



Trading between agents for a better match [☆]

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ABSTRACT

This paper studies externalities that arise when agents can trade outcomes ex post. I show that when agents can trade outcomes ex post, principals are incentivized to contract with agents ex ante to reduce ex post transfers to outside agents with whom the principals do not directly contract. This causes principals to offer agents piece-rates that are inefficiently low and lower than the piece-rates they would offer if trading was not allowed. Although trading reduces an agent's effort and could increase the agent's outside option of rejecting a principal's ex ante contract, principals ultimately gain from allowing ex post trading because such trading results in outcomes that better match their tastes.

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1. Introduction

In some principal–agent relationships, agents can trade with other agents after they have exerted effort and thereby better match what they deliver to their principals with what their principals want. For example, a firm may hire a headhunter to find a banking executive. The headhunter, by exerting effort, may find a candidate who has good credentials and capabilities, but is still less than a perfect match for the firm. For instance, the firm may prefer a candidate with more experience in retail banking, but the candidate the headhunter finds has more experience with institutional clients. But another firm, that has engaged another headhunter, might want a candidate who specializes in serving institutional clients. If these two headhunters talk to each other, they can create a mutually beneficial arrangement: the first headhunter supplies his candidate's contact information to the second headhunter for some payment. In fact, headhunters engage in such “trading” activities. According to an article in US News,¹

“Many contingency recruiters form networks or alliances to cooperate with each other and do ‘splits’ where they share job listings with one side, taking 50 percent of the commission for getting the listing

and another side taking 50 percent for finding the successful candidate.”(US News)

Moreover, the fees that headhunters receive are contingent on the salary that the firm eventually pays the candidate:

“In almost every situation, recruiting fees are pegged as a percentage of the new hire's first year base salary.”(US News)

If one thinks of the salary as a measure of the new hire's quality (i.e., a more valuable employee is paid more), then the headhunters' fee is effectively tied to the quality of their search outcome.

The relationship between house sellers and their real estate agents displays similar features. House sellers hire agents to identify suitable buyers. The agents pay effort to identify buyers that are eager to buy, possibly because of a relocation or family expansion, but in the process the agents can also observe some elements of mismatch between the houses they are representing and the buyers' particular preferences. There are thus potential gains in supplying a buyer to another agent who represents a different house that's a better match in exchange for a fee. Eventually, agents are paid a percentage of the house's selling price, which is an indication of the buyer's value to the sellers.

Matchmaking services provide another example. According to an article in the New York Times, so-called “love hunters” in China are entrusted to search for potential wives for Chinese men by physically approaching women in public places. These love hunters are paid, in addition to a fixed fee, a bonus if their search outcome eventually becomes the man's wife. The principals, mostly wealthy men, may differ in their criteria for a good wife. One matchmaking company featured in

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¹ Fertig A., September 25 2012, “5 Myths About Working With Recruiters”, US News, On Careers.

the article hires “200 full-time love hunters and hundreds more part-time scouts” and actively builds a database of contacts of women accessible to all love hunters in the same company.²

All of these examples share certain features: (1) there is cooperation among the agents, (2) principals are aware of such cooperation and make no attempt to forbid it, and (3) agents are paid by performance. However, in other circumstances, principals actively forbid agents from cooperating. For example, a researcher at a pharmaceutical company is not allowed to go to a researcher at another pharmaceutical company and deliver a new drug idea in exchange for a payment because his employment contract typically specifies that the company, not the researcher, owns the patents to the scientific discovery, and thus prohibits such behavior.

Generally, the literature on principal–agent relationships assumes that agents serve only the principals with whom they formally contract. But as the above examples illustrate, some agents interact with other agents and thereby indirectly serve principals with whom they do not formally contract. This raises several interesting questions. First, when such *ex post* trading is allowed, what happens to agents' effort levels and the *ex ante* contracts principals offer the agents? Second, is it socially efficient to allow such trading? Finally, does such trading make principals better off?

To answer these questions, I study a simple symmetric setup of two principals and two agents with three stages of timing: first, a contracting stage where principals offer agents contracts; second, an effort stage where agents exert effort; and third, a trading stage where agents can engage in mutually beneficial trading. This simple setup is not intended to reflect any particular industry, but it does provide a model that allows for explicit solutions of equilibrium contracts and effort levels. The basic ingredients of the model are the following. Principals have heterogeneous tastes, modeled by a Hotelling line. They can offer linear contracts that make payments contingent on the observable value of the outcome the agents deliver. The agents can each create one outcome, and can exert effort to increase the vertical value of the outcome, but the horizontal match with the principals' tastes is determined by random draws. After agents exert effort and the horizontal components of the outcomes are realized, the agents can Nash-bargain (with transfers) to reach an allocation of outcomes that is mutually beneficial for the agents. An important feature of the setup is that the principals have limited contracting ability. Each principal can contract with only one agent and the contracts can be contingent on only the outcomes, not the agents' effort levels or trading activities.

When trading is allowed, agents first exert effort and then trade to create better matches. The additional trading stage affects the agents' effort. First, agents' incentive to trade is affected by their initial effort levels and their contracts with the principals. When two agents exert the same effort level, which results in the same vertical qualities of the outcomes regardless of the principals' piece-rates, trading is motivated entirely by creating a better match and is thus done most efficiently. But when two agents exert different effort levels, which results in different vertical qualities of the outcomes, an agent may not profit from sending a higher quality outcome away from the principal who pays a higher piece-rate, even if it creates a better match on the taste dimension, so trading probability is reduced from the efficient level. Second, in the effort stage, the agent whose principal offers the higher piece-rate is partially influenced by the other principal's lower piece-rate because with trading the lower piece-rate partially determines the agent's contingent payment, so the agent exerts lower effort than he would without trading. As a result, when principals offer different piece-rates, the possibility of trading draws the two agents' effort levels closer. I characterize and show the existence of the unique subgame equilibrium in efforts given any pair of piece-rates. I find that when the piece-rates are set close enough to each other, in the unique subgame equilibrium, the agents trade with positive probability, and when the piece-rates are sufficiently apart, the agents do not trade with any probability.

In a traditional moral hazard problem with risk neutral agents, when setting the piece-rates, a principal needs to consider only the motivating effect from the piece-rate. When agents can trade, the motivating effect from the principal's piece-rate weakens because the agent is partially influenced by the other principal's piece rate. The principal also cares about the outside agent's effort because, through trading, she sometimes receives the other agent's outcome. Moreover, trading introduces a new role for the piece-rate: the piece-rate influences the transfer between the agents. This is important to the principal's payoff because she can eventually extract her own agent's share of the trading surplus through the fixed part of her contract, but she cannot extract the outside agent's share of the trading surplus because she does not contract directly with the outside agent. I show that this incentivizes a principal to lower her piece-rate to lower the amount of the trading surplus that gets “leaked out” to the other agent.³ I show that the incentive to reduce leak-out causes the symmetric equilibrium piece-rate to be lower when trading is allowed compared with when trading is not allowed. Since the incentive to reduce leak-out increases with the trading surplus, and thus with the level of the taste differentiation between the principals, the symmetric equilibrium piece-rate is decreasing in the level of taste differentiation. When the taste differentiation is too big, the incentive to reduce leak-out is so strong that the principal offers a flat-fee or near-flat-fee contract, where the principal simply gives up motivating the vertical quality and just lets the agents trade to create a good horizontal match.⁴

When trading is allowed, an agent's outside option of rejecting a contract offer may become better because even when he is without a contract he may be able to profitably supply an outcome to an agent who has a contract. Whether such a trading opportunity exists for an unemployed agent depends on the piece-rate of the employed agent. I show conditions under which the agents' outside option of rejecting a contract is improved by the possibility of trading. The better outside option of rejecting a contract gets reflected in a higher fixed payment to the agents in the equilibrium contract. Despite this possibility of an improved outside option for the agents, I show that the principals would still prefer to allow the agents to trade.

I also evaluate the efficiency level of the symmetric equilibria under trading. In the no-trading benchmark, the effort and thus the vertical quality of the outcomes are efficient, but the matching of outcomes to principals is less than efficient. When trading is allowed, trading activity is efficient and tastes are perfectly matched to principals in a symmetric equilibrium, but the effort level, and thus the vertical quality, is too low due to the lower-than-efficient piece-rates. However, I show that the efficiency level is higher under trading than no-trading because the gain in the trading surplus dominates the loss from lower vertical quality.⁵

The rest of the paper is organized as follows. Section 2 discusses related literature. Section 3 presents the model. Section 4 presents the analysis of the no-trading benchmark. Section 5 analyzes the model and contrasts its results on equilibrium phenomenon, efficiency and

³ The incentive to reduce leak-out is present because each principal can only contract with one agent. In Section 6, I relax this assumption and show that when principals can contract with multiple agents, this incentive disappears.

⁴ In this parameter case, a flat-fee contract is optimal if the agents choose to trade when they are indifferent between trading and not trading. To always break this indifference in favor of the principal, the principals just need to offer an infinitely small piece-rate, i.e., a near-flat-fee contract. The principal's incentive to motivate the other agent disappears if the other agent can observe only the contract offered by the other principal. In this case, the equilibrium piece rate would be even lower.

⁵ If one ventures to interpret this model more broadly in the context of the boundary of the firm, one can think of one way to eliminate this source of inefficiency: to allow the two principal–agent pairs to merge into one firm *ex ante* so that they can contract with each other. The analysis in this paper suggests that the inefficiency caused by the inability to contract is higher when the principals have more divergent tastes as a higher probability of trading would suppress the agents' efforts more, so more divergent tastes increase this benefit of being merged together. Of course, this has to be weighed against the cost of merging. As it is often the case, divergent tastes in principals are likely to cause more costs elsewhere in a merged firm, so the final impact of more divergent tastes on the merit of a merger is ambiguous.

² Larmer B., March 9 2013, “The Price of Marriage in China”, New York Times.

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