NBER WORKING PAPER SERIES

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Working Paper 31886
http://www.nber.org/papers/w31886

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November 2023

I thank Mike Bordo, Bill Dougan, Rob Fleck, Matthew Jaremski, Ben Jaros, Jonathan Leganza, Mike Makowsky, Eugene White, and seminar participants at Clemson and Rutgers for valuable comments on earlier drafts. The views expressed herein are those of the author and do not necessarily reflect the views of the National Bureau of Economic Research.

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JEL No. N21

ABSTRACT

How far did antebellum bank notes travel? Up to now, we did not know. Using previously overlooked data on interbank holdings of bank notes and the records of a small-time note broker, I find that most bank notes circulated within about 50 miles of the issuing banks. Few notes were observed from as far as 200 miles away. Several studies of secondary markets for privately issued currencies assume that notes moved across vast geographic space, but these new findings suggest that we may need new models of bank note pricing and the efficiency of relatively unfettered markets in private currencies.

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1. Introduction

Stigler and Sherwin (1985, p.555) observed that the "market for a good is the area in which the price of the good tends to uniformity, allowance being made for transportation costs." If there is a uniform price, accounting for transportation costs over a geographic range, buyers and sellers consider a transaction at any point within that range to be a perfect substitute for a transaction at another point within that range. As an example, Stigler and Sherwin discuss the nineteenth-century Atlantic market for English gold sovereigns, which tended to trade within the gold points defined by the costs of moving gold between London and New York City. For modern Americans, the market for dollars encompasses nearly the whole of North America. Up until 1996 each regional Federal Reserve bank issued its own notes identifiable by a unique district seal on the notes' faces; wandering notes were returned to their issuing regional bank when cleared through a distant bank. The "Fed points" were infinitesimal, which is consistent with a near-zero marginal cost of returning notes to the regional bank of issue and the perfect substitutability of regional notes in trade.

Yet, in a series of studies Brockman and coauthors find that even in the early twenty-first century Federal Reserve notes do not travel very far very fast (Brockman, Hufnagel and Geisel 2006, Brockman and Hufnagel 2007, Brockman and Thies 2008, Brockman 2009). Using tracking data on a half-million bank notes gathered from a popular note-tracking website, they find that the dispersal of modern United States currency follows a process approximated by an inverse power law equation.[1] In an era of trains, planes and automobiles, the probability that a note will travel a substantial distance in a short time decays quickly, from an 8 percent probability that a note travels just 5 km to an 0.2 percent probability that it will travel 50 km between observations. Although about one-fourth of tracked notes disperse beyond 800 km from their point of origin, about one-fifth remain within 50 km of their origins.

[1] Specifically, the probability that a note will travel d kilometers in five days or less is distributed $p(d) \sim d^{-(1+\beta)}$, where $\beta = 0.59 \pm 0.02$.

A statistical issue not considered in these studies of bank note dispersal is selection bias. The note tracking site relies on members receiving a tracked note, logging into the website, and recording the information. Movements are not recorded with each transaction; they are recorded with each transaction in which members choose to enter the information. We do not know the underlying selection process by which people choose to record (or not) the tracked notes they encounter.

For nineteenth-century Americans, the market for currency – paper currency, in particular – was smaller yet in geographic scope; it sometimes encompassed no more than a few score miles around the issuers of private bank currencies that constituted the principal media of exchange. Hildreth (1840, p.139) noted that in "Boston, a Boston bank note passes in all commercial transactions the same as coin," because the note is redeemable at the bank of issue at low cost, but a "Philadelphia bank note does not pass in Boston." The Boston owner of a Philadelphia bank note either needed to find someone in Boston who had business in Philadelphia and was willing to buy Philadelphia currency, which implies that nineteenth-century currencies mitigated but did not eliminate the double-coincidence of want problem. Or, more likely, the Boston owner of a Philadelphia bank note sold the note to a trader who specialized in buying "foreign" exchange at less than the note's face value.

Like gold coins, which traded at prices consistent with their intrinsic value, early nineteenth-century currencies traded at prices that reflected their value in trade, conditional on the risks of holding notes and the cost of returning notes to their issuers' places of business. Because the convenience yield of bank-issued currencies declined and redemption costs increased in distance from the notes' issuers, the question of how far antebellum bank notes traveled – and, by implication, how well they served as a medium of exchange – is a foundational question. The answer speaks to the efficiency of early American financial markets and whether bank-issued currencies greased the wheels of exchange, facilitated impersonal market exchange, and promoted (or at least did not impede) economic growth and development.

In an oft-quoted passage, Cagan (1963) argued that the antebellum system of bank-issued currency confused consumers, abetted fraud, and encouraged counterfeiting, all of which increased the costs of transacting. "The nation," Cagan (1963, p.20), "could not so easily have achieved its rapid industrial and commercial expansion during the second half of the nineteenth century with the fragmented currency system it had during the first half." Although some historians still cast the antebellum system as confusing, costly, and prone to counterfeiting (Mihm 2009, Greenberg 2020), economic historians doubt Cagan's assertion. Rockoff (1974) showed that the use of private bank notes imposed costs less than would be suffered by holding cash in a 1 percent inflation. King (1984) estimates expected losses of holding New York

free bank notes of less than 0.2 percent in the late antebellum era. In states with well-regulated banking systems, bank notes were low risk assets, which is consistent with their widespread acceptance. Nevertheless, there is reason that notes, though useful media close to their point of issue, were less useful in long-distance transactions.

In his analysis of the dispersal of modern bank notes, Brockman (2009) finds symmetry in the inflows and outflows of currency from a given location, yet he also observes considerable heterogeneity in dispersal patterns based on region of origin and the size of the city. Although Brockman (2009, p.11) finds that more populous counties are more connected and more strongly connected with other counties, he is unaware of "a plausible evolutionary mechanism that can account for the emergence of these distributions." In the specific historical context of antebellum American banking, Gorton (1996, 1999) treats bank notes as small-denomination perpetual bonds with an embedded put option. He then uses a Black-Scholes-type option pricing model in conjunction with data on distances and travel times between issuing banks and note-using consumers to calculate the effective maturity of bank notes. Gorton, Ross and Ross (2022) estimate an effective maturity of 23.3 days, a result they label *distance*, but given the wide range of transportation modalities available at the time – walking, horseback, stagecoach, canal and river boats, and railroads – it is not obvious how to translate their estimate into geographical distance. If we assume that notes traveled at a constant speed so that they spent half their life traveling outbound and half traveling inbound and that all the people who accepted bank notes traveled (conservatively) 20 miles per day on a straight line, the notes reached their maximum distance from point of issue of 233 miles, or about the distance between Philadelphia and Canandaigua, New York, or Pittsburgh, or Norfolk, Virginia.

Despite its deep institutional grounding and careful construction of travel networks, Gorton's model ultimately treats geographic space – a featureless plain – in much the same way Brockman treats it. Bank note maturities radiate outward in concentric circles. While we can construct a plausible rail network between Canandaigua, New York and Philadelphia, Pennsylvania, measure its distance and the likely travel time at nineteenth-century speeds, it does not tell us how often, if ever, someone made the trip. Or, if anyone did, whether they carried some notes of the Ontario Bank of Canandaigua with

them, tried to spend them in Philadelphia, and thus generated a transaction price for the small-denomination, zero-coupon security.

A question that appears in both the historical and modern literature is: Why would the public tolerate, even embrace, a currency that depreciated as it moved away from its issuer? We are now able to answer the question. *Bank-issued currency did not move far from its point of issue*. I use the records of a small-scale bank note broker, as well as two special bank reports collected in the 1840s by Pennsylvania's bank regulator. All three sources report the number of notes of issuing banks purchased or held at a moment in time. I connect these quantity values with information on plausible trading networks and distances separating issuing and receiving banks from which I can estimate the distances over which bank notes ranged. The results imply that there was a 50-50 chance that a bank, and banks surely dealt with more notes than the public, encountered or held a note issued by a bank 50 miles distant on a given day. The average discount in Philadelphia of a note issued by a bank 50 miles away was 0.67 percent; the median discount was zero. Thus, the currency that an individual was likely to encounter was issued close to where he or she lived, was familiar, and the costs, including the verification costs, of using it were very small.

2. Antebellum monies, coins, and bank notes

Between 1793 and 1820 the United States mint coined less than $11 million in silver and $7.5 million in gold relative to an average $350 million gross domestic product (US Department of the Treasury 1978). Complaints about the chronic shortage and low quality of coins formed a constant refrain throughout the colonial period into the early republic (Redish 1984, Grubb 2016). Because the mint was slow to provide an adequate domestic coinage, the public relied on a hodgepodge of domestic and foreign coins, many of which were of relatively low quality — clipped, abraded, and old — that tended to trade by weight rather than tale. Pamphlets circulated with fine metal ratios of nearly all foreign coins so that merchants could weigh and accept coins at their market rather than face value (Thompson Brothers 1860). Financial reports printed in nearly all major U.S. daily newspapers detailed the current dollar price of commonly encountered foreign coins. As late as the 1850s, newspapers reported current market prices of Spanish and Mexican silver dollars and French five-franc pieces, all of which were

convenient for use in trade because they traded at prices close to one U.S. dollar. English gold guineas traded for just more than five US dollars; and Spanish gold doubloons traded around $16.25. Commercial banks rarely provided details of their specie reserves, but the few extant reports reveal that they received and held a variety of domestic and foreign coins (Cable 1923, p. 211).[2]

The inadequate quantity and low quality of hard currency in circulation in early nineteenth-century America encouraged state legislatures to charter commercial banks, each of which issued its own form of circulating currency and most states' chartering policies grew increasingly liberal over time (Rockoff 1974, Sylla 1985). In 1810, 92 banks operated across the country; in 1835 there were 527; in 1860 there were 1,345 banks (Weber 2006). All banks issued their own private monies, known as bank notes, as an integral part of extending credit and making loans. Borrowers discounted promissory notes and bills of exchange at banks and received bank notes in return that they then carried into the marketplace. Nineteenth–century banks were depositories, but deposit creation was not yet an integral part of the lending and money–creation process.

Notes were issued in denominations that made them useful in everyday consumer transactions — one, two, three, and five dollars — and in commercial transactions — ten, twenty, and fifty dollars and more, though some states prohibited small denomination notes (Bodenhorn 1993)[3]. Although the US mint coined silver dollars, as well as $5 and $10 gold coins, the most minted denominations by value were silver half dollars ($0.50) and gold quarter eagles ($2.50). Bank notes not only saved the public the costs and risks of moving coins, notes filled denominational gaps in the domestic and foreign coinage.

Because each of 1,300-odd banks issued bank notes in several denominations, there were between 8,000 and 10,000 distinct notes in circulation in 1860 (Cagan 1963, Greenberg 2020). Contemporary observers and historians alike depict the antebellum currency as a confusing, chaotic, ragtag mixture of low-quality coins, low-quality bank

[2] The Columbia Bank & Bridge Company of Columbia, Pennsylvania, for example, reported in March 1842 that its specie holdings included just $137.75 in US gold, $39,566.14 in US silver, and $7971.38 in assorted foreign coins (Pennsylvania Auditor General 1842, p. 481).

[3] It was not unusual for banks to issue notes in denominations not seen today. The Farmers Bank of Virginia, for example, issued notes in denominations of $1, $2, $5, $6, $7, $8, $9, $10, $30, $50, $100 (Farmers Bank 1841).

notes, and counterfeits that imposed substantial and potentially growth–inhibiting inspection and verification costs on even ordinary daily transactions (Cagan 1963, Mihm 2009). Merchants and the public alike viewed unfamiliar bank notes offered in impersonal transactions skeptically and rarely accepted them uncritically (Dillistin 1949, Greenberg 2020). Despite the costs of using bank notes, people relied on them in daily exchanges. During his travels through America in 1819, Englishman Henry Fearon (1819, p.232) observed that "the paper money system has gone beyond all bounds …. Specie of the small amount [denomination] is rarely seen." A generation later, Philadelphian William Gouge (1833, p. 57) wrote that "of large payments, 999 in a 1,000 are made with paper. Of small payments, 99 in a 100." These men's observations square with the available facts. In 1834 the currency–coin ratio in the United States was 12.6; in 1859 it was 20.9 (Temin 1969). Demand deposits did not yet constitute the majority share of the money stock, and they were used mostly by merchants in wholesale transactions not households in retail transactions (Weber 2018, Redlich and Christman 1967).[4]

2.a. The market for bank notes

Pre-Civil War banks issued their own private currencies that served as the principal media of exchange, but they can be thought of as small-denomination, non-interest bearing, perpetual debt obligations of issuing banks (Gorton 1999).[5] The holder of a note had the right to present the note for redemption into legal tender (specie) at face or par value at any time. Despite government regulations designed to enforce continuous par redemption, note holders bore a risk of loss. Banks failed. They failed for any number of reasons: bad management, bad luck, recessions, poor regulations, and poor enforcement of potentially effective regulations (Rockoff 1974). And when banks failed note holders joined other creditors, albeit as priority creditors, in bankruptcy proceedings. Losses borne by holders of failed banks' notes varied by state, regulatory

[4] For Pennsylvania banks, the deposit/deposit–currency ratio was 0.197; in 1825 the ratio reached 0.443 and remained near that level up to the Civil War (Weber 2018). In New York State, the ratio did not exceed 0.40 until 1852.

[5] Hildreth (1840, p.139) recognized the same when he described a bank note as: "a bill of exchange, payable to the bearer at sight. It is a title deed to a certain amount of coin, at a certain place mentioned and described on the note, the possession of which coin may be had, whenever it is demanded."

regime, and the speed at which bankruptcies were resolved. In New York State circa 1850, note holders' ex post losses from bank failures were as small as 0.1 percent, which was probably less than losses arising from lost or accidentally destroyed notes (King 1983, Dwyer 1996). In Wisconsin circa 1856, ex post losses reached 10.4 percent (Rolnick and Weber 1983).

Gorton (1999) observes that the continuous redemption option may have limited bank risk taking because it allowed note holders to run banks that engaged in risky lending. Calomiris and Khan (1991) argue that the first come—first serve feature of the redemption option encourages at least some note holders to invest in information and monitor banks' risk–taking activities. Private monitors receive a return on their costly monitoring because they will be first in the redemption queue when a bank approaches insolvency. Currency holders at the head of queue cash out; those at the end do not. Exercising the embedded redemption option, however, means redeeming at the issuing bank, the costs of which depend on the distance between the note holder and the bank, as well as the available transportation technologies — horseback, coach, canal, or rail — connecting the two points.

It was uneconomic for most individual note holders to monitor banks. Any single household held too few notes at any moment for the benefits from monitoring to exceed the costs. Two systems arose that monitored and provided note holders with information about the liquidity and solvency risks of holding bank notes. The first were private redemption systems, the most notable of which was Boston's Suffolk System (Whitney 1878, Fenstermaker and Filer 1986, Smith and Weber 1999). In 1824, the Suffolk Bank established a region-wide clearing system that created an effective monetary union in that (virtually) all private bank currencies traded a face value throughout New England.

New York State imposed a Suffolk–like system on its country banks. Beginning in 1842, New York mandated that all banks outside Albany and New York City contract with either an Albany or New York City bank, which would act as their redemption agent and stand ready to redeem that bank's notes at a small discount from face value. By the early 1850s, two Albany and three New York City banks served as the cities' principal redemption agents (Myers 1931). By that time, nearly all New York State

country banks' notes traded at 99.625 or 99.75 cents on the dollar in New York City (Weber 2021a).

Banks in other places created their own interbank redemption networks to enhance the quality of the monetary services provided by their notes and to extend the geographic extent of their circulation. In a response to an investigation by a state legislative committee into the State Bank of Indiana's practices, the chief operating officer of the Lawrenceburg branch informed the committee that it was imperative for the bank to create facilities for the users of its notes to convert them into specie "with the least possible inconvenience" (John 1837, p. 492).[6] To reduce any inconvenience, the Lawrenceburg branch established a relationship with a Cincinnati bank so that note holders could readily redeem the branch bank's notes at par. The redemption agreement facilitated the notes' "free circulation in Cincinnati" so that they would serve "as a circulating medium throughout the whole valley of the Ohio" (ibid, p. 492). The branch's redemption account was replenished by discounting bills of exchange drawn by local grain and livestock merchants to finance the movement of farm products to market. The bills were payable in Cincinnati and collections credited to the branch's account. The Lawrenceburg branch's discounting and redemption practices provided essential financial and monetary services to the local community and beyond. Pennsylvania banks in Philadelphia's trading hinterland held comparable accounts with city banks to facilitate redemptions and trade (Weber 2003).

The second private redemption system centered on urban traders who made secondary markets in distant bank notes. Where New York and Boston relied on bankers to redeem notes, Philadelphia, Baltimore, Cincinnati, and other trading centers relied on private note brokers. As the name implies, note brokers were traders who stood ready to purchase notes issued by distant banks at discounts from their face value for specie. Note brokerage was a competitive industry; larger cities often had as many as a dozen brokers operating at a given time. By creating competitive liquid secondary markets for notes, note brokers enhanced the medium–of–exchange function of private currencies. Brokers, in effect, provided assurances that noteholders could trade the

[6] Lawrenceburgh, Indiana is located on the Ohio River about 30 miles west of Cincinnati.

notes of operating banks for specie at some price, though discounts sometimes exceeded 10 and even 20 percent.

Although note brokers made retail markets in notes, the wholesale trade made the business profitable. Local retail and wholesale merchants accepted notes issued by banks within the trading hinterlands of mercantile centers in return for the goods that traveled outward to hinterland market towns. City merchants who had taken in substantial quantities of distant notes would then send a clerk to survey the local currency brokers and sell to the one who offered the best prices (Rottenberg 2001). Brokers then sent agents to the issuing banks to redeem the notes for gold or silver. Brokers profited by offering prices that allowed them to earn a return based on the difference between the price they paid and the redemption value of the notes, net of transportation and transaction costs, that compensated them for holding–period liquidity and bankruptcy risks.

Several prominent brokers published weekly, or twice monthly bank note reporters, which provided descriptions of legitimate notes and counterfeits, and, importantly, local prices for notes of nearly every bank operating in the United States and Canada (Dillistin 1949, Gorton 1989). Merchants subscribed to the newspapers and turned to them when they encountered an unfamiliar bank note. Merchants would then accept the note at a discount consistent with the price paid by a specialized broker.[7] Note prices were reported in the form of discounts from face value. A reported price of ¾ in Philadelphia for notes of a Baltimore bank, for example, meant that the current market price for a one–dollar note was 99¼ cents in specie. It is not known whether reported prices are transaction prices, but they likely reflect informed assessments of market values. Although sources quoted different prices, which suggest that quotes are not transaction prices, correlations across sources typically exceed 0.90.

Figure 1 plots discounts from face value for 220 banks in Pennsylvania and six contiguous states reported in *Bicknell's* (29 March 1842).[8] The diameter of the circles

[7] Much has been written about the costs and risks of this system, but the risk was probably comparable to the risk of accepting personal checks (when payment by check was common). The costs were not unlike the swipe fees charged merchants when they accept credit card payments today.

[8] Figure 1 excludes discounts of 50 to 90% on five previously failed Buffalo banks and two failed banks, which were reported as "no sale," which is often interpreted as 100% discount. These data are discussed in greater detail in Section 3, below.

reflect the relative size measured by total assets of each bank. *Bicknell's* tended to report discounts in 1.0 and 2.5–percentage point increments, which is apparent in the clustering of prices at different distances at zero, 1.0, 2.5, 5.0, 10.0, and 12.5 percent. There is a distinct break in discounts around 80 miles, which is the approximate distance between Philadelphia and New York City. Several other researchers have estimated OLS or panel fixed effects models of note prices and find that they rise in bank-specific factors — travel costs (or distance) between the issuing bank and Philadelphia or New York and loan-to-asset or other leverage ratios — as well as to common macroeconomic shocks such as substantial, unanticipated changes in interest rates and financial crises (Haupert 1994, Gorton 1996, Jaremski 2011, Hilt and Liang nd).

The evidence leaves open the possibility that notes of distant banks flowed into and circulated in commercial centers, like Philadelphia, New York, and Cincinnati. Despite the widely held belief that country banks were able to engage in "elaborate schemes" designed circulate their notes for long periods in distant urban markets (Greenberg 2020, p. 32), it is unlikely that country bank notes achieved either a wide or lasting circulation in distant cities. A few pages after explaining how bankers tried to push their notes into distant markets to avoid redemption calls, Greenberg (2020, pp.39-45) observes that there were too many brokers and too many redemption agents for the banks' ploys to work: "professional paper money men," he writes, "maximized profits through the quick movement of bank notes and their redemption for specie."

2.b. Modeling the secondary market for bank notes

Gorton (1996, 1999) offers a model of bank note pricing in which the market price of notes varies inversely with distance to the issuing bank and the issuing bank's leverage and risk taking. Because banks operate with different degrees of leverage and other risk characteristics, not all notes issued by banks an equal distance from a given location will circulate in that location. A second implication of the model follows from a fundamental no–arbitrage condition, namely that all notes issued by solvent banks at a given location will trade at the same price at a second distant location.[9] The third implication is that there is an optimal distance from home that a consumer will travel to

[9] The model developed in Ales et al (2006) generates a similar result.

purchase consumption goods with the notes of a particular bank. Thus, there is a critical distance beyond which a bank's notes will not circulate as a medium of exchange.

In the bank note market, households face the choice between holding a given bank note for another period to satisfy the cash–in–advance constraint or sending the note back to the issuing bank for redemption, which generates a risky payoff in d periods (distance). If preferences exhibit constant relative risk aversion, notes can be priced as risky pure discount bonds with maturity d, and prices are determined according to the Black-Scholes theorem. The resulting price of a bank's notes at time t, $p_t(d)$, varies inversely with time to maturity (d), bankruptcy risk, and bank leverage or redemption risk. The value of the note decreases in d and equilibrium implies that there is a critical distance, d^*, beyond which the notes of a given bank will not circulate.

A fundamental question is: How far is that critical distance? Gorton (1996, p.353) observes that it is not "clear whether bank notes circulated across different states and regions in significant amounts." He offers some anecdotal evidence to suggest that notes circulated over sizeable areas but offers no substantive evidence to support his claim. Gorton, Ross, and Ross (2022) address the issue directly. They use the Black-Scholes theorem to back out the effective maturity of bank notes from travel times between the point of issue and a central market city, namely Philadelphia or New York City. After backing out the effective maturity of banks' notes, they then calculate the convenience yield, or the liquidity value of each bank's notes as:

$$Covenience\ yield_{it} = Benchmark\ yield_{it} - \frac{100}{100 - bank\ note\ quote_{it}}.$$

Suppose a \$100 Pittsburgh bank note traded in Philadelphia for \$95 a note broker could earn a potential yield on that note by purchasing it in Philadelphia and returning it to Pittsburgh for \$100 in silver, which generates a yield of 5.3% ($100/95 \approx 1.053$).

The convenience yield of a bank note, stated briefly, is the value of being able to tender a debt instrument that is accepted by the other party to the transaction with no questions asked relative to the yield on an alternative debt money-like instrument that is less liquid and less readily accepted at face value. Gorton, Ross, and Ross (2022) define d*, or effective maturity, as the distance at which a bank note switches from a

negative to a positive convenience yield. Between 1820 and 1860, the average d* is estimated to be 23.3 days, but travel costs declined sharply after the construction of canals and introduction of the steamboat in the 1820s and the build-out of the railroad network beginning in 1840s. They further estimate that the convenience yield declines by about one percentage point for two additional days of travel or an additional $16, which is approximately the time and the cost of travel between New York City and Buffalo circa 1849 (Gorton 1989).

It is a challenge to translate the Gorton, Ross, and Ross (2022) estimates of travel time to plausible distances. Except for three failed banks, the convenience yield banks in the seven-state sample used here lies between 6.2 and 7.5 percent. Some of the banks in the sample are 500 miles or more away from Philadelphia and few notes traveled that far. More to the point, the Gorton, Ross, and Ross (2022) approach more resembles an effective period of circulation between issuance of a note and its redemption at the issuing bank than a distance over which a typical note might range. Some observers at the time estimated that country bank notes circulated for about 40 days. New York's bank commissioners estimated that the average country bank's entire circulation turned over every 90 days (New York Senate 1850). Studies by the Bank of England determined that its £10 notes circulated for an average of 236 days in 1792, 137 days in 1818, and 73 days in 1850 (Lord Liverpool 1819, Anon. 1850). Larger denomination notes stayed in circulation for shorter periods. For several reasons, it is likely that Bank of England notes circulated for longer times than privately issued bank notes in the United States. The Bank of England held a virtual monopoly of note issues during the early part of the period. More recent studies find that the Dutch 25-guilder (approximately $5) note circulated for about 25 days in 1965 and 46 days in 1970 (Boeschoten and Fase 1992). Bank of England and De Nederlandsche Bank notes satisfy the no-questions-asked-in-exchange criterion, and the Gorton, Ross and Ross (2022) estimate is consistent with their circulation periods.

2.c. A narrative approach to bank note dispersal

Gorton's (1996, 1999) and Jaremski's (2011) empirical estimates of bank note prices are built on detailed reconstructions of travel times and costs based on overland and water networks connecting the location of each note-issuing bank and the city in

which a note price was published. Yet, we know that quoted prices were not (necessarily) transaction prices for most bank notes. Although bank note reporters provided universal coverage of all banks, including failed, closed, and fraudulent banks, there is no quantity data. Note brokers made markets in notes, but the market for most notes was surely illiquid. It is not clear how price discovery occurs or how efficient pricing can be in markets in which assets trade only rarely. Amihud and Mendelson (1991) show that assets that trade in illiquid markets sell for lower prices, relative to comparable assets traded in liquid markets. Lower prices compensate holders of the illiquid asset for the lower returns and greater risks than they could earn holding liquid assets.

In similar fashion, Brockman's (2009) analysis of dispersal of modern bank notes, on the other hand, uses the quantity of bank notes moving between places and finds symmetry in the inflows and outflows of currency from given locations. He also observes considerable heterogeneity in dispersal patterns based on region of origin and the size of the city. Although Brockman (2009, p.11) finds that more populous counties are more connected and more strongly connected with other counties, he is unaware of "a plausible evolutionary mechanism that can account for the emergence of these distributions."

The plausible mechanism used here to understand the dispersal of nineteenth-century bank notes is trade flows. Weber (2003) observes that banks provided various services by which their customers could settle debts: they issued bank notes, which were the principal form of currency; they discounted inland and foreign bills of exchange; and they guaranteed long-distance payments. In providing these services banks accepted the notes of other banks. Banks also held substantial, semi-permanent accounts in banks in distant markets, usually located in cities and towns in which their customers conducted business. And banks kept accounts of distant banks whose customers had business in their cities. The first two were reported on the asset side of a bank's balance sheet; the last appeared as a liability. In the 1840s and 1850s between 11 and 20 percent of aggregate bank note circulation was held by other banks; between 7 and 9 percent of assets were accounts held in other banks, typically labeled "due from other banks;" and 10 to 15 percent of liabilities were accounts of other banks, typically labeled "due to other banks" (Weber 2003).

The *due to* and *due from* accounts facilitated intercity and interregional trade and contributed to the integration of early American financial markets (Bodenhorn 1992, Bodenhorn and Rockoff 1992). Merchants and market traders in everything from grain, timber, livestock and, most importantly, cotton, did not need to move coin or currency in financing long-distance trade, though some bank notes surely moved about as people conducting business moved about. Rather, they drew bills of exchange on local banks payable at distant banks several weeks or months hence. Banks simply credited or debited each other's accounts as bills were drawn in one place and repaid in another. Weber's (2003) study of these accounts in 1850s Pennsylvania reveal four facts. First, country banks kept deposits with banks in financial centers, namely Philadelphia or Pittsburgh. Second, they developed stable long-term relationships with a single urban correspondent bank. Third, trade patterns determined in part by canal and rail linkages determine the location of correspondents. Fourth, Philadelphia's banks did not establish correspondent relationships with banks in other financial centers, most notably with New York City, the emergent financial center of the United States. This last fact suggests that while New York and Philadelphia merchants were deeply integrated into North Atlantic trading networks, merchants in one did not trade to any extent with merchants in the other.

Weber's (2003) focus on stable, long-distance relationships between Pennsylvania's hinterland and urban banks overlooks an important feature. Trade goods flowed not just from hinterland to city and vice versa; goods, people, and funds flowed between towns in the hinterland along roads, canals, and rail. Regional and local specialization implies trade between small towns: farm products from central Pennsylvania moved here; timber and lumber from the north moved there; coal from the west and northeast moved hither and yon.

To make the discussion more concrete consider Table 1, which provides data on *Due to*, *Due from*, bank note balances, and distances between banks for two representative banks. The city or town of a correspondent bank is included if any of the three accounts exceeds $100. The Easton Bank was advantageously located at the conjunction of the Delaware River, the Delaware Canal, the Lehigh Valley Canal, and the Morris Canal. The Delaware Canal paralleled the Delaware River, which flowed south from the Pocono Mountains past Easton, Trenton, and Philadelphia and into the

Atlantic Ocean. The Lehigh Canal's southern terminus was the Delaware Canal at Easton; it connected the coal-mining regions of northeastern Pennsylvania into the Delaware and Morris canal systems. The Morris Canal's western terminus was Phillipsburg, New Jersey, which is directly across the Delaware River from Easton; its eastern terminus was the conjunction of the Hudson River and Upper New York Bay at Jersey City, New Jersey.

Given the Easton Bank's location at the termini of three canals, local merchants conducted business with merchants in New York, Trenton, and Philadelphia evidence of which are the relatively large interbank balances held with banks in those cities. In March 1842, the Easton Bank had a credit balance with two Philadelphia banks that exceeded $31,500 or about 4.2 percent of its total assets. The bank had account balances with New York City banks of nearly $8,500. These interbank balances served the dual purpose of bank note redemption and city funds that local merchants could draw on to finance trade between an urban center and its trading periphery. A second feature to note is that the average distance between the Easton Bank and its correspondents was just 67.6 miles. If the distances are weighted by *due from* balances, the average is 52.7 miles; weighted by bank note balances, it is just 43.2 miles. Trading networks in the interior, even those defined by busy canals, covered only modest distances. Bank notes then should not have wandered too far from home because they mostly moved along these well-traveled routes.

The York Bank provides an informative juxtaposition. Unlike the Easton Bank it lay about 13 miles west of the junction of the Susquehanna River, the Susquehanna-Tidewater Canal, and the Columbia-Philadelphia Railroad. Given its location in south-central Pennsylvania's vast grain belt and proximity to the Susquehanna-Tidewater Canal, which connected Baltimore to this productive hinterland, it is not surprising that the York Bank held larger balances with Baltimore's banks than with Philadelphia's. The *due to*, *due from*, and bank note accounts imply that York's merchant community engaged in considerable trade within Pennsylvania's farm belt. The average distance between York and its correspondent banks was 62.2 miles. If the distances are weighted by the "due from" balances, the average distance is 38.4 miles; if weighted by note balances the average distance is 56.0 miles. Like the employees at the Easton Bank, clerks and tellers

at the York Bank did not encounter a meaningful number of far-flung, out-of-state bank notes.

3. Data

The hand–coded data assembled here sheds light on the distances over which bank notes circulated. Evidence is assembled from three sources: reports of 17 Pennsylvania banks in March 1842; and annual reports of the Columbia Bank & Bridge Company of Columbia, Pennsylvania in 1849 and 1850; and, the business journals of a small-town bank note broker in Darien, Connecticut, circa 1850. Each source offers unique insights into the extent to which bank notes circulated in the Mid-Atlantic region in the middle of the nineteenth century.

3.a. Pennsylvania, March 1842

On March 16, 1842, Philadelphia banks jointly refused to accept the notes of the Bank of Penn Township, located in Philadelphia County but outside the city limits. The city banks' refusal ignited a bank run that ended with the Bank of Penn Township's temporary suspension (Jalil 2015). A city-wide run occurred the following day, which forced all Philadelphia banks to suspend specie payments. On the afternoon of March 17, directors from several banks met to coordinate their responses. They emerged from the meeting to announce that their banks were sound and assured the public that they would accept all notes of specie-paying banks on deposit and would redeem their own notes for specie to "entitled persons," which probably meant individuals, mostly customers, holding a modest quantity of notes. They would not meet sizeable redemption requests from note brokers. The run soon subsided.

In response to the crisis, Pennsylvania' legislators asked the Auditor General, whose office oversaw the state's banks, to request statements of condition from the banks as of March 2, 1842, or two weeks prior to the run. Banks were instructed to submit the standard balance sheet entries. The banks were also instructed to include details of all notes of other banks held, as well as all interbank balances. Of Pennsylvania's 48 banks, 37 responded, but only 17 provided details of their holdings of notes of other banks. Most of the others reported aggregate values of notes by state of origin rather than notes by individual issuer.

The reporting banks provide a plausibly representative sample of Pennsylvania banks. The sample includes five Philadelphia banks, three from the counties bordering Philadelphia, one Pittsburgh bank, and two from bordering counties; the others were in regional market towns across the state, including Carlisle, Easton, Gettysburg, Honesdale, Lebanon, and York. Although the reporting banks appear to provide a reasonable cross section, there is the possibility that the sample is subject to selection bias. The banks that chose to report may have been in stronger financial conditions than non-reporting banks. Reporting banks may have held more or fewer notes of other banks than non-reporting banks. It is difficult to determine whether the reporting banks selected on some unobservable characteristic correlated with the variables of interest, namely the quantity of other banks' notes and the distances separating them.

The objective is to determine the distance between the issuing banks and the banks holding these distant bank notes, and to calculate the likelihood that a given bank would receive on deposit the notes of banks a given distance away. To do so, the data were assembled under the assumption that each reporting bank may have received the note of any other bank operating in the mid-Atlantic region. An initial survey of the reports revealed that banks held very few "foreign" notes — as notes issued in other states were then called — from other than the six states contiguous to Pennsylvania. Of the $44,716 in notes of other banks held by the Bank of Pittsburgh, for example, $537 were notes of the State Bank of Indiana, $28 were from Michigan banks, it held a single $5 note from Boston and a $5 note from Maine (Pennsylvania Auditor General 1842). Two other Pittsburgh banks reported holding modest amounts of western bank notes but did not provide details. An unexpected result was that only two of five Philadelphia banks reported holding New York City bank notes; the combined total was less than $500. Of the $233,587 in other banks' notes held by Philadelphia's Bank of Pennsylvania the only western bank note was a single $10 note on the State Bank of Tennessee.

The data used here matches each reporting bank with all other banks in the seven–state area — Pennsylvania, New York, New Jersey, Ohio, Delaware, Maryland, and Virginia — and records the value of bank notes held from each issuing bank. If no notes were reported, a zero is recorded in the data. Further, the matched bank sample includes each bank's balance sheets from the reporting date closest to March 1842 (Weber 2018). The balance sheet data affords the opportunity to construct liquidity and

leverage measures for each note–issuing bank to determine if these factors are related to the likelihood that a Pennsylvania bank held one or more of its notes.

In addition to note holdings, other valuable data include *balances due to* and *balances due from* other banks.[10] Banks maintained interbank deposits for several reasons, one of which was for note clearings. Country banks held balances in city banks, which stood ready to redeem the country banks' notes. Because they were redeemable at par in an urban market, the country banks' notes attained a wider circulation but, more importantly, provided greater liquidity services to the country banks' customers who traded in city markets (Appleton 1841, Weber 2003). After a country banks' notes were presented to a city correspondent, either on deposit or for redemption into specie, the city bank bundled them and sent them back to the issuing bank along with a request to replenish their correspondent balances.

These interbank balances due to and due from other banks provide information on regular or anticipated trade flows between places. Country merchants traveled to city to restock their goods for local retail customers. Urban merchants, especially those engaged in the export of agricultural goods, lumber and so on, traveled to smaller market towns to buy goods for export. Trade — and thus bank notes — flowed in both directions. Interbank balances provide information on the direction and distance that banks expected their customers to travel while conducting business.

3.b. Columbia Bank & Bridge, Columbia, Pennsylvania, 1849-1850

In accordance with state law, Pennsylvania's Auditor General requested, collected, and published annual balance sheets of chartered commercial banks. The Columbia Bank & Bridge Company was a banking corporation that financed the construction of a toll bridge across the Susquehanna River from the profits of its banking operations. Columbia is located about midway between Lancaster and York, about 60 miles west of Philadelphia, and on the Susquehanna River, the Susquehanna-Tidewater Canal, and was the western terminus of the Columbia-Philadelphia Railroad, one of the nation's earliest railroads. Thus, the bank was situated such that it might

[10] The *due to* and *due from* data are separate from the due to and due from accounts reported in annual balance sheets. Annual balance sheets report aggregate values. The 1842 reports include detailed account for each debtor and creditor bank.

expect to receive substantial numbers of distant bank notes as they moved up and down the river, the canal, and the railroad. Otherwise, Columbia Bank & Bridge appears to be an average country bank circa 1850 when measured by capital, deposits, bank note issues and other measures. It just happened to operate a toll bridge subsidiary.

Although Columbia Bank & Bridge failed to report its holdings of other banks' notes in March 1842, it included a detailed accounting of its holdings in reports it submitted to the Auditor General with its 1849 and 1850 annual reports. These data take the same form as those from the 1842 call, but they are treated separately here. We do not know why Columbia Bank & Bridge included this information when no other bank did, and the information is sufficiently removed in time and circumstances from the 1842 call that conservative empirical practice points toward separate treatment.

Otherwise, the Columbia Bank & Bridge data are assembled in the same way as the data from the 17 banks that reported in 1842. The bank notes issued in Pennsylvania and six contiguous states and held at Columbia are matched to the nearest dated balance sheet provided in Weber (2018). Distances between Columbia, Pennsylvania and the issuing bank are geodetic distances based on GPS coordinates of the cities and towns in which the notes originated. And Columbia Bank & Bridge's balances sheets provide details on its interbank balances, which are used to account for regional trade flows.

4. Empirical Approach

The data brought to bear on the question of interest raised in this study — the number or the discrete dollar value of notes accepted by a merchant or a bank and issued by another distant bank — are count data. That is, the values considered here are, by construction, non–negative integers (i.e., 0,1,2,3, ….). How many notes issued by a particular bank did Gorham accept at his grocery? What was the dollar value of notes accepted on deposit by Bank A and issued by Bank B located some distance away?

Count data are commonly observed in the social and physical sciences and are analyzed using Poisson or negative binomial models, each of which assumes that the data–generating process produces non–negative integers. Examples include physician and hospital visits, bicycle crashes, cigarettes smoked in a week, and credit card defaults, among many others (Cameron et al 19xx, Sheu et al 2004, Greene 1994, Raihan et al. 2019).

There are advantages and disadvantages to modeling the arrival of bank notes as either Poisson or negative binomial. Modeling arrivals as Poisson, for example, avoids the incidental parameters problem when including fixed effects. Estimating arrivals as Poisson does not require that arrivals strictly follow a Poisson process, and the assumption of equal mean and variance can be relaxed using robust standard errors (Wooldridge 1997, Cameron and Trivedi 2013). If the data are overdispersed, the standard approach is to estimate a negative binomial regression. This approach assumes that the Poisson parameter follows a gamma distribution. The asymmetry of the log of the gamma function implies that an increase in the random variable by a multiple of x is less likely than a decrease by a multiple of x. Thus, a bank that receives an average of ten notes of another bank per period is more likely to receive eight of its notes than it is to receive twelve (Plassman and Tideman 2001).

The negative binomial model may be more appropriate when the data contain an excessive number of zeroes. The problem of excess zeroes can be thought of as the consequence of a data–generating process that involves a combination of a count random variable and a binary random variable with a probability mass at zero. Staub and Winkelmann (2013), for example, consider physician visits. A person might have zero visits over a given period because she is healthy and has no need to visit a physician, or she follows alternative medicine and will never visit a doctor. Zeroes of the first type are *incidental*; she may have seen a physician but did not and the zero is a natural realization of a Poisson–type process. Zeroes of the second type are *structural* or *strategic*; people follow either traditional or alternative medicine and the decision to visit the doctor follows from a binary decision process. Followers of traditional medicine may or may not see a doctor (non-negative integers); followers of alternative medicine will never visit a doctor (zeroes).

Greene (1994) argues that when excess zeroes are strategic, the empirical problem resembles the sample–selection problem analyzed by Heckman (1979) and can be approached in a similar fashion. The *strategic* choice is modelled as either a probit or logistic (logit) process and the observed outcome is modeled as a count random variable. Such zero-inflated count data models have a probability function, which can be written in general form as:

$$f(y) = \begin{cases} \pi + (1 - \pi)g(0) \; for \; y = 0 \\ (1 - \pi)g(y) \; for \; y = 1, 2, 3, \ldots \end{cases}$$

where y is a count–valued random variable, π [0,1] is a zero-inflation parameter, and g(.) is the probability function of the count model.[11] Excess zeroes occur whenever $\pi > 0$. If we adopt the standard assumptions, we can write the expected value of y, conditional on a set of covariates, x, as:

$$E_g(y \,|x) = \exp(x'\beta)$$

and π, conditional on a set of covariates, z, as:

$$\pi(z) = \frac{\exp(z'\delta)}{1 + \exp(z'\delta)}$$

Then the conditional expectation of the zero-inflated count data model is given by:

$$E(y|x, z) = \big(1 - \pi(z)\big) \exp(x'\beta) = \frac{\exp(x'\beta)}{1 + \exp(z'\delta)}.$$

Unlike the Heckman selection model in which statistical identification requires that covariates in the binary-choice model contain at least one variable not included in the outcome model, the set of conditioning variables z in zero-inflated count models can be identical to x, share some elements with x, or share no common elements with x (Staub and Winkelmann 2013).

Figure 3 provides two histograms of the dollar value of notes accepted by Pennsylvania banks from issuing banks in six neighboring states. Both graphs are restricted to a maximum of $500 because few banks reported holding notes worth more than this amount. The left–hand graph shows that Pennsylvania's banks reported holding zero dollars-worth of other bank's notes for about 85 percent of all banks

[11] See Greene (1994), Staub and Winkelmann (2013), and Garay et al (2011) for the precise function forms and derivations of the zero-inflation Poisson (ZIP) and zero-inflated negative binomial (ZINB) models.

operating in six contiguous states. The right–hand graph excludes the zeroes to better illustrate the distribution of non-zero note holdings. The mass of the distribution of non-zero note holdings is less than $50.

The excess zeroes may have been *incidental* in that they are the natural outcome of antebellum American bank note circulation patterns — notes of distant banks may have been presented on deposit at a bank, but they tended not to travel very far from home. On the other hand, the excess zeroes may have been *strategic* in that notes of distant banks were (or may have been) presented for deposit and the bank to which they were presented refused to accept them on deposit. That is, at least some zeroes are the result of the reporting banks not having seen some bank notes, while others are the result of the reporting banks refusing to accept notes of some far–flung banks.

Table 2 reports the summary statistics of the covariates used for the 17-bank sample. The dependent variable in the count–data model is the dollar value of notes held by one of the 17 banks. These banks held an average of $86.50 in notes issued by other banks. Covariates used in a series of parsimonious count–data regressions include a third–degree polynomial in the miles separating the holding bank and all issuing banks in the six contiguous states.[12] The average overland distance between the holding and the issuing banks is 166.9 miles and the average age of the issuing banks is 16.46 years. Issuing banks have an average circulation of $151,291, which is included in the analysis to account for differences in the likelihood of a bank holding another bank's notes. The greater a bank's circulation, the more notes it had in circulation (holding constant the denominational mix). More notes in circulation may be positively correlated with the likelihood of another bank encountering one of its notes. The regressions also include the interbank accounts – due to and due from – to account for prior correspondent and note clearing relationships between banks (Weber 2003).

The logistic regressions, which account for the excess zeroes, include as regressors the miles between issuing and accepting banks, but not the higher order terms because the higher order terms were small and statistically insignificant in preliminary regressions. The logistic regressions also include the issuing banks' circulations and the *due to* and *due from* values to account for trade flows between cities and towns. To further

[12] Preliminary regressions included fourth- and fifth-order polynomials in miles, but neither was statistically significant, so they are not included in the reported regressions.

account for the strategic nature of the excess zeroes, the logistic regressions include the number of counterfeited notes and a Philadelphia note broker's discount on notes of each issuing bank reported in January 1842 (Van Courts 1842). Banks, like merchants, subscribed to counterfeit detectors and would have refused likely counterfeits or heavily discounted notes. Zero holdings may have been incidental – zero notes of another bank were presented for deposit – or they may have been strategic – a bank reported zero notes because it refused to accept unfamiliar notes with known counterfeits.[13] Strategic zeroes may also follow from the age of issuing banks. Gorton (1999) finds that the discounts on new banks converge to the discounts on seasoned banks as new banks develop a reputation.

The logistic regressions also include a dummy variable that equals one if the issuing or accepting bank is located on a major river or one of the region's canals.[14] Primary goods moved down the Susquehanna River, for example, from southern New York, through central Pennsylvania and on to Baltimore. Imported and finished goods moved upriver from Baltimore. It is likely, therefore, that banks along the river encountered notes issued by other banks along the river as the notes moved with traders. Goods moved along the canals in similar fashion, so modest numbers of bank notes traveled along the canals, even though long-distance trade was financed through inland bills of exchange. Except for miles and circulation, none of the covariates included in the logistic regression were statistically significant in preliminary estimates of the count–data regressions.

5. Evidence on the extent of the market for bank notes

5.a. Pennsylvania 1842

Figure 3 plots the log value (plus 1) of notes of other banks held by Philadelphia banks, by the place of issue and miles between that place and Philadelphia. Five features stand out. First, the distribution approximates a Pareto Type I distribution, or one in

[13] Preliminary regressions included the count of all counterfeits and the count of small–denomination ($5 and less) counterfeits because the latter were more likely to be tendered by travelers. The results are not substantially different.

[14] The Lehigh and Delaware rivers are not included because the Lehigh-Delaware Canals parallel these rivers.

which a large fraction of all notes presented for deposit are issued by a small fraction of all banks.[15] One implication is that the market for bank notes encompassed a relatively compact geographic space. The distribution is also consistent with the inverse power law estimated by Brockman (2009). Second, the bank reported holding zero notes for most of the region's banks. Third, as might be expected, Philadelphia banks held substantial quantities of notes of other Philadelphia banks (zero miles). Prior to the establishment of a formal, multilateral clearing system, Philadelphia's banks tended to engage in daily bilateral clearings (Cannon 1905). If Cannon's account is correct, it is reasonable to assume that the reported values of Philadelphia notes were accepted within the past day or two. Bank note velocity was high and interbank redemptions were common in large, urban markets. Fourth, the places of issue of most of the other non-zero holdings are within 50 miles or less of Philadelphia – Doylestown, West Chester, Wilmington – or places that are now considered Philadelphia suburbs — Chester, Doylestown, Germantown, Norristown. Bank notes from more distant places – Easton, Northumberland, Wilkesbarre — followed goods traded intraregionally and moving on the canal system. Because Cincinnati was integrated into Ohio and Mississippi valley trade networks rather than North Atlantic networks, Philadelphia's bank held no notes of a Cincinnati-based bank. Finally, the figure highlights the notion that trade networks were more relevant than the sheer size of a distant market in the dispersal of bank notes. Of notes held and issued in three major markets, only one of which – Pittsburgh – was connected to the Philadelphia market through the canal network, Pittsburgh loomed largest. Although New York had 26 banks compared to Pittsburgh's three and Pittsburgh is more than twice as far away as New York or Baltimore, Philadelphia's banks held an average of just $3.46 in New York City notes and $9.33 in Baltimore notes compared to $84.33 in Pittsburgh bank's notes.

Table 4 reports the results of four separate regressions, including three count data models. Column (1) reports the results of a Tobit estimation, which is included to demonstrate the problem with using a linear estimators when the data include an excess of zeroes. The Tobit coefficients imply that the maximum value of other banks' notes

[15] The graphs for individual banks, including those in Philadelphia, demonstrate similar distributions. Pareto distributions describe several economic phenomena, including the distribution of income and wealth in modern economies (Wold and Whittle 1957, Piketty and Saez 2003).

is maximized at 4.1 miles, the mean predicted values are negative beyond 10 miles, and all predicted values are negative beyond about 100 miles.

Column 2 reports the estimated coefficients from a Poisson specification with robust standard errors and Column 3 reports estimates from a negative binomial procedure. The values reported in the table are incidence rate ratios, which are interpreted as the expected count for a value of X+1 of an independent variable divided by the expected count for a value X of the independent variable. The reported coefficient value of 0.986 on the Miles variable in column 2 implies that an additional mile separating a note issuing bank and a potential receiver of the issuing bank's notes decreases the expected value by a factor of 0.986. An equivalent statement is that an additional mile decreases the expected dollar value by 1.4 percent [100*(0.908 – 1)% = −1.4], holding all else constant.

The magnitude and significance of the log alpha (over-dispersion) test statistics implies that the negative binomial model is preferred to a Poisson model. Although an informal comparison of the estimated coefficients from the Poisson and negative binomial model suggest that they are of comparable magnitude and significance, a cross-equation test shows that, with the exception of Counterfeits, Bank Age, and Discounts, they are statistically different individually and jointly. Given the excess zeroes, the zero-inflated negative binomial is preferred to the negative binomial.

Column (4b) reports odds ratios for the variables included to predict the excess zeroes under the plausible assumption that the excess zeroes are strategic rather than incidental. Thus, the odds that we observe an excess zero is 1.011 times the odds that we do not observe an excess zero for a bank note that circulates one mile farther from its issuing bank. The other variable of interest that leads to an increase in excess zeroes is the number of reported counterfeits of an issuing bank's notes as reported in *Van Court's Counterfeit Detector* (1842). Each additional known counterfeit increases the odds that we observe an excess zero by 1.092 times the odds that we do not. The distance and counterfeit results are consistent with anecdotal evidence that individuals, merchants, and bankers were all wary of accepting unfamiliar notes from distant banks with several known counterfeits (Hildreth 1840, Mihm 2009).

The estimated odds ratios reported in Column (4b) are also consistent with our priors. The odds of observing an excess zero declines in the circulation of the issuing

bank, the age of the bank, whether the issuing bank is located on a waterway trade route, and whether the bank had an correspondent relationship with the issuing bank, measured by the *due to* and *due from* variables. The age variable is consistent with Gorton's (1996) finding that the discounts on notes issued by new banks are intially higher than comparable incumbent banks and then converge toward the discounts observed for seasoned banks. Seasoned banks become so because they have a history of redeeming their notes. The magnitude of the odds ratios on the Susquehanna River and canal variables are telling. The odds of observing an excess zero for an issuing bank located on the Main Line Canal, which was the link between Pittsburgh and the Susquehanna River at Columbia, is just 0.202 times the odds of not observing an excess zero. It is likely that notes of banks adjacent to canals traveled in the pockets and pocketbooks of canal boat crews, passengers, and traveling salesmen and merchants and so would have been familiar to other banks located on or near the waterways.

After accounting for the excess zeroes the incidence rate ratios reported in Column (4a). The estimated ratios are consistent with plausible priors. First, for each additional mile separating two banks, the likelihood that one bank would receive another bank's notes on deposit falls by 4.02 percent [(0.9598-1)*100]. Second, the likelihood that one bank accepted another's notes increases by 71.6 percent for a log-point increase in the issuing bank's circulation. The estimated effect of having more notes in circulation is smaller in the zero-inflated than in the negative binomial model, which points to the value of controlling for the excess zeroes. The effects of having a correspondent relationship exhibit the same feature: a log-point increase in either the *due to* or *due from* correspondent balances increases the likelihood of accepting another bank's notes by 15 percent. The percentage point increase in the reported discount on a bank's notes in Philadelphia have a statistically insignificant effect on the likelihood of accepting another's notes. Moreover, the imprecise positive estimate is the opposite of an expected negative effect. The counterfeit, bank age, and waterway variables are not included in the regression because preliminary estimates revealed that they were not statistically significant once they are accounted for in the Inflate (excess zero) equation.

Once the zero-inflated binomial regression is estimated, it is a straightforward exercise to calculate the expected probability that each reporting bank would hold zero dollars ($0) in notes of each note-issuing bank by miles separating the reporting and

issuing bank in the seven-state sample. Doing so will generate some insight into the critical distance beyond which a bank (or a noteholder) might expect a bank note not to circulate or to be generally accepted in trade. The scatterplot of probabilities by miles appears in Figure 4. The central tendency of the estimates is shown by the curve. The vertical red line demarcates the distance between Philadelphia and New York City. The blue triangles signify each bank's expected probability of holding notes issued in Philadelphia; the red diamonds signify each bank's probability of holding notes of New York City banks.

Several features stand out in Figure 4. First, the probability that a Philadelphia bank held zero notes of other Philadelphia banks is generally below 30 percent, but nonzero. Blue triangle markers will appear at zero (0) miles in Figure 4 for five Philadelphia banks and the Bank of Germantown, which was in Philadelphia County but 5.25 miles from center-city Philadelphia. For most of the Philadelphia banks, there is less than a 30 percent probability of holding $0 in notes of other Philadelphia banks. Alternatively, there is a greater than 70 percent chance of holding a positive value of other Philadelphia's banks' notes. Given the proximity to each other, why not 100 percent? In Philadelphia city proper the notes of all city banks circulated at par and there was no reason not to accept each other's notes on deposit because they could be returned and redeemed bilaterally each day. Prior to the creation of a formal multilateral clearing system in 1849, each bank's pistol-toting, cash-laden runner made an early morning round calling on all other banks at which time they returned bank notes and acceptances of issuing banks received the day before, received their own banks' notes and acceptances in return, and signed a memorandum of each transaction (Cannon 1905). Thus, the reported values, and the corresponding estimated probabilities, are as of end of day on March 2, 1842. Despite daily clearings, the probabilities of holding zero notes are not all zero because not every city bank would receive the notes of *every* other city bank *every* day.

A second notable feature is the low likelihood of Pennsylvania's banks, including those in Philadelphia, holding notes issued by any of New York's City's 26 banks. Due in part to the quality of its harbor and to its being the effective eastern terminus of the Erie Canal system, New York City was by 1842 the United States' busiest port and the nation's principal link to the North Atlantic trade (Albion 1939). By 1842 the City was

also fast supplanting Philadelphia as the nation's financial capital. Yet only the Bank of Pennsylvania ($445) and the Kensington Bank ($5) of Philadelphia reported holding notes issued by a New York City bank. Only the Bank of Pennsylvania, of which the state owned a 20 percent stake and served as the state's fiscal agent, maintained any significant interbank balances with any New York City bank. The Bank of Pennsylvania's New York balances probably facilitated the payment of interest on the state's debt to New York-based creditors. Its correspondent relationship with the Bank of Commerce of New York likely was not a bank note redemption account.

The third notable feature is that the probability of holding notes of another bank becomes a coin flip at 50 miles, or about the distance between Philadelphia and Reading, Easton, or New Brunswick, New Jersey. At 100 miles (Wilkes-Barre or Annapolis, Maryland), the probability of holding a distant bank's notes is 20 percent. At 200 miles (Albany or Richmond, Virginia), it is less than 10 percent. At 300 miles — approximately the distance between Philadelphia and Wheeling or Boston — it is effectively zero. Philadelphia's banks in fact collectively reported holding zero notes from either city.

A question that appears in both the historical and modern literature is: Why would the public tolerate, even embrace, a currency that depreciated as it moved away from its issuer? We are now able to answer the question. *Bank-issued currency did not move very far from its point of issue*. There was a 50-50 chance that a bank, and banks surely dealt with more notes than the public, encountered or held a note issued by a bank 50 miles distant on a given day. The average discount in Philadelphia of a note issued by a bank 50 miles away was 0.67 percent; the median discount was zero. Thus, the currency that an individual was likely to encounter was issued close to where he or she lived, was familiar, and the costs, including the verification costs, of using it were very small. Among the banks in the seven-state sample, the average number of known counterfeits was 3.7; the median was one. The average number of counterfeits with a face value of $5 or less was 2.3 and the median was zero. Even the cost of using notes issued 200 miles away was modest, as well; the average discount on notes issued by banks between 190 and 210 miles distant was 4.3 percent; the median was just 2 percent. But the evidence suggests that 200-mile notes were rarely encountered, even when they moved along the canals. Notes issued by banks less than 50 miles away satisfied the 'no-questions-asked" criterion (Gorton, Ross and Ross 2022).

The intuition of Gorton's (1996) model is correct. There is a radius around an issuing bank beyond which that bank's notes lose their currency. But Gorton's empirical approach does not offer much insight into the extent of the radii. For most banks, the radius was about 50 to 100 miles. For some well-known, reputable banks situated along a busy trade route, it may have extended to 200 miles. It was rare for a note to be offered on deposit at a bank 300 miles from its point of origin.

5.c. Philadelphia and country banks 1842

It is possible that Philadelphia banks accepted notes under different circumstances (i.e., variation in seasonal trade flows), institutional arrangements (i.e., correspondent relationships), or rules (i.e., special deposits only) than country banks. This section considers whether there are any differences between city and country banks. Table 5 reports the results of zero-inflated negative binomial regressions like those reported for the full sample.

In the sake of space, the results are not discussed in detail because they are not notably different than the full-sample regressions. Incidence rate ratios imply that the likelihood of receiving the note of a distant bank decline in distance, increase in the amount of correspondent balances, and the issuing banks' circulation. The odd ratios generated from logistic regressions, which account for the inflated number of zeroes, imply that a bank receiving another bank's notes on deposits may be strategic rather than incidental. The odds of *not* holding another bank's notes increase in distance and the number of known counterfeits, and decline in correspondent balances, in issuing bank's circulation, and location on a canal or the Susquehanna River.

Figure 5 captures the results in plots of the estimated probabilities of notes of each issuing bank by miles separating the reporting and issuing banks. The results reveal that Philadelphia bank were less, not more, likely to hold the notes of banks a given distance away than were country banks. This result runs counter to the traditional narrative, which holds that notes of country banks poured into cities much to the displeasure and inconvenience of urbanites, merchants, and city bankers (Whitney 1878). But most accounts focus on the Boston experience. Van Fenstermaker and Filer (1986), however, show that the Suffolk system, rather than limiting country bank issues and limiting their flow into the city, exacerbated the "flood" of notes moving into

Boston. The Suffolk Bank's redemption system, with its region-wide par circulation of notes, made every note issued by a member bank a perfect substitute for every other member bank's notes. An ancillary effect of the system was that it may have slowed the spread of demand-deposit banking. Philadelphia's reliance on bilateral interbank redemptions and private markets in bank notes may have limited the flow of far-flung country bank notes into the city because the convenience yields on distant notes were low.

6. The Columbia Bank and Bridge Company, 1849-1850

The second source of evidence bearing on the distance bank notes traveled from the issuing bank is two annual reports submitted by the Columbia Bank and Bridge Company in 1849 and 1850. Although Pennsylvania's Auditor General did not request the information, Columbia Babk included detailed reports of notes of other banks on hand, as well as details of it correspondent or interbank balances. The empirical analysis of the Columbia Bank's holdings follows the template of the 1842 17-bank sample.

Table 5 reports the results of Poisson, negative binomial and zero-inflated negative binomial regressions on the same variables as above. The dependent variable is the non-negative integer value of other banks' notes on hand; the independent variables are the same as the previous analysis. Because there are only 536 observations in the Columbia Bank sample, compared to more than 3,000 in the 17-bank sample, some coefficients are not as precisely estimated as in the 1842 sample.

The Columbia Bank generally held fewer notes issued by more distant banks. It held more notes of banks with more notes in circulation. The results on interbank relationships are mixed, but the zero-inflated model predicts that larger interbank balances are associated with holding more notes. The logit estimates from the zero-inflated model is consistent with the notion that banks were strategic in their acceptance of at least some notes issued by distant banks. The odds that we observe an excess zero declines in issuing banks' total circulation; it declines markedly if the issuing bank is located on one of the principal canals; and it increases in the number of known counterfeits.

Figure 5 plots the predicted probabilities of holding zero notes from the negative and zero-inflated negative binomial models. The results are consistent with the 1842

sample in that the probability increases quickly up to about 50 miles. For banks 200 miles away from Columbia, Pennsylvania there is a 90 percent probability that the Columbia Bank will hold none of their notes. The figure further illustrates the importance of trade flows. The red line to the left identifies Baltimore, which was connected by way of the Susquehanna River and there is a 40 percent probability that the bank held some Baltimore notes. The red line to the right identifies Philadelphia, which was connected to Columbia by the Union Canal, which was known to be narrow, slow and inefficient (Livingood 1947). There was about a 20 percent chance that the Columbia bank held one or more notes issued by one of Philadelphia's banks.

An analysis of the evidence available from mid-nineteenth-century Pennsylvania suggests that privately issued currencies (e.g., bank notes) traded within a relatively compact geographic space. Notes issued by a bank 200 miles away were rarely accepted on deposit by another bank. Fifty to one hundred miles from an issuing bank appears to have been the distance over which a bank notes served as currency. Such a limited radius is consistent with historical transportation travel times and costs and the rate at which information degraded in distance. In the mid-1840s a traveler headed to Utica from New York City for example, faced a two-and-a-half-day trip by steamboat to Albany then canal boat to Utica. Our hypothetical traveler moved at a breakneck average speed of 4.25 miles per hour and paid $1.50 (≈$60.00 in 2023) for the privilege (Gorton 1989).[16] And if our hypothetical traveler started the trip with the notes of New York City bank in her pocketbook, she may have exchanged them for the notes of an Albany bank during her layover and then exchanged these for the notes of Utica bank once she reached her destination. Local trade was transacted with local currencies.

7. Discussion

It is reasonable to raise some concerns with the Pennsylvania bank data and the interpretation given the results. First, banks may have gotten rid of distant or unfamiliar bank notes as quickly as possible with the result that any such notes do not appear in the historical records and are unobserved by the historian. Second, and related to the first, banks and businesses utilized the services of note brokers so that they held notes

[16] Google Maps currently predicts a travel time of 4 hours and 15 minutes by automobile.

only for a brief period before disposing of them. Third, the 1842 data were reported just as the United States was just beginning to recover from the Panic of 1839 and the ensuing recession, which was one of the longest and deepest of the nineteenth century. A natural response to a panic was for the public to become wary of banks and bank-issued currencies and for banks themselves to reduce counterparty risks by being more selective in the notes of distant banks they were willing to accept on deposit. The market for banknotes may have been wider before or after the recessions of the Jacksonian era.

7.a. Strategic refusals or rapid redemption of risky or unfamiliar notes

One implication of Gorton's (1996) model is that note holders are not indifferent between notes issued by banks with different redemption risk characteristics equidistant from the individual or bank presented with these notes. The redemption claim on the riskier bank will be worth less than the claim on safer banks so that holders of the riskier banks' notes will return its notes more quickly than the notes of safe banks. Expeditious redemption serves to monitor bank riskiness, and continuous redemption of early calls leads to a reputation for safety. A similar implication arises for redemption of nearby and more distant banks that are otherwise observationally equivalent. It may be that we do not observe more distant notes in the records because information degrades, perhaps rapidly given contemporary technology, in distance, which makes more distant banks appear riskier and banks that accept such notes on deposit as a courtesy to their customers dispose of them more quickly either by returning them directly or through a note broker. If this were so, we might be misinterpreting the zeroes as bank notes not traveling a certain distance when, in fact, they travel but are returned before they are observed in the public record.

Several pieces of evidence from the historical record speak to this issue. First, following the suspension of specie payments in 1837, the Indiana legislature appointed a committee to investigate the operations of the State Bank of Indiana, in which the state owned a fifty percent stake. In deposing the president and cashier of each of the bank's eight branches, it inquired into which bank notes each were willing to accept at par, which of these notes they accepted in practice, and how they disposed of distant notes once they were accepted. Importantly, the branch officers' responses refer to the

period prior to the panic. Once banks across the region suspended payments, they became much more selective in the notes they accepted.

It is surprising to learn that the list of bank notes they stood ready to accept at par value included those issued by the banks of Ohio, Kentucky, Virginia, Pennsylvania, New York, Boston, and most southern banks in good standing. Most branches accepted State Bank of Illinois bank notes only at a discount. The list of banks issuing notes encountered by the branches tended to be from fewer and closer locations than the notes that they would, in the abstract, stand ready to accept. The New Albany branch, for example, accepted notes issued by banks in Kentucky, Cincinnati, Pittsburgh, and Wheeling, all of which – as is New Albany – are located on the Ohio River. The Richmond branch accepted notes issued by Kentucky, Ohio, and Virginia banks. The Richmond branch's cashier provided the curious detail that he once accepted $25 in South Carolina notes to accommodate a long-standing customer, and $900 in Virginia notes for another regular customer. The cashier of the Indianapolis branch testified that notes of banks other than Kentucky, Ohio, and Illinois circulated "but to a limited extent" near his branch (Indiana House 1837, p. 476).

How and how quickly did these branches redeem notes issued by distant banks. The Richmond branch remitted the South Carolina notes to a New York broker and the Virginia notes to a Baltimore broker. Some branches quickly forwarded distant notes to brokers, most often in Cincinnati. Others, like the Richmond branch, let balances of as much as $12,510 accumulate before sending them to Cincinnati (ibid, p. 459). Some branches engaged in direct redemptions after accumulating substantial balances, such as the New Albany branch, which negotiated a $12,740 redemption with the Union Bank of New Orleans (ibid, p.445). Other branches held on to modest balances of regional notes to accommodate merchants and travelers bound for those places who asked for them (ibid, p. 477, 509).

A second piece of evidence concerning the likelihood of observing distant notes in the data arose out of a growing frustration among New York's country banks with the 1840 redemption law. That law obligated every country bank to appoint a redemption agent in Albany or New York City, which agreed to accept the country correspondents' notes at one-half percent discount conditional on the country bank maintaining an interbank deposit with its redemption agent. In a petition to the state legislature asking

for an amendment to the law, the directors of the Oneida Bank of Utica asserted that "long established usage and the force of public opinion" forced country banks to accept the notes of any other New York country bank at par (Oneida Bank 1850, p.1). The redemption system notwithstanding, country banks were "the largest dealers in country bank notes," not the urban redemption agents. Although country notes flowed to urban markets, they were more likely to be redeemed at other country banks. The system put in place in 1840, from the country banks' perspective, did them a disservice by tying up funds in Albany or New York City and allowing the respondent banks a small profit on redemptions where country banks earned none.[17]

A legislative committee appointed to investigate, offer advice, and recommend any necessary amendments to New York's redemption system (New York Senate 1850). They estimated, based on an average note turnover of 90 days, that banks and brokers redeemed approximately $32 million worth of bank notes each year. Contrary to the Oneida Bank's assertions, country bank par redemptions of other country bank's notes accounted for just $5 million to $8 million of that $32 million. The balance was redeemed by banks or brokers in Albany or New York City. It was common practice for the redemption agents, whether bank or broker, to redeem notes, then return packages of redeemed notes every 13 to 30 days, depending on the agreement between an issuing bank and its redemption agent. Agreements further stipulated that the redemption agent's compensation derived from either discounting the notes at the lawful one-half percent rate or redeeming the notes at par and charging the issuing bank interest on the agent's average balance.

The relevant feature of these redemption practices and agreements is that notes of regional banks, even those hundreds of miles distant from the bank accepting them, were not disposed of as quickly as possible. Pennsylvania did not have a formal redemption system like New York's, but country banks had redemption agreements with Philadelphia and other banks. It is likely they operated in a similar fashion.

7.b. Bank note brokerage in Darien, Connecticut

[17] The frustration expressed by New York State's country banks is reminiscent of that expressed by New England banks over the demands of the Suffolk Bank on its correspondent banks. The frustration among New England's bank led to the dissolution of the Suffolk System in the late 1850s (Bodenhorn 2002).

Sometime after 1850, Samuel B. Gorham opened a grocery in Darien, Connecticut and operated a bank note brokerage business as a sideline business (Hasse 1957).[18] A handwritten ledger records every note Gorham accepted at his brokerage. Each entry records the name of the person discounting the notes, the name of the issuing bank, the denomination of the note, and the serial number on the note. No record exists of the price at which Gorham accepted the notes. Each entry was then matched to Weber's (2005) bank census, which provides the city in which the bank was located and the date the bank was established. From these pieces of information, I calculated the total number and total value of notes by bank of issue and city or county of origin. GPS coordinates were then gathered for each locality and the geodetic distances between the city or town of issue and Darien, Connecticut were calculated.

Over an unknown period circa 1850 (the ledger failed to record dates), Gorham accepted 483 notes tendered by 192 individuals issued by 85 banks located in 54 cities and towns. The average distance between Darien and the city of origin is 107.1 miles (sd = 113.2); the median distance is 70.4 miles. The average distance weighted by the total value of notes discounted is 65.9 miles. The weighted median is 60.7 miles. The typical note accepted by Gorham was not far removed from its point of origin. The Gorham data, therefore, is consistent with the Pennsylvania bank reports.

Figure 7 provides a scatterplot of the natural logarithm of the total value of notes by city of origin by miles between the origin and Darien. Gorham's brokerage discounted more notes issued in New York City, which was 60 miles distant than any other place. Other cities in Connecticut, including New Haven, Norwalk, and Hartford, were also common cities of origin. But cities such as Goshen and Utica, New York were points of origin for substantial values of notes, as was Jersey City, New Jersey. One takeaway from the figure is that the value of notes brokered by Gorham exhibits the inverse power law pattern that found for notes in the early twenty-first century and the for the Pennsylvania banks in the mid-nineteenth century.

To better understand the pattern of note issuers, Figure 8 provides a map of the counties of issue recorded by Gorham. The circles are proportional to the dollar value of notes brokered by Gorham; the largest is New York City, with a value of $670. The

[18] Details of Gorham, his business, and the records appear in the Appendix.

black diamond signifies Darien. Most of the notes received at the Darien grocery were issued by banks in Connecticut, especially those on Long Island Sound, or banks in counties surrounding New York Harbor. The locations of the other issuing banks are consistent with mid-nineteenth-century regional trade patterns. Notes from New Jersey were issued by banks in the Raritan River Valley, which empties into New York harbor, or along the Morris Canal, which connected Jersey City on New York harbor with Phillipsburg on the Delaware River, by way of Patterson. A substantial number of notes were issued by banks located in towns in New York's Hudson River Valley, and the few notes that originated in Upstate New York were from towns along the Erie Canal — Poughkeepsie, Syracuse, and Utica — or Plattsburgh, which was connected to the Hudson River trade by way of the Champlain Canal.

It is not surprising that New York City notes circulated in Darien, Connecticut given the proximity (60 miles) and the extensive trade between New York and cities and towns on Long Island Sound. Notes from other banks also followed greater New York's trade flows, namely cities on New York harbor and cities and towns in the Hudson River Valley, which was a deep-water port as far north as Albany. Another notable feature evident in Figure 8 is that Gorham recorded no bank notes issued by any Rhode Island bank and only a few from Massachusetts' banks. Providence, by way of Narragansett Bay, and New Bedford, by way of Buzzards Bay, had easy access to Long Island Sound, yet no notes from any of the several banks operating in each city were recorded in Gorham's ledger. Despite the belief that the Suffolk Bank created a common currency zone throughout New England, notes did not circulate in areas that did not trade with Boston or Providence.

The limited information provided in Indiana's 1837 legislative inquiry and the Gorham note brokerage data provides evidence consistent with the conclusions drawn from the Pennsylvania data. Although a few notes might appear hundreds of miles from their issuing banks, most bank notes circulated over a limited range. Indiana's banks encountered Ohio and Illinois notes, but relatively few from other states. Gorham recorded receiving more notes issued by New York City banks and from banks located in neighboring Connecticut counties than from any other places. The second relevant feature is that the pattern of note redemptions observed in 1842 Pennsylvania were not driven by a contraction of the market for bank notes in the late stages of a recession.

Indiana's experience dates to the before the banking crisis of 1837; Gorham's experience is from a long economic expansion between 1843 and 1854 (Jalil 2015). Their experiences are consistent with Pennsylvania's.

8. Conclusions

Generations of banking historians have been vexed by the question of how well bank-issued currencies served as the media of exchange. The modern consensus – among economic historians, at least – is that the benefits of these currencies outweighed their costs, excepting a couple brief periods of wildcat banking (Rockoff 1974, Rolnick and Weber 1984, King 1983. Gorton 1996). Several mechanisms arose to facilitate the notes' circulation, clearing, and redemption. New England relied on centralized private coordination; New York mandated interbank redemption; much of the remainder of the country relied on note brokers.

The issue addressed here is the range over which bank notes served as useful currencies. Nineteenth-century travelers recounted tales of frequent, sometime costly exchange, as they traveled between cities and regions. Evidence from mid-nineteenth-century Pennsylvania and Connecticut is consistent with travelers' accounts. Bank notes traded within a relatively compact geography. Notes issued by banks 200 miles away from a given bank or broker were rarely encountered. Fifty miles or less appears to be the distance within which notes satisfied the no-questions-asked criterion (Gorton, Ross and Ross 2022). The operative mechanism that explains the direction and reach of traveling bank notes is trade flows. Notes did not disperse across a featureless plain. Notes moved with travelers, provisioning merchants, and traders as they moved along a region's roads, rivers, and canals. Notes followed trade in the pockets of traders.

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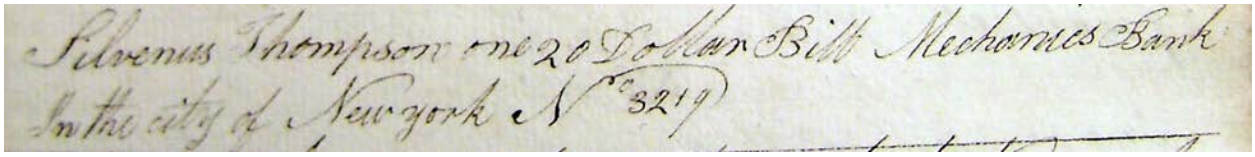
APPENDIX: Gorham's grocery and note brokerage

The evidence of Gorham's note brokerage comes from a business ledger in the Gorham Family Records (1824) held at Harvard's Baker Library, in which a merchant maintained a detailed record of the various bank notes he received. Each handwritten page contains the details of six to eight bank notes, including the names of the customer who tendered the note, the issuing bank, its denomination, and the serial number on the note. A typical example is shown in Figure 2.

Figure 2

Typical entry in Gorham ledger



[Silvenus Thompson one 20 Dollar Bill Mechanics Bank in the city of New york No. 3219 (Gorham Family Records 1824, p.3)]

Although the finding aid dates the volume to between 1824 and 1840, it appears to date to the early 1850s. In matching the entries to Weber's (2005) census of state banks, the earliest chartered bank whose notes appear is the Bank of New York,

established in 1784, and the latest chartered bank whose notes appear is the City Bank of Cape May, New Jersey, established in 1851. Three other banks listed in the journal were established in 1850. Huntington (1868) provides a list of businesses operating in Darien before the Civil War, in which he lists Gorham & Garland, grocers, established in 1850, without any first names or other information. It is likely that the Gorham identified by Huntington is Samuel B. Gorham. A Samuel Gorham appears on the second page of the journal in reference to a sale of shingles in 1848. A Samuel Gorham also appears in the 1870 federal census of Darien, Connecticut. He is a 51–year old, married, grocer, born in New York, and owner of real estate valued at $1,400 and personal estate of $200. Gorham's household includes his wife, Mary R., three teenage children, and Mary's 46–year old sister. It is likely that the bank note register attributed to Gorham is one of the earliest business records kept by the firm of Gorham & Garland.

As a grocer in Darien, which is located on Long Island Sound between Stamford and Norwalk, approximately 60 miles northeast of New York City and 35 miles southwest of New Haven, Gorham might have anticipated receiving bank notes from overland travelers between New York City and Boston. Hasse (1957) suggests that Gorham may have engaged in note brokerage as sideline to his grocery. It is plausible given the details concerning each note in the ledger, but no discounts are recorded in the ledger. If Gorham brokered bank notes, it was more likely a sideline than a principal business.

FIGURES

Figure 1

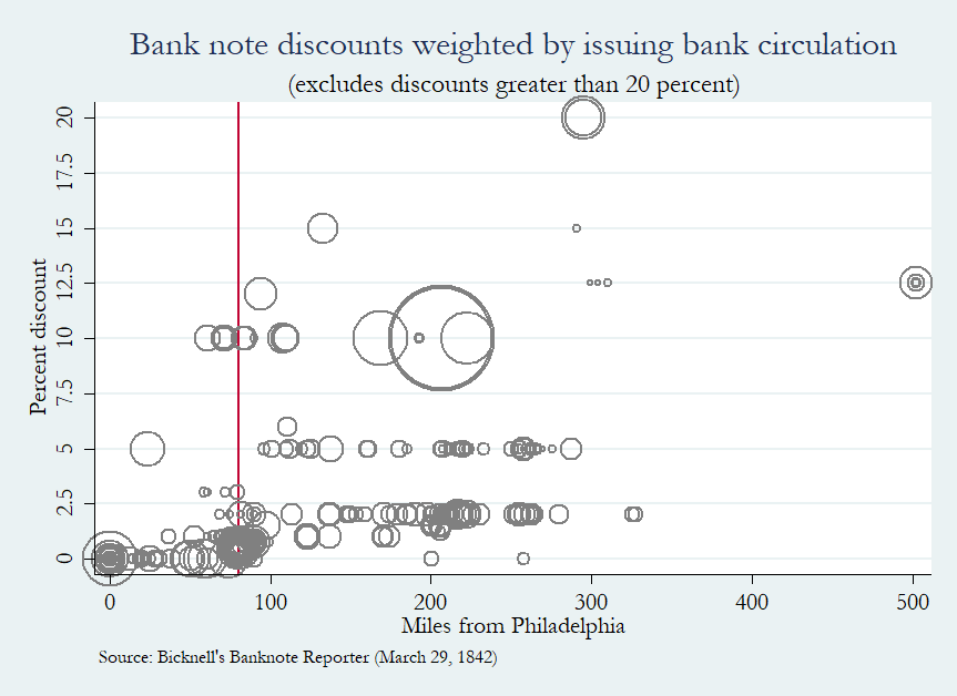


Figure 2

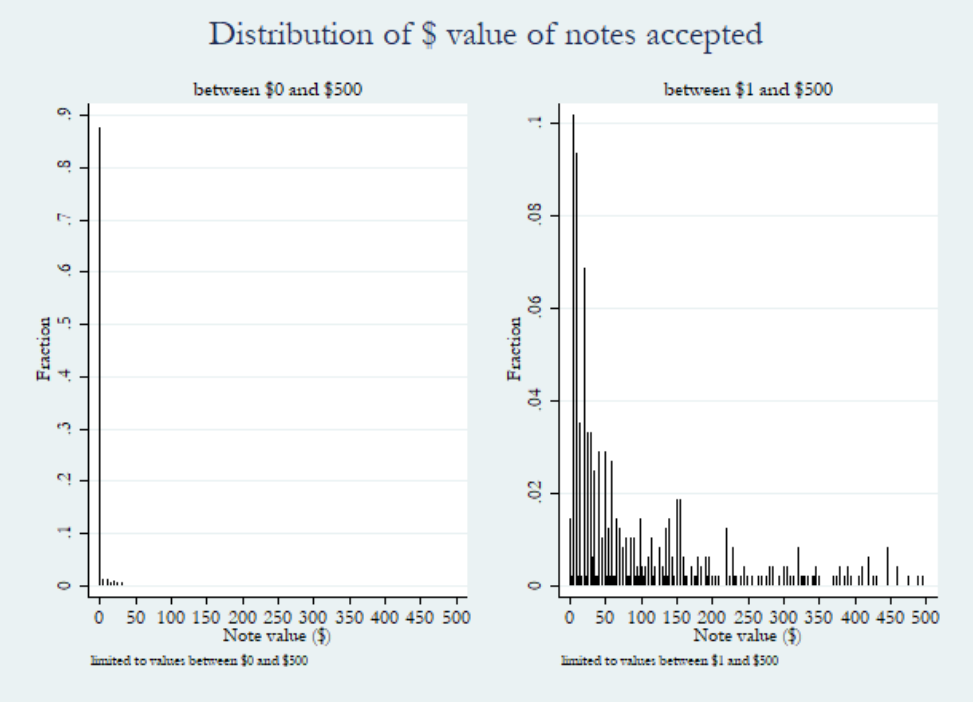


Figure 3

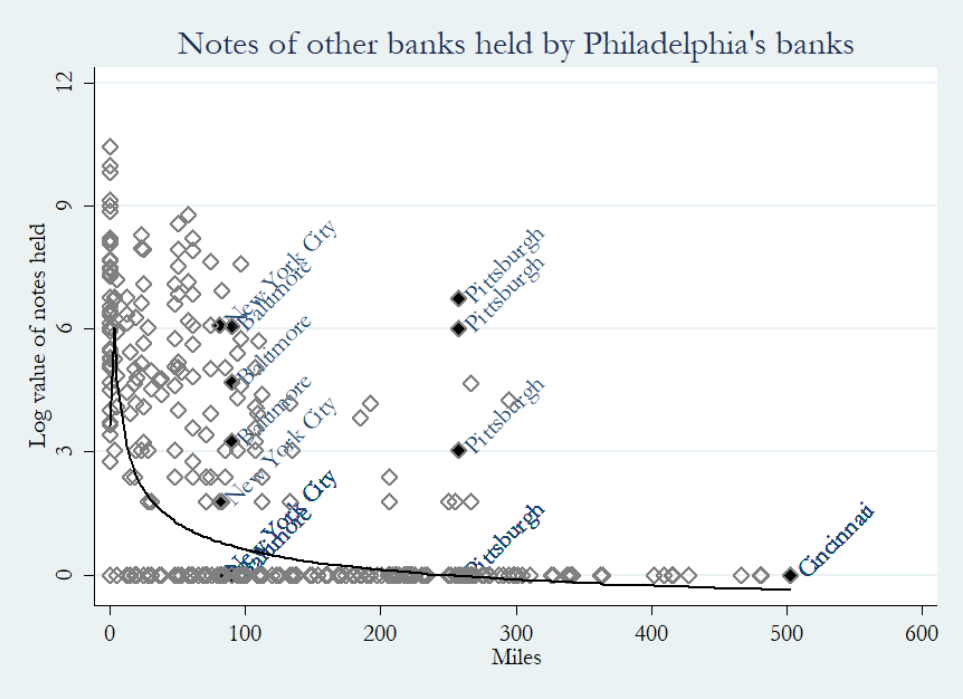


Figure 4

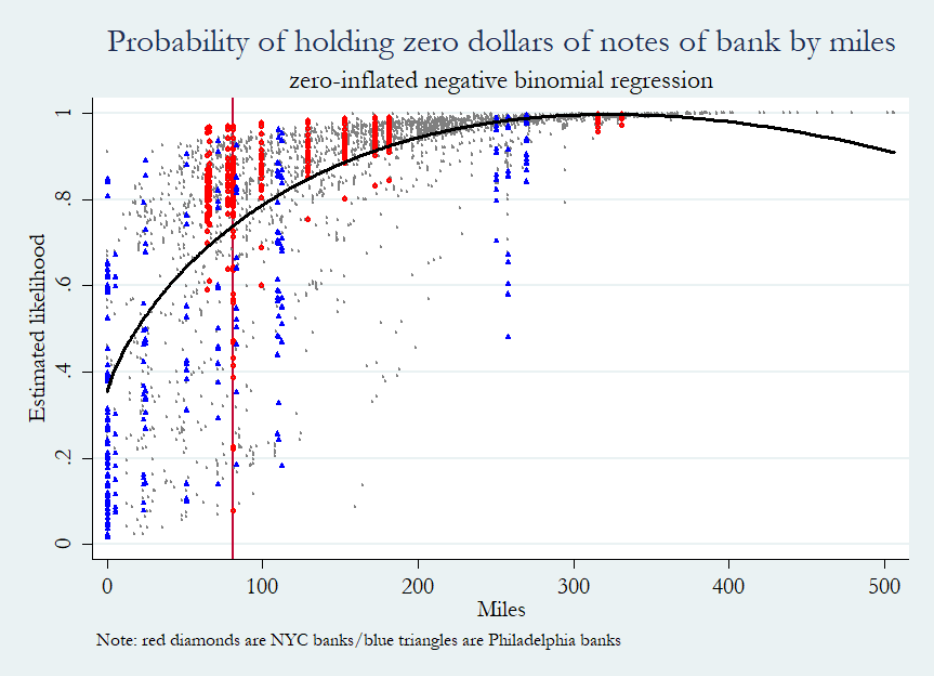


Figure 5

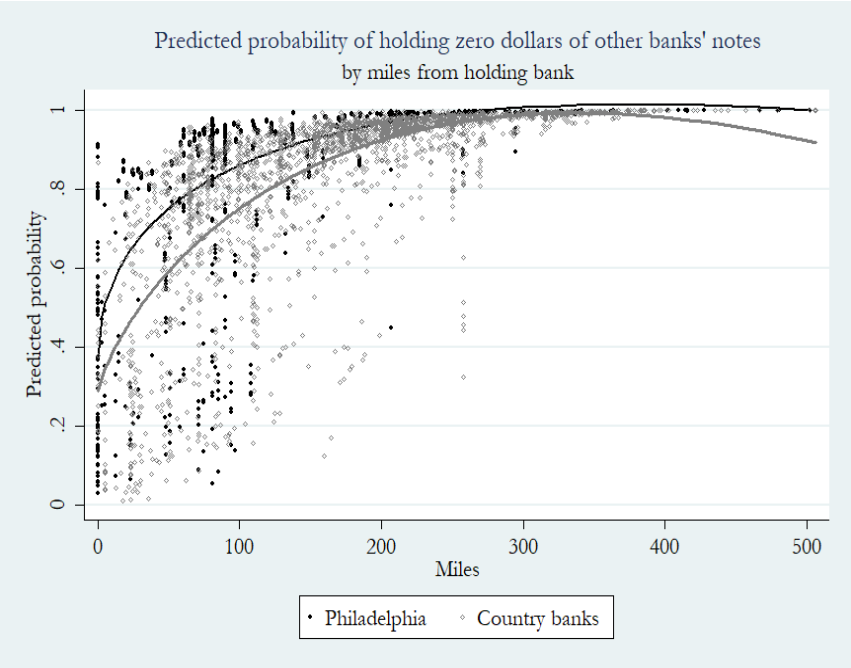


Figure 6

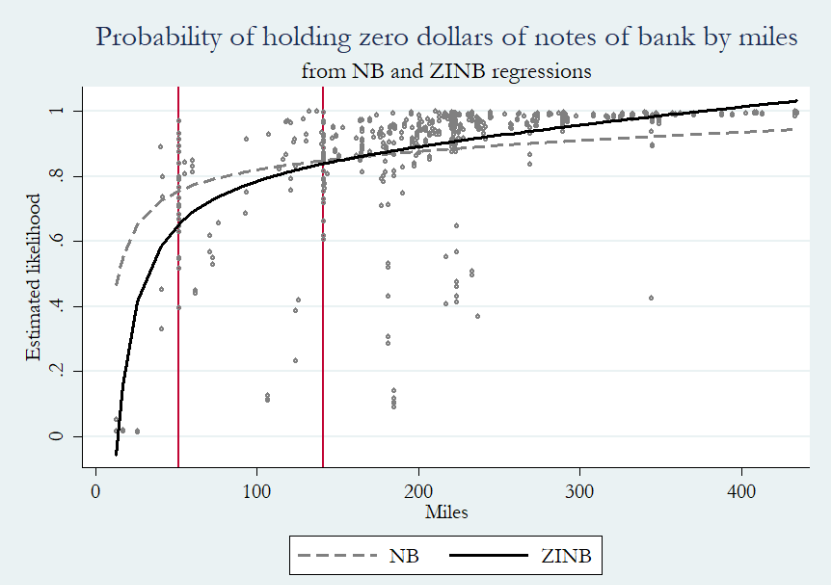


Figure 7

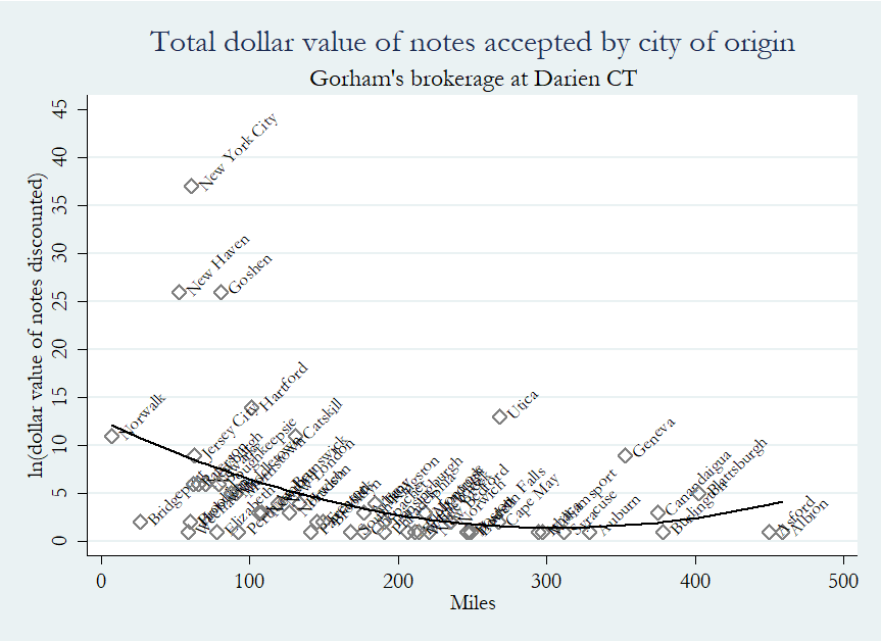
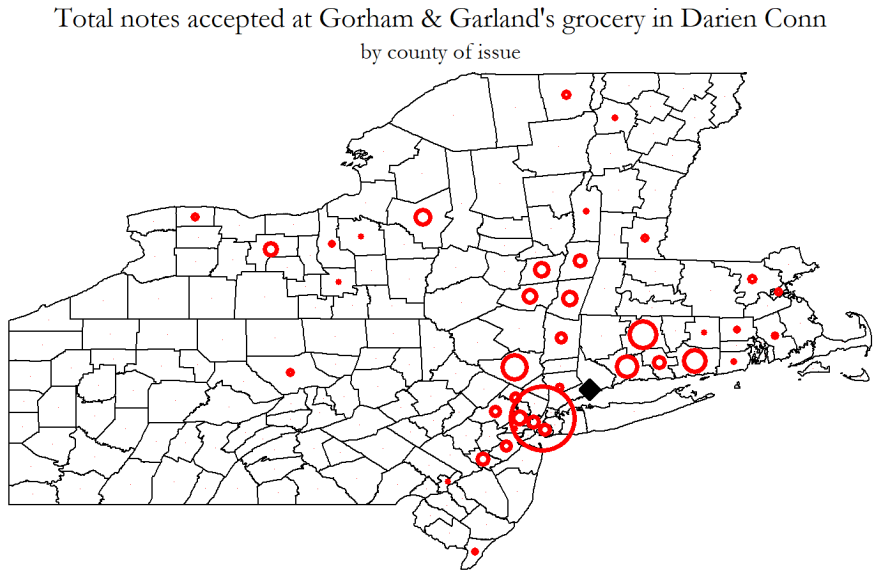


Figure 8

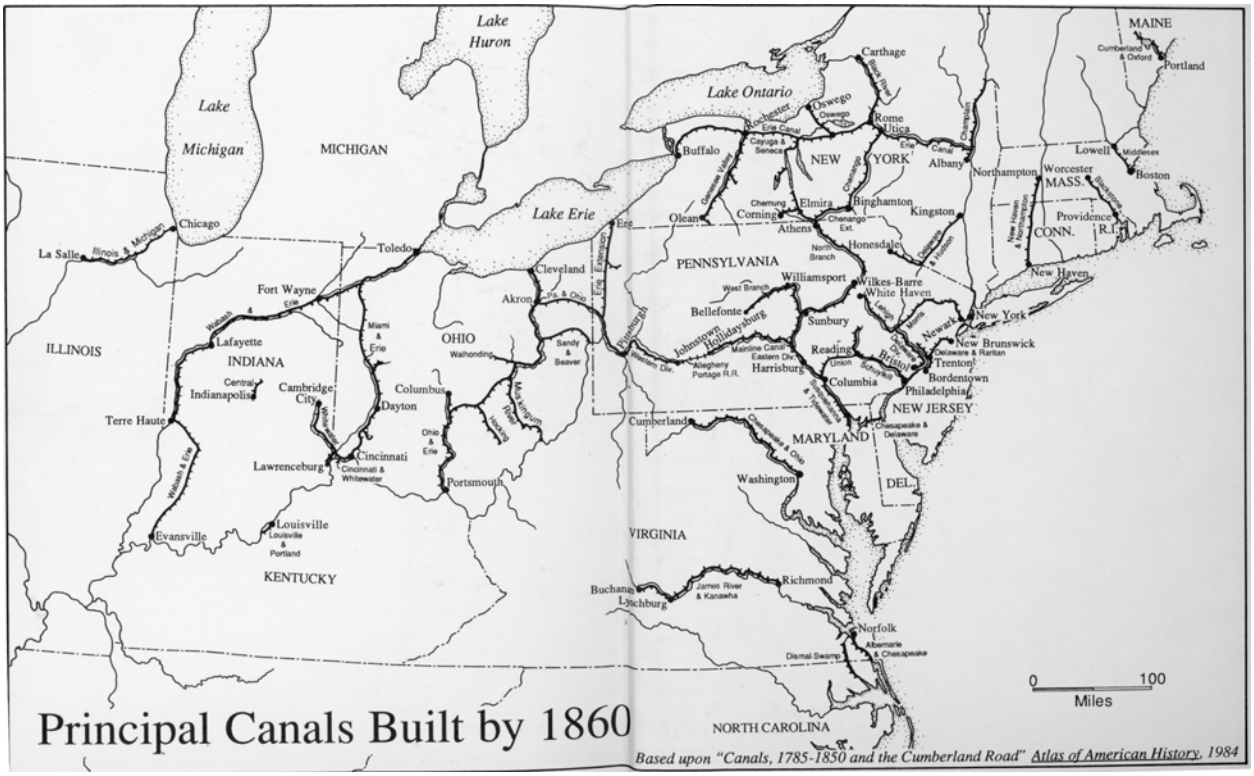


Note: black diamond signifies location of Gorham's grocery

Appendix Figure A1

United States canal network, circa 1860

(most of the canals shown were completed by mid-1840s)



TABLES

Table 1

Interbank accounts and bank note holdings at two Pennsylvania banks

City/town	Due to banks	Due from banks	Note balances	Miles
		Easton Bank -- Easton, PA		
Allentown, PA	na	493	2010	14.4
Baltimore, MD	na	290	0	121.5
Bridgeton, NJ	na	0	155	87.9
Bristol, PA	na	68	1805	45.0
Doylestown, PA	na	569	875	26.5
Germantown, PA	na	0	1060	45.5
New York, NY	na	8491	0	63.8
Northumberland, PA	na	0	1035	83.9
Philadelphia, PA	na	31586	8325	50.8
Reading, PA	na	0	1305	44.4
Trenton, NJ	na	1608	155	40.4
West Chester, PA	na	0	795	54.1
Wilkes-Barre, PA	na	9	150	51.7
Williamsport, PA	na	0	335	141.5
		York Bank -- York, PA		
Baltimore, MD	1053	3211	0	46.8
Carlisle, PA	0	3275	2110	29.9
Chambersburg, PA	0	3139	875	49.6
Columbia, PA	0	825	345	12.9
Gettysburg, PA	0	4732	570	28.2
Harrisburg, PA	64	1104	75	23.0
Lancaster, PA	1547	0	225	23.0
Philadelphia, PA	0	1156	185	83.0
Richmond, VA	0	0	607	171.4
Wilmington, DE	0	0	155	64.5
Wheeling, VA	0	0	160	211.9

Note: City/town included if any account value exceeded $100.

Source: Pennsylvania Auditor General (1850), Pennsylvania Auditor General (1851).

Table 2

Summary statistics for 17-bank sample

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	mean	sd	mean	sd	mean	sd
	Full sample		Philadelphia only		Country banks	
Circulation ($)	151,291	273,482	142,610	255,161	152,002	274,845
Bank notes held ($)	86.50	878.9	150.8	1,376	47.29	337.8
Due to bank ($)	105.0	1,361	251.6	2,227	19.50	183.3
Due from bank ($)	99.65	1,216	124.7	1,620	81.23	876.5
Counterfeits (#)	4.033	7.208	3.764	6.927	4.031	7.200
Miles	166.9	98.49	165.7	112.8	175.5	97.18
ln(circulation)	11.41	0.971	11.35	0.991	11.41	0.976
ln(Due to bank)	0.259	1.302	0.417	1.700	0.166	0.986
ln(Due from bank)	0.277	1.341	0.347	1.480	0.226	1.225
Bank age (yrs)	16.46	12.54	15.61	12.22	16.55	12.54
Susquehanna River (0/1)	0.0289	0.167	0.0276	0.164	0.0297	0.170
Delaware Hudson Canal	0.0136	0.116	0.0118	0.108	0.0136	0.116
Lehigh Delaware Canal	0.0785	0.269	0.0709	0.257	0.0814	0.274
Main Line Canal	0.0534	0.225	0.0512	0.221	0.0551	0.228
Morris Canal	0.0211	0.144	0.0165	0.128	0.0221	0.147
Number of banks	17		5		12	
Observations	3463		1269		2356	

Table 3

Determinants of dollar value of other banks' notes held

	(1)	(2)	(3)	(4a)	(4b)
VARIABLES	Tobit	Poisson	NB	ZINB	ZINB
Miles	-41.8461***	0.9686***	0.9040***	0.9598***	1.0108***
	(12.6649)	(0.0080)	(0.0120)	(0.0070)	(0.0012)
Miles squared	0.1795***	1.0000	1.0004***	1.0002***	
	(0.0649)	(0.0001)	(0.0001)	(0.0001)	
Mules cubed	-0.0003**	1.0000	1.0000***	1.0000***	
	(0.0001)	(0.0000)	(0.0000)	(0.0000)	
ln(Circulation)	636.9052***	1.6731***	2.4429***	1.7165***	0.5872***
	(161.2047)	(0.2117)	(0.2709)	(0.1149)	(0.0718)
ln(Due to bank)	162.1009***	1.1837***	1.5675***	1.1510***	0.7812***
	(33.3291)	(0.0463)	(0.0849)	(0.0342)	(0.0309)
ln(Due from bank)	199.6073***	1.2752***	1.4627***	1.1546***	0.8236***
	(67.0274)	(0.0849)	(0.1536)	(0.0393)	(0.0299)
Counterfeits	-56.6893**	0.9586	0.9761		1.0923**
	(28.8497)	(0.0356)	(0.0148)		(0.0472)
Bank age	12.2656	0.9813	1.0205		0.9732**
	(10.4367)	(0.0163)	(0.0139)		(0.0130)
Bank note discount	-15.5765	1.1044	1.2926*	1.1413**	1.1324
	(111.7468)	(0.1929)	(0.1771)	(0.0740)	(0.1687)
Susquehanna River	681.9797	1.4463	10.7289**		0.2602*
	(521.4427)	(0.8598)	(10.9239)		(0.1790)
Delaware-Hudson Canal	1,074.9202	0.0502***	3.5624		0.3303
	(777.1309)	(0.0242)	(3.0098)		(0.2790)
Lehigh-Delaware Canal	1,081.4822***	1.7384*	5.4757***		0.3342***
	(398.1243)	(0.5805)	(2.6227)		(0.1160)
Main Line Canal	1,172.6394***	1.2312	29.6973***		0.2024***
	(439.6047)	(0.5183)	(23.9688)		(0.0829)
Morris Canal	-472.1331	1.0574	0.1727**		1.5245
	(481.1431)	(0.3635)	(0.1438)		(0.9239)
Constant	-7,713.1432***	0.6672	0.0877	0.8117	1,023.5875***
	(1,913.2951)	(1.0100)	(0.1395)	(0.6758)	(1,393.7682)
ln(alpha)			2.940***	0.560***	
			0.107	0.081	
Observations	3,463	3,463	3,463	3,463	3,463

Note: standard errors clustered on issuing bank in parentheses; all regressions include receiving bank fixed effects.

*** p<0.01, ** p<0.05, * p<0.1

Table 4

Determinants of dollar value of other banks' notes held

	(1)	(2)	(3a)	(3b)
VARIABLES	Philadelphia	Philadelphia	Country	Country
	ZINB	Inflate	ZINB	Inflate
Miles	0.970*	1.021***	0.961***	1.011***
	(0.016)	(0.004)	(0.007)	(0.001)
Miles squared	1.000		1.000***	
	(0.000)		(0.000)	
Miles cubed	1.000		1.000***	
	(0.000)		(0.000)	
ln(Circulation)	1.639***	0.675**	1.839***	0.593***
	(0.270)	(0.127)	(0.116)	(0.069)
ln(Due to bank)	1.200***	0.760***	1.109***	0.734***
	(0.061)	(0.040)	(0.039)	(0.060)
ln(Due from bank)	1.144*	0.678***	1.088***	0.890**
	(0.085)	(0.063)	(0.031)	(0.043)
Counterfeits		1.053		1.092**
		(0.049)		(0.045)
Bank age		0.985		0.971**
		(0.017)		(0.013)
Bank note discount	1.009	0.984	1.028***	0.992
	(0.038)	(0.022)	(0.011)	(0.009)
Susquehanna River		0.242		0.331*
		(0.220)		(0.195)
Delaware-Hudson Canal		0.098***		0.457
		(0.086)		(0.350)
Lehigh-Delaware Canal		1.053		0.282***
		(0.058)		(0.086)
Main Line Canal		0.115**		0.242***
		(0.115)		(0.117)
Morris Canal		0.921		1.523
		(0.620)		(0.926)
Constant	5.58	178.825***	0.446	827.935***
	(10.133)	(346.125)	(0.367)	(1,079.073)
ln(alpha)	1.008***		0.361***	
	0.123		0.104	
Observations	1,105	1,105	2,358	2,358

Note: standard errors clustered on issuing bank in parentheses; all regressions include receiving bank fixed effects

*** p<0.01, ** p<0.05, * p<0.1

Table 5

Determinants of dollar value of other banks' notes held at Columbia Bank & Bridge

	(1)	(2)	(3a)	(3b)
VARIABLES	Poisson	NB	ZINB	ZINB
Miles	0.9751	0.9304**	1.0094	1.0158***
	(0.0267)	(0.0297)	(0.0193)	(0.0030)
Miles squared	1.0000	1.0002	0.9998	
	(0.0002)	(0.0002)	(0.0001)	
Miles cubed	1.0000	1.0000	1.0000	
	(0.0000)	(0.0000)	(0.0000)	
ln(Circulation)	2.7363***	10.9708***	1.6126*	0.2329***
	(0.6963)	(4.1352)	(0.4096)	(0.0538)
ln(Due to bank)	0.6557***	0.8536	1.1096	1.0917
	(0.0870)	(0.1242)	(0.0902)	(0.1795)
ln(Due from bank)	0.6902**	0.7618***	1.0522	1.0576
	(0.1094)	(0.0725)	(0.1542)	(0.1810)
Counterfeits	0.9087	0.8985***		1.0534*
	(0.0669)	(0.0299)		(0.0288)
Bank age	1.0529***	0.9917		0.9920
	(0.0168)	(0.0214)		(0.0126)
Bank note discount	2.4812***	14.2185***	3.8168***	0.4692***
	(0.4885)	(7.5066)	(1.4063)	(0.1286)
Susquehanna River	0.4343	1.1324		0.9017
	(0.2389)	(1.2739)		(1.0222)
Delaware-Hudson Canal	3.5470**	0.3416		0.4843
	(2.2421)	(0.3053)		(0.4148)
Main Line Canal	30.8539***	15.4739***		0.0206***
	(14.2862)	(8.7482)		(0.0248)
Morris Canal	0.0000***	0.0000***		4.4876e+15***
	(0.0000)	(0.0000)		(2.6218e+15)
lnalpha		2.888***	0.197	
		(0.188)	(0.163)	
Constant	0.0004***	0.0000***	0.6083	1.3637e+07***
	(0.0012)	(0.0000)	(1.8919)	(3.7612e+07)
Observations	536	536	536	536

Notes: standard errors clustered on issuing banks in parentheses; all regressions include issuing bank fixed effects

*** p<0.01, ** p<0.05, * p<0.1