



## Inside trading, public disclosure and imperfect competition

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### ABSTRACT

We present a multi-period trading model in the style of Kyle's (1985) inside trading model, by assuming that there are at least two insiders in the market with long-lived private information, under the requirement that each insider publicly disclose his stock trades after the fact. The influences of "public disclosure" and "competition among insiders" on the trading behaviors of insiders and the market are studied. Moreover, we give the exact speed of the revelation of the private information, and show that all information is revealed immediately and the market depth goes to infinity immediately as trading happens infinitely frequently.

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### 1. Introduction

The Sarbanes–Oxley Act, which was passed by congress on July 25, 2002, requires the insiders of a firm to report any equity transactions they conduct to the Securities and Exchange Commission (SEC) not later than two business days following the transaction. The insiders' reports are filed after the trade is completed and are publicly available immediately upon receipt by the SEC. Sarbanes–Oxley has been attacked as a costly regulatory overreaction and lots of economists are interested in what effect Sarbanes–Oxley has. For example, [John and Coates \(2007\)](#) argued that Sarbanes–Oxley should bring net long-term benefits. [Cheng, Nagar, and Rajan \(2007\)](#) and [Brochet \(2010\)](#) have studied the effect of this regulation changes on insider trading. Before the Sarbanes–Oxley Act became law, economists had debated on the effectiveness of the trade disclosure rule. [Fishman and Hagerty \(1992\)](#) analyze several aspects of the debate on insider trading regulations and show that under certain circumstances, insider trading leads to less efficient stock prices. And [Fishman and Hagerty \(1995\)](#) analyze an insider's manipulation strategy so that the trade disclosure may lead to mispricing from which the insider can increase trading profits. However, [Huddart, Hughes, and Levine \(2001\)](#) present an insider's equilibrium trading strategy in a multi-period rational expectations framework based on [Kyle \(1985\)](#), given the requirement that the insider must publicly disclose his stock trades after the fact. They find that the insider garbles the information conveyed by his trade by playing a mixed strategy in every round except the last one and such a dissimulation strategy does not improve the insider's profits. Nevertheless, the public disclosure of the insider's trades accelerates not only the price discovery process but also the trading intensity of the insider comparing with [Kyle's \(1985\)](#) model.

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In his pioneering and insightful paper, [Kyle \(1985\)](#) proposes a model pricing a risky asset in the presence of new private information, and obtains a unique linear equilibrium by assuming that the ex-ante asset value is normally distributed and the price is a linear function of the aggregated market order. The monopolistic insider, in order to maximize his conditional profit, will trade in a recursive manner in a discrete model, while in a continuous time case when the time interval goes to zero, the private information is incorporated into market price at a constant speed, and the market depth is constant over time. Based on [Kyle's \(1985\)](#) model, [Holden and Subrahmanyam \(1992\)](#) give a model in which there are more than two informed traders in the market, and find that informed traders will trade aggressively and the market depth becomes extremely large almost immediately. The only difference between the two papers is that, [Holden and Subrahmanyam \(1992\)](#) assume that at least two insiders have the same information, and [Kyle \(1985\)](#) assumes that there is only one monopoly insider in the market. The intuition lies in that, there is a trade-off of two effects between information for one agent and that for others in multiple agents decision games. Better information may improve an agent's decision, but this may also cause other agents' decisions to strategically shift, and which in turn has an impact on the original agent's decisions. So, in [Holden and Subrahmanyam's \(1992\)](#) model, each trader tries to beat the others to the market, with the result that their information is revealed almost immediately. Comparing these two papers we can get the conclusion that, the number of insiders has a big influence on the market structure.

In the actual financial markets, it is reasonable to expect that at least a few players will have access to private information and will be required to disclose the quantity they have traded at the end of each trading round. What is the trading behavior of competitive insiders under the public disclosure requirement? Is the adverse selection always lower than the monopolistic case or does it have some relation with the number of insider? This paper is to address how competitive insiders use private information to trade when the public disclosure requirement is in place and studies the interaction of “public disclosure” and “competition among insiders”. We follow the model structure in [Holden and Subrahmanyam \(1992\)](#) and provide an answer in light of [Huddart et al. \(2001\)](#).

Our starting point is a two-period discrete time model based on [Holden and Subrahmanyam \(1992\)](#), with the public disclosure requirement. In equilibrium, in order to dissimulate their information, each insider's order flow in the first period consists of an information-based component for marking profit and a random component for hiding information. In the second period, insiders do not have to worry about the effect of trade disclosure on future expected profits, thus they trade on information only. We show that the market depth of the first auction in our model is smaller than [Huddart et al.'s \(2001\)](#) when the number of insiders is less than 5, however, the opposite conclusion holds if the number of insiders is more than 5. That is to say, whether market makers set the marginal cost of the first period trades lower or higher depends on the number of insiders. If the number of insiders is big enough (bigger than 5), the adverse selection becomes small. The intuition lies in that, under the public disclosure, if the competition among insiders is not very “fierce”, the adverse selection is higher than the monopolistic case, while the adverse selection is lower when the competition among insiders is very “fierce”. Despite the dissimulation motive and the mixed strategy in the first period, all the insiders want to use the private information to get more information, resulting in greater price informativeness than that of [Huddart et al. \(2001\)](#) in the first trading period.

We further study the existence and the uniqueness of insiders' equilibrium trading strategy in a multi-period rational expected framework and give the analysis of the sequential equilibrium. In equilibrium, in order to maintain information superiority and diminish market makers' ability to draw inference from disclosure, each insider also plays a mixed strategy in every round except the last one. We show that “trade public disclosure” and “competition among insiders” leads to the accelerated price discovery and higher market depths. Furthermore, in the sequential auction equilibrium, market depths become infinite and all private information is revealed immediately when the time interval between auctions approaches zero. The speed of the revelation is faster than that of [Holden and Subrahmanyam \(1992\)](#) and [Huddart et al. \(2001\)](#), and the market becomes strong-form efficient. The intuition lies in that, when there are more than two insiders in the market, each insider tries to beat the others in the market, and also all insiders worry that market makers may share their private information from trade disclosure, with the result that their information is revealed almost immediately. Although market depth becomes infinite immediately, the initial market depth in our model is a constant, as the total number of auction goes to infinity. This is very different from that of [Holden and Subrahmanyam \(1992\)](#), where as the number of trading rounds per unit time becomes larger, the market depth in the initial period becomes larger. In [Holden and Subrahmanyam \(1992\)](#), the adverse selection is high in the earlier periods because the information content of the order flow is high, and negligible in the later periods because market makers have very little to fear from traders that have already exploited most of their informational advantage. As the number of auctions is increased, trading becomes more concentrated at earlier auctions and hence there is greater adverse selection at these auctions. But under the requirement of “public disclosure”, market makers know that there is “competition” among insiders and insiders may choose a mixed strategy to dissimulate their information, they set the adverse selection at the initial auction to the same even if the number of auctions increases.

Moreover, we give the near-continuous trading results by starting with discrete time and then taking the limit, rather than formulating the model directly in continuous time. By using a method that is different from the method used by [Holden and Subrahmanyam \(1992\)](#) and [Kyle \(1985\)](#), we get the convergence results and give the expression of the error variance of the price and the depth of the market at any positive time. We find that the speed of insiders' information incorporated into the price is a linear function of the time  $t$  when there is one insider in the market. Under no public disclosure requirement, [Kyle \(1985\)](#) gives the same information revelation speed.<sup>1</sup> This indicates that in near-continuous equilibrium the “public disclosure” has no effect on the speed of insiders' information revelation when there is one insider in the market. But the market depth is

<sup>1</sup> This result is given in Theorem 3.14.1 in [Kyle \(1985\)](#), but is not analyzed by [Huddart et al. \(2001\)](#).

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