

Integration of Trans-Atlantic Capital Markets, 1790–1845[★]

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Abstract. During the 1790s, European investors began to purchase substantial quantities of US government and corporate securities. A number of these securities were traded in markets on both sides of the Atlantic. Based on market price quotations we compiled for the same securities in London and New York markets, we ask if these early trans-Atlantic securities markets were integrated, and, if so, when they became integrated. We find little evidence of market integration before 1816, and substantial evidence of it thereafter. Financial globalization – the convergence of financial asset prices in markets on different continents – began earlier than most have suspected.

1. Introduction

Heralding the arrival of what many now call the first age of financial globalization, 1870–1914, Bagehot in *Lombard Street* (1873) noted that it was “sometimes said that any foreign country can borrow in Lombard Street at a price: some countries can borrow much cheaper than others; but all, it is said, can have some money if they choose to pay enough for it”. “Perhaps this is an exaggeration”, he conceded, “but confined, as of course it was meant to be, to civilised Governments, it is not much of an exaggeration. There are very few civilised Governments that could not borrow considerable sums of us if they choose, and most of them seem more and more likely to choose”. The following year, in *The Theory of Stock Exchange Speculation*, Crump (1874, p. 409) made a similar point, arguing that there were “few countries whose names are still withheld from Wetenhall’s list [a periodical that tracked the stock market], among which China may be mentioned, but they are few”. Just three years later, even China would borrow in London.

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Those and numerous similar claims made in the latter half of the nineteenth century have led scholars to believe that international financial integration did not make much headway in the first half of that economically crucial century. The first Latin American debt crisis (1822–1825), which ended disastrously for Britain, reinforces their conviction (Dawson 1990), as do the facts that the telegraph diffused only after 1850, and the trans-Atlantic telegraphic cable was not successfully completed until the 1860s. So it is not unusual to find scholars such as Ferguson (2001, pp. 283–288) alluding to “the paradox of convergence, 1870–1914”, by which he meant that a convergence of international bond yields in the period demonstrated “a gradual process of financial integration” that appeared to ignore the growingly visible risks of war among the great powers of Europe. Neal (1990, pp. 229–230), in work that conclusively demonstrated financial integration of the eighteenth-century Amsterdam and London securities markets, similarly argued that integration broke down in the Napoleonic War era and that integration of the London and Paris markets did not occur until after the telecommunications revolution of the second half of the nineteenth century. And Obstfeld and Taylor (2003, p. 124) observed that most studies of “international capital mobility” discuss the “post-1870” era, which they and others term the first age of financial globalization.

In this paper we argue that financial globalization commenced at least a half century before 1870–1914.¹ As part of a larger project investigating the emergence and development of US securities markets, we gathered information on the prices of several American securities that traded in both US and British markets after 1790. The analysis presented here of the new data on prices in London and New York along with information travel times between those two places suggests that trans-Atlantic financial market integration was underway well before 1850. Getting the timing of globalization right is important for financial history, but it takes on added importance given the scholarly scrutiny of the latest wave of international financial market integration and crises among the financial centers of the core and those of the emerging periphery (Edwards, 2000; Lamfalussy, 2000). The USA is now part of the core, but in the period analyzed here it was an emerging market (Sylla 1999). There is therefore much to learn from its experience.

2. The US Emerging Market and International Financial Market Integration, 1790–1845

Loans from the French and Spanish monarchies as well as from Dutch private investors helped Americans finance the War of Independence from Great Britain that lasted from 1775 to 1783. In 1789, Americans owed to foreigners about 29

¹ Financial globalization is a larger concept than international financial integration. Neal (1990) demonstrated that the latter occurred in the eighteenth century between the markets of Amsterdam and London, which are separated by about 230 miles in Western Europe. In contrast, the London and New York markets we study here are situated on different continents and separated by roughly 3,500 miles. Financial globalization implies intercontinental financial integration.

percent of a US nominal national debt of \$54.1 million, excluding state debts assumed by the new government a year later (Wilkins, 1989). That debt included \$11.7 million of direct loans to the USA (including interest arrears, since the debt was essentially unserviced), as well as about \$4 million of domestic US securities that had been purchased by foreign private investors at prices well below nominal par value. Foreign investors were speculating on a rise in security prices if the new country could put its finances in order. They would not be disappointed.

Those initial investments in US securities were merely the beginning of what would be a continuing interest of foreign investors. Financial reforms of the early 1790s gave the new republic a modern financial system – rare amongst the world's nations at the time – and quickly converted what formerly had been the equivalent of junk bonds in default into high-grade securities. Attracted by higher returns on American securities than what they were accustomed to at home, foreign investors bought more and more of them. In 1803, the USA financed most of the Louisiana Purchase, which doubled the size of the country, by issuing new US debt securities to France, which with the help of European bankers sold the securities to European private investors. During the quarter century after 1817, when New York began construction of its cross-state Erie Canal, European investors purchased large amounts of state bonds issued to finance state-sponsored investments in transportation and banking facilities. There followed decades of European investments in the securities of American railroads and other US corporations.

Much of this history is well documented (see Wilkins 1989). There is a gap in the record, however, particularly for the early decades of US history. Compared to the wealth of available information on the American assets that interested Europeans, and on the institutions that were active on both sides of the Atlantic as financial intermediaries in various periods, we know little about the nature and the efficiency of the market mechanisms that linked investors in Europe with securities issuers in America.

Our study attempts to narrow that gap by studying securities prices in the trans-Atlantic markets and flows of information that linked issuers of US securities with investors in Europe. The study also bears on a larger historical discussion of the beginnings of international economic and financial integration. It might be supposed that the flow of US securities to Europe that commenced around 1790 is itself an indication that capital markets had by then become international. But as O'Rourke and Williamson (2002a, 2002b, 2004) cogently noted, an expansion of international trade in commodities (and by extension, in securities) is not necessarily an indication of market integration. Trade expansion, they note, can result from growing demands and supplies *within* trading economies, without an integration of markets and a convergence of prices between trading economies. Price convergence in their view is a *sine qua non* of market integration, and they found little evidence of price convergence across continents before the nineteenth century.

In a capital-market context, the documented investments of Europeans in American securities dating from the 1790s could have resulted from increasing demands

for securities within Europe and from increasing supplies of securities within the United States. Such investments do not necessarily imply an integration of the capital markets of the Europe and the USA. Indeed, with respect to the first part of the 1790–1845 period studied here, our evidence is consistent with such an interpretation. From 1816 to 1845, on the other hand, our evidence indicates that trans-Atlantic securities markets were integrated. Prices of the same US securities traded in New York and London converged from their pre-1815 levels.

We have collected extensive information on the prices of American securities in both US and European securities markets during the period 1790–1845.² For markets in the USA, weekly quotations of securities prices reported in the newspapers of several cities and in other archival sources are fairly complete for the entire time period. Quotations of American securities in the London market, however, are less complete, particularly for the first two decades. Beginning with 1811, they are more available, often at weekly or even shorter intervals. It was in 1811 that the quasi-official *Course of the Exchange* expanded its format and began coverage of American securities prices at the London Stock Exchange. Interestingly, these were the first international securities reported in *Course*; securities of other European countries were not covered until a few years later, followed by securities of the new Latin American republics in the 1820s.

We focus on monthly, end-of-month securities price data. That is sufficient for our purposes. Wooden sailing ships were the transoceanic information and communications technology during the period 1790–1845. Because it took ships approximately a month on average to cross the Atlantic in the period, there was a lag of roughly that length in the flow of information between European and US markets. The telegraph did not arrive to provide faster communications between domestic markets until the mid 1840s, at the end of the period we study, and the undersea cable did not link trans-Atlantic markets until the 1860s. So the increased degree of integration was not caused by a major technological breakthrough.

3. A US Financial Revolution Promotes Capital Imports

During the first Federalist administrations led by George Washington (1789–1797), the USA experienced a financial revolution. By the mid 1790s, the new nation had all of the key institutional components of a modern financial system: a central government with sound finances and public debt management, a stable currency, a banking system, a central bank, and rapidly expanding numbers of corporations, financial and non-financial, relying on banks and securities markets for external financing.

In 1788, the year of ratification of the US Constitution, it had none of these elements. Under the Articles of Confederation before 1789, the United States was

² Our entire data set, of which the series used in this paper are but a small part, is archived at the Interuniversity Consortium for Political and Social Research, and may be accessed at <http://webapp.icpsr.umich.edu/cocoon/ICPSR-STUDY/04053.xml>.

for all practical purposes a bankrupt country with large foreign and domestic debts and no good way of servicing them, apart from increasing the balances owed by issuing more promises to pay. The national government's evidences of debt sold in what fragmented markets there were at the time at small fractions of par value.

By the end of 1791, in contrast, the largest single component of a newly restructured national debt, a 6 percent security, sold at or above par value in the newly active securities markets of Boston, New York, Philadelphia, and Charleston. It paid interest quarterly in a new currency, the US dollar, which was based on gold and silver. Reform of the public finances under the leadership of Alexander Hamilton, the first Secretary of the Treasury from 1789 to 1795, was the key to the entire financial revolution, which became an enduring achievement of the Federalists (Rousseau and Sylla, 2005; Sylla, 1998, 2002; Wright, 2002). Hamilton had studied the earlier financial revolutions of the Dutch Republic and Great Britain, as well as John Law's failed attempt at one in France. He drew on those precedents in formulating and implementing his comprehensive plan that in just a few years gave the USA a modern financial system.

The effect of the US financial revolution on the willingness of foreign investors to purchase American financial assets was extraordinary. To give a concrete example, one of the foreign investors was London merchant Henry M. Bird. In 50 separate transactions between 19 November 1791 and 16 March 1792, Bird purchased \$103 thousand of US debt in the market of Charleston, South Carolina. This was in the first months of Hamilton's debt restructuring program. Nor was Bird an aberration. Of the 854 different accounts recorded in the Charleston transfer books between 1790 and 1797, at least 84, or almost 10 percent, were foreigners. Those foreigners owned \$728,000 par value of bonds, or about 9.25 percent of the total registered in Charleston in those years (Records of the Bureau of Public Debt, South Carolina Loan Office Records, National Archives and Records Administration, Record Group 53, T719, reel no. 1).

Table I provides an accounting for the year 1803/1804 of all U.S. securities outstanding, most of which had been issued after 1789, with a breakdown by amounts held both domestically and overseas. Of the total of \$122 million, nearly half, about \$59 million, was in foreign hands. More than half (53 percent) of the federal government's debt had been purchased by foreign investors, as had 62 percent of the \$10 million capital stock of the Bank of the United States, the central bank chartered by the federal government in 1791.

A remarkable characteristic of the young USA as an emerging market was that after the year 1794, it was able to raise large sums from foreign investors by transferring to them securities denominated in its own currency, the new U.S. dollar. Today's emerging-market countries usually find that large foreign loans have to be denominated in currencies of leading developed countries that provide the credit. The USA succeeded in attracting foreign investment in dollar-denominated securities for two reasons. First, it made the dollar a credible convertible currency defined in terms of gold and silver, as were the currencies of the leading European nations

Table I. U.S. debt and other stocks, by type, held by domestic and foreign investors, 1803–1804, in millions of dollars

The table reconciles two different summaries of domestic and foreign indebtedness in the United States as of 1803–1804. These basic data are from Blodget (1806) and Bayley (1880), rearranged and re-totaled. Blodget's total US domestic holdings were \$36.011 million compared to the revised figure of \$38.035 million as shown in the table. Blodget's total was \$129.805 million compared to our calculated value of \$121.925 million. Sums may not add to totals due to rounding. Other data indicate that most of the foreign held debt was owned by investors in Great Britain, although the Dutch on a per capita basis held more than did British. Blodget dated his estimates as 1803, but the Louisiana Purchase bonds issued by the USA did not reach Europe until 1804.

Security type	Domestic	Foreign	Total
Sixes	\$16.572	\$11.662	\$28.236
Threes	7.843	11.230	19.072
Deferreds	6.991	6.657	13.648
Eights	5.239	1.228	6.467
Five and one-half	0.577	1.271	1.847
Four and one-half	0.125	0.050	0.176
Navy 6's	0.687	0.022	0.709
Louisiana 6's	—	11.250	11.250
Total US debt	38.035	43.369	81.405
Bank of US shares	3.800	6.200	10.000
State bank shrs.	7.120	9.000	16.120
Insurance co. shrs.	10.500	0.500	11.000
Turnpike and canal co. shrs.	3.220	0.180	3.400
Grand Total	62.675	59.249	121.925

of that era. This meant that dollar-denominated securities purchased by foreign investors carried an implicit exchange clause or specie-convertibility guarantee. Second, the US government and national bank made arrangements with bankers in foreign financial centers for the payment in those centers of interest on U.S. debts and dividends on Bank stock. Dutch bankers in Amsterdam and British bankers in London began in the 1790s to handle such payments in Europe. By 1803, Barings in London became a quasi-official European agent of the USA for such transfers (Hidy 1949, pp. 34–35).³ Other emerging nations such as the new Latin American

³ Bordo et al. (2005), in a comparative study of the USA and British dominions (Canada, Australia, New Zealand, and South Africa), also note that the USA was exceptional: "... the United States was different from the Anglo countries in its ability to abstain from loans denominated in foreign currencies and to have its securities listed in dollars in foreign markets". After noting that all five countries had sound fiscal institutions, credible monetary regimes, and significant financial development, they account for US "exceptionalism" in terms of the USA being larger in economic size than

republics of the 1810s and 1820s found it necessary to issue debt with explicit specie clauses at least in part because London was their major or only market. In the case of US securities, London never dominated trading volume. Except during the War of 1812, foreign investors could and did trade in the large, liquid domestic US markets in Boston, Philadelphia, and New York, as well as their home markets in London and Amsterdam.

Foreign investors found it expedient to own US securities because these securities allowed them to diversify portfolios against country risk at little cost in terms of liquidity. As early as 1796, the second edition of a London investment manual, Thomas Fortune's *An Epitome of the Stocks and Public Funds* added the subtitle *Together with an Appendix, containing the only Account ever yet published of the Bank Stock and Funds of the United States of America*. Between that year and 1838, roughly a dozen further editions of Fortune's manual appeared, each updating British investors on the particulars of US investment opportunities, including the names of London brokers who traded in American securities and their commission rates (Fortune, 1794; Fortune and Evans, 1850). By the middle of the period we study here, some London brokers specialized in U.S. securities. *Holden's Annual Directory, For the Years 1816 & 1817*, a London publication, listed three: "John Gill, American and British stock broker", "George Palmer, American and English stock broker, and agent for canal and dock shares", and "Robson and Gill, American stockbrokers".

The 1803/1804 data of Table I likely represent a high-water mark of the relative, and for some decades even the absolute dollar amount of, foreign ownership of American securities. It was the year of the Louisiana Purchase, perhaps the largest international financial transaction in history to that time. As the table indicates, foreign investors initially absorbed all of the Louisiana 6s, which were 6 percent, 15-year US government bonds that began to mature in 1818. During the following decade budget surpluses allowed the federal debt to be reduced. Moreover, the charter of the Bank of the United States, whose shares were widely held in Europe, lapsed in 1811, leading to the liquidation of its equity shares. The growing turmoil of the Napoleonic wars was another factor that led European investors to send American securities back to the USA, just as they would do a century later dur-

the others and having the dollar serve as a vehicle or key currency in international transactions. Both explanations may be questioned. When foreigners began to purchase US securities in the 1790s, the country was considerably smaller in economic size than Britain, France, and other European powers, and probably then no bigger economically than the British dominions were in the second half of the nineteenth century when they began to borrow internationally in key currencies rather than their own. Further, the US dollar was a new currency in the 1790s and would not become a key currency for a long time. Flandreau and Sussman (2005) make a similar point about vehicle currencies, rooted in long established trading patterns, allowing countries with weak financial systems to have foreign investors hold their securities even when denominated in the home currency. Again, while colonial America and the early USA did have long-established trading relationships with Great Britain, the new US dollar could hardly be termed a vehicle currency when it first appeared in the 1790s, or indeed for a considerable period thereafter.

ing the First World War. Meanwhile, the amount of securities issued in domestic US markets steadily increased, causing foreign-owned securities to decline as a proportion of the total.

Benchmark estimates of the absolute amounts of foreign holdings of American securities during the first half of the nineteenth century begin with a total of \$17–18 million in 1789. The total rises to \$65–70 million in 1803, somewhat higher than our figure in Table 1 because it includes some foreign investments in land. Foreign holdings fell to a range of \$30–50 million between 1818 and 1824. The amount is estimated at \$50 million in 1833, and it then rose rapidly to new absolute highs of \$110 million in 1838, \$200 million in 1840, and \$222 million in 1853 (Wilkins, 1989, Table 3, pp. 50ff).

There were changes over time in the composition of foreign holdings. Before the 1830s, most took the form of US national debt securities and equity shares in the two Banks of the United States (1791–1811 and 1816–1836). By the mid 1830s, however, the U.S. government had redeemed its outstanding debt. The large increases in foreign holdings during that decade were mostly in the form of securities issued by US states, which benefited from both the rapid growth of the US economy and the favorable experience European investors had with the securities of the federal government. While the Second Bank of the United States was a federally chartered institution before 1836, foreign investors never owned a majority of its shares, as they had of the first Bank of the United States in the early 1800s. But after the Bank was re-chartered as a Pennsylvania state bank in 1836, foreign ownership apparently increased to 80 percent of its shares outstanding by 1841, the year the Bank failed and ceased operations. In 1853, American state debts made up half of foreign holdings, with the securities of American railroad corporations accounting for an additional quarter of the total of \$222 million.

Although the amounts and composition of American securities held by foreign investors changed over time, foreign interest in American investments persisted from the first years of the country's existence on the world stage. The comparative success of the USA in attracting foreign capital appears to have been based on its initial commitments to fiscal and monetary stability, and its early development of domestic securities markets and banking. The implications of the US experience for today's emerging markets are clear, although their slow progress toward improved financial systems might indicate that the financial-system achievements of the US founding fathers, a remarkably talented group of statesmen, are not so easy to replicate.

4. Securities Price Data, Models and Preliminary Tests of Market Integration

Tests of market integration ideally involve comparisons of prices of the same commodity or asset in separate markets. Arbitrage across markets tends to eliminate price discrepancies. With perfect, instantaneous arbitrage, prices in separate mar-

kets would always be the same, and they therefore would move the same way over time in response to whatever forces cause prices to change.

A looser test of market integration could involve similar but not exactly the same assets traded in different markets. For example, the globalization of capital markets in recent times appears to have caused a convergence of yields on, say, ten-year government securities issued by leading developed countries (Homer and Sylla, 2005, Chapter 29). The securities are not the same, but they are similar enough in the eyes of investors to bring about a convergence of their yields. A similar convergence of government-securities yields occurred during what some have called the first period of financial globalization, 1870–1913 (Ferguson, 2001). Such developments perhaps indicate that the price of systematic risk converged in developed-country bond markets during both periods of financial globalization.

The US securities price data we have gathered allow us to make the first type of test. The looser test could be made by comparing prices of one US security, the 3s issued in 1790, with British Consol 3s, but we defer that comparison to future work that will also investigate the risk premium on US debt. Here, we examine three American securities that were traded both in US securities markets and in London for long sub-periods during the years 1790–1845. One is the 3s of 1790, a 3 percent bond issued in 1790 as a part of Hamilton's restructuring of the Revolutionary War debt. It was payable at the pleasure of the government rather than having a fixed maturity date. Nearly \$20 million of US 3s were outstanding and traded on both sides of the Atlantic from 1790 until the issue was redeemed in 1832.

The other two American securities are equities, the shares of the First and Second Banks of the United States. Congress chartered the First Bank for 20 years in 1791, but allowed the charter to lapse in 1811. The Bank's capital was \$10 million, in the form of 25,000 shares with a par value of \$400 per share. The shares were actively traded in several U.S. markets from the Bank's inception. By 1803, if not earlier (see Table I) a majority of the shares were owned in Europe. Unfortunately, we have been able to locate only a limited number of monthly London price quotations for the Bank during its twenty-year existence. Since most of the First Bank's shares were owned in Europe, we surmise that the paucity of quotes is more the result of a lack of price reporting than a lack of trading. *Course of the Exchange* did not begin regular reporting of American securities prices until 1811, so we have only scattered London quotes for earlier years.

We are more fortunate in the case for the Second Bank, the successor institution founded in 1816, again with a 20-year charter from Congress. The capital of the Second Bank was \$35 million, in the form of 350,000 shares with a par value of \$100 per share. The Second Bank's shares were actively traded on both sides of the Atlantic. Starting with 1817, we have virtually complete monthly quotations for Second Bank shares in the USA and London, not only for the period of its existence as a federal central banking institution up to 1836, but also for the period after 1836 when, with its federal charter not renewed, the Bank continued to operate as a Pennsylvania state-chartered institution. The Bank suspended specie payments in

1839 and it failed in 1841, but its shares continued to trade on the basis of their potential liquidation value into the mid 1840s.

We adjusted all of the London price quotations we gathered to make them economically comparable with our more abundant US market quotations.⁴

In the sense that they did not have any unusual contractual characteristics, the securities analyzed here are representative of the thousands of other securities issued by U.S. governments and businesses during the period under study. They were unusual, however, in the degree of the liquidity of their secondary markets on both sides of the Atlantic. The par value of US 3s outstanding (\$19.7 million) was unusually large compared to the value of most of other issues of federal, state, municipal, and corporate bonds; the par value of shares of both Banks of the United States outstanding (\$10 million for the First Bank and \$35 million for the Second) was large compared to the par value of shares issued by state banks or indeed any other American enterprises (Bodenhorn, 2000; Bodenhorn, 2002; Wright, 2002).

⁴ From Queen Anne's time the British rated the Spanish peso, a forerunner of the silver US dollar, at 4/6 (4 shillings, 6 pence) in terms of sterling, which then was moving toward the gold standard. That convention yielded a "dollar"-sterling exchange rate par of 4.44 "dollars" per pound. The British then continued for the better part of the next two centuries to maintain the fiction that anything called a dollar was worth the reciprocal of 4.44 in terms of pounds sterling.

When the US dollar came along in the early 1790s, it contained less silver than a Spanish peso. Since it was called a dollar, the British rated it at 4.44, even though, as Officer (1996) demonstrates, the mint parity rate of the U.S. silver dollar in terms of sterling between 1791 and 1834 – in the latter year the United States effectively joined Britain on the gold standard – ranged between 4.57 and 4.95 dollars per pound sterling. The variation in parities results from the changing relative price of silver in terms of gold and, in periods when either country's currency was not convertible to specie (e.g., in Britain during the period of the paper pound from 1797 to 1821), from the discount of paper currency to specie-convertible currency. The newly independent Americans went along with the British fiction, quoting market exchange rates on London at a premium of several percentage points even when they approximated the true parity.

The implications of this arcane bit of monetary history for our price quotations are several. Since it usually took more than 4.44 US dollars to purchase a pound, quotations showing dollar-sterling exchange at a premium, as they usually do, are misleading. For 1824, Officer (1996, p. 55) indicates a true parity of 4.8153 dollars per pound, which would imply a parity exchange rate quotation of 1.0835 (4.8153/4.4444) for that year. This is within the range of actual monthly market exchange quotations we observed for that year. Further, when the British quoted a security such as US 3s as percent of par in London, par meant 4.44 dollars per pound, so that to compare that percent-of-par quotation meaningfully with a US-market percent-of-par quotation, we have to multiply the British quotation by the exchange rate. Finally, when the British quoted a security such as shares of the Bank of the United States in pounds sterling in their market, to compare it meaningfully with a U.S. market quote we have to multiply the price in pounds by 4.44 (or 4.4444, to be precise), and then multiply that result by the dollar-sterling exchange rate.

Readers might note that in later periods different conversions are necessary. For example, according to Fenn and Nash (1893, p. 209), "prior to 1874, the quotations for American securities in this market [London] were calculated at 4s. 6d per dollar, and from that date at 4s. As par is 4s 1 1/4d, our stocks are quoted generally 2 1/2 per cent above New York to allow for this artificial depreciation of the dollar".

The foregoing discussion suggests the types of models we can formulate to study relationships between prices of American securities in the U.S. and British markets. For the US 3s, a security traded extensively in both markets during the 1790–1832 period of its existence, the functional relationship could be of the form:

$$P_{lon,t} = f(P_{ny,t-n}, X_t), \quad (1)$$

where $P_{lon,t}$ is the price of US 3s in London at time t , $P_{ny,t-n}$ is the price of US 3s in New York n periods earlier, and X_t is the dollar-sterling exchange rate, for which we use price quotations in the USA of 60-day bills on London (see appendix on data and sources).⁵ The same model, with slight variations dependent upon the form of price quotation in each market, is applicable to the prices of Bank of the United States stock. The functional form we assume, and the expected parameter values assuming market integration are:

$$P_{lon,t} = a P_{ny,t-n}^b X_t^c, \quad (2)$$

with the expected values of the coefficients being: $a = 1.0$, $b = 1.0$, and $c = -1.0$. This equation is linear in the logarithms,

$$\ln P_{lon,t} = \ln a + b \ln P_{ny,t-n} + c \ln X_t. \quad (3)$$

Equation (3) can be rearranged easily by moving variables from the right-hand side to the left-hand side should it be desired to constrain any of the coefficients to be equal to the theoretical value, or to reverse the direction of causation between markets. Although regression models often are interpreted to imply causality of the dependent variable by independent variables, here we are more interested here in the association among the variables, and whether the estimated coefficients conform to the expected values than with whether the price in one market “causes” the price in the other market. Arbitrage between markets is usually a two-way street.

In Equation (3) the coefficients are elasticities indicating the percentage responses of prices in London to price changes in New York and to changes in the dollar-sterling exchange rate. The value of the constant, $\ln a$, in different applications of the model can take on different meanings, as explained below. Since the London market expressed prices of US 3s in dollars assumed to be 4.4444 to the pound, we must multiply London prices by the dollar-sterling exchange rate to get a price comparable to the New York price.

Shares of the First and Second Banks of the United States, however, were quoted in London in pounds sterling, not as percent of par. Equation (3) remains applicable, with expectations again that $b = 1.0$ and $c = -1.0$, but now with the expectation that the constant, $\ln a = \ln (1/4.4444) = -1.49165488$. In other words,

⁵ With today's instantaneous communications between markets, time subscript n would be virtually zero. That was far from being true two centuries ago, a point of some relevance in the analysis developed in this paper.

to express prices of First and Second Bank shares in London in terms comparable to price quotations in New York, we must multiply the London price in pounds sterling by 4.4444, which is then multiplied by the dollar-sterling exchange rate prevailing in New York at the time. For the First Bank, whose shares had a par value of \$400, the dollar price in London calculated in this manner is divided by \$400 to obtain a London percent-of-par quotation to compare with percent-of-par quotations in US markets. Second Bank shares had a par value of \$100, making such an adjustment unnecessary.

Figures 1, 2, 3, and 4 present some of the characteristics of our comparative US-London price data as well as their limitations in terms of the available number of observations. The figures show monthly prices of First Bank shares, US 3s, and Second Bank shares for two periods. (The data are further described in the appendix.) Although it is not our purpose here to explore particular events illuminated by the securities price data, a few are perhaps worth mentioning. During the War of 1812, when Britain and the USA were belligerents, securities traders in London drove prices of First Bank shares (Figure 1) and US 3s (Figure 2) to lower levels than the prices that prevailed in US markets. The deviation from parity might be understood in terms of British investors in US securities perceiving that the risks of their not being compensated had increased with the war, although in fact the US government via Barings met all of its payments due British investors. The larger point is that wars can easily undermine market integration by causing a divergence in the price of systematic risk between two markets. Similarly, during the British financial crisis of 1825, liquidity constraints caused prices of shares of the Bank of the United States (usually New York) to fall much more in London than they did in New York. On the other hand, when the Bank suspended convertibility and then failed during 1839–1841, the share price collapse in London tracks that in the USA quite well (Figure 4).

Table II presents for various periods the distribution of the log ratio of the end-of-month prices of U.S. 3s, First Bank shares, and Second Bank shares in the United States (usually New York) to prices at the same time in London. This ratio in effect is just a variant of Equation (3). With perfect market integration, that is, with instantaneous communications between markets and instantaneous arbitrage, the ratio would always be 1.0. It is obvious from the table that the trans-Atlantic markets two centuries ago were not perfectly integrated. But market integration appeared to be improving substantially over the period 1790–1840, as indicated in Table II by the narrowing range of the ratio differences from earlier to later sub-periods of the New York and London prices of a particular asset.

For US 3s, we have 272 comparative month-end price observations for the period they were outstanding, a little more than half of the observations that we would have if we had quotations for both markets in every month of the period. Of the 272 observations, 189 or 69 percent fall in the range of 0.95 to 1.05. The distribution, however, becomes much tighter over time. For the period 1790–1815, there are 99 observations on both markets, and only 41 percent of them are in

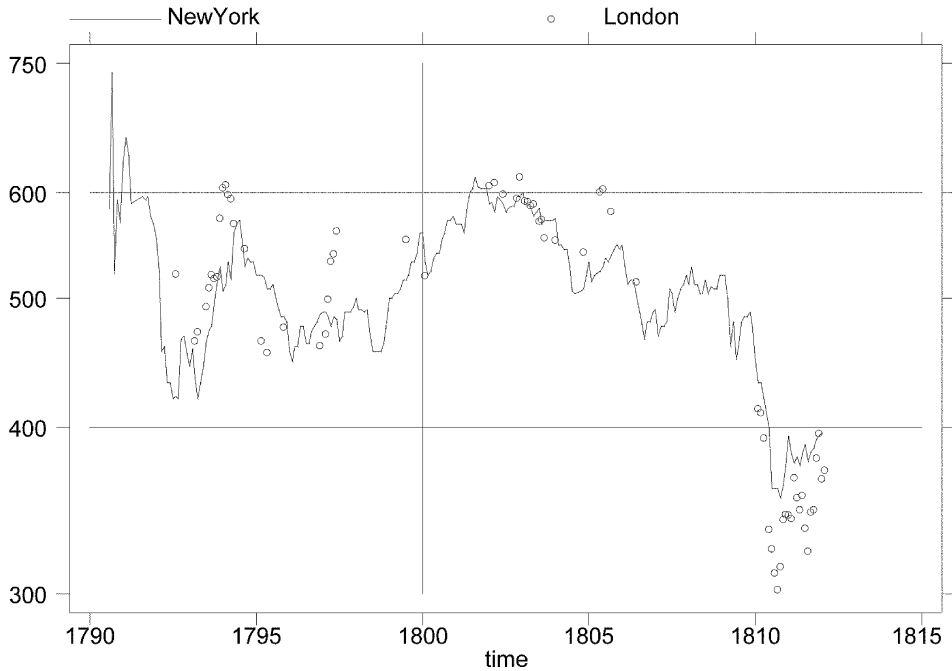


Figure 1. First Bank of the United States share price in New York and in London, 1792–1813, month-end prices in dollar equivalents. The figure compares the abundant price quotations of First Bank shares in the US with less abundant quotations for the same shares in London. Horizontal reference lines are drawn at the par price of 400 and at 600. A vertical reference line is drawn at 1800. Regular monthly quotes begin in 1811, when the Bank lost its US charter and the two countries were on the verge of the War of 1812.

the 0.95 to 1.05 range. From 1816 to 1832, on the other hand, 148 of 173, or 86 percent, fall within that range. The trans-Atlantic markets appear to have been considerably more integrated after the Napoleonic War era than they were during it, which perhaps may come as no surprise.

We reach much the same conclusion when comparing the results for the First and Second Banks. For the First Bank, we have only 66 U.S.-London price comparisons during the period 1793–1812, and only 26 of these, or 39 percent, are in the 0.95 to 1.05 range. Comparative data are much richer for the Second Bank. For the period 1817 through mid-1839, chosen because the Bank suspended specie payments and began its plunge toward failure in the latter half of 1839, we have 261 price comparisons, and 217 of them, or 83 percent, fall in the 0.95 to 1.05 range.

A lack of consistent price quotations might be taken as a measure of a lack of market integration. Possibly British investors before 1815 had little interest in the pricing of US securities in the USA, as long as they received their interest and dividend payments in London. For the US 3s from 1790 to 1815, there are only 99 monthly paired observations of the possible 303 months covered (33%),

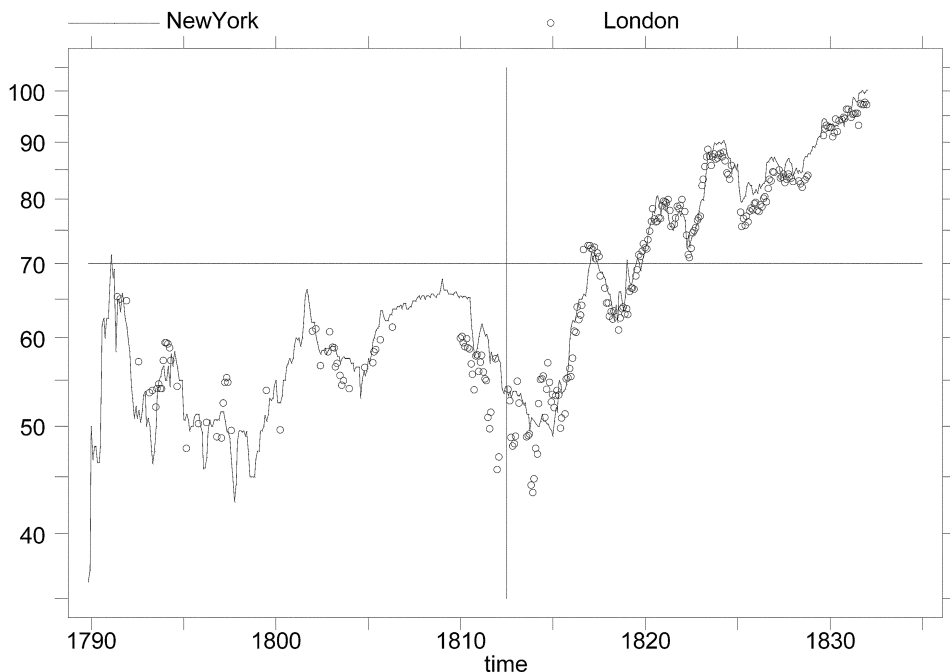


Figure 2. US 3s of 1790, prices as percent of par in New York and in London, 1790–1833. The figure compares abundant monthly price quotations of US 3s in the USA with less frequent quotations in London, especially before 1811. A vertical reference line is drawn in at mid-1812 and a horizontal line drawn at 70. The congruence of trans-Atlantic quotations is greater after 1815 than before.

whereas for the 1816–1832 period, there are 173 monthly paired observations of the 204 possible months (84%). For the First Bank, there are only 66 monthly pairs of observations for a possible 240 months (28%), whereas for the Second Bank, there are 261 monthly observations of paired prices out of a possible total of 263 (99%). Clearly, the availability of market price quotations is much more complete in the post-1815 time period, and this might indicate a growing interest in the arbitrage behavior that would make markets more integrated. The possibility remains, however, that subsequent investigations will discover other London data sources that increase the number of paired observations, especially for the pre-1816 period.

Figures 5 and 6 provide a convenient graphical summary of this discussion. They can be thought of as smoothed versions of histograms showing the distributions of the ratios of New York to London prices before and after 1815. Clearly apparent in the two figures is that the trans-Atlantic price ratios cluster much closer to 1.0 after 1815 than before. A warrantable inference is that the New York and London markets became considerably more integrated in the later period.

Despite the limitations of our data – missing values, only a rough correspondence of end of month dates, and so on – we ran OLS regression estimates of

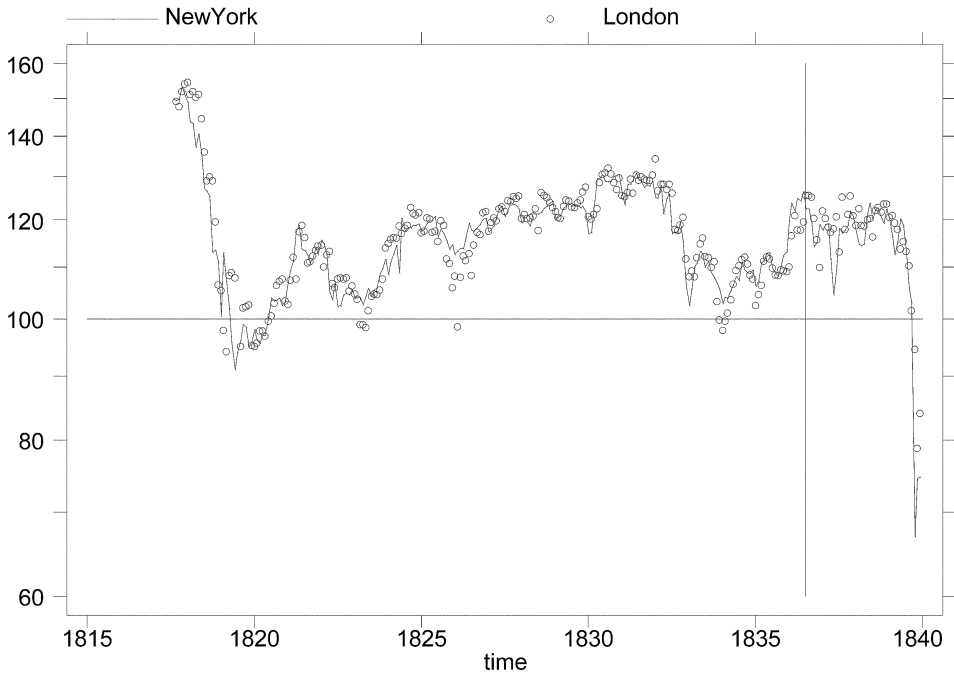


Figure 3. Second Bank of the United States share prices in New York and London, 1817–1839, month-end prices in dollar equivalents, \$100 par value. The figure compares prices of Second Bank shares in the USA with contemporaneous quotes in London. A horizontal line is drawn in at the par price and a vertical line in mid-1836 when the Second Bank ceased to be the US national bank. The London price has been converted to dollar equivalents using the British pound price multiplied by 4.4444 times the dollar-sterling exchange rate to achieve comparability of London and US quotes.

equation 3 above. We regressed the prices of US 3s, and First and Second Bank shares in London on their prices in New York one month earlier and the dollar-sterling exchange rate. We introduced the one-month lag to take into account the approximate time it took for information to reach one trans-Atlantic market from the other, to be discussed more fully in the next section. We viewed these exercises as mostly descriptive and not indicative of causality. In general, the regression results confirmed the visual impressions conveyed by Figures 5 and 6. The trans-Atlantic securities markets could be described as integrated after 1815, but not before. Estimated regression coefficients and constants for the later period, but not for the pre-1815 years, often were within or close to 95-percent confidence intervals of the theoretical values predicted by our model under the hypothesis that the markets were integrated.

We found, however, that non-stationarity of our series, and hence the possibility of spurious regression results, were problems for some of the series and subsets of them, which is why we do not present all of the regression results here. But our longest and most complete series, those for London and New York prices of

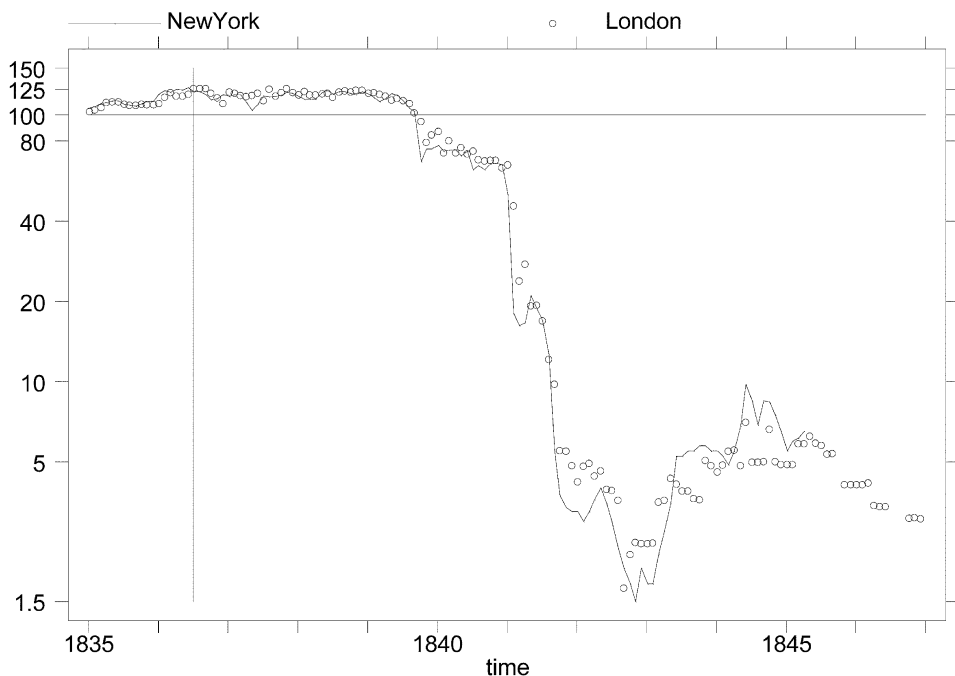


Figure 4. Second Bank of U.S. share prices in New York/Philadelphia and in London, 1835–1847, month-end dollar equivalents, par = \$100. The figure compares share prices in the USA and London for the period in which the Second Bank ceased to be a national bank in 1836, and then, as a Pennsylvania state bank, suspended convertibility in 1839 and failed in 1840–1841. A horizontal line is drawn at par value and a vertical line is drawn in mid-1836 when the Second Bank ceased to be the US national bank. The London prices were calculated as in the note to Figure 3.

Second Bank shares, 1817–1845, for which we have 99 percent of possible end-of-month price observations in both trans-Atlantic markets, were stationary. The data are portrayed in Figures 3 and 4. Estimating Equation (3) with these data (347 observations) yielded the following results, with standard errors and 95 percent confidence intervals below the coefficients:

$$\begin{aligned}
 P_{lon} = & 0.9906P_{ny-1} - 1.3011X_t - 1.4274, & \text{adj. } R^2 = 0.9879 \\
 & (0.0059) & (0.2359) & (0.0319) \\
 & 0.98/1.0 & -1.76/-0.84 & -1.49/-1.36.
 \end{aligned} \tag{4}$$

With market integration, the price coefficient expectation is 1.0, that of the exchange rate is -1.0 , and that of the constant is -1.4917 , the logarithm of the reciprocal of 4.4444. The expected coefficients of price and the exchange rate are within 95-percent confidence intervals of the expected values of the coefficients, as is the estimated constant. The London and New York markets for shares of the Second Bank appear to have been well integrated in the period 1817–1845.

Table II. Distributions of the ratio of a security's price in the United States to its price in London

Using month-end data for a security, the ratios of the price in New York to the price in London for the same month were calculated and formed into frequency distributions. The better the two markets are integrated the less should be the dispersion of the distributions around the value of 1.00. Distributions were formed for the US 3s for two different periods and the combined period, as well as for the First Bank of the United States and the Second Bank of the United States over the lives of their charters. The distributions of the ratio are clustered substantially closer to 1.00 after 1815 than before.

Ratio, P_{us}/P_{lon}	US 3s 1790–1815	US3s 1816–1832	US 3s 1790–1832	First bank 1793–1812	Second bank 1817–1839.5
0.80–0.85				3	1
0.85–0.90	3		3	8	3
0.90–0.95	18	2	20	8	20
0.95–1.00	14	48	62	16	126
1.00–1.05	27	100	127	10	91
1.05–1.10	22	21	43	8	17
1.10–1.15	10	2	12	8	2
1.15–1.20	3		3	5	1
1.20–1.25	1		1	2	
1.25–1.30	1		1	1	
Total observations	99	173	272	66	261
Total months	303	204	507	240	263

For the period from 1790 to 1815, on the other hand, evidence of trans-Atlantic market integration is modest at best. In that era, the trans-Atlantic trade in American securities may well have been driven more by the demand for capital of the USA on the one hand, and the demand for income-producing investments in Europe on the other, than by improved market integration. In the period after 1815, market integration and price convergence become evident.

5. Trans-Atlantic Information Flows and Lagged Market Responses

For two markets to be integrated and thereby allocate capital efficiently, price and other information must flow between them. Having found in previous sections that the trans-Atlantic London and New York securities markets were not integrated before 1815, but became better integrated thereafter, we discuss in this section evidence that indicates the flow of information between the two markets improved after 1815. We also draw attention to one institutional change that might help account for the improvement. Finally, we present a stronger test of market integration based on comparing correlations of the log differences of prices of the same securities in

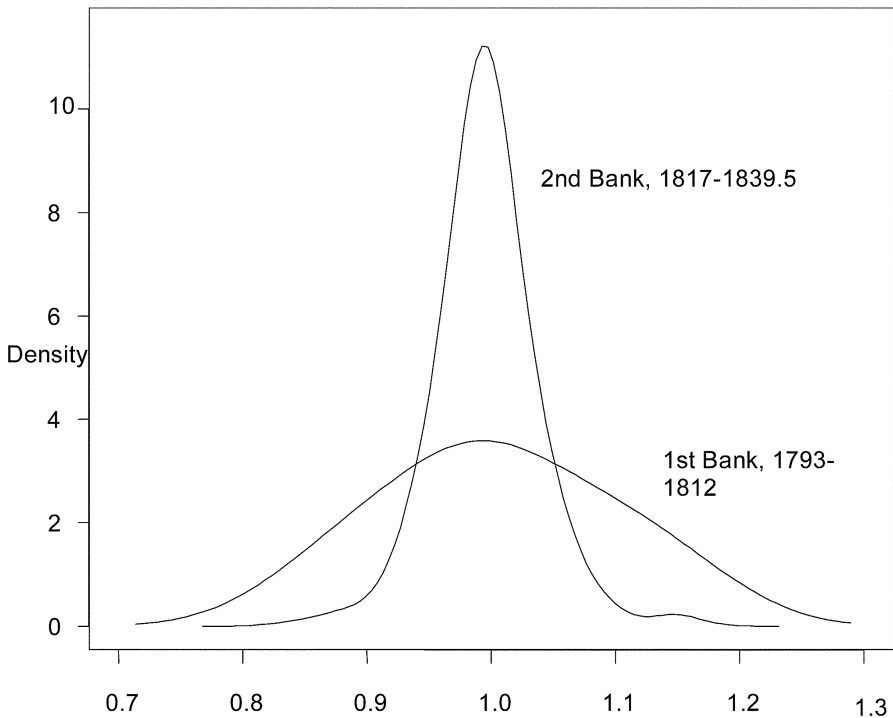


Figure 5. First (1793–1812) and Second (1817–1839) Bank of the United States: Distribution of the ratio of the stock price in USA to the stock price in London. The figure shows the tighter clustering of US/London price ratio around 1.0 after 1815, a sign of increased market integration. The raw data underlying Table II are here smoothed by the procedure given in Simonoff (1996).

the two markets with lagged responses that reflect the time it took for information to flow between them.

How long did it take for information to cross the Atlantic? During the period 1790–1845, information flowed across the Atlantic on wooden sailing ships. It was a pre-telegraphic period, and trans-Atlantic steamships came into limited use only in 1838. Early in the period, information was carried aboard cargo ships on irregular schedules. Shipping schedules improved somewhat with the advent of “regular” traders, which limited their routes to include two or perhaps three ports, and made approximately two round trips per year (Albion, 1938, 1939). But the so-called regular traders varied schedules considerably, depending upon weather and having sufficient cargo for a profitable voyage (Officer, 1996). For 1790, we have an estimate from Pred (1973, p. 26) that the mean time for westbound Liverpool information to appear in Philadelphia newspapers was 65.5 days; from London it was 67.5 days.

Starting in 1811, we can be more precise about the time it took for information to flow between US and London securities markets. That year the *Course of the*

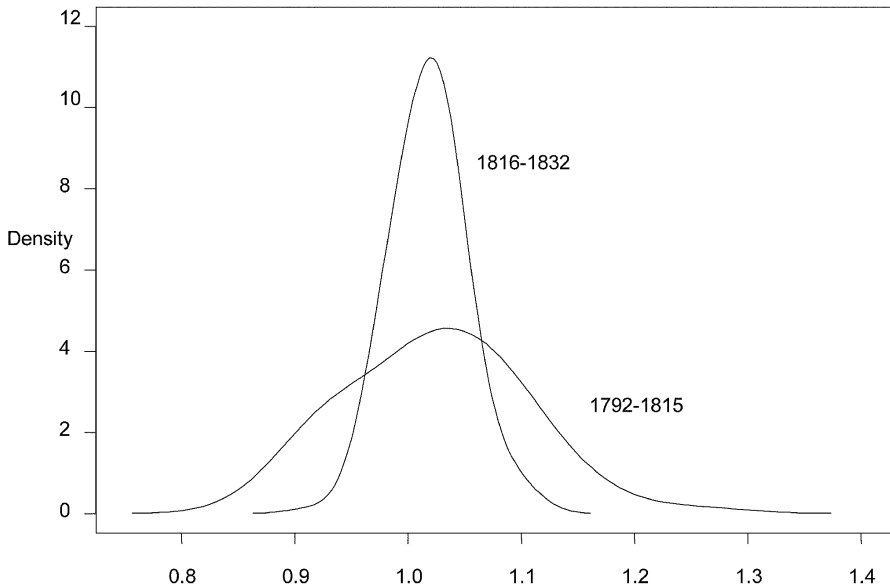


Figure 6. US 3s: Distributions of the ratio of the security price in USA to the price in London, 1792–1815 and 1816–1832. The figure, like Figure 5, shows the greater clustering of the US/London price ratio of US 3s around 1.0 after 1815 than before, which we take to be an indication of greater market integration. See the notes to Figure 5.

Exchange, the semi-weekly London publication that reported on activity at the London Stock Exchange, expanded its format and began to report regularly the prices of American securities in London. Given what we understand of the economics of such early information businesses (McCusker and Gravestijn, 1991), we suspect that an increased volume of trading of U.S. securities in London relative to earlier periods may have spurred the change. The *Course of the Exchange* also began to report, next to its London prices, the prices of American securities in the USA, according to the latest information it had received. By comparing the dates given in *Course* for its US quotations with the date of the issue in London that reported those quotations, we can derive estimates of time it took for information to reach the London market from US markets.

Table III reports the estimated time in days that we calculated from the *Course* dates for the period 1811–1843. It is apparent from the table that in 1811 it took on average about six weeks for information to cross the Atlantic eastbound from New York, but by the 1830s it took four weeks or less. It is also apparent from the 1812–1816 estimates that war and its aftermath could seriously disrupt information flows when shipping was the main means of communication across oceans.⁶ In 1838 and

⁶ Table III indicates that standard deviations as well as means of information-flow times across the Atlantic – especially during the War of 1812 – were larger before the 1820s than later. Hence, we cannot rule out the possibility that the lack of market integration we find for the pre-1816 period was

Table III. The time lag in days for New York financial quotations to reach the London market, for years with available data: 1811–1843, with the mean, standard deviation, and the minimum and maximum lags

The data are calculated from a tally of the dates included in the London *Course of the Exchange* for the published New York quotes compared to the date of their publication in London. The data for 1811 are only for the last three months of the year of the initial publication of the Course, the 1814 data are only for the first part of the year preceding the British blockade of US ports, and the 1841 data are unavailable for February through May due to missing data.

Year	Mean days	Std. dev.	Minimum	Maximum
1811	43.17	9.81	26	61
1812	49.02	12.45	24	89
1813	66.28	21.79	31	129
1814	100.73	38.21	43	162
1816	55.16	16.40	29	94
1821	34.29	7.57	24	52
1826	31.16	5.55	22	48
1827	30.77	5.29	22	45
1828	30.02	4.70	21	43
1829	30.83	4.49	23	44
1830	31.96	5.19	23	48
1831	31.62	6.62	20	48
1832	28.58	4.49	20	40
1833	27.38	4.86	20	38
1834	28.79	4.32	21	41
1835	29.24	4.46	19	38
1836	27.00	4.44	17	37
1837	28.60	5.94	20	45
1838	28.13	6.50	15	44
1839	25.61	4.98	16	38
1840	24.67	5.29	16	41
1841	27.21	7.57	16	51
1842	23.63	5.71	15	40
1843	23.90	5.59	15	36

subsequent years, the first steamships reduced mean and minimum crossing times from what they previously had been.

related to longer average crossing times and larger variations in crossing times, with the latter being a noise factor in terms of our model with 1, 2, or more monthly lags in our data.

In the four-decade period of Table III, the largest decline in the time it took information to reach London from the USA occurs between 1816 (or 1811) and 1821. What might have caused this decline? In January 1818, the Black Ball Line of American packet shipping began. Packets introduced regularly scheduled departures from New York and from Liverpool, and had a mean time of crossing of 24 days eastbound, and 38 days westbound (Albion, 1938, p. 322). Thus, packets could make about six roundtrips a year. They carried cargo, specie, bills of exchange, and commercial information from the press and other sources. The Black Ball Line began with four ships, and the original schedule called for regular monthly departures from New York on the first of each month, and from Liverpool on the fifth of each month.

Given the average number of roundtrips per year a ship could make, the more ships that were in service, the shorter would be the mean age of information received in both New York and London. The Black Ball Line encountered competition soon after its inaugural crossings in 1818, being joined by the Red Star, Blue Swallowtail, and Black X lines. As these additional lines began crossings between New York and Liverpool/London, the number of ships on those routes increased. In 1820, four ships plied the New York-Liverpool route; by 1825 it was 16, and an additional four were in service on the New York-London route. By 1830, the number on the latter route increased to ten. In 1845, 20 packet ships were in service on the New York-Liverpool route, and 12 on the New York-London route (Albion, 1938, p. 274). The growing number of ships in service insured one or more departures from the ports weekly, but, as indicated in Table III, the larger number of ships plying these routes did little to alter the standard deviation of the number of days per voyage.

The timing of the decline in trans-Atlantic information-flow times documented in Table III suggests that the introduction of regularly scheduled packet shipping played a role. Packets reduced the average time for information to cross the Atlantic from six or more weeks to four weeks or less. They also regularized the arrival of new information; an investor in London curious as to prices of American securities in the USA could, in the 1820s and 1830s, look forward to updated prices about once a week. True, given the limitations of transmitting information by sailing ship, the latest news from America was about four weeks old when it arrived in London, but that was better than six weeks old, and it was far more regular in its arrival. We conclude that improvements in trans-Atlantic communication times and regularity introduced by packet shipping might well have promoted the increased trans-Atlantic market integration we find in the securities price data. Because shipping technology changed but little during our period, the improvement was apparently was one of better organization and use of existing technology than one that can be attributed to technological change.

Can our securities price data lend support to a contention that organizational improvement in shipping and communications promoted market integration? The main issue can be phrased in the following way. Since it took roughly one to two

months for information to flow across the ocean, and since we know that price information from a trans-Atlantic market often appeared side-by-side or on the same page as more recent price information from the local market, is there any evidence of a lagged response of prices in the local market to information about prices established a month or two earlier in a trans-Atlantic market? Another issue derives from the answer to the first. If there is evidence of lagged responses, which market responded most to the other's prices? With large amounts of American securities held and traded on both sides of the Atlantic, did London respond more to New York, or did New York respond more to London?

Neal (1990) dealt with similar issues in his study of the London and Amsterdam markets during the eighteenth century. Then it took two to three days for information to flow between the two cities. So Neal studied the differences in prices of the same security in the two markets on the same day, and the price difference of London from Amsterdam three and six days after London. He found some evidence that the three-day lag mattered, but curiously the matching of prices on the same day was just as good even though one market could not have been aware of activity in the other on that day (Neal 1990, p. 43).

In Table IV we correlate log-percent *changes* of prices in one city with contemporaneous and lagged log-percent changes in the other city. Analyzing relationships between price changes in the two trans-Atlantic markets avoids the problems of non-stationarity and potentially spurious regressions that can arise in analyses using price levels instead of price changes. Panel IV-A of Table IV presents the results for US 3s prices. London price changes were more highly correlated with New York price changes one, two, and even three months earlier than they were with changes in the same month. And New York price changes were more related to London price changes two and three months earlier than to prices in the same month or one month earlier. We think these results may be related to the asymmetry of ocean-crossing times – it took longer to sail westbound from London to New York than it did to sail eastbound from New York to London.

Panels IV-B and IV-C repeat the exercise for prices of the stock of the Second Bank during its run as a national bank, and for the whole period of our data set including the period after 1836 when the Bank was a Pennsylvania-chartered bank. For both periods, the correlations of London price changes with New York price changes one month earlier is greater than the correlation of prices in the same month. That is not the case in Panel B when New York price changes are correlated with London price changes. Moreover, the responses of London price changes to New York price changes are considerably larger than are the responses of New York price changes to London's. We conclude that securities markets did respond to the arrival of information from one another, and that on balance the response of London to information from New York was stronger than that of New York to the somewhat slower arrival of information from London. Possibly that was because US markets for American securities were more active and more liquid than the London market for those same American securities.

Table IV. Cross-correlations of the logarithmic monthly asset price changes in New York and in London, contemporaneous and with lags of from one to five months

Panel A. United States 3s, 1816–1832		
Percent changes in London (t) with percent changes in New York in t to $t - 5$	Time period	Percent changes in New York (t) with percent changes in London in t to $t - 5$
0.0796	t	0.0399
0.2835	$t - 1$	0.0438
0.2132	$t - 2$	0.2549
0.1864	$t - 3$	0.3438
0.0954	$t - 4$	0.1645
0.0414	$t - 5$	−0.0083
150	# observations	96
Panel B. Second Bank of the United States shares, 1817–1835		
Percent changes in London (t) with percent changes in New York in t to $t - 5$	Time period	Percent changes in New York (t) with percent changes in London in t to $t - 5$
0.1097	t	0.1050
0.2693	$t - 1$	0.0683
0.3021	$t - 2$	0.0223
−0.0638	$t - 3$	0.0741
0.0088	$t - 4$	0.0958
0.0494	$t - 5$	0.1277
213	# observations	207
Panel C. Second Bank of the United States shares, 1817–1845		
Percent changes in London (t) with percent changes in New York in t to $t - 5$	Time period	Percent changes in New York (t) with percent changes in London in t to $t - 5$
0.1929	t	0.1937
0.5164	$t - 1$	0.2437
−0.0324	$t - 2$	0.1408
0.1296	$t - 3$	−0.0736
−0.0847	$t - 4$	0.2500
0.0719	$t - 5$	−0.0693
339	# observations	326

Although organizational improvements in shipping likely did much to improve trans-Atlantic capital market integration, other factors probably mattered, too. The return of peace to a war-torn Europe after 1815 is one such factor. Indeed, a recent paper shows that the volatility of British consol returns after 1815 was less than half of what it had been in previous decades (Brown et al., 2004). No doubt the securities markets, and more generally the financial systems, of Great Britain and the USA also became larger, deeper, more active, and more liquid as well. It is not easy to disentangle these possible explanations, which in any case we regard as more complementary than competing.

6. Conclusion

Trans-Atlantic capital markets were pretty well integrated by the period 1815–1845. Our results also indicate that despite a movement of European capital to the United States and a flow of American securities to Europe during the quarter century before 1815, the markets in that earlier period were not very well integrated. Although limitations of our securities price data – mostly the paucity of London quotations before 1811 – should make us cautious in concluding that trans-Atlantic markets were not integrated before 1815, there are ample historical reasons why that may have been the case. Unlike the period after 1815, there was considerable political and military turmoil in Europe, and in trans-Atlantic politics and economics as well, during the period 1790–1815. Despite that turmoil, or perhaps even because of it if the USA might have been viewed as a safe haven for European capital, European investors demonstrated considerable confidence in the young US government and in the US economy by purchasing large quantities of outstanding American securities.

The integration of trans-Atlantic capital markets began after 1815, far earlier than previously thought by those who consider the period 1870–1914 to be the first era of financial globalization. International financial integration across continents did not have to wait for telegraphic, undersea cable, and steam navigation innovations, or for most countries to adopt the gold standard. By the second or third decade of the nineteenth century, price information flowed with regularity among trans-Atlantic securities markets, albeit with lags of approximately one to two months. Coming as early as it did, this first financial globalization contributed to the rapid development of the young US economy. Capital inflows from Europe meant that Americans could have higher rates of investment than would have been possible based on their own savings, and that US interest rates and bond yields were correspondingly lower. At the same time, European investors reaped better returns and held more diversified portfolios than if they had been restricted to investing only in domestic securities, other domestic assets, and securities of near-by countries.

Why trans-Atlantic capital market integration came so early is a question that bears more investigation. Our paper is just a beginning. Was market integration

fostered by such organizational innovations as the regularly scheduled sailings of packet ships shortly after the close of the Napoleonic war era? Based on the evidence presented above in Section 6, we deem it likely. Regular packet ship sailings reduced the time it took for price information to cross the Atlantic and regularized its appearance in British and American financial markets. As capital flowed from Europe to America, investors on each side of the Atlantic responded to new information by adjusting asset prices to maintain a rough correspondence of prices in their market with prices in the market across the Atlantic.

Our findings have wider implications. The international financial integration that Neal (1990) found for the eighteenth-century Amsterdam and London securities markets, although interrupted in Europe from the era of the French Revolutionary and Napoleonic wars until the second half of the nineteenth century, became evident earlier, after 1815, in the London and New York/USA markets. International financial integration was thus a continuing, if sometimes interrupted development of the eighteenth, nineteenth, and twentieth centuries.

Our work also bears on the debate opened up by North and Weingast (1989) on the importance of changes in political institutions that foster financial development by securing property rights and limiting the powers of government. North and Weingast argued that the Glorious Revolution of 1688 in England led to the English financial revolution precisely because it secured private property rights and limited governmental powers while at the same time making government more representative, energetic, and effective. Although North and Weingast have been challenged on the English case, and others have noted that the relationship of institutional development and a country's ability to access international capital markets is far from clear (Bordo et al., 2005; Flandreau and Sussman, 2005), we think that the US financial revolution of the 1790s, which was made possible by the constitutional changes of the late 1780s, furnishes some support for the North-Weingast hypothesis. In the US case, political change led to financial development, and then financial development after 1789 helped to quicken the pace of economic development, just as it began to do in Great Britain a century earlier (Wright, 2002).

Other recent historical research tends to confirm the insight that modernized financial institutions and systems promote economic growth and emerging market success. Using a cross-country panel of 17 countries covering the period 1850–1997, Rousseau and Sylla (2003) find that countries with more sophisticated domestic financial systems grew faster, engaged in more international trade, and became better integrated financially with other economies than did countries with less sophisticated financial systems. Financial modernization within a country can thus be regarded as playing an important role in its economic growth and the integration of its markets with those of other national economies.

Appendix on Data: Notes and Sources

The data used in our analysis are newly compiled from our searches of contemporary newspapers and other periodicals. This note outlines those sources and types of data that are used and not used, with rationale for our choices.

BASIC PRICE DATA

The basic monthly series we analyze include the US exchange rate on London; the price in the U.S. and London of the US three percent bonds (3s), which were outstanding from October 1790 through December 1832; the price of the stock of the First Bank of the United States in the USA and in London from August 1791 through October 1812; and the price of stock of the Second Bank of the United States in London and New York from January 1817 through 1845 and into 1846. Data availability from 1790 to 1811 is limited, mostly because we found only a few observations from the London market. From 1811 on, the quality of securities market data is better, with fewer instances of missing month-end prices. Comments and source materials are provided here for each of these four series.

U.S. EXCHANGE ON LONDON

The exchange rate is primarily for sixty-day bills, an instrument often quoted, perhaps reflecting that the journey between ports in the U.S. and Britain was approximately thirty days in each direction. The sixty-day bill rates include short-term interest, insurance, and other minor costs.

The primary guide to data sources of the monthly rates of exchange is Officer (1985, 1993, and 1996). Officer provides US/UK exchange rates as quarterly averages instead of our desired monthly rates, and his quarterly data are the averages of the monthly data making up each quarter – that is time-averaged. Even if we could use quarterly data for our analysis, time-averaging makes Officer's data unsuitable for the type of analysis that we wish to perform. Nevertheless, we have been able to retrieve the primary monthly data underlying Officer's work, and we have used those data in our analysis.

The exchange rate quotes are usually expressed in terms of percent of premium to, or discount from, "par". "Par", however, was a complex concept in that it differed between the London and the US definition, and it changed over time as discussed in footnote 3. Officer (1996) indicates that there was nothing like exchange rate stability for the period 1792 to 1834, and highly variable exchange rates are what he and we found in our sources, as discussed below. The highest quality data are not consistently found in a single market, but seem to be available at different times in different inland markets.

Baltimore

The earliest, consistently defined and continuous, data for the U.S. exchange on London are based on Baltimore quotations. These monthly data extend from January 1791 through 1829, are spot (not time-averaged data). The original source of these data are from John White, cashier of the Bank of the United States, and are available in U.S. government documents (US House of Representatives, Secretary of the Treasury Report, 1830, pp. 78–85). The advantage of these data is that they precede our Boston exchange quotations by five years, and New York and Philadelphia quotations by considerably longer. The disadvantage is that they seem to be more rounded than later quotations from other markets.

Boston

In the earliest days of U.S. asset markets, Boston was a major market, and several sources of high quality monthly exchange rate data exist from, at least, September 1795. These data were compiled by Smith and Cole (1935, Appendix E, pp. 187–191) and have been available to researchers for many years. The data are spot, near mid-month, quoted in terms of a narrow bid-asked range. The data extend through December 1823 in Smith and Cole, when we extend the series with monthly New York exchange rates, which are discussed below.

New York

Smith and Cole (1935) in Appendix E give New York exchange quotes from January 1824 to December 1862. These data are provided as near the first of each month, and we lagged the observations by one month for our desired nearest-month-end quotations.

THREES OF 1790

This was one of three debt instruments included in Treasury Secretary Alexander Hamilton's restructuring and funding of the U.S. debt incurred during and after the Revolution. Issued first in 1790, the instrument paid 3 percent annual interest on the par value of the bonds. Two other instruments were included in Hamilton's restructuring, the 6s of 1790, and the Deferred 6s of 1790. Hamilton and Congress established a "sinking fund" for gradual repayment of this debt, with provisions to buy back in the open market two percent per annum of the 6 percent debt outstanding (Sylla and Wilson, 1999). The 3s, being less of an interest burden on the government, continued to be considered "redeemable at the pleasure of the government", and were outstanding until repaid in 1832. This instrument was in existence for 42 years, and is the most consistently defined and longest lasting asset for trading in U. S. asset markets over this early time period.

The earliest presentation of US 3s prices that we are aware of is of month-end prices in Boston from October 1790 through December 1793 in Davis (1917, v. 1,

Appendix A, pp. 339–340). Smith and Cole (1935, Appendix C, Table 59, p. 171) have prices of 3s in Boston from November 1795 through 1820, with 20 missing values. We used similar Boston sources to collect weekly prices of Boston-traded securities from 1789, filling in the missing values of Smith and Cole between 1795 and 1820, and revising some of their quotations to match with our nearest month-end quotations, usually as the midpoint of the bid and asked quotations. Further, we extended the monthly prices of 3s in Boston beyond 1820, with few missing values.

We also collected weekly prices of the 3s in New York and in Philadelphia over the complete life of the 3s between 1790 and 1832. With Philadelphia, we can match the first monthly price quotations in November 1790, whereas consistent monthly New York prices of 3s begin almost a year later. From that point, the New York data are generally available and consistent through the Treasury repurchases that retired the issue at the end of 1832. Despite the widespread holdings of U.S. debt in Britain, price quotations of the U.S. Threes in London are sparse before 1811.

FIRST BANK OF THE UNITED STATES

Quotations of the prices for “full shares” of the First Bank stock (BUS) begin in July 1791, along with partial share subscription prices as the Bank was gradually organized after that date. Quotations throughout the life of this stock were as a percentage of par in the United States, but in pounds in London.

Foreigners were large holders of the shares of the First Bank. As of June 30, 1803, of the \$10 million in shares outstanding, \$6.2 million was held by foreigners, with roughly \$4 million held by British investors and \$2 million held by the Dutch (Blodget, 1806, pp. 198–199). Nevertheless, we have been unable to find many quotes of London prices before 1811, when the English *Course of the Exchange* began regular coverage. This limits our statistical analysis of trans-Atlantic market integration. We have for London only 45 month-end quotations of the approximate total of 250 months possible.

For U.S. markets, ours are the first series of monthly stock prices for the First Bank ever assembled. We have collected nearest month-end prices for the First Bank stock from mid 1791 through 1811 in Boston, New York, and Philadelphia, which are relatively complete, in contrast with the sparse quotations for London.

SECOND BANK OF THE UNITED STATES

The life of the Second Bank of the United States as a federal institution extends from its charter on April 10, 1816, with a capital of \$35 million, until 1836, when the federal charter lapsed. The institution continued to do business under a state charter as the Bank of the United States of Pennsylvania until it failed in 1841. We

have month-end prices of Bank stock for U.S. and London markets from 1817 to the mid 1840s.

Foreign holdings of shares in the Second Bank were large. Of the 350,000 total shares, \$100 par value per share, it is estimated that 29,288 shares were foreign held in October 1820. By 1828 the foreign holdings had increased to 40,412 shares, and by 1832 foreign holdings had increased to 84,055 shares (Catterall, 1903, p. 508). After the federal charter expired, foreign investors increased their holdings; as a state-chartered institution, the Bank was active in London foreign exchange and securities markets.

American data for nearest month-end prices from Boston, New York, and Philadelphia are complete through 1836. Monthly quotes from Philadelphia and New York continue after the Pennsylvania charter in 1836 through June 1841, when New York quotations cease, and even the listing is withdrawn. From July 1841 through April 1845, we use Philadelphia quotations. London quotations have few missing values throughout the complete period, and even continue through 1846. We use New York quotes through June 1841, switching then to the available Philadelphia quotations – along with the extended prices from London.

American quotations of the monthly prices throughout can be interpreted either as in dollars or as percent of par, since the par value per share was \$100. London quotations throughout are in pounds, shillings, and pence, which we convert to pounds in decimal form. The data are quotations we have collected from primary sources. Our extensive monthly quotations of BUS stock on both sides of the Atlantic make it the most useful security for studying market integration.

NEWSPAPER AND ARCHIVAL DATA SOURCES

For U.S. securities prices, some of the most important newspapers, in terms of circulation, longevity, innovation, and frequency of price quotations include the following: *American Price Current* [New York], 1786; *Baltimore American and Daily Advertiser* [Baltimore American & Commercial Daily Advertiser], 1830–1839; *Baltimore Patriot Mercantile Advertiser*, 1813–1830; *Baltimore [Weekly] Price Current*, 1803–1830, 1853–1860; *Boston Courier*, 1837–1841; *Boston Columbian Centinel*, 1811–1820; *Boston Daily Advertiser*, 1830–1836; *Boston Shipping List, Prices Current, &c.*, 1843–1850; *Charleston Carolina Gazette*, 1823–1829, 1837–1840; *Charleston City Gazette*, 1815–1832; *Charleston Courier*, 1803–1849; *Charleston Mercury and Morning Advertiser*, 1822–1833; *Comparative Price Current*, and *European and American Commercial Reporter*, [New York], 1827; *The Diary, or Loudon's Register* [New York], 1792; *Finlay's American Naval and Commercial Register* [Philadelphia], 1795–1798; *Gazette of the United States* [Philadelphia], 1798–1806; *Grotjan's Philadelphia Public Sale Report and General Price Current* [Philadelphia], 1816–1830; *Hope's Philadelphia Price Current*, 1805–1813; *Howard's Prices Current*, [Charleston], 1832; *Lyford's Baltimore Price Current*, 1839–1849; *Merchants' Daily Advertiser* [Philadelphia], 1797–

1798; *New Orleans Price Current & Commercial Intelligencer*, 1824–1830; *New York Price Current*, 1797–1860; *Pelosi's Marine List and Price Current* [Philadelphia], 1791–1793; *Pennsylvania Mercury and Philadelphia Price Current*, 1790–1792; *Richmond Enquirer*, 1815–1860; *Southern Patriot and Commercial Advertiser*, [Charleston], 1821–1843.

Important brokers' account and letter books include those of Christie and Porter (Pennsylvania State Archives), brokerages run by various members of the Biddle family (Historical Society of Pennsylvania, HSP), Mark Prager (HSP), Andrew Summers (HSP), Alexander Lardner (HSP), and Andrew Craigie (American Antiquarian Society).

For London securities prices the main source, popularized by Neal (1990), is Wetenhall's *Course of the Exchange*, supplemented by quotes of London prices that appeared in the US newspaper sources.

References

- Albion, R. (1938) *Square-Riggers on Schedule*, Princeton University Press, Princeton.
- Albion, R. (1939) *The Rise of the New York Port: 1815–1860*, Charles Scribner's Sons, New York.
- Bagehot, W. (1873) *Lombard Street: A Description of the Money Market*, Henry S. King and Co., London.
- Bayley, R. (1880) *History of the National Loans of the United States. Tenth Census of the United States*, Vol. 7. Government Printing Office, Washington, DC.
- Blodget, S. (1806) *Economica: A Statistical Manual for the United States of America*, A. M. Kelley reprint ed., 1964, New York.
- Bordo, M., Meissner, C., and Redish, A. (2005) How original sin was overcome: The evolution of external debt denominated in domestic currencies in the United States and British dominions, 1800–2000, in B. Eichengreen and R. Hausman (eds.), *Other People's Money: Debt Denomination and Financial Instability in Emerging Market Economies*, University of Chicago Press, Chicago, pp. 122–153.
- Brown, W., Burdekin, R., and Weidenmier, M. (2004) Consols, financial stability, and pax Britannia, unpublished working paper, Claremont McKenna College.
- Catterall, R. (1903) *The Second Bank of the United States*, University of Chicago Press, Chicago.
- Crump, A. (1874) The theory of stock exchange speculation, in R. E. Wright (ed.), *The History of Corporate Finance*, Pickering and Chatto, London 2003, vol. 5, pp. 287–443.
- Davis, J. (1917) *Essays in the Earlier History of American Corporations*, Harvard University Press, Cambridge, MA.
- Dawson, F. (1990) *The First Latin American Debt Crisis: The City of London and the 1822–1825 Loan Bubble*, Yale University Press, New Haven.
- Edwards, S. (2000) *Capital Flows and the Emerging Economies: Theory, Evidence, and Controversies*, University of Chicago Press, Chicago.
- Fenn, C. and Nash, R. (1893) in R. E. Wright (ed.), *The History of Corporate Finance*, Pickering and Chatto, London, 2003, vol. 2, pp. 1–232.
- Ferguson, N. (2001) *The Cash Nexus: Money and Power in the Modern World, 1700–2000*, Basic Books, New York.
- Flandreau, M. and Sussman, N. (2005) Old Sins: Exchange Clauses and European Foreign Lending in the Nineteenth Century, in B. Eichengreen and R. Hausman (eds.), *Other People's Money: Debt Denomination and Financial Instability in Emerging Market Economies*, University of Chicago Press, Chicago, pp. 154–189.

- Fortune, T. (1794) An epitome of the stocks and publick funds, in R. E. Wright (ed.), *The History of Corporate Finance*, Pickering and Chatto, London, 2003, vol. 1, pp. 17–91.
- Fortune, T. and Morier Evans, D. (1850) in R. E. Wright (ed.), *The History of Corporate Finance*, Pickering and Chatto, London, 2003, vol. 1, pp. 93–202.
- Hidy, R. (1949) *The House of Baring in American Trade and Finance: English Merchant Bankers at Work, 1763–1861*, Harvard University Press, Cambridge, MA.
- Homer, S. and Sylla, R. (2005) *A History of Interest Rates*, 4th edn., John Wiley & Sons, New York.
- Lamfalussy, A. (2000) *Financial Crises in Emerging Markets: An Essay on Financial Globalisation and Fragility*, Yale University Press, New Haven.
- McCusker, J. and Gravesteijn, C. (1991) *The Beginnings of Commercial and Financial Journalism: The Commodity Price Currents, Exchange Rate Currents, and Money Currents of Early Modern Europe*, Nederlandsch Economisch-Historisch Archief, Amsterdam.
- Neal, L. (1990) *The Rise of Financial Capitalism*, Cambridge University Press, Cambridge.
- Neal, L. (1992) The disintegration and re-integration of international capital markets in the 19th century, *Business and Economic History, Second Series*, **21**, 84–96.
- North, D. C. and Weingast, B. R. (1989) Constitutions and commitment: The evolution of institutions governing public choice in seventeenth-century England, *Journal of Economic History* **49**, 803–832.
- Obstfeld, M. and Taylor, A. M. (2003) Globalization and capital markets, in M. Bordo, A. M. Taylor, and J. G. Williamson (eds.), *Globalization in Historical Perspective*, University of Chicago Press, Chicago, pp. 121–183.
- Officer, L. H. (1985) Integration in the American foreign-exchange market, 1791–1900, *Journal of Economic History* **45**, 557–586.
- Officer, L. H. (1993) Dollar-sterling mint parity and exchange rates, 1791–1834, *Journal of Economic History* **43**, 579–616.
- Officer, L. H. (1996) *Between the Dollar-Sterling Gold Points: Exchange Rates, Parity, and Market Behavior*, Cambridge University Press, Cambridge.
- O'Rourke, K. H. and Williamson, J. G. (2002a) When did globalization begin?, *European Review of Economic History* **6**, 23–50.
- O'Rourke, K. H. and Williamson, J. G. (2002b) After Columbus: Explaining Europe's overseas trade boom, 1500–1800, *Journal of Economic History* **62**, 417–456.
- O'Rourke, K. H. and Williamson, J. G. (2004) Once more: When did globalization begin?, *European Review of Economic History* **8**, 109–117.
- Pred, A. R. (1973) *Urban Growth and the Circulation of Information*, Harvard University Press, Cambridge, MA.
- Rousseau, P. L. and Sylla, R. (2003) Financial systems, economic growth, and globalization, in M. D. Bordo, A. L. Taylor and J. G. Williamson (eds.), *Globalization in Historical Perspective*, University of Chicago Press, Chicago, pp. 373–413.
- Rousseau, P. L. and Sylla, R. (2005) Emerging financial markets and early U.S. growth, *Explorations in Economic History* **42**, 1–26.
- Simonoff, J. (1996) *Smoothing Methods in Statistics*, Springer Verlag, New York.
- Smith, W. B. and Cole, A. H. (1935) *Fluctuations in American Business, 1790–1860*, Harvard University Press, Cambridge, MA.
- Sylla, R. (1998) U.S. securities markets and the banking system, 1790–1840, *Federal Reserve Bank of St. Louis Review* **80**, 83–98.
- Sylla, R. (1999) Emerging markets in history: The United States, Japan, and Argentina, in R. Sato, R. V. Ramachandran and K. Mino (eds.), *Global Competition and Integration*, Kluwer Academic Publishers, Boston, pp. 427–446.
- Sylla, R. (2002) Financial systems and economic modernization, *Journal of Economic History* **62**, 277–292.

- Sylla, R., and Wilson, J. W. (1999) Sinking funds as credible commitments: Two centuries of U.S. national-debt experience, *Japan and the World Economy* **11**, 199–222.
- U.S. House of Representatives (1830) *U.S. Secretary of the Treasury Report Respecting the Relative Value of Gold and Silver*, House Document No. 117, 1st Congress, 1st Session, 78–85. Reprinted in International Monetary Conference, Senate Executive Document No. 58, 45th Congress, 3rd Session, 1879.
- Wilkins, M. (1989) *History of Foreign Investment in the United States to 1914*, Harvard University Press, Cambridge, MA.
- Wright, R. E. (2002) *The Wealth of Nations Rediscovered: Integration and Expansion of the U.S. Financial Sector, 1780–1850*, Cambridge University Press, Cambridge.

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