STEPHEN QUINN
WILLIAM ROBERDS

Responding to a Shadow Banking Crisis: The Lessons of 1763

In August 1763, northern Europe experienced a financial crisis with numerous parallels to the 2008 Lehman episode. The crisis affected merchant banks that were funded by short-term credit instead of deposits. We use archival data to show that these "shadow" banks suffered a sudden loss of funding after the failure of a major bank. The central bank at the hub of the crisis, the Bank of Amsterdam, responded by broadening the range of collateral it accepted. The data also show how this emergency liquidity helped to contain the crisis, by preventing the collapse of at least two other major banks.

JEL codes: E58, G01, G21, N21
Keywords: shadow banks, central banks, liquidity.

THE 2008 LEHMAN CRISIS was notable as a banking panic where bank deposits were rarely questioned. In place of commercial bank runs, investors stopped funding a lightly regulated group of institutions subsequently called shadow banks (Pozsar et al. 2010). Before the crisis, shadow banks had learned to fund operations by selling short-term financial claims with the money-ish quality of "information insensitivity" (Dang, Gorton, and Holmström 2009). Then dysfunction in certain securities markets, like mortgage-backed securities, upset investor perceptions of insensitivity, and suddenly shadow banks were unable to renew their funding.

Views expressed are solely those of the authors and not necessarily those of the Federal Reserve Bank of Atlanta or the Federal Reserve System. Helpful comments on earlier drafts were provided by Olivier Accominotti, Christiaan van Bochove, Roger Farmer, Rod Garratt, Peter Koudijs, Angela Redish, Rob Reed, Charlie Sawyer, Ellis Tallman, François Velde, Larry Wall, and participants in seminars at the Atlanta Fed, the Bank of Canada, De Nederlandsche Bank, George Mason University, and the University of Utrecht. Christina Hartlage provided research assistance.

STEPHEN QUINN *is a Professor, Department of Economics, Texas Christian University* (*E-mail:* s.quinn@tcu.edu). WILLIAM ROBERDS *is a Research Economist and Senior Policy Advisor, Research Department, Federal Reserve Bank of Atlanta* (*E-mail:* william.roberds@atl.frb.org).

Received November 13, 2013; and accepted in revised form August 1, 2014.

Journal of Money, Credit and Banking, Vol. 47, No. 6 (September 2015)

The shadows also concealed the situation from most economists. Some postcrisis analysis has gained perspective by considering the functional equivalence of shadow runs to traditional bank runs (Gorton 2012). However, the question remains whether Wall Street's system was highly unique. This paper shows it was not, by reconstructing the example of the Amsterdam Crisis of 1763. In doing so, we follow Schnabel and Shin (2004) by drawing parallels between pre-Napoleonic Continental banking institutions and the financial market structures of today, but our analysis emphasizes the "liability side" of the crisis (inability to roll over funding) rather than the "asset side" (collateral shocks). During this time period, Amsterdam was replete with merchant banks lending money throughout Europe via a process called acceptance credit. The Dutch banks funded their operations by issuing new debt instead of accepting deposits, and dependence on debt rollover made Amsterdam in 1763 as vulnerable to aggregate shocks as New York was in 2008.

The impetus for the 1763 crisis was the Lehman-like failure of the banking house Gebroeders de Neufville. De Neufville suspended payments on July 30, sparking a panic that made creditors reluctant to purchase new debt from surviving banks. The resulting shadow run was of approximately the same magnitude (relative to the size of the market) as that experienced in 2008. To measure the run, we have reconstructed the weekly flow of funds into and out of accounts maintained by the eight largest merchant banks at the Bank of Amsterdam (also referred to as the Bank). Large merchant banks were often obliged to use the Bank to settle their debts, called bills of exchange, but light regulation otherwise meant that the Dutch banks did not hide their trading activity. Rich archival data and straightforward financial architecture allow us to reconstruct the portion of the panic that occurred through the Bank's accounts.

A second parallel is in the Bank of Amsterdam's response to the crisis. As in 2008, access to central bank liquidity was expanded in an unprecedented and *ad hoc* basis. Differently, this expansion was relatively narrow in scope. The Bank of Amsterdam expanded liquidity through its traditional repurchase (repo-like) facility for coins, and the Bank broadened the set of assets eligible for repo to include silver bullion. This response was more modest in scale than the analogous elements of the Fed's expansion. Still, the aggregate increase in Bank of Amsterdam money was 40% over 6 months,[1] more impressive when one considers that the Bank did not operate a traditional discount window or engage in transactions with other central banks.

Bullion collateral accounts for a relatively small proportion of the Bank's postcrisis balance sheet, but the micro evidence shows that this liquidity channel had disproportionately large effects. Our new data set tracks liquidity creation by merchant bank, and examination of these data shows that bullion likely prevented the failure of at least two additional large banks. In this way, the Bank's policies avoided further major failures within Amsterdam and avoided too-big-to-fail bailouts. The costs, however, of this conservative policy intervention were disproportionately felt in Amsterdam's

1. Weekly summary balance sheets of the Bank are given in Table A1.

satellite markets (Berlin, Hamburg, Stockholm, etc.), which experienced an almost complete shutoff of credit flows.

As a precedent, the Crisis of 1763 confirms the model of a shadow bank as a financial firm that has to roll over its financing before the backing assets mature. Shadow runs are the sudden inability to sell new debt, as arrangements designed to make claims money-like fail. This history opens potential explanations for the ascent of modern shadow banking, for the Dutch system evolved in response to demand for credit enhancement rather than to avoid regulation. Finally, the story shows how a shadow run was alleviated—if only partially—through aggressive repurchase facilities but without explicit bailouts or too-big-to-fail guarantees.

The rest of this paper is organized as follows. Section 1 reviews related literature. Sections 2 and 3 discuss banking institutions in eighteenth-century Amsterdam, and Section 4 shows the use of leverage by merchant banks. Section 5 discusses the collateral shocks and the outbreak of the crisis. Section 6 presents empirical evidence on the severity of the crisis, and Section 7 analyzes policy responses. A final section reviews the striking similarities between shadow banking crises separated by almost 250 years.

1. RELATED LITERATURE

The Panic of 1763 was a major historical event, and it has a rich historical literature with contributions by Büsch (1797), Soetbeer (1855), Sautijn Kluit (1865), van Dillen (1922, 1931), Skalweit (1937), Henderson (1962), and Spooner (2002), among others. The analysis below relies on these works, and especially on the monograph of de Jong-Keesing (1939), both for historical narrative and for guidance to primary sources. More recently, Schnabel and Shin (2004) synthesize the historical literature and propose a theoretical model of contagion effects stemming from de Neufville's failure.

While Schnabel and Shin (2004) focus on how a collapse of collateral values could reduce asset liquidity, our paper looks at the withdrawal of wholesale funding from merchant bankers. Much of de Neufville's debt lacked backing collateral, and the immediate cause of de Neufville's failure, and the distress of other bankers, was a sudden inability to replenish liquidity through established channels of unsecured borrowing.

Our paper also reveals for the first time how the Bank of Amsterdam acted as lender of last resort to limit the outbreak of contagion. The intervention, though modest and localized, appears to have been of value to some key banks in the Amsterdam market.[2] While additional small banks did fail in Holland, the Bank's intervention helped ensure the survival of the merchant banks that anchored the acceptance credit market. A similar crisis and response story is investigated by Flandreau and Ugolini (2013) for London in 1866. In England, the failure of a large bank caused shadow banks (called

2. This finding (see Section 7) contrasts with Schnabel and Shin's (2004) conclusion that "the 1763 crisis demonstrates vividly the effects of a liquidity crisis in the absence of official intervention" (p. 965).

bill brokers) to suddenly become unable to finance international acceptance credit. The Bank of England responded by rapidly expanding liquidity. Unlike Amsterdam, the London banks did not necessarily settle bills at their central bank. For the panic we study, Amsterdam's reliance on its central bank for settlement services allows a fuller reconstruction of the obligations pressing on shadow banks and of the impact of lender-of-last resort funding.

The efficacy of the Bank of Amsterdam's efforts at emergency lending does not contradict a major conclusion of the earlier literature, that much of the liquidity strain on Amsterdam merchant banks was ameliorated by contracting credit to foreign counterparties. Indeed, the calculations given in Table 2 later in this article are the first attempt to quantify this story. Our data indicate that major merchant banks reduced their bill redemptions by 22% in the 2 months following Neufville's failure. In the short run, such a reduction could have only been accomplished by a disruptive strategy of protesting (i.e., refusing to accept) incoming bills from foreign counterparties with potential exposure to de Neufville. In subsequent months, banks' lending continues to contract, falling by one-third of its precrisis volume.

A similar pattern of repatriating liquidity has been documented for the 2008 crisis. German savings banks, seemingly distant from pressures in New York, increased credit rationing (Puri, Rocholl, and Steffen 2011). Throughout central Europe, banks that relied on international funding contracted lending more than did locally funded banks (Ongena, Peydro, and van Horen 2013), although established borrowing relationships sometimes mitigated the contraction (Cotugno, Monferrà, and Sampagnaro 2012). A more direct and worrisome parallel to 1763 was the post-Lehman dysfunction of markets for foreign exchange swaps, which non-U.S. banks had relied upon for dollar funding (Baba and Packer 2009, McGuire and von Peter 2009, Goldberg, Kennedy, and Miu 2011). The impact of the resulting "global dollar shortage" was blunted through a massive implementation of central bank swaps. In 1763, analogous cross-border forms of emergency liquidity provision would not have been feasible, principally because the places most in need of Amsterdam funds either had no central bank (like Berlin) or a shaky one (like Hamburg and Stockholm).[3] Many of the Amsterdam's counterparties in these locations were thus left exposed to the full force of the "florin shortage."

2. SHADOW BANKING IN 1763

Financial activity in late-eighteenth-century Amsterdam was dominated by merchant banks. In contemporary parlance, these firms were known simply as *banquiers*

3. The Bank of Hamburg had been forced into suspension during earlier crisis episodes in 1672 and 1755. It remained open throughout the 1763 crisis, but was soon (1766) forced to suspend again. The Swedish Bank of the Parliament had suspended redemptions from 1745. The Bank of Amsterdam, by contrast, had never suspended since its opening in 1609, and had kept its money at a more or less constant metallic value for over 100 years. None of these institutions had a lending facility that resembled a modern discount window. See Roberds and Velde (2014) for an introductory survey of early public banks.

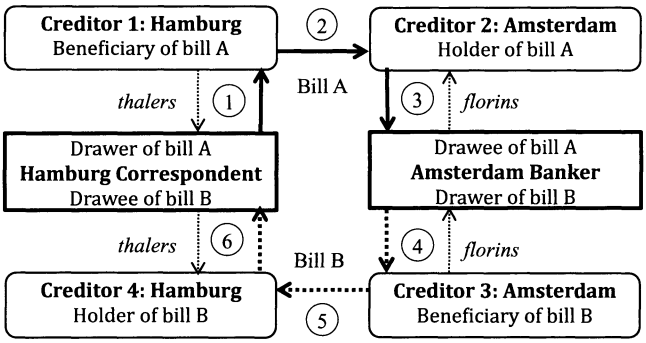

FIG. 1. Acceptance Credit with Re-Exchange.

or "bankers" (de Jong-Keesing 1939, p. 69). Bankers were private firms that dealt in trade goods and that also provided extensive financing to other merchants. Both bankers and ordinary merchants dealt in both goods and bills of exchange. Bankers tended to specialize in the latter, however, and dominated the acceptance market. There were however, no charter requirements or other formal barriers to entering the banking business. Regulation was provided by market discipline (or "honor" as it was then called).

Amsterdam's banks were not the deposit banks of the Anglo-American tradition; deposit taking was viewed as a dangerous and disreputable source of funding (de Jong-Keesing 1939, p. 69; Buist 1974, p. 37). Instead, financial intermediation was supplied through the acceptance loan (*acceptcrediet*) and funded through re-exchange (*hertrekken*). Both processes used an instrument known as the bill of exchange.

A bill of exchange combined the elements of a loan and a foreign exchange transaction. In a bill transaction, a party known as the *drawer* wrote and sold the bill to the *beneficiary* in exchange for local money (e.g., *thalers* in Hamburg).[4] The bill ordered a third party, the *drawee*, to pay a certain sum at a specific future date, at a second location (e.g., *florins* in Amsterdam, 1 month later). Next, the beneficiary often transferred the bill to a fourth party, the *holder*, as a means of payment. The holder then waited until maturity, when the drawee would settle the bill in the second location's unit of account (Denzel 2010, pp. xxiv–xlvi).

Figure 1 illustrates the use of bills of exchange to create and discharge an acceptance loan. In Figure 1, a Hamburg Correspondent (HC) receives an acceptance loan from an Amsterdam Banker (AB).[5]

4. In essence, the drawer of a bill is borrowing in one currency and offering to repay in another at a later date. This "bundling" of credit and foreign exchange had its origins in bills' original purpose of financing long distance trade. As explained below, a bill could also be used for purely financial purposes, for example, as a means for borrowers in outlying markets to take advantage of lower financing costs in Amsterdam, or as a vehicle for taking speculative positions.

5. The Hamburg correspondent might also be considered a "banker," or might be simply a merchant.

There are six steps in this stylized example. The first three steps involve the creation of such a loan:

1. HC draws bill A on AB, and sells it to Creditor 1 (C1) for Hamburg thalers;
2. C1 sells bill A to another creditor C2, who is located in Amsterdam;
3. At maturity, C2 presents bill A to AB in return for Dutch florins.

The process of re-exchange allowed merchant banks to maintain a leveraged portfolio of acceptance loans. In Figure 1, re-exchange occurs in three additional steps:

4. AB draws bill B on HC, and sells it to Creditor 3 (C3) for florins;
5. C3 sells bill B to another creditor C4, located in Hamburg;
6. At maturity, C4 presents bill B to HC in return for thalers.

The acceptance loan begins (step 1) with the Hamburg correspondent drawing a bill on his Amsterdam banker. Because the bill originated in a distant city, the drawee (the Amsterdam Banker in Figure 1) was not obliged to pay until he *accepted* the bill by signing it. Ordinarily, acceptance occurred after the bill migrated to its final destination (step 2), but acceptance credit could move this forward in the process (step 1). This eliminated the risk of the drawee not accepting the bill (Schnabel and Shin 2004, pp. 935–39). Acceptance transformed a potentially shaky credit (that of the drawer) into a liquid security owed by a prominent merchant banker (the drawee). Acceptance was similar in effect to a letter of credit, and such credit enhancement constituted the key added value of acceptance banking.

Settlement of the bill (step 3) still left the Amsterdam banker with a balance sheet credit owed by his Hamburg correspondent. To settle this obligation, the Hamburg correspondent would customarily ship commodities to Amsterdam for the merchant banker to sell.[6] The proceeds from the sales settled the bill, and the banker earned a sales commission. During the Seven Years' War (1756–63), however, trade settlement became difficult as unsold goods piled up in Amsterdam warehouses (de Jong-Keesing 1939, pp. 63–64). At the same time, demand for military supplies in areas nearer the conflict pulled capital from Amsterdam.

Merchant bankers adapted by supplying credit for the movement of such goods and using the proceeds to fund acceptance credit. The most direct way of doing this had the banker "re-exchange," that is, draw and sell a second bill back on the original drawer (step 4). In Figure 1, the banker uses bill B to fund settlement of bill A.[7] Figure 1 carries forward this simplest of leverage scenarios by adding steps 5 and 6 (sale and settlement of bill B). In the end, the correspondent in Hamburg borrows money for a period of six steps. The merchant bank funds this loan by, in essence, issuing a short-term (three-step) liability (bill B) in the Amsterdam market.

6. In their capacity as wholesale merchants, bankers maintained warehouse facilities for the storage and sale of goods shipped by their counterparties.

7. Adam Smith describes this well-known practice as "raising money by circulation" (Smith 1937 [1776], p. 294).

The acceptance business offered three potential sources of profit for the bankers involved. First, correspondents typically paid a commission to the banker for the acceptance. Competition kept the market premia on acceptance loans quite low, however, ⅓% or less (Büsch 1797, p. 121; de Jong-Keesing 1939, p. 71). Second, the correspondent paid a time premium (implicit interest). The premium emerges endogenously because bill markets priced the exchange rate of Hamburg on Amsterdam slightly off from the rate of Amsterdam on Hamburg. The Hamburg correspondent in the Figure 1 example sees this as paying more thalers in step 6 than he got in step 1. Third, the banker could use the bill transactions as a way to take speculative positions on the prices of commodities and exchange rate movements.

Re-exchange posed a number of risks, including the "rollover risk" stemming from disruptions in the bill market. Informally, bankers mitigated these risks by holding warehoused commodities from their counterparties, although a bill could not be formally bound to any specific collateral. Many bankers limited undercollateralized credit, but some welcomed the opportunity to earn profits from leveraging ledger credit (de Jong-Keesing 1939, pp. 65–66). The most aggressive banks extended acceptance credit entirely without collateral (*blanco-crediet* or "naked credit"). An aggregate shock, however, made both the sale of bills and the sale of commodities difficult. Such circumstances forced bankers to use their own reserves to fund acceptances, and that meant maintaining an adequate balance at the Bank of Amsterdam.

The stylized example in Figure 1 suggests that the banker is running a simple "matched book" of short and long bill positions with just a few counterparties. Available data (from de Neufville's bankruptcy filing, discussed in Section 4 below) indicate that in practice, merchant banks pursued complex financing strategies involving hundreds of counterparties spread over many locations. These data also show that by mid-1763, Gebroeders de Neufville was already deeply insolvent, but had been able to mask its insolvency through its activity in the Amsterdam bill market.

3. THE BANK OF AMSTERDAM

The Bank of Amsterdam records the crisis of 1763 because its accounts were the predominant medium of settlement for bills of exchange (van Dillen 1934, Dehing and 't Hart 1997). At a bill's maturity, the debtor discharged his obligation by transferring Bank funds to the holder in the full amount of the face value of the bill; there was no netting or other clearing of obligations. Most bills drawn abroad on Amsterdam were obliged to settle at the Bank, and foreign bills drawn in Amsterdam were sold for bank florins. Since the Bank did not issue notes, it is possible to track much of this bill market activity through transfers within the Bank.[8] Meticulous and virtually

8. The historical literature suggests that the Bank was the predominant, but not monopolistic provider of settlement services to the Amsterdam bill market. It is not possible to quantify the Bank's market share, but some corroborating evidence for the Bank's predominance is provided by the bill price series in Schneider, Schwarzer, and Schnelzer (1991): prices of most bills drawn either in or on Amsterdam are quoted in Bank money.

complete records of these transfers are preserved in the Bank's ledgers. The ledgers for 1763 record around 160,000 transactions in almost 2,500 accounts (Dehing and 't Hart 1997, p. 47; Dehing 2012, p. 82). These data offer an almost complete picture of the movement of funds on the right side of Figure 1.

Supplying the means of settlement also gave the Bank monetary power, but the Bank was owned by the city and directed by an appointed commission of merchants, bankers, and former municipal magistrates ('t Hart 2009, p. 154). Commissioners maintained a stable value of money through an interlocking set of policies. Those policies made payment by book-entry transfer of Bank money (meaning funds held in Bank accounts) popular with the international bill market, and use of Bank money generated fee revenue for the city. Bank money became Europe's reserve currency, and Amsterdam became the hub of acceptance credit.

What determined the stock of Bank money? Most commonly, Bank money was created when the Bank accepted coins in a process similar to a modern central bank repurchase (repo) transaction.[9] Someone bringing high-quality trade coins (*negotiepenningen*) into the Bank was credited Bank funds at official valuations, and he also received a negotiable receipt endowing its holder with the option to repurchase the exact same coins within a 6-month period at a small cost (¼% for most silver coins), renewable indefinitely.[10] Examination of the Bank's vault records indicates that virtually all of these redemption options were eventually exercised, that is, that in practice "deposits" into the Bank functioned as term repurchase agreements. The availability of repos effectively pegged the risk-free annualized short-term interest rate at slightly more than ½%, and an income stream followed from customers keeping coins parked at the Bank. The Bank only charged a slight fee of 2.5 basis points on internal transfers, which promoted large balances and a high velocity.

Money in Bank accounts could be created in other ways as well, that is, through the Bank's lending and open market operations. No receipts were associated with these operations. Moreover, receipts offered the only way to redeem Bank money for trade coins, so accounts alone had many of the characteristics of fiat money (van Dillen 1964a, 1964b, Quinn and Roberds 2014). Receipts were negotiable apart from the underlying deposit, so an account holder without a receipt could usually purchase one on the open market.[11] By the same token, an account holder without a receipt could no more run the Bank than a modern holder of fiat money can run a central bank. Keeping total accounts greater than total receipt obligations prevented a potential run from shuttering the Bank. Bank money (account balances), despite its quasi-fiat

9. A repurchase agreement or repo is an arrangement between two parties, in which one party sells an asset to another, and repurchases the same asset at a later date. In modern parlance, a "term" repo is one for which the two transactions are separated by more than 1 day. Repurchase agreements in government securities are employed by most modern central banks as a means of implementing monetary policy.

10. If a receipt holder chose not to exercise the repurchase option, the initial deposit was treated as a true sale. This feature of the receipt system apparently incorporates the "safe harbor" bankruptcy preference of modern repurchase contracts (see, e.g., Gorton and Metrick 2010, pp. 276–78).

11. Observe that receipts were not banknotes (demandable debt claims) but American call options on a specific coin. That is, to withdraw a coin one needed both a receipt and a Bank balance sufficient to exercise the option.

TABLE 1

BANK OF AMSTERDAM BALANCE SHEET, AUGUST 1, 1763, IN BANK FLORINS

Assets		Liabilities	
Coins under receipt ("repo")	21,606,690	Accounts	22,660,145
Coins unencumbered	288,434		
Loans	527,264	Capital	−237,757
total	22,422,388	total	22,422,388

NOTE: Derived from Stadsarchief Amsterdam 5077 and authors' calculations.

character, was backed by reserves held by the Bank, and ultimately by the credibility of the city of Amsterdam. Table 1 reports the elements of the Bank's balance sheet on the eve of the crisis. Ninety-five percent of the Bank's accounts were encumbered by receipts, and the Bank kept all this collateral on hand in its vaults.

While the Bank could not default, the value of its money could suffer. Bank funds could be purchased using an open outcry market held in front of the Bank every day in which (effectively) coin was traded against funds in Bank money (i.e., funds in Bank accounts; see van Dillen 1964b). The market price was the agio, or gap, between two units of account: Bank money (the "bank" florin, applied to Bank accounts) versus the value of circulating money (the "current" florin or guilder). By design, the value of the bank florin (reflecting the value of its primary backing asset, trade coins) exceeded the value of the current florin (reflecting the value of circulating coinage of variable quality). Arbitrage tended to keep the agio close to official differentials between these two units of account, that is, between 3.85% and 4.1%.[12] During the first half of 1763, however, bank florins traded at a low agio of 2% meaning that the Amsterdam bill market had abundant liquidity relative to the rest of the Dutch economy, and that repurchases tended to pull coin out of the Bank.

During the first week of the 1763 crisis, however, the market suddenly bid down the agio. Bank florins were still in high demand to settle accepted bills of exchange that were now coming due, yet the agio fell to a discount of ½% by Saturday, August 6, 1 week after de Neufville's suspension. This development called into question the integrity of Bank money, which was the basis of valuation in the Amsterdam market. A negative agio had been observed only once before, during the French invasion of 1672 (Quinn and Roberds 2014), and it explains why the Bank, in consultation with major bankers, suddenly authorized a new repo window for bullion the prior Thursday and started supplying emergency liquidity that same Saturday.[13] The agio was back in positive territory 2 days later.

12. These boundaries are for the *ryxdaalder* (originally called the *dukaat*), a silver coin that was the primary domestic coin used for repurchase agreements at the Bank at this time (van Dillen 1925, p. 906; Polak 1998, pp. 73–74). For arbitrage calculations, see Quinn and Roberds (2014).

13. Authorization was August 4 (van Dillen 1925, p. 412) and activity began August 6 (Stadsarchief Amsterdam 5077/1390, p. 30).

During ordinary times, the Bank kept the agio stable with a conservative approach to nonrepo interventions. The Bank did not extend credit against bills, allow accounts to overdraft, or operate a Lombard facility.[14] The Bank, with city approval, made limited uncollateralized loans to the Dutch East India Company and the Province of Holland. During a crisis, the city could go further and approve new lending, as it did in 1672 and 1772, but in 1763, political will was against bailout lending. A proposed (temporary and partial) bailout of de Neufville in particular appears to have been feasible, as the size of the proposed bailout fund was only 700,000 florins, small relative to the size of the large Amsterdam bankers.[15] The proposal was floated on August 1 and rejected within days, largely due to the perception of the Neufvilles as reckless risk takers who (together with their counterparties) were only getting what they deserved (de Jong-Keesing 1939, p. 121; Spooner 2002, p. 83).

The Bank also used open market operations sparingly. Traditionally, the Bank made small open market purchases of silver to acquire coins unencumbered by receipts.[16] Then, annually, the city paid itself a dividend by removing unencumbered coins and writing down accumulated profits, so the Bank's long-term capital fluctuated around zero (Quinn and Roberds 2014). In other eras, the Bank used large-scale purchases of silver to bolster the long-term stock of bank florins, but no such programs had been used for at least a decade before the crisis. During the crisis, the Bank could have purchased coins or bullion, but such moves would have exacerbated the liquidity scramble outside the Bank, and it was the external crisis that was choking off funding for the merchant bankers. Going the other way, the Bank held only a modest stock of "unencumbered reserves," so a sale policy was not a realistic option.[17]

Instead of active manipulation, the Bank typically let the repo window anchor its paper money to the commodity world by choosing not to vary the terms of its coin window. Nor did it attempt to manage the quantity of receipts outstanding. It simply allowed these to adjust to market conditions, so, when the crisis hit, it was the bankers who turned the coin facility into a lender of last resort. Even when the Bank did respond with the new bullion facility, it did not manipulate terms, but left decisions regarding it usage to the market.[18]

14. A Lombard facility is one in which a central bank offers credit to banks against broad categories of pledged collateral.

15. A single bank, Hope & Co., offered to contribute the bulk of the necessary funds for the bailout, half a million florins (van Dillen 1922, p. 249). The remainder was greatly exceeded by funds the other merchant banks had available at the Bank.

16. In the eighteenth century, open market transactions were conducted primarily in single-guilder coins that had no collateral rights at the Bank. Previously, open market operations had been conducted in bullion (Quinn and Roberds 2014).

17. Mees (1838, p. 109) reports that the Bank also feared that coins used to purchase bank florins would quickly be shipped abroad, depriving Amsterdam of needed collateral.

18. That is, in modern central banking terminology, credit against bullion was provided through a "standing facility" (had a standing offer to transact against certain types of collateral at a fixed price) rather than through open market operations (offers of a fixed quantity of bank credit at a certain time). The distinction between these two channels is not always precise. For example, the European Central Bank engaged in a number of fixed-rate open market operations of indefinite size ("fixed rate tenders with full allotment") in order to meet post-Lehman demands for liquidity (see Catalão-Lopes 2010).

4. LEVERAGE

Despite the conservative policies of the Bank, the evidence shows that Amsterdam bankers were routinely able to settle bills in amounts that greatly exceeded their average balances at the Bank, without tying up much in the way of high-quality collateral. This trick required the use of re-exchange arrangements illustrated in Figure 1. According to our simple model of eighteenth-century merchant banking, a banker's source of market funding would consist of bills drawn on correspondents abroad. In normal times, the banker could easily sell these in the Amsterdam bill market. On the other side, liabilities would consist largely of bills drawn on and accepted by the banker, originating with this same group of debtors.

To measure the use of wholesale funding, we collected a sample of payments data from the ledger accounts of the Bank of Amsterdam. An unfortunate limitation of the data is that the Bank's ledgers record no information on a given transaction other than the payment amount between the two counterparties. This means that the recorded payments undoubtedly do, in some cases, correspond to activity other than bill transactions. The historical literature, however, seems to agree that the principal use of Bank accounts was for bill transactions, so we will simply assume that each recorded transaction corresponds to the transfer of a bill. Also, there is no reliable way to tell if a payment is settlement of a bill or the purchase of a bill as an investment. This distinction does not matter for many of our inferences; however, at the peak of the crisis (August–September 1763) our calculations will assume that virtually all observed transactions are nondiscretionary settlement, for failure to honor an accepted bill had legal consequences such as bankruptcy.

The typical entry in the Bank's ledgers is an entry of the form x_{ijd} representing a transfer of x florins from account j to account i on day d, entered as a debit under merchant j's accounts, with a corresponding credit entry for merchant i. We focus on bankers' accounts, so a debit entry corresponds to a bill settlement (step 3 in Figure 1), and a credit entry to the bankers' funding transaction (step 4 in Figure 1). These were generally large-value payments: in our sample, the average payment size in the bankers' accounts is about 4,000 florins, as compared to the contemporary daily wage for a laborer of approximately one florin (de Vries and van der Woude 1997, p. 616).

Our data set aggregates daily payment data into weekly flows for the eight most active merchant bankers (those engaged in the activities of the Amsterdam banker in Figure 1) in the years leading up to the panic, as identified in de Jong-Keesing (1939, p. 120). Together, payments to and from these players account for about 12% of the transactions (by volume) in the Bank's ledgers in 1763. Transactions between these eight accounts and the other account holders are aggregated into the account of a ninth category of "nonbankers" (as a shorthand term for all other accounts). We also collected initial balances for these nine accounts on a weekly basis. Finally, we employ a tenth account to keep track of coin inflows to and outflows from the first nine accounts. The compressed data set contains 4,475 data points and covers the

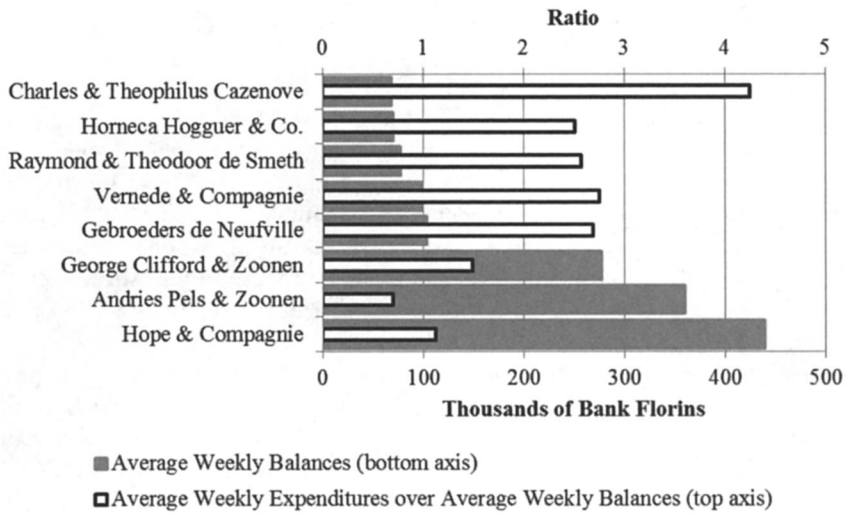

FIG. 2. Ratio of Banker Expenditures to Balances, January–July 1763.

NOTES: Source is Stadsarchief Amsterdam 5077.

50-week banking year of January 1763 to January 1764, with a "gap week" in July when the Bank was closed to reconcile accounts.

The data show the dominance of rollover financing through (i) the scale of payments by bankers and (ii) the near equality of those debits with payments to bankers from the rest of the Bank. Over the first half of 1763, the eight bankers had a mean weekly expenditure of 1.97 million florins and a mean weekly starting balance 1.49 million florins, so each week the bankers spent 132% of initially available funds. At the same time, nonbankers paid the bankers an average of 1.81 million florins per week, so a typical week had sales of new bills nearly equivalent to the settlement of old bills. The small difference was florins spent to withdraw coins or pay fees.

To see the variation within this group, Figure 2 reports each banker's average balances and the ratio of expenditures-to-balances. The data are consistent with de Jong-Keesing's (1939, pp. 74–75) classification of Amsterdam bankers into the established, well-capitalized houses (Hope, Pels, and Clifford) and a more levered group (de Neufville, Vernede, de Smeth, Horneca Hogguer, and Cazenove) who had been able to break into the top ranks of the bankers during the credit boom of the Seven Years' War (1756–63). The turnover by the smaller bankers is quite active despite having Bank balances distinctly lower than the old houses. Viewed from the perspective of its settlement accounts, Gebroeders de Neufville does not appear any riskier than similar firms.

The data in Figure 2 can be combined with data from de Neufville's bankruptcy filing (de Jong-Keesing 1939, p. 121) to shed some light on de Neufville's trading activities. At the time of the bankruptcy, creditors' claims against de Neufville amounted to 9.6 million florins, mostly in bills, as compared to a (book) capital of 413,000 florins, implying a leverage of at least 24 times capital. De Neufville's

weekly settlements through the Bank amounted to about 239,000 florins, indicating that least 2.5% of the firm's portfolio was rolled over through the Bank during an average week.

It was soon discovered, however, that these numbers understated de Neufville's actual degree of leverage. One year after failure, the bankruptcy trustees told unsecured creditors to expect a recovery of 70% of claims, but 3 additional years of investigation reduced anticipated recovery to 10% (de Jong-Keesing 1939, pp. 125–27). How de Neufville lost so much during the Seven Years' War remains unknown, but the firm evidently kept going by drawing ever increasing amounts on its correspondents. Bill claims against de Neufville totaled 7,875,019 florins (from Figure 1, steps 4–6) but bills payable amounted to only 537,098 (from Figure 1, steps 1–3).[19] These figures indicate that by mid-1763, de Neufville was operating as a Ponzi scheme.

5. OUTBREAK OF THE CRISIS

The Seven Years' War led to a sharp expansion in lending activity in Amsterdam. The Amsterdam bill market financed a wide range of activities associated with the war, including the movement of military supplies, the floatation of sovereign loans, and movements of specie designed to take advantage of fluctuating exchange rates (de Jong-Keesing 1939, pp. 55–86; Henderson 1962, pp. 94–95). The countdown to the August 1763 panic began with the slowdown of hostilities in late 1762. The Treaty of Hubertusburg (February 1763) concluded the war and spawned two shocks that diminished the value of the collateral (implicitly) backing Amsterdam's bill transactions.

The first shock was a drop in the value of grain: prices in Berlin and Hamburg dropped by 30% between November 1762 and May 1763. As documented in Schnabel and Shin (2004, pp. 956–9), the situation worsened in May 1763, when Prussia decided to dump its unused wartime grain supplies on the Berlin market, causing a 75% drop in the local price of wheat, with other agricultural prices soon following. These sudden price movements weakened many Amsterdam counterparties abroad.

The analysis below focuses on the effects of a second shock, which resulted from a monetary policy reversal. During the war, Prussia conducted a series of debasements that moved its monetary standard (i.e., mint equivalent) from 14 Reichsthalers per mark of fine silver to 40 thalers per mark for some coins (Koser 1900, pp. 341–51). In May 1763 Prussia reversed policy, demonetizing the depreciated war coinage and reducing the mint equivalent of new Reichsthalers to 19.75 thalers per mark (Henderson 1962, p. 96). Prussian merchants holding debased wartime coinage saw the nominal value of their collateral cut in half, and they responded by funding

19. Authors' calculation using de Jong-Keesing (1939, pp. 101–10).

immediate debts with new bills drawn on markets such as Hamburg and Amsterdam. They also sent the demonetized coins to the same cities in the hopes of finding higher value as bullion (Büsch 1797, p. 123; Skalweit 1937, p. 45). In Amsterdam, a merchant wrote, "The crude bars of silver that are being smelted here from the money arriving in great quantities from Germany, cannot be sold and are everywhere being borrowed against" (de Jong-Keesing 1939, p. 88, note 4). Loans secured by silver bullion carried an interest rate of 7%, and the implicit interest rate on first-quality acceptance loans rose to 5% from the customary 2% or 3%.

In this environment, the proximate cause of the failure of Gebroeders de Neufville was the suspension of payments by the firm of Aron Joseph en Compagnie on July 28, 1763 (de Jong-Keesing 1939, p. 121). De Neufville's exposure to Aron Joseph was 163,000 florins, small relative to de Neufville's total book of 10 million florins, but meaningful in the context of its 239,000 florin weekly funding requirement. Aron Joseph (playing the role of Creditor 3 in Figure 1) was a frequent supplier of funds to de Neufville (an Amsterdam banker in Figure 1) and this source of liquidity could not easily be replaced. De Neufville suspended payments at the Bank on July 30. The failures had only an indirect effect on the Bank of Amsterdam, but outside the Bank, de Neufville's failure caused a sudden, extraordinary demand for coins.[20]

An indication of the severity of the liquidity crisis came from Amsterdam's most important satellite market, Hamburg. In Hamburg, claims against de Neufville amounted to around 3 million florins, spread over 38 counterparties (de Jong-Keesing 1939, p. 102). The bill market there was faced with collapse. On August 4, the City of Amsterdam received a petition from a group of prominent Hamburg merchants, demanding a bankruptcy preference, and threatening a shutdown of their market for Amsterdam bills if this was not granted:[21]

> This morning ... we received a fatal express, with the terrible news that you, the gentlemen of Amsterdam, would leave the Neufvilles to sink, by which we were all thunderstruck; never dreaming that so many men in their senses in your city could take such a step ... which will infallibly plunge all Europe in an abyss of distress, if not remedied by you whilst it is still time.

The Hamburgers' request was rejected, as was a similar entreaty received from Prussia on August 21. As noted above, a proposal for a partial bailout of de Neufville was also rejected. The unprecedented size and complexity of the bankruptcy case (de Neufville had 361 creditors) delayed the formal filing until October 7, while the authorities debated alternative proposals for creditor representation (de Jong-Keesing 1939, pp. 122–23).

The breakdown of bailout negotiations and general atmosphere of legal uncertainty brought about a 3-month contraction of the Amsterdam bill market, particularly for bills drawn on Hamburg. Surviving records from July through October 1763 indicate either no bill trade or sparse quotations for Amsterdam bills drawn on virtually

20. In this era, suspension was in virtually all cases quickly followed by bankruptcy.

21. See Soetbeer (1855, p. 51) and Sautijn Kluit (1865, pp. 25–26); English translation is from Tooke (1838, pp. 149–50).

all locations. When bills could be sold they went at depressed prices, even if they were drawn on places unaffected by the de Neufville failure (de Jong-Keesing 1939, p. 167). For example, we calculate that annualized re-exchange borrowing rates using London jumped from 4% to over 10% despite the efforts of London bankers to assist their Amsterdam correspondents (Wilson 1941, pp. 168–69). To preserve their own liquidity, Amsterdam bankers declined to accept ("protested") virtually all incoming bills drawn by Hamburg counterparties (de Jong-Keesing 1939, pp. 166–71). In Hamburg, loss of access to acceptance credit forced 93 firms into bankruptcy during the month of August (Soetbeer 1855, p. 52; Schnabel and Shin 2004, pp. 943–44).[22]

Similar shutoffs of credit and clusters of failures occurred in other places dependent on the Amsterdam bill market, including Berlin (Skalweit 1937, p. 50) and Stockholm (de Jong-Keesing 1939, pp. 193–98). Berlin saw "few" first-round bankruptcies, but the failure of the prominent merchant Johann Ernst Gotzkowsky and the potential for knock-on effects led the Prussian authorities to suspend commercial payments law. This action caused legal chaos, undermined the exchange rate, depressed domestic prices, and disrupted credit flows for years afterward (Schnabel and Shin 1994, pp. 945–46). In Stockholm the impact was mainly felt through the sudden drop in the external value of the Swedish currency, for example, between August and December 1763 the exchange rate against Hamburg fell by 16% (Schneider et al. 1991, p. 311). The currency crisis resulted in an unspecified number of bankruptcies and a virtual cessation of manufacturing activity. The crisis was prolonged by a subsequent (1765–78) attempt to restore the Swedish currency to its prewar parity, resulting in a 50% drop in the domestic price level (Heckscher 1934, pp. 181–82) and a continued credit contraction.

6. MEASURING LOSS OF LIQUIDITY IN THE AMSTERDAM BILL MARKET

The direct exposure of Amsterdam bankers to de Neufville was rather limited. Rumors had been circulating for some time concerning de Neufville's solvency, and most of the large firms appear to have limited their exposure accordingly.[23] Instead, the contraction of the bill market constricted the ability of the Amsterdam merchant bankers to draw and sell bills. Although the bankers did not issue deposits and could therefore not be "run" in the classical sense, they faced a broadly equivalent loss of "funding liquidity" (Brunnermeier 2009, p. 91). The bankers were subject to an immovable requirement to settle accepted bills: since the customary maturity ("usance") of bills drawn by Hamburg on Amsterdam was 6 weeks to 2 months

22. From the viewpoint of the Amsterdam bankers, the blanket protests of foreign bills seemed justifiable as a way to insulate themselves from potential insolvencies of Neufville's counterparties. To the merchants in the outlying markets, these protests were seen as a liquidity grab; a common complaint was that Amsterdam bankers protested bills that were covered by goods received and therefore posed no credit risk to the drawee (Skalweit 1937, p. 86). Our data do not allow us to distinguish between these views.

23. The exception was de Smeth, whose bankruptcy claim against Neufville amounted to 318,750 bank florins (de Jong-Keesing 1939, p. 110), twice its average weekly funding need (Figure 2).

TABLE 2

AVERAGE WEEKLY LIQUIDITY FLOWS, IN BANK FLORINS

	Precrisis	Crisis	Postcrisis
	1763:1–1763:7	1763:8–1763:9	1763:10–1764:1
Payments			
To bankers from others	1,598,366	1,027,013	1,046,029
To others from bankers	1,566,776	1,219,799	1,070,988
Net to bankers	31,590	−192,786	−24,959
Net banker repos			
Using coin	−71,150	229,669	25,608
Using bullion	—	39,148	8,888

NOTES: Source is Stadsarchief Amsterdam 5077. Calculations exclude de Neufville.

(Schneider et al. 1991, pp. 66–101), each banker began the panic with an outstanding stock of settlement obligations.

Loss of funding liquidity is evident in the payments data. In our sample, the total value of payments (for consistency, excluding de Neufville) contracts about 29% following the outbreak of the crisis.[24] The distribution of these payments also becomes less balanced. A summary measure of this distribution, the percentage of (noncash) payments funded by incoming payments (McAndrews and Rajan 2000), averages 89% before the de Neufville failure, but falls to 85% over the 2 months following the outbreak of the crisis. This indicates a greater need for bankers to fund positions through the posting of collateral. In the last 4 months of the sample, there is a recovery of this measure, to 88%.

This narrative is confirmed in Table 2, which reports the flow of payments to and from bankers in our sample. The table again excludes de Neufville. Average weekly payments to bankers fall by one-third at the outset of the crisis, and do not recover in our sample. Average payments from bankers also decline, but do so by only 22%. The result for bankers is a weekly drain of 200,000 florins in net liquidity during August and September. After 2 months (by which time most bills outstanding at the outbreak of the crisis would have been settled), the bankers were better able to adjust their flow of obligations to match the new, lower flow of funding.

The table also shows how the sudden drop in wholesale funding pushed collateral into the Bank. Bankers switched from the net repurchase of coins to an average weekly net deposit of 230,000 of the same. They also brought in a sixth of that amount in bullion. After September, the infusion of collateral abated as the funding squeeze relented.

The size of an individual banker's liquidity squeeze strongly correlates with each banker's leverage. For example, each banker's rollover problem can be measured as the accumulation of payments into the Bank, less its payments out. During August

24. See the breakdown in Table 2 below. To give some idea of the relative magnitude of this contraction, payment flows over U.S. dollar large-value payment systems fell by 18% from 2008 to 2009.

and September, accumulation of net payments is negative for all bankers. For Pels, the most conservative banker, negative net payments cause his July 29 balance to decline 10% by the end of September. The aggressive Cazenove sees a 570% decline. The other declines fall in between with Hope at 49%, Horneca at 81%, Clifford at 167%, de Smeth at 168%, and Vernede at 266%. These percent changes from starting balances have a correlation of −.89 with precrisis leverage, measured as the ratio of weekly payments-to-balances in Figure 2.

7. POLICY RESPONSE

The post-Neufville credit freeze-up ultimately forced 38 Amsterdam firms into bankruptcy during August and September 1763 (de Jong-Keesing 1939, pp. 130–45). Compared to de Neufville, however, these were small enterprises,[25] and many were able to reopen within a few months, after settling with creditors. By October, there are signs of the market returning to a more "normal" state, albeit at two-thirds the previous levels of activity (Table 2). These include a return of the agio to a more normal range, an increase in the percentage of payments funded through incoming transfers, and a reduction in short-term borrowing rates. The Amsterdam market as a whole was able to escape the devastation that took place in outlying locations.

This section argues that a major reason for the comparatively mild impact of the panic in Amsterdam was the provision of liquidity through the Bank of Amsterdam, which was able to compensate for a shortage of market liquidity. As noted earlier, demand for Bank balances was accommodated through two mechanisms. The first was the traditional "repo" (i.e., receipt) window for trade coins. The second was a new facility, a repo window for silver bullion.

The basic situation in Amsterdam in August 1763 is easily recognized from the recent crisis: an extraordinary demand for central bank balances, combined with a surfeit of unwanted collateral (silver bullion), thanks to the demonetization of Prussian wartime coinage. The improvised solution, proposed by merchant bankers and adopted by the Bank, was to open a repo window for the unwanted bullion. The terms of this "emergency facility" could not be made too generous, however, without undermining the other possible path out of the crisis, that is, for market participants to convert collateral that was ineligible for central bank transactions (bullion) to an eligible form of collateral (trade coins) by simply taking the former to a mint. Minting did occur at extraordinary levels during the crisis, but production was slowed by technological and labor issues (Polak 1998; de Jong-Keesing 1939, p. 50) and, we suspect, binding capacity constraints.

The bullion window offered a balanced response to the policy dilemma. By expanding the established repo system, the new facility could open quickly and offer

25. The next largest bankrupt after Neufville was Cornelis Karsseboom, with liabilities of 3.5 million guilders (de Jong-Keesing 1939, p. 146). The average liability of a bankrupt was 669,000 guilders (Schnabel and Shin 2004, p. 963).

large amounts of liquidity through a familiar structure. The Bank charged a ½% fee (i.e., interest) per 6 months. Three months before the panic, lenders were charging as much as 7% (we assume annually) for loans against bullion (de Jong-Keesing 1939, p. 88, note 4). The short-term rates during the crisis were higher still, if a lender could be found at all, so the window offered guaranteed access to loans at an attractive rate.

A politically important constraint on the operation of a bullion window was that it not openly undercut the mints' business. This constraint was addressed through aggressive haircutting of collateral, for the Bank's window price in bank florins was 9% below the price offered at mints (expressed in current florins). The market charged a 2% agio to exchange current money to Bank money, so a borrower's net haircut was 7%. Private creditors may have haircut such collateral even more severely, for precrisis loans to de Neufville made against metal collateral carried a haircut of as much as 25% (de Jong-Keesing 1939, p. 93).[26] The Bank's haircut meant that only people who needed florins quickly found the bullion window attractive. Also, borrowers had a strong incentive to execute the repurchase (endogenously unwind) when conditions calmed.

7.1 Coin Window—Micro Evidence

Because the Bank of Amsterdam did not vary the terms of its repo window for coins, much of post-Neufville expansion in the stock of Bank money can be attributed to endogenous shifts in the use of this facility, reflecting changes in market strategies of the merchant bankers. To maintain their overall balances, the seven surviving bankers brought enough coin collateral into the Bank to create 2 million new florins.

To see this process at the firm level, Figure 3 displays the weekly balances of two merchant bankers that made use of the coin window but not the *ad hoc* bullion window. The data show that Horneca Hogguer kept its balances positive (data are shown as "baseline" series in the figure), but removing the liquidity created through the coin window reveals that net transfers out of the Bank were substantial. Without new coins, the account would have gone illiquid the week of August 8. Even Hope, the largest merchant banker, also suffered a run. Through August–September, Hope lost 600,000 bank florins in net transfers ("without coin window" series). While not threatened with imminent failure, Hope did use the coin window to keep its balances above 500,000 ("baseline" series).

7.2 Bullion Window—Micro Evidence

While much smaller in scale than coin receipts, we find that the bullion window made a critical difference for some bankers. Figure 4 reports the evolution of balances

26. The bank's relatively generous terms may have been possible only because by tradition, the Bank enjoyed much the same creditor protection as a modern repo lender. By contrast, private creditors who lent to Neufville against bullion collateral were not able to liquidate collateral until formal bankruptcy proceedings were initiated, some 10 weeks after the firm suspended payments. In the meantime there was considerable uncertainty concerning the character and duration of the bankruptcy process (de Jong-Keesing 1939, p. 124).

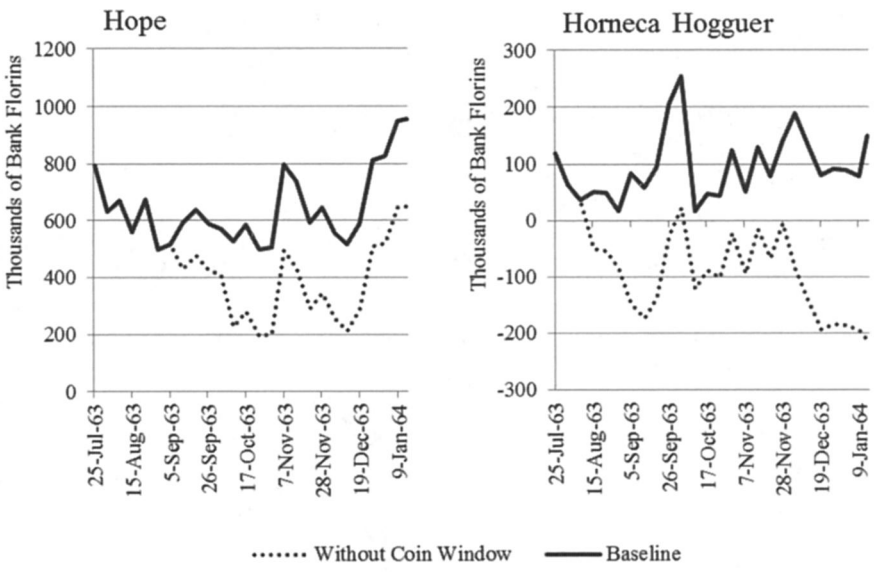

FIG. 3. Weekly Balances of Two Bankers.

NOTES: Derived from Stadsarchief Amsterdam 5077 and authors' calculations.

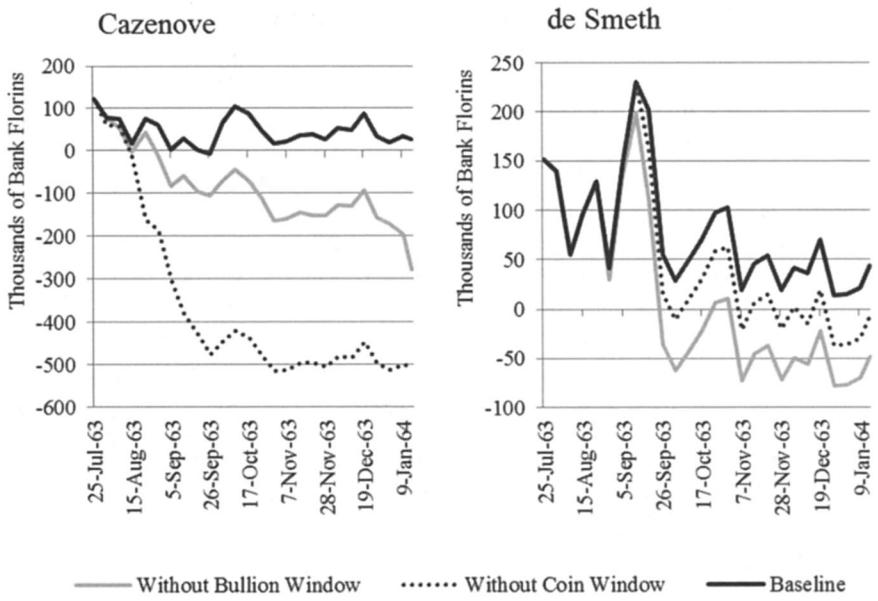

FIG. 4. Weekly Balances of Two Bankers.

NOTES: Derived from Stadsarchief Amsterdam 5077 and authors' calculations.

for the firms Cazenove and de Smeth. Each figure separately strips balances of coin window liquidity (dots) and bullion window liquidity (gray). Without bullion, Cazenove would have become illiquid the week of August 22. De Smeth needed bullion toward the end of September when a second wave of payments would have eaten the last of his balances.

Thus, under the defensible assumptions that Cazenove's and de Smeth's acceptance obligations are predetermined over the months of August and September (due to usance conventions), and that their use of the bullion window demonstrated that they had little or no coin left to serve as collateral (due to the Bank's haircut), it is reasonable to conclude that use of the bullion window prevented the failure of two more bankers—market players of approximately the same size and leverage as de Neufville (Figure 2). The window also prevented a close call, for without bullion Vernede's balances (not pictured) would have been only 5,458 bank florins the week of August 15.

7.3 Contagion

If there had been no bullion window and if Cazenove and de Smeth had failed, would additional bankers have failed? To investigate this question, we employ the simulation methodology of papers in the "contagion" literature (see, e.g., Upper 2007, Mistrulli 2011). To apply this methodology, we again interpret the post-Neufville payments data as a set of obligations predetermined at the outset of the crisis. A hypothetical sequence of balances is then constructed by taking initial balances at the outbreak of the crisis, and removing inflows from the bullion window, as well as payments due to and due from failing bankers (Cazenove and de Smeth).[27] This exercise indicates that two other bankers would have experienced noticeable impacts, Horneca Hogguer and Hope.

Figure 5 contrasts the evolution of balances under the contagion scenario against their realized values in the data. The simulation has Horneca Hogguer becoming illiquid during the week of August 8. Even if that banker had accelerated the deposit of 130,000 florins worth of coins from late to early August, Horneca Hogguer would still have needed 50,000 additional florins to meet its payment obligations.

Under the contagion scenario, Hope had a cumulative reduction in balances of about 200,000 florins.[28] This loss, however, comes primarily late in the year, so the number serves as more of an upper bound than a point estimate of the loss. Buist (1974, p. 520) puts the capital of Hope at 4.6 million current guilders in 1763, suggesting that Hope would have easily absorbed shortfalls stemming from the failures of additional bankers, so long as asset liquidation was not a problem. Nonetheless, even for Hope, a 200,000 florin loss would have been equal to 44% of the firm's distributed profits for the year (Buist 1974, p. 521).

27. This exercise assumes that Cazenove and de Smeth fail at the outset of the crisis. Variations on this assumption yield substantially similar results.

28. This figure does not change substantially if we assume that Horneca Hogguer also fails.

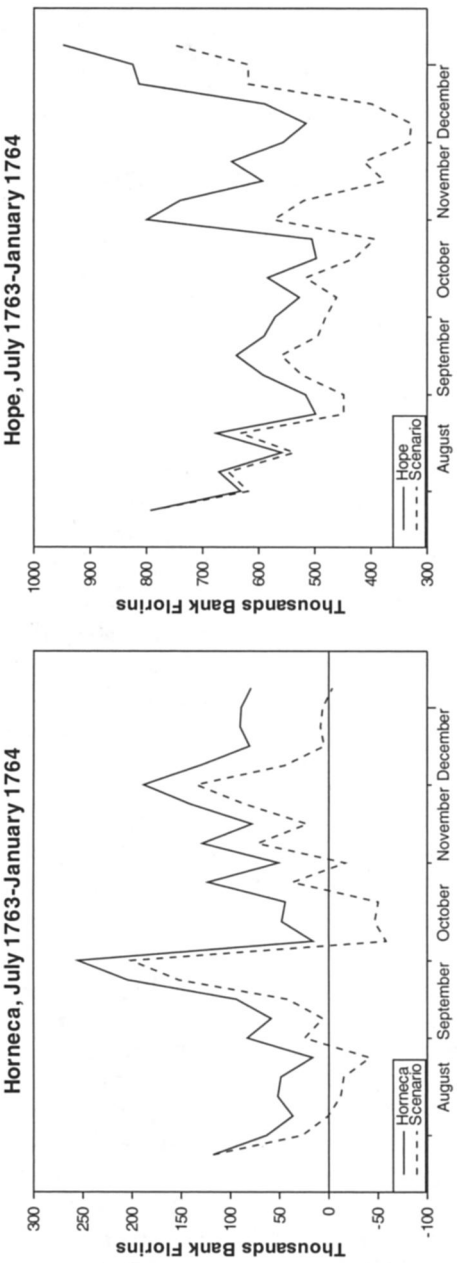

FIG. 5. Simulated Balances with No Bullion Window + 2 Failures.

NOTES: Derived from Stadsarchief Amsterdam 5077 and authors' calculations.

The above exercise does not calculate additional contagion effects within the rest of the Bank of Amsterdam. This is a limitation of our data, but it is probable that the bullion window succeeded in stopping additional failures, even if the number and magnitude of these are unknown. In the second half of our sample, total nonbanker use of bullion repos was greater than that of bankers, and nonbankers relied on the bullion window for 48% of their liquidity creation compared to 14% for the seven bankers.

Use of the bullion window ceased after the worst effects of the banking crisis in Amsterdam had passed. Outside Amsterdam, however, the Panic of 1763 only served to mark the beginning of a deep and long recession, most notably in Prussia (Schnabel and Shin 2004, pp. 945–46). One consequence of the lingering effects of the crisis seems to have been a "flight to quality": net coin flows into the Bank of Amsterdam surged by 4.1 million florins in the fourth quarter, and the Bank reached its two-century maximum balance of 30.9 million florins (van Dillen 1925, pp. 962–66). This tsunami of silver receded the next year.

8. LESSONS LEARNED

Eighteenth-century Amsterdam demonstrates that the New York crisis of 2008 is not unprecedented, for the Panic of 1763 records a distressingly familiar conflagration. Numerous cross exposures (acceptance loans), an aggregate shock to collateral values (the end of the Seven Years' War), and erratic policy decisions (on the part of the Prussian monetary authorities) built a flammable base. The spark was the collapse of a single participant (de Neufville) that was "too interconnected to fail" (in the view of Hamburg petitioners), but that failed nonetheless. This paper stresses that the accelerant is the vulnerability of shadow banks to a cutoff of short-term wholesale funding. This rollover pressure forces banks to find collateral and curtail the supply of new credit. Outlying credit markets that rely on bank intermediation stall and remain dysfunctional well after the core stabilizes.

Similarly, the Bank of Amsterdam serves as a precedent for the Federal Reserve's response. In Amsterdam, unlimited amounts of liquidity were made available, on fixed terms, through the Bank's traditional (coin) repo window. A second window was opened for less conventional assets (bullion). This window was lightly used, yet it was well designed for its limited purpose. It assisted a central niche of market participants and did not disrupt adjustment processes occurring outside the Bank. The two liquidity facilities, working in combination, prevented additional failures of major market participants and contained the domestic fallout from the crisis.

These similarities make the differences more telling. Conspicuously absent from the 1763 crisis are the too-big-to-fail distortions of modern financial environments, but these seem not to have been necessary in the lightly regulated world of eighteenth-century finance. Market discipline constrained risk taking by larger, established banks, but exerted little effective control over their smaller rivals. Not

surprisingly, it is the latter that were the most direct beneficiaries of the Bank's emergency policy.

The Bank of Amsterdam's firefighting efforts also display a lighter touch—by the standards of 2008—yet our evidence shows that they were effective within the confines of the Amsterdam market. An unfortunate aspect of this light-touch approach, however, was that nothing occurred in 1763 like the swaps between central banks that followed in the wake of the Lehman crisis. The Bank of Amsterdam had no mechanism to route liquidity to where it was needed most—to satellite markets such as Hamburg and Berlin, where the flow of trade depended on unimpeded access to the Amsterdam bill market. Nor could the Bank prevent the mass unwinding of bill transactions through protests, which may have preserved the liquidity of the Amsterdam bankers but which also led to a collapse of some outlying credit markets. Seen from Amsterdam, this may have seemed a fair outcome, since the underlying shocks had originated on the periphery. To people in the periphery, however, the economic punishment was severe and long lasting.

APPENDIX: BANK OF AMSTERDAM DATA FOR FISCAL YEAR 1763

TABLE A1

BANK OF AMSTERDAM BALANCE SHEET FOR FISCAL YEAR 1763, BY WEEK IN BANK FLORINS

Date		Assets		Liabilities		
Start	Week	Total	Metal	Loans	Accounts	Capital
28-Jan-63	1	23,120,636	22,893,372	227,264	22,945,231	175,405
31-Jan-63	2	23,180,956	22,953,692	227,264	23,002,323	178,633
7-Feb-63	3	23,177,201	22,949,937	227,264	22,994,333	182,868
14-Feb-63	4	23,152,841	22,925,577	227,264	22,965,734	187,107
21-Feb-63	5	23,180,901	22,953,637	227,264	22,992,525	188,376
28-Feb-63	6	23,129,321	22,902,057	227,264	22,942,009	187,311
7-Mar-63	7	23,677,121	23,449,857	227,264	23,556,140	120,981
14-Mar-63	8	24,291,006	24,063,742	227,264	24,205,654	85,352
21-Mar-63	9	24,252,486	23,925,222	327,264	24,139,929	112,557
28-Mar-63	10	24,464,586	24,037,322	427,264	24,258,772	205,813
4-Apr-63	11	24,238,376	23,811,112	427,264	24,038,524	199,851
11-Apr-63	12	24,389,116	23,961,852	427,264	24,188,447	200,669
18-Apr-63	13	23,961,316	23,734,052	227,264	23,754,320	206,996
25-Apr-63	14	23,620,976	23,393,712	227,264	23,372,356	248,620
2-May-63	15	23,242,331	23,015,067	227,264	23,174,987	67,345
9-May-63	16	23,241,531	23,014,267	227,264	23,198,377	43,154
16-May-63	17	23,182,131	22,954,867	227,264	23,153,277	28,854
23-May-63	18	23,023,651	22,796,387	227,264	22,982,126	41,525
30-May-63	19	22,985,711	22,758,447	227,264	22,936,736	48,976
6-Jun-63	20	22,906,991	22,679,727	227,264	22,704,553	202,439
13-Jun-63	21	22,691,791	22,464,527	227,264	22,645,234	46,558
20-Jun-63	22	22,377,951	22,150,687	227,264	22,329,660	48,291
27-Jun-63	23	22,193,311	21,966,047	227,264	22,224,267	−30,956
4-Jul-63	24	22,068,651	21,841,387	227,264	22,314,777	−246,126

(*Continued*)

TABLE A1

CONTINUED

Date		Assets		Liabilities		
Start	Week	Total	Metal	Loans	Accounts	Capital
11-Jul-63	25	22,176,156	21,848,892	327,264	22,298,864	−122,708
18-Jul-63	26	22,295,163	21,767,899	527,264	22,244,207	50,956
29-Jul-63	27	22,295,163	21,767,899	527,264	22,344,207	−49,044
1-Aug-63	28	22,422,388	21,895,124	527,264	22,660,145	−237,757
8-Aug-63	29	22,826,928	22,199,664	627,264	22,940,267	−113,338
15-Aug-63	30	23,361,975	22,534,711	827,264	23,414,273	−52,298
22-Aug-63	31	23,917,410	22,990,146	927,264	24,024,037	−106,626
29-Aug-63	32	24,804,943	23,677,679	1,127,264	24,668,294	136,649
5-Sep-63	33	25,770,675	24,643,411	1,127,264	25,438,106	332,569
12-Sep-63	34	26,521,899	25,394,635	1,127,264	26,398,435	123,464
19-Sep-63	35	26,750,906	25,623,642	1,127,264	26,681,862	69,044
26-Sep-63	36	27,227,297	26,100,033	1,127,264	27,046,318	180,979
3-Oct-63	37	27,512,605	26,385,341	1,127,264	27,318,559	194,046
10-Oct-63	38	27,761,045	26,633,781	1,127,264	27,675,445	85,601
17-Oct-63	39	28,283,291	27,156,027	1,127,264	27,983,359	299,932
24-Oct-63	40	28,742,173	27,614,909	1,127,264	28,590,493	151,680
31-Oct-63	41	29,268,410	28,141,146	1,127,264	28,906,700	361,710
7-Nov-63	42	29,568,851	28,441,587	1,127,264	29,466,072	102,779
14-Nov-63	43	30,010,488	28,883,224	1,127,264	29,883,099	127,389
21-Nov-63	44	29,945,180	29,717,916	227,264	29,731,910	213,270
28-Nov-63	45	29,995,039	29,767,775	227,264	29,860,840	134,199
5-Dec-63	46	30,249,001	30,021,737	227,264	30,099,279	149,722
12-Dec-63	47	30,326,299	30,099,035	227,264	30,198,588	127,711
19-Dec-63	48	30,490,984	30,263,720	227,264	30,350,896	140,088
26-Dec-63	49	30,580,639	30,353,375	227,264	30,462,793	117,846
2-Jan-64	50	30,695,547	30,468,282	227,264	30,539,826	155,720
9-Jan-64	51	30,793,889	30,566,625	227,264	30,649,858	144,031
16-Jan-64	52	31,085,138	30,857,874	227,264	30,966,847	118,291

TABLE A2

BANK OF AMSTERDAM METAL STOCK IN FY 1763, BY WEEK IN BANK FLORINS

		Under Receipt Coins			Unencumbered	
Week	Total	Dutch	Dollars	Gold	Bullion	Reserves
1	22,893,372	1,132,420	21,225,600	61,380	0	473,972
2	22,953,692	1,175,140	21,243,200	61,380	0	473,972
3	22,949,937	1,197,785	21,216,800	61,380	0	473,972
4	22,925,577	1,166,825	21,223,400	61,380	0	473,972
5	22,953,637	1,203,245	21,201,400	75,020	0	473,972
6	22,902,057	1,239,665	21,113,400	75,020	0	473,972
7	23,449,857	1,264,745	21,595,200	115,940	0	473,972
8	24,063,742	1,271,430	22,202,400	115,940	0	473,972
9	23,925,222	1,267,110	22,068,200	115,940	0	473,972
10	24,037,322	1,188,030	22,266,200	109,120	0	473,972
11	23,811,112	1,072,040	22,162,800	102,300	0	473,972
12	23,961,852	1,025,000	22,367,400	95,480	0	473,972
13	23,734,052	862,980	22,294,800	102,300	0	473,972

(*Continued*)

TABLE A2

CONTINUED

		Under Receipt Coins			Unencumbered	
Week	Total	Dutch	Dollars	Gold	Bullion	Reserves
14	23,393,712	789,060	22,035,200	95,480	0	473,972
15	23,015,067	715,620	21,905,400	95,480	0	298,567
16	23,014,267	673,020	21,947,200	95,480	0	298,567
17	22,954,867	673,020	21,887,800	95,480	0	298,567
18	22,796,387	644,340	21,758,000	95,480	0	298,567
19	22,758,447	618,060	21,766,800	75,020	0	298,567
20	22,679,727	625,140	21,681,000	75,020	0	298,567
21	22,464,527	614,100	21,463,200	88,660	0	298,567
22	22,150,687	639,060	21,124,400	88,660	0	298,567
23	21,966,047	683,220	20,895,600	88,660	0	298,567
24	21,841,387	684,180	20,776,800	81,840	0	298,567
25	21,848,892	665,065	20,796,600	88,660	0	298,567
26	21,767,899	662,185	20,721,800	95,480	0	288,434
27	21,767,899	662,185	20,721,800	95,480	0	288,434
28	21,895,124	710,210	20,801,000	95,480	0	288,434
29	22,199,664	751,100	20,807,600	278,665	73,866	288,434
30	22,534,711	755,195	21,058,400	253,790	178,893	288,434
31	22,990,146	758,110	21,423,600	253,790	266,213	288,434
32	23,677,679	764,325	21,881,200	301,530	442,191	288,434
33	24,643,411	769,155	22,660,000	328,590	597,232	288,434
34	25,394,635	804,185	23,009,800	336,053	956,164	288,434
35	25,623,642	825,655	23,097,800	336,053	1,075,701	288,434
36	26,100,033	839,215	23,485,000	336,053	1,151,332	288,434
37	26,385,341	887,095	23,643,400	315,593	1,250,820	288,434
38	26,633,781	940,470	23,889,800	206,473	1,308,605	288,434
39	27,156,027	953,940	24,343,000	199,653	1,371,001	288,434
40	27,614,909	1,088,465	24,602,600	199,653	1,435,758	288,434
41	28,141,146	1,158,955	25,000,800	199,653	1,493,305	288,434
42	28,441,587	1,200,185	25,275,800	199,653	1,477,516	288,434
43	28,883,224	1,226,795	25,680,600	199,653	1,487,743	288,434
44	29,717,916	1,329,270	26,408,800	206,473	1,484,940	288,434
45	29,767,775	1,336,640	26,492,400	206,473	1,443,829	288,434
46	30,021,737	1,424,715	26,622,200	249,593	1,436,796	288,434
47	30,099,035	1,517,575	26,666,880	249,593	1,376,554	288,434
48	30,263,720	1,629,085	26,774,680	239,643	1,331,879	288,434
49	30,353,375	1,717,095	26,801,080	234,668	1,312,099	288,434
50	30,468,282	1,852,570	26,831,880	214,208	1,281,191	288,434
51	30,566,625	1,939,370	26,853,880	194,308	1,290,634	288,434
52	30,857,874	1,913,585	27,161,880	177,538	1,325,315	279,556

LITERATURE CITED

Baba, Naohiko, and Frank Packer. (2009) "From Turmoil to Crisis: Dislocations in the FX Swap Market before and after the Failure of Lehman Brothers." *Journal of International Money and Finance*, 28, 1350–74.

Brunnermeier, Markus K. (2009) "Deciphering the Liquidity and Credit Crunch 2007–2008." *Journal of Economic Perspectives*, 23, 77–100.

Buist, Marten G. (1974) *At spes non fracta: Hope & Co. 1770–1815*. The Hague: Martinus Nijhoff.

Büsch, Johann Georg. (1797) *Versuch einer Geschichte der Hamburgischen Handlung nebst 2 kleineren Schriften verwandten Inhalts*. Hamburg: Benjamin Gottlob Hoffman.

Catalão-Lopes, Margarida. (2010) "Fixed- and Variable-Rate Tenders in the Management of Liquidity by the Eurosystem: Implications of the Recent Credit Crisis." *International Journal of Central Banking*, 6, 199–230.

Cotugno, Matteo, Stefano Monferrà, and Gabriele Sampagnaro. (2013) "Relationship Lending, Hierarchical Distance and Credit Tightening: Evidence from the Financial Crisis." *Journal of Banking and Finance*, 37, 1372–85.

Dang, Tri Vi, Gary Gorton, and Bengt Holmström. (2009) "Opacity and the Optimality of Debt for Liquidity Provision." Manuscript, Yale University.

Dehing, Pit. (2012) *Geld in Amsterdam: Wisselbank en wisselkoersen, 1650–1725*. Hilversum: Uitgeverij Verloren.

Dehing, Pit, and Marjolein 't Hart. (1997) "Linking the Fortunes, Currency and Banking, 1550–1800." In *A Financial History of the Netherlands*, edited by Marjolein 't Hart, Joost Jonker, and Jan Luiten van Zanden, pp. 37–63. Cambridge, UK: Cambridge University Press.

De Jong-Keesing, and Elisabeth Emmy. (1939) *De Economische Crisis van 1763 te Amsterdam*. N.V. Intern. Amsterdam: Uitgevers en h. Mij.

Denzel, Markus A. (2010) *Handbook of World Exchange Rates, 1590 to 1914*. New York: Ashgate.

DeVries, Jan, and Ad van der Woude. (1997) *The First Modern Economy: Success, Failure, and Perseverance of the Dutch Economy, 1500–1815*. Cambridge, UK: Cambridge University Press.

Flandreau, Marc, and Stefano Ugolini. (2013) "Where It All Began: Lending of Last Resort and the Bank of England during the Overend, Gurney Panic of 1866." In *The Origins, History, and Future of the Federal Reserve*, edited by Michael Bordo and William Roberds, pp. 113–61. Cambridge, UK: Cambridge University Press.

Goldberg, Linda S., Craig Kennedy, and Jason Miu. (2011) "Central Bank Dollar Swap Lines and Overseas Dollar Funding Costs." *Federal Reserve Bank of New York Economic Policy Review*, 17, 3–20.

Gorton, Gary. (2012) *Misunderstanding Financial Crises: Why We Don't See Them Coming*. New York: Oxford University Press.

Gorton, Gary, and Andrew Metrick. (2010) "Regulating the Shadow Banking System." *Brookings Papers on Economic Activity*, (Fall), 261–303.

Heckscher, Eli F. (1934) "The Bank of Sweden in Its Connection with the Bank of Amsterdam." In *History of the Principal Public Banks*, edited by Johannes Gerard van Dillen, pp. 161–200. The Hague: Martinus Nijhoff.

Henderson, W. O. (1962) "The Berlin Commercial Crisis of 1763." *The Economic History Review*, New Series 15, 89–102.

Koser, Reinhold. (1900). *Die preussischen Finanzen im siebenjährigen Krieg*. Leipzig: Forschungen zur brandenburgischen und preussischen Geschichte.

McAndrews, James, and Samira Rajan. (2000) "The Timing and Funding of Fedwire Funds Transfers." *Federal Reserve Bank of New York Economic Policy Review*, 6, 17–32.

McGuire, Patrick, and Goetz von Peter. (2009) "The US Dollar Shortage in Global Banking." *BIS Quarterly Review* (March), 47–63.

Mees, Willem C. (1838) *Proeve eener Geschiedenis van het Bankwezen in Nederland geduerende den Tijd der Republiek*. Rotterdam: W. Messcuert.

Mistrulli, Paolo Emilio. (2011) "Assessing Financial Contagion in the Interbank Market: Maximum Entropy versus Observed Interbank Lending Patterns." *Journal of Banking and Finance*, 35, 1114–27.

Nogues-Marco, Pilar. (2013) "Competing Bimetallic Ratios: Amsterdam, London and Bullion Arbitrage in the 18th Century." *Journal of Economic History*, 73, 445–76.

Ongena, Steven, Jose Luis Peydro, and Neeltje vanHoren. (2013) "Shocks Abroad, Pain at Home? Bank-Firm Level Evidence on the International Transmission of Financial Shocks." De Nederlandsche Bank Working Paper No. 385.

Polak, Menno. (1998) *Historiografie en Economie van de "Muntchaos," Deel II*. Amsterdam: NEHA.

Pozsar, Zoltan, Tobias Adrian, Adam Ashcraft, and Hayley Boesky. (2010). "Shadow Banking." Federal Reserve Bank of New York Staff Report No. 458.

Puri, Manju, Jörg Rocholl, and Sascha Steffen. (2011) "Global Retail Lending in the Aftermath of the US Financial Crisis: Distinguishing between Supply and Demand Effects." *Journal of Financial Economics*, 100, 556–78.

Quinn, Stephen, and William Roberds. (2014) "How Amsterdam Got Fiat Money." *Journal of Monetary Economics*, 66, 1–12.

Roberds, William, and François Velde. (2014) "Early Public Banks." Federal Reserve Bank of Atlanta Working Paper 2014–9.

Sautijn Kluit, W.P. (1865) *De Amsterdamsche Beurs in 1763 en 1773*. Amsterdam: W.H. Zeelt.

Schnabel, Isabel, and Hyun Song Shin. (2004) "Liquidity and Contagion: The Crisis of 1763." *Journal of the European Economic Association*, 2, 929–68.

Schneider, Jürgen, Oskar Schwarzer, and Petra Schnelzer. (1991) *Historische Statistik von Deutschland. Band XII: Statistik der Geld- und Wechselkurse in Deutschland und im Ostseeraum (18. Und 19. Jahrhundert)*. St. Katharinen: Scripta-Mercuratae-Verlag.

Skalweit, Stephan. (1937) *Die Berliner Wirtschaftskrise von 1763 und ihre Hintergründe*. Stuttgart-Berlin: W. Kohlhammer,.

Smith, Adam. (1937) [1776] *An Inquiry into the Nature and Causes of the Wealth of Nations*. New York: Modern Library.

Soetbeer, Adolf. (1855) *Beiträge und Materialien zur Beurtheilung von Geld- und Bank-Fragen mit besonderer Rücksicht auf Hamburg*. Hamburg: Herold'sche Buchhandlung.

Spooner, Frank C. (2002) *Risks at Sea: Amsterdam Insurance and Maritime Europe, 1766–1780*. Cambridge, UK: Cambridge University Press.

't Hart, Marjolein. (2009) "Corporate Governance." In *The Bank of Amsterdam*, edited by Marius van Nieuwkerk, pp. 144–55. Amsterdam: Sonsbeek.

Tooke, Thomas. (1838) *A History of Prices and of the State of Circulation from 1793 to 1837*, Vol. I. London: Longman, Orme, Brown, Green, and Longmans.

Upper, Christian. (2007) "Using Counterfactual Simulations to Assess the Contagion in Interbank Markets." Bank for International Settlements, Working Paper No. 234.

van Dillen, Johannes Gerard. (1922) "De Beurscrisis te Amsterdam in 1763." *Tijdschrift voor Geschiedenis* 37, 241–53.

van Dillen, Johannes Gerard. (1925) *Bronnen Tot de Geschiedenis der Wisselbanken*. The Hague: Martinus Nijhoff.

van Dillen, Johannes Gerard. (1931) "Effectenkoersen aan de Amsterdamsche Beurs 1723–1794." *Economisch-Historish Jaarboek*, 17, 1–46.

van Dillen, Johannes Gerard. (1934) "The Bank of Amsterdam." In *History of the Principal Public Banks*, edited by Johannes Gerard van Dillen, pp. 79–124. The Hague: Martinus Nijhoff.

van Dillen, Johannes Gerard. (1964a) "Bloeitijd der Amsterdamse Wisselbank 1687–1781." In *Mensen en Achtergronden, Studies uitgegeven ter gelegenheid van de tachtigste jaardag van de schrijver*, edited by Johannes Gerard van Dillen, pp. 337–85. Groningen: J.B. Wolters.

van Dillen, Johannes Gerard. (1964b) "Oprichting en Functie der Amsterdamse Wisselbank in de zeventiende Eeuw 1609–1686." In *Mensen en Achtergronden, Studies uitgegeven ter gelegenheid van de tachtigste jaardag van de schrijver*, edited by Johannes Gerard van Dillen, pp. 386–415. Groningen: J.B. Wolters.

Wilson, Charles. (1941) (1966 reprint) *Anglo-Dutch Commerce and Finance in the Eighteenth Century*. Cambridge, UK: Cambridge University Press.