

'Those who know most'

Insider trading in 18th c. Amsterdam

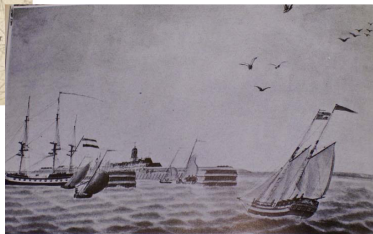
Peter Koudijs

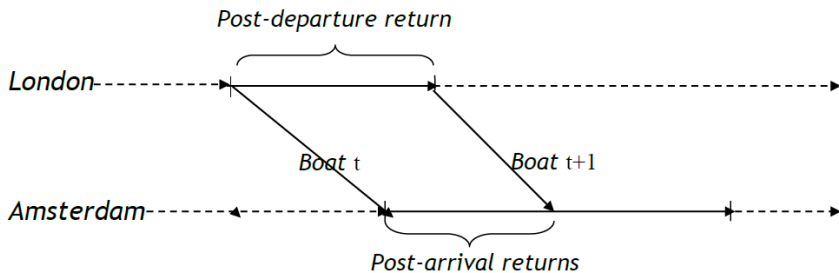
Stanford GSB

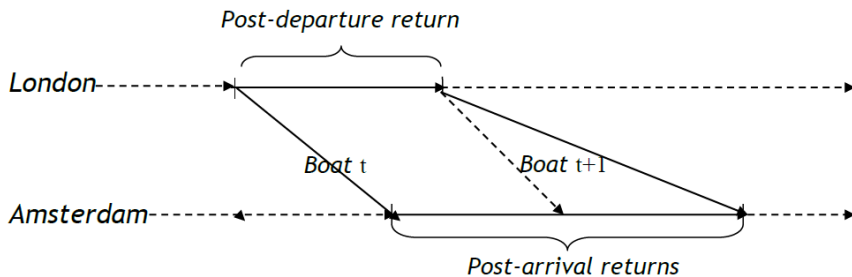
October 2013

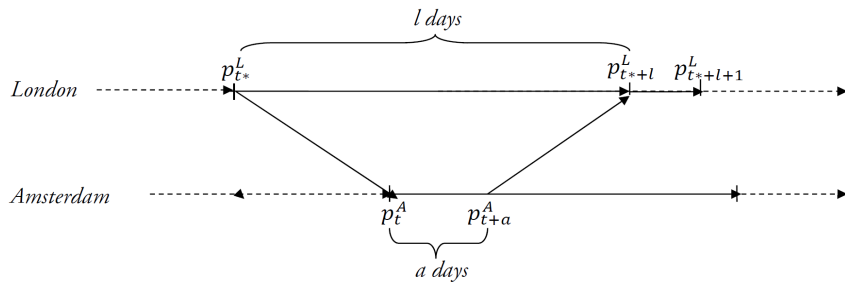
Introduction

- How is private information incorporated into prices?
 - Strategic or price taking behavior? (Kyle 1985 vs Grossman and Stiglitz 1980)
 - Speed of information revelation
- Empirical evidence difficult
 - Timing of information and actual trades...
- Natural experiment from the 18th century
 - English securities traded in London and Amsterdam
 - London insiders used both markets
 - Boats: new signal and (partial) revelation old signal
- Identification
 - Price discovery in absence of communication
 - Expected boat arrival
 - Feedback effect AMS→LND
- Evidence in favor of strategic behavior









Introduction

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Outline

- Related literature
- Historical background
- Empirical evidence
 - Baseline
 - Expected boat arrival
 - Feedback effects in London
- Robustness
 - Slipping through of news?
 - Information vs liquidity shocks
 - Delayed response to public news?

Related literature - theory

- Competitive benchmark (Grossman and Stiglitz 1980; Vives 1995)
- Strategic insiders and long lived private information (Kyle 1985)
- Speed information revelation (back to strong market efficiency):
 - Competition (Holden and Subrahmanyam 1992, 1994; Foster and Viswanathan 1996)
 - Risk aversion (Holden and Subrahmanyam 1994)
 - New signals (Chau and Vayanos 2008; Caldenteu & Stacchetti 2010)
 - **Risk revelation (Caldenteu & Stacchetti 2010)**

Related literature - empirical

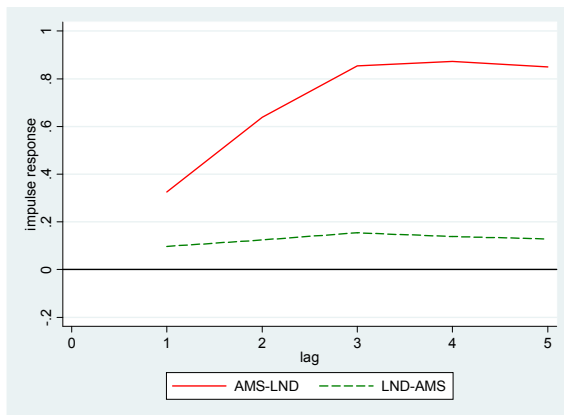
- Evidence private information:
 - Order flow imbalance
[Easley and O'Hara 1987; Hasbrouck 1991; Evans and Lyons 2006]
 - Registered insider trades
[Cohen et al. 2011]
 - Recent new approaches
[Cohen et al. 2008, 2010; Tetlock 2010; Kelly and Ljungqvist 2011]
- Evidence strategic behavior insider: revelation private information over time
 - Indirect: intradaily price and volume patterns (Madhavan et al. 1997)
 - **Direct: trading behavior institutional investors (Boulatov et al. 2011; Hendershot et al. 2012)**

Historical background

- Focus on EIC: trade with Asia, politics
 - BoE, 3% Annuities
- Mail packet boats: sailed twice a week. Public news (incl. stock prices) and private letters
- Practically only source of information
 - Newspapers
 - Private correspondence Hope & Co.
- Departures on fixed days (Wednesday and Saturday)
- Sailing times depended on weather conditions
- Median travelling time: 4 days

Origin and direction of news: VECM

Figure: VECM EIC - Impulse response (one sd Cholesky)



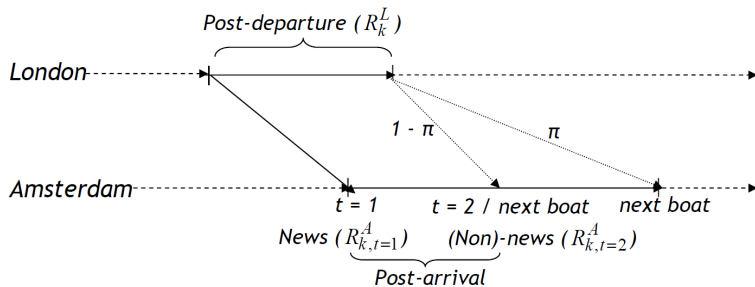
Private info in the 18th c.

- Example from archives of Hope & Co.
 - Were in business with Thomas Walpole (British MP and Banker) to speculate in EIC stock.
 - December 1772: bad news about EIC.
- Walpole to Hope & Co., Dec. 18th, 1772 (received Dec 22nd, through packet boat)
 - *'Those who know most think the stock will fall and we are of that opinion'*
 - Sell! *'to such extent as you think proper and with the usual dex[t]erity'*
 - Stop selling at the price of 154, *'at that price or higher people may begin to speculate for the rise which will undoubtedly take place when any plan shall be fixed for the relief of the company'*
 - From December 22 to January 4, fall EIC in AMS from 169.5 to 157.50.
 - Middle of January: plan. Price back to 169.5 on January 29.

Data

- Samples: Sept 1771 - Dec 1777 & Sept 1783 - March 1787
- Prices
 - Amsterdam: three prices a week in Amsterdam for all stocks: in Pounds.
 - London: daily prices (Neal 1990)
- Arrival dates of boats, dates of departures, Holland and England
- Hand collected from Dutch and English historical newspapers
- Weather data:
 - Observatory of Zwanenburg (*KNMI*)
 - 3 observations a day

Empirical evidence



- $cov(R_k^L, R_{k,t=1}^A) > 0, cov(R_k^L, R_{k,t=2}^A) > 0$
- $\frac{\delta[cov(R_k^L, R_{k,t=1}^A)]}{\delta\pi} < 0$

Co-movement - news/non-news (1)

Figure: News

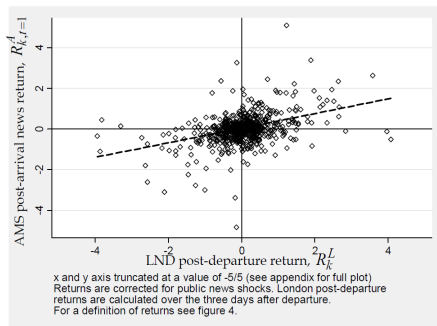
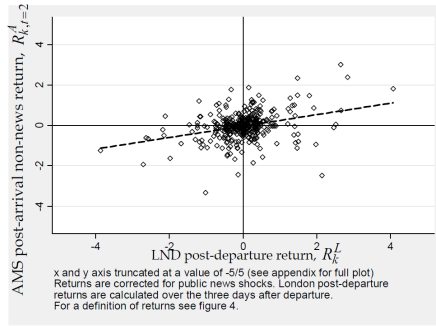


Figure: Non-news



Co-movement - news/non-news (2)

Table 1: Co-movement of returns - EIC

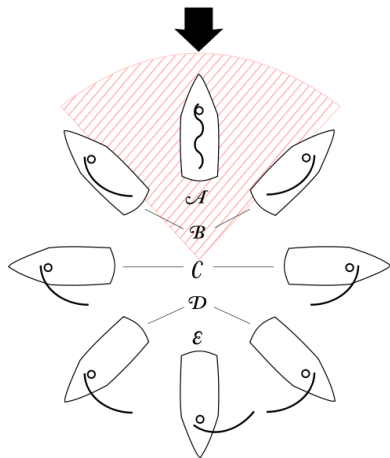
	(1) AMS post-arrival news return, $R_{k,t=1}^A$	(2) AMS post-arrival non-news return, $R_{k,t=2}^A$
LND post-departure return, R_k^L	0.338 (0.048)***	0.220 (0.062)***
Public news shock ΔN_{k-1}	0.441 (0.040)***	0.077 (0.038)**
Constant	0.005 (0.026)	-0.023 (0.030)
Obs	666	355
Adj. R2	0.36	0.10
Chi^2 test (p-value)	2.27 (0.132)	

Expected boat arrivals (1)

- Two definitions:
 1. Simple: departure next expected boat + median travelling time
 2. Extended: departure next expected boat + conditional travelling time
- Good fit: correlation predicted-actual 0.36 - 0.52
- Implementation:
 - $E[A|simple] \gtrless 3.5$
 - $E[A|extended] \gtrless 3.5$

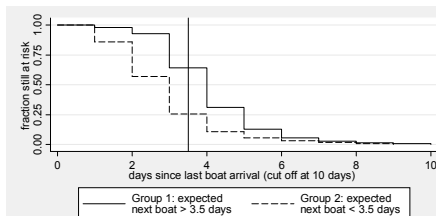
Expected boat arrivals (2)

- Conditional travelling time
- Duration model, flexible Gamma distribution, including
 - Month dummies
 - Dummies for number of daily wind observations $\{0, 1, 2, 3\}$ featuring a "no-go zone"
 - Ice dummy
 - Measured at Zwanenburg (close to Amsterdam), day of news arrival



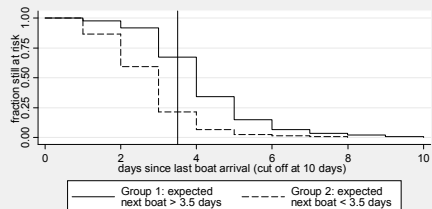
Expected boat arrivals (3)

Figure: Simple



Evaluation precision estimate of the time until next boat arrival. Expected arrival of next boat estimated by adding the median sailing time to the date a boat was scheduled to depart. The vertical black line indicates the unconditionally expected time until the next boat arrival of 3.5 days. If the empirical model has a perfect fit, we would expect all group 1 observations to be still at risk at 3.5 days, and all group 2 observations to have failed at 3.5 days.

Figure: Extended



Evaluation precision estimate of the time until next boat arrival. Expected arrival of next boat estimated using a duration model with a Gamma distribution including month dummies and a range of weather variables (see text). The vertical black line indicates the unconditionally expected arrival time until the next boat arrival of 3.5 days. If the empirical model has a perfect fit, we would expect all group 1 observations to be still at risk at 3.5 days, and all group 2 observations to have failed at 3.5 days.

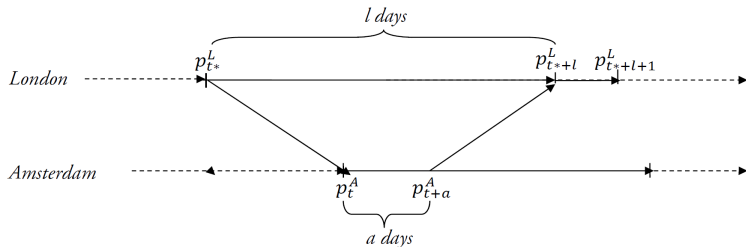
Expected boat arrivals (2)

Table 2: Co-movement EIC, different expectations next boat

	AMS post-arrival news return, $R_{k,t=1}^A$	
London post-departure return, R_k^L	0.256 (0.060)***	0.251 (0.058)***
$R_k^L \times E[A simple] < 3.5$	0.223 (0.101)**	
$E[A simple] < 3.5$	-0.054 (0.060)	
$R_k^L \times E[A extended] < 3.5$		0.277 (0.091)***
$E[A extended] < 3.5$		-0.031 (0.055)
Public news shock, ΔN_{k-1}	0.479 (0.037)***	0.473 (0.039)***
Constant	0.021 (0.036)	0.007 (0.038)
Obs	627	627
Adj. R2	0.39	0.39

Feedback effects (1)

- Price discovery in two (temporarily) segmented markets
- Assumption: noise not perfectly correlated
- If private information truly long-lived: expect feedback effects in London



Feedback effects (2)

- Equation to estimate

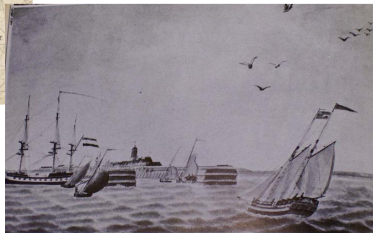
$$\begin{aligned} p_{t^*+l+1}^L - p_{t^*+l}^L &= \beta_0 + \beta_1 \left(p_{t+a}^A - p_{t^*}^L \right) + \beta_2 \left(p_{t^*+l}^L - p_{t^*}^L \right) \\ &\quad + \beta_3 \left(p_{t+a}^A - p_{t^*}^L \right) \times a + \beta_4 \left(p_{t+a}^A - p_{t^*}^L \right) \times l \\ &\quad + \gamma_1 a + \gamma_2 l \end{aligned}$$

- Hypotheses:
 - $\beta_1 > 0$ (if univariate: ~ 0)
 - $\beta_2 < 0$
 - $\beta_3 > 0$
 - $\beta_4 < 0$

Table 3: Feedback effects - EIC

	London returns between $t^* + l + 1$ and $t^* + l$ ($p_{t^*+l+1}^L - p_{t^*+l}^L$)				
	(1)	(2)	(3)	(4)	(5)
Amsterdam news returns ($p_{t+a}^A - p_{t^*}^L$)	0.066 (0.034)*	0.100 (0.039)***	0.100 (0.038)***	0.107 (0.039)***	0.111 (0.039)***
London pre-news returns ($p_{t^*+l}^L - p_{t^*}^L$)		-0.073 (0.041)*	-0.073 (0.041)*	-0.072 (0.041)*	-0.066 (0.041)*
Amsterdam period a			-0.027 (0.023)		-0.046 (0.035)
$a \times (p_{t+a}^A - p_{t^*}^L)$			0.011 (0.019)		0.067 (0.031)**
London period l				-0.004 (0.013)	0.022 (0.020)
$l \times (p_{t+a}^A - p_{t^*}^L)$				-0.013 (0.011)	-0.051 (0.019)***
<i>constant</i>	0.054 (0.037)	0.049 (0.036)	0.042 (0.037)	0.050 (0.036)	0.043 (0.038)
χ^2 test ($p_{t+a}^A - p_{t^*}^L$): (1) = (2) (p-value)		2.89 (0.089)*			
N	696	695	695	695	695
Adj. R^2	0.01	0.02	0.02	0.02	0.03

Slipping through of news? (1)



Slipping through of news? (2)

Non-news returns ($t = 2$) during bad weather

Three different definitions:

- A. Boat expected to arrive before $t = 2$ (according to schedule and median sailing time)
- B. Wind during $t = 2$ from the East (0 - 180 degrees)
- C. Wind during $t = 2$ in no-go zone (35 - 125 degrees)

Slipping through of news? (3)

Figure: Bad weather A.

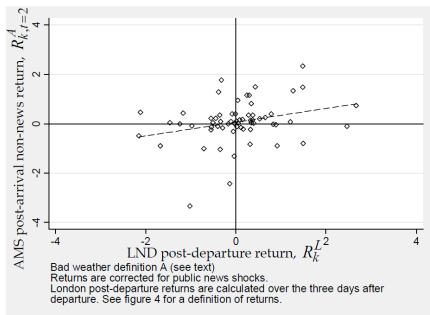


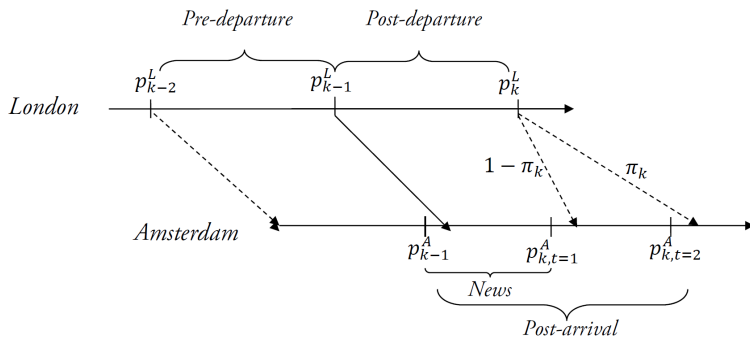
Table 4: Co-movement EIC, bad weather

	AMS post-arrival no-news return, $R_{k,t=2}^A$		
London post-departure return, R_k^L	0.258 (0.074)***	0.223 (0.089)***	0.266 (0.073)***
$R_k^L \times \text{badweather}(A)$	0.012 (0.148)		
$\text{badweather}(A)$	0.119 (0.111)		
$R_k^L \times \text{badweather}(B)$		0.115 (0.116)	
$\text{badweather}(B)$		0.067 (0.072)	
$R_k^L \times \text{badweather}(C)$			-0.020 (0.154)
$\text{badweather}(C)$			0.130 (0.094)
Difference London depart- ure and Amsterdam pre- arrival price, $P_{k-1}^L - P_{k-1}^A$	0.120 (0.067)***	0.126 (0.045)***	0.120 (0.043)***
Constant	-0.068 (0.034)	-0.067 (0.040)	-0.071 (0.037)
Obs - total	363	363	363
Obs - $\text{badweather}(A)$	65		
Obs - $\text{badweather}(B)$		117	
Obs - $\text{badweather}(C)$			67
R2	0.12	0.12	0.12

► Other two

Slow response to public news? (1)

- All estimates corrected for momentum
- Zero returns (limits to arbitrage): news simply not yet incorporated into prices (Lesmond et al. 1999)
- Interaction co-movement with past London zero returns



Slow response to public news? (2)

Table 5: Co-movement after zero returns in London, EIC

	Amsterdam post-arrival news return, $R_{k,t=1}^A$	Amsterdam post-arrival non-news return, $R_{k,t=2}^A$
London post-departure return, R_k^L	0.314 (0.055)***	0.218 (0.067)***
Zero London pre-departure return ($R_{k-1}^L = 0$)	-0.065 (0.064)	0.147 (0.074)**
× London post-departure return, R_k^L	0.183 (0.092)	0.034 (0.135)
Public news shock, ΔN_{k-1}	0.474 (0.039)***	0.050 (0.036)
Constant	0.012 (0.033)	-0.047 (0.034)
Obs - total	628	327
Obs - zero returns	108	58
Adj. R ²	0.39	0.10

Permanent price changes?

Table 6: Permanent price changes? EIC

	Amsterdam return over period T after episode k ($p_{k+T}^A - p_{k,t=1}^A$)					
	<i>2/3 days</i>	<i>4/5 days</i>	<i>1 week</i>	<i>2 weeks</i>	<i>3 weeks</i>	<i>4 weeks</i>
London return (R_{k-1}^L)	0.043 (0.043)	0.028 (0.060)	0.077 (0.060)	0.077 (0.077)	0.087 (0.104)	0.195 (0.115)*
Constant	-0.007 (0.028)	0.011 (0.038)	0.068 (0.048)	0.131 (0.067)*	0.159 (0.087)	0.214 (0.102)
N	734	733	731	726	719	717
Adj. R^2	0.00	0.00	0.00	0.00	0.00	0.00

What do we learn?

Role of private information in financial markets

- Strategic behavior
- Speed of revelation
 - Slow (markets not strong form efficient)
 - Faster when next boat expected to arrive soon (Caldentey and Stacchetti 2010)