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# Rational expectations equilibrium with transaction costs in financial markets

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### ABSTRACT

We obtain a closed-form solution to a rational expectations equilibrium model with transaction costs in the framework of Grossman and Stiglitz [1980. *American Economic Review* 70, 543–566]. Individual private information incorporated into prices is reduced due to suppressed trading activities by transaction costs. The fraction of informed traders in equilibrium increases (decreases) with transaction costs when the costs are low (high). The informativeness of prices decreases with transaction costs.

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## 1. Introduction

In rational expectations models, prices aggregate and convey information. When traders are asymmetrically informed in financial markets, the information is transmitted from informed traders to uninformed traders through prices, *i.e.* the uninformed traders can learn from prices. Transaction costs suppress traders' trading activities, hence reduce the amount of individual private information that is incorporated into prices. This will influence the information acquisition and transmission in rational expectations equilibrium.

As is remarked in Barron and Karpoff (2004), "it is difficult to incorporate transaction costs into rational expectations models." This remark is true if the transaction costs are fixed or proportional to the traded shares of risky assets. In this letter, we adopt the quadratic form of transaction costs instead, and solve the rational expectations equilibrium in closed form. More discussion about the quadratic form will be presented in Section 3.2.

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The purpose of this letter is twofold. First, we study the problem of how the equilibrium fraction of informed traders depends on transaction costs. If the transaction costs are prohibitively high, no trader is willing to trade, hence no one will be interested in acquiring information. If the transaction costs are not very high, transaction costs suppress trading activities, hence reduce individual private information incorporated into prices. This helps the informed traders to keep their relative informational advantage over the uninformed. In this situation, the traders have motives to acquire private information, resulting in a higher fraction of informed traders than that without transaction costs. Consequently, we expect that the equilibrium fraction of informed traders is not a monotonic function of transaction costs. To be specific, we find that when transaction costs are low (high), the equilibrium fraction of informed traders is an increasing (decreasing) function of transaction costs.

The second point of this letter is to study the informativeness of equilibrium prices in presence of transaction costs, which depends on three factors. The first is how much individual private information is incorporated into prices; the second is how many traders acquire information, *i.e.* the equilibrium fraction of informed traders. The third is the random supply of the risky asset provided by the noise traders. Since the behavior of the noise traders is not modeled in this letter, we assume that this random supply is not affected by transaction costs, and we will only focus on the first two factors. On one hand, when the transaction costs are high, both the fraction of informed traders and the amount of individual private information revealed through prices are low. Consequently, we find that the informativeness of equilibrium prices is low with high transaction costs. On the other hand, when the transaction costs are not very high, a larger fraction of traders acquire private information with each revealing a reduced amount of information compared to the case without transaction costs. We find that the net effect of these two factors reduces the informativeness of equilibrium prices. Thus we reach the conclusion that the informativeness of equilibrium prices is a monotone decreasing function of transaction costs.

This letter is organized as follows. In Section 2, we solve the rational expectations equilibrium with quadratic transaction costs in the framework of Grossman and Stiglitz (1980). We discuss in Section 3 and conclude in Section 4.

## 2. Rational expectations equilibrium with transaction costs

In this section, we will focus on the effect of suppressed optimal changes in stock positions due to quadratic transaction costs on information acquisition and transmission in the framework of Grossman and Stiglitz (1980). Since there are no market makers in Grossman and Stiglitz (1980), we cannot include the behavior and effect of those who receive transaction costs within this framework, and thus we take them as exogenous. Further discussion about the endogeneity of transaction costs is provided in Section 3.1.

To begin, we consider the same setup as in Grossman and Stiglitz (1980). There are two assets in the market. One is risk-free with the interest rate normalized to zero, and the other is risky, which we will simply call it stock. Its random payoff is  $\tilde{u} = \tilde{\theta} + \tilde{\epsilon}$ , where  $\tilde{\theta}$  and  $\tilde{\epsilon}$  are normal random variables with expectations  $\bar{\theta}$  and 0, and variances  $\sigma_{\tilde{\theta}}^2$  and  $\sigma_{\tilde{\epsilon}}^2$ , respectively. Moreover,  $\tilde{\theta}$  and  $\tilde{\epsilon}$  are not correlated.

There is a continuum of informed and uninformed traders in the market with a total number of 1. A fraction  $\lambda$  of the traders is informed and they are indexed by  $i \in [0, \lambda]$ . The rest  $1 - \lambda$  is uninformed indexed by  $j \in (\lambda, 1]$ . Both types of traders have the same CARA utility function  $U(z) = -\exp(-a z)$  where the constant  $a$  measures the agents' risk aversion. The informed traders can observe  $\tilde{\theta}$  directly by paying a fixed cost  $c$ , and the uninformed traders can only observe the stock price  $P_{\lambda}$  for a given value of  $\lambda$ . Both types of traders have the same initial wealth  $W_0$  composed of the same cash amount  $\bar{M}$  and the same  $\bar{X}$  shares of stock.

In addition to the above two types of traders, there are noise traders who transact for reasons not modeled in this letter. Their role is to provide a random supply  $\tilde{x}$  shares of the risky asset to the market, which is a normal variable with mean zero and variance  $\sigma_{\tilde{x}}^2$ . Moreover, the random variable  $\tilde{x}$  is independent of  $\tilde{\theta}$  and  $\tilde{\epsilon}$ . In our model with transaction costs, we assume that transaction costs have no effect on the noise traders' behavior.

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