TRANS-ATLANTIC CAPITAL MARKET INTEGRATION, 1790-1845

(Preliminary draft, February 2002)

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Abstract

During the 1790s, European investors began to purchase substantial quantities of U.S. government debt securities and the equity securities issued by American corporations. A number of these securities were listed and traded in markets on both sides of the Atlantic. Based on market price quotations we compiled for the same American 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. Studying information-flow times, we suggest that the advent and expansion of regularly scheduled packet shipping services increased and regularized information flowing from one market to the other, promoting integration. Evidence on lagged market responses to the arrival of information suggests that London prices were more affected by New York prices than vice versa. Our findings suggest that the Federalist financial revolution of the 1790s was instrumental in making the United States a successful emerging market, and that financial globalization began by at least the second decade of the nineteenth century, quite a bit early than most of us had suspected, despite the slowness of trans-Atlantic communications.

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Trans-Atlantic Capital Market Integration, 1790-1845

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If a sustained ability to attract capital from foreign investors is a key attribute of a successful emerging market, then the United States of America is almost certainly the most successful emerging market in history. The interest of foreigners in U.S. investments began at the time the country gained its independence, and it has persisted with few interruptions for more than two centuries. During the nineteenth century foreign borrowing made the United States the world's largest debtor nation. With the help of foreign capital, it also in that century became the world's largest national economy.

In recent decades the United States, after being a net international creditor for much of the twentieth century, has once again become a net international debtor. Since the United States is a rich country and rich countries might be expected to export, not import, capital, the recent return to net debtor status has surprised many observers and concerned some of them. But economic historians recognize it as merely a return to conditions that prevailed throughout U.S. history until 1914, a long period when the country was also rich relative to other countries.

Factors other than relative income and wealth must therefore account for the secular attractiveness of the United States to foreign investors. In this paper we explore one such factor, namely, institutional developments in finance, including efficient international market mechanisms that promoted the flow of capital to the United States during the first decades of the republic. These developments made it possible for foreign investors to tap into the higher expected returns offered by U.S. assets because transactions costs were low enough to make such investments worthwhile. Financial developments dating from the 1790s within the United States and between the United States and European markets thus laid the groundwork for two centuries of foreign capital flows to the United States.

1.The United States Emerging Market and Financial Globalization, 1790-1845

The American War of Independence, 1775-1783, was underwritten for a combination of political and economic reasons by loans from the French and Spanish monarchies as well as from Dutch private investors. Wilkins (1989) estimates that, at the time the new federal government authorized by the Constitution formed in 1789, about 29 percent of the country's nominal national debt of $54.1 million, excluding state debts assumed a year later, was owed to foreigners. That debt included $11.7 million of direct loans to the government (including interest arrears, since the debt was essentially unserviced), and $4 million of domestic securities that had been purchased by foreign investors at prices well below nominal par value. Presumably these investors were speculating on a rise in security prices as the new country put its finances in order. They would not be disappointed.

These early investments 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 and quickly converted what formerly had been the equivalent of junk bonds in default into high-grade securities. Foreign investors, attracted by higher returns on American securities than what they were accustomed to at home, bought more of them. The United States financed most of the Louisiana Purchase of 1803, which doubled the size of the country, by issuing new federal securities to France, which in turn sold the bonds to European private investors. During the quarter century after 1817, the year New York State began construction of the Erie Canal, state-sponsored investments in transportation and banking facilities often were financed by marketing bonds to European investors. There followed decades of European investments in the securities of private American railroads and other corporations.

Thanks to the work of generations of historians, much of this history is well documented. Their labors are conveniently summarized in Mira Wilkins's encyclopedic study, *The History of Foreign Investment in the United States to 1914* (1989). There is a gap in the record, however, particularly for the early decades of U.S. history. Compared to the wealth of available information on the types of American investments that interested Europeans and on the institutions that were active on both sides of the Atlantic as financial intermediaries in various periods, we know relatively little about the nature

and the efficiency of the market mechanisms that linked investors in Europe with securities issuers in America.

Our paper represents an attempt to narrow that gap, and it bears on a larger historical discussion of when the globalization of markets began. It might be supposed that the well-documented flow of American securities to Europe starting in the 1790s is an indication that capital markets had by then become global. But as O'Rourke and Williamson (2000) have cogently noted, an expansion of international trade in commodities (and by extension, in securities) is not necessarily an indication of globalization. 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. They demonstrate that although world commodity trade expanded greatly in the centuries after Columbus discovered the new world in 1492, there is little evidence of commodity price convergence across continents and countries before the nineteenth century. In our capital-market context, the documented investments of Europeans in American securities dating from the 1790s could have resulted from economic expansion within Europe and within the United States rather than from an integration of the capital markets of the two continents. Here we show when that integration most likely occurred and thus when capital markets became global.

In the course of a larger project designed to retrieve and organize the quantitative records of early U.S. capital markets, we have gathered extensive information on the prices of American securities in both domestic U.S. and European securities markets during the years from 1790 to 1845. For markets in the United States, 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 far from complete, particularly for the first two decades. Beginning around 1811 they become more available, often at weekly or even shorter intervals. But there are large gaps in weekly data on U.S. securities prices in London, so in this paper we focus on monthly, end-of-month data. In any case, because it took ships roughly a month to cross the Atlantic in the period, there was a lag of that length in the flow of information between European and American markets. The

telegraph did not come in to provide faster communications between domestic markets until the mid 1840s, and the undersea cable did not arrive until the mid 1860s.

Given the slowness of communications across the Atlantic and the great distances involved, one might not expect to find much evidence of securities market integration between trans-Atlantic markets. We find the opposite. Despite slow communications, currency differences, fluctuating exchange rates, different market institutions, and a host of other considerations that would be expected to make market integration difficult if not impossible, we find that during the decades after 1815, if not earlier, the very same U.S. securities traded at virtually the same prices in London and in U.S. markets at the same time. Trans-Atlantic securities markets were well integrated before the telegraphic age.

Our findings imply that the globalization of financial markets occurred earlier than most had thought. Neal (1990), to be sure, demonstrated that the London and Amsterdam capital markets were well integrated during the eighteenth century. Those two markets, of course, while international, were hardly global. They were 220 miles from each other across the North Sea, a small distance in comparison with the 3500 miles of Atlantic Ocean that separated London and New York. Information in the eighteenth century flowed between London and Amsterdam in three to six days, not the four to six weeks of a typical crossing between Europe and America.

Current stylized facts concerning the history of financial globalization are (1) that globalization first occurred in the late nineteenth century when steam navigation reduced transoceanic passage times, major economies adopted the gold standard, and telegraphic and cable communications linked various national securities markets, and (2) that after a period of disintegration lasting from World War I through most of the Cold War era, an integration of capital markets emerged again in the last decades of the twentieth century (Obstfeld and Taylor 2001, 2002). Our work implies that the financial globalization and capital market integration others find during the late nineteenth century was not a new development in history. Instead, it was an extension of the integration of European and U.S. capital markets that had occurred during the first decades of the nineteenth century.

2. The U.S. Financial Revolution and Capital Imports

An under-appreciated fact of U.S. history is the financial revolution that occurred from 1789 to 1795. By the latter year, the United States had all of the major 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 thriving securities and insurance markets. In 1788, the year the Constitution was ratified, it had none of them. Under the Articles of Confederation before 1789, the United States was for all practical purposes a bankrupt country with large foreign and domestic debts and no good way servicing them, other than to increase the balances owed by issuing more promises to pay. The national government's evidences of debt sold in what fragmented markets there were for them in the 1780s at small fractions of par value. By the end of 1791, in contrast, the largest component of a newly restructured federal debt sold at or even above par value in emerging, active securities markets, with interest payments made quarterly in hard money. The evident reform of public finances was the key to the entire financial revolution, which became an enduring achievement of the Federalists who led the country during the 1790s (Sylla 1998, 2002).

The effects of the Federalist financial revolution on the willingness of foreign investors to purchase American financial assets were extraordinary. Table 1 provides an accounting for the year 1803 of all U.S. securities outstanding, most of which had been issued since 1790, 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.

[Table 1: domestic & foreign securities holdings, 1803]

A remarkable characteristic of the young United States as an emerging market is that 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 often find that large foreign loans have to be denominated in currencies of leading developed countries that provide the credit. The United States succeeded in

attracting foreign investment in dollar-denominated securities for two reasons. First, it made the dollar a credible currency by defining it in terms of, and making it convertible into, precious metals—silver and gold. Second, the U.S. government and the central Bank of the United States from the first years of the Federalist financial revolution 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. For example, the Barings banking house in London began in the 1790s to handle such payments in Europe, and by 1803 it became a quasi-official European agent of the United States for such transfers (Hidy 1949, 30, 34-35).

The foreign investor thus found it convenient to own American securities. 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 this investment manual appeared, each updating British investors on the particulars of U.S. investment opportunities, including the names of London brokers who traded in American securities and their commission rates (Wright 2002b). 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 data shown in Table 1 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, and, as the table indicates, foreign investors initially absorbed all of the Louisiana 6s (6 percent, 15-year federal bonds maturing in 1818). During the following decade the federal debt was reduced, and the charter of the Bank of the United States, whose shares were widely held in Europe, lapsed in 1811. Moreover, the turmoil of the Napoleonic wars led European investors to send American securities back to the United States, just as they would do a

century later during World War I. Meanwhile, the amount of securities issued in domestic U.S. markets steadily increased, meaning that foreign ownership fell as a proportion of the total.

Wilkins (1989, Table 3.1, pp. 50ff) provides benchmark estimates, compiled from a variety of sources, of the absolute amounts of foreign holdings of American securities during the first half of the nineteenth century. The total rose from $17-18 million in 1789, to $65-70 million in 1803. It then fell to a range of $30-50 million between 1818 and 1824. The amount was estimated at $50 million in 1833, and then it rose rapidly to new absolute highs of $110 million in 1838, $200 million in 1840, and $222 million in 1853.

The totals mask changes in the composition of foreign holdings. Before the 1830s, most foreign holdings were of federal 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 entirely redeemed its outstanding debt. The large increases in foreign holdings during that decade were mostly in the form of securities issued by U.S. states, which benefited from the excellent experience European investors had with federal securities. 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 rechartered 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, state securities made up half of foreign holdings, with railroad companies' securities 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, the foreign interest in American investments persisted from the first years of the country's existence on the world stage. The U.S. record is one that most subsequent emerging-market nations, actual and potential, would find worthy of emulation.

What accounts for the remarkable U.S. success as an emerging market? Surely a key reason was the quality and modernity of the domestic U.S. financial system installed

by the Federalists in the early 1790s. These institutions assured foreign investors that liquid markets for American financial assets existed in the United States even if, as was sometimes the case, they did not exist in the foreign investors' own country. Recent research tends to confirm this insight. Using a cross-country panel of 17 countries covering the period 1850-1997, Rousseau and Sylla (2001) find that countries with more sophisticated financial systems grew faster, engaged in more 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 a leading role in its economic growth and the integration of its markets with those of other national economies. The United States made this discovery more than two centuries ago, before almost all other countries (the Dutch Republic and Great Britain, which had modernized their financial systems before there was a United States, are two exceptions). The United States benefited from having a modern financial system from that time to the present.

3. Securities Price Data and Required Adjustments for Trans-Atlantic Market Integration Tests

Tests of market integration ideally involve simultaneous comparisons the prices of the same commodity or asset in separate markets. Arbitrage across markets would eliminate price discrepancies. With perfect, instantaneous arbitrage, prices in separate markets 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 economies. 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 (Neal 1992).

The securities price data we have gathered allow us to make both types of tests, although the limited availability of data for U.S. securities prices in London in the earlier decades of the period 1790-1845 allows only rough rather than sophisticated tests of market integration. We examine three American securities that were traded both in U.S. securities markets and in London for long sub-periods of the 1790-1845 period. One is a U.S. government security, 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, and it was outstanding and traded on both sides of the Atlantic from 1790 until it was entirely redeemed in 1833.

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 1) 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.

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 United States and London, not only for the period of its existence as a federal institution before 1836, but also for the period after 1836 when--its federal charter not renewed—the Bank continued to operate as a Pennsylvania state-chartered institution. The Bank failed in 1841, but its shares continued to trade on the basis of their potential liquidation value into the mid 1840s. (More details about these and other early American securities are contained in the appendix on data below.)

For a looser test of market integration, we compare the prices of two similar securities, the U.S. 3s of 1790, payable at the pleasure of the government and redeemed in

1833, and the British Consol 3s, a perpetual bond with a price history extending back to the mid-eighteenth century. An international investor could have purchased either or both of these securities with the same nominal yield between 1790 and 1832, and a comparison of their prices in the markets of that day is of both economic and historical interest.

To give the reader a more concrete idea of the data we have gathered, we give a sample of it for the year 1824 in Table 2. The table presents 1824 end-of-month prices of British Consol 3s in London, US 3s in New York and London, shares of the Second Bank in New York and London, and the dollar-sterling exchange rate on London prevailing in the United States. The prices with two exceptions are expressed as "percents of par," although that is a concept requiring further discussion. One exception is the share price of the Second Bank in London. It is in pounds sterling, expressed by us in decimal form from the actual market quotes that were in terms of pounds/shillings/pence. Thus, at the end of January 1824, and for some months thereafter, the price of a Second Bank share in London was 24 pounds sterling. In New York that month, it was 108.50, or 8.5 percent above a par of $100 per share, so in this case the percent of par quote is the same as a dollar quote. The other exception is the market exchange rates, which are expressed as a par of 1 with the digits after the decimal point indicating a premium over par.

[Table 2. sample of securities price etc data for 1824]

When we first examined quotes such as these for possible signs of trans-Atlantic securities market integration, we were puzzled, even disappointed. In the case of the U.S. 3s, the London quote in every month of 1824 is below the U.S. quote at approximately the same end-of-month date in the New York, and the amount by which it is below the U.S. quote varies quite a lot over the year. For example, the quotations ostensibly indicate that at the end of December 1824, an investor could purchase US 3s in London at 80 and sell them in New York at 90, hardly a sign of a well-integrated market, unless, that is, transactions costs were indeed quite substantial. In the case of Bank shares, the London price in pounds sterling varies from 24 to 25, about 4 percent, over the year, whereas the U.S. price ranges from 108.50 to 120.375, a variability of about 11 percent. The dollar-sterling exchange rate also varied over the year between 1.0775 and 1.10375, but that does not seem like enough variation to explain the differences in securities prices

and their variability. Were the trans-Atlantic markets really so far out of touch that the prices of two identical American securities, widely owned and extensively traded in both markets, could behave so differently in them?

Further investigations indicated that the quotations were not what they seemed to be. "Percent of par," in particular, turned out to be a slippery concept. In one of those oddities or quirks for which they are justly famous, the British back in the era of Queen Anne early in the eighteenth century—long before the U.S. dollar came into existence—decided that Spanish silver pesos, which they called "dollars," were to be rated at 4/6 (4 shillings, 6 pence) in terms of sterling, then moving toward the gold standard. That convention yielded a "dollar"-sterling exchange rate par of 4.44 "dollars" per pound. The British then proceeded 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 U.S. dollar came along in the early 1790s, it contained less silver than a Spanish peso or "dollar." Since it was called a dollar, the British rated it at 4.44, even though, as Officer (1996) demonstrates, the 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 was accounted for by the changing relative price of silver in terms of gold and, in periods when either country's currency was not convertible to specie, 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 U.S. 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 our actual monthly market exchange quotations in Table 2 for that year. Further, when the British quoted a security such as U.S. 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 U.S.-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, and then multiply that result by the dollar-sterling exchange rate. We follow these procedures in adjusting our raw quotations in the tests of market efficiency to which we now turn.

4. Integration of U.S. and British Securities Markets: Models and Tests

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 U.S. 3s, one security traded extensively in both markets during the 1790-1832 period of its existence, the functional relationship could be of the form:

(1) $P_{lon} = f(P_{ny}, X)$

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

(2) $P_{lon} = aP_{ny}^{b}X^{c}$

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,

(3) $\ln P_{lon} = \ln a + b \ln P_{ny} + c \ln X.$

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 imply causality on the "dependent" variable from the "independent" variables, we are more interested in the "association" between the

variables, and whether the estimated coefficients conform to the expected values. From equation (3) the coefficients are elasticities, and, for instance, the value of "b" being unity means that a one percent change in the price of the asset in New York is reflected in an estimated one percent change in the price of the asset in London. Similarly, the expected value of "c" = -1.0 means, for example, that a one percent increase in the New York exchange rate on London would lead to a minus one percent change in the price of the asset in London. The assumed value of the constant, ln a, in different applications of the model, takes on different meanings as explained below. Since the London market expressed its prices of U.S. 3s in dollars assumed to be 4.4444 to the pound, we must multiply the London prices by the dollar-sterling exchange rate to get a price comparable to the New York price.

Slight variations in the model are applicable to the shares of the First Bank, which were quoted as percent of par in both U.S. and London markets. Second Bank shares, however, were quoted in pounds sterling, not percent of par, in London. Equations 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, to express the prices of 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 that time.

Before turning to our regression results, we present in Table 3 some of the characteristics of our comparative U.S.-London price data and their limitations in terms of the available number of observations. The table presents for various periods distributions of the log ratio of the end-of-month price of U.S. 3s, First Bank shares, and Second Bank shares in the United States (usually New York) to the price at that time in London. This ratio in effect is just a variant of equation (3). The adjustments described above were made to achieve comparability of prices in the two markets. 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 far from perfect. But they appeared to

be improving over the period 1790-1840 as shown by the range of the ratio differences between the New York and London prices of a particular asset.

[Table 3. distributions of ratios of US to London prices for 3 securities}

For the U.S. 3s, Table 3 indicates, we have 271 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 271 observations, 187 or 69 percent fall in the range of .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 the .95 to 1.05 range. From 1816 to 1832, on the other hand, 146 of 172, or 85 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 is hardly surprising.

We reach the same conclusion when comparing the results for the First and Second Banks. For the First Bank, we have only 45 U.S.-London price comparisons during the period 1793-1812, and only 16 of these, or 36 percent, are in the .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 .95 to 1.05 range.

The lack of availability of consistent price quotations in a market could be taken as a measure of lack of market integration. For the US 3s from 1790, there are only 99 monthly paired observations of the possible 303 months covered (33%), whereas for the 1816-1832 period, there are 172 monthly paired observations of the 204 possible months (84%). For the First Bank, there are only 45 monthly paired observations of a possible 240 months (19%), 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. The possibility remains, however, that we and subsequent investigators will discover other London data sources that increase the number of paired observations, especially for the pre-1816 period.

Table 4 presents our regression results using the model described at the beginning of this section. For each of the regressions, the coefficient estimates are provided along with the standard errors. The standard errors are useful to those who wish to follow hypothesis-testing methodology, or for those who prefer different confidence levels than we have provided in the table. It is possible that the standard errors are downward biased due to the expected "time series problem" of autocorrelation, but with so many missing observations in the regressions, there is no good way to test for such biases. We use the popular level of 95% confidence, and show upper and lower bounds of the intervals in the tables. The coefficient of multiple determination, adjusted for degrees of freedom, is provided for a description of the "goodness of fit" of the estimate. The number of observations is provided in the table for each regression as information regarding the quality of the data used in terms of missing observations for the period.

Regressions 4-A and 4-B regress the price of U.S. 3s in the United States on the price of the same security in London and the exchange rate. Regression 4-A is for the whole period 1792-1832. If the markets were well integrated, the coefficient on the price in the United States should be 1.0, that on the exchange rate should be 1.0, and the constant, ln a, should be 0.0, that is, a = 1. Our calculated 95%-confidence-interval estimates for both equations do not include the expected values for the coefficients. On that criterion the markets do not appear well integrated. For the period 1816-1832, however, the coefficients on both the price and the exchange rate meet the criterion for asset market integration, although the estimated value of the constant lies outside the expected range of the 95% confidence interval. The coefficients of determination are relatively high.

[Table 4. regression results]

Regression 4-C provides the results of the estimate of the price of First Bank shares in New York on their price in London and the exchange rate for the period 1793-1812. Since there are only 45 month-end observations for months with both the London and New York price, the fit of the equation is not as good as when our data points are more numerous. A value of 1.0 is within the 95% confidence interval for the price

coefficient, and 0.0 is within that range for the constant. But the expected value of 1.0 for the exchange rate coefficient falls outside of the 95% confidence range.

Regressions 4-D, 4-E, and 4-F use the London price of Second Bank shares as the dependent variable and the price of the asset in the United States and the exchange rate for three periods. With market integration, the price coefficient expectation is 1.0, that of the exchange rate is –1.0, and that of the constant is approximately –1.4917, the logarithm of the reciprocal of 4.4444. Regression 4-D uses the entire range of price data, 332 observations covering the years 1817-1845. This includes the period after 1839 of the free-fall Second Bank share prices from above par to near zero. The expected coefficients of price and the exchange rate are within 95% confidence intervals of our coefficients, while the estimated constant lies just outside the interval. The coefficient of determination in this regression is .9843, very high, but is not really comparable with the values in the following two regression estimates, because of the very large addition of total variance caused by the price change during the final years of the period. Regression 4-E repeats the analysis for the period 1817-1836, the period when the Second Bank operated as a central bank under its federal charter. The three coefficients expected under a hypothesis of market integration fall within a 95% confidence interval of the estimated coefficients. Regression estimate 4-F covers the period 1817-1838, the latter year being the last before the Bank suspended convertibility of its liabilities to specie and began its descent toward failure in January 1841. The results are similar to those of Regression estimate 4-E.

On the whole, these regression results argue for a conclusion that the London and U.S. securities markets were well integrated after 1815, the year the Napoleonic wars in Europe and the War of 1812 in America ended. For the period from 1790 to 1815, 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 by the demand for capital of the United States on the one hand, and the demand for income-producing investments in Europe on the other, rather than by market integration itself. In the period after 1815, market integration and price convergence become evident. The transition from securities trade without market integration to trade with integration parallels the

pattern found by O'Rourke and Williamson (2000) for world commodity trade before and during the nineteenth century.

The analysis to this point has been of the same securities traded in two different markets. We also can examine two similar securities, the U.S. 3s of 1790 and the British Consol 3s that were available to investors—at least to British investors, since we have found no evidence indicating that Consols were traded in the United States--during the period 1790-1832. Figure 1 plots the prices of U.S. 3s in the United States and Consols in London over that period. In the 1790s, when the United States restructured its debt and became an emerging market, the new U.S. 3s sold at a discount to seasoned Consols. Shortly after 1800, the price levels and movements of the two securities become similar, except for a period of divergence during the War of 1812 era when Britain and the United States were belligerents, and the early 1830s when the U.S. 3s were about to be redeemed and hence moved toward par.

[Figure 1. US & British Consol 3s prices 1790-1832] TK

Table 5 presents four regressions relating the prices of U.S. 3s and British Consol 3s. Regression equations 5-A and 5-B provide estimates of the price of U.S. 3s in American markets on the price of British 3% Consols in the London market. We have excellent data on the price of Consols in London from Neal (1990), with the latter portion of the monthly prices provided by private correspondence with him. If investors did indeed perceive the two securities as being equivalent, the coefficient on the Consol price would be 1.0 and the constant would be 0.0. That is more or less what we find in regression estimates 5-A and 5-B, with the first using matched data for the entire period 1792-1832, and the second covering the period 1816-1829, which excludes the early 1830s when the U.S. 3s became a short-term security soon to be redeemed. A hypothesized coefficient of 1.0 for Consol price is within a 95% confidence interval in both of these regressions, as is 0.0 for the constant. One indication of how successful the young United States was as an emerging market is how quickly its debt securities became roughly equivalent to those of Britain.

[Table 5. US 3s and British Consol 3s regressions]

Regression equations 5-A and 5-B compare prices of the two countries' 3-percent securities in their own markets. We can also examine the relationship between their prices in the one market where both were traded, London. Regressions estimates 5-C and 5-D regress the price of Consols in London on the price of U S 3s in London and the exchange rate, which is required in this estimate to make the prices comparable given the London 4.4444 quotation convention. If the two securities were regarded in London as similar, the expected coefficient on the U.S. 3s price should be 1.0, that on the exchange rate would be –1.0, and the expected constant would be 0.0. With regression equation 5-C, covering the entire period 1792-1832 when the US 3s were outstanding, the elasticity of British 3s and U.S. 3s has a 95% confidence interval between .81 and .87, and the exchange rate limits are between -.63 and - .48. These coefficients fall outside of the ranges that would be expected if (a) the securities were regarded as similar and (b) markets were integrated. In the regression estimate 5-D covering the years 1816-1829, when our other evidence indicates the trans-Atlantic markets were integrated, the 95% confidence limits for the coefficient of P_{us3s} have a range of .87 to .99, not quite encompassing the expected value of 1.0, and the expected constant of 0 is also just outside the 95% confidence limits. The expected exchange-rate coefficient, -1.0, falls within the 95% confidence interval. Although these two regression results might be considered as offering at best weak support for market integration, they could also be interpreted as meaning that the U.S. 3s were considered an asset different from U.K. Consol 3s by British investors. But judging by their market prices during much of the period 1790-1832, they were not thought by investors to be very different.

5. Trans-Atlantic Information Flows and Lagged Market Responses

Between 1790 and 1845, information flowed across the Atlantic on sailing ships. It was a pre-telegraphic period, and trans-Atlantic steamships came into limited use only in 1839. 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). But, the "regular" traders varied

their 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 Liverpool information to appear in Philadelphia newspapers was 65.5 days; from London it was 67.5 days. The shortest routes were known, using the Gulf current eastbound from America, and adjacent to that current westbound from either Liverpool or from Southampton (London). The westbound route, however, was approximately 500 miles longer than the eastbound route (Albion, 1938, pp. 9-10). The time for a journey eastbound to England was "frequently within the range" of 21 to 28 days, whereas the westbound trip ranged from 35 to 84 days (Albion and Pope, 1942, p. 27, and Officer, 1996, p. 166).

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). Obviously, information-flow times were asymmetric, with information from New York in the period 1818-1857 being on average 12 days faster in reaching Liverpool than information from England was in reaching New York (see Table 6A). The mean times were from one city to another, and not simply land to land. Using only the mean times of crossing, this indicates that one ship could make about 6 round trips per year. But as we shall report, there was considerable variability around the mean times because of the vagaries of wind and ice. Times in port to load and unload cargo also varied somewhat. Packet ships carried cargo, specie, bills of exchange, and commercial information from the press and other sources.

[Table 6. Trans-Atlantic crossing times, etc.]

For our purposes, we are primarily interested in the market information from New York arriving in London, and vice versa. 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 5th of each month. Albion provides some detailed frequency distributions of the crossing times eastbound and westbound, and we have used these values to estimate not only mean times of crossing, but the standard deviations as well. The means and standard deviations for the westbound and eastbound sailing times

for the periods provided by Albion are shown in the Table 6A. For westbound traffic from Britain to America, the mean for the period 1818-1832 was 37.92 days with a standard deviation of 8.58 days, with a minimum time of 17 days to a maximum of 71 days. From Southampton (London), the mean time was 37.75 days with a standard deviation of 8.20 days. For the two cities combined, the crossing time averaged 37.89 days with a standard deviation of 8.50 days for the period.

For the period 1833-1847, the mean crossing times are slightly less, with a smaller standard deviation as well. Combining all 1,942 crossings in Albion's sample for 1818-1847 into a single estimate, we find a mean time of 35.99 days and a standard deviation of 7.89 days.

The sample of eastbound crossings from America to Britain is smaller, with only 188 voyages for the earlier period of 1818-1827. This mean time was 23.73 days, with a standard deviation of 4.19 days, from a minimum time of 16 days and a maximum of 37 days. For 1818-1827, Albion provides the mean times by month of the year. Because of prevailing currents, ice, wind, and other variables, the variation of the average time eastbound was small compared to westbound trips, which were longer in the fall and winter months than in the spring and summer (see Table 6C). Variation in travel times by season implies that variations existed in the mean age of information received in America over a year. The mean age of information from America in London was not only less but also did not have the same seasonal variation as that received from Britain America.

Given the average number of roundtrips per year a ship could make, based on mean eastbound and westbound crossing times, it is obvious that 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 about four years after its inaugural in 1818. Additional lines began between New York and Liverpool/London, and the number of ships on those voyages increased. The total number of ships on those routes during the period 1820-1845 is provided in the Table 6D at five-year intervals. The Black Ball became known as the Old Line after it was joined by the Red Star, Blue Swallowtail, and Black X Lines, and the number of ships on the trans-Atlantic Liverpool route increased from the original four to 16 between 1820 and 1825. The number on the

Liverpool-New York route increased to 20 in 1840 and 24 in 1845. London had no ships to New York until 1825, then four, increasing to 10, then to 12 by 1840. The growing number of ships in service insured at least one or more departures from the ports weekly, but the larger number of ships plying these routes did little to alter the standard deviation of the number of days per voyage.

Attempts were made in New York to shorten the time of the information flow for each trip through the use of semaphore signaling stations to announce the impending arrival of a ship, and to provide information from the ship two or three days before it reached port (Pred, 1973, p. 31). The New York Journal of Commerce operated boats to bring news from the stations to their publishing location. Semaphore systems were in place prior to the advent of regularly schedule packet ships; the stations were rebuilt and improved in 1815, Pred reports, following the War of 1812 when the operations were temporarily halted. The use of semaphore signals must have become widespread, as the number of vessels equipped with semaphore equipment increased from 799 in 1824-1825 to 1,922 in 1834-1835. New York very early became the premier American port for the receipt of information from Europe. The Philadelphia Stock Exchange history (www.phlx.com/exchange/history.html) reports the establishment of signal transmission between New York and Philadelphia—the date is uncertain, but most likely in the 1790s--so that stock traders in New York could not take undue advantage, based on better information, of their Philadelphia counterparts. Signal stations at high points between the New York and Philadelphia could relay information between the cities in ten minutes. The use of semaphore technology lasted until 1846, when telegraphic technology superseded it.

Additional insights into the average age of information arriving in New York from London, and in London from New York can be gained from financial reports in the commercial press. The Course of the Exchange in London, at least from 1825, listed the price of U. S. securities in London, and in an adjoining column listed the prices of the securities in New York at an earlier, stated, date. Similarly, the New York Shipping List and Price Current printed the prices of U. S. securities in London in various places in their bi-weekly publications, at irregular times, along with their regular reports of New

York securities prices. For the period 1825-1827, we have tallied some of this information, in the sense of a sample, to compare travel times of the ships with the "age of the news". For 48 observations over the years 1825-1827, the mean age of the price information from London in New York averaged 39.88 days with a standard deviation of 6.04 days, and a minimum of 28 days and a maximum of 56 days. The mean time is slightly longer, by a couple of days, than the mean travel time of ships, but the standard deviation for this short period is slightly smaller, possibly due to the increased number of ships on the route. In the other direction, the mean time receipts of price information in London from New York in 1827 was 30.54 days with a standard deviation of 5.18 days, and with a minimum time of 24 days and a maximum of 45 days. Here the mean is 6.5 days longer than the mean voyage, which possibly results from the bi-weekly publication schedule of New York financial information. These sample data provide further insight into the asymmetry of the timing of information flows between the U. S. and London markets, with some detail on the variability of the receipt of information on both poles of the trans-Atlantic market for American securities.

Packet shipping continued beyond 1847, after the period of our study, but square-rigger technology became less and less important as the sole means of efficient information flows. Steamships began to be used on trans-Atlantic routes in 1839, and they cut the time of passage considerably. The eastbound and westbound means were reduced, along with the standard deviations. In 1839-1849, the mean time was around 15 days, and by 1856 it narrowed further to about 13 days (Officer, 1996, p. 166). And, of course, a successful trans-Atlantic telegraphic cable followed in 1866.

We may summarize the above discussion of the time it took information to flow across the Atlantic during the period 1790-1845 as follows. Considering the period as a whole, it took from just under a month to somewhat more than two months for wooden sailing ships to cross the ocean. There was an asymmetry: the eastbound crossing from New York to English ports was considerably shorter than the westbound crossing from Britain to America. Over the period, there was a tendency for the mean days of a crossing in either direction to decline, but it was only a slight tendency. Mean crossing times were always highly variable; coefficients of variation ranged from 18 to 25 percent.

Nonetheless, information flows became more regular with the advent of regularly scheduled packet ships between New York and English ports, and they became more frequent as the number of packet ships operating on these routes increased.

Improved trans-Atlantic communications most likely promoted the integration of securities and other markets. Do our data lend support to such a contention? 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 at least 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 his general conclusion was that:

> …it appears that the Amsterdam market was tracing much more closely the actual prices on the London market on the same trading day as in Amsterdam, rather than following with a lag of three days or more the prices reported from London. This is yet another piece of evidence to add to the growing evidence that those early capital markets were as efficient and effective in their use of information as are our modern capital markets (Neal 1990, p. 43).

Our first pass at the issue of lagged responses led to a similarly surprising conclusion that the New York and London markets seemed to be as much in synch simultaneously, when they could not possibly have known each other's prices, as they were when they had information from the other market. We estimated the same models as in section 4 above, but relating London prices to prices in New York one, two, or three

months earlier, and also New York prices to prices in London one, two, or three months earlier in addition to prices in the two cities at the end of the same month. In each comparison, the equations with concurrent and lagged prices turned out to virtually the same, probably because our monthly price series are highly autocorrelated. Comparing the two sets indicated only one difference: the four equations relating London prices to New York contemporaneous and lagged prices had better fits judging by R^2s than did the four equations relating New York prices to London prices contemporaneously and with the three lags. This suggests that London keyed off New York more than vice versa.

Our second pass at the issue of lags produced Table 7, where instead of using log-levels of prices in regressions, we correlated log-percent changes of prices in one city with contemporaneous and lagged log-percent changes in the other city. Panel 7A presents the results for US 3s prices. Lags now appear to matter. London price changes are more highly correlated with New York price changes one, two, and even three months earlier than they are with changes in the same month. And New York price changes seem 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 eastbound versus westbound, and that they may also indicate that London keyed off New York more than New York off London.

[Table 7. Lagged price correlations]

Panels 7B and 7C repeat the exercise for prices of the stock of the Second Bank during its run as the federal bank, and for the whole period of our data set including the period 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 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, especially in the 1817-1835 period, 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.

6. Conclusion

Trans-Atlantic capital markets were integrated by the period 1815-1845. Our results point to that conclusion. They 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 well integrated. Although limitations of our securities price data for that period should make us cautious in concluding that trans-Atlantic markets were not integrated before 1815, there are ample historical reasons why that was likely the case. There was considerable turmoil in Europe and in trans-Atlantic politics and economics during the period 1790-1815, unlike the period after 1815. Despite that turmoil, or perhaps even because of it, European investors demonstrated considerable confidence in the young U.S. government and the American economy by purchasing American securities. That is a tribute to the Federalist political initiatives of the 1780s, and their financial revolution of the 1790s.

The integration of trans-Atlantic capital markets after 1815 suggests that financial globalization occurred earlier than most had thought. It 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 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 U.S. economy. Why trans-Atlantic capital market integration came so early is a question that bears investigation. Was it fostered by innovations such as the regularly scheduled sailings of packet ships shortly after the close of the Napoleonic war era? Based on the evidence presented in Section 5, we deem it likely. Regular packet sailings reduced the time it took for price information to cross the Atlantic and regularized its appearance in British and American financial markets. Investors responded to new information by adjusting prices.

APPENDIX ON DATA: notes and sources

The data used in our analysis are largely newly acquired 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.

End-of-month vs. Time-averaged Data

We avoid using "time-averaged" data because of biases when such data are used in statistical analyses. Monthly data are used, and the dates of the observations are "nearest month-end". Time-averaged data come in various forms. It is not unusual even today for government and business sources (like the Board of Governors of the Federal Reserve System) to present monthly data as the average of daily observations, average of weekly observations, etc. Much historical data on asset prices are provided in terms of the high and low prices of the daily observations within-month, as reported by Martin (1898), or by the *Financial Review*, which was the annual summary of *Commercial and Financial Chronicle* [1860-1922]. Monthly time series of asset prices have been formed using the midpoint of the high and low monthly prices by Macaulay [1938] for railroad stocks and bonds, Cowles [1938, 1939] for various sector indexes for stocks, Fenstermaker, Malone, and Stansell [1988] for bank stock returns, and Atack and Rousseau [1999] for the Boston stock market. These data, and other kinds of time-averaged data, are biased when used in both descriptive and analytical statistical analyses.

This fact has been known since Working [1960] offered a criticism of an analysis of Cowles and Jones [1940] that showed autocorrelation in monthly stock prices over time. Working showed, algebraically, that the kind of time-averaged data used by Cowles and Jones would have downward biased variances by 50% relative to the end of period data, and that there would be a built in first-order correlation of +.25 above that of the spot observations. Schwert [1989] reviewed those results and suggested that the covariance of time-averaged data with another series would also be downward biased. Wilson, Jones, and Lundstrum [2001] have described and illustrated the biased results with various types of time-averaged data using monthly stock prices over the period 1957-2001. Their results extend the biases in autocorrelation through higher orders, and report on the futility of using time-averaged data for regression and statistical inference.

Basic Price Data

The basic monthly series we analyze include the U. S. exchange rate on London; the price in the U. S. and London of the U. S. three percent bonds (Threes), which were outstanding from October 1790 through December 1832; the price of the stock of the First Bank of the United States in the U. S. and in London from August 1791 through October 1812; and the price of stock of the Second Bank of the U. S. in London and New York from January 1817 through 1845 and into 1846. Data availability in the very early period limited, mostly because of few observations from the London market. From around 1811, the quality of the market data is better, with fewer instances of missing

month-end prices. Detailed comments and source materials are provided 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. Data on exchange rates on London and other international centers, as well as discounts on banknotes among various U. S. cities during this period are available in Eliott [1845, pp773-774]. Related data on specie exchange rates from 1814-1815 through 1820-1821 are available from Gallatin [1831, p. 126].

The primary guide to data sources of the monthly rates of exchange is Officer [1985, 1993, and 1996]. Officer provides U. S. / U. K. 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 U. S. definition, and changed over time. An explanation from *The Financial Review* (p. 33, January 1891) provides a helpful, if oversimplified, historical summary:

> The methods of quoting sterling exchange have varied widely in the past, and a glance at the changes which have occurred is somewhat interesting. In the early history of the country the pound sterling was valued at $4 44 4-9, based on the worth of the Spanish dollar, then current here, as a standard. Exchange was then quoted at its real value, the dollar being worth almost exactly 4s. 6p. English money. From 1792 to 1834 our gold coin was of the same standard as the pound sterling—viz., 22 carats, or 916 2/3 parts in 1,000; and at its legal weight of 27 grains the dollar was worth about 97 ½ cents, and the pound sterling in our money about $4.56 ½. In 1834 there was a material reduction in the value of our gold coin the Custom House valuation of the sovereign was put at $4.84, and so remained till January 1, 1874. During the changes from 1834 to January 1, 1874, the London Stock Exchange continued to reckon the dollar at 4s. 6d. (about 9 to 9 ½ per cent too high), involving the practice of quoting American securities about 8 5/8 per cent below their actual value. To correspond to the English custom, bankers in New York from 1834 to 1874 quoted sterling exchange at 109.45 5/8 as par.

This description extends beyond the time period of 1790-1850 on which we focus, and it is oversimplified for our period. Officer, for example, indicates that there was nothing

like the exchange rate stability suggested in the passage 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. We have sought to match the highest quality asset price data for our series with the corresponding market exchange rates. We have a monthly file of all of the exchange rate data discussed below. The data used in our regressions are in "1 + r" form. For instance, a rate from a source given as a premium of "+ 5.0" would be recorded as "1.0500". Data availability on monthly exchange rates by periods and by cities is reviewed in the following paragraphs.

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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), but they seem to be highly rounded relative to other exchange rate data for overlapping periods in other markets. It is seldom that the premium or discount is not to the nearest percent, whereas in other markets the rate is measured to one-quarters and one-eights. 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 [Secretary of the Treasury Report of 1830, pp. 78-85, and also in the International Monetary Conference report to the U. S. Senate in the Executive Document #58 of 1879, pp. 634-541], 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 disadvantages are that they seem to be highly rounded, and that the Baltimore asset market was considerably less liquid than of Boston, New York, or Philadelphia.

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 and have been available for researchers for many years [1935, Appendix E, pp. 187-191]. The data are spot, near mid-month, quoted in terms of a narrow bid-asked range, and were collected from *Boston Price Current and Marine Intelligencer, Russell's Gazette,* and *The Boston Gazette*. The data extend through December 1823 in Smith and Cole, when they are replaced with monthly New York exchange rates, which are discussed below. Similar data for the Boston market, for exactly the same period, are available in the Report of 1830, House Document #117, May 29, 1830, pp. 57-61. Unlike the highly rounded character of the Baltimore data, the Boston quotations are at least to one-half percents for the very early period, and around 1815 to one-quarter percents. The Boston exchange rate data could be extended, but we have not pursued this collection because of the decline of importance of the Boston asset market relative to Philadelphia and New York.

New York. New York monthly exchange rate data sources prior to 1824 are rare. We have been unable to find consistent data for New York prior to the data provided by Martin and by Smith and Cole. Smith and Cole [1935] in their Table in Appendix E give New York exchange quotes from January 1824 to December 1862. The data are from *Bankers' Magazine* through 1852. The same data from 1835 through 1897 are contained

in Martin [1898, p. 28 and p.51ff]. 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. We also collected new data for the nearest month-end dates from February 1814 through December 1833 for New York sixty-day exchange on London from *New York Shipping and Commercial List*. For the overlap period 1824 through 1833, the quotations for the two different sources are similar. In addition, similar monthly quotes for beginning of the month are available in Elliott from June 1825 through 1838 [1845, pp. 1134-1147]. All of these data represent quotations nearest month-end, and values include one-quarter and one-eighth percents.

Philadelphia. High quality monthly exchange rate data exist for the Philadelphia market over the complete period of our study. We make little use of asset prices in this market and, hence, little use of the Philadelphia rates. Annual data are available for the period 1788-1814, and monthly data from 1815 through 1829 are available in the Report of the Secretary of the Treasury of 1830, House Document 117, Table H, pp. 52-57. Monthly rates of exchange at Philadelphia at the beginning of each month from 1825 through 1831 are available in Elliott [1845, pp. 1129-1133].

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 Sixes of 1790, and the Deferred Sixes of 1790. The Sixes made up the largest portion, $30 million, of the total par value of $64.3 million of the domestic national debt and totaled $60 million, which also included $14.6 million in Deferred Sixes, and $19.7 million in Threes [Homer and Sylla, 1996, p. 293]. All three instruments were referred to as "stocks", were repayable "at the pleasure of the government," and therefore had no specified maturity date. All of the bonds were marketable, and markets developed quickly, particularly in port cities. The Deferred Sixes would eventually pay interest at the annual rate of 6% of par value, but interest payments did begin for another ten years, after 1800. Interest payments on the debt were quarterly, an innovation of Hamilton. Government bonds of other countries at the time paid semi-annual interest, and decades would pass before American corporations switched from semi-annual to quarterly dividend payments. The Threes paid $.75 per quarter, and the Sixes paid $1.50 per quarter, per $100 par value. Details of the issuance of the new securities to individuals and the states are available from Bayley [1880]. Initially, each individual bond was for a unique amount, determined by the value of old securities individual debt holders exchanged for it. The only way for these instruments to be traded was at a percentage of par value, and this was also the basis for calculation of the amount of interest to the recipient of the interest on payment dates.

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 debt outstanding. Congress in the later 1790s decided to convert the Sixes and Deferreds to eight percent annuities, to be redeemed and retired over a specified period of years. The

Threes were not included specifically in this debt retirement plan. Details of this arrangement are complex, but explained in Sylla and Wilson [1999]. After the Sixes and Deferreds were converted to annuities in 1800, the Sixes were fully redeemed by 1818 and the Deferreds by 1824. The Threes, 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 existent for 42 years, paying three percent interest per annum, and is the most consistently defined and longest lasting asset for trading in U. S. asset markets over this early time period. All three U.S. bond issues of 1790 were bought by European investors, primarily British and Dutch investors at a time when London and Amsterdam had the most highly developed securities markets in the world [Neal, 1990]. The Threes were traded in all U. S. markets and in foreign markets. They totaled about $20 million of marketable securities, were highly liquid, and were consistently defined over a long period. They are thus an excellent asset for our capital market integration investigation.

Prices of the Threes in Boston have been partially available for many years. The earliest presentation that we are aware of is the monthly prices of various bonds from January 1789 through December 1793 in Davis [1917, v. 1, Appendix A, pp. 339-340]. The source of Davis' data was the *Massachusetts Magazine*, which we used to add data through 1794. The Boston price series for the Threes began in October 1790, and are month-end quotations. Prices of Threes in Boston from November 1795 through 1820, with 20 missing values, were collected by Smith and Cole, primarily from the *Boston Gazette* [1935, Appendix C, Table 59, p. 171]. 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 Threes in Boston beyond 1820, with few missing values.

We also collected weekly prices of the Threes in New York and in Philadelphia over the complete life of the Threes between 1790 and 1832. With Philadelphia, we can match the first monthly price quotations in November 1790, whereas consistent monthly New York prices of Threes 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. Monthly Philadelphia quotes are also cover the whole period, but there are some missing data in 1801-1802 and 1823-1824.

The Threes, Sixes, and Deferred Sixes were held widely in Europe. For instance, as of June 30, 1803, $7.843 million of the Threes were held in the United States, and $11.230 million in Europe (see Table ?). Of the Threes owned in Europe, $6.663 million were held by the British, $3.902 million by the Dutch, and $0.664 million by other European investors [Blodget, pp. 198-199]. On January 1, 1818, it is estimated that $6.056 million of the Threes were held in the United States and $7.392 million was in foreign hands, with $2.601 million held by the British and $3.766 million by the Dutch [Seybert, p. 757]. In 1824 and in 1828, the estimated values of the Threes held by Americans and by foreign

investors were $7.554 million and $7.740 million, respectively [Smith, p. 68]. In 1828, of the total U. S. federal debt of approximately $58.421 million, the British held $14.462 million, the Dutch held $2.162 million, and other foreign investors held $2.802 million.

Despite the widespread holdings of U. S. debt in Britain, price quotations of the U. S. Threes in London are sparse before 1811. In that year, a major British source we have used, the semi-official *Course of the Exchange*, expanded its coverage of the London securities market and began to quote U.S. securities. Quotations remained somewhat sporadic until Treasury redemption of the Threes in 1832. Over the life of the Threes, there are potentially 507 observations, with 255 prior to 1812, and 252 following. London monthly quotations number only 62 prior to 1812, and 209 thereafter.

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. The capitalization of the BUS was $10 million, 25,000 shares with a par value of $400 per share. The capital was raised by open subscription, and included a purchase of 5,000 shares by the U. S. Government. It was Hamilton's plan to borrow the money for this purchase from the First Bank and to repay the loan at six percent interest. Hamilton thought that the shares would provide income to the government from dividend payments that might be in excess of the six percent interest on the loan. [Lane, p. 602]. Quotations throughout the life of this stock were as a percentage of par in the United States, and also in London. The stock paid handsome semi-annual dividends each January and July, averaging over eight percent of par value per annum until the failure of Congress to re-charter on March 4, 1811. Over the period July 1791 through March 1811, the stock never traded at a price below par in Boston, New York, or Philadelphia, and often traded at a price of 150 or more, equivalent to $600 or more per share.

Foreigners were large holders of the shares of the First Bank of the U. S. 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, pp 198-199]. Nevertheless, we have been unable to find very many quotes of London prices, limiting 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.

The dissolution of the First Bank after 1811 went smoothly, with 70 percent of the capital stock returned to its shareholders in June 1812, 18 percent in October 1812, seven percent in April 1813, and the final five percent in April 1815. Additional dividends were paid at later dates [Seybert, p. 522]. Seybert reports an additional of four percent of par on the 28th of February 1817, and Bray Hamilton [p.225] reports a dividend payment as late as 1854. The original purchase of $2 million of stock by the U. S. Government was liquidated by 1802.

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, 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 relative complete through 1836, when Boston data become scarce. Monthly quotes from Philadelphia and New York continue after the new 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 the data from Cole's 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.

Dividends of the Second Bank were less generous those of the First Bank. They averaged over six percent per annum through 1834, and were 3.5 percent semiannually from 1829 through 1834. Dividends continued at the rate of five to eight percent from 1835 through 1839 for the reconstituted Second Bank of the U. S. of Pennsylvania. The original investment by the U. S. Government paid off handsomely, in addition to the functional benefits it rendered to governmental operations. An estimate by Smith summarizes the return to the government: [Smith, p. 71]:

> For the government, the investment in the 'old' Bank turned out well. In return for $7,000,000 of 5 per cent government bonds issued January 1, 1817, the Treasury received a bonus of $1,500,000, dividends of $7,118,416, and principal and interest on redemption of its shares amounting to $8,393,526. The total received over the years amounted to $17,778,342. This was a good investment.

Our extensive monthly quotations of BUS stock on both sides of the Atlantic make it a 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), 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.

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Table 1: Reconciliation of U. S. Debt and other Stocks, by Type and Origin Held by Domestic and Foreign Investors: June 30, 1803, in Millions of Dollars

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	.577	1.271	1.847
Four and One-Half	.125	.050	.176
Navy 6's	.687	.022	.709
Louisiana 6's	-	11.250	11.250
Total U. S. Debt	38.035	43.369	81.405
Bank of U. S.	3.800	6.200	10.000
State Banks	7.120	9.000	16.120
Insurance Cos.	10.500	.500	11.000
Turnpike, Canal	3.220	.180	3.400
Grand Total	62.675	59.249	121.925

Note: Sums may not add to totals due to rounding. These data represent the factual balances between Bayley (1880) and Blodget (1806) data in their separate interpretations of Treasury sources.

Source: These basic data are from Blodget, rearranged, with Louisiana 6s shifted from private to public, as revised in Table 3 above, and retotaled. Blodget's total U. S. debt holding for individuals in the U. S. was $36.011 million. relative to the revised figure of $38.035 million above. Blodget's Grand Total was $129.805 million relative to our calculated value of $121.925 million.

Table 2: Securities Prices in London and New York and Dollar-Sterling Exchange Rate, 1824

(end-of-month quotations)

Year	Month	UK3s London	US3s London	US3s New York	BUS London(£)	BUS New York	Exchange Rate
1824	1	90.500	76.25	80.000	24.00	108.50	1.0775
1824	2	92.125	76.75	79.750	24.00	111.00	1.0850
1824	3	94.500	78.50	83.000	24.00	112.75	1.08875
1824	4	95.875	80.25	86.000	24.00	114.50	1.0875
1824	5	94.125	80.50	88.125	24.25	108.8125	1.1000
1824	6	94.750	80.50	87.125	24.25	120.375	1.0850
1824	7	92.000	79.00	87.750	24.50	117.50	1.0850
1824	8	93.625	80.00	88.3125	24.50	118.1875	1.0900
1824	9	95.375	79.50	89.875	25.00	118.25	1.10375
1824	10	96.000	79.50	89.500	25.00	118.875	1.0925
1824	11	94.875	79.50	89.750	24.875	118.75	1.0950
1824	12	94.750	80.00	90.000	25.00	119.125	1.09375

Table 3. Distributions of the ratio of a security's price in the US to its price in the UK
(end of month)

Ratio, P_{us}/P_{uk}	US 3s	US 3s	US3s		First Bank		Second Bank
	1790-1832	1790-1815	1816-1832		1793-1812		1817-1839.5
.8-.85							1
.85-.9	3	3			1		3
.9-.95	20	18	2		2		20
.95-1	62	14	48		8		126
1-1.05	125	27	98		8		91
1.05-1.1	43	22	21		10		17
1.1-1.15	13	10	3		10		2
1.15-1.2	3	3			3		1
1.2-1.25	1	1			2		
1.25-1.3	1	1			1		
Total observations	271	99	172		45		261
Total months	507	303	204		240		263

Table 4. Log-linear Regressions of a security price in one market on its price in a trans-Atlantic market and exchange rate, 1790s-1840s

#, period	**Security** Dep. Var.	Coeff. Std. Error 95% c.i.						# observ		Adj. R^2
	US 3s									
	P_{us}	P_{lon}		Exch. rate		Constant		.		
A. 1792-1832		1.0744 (.0201) 1.04/1.11		.7291 (.0349) .66/.80		-.3102 (.0844) -.48/ -.14		271		.9513
B. 1816-1832		.9516 (.0220) .91/1.00		1.0772 (.0695) .94/1.21		.1968 (.0917) .02/.38		172		.9601
	First Bank									
	P_{ny}	P_{lon}								
C. 1793-1812		.8294 (.1002) .63/1.03		.2155 (.1867) -.16/.59		.8880 (.4798) -.08/1.85		45		.6252
	Second Bank									
	P_{lon}	P_{us}								
D. 1817-1845		.9848 (.0062) .97/1.0		-1.2924 (.2202) -1.72/ -.85		-1.3994 (.0324) -1.46/ -1.33		332		.9843
E. 1817-1836		.9965 (.0286) .94/1.05		-1.0621 (.0760) -1.21/ -.91		-1.4674 (.1351) -1.73/ -1.20		231		.8461
F. 1817-1838		.9800 (.0284) .92/1.04		-.9825 (.0695) –1.11/ -.85		-1.3936 (.1344) -1.65/ -1.12		355		.8310

Table 5. Log-linear regressions of US 3s and UK Consol 3s, 1792-1832

	US 3s in US on UK 3s in London	Coeff. Std. Error 95% c.i.					
#, period	Dep. Var. P_{us}	P_{lon}	Exch. Rate	Const.		# observ.	Adj. R^2
A. 1792-1832		.9499 (.0375) .87/1.02		.1253 (.1593) -.19/.44		507	.5601
B. 1816-1829		1.0571 (.0445) .97/1.14		-.2963 (-.1946) -.68/-.09		168	.7712
	UK 3s in London on US 3s in London						
	Dep. Var. P_{uk3s}	P_{us3s} in London					
C. 1792-1832		.8474 (.0158) .81/.87	-.5538 (.0370) -.63/-.48	.6200 (.0666) .49/.75		271	.9307
D.1816-1829		.9308 (.0315) .87/.99	-.8460 (.1000) -1.04/-.64	.2718 (.1315) .01/.53		145	.9069

Table 6. Westbound and Eastbound Time in Days between New York and English Port Cities, 1818-1847, Showing Mean Days per Trip, Standard Deviations, and Minimum and Maximum Times, Monthly Average Times, and Packet Ships in Service

6A. Westbound

Time Period	Origin	Number of Trips	Mean Days	Std. Dev.	Minimum	Maximum	Coefficient of Variation
1818-1832	Liverpool	521	37.92	8.58	17	71	22.62%
1824-1832	London	134	37.75	8.20	17	66	21.73
1818-1832	Combined	655	37.89	8.50	17	71	22.42
1833-1847	Liverpool	835	34.32	6.96	16	73	20.27
1833-1847	London	452	36.34	7.97	19	83	21.93
1833-1847	Combined	1287	35.03	7.39	16	83	21.09
1848-1857	Liverpool	637	34.68	8.13	16	89	23.47
1848-1857	London	342	35.18	8.68	17	85	24.68
1848-1857	Combined	979	34.85	8.33	16	89	23.90
1818-1857	All Liverpool	1993	35.37	7.93	16	89	22.42
1824-1857	All London	928	36.12	8.31	17	85	23.00
1818-1857	All Combined	2921	35.61	8.06	16	89	22.63

6B. Eastbound

Time Period	Destination	Number of Trips	Mean Days	Std. Dev.	Minimum	Maximum	Coefficient of Variation
1818-1827	Liverpool	188	23.73	4.19	16	37	17.66%

6C. Monthly Average Days per Trip by Month of Year, Eastbound and Westbound, 1818-1827

Month	Eastbound	Westbound
January	24 days	42 days
February	24	40
March	23	36
April	24	34
May	24	35
June	25	38
July	24	40
August	23	36
September	25	33
October	24	37
November	22	38
December	24	48

6D. New York Packet Service by Number of Ships on Each Route as of Benchmark Dates

Year	Liverpool	London
1820	4	0
1825	16	4
1830	16	10
1835	16	10
1840	20	12
1845	24	12

Source: Albion (1938)

Means and standard deviations were calculated from Albion's frequency distributions on pp. 318-319, and p. 322. Monthly averages are from Albion, p, 322, and the number of ships in service to and from Liverpool and London, p. 274.

Table 7. Correlations of Log-Percent Changes of Prices in New York and London Markets, contemporaneously and with lags

7A. U.S. 3s, 1816-1832

	ln%chnge London			ln%chnge NY
ln%chnge London	1.0000		ln%chnge NY	1.0000
ln%chnge NY	0.0796		ln%chnge London	0.0399
ln%chnge NY-1	0.2835		ln%chnge London-1	0.0438
ln%chnge NY-2	0.2132		ln%chnge London-2	0.2549
ln%chnge NY-3	0.1864		ln%chnge London-3	0.3438
ln%chnge NY-4	0.0954		ln%chnge London-4	0.1645
ln%chnge NY-5	0.0414		ln%chnge London-5	-0.0083
observ.	150			96

7B. Second Bank of the United States, 1817-1835

	ln%chnge London		ln%chnge NY
ln%chnge London	1.0000	ln%chnge NY	1.0000
ln%chnge NY	0.1092	ln%chnge London	0.1044
ln%chnge NY-1	0.2682	ln%chnge London-1	0.0684
ln%chnge NY-2	0.3009	ln%chnge London-2	0.0218
ln%chnge NY-3	-0.0634	ln%chnge London-3	0.0743
ln%chnge NY-4	0.0094	ln%chnge London-4	0.0960
ln%chnge NY-5	0.0519	ln%chnge London-5	0.1291
observ.	212		206

7C. Second Bank of the United States, 1817-1845

	ln%chnge London		ln%chnge NY
ln%chnge London	1.0000	ln%chnge NY	1.0000
ln%chnge NY	0.3767	ln%chnge London	0.3769
ln%chnge NY-1	0.4825	ln%chnge London-1	0.2566
ln%chnge NY-2	0.0541	ln%chnge London-2	0.1269
ln%chnge NY-3	0.1241	ln%chnge London-3	0.0644
ln%chnge NY-4	0.0414	ln%chnge London-4	0.1354
ln%chnge NY-5	-0.0221	ln%chnge London-5	0.1315
observ.	325		319