The Servant of Two Masters: A Common Agency-Based
Explanation for Side-by-Side Management*

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Abstract

Side-by-side (SBS) management refers to the practice that a fund manager/family simultaneously manages two funds and separately contracts with the two fund principals. In this paper, I present a common agency model to study the motivations for and effects of SBS. With decentralized contracting, there are two types of contractual externalities: the manager’s efforts are substitute and the effort exerted on one fund generates a performance spillover on the rival fund. When one principal increases incentives, the rival principal has two choices to respond: she can either compete by increasing incentives or free ride by reducing incentives but enjoy the spillover effect. Under public contracting, competition is more likely to dominate free-riding. Under private contracting, however, free-riding becomes important. In either contracting, SBS could generate better performance relative to standalone management. As a result, this paper reconciles the conflicting findings on SBS management in Cici, Gibson and Moussawi (2010) and Nohel, Wang and Zheng (2010). The proposed model also provides new testable implications such that SBS is more likely to happen in fund families and to be managed by managers with higher ability.

JEL Classification: G10, G20, G30, G23, G32

Key words: Side-by-side management; common agency; decentralized contract; mutual fund; hedge fund
No man can serve two masters: for either he will hate the one, and love the other; or else he will hold to the one, and despise the other. You cannot serve both God and Mammon.

— Matthew 6: 19-24

1 Introduction

Side-by-side management (SBS) refers to the growing financial practice that the same fund manager/fund family simultaneously manages two or more funds, and separately contracts with the two or more fund principals via different compensation schemes. Critics contend that this practice creates conflicts of interest that SBS managers may favor one fund over the other because of limited and substitutable attention. Even worse, the managers may directly shift performance from the lower incentivized fund to the higher incentivized fund. However, industry proponents argue that investors may benefit from their affiliation funds due to spillover effect if the funds are delegated to a superior talent or if one of the funds under SBS management shows star performance. In addition, with reputation effect and SEC regulation, SBS managers have a strong incentive to avoid favoritism.

Since SBS management directly influences fund performance and hence shareholders’ interest, it is logical to investigate the effects that SBS managers will have on the SBS funds. What are the costs and benefits of SBS management and why do some fund investors/principals choose to delegate different fund management to a common fund manager instead of the traditional exclusive individual managers (standalone management)? With SBS management, what kind of contract should the principals offer, public contracting or

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1 In the hedge fund industry, each manager operates on average 1.84 funds according to the AltVest database (Kolokolova, 2011). In contrast, in the equity mutual fund industry according to the CRSP Mutual Fund Database, the average number of funds under SBS management is 2.2 (Yadav, 2011). Also, the proportion of SBS managers amounts to 30%, managing 36% of the total assets (Agarwal and Ma, 2011).

2 Cici, Gibson and Moussawi (2010) list six examples where favoritism can take different forms.

3 As of 2006, all managers are required to disclose all of the funds and accounts they manage in the Statements of Additional Information.
private contracting?

This paper develops a common agency model to answer these questions by investigating the benefits and the costs of SBS management and to find the condition under which SBS management is beneficial relative to standalone management. In my model, two risk-neutral fund principals have two channels to delegate the fund management to risk-neutral managers who are skilled and have some special ability to generate abnormal returns. The principals can use the traditional standalone management and sign exclusive contracts with two different managers. This is the standard one principal-one agent delegation. Alternatively, they can choose SBS management, i.e., they delegate the two funds and sign different contracts with a common manager separately. In doing so, they may enjoy a spillover performance among SBS funds, which is well recognized in practice. For example, effort may generate a positive externality, i.e., a manager may efficiently exert effort and transfer information across funds by holding same stocks among the different funds. This is achieved by holding his best stocks in all of his funds he has better stock-picking or timing skills. With common holding, he can spend his limited efforts on concentrated stocks and hence obtains more precise information. Another type of spillover is performance externality. Yadav (2011) finds that a fund receives 7.8% higher new money inflows per year if one of the other funds under SBS management is a star fund.

However, the concern of SBS is that both principals face conflicts of interest that prevent them from dealing with the fund management at arms-length. With different incentives, the manager may favor one principal that offers him more incentives over the other one. That is, SBS management may raise favoritism, unequal trading costs, different trading priorities and disproportionate allocations of securities, even among funds with nearly identical objectives and investment philosophies. To capture this concern by SEC and investors, I assume in this paper that the manager’s efforts exerted on the two funds are substitutable (Homstrom and

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Milgrom, 1991; Peng and Röell, 2008; Liang and Nan, 2011), which generates an indirectly negative externality between the two contracts, implying that an increase in one fund’s incentive will lead to an increase in the marginal cost of the rival fund.

Under SBS management, the two principals can choose to public contracting or private contracting. Under public agency, the two fund principals make the effort public and contract on efforts exerted on the two funds. Under private agency, each principal cannot observe the effort exerted on the rival’s fund and hence can only control the effort on her own fund. Given the rival fund’s contract, the fund principal can compete by providing more incentives to the manager, or she can free ride on the rival’s contract by reducing the incentives but enjoying the spillover effect. Our model predicts that the competition is more likely to be dominant in the public contracting while free-riding occurs in the private contracting. This implies that public contracting is more likely to occur when the SBS funds are from the same fund family, whereas the private contracting is more often to occur when the SBS funds are from different fund families.\(^5\)

It should be noted that, under standalone management, the principal’ expected payoff corresponding to a given equilibrium effort is well defined, but under SBS management, this value needs to be defined more precisely either with full or incomplete information. Under SBS, the binding participation constraint of the least-efficient manager determines only the sum of performance generated to both principals. There is an indeterminancy in the exact sharing of this surplus, and therefore only the sum of the principals’ payoff is determined. If a specific sharing rule is not chosen, it will introduce multiple perfect Bayesian equilibria of the game in which SBS management is chosen, as long as the corresponding sharing rules satisfy both principals’ reservation constraints. Because the principals’ total payoff and the levels of effort are the same under any of these equilibria, there is no loss of generality in

\(^5\)This is consistent with Chen, Kubik and Hong (2011) who document that mutual fund families outsource the management of their funds to unaffiliated advisory firms and find that funds managed externally significantly under-perform those run internally. They attribute this to the inability for fund families to coordinate with the external firm who manage other funds simultaneously.
restricting ourselves to the symmetric, differential equilibria.

Another striking characteristic of SBS is that there are multiple symmetric, differential equilibria even in the case of complete information when the contracting is private. The reason underlying is that principals in SBS can provide nonlinear compensations that are unchosen in equilibrium, which generates intense competition between the principals, serving as implicit threats to prevent the rival principal from deviating from the equilibrium allocation. That is, these out-of-equilibrium offers are irrelevant to the offering principal’s payoff but have impact on the rival principal’s strategy.

Our model can reconcile and rationalize the contradicting evidence in Cici, Gibson, and Moussawi (2010) and Nohel, Wang, and Zheng (2010). Cici, Gibson, and Moussawi (2010) track 71 advisory firms engaged in both hedge and mutual fund management and find SBS mutual funds underperform unaffiliated mutual funds. In a contemporaneous paper, however, Nohel, Wang, and Zheng (2010) study 344 portfolio managers who manage a total of 693 mutual funds and 538 hedge funds simultaneously, and find that SBS mutual funds outperform unaffiliated funds and SBS hedge funds perform at best on par as good as unaffiliated funds. Agarwal and Ma (2011) examine the determinants and consequences of SBS in the mutual fund industry and find that well-performing and more experienced managers are more likely to switch to SBS by either taking over other funds within fund companies (i.e., acquired funds) that are poorly performing or launching new funds, and that funds managed prior to multitasking experience significant performance deterioration improve within two years after the switch. Yadav (2011) examines the portfolio management strategies of SBS mutual fund managers who are classified to be low-match managers or high-match managers according to whether they hold low or high fraction of common holdings across the different funds they manage. He shows that high-match managers perform significantly better than low-match managers. The star performance of a fund results in high level of new money flows not only to the fund itself but also to the other funds managed by the manager.⁶

⁶Our paper is also related to the literature on fund family where performance spillover and favoritism are well acknowledged (Massa, 2003; Nanda, Wang and Zheng, 2004; Massa, Gaspar and Matos, 2006; Elton,
This paper differs from the traditional centralized contracting where the manager has no other option than accepting or refusing the contract offered by the principal. This participation constraint is most often modeled by an exogenously reservation utility for the manager. Under decentralized contracting, the manager may either accept all contracts at once or accept only a subset of the offers he receives. Also, a major difficulty in the common agency literature is to understand the new frictions due to the principals’ non-cooperative behaviors. This requires a careful study of the contracting possibilities available to the principals, which may either alleviate or exacerbate distortions depending on the contexts. Readers may refer to Bernheim and Whinston (1986a), Dixit (1997), Martimort (1996), Martimort (2007), Martimort and Stole (2009) for common agency theory.

The rest of our paper proceeds as follows. Section 2 introduces the basic model. Section 3 discusses standalone management, which will serves as a benchmark. Section 4 studies SBS management under complete information, which is followed by Section 5 with incomplete information. Section 6 extends the model to the case where the SBS manager has an ownership in both funds. Section 7 summarizes our findings and concludes.

2 Model

In this section, we introduce our common agency model and analyze the effects of SBS on the manager’s effort exertion and fund performance. For simplicity, we assume all players in the market are risk-neutral throughout the paper.

Suppose in the market there are two funds, A and B. To obtain abnormal returns, the fund principals delegate the funds to managers who have some scarce skills. There are two mechanisms for delegation, standalone management and SBS management. With standalone management, the two principals delegate their funds to two exclusive fund managers who

will respectively generate risk-adjusted returns as

\[ r_A = \sigma e_A + \varepsilon_A; \]  
\[ r_B = \sigma e_B + \varepsilon_B; \]

where \( e_A \) and \( e_B \) are the efforts exerted by fund managers, and \( \varepsilon_A \) and \( \varepsilon_B \) are two i.i.d residuals with mean zero and variances \( \sigma^2 \). Since everyone is risk-neutral, the mean-zero residual terms and their distributions have no effect on the results, but are introduced to demonstrate their generality (Laffont and Tirol, 1986). Also, we assume that the standalone managers have the same cost function as \( C(e) = \frac{\rho}{2} e^2 \), where \( \rho \) is the cost-aversion coefficient.

With SBS management, the two fund principals delegate the two funds to one common manager, and contract with the manager separately. The benefit is the spillover effect between the two funds, i.e., the effort exerted on one fund has a positive effect on the other fund. The cost is the substitutable effect of efforts, i.e., the manager opts to allocate his limited efforts to align with each specific principal. To capture these two characteristics, we assume that the fund returns follow

\[ r_A = \sigma (e_A + \theta e_B) + \varepsilon_A; \]  
\[ r_B = \sigma (e_B + \theta e_A) + \varepsilon_B; \]

and that the cost function is

\[ C(e_A, e_B, \delta) = \frac{\rho}{2} (e_A^2 + e_B^2) + \delta e_A e_B, \]

where \( \theta \in (0,1) \) measure the spillover effect and \( \delta \in [0, \rho] \) captures the substitute effect.

With such assumptions, when a principal raises the agent’s incentive in order to attract more services, the agent will reduce his effort to the other principal since his skills are substitute. Specifically, when \( \delta = 0 \), the efforts are independent of each other and SBS has an obvious benefit due to the spillover effect. However, when \( \delta \) approaches \( \rho \), the efforts

\footnote{Generally, we may assume the fund excess return as \( R = \sigma e + \beta (R_m - R_f) + \varepsilon \). This implies that \( \sigma e \) is the fund alpha or the risk-adjusted return.}
for the two funds are perfectly substitutable and hence the manager will exert all his efforts on the fund with more incentive. This assumption ensures that the managerial attention is limited \( \frac{\partial C(e_A,e_B)}{\partial e_A, \partial e_B, \delta} \geq 0 \). A positive cross-partial derivative implies a limited managerial attention where higher level of one effort increases the marginal cost of performing the other effort.\(^8\)

The key principle stressed here is the desirability of keeping a balance between incentives across funds to avoid a form of fund arbitrage by the manager that results in some fund being neglected, i.e., when higher effort on one fund raises the marginal cost of effort on the other fund. Without any conflict between funds, SBS is obviously beneficial for both principals who prefer to hiring a common manager to manage both funds rather than hiring one manager per fund. However, introducing conflicts change the results because the manager may extract more rents from another fund by exerting efforts.

An alternative explanation for the effort substitutability is that we can decompose the ability of SBS manager into two dimensions, market-timing ability \( (e_A) \) and stock-picking ability \( (e_B) \). Each type of ability can contribute a positive abnormal return to the two funds, but the contributions are different. With our assumption of \( \theta \in (0,1) \), fund A is more dependent on the market-timing ability while fund B is more dependent on the stock-picking ability. The difference may be due to the fact that each fund uses different investment strategies and is subject to different restrictions. For example, fund B is a mutual fund and hence is subject to short-sale constraint. As a result, fund B’s performance is more likely to be attributed to the manager’s stock-picking ability. Instead, fund A is a hedge fund and its performance is more likely to be attributed to the manager’s market-timing ability.

Both the spillover effect \( \theta \) and the substitute parameter \( \delta \) can be used to measure the manager’s type. The larger \( \theta \) or the smaller \( \delta \), the higher the manager’s ability. For simplicity, we fix \( \theta \) and only use \( \delta \) to define the manager’s type throughout the paper. The information

\(^8\)This assumption is in the spirit of Homstrom and Milgrom (1991), Peng and Röell (2008) and Liang and Nan (2011) where there authors consider multitask principal-agent problem. Our departure from them is that we are concerned with the multiple principal-agent contract.
asymmetry hence means that the manager’s ability $\delta$ is only known to the manager but unknown to both principals. However, we assume it follows a special distribution that is common knowledge among the two principals and the manager.

The SBS manager has a quasi-linear utility function:

$$U(\delta) = w_A + w_B - C(e_A, e_B, \delta),$$ \hspace{1cm} (5)

where $w_A$ and $w_B$ are compensation schedules that should be specified in detail according to the contract contexts. Specifically, we consider in this paper two compensation schemes with SBS management, public contracting or private contracting. Under public contracting, fund A can contract with the manager on both $e_A$ and $e_B$, i.e., $w_A = w_A(e_A, e_B)$. Under private contracting, however, fund A can only contract with the manager on effort $e_A$ and $e_B$ is unobservable to him, i.e., $w_A = w_A(e_A)$, and vice versa.

Although the principals can change the compensation $w$ to change the manager’s incentive, SBS management introduces some new features that are not present under centralized contracting. For example, the manager’s effort contracted upon by the fund A enters directly into fund B’s objective function, and vice versa. This arises the direct contractual externalities (Martimort and Stole, 2003). Another kind of externalities occurs because the manager’s cost function for fund A depends also on contractual effort $e_B$. With these two externalities, there may have multiple equilibria in the case of private agency even under complete information. The multiplicity is driven by the nonlinear compensations available to the manager that will not be chosen in equilibrium. Offering a nonlinear compensation schedules that are unchosen by the manager can prevent the rival principal from deviating from the equilibrium (Martimort and Stole, 2003). With SBS as a special characterization of common agency, the two compensation schemes are not determined at the equilibrium although the sum is determined that jointly satisfies the manager’s participation constraint. In this sense, we only consider symmetric, differential equilibriums that equally assign the joint payoff at the equilibrium between the two principals. When we say SBS is beneficial, it means the joint payoff is larger than the sum of payoffs from standalone management.
Lastly, we assume once when the two principals decide SBS management, the manager cannot reject one but accept the other one, and he can only reject or accept both (Martimort and Stole, 2009).

To sum up, the sequence of events is illustrated in Figure 1 and proceeds as follows:

1. Nature draws $\delta$. This parameter is known only by the common manager in the case of asymmetric information or by all players with complete information. The manager reports $\delta$ to both principals.\(^9\)

2. Principals choose the contracting scheme, standalone or SBS. If they choose SBS management, they need a new step to choose either public agency or private agency.\(^10\) Then they propose separate contracts to the manager.

3. The common manager accepts or refuses both contracts.

4. If the SBS manager refuses, gets his reservation utility zero. If he accepts, he chooses efforts to exert on both funds.

\[\text{[Insert Figure 1 here]}\]

We are ready now to define the equilibrium of SBS as a triplet that includes the manager’s effort level and the two incentive schemes offered by the principals, $(e, w_A, w_B)$, such that

1. The manager chooses the effort levels to maximize his expected utility, taking the incentive schemes offered by the two principals as given, and

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\(^9\)The manager could report different values to the two principals. With truthful equilibrium, the manager will only report the same values.  
\(^10\)We will not consider the situation where one principal uses public contracting while the other uses private contracting, which could be the third type of SBS management. Maier and Ottaviani (2009) show that the welfare with this semi-public contracting is the same with public contracting.
2. Each principal offers the incentive scheme that gives her the highest expected performance, taking as given the incentive scheme provided by the rival principal and the manager’s optimal efforts.

3 Standalone Management

For comparison, we consider here the standard case of standalone management (Bhat-tacharya and Pfleiderer, 1985). Since the manager’s effort is contractible, the problem for principal A is to choose $e_A$ and $w_A$ to maximize the expected payoff subject to the manager’s participation constraint.

$$
\max_{e_A, w_A} E_{e_A} [\sigma e_A + \varepsilon_A] - w_A \\
\text{s.t. } w_A - C(e_A) \geq 0,
$$

where we assume the manager’s reservation utility is zero which holds throughout this paper.

It is clear that at the equilibrium, the participant constraint is binding and the optimal effort is

$$
e_A^{S,fb} = \frac{\sigma}{\rho}.
$$

In this case, the principal provides the manager with a contract as

$$w_A = \frac{\sigma^2}{2\rho},
$$

which equals the cost of exerting $e_A^{S,fb}$. The expected payoff for fund A is

$$\Pi^{S,fb}(A) = \frac{\sigma^2}{2\rho}. \tag{8}
$$

Similarly, the optimal effort for fund B with standalone management is

$$e_B^{S,fb} = \frac{\sigma}{\rho},$$

$$w_B = \frac{\sigma^2}{2\rho},
$$

$$\Pi^{S,fb}(B) = \frac{\sigma^2}{2\rho}. \tag{8}
$$
and the expected payoff is
\[ \Pi^{S,f_b}(B) = \frac{\sigma^2}{2\rho}. \]

The sum of the two funds’ expected payoffs is
\[ \Pi^{S,f_b}(A, B) = \frac{\sigma^2}{\rho}. \]

### 4 SBS with Complete Information

To characterize the complexity of SBS management, in this section we consider the simplest case where both principals can observe the manager’s type \( \delta \). The reasons for focusing on complete information are at least twofold. First, SBS is totally different from the traditional standalone management as “significant complexities arise even when there is no private information” in a common agency game (Bernheim and Whinston, 1986). Second, ruling out information asymmetry permits us to isolate the effect on the outcomes of the game of the competition between the principals from the effect of incomplete information.

The contracts can be formulated as a two-objective optimization problem subject to a participant constraint:

\[
\begin{align*}
\max_{w_A} & \quad E_{\epsilon_A}[r_A] - w_A \\
\max_{w_B} & \quad E_{\epsilon_B}[r_B] - w_B \\
\text{s.t.} & \quad w_A + w_B - C(e_A, e_B, \delta) \geq 0.
\end{align*}
\]

Comparing this problem with standalone management, the key difference is that the contract is decentralized and there are two competing objectives in the contract formulation. This is also the main difference between single principal- and multiple principal-agency contracts. Subject to a joint participant constraint, the two principals choose incentives to maximize their own expected payoffs. The trilateral relationships make the problem much more complex. On the one hand, the principals should provide incentives to make the manager work efficiently. On the other hand, when one principal makes an offer to the manager,
she has to consider the potential conflict of interest from the rival principal who may attenuate the manager’s incentive. Because the efforts are substitutable and the manager works for both funds, a small change in the compensation scheme offered by one fund affects the other fund performance. This interaction between the two funds’ incentive schemes complicates the analysis of SBS management.

4.1 Public contracting

We now consider a situation where the effort exerted on one fund is observable to the other fund principal. We call this public agency SBS management. That is, the two principals agree to rely on common efforts \((e_A, e_B)\) but simultaneously and independently provide contracts to the manager. The conflict of interest is that each principal affects the manager’s efforts and thus tries to use the manager to mislead the other principal. For technical purposes, we restrict attention to contracts which are differentiable almost everywhere.

**Proposition 1** Under complete information, the symmetric, differential equilibrium efforts are

\[
e^C_{A,fb} = e^C_{B,fb} = \frac{(1 + \theta)\sigma}{\rho + \delta}.
\]

When \(\delta \leq \rho\theta\), fund principals compete for effort and SBS management is over-incentivized relative to standalone management, i.e., \(e^{C,fb} \geq e^{S,fb}\). Otherwise, fund principals free ride on the rival’s contract and hence SBS management is under-incentivized.

The proof of the first part is an adaptation to Bernheim and Whinston (1986b). Here I give an intuitive proof to characterize the difference of SBS management with standalone management. First, the incentive compatibility constraint (11) is binding at any equilibrium. Otherwise, either principal A or B can obtain a higher payoff by decreasing \(w_A\) or \(w_B\).

Second, given \(w_A(e)\) and \(w_B(e)\), the manager chooses \(e\) to maximize his utility as

\[
\max_e w_A(e) + w_B(e) - C(e),
\]
which yields the first-order conditions as

\[
\frac{\partial w_A}{\partial e_A} + \frac{\partial w_B}{\partial e_A} - \rho e_A - \delta e_B = 0, \tag{13}
\]
\[
\frac{\partial w_A}{\partial e_B} + \frac{\partial w_B}{\partial e_B} - \rho e_B - \delta e_A = 0. \tag{14}
\]

Third, for any given compensation \(w_B\) chosen by fund B, fund A chooses \(w_A\) so that the participation constraint binds and induces the manager to choose the effort level that maximizes her expected payoff. This amounts to choosing an output \((e_A, e_B)\) which maximizes the bilateral payoff of the coalition he forms with the manager:

\[
\max_{w_A} \quad E_{e_A}[r_A] - w_A(e_A, e_B) \\
\text{s.t.} \quad w_A(e_A, e_B) + w_B(e_A, e_B) - C(e) \geq 0,
\]

where \(w_B(r_B)\) is taken for granted optimal with respect to fund B.

Compared with the contract in standalone management, a new term \(w_B(e_A, e_B)\) occurs in SBS management. When fund A chooses a compensation scheme, he has to consider the effect of \(w_B(e_A, e_B)\) on the manager’s effort choice. To solve this problem, fund A’s offer will make the manager choose \(e\) to maximize

\[
E_{e_A}[r_A] + w_B(e_A, e_B) - C(e).
\]

Suppose the compensation scheme \(w_B(e_A, e_B)\) is piecewise differentiable. We have the first-order conditions for fund A as

\[
\sigma + \frac{\partial w_B}{\partial e_A} - \rho e_A - \delta e_B = 0, \tag{15}
\]
\[
\theta \sigma + \frac{\partial w_B}{\partial e_B} - \rho e_B - \delta e_A = 0. \tag{16}
\]

Similarly, the problem for fund B is

\[
\max_e \quad E_{e_B}[r_B] - w_B(e_A, e_B) \\
\text{s.t.} \quad w_A(e_A, e_B) + w_B(e_A, e_B) - C(e) \geq 0,
\]
where \( w_A(e_A, e_B) \) is again taken for granted optimal with respect to fund A. The first-order conditions for fund B is

\[
\begin{align*}
\theta \sigma + \frac{\partial w_A}{\partial e_A} - \rho e_A - \delta e_B &= 0, \\
\sigma + \frac{\partial w_A}{\partial e_B} - \rho e_B - \delta e_A &= 0.
\end{align*}
\]

(17) (18)

Solving these six equations (13) - (18), we have (12).

The second part of proposition 1 shows us that how the two fund principals trade off between the positive spillover effect and the negative effort substitute. As introduced in section 2, there are two types of contractual externalities in SBS management. When \( \delta \leq \rho \theta \), principals think the substitute effect from the rival principal is relative small, so each principal increases incentives to let the manager exert more effort to her own fund relative to that in standalone management. On the other hand, when \( \delta \) is large, the substitute effect is so strong to be offset by the spillover effect. As a result, each principal reduces the incentive and just enjoys the rival’s spillover performance.

The joint expected payoff between the two principals is

\[
\Pi^{C,f_b}(A, B) = \frac{(1 + \theta)^2}{\rho + \delta} \sigma^2.
\]

(19)

Proposition 2 Under complete information, the symmetric, differential equilibrium payoffs are

\[
\left[ \frac{\Pi^{C,f_b}(A, B)}{2}, \frac{\Pi^{C,f_b}(A, B)}{2}, 0 \right].
\]

Moreover, when \( \delta \leq \rho(2\theta + \theta^2) \), SBS is beneficial. Otherwise, it is detrimental.

As discussed in Introduction, SBS may generate multiple equilibria. Proposition 2 presents the unique symmetric, differential equilibrium outcome such that the two principals equally assign the total surplus. Actually, any proportional assignment between the two principals will implement an efficient outcome. This implies the challenge in SBS management that,
while each principal can separately determine the incentives in $w_A$ and $w_B$, they need to jointly determine the compensations satisfying the manager’s participation condition.\footnote{Martimort and Stole (2003) exclusively discuss the multiplicity of equilibria in common agency with complete information and pure strategy.}

When the substitutable parameter $\delta$ is small, i.e., the manager is more talent, the equilibrium efforts are larger in SBS. The reason is that the performance spillover effect dominate the effort substitute effect. This says that SBS management may not necessarily underperform standalone management. Moreover, together with proposition 1, this proposition also implies that even the efforts in SBS management are less then that exerted in standalone management ($\rho\theta < \rho(2\theta + \theta^2)$), SBS management could be better off due to the spillover effect.

We can intuitively relate the substitute parameter $\delta$ to the manager’s ability. As a result, we have the following implications.

**Implication 1** *Fund managers with lower abilities are more likely to be confined in managing one fund; on the other hand, managers with higher ability tend to SBS management.*

This prediction is consistent with the work of Nohel, Wang and Zheng (2010), and Agarwal and Ma (2011) who document that SBS is more likely to be granted to well-performing and skilled managers. Particularly, Nohel, Wang and Zheng (2010) find that the outperformance on the mutual fund side is driven by those who began their careers as mutual fund managers, which implies that the experience or skill is a key factor for SBS delegation.

**Implication 2** *SBS management serves as an outside option for retention and promotion, which can retain high-skilled money managers.*

This is consistent with the work of Kostovetsky (2009), Nohel, Wang, and Zheng (2010), and Deuskar, Pollet, Wang and Zheng (forthcoming). Considering the compensation schemes in practice, mutual fund managers are typically paid a fixed proportion of assets under
management, say 1%, while hedge fund managers are usually paid a similar percentage of
assets under management plus a performance bonus, say 20% of the payoffs beyond the high
watermark. Theoretically, the option-like compensation of hedge funds is more likely to
attract talented fund managers. As a response, mutual funds can use SBS as retention and
promotion to retain well-performing managers. Also, SBS is not necessarily detrimental to
the first fund since the star performance of the second fund will in turn generates a spillover
performance (Yadav, 2011).

4.1.1 Private contracting

Now we consider the case where the two principals propose contracts noncooperatively and
hence each principal can only contract with the manager on effort $e_i$, i.e., $w_i = w_i(e_i)$. The
reason may be that the principal does not have the auditing rights or monitoring technologies
to observe $e_j$ exerted on the other fund. This will lead some interesting results. First, there
are multiple symmetric, differential equilibria. Second, free-riding will becomes central.
Third, the equilibrium payoff of SBS is still larger than that in standalone management.

Since each principal $A$ pays for the effort $e_A$, the indirect mechanism we consider stipu-
lates a compensation scheme based directly on the observable effort $e_A$. In this setting, the
manager picks efforts to implement and privately discloses the pair $(e_A, w_A)$ to fund $A$.

$$\max_{w_A, e_A} \sigma(e_A + \theta e_B) - w_A(e_A)$$

s.t. $w_A(e_A) + w_B(e_B) - C \geq 0$. (21)

Define the indirect utility function of fund $A$, given fund $B$’s equilibrium contract:

$$v(e_A) = \max_{\tilde{e}_B} \sigma(e_A + \theta \tilde{e}_B) + w_B(\tilde{e}_B) - C(e_A, \tilde{e}_B, \delta).$$ (22)

where $w_B(e_B)$ satisfies the first-order condition of the manager

$$\frac{\partial w_B}{\partial e_B} = C_2(e_A, e_B, \delta) = \rho e_B + \delta e_A,$$

\footnote{He and Xiong (2010) give an example that principal cannot observe the effort exerted on another market even the contract is centralized due to market segmentation.}
which characterizes the manager’s choice of \( e_B \), which implies
\[
\frac{\partial e_B}{\partial e_A} = \frac{\delta}{w''_B - \rho}.
\] (23)

The FOC with respect to fund A is
\[
\sigma \left[ 1 + \theta \frac{\partial e_B}{\partial e_A} \right] + w'_B \frac{\partial e_B}{\partial e_A} = (\rho e_A + \delta e_B) + \left[ \rho e_B + \delta e_A \right] \frac{\partial e_B}{\partial e_A},
\] (24)
i.e.,
\[
\sigma \left[ 1 + \theta \frac{\partial e_B}{\partial e_A} \right] = \rho e_A + \delta e_B.
\] (25)
Together with (23), we have
\[
\sigma \left[ 1 + \frac{\theta \delta}{w''_B - \rho} \right] = \rho e_A + \delta e_B.
\] (26)

The necessary conditions for a symmetric, differential equilibrium are that the Hessian of the symmetric problem computed at the equilibrium is semi-negative definite:
\[
w''_B - \rho \leq 0,
\] (27)
\[
(w''_B - \rho)^2 \geq \delta^2.
\] (28)

We use these two necessary local concavity conditions to derive the boundaries of the equilibrium sets.

Substituting (27) into (26) gives
\[
(\rho + \delta)e \leq \sigma,
\] (29)
i.e.,
\[
e_{NC,fb}^A = e_{NC,fb}^B \leq \frac{\sigma}{\rho + \delta}.
\]

From (28),
\[
e_{NC,fb}^A = e_{NC,fb}^B \geq \frac{1 - \theta}{\rho + \delta} \sigma.
\]
Proposition 3 \textit{Under complete information, any effort }\( e^{NC,fb} \in \left[ \frac{1-\theta}{\rho+\delta} \sigma, \frac{1}{\rho} \sigma \right] \text{ can be a symmetric, differentiable equilibrium. Moreover, in all such equilibria, the agent gets zero rent:}

\[
U(\delta) = w_A + w_B - C(e_A, e_B, \delta) = 0.
\]

The requirements for the existence of equilibrium are satisfied, and the proof is especial adaption of proposition 1 in Martimort and Stole (2003).

By using a nonlinear differential compensation, fund A restricts not only the manager’s equilibrium effort \( e_A \) but also the behavior of the manager around this equilibrium. This extra control of the manager’s behavior off-the-equilibrium path changes the degree of the fund principals’ competition. Choices offered by one principal that are not taken in equilibrium constrains the rival principal from inducing the manager to exert a different effort.

Since the SBS manager can always substitute away effort for fund A against effort for fund B, each principal will not pay at the margin as much as that in the standalone management. Instead, they free ride on the effort bought by the other principal which can generate a positive spillover performance. In equilibrium, the manager thus decreases the effort for each principal with respect to a situation where the principals would have competed. In the extreme, the maximum degree of free-riding is obtained when the efforts are perfect substitute. This responds to the equilibrium \( e^{NC,fb} = \frac{(1-\delta)\sigma}{\rho+\delta} \) when when both principals offer a flattest nonlinear compensations around the equilibrium. On the other hand, the maximal degree of competition is obtained when each principal provides the steepest contract that is independent of the rival one. In such a case, no principal can increase incentive anymore \( e^{NC,fb} = \frac{\sigma}{\rho+\delta} \). By varying the slope of the out-of-equilibrium transfer-effort pairs, any effort between the extremes can be implemented.

From proposition (3), in any equilibrium, each fund principal does not choose effort level larger than that in standalone management except \( \delta = 0 \). One may wonder if this kind of free-riding equilibra is detrimental or not. To answer this question, let us calculate the joint
payoff between the two principals
\[ \Pi_{NC,fb}(A, B) = 2\sigma(1 + \theta)e^{NC,fb} - (\rho + \delta)(e^{NC,fb})^2, \]
which is increasing over \([\frac{1}{\rho + \delta}\sigma, \frac{1}{\rho + \delta}\sigma]\). Hence,
\[ \frac{1 + 2\theta - \theta^2}{\rho + \delta} \leq \Pi_{NC,fb}(A, B) \leq \frac{1 + 2\theta}{\rho + \delta} \sigma^2. \]

**Proposition 4** Under complete information, SBS management with private contracting is better off relative to that of standalone management when \(\delta \leq \rho(2 - \theta)\).

The proof is simple since when \(\delta \leq \rho(2 - \theta)\), \(\frac{1 + 2\theta - \theta^2}{\rho + \delta} \sigma^2 \geq \frac{\sigma^2}{\rho}\), i.e., the joint payoff with SBS is larger than that in standalone management.

Some people may argue that we can use direct mechanism by restricting attention to contracts which are singletons. However, singleton contracts cannot include compensations that will not be implemented in equilibrium.

**Proposition 5** When principals are restricted to singleton contracts of the form \(\{w_i, e_i\}\), \(\frac{\sigma}{\rho + \delta}\) is the unique equilibrium of SBS with complete information.

**Proof.** The proof is similar to proposition 2 of Martimort and Stole (2003). This equilibrium corresponds to the least degree of free-riding. Assume that fund B offers the direct revelation mechanism \(\{w_B(\theta), e_B(\theta)\}\), then fund A’s problem is
\[
\begin{align*}
\max_{w_A,e_A} & \quad \sigma(e_A + \theta e_B) - w_A \\
\text{s.t.} & \quad w_A + w_B(\theta) - C(e_A, e_B, \delta) \geq 0.
\end{align*}
\]
The first-order condition yields
\[ \sigma = \rho e_A + \delta e_B. \]
In a symmetric equilibrium, we have
\[ e_A^{NC,fb} = e_B^{NC,fb} = e^{NC,fb} = \frac{\sigma}{\rho + \delta}. \]
The joint payoff for the two principals at the equilibrium is

\[ \Pi^{NC,f_b} = 2(1 + \theta)\sigma e^{NC,f_b} - C(e^{NC,f_b}, e^{NC,f_b}, \delta) = \frac{1 + 2\theta}{\rho + \delta} \sigma^2. \]

**Proposition 6** Suppose the direct mechanism is implemented, i.e., the equilibrium effort is \( e = \frac{1}{\rho + \delta} \sigma \). When \( \delta \leq 2\rho\theta \), SBS is preferred.

This may be the most counterintuitive result in this paper. Even both principals free ride on each other’s contracts by providing a flatter incentive to the manager, the expected payoff could still be better than standalone management due to the spillover effect. The reason is that principal A freely enjoys the benefit from the performance spillover but does not pay anything for effort \( e_B \) bought by principal B, and vice versa.

## 5 Incomplete Information

This section studies a more realistic situation where the manager’s type \( \delta \) is unobservable and noncontractable, but it is common knowledge that \( \delta \) follows a uniform distribution with distribution function \( F(\delta) \) and density \( f(\delta) \) over \([0, \bar{\delta}]\). In this framework, I assume that each fund principal chooses a direct compensation scheme consisting of a pair of functions specifying, for any reported type, the compensation to the manager and the effort level in the principal’s own fund. It is important to stress that the manager must send a separate report to each fund principal. Although the manager’s reports to the two principals could differ, in equilibrium they coincide with the manager’s true type (Martimort and Stole, 2009). I assume that the two principals use continuous, piecewise differentiable compensation functions.
5.1 Public contracting

I now analyze the case when the two fund principals contract on both $e_A$ and $e_B$. As in the full information case, we can write fund A’s problem as

\[
\max_{e_A, e_B, w_A} \int_0^\delta \left[ \sigma(e_A + \theta e_B) - w_A \right] f(\delta) d\delta \\
\text{s.t.} \quad w_A + w_B - C(e_A, e_B, \delta) \geq 0,
\]

\[
(e_A, e_B) \in \arg\max_{e_A, e_B} w_A + w_B - C(e_A, e_B, \delta).
\]

Define the manager’s rent when taking all contract is

\[
U(\delta) = \max_{e_A, e_B} w_A(e_A, e_B) + w_B(e_A, e_B) - C(e_A, e_B, \delta),
\]

where $U(0) = 0$. With envelop theory, we have

\[
\dot{U}(\delta) = -C_\delta(e_A, e_B, \delta) = -e_A e_B \leq 0.
\]

As in centralized contracting, we can rewrite fund A’s objective function (32) as

\[
\Pi^{C,sh}(A) = \int_0^\delta [\sigma_A(e_A + \theta e_B) - w_A] f(\delta) d\delta
\]

\[
= \int_0^\delta \left[ \sigma_A(e_A + \theta e_B) + w_B - C(e_A, e_B, \delta) - \frac{F(\delta)}{f(\delta)} e_A e_B \right] f(\delta) d\delta.
\]

Define

\[
\delta_C = \delta + 2 \frac{F(\delta)}{f(\delta)} = 3\delta.
\]

With mild assumption that ensures the existence of optimal effort, the FOC for fund A is

\[
\sigma + \frac{\partial w_B}{\partial e_A} - \rho e_A - \delta_C e_B = 0,
\]

\[
\theta \sigma + \frac{\partial w_B}{\partial e_B} - \rho e_B - \delta_C e_A = 0.
\]

Similarly, the FOC for fund B is

\[
\theta \sigma + \frac{\partial w_A}{\partial e_A} - \rho e_A - \delta_C e_B = 0,
\]

\[
\sigma + \frac{\partial w_A}{\partial e_B} - \rho e_B - \delta_C e_A = 0.
\]
and the FOC for the manager is
\[
\frac{\partial w_A}{\partial e_A} + \frac{\partial w_B}{\partial e_A} - \rho e_A - \delta e_B = 0, \tag{40}
\]
\[
\frac{\partial w_A}{\partial e_B} + \frac{\partial w_B}{\partial e_B} - \rho e_B - \delta e_A = 0. \tag{41}
\]

**Proposition 7** Under incomplete information and public contracting, the symmetric, differential equilibrium efforts are given by
\[
e^{C, s_b}_A = e^{C, s_b}_B = \frac{1 + \theta}{\rho + \delta C} \sigma = \frac{1 + \theta}{\rho + 3\delta} \sigma, \tag{42}
\]
When \(\delta \leq \frac{1}{3} \rho \theta\), the SBS manager is over incentivized relative to the standalone manager. Otherwise, he is under incentivized.

Comparing with the equilibrium effort under complete information, each principal reduces the manager’s efforts under incomplete information to better extract his rent. The reason is that each principal affords the full cost of information disclosure but only enjoys a part of its benefit.

Now we can compute the rent of the SBS manager with type \(\delta\) as
\[
U(\delta) = -\int_0^\delta e_A e_B d\delta = \frac{(\bar{\delta} - \delta)(1 + \theta)^2}{(\rho + 3\delta)(\rho + 6\delta)} \sigma^2, \tag{43}
\]}
and the joint expected payoff of the two fund principals as
\[
\Pi_{C, s_b}^{s_b}(A, B) = \int_0^\delta \left[ \sigma_A(e_A + \theta e_B) + \sigma_B(e_B + \theta e_A) - C(e_A, e_B, \delta) - U(\delta) \right] f(\delta) d\delta
\]
\[
= \sigma^2(1 + \theta)^2 \left\{ \left[ \frac{5}{9\delta} \log(\rho + 3\bar{\delta}) - \log(\rho) \right] - \frac{2}{3(\rho + 3\delta)} - \frac{\log(\rho + 3\delta) - \log(\rho)}{9\delta} + \frac{\log(\rho + 3\delta)}{3(\rho + 3\delta)} \right\}
\]
\[
= \sigma^2(1 + \theta)^2 \left\{ \left[ \frac{4}{9\delta} \log(\rho + 3\bar{\delta}) - \log(\rho) \right] - \frac{1}{3(\rho + 3\delta)} \right\}
\]
Define \(\delta_U\) to be the solution to \(\Pi_{C, s_b}^{s_b}(A, B) = \frac{\sigma^2}{\rho}\).

**Proposition 8** When \(\bar{\delta} \leq \delta_U\), SBS is beneficial.
5.2 Private contracting

Now we consider the non-cooperative case where principal A only contracts on effort $e_A$ and principal B only contracts on effort $e_B$ as in the complete information case.

Given principal B’s contract that satisfies the manager’s first-order condition,

$$ w'_B(e_B) = C_2(e_A, e_B, \delta) \quad (44) $$

Fund A’s objective function can be written as

$$ \max_{U(\delta), e_A} \int_0^\delta \left[ \sigma(e_A + \theta e_B) + w_B - C(e_A, e_B) - U(\delta) \right] f(\delta)d\delta \quad (45) $$

s.t. \quad $\dot{U}(\delta) = -e_A e_B \quad (46)$

$U(\delta) \geq 0, \quad (47)$

$\dot{e}_A(\delta) \text{ is non-increasing} \quad (48)$

Proceeding as usual, fund A’s best response satisfies

$$ \sigma_A(1 + \theta \frac{\partial e_B}{\partial e_A}) - (\rho e_A + \delta e_B) - \frac{F(\delta)}{f(\delta)} [\sigma e_B + e_A \frac{\partial e_B}{\partial e_A}] = 0. \quad (49) $$

Differentiating (44) with respect to $e_A$ gives

$$ \frac{\partial e_B}{\partial e_A} = \frac{\delta}{w''_B - \rho}. $$

Hence, the differential equilibrium equation (49) can be rewritten as

$$ \sigma_A - (\rho e_A + \delta e_B) - \frac{F(\delta)}{f(\delta)} e_B + [\theta \sigma_A - \frac{F(\delta)}{f(\delta)} e_A] \frac{\delta}{w''_B - \rho} = 0. $$

With the symmetric equilibrium, we have

$$ \sigma - (\rho + \frac{F(\delta)}{f(\delta)} e + (\theta \sigma - \frac{F(\delta)}{f(\delta)} e) \frac{\delta}{w''_B - \rho} = 0. $$

**Proposition 9** Under incomplete information, any symmetric differentiable equilibrium with SBS are such that

$$ \frac{\sigma}{\rho + 2\delta} < e_{NC,sb} < \frac{\sigma}{\rho + \delta} $$

25
over \((0, \bar{\delta})\). When \(\delta = 0\), \(e = \frac{\sigma}{\rho}\). The manager with type \(\delta\) has the information rent

\[ U(\delta) = -\int_{\delta}^{\bar{\delta}} e^2 dz \]

The proof is similar to proposition 6 of Martimort and Stole (2003).

In the following, we calculate the bounds of the joint expected payoff. If \(e = \frac{\sigma}{\rho+2\delta}\),

\[ U(\delta) = \frac{(\delta_0 - \delta)\sigma^2}{(\rho + 2\delta)(\rho + 2\delta_0)}. \]

We have

\[
\Pi^{NC, sb}(A, B) > \int_{0}^{\bar{\delta}} \left[ 2(1 + \theta)\sigma e - C(e, e, \delta) - U(\delta) \right] f(\delta)d\delta \\
= \sigma^2 \left[ \frac{(3 + 4\theta)[\log(\rho + 2\delta) - \log(\rho)]}{4\delta} \right] - \frac{1}{2(\rho + 2\delta)} - \frac{\log(\rho + 2\delta) - \log(\rho)}{4\delta} + \frac{1}{2(\rho + 2\delta)} \\
= \sigma^2 \left( 1 + 2\theta \right) \frac{\log(\rho + 2\delta) - \log(\rho)}{2\delta} 
\]

(50)

On the other hand, if \(e = \frac{\sigma}{\rho+\delta}\)

\[ U(\delta) = \frac{(\bar{\delta} - \delta)\sigma^2}{(\rho + \bar{\delta})(\rho + \delta)}. \]

Hence,

\[
\Pi^{NC, sb}(A, B) < \int_{0}^{\bar{\delta}} \left[ 2(1 + \theta)\sigma e - C(e, e, \delta) - U(\delta) \right] f(\delta)d\delta \\
= \sigma^2 \left[ \frac{(1 + 2\theta)[\log(\rho + \bar{\delta}) - \log(\rho)]}{\delta} \right] - \frac{\log(\rho + \bar{\delta}) - \log(\rho)}{\delta} + \frac{1}{\rho + \delta} \\
= \sigma^2 \left( 2\theta \right) \frac{\log(\rho + \bar{\delta}) - \log(\rho)}{\delta} + \frac{1}{\rho + \delta} 
\]

(51)

Define \(\delta^U\) to be the solution to

\[ \frac{(1 + 2\theta)[\log(\rho + 2\delta) - \log(\rho)]}{2\delta} = \frac{1}{\rho} \]

**Proposition 10** Under incomplete information, SBS with non-cooperative contracting is beneficial when \(\bar{\delta} \leq \delta^U\).
The proof is simple since both (50) and (51) are decreasing with respect to $\bar{\delta}$.

**Implication 3** *SBS is more likely to happen in fund families.*

The intuition of this implication is that the two funds from one fund family are more likely to cooperate with each other. On the other hand, to understand the basic externality across funds that leads to a private agency outcome different from the public contracting, we need to describe how a change in one compensation affects the choice of the other one. Under asymmetric information, there is a tradeoff between increasing the marginal efficiency of the effort allocation and reducing the informational rent left to the manager. If fund A distorts its compensation further downward, this makes the manager choose a higher effort to fund B. Since fund A’s compensation is distorted downward, a marginal increase of incentive in fund B is beneficial for fund B. On the other hand, under private contracting, principal A cannot observe the effort exerted on fund B, and hence she does not pay it but can enjoy the spillover effect. With this direct positive externality, each principal will free ride on the rival principal’s contract until the maximal free-riding equilibrium is achieved.

With our theoretical results, we can easily explain the conflicting, empirical evidence of SBS management. Recall that in Cici, Gibson, and Moussawi (2010), they define SBS managers to be *firms* who simultaneously manage mutual funds and hedge funds, and find that SBS mutual fund underperform unaffiliated funds. This is more likely to correspond to our private contracting case for SBS management. Regarding a firm/fund family as an SBS manager, investors invested in one fund do not even know those investors invested in another fund managed by the same firm/family. In this case, it is impossible for one principal to observe the effort exerted on the rival fund. As a result, the contracts are private, and the final fund performance may be worse due to more distortion. Instead, in Nohel, Wang and Zheng (2010), they define an SBS manager as an identified person who simultaneously manage two funds. With this definition, they find that SBS mutual funds outperform unaffiliated funds. In this case, SBS funds are more likely to belong to one fund family.
6 Future Research

So far, we have focused on the case where the SBS manager does not have any ownership in the funds he manages. With this implicit assumption, the decentralized compensation schemes distort the optimal efforts in the case of information asymmetry, especially when the two principals are competing with each other. In this section, we consider an extension for future research that may relieve the distortions of SBS.

Khorana et al. (2007) find that mutual fund performance improves by about three basis points for each basis point of managerial ownership. This motivates us to consider the case where the manager has a proportion of \( \alpha \) ownership in both funds.\(^{13}\) We only consider the case of cooperation contracting. In this case, principal A’s objective function is

\[
\max_{\epsilon} \int_{0}^{\delta} \left[ \sigma(e_{A} + \theta e_{B}) + w_{B} - C(e_{A}, e_{B}, \delta) - (1 - \alpha) \frac{F(\delta)}{f(\delta)} e_{A} e_{B} \right] f(\delta) d\delta.
\]

Define

\[
\delta_{O} = \delta + 2(1 - \alpha) \frac{F(\delta)}{f(\delta)} = (3 - 2\alpha)\delta,
\]

which implies the optimal efforts as

\[
e_{A}^{O} = e_{B}^{O} = \frac{(1 + \theta)\sigma}{\rho + \delta_{O}} = \frac{(1 + \theta)\sigma}{\rho + (3 - 2\alpha)\delta}.
\]

(52)

Obviously, ownership can reduce the effort distortion with information asymmetry, and as a result, it may then be nearly optimal relative to the case with full information.

7 Conclusion

In this paper, we present a common agency model to explore the benefits and costs of SBS when one manager is simultaneously managing multiple funds with different incentives. In

\(^{13}\)Remind that our objective here is to explore the effect of ownership on the optimal efforts and the case of different ownerships in the two funds is beyond the scope of our paper.
contrast to the traditional centralized contracting, our SBS contract is decentralized and explicitly considers the competition between the two fund principals. This explains the empirical puzzle why the SBS performance is mixing in practice.

References


Figure 1: Sequence of events