

Talent Allocation, Human Capital Accumulation and Hierarchical Firm Cross-section

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Abstract

This proposal explores structure of talent allocation in such talent-oriented industry as finance, and studies how talents flow between firms of heterogeneous organizational structure, which is mainly characterized by contractual environment. Shifting from forms of partnership/SOE to public firm/POE can expand the Pareto frontiers, generate higher profits, and compensate managers more while benefiting the remaining partnerships. However, in reality two forms of organizational structure coexist. We propose that a talented manager will flow back to more inefficient institutions if he receives a better external offer, and such back flow could generate a stable hierarchical firm cross-section structure. This observation also coincides with empirical findings that state-owned enterprise work as a potential talent pool.

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1 Introduction

Starting from 1970s, organizational shift gradually took place in US's financial sector, beginning with Merrill Lynch in 1971, followed by Morgan Stanley, Lehman Brothers and other major investment banks. And Goldman Sachs became the last shifting from partnership to public firm in 1999. After the organizational shift, demand for complex and intensive skills in financial jobs significantly increased and wages became relatively high (Philippon and Resheff, 2012). Income accruing to CEOs from the sale of stock has increased and average compensation of CEOs in financial sectors increased double than other sectors from 1993 to 2006 (Clementi and Cooley, 2009).

Surprisingly, drastic shift of organizational form happened almost simultaneously in China. In early 1990s, China started to establish modern capital market¹, where all firms were SOEs (state-owned enterprises) at the start. There came the turn in 1994 when the Company Law issued and small SOEs began its privatization. SOEs have long been criticized for its low performance and privatization improves firm's performance as empirical literature has stated. Lin et al. (1998) documented that over 40 percent of SOEs were still suffering from deficits during 1990s and Lin criticized SOE's poor performance on soft-budget constraints and separation of ownership and control. Liao et al. (2014) showed that SOEs' output and profit both increased substantially after the spilt share reform in 2005. Jiang et al. (2020) showed that median ROA of SOEs and POEs differ, and were 2.2 and 3.5% respectively.

The difference between partnership and public firm mainly lies within ownership intuitively. In public firms, ownership is separated from decision right which might arise principle-agent concern and also limited commitment problem of shareholders. The contractual environment of public firms is two-sided. In other words, managers face the risk of being fired at any time if their performance brings negative value to the firm and shareholders face the risk of losing their manager if he gets a better external offer. In partnership, however, the ownership is in alignment with decision right so that managers do not face the risk of being fired by the firm anymore, thus could be characterized as one-sided limited commitment.

Interestingly, this setting can be adopted in cross-sectional comparison of SOE (state-owned enterprise) and POE (private-owned enterprise). We could characterize SOE as another form of partnership in terms of contractual environment as managers of the SOEs never worry about being fired except that they face political risk which could be ignored in most cases. Similar as managers who will never be fired in partnerships, SOEs face only one-sided limited commitment where managers could transfer to POEs autonomously but SOEs rarely fire them.

A natural question that easily comes into mind is that in market of firms that provides professional services (aka firms which are highly talent-oriented), why two kinds of organizational form

¹China launched its first stock market in Shenzhen in November 1990, followed by Shanghai Securities in December 1990.

still coexist even if one's performance obviously outperforms another and why this hierarchical structure of organizational form (SOE vs POE in China and partnership vs public firm in U.S.) seems quite stable in real world setting ².

In this proposal, we start from a novel perspective of human capital and purposefully wind out such agency problem as moral hazard of managerial talents. Instead, we focus mainly on searching and matching of talents to different organizational forms, flow of human capital, and its impact on the contractual environment as well as the stable hierarchical structure. We try to give an explanation about the stable cross-sectional hierarchical firm structure in long run from view of talent allocation, where the mechanism deeply lies in the fact of limited commitment of shareholders to managerial talents in public firms and endogenous outside options for talents where their human capital also plays a role in deciding the external offer.

Our attempted conclusion is that under an idealized environment, the hierarchical structure of organization form (i.e. ratio of partnership versus public firm in professional service sector) is stable; and under a more frictional environment considering traditional agency problems, we also want to prove a weak steady state exists that the distribution of talents does not change a lot in long run.

The article is organized as follows. After a brief literature review on organizational form and talent allocation in Section 2, Section 3 introduces the basic setting of an infinite horizon model with heterogeneous human capital and Section 4 further characterizes the optimal contract and the market equilibrium. To illustrate the central theoretical mechanism proposed in the general model, Section 5 illustrates the result of a two-period stylized model by introducing two crucial economic force: TFP effect and bargaining effect. Section 6 discusses the possible qualitative exercise and Section 7 concludes.

2 Literature Review

2.1 Organizational Form

Though the causal relationship between change of organizational form and better performance improvement (i.e. output/profit growth)³ as well as higher compensation for managers still remains unclear empirically due to endogeneity problems⁴, we could still get valuable insight from previous theoretical literature and interview scripts on mechanism rooted behind how firms trade off between

²Cited from report from World Bank's Document "How Much Do State-Owned Enterprises Contribute to China's GDP and Employment?"

³As Lin have pointed out, whether privatization is a necessary condition for improving the efficiency of the SOE's cannot be determined a priori.

⁴Omitted variables such as market condition could simultaneously affect two sides and there might exist reverse causality when better firms could attract better managers

different forms of organizations. Within our searching ability, most literature focuses on short-term agency problems existing in firms and few empirical literature relates shifting of organizational form to talent reallocation.

2.1.1 Partnership versus Public firm

Traditional literature on comparison of organizational forms between partnership and public firm focuses mainly on agency problems where separation of ownership and control right exists in most public firms. Levin and Tadelis (2005) argue that organizing as a profit-sharing partnership can alleviate agency frictions, endowing forms of partnership comparative advantage; Kaya and Vereshchagina (2014) show that choice of organizational form might affect the trade-off between technological complementarities and concern of free-ridership. While partnership could cause cost of free-ridership due to lack of overseeing from investors, stronger commitment of a partnership allows more flexibility in the design of contracts and should increase technological complementarities from view of a single firm. Another common explanation of why firms choose going public comes from capital raising. Interview scripts with Goldman Sachs's CFO David Viniar suggests that the main reason of private firm going public is to secure permanent capital growth, to use publicly traded securities to undertake acquisitions and to enhance culture of ownership (Demarzo and Berk, 2017). Charles Ellis (2008) in his book: *The partnership: the making of Goldman Sachs*, proposes a similar idea that the major motivation for most firms going public is to increase capital available for proprietary trading operations through IPO.

The most recent literature, however, starts to analyze the mechanism behind the shift from a novel and interesting perspective concerning contractual commitment (Cooley et al., 2020), showing that a change in organizational structure from partnerships to public companies could weaken contractual commitment and thus lead to higher profit. The core idea of Cooley et al. (2020) lies in the fact that public firms are characterized by weaker contractual commitment than partnership, leading to lower internal efficiency but higher mobility of re-matching. Higher internal efficiency of existing partnerships implies that it will be more difficult for new entrants to hire the managers of existing partnerships, thus deterring entry of new partnership. Public firms, however, encourage entry of new public firms which facilitates turnover and reallocation of talents, whose equilibrium benefit proved to dominate the internal inefficiency.

2.1.2 SOE versus POE

Though SOE is defined as state-owned enterprise, the state still needs to delegate the control right to managers; And SOE's objective, besides maximizing profit like POE (Bruton et al., 2016), might also depend on the motivation behind the public ownership and to satisfy other objectives (i.e. social or political).

Very similar to what have been discussed in the performance comparison of partnership and public firm, current survey papers on SOE focus mainly on agency problem, both horizontal and vertical (Jiang and Kim, 2020). Agency theory argues that managers of SOEs might hold different objectives instead of maximizing the profit the firm due to the separation of ownership and control right (Estrin and Perotin, 1991). Unlike managers who are faced with higher risk of dismissal and replacement in private firms, managers of SOEs lack incentive to improve their performance as compensations are independent of managers' performance due to vacancy of clear firm objective and monitoring system (Shleifer and Vishny, 1998), leading to several potential agency problems such as managerial slacks, discretion and moral hazard (Lin et al., 1998).

Concerning why SOE is still becoming an increasing trend in emerging market despite its poor performance⁵, Estrin (2020) argues in his survey paper that severity of SOE's governance problems relative to POEs should be sensitive to different context. More specifically, it depends on the extent of state ownership (fully state-owned, majority state-owned, minority state-owned) (Estrin et al., 2009), the ways in which ownership is exercised (direct or indirect state control)(Megginson, 2005), the micro-level institutions that influence the performance criteria for resource allocation(Estrin and Pelletier, 2018), and the selection of SOE managers, their incentives, their values, and their perception of how to do business (Bruton et al., 2015).

It is also noteworthy that some literature mention functioning of managerial labour market in performance of SOE (Bruton et al., 2015). In the past, the managerial labour market was highly segmented, and SOE managers were known as "civil servants" in China, who did not compete in the wider managerial market (Jiang and Kim, 2020). However, in recent years market discipline has become increasingly applied to SOEs as well as POEs; for example, competition has been introduced in the product market by franchising operating licenses and integrating the managerial labour market (Bruton et al., 2016) and this could strengthen the assumption in our model, where managers of SOE might flow to POE.

2.2 Talent Allocation

To solve the agency problem and provide incentive compatibility, Fama (1980) first proposed that a firm's performance in a competitive market could provide an indirect signal to the managerial labor market about the manager's talent and behavior, and the signal could determine the manager's future wages. Few empirical studies have been conducted on how the switch in organizational structure is related to competition and allocation of managerial talents. Below list a few we have searched within ability.

Recent literature focuses on the period of financial crisis and how change of organizational form or exogenous risk could influence managers' compensation, and thus their incentive and behavior.

⁵Economist entitled its front cover "The rise of state capitalism" in Jan 2012

Acharya et al. (2016) investigates whether incentives provided to non-executives in BHCs in 2003-2006 is related to BHC risk during financial crisis and get the valuable implication that firms' fiercer competition for managerial talent could lead to risk taking behavior among executives as managerial talents would churn across firms and weaken the disclosure of their type. Cheng et al. (2015) used long lags of stock price risk to capture exogenous firm risk and prove that riskier firms are more productive and more likely to be held by institutional investors. And exogenous increase in risk would more likely bring risk-averse financial managers higher compensation in the principle-agent model even without managerial entrenchment. Bolton et al. (2016) propose that cream skimming would surface in a more opaque financial transaction and it is encouraged by excessive compensation for financial managers.

2.3 Summary

Despite slightly different ownership and control right separation form, we believe that SOE and partnership share an important common feature concerning contractual environment, and therefore our model could be applied to both the hierarchical structure of SOE versus POE and partnership versus public firm. In both public firms and POE, there is separation between control right (aka management) and ownership and the firm would choose to repudiate the contract signed with the manager if he/she makes firm's value become negative; However, in organizational form of SOE and partnership, the firm would commit to the contract signed with managers and never hire the manager even if he performs badly.

Besides the limited commitment on investor side, another important assumption we made is an endogenous outside option and probability of human capital motion. Typical assumption made by literature of agent-principle model is that outside option is exogenous, but we would like to take it endogenous in our model as probability of managers in firms seeking employment opportunities elsewhere relies heavily on his/her own ability and average ability of the human resource market.

We temporarily wind out the moral hazard and free-rider problems considered to be significant as previous literature stated. The main reason is that when we try to probe the stable hierarchical structure of organizational form in the long run, these concern might vanish. And we would give a bold guess that in talent-oriented industry, the high reallocation rate might act as another proxy of incentive compatibility mentioned by Fama (1980). To be specific, for rational managers in talent-oriented industry such as financial or law service sector where human capital of managers signal their ability and influence their lifelong utility due to future career concern, they would not choose to be lazy at work or pretend to be a low type talent to avoid risk. The main reason lies in the endogenous outside option assumption as the outside option is also related to managers' lifetime utility. Many might also concern that if a high-type manager chooses a higher-risk behavior (i.e. go to the riskier public firm instead of partnership), the probability of bringing negative value to

the firm and being fired would increase, thus influencing talents' optimal choice. But in our case, the talent's human capital would either be forced to or spontaneously accumulate faster thanks to fiercer competition and higher turnover rate of public firms, thus benefiting his lifetime utility.

3 Model

3.1 Agents

3.1.1 Firms

For simplicity, we assume there are 2 types of firms in the market: public firms and partnership, where both firms maximize their own stock value. The main difference of two types of firms lies in the contractual environment. Private firms are owned by managers but public firms are owned by shareholders. We assume state-owned enterprise (SOE) meets with one-sided limited commitment problem, while POE is like public firm which should also meet with shareholder's limited commitment. The below formula gives us firm's objective function in two contractual environments.

$$V_0^j = \mathbb{E} \sum_{t=0}^{\infty} (\Pi(h_t, z_t) - C_t) \quad (3.1)$$

Here j is the indicator of firm's type representing different contractual environment⁶: $j \in \{1, 2\}$. V_0^j calculates stock value of the enterprise in infinite time horizon, $\Pi(h_t, z_t)$ represents value created by managers, and C_t is compensation for the managers.

3.1.2 Managers

We assume investors (owners) of the firm risk neutral and managers of the firm risk averse, and further assume a unit mass of managers. Managers' survival rate is assumed to be $\bar{\omega}$, born with human capital h_0 who enter the market, where h_0 is drawn from a cumulative density function $F(h)$, $h \in \mathcal{H}$, after which new born managers match with firms through direct search, and gain their utility through working and accumulating experience. The expected life time utility of managers is given as below,

$$Q_0^j = \mathbb{E} \sum_{t=0}^{\infty} u(C_t) \quad (3.2)$$

where the consumption flow C_t depends on realized productivity shock z_t , employment state ξ_t ⁷, human capital h_t , and contractual environment j .

⁶ j is assumed binary, where 1 signals one-sided commitment and 2 signals two-sided commitment

⁷ $\xi_t = 1$, if employed, and $\xi_t = 0$ if unemployed

3.1.3 Human Capital Motion

We assume that human capital follows equation of motion given below,

$$h_{t+1} = g^j(h_t, z_t, \xi_t) \quad (3.3)$$

The dynamic of z_t is assumed to be Markovian⁸. Manager's human capital in the next stage depends on his past human capital, current performance and employment state. For simplicity, we only consider potential limited commitment problem here, where moral hazard does not enter into compensation⁹. In addition, we assume partnership's (SOE's) *cultivation* on human capital is strictly weaker than public firm's (POE's),

$$g^1(h_t, z_t, 1) < g^2(h_t, z_t, 1) \quad (3.4)$$

3.2 Market for Talents

We assume talents could match with new posted vacancies when also being employed with an incumbent firm. Each matching is determined by his human capital h and production level¹⁰ A : $\mathcal{M} = \mathcal{M}(A, h)$. Manager himself will make the final decision if he receives two offers simultaneously.

We follow Ljungqvist and Sargent ch.29 (2018) model of labor matching in a macroeconomic environment. To characterize a flow between different form of organizations, we formulate a hierarchical searching platform for talents who receive external offers, and the bargaining power is assumed to be $\eta_{2 \times 2}$ ¹¹, where $\tilde{\eta}$ measures the bargaining power gap (i.e: high human capital man from public firm is owns more bargaining power if he receives an offer from a state-owned firm). Since matches depend on the number of vacancies N and number of managers with low productivity S , we assign the filling probability of a vacancy ϕ and matching probability ρ satisfying that ρ is strictly increasing in N and $\lim_{N \rightarrow 0} \rho(N) = 0$, $\lim_{N \rightarrow \infty} \rho(N) = 1$; while ϕ is strictly decreasing in N and satisfies $\lim_{N \rightarrow 0} \phi(N) = 1$, $\lim_{N \rightarrow \infty} \phi(N) = 0$. Matches are determined by:

$$m(A, h) = \bar{m} N(A, h)^\eta S(A, h)^{1-\eta} \quad (3.5)$$

where \bar{m} is a constant. And the filling and matching probabilities¹² are:

$$\begin{aligned} \phi(A, h) &= \frac{m(A, h)}{N(A, h)} \\ \rho(A, h) &= \frac{m(A, h)}{S(A, h)} \end{aligned} \quad (3.6)$$

⁸Realized productivity shock can be persistent or i.i.d, depending on the transition matrix

⁹A snapshot shirk slows down the human capital growth speed, which may lower the life long utility of a manager.

¹⁰For unemployed ones, we assign A to be 0.

¹¹i.e: $\eta_{1,1} = \eta_{2,2} = 0.5$, $\eta_{1,2} = \tilde{\eta}$, $\eta_{2,1} = 1 - \tilde{\eta}$

¹²We parsimoniously write the filling and matching probability in a subscript-free format. In reality, m is actually a matrix, i.e: $\phi = \phi_{ij}$, $\frac{m(A, h)}{N(A, h)} = \frac{m_{ij}(A, h)}{N_{ij}(A, h)}$, $i, j \in \{1, 2\}$.

When new match is formed, the manager will negotiate the value of contract with new firm. The closed form of the value is derived from a Nash Bargaining problem:

$$Q^{Nash}(Q_t, h_t) = \arg \max_{Q_t^i} V^i(\bar{A}, \hat{Q}, h_t)^{\eta_{i,j}} \left(\hat{Q}_t^i - Q_t^j \right)^{1-\eta_{i,j}} \quad (3.7)$$

For simplicity, we assume the bargaining power is same as the supply Cobb-Douglas factor η . In a word, the bargaining result is determined by the incumbent firm's type, outside offerer's type, manager's human capital, production level and promised life-time utility \hat{Q}_t^j by the incumbent firm (aka. *threat value of the manager*).

Managers can choose to quit and become unemployed (if he receives no offer) or take a new job (if he receives a better offer, either from a firm whose type is the same as incumbent firm or another firm with different type). Denote ζ as the indicator of manager's external offer's state, outside value for a manager is:

$$D_t(A, h_t) = \begin{cases} U(h_t) & \text{if } \zeta_t = 0 \\ Q^{Nash}(Q_t, h_t) & \text{if } \zeta_t \in \{1, 2\} \text{ and } Q_t < \hat{Q}_t^{Max} \\ \hat{Q}_t^{Max} & \text{if } \zeta_t \in \{1, 2\} \text{ and } Q_t \geq \hat{Q}_t^{Max} \end{cases} \quad (3.8)$$

Note that when firm's threat point value is 0, the outside value for a manager remains \hat{Q}^{Max} since the contract value for the external firm will be negative. For simplicity, we implicitly assume $U(h_t)$ is always smaller than Q_t .

4 The Optimal Contract and Equilibrium

The definition of the outside value of the manager relies on the function V as we have discussed above. To derive this function, we need to characterize the optimal contract, which depends on the organization form and commitment environment. Optimal contract can be solved either through Ramsey Planing or Hamilton-Jacobi-Bellman Equation.

4.1 The One-sided Limited Commitment Case

One-sided limited commitment is used to characterize the case that firm cannot fire the manager while manager can walk away if he receives a better offer. In a partnership managers are the owners of the firm. So, in principle, there should not be any contractual frictions. This would certainly be the case if there were only one owner-manager. But in a partnership there is more than one partner. The firm wants to maximize its value V . The expression of it is:

$$V_i(\bar{A}, Q_0, h_0) = \max_{C_t, \omega_{t+1}, Q_{t+1}^s} \Pi_0(A_0, h_0) - C_0 + E_0 \sum_{t=1}^{\infty} \delta_{0,t} \omega_t [\Pi_t - C_t] \quad (4.1)$$

where ω_t is the indicator of separation (i.e: $\omega_t = 0$ means separation of manager and firm.), $\delta_{0,t}$ is defined as the product of discount factor and separation indicator $\delta_{0,t} = \beta^t \prod_{i=0}^{t-1} \omega_i$. Routinely, participation constraints and promise-keeping constraints:

$$u(C_0) + \mathbb{E}_0 \sum_{t=1}^{\infty} \delta_{0,t} [\omega_t u(C_t) + (1 - \omega_t) D(Q_t^s, h_t, \zeta_t)] \geq Q_0 \quad (4.2)$$

$$u(C_t) + \mathbb{E}_t \sum_{n=1}^{\infty} \delta_{t,n} [\omega_{t+n} u(C_{t+n}) + (1 - \omega_{t+n}) D(Q_{t+n}^s, h_{t+n}, \zeta_{t+n})] \geq D(\hat{Q}^{\text{Max}}(h_t), h_t, \zeta_t) \quad (4.3)$$

Equation (4.2) characterizes the constraint that manager enters into the firm at time 0. Equation (4.3) characterizes that the manager will stay in the firm from time t . The left-hand side is the value of the contract for the manager in period t conditional on continuation. Individual rationality requires that manager will quit if he receives a more appealing external offer, that is:

$$Q_t^s \leq D(Q_t^s, h_t, \zeta_t)$$

4.2 The Two-sided Limited Commitment Case

Firm will fire the manager if he generates a negative profit for the firm in the public firm case. The original three constraints on managers still hold while we have to impose another participation constraint (and promise keeping constraints) of the firm's owner:

$$\Pi_t - C_t + \mathbb{E}_t \sum_{n=1}^{\infty} \delta_{t,n} \omega_{t+n} (\Pi_{t+n} - C_{t+n}) \geq 0 \quad (4.4)$$

For any t , firm's promise is *credible* if stay of manager can generate a positive profit for him, which means the firm has no chance of to persuade the manager staying in the incumbent firm. Formally, it should be:

$$V(A_t, Q_t^s, h_t) \geq 0 \quad (4.5)$$

4.3 Equilibrium

In each period t , new vacancies are posted, a fraction of managers die and new matches are formed. We denote the cost of posting a vacancy as τ and impose a free-entry condition to pin down the market equilibrium for talents:

$$\phi(A, h) \bar{V}(Q, h) \leq \tau h \quad (4.6)$$

It catches the key character of idealized competition for talent: a vacancy for talent cannot generate a positive profit for firms in some highly competitive industries, the return fully depends on managers' idiosyncratic shock. Now we could define two types of industrial equilibrium:

Definition 1. Separation Industrial Equilibrium: A Steady State Separation Industrial Equilibrium (*SSSIE*) is defined by a distribution of managers $\mathcal{M}(A, h)$ and vacancies $N(A, h)$ such that: (1) Talent flow channels between different type of firms are shut down. (2) Contracts are optimal. (3) Free entry conditions are satisfied for $\forall A, h$. (4) The distribution of managers does not change over time.

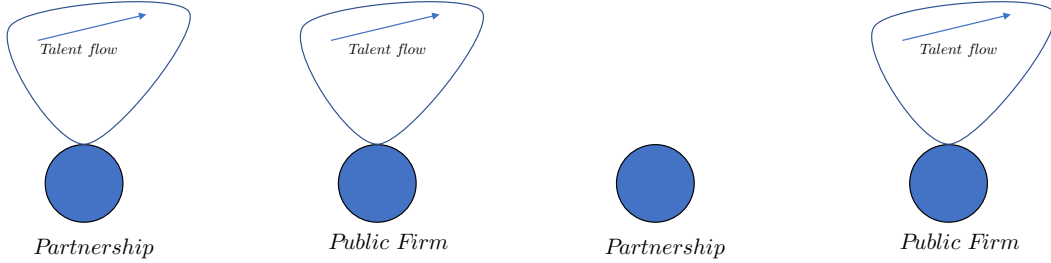


Figure 1: left one: Talent flow assumed in SSSIE; right one: Talent flow outcome in SSSIE

Proposition 1. In a *SSSIE*, partnerships do not post any vacancies for talents while public firms do, if a manager's production level A drops to \underline{A} . Furthermore, partnerships' value is lower than public ones as well as the compensation for managers of the same human capital.

Proof. See in Appendix, the Cooley et al. (2020)'s methodology applies. \square

The intuition is straight forward. In a separation, partnership can promise the manager a high Q_t while public firm cannot do so. By increasing the future outside value of the manager, the incumbent firm can reduce the compensation paid to the manager today. A higher future life time utility conditional on separation Q_{t+1}^s allows managers to negotiate a higher contract with the new firm. Conditional on separation, cheap talk has no cost for the incumbent firm because it is credible for a partnership¹³. In this way, posting a vacancy will only generate a negative profit for an external offer.

Definition 2. Industrial Equilibrium: A Steady State Industrial Equilibrium (*SSIE*) is defined by a distribution of managers $\mathcal{M}(A, h)$ and vacancies $N(A, h)$ such that: (1) Contracts are optimal. (2) Free entry conditions are satisfied for $\forall A, h$. (3) The distribution of managers does not change over time.

¹³No commitment for incumbent firm in partnership case.

4.4 Discussion on Transformation Cost

A transformation from partnership to public firm has both tangible and intangible cost. Generally, underwriting fees are the largest single direct cost associated with an IPO. Based on public filings of 829 companies, costs to companies range an average of 3.5% to 7.0% of gross IPO proceeds. Such cost does not exceed the benefit of a transformation, according to the computed firm value based on common parameter settings in Cooley et al. (2020). Therefore, it's not the key factor for the partner to decide whether to change the organization form.

4.5 Frequent Firing and Inverse Talent flow

When human capital accrues to a very high level, a manager might invest more aggressively and thus meet with higher uncertainty. Higher risk incurs more frequent binding of shareholder's commitment constraint, which might ultimately lead to a dismissal. Such insurance free case may deter the resolution of manager's staying in a public firm, which leads to an inverse talent flow, coinciding with . We are still working on this part, where the general idea of talent flow is listed as below.

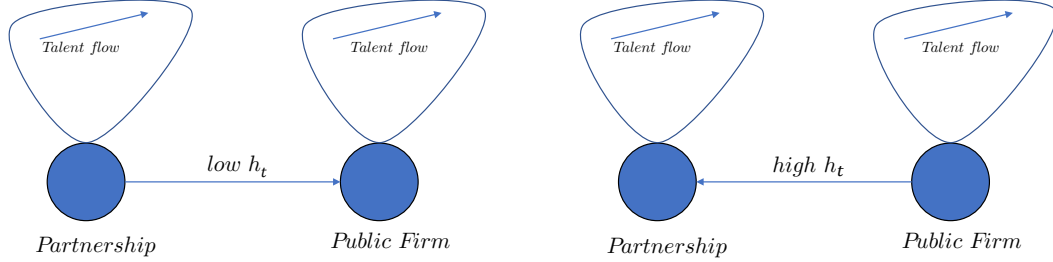


Figure 2: Talent flow in SSIE.

5 A Stylized Model

In this part, we try to illustrate the mechanism discussed above by proposing a stylized model to demonstrate how public firms could raise efficiency, following Cooley et al. (2020). For simplicity, we first consider a stylized model within 2 periods and provide the main intuition.

In period one, there are two firms matched with one manager, who could invest one unit of financial capital in both periods respectively. The return realized in period one is assumed to be \bar{A} , while return realized in period 2 is either \bar{A} or \underline{A} with equal probability $1/2$. We assume that the

manager can rematch with another firm to restore his productivity to be exactly \bar{A} . The probability of job-hopping is assumed to be:

$$\boldsymbol{\rho}_{2 \times 2} = \begin{bmatrix} \rho & \tilde{\rho}_1 \\ \tilde{\rho}_2 & \rho \end{bmatrix}$$

We have to remark that, in a steady state, off diagonal terms are the same if no talents are born and died in every period. Talent flow follows a hierarchical structure in dynamic models. Both firm's manager has an outside option $D < \underline{A}$, which represents that an unemployment wage or compensation is lower for those being mismatched to another industry where human capital plays little role.

5.1 Manager's Compensation and Optimal Contract

Like we have mentioned in Section 4, an indicator ζ is introduced to characterize the talent's employment state where $\zeta = 0$ denotes that the manager stays in the incumbent firm. Directly from Nash bargaining solution provided, the compensation of management¹⁴ contingent on productivity and employment state is (conditional on positive surplus for firms):

$$\hat{C}(C(A, 1)) = [C(A, 1) + (I_{2 \times 2} - \boldsymbol{\eta}_{2 \times 2})(\bar{A} - C(A, 1))] \otimes [1 \ 1] \quad (5.1)$$

where I is identity matrix and $\boldsymbol{\eta}$ is the bargaining power matrix for different types of matching of talents. Here we focus on the complete contract, where $\hat{C} = \hat{C}(C(\underline{A}, 1))$. For simplicity, we ignore the possible situation that compensation is contingent on external offer's type, which might be caused by adverse selection.

5.1.1 The Optimal Contract with One-sided Limited Commitment

Firm's objective function could be written as:

$$\max_{C(\cdot, \cdot)} \bar{A} - C + \frac{1 - \rho - \tilde{\rho}_1}{2}(\bar{A} - C(\bar{A}, 0)) + \frac{1 - \rho - \tilde{\rho}_1}{2}(\underline{A} - C(\underline{A}, 0)) + \frac{\rho + \tilde{\rho}_2}{2}(\bar{A} - C(\bar{A}, 1)) \quad (5.2)$$

s.t.:

$$C + \frac{1 - \rho - \tilde{\rho}_1}{2}(C(\bar{A}, 0) + C(\underline{A}, 0)) + \frac{\rho(C(\bar{A}, 1) + \hat{C}_{11}) + \tilde{\rho}_1(C(\bar{A}, 1) + \hat{C}_{12})}{2} \geq D; \quad (5.3)$$

$$C(\cdot, 0) \geq D; \quad (5.4)$$

$$C(\bar{A}, 1) \geq \bar{A} \quad (5.5)$$

$$C(\underline{A}, 1) \leq \bar{A} \quad (5.6)$$

The solution is undetermined. (5.3) binds and $C(\underline{A}, 1) = \bar{A}$ while others with inequality and equaility are optimal.

¹⁴Here, we parsimoniously omit the subscript 1,2 and the matrix's explicit representation¹⁵, which characterizes the contractual environment of different types of firms.

Proof. See in Appendix. □

5.1.2 The Optimal Contract with Two-sided Limited Commitment

Firm's objective function remains the same while constraints vary:

$$C + \frac{1 - \rho - \tilde{\rho}_1}{2}(C(\bar{A}, 0) + C(\underline{A}, 0)) + \frac{\rho(C(\bar{A}, 1) + \hat{C}_{22}) + \tilde{\rho}_2(C(\bar{A}, 1) + \hat{C}_{21})}{2} \geq D; \quad (5.7)$$

$$A \geq C(A, \cdot) \geq D \quad (5.8)$$

$$C(\bar{A}, 1) \leq \bar{A} \quad (5.9)$$

$$C(\underline{A}, 1) \leq \underline{A} \quad (5.10)$$

The solution is undetermined. (5.7) binds and $C(\underline{A}, 1) = \underline{A}$, $C(\bar{A}, 1) = \bar{A}$ while others with inequality and equality are optimal.

5.2 The Industrial Equilibrium within Two Periods

We denote the cost of posting a vacancy as τ . And the free entry condition for talents should satisfy:

$$\phi(N)(\bar{A} - \hat{C}) \leq \tau \quad (5.11)$$

where the left hand side represents the expected payoff of posting a vacancy. The free-entry condition illustrates a very important equilibrium effect on both one-sided and two-sided cases. A circulation between partnerships creates no profit because \hat{C} can reach \bar{A} . In the regime with two-sided limited commitment, the compensation for a new manager is $\hat{C} = \underline{A} + (1 - \eta)(\bar{A} - \underline{A})$, which creates a positive profit $\eta_{21;22}(\bar{A} - \underline{A})$.

So far, we have considered the outcome of different contractual environments. We have shown that partnerships post no vacancies because their manager's participation contingent on separation with low productivity binds. This would deter entry of partnership's posting of vacancies for talents.

Proposition 2. Cooley Marimon Quadrini Benchmark: *For diagonal ρ, η . In an industry full of partnerships, $\rho(N) = 0$ while $\rho(N) > 0$ in an industry full of public firms. Furthermore, if transformation cost is lower than $-\frac{(1-\eta)\rho}{2}(\bar{A} - \underline{A})$, all firms will go to public.*

Proof. Directly from the optimal contract's formulation. □

Proposition 2 shows that the only cost deterring transformation is firms' value spread. For a very large N , ρ is approaching 1 and reallocation works as if it were in first best that managers reallocate whenever his productivity drops. Interestingly, under moderate assumptions, we can show that different from CMQ's benchmark, the talent flow channel between different types of firms still works: partnership's situation is not as bad as in the CMQ's benchmark.

Arbitrarily, we could assume $\tau < \min\{\eta\}(\bar{A} - \underline{A})$ and $\bar{A}^{public} \geq \bar{A}^{Partnership} > \underline{A}^{public}$, and could directly come into an observation that,

Proposition 3. $\rho_{12}(N), \rho_{21}(N), \rho_{22}(N) > 0$, while $\rho_{11}(N) = 0$.

Proof. See in Appendix. □

The talent flow channel works because the return of recruiting a manager generates profit for both partnerships and public firms. The only difference is that there's still no talent flow within partnerships, the reason is the same as in CMQ Benchmark.

Note that mild assumption on η only serves as a stepping stone for profitable sending external offers for both type of firms. There are still no vacancies posted from partnerships to partnerships even when τ is a infinite small one, because the promised value for managers exceeds the potential profit (decision makes must take a positive cost $\tau > 0$ into consideration).

Another mild assumption on productivity A reflects the observation that shareholders' opinion on managers' performance really reduces potential frictions inside a public company. Also, it has been proved empirically that the productivity in SOEs is quite lower than POEs. If the second part of assumption is removed, talent flow from public firms to partnerships could still exist.

In a sense, public firms have a positive externality on partnerships by contracting a low compensation conditional on low productivity, which lowers the threat point value of managers in the labor market. Thus partnerships receive a positive profit for recruiting new managers.

6 Empirical Strategy

6.1 Calibration Strategy

In this section, we try to calibrate the model using data of CPS from 1970 till now. The setting of calibration parameters mainly follow Cooley et al. (2020) while we add two important parameters: initial TFP gap η ; initial bargaining effect gap h_0 (shown in table 1).

Table 1: *Model parameters*

| Description | Value |
|---|---|
| Intertemporal discount rate/interest rate | $r = 0.04$ |
| Survival probability | $\bar{\omega} = 0.975$ |
| Matching function efficiency and bargaining | $\bar{m} = 0.5, \eta_0 = 0.5, \eta_{1,2} = \eta_0 \pm 0.2$ |
| Consumption when unemployed | $\underline{c} = 0.0001$ |
| TFP on average | $\underline{A} = 0.05, \bar{A} = 0.075, \theta = 0.026$ |
| The TFP gap (<i>on percentage</i>) | $\mu = x\%$, i.e: $\bar{A}^{One,Two} = \bar{A} (1 \pm \frac{1}{2}\mu)$ |
| Risky investment iid shock | $\underline{z} = -6.5, \bar{z} = 9.5, p = 0.5$ |
| Cost of risky investment | $\alpha = 0.032$ |
| Human capital dependence on investment return | $\kappa = 0.232$ |
| Cost of posting a vacancy | $\tau = 0.35$ |
| The Initial Human Capital distribution | $h_0 \sim N(1.0, 0.1^2)$ |

6.2 Counterfactual

After getting the simulation result of the equilibrium properties with two forms of contractual environment, we are going to evaluate the consequence if

- (1) People with *relatively low human capital* are deterred from the job market.
- (2) The TFP gap is filled.
- (3) Bargaining power gap is filled.

Expectation on the outcomes:

For the first one, we expect a drop in the unemployment rate (if deterred ones are not recorded by the labor bureau) and the shrink of partnerships. People with low capital are more likely to be allocated to the partnerships. As those with low human capital are deterred from the job market, the supply drops and partnerships have to compete more contentiously with the public firms, which are more efficient.

The second case, in which the TFP's channel has been shut down, will generate a more stable hierarchical firm structure, as a weakened talent flow from partnerships to public firms is realized. Also, it will strengthen the bargaining gap's channel, since this channel's existence mainly depends on the $\eta_2 - \eta_0$ and the production gap $\bar{A}^{TWO} - \bar{A}^{ONE}$ (*negatively correlated*). Therefore, the outcome that senior employees are more likely to flowback, accompanied with a narrowed TFP channel cementing the existing partnership-public partition.

Lastly, once the bargaining power gap is filled, we expect to see a similar shrink within the partnerships. The main mechanism quite resembles the above firstly mentioned case. Still, culti-

vated employees from the partnerships have the chance of job-hopping from current firm to a public corporation while transfer from public to partnership seem less possible.

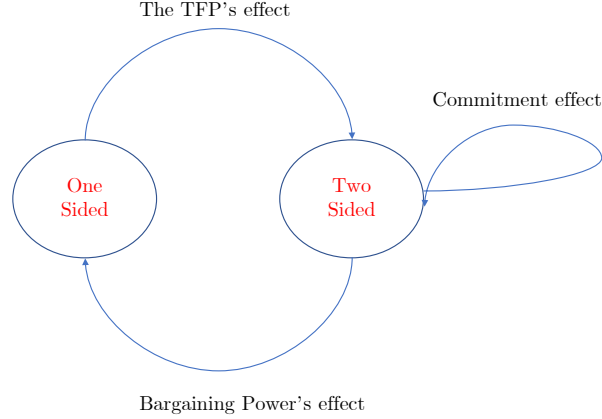


Figure 3: Talent Flow's Main Mechanism

6.3 Empirical Evidence

We would also like to provide some empirical evidence for validation of the steady state result and assumption our model gives if possible. i) The first conclusion of the model we want to prove in further empirical study is that there exists an obvious separation of types of talents admitted to different types of organizational form at initial stage and after an observable period, the hierarchical structure of distribution and mobility of talents in different organization form would be stable. ii) The second issue we want to prove is that the cultivation of POE/public firm is better than that of SOE/partnership as equation 3.4 assumes. iii) And finally, we also want to check if our model only supports the sector of professional service like finance and laws or it could be applied to other areas.

One important measurement problem we met with is how we index bargaining effect of talents. Under the assumption of complete contract, the salary could be constituted by individual's bargaining effect over firm and firm's TFP which contains the resources firms hold. So by winding out the TFP effect from salary, we could get the adjusted bargaining effect index, which could be ranked from 1 to n in our sample and than standardized to $c[0, 1]$.

i, ii) We index individual bargaining effect of fresh graduates who will enter the secondary fund management labor market as initial human capital h_0 , and index if the individual is admitted to mutual fund or private equity in financial sector as a dummy variable d_0 . Then we could document the same sample of individual samples¹⁶. The most ideal case, however, is that we could get

¹⁶either population or random sampling is suitable for our test as we assume i.i.d manager born and died at each period t in this market

the exactly same sample of individuals as the initial stage 0 each year and track their adjusted bargaining effect as the human capital as h_i , where $i = 1, 2, \dots, t$. What we should notice here is that the measurement of adjusted bargaining effect, which should index the change of human capital, is difficult to measure due to lots of noise. This index should be comparable to the initial human capital h_0 and also represent how individuals signal their ability in the market¹⁷. For mutual fund manager, the performance of each manager is comparable within each industry, and those ROI data in the same field of investing could be comparable and the only difficulty lies in getting the performance ROI data from those managers of private equity.

iii) Besides individual human capital h_0 , we would also like to introduce comparative index (i.e. relative turnover and relative compensation), which could measure the average/median managerial compensation and managerial turnover rate between within professional sector (PS) and outside professional service sector (NPS) and thus prove our final assumption. Related data could be collected from CPS (Current Population Survey) which contains the individual data sample from 1970 till now. Starting from 1975, the turnover of each employee is provided and the complete time period contains the time when organizational shift happens in US. By restricting professional sector (PS) sample to full-time male managers of finance sector in industry code named "IND50LY", we could test if the result of our model could be extended to every sector. "INCWAGE" variable could measure the pre-tax wage.

$$\text{Turnover}_t^j = \frac{\sum_{i=1}^{I_t} (n_{it} - 1) \omega_{it} d_{it}^j}{\sum_i^{I_t} \omega_{it} d_{it}^j}$$

$$\text{Relative turnover}_t = \text{Turnover}_t^{PS} - \text{Turnover}_t^{NPS}$$

$$\text{Relative compensation}_t = \frac{E_t^{PS}(C_{t,0.5})}{E_t^{NPS}(C_{t,0.5})}$$

where d_{it}^j is the dummy variable that takes the value of 1 if the individual is employed in industry j in year t.

7 Conclusion & Discussion

Conclusively, this proposal explores structure of talent allocation in such talent-oriented industry as finance, and studies how talents flow between firms of heterogeneous organizational structure, which is mainly characterized by contractual environment. Shifting from forms of partnership/SOE to public firm/POE can expand the Pareto frontiers, generate higher profits, and compensate managers

¹⁷We assume that there exist such a standard performance evaluation system (such as peer evaluation mixed with boss evaluation in investment banking and performance (ROI) in fund management) deciding the final compensation/bonus in each firm and by controlling each firm's fixed effect, we could still do a testable empirical study.

more while benefiting the remaining partnerships. However, in reality two forms of organizational structure coexist. We propose that a talented manager will flow back to more inefficient institutions if he receives a better external offer, and such back flow could generate a stable hierarchical firm cross-section structure. This observation also coincides with empirical findings that state-owned enterprise work as a potential talent pool.

The main contributions of our work are as follows. Theoretically, we added another channel of talent flow between different forms of organizations which is insufficiently mentioned in applied dynamic contract literature. Also, our interpretation of dynamic career promotion also offsets the agency friction to some extent, which is less considered in traditional contract theory (both static and dynamic), i.e: Hengjie Ai and Rui Li (2015), where authors used an exogenous outside option for CEOs. Practically, we provide advice for regulators who care about unemployment rate, talent allocation and consequence of organizational shift.

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A Appendix

A.1 A Micro Foundation for Equation of Motion

This is drawn from Cooley et al. (2020), slight modification of this way renders different formulation of $g(\cdot)$. Manager allocate his human capital between risk-free asset and risky assets, the investment return is:

$$R_{t+1}^s = A_t f(\min\{K_t^s, h_t^s\}), R_{t+1}^r = z_{t+1} A_t f(\min\{K_t^r, h_t^r\}). \quad (\text{A.1})$$

where f is the investment function. Risky asset has a higher expected return while it's uncertain: $\mathbb{E}z_t > 1$. To achieve an internal solution of asset allocation, we add a normalized adjustment cost on risky asset allocation: $e(\lambda_t)$, λ_t is the fraction of risky asset at time t . With the assumption of human capital depends on return of assets $h_{t+1} = h_t + \kappa R_{t+1}$, we can directly write (we assume that $f = 1$):

$$\begin{aligned} \Pi_t &= \pi(A_t, \lambda_t) h_t, \pi = -1 - e(\lambda_t) + \bar{\beta} \{1 + [1 + \lambda_t(\mathbb{E}z - 1)] A_t\} \\ h_{t+1} &= g(A_t, \lambda_t, z_{t+1}) h_t, g = 1 + \kappa [1 + \lambda_t(z_{t+1} - 1)] A_t \end{aligned}$$

The gap of accumulation speed depends on the production technology of SOEs and POEs, which in turn creates the spread in $g^1(\dots)$ and $g^2(\dots)$.

A.2 Proof of Proposition 1

Proof. Given a candidate solution in one-sided limited commitment case, suppose that we consider an alternative with $\tilde{Q}_{t+1}^s = Q_{t+1}^s + \epsilon < \hat{Q}^{Max}(h_{t+1})$, where ϵ is a small positive number. We also choose $\tilde{C}_t < C_t$ so that promise-keeping constraint is satisfied. Since \tilde{Q}_{t+1}^s does not enter the objective function while C enters negatively, the alternative one is strictly preferred.

However, this does not work for two sided case. It is easy to verify V is decreasing and concave of h while decreasing of A , $Q_t^s = Q^{Max}$ violates the desired "Credible" constraint of the public firm.

The rest of the proof is easy, for we have already shown that the channel of talent flow between firms in **SSSIE** shuts down. \square

A.3 Proof of Proposition 3

It follows directly from free entry condition. Note that as $\bar{A} - \hat{C}$ approaching to *zero*, the equailiy requires $N \rightarrow 0$. That is $\rho(N) \rightarrow 0$ for ρ_{11} .

A.4 Proof of Main Conclusion in Stylized Model

The objective function does not depend on $C(\underline{A}, 1)$ but an increase in $C(\underline{A}, 1)$ relaxes constraint (5.3). Therefore, the optimal solution is that $C(\underline{A}, 1)$ reaches \bar{A} .

Other variables like $C, C(\underline{A}, 0), C(\bar{A}, 0), C(\bar{A}, 1)$ relaxes (5.3) but have negative impact on objective function. An increase in compensation reduces the profit, if other constraints hold.

Note that $C(\underline{A}, 1)$ cannot reach \bar{A} because of the credible payment constraint $C(\underline{A}, 1) \leq \underline{A}$. The rest of the proof is trivial.