the agents' incentive constraints. When unit 1 must give the favor, these are:

$-c + B_1 + V_1^{MI}(\rho) \geq V_1^{MID}(\rho)$ for the agent at unit 1, and (A7)

$-B_1 + V_2^{MI}(\rho) \geq V_2^{MID}(\rho)$ for the agent at unit 2. (A8)

Similarly, when unit 2 must give the favor, the incentive constraints are:

$-c + B_2 + V_2^{MI}(\rho) \geq V_2^{MID}(\rho)$ for the agent at unit 2, and (A9)

$-B_1 + V_1^{MI}(\rho) \geq V_1^{MID}(\rho)$ for the agent at unit 1. (A10)

Notice that rotation effectively redistributes each unit's payoff among the two agents:

$V_1^{MI}(\rho) + V_2^{MI}(\rho) = \frac{\delta}{1-\delta}(\tilde{u}_1 + \tilde{u}_2) = \frac{\delta}{1-\delta}(u_1^* + u_2^*)$, and

$V_1^{MID}(\rho) + V_2^{MID}(\rho) = \frac{\delta}{1-\delta}[(u_1^* - \pi_1^*) + (u_2^* - \pi_2^*)]$.

Thus, the sum of (A7) and (A8) is identical to the sum of (A9) and (A10) and coincides with condition (3), which is therefore necessary for our relational contract to be an equilibrium. Since (3) is necessary and sufficient for the relational contract to be an equilibrium under fixed roles, this implies that rotation cannot make the relational contract easier to sustain, relative to a policy of fixed roles. This completes the proof of Proposition 1.