Transaction Taxes in a Price Maker/Taker Market


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Regulators recently proposed taxing financial transactions: 

Goals of such a tax:
- Reduce price volatility
- Raise large revenue from very small tax
- Solve problem of “too much” trading?
- Encourage long-term investing
- Push harmful (?) speculators out of the market

Arguments claimed against such a tax:
- Reduces: securities’ values, market volume, and liquidity
- Distorts market (reduces market efficiency)
- Pushes trade to other venues/countries

Our goal: study costs and (some) benefits of a tax.
Results Summary

We find that a transaction tax:

- Widens optimal and effective spreads by $> 3 \times$ the tax;
- Reduces likelihood of trading (i.e. volume);
  - $\Rightarrow$ half volume @ 50 bp; double search time.
- $E(quote\ revenue) \downarrow 50\%$, gains from trade $\downarrow 60\% @ 50$ bp;
- Lowers volatility slightly if no/few market makers, tax $< 15$ bp;
- Otherwise: Increases volatility (up to $3 \times @ 50$ bp);
- Is revenue-optimal for 55–70 bp; (!)
- Deadweight loss suggests no tax is socially optimal; and,
  - Increases the effects of destabilizing speculators.

More market makers: increased spreads, much lower volatility.
Thinking on Transactions Taxes

- Tobin (1974): help economies manage FX = political goal.
- Umlauf (1993): Sweden, 1% tax; trading left, volatility ↗.

Are transaction taxes like trading fees?
- No: fees often benefit one side; taxes hurt both sides.
Traders actively choose price taking versus price making.
  If tax changes decisions, strategic action is key.

  Traders only have two reservation values, $v \pm L$
  $\Rightarrow$ either no effect or eliminates trading.

Extension allows studying endogenized market phenomena:
  Traders strategically set bid and ask values;
  Fail to trade if quotes not appealing to next trader;\(^1\)
  Differences between quoted and effective spreads;
  Realized volatility.

Offers insight into how market quality changes with tax

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\(^1\)More fine-grained than buy vs sell in Foucault (1999).
Setup

- \( v = \) asset value (constant)
- Sequence of iid traders enter market, one per period
- Traders iid; may be market maker w.p. \( \mu \) or investor.
  - Private reservation value: \( v + d_t \) where \( d_t \overset{iid}{\sim} F \).
  - Market maker: \( d_t = 0 \);
  - Investors: \( d_t \overset{iid}{\sim} (0, L^2) \).
- Market continues w.p. \( \rho \in (0, 1) \) after each period.
- Each trader taxed \( \tau / \text{share} \) at position entry+exit.
Strategic Quoting

Traders choose strategically whether or not to quote a bid and ask.

- Consider traders at time $t$ (Ilisa), $t + 1$ (Rick), $t + 2$ (Sam).
- Price maker/taker model; Rick strategically chooses:
  - Take: Trade against Ilisa’s quote, or
  - Make: Quote bid $\nu - \delta$ and ask $\nu + \beta$ for Sam.
- Rick must also determine his optimal $\delta$ and $\beta$.
- Thus Rick chooses $\max(R_T, R_Q|d_{t+1})$ where:
  - $R_T$ = benefit of taking Ilisa’s bid/ask
  - $R_Q|d_{t+1}$ = benefit of quoting optimal bid, ask for Sam
Ilsa is in the same position.

Denote prior trader’s\(^2\) quotes by \(\nu - \delta_{t-1}, \nu + \beta_{t-1}\).

\[
R_T = \max(-d_t - \delta_{t-1}, d_t - \beta_{t-1}) - 2\tau
\]
\[\tag{1}
P(\text{next trader sells at bid})
\]

\[
R_Q|d_t = \rho \left\{ F(-R_Q^{0*} - \delta - 2\tau) (d_t + \delta - 2\tau) + \\
+ \rho \left\{ F(-R_Q^{0*} - \beta - 2\tau) (\beta - d_t - 2\tau) \right\}
\right\}
\]
\[\tag{2}
P(\text{next trader buys at ask})
\]

\[
R_Q^{0*} = \int_{\Omega} R_Q|d_t \, dF
\]
\[\tag{3}
\]

But we need to know that \(R_Q^{0*}\) exists.

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\(^2\)Ugarte’s?
We characterize equilibrium by proving a few propositions.

1. Rick will only want to buy from Ilsa, sell to her, or quote.
2. If $d_t > 0$, the bid-ask quote is shifted higher ($\beta > \delta$)\(^3\)
3. Bid-ask spread $\delta + \beta > 4\tau = \text{twice trader’s tax}$.
4. For quasi-concave pdf w/support on $\mathbb{R}$: equilibrium exists.
5. For $F = \Phi$ (Gaussian cdf): unique Markov Perfect equilibrium. Coming soon: closed form results for uniform distribution.

\(^3\)And likewise for $d_t < 0$. 
Consider a market calibrated to typical characteristics:

- Value $v = $20; private reservation values $v + d_t$.
- Traders: $d_t \sim F$
- P(trading continues next period) $\rho = 0.9$
- Transaction tax $\tau$: $0–0.10$/share traded (0–50 bp).
- Investor: w.p. $1 – \mu$, $d_t \sim N(0, L^2)$
- Reserve price volatility $L = $0.5 = 2.5%\(^4\)

Some results found via simulation after solving model.

\(^4\)If daily net trades $\Rightarrow$ 40% annual volatility.
Optimal (Considered) and Quoted Bid-Ask Spread

From no tax to 50 bp tax:

- Opt. spread: 60→240 bp (no MMs), 85→240 bp (50% MMs).
- More MMs = more competition for fill: quoted spread ↑.
- Quoted spreads increase by $> 3 \times$ tax.
- Quoted spreads are about the same regardless of MMs.
Effective (Realized) Spread and Fill Rate (Volume)

From no tax to 50 bp tax:

- Eff. spread: 0→150bp (no MM), 40→200 bp (50% MM).
- More MM = more competition for fill: effective spread ↑.
- Effective spreads increase by > 3× tax.
- Fill rate: 75%→45% (no MM), 54%→27% (50% MM)
From no tax to 50 bp tax:

- Value of providing liquidity halved.
- Gains from trade decrease by about 60%.
Volatility and Dispersion of Traders’ Reserve Prices

- For taxes up to 50 bp, more MMNs → lower volatility.
- No MMNs: volatility ↓ by up to 4% at 15 bp, then increases.
  - Only (weakly) positive benefit but MMNs lower volatility more.
- 50% MMNs: volatility tripled (!) at 50 bp; most sensitive.
- Taxes chase away traders with less extreme views.
Tax Revenues and Deadweight Loss

- More MMs ⇒ lower optimal tax.
- Socially-optimal tax: 0 bp.