Efficient Markets in the Eighteenth Century? Stock Exchanges in Amsterdam and London

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Early in the seventeenth century, the goldsmiths of London complained about the competition of Dutch and other "aliens and strangers....[who] make and sell many deceitful jewels, pearls, counterfeit stones and other goldsmiths wares of gold and silver" [13, p. 6]. These early incursions of the Dutch were no doubt related to the increasingly frequent practice of the late Tudors and early Stuarts of financing their wars by pawning the Crown Jewels in Holland. But the importance of the Dutch in English public finance was only institutionalized in 1689 as William III began to apply to his new domain the same techniques for raising credit that he had employed as Stadtholder in the Netherlands. William needed every resource he could muster to continue his War of the Grand Alliance against Louis XIV. Daniel Defoe is credited with authoring a piece of doggerel lamenting the preeminence of Dutch counsel in William's affairs of state:

> We blame the King that he relies too much
> On Strangers, Germans, Huguenots, and Dutch
> And seldom does his just affairs of State
> To English Councillors communicate.
> [13, p. 17]

The most noteworthy example was the founding of the Bank of England in 1694 under the Tunnage Act of that year. Under the terms of this Act, commissioners were appointed to accept subscriptions from "any person or persons, natives or foreigners, bodies politic or corporate," and the subscribers were to be incorporated under the title of "Governor and Company of the Bank of England" [16, pp. 204-05].

From the issue of its General Stock in 1657, the English East India Company had been willing to accept foreign ownership of its stock. However, its unwillingness to enlarge its stock

issue during the first decade of William's rule led directly to the formation of the competing New English East India Company. The right of foreigners to hold stock in the United East India Company (formed in 1702) was confirmed in 1730 when an attempt was made to block the sale of certain shares belonging to the leading banking house of Amsterdam, Andrew Pels. The company immediately pointed out "the damage that may arise to the Discredit of the Company's stock if the proprietors should be hindered transferring the same...especially as to merchants abroad who lend money on the credit of it" [3, p. 446].

In the original subscription lists for the South Sea Company, founded in 1711, out of the 200 names of private individuals entered, 37 were Dutchmen, Italians, or Jews [2, p. 57]. Much of the speculative fever that started the rise in South Sea stock in the ill-fated year of 1720 has been attributed to the strong interest shown in Amsterdam. A contemporary satire on the Bubble in the Netherlands described the scene in the French Coffee House in Kalver-straat:

> It was so full that there was no room to stand --
> What with shrieking of English and all kinds of croakers
> I was deafened by the lies of the Jews and the Brokers.
> [21, p. 103]

To summarize, all three of the great joint-stock companies whose shares were to constitute the first part of the perpetual debt of the British government (compare [7]), and which were to continue throughout the eighteenth century as the major part of "the Funds," had important elements of ownership by foreigners, especially the Dutch. These shares were, for all concerned, liquid assets due to the existence of an active resale market for them. I argue in this paper that the Amsterdam Beurs played an especially important role in sustaining the liquidity of these assets, specifically, by concentrating in futures and options while the London Exchange focused on spot deliveries of transfer deeds.

The first treatise on speculation, futures contracts, hedging, "bulls," "bears," options for puts and refuses -- in short, all the paraphernalia of viable markets in contingent claims, is Joseph de la Vega's Confusion de Confusiones published in Amsterdam in the year 1688 [19]. This work, written in Spanish and only translated into Dutch in 1939 and into English in 1957, was clearly intended for the edification of the Jewish community of Amsterdam, largely Portuguese, who had become active in trading shares of the Dutch East India Company after 1650 [20, p. 22]. De la Vega ascribed the rise of

an active, well-organized stock market in Amsterdam to the nature of the Dutch East India Company. With its capital of nearly 6.5 million florins divided into transferable shares of 3,000 florins each and with dividends which averaged 22.5 percent annually on the original share capital for the next 120 years [15, p. 400] the VOC provided continued opportunities for profit taking by shareholders.

References in the secondary literature to the financial innovations brought into England by the Dutch financiers and advisors who flocked into London with William of Orange after the Glorious Revolution of 1688 all seem to derive from the remarkable description of London's stock market by John Houghton in 1694 [8]. Houghton, a Fellow of the Royal Society, determined to bridge the gap between pure science and applied technology in all fields of human endeavor in a weekly series of pamphlets entitled, "A Collection for Improvement of Husbandry and Trade," which began to appear in 1691. Between a series on wheat and another on cattle, Houghton decided to relax by describing the techniques of trading shares in joint-stock companies in the coffeehouses of Exchange Alley. His description of "refuses" is a model of clarity and merits reproduction.

> ...when India shares are at seventy-five, some will give three guineas a share, action, a hundred pound, down for refuse at seventy-five, any time within three months, by which means the acceptor of the guineas, if they be not called for in that time, has his share in his own hand for his security and the three guineas....so in plain English, one gives three guineas for all the profits if they should rise, the other for three guineas runs the hazard of all the loss if they should fall. [8, p. 264]

Houghton appended copies of a "Course of the Exchange" (22 May 1694) sheet showing prices of shares for a large number of joint-stock companies as well as exchange rates on various European cities and prices of gold in various forms. W. R. Scott, in his definitive Constitution and Finance....of Joint-Stock Companies [18], reproduces one of these lists, but he states that Houghton's venture lapsed after a few issues. In fact, it does not appear that Houghton ever intended to issue a stock list on a regular basis, but rather simply reproduced one of those currently in use in Exchange Alley.

We now have, thanks to the joint efforts of the British Library and the Goldsmiths' Library, a microfilmed version of the "Course of the Exchange" which began to appear in January

1698 and was produced by John Castaing [4], broker at Jonathan's Coffee House. Castaing's "Course of the Exchange" was issued twice weekly, on Tuesdays and Fridays (see Facsimile). It appeared faithfully under a succession of publishers throughout the eighteenth century and into the second decade of the nineteenth century when, published by Wetenhall, it was transformed into the official price list of the London Stock Exchange. More remarkable than the regularity of its publication, perhaps, is the constancy of its format. On a single sheet, 3 1/2 - 5 1/2 by 12 inches, a single column gave exchange rates on various European cities, always starting with Amsterdam and ending with Dublin; then followed prices for gold and silver in various forms, the price of cochineal, and later in the century prices of various grains. Directly below were three columns, one for each of the last three days, containing the prices of the major securities traded. These were always headed by the Bank of England, the East India Company and, after 1711, the South Sea Company shares. At the bottom were generally notes on the dates when transfer books would be opened for the various companies and dividends paid.

The constancy of the form argues that it began already perfected; indeed, it is very similar to Houghton's exemplars of 1694. The top half of the "Course of the Exchange" was most likely to give brokers and jobbers, as well as any potential customers for securities, the conversion rates for the various means of payment which were likely to be proffered in the daily course of business. The preeminence of Amsterdam (and Rotterdam) argues for the greater volume of business on the London market emanating from the Dutch than from any other foreign source. The means of payment actually offered in the London stock exchange would, of course, have been bills of exchange on merchants in the leading ports of Europe. Given the continued importance of Amsterdam as a trading center throughout the eighteenth century, the bills of exchange on Amsterdam offered for payment in Exchange Alley could have been as easily for the account of English merchants as well as of Dutch merchants or any other customers.

It is remarkable that no comparable stock list exists for the Amsterdam Beurs until 1795. The earliest example of a stock list known to date is dated 25 September 1720. It is a printed form 4 3/4 inches by 8 1/2 inches which lists the names of three classes of securities--"Options," "Shares," and "Domestic Shares." The right-hand column for the price was left blank to be filled in by hand. The most recent historian of the Amsterdam Stock Exchange argues that formal or even printed stock lists were deliberately avoided by the stockbrokers in

Amsterdam on the principle that without documentary evidence on their activities they could not be regulated by the city authorities [20, p. ii]. But it is not clear that the London stockbrokers were put under more onerous regulations during the eighteenth century than were the Amsterdam brokers, with the exception of Barnard's Act in 1733 (to be discussed later). Indeed, Thomas Mortimer in his Every Man His Own Broker [11] in the latter eighteenth century argued that the regularly published stock lists in London undermined the monopoly which otherwise would be exercised by the brokers on transactions of shares. Printed lists therefore forestalled any need for formal regulation rather than facilitated it.

A more persuasive reason for the absence of printed lists in Amsterdam may derive from the much greater importance of Jewish stockbrokers in the Amsterdam than in London. In 1739, 22 of the 32 stockbrokers listed in Amsterdam are Jewish. In 1764 another publication showed 36 or 37 of the 41 brokers listed to be Jewish. Despite Sombart's emphasis on allusions to the presence of "Hebrews" in Exchange Alley which were found in contemporary pamphlets, most notably "Anatomy of Exchange Alley" by Daniel Defoe, the relative importance of Jews in London was much less. The most dramatic evidence of this is that no quotations are ever given in the Course of the Exchange for Sunday while Saturday was always listed as a day of business in the Tuesday edition.

In the Amsterdamsche Courant, (discussed later), however, quotations were often given on Sundays but never on Saturday, the Jewish Sabbath. The Jew's specific fear of unfriendly litigation in Amsterdam rather than opportunistic stockbrokers' and jobbers' more general fear of government regulation may therefore explain the absence of regular, printed stock price lists in Amsterdam until the effects of the French Revolution were felt in 1795 (imposed by military occupation). It may be that we will have to search Jewish archival records for Amsterdam rather than official ones to unearth the printed equivalents of Castaing's Course of the Exchange.

Such figures as we now possess for the Amsterdam Beurs were given by J. G. Van Dillen, in his 1931 article in the Netherlands' Economic History Yearbook [6]. Van Dillen explained at the outset that his data were taken from the Amsterdamsche Courant which only appeared fortnightly. Before 1723 it carried no price quotations from the Beurs whatsoever. Van Dillen's series covered not only the quotations on shares for the three great English companies but also for the two great Dutch companies, the East Indies Company and the West Indies Company. At the time he presented the figures, Van Dillen was

not aware of the existence of an even superior source for quotations on the London Exchange, so he believed these figures were most useful for comparing the course of the two competing East Indies Companies -- the Dutch and the English.

Charles Wilson, in his classic study of Anglo-Dutch finance [21], referred frequently to the Van Dillen article but made no systematic use of the evidence embodied there. Nor was Wilson aware of similar figures being available for the London Exchange. Wilson's study is invaluable, however, for the detailed description of how Dutch rentiers were able to buy and sell in the London market as well as in the Amsterdam market. In the first decade of the eighteenth century, Wilson argues, a system arose for fully developed speculation by capitalists on both exchanges. Capitalists operating in the Amsterdam Beurs could take positions in the London Exchange through the mediation of permanent corresponding attorneys. Since the three great companies required that ownership of their stock be inscribed at dividend dates in their books,

> an Amsterdam merchant had to have a permanent agent in London who was legally accredited to negotiate his transfers and investments and who kept him informed on points of economic or political importance.... The London attorney was appointed by a procuration (or a letter of attorney) signed by the fundholder and witnessed by a notary public in Amsterdam, a copy of which was sent to London for presentation (together with the transfer deed) by the attorney in any transactions of inscribed stock [21, pp. 95-98].

We have then, the possibility of comparing directly the prices of the same security, namely shares of the English East India Company, of the Bank of England, or the South Sea Company, as quoted in two active, separate, but closely linked markets -- Amsterdam and London. The definitive source is the English price series which contains well over 30,000 observations. We may well be grateful to Van Dillen [6] for limiting our number of observations to the years 1723-1794 and confining our quotations to once fortnightly rather than daily. The end total became only 1,676 observations. By comparing the Amsterdam prices with those the same day in London we have the possibility of determining the special features of each market as well as the movements in common. We are fortunate that the years 1723-1794 are not disturbed by any major disruptions that would permanently alter the state of financial markets in the two centers. Rather, our data cover a period in which financial leadership shifted from one center to the other while punctuated

by three serious wars (the War of Austrian Succession, the Seven Years War, and the War of American Independence) and several market disturbances, two of which can be classified as panics (1763 and 1772-73).

Let us begin with some crude measures of the closeness of price movements between the two markets and gradually extend the analysis. Table 1 presents some summary totals that are useful for analyzing the overall period. The striking thing revealed in even this crude analysis of the data is the persistently higher price prevailing in Amsterdam for each of the three major stocks. This is very strange since dividends on each stock were paid only in London and commission, brokerage, and transportation expenses to return Dutch investors' dividends to them in Amsterdam or to insure that they were reinvested properly had to be higher than those for London investors. While I have argued previously that what we have here is a rare example of the same good being traded at the same time in two physically distinct markets, the encumbrances upon dividend payments meant a stock could not be the same in Amsterdam as in London. One can argue how much the difference might have been -- the average Dutch investors were no doubt larger than the average British investors and consequently enjoyed lower brokerage and commission fees. The costs and time delay of swift sloops from London to Amsterdam might be less than overland transport to North Wales or Cornwall. The fact remains that to equalize rates of return on the stocks between the two financial markets would seem to require lower prices on them in Amsterdam, even if only a small amount lower. We certainly should not expect higher prices.

There are two hypotheses I can put forward to resolve this paradox. The first hypothesis is that the two markets were separated more from each other than from markets for alternative domestic securities within each country. According to this hypothesis, the Dutch may have found it more difficult to switch from investments in English securities on the Amsterdam Beurs to the same securities in Exchange Alley than to switch to provincial and city bonds issued in the Netherlands or to Dutch East India Company Stock. Since the rate of return on alternative domestic securities was generally lower in Amsterdam throughout the eighteenth century than in London, the same securities would have to command a higher return in London than in Amsterdam. On average then, and probably more so early in the eighteenth century than later, the prices of stocks would tend to be higher in Amsterdam than in London.

The second hypothesis is that the securities traded in the two markets were not, in fact, the same. While the London

market dealt with both "spot" transactions and futures, the prices published by Castaing and his successors were spot prices. A variety of futures contracts were possible, depending upon which of the next three rescounter dates one wished to deal in. Moreover, a variety of Acts of Parliament, especially John Barnard's Act of 1733 which became law the following year, attempted to check speculation by forbidding trade in futures, options, or both. It is very doubtful these acts were effective (new bills were introduced in the House of Commons in 1745, 1756, 1771, and 1773 although none became law). Nevertheless, Barnard's Act made it a legal offense, punishable by a stiff fine on both the principals in the transaction and the broker, to deal in options -- so that no one would be disposed to give information to the Course of the Exchange that could be used as evidence of illegal dealings. In the Amsterdam Beurs, most of the business, especially in English funds, was in futures and options. It is not clear whether our prices taken from the Amsterdamsche Courant are spot or future prices. As Van Dillen says:

> The question whether the figures in the table show the cash price or the forward rate is complicated. Until 1747 this is not mentioned, but in comparing them with those found in brokers' notes preserved from 1725 to 1737 it appears that in that period the quotations are cash prices. In the year 1737 both prices are sometimes mentioned. After this year we find generally the forward rates. From 1759 onwards the quotations are often followed by the name of the next pay month, e.g., "all of February." The difference between the cash price and the next paying month is, however, not more than a few percent. [6, p. 13]

What direction should this difference be? Louis Bachelier, whose doctoral dissertation, "La Theorie de la Speculation" in 1900 [1], is now taken as the founding work in the use of modern probability theory for analyzing the movement of stock market prices, presents a simple graph (Chart 1) that illustrates elegantly the relationship of spot and futures prices. At regular intervals, dividends are paid on each of our securities. If nothing else happens to disturb the price of the shares from time 0 to time A, the nominal value of the share will be fixed until the dividend is paid, at which time the value rises abruptly. Spot transactions in the shares between time 0 and time A will take into account, however, the sure payment of the dividend at time A, and these prices will show a gradually

upward trend as the dividend date approaches. The line OB then shows the predicted course of spot prices over the time interval OA. A futures contract made at time 0 for delivery of the same stock at time A, however, will require payment of a "contango." The buyer will receive the dividend when delivery is made, but at time 0 he must give up the contango. If the contango rate is the same as the dividend rate (OC=AB) then the equivalent rate for the futures contract runs along the line CB, gradually converging to the spot price as the time remaining on the futures contract approaches zero. Most often we should expect the contango rate to lie below the dividend rate, but it will almost always be positive so that the futures price will lie above the spot price. (The exception, which becomes important when examining some of the panics that occurred, is when "backwardation" occurs and the contango rate becomes negative.)

This exposition by Bachelier explains why the Amsterdam series should generally lie above the London series if, as hypothesis 2 maintains, the Amsterdam prices are for future delivery while the London prices are for spot delivery. On this hypothesis, the Amsterdam prices should be very close to the London prices until Barnard's Act in 1734 or 1737 when Barnard's Act was made a perpetual law. Afterwards, Amsterdam prices should rise above London prices and remain there.

Table 2 shows the results of comparing Amsterdam and London prices for the two sub-periods, August 1723 to December 1737 and January 1738 to December 1794. It is clear without any formal statistical testing that the chances were equal for Amsterdam prices to be above London prices as for London prices to be above Amsterdam prices during the period 1723 to 1737 as a whole. This means, as Panel B in Table 2 demonstrates, that the tendency for Amsterdam prices to be above London prices is concentrated entirely in the period after 1737. The evidence is clear that our first hypothesis fails to explain the facts while the second hypothesis is borne out, but only for the period after 1737. This evidence also bolsters Van Dillen's conjecture that the Amsterdamsche Courant prices were futures prices after that date. It means, however, that Thomas Mortimer [11] was wrong when he said that the futures market in the London Stock Exchange had not been affected by the Act of 1733. He had also observed that,

> some tradesmen or rather merchants of great eminence have occasionally given a terrible blow to stock-jobbing by refusing to pay the loss on their jobbing accounts, artfully pleading the act against jobbing.... A few more instances of this kind will answer the end of extirpating the

> infamous practice, more effectively than twenty acts of Parliament [10, p. 63].

Lack of legal recourse in case of default meant that really serious speculation was confined to the Amsterdam market.

What were the consequences of this? Visual evidence is presented in Charts 2-7. These show for ten-year periods the first differences of natural logarithms of stock prices for Bank of England stock and East India Company Stock, comparing these in the Amsterdam and London markets. The first ten-year span is January 1724 through December 1733. For both the Bank of England and the East India Company, we can make two observations. First, their share prices compared well to a "random walk" model of price behavior. Such a model generates a time series whose first-differenced logarithms look like "white noise" -- a zero mean with scattered extreme movements with no regularity in periodicity or any tendency to increase or decrease amplitude. Second, the extreme values appear to be sometimes in the Amsterdam market, sometimes in the London market.

The second ten-year interval is January 1784 through December 1793. Again we see the basic elements of white noise in both markets but with considerably more fluctuation. The truly extreme values again tend to be in the London market.

Much more work on the quantitative analysis of the interaction of the two markets and the interplay of spot and future prices can and should be done. Gold and silver prices in the two centers, reflecting monetary disturbances, short-term interest rates in each center, and the spot and usance exchange rates of London on Amsterdam can be brought explicitly into the analysis of the period as a whole and of specific incidents.

However, enough has perhaps been presented already to make us appreciate the justice of Isaac de Pinto's comments in 1781 when he argued,

> There are a large number of pecunious men, as many in England as in Holland, who do not wish to commit definitively their money in new securities in order not to run risks during wartime. But what do they do? They buy up even so 10, 15, or 20 thousand pounds sterling in annuities, that they sell at term to speculators, by means of which they draw a huge interest on their money, without being subject to fluctuations, which are taken by the speculators. This practice has gone on for years and has been done for millions. It's thanks to this that the Government of England has been able to make such large borrowings. [14]

And, as a consequence, he concluded, England was able to win all its wars.

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TABLE 1

FREQUENCY OF PRICE DIFFERENTIALS IN THE FUNDS BETWEEN AMSTERDAM AND LONDON, 1723-1794

	(L-A)>3	3>L-A>1	1>L-A>0	A=L	0<A-L<1	1<A-L<3	(A-L)>3
Bank of England	27	151	246	95	388	507	262
		Σ = 424				Σ = 1157	
East India Company	96	211	175	68	222	418	486
		Σ = 482				Σ = 1126	
South Sea Company	32	148	263	94	419	559	161
		Σ = 443				Σ = 1139	

TABLE 2

COMPARISON OF AMSTERDAM AND LONDON SECURITY PRICES FOR THE SUB-PERIODS 1723-1737 AND 1738-1794

Panel A. 1723-1737

L-A>3	3>(L-A)>1	1>(L-A)>0	A=L	0<(A-L)<1	1<(A-L)<3	A-L>3
Bank of England						
15	72	63	29	66	60	43
	Total = 150				Total = 169	
East India Company						
44	88	47	19	36	45	69
	Total = 179				Total = 150	
South Sea Company						
17	59	82	14	92	51	33
	Total = 158				Total = 176	

Panel B. 1738-1794

Bank of England						
12	79	183	66	322	447	219
	Total = 274				Total = 988	
East India Company						
52	123	128	49	186	373	417
	Total = 303				Total = 976	
South Sea Company						
15	89	181	80	327	508	128
	Total = 285				Total = 963	

The Courſe of the EXCHANGE, &c.

London, Friday the 29th of *July*, 1720.

Amſterdam	34 1 a 2	Rotterdam	34 3 a 4
Antwerp	34 8	Hamburgh	33 9 a 8
Paris	11 ¼ a 10 ½	Bourdeaux	11 ¼ a 10 ½
Cadiz	50 ¼ a ½	Madrid	48 ¼ a ½
Bilboa	47 ½ a 48	Leghorn	52 ½
Genoua	55	Venice	48 ½
Lisbon	5 5 ¼	Porto	5 3 ¼ a 4

Dublin — 15 a 14 ½

Colch. Cr. Bays 16 *d. per Ell.* —— } Dit. 6 Seals 14 *d.* dit. —— and 20 *s. per Piece.* }

Gold in Bars 4*l.* 01*s.* 0*d. per Oz.* Dit. in Coyn 4*l.* 1*s.* 0*d.*

Pcs of Eight 5 *s.* 6 ½*d.* Silver in Bars Stand. 5*s.* 6½*d.*

Divides *per C.*		*Wedneſday*,	*Thurſday*,	*Friday*
7	Bank Stock	239 a ½	236	233 a 34
10	Eaſt India	370 a 75	370	370 a 65
10	*SOUTH-SEA*	860	860	850
20	Mill. Bank	425	425	425
	African —	138 a 41	139 a 40	140 a 38
	Dit. *New Sub.*	119 a 21	117 a 20	120 a 18
½	*Roy. Exc.* Aſſ.	156	155	154
½	*Lond.* Aſſur.	82	80	81

Note, *South Sea* ſells as above without the Dividend.

10*l.* PRIZES —— at 4 *per Ct.* Præ.

Bank Annuit. Lott. Annuit. & 4 *per Cts.* Subſcrib'd into *South-Sea* Stock, are at 125 a 28 *per Cent.*

N.B. July 14th, The *Bank* lends Money on their Stock at 4 *per Ct.* Intereſt from this Day.

Intereſt *per C.* ——		*Bonds*: Viz.		
5	India ——	42 *s.*	43 *s.*	43 *s.* Præ.
4	South ſea--	2 *s.*	3 *s.*	5 *s.*

Int. 4 *per C. Lott.* 1713, *Civ. Liſt for* 32 *Ye.* at 4 *per Ct.* Præ.

Ditto is Paid to N°. 74 incluſive, in the 6th Courſe.

Lottery 1714, *Courſes for* 32 *Years.*

1714 Blanks 5 *per C.* 5 ½ *per C.* Præ. — 1714 Prizes 4 *per C.* At 4 *per C.* Præ.

Ditto are Paid to N°. 28, in the 14th Courſe.

LONG ANNUITIES, all at 35 Years Purch.

Dit. 9 *per Ct. An.* 1710, at 17

Sou. Sea	1ſt Subſcr.	at 300*l.* paid in 90*l.*	at 615 a 10	
	2d Subſcr.	at 400	40	550 a 40
	3d Subſcr.	at 1000	100	270 a 60 Præ.

The Time of Payment into the Subſcriptions.

1ſt Subſcrip.			2d Subſcrip.			3d Subſcrip.		
April,	1720,	60	*April*,	1720,	40	*June*	1720,	100
June,		30	*Sept.*		40	*December*		100
Auguſt,		30	*Janu.*		40	*June*	1721,	100
Octob.		30	*May*,	1721,	40	*December*		100
Decem.		30	*Sept.*		40	*June*	1722,	100
Febru.		30	*Decem.*		40	*December*		100
April,	1721,	30	*March*,		40	*June*	1723,	100
June,		30	*June*,	1722,	40	*December*		100
Auguſt,		30	*Sept.*		40	*June*	1724,	100
			Decem.		40	*December*		100
		300			400			1000

Chart 1
Equivalent Prices of Spot and Future Deliveries

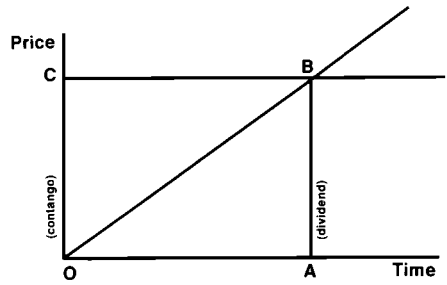
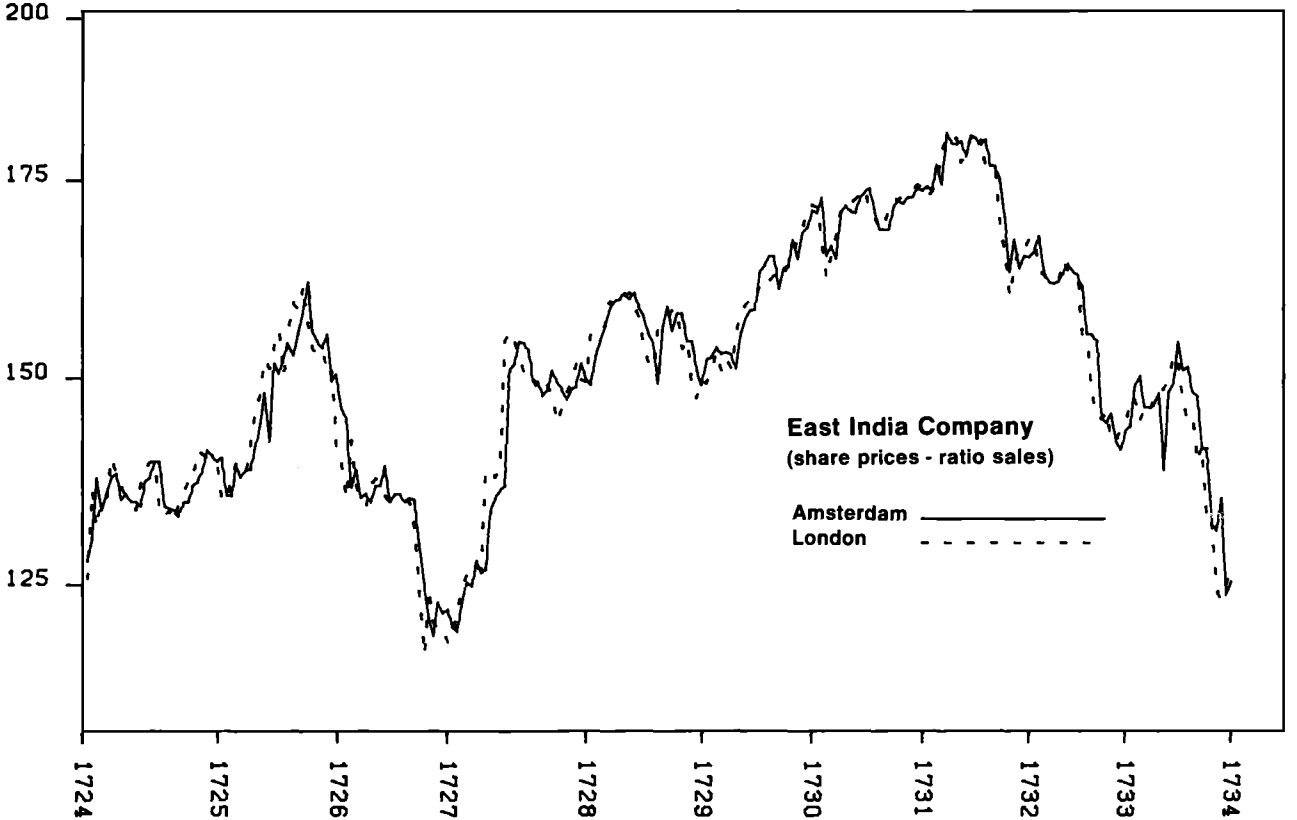


Chart 2


200
175
150
125
East India Company
(share prices - ratio sales)
Amsterdam
London
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734

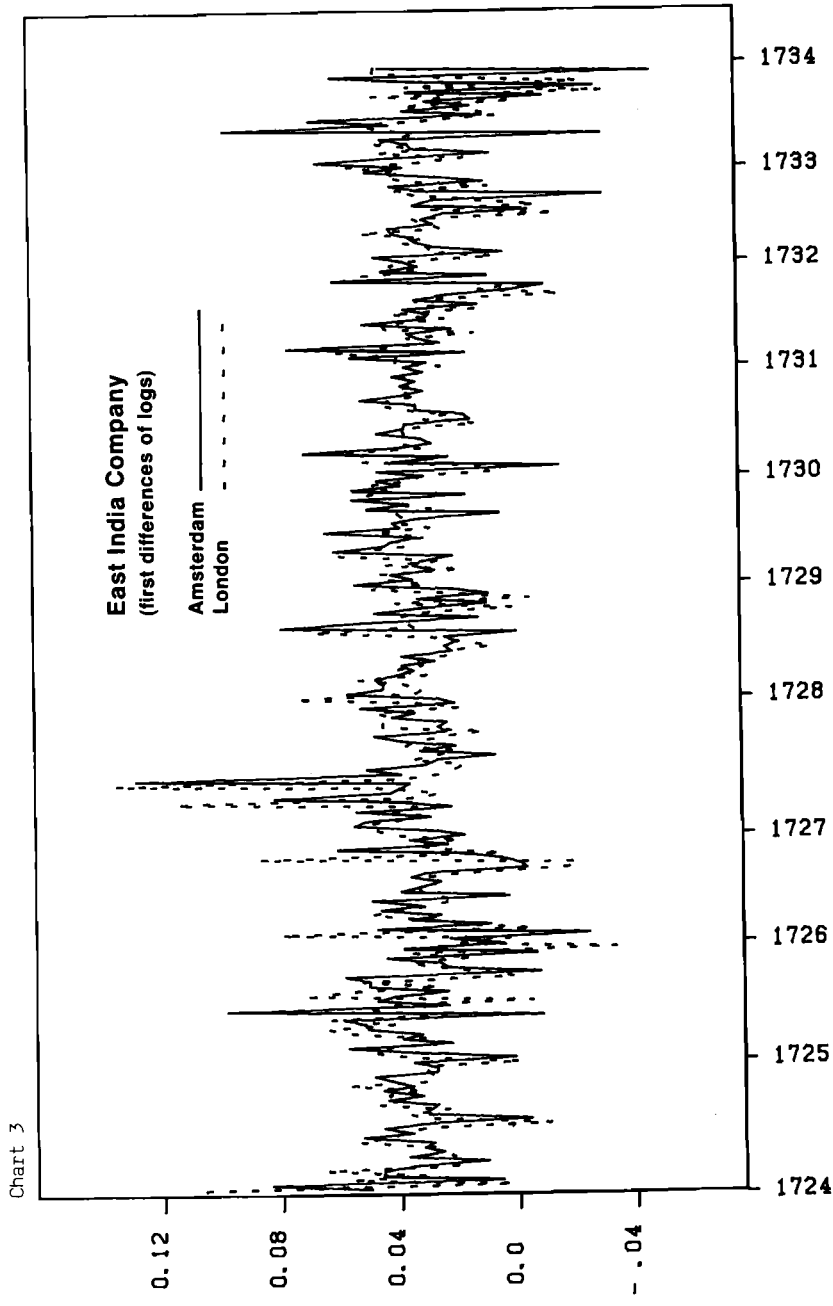
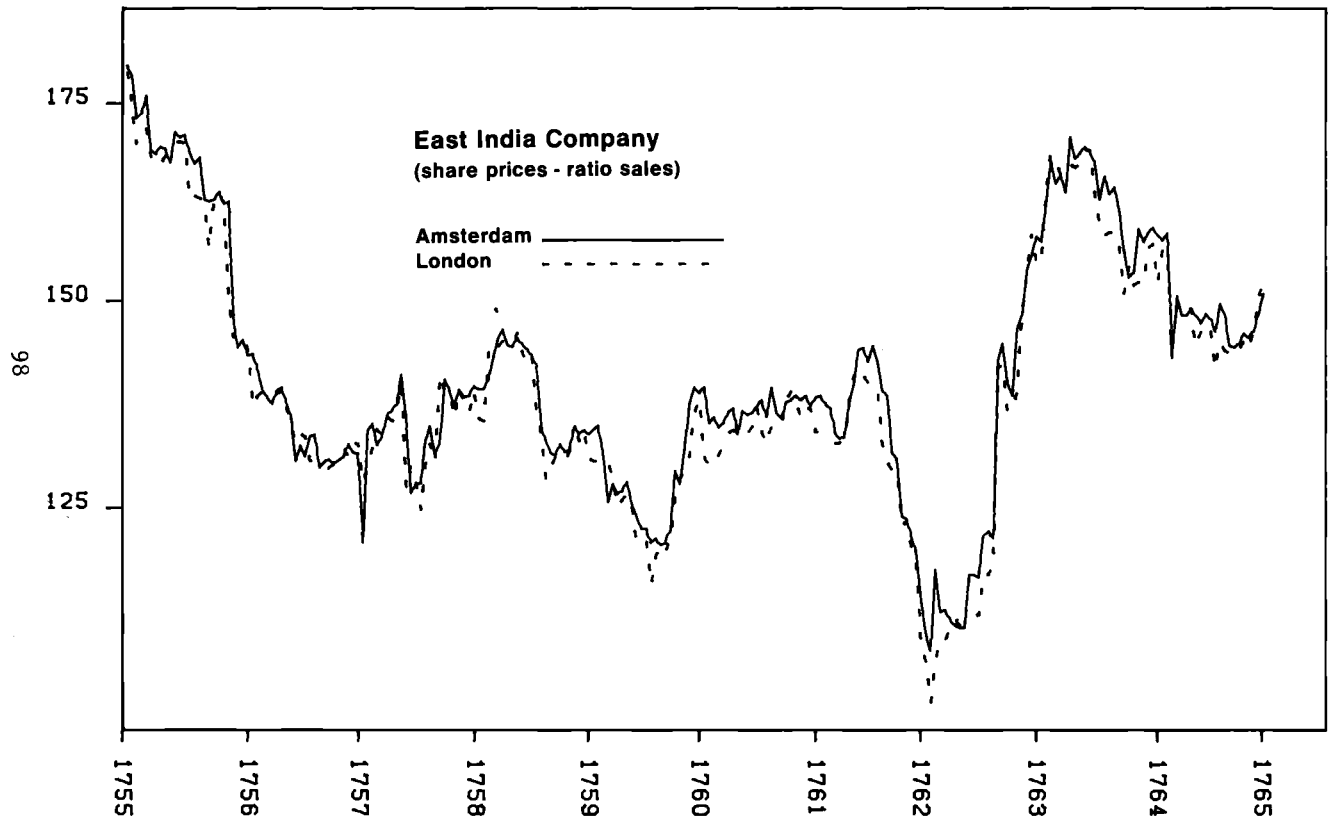

East India Company
(first differences of logs)
Amsterdam
London
1734
1733
1732
1731
1730
1729
1728
1727
1726
1725
1724
0.12
0.08
0.04
0.0
-.04

Chart 3

Chart 4


East India Company
(share prices - ratio sales)
Amsterdam
London
175
150
125
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765

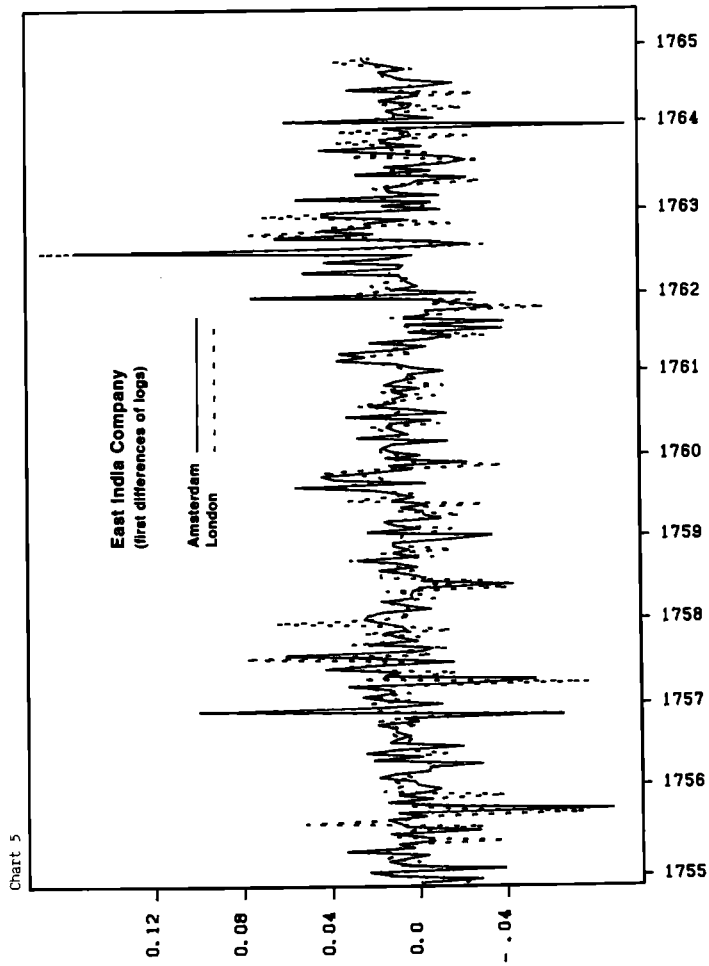
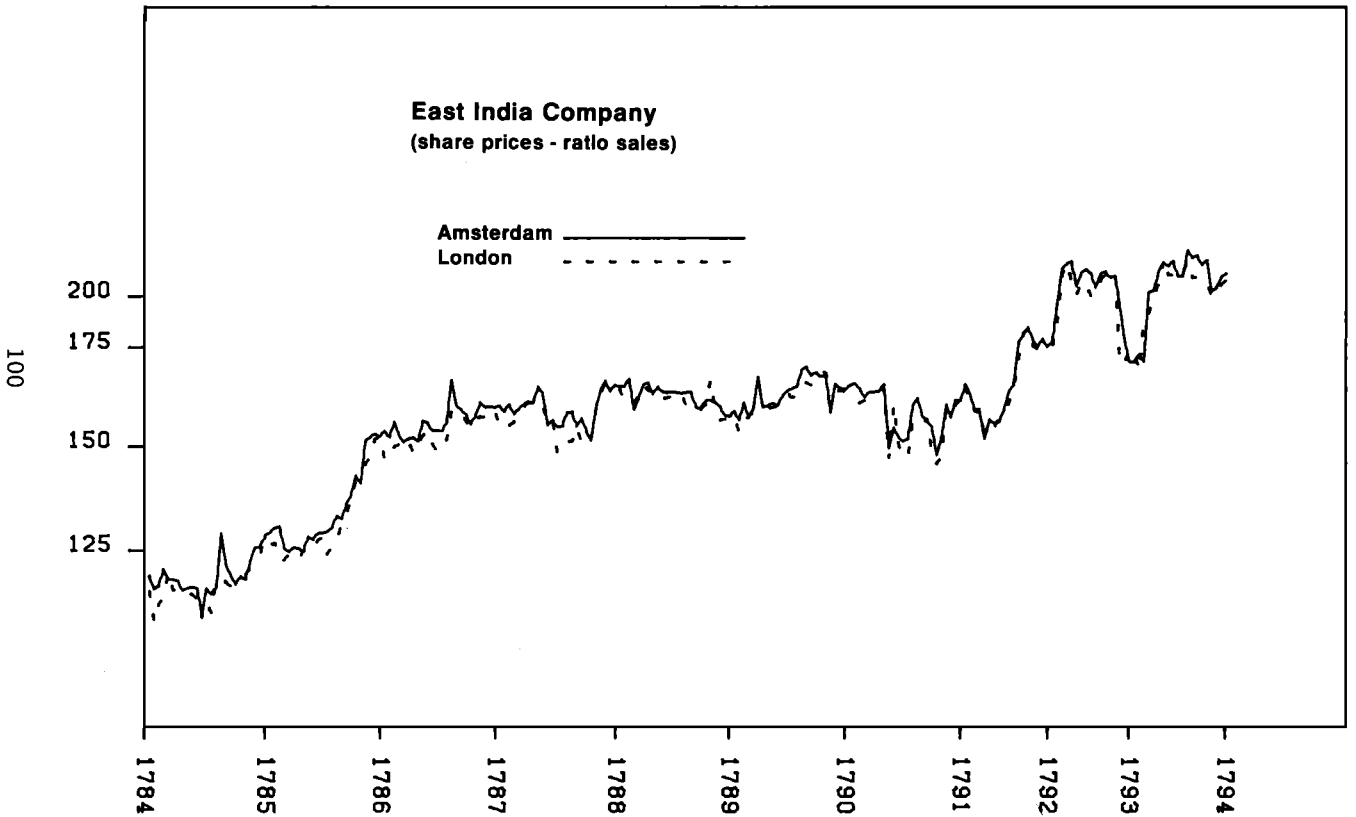

East India Company
(first differences of logs)
Amsterdam
London
Chart 5
1765
1764
1763
1762
1761
1760
1759
1758
1757
1756
1755
0.12
0.08
0.04
0.0
-.04

Chart 6


East India Company
(share prices - ratio sales)
Amsterdam
London
200
175
150
125
100
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794

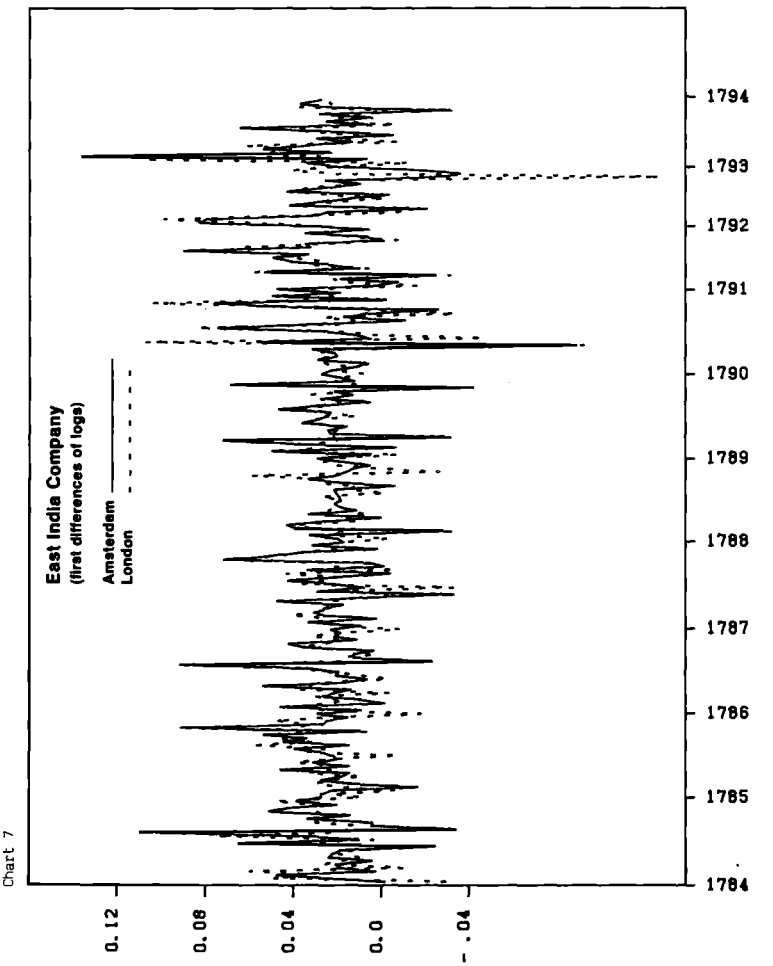


Chart 7
East India Company
(first differences of logs)
Amsterdam
London
0.12
0.08
0.04
0.0
-.04
1794
1793
1792
1791
1790
1789
1788
1787
1786
1785
1784