Transaction Taxes in a Price Maker/Taker Market

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Introduction

- 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.
- Pro: DeFazio, Merkel, Summers and Summers (1989), Stiglitz (1989), ul Haq *et al* (1996), Spahn (2002), Pollin *et al* (2003).
- Con: Friedman (1953), Campbell and Froot (1994), Kupiec (1995,1996), Habermeier and Kirilenko (2001), Forbes (2001).
- Umlauf (1993): Sweden, 1% tax; trading left, volatility $\searrow$.

Are transaction taxes like trading fees?

- No: fees often benefit one side; taxes hurt both sides.

Why Extend Foucault (1999)?

- Traders actively choose price taking versus price making.
  - If tax changes decisions, strategic action is key.
- Why extend? Taxes do not play nicely with Foucault (1999).
  - 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

[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. μ 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 τ/share at position entry+exit.

Strategic Quoting

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

- Consider traders at time t (Ilsa), $t+1$ (Rick), $t+2$ (Sam).
- Price maker/taker model; Rick strategically chooses:
  - Take: Trade against Ilsa's quote, or
  - Make: Quote bid $v-\delta$ and ask $v+\beta$ for Sam.
- Rick must also determine his optimal δ and β.
- Thus Rick chooses $\max(R_T, R_Q|d_{t+1})$ where:

$$\begin{aligned} R_T &= \text{benefit of taking Ilsa's bid/ask} \\ R_Q|d_{t+1} &= \text{benefit of quoting optimal bid, ask for Sam} \end{aligned}$$

Taking and Quoting Benefits

- Ilsa is in the same position.
- Denote prior trader's[2] quotes by $v - \delta_{t-1}$, $v + \beta_{t-1}$.

$$R_T = \max(-d_t - \delta_{t-1}, d_t - \beta_{t-1}) - 2\tau \tag{1}$$

$$\begin{aligned} R_Q | d_t = {} & \rho \overbrace{F(-R_Q^{0*} - \delta - 2\tau)}^{P(\text{next trader sells at bid})} (d_t + \delta - 2\tau) + \\ & + \rho \underbrace{F(-R_Q^{0*} - \beta - 2\tau)}_{P(\text{next trader buys at ask})} (\beta - d_t - 2\tau) \end{aligned} \tag{2}$$

$$R_Q^{0*} = \int_\Omega R_Q | d_t dF \tag{3}$$

- But we need to know that R_Q^{0*} exists.

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[2] Ugarte's?

Characterizing Propositions

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 $\delta + \beta > 4\tau =$ 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 $d_t < 0$.

Model Setup: Numerical Analysis

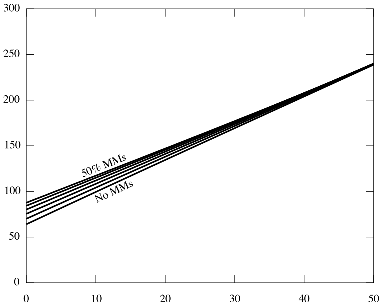
Consider a market calibrated to typical characteristics:

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

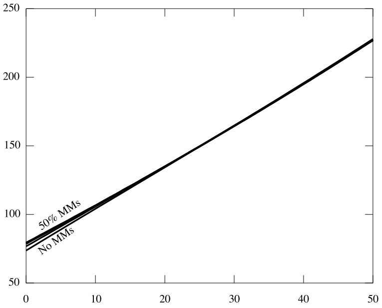
Some results found via simulation after solving model.

[4] If daily net trades $\Rightarrow$ 40% annual volatility.

Optimal (Considered) and Quoted Bid-Ask Spread



Optimal Spread (bp) vs. tax (bp)

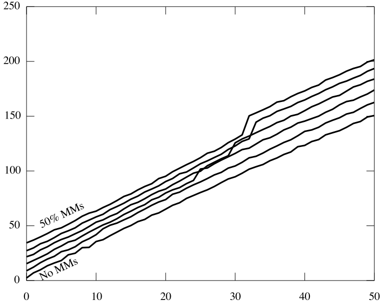


Quoted Spread (bp) vs. tax (bp)

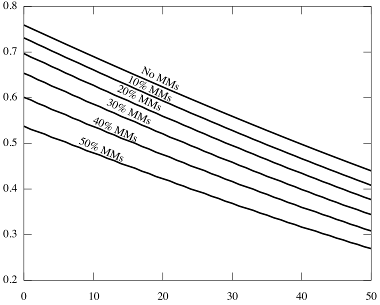
From no tax to 50 bp tax:

- 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)



Effective Spread (bp) vs. tax (bp)

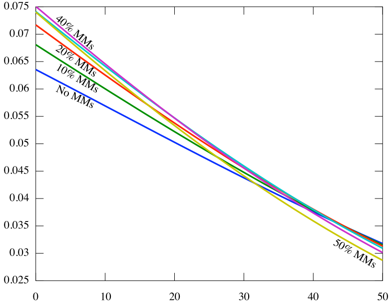


Fill Rate (Volume) vs. tax (bp)

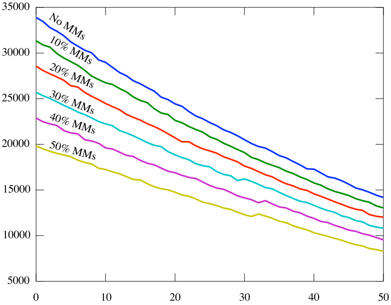
From no tax to 50 bp tax:

- Eff. spread: $0 \rightarrow 150$bp (no MMs), $40 \rightarrow 200$ bp (50% MMs).
- More MMs = more competition for fill: effective spread $\uparrow$.
- Effective spreads increase by $> 3\times$ tax.
- Fill rate: 75%$\rightarrow$45% (no MMs), 54%$\rightarrow$27% (50% MMs)

Gains from Quoting and Gains from Trade



E(Quoting Benefit) R_Q^{0*} vs. tax (bp)

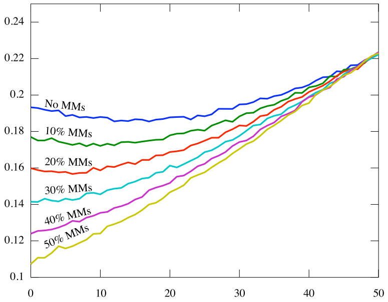


Gains from Trade vs. tax (bp)

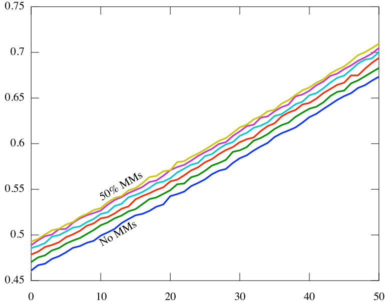
From no tax to 50 bp tax:

- Value of providing liquidity halved.
- Gains from trade decrease by about 60%.

Volatility and Dispersion of Traders' Reserve Prices



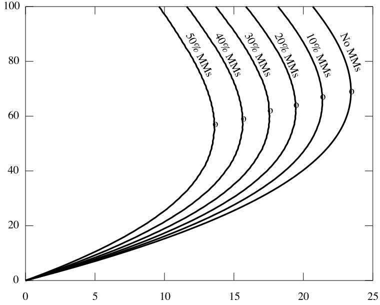
Volatility ($) vs. tax (bp)



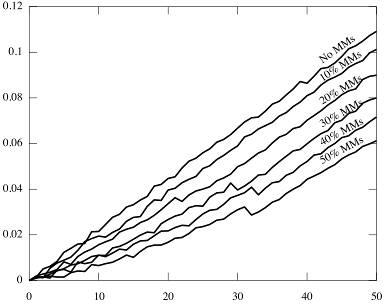
Reserve Price Dispersion (MAD) vs. tax (b

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

Tax Revenues and Deadweight Loss



Tax (bp) vs. Revenue



Deadweight Loss/Order vs Tax (bp)

- Revenue-optimal tax: 57–69 bp; revenue/order: 14–23 bp.
- More MMs $\Rightarrow$ lower optimal tax.
- Socially-optimal tax: 0 bp.