Internet Appendix for "The Boats That Did Not Sail: Asset Price Volatility in A Natural Experiment"

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This appendix contains additional information not provided in the main text. Section I provides additional information on the construction of the dataset. Section II presents the VECM analysis of teh flow of information between London and Amsterdam. Section III discusses a number of alternative sources of information. Section IV discusses the exogeneity of information flows. Section V provides additional Figures and Tables. Finally, Section VI discusses the identification of private information with correlated signals.

I. Data

A. Conversion of Amsterdam Future into Spot Prices

While security prices for the Amsterdam market refer to future contracts, London prices are spot. To make these two price series consistent I convert Amsterdam future prices into spot prices using the cost-to-carry rate. Generally, no commercial interest rates are available for the 18^{th} century (see Flandreau et al. 2008 for an exception). Moreover, the cost-to-carry rate could be driven by counterparty risk specific to the futures market for a given security. Finally, since time to expiration could take up to three months, the yield curve also needs to be taken into account. To approximate relevant interest rates and the yield curve I run the following regression:

$$\log(p_{it}^{AMS}) = \log(p_{is}^{LND}) + r_t\tau,$$

where $\tau = \frac{T^{\text{expiration}} - d}{365}$, d is the calendar date associated with p_{it}^{AMS}, and $r_t = \beta_0 + \beta_1\tau + \beta_2\tau^2 + \beta_3\tau^3$. the price p_{is}^{LND} is the London spot price observed in Amsterdam at time t. Note that ex-dividend days in London and Amsterdam differed; security prices are adjusted accordingly. The β parameters approximate the relevant interest rate at time t. I allow the β's to differ for the two sample periods. I also allow different interest rates for each security. Average annual interest rates are in the ballpark of 3% (1771 to 1777) to 7% (1783 to 1787) and are generally upward-sloping, especially for the first sample period. Note that the regression does not contain a constant. Thus, if there are any structural differences between the Amsterdam and London prices, these are **not** filtered out in the conversion process from future to spot prices.

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*Koudijs, Peter, Internet Appendix for "The Boats That Did Not Sail: Asset Price Volatility In A Natural Experiment" *Journal of Finance* [DOI]. Please note: Wiley-Blackwell is not responsible for the content or functionality of any supporting information supplied by the author. Any queries (other than missing material) should be directed to the author of the article.

B. *Boat Arrivals*

I collect the arrival dates of packet boats in Hellevoetsluis by hand from the *Rotterdamsche Courant*. The only available collection of newspaper copies (held by the City Archives in Rotterdam) starts in 1738. The newspaper's coverage of the arrival of packet boats is incomplete and thus is only available for specific sub-periods. For these periods, the newspaper reports the day a specific boat arrived and whether it arrived before or after 12 PM. These data can be used to determine when news from England arrived in Amsterdam. It took approximately 16 hours for news from Hellevoetsluis to be transported to Amsterdam (Stitt Dibden (1965), p. 9). This means that the information brought in on a certain day was available to investors in Amsterdam the next day.[1] Note that the *Rotterdamsche Courant* not only mentions the day a specific boat arrived but also the date of the news it carried. This information can be used to reconstruct what London price information was available to Amsterdam investors at certain points in time.

The timing of news transmission can be described as follows. In London, letters, newspapers, etc. were collected by the end of the day on Tuesday or Friday (day of departure: day 1). This information was transported to Harwich in the early morning, from where a mail packet boat would set sail in the afternoon (day 2). The boat would usually arrive in Hellevoetsluis on the next day (day 3). After the news had arrived it was sent to Amsterdam, where it usually arrived the next day (day 4).

The historical evidence suggests that market participants such as Hope & Co. received all information from England through the packet boat system. Most English letters in the Hope archive mention both the date a letter was written in London and the date it was received and opened in Amsterdam. There are 112 letters available that Hope received from London. Of these 99 were dated on mail days and were written right before the next mail packet would leave. For 83 of these, it is possible to identify on what day Hope received and opened these letters. Of these 83 letters, 73 were received on days the mail packet arrived in Amsterdam, five letters were opened one day late, after the news had arrived in the evening of the previous day, and the remaining final five letters were for some reason opened a number of days later.[2]

C. *Weather Data*

Some of the robustness tests (especially Sections III.A and IV of the Internet Appendix) use data on weather conditions from the Zwanenburg observatory, a town close to Amsterdam. These data provide three observations a day on the wind direction and other weather variables. I obtain these data from the Royal Dutch Meteorological Institute (*KNMI).*

II. VECM

In this Appendix I analyze the flow of information between London and Amsterdam using a Vector Error Correction Model (VECM) (see Dempster et al. (2000) for a similar analysis using data with a two weekly frequency). For the Amsterdam market three prices per week are available; for Monday, Wednesday and Friday. Based on these prices, I calculate returns for two-day (Monday-to-Wednesday and Wednesday-to-Friday) or three-day periods (Friday-to-Monday). Prices in London are available on a daily frequency, but to make the empirical testing consistent I only use price data for the same days as I have data for Amsterdam. Detailed price data in London are only available for the EIC, BoE, and 3% Annuities.

Based on these two- or three-day returns, I estimate a VECM model with a total of five lags of the form[3]

$$\Delta p_t = \alpha_0 - \alpha_1 z_{t-1} + \beta_1 \Delta p_{t-1} + ... + \beta_5 \Delta p_{t-5} + \varepsilon_t, \tag{IA.1}$$

where $\Delta p_t = \begin{bmatrix} \Delta p_t^{LND} \\ \Delta p_t^{AMS} \end{bmatrix}$, $z_{t-1} = \left(p_{t-1}^{AMS} - p_{t-1}^{LND}\right)$, and t equals two or three days. I estimate the VECM separately for EIC and BoE stock and the 3% Annuities. To be clear, in these regressions I use no data on the actual flow of information.

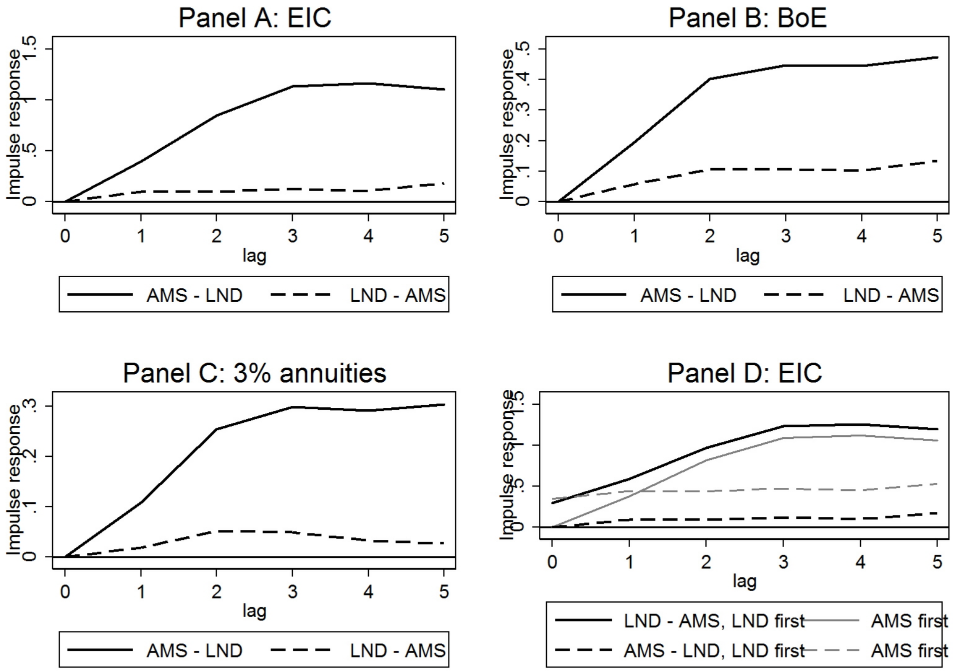

Figure IA.1: Impulse response functions - Peace. Panels A to C plot nonorthogonalized one-standard-deviation innovations. Panel D plots Cholesky (degrees-of-freedom adjusted) one-standard-deviation innovations for different orderings. Sample periods: September 1771 to December 1777 and September 1783 to March 1787 (1,498 observations). One lag corresponds to two or three days (Monday–to-Wednesday, Wednesday–to-Friday or Friday–to-Monday).

Based on the regression output I estimate Impulse Response Functions (IRFs) in response to nonfactorized one-standard-deviation innovations in either the London or Amsterdam return. Using nonfactorized innovations, rather than orthogonalized Cholesky innovations, has the advantage that it is not necessary to make any assumptions about the ordering of the variables. A priori it is not clear what the Cholesky ordering of the variables should be. Intuitively it seems obvious to order London prices first. However, this would bias the results toward finding that London has an important impact on Amsterdam. The nonfactorized results are therefore more relevant in this context. The results are presented in Figure IA.1, Panels A to C. For completeness, Panel D presents the EIC's IRF for orthogonalized Cholesky innovations, where either London or Amsterdam is ordered first. The figure clearly shows that Amsterdam prices strongly respond to London prices, but that the reverse response is very weak. This is true for all three stocks. It seems that most relevant information was generated in London.

The findings are not necessarily representative for the entire 18$^{\text{th}}$ century (Neal (1990), Dempster et al. (2000)). To illustrate this point, I repeat the analysis for the January 1778 to August 1783 period. As indicated in the historical overview, this period featured a war between England, France, and the Dutch Republic. It is likely that news from other sources played an important role during this period. Figure IA.2 presents the IRFs for this period of international conflict. The results clearly show that during this period news did come from other sources. The IRFs show a stronger response of London returns to price changes in Amsterdam. This seems to have been especially the case for BoE stock. These results shed additional light on the evidence that for 1771 to 1777 and 1783 to 1787, most news originated in England. This evidence is not just an artefact of the methodologies used or the specific form of the data. Rather, this finding is primarily driven by the choice of sample periods.

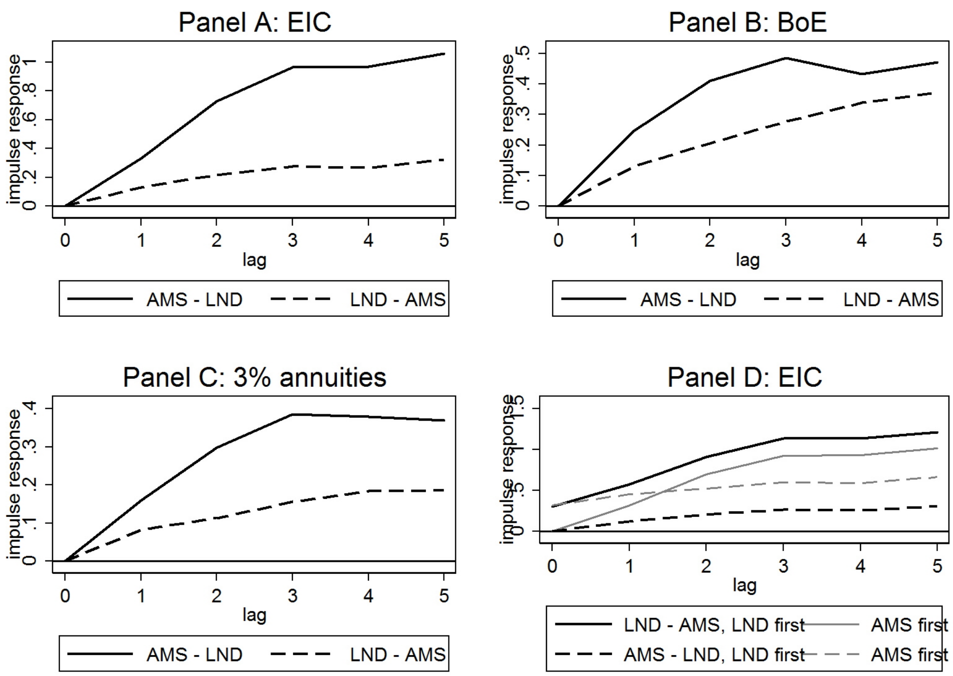

Figure IA.2: Impulse response functions - War. Panels A to C plot nonorthogonalized one-standard-deviation innovations. Panel D plots Cholesky (degrees-of-freedom adjusted) one-standard-deviation innovations for different orderings. Sample period: January 1778 to August 1783 (834 observations). One lag corresponds to two or three days (Monday–to-Wednesday, Wednesday–to-Friday or Friday–to-Monday).

III. Possible Alternative Sources of Information

This Section discusses alternative sources of information. Specifically, in subsections III.A and III.B I discuss channels other than the official packet boats through which information from England could have arrived in Amsterdam. In subsection III.C I discuss the role of information that may have originated in a third location, such as London or the (British) East Indies.

A. Ships Other Than The Packet Boats

The packet boats were not the only ships that sailed between London and Amsterdam. Freightships coming in from England would frequently dock in the Amsterdam harbor. In terms of keeping up with current affairs, these ships were always behind the packet boats (*Rotterdamsche* and *Amsterdamsche Courant*, passim) as they were slower and had to sail via the island Texel, which would take additional time.

It is possible that investors set up private initiatives to get information from London.[4] The packet boat service allowed for two crossings a week. Investors may have used private boats to get information from England on the days the official boats did not sail. These crossings could drive the no-news returns. Hope & Co.'s private correspondence suggests that, in practice, market participants did not rely on private boats (see Section I of the Internet Appendix for details). This is most clearly illustrated by the example in Figure 1 of the main article. The decline in EIC stock after Prime-Minister Fox's speech was the largest price movement in London within a single day between 1720 and 1800 (Neal (1990)). Nevertheless, this information was not transmitted to Amsterdam until the packet boats were able to cross the North Sea, 10 days later.

To investigate this issue further, I restrict the sample to periods in which, after the arrival of a packet boat, wind conditions deteriorated and future packet boats were significantly delayed. The underlying assumption is that during these periods it was impossible for all boats to sail across.[5] I construct these bad weather samples in three ways. First, I distinguish between no-boat periods that were purely the result of bad weather and those that can be explained by the sailing schedule. Using a median travelling time of four days, for every no-boat observation I check whether the sailing schedule would predict this to be a no-news observation or not. If not, I include this observation in bad weather sample A. Bad weather sample B is based on wind directions. Returns in Amsterdam are measured over two- or three-day periods. For every return period I determine the average daily wind direction. Hellevoetsluis was exactly east (90 degrees) from Harwich. If the average wind condition was from an eastern direction (from 0 to 180 degrees) every single day, I include the observation in bad weather sample B. To construct bad weather sample C, I look at the no-go zones discussed in Section IV of the Internet Appendix. For every day in the two- or three-day periods, I check how many wind observations within that day (out of two or three total) featured a no-go zone. If for every day at least two of these daily wind observations feature a no-go zone, I include this return in bad weather sample C.

Figure IA.3, Panels A to C presents the kernel densities of EIC returns for no-boat periods differentiated by good and bad weather. Differences between good and bad weather episodes are small. In Table IA.I I present the corresponding summary statistics for all five stocks. In most cases, the variance of no-boat returns is slightly lower during bad weather episodes. The difference in the variance between good and bad weather episodes is not statistically significant. These results suggest that the slipping through of news played a minor role.

B. Carrier Pigeons

As an alternative to sailing boats, market participants may have used carrier pigeons. It is important to note that, even though carrier pigeons can be retraced to antiquity, the historical record suggests that in Western Europe they were in use only after 1800 (Levi (1977)). Dickens' (1850) description of the use of carrier pigeons in the 1840s indicates that a well-organized system had to be in place to transmit

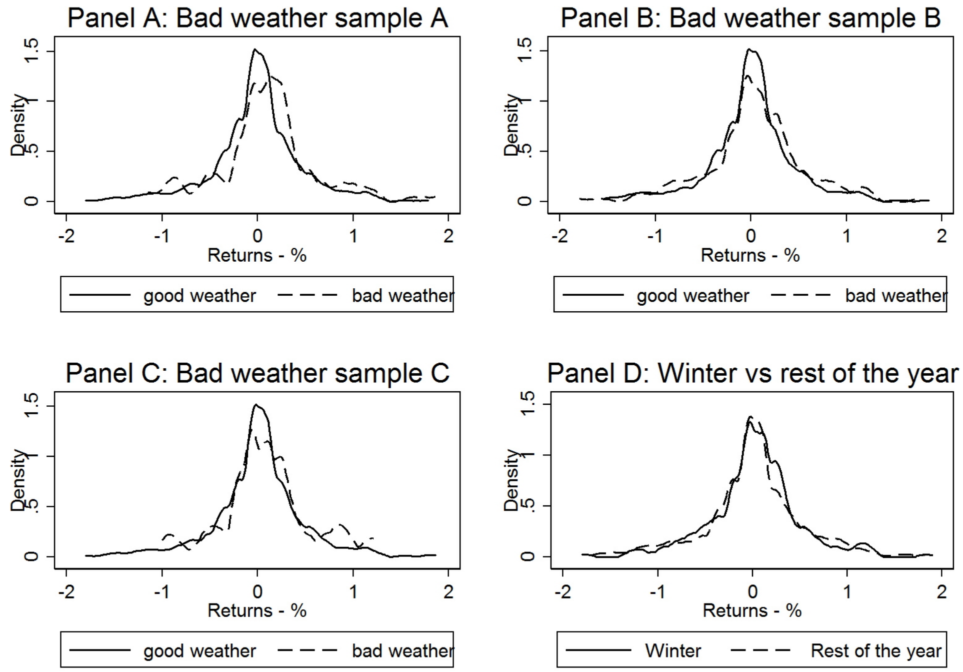

Figure IA.3: Return distributions EIC (no-boat periods): bad weather and winter. This Figure plots return distributions of no-boat observations for good versus bad weather or winter versus the rest of the year. Panel A uses bad weather definition A. Good weather obs.: 395; bad weather obs.: 85. Panel B uses bad weather definition B. Good weather obs.: 336; bad weather obs.: 145. Panel C uses bad weather definition C. Good weather obs.: 392; bad weather obs.: 89. Panel D considers winter, defined as November to February versus the rest of the year. Winter obs.: 186; rest of year obs.: 295. Kernel = Epanechnikov, bandwidth = 0.07. X-axis truncated at -2% and 2%.

information from London to Amsterdam.[6] There is no historical evidence indicating that such a system existed before 1800. Hope & Co.'s private correspondence confirms that carrier pigeons were not used. If one of the most important Anglo-Dutch banks of the period did not use carrier pigeons, it is hard to imagine who would have.

If, contrary to historical evidence, carrier pigeons did play a role in the 1770s and 1780s, they were likely not in use during the winter months. Dickens (1850) indicates that carrier pigeons did not cope well with adverse weather conditions.[7] This is illustrated by the carrier pigeon service that was set up between Antwerp and Rotterdam in 1848 when the two cities were not yet connected by telegraph: during the winter carrier pigeons were replaced by horses (Ten Brink (1957)). If people did use pigeons in the 1770s and 1780s, we would expect to see different volatility patterns in Amsterdam in the winter months than in the rest of the year. Table IA.I compares the return variance on no-boat days during winter months and the rest of the year. Figure IA.3, Panel D plots the corresponding return distributions for EIC stock. The results indicate that there were little seasonal differences. If anything, the variance of no-boat returns is slightly higher during the winter. However, these differences are not statistically significant. In short, the evidence does not suggest that carrier pigeons played an important role.

Table IA.I

Bad Weather and Winter Samples

This Table presents variances of security returns in Amsterdam. Percentage log returns are calculated over two or three day periods (denoted t), based on no-boat observations only. The sample is split into good and bad weather episodes and into winter versus the rest of the year. Weather classifications:
- Sample A: arrival of news during period t is predicted according to the sailing schedule, but no news arrives.
- Sample B: wind constantly blows from the east during period t.
- Sample C: for all days of period t at least two of the two or thre daily wind observations in the no-go zone.

Sample periods: September 1771 to December 1777 and September 1783 to March 1787. The equality of variances for different subsamples is tested using a Brown-Forsythe (B-F) test ($H_0 : ratio = 1$).

		$var(\Delta p_t^{AMS})$					
		EIC	SSC	BoE	3% ann.	4% ann.	Obs.
Bad weather sample A	Good weather	0.279	0.172	0.142	0.196	0.137	395
	Bad weather	0.278	0.202	0.083	0.188	0.211	85
	B-F test	0.001	0.004	1.222	0.434	1.210	
	(p-value)	0.970	0.947	0.270	0.511	0.272	
Bad weather sample B	Good weather	0.295	0.182	0.143	0.189	0.165	336
	Bad weather	0.243	0.173	0.105	0.206	0.112	145
	B-F test	0.018	0.029	1.053	0.001	2.159	
	(p-value)	0.892	0.865	0.305	0.975	0.142	
Bad weather sample C	Good weather	0.289	0.174	0.139	0.194	0.160	414
	Bad weather	0.215	0.209	0.085	0.196	0.089	67
	B-F test	0.036	0.005	0.639	0.228	2.173	
	(p-value)	0.850	0.943	0.424	0.633	0.141	
Winter	Mar - Oct	0.274	0.114	0.171	0.161	0.135	295
	Nov - Feb	0.288	0.159	0.192	0.247	0.173	186
	B-F test	0.293	3.200	0.292	3.071	1.244	
	(p-value)	0.589	0.074	0.589	0.080	0.265	

C. News from France, The East Indies, and The U.S.

The underlying assumption of this paper is that (virtually) all relevant news affecting the prices of English securities in Amsterdam originated in England. In this subsection I examine whether there is evidence that relevant news could have also originated in a different place, most importantly France, the U.S. or the East Indies.

France played an important role in the international politics of the 18^{th} century. During the two periods considered in this paper (1771 to 1777 and 1783 to 1787), developments in France were relatively unimportant. Presumably, the impact of news from France was therefore small. How can we formally test for this? An official mail service between Paris and Amsterdam that ran twice a week, arriving in Amsterdam on Saturday and Wednesday. This mail service carried both official news items and private letters (Ten Brink (1969), p. 28; *Amsterdamsche Courant*, passim). Because this mail service did not depend on sailing boats, there was no variation in the time it took for news to arrive in Amsterdam. I test whether returns on the English securities in Amsterdam were more volatile after the arrival of news from Paris. Table IA.II compares Friday-to-Monday and Monday–to-Wednesday returns, which reflect the arrival of news from Paris, with Wednesday-to-Friday returns, which do not. The sample is restricted to periods in which no information arrived from England.[8] The Table shows that differences in volatility were small. For the EIC and the 3% annuities, the return variance is even slightly lower on the days news arrived from Paris. For the BoE, SSC, and the 4% annuities the return variance is higher, but only marginally so and differences are statistically insignificant with the exception of the 4% annuities, for which the difference is marginally statistically significant. Overall, the evidence suggests that information from Paris was not important for the pricing of the English securities during the paper's sample periods.

Another source of information was the U.S. The American War of Independence started in 1775 and had an important impact on the financial situation of the English government. As a consequence, English government securities (and related stocks such as the BoE and the SSC) were affected from 1775 onwards. The historical record indicates that all relevant information from the U.S. reached England before it arrived in Amsterdam. There was no official mail service between the U.S. and Amsterdam: all letters traditionally arrived through England (Ten Brink (1969), p. 22; Hogesteeger (1989), p. 29). In addition, a closer inspection of the Dutch newspapers of the period indicates that all U.S.-related information came in with packet boats from London.

There could be an additional complication for EIC stock. A significant fraction of relevant news for this company came from Asia. The Dutch also had an important presence in Asia through their own East India Company (VOC). It is therefore possible that news from Asia may have reached Amsterdam through Dutch VOC ships before it reached London. When Amsterdam did not receive any news from England, relevant information could still have arrived from Asia. A closer examination of the *Amsterdamsche Courant* suggests that this concern is of minor importance. First, there were more English ships sailing between Asia and Europe than Dutch ones. As a result, most news about the Dutch East Indies arrived through English ships. Second, Dutch ships from the East Indies often docked at the English harbor of Plymouth to get fresh water and supplies before sailing to Amsterdam. As a result, news from the Dutch East Indies often reached England first. As a final check, I collect data on the arrival of news from the Dutch East Indies from the *Amsterdamsche Courant* and Bruijn, Gaastra, and Schöffer (1979). Table IA.II compares the variance of stock returns on days with and without news from Asia. Again, the sample is restricted to days when no news arrived from England. The Table shows that the arrival of news from Asia was relatively infrequent and did not lead to more volatile EIC prices – indeed, the results suggest the opposite but the differences are not statistically significant. Results for the other securities look very similar.

Table IA.II

News from Paris and Asia

This Table presents the variances of security returns in Amsterdam. Percentage log returns calculated over two or three day periods (denoted t) and are based on no-boat observations only ($B_t = 0$). The sample is split into observations with or without news from Paris or Asia ($P_t = 0, 1$; $A_t = 0, 1$). Sample periods: September 1771 to December 1777 and September 1783 to March 1787. The equality of variances for different subsamples is tested using a Brown-Forsythe (B-F) test ($H_0 : ratio = 1$).

	EIC	SSC	BoE	3% ann.	4% ann.	Obs.
Panel A: News from Paris						
$var(\Delta p_t^{AMS} \| B_t = 0, P_t = 0)$	0.301	0.157	0.121	0.207	0.136	230
$var(\Delta p_t^{AMS} \| B_t = 0, P_t = 1)$	0.260	0.199	0.141	0.182	0.161	251
B-F test	0.002	1.417	0.450	0.267	2.934	
(p-value)	0.962	0.234	0.502	0.605	0.087	
Panel B: News from Asia						
$var(\Delta p_t^{AMS} \| B_t = 0, A_t = 0)$	0.294	0.187	0.140	0.208	0.156	433
$var(\Delta p_t^{AMS} \| B_t = 0, A_t = 1)$	0.143	0.106	0.056	0.064	0.087	48
B-F test	1.041	1.800	2.736	3.237	0.007	
(p-value)	0.308	0.180	0.099	0.073	0.935	

IV. Exogeneity

It is possible that the flow of information from London to Amsterdam was endogenous to (market) developments in London. For example, packet boats may have left earlier (or later) than scheduled if there were important developments. Alternatively, boats could have sailed faster after important events. There is no historical evidence that suggests this was the case. First, the exact timing of boat departures from England was determined by a fixed sailing schedule. During the periods under study (1771 to 1771 and 1783 to 1787), the packet boats never deviated from the official schedule. Second, the historical evidence suggests that sailing times were determined by weather conditions alone.

In this section I first provide more evidence on the extent to which sailing times were determined by weather conditions. I then use information about the sailing schedule and weather conditions to instrument news flows. These IV estimates should correct for any endogeneity that might be present.

A. Weather and Delays

I investigate the link between weather conditions and sailing delays as follows. Sail boats do not need to sail parallel to the wind as they can adjust their sails to move perpendicular to the wind. However, when they get too close to the direction of the wind, sails cannot be adjusted further as a sail boat enters a so-called no-go zone. If the boat's direction lies within this no-go zone, it will have to tack (that is, constantly change direction in a zigzag fashion). In other words, it will constantly have to change direction, leading to both a longer sailing distance and time at sea.

There is no historical data available about conditions at sea. However, two or three daily observations on wind directions are available from the observatory of Zwanenburg (close to Amsterdam). For each of these observations I determine whether a packet boat sailing east from Harwich to Hellevoetsluis would face a no-go zone. For modern sail boats this no-go zone lies around 30 to 50 degrees from the winddirection. I assume that 18^{th} century packet boats had a no-go zone of 55 degrees around the prevailing wind direction. For each trip I determine what fraction of wind observations observed during that trip was in the no-go zone.

The correlation between sailing times and the fraction of no-go zone observations is 0.47. Figure IA.4 presents this relation graphically. I divide the sample of sailing trips into subsamples according to the fraction of no-go zone observations (0, 0 to 0.25, 0.25 to 0.5, 0.5 to 0.75, and 0.75 to 1). Figure IA.4 presents the distributions of sailing times for each of these sub-samples (number of observations in parentheses) in the form of boxplots. The figure demonstrates that, to a large extent, the length of a sailing trip was determined by wind conditions.

B. IV Analysis

To study the possible endogeneity of boat arrivals in further detail, I perform an IV analysis using the official sailing schedule and weather conditions as instruments. These IV estimates should correct for any endogeneity that might be present. More specifically, I estimate the following IV regression:

$$\begin{aligned} \left(\Delta p_t^{AMS}\right)^2 &= \alpha_0 + \alpha_1 B_t + \varepsilon_t \\ B_t &= \beta' Z_t + \eta_t. \end{aligned} \tag{IA.2}$$

The first variable in Z_t measures how many days ago the next news packet expected to arrive in Amsterdam was scheduled to depart from London:

$$\tau = t^{AMS} - t^{LDN,departure},$$

where t^{AMS} is calendar time in Amsterdam and $t^{LDN,departure}$ is the date news was scheduled to depart from London.[9] The longer a packet boat was at sea (larger τ), the more probable was the arrival of news

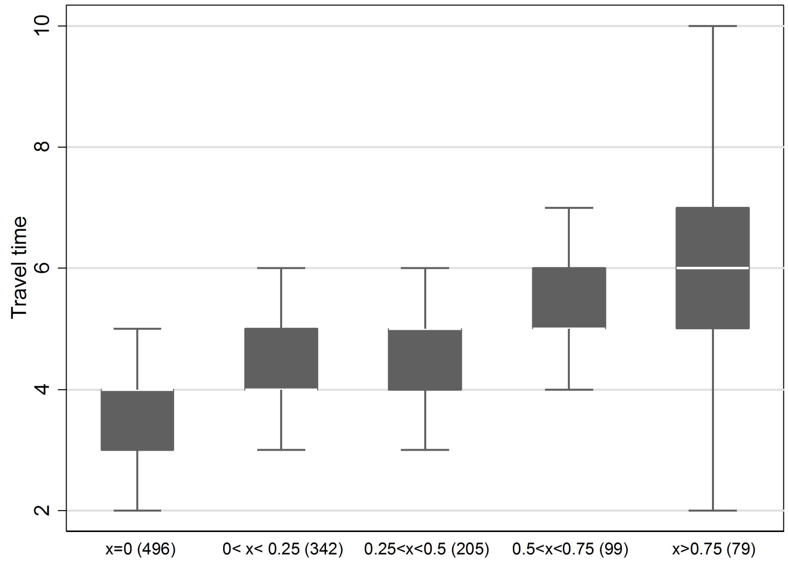

Figure IA.4: Travel times and no-go zones. The figure relates wind conditions during time at sea (including days of departure and arrival) to sailing duration. Wind conditions: fraction of wind observations in the no-go zone (+/- 55 degrees from th east); denoted by x. The number of observations for each category is given in parantheses. Inner region: 25th to 75th percentile. Outer region: upper and lower adjacent values. The boxplot excludes outside values.

on day t^{AMS}. The marginal change in arrival probability is not necessarily constant in τ. For example, a longer time since departure may indicate that conditions at sea are relatively bad, in which case the marginal increase in arrival probability falls with τ. To account for this I also include τ^2 and τ^3 (higher-order polynomials are insignificant, both economically and statistically). The sailing schedule itself is fixed and therefore τ is exogenous. The second set of variables in Z_t capture weather conditions. For each day I calculate what fraction of available wind observations featured a no-go zone; $\in \{0, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, 1\}$. I include this information as dummy variables. I also include a dummy for temperatures less than 3 degrees Celsius.[10] The first stage has a good fit. The F-value lies around 59 and the adjusted R^2 is 0.29. Figure IA.5 shows a graphical representation of the first stage.

Table IA.III presents the corresponding IV results. The IV estimates are highly statistically significant at the 1% level (for the BoE, at the 5% level). The differences between the IV and OLS estimates are small. For the BoE, the OLS and IV coefficients are virtually the same; for the other securities, the IV estimates are somewhat higher. A Hausman test indicates that there is no significant statistical difference between the two sets of coefficients. The p-values range between 0.17 and 0.96. In sum, there is no evidence that the arrival of boats was endogenous to stock market conditions or important economic or political events.

Table IA.III
IV Estimates

This Table presents OLS and IV estimates of the impact of boat arrivals on squared security returns in Amsterdam. Squared percentage log returns are calculated over two or three day periods (denoted t) with or without the arrival of a boat. $B_t = 1$ captures the difference in variance between boat and no-boat observations. The constant captures the benchmark no-boat variance. Instruments used for the arrival of boats: days since the departure of the next expected news packet, wind direction in the no-go zone, and temperature below 3 degrees Celcius (dummy variable). Information about the wind direction in the no-go zone is included as follows. For each wind observation (availability: two or three observations a day), I determine whether the wind is in the no-go zone (55 degrees on either side of a strictly eastern direction). For each day I calculate the fraction of no-go zone observations $(0, 1/3, 1/2, 2/3, 1)$. I include this information as dummy variables. Sample period: September 1771 to December 1777 and September 1783 to March 1787. A Hausman test is reported on the equality of the boat coefficients ($H_0 : ratio = 1$). Robust bootstrapped standard errors (1000 replications) are reported in parentheses. ***,**, and * denote statistical significance at the 1%, 5% and 10% level respectively.

				$(\Delta p_t^{AMS})^2$		
		EIC	SSC	BoE	3% ann.	4% ann.
OLS	Boat ($B_t = 1$)	0.429	0.144	0.099	0.222	0.151
		(0.079)***	(0.039)***	(0.030)***	(0.056)***	(0.041)***
	Constant	0.279	0.177	0.132	0.194	0.150
		(0.035)***	(0.021)***	(0.018)***	(0.023)***	(0.022)***
	Obs.	1159	1159	1159	1159	1159
	$\frac{Constant}{Boat+Constant}$	0.394	0.551	0.571	0.466	0.498
IV						
First stage	F-stat.	56.9	56.9	56.9	56.9	56.9
Second stage	Boat ($B_t = 1$)	0.517	0.189	0.104	0.254	0.200
		(0.148)***	(0.063)***	(0.057)*	(0.095)***	(0.069)***
	Constant	0.228	0.151	0.129	0.176	0.121
		(0.073)***	(0.033)***	(0.036)***	(0.046)***	(0.034)***
	Obs.					
	$\frac{Constant}{Boat+Constant}$	0.306	0.444	0.554	0.409	0.377
Hausman	χ^2	0.485	0.846	0.012	0.172	0.775
	(p-value)	(0.486)	(0.358)	(0.913)	(0.679)	(0.379)

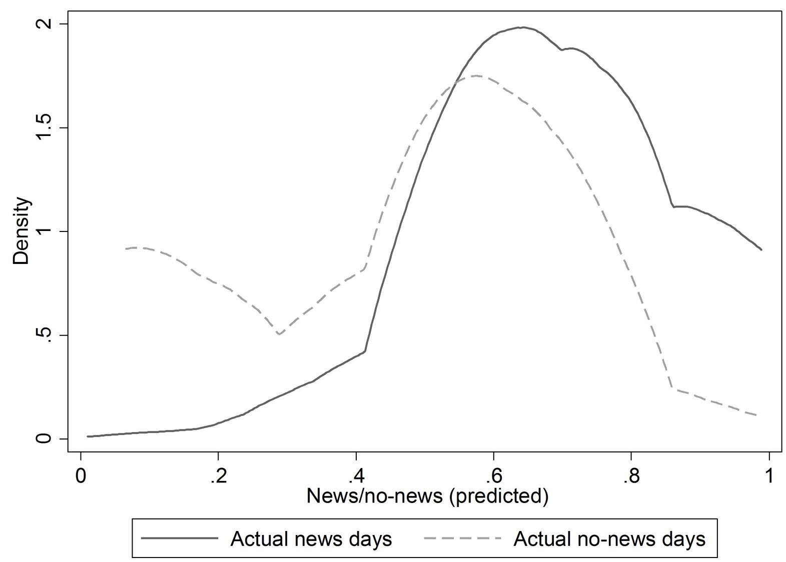

Figure IA.5: First stage IV - linear probability model. The figure plots estimated probabilities of arrival of news based on a linear probability model using the sailing schedule and a number of weather variables. Kernel = Epanechnikov, bandwidth = 0.1. The x-axis truncated at zero and one.

V. Additional Figures and Tables

This appendix contains figures and tables omitted from the main article.

A. *Weekend Effects*

Friday-to-Monday returns correspond to three instead of two days, but include the weekend. Should these returns be scaled up or down? During the 18th century, trading continued over the weekend. However, trade on Sunday was limited due to the absence of Christian traders. Likewise, Jewish traders did not participate on Saturdays (Spooner (1983), p. 21). Table IA.IV indicates that there is no evidence of more or less volatility over the weekend. I therefore treat the three day weekend returns the same as Monday-to-Wednesday or Wednesday-to-Friday returns.

Table IA.IV
Weekend Effects

This Table tests for the presence of weekend effects in squared Amsterdam security returns.
Spec. (1): $(\Delta p_t^{AMS})^2 = \alpha_0 + \alpha_1 B_t + u_t$
Spec. (2): $(\Delta p_t^{AMS})^2 = \beta_0 + \beta_1 B_t + \beta_2 Weekend + v_t$
Squared log percentage returns calculated over 2 or 3 days periods (denoted t) with or without a boat arrival. The boat variable ($B_t = 0, 1$) captures the difference in variance between boat and no-boat observations. The constant captures the benchmark no-boat variance. The weekend coefficient captures whether returns (conditional on the arrival of a boat) are more volatile over the weekend. The reported χ^2 is based on a test of the equality of the coeffcient on B_t in specifications (1) and (2). News was more likely to arrive over the weekend, and this test captures whether this biases the variance of boat returns. Robust bootstrapped standard errors (1000 replications) are reported in parentheses. ***,**, and * denote statistical significance at the 1, 5 and 10% level, respectively.

				$(\Delta p_t^{AMS})^2$		
		EIC	SSC	BoE	3% ann.	4% ann.
Spec. (1)	Boat ($B_t = 1$)	0.431	0.147	0.099	0.234	0.151
		(0.077)***	(0.038)***	(0.030)***	(0.058)***	(0.041)***
	Constant	0.279	0.179	0.131	0.194	0.150
		(0.035)***	(0.021)***	(0.019)***	(0.023)***	(0.021)***
Spec. (2)	Boat ($B_t = 1$)	0.420	0.126	0.104	0.212	0.143
		(0.084)***	(0.042)***	(0.034)***	(0.058)***	(0.048)***
	Weekend	0.036	0.074	-0.016	0.076	0.028
		(0.098)	(0.052)	(0.036)	(0.078)	(0.056)
	Constant	0.273	0.166	0.134	0.181	0.145
		(0.041)***	(0.022)***	(0.021)***	(0.026)***	(0.022)***
	Obs.	1162	1162	1162	1162	1162
χ^2	Boat (1) = Boat (2)	0.127	1.866	0.219	0.925	0.253
	(p-value)	(0.722)	(0.172)	(0.640)	(0.336)	(0.615)

Table IA.V
Time to Expiration

This table presents variances of security returns in Amsterdam. Percentage log returns are calculated over two or three day periods (denoted t). Each year there were four possible expiration dates (the 15$^{\text{th}}$ of February, May, August, and November). The newspaper reported the price of a future contract ending on the next expiration date T. This means that an (observed) contract had a maximum maturity of 13 weeks. For each return we can calculate the time to expiration in weeks: $\tau = (T - d)/7$ where d is the calendar date associated with f_t^{AMS}. The table presents the return variance for different subsamples with $\tau \leq 3$ and $11 \leq \tau \leq 13$. Sample periods: September 1771 to December 1777 and September 1783 to March 1787. Brown-Forsythe tests are performed on the equality of variances for returns on contracts with long and short time to expiration. If shocks to the cost-to-carry component drive a significant fraction of returns, we would expect $var(\Delta f_t^{AMS}|11 \leq \tau \leq 13) > var(f_t^{AMS}|\tau \leq 3)$.

	EIC	SSC	BoE	3% ann.	4% ann.	Obs.
$var(\Delta f_t^{AMS}|10 \leq \tau \leq 12)$	0.463	0.160	0.265	0.252	0.203	306
$var(\Delta f_t^{AMS}|\tau \leq 3)$	0.588	0.197	0.298	0.418	0.242	290
B-F test	0.032	0.164	0.204	2.017	1.704	
(p-value)	0.858	0.686	0.652	0.156	0.192	

B. Time to Expiration

As noted before, Amsterdam prices reflected future transactions. I convert Amsterdam prices into spots using a fixed cost-to-carry rate (details are in Section 1 of the Internet Appendix). It is possible that short-term fluctuations in the interest rate contributed to the variance of returns. The maturity of future contracts was relatively short, varying between one day and three months. Simple calculations in the main text suggest that interest rate fluctuations at such short maturities played a limited role. Table IA.V provides an additional robustness test. If fluctuations in the cost-to-carry rate are quantitatively important, we would expect returns on futures with a longer time to maturity (for example, between 11 and 13 weeks) to be more volatile than returns on futures with shorter maturities (for example, up to three weeks). More formally, the return on a future with a maturity τ is given by

$$\Delta f_t^{AMS} = \Delta s_t^{AMS} + \tau \Delta r_t,$$

where f_t^{AMS} and s_t^{AMS} are log future and spot prices in Amsterdam. Under the assumption that Δs_t^{AMS} and Δr_t are independent,

$$var(\Delta f_t^{AMS}) = var(\Delta s_t^{AMS}) + \tau^2 var(\Delta r_t).$$

If interest rate fluctuations are quantitatively important, then

$$var(\Delta f_t^{AMS}|11 \leq \tau \leq 13) > var(f_t^{AMS}|\tau \leq 3).$$

Table IA.V shows that is not the case. If anything, the variance of returns on futures with longer maturities is lower. This suggests that fluctuations in interest rates had little impact on overall volatility.

C. News Content

To what degree did the arrival of a packet boat imply the transmission of actual news? Following Cutler et al. (1989) and Fair (2002), Table IA.VI revisits the largest 25 returns on EIC stock, 22 of which took place after the arrival of a packet boat. The Table documents the specific content of news brought in from London. In 20 of the 22 cases, the arrival of a boat coincided with the transmission of relevant information, such as significant events in India or decisions in Parliament affecting the Company. Table IA.VII presents similar results for the 3% annuities (as a representative of the other four government-related securities). In this case a boat arrival implied the transmission of material information in 21 of the 22 cases, such as news about the national debt, developments in the U.S. revolutionary war, or the situation in Ireland. For the largest returns (the most important drivers of the variance estimates), there seems to be a close link between the arrival of a boat and the transmission of relevant information.

Finally, Table IA.VIII gives a description of the different news categories used in the main article's statistical analysis of the impact of news on EIC returns (Table V).

Table IA.VI
Top 25 Largest Returns, EIC

This Table presents the largest 25 returns on EIC stock during the two sample periods, September 1771 to December 1777 and September 1783 to March 1787. The "Boat" column indicates whether a return reflected the arrival of a boat. The "News from London" column reports the most important news items related to the EIC or general political/economic conditions in England published in the Dutch newspapers. Sources: the *Leydse* and *Amsterdamsche Courant*.

Date	Return	Boat	News from London
7-Oct-71	3.77	1	EIC decides to pay out a half-yearly dividend of 6.25%. Company refuses to make its books public.
1-Jun-72	2.52	1	Capitulation of City of Tanjore (Thanjavur, India); peace treaty.
18-Sep-72	-2.26	1	War ships sent to India.
21-Sep-72	-3.19	1	Military plans to reestablish order in Bengal.
23-Oct-72	-3.47	1	Mutiny on EIC ships docked in the Thames.
20-Nov-72	-2.97	1	Discussion in Parliament about sending superintendants to India; decision delayed.
25-Nov-72	-2.27	1	Parliament approves sending super-intendants to India
27-Jan-73	4.57	1	EIC in better shape than previously thought. Expectation of a government bailout.
26-Apr-73	-2.86	1	Discussion in Parliament about EIC's monopoly on salt and tobacco. Statement EIC about the favorable situation in Bengal.
30-Apr-73	2.21	1	The EIC can export tea to America free of any duties.
23-Jun-73	3.53	1	Parliament votes in favor of giving the EIC subsidies and a loan.
25-Jun-73	-2.35	0	
26-Jul-73	3.27	1	EIC general shareholder meeting; even though company heavily indebted, enough cash to fund activities up to the end of the year.
12-Nov-73	-2.76	1	The EIC needs to borrow large sums of money to continue its operations; talk of a (forced) capital call of 12.5%.
6-Jun-74	3.26	1	Update about civil unrest in Boston (aftermath of the Boston Tea Party).
22-Jun-74	-2.67	0	
28-Oct-76	-2.95	1	General Washington retreats from New York, but holds his position in Harlem Heights.
28-Nov-83	-13.71	1	Prime Minister Fox speaks on the "deplorable state" of the EIC's finances.
15-Mar-84	-2.85	1	Continued conflict between the British Cabinet and House of Commons.
11-Jun-84	-2.17	1	*Nothing of importance*
28-Jun-84	2.89	1	Favorable news from India; Prime Minister Pitt introduces a bill to permit the EIC to pay out a half-yearly dividend of 4%.
6-Aug-84	3.39	1	Arrival of ships from the East Indies; discussion of new East Indies bill in the House of Lords.
9-Aug-84	2.20	1	Peace treaty between the EIC and the Sultan of Mysore (India). House of Commons approves several subsidies to the EIC.
29-Dec-84	2.25	1	*Nothing of importance*
11-Nov-85	3.16	0	

Table IA.VII

Top 25 Largest Returns, 3% Annuities

This Table presents the largest 25 returns on 3% annuities during the two sample periods, September 1771 to December 1777 and September 1783 to March 1787. The "Boat" column indicates whether a return reflected the arrival of a boat. The "News from London" column reports the most important news items related to the EIC or general political/economic conditions in England published in the Dutch newspapers. Sources: the *Leydse* and *Amsterdamsche Courant*.

Date	Return	Boat	News from London
7-Oct-71	2.35	1	Results of major elections in London
13-Jan-72	2.57	1	Hopes for continued peace, in spite of conflict with the Spanish over Falkland Islands. New tax bill for Ireland approved.
12-Jun-72	2.25	1	King's speech in House of Lords about reduction national debt.
26-Apr-73	-3.53	1	English Secretary of War had long meeting and sent express messages to Ambassadors on the continent; fear of War.
24-May-73	1.80	1	10% of the £ 1.5 million loan to the EIC subscribed.
28-Oct-76	-1.96	1	General Washington retreats from New York, but holds his position in Harlem Heights.
1-Nov-76	-1.98	0	
5-Nov-77	1.88	1	English General Howe landed his troops in Chesapeake Bay; marches on Philadelphia.
1-Sep-83	-2.90	1	Fear that peace treaty with the Dutch Republic will be delayed.
8-Sep-83	3.31	1	Quick signing of the peace treaty expected.
15-Sep-83	-1.82	1	Signing of final peace preaty with the French and preliminary preaty with the Dutch; convening of Parliament delayed.
22-Sep-83	-1.87	1	Final peace treaty with the Dutch almost finalized, no restrictions on Dutch trade. Surprisingly, definitive restoration of peace accompanied by decline in security prices.
29-Sep-83	-1.93	1	The French ratify final peace treaty with the Spanish, preliminary treaty with the Dutch. Again, securities decline in value in response.
17-Oct-83	2.05	0	
22-Oct-83	-3.30	1	Corps of Irish Volunteers demand right to elect the Governor; fear of armed conflict.
7-Nov-83	-1.83	1	New government debt issue only fully subscribed due to credit provision of Bank of England.
12-Nov-83	3.88	1	British government states that a peaceful resolution with the Irish, satisfactory for both parties, is within reach.
2-Jul-84	-2.05	1	Prime Minister Pitt announces new government debt issue. Bad news from Ireland, rumors that Irish governor will tender his resignation.
14-Oct-85	3.45	1	The Ministerial Party in Ireland wins more votes in favor of the proposed trade agreement.
7-Nov-85	2.40	1	The Cabinet indicates that the proposed trade agreement with Ireland has a high probability of succeeding.
11-Nov-85	1.96	0	
16-Dec-85	2.11	1	*Nothing of importance*
20-Jan-86	2.11	1	Government serious about trade agreement with Ireland; delays trade agreements with other countries so Ireland can be included.
24-Mar-86	-2.10	1	Jefferson and Adams discuss (existing) trade agreement between the U.S. and England.
27-Mar-86	2.23	1	Continued talks with Jefferson and Adams.

Table IA.VIII

Description of Different News Categories

This table unpacks the different news categories introduced in Table V in the main article. News items are based on capitalized words in articles published in the *Leydse Courant* with news from England between September 1771 and December 1777.

Category (short)	Category (long)	Words included:	
Cape	Cape (of Good Hope) Colony	Cape Cape Coast Castle	Table Bay
EIC	East India Company	East India Company	
Finance	Financial terminology (excludes "stocks")	Bills of exchange Bond Capital Certificates Credit Debt Funds Gold	Loan Loan (on collateral) Millions Premium Public issue Silver Specie
India	Regions, towns, and/or persons in the British East Indies	Arcote Bahar Bengal Bombay Coromandel Couchim Governor General Indies Leonan	Madras Mogol Nabab Orient Orika Raja Superintendants Tanjour
Background	Words signalling background information	Declaration Extract Instruction Letter Message Petition	Plan Proclamation Publication Request Statement

D. *Returns in London on Boat and No-Boat Days*

In this section I test whether there is any evidence for Dutch liquidity shocks affecting prices in England. Table IA.IX computes the variance of security returns in London on days with or without boat arrivals from Amsterdam.[11] There is no significant difference. If anything, volatility is lower on days with news from Amsterdam.

Table IA.IX

Volatility in LND - Days with/without A Boat Arrival from AMS

This Table presents descriptive statistics for percentage log returns in London over two or three day periods (denoted by t) with or without the arrival of a boat from Amsterdam ($B_t = 1$ or $B_t = 0$). Sample periods: September 1771 to December 1777 and September 1783 to March 1787. The equality of variances for news and no-news periods is tested using a Brown-Forsythe test (H_0 : $ratio = 1$). ** denotes statistical significance at the 5% level.

			Δp_t^{LND}	
		EIC	BoE	3% ann.
Mean	Boat ($B_t = 1$)	0.013	0.014	0.019
	No-boat ($B_t = 0$)	0.066	0.051	0.034
Variance	Boat ($B_t = 1$)	0.629	0.228	0.218
	No-boat ($B_t = 0$)	0.630	0.274	0.328
	(B-F statistic)	(0.09)	(1.60)	(5.37)**
Skewness	Boat ($B_t = 1$)	−0.090	0.390	0.214
	No-boat ($B_t = 0$)	−0.762	−0.072	0.008
Kurtosis	Boat ($B_t = 1$)	10.49	12.40	9.22
	No-boat ($B_t = 0$)	12.94	14.88	12.84
% zero	Boat ($B_t = 1$)	17.16	15.46	23.42
	No-boat ($B_t = 0$)	16.95	18.27	20.73
Obs.	Boat ($B_t = 1$)	746	731	854
	No-boat ($B_t = 0$)	590	613	685

E. Price Differences

In this section I examine price differences between London and Amsterdam before and after the arrival of a boat. Figure IA.6, Panels A - C plot the distributions of price differences for EIC stock, the BoE, and the 3% annuities. Table IA.X presents the corresponding moments. The results indicate that price differences narrowed after the arrival of a boat (more mass around zero) but remained significant.

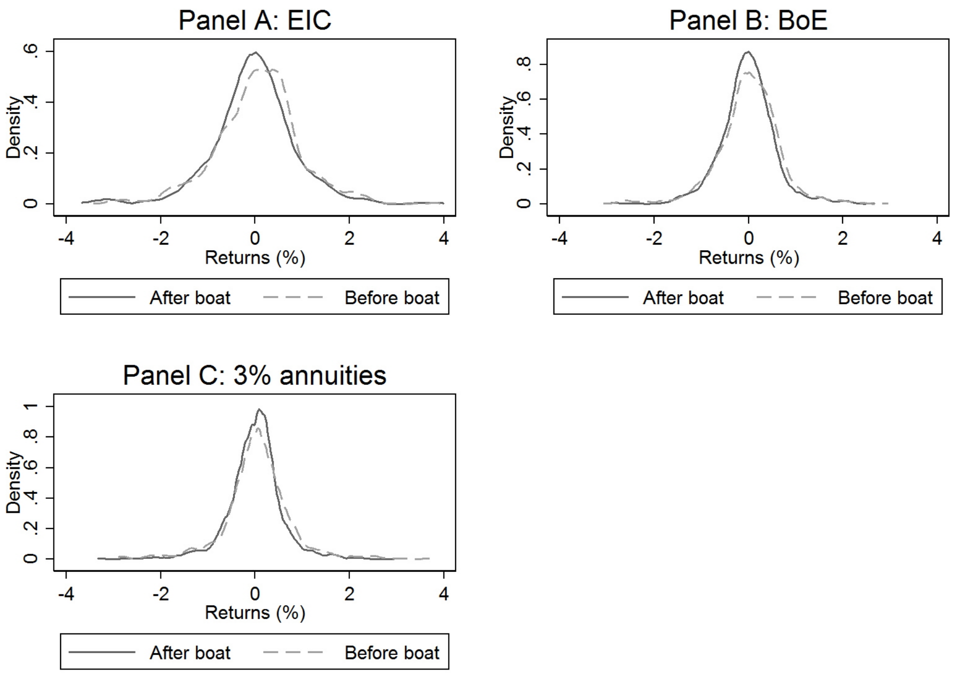

Figure IA.6: Price differences London-Amsterdam. This figure plots distributions of the difference between LND and AMS prices before and after the arrival of a boat. The AMS price is the one recorded before or after the arrival of a boat. The LND price is the price that is transmitted by that boat. The price difference is defined as log(LND / AMS)*100. The X-axis is truncated at -4% and 4%.

Table IA.X

Price Differences: London-Amsterdam

This table presents the percentage log price differences between London and Amsterdam before and after the arrival of a packet boat. Amsterdam prices p_{t-1}^{AMS} and p_t^{AMS} are the prices observed before or after the arrival of a boat. p_{s-1}^{LND} is the London price transmitted by that boat. The equality of the variance of price differences before and after boat arrivals is tested with a Brown-Forsythe (B-F) test ($H_0 : ratio = 1$). *** denotes statistical significance at the 1% level.

		Price differences Amsterdam - London		
		EIC	BoE	3% ann.
Before boat	Mean	0.052	0.004	0.038
$\log(p_{t-1}^{AMS}/p_{s-1}^{LND})$ (%)	Variance	1.008	0.468	0.587
	5^{th} perc.	−1.575	−1.093	−1.217
	95^{th} perc.	1.535	0.993	1.176
	Obs.	747	748	748
After boat	Mean	0.004	−0.021	−0.003
$\log(p_t^{AMS}/p_{s-1}^{LND})$ (%)	Variance	0.877	0.341	0.332
	5^{th} perc.	−1.358	−0.934	−0.909
	95^{th} perc.	1.431	0.823	0.828
	Obs.	750	751	751
B-F test		2.30	9.20***	17.29***

F. Return Distributions

Figure IA.7, panels A - D present the kernel densities of boat returns (solid line) and no-boat returns (dashed line) in Amsterdam. It is clear that returns are more volatile after the arrival of new information. The distribution of news returns has considerably more mass in the tails.

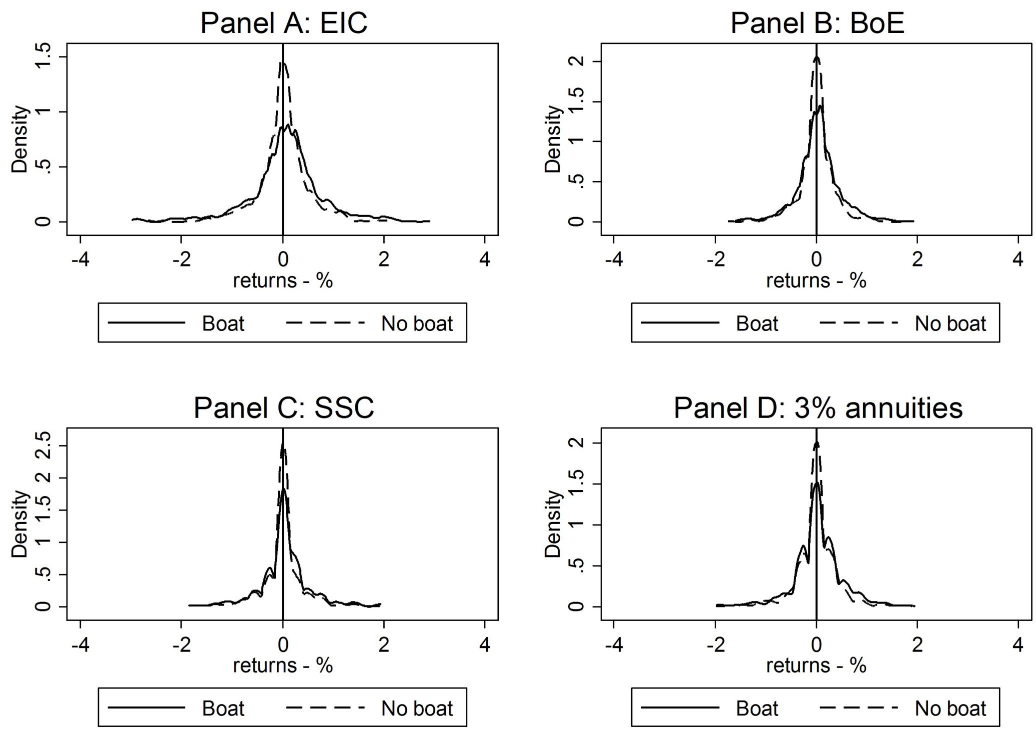

Figure IA.7: Return distributions. The figure plots kernel densities of percentage log returns during periods with and without the arrival of a boat. Kernel = Epanechnikov, bandwidth = 0.07. The X-axis is truncated at -3% and 3%.

VI. Staleness News

Table IA.XI tests whether returns in the absence of boats were more volatile if the most recent news from London was relatively old. This could potentially reflect aversion to ambiguity. The table shows that this is not the case. Average returns did not differ in any significant way either.

Table IA.XI

No-boat Returns and Age of the News

This table studies the properties of the percentage log returns during periods without boats ($\Delta p_{t+d}^{AMS,no-boat}$), depending on how old the most recent news from London is. Old versus recent is defined as follows. For each no-boat observation I subtract the date of the most recent English news shipment from the current date (min.: 5, max.: 21, median: 7 days). Old: $>$ 6 days, Recent: $<$ 7 days. A Brown-Forsythe test is used to determine whether the variance of returns differs between the two cases.

		EIC	SSC	BoE	3% ann.	4% ann.
Mean	Recent	-0.026	0.022	0.018	0.026	0.045
	Old	0.045	0.027	0.017	0.004	0.008
	t-stat	-1.427	-0.117	0.033	0.524	1.007
Variance	Recent	0.273	0.197	0.160	0.171	0.135
	Old	0.283	0.165	0.115	0.209	0.159
	B-F test	0.154	1.048	1.276	0.138	0.337
	(p-value)	0.695	0.307	0.259	0.710	0.562
Obs.	Recent	182	182	182	182	182
	Old	289	298	298	298	298

VII. Inventory Cost Model

Figure IA.8 illustrates the inventory cost model introduced in Section E.2. in the main article. Lag length is on the horizontal axis, autocovariances are on the vertical axis. Panel A presents two examples where $\lambda = 1/2$ and $\rho \in \{1/4, 3/4\}$. Autocovariances are based on Monte Carlo simulations with 10,000 observations (dropping the first 1,000 observations). Panels B to F present the actual covariances in the data for the five different English securities traded in Amsterdam (dotted red line). They also display the implied autocovariances from the stylized model. For each individual security I pick the $\{\lambda, \rho\}$ combination that minimizes the mean squared error between actual and model-implied covariances (using a grid search). The model-implied covariances are again based on Monte-Carlo simulations with 10,000 observations (dropping the first 1,000 observations). For the EIC the mean squared error is minimized with $\lambda = 0$.

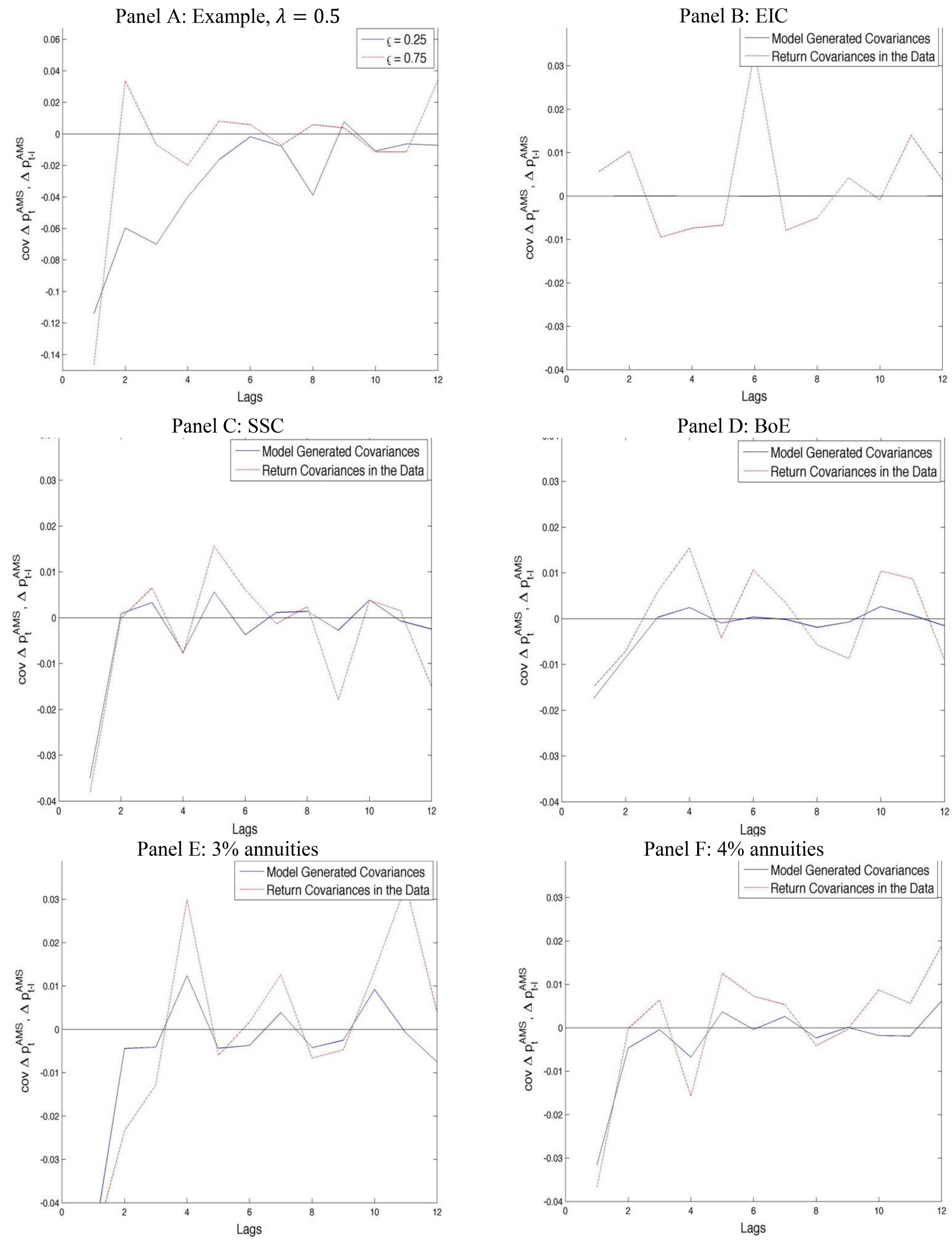

Figure IA.8: Simulations inventory cost model. The panels in this figure display actual and model-implied autocovariances at different lag lengths: $l \in [1, 12]$, where each lag corresponds to two or three days. A lag length of 12 corresponds to four weeks. The model-implied covariances are based on simulated returns where $\Delta p_t = \Delta f_t + \lambda q_t$, $q_t = \{1, -1\}$, with probabilities $\{\pi_t, 1 - \pi_t\}$, where $\pi_t = \min\{\max[1/2 + \rho(f_{t-1} - p_{t-1}), 1], 0\}$, and λ and ρ minimize the mean squared error between the actual and simulated data.

VIII. Identification of Private Information with Correlated Signals

The exposition of the simple variance decomposition in Section D. of the main article assumes that the different private signals observed during a between-boat period (θ_{t+d} with $d \in [0, 7]$) are uncorrelated. In this section of the Internet Appendix I show that the variance decomposition has exactly the same form if signals are correlated.

Consider the simple case of $d = 2$ (results go through for $\dot{d} > 2$). Amsterdam news returns can still be written as

$$\Delta p_t^{AMS,boat} = \widetilde{\eta}_t + \lambda_0 \theta_t + w_t, \tag{IA.3}$$

where

$$\lambda_0 = \frac{\sigma_\varepsilon^2}{\sigma_{\theta_t}^2}. \tag{IA.4}$$

The expression for the subsequent no-boat return changes somewhat to

$$\Delta p_{t+1}^{AMS,no-boat} = \left(\widehat{\lambda}_0 - \lambda_0\right) \theta_t + \widehat{\lambda}_1 \theta_{t+1} + w_{t+1}. \tag{IA.5}$$

The two available signals, θ_t and θ_{t+1}, are given respective weights $\widehat{\lambda}_1$ and $\widehat{\lambda}_2$. These signals are correlated, which means that, compared to the first period, the weight on signal θ_t changes. This is captured by $\left(\widehat{\lambda}_1 - \lambda_1\right)$. Applying the projection theorem, it can be shown that

$$\widehat{\lambda}_0 = \lambda_0 - \widehat{\lambda}_1 \frac{cov(\theta_t, \theta_{t+1})}{\sigma_{\theta_t}^2} \tag{IA.6}$$

$$\widehat{\lambda}_1 = \lambda_1 - \widehat{\lambda}_0 \frac{cov(\theta_t, \theta_{t+1})}{\sigma_{\theta_{t+1}}^2} \tag{IA.7}$$

with

$$\lambda_1 = \frac{\sigma_\varepsilon^2}{\sigma_{\theta_{t+1}}^2}. \tag{IA.8}$$

Similar to Section D. in the main article, the covariances with price changes in London uncover what fraction of the return variance in Amsterdam can be attributed to public and private information. To see this, first note that

$$cov\left(\Delta p_t^{AMS,boat}, \Delta p_{s-1}^{LND}\right) = cov\left(\widetilde{\eta}_t, \eta_t + \varepsilon_t\right) = \sigma_{\widetilde{\eta}}^2 \tag{IA.9}$$

$$cov\left(\Delta p_t^{AMS,boat}, \Delta p_s^{LND}\right) = \lambda_0 \sigma_\varepsilon^2 \tag{IA.10}$$

$$cov\left(\Delta p_{t+1}^{AMS,no-boat}, \Delta p_s^{LND}\right) = \left(\widehat{\lambda}_0 - \lambda_0 + \widehat{\lambda}_1\right) \sigma_\varepsilon^2. \tag{IA.11}$$

Covariance $cov\left(\Delta p_t^{AMS,boat}, \Delta p_{s-1}^{LND}\right)$ simply measures how much of the return variance can be attributed to the arrival of public information $\widetilde{\eta}_t$. The covariance between $\Delta p_t^{AMS,boat}$ and Δp_s^{LND}, and that between $\Delta p_{t+1}^{AMS,no-boat}$ and Δp_s^{LND}, measure the impact of the (noisy) incorporation of private information on the variance of returns.

Expressions (IA.9) to (IA.11) can then be used to decompose the variance of Amsterdam returns into its different components. To see this, plug (IA.4) and (IA.6)-(IA.8) into the expression for $var\left(\Delta p_t^{AMS,boat}\right)$:

$$\begin{aligned} var\left(\Delta p_t^{AMS,boat}\right) &= \sigma_{\widetilde{\eta}}^2 + \lambda_0^2\sigma_{\theta_t}^2 + \sigma_{w_t}^2 \\ &= \underbrace{\sigma_{\widetilde{\eta}}^2}_{cov\left(\Delta p_t^{AMS,boat},\Delta p_{s-1}^{LND}\right)} + \underbrace{\lambda_0\sigma_{\varepsilon}^2}_{cov\left(\Delta p_t^{AMS,boat},\Delta p_s^{LND}\right)} + \sigma_{w_1}^2 \end{aligned} \tag{IA.12}$$

and

$$\begin{aligned} var\left(\Delta p_{t+1}^{AMS,no-boat}\right) &= \left(\widehat{\lambda}_0 - \lambda_0\right)^2\sigma_{\theta_t}^2 + \widehat{\lambda}_1^2\sigma_{\theta_{t+1}}^2 \\ &\quad + 2\left(\widehat{\lambda}_0 - \lambda_0\right)\widehat{\lambda}_1 cov\left(\theta_t, \theta_{t+1}\right) + \sigma_{w_2}^2 \\ &= \underbrace{\left(\widehat{\lambda}_0 - \lambda_0 + \widehat{\lambda}_1\right)\sigma_{\varepsilon}^2}_{cov\left(\Delta p_{t,2}^{AMS},\Delta \widetilde{p}_{t+1}^{LND}\right)} + \sigma_{w_2}^2. \end{aligned} \tag{IA.13}$$

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Notes

[1]There are a few exceptions. If a boat arrived in Hellevoetsluis very early in the morning, it could happen that the information from London was available in Amsterdam on the same day. I use the publication dates of English news in the *Amsterdamsche Courant* and *Rotterdamsche Courant* to identify these cases.

[2]Hope & Co., Amsterdam City Archives 735: 78, 79, 115, and 1510.

[3]The lag length of 5 is standard in the literature. If the AIC or BIC are used to select the optimal number of lags, results are virtually unchanged.

[4]For example, there are rumors from the South Sea bubble in 1720 that Dutch investors chartered their own fishing ships to get the most recent information from London (Smith (1919), Jansen (1946)). Jansen, however, was unable to find any evidence supporting these rumors.

[5]The *Rotterdamsche Couran*t gives some details about conditions at sea during such episodes of bad weather. If the packet boats were unable to sail, no other boats from England arrived in Hellevoetsluis.

[6]Carrier pigeons could only fly limited stretches. The pigeon post connection between London and Paris in the 1840s therefore featured multiple stages of individual pigeon flights. To send a message from London to Amsterdam a single bird flying the whole stretch would not suffice. Rather, an intricate system of carrier pigeon stations would have needed to be in place.

[7]Among other things, pigeons rely on visual landmarks and they can lose their way under foggy conditions. In addition, Dickens indicates that two out of three birds were usually lost in a storm.

[8]The arrival of English news was not uniformly distributed over the week – it was clustered around the weekend. Using both news and no-news observations would therefore bias the results.

[9]Variable τ can be negative, in that case news hasn't left London yet.

[10]Hellevoetsluis was situated in the mouth of several rivers. Ice floating downstream could make it hard to reach the harbor. A dummy for temperatures below three degrees has most explanatory power.

[11]As before, frequent prices observations in London are only available for the EIC, BoE and 3% annuities.