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DUAL CAPACITY TRADING AND THE QUALITY OF THE MARKET

by Ailsa Roell

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Ailsa Roell

London School of Economics,
Houghton Street, London WC2A 2AE, United Kingdom

ABSTRACT

The paper considers a securities market where orders are channelled through professional broker-dealers such as London's market makers or the large banks operating on continental exchanges. If these dual-capacity dealers can judge the motives behind their customers' orders, they can trade profitably on own account (even if they cannot "front run", that is, trade on own account before executing a customer order). It is shown that the dealers have an incentive to satisfy roughly half their customers' orders from their own inventory if they are sure that orders are liquidity-motivated and not based on inside information. As a result of dual-capacity dealing, transaction costs for liquidity-motivated traders in the aggregate fall, though they rise for those traders who are unable to convince any dealer that they have no inside information. The liquidity of the main market worsens, though its effective liquidity for customers whose orders are partly filled from broker-dealer inventories improves.

August, 1989

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1. Introduction

This paper considers the role of dual-capacity traders in an auction market for securities. Dual-capacity traders act both as brokers who bring clients' orders to the market and as dealers who trade on their own account. Examples that come to mind are London's market makers after the Big Bang, Chicago's floor traders and the major banks in continental Europe.

The paper will not focus on the obvious conflict of interest inherent in determining a price when a dealer can execute clients' orders against his own (or an associate's) book. Most exchanges have rules safeguarding against abuses, though the recent scandals in Chicago suggest that they are far from watertight. Instead, it will be taken for granted that dealers keep to rules designed to ensure fair pricing. In London, for example, market makers may satisfy brokerage orders in-house provided that "best execution" is obtained: the price must be the best one quoted in the market. Similarly, in Italy banks who fill customer orders from their own inventory must do so at the market price reigning in the first following stock exchange batch auction in Milan.

Even so, in Italy it is commonly argued that banks are able to manipulate prices and take advantage of ordinary traders, and that this may be a principal cause of the poor liquidity of the main market. Along similar lines, in London it has been argued that British market makers with a strong customer base have an unfair advantage over their (American) rivals, and that the current Stock Exchange rule changes (which reduce the visibility of true available prices and recent trading history[1], turning back the clock on some of the changes introduced at the time of the Big Bang) exacerbate this problem.

In this paper I will attempt to model dual-capacity trading in a market where dealers are risk neutral and competitive, and orders are placed by both uninformed agents trading for liquidity purposes and traders with some measure of inside information. Dual-capacity traders' competitive

1 Market makers are now allowed to execute small orders in-house at the best quoted market price even if they themselves are not quoting that price onscreen. Also, the publication of large trades onscreen is to be delayed.

advantage rests in their ability to identify at least some of their brokerage customers as liquidity traders and use this information in taking profitable positions[2].

2. A model where dealers know their brokerage customers

The setting to be investigated in this paper is one where broker-dealers are able to identify the customer who places an order with them and judge his motives for wishing to trade. This might stem from a longstanding relationship with the customer or a detailed knowledge of his current financial needs, so that the dealer can infer with some degree of certainty that his customer's wish to buy or sell does not stem from inside information.

For simplicity, it is assumed that the dealer either knows for sure that a particular customer is an uninformed liquidity trader, or knows nothing at all about him (in practice, of course, intermediate degrees of knowledge are likely to prevail). Moreover, for now any given uninformed customer has at most one, if any, broker-dealer available who knows that he is uninformed.

Suppose that aggregate liquidity traders' demand u is a mean-zero normally distributed variable with variance σ_u^2. There are N broker-dealers, each of whom has a customer base which allows him to identify a portion of uninformed traders' demand u_i that has variance σ_i^2, for i=1, ..., N. For ease of computation it will be assumed that all dealers have an equally large customer base, so that $\sigma_i^2=\sigma^2$ for all i. Individual traders' demands are independent, so that:

$$\sigma_0^2 + \sigma_1^2 + \ldots + \sigma_N^2 = \sigma_u^2$$

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2 The paper does not consider a second potential source of profit for broker-dealers: "front running", that is, trading on own account after receiving customer orders but before executing those orders.

where the index is i=0 refers to that portion of liquidity trading demand which none of the broker-dealers can certify as such ($\sigma_0^2 = 0$ is not ruled out). Such demand might be chanelled through single capacity (agency-only) brokers; or it might be placed via broker-dealers who are ignorant of the identity and motives of the agents placing the orders.

The broker-dealers submit net demand schedules on their own account of $Z_i(u_i,p)$, $i=1, \ldots, N$.

For simplicity let there be just one informed trader whose informational advantage over all other market participants enables him to form a best estimate of the security's true value, differing from the current public-information best estimate p_0 by a mean-zero, normally distributed amount $(v-v_0)$ with variance V. He is presumed to submit a net demand schedule $x = X(v,p)$ to the market.

It is assumed that there is a large enough number of competing market makers or "uninformed speculators" who submit price-quantity schedules to ensure that in equilibrium, the market price is equal to the expected value of the security, given aggregate net demand and public information. Total market demand (y) submitted to this group of competitive single-capacity market makers comes from the three main groups of agents identified above: the insider(s), the noise traders and the noise traders' broker-dealers:

$$y = \sum_{i=0}^{N} u_i + \sum_{i=1}^{N} Z_i(u_i,p) + X(v,p).$$

Perfect competition then ensures that the market is efficient:

$$p = E[v|y].$$

<u>Proposition 1:</u> The unique linear equilibrium of the model described above is given by:

$$P(y) = v_0 + \lambda y$$

$$X(v,p) = \beta(v-p)$$

$$Z_i(u_i,p) = -\delta\, u_i - \gamma(p-v_0) \qquad i=1, \ldots, N$$

where δ is the unique real root (for $\sigma_0^2 \neq 0$) of:

$$(1-\delta)^3 (2N-1) \sigma^2 - (1-\delta)^2 (N-1) \sigma^2 + 2(1-\delta) \sigma_0^2 - \sigma_0^2 = 0.$$

Note that $\frac{1}{2} \leq \delta \leq 1$ and $\delta \to \frac{1}{2}$ as $N \to \infty$, holding $N\sigma^2$ fixed[3]. Given δ, the other parameters follow from:

$$\beta = \sqrt{\frac{\sigma_0^2 + N(1-\delta)^2\sigma^2}{V}}$$

$$\gamma = \frac{1-2\delta}{1-\delta} \beta$$

$$\lambda = \frac{1}{\beta} \frac{1-\delta}{1-\delta-N(1-2\delta)}$$

Proof: We look for a Nash equilibrium in trading strategies. A justification for the method used is given in Section 5 of Kyle (1989).

I. The insider chooses a net demand schedule $X(v,p)$ that maximises his expected profits, given that he knows v, the value of the security, and infers (from the market price) the noise traders' demand net of the resulting supply from broker-dealers:

$$\max_{\{x\}} (v-p)\, x$$

where $p = v_0 + \lambda(W - N\gamma(p-v_0) + x)$

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3 In a simpler model in which dual-capacity traders are presumed to submit price-inelastic net demands (i.e., $\gamma=0$), we obtain $\delta=\frac{1}{2}$, $\beta=\sqrt{\frac{\sigma_0^2 + \frac{1}{4}N\sigma^2}{V}}$, and $\lambda=\frac{1}{\beta}$. Because dual-capacity traders are professional speculators who play a central role in the market, it seems more reasonable to model them adjusting their demand to market conditions, i.e., setting price-quantity schedules.

$$W \equiv \tilde{u} - \delta \sum_{i=1}^{N} \tilde{u}_i .$$

Substituting in for p and taking the first order condition:

$$x = \frac{1+\lambda N\gamma}{2\lambda} (v-v_0) - \tfrac{1}{2}W$$

$$x = \frac{1+\lambda N\gamma}{\lambda} (v-p)$$

$$\beta = \frac{1+\lambda N\gamma}{\lambda} \qquad (1)$$

II. Broker-dealer i maximises expected profits, given u_i and the market price (from which he infers $K \equiv \tilde{u}_0 + \sum_{j\neq i} (1-\delta)\tilde{u}_j + \beta(\tilde{v}-v_0))$:

$$\max_{\{z_i\}} \quad E[(v-p)z_i]$$

$$\text{where } p = v_0 + \lambda(u_i + K - \beta(p-v_0) - \sum_{j\neq i} \gamma(p-v_0) + z_i)$$

Substituting in for p, taking the first order condition, and rewriting in terms of p:

$$z_i = \frac{1+\lambda\beta+\lambda(N-1)\gamma}{\lambda} (E[v-v_0) - (p-v_0))$$

But $E[v-v_0 | \tilde{u}_0 + \sum_{j\neq i} (1-\delta)\tilde{u}_j + \beta(\tilde{v}-v_0) = K]$

$$= \frac{\beta V}{\beta^2 V+\sigma_0^2+(N-1)(1-\delta)^2\sigma^2} K$$

$$= \frac{\beta V}{\beta^2 V+\sigma_0^2+(N-1)(1-\delta)^2\sigma^2} \left[\frac{1+\lambda\beta+(N-1)\gamma}{\lambda} (p-v_0)-u_i-z_i\right]$$

Hence

$$\left[1 + \frac{\beta V}{\beta^2 V+\sigma_0^2+(N-1)(1-\delta)^2\sigma^2} \frac{1+\lambda\beta+(N-1)\gamma}{\lambda}\right] z_i$$

$$= \frac{1+\lambda\beta+\lambda(N-1)\gamma}{\lambda}\left[\left[\frac{\beta V}{\beta^2 V+\sigma_0^2+(N-1)(1-\delta)^2\sigma^2}\,\frac{1+\lambda\beta+(N-1)\gamma}{\lambda}-1\right](p-v_0)\right.$$

$$\left. - \left[\frac{\beta V}{\beta^2 V+\sigma_0^2+(N-1)(1-\delta)^2\sigma^2}\right]u_i\right]$$

$$\gamma = \frac{1+\lambda\beta+\lambda(N-1)\gamma}{\lambda}\left[\frac{1-\dfrac{1+\lambda\beta+\lambda(N-1)\gamma}{\lambda}\,\dfrac{\beta V}{\beta^2 V+\sigma_0^2+(N-1)(1-\delta)^2\sigma^2}}{1+\dfrac{1+\lambda\beta+\lambda(N-1)\gamma}{\lambda}\,\dfrac{\beta V}{\beta^2 V+\sigma_0^2+(N-1)(1-\delta)^2\sigma^2}}\right] \tag{2}$$

$$\delta = \frac{\dfrac{1+\lambda\beta+\lambda(N-1)\gamma}{\lambda}\,\dfrac{\beta V}{\beta^2 V+\sigma_0^2+(N-1)(1-\delta)^2\sigma^2}}{1+\dfrac{1+\lambda\beta+\lambda(N-1)\gamma}{\lambda}\,\dfrac{\beta V}{\beta^2 V+\sigma_0^2+(N-1)(1-\delta)^2\sigma^2}} \tag{3}$$

III. Semi-strong market efficiency. A competitive group of market makers or speculators ensures that:

$$p = E[v|y]$$

$$= E\{v|y = \tilde{u} + \beta(\tilde{v}-p) - N\gamma(p-v_0) - \sum_{i=1}^{N}\delta u_i]$$

$$p-v_0 = \frac{\beta V}{\beta^2 V+\sigma_0^2+N(1-\delta)^2\sigma^2}\,(y+(\beta+N\gamma)(p-v_0))$$

$$p = v_0 + \frac{\beta V}{\sigma_0^2+N(1-\delta)^2\sigma^2-\beta VN\gamma}\,y$$

$$\lambda = \frac{\beta V}{\sigma_0^2 + N(1-\delta)^2\sigma^2 - \beta V N\gamma} \tag{4}$$

Inserting (4) into (1), we have

$$\beta = \frac{\sigma_0^2 + N(1-\delta)^2\sigma^2 - \beta V N\gamma}{\beta V} + N\gamma$$

$$\beta^2 V = \sigma_0^2 + N(1-\delta)^2\sigma^2 \tag{5}$$

using (1) and (3) in (2):

$$\gamma = (2\beta-\gamma)(1-2\delta).$$

Hence $\gamma = \beta \frac{1-2\delta}{1-\delta}$ (6)

and from (3), using (5):

$$1-\delta = \frac{1}{1+(2\beta-\gamma)\dfrac{\beta V}{2\sigma_0^2+(2N-1)(1-\delta)^2\sigma^2}}$$

Using (6) and (5) to eliminate γ and β in this equation, the cubic expression for δ is obtained.

It is readily verified that the cubic equation's real roots must lie in the interval [½,1]. Inside that interval, the slope with respect to $(1-\delta)$:

$$3(1-\delta)^2(2N-1)\sigma^2-2(1-\delta)(N-1)\sigma^2+2\sigma_0^2$$

must be positive whenever the cubic expression equals zero, since in that event $(1-\delta)^3(2N-1)\sigma^2-(1-\delta)^2(N-1)\sigma^2>0$ (given that $2(1-\delta)\sigma_0^2-\sigma_0^2<0$). Hence, there is only one real root when $\sigma_0\neq 0$. ∎

At this point it seems appropriate to make some comments justifying our assumptions concerning the nature of the information exploited by the dual-capacity dealers.

Why need we assume that dealers know something about the identity of the traders who place the order flow? In our static model, where front running by dealers is excluded, the order flow to each dealer will not in itself convey any useful information over and above the aggregate order flow. If dealers 1...N were to receive independent anonymous components of the uninformed order flow with standard deviations $s_1 \ldots s_N$ respectively, then an insider would optimally divide up his total market order among the dealers in proportion to these standard deviations. Individual dealers' order flow would then convey no information on the insider's total trade that is not expressed in the aggregate order flow, and hence in the competitive market price. Thus dual-capacity dealers would not be able to trade profitably.

Why not have the dual-capacity dealers identify insider orders rather than liquidity trading orders, and thus deduce some exclusive information about security value from their order flow?[4] If able to identify an insider order, the dealer would have an incentive to take a similar trading stance. This competition would spoil the market for the insider. Hence insiders have every incentive to hide behind anonymous intermediaries and/or to place orders directly via single capacity (agency only) brokers. In contrast, identifiable liquidity traders benefit from their dealer's trading from own inventory.

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4 In Cripps' (1989) model, the order flow to a particular dealer conveys information about the security's value that is not contained in the aggregate market quantity. However, in that model the dealer uses the insider's naive one-shot trade to devise an optimal trading strategy that trickles the information slowly into the market over time and maximises the expected profit obtained from the information. Thus the dealer would be able to more than compensate the insider for any losses incurred if he competes with the insider's trade in the first period.

3. Comparison of market equilibrium with and without dual capacity dealing

Let us compare the results obtained in Proposition 1 with the situation in which dual-capacity trading is banned. In that case, our model coincides with a limiting case discussed in Section 8 of Kyle (1989). Setting $\delta=\gamma=0$ in equations (1) and (4) of the proof, we readily obtain:

$$\beta^* = \sqrt{\frac{\sigma_0^2+N\sigma^2}{V}}$$

$$\lambda^* = \frac{1}{\beta^*} = \sqrt{\frac{V}{\sigma_0^2+N\sigma^2}}$$

Thus in the absence of dual-capacity trading, the insider trades somewhat more vigorously (β is greater) in response to his information.

The presence of dual-capacity trading does harm the liquidity of the main market. Intuitively, dual-capacity traders offset a proportion $\delta\approx\frac{1}{2}$ of their liquidity customers' demand by supplying from their own inventory. This means that total liquidity trading on the main market is sparser. Then any order placed directly on the main market will have a greater impact on prices.

To see this, the price impact of an order from an anonymous liquidity trader (who does not have a relationship of trust with any broker-dealer) can be calculated. Solving the equilibrium conditions for the price in terms of exogenous variables, and using equation (1):

$$p-v_0 = \lambda(u_0 + \sum_{i=1}^{N} (1-\delta)u_i + \beta(v-p)-N\gamma(p-v_0))$$

$$p-v_0 = \frac{\lambda}{1+\lambda(\beta+N\gamma)} (u_0 + \sum_{i=1}^{N} (1-\delta)u_i + \beta(v-v_0))$$

$$= \frac{1}{2\beta} (u_0 + \sum_{i=1}^{N} (1-\delta)u_i) + \tfrac{1}{2}(v-v_0) \qquad (7)$$

i.e. $\frac{dp}{du_0} = \frac{\lambda}{1+\lambda(\beta+N\gamma)} = \frac{1}{2\beta}$

Similarly, in a market without dual-capacity trading

$$\frac{dp^*}{du} = \frac{1}{2\beta^*}.$$

Since $\beta^* \geq \beta$, $\frac{dp}{du_0} \geq \frac{dp^*}{du}$. Thus an order from a customer who cannot convince a dealer that he is uninformed moves the market price more than it would in the absence of dual-capacity trading. However, liquidity traders who are able to convince a broker-dealer that they have no information are better off. Their orders do not exert as much price pressure because the broker-dealer will satisfy roughly one half of their order from his own inventory:

$$\frac{dp}{du_i} = \frac{1}{2\beta} (1-\delta)$$

$$= \tfrac{1}{2} \sqrt{\frac{V}{(\sigma_0^2/(1-\delta)^2)+N\sigma^2}}$$

$$< \tfrac{1}{2} \sqrt{\frac{V}{\sigma_0^2+N\sigma^2}}$$

$$= \frac{dp^*}{du}.$$

Thus these agents trade on better terms than they would in the absence of dual-capacity trading.

Are aggregate transaction costs for all liquidity traders reduced by the presence of dual-capacity trading? To see that this is indeed the case, the ex ante (before observing v or u_i) expected profits of the insider and the dual-capacity traders taken together need to be calculated. These are equal to the average transaction costs borne by the liquidity traders as a group.

Insider profit $= (v-p)x$

$$= \beta(v-p)^2$$

$$= \beta[\tfrac{1}{2}(v-v_0) - \frac{1}{2\beta}(u_0 + \sum_{i=1}^{N}(1-\delta)u_i)]^2$$

using equation (7).

Ex ante expected insider profit

$$= \tfrac{1}{4}\beta\ (V + \frac{1}{\beta^2}(\sigma_0^2 + N(1-\delta)^2\sigma^2))$$

$$= \tfrac{1}{2}\beta V$$

using equation (5).

Broker-dealers' total profit

$$= (v-p)\ (\sum_{i=1}^{N} z_i)$$

$$= [\tfrac{1}{2}(v-v_0) - \frac{1}{2\beta}(u_0 + \sum_{i=1}^{N}(1-\delta)u_i)][-\delta\sum_{i=1}^{N}u_i - N\gamma(\tfrac{1}{2}(v-v_0)$$

$$+ \frac{1}{2\beta}(u_0 + \sum_{i=1}^{N}(1-\delta)u_i))]$$

$$= \tfrac{1}{2}[(v-v_0) - \frac{1}{\beta}(u_0 + \sum_{i=1}^{N}(1-\delta)u_i)]\ [-\tfrac{1}{2}N\gamma(v-v_0) - \frac{N\gamma}{2\beta}u_0$$

$$- (\delta + (1-\delta)\frac{N\gamma}{2\beta}\sum_{i=1}^{N}u_i]$$

Ex ante expected broker-dealers' profit

$$= \frac{N\gamma}{4}(-V + \frac{\sigma_0^2 + (1-\delta)^2 N\sigma^2}{\beta^2}) + \frac{1}{2\beta}(1-\delta)\delta\, N\sigma^2$$

$$= \frac{(1-\delta)\delta}{2\beta} N\sigma^2$$

Adding up, total expected profits of insider and broker-dealers

$$= \frac{1}{2\beta}(\sigma_0^2 + (1-\delta)N\sigma^2).$$

This expression measures the total transaction cost to liquidity traders. to see that it is smaller than it would be in the absence of dual capacity, observe that:

$$\frac{\text{Transaction cost with dual capacity}}{\text{Transaction cost without dual capacity}}$$

$$= \frac{\frac{1}{2\beta}(\sigma_o^2 + (1-\delta)N\sigma^2)}{\frac{1}{2\beta^*}(\sigma_0^2 + N\sigma^2)}$$

$$= \sqrt{\frac{(\sigma_0^2 + (1-\delta)N\sigma^2)^2}{(\sigma_0^2 + N(1-\delta)^2\sigma^2)(\sigma_0^2 + N\sigma^2)}} < 1 \text{ if } \delta \neq 0.$$

Thus the profits of the dual-capacity traders are more than offset by the reduction in insider profits. The overall quality of the market improves because more is known about the liquidity traders, reducing the order flow "noise" behind which the insider hides his trades.

Observe, however, that the reduction in insider profits means that there is less of an incentive to gather information. This may reduce the informational efficiency of the market. Our model is not complete enough to address the question of whether the current situation provides over- or underinvestment in information gathering. Indeed, it also fails to consider the distortionary effect of high transaction costs: liquidity traders' demand is taken to be exogenous and price-inelastic.

Note that throughout this discussion it has been assumed that either noise traders do not behave strategically or, equivalently, broker-dealers can observe the total net demand of any noise trader identified as such. For if not, even a noise trader with an inelastic net demand for the security can place an order for a large multiple of his true demand with his broker-dealer, and reverse the excessive demand with a direct order on the open market. This strategy yields a better execution price, at the expense of the broker-dealer who supplied half the order from his own account. Under these circumstances broker-dealers would not wish to trade on own account, and the equilibrium would be that of the standard model where all orders are placed anonymously.

4. The role of competition among dual-capacity dealers

In the model analysed so far, it has been assumed that each liquidity trader can find only one, if any, broker-dealer whom he can convince that he is uninformed. Can the dealer exploit his monopoly power with regard to this information, by raising his commission fee to negate all or part of his client's gain from the improved execution price resulting from the dealer's offsetting trade from own inventory? Probably not. All the client has to do is make known to this particular dealer how much he intends to trade. If the dealer attempts to extract a noncompetitive commission fee from him, the client is free to take his order to any other broker or broker-dealer. As long as the spurned dealer knows the potential client's planned order, he will still have an incentive to exploit this information by offsetting roughly half the order through his own proprietary trading, just as if the order were placed through him. In any case, commission fees are fixed in several of the European continental exchanges, so that there broker-dealers cannot exploit informational power by raising commission fees anyway.

What happens when more than one broker-dealer knows that a particular segment of the order flow is pure liquidity trading? We consider one such setting in which there are N segments of such liquidity demand, about each of which K different dual-capacity traders are informed. For simplicity it is assumed that each dual-capacity trader has only one piece of such information[5], so that there are in total NK dual-capacity traders with some information.

<u>Proposition 2:</u> The unique linear equilibrium of the model described above is given by:

$$P(y) = v_0 + \lambda y$$

$$X(v,p) = \beta(v-p)$$

$$Z_i(u_i,p) = -\delta u_i - \gamma(p-v_0) \qquad i=1, \ldots, KN$$

where δ is the unique real root of:

$$((K+1)N-1)(1-K\delta)^3\sigma^2-(N-1)(1-K\delta)^2\sigma^2 + (K+1)(1-K\delta)\sigma_0^2-\sigma_0^2 = 0$$

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5 In a model with price inelastic dual-capacity trader demands this assumption would have no effect on the outcome.

Note that $\frac{1}{1+K} \le \delta \le 1$ and $\delta \downarrow \frac{1}{1+K}$ for large N [6].

The other parameters are:

$$\beta = \sqrt{\frac{\sigma_0^2 + N(1-K\delta)^2\sigma^2}{V}}$$

$$\gamma = \beta\left(\frac{1-(K+1)\delta}{1-K\delta}\right)$$

$$\lambda = \frac{1}{\beta}\,\frac{1-K\delta}{1-K\delta-KN(1-(K+1)\delta)}$$

<u>Proof:</u> Not shown. Exactly analogous to the method used in proving Proposition 1. ∎

Observe that as K increases $(1-K\delta) \approx \frac{1}{K+1}$ decreases. As the number of competing dealers who know that a particular trade is liquidity-motivated increases, the proportion not supplied directly from dealers' inventory decreases. Liquidity traders have an incentive to convince as many dealers as possible that the order that they plan to place is not motivated by inside information. "Sunshine trading", in which agents publicly announce in advance their intention to make a large deal, is an example. In practice

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6 It can be shown that with price-inelastic dual-capacity trader demands, $\delta = \frac{1}{1+K}$ as in the linear Cournot-Nash model. Then any uninformed trader identified as such by K dealers will see a proportion $\frac{K}{K+1}$ of his order satisfied from dealers' inventories, with only a proportion $\frac{1}{K+1}$ going to the main market. Hence,

$$\beta = \sqrt{\frac{\sigma_0^2 + \left(\frac{1}{K+1}\right)^2\sigma^2}{V_0}}, \quad \lambda = \frac{1}{\beta}.$$

such announcements often fail to achieve the desired effect for two reasons. Firstly, market professionals may not believe that the proposed deal is not information-generated. Secondly, such an announcement may not be credible for reasons discussed at the end of Section 3: traders have an incentive to announce a very large intended trade, and then place a smaller actual order. Dealers who trade based on the announcement then make losses.

In the limit, as $K \to \infty$, a situation is achieved where only the anonymous component of order flows determines market liquidity:

$$\beta \to \sqrt{\frac{\sigma_0^2}{V}}$$

$$\lambda \to \frac{1}{\beta}$$

$$(1-\delta K) \to 0.$$

Here main market liquidity is minimal, but certified liquidity traders exert no pressure on prices and thus trade at near-zero transaction cost. Broker-dealers are too competitive to make profits, and insider profits are minimal. Thus aggregate transaction costs to liquidity traders as a group are minimized; however, they are borne entirely by those liquidity traders who are unable to convince the market professionals that they are uninformed.

In theory, much the same effect may be achieved indirectly if dual-capacity firms are forced to announce their price-quantity schedules publicly during the auction market tatonnement. The outcomes described in Propositions 1 and 2 would then no longer be an equilibrium because the schedules $Z_i(u_i, p)$ reveal $\{u_1, \ldots, u_N\}$ publicly to all other market participants, who adjust their behaviour accordingly. Instead, the limiting outcome described above would be an equilibrium.

With dual-capacity firms forced to reveal their price-quantity schedules for proprietary trading, the equilibrium that fully reveals $(u_1 + \dots + u_N)$ could emerge:

$$P(y) = v_0 + \lambda(y - \sum_{i=1}^{N} u_i)$$

$$X(v,p) = \beta(v-p)$$

$$Z_i(u_i,p) = 0 \qquad i=1, \dots, N$$

where $\beta = \sqrt{\frac{\sigma_0^2}{V}}$

$$\lambda = \sqrt{\frac{V}{\sigma_0^2}}.$$

This equilibrium minimises total transaction costs for liquidity traders[7].

London's market makers are an example of a group of dual-capacity dealers who are to some degree forced to publicize their trading strategy in the form of bid and ask quotes. However, these quotes are not fully

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7 In this equilibrium the agents who have private information (the dual-capacity dealers) have no incentive to trade and thus express their information (the u_i) in the final equilibrium; see Hellwig (1980) for a discussion of this problem in the context of a competitive rational expectations equilibrium. Presumably the information is conveyed during the preceding tatonnement process, in which dealers have no incentive to hold back information (given that in the final equilibrium they will be held to zero trading on own account anyway) but also no incentive to reveal it.

informative because they are only firm for small trades. Moreover, now dual-capacity firms are allowed to satisfy small orders from own inventory at will at the best price quoted in the market even if they themselves are not quoting that price. Hence there is now even more scope for adopting a proprietary trading policy that is not visible to other market participants via the bid-ask quotes. This should thus lead to higher transaction costs for liquidity traders in the aggregate even if the firm's own customers benefit.

5. Policy implications

In our model dual-capacity trading reduces total transaction costs for liquidity traders. True, the liquidity for anonymous orders on the main market deteriorates. But this effect is more than offset by benefits to customers of dual-capacity firms which partly fill orders from own inventory, resulting in less price pressure and improved execution quality. A Chicago Mercantile Exchange Panel defended dual capacity trading (Wall Street Journal, April 20, 1989) on these grounds: "Dual trading is needed ... to maintain enough liquidity".

There are two potential disadvantages associated with dual-capacity trading. Firstly, it may be considered unfair that some traders' transaction costs actually rise though the total falls. Equal treatment of all potential investors is a principle on which many current rules are based[8]. Secondly, insiders' profits are reduced. This might be undesirable if the market currently provides insufficient incentives for gathering information.

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8 For example, the London and NASDAQ rule requiring market makers to quote "firm" prices for deals up to a certain size means that it is hard to take advantage of inexperienced traders. But it also means that market makers are less able to protect themselves against known insiders and must therefore charge higher average spreads.

In Section 4 it was shown that these effects are particularly strong if liquidity traders can convince multiple competing broker-dealers that they have a trade that is not information-driven in mind, or if broker-dealers are forced to make public their price-quantity schedules.

One final word of caution. Our model does not explore the full range of effects associated with dual capacity trading. In particular, our static approach precludes an analysis of "front running" whereby dual traders trade on own account in advance of customer order execution. We also do not address one of the prime practical reasons why broker-dealers in continental Europe have diverted order flow away from the main exchange: fixed brokerage commissions. When these exceed order processing costs, there is a strong incentive to cross orders in-house or fill them from own inventory. This particular motive for in-house execution should disappear once commission rates are left to be determined by competitive market forces.

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