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Death of a Reserve Currency

Stephen Quinn and William Roberds

Working Paper 2014-17

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Abstract: The Dutch bank florin was the dominant currency in Europe during much of the 17th and 18th centuries. The florin, a fiat money, was managed by an early central bank, the Bank of Amsterdam. Using a new reconstruction of the Bank of Amsterdam's balance sheet, we analyze the florin's loss of reserve currency status during the period 1781–92. The reconstruction shows that by 1784, accommodative policies rendered the Bank of Amsterdam “policy insolvent,” meaning that its net worth would have been negative under continuation of its policy objectives. Policy insolvency coincided with the Bank of Amsterdam's loss of control over the value of its money.

JEL classification: E58, F33, N13

Key words: central banks, reserve currency, policy insolvency

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The U.S. dollar reigns as the dominant reserve currency today. The British Pound occupied a similar status in the nineteenth and early twentieth centuries. Preceding the British pound in this leading role was the Dutch guilder, also known as the florin. This paper explores the florin's loss of reserve currency status over the period 1781-1792, employing a new dataset assembled from archival sources.

This historical episode is of continued relevance, because the reserve-currency florin was in many ways a modern construct. The "florin" in question was not a coin, but existed only as ledger entries in the accounts of an early central bank, the Bank of Amsterdam (or "Bank"). And, unusually for the time, the Bank's money was not inherently redeemable in coin, nor was its value defined by any specific coin. To call it by its modern name, the florin was fiat money.

As a supplier of fiat money, the Bank of Amsterdam engaged in many of the same activities as central banks today. The Bank operated a large-value payment system; it provided liquidity to the Amsterdam money market through repo-like arrangements; it engaged in open market operations to stabilize market conditions; it lent to selected counterparties; and it returned seigniorage to its sponsoring government, the City of Amsterdam ("City"). The main policy objective of the Bank was to stabilize the market price of its money relative to high-quality collateral—the large-denomination "trade coins" circulating among merchants in Amsterdam—while smoothing short-term fluctuations in the stock of Bank money. The Bank's adherence to this goal of "price stability" made the florin into a bellwether money for much of the seventeenth and eighteenth centuries.

When confronted with a major crisis in 1781, the Bank reacted in a manner that may also seem familiar to modern observers. Responding to the outbreak of war between the Dutch Republic and Britain (the Fourth Anglo-Dutch War), the Bank embarked on a policy of aggressive open market purchases. This policy was paired with an unprecedented increase in the Bank's lending activity, particularly to a large government-sponsored enterprise, the Dutch East India Company ("Company"). This last policy was especially daring, as wartime disruptions to the Company's operations soon meant that it was in no position to repay its debts. By 1783, the value of the florin began to suffer. The Bank then reacted by reversing the direction of its open market activity, but it lacked adequate reserves with which to conduct defensive operations. The Bank's difficul-

ties soon ran deeper than illiquidity, however. Our data show that by 1784, nonperformance of the Bank's credit portfolio had caused it to become "policy insolvent," meaning that its net worth was negative under its policy objectives (Stella and Lönnberg 2008). A lasting solution to the Bank's problems required either a fiscal intervention or a policy shift, but neither option was pursued at this stage.

The bank florin came under acute pressure in 1790, following the outbreak of the French Revolution. The Bank responded by attempting to enforce a sudden nine percent reduction in the value of its money relative to silver. Protests from market participants led the City to inject capital into the Bank over 1791-1792. The recapitalization temporarily halted the decline in the value of the florin, but was unable to restore the Bank's credibility over the longer term. The data show that the capital injection failed to remedy the Bank's policy insolvency, in large part because the City did not give up its claim on the Bank's income. The reconstructed balance sheets also reveal that much of the injection was immediately diverted to the City's own fiscal needs.

The end of currency's reserve status is a rare event, and the florin's downfall teaches that preeminence of a central bank does not necessarily guard against fiscal overexploitation or a sudden loss of market confidence. Our reconstruction offers a precise narrative of a dominant currency's quick transition from a reserve asset to a monetary also-ran. The transition is punctuated by two large monetary shocks—the wartime crises of 1781 and 1790—and two mismanaged policy responses. The first response—the expansionary bravado of 1781-1783—undermined market confidence in the Bank. The second—the belated and ineffective recapitalization of 1791-1792—helped ensure that this loss of confidence would be permanent.

The rest of this paper is organized as follows. Section 1 reviews some relevant literature. Section 2 lays out the structure and policies of the Bank. Section 3 provides a detailed analysis of the florin's collapse. A concluding section considers the implications of this episode for modern central banking practice.

1. Connections to the literature

The narrative history of the Bank of Amsterdam's decline is known from the classic works of Mees (1838) and Van Dillen (1925, 1964). Van Dillen (1934) provides an English synopsis of this history and yearend summaries of the Bank's accounts. Our analysis extends this literature by providing the first detailed, high-frequency (monthly) breakdown of the Bank's balance sheet over this period, presented in a manner compatible with modern central bank accounting. Examination of the details provides new insights, e.g., the course of the Bank's open market operations, the extent of its insolvency, and the failure of the City's attempted recapitalization.

Central bank accounting and central bank solvency in particular are studied in a large body of literature, recently surveyed in Archer and Moser-Boehm (2013). A prominent theme of this literature is that standard concepts of solvency are difficult to apply to central banks, which, because of the unique monetary status of their liabilities, are often able to operate with thin or even negative levels of equity (assets minus liabilities). Below we will show that the Bank of Amsterdam offered no exception to this rule, as its equity was virtually always negative. Fry (1993) argues that net worth (equity adjusted for "off balance sheet" items including discounted future seigniorage income¹) provides a better measure of the sustainability of a central bank's policies than does conventional equity.² Intuitively, a central bank with positive net worth can meet its financial commitments by issuing debt claims against future income. Negative net worth is problematic, since it indicates a central bank may be forced to compromise its policy goals in order to meet expenses.

Fry's conclusions have been echoed in subsequent papers, theoretical and empirical (see e.g., Stella 1997, Ize 2005, Stella 2005, Buiters 2008, Klüh and Stella 2008). Our dataset will offer some additional confirmation. Del Negro and Sims (2013) emphasize, however, that estimates of a central bank's net worth can vary widely with projections of money demand and with expectations of policy. This is an issue that is present in our calculations, as will be seen below.

¹ Archer and Moser-Boehm (2013, 7) call this "comprehensive net worth."

² The empirical relevance of this distinction is easily seen from figures compiled by Archer and Moser-Boehm (2013, 11) for the European Central Bank (€411 billion equity versus €5.1 trillion estimated net worth in 2010) and the Federal Reserve System (\$134 billion equity versus \$4.1 trillion estimated net worth in 2010).

A related theme of this literature is the importance of fiscal backing for the effectiveness of central banks, and particularly of mechanisms for recapitalization under certain scenarios. Sims (2004) lays out the essential policy dilemma, arguing that a central bank without credible fiscal backup will either miss its policy targets or be forced to amass politically unsustainable amounts of reserves (to fend off speculative attacks). Below we describe how the Bank of Amsterdam traditionally confronted this dilemma by using market funding. Its continuous rollover of market-supplied reserves both anchored policy targets and prevented the City from depleting this category of reserves. Confidence in this solution met its limits in 1781-1783 when the Bank was called upon to provide emergency funding to the cash-strapped East India Company. The inadequate recapitalization of 1791-92 made the Bank's lack of fiscal underpinnings all the more evident to contemporary observers.

Recently there has been an upsurge of interest in the topic of central bank accounting, stemming from the rapid expansion of central banks' balance sheets since the 2008 crisis (see Fawley and Neely 2013 for a survey). A number of studies (as of this writing: Stella 2009, Carpenter, Ihrig, Klee, Quinn, and Boote 2013, Del Negro and Sims 2013, Greenlaw, Hamilton, Hooper, and Mishkin 2013, Hall and Reis 2013) have considered the effects of the Federal Reserve's quantitative easing (QE) programs on its equity position going forward.³ One message of this literature is that the unwinding of QE could diminish the Fed's equity by as much as \$100 billion under unfavorable scenarios, although book equity must remain nonnegative under the Fed's accounting rules.⁴ Even potential losses of this magnitude, however, are dominated by other components of the Fed's net worth, estimated in trillions of dollars when potential income from note seigniorage is included in the calculation (Buiters and Rahbari 2012, Del Negro and Sims 2013). Equity impacts from the unwinding of QE are thus seen as unlikely to constrain the Fed's future policy decisions.

The discussion below will make clear that while the design of the Bank of Amsterdam was in many respects comparable to modern central banks (including the Fed), one key difference was

³ Comparable exercises for the European Central Bank can be found in Buiters and Rahbari (2012) and Hall and Reis (2013).

⁴ If the Fed's income were to be insufficient to cover expenses, its accounting rules call for the creation of reserves against a "deferred asset," which is a claim against future remittances by the Fed to the U.S. Treasury.

that it did not issue circulating notes backed by a transparently funded government debt. In the eighteenth century this was a new concept in central banking, one that was still being worked out by the Bank of England (Clapham 1970) and a few other institutions. The corresponding lack of access to a stable stream of earnings had negative implications for the Bank of Amsterdam's financial stability. As will be seen below, the Bank did have other sources of income, which, though adequate in normal times, proved insufficient during the circumstances of 1781-1792.

The demise of the Bank of Amsterdam ushered in a long period of currency dominance for the British pound. The passing of the torch from the florin to the pound in the 1780's has a number of parallels with the better-known transition from the pound to the dollar in the 1920's and 1930's (Eichengreen and Flandreau 2009, 2010). These include the pound's loss of trade dominance to the dollar in the early twentieth century, the initial weakening of the pound by the fiscal pressures of World War I, followed by a second crisis and the removal of the pound from the gold standard in 1931 (Kindleberger 1984). There are also some noteworthy differences. Chief among these is that the pound survived (though in a diminished role) while the bank florin did not. France's military conquest of the Dutch Republic in 1795 brought about the last phase of the florin's collapse. After the Napoleonic period, the remnant portion of the Bank of Amsterdam was liquidated, and its functions were taken over by a national institution of the newly established Kingdom of the Netherlands, De Nederlandsche Bank (Jonker 1996).

2. Some (very) old-style central banking

This section describes the Bank of Amsterdam's structure and balance sheet. Additional details are provided in Van Dillen (1934), Dehing (2012), and Quinn and Roberds (2014).

The Bank was founded in 1609 and liquidated in 1820. It was owned by the City of Amsterdam and was directed by an appointed commission of merchants, bankers, and former municipal magistrates ('t Hart 2009, 154). The principal objective of the Bank was to provide a stable money for the settlement of bills of exchange payable in Amsterdam. As noted above, this involved stabilizing the value of the bank florin relative to trade coins. This stability made payment by book-entry transfer of Bank balances popular with the international bill market, and use of Bank money generated revenue for the City.

2.1 Balance sheet structure

Table 1 gives a stylized balance sheet for the Bank of Amsterdam during our era of interest.

<i>Assets</i>	<i>Liabilities</i>
Coins held subject to receipts Unencumbered coins Loans	Account balances Equity

Table 1: Balance Sheet of the Bank of Amsterdam (18th century)

The table reveals two fundamental differences between the Bank and modern central banks. The first is on the asset side, where the traditional “building blocks” of the Bank’s portfolio were not government securities but silver (much less often, gold) coins.⁵ The second is on the liability side, where the Bank’s monetary liabilities existed only as balances on its books, never as circulating notes.⁶

Assets in modern central banks’ portfolios are often held under repurchase agreements. The Bank did not engage in repurchase agreements, but it did create money through a comparable mechanism, famously described by Adam Smith in the *Wealth of Nations* (1776, 446-455). Anyone with an account at the Bank could sell high-quality, large-denomination coin (known as “trade coin”⁷) to the Bank at a fixed price, receiving in return a credit in their account with the Bank,

⁵ There were several reasons why the Bank used coins rather than government bonds as its principal backing asset. Public finance in the Dutch Republic was relatively advanced for its era, but unlike contemporary Britain, there was no unified national debt (De Vries and Van der Woude 1997, Chapter 4). The debt of the largest province, Holland, played a somewhat similar role to a national debt (Gelderblom and Jonker 2011) but secondary markets for Holland debt were generally quite thin (Van Bochove 2013). Finally, the charter of the Bank did not incorporate any explicit role for the Bank in public finance. The coins held by the Bank may be compared to foreign exchange assets held by many modern central banks; see the discussion below.

⁶ This mattered because it meant that Bank’s money was a “wholesale” product used primarily by wealthy merchants. During our era of interest, there were approximately 2000 accounts at the Bank, held by about one percent of Amsterdam’s population (Van Dillen 1925, 985). The average value of a payment over the Bank’s books was 2500 florins (Dehing 2012, 82 and 140) as compared to a typical laborer’s daily wage of about one florin (De Vries and Van der Woude 1997, 616). Payments through the Bank are thus comparable to payments over today’s large value settlement systems (Fedwire, TARGET2, etc.).

⁷ Trade coins had special liquidity value as the preferred medium of exchange for transactions in foreign markets. Both foreign and domestic trade coins were eligible for sale against receipts at the Bank.

and a *receipt*. The receipt entitled its holder to repurchase the same coin within a six month interval at the same price they sold it for, plus a small fee (¼ percent for most silver coins and ½ percent for gold coins).⁸ Receipts were issued in the name of the party selling the coin, but were fully negotiable.⁹ Receipts could also be rolled over at 6-month intervals, at the same cost as a redemption. In practice, most receipts were eventually redeemed, so they functioned much like “term repos” between the Bank and its account holders. **Table 2** gives an example of how this type of transaction is recorded.

<i>Assets</i>			<i>Liabilities and Equity</i>
	<u>July 26, 1776</u>		
Coins under receipt	+5,650	+5,650.0	Accounts
	<u>January 31, 1777</u>		
		-14.1	Accounts
		+14.1	Equity
	<u>July 3, 1777</u>		
Coins under receipt	-5,650	-5,650	Accounts
		-14.1	Accounts
		+14.1	Equity
	0	0	Net change

Table 2: Receipt Transactions on the Balance Sheet, in Bank Florins

Source: Amsterdam Municipal Archives

In the Table 2 example, the Bank’s records show that the firm of Elmenhorst & Kerkoff delivered 2,000 silver *driegulden* coins to the Bank in the summer of 1776. The Bank credited the firm 5,650 bank florin and gave them a receipt. Six months later, the firm paid 25 basis points (=14.1 florins) to the Bank (from other funds it had on account) to extend the receipt for another half year. Then, in the summer of 1777, the firm used the receipt to repurchase the coins, paying another 25 basis point fee (again from other funds). The last line of the Table gives the cumulative

⁸ I.e., in modern terms, a receipt was an American call option on the coin sold, the strike price being the original sale price plus the fee. A receipt was also a put option on the bank florin. Coins under receipt were tested for quality and held in standardized, numbered bags. In the original implementation of this system, someone redeeming a receipt received literally the same bag of coins that were sold to generate the receipt. Later on, the Bank appears to have allowed some substitution of fungible bags across receipts.

⁹ Unfortunately very few prices of receipts have survived, so these cannot be employed in the analysis below.

net impact over all balances recorded in the ledgers, including the balance in the Bank's own master account.

A curious quality of the Bank's liabilities (i.e., account balances), of great fascination to Adam Smith and other contemporary observers, was their fiat nature (Smith 1937, 450). After the introduction of the receipt system in 1683, Bank balances *could no longer be redeemed for coin without a receipt*. This led to the creation of a daily secondary market in Bank funds, in which Bank money could be traded against (the equivalent of) circulating coin or "current money." Bank money, which was backed predominantly by trade coins, almost always went at a premium (called the *agio*) to current money, which consisted of a mixture of coins of varying quality. The distinction between Bank money and current money gave rise to two legally distinct, parallel units of account in the Dutch Republic, known as the *bank florin* or bank guilder, and the *current florin* or current guilder. For expositional shorthand, we will often use the term "florin" for bank florins and "guilder" for current florins.

In the Table 2 example, each coin brought to the Bank had an official value of 3 current guilders and also an official value of 2.825 bank florins, so for these transactions, the Bank used an (implicit) exchange rate of 1.062 guilders per florin. The secondary market, however, typically offered an exchange rate of 1.05 or less. If instead Elmenhorst & Kerkoff had sold its coins to a private broker or "cashier" for bank florin at an agio of 5 percent, then the firm would have gained an extra 64 bank florin but no receipt. Most people chose the extra money, and the receipt business in *driegulden* coins was thin. Indeed, we use that coin in Table 2 precisely because its infrequency allows us to connect individual transactions. In contrast, another Dutch silver coin, the *ducaton*, had a bank exchange rate of 1.05 and a substantial receipt business.

In addition to coins held under receipt arrangements, the Bank held coins not encumbered by receipts. These might consist of coins for which receipts had expired, but more commonly these were coins acquired through the Bank's open market operations, i.e., through purchase of coin in the daily market for Bank funds. In the eighteenth century, such operations were generally conducted in small-denomination coins (*gulden* coins with a nominal value of one current guilder each). These coins were not recognized as trade coins and were thus ineligible for sale to the Bank against receipts. To ease monetary conditions, the Bank would on occasion purchase such

coins (with Bank funds, much as central banks today) at the going price (always less than one bank florin per guilder for a positive agio), and to tighten, the Bank would sell these coins into the market.¹⁰

An example may be instructive. At the start of 1778, the Bank purchased 42,000 *gulden* coins at a premium or agio of 4 7/8%. The next month, the Bank sold the same coins at 4 5/8%. **Table 3** gives the balance sheet effects. Note that, by convention, the Bank always recorded coin purchases and sales in its account balances “as if” these transactions occurred at a 5 percent premium (i.e., at 40,000 florins in this case). Each operation therefore requires a profit or loss adjustment to correct for the difference between actual transaction price and the benchmark 5 percent price of Bank money (see the Appendix for the full details of this accounting).¹¹

<i>Assets</i>		<i>Liabilities and Equity</i>	
<u>January 30, 1778</u>			
Unencumbered Coins	+39,952.38	+40,000.00	Accounts
		-47.62	Equity
<u>February 11, 1778</u>			
Unencumbered Coins	-39,857.14	-40,000.00	Accounts
		+142.86	Equity
	+95.24	+95.24	Net change

Table 3: Open Market Operations on the Balance Sheet, in Bank Florins

Source: Amsterdam Municipal Archives.

The unencumbered coin residing in the Bank’s vault was a source of revenue for the City. Annually, the City paid itself a seigniorage “dividend” by removing the Bank’s profit from the previous year, so the Bank had no retained earnings. Occasionally, the City would take more coin and

¹⁰ Guilder coins were purchased with bank florins at a market price, rather than a fixed price as with trade coins. Also, no receipts were given for purchased guilders, so that someone who sold their guilders to the Bank had no right to withdraw coin from the Bank, without the purchase of a receipt from someone who had sold trade coins to the Bank. This is somewhat analogous to the situation with modern central banks, where a party that sells collateral to a central bank in a repo may (and is expected to) later repurchase that same collateral at a fixed price, but a party that sells a security outright to a central bank may not then expect a return of that security at a prearranged price.

¹¹ We suspect this accounting convention was adopted to simplify bookkeeping. For lack of practical alternatives, our reconstruction reluctantly follows this convention. For much of our sample, this results in some undervaluation (on the order of 1/2 percent) of the Bank’s total assets relative to market value. This distortion is however swamped by fluctuations in the value of the Bank’s credit portfolio.

call it a loan to prevent the Bank from having to acknowledge its negative equity position. The City paid neither interest nor principal to the Bank. Throughout this paper, we treat City “loans” as takings and adjust the Bank’s equity accordingly.

The charter of the Bank prohibited lending activity. In practice, however, the Bank routinely lent to the Dutch East India Company. For most of the eighteenth century, Bank lending to the Company took the form of short-term loans that allowed one year’s trading fleet to be dispatched while the previous year’s fleet was still on its return voyage from Asia. These loans provided a regular source of income to the Bank (Uittenbogaard 2009). Occasional loans to the Province of Holland added a minor source of income.

To give an example of this type of transaction, in April 1775, the Company borrowed 100,000 unencumbered florins from the Bank at 3 percent.¹² Eighteen days later, the loan was repaid with interest. **Table 4** gives the balance sheet effects (in this example, the Company has sufficient funds available to repay the interest and principal on the loan).

<i>Assets</i>		<i>Liabilities and Equity</i>	
	<u>April 6, 1775</u>		
Loans	+100,000	+100,000	Accounts
	<u>April 24, 1775</u>		
Loans	-100,000	-100,000	Accounts
		-150	Accounts
		+150	Equity
	0	0	Net change

Table 4: East India Company Borrowing on the Balance Sheet, in Bank Florins

Source: Amsterdam Municipal Archives.

Putting the elements together, the Bank of Amsterdam was an amalgam of two structures. The receipt system created a “narrow bank” with 100 percent reserves that could be withdrawn on demand. This portion of the bank generated fee income. At the same time, a fractional reserve bank made loans backed by unencumbered coins. This portion generated interest income and

¹² I.e., the Company received the loan as balances in its Bank account. This was the usual type of loan, although on rare occasions, the Company would also borrow coin from the Bank.

profits from open market operations. Reflecting this dual structure, we find it convenient to divide Bank balances into those matched by an unexpired coin receipt (“encumbered balances”) and other balances (“unencumbered balances”). It should be emphasized, however, that this is an artificial distinction that never occurs in the Bank’s accounts: the right to redeem Bank balances in coin was bound to receipts rather than the balances themselves.¹³

2.2 Monetary policy

As a central bank in an open economy, the Bank of Amsterdam was subject to the constraints of the standard policy trilemma—mutual incompatibility of fixed exchange rates, absence of capital controls, and control over the money stock. The Bank generally attempted to resolve the trilemma by ceding control over its money, with some qualifications. By offering to “repo” trade coins, the Bank anchored (within arbitrage bands) the value of its balances vis-à-vis silver, which served as the metallic standard for most of eighteenth-century Europe. In addition, the ¼ percent six-month redemption fee for receipts anchored Amsterdam’s risk-free short-term interest rate at slightly more than ½ percent per annum.¹⁴ Unlike modern central banks, the Bank had no mechanism for varying this rate. There were no capital controls, and apart from occasional open market interventions, the stock of Bank money ebbed and flowed according to market conditions.

In its overall design the Bank may be compared to a modern currency board, but with some noteworthy differences. First, the Bank did not offer to buy and sell foreign exchange at fixed prices, but instead offered fixed terms for the equivalent of repo transactions in trade coins, both foreign and domestic. Second, the Bank’s operational target was not a foreign exchange rate, but the market value of the bank florin’s domestic exchange expressed through the agio. Throughout most of the eighteenth century, the agio remained within the 4½ to 5 percent range that was embodied in the coinage laws of the Dutch Republic. These assigned two official values to each trade coin, one in bank florin and a slightly higher one in current guilders (Polak 1998, 73-74).

¹³ This dual structure invites comparison to the Bank of England following the passage of Peel’s Act in 1844. This law split the Bank of England into Banking and Issue departments, constrained the size of the former and enforced a 100 percent marginal backing requirement on the latter (Clapham 1970b). Bank florins matched with a receipt similarly had 100 percent backing. However, all Bank of England liabilities (notes and accounts) retained an inherent right of redemption whereas Bank of Amsterdam accounts did not.

¹⁴ This was strictly a lending rate, as the Bank never paid interest to its account holders.

An agio within this range signaled a stable value of the bank florin relative to circulating money. Third, maintenance of the agio appears to have been a largely informal objective, as an explicit target band is not mentioned in the Bank archives until 1782 (Van Dillen 1925, 433-434). Informality of its target band allowed the Bank to engage in operations to smooth short-term fluctuations in its money (Quinn and Roberds 2014). The Bank was also sometimes willing to tolerate deviations of the agio from its target range during periods such as the Seven Years' War (1754-1763), when heavy wartime demand for coin depressed the agio to around two percent.

A fourth and final difference between the Bank and modern currency boards is that the latter typically operate with a 100 percent (or greater) "backing ratio" of external assets to central bank money. The Bank, on the other hand, often operated with a backing ratio that was substantially lower, averaging 80 percent over its lifetime (Dehing and 't Hart 1997, 49). One reason the Bank may have felt comfortable with this lower ratio was the relatively lax, informal nature of its policy target. Another reason may have been the apparent safety of the receipt system: account holders could not threaten the Bank with a classic bank run, since the Bank did not traditionally redeem its balances except against a receipt, and the total stock of receipts was always less than the stock of bank florins. The market value of the bank florin could suffer, however, and for the Bank, the safety of the receipt system ultimately proved more apparent than real.

2.3 Reserve currency role

Amsterdam's combination of steady exchange rates, absence of capital controls, and low interest rates allowed its markets to flourish, and conferred something of a "reserve currency" status on the bank florin. Bills of exchange drawn on Amsterdam were a liquid form of short-term credit readily available in most European commercial cities (Flandreau, Galimard, Jobst and Nogués-Marco 2009, Dehing 2012). The bank florin was a "reference" unit of account for commercial transactions over much of Europe (Gillard 2004 calls it "the European florin"), and top-quality bills payable through the Bank were a reliable and liquid store of value.¹⁵ At the center of this

¹⁵ Bills of exchange drawn on merchant banks served this role rather than deposit accounts in banks or government securities. Deposit banking existed in 18th-century Amsterdam but was underdeveloped relative to contemporary Britain (Jonker 1996, 233-6). By contrast, bills on reputable merchant banks were widely available and easily traded in secondary markets.

network, in Amsterdam's capital markets, the bank florin served both as numeraire and the most liquid medium of exchange. The Bank was seen as bulwark of financial stability and attracted favorable reviews from observers such as Adam Smith, William Patterson (who proposed the design of the Bank of England), and Alexander Hamilton (Smith 1937, 451; Patterson 1694, 14; and Hamilton 1851, 164).

One modern "reserve currency" function the bank florin could not fulfill was to serve as a backing asset for other currencies. There were two reasons for this. One was operational: the City limited ownership of Bank accounts to local residents (in practice, merchants and wealthy individuals), its own treasury, and government-sponsored entities such as the East India Company. The other was conceptual: in the eighteenth century, the only universally acceptable backing asset for money was precious metal.

By 1770 or so, however, Europe's financial center of gravity was clearly shifting toward London (Carlos and Neal 2011). Amsterdam's markets nonetheless continued to thrive during the 1770's. Quantitative indicators such as the level of Bank balances and payments activity show relatively modest declines from peak values observed in the 1760's (Dehing 2012, 82).

2.4 Equity, income, and net worth

As explained above, the Bank did not hold a portfolio of government securities, nor did it issue circulating notes. This meant that the Bank did not have access to the most common source of revenue for modern central banks, which is seigniorage income from notes backed by government bonds. The Bank did have other streams of income, however, and it was solidly profitable for most of its existence. This section presents a summary of the Bank's income and expenses, and describes how these impacted the evolution of its net worth. Details are given in the Appendix.

In basic terms, the Bank's equity at time t is the value of its stock of unencumbered coin plus its loan portfolio, minus its "unencumbered accounts" (those accounts not matched by receipts). The Bank's time t net income (or profit) is given by the sum of: income from loans, losses on pur-

chases (gains on sales) of coin, fee income from receipts, and other fee income; less: loan write-offs, operating expenses, and profit taking by the City.¹⁶

Following the literature reviewed in Section 1, the *net worth* of the Bank is given by the value that a hypothetical, fully informed outside investor would place on the Bank. Operationally, net worth is derived by adjusting book equity for off-balance sheet income and expenses. The elements creating the Bank of Amsterdam's off-balance sheet profits were fees, interest on certain short-term credits,¹⁷ and operating expenses. Expected payments from annuity-style debts are not included because those income streams are embedded within asset values on the balance sheet. Our estimates of net off-balance sheet incomes assume 1) that such profits follow a random walk, and 2) that going forward, the City does not take the Bank's profits, so that the entirety of such profits can be incorporated into net worth as a "deferred asset."

For simplicity, our net worth calculations apply risk-neutral pricing to these income streams, using a constant risk-free annual interest rate of three percent. This is the average implicit rate for a bill of exchange (i.e., an unsecured debt claim) drawn on a high-quality counterparty (often a merchant bank) during our sample period, comparable to AAA commercial paper in a modern context.¹⁸ Thus, with sufficiently positive net worth the Bank could have hypothetically made its account holders whole by issuing debt at this favorable rate, assuming that the new debt holders would have first claim to the Bank's income. Negative net worth is taken as an indication of the unsustainability of the Bank's policies.

In addition to the Bank's net worth, two other quantities of interest are the Bank's *overall reserve ratio* and its *unencumbered reserve ratio*. The overall reserve ratio ρ (or "cash ratio" or "backing

¹⁶ Equity, profit, and net worth are denominated in bank florin. Standard practice in the literature would be to deflate these by a price index to obtain real values. We do not do this for two reasons. First, monthly price series are not available for this time period. Second, available data (Van Zanden 2013) suggest that inflation was largely negligible in the Dutch Republic over most of the eighteenth century. Measured annual inflation averages 0.5 percent for 1700-1792 and for our specific period of interest 1781-1792, annual inflation averages 0.4 percent. These rates are close enough to zero that it did not seem worthwhile to deflate with an interpolated monthly price series.

¹⁷ As detailed in the next section, these items include interest on Company anticipations and interest from the Municipal Loan Chamber.

¹⁸ Such bills were liquid and generally secure. We use this as benchmark rate rather than a rate on government debt since the debt issues of the Dutch Republic and its provinces were rarely traded.

ratio”) is the ratio of all metal assets (encumbered plus unencumbered coin) to all account liabilities. The unencumbered reserve ratio ρ_u is the ratio of unencumbered coin to unencumbered accounts.

3. Data

The Bank of Amsterdam did not operate in an era of central bank transparency, and it never published balance sheets or income statements. However, many of the original records of the Bank are preserved at the Amsterdam Municipal Archives, and these can be used to reconstruct the Bank’s financial statements. To piece together the Bank’s history over the period January 1775-January 1792, data were collected from original documents.¹⁹ Our dataset starts in 1775 to provide a five-year baseline of pre-crisis activity by the Bank and ends in 1792 because this is the last year that specialized data is available for the Bank’s master account.

The balance sheet of the Bank involves 22 categories of assets and liabilities that can enter at a daily frequency, potentially yielding over 4200 daily observations on the Bank’s condition. For clarity in presentation, these data were condensed to more manageable series of 204 monthly observations. Because some income items only show up at a yearly frequency, income data were further condensed to annual series. Details of the data reconstruction are given in the Appendix. Agio data are taken from Gillard (2004) and exchange rate data (average of London and Hamburg sight rates on Amsterdam) are from Schneider, Schwarzer, and Schnelzer (1991).

3.1 Reconfiguration: 1781-1783

The Bank’s initial loss of credibility occurred during the Fourth Anglo-Dutch War (declaration in December 1780; ceasefire in January 1783). This section traces the fundamental changes experienced by the Bank during the wartime period.

¹⁹ These documents are the general ledgers of the Bank (AMA 5077/507-603), detailed breakdowns of the Bank’s master account (AMA 5077/1402-1419), and accounts of the Municipal Loan Chamber (AMA 5077/ 38-40). The Bank’s master account is roughly comparable to the Federal Reserve’s System Open Market Account (SOMA) and analogous accounts at other modern central banks.

Figure 1 shows the Bank’s balance sheet over our data sample. The aggregate size of the balance sheet stays roughly constant at about 20 million florins.²⁰ What changes markedly is the composition of the Bank’s assets. Lending replaces coins held under receipt, and this dramatic change mostly occurs during the Fourth Anglo-Dutch War. Figure 1 shows that the stock of encumbered coin held at the Bank began falling with the threat of hostilities in 1780 and continued to fall throughout the course of the war. People rapidly abandon receipts, a funding stream that had been continuously rolled over for one hundred years. The level of coins under receipt (and accounts under receipt) collapses from 17 million florins in March 1780 to a mere 0.3 million by January 1783. The “narrow bank” within the Bank of Amsterdam implodes.

We conjecture that this collapse is a run that cascades from a fear that fiscal distress might imperil receipt claims. Account holders might worry that the Bank will not promptly return high-value collateral, or that the Bank will retroactively hike the fees charged for redeeming a receipt. Such fears would have been amplified by uncertainty over the outcome of the war and worries that coins might be subject to military seizure. Functionally the “repo run” observed on the Bank is the opposite of that experienced by Lehman Brothers in 2008, when repo investors in Lehman unwound positions for fear that funds sold might not be returned (Copeland, Martin, and Walker 2011). Here, people return funds for collateral.

The overall balance sheet, however, does not collapse because the Bank simultaneously builds its asset holdings with loans and open market purchases.²¹ During the war, the credit portfolio grows by 7.6 million and the level of unrestricted coins by 3.8 million. Both activities create unencumbered accounts, so total monetary liabilities remains relatively stable despite the run. This balance sheet reconfiguration remains the norm through the remainder of the sample.

To underscore the transformation, **Figure 2** reports the Bank of Amsterdam’s reserve ratio ρ over our sample period. From 1775 through 1779, the average was 95 percent, and even the ratio of

²⁰ This is perhaps 15 percent of contemporaneous Dutch GDP, which does not seem excessive given the low interest rates inherent in the receipt system. By comparison, the central bank liabilities/GDP ratio for the U.S. was about 24 percent at yearend 2013.

²¹ Also, in July 1782, the City puts coins worth 85,714.3 bank florins into the Bank. That sum is about one year’s operating profit and is the only capital injection of coins that we know of over the Bank of Amsterdam’s entire two-century existence.

unrestricted coins to unencumbered accounts ρ_u was 87 percent. For comparison, the Bank of England's average ratio is 42 percent over the same period (Clapham 1970, 296-297). By 1783, the Bank of Amsterdam's ratio is down to 37 percent, and the unencumbered ratio is nearly identical because so few coins are under receipt. At war's end, Amsterdam is still above London's ratio of 14 percent, but remainder of the decade shows a new pattern. From 1785 through 1791, the Bank of England rebounds to an average of 55 percent while the Bank of Amsterdam retains an average of 31 percent. In other words, Amsterdam experiences a persistent shift from minimal to substantial fractional reserves.

Figure 3 details the composition of the Bank's new lending. Before the war, its credit activity was dominated by loans to the East India Company called anticipations. Anticipations were short-duration, seasonal loans secured on the return of fleets from Asia, typically towards the end of the year. The longest maturity for anticipations during the first three years of our sample was 4 months. In 1779, however, the Company delays some repayments for over a year, after borrowing heavily. In 1780, the Company again borrows heavily and fails to repay any of these anticipations, but it does manage intermittent interest payments. War then reduces shipments to and from Holland to their lowest levels in a century (De Korte 1984, appendix 8C). In February 1781, the largest division ("chamber") of the Company receives permission from the province of Holland to suspend payment on its anticipations (Steur 1984, 116). The Bank stops new lending to the Company in 1781, and receipt-holders begin to "run" the Bank, with the extent of the run limited by the stock of outstanding receipts.

In 1782, near the end of the run, the Company offers to convert its suspended debt into Company bonds that, in theory at least, will be guaranteed by the States (Parliament) of Holland (De Korte 1984, 81). To participate, however, current creditors of the Company have to loan it an additional 50 percent. In May, the City formally sanctions Bank participation in this conversion (Van Dillen 1964, 417), and the Bank loans the Company an additional 2.5 million. By year end, total Company debt at the Bank is 7.7 million florins.

During the war, the City also uses the Bank to fund City lending to the Province of Holland.²² The City takes 2 million from the Bank and lends it to Holland in exchange for obligations paying 3 percent. Perhaps to reclaim some credibility for the Bank's balance sheet, the City commits to redirect the expected interest towards amortization. Instead of the becoming the non-performing City loan, these debts become zero-interest obligations that are scheduled to be amortized over four decades.

The war also saw credit expanded through another channel, a City-operated lending facility known as the Loan Chamber (Van Dillen 1964, 418).²³ The Loan Chamber was entirely funded by the Bank and provided credit to local merchants. By January 1783, this facility owes 1 million florins. After the war, the Loan Chamber's debt rises to over 2 million and becomes an important source of income for the Bank.

From Figures 1 and 3, we see lending to the East India Company and to the Loan Chamber directly create unencumbered account balances to replace the loss of balances matched by a receipt. The Bank adds more unencumbered balances with aggressive open market operations. From May 1781 to July 1782 (the nadir of the receipt run), purchases add 7.1 million in unencumbered balances to the balance sheet. Besides creating bank money, this incoming coin more than offsets the coins removed by the City. The City's depletions cause the Bank's adjusted equity (i.e., equity net "loans" to the City), which starts off slightly negative at -482,001 florins in January 1780, to decline to -778,200 by the end of the war and to -2.3 million by 1791.

Finally, the rapid restructuring of the balance sheet alters the Bank's flow of income: earnings flip from being primarily derived from people using the receipt facility to one heavily reliant on interest from loans. **Figure 4** breaks down the Bank's income by source and shows that before the crisis, the Bank made most of its revenue from usage fees. The run greatly reduces fee income, so interest income now dominates. Massive lending to the East India Company initially

²² The Bank starts the war already holding a small perpetual Holland annuity with a principal of 227,000 bank florin.

²³ The Municipal Loan Chamber was originally created in response to the financial crisis of 1772-1773 (Breen 1900, De Jong 1934). Creation of the Loan Chamber was necessary because direct lending to merchants was seen as a violation of the Bank's charter. At that time the Loan Chamber saw only light use, and it was closed within a few months. Loss of credit availability during the Fourth Anglo-Dutch War resulted in the Chamber's reopening.

resulted in a substantial rise in the Bank's profits -- until the Company stopped paying. Thereafter, interest from the Loan Chamber rivals fee income.²⁴

3.2 Decline: 1784-1789

The armistice of January 1783 effectively ends the Fourth Anglo-Dutch War (the treaty arrives in May 1784), but peace does not return the Bank to its prewar condition. This section describes the extent of the problems faced by the Bank, and its attempts at recovery before the outbreak of a second crisis in 1790.

The disruptions of the Fourth Anglo-Dutch War to the Company's operations are severe, and as a condition of peace, the British gain permanent free trade access to the Dutch East Indies, undermining an important source of the Company's profit. Costs to equip outbound ships exceed the Company's revenue from traded goods in every year from 1780 until the end of the Dutch Republic in 1795 (De Korte 1984, 85). At war's end, the Company's total debt is 38 million (20 percent held by the Bank; De Korte 1984, 87 and appendix 1E), and subsequent government injections inflate the Company's total debt to 91 million by 1790, by which time 81 million is in arrears (De Korte 1984, 84).

The immediate consequence of this for the Bank is that its largest debtor completely fails to perform for three years. By early 1783 this situation begins to erode the value of the bank florin (**Figure 5**). A directive from the governing commission of the Bank, dated April 1782, instructs Bank employees to try and hold the agio between four and five percent through open market operations, when these can be undertaken without significant losses to the Bank (Van Dillen 1925, 433-434). By early 1783, however, Figure 5 shows that the agio on the bank florin is already trading in the three percent range. Moreover, the foreign exchange value of the florin falls by about five percent over the course of the war. The Bank responds to these depreciations through a "tightening operation": selling 3.5 million florins' worth of guilder coins into the market during the first half of 1783. This policy seems to have had some beneficial effect: by January 1783 the

²⁴ Low interest rates implicit in the receipt system and nonperformance of credits to the East India Company cause the Bank's profitability to be quite low as compared to modern central banks, with an average return on assets of only 0.38% over our sample. For comparison, the average ROA for central banks during the Great Moderation was about 1.5% (Klüh and Stella 2008).

slide in the agio abates and by yearend, the agio briefly returns to the four percent range. Trade coins trickle back into the Bank (Figure 1).

Yet the Bank cannot sustain this policy. By the summer of 1783, the Bank's stock of unencumbered coins falls to 4.4 million florins, leaving its overall reserve ratio at a perilously low 28 percent (Figure 2). This ratio was 97 percent just four years earlier. Open market sales of silver are abruptly interrupted. The Bank's problems, however, extend beyond illiquidity, for the continued nonperformance of loans to the Company cause the Bank to become insolvent. As long its profits are taken by the City, the Bank has no way to offset its losses on loans to the Company. And, even if the Bank did start to retain all of its earnings, it is doubtful that these would have proved sufficient to return the Bank to solvency.

3.2.1 Policy insolvency

Figure 6 charts the evolution of the Bank's net worth in January of each year under different scenarios. As noted above, calculation of net worth requires at each date an adjustment for "franchise value," i.e., for the value of future net income not reflected in book assets.

The net worth estimates also require an evaluation of the Bank's credit portfolio. The Bank recorded loans as their principal due, but this can differ substantially from what an investor might pay for the Bank's long-term assets. For example, the 1781 and 1782 loans to the City did not pay interest, so we have re-valued them as the present value of the expected amortization payments (see the appendix for details). The more difficult valuation is the restructured Company debt that did not pay interest *and* had a substantial credit risk. So Figure 6 reports how insolvent the Bank of Amsterdam became based on three ways of assessing the restructured Company debt held by the Bank.

Our first estimate of net worth applies four price observations from auctions of new Company debt.²⁵ There was little or no secondary market for these instruments, so such data points are rare. The prices were the percent of principal the buyer was willing to pay, but the maturity of the bonds were not recorded, so we assume that they were similar to the 33 year maturity held by the

²⁵ These data were generously supplied by Christiaan van Bochove and Joost Jonker.

Bank.²⁶ If the auctioned debt was actually of a shorter maturity, then the implied default probability would be greater, and the insolvency worse, than that shown in Figure 6. The auction prices suggest that the Bank's insolvency in 1784 was -2 million florin, but market perceptions of the Company worsened over time, causing the Bank's insolvency to double by 1789. The decline corresponds with years the Company did not pay anything to the Bank, and presumably other creditors.

A second approach views the restructured debt from the Bank's internal perspective. When the Company did start making payments again, the Bank received only amortization payments. The internal valuation line uses this as the expected reality of the restructured debt. It calculates the present value of these payments for each year starting in 1783, and it produces the Bank's net worth if the Company met its 33 year amortization schedule but never paid interest. This view of the restructured debt puts the net worth below - 4 million half a decade before the market does.

Finally, as a lower bound, a third and final approach (dotted line in Figure 6) reports the Bank's net worth if the restructured debt fails entirely and irrevocably. Under this scenario, the Bank's goes to almost -10 million in January 1784. This would have been the most prescient valuation, since the Company was in default over most of our sample, and completely so after seizure of its ships by the British navy in 1795 (De Korte 1984, 91).

Thus, under all three scenarios depicted in Figure 6, the Bank is insolvent by 1784. The actual shortfalls faced by the Bank would have been larger than those shown in the Figure, since the City never fully foregoes Bank profits as a source of revenue.

3.2.2 Attempts at self-repair

Although the Bank did not publish its balance sheets, the market prices the Bank's weakness over the rest of the 1780s. The agio and the foreign exchange rate continue to decline (Figure 5) and the Bank does not engage in defensive open market operations. And new initiatives indirectly acknowledge the Bank's credibility problem. For example, the City attempts to limit dividends beyond yearly profit by treating them as actual loans. In 1783, the City opened a line of credit

²⁶ Other bonds mentioned in de Korte (1984, 87) were of a similar maturity: 33 years in 1781 and 30 years in 1791.

with the Bank and repaid 800,000 (with interest!) of the 1.4 million borrowed. The effort, however, soon ends as the remaining principal returns to non-performance in 1784. The City then returns to form and takes an additional 943,714 florins in non-performing loans over the rest of our sample.

The Bank's accounting treatment of Company debt also shifts in 1783. The Company suspends all payments for three years and the Bank stops accruing interest on Company debt. The Bank however rolls over, or "evergreens," the debt principal. When a 3 percent coupon payment does show up 1786, after a three-year abeyance, the City then uses the funds to shift bonds from the Bank's balance sheet and, presumably, to the City's balance sheet. From the Bank's perspective, the process slowly amortizes the principal but ignores interest due. The process starts an incremental improvement of the Bank's net worth under the second scenario shown in Figure 6 (solid black line).²⁷

Amortization reduces the Bank's vulnerability to future Company non-performance at the expense of immediate gains. If the Bank instead accounts for Company payments as interest income on a perpetual debt, then the Bank's net worth would increase substantially: discounted at 3 percent, these payments would have added a present value of 7.65 million. The City would benefit as well, taking the income as dividends. Instead, principal was reduced. As a result, the amount of potential insolvency was made less each passing year. This policy better helps the Bank *if* the Company's long-term credibility is highly suspect. At the time, Holland was subsidizing the Company with vast sums, and the Company's unsubsidized outlook remained bleak. With this policy, the City chose to slowly re-separate the bank florin from the Company rather than accept a florin built on a massive Company debt. This variation on a strategy of "extend and pretend" was however insufficient to remedy the Bank's insolvency.

Sustained growth in receipt balances (Figure 1) brings a different sort of relief for the Bank in 1789. This coincides with the political instability of the French Revolution, but we cannot track where coins are coming from. Still, the influx of new coin types from Brabant, Prussia, Russia,

²⁷ Resumption of payments seems to have allowed the Bank to reopen some short-term lending to the Company. The Bank makes three new loans, and the Company repays each in full. One loan, a 1788 loan for 700,000, is even repaid with interest.

and Sweden suggest a new pattern at work. Yet, the bank florin continues to weaken both in terms of the agio and relative to London and Hamburg, so the inflows are unlikely to be coming through those channels. A contemporary observer attributes the florin's weakness to sovereign loans made by Amsterdam merchant banks to Russia, Sweden, and Austria in amount of 40 million florins (Van Dillen 1964, 420).

3.3 Crisis: 1790-1791

The appearance of another crisis in 1790 leads the Bank to undertake a series of unconventional policies designed to restore its credibility. This section describes the nature and extent of these policies.

Beginning in 1790, the Bank attempts to use the renewed inflow of trade coins to stabilize the rest of the Bank and halt the decline in the agio. First, the Bank acquires encumbered silver coins by purchasing receipts on the market instead of purchasing coin outright as it had in the past. From June 1790 to May 1791, the Bank converts 3.7 million in silver coin from encumbered to unencumbered. The logic behind this operation may have been to reduce the scope of a possible run by diminishing account holders' ability to redeem Bank balances in coin. From a modern perspective, however, a policy of purchasing receipts is seen as the Bank buying a large number of put options on its own currency. Not surprisingly, this intervention proves ineffective.

The agio drops below zero by November 1790 (Figure 5). In a desperate move to halt the florin's slide, the Bank offers to redeem the balances of large account holders in silver bars at a price of 26.75 florins per silver mark (Van Dillen 1964, 421). This is a de facto devaluation of 9-10 percent over the traditional (implicit) silver value of the florin, of 24.1-24.25 florins per mark. No one takes the Bank up on this offer. Instead, in January 1791, prominent account holders file a formal protest with the City, accusing the Bank of having increased its money stock in an "unnatural fashion" without "backing of saleable specie or coin material" (Van Dillen 1964, 422). The protesters demand that all accounts be made directly convertible to (silver) specie at the former value, as had occurred prior to the introduction of the receipt system.

The data show that the Bank makes two additional policy moves in early 1791. The first of these is to raise the bank price of gold coins by 2.5 percent, effectively a reduction in the Bank's "hair-

cut” when people use gold as collateral: a backdoor devaluation. The second move, an apparent response to the account holders’ protest, is to set a price floor for the agio by using unencumbered silver coins to fund a traditional (i.e. non-receipt) process of withdrawal, an option that has been in abeyance for over a century. The Bank makes the new facility available only to dealers in the agio market and sets the initial withdrawal agio of -1 percent. This means people get 99 current guilder coins per 100 bank florin in account. At that below-market rate (Figure 5), dealers withdraw 344,000 bank florins in two weeks. Perhaps feeling overly confident, the Bank then raises the withdrawal agio to zero percent (just above market rates), and 1.6 million leaves in two weeks. Belatedly realizing that it has been funding a run, the Bank abandons this effort to stabilize the agio in mid-February 1791. The Bank proves unable to re-stabilize itself.

3.4 Recapitalization: 1791-1792

Over an eight year span beginning in 1783, the Bank is too far from solvency to re-establish credibility. Efforts to introduce a meaningful, if devalued, peg for the florin fail. Efforts also fail to add loans that perform. Indeed, the City continues to take operating profits, and more, from the Bank. Under pressure from market participants, the City finally attempts to recapitalize the Bank in 1791. This section describes the recapitalization.

On February 17, 1791, the City Council authorizes a bond issue of 6 million florins (Van Dillen 1964, 422) for recapitalization, with prominent merchant banks agreeing to support the issue. Calculations shown in Figure 6 suggest that this was, on its face, a reasonable move given the extent of the Bank’s accumulated losses. And, examination of the Bank’s ledgers confirms that from April 1791 through January 1792, the City gives over 6 million in balances to the Bank for destruction.

The Bank’s reconstructed balance sheet shows why the recapitalization did not succeed in restoring the bank florin. The City does not restrict the use of the injected funds to restoring equity. As **Table 5** shows, 40 percent goes to increasing the Bank’s equity, but the remainder is diverted. Almost one-third goes to retire self-amortizing loans secured by Holland bonds and by interest-earning loans to the City Loan Chamber. 28 percent is taken out by the City as coin. During the operation, the agio appreciates 1.4 percentage points (from -.56 to .84) and the exchange rate ap-

preciates 2.8 percent. The Bank's reserve ratio rises to 48 percent, a ratio similar to the Bank of England's. At the same time, the nonperforming East India Company debt remains, and this means that the Bank is insolvent with a net worth of -4.96 million florins under the no-recovery scenario. Again, even that estimate of net worth assumes the City will stop taking all future earnings, which seems unlikely given the City could not resist taking 1.7 million in coin from the Bank's recapitalization.

	Full Company Performance	No Company Performance
Initial equity	-2,303,300	-8,805,800
Initial net worth	-40,477	-6,542,977
Change in Accounts (Liabilities)	-6,076,893	
<u>Balance Sheet Effects</u>		
Change in Equity due to re-capitalization	+2,418,438	
Other changes in balance sheet:		
Change in Loans (Assets)		
Holland (performing)	-952,381	
Loan Chamber (performing)	-999,741	
East India Company (no interest)	0	
Change in Coins (Assets)	-1,706,333	
Equity after all changes	-145,590	-6,418,590
Net worth after all changes	1,310,865	-4,962,135

Table 5. Recapitalization of April 1791-January 1792 (quantities are bank florins)

Source: Amsterdam Municipal Archives and authors' calculation.

3.5 Epilogue: 1793-1795

The Bank of Amsterdam's decline does not stop in January in 1792. Unfortunately, the records of the Bank's master account are not available after that date, so we are unable to continue our data reconstruction. The basic story of the Bank's further decline is described in the literature, however, and **Table 6** summarizes that story using fiscal 1793-1795 fiscal yearend (January) data compiled by Van Dillen (1934, 122).

Date	Exchange rate index (1781:1=100)	Agio (percent)	Coin (bank florins)	Reserve Ratio (percent)	Profits and losses (bank florins)
1792:1	94.4	0.84	8,408,441	48	68,696
1793:1	93.9	0.81	13,238,010	60	-27,955
1794:1	90.7	1.91	8,471,075	48	-10,402
1795:1	85.9*	-25.00	2,506,046	21	-155,314

Table 6: The Bank of Amsterdam, 1792-1795

* December 1794 value. Sources are Van Dillen (1934, 122), Gillard (2004), Schneider, Schwarzer, and Schnelzer (1991). 1792 financials are from authors' calculations.

The international strength of the bank florin is gone, and its exchange rate continues to deteriorate. Some metal returns to Amsterdam in late 1792, and Van Dillen (1964, 425) attributes this to an influx of Spanish silver and to continued capital flight from the consequences of the French Revolution. The agio briefly climbs to the two percent range in the second half of 1793 after war breaks out with France, but it returns to negative territory in August 1794. Encumbered coin leaves the Bank and the Republic. The bank florin departs the world stage when the French army reaches Amsterdam in January 1795.

4. Conclusion

The above calculations indicate that accommodative policies pursued by the Bank of Amsterdam over 1781-1783 caused it to become policy insolvent by 1784 at the latest. The extent of the insolvency remained hidden from public view, but the markets sensed that something was wrong, and kept the bank florin under pressure until its full collapse in 1795.

We conclude by considering the implications of this episode for modern central banks. The florin's downfall illustrates three types of policies that have been identified in the literature as detrimental to central banks' net worth and credibility more generally. The Bank's first policy error (see e.g. Cukierman 2011, 36) was its decision to support a large, bankrupt government-sponsored enterprise (the Dutch East India Company) while trying to maintain an indefensible policy target (the agio peg of 4-5 percent). Negative impacts on the Bank's net worth were amplified by a second policy error (Archer and Moser-Boehm 2013), which was the City of Amster-

dam's practice of keeping Bank profits to itself and allocating losses to the Bank. The first two policies eroded the net worth of the Bank until a fiscal bailout offered the only feasible way to restore the Bank's reputation. A third policy error, of inadequate fiscal backup (Sims 2004), was manifested in the City's botched recapitalization of 1791-92. Applied in isolation, any of these policies would have worked to undermine the Bank. The key lesson seems to be that a combination of all three was particularly toxic.

A noteworthy contrast with Amsterdam's experience is provided by the contemporaneous Bank of England. During our period of interest, the Bank of England was often less liquid than the Bank of Amsterdam (Figure 2). Moreover, the bulk of the Bank of England's non-metallic assets consisted of government debt (Clapham 1970a, 210), yet its credibility was not called into question. Chartered as a private, for-profit institution, the Bank of England nonetheless had an explicit mission to manage the finances of the national government. Thus, unlike in Amsterdam, there was a fairly direct line of responsibility from Parliament to the obligations of the Treasury to the liabilities of the central bank. The Bank of Amsterdam was, on the other hand, not supposed to be in the lending business at all. Through extraordinary quasi-fiscal actions, it had ended up with a large portfolio of nonperforming debt, but without any consensus on whose responsibility this was. For a time, the Bank's weakness was masked by the liquidity of the florin, liquidity which however depended on the whim of market perception. Such perception proved an insufficient basis for stable money.

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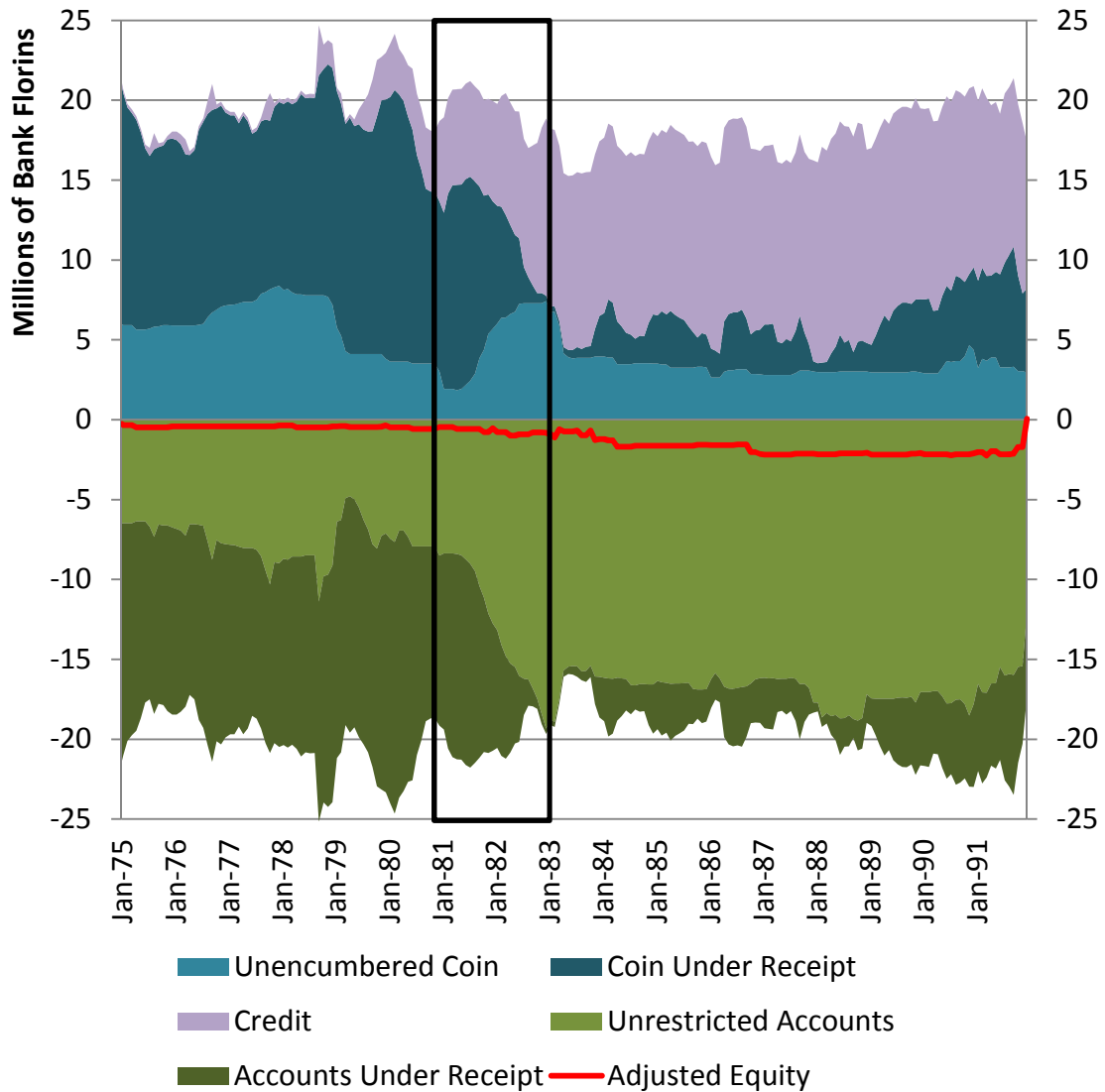
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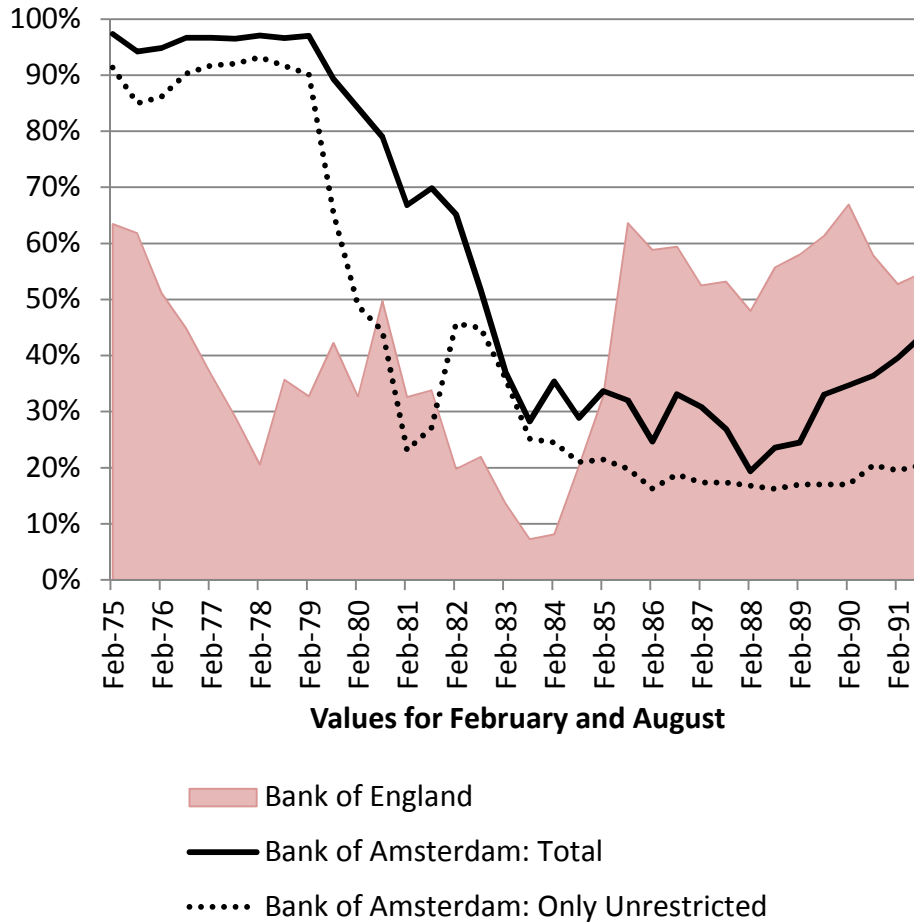
Figure 1. The Bank of Amsterdam's Assets and Liabilities, 1775:1-1792:1



Source: Amsterdam Municipal Archives.

Notes: The Fourth Anglo-Dutch War is highlighted. Graphical presentation follows Carpenter et al. (2013, Figure 1). Note that the top scale applies to the Bank's (negative) equity. Equity is adjusted by treating City loans as subtractions from equity rather than credits.

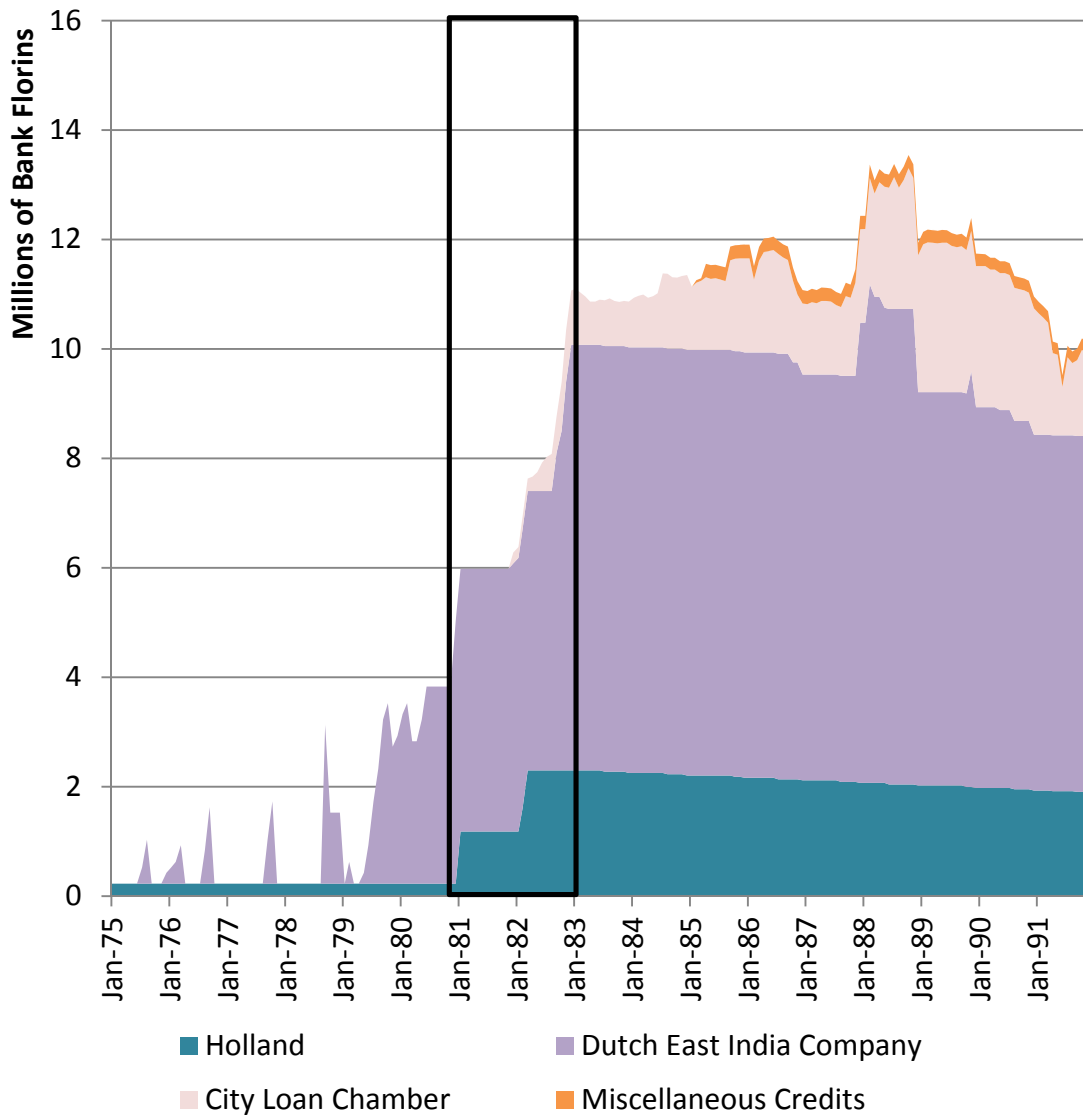
Figure 2. Reserve Ratios (Precious Metal to Monetary Liabilities)



Sources: Amsterdam Municipal Archives, and Clapham (1970, 296-7).

Notes: The Bank of England's ratio is bullion over notes in circulation plus accounts. The Bank of Amsterdam's ratios are 1) total coins over total accounts and 2) unrestricted coins over unrestricted accounts. The February and August dates conform to available Bank of England observations.

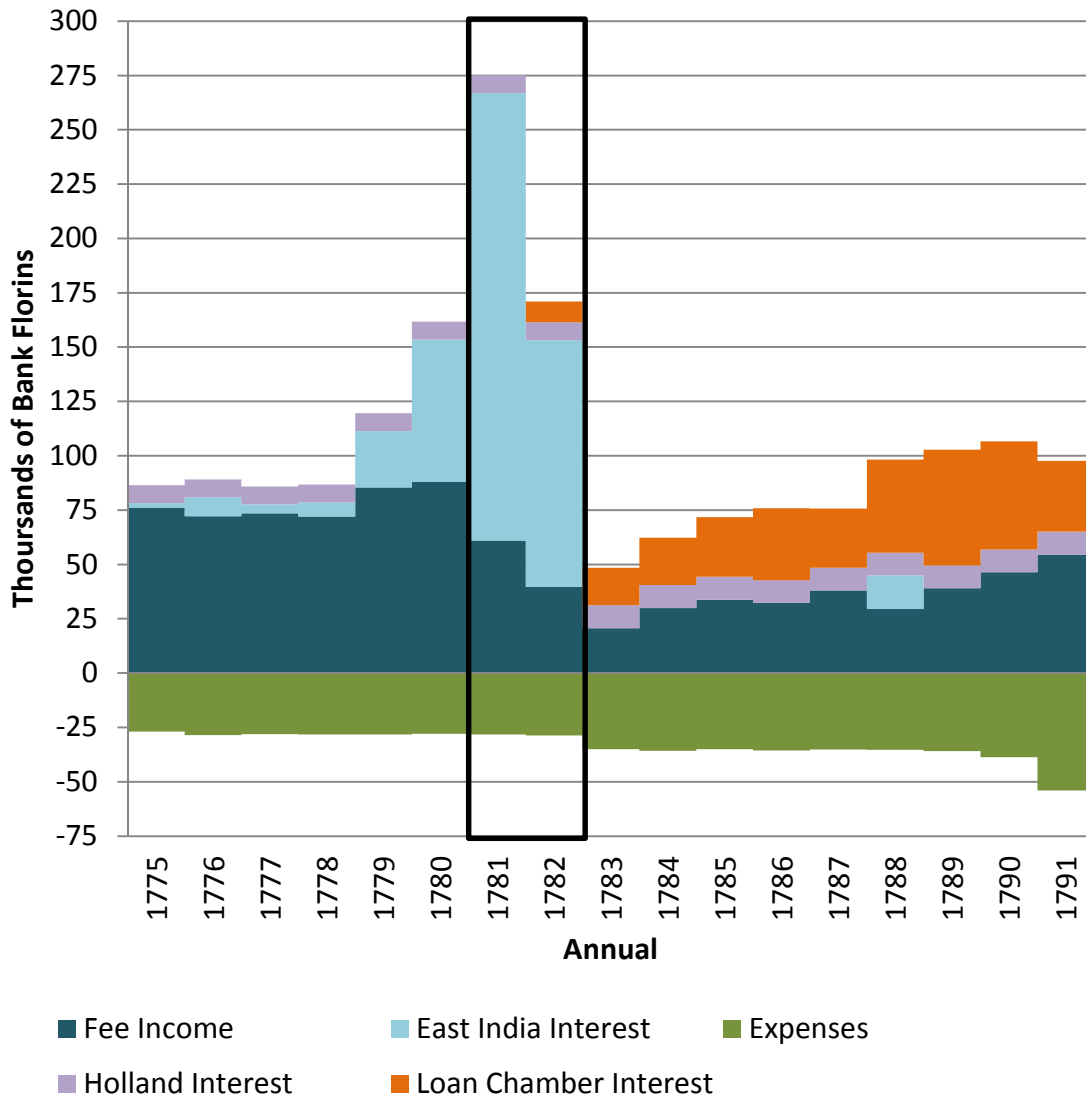
Figure 3. The Bank of Amsterdam's Loans Outstanding



Source: Amsterdam Municipal Archives.

Note: The Fourth Anglo-Dutch War is highlighted.

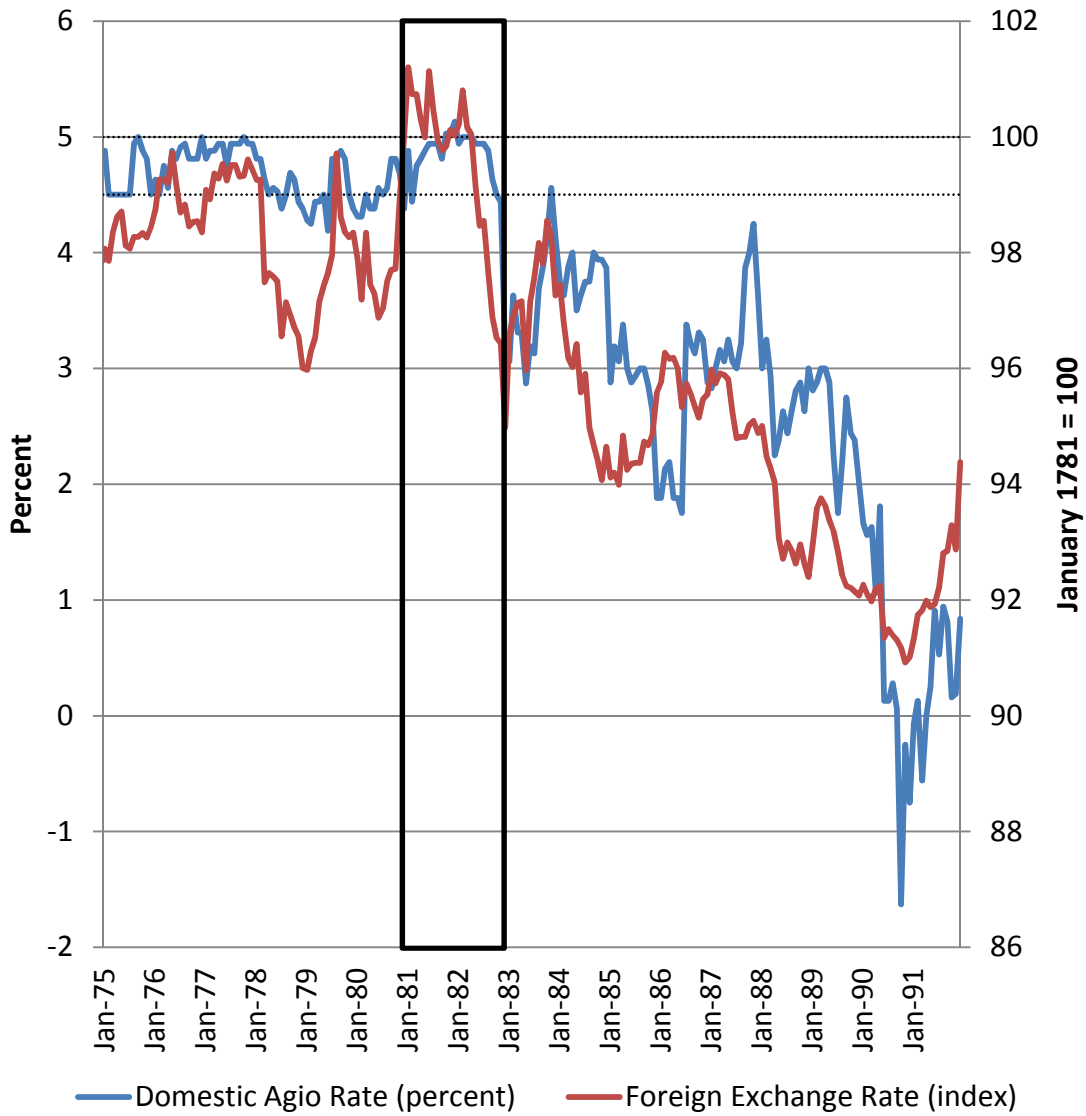
Figure 4. The Bank of Amsterdam's Income and Expenses



Source: Amsterdam Municipal Archives.

Note: The Fourth Anglo-Dutch War is highlighted.

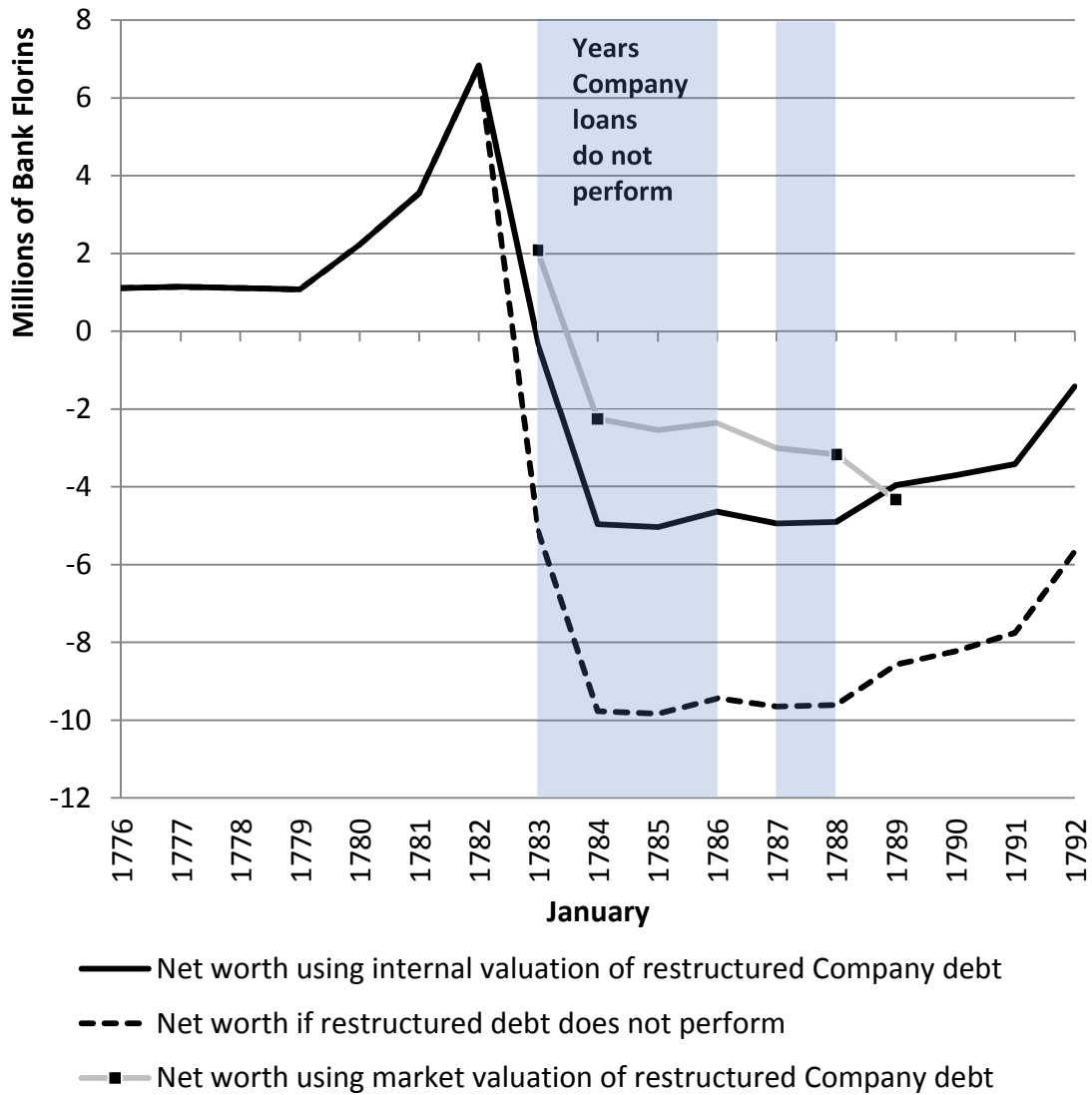
Figure 5. The Bank Florin Agio and Exchange Rate



Sources: Gillard (2004) and Schneider, Schwarzer, and Schnelzer (1991).

Note: The Fourth Anglo-Dutch War is highlighted. The agio's traditional trading range is horizontally highlighted at 5 and 4.5 percent.

Figure 6. The Bank of Amsterdam's Net Worth by Scenario



Source: Amsterdam Municipal Archives and authors' calculation.

Note: The net worth using market valuations relies on auction prices of new Company debt issued in March 1783, December 1783, April 1788, and February 1789, and linear interpolations between auction dates.

Appendix for “Death of a Reserve Currency”

1. Simplified balance sheet

In the tradition of the macroeconomics literature, this section presents a version of the Bank’s balance sheet where time is divided into discrete model “periods,” which are taken as six months (the maturity of a coin receipt).²⁸ For simplicity, we assume coin receipts are not allowed to expire (in reality they were usually redeemed or rolled over). Primes are used to denote variables one period ahead, and all values are given in bank florin. From Table 2, the Bank held three types of assets: trade coins under receipt, unencumbered coins, and loans. In terms of notation, let

$$S_r = \text{trade coins held under receipt}; \quad (1)$$

$$S_u = \text{unencumbered one-guilder coins purchased/sold by the Bank}; \quad (2)$$

$$S_m = \text{miscellaneous other unencumbered coins (known as the } \textit{restant}\text{)}; \quad (3)$$

$$B = \text{loans outstanding at interest rate } r \text{ per period}. \quad (4)$$

The liabilities of the Bank, from Table 2, are given by its account balances. Conceptually, these can be divided into “restricted” and “unencumbered” categories, i.e.,

$$V_r = \text{balances matched by an unexpired coin receipt}; \quad (5)$$

$$V_u = \text{other bank balances}, \quad (6)$$

although we again emphasize that the Bank’s actual ledgers never make this distinction. The Bank’s equity Q at any given time is just the value of its assets minus the value of its liabilities, i.e.,

$$Q = S_r + S_u + S_m + B - V_r - V_u. \quad (7)$$

²⁸ The actual balance sheets, described in Appendix section 2 below, are more complicated than this stylized presentation primarily due to 1) the irregular frequency of entries; 2) the presence at any given time of receipts of different coin types and maturities, and 3) ad hoc adjustments applied when the Bank pursued unconventional policies.

Since $S_r = V_r$ by definition, i.e., restricted balances are perfectly matched by coins under receipt, equation (7) simplifies to

$$Q = S_u + S_m + B - V_u. \quad (8)$$

To keep track of the evolution of the Bank's equity position (8), we first introduce the following notation. Let

$$D = \text{net "deposits" of trade coin into the bank;}^{29} \quad (9)$$

$$b = \text{the market price of guilder coins;} \quad (10)$$

$$b^* = \text{the Bank's "official" price of guilder coins;}^{30} \quad (11)$$

$$P = \text{net number of guilder coins purchased;} \quad (12)$$

$$\delta = \text{the fee charged for redemption/renewal of receipts;} \quad (13)$$

$$L = \text{net lending (loans less repayments of principal);} \quad (14)$$

$$W = \text{writeoffs of bad loans;} \quad (15)$$

$$F = \text{transactions fees charged by the Bank;} \quad (16)$$

$$O = \text{operating expenses;} \quad (17)$$

$$T = \text{taking of profits (unencumbered coin) by the City.} \quad (18)$$

The Bank's sources of income include receipt fees δV_r charged on restricted balances V_r (effectively, an interest rate of δ is charged on these balances), fees charged for transactions made through the Bank's accounts F (these were 2.5 basis points on the transferred amount), income from loans rB , and gains/losses from open market operations $(b - b^*)P$. The Bank's expenses include writeoffs of bad loans, operating expenses and takings of profits by the City. The one-period change in the Bank's assets is given by

²⁹ Here we use the term "deposit" as shorthand for sale of trade coins in return for Bank credit and a receipt. These were not deposits in the modern sense of a general, demandable debt claim. I.e., the receipt only gave its holder the option to repurchase the specific coin sold, at a slight premium above its original sale price.

³⁰ As noted above, the Bank's ledgers carry guilder coins at a fixed agio of five percent, or 1.05 current guilders per bank florin (equivalent to $b^* = .95238$); see also the transaction example in Appendix section 2.3 below.

$$D + bP + L - W - O - T, \quad (19)$$

i.e., by the sum of: “deposits,” net purchases of unencumbered coin, and net lending less: loan writeoffs, operating expenses, and the City’s profit taking. The one-period change in the Bank’s liabilities is given by

$$D + b^*P + L - rB - F - \delta V_r, \quad (20)$$

i.e., by the sum of: “deposits”, open market purchases, and net loans less: interest payments, transaction fees, and fees on receipts. The Bank’s profit π is the one-period change in the Bank’s equity, and is given by expression (19) less (20), which simplifies to

$$\pi \equiv \Delta Q = rB + (b - b^*)P + \delta V_r + F - W - O - T, \quad (21)$$

i.e., by the sum of: income from loans, losses on purchases (gains on sales) of guilder coins, income from receipts, and fee income; less: loan write-offs, operating expenses, and profit taking. Transition equations for the Bank’s assets are:

$$S'_r = S_r + D, \quad (22)$$

$$S'_u = S_u + b^*P - T - O, \quad (23)$$

$$S'_m = S_m - (b - b^*)P, \quad (24)$$

$$B' = B + L - W, \quad (25)$$

and for Bank liabilities, transitions are

$$V'_r = V_r + D, \quad (26)$$

$$V'_u = V_u + b^*P + L - rB - F - \delta V_r. \quad (27)$$

The Bank’s overall reserve ratio ρ (or “cash ratio” or “backing ratio”) of metal assets against all liabilities is

$$\rho = \frac{S_r + S_u + S_m}{V} = \frac{S_r + S_u + S_m}{V_r + V_u}. \quad (28)$$

The Bank's unencumbered reserve ratio is likewise defined as

$$\rho_u = \frac{S_u}{V_u}. \quad (29)$$

2. Data reconstruction

The 1780s brought a diversity of new types of lending and Bank's accounting becomes complicated. This section sets out our reconstruction of what happened and how the Bank accounted for it.

Table of contents for this section:

- 2.1 Bank of Amsterdam Lending in the 1780s
- 2.2 Bank "Rekeningen" (profit and loss) for 1783
- 2.3 Accounting for Open Market Operations
- 2.4 Details of Calculating Net Worth

2.1 Bank of Amsterdam Lending in the 1780s

Table 1 lists Bank of Amsterdam lending from 1780 through 1791. The three borrowers were the Dutch East India Company (Company), the City of Amsterdam (City), and the Municipal Loan Chamber (Chamber). Some loans are single payments while others are serial payments within a fiscal year (ending in mid-January). Sometimes the intended interest rate and maturity are derived actual loan repayments.

Table 1. Bank Lending in the 1780s

<u>Borrower</u>	<u>Fiscal</u> <u>Year</u>	<u>Principal</u> <u>in bank</u> <u>florin</u>	<u>Form of</u> <u>Principal</u> <u>lent</u>	<u>interest</u> <u>rate</u>	<u>Maturity</u>	<u>Secured by</u>
Company	1780	4,800,000	account	4%	≤ one year	Anticipations
Company	1782	300,000	account	3%	≤ one year	Anticipations
Company	1782	126,286	capital	0%	unclear	
Company	1787	991,150	coins	0%	≤ one year	
Company	1787	2,478	capital	0%	≤ one year	
Company	1788	700,000	account	3%	≤ one year	
Company	1789	400,000	account	0%	≤ one year	
Company	1782	2,550,000	account	0%	33 years	Company bond
City	1780	118,000	coins	0%	perpetual	
City	1781	952,381	coins	0%	40 years	Holland bond
City	1781	200,000	coins	0%	perpetual	
City	1782	1,119,048	coins	0.25%	49 years	Holland bond
City	1782	200,000	account	2.50%	≤ one year	
City	1783	1,200,000	account	2.50%	≤ one year	
City	1784	404,762	coins	0%	perpetual	
City	1786	478,952	coins	0%	perpetual	
City	1789	60,000	coins	0%	perpetual	
Chamber	1782	28,571	account	0%	perpetual	
Chamber	1782	990,000	account	2%	variable	Chamber loans
Chamber	1783	304,000	account	2%	variable	Chamber loans
Chamber	1783	74,757	coins	2%	variable	Chamber loans
Chamber	1784	776,000	account	2%	variable	Chamber loans
Chamber	1785	806,500	account	2%	variable	Chamber loans
Chamber	1786	722,500	account	2%	variable	Chamber loans
Chamber	1787	739,600	account	2%	variable	Chamber loans
Chamber	1788	1,537,500	account	2%	variable	Chamber loans
Chamber	1789	413,000	account	2%	variable	Chamber loans
Chamber	1790	258,000	account	2%	variable	Chamber loans
Chamber	1791	1,016,500	account	2%	variable	Chamber loans
Surinam?	1785	247,619	coins	0%	unclear	Surinam?

2.1.A Traditional Lending before 1781.

Table 2 shows an example of the balance sheet effects of each of these traditional lending activities.

Table 2. Examples of Balance Sheet Effects of Traditional Bank Lending circa 1780

<u>Interest from Holland Annuity: each year 1775-1792</u>			
	ASSETS	EQUITY	
Coins from Holland	+8,260	+8,260	Income
	+8,260	+8,260	Net Change
<u>1780 Loan to City: Bank's Accounting</u>			
	ASSETS		
Coin to the City	-118,000		
City obligation	+118,000		
	+0	+0	Net Change
<u>1780 Loan to City: Adjusted Accounting</u>			
	ASSETS	EQUITY	
Coin to the City	-118,000	-118,000	Capital reduction
	-118,000	-118,000	Net Change
<u>Loan to Company</u>			
	ASSETS		
6 April 1775			
Anticipation	+100,000	+100,000	Accounts
24 April 1775			
Principal repaid	-100,000	-100,000	Accounts
		-150	Accounts for interest
		+150	EQUITY
	0	0	Income
			Net Change

Transactions in shown in Table 2:

1. To the Province of Holland

The Bank held a perpetual annuity owed by Holland with a principal of 227,264:6:8 bf paying 8,260 bf in coin per year. Interest arrives into a special entry known as “Koper Kas,” so it does not appear in the Account Ledgers or in the Cash Book. As a result, we have no date, so we ascribe the payment to the last day of the fiscal year. The Bank treats this interest as income and this principal as an asset. To avoid double counting this annuity when calculating net worth, we count only the present value of the stream of perpetual payments (see Section 2.4 below).

2. To the Treasury of the City of Amsterdam (the City).

The Bank lends to the City when the City Treasury takes coin from the Bank other than of the dividend of the Bank's operating profit from the previous year. This prevents the Bank from recording a negative equity position. The City can eventually decrease this principal by having the Bank write it down. Treasury loans do not pay interest. The Bank treats this principal as an asset. We do not. Our "adjusted equity" of the Bank treats these loans as capital losses when they are made rather than when they are formally written down.

3. To the Dutch East India Company (the Company).

The Bank routinely made loans to the Company. These loans, called anticipations, were secured by the revenue from fleets that usually returned to Holland late in the year. Anticipations were usually repaid within a year. The Bank treats this interest as income and this principal as an asset. We do also for calculating net worth.

2.1.B. New Lending to the City secured by Holland in 1781

In February 1781, the Bank lends 952,380.95 bf in coin (1,000,000 cg at a 5% agio) to the City treasury, and the City then lends the coin to the Province of Holland for a Holland and West Friesland obligation paying 2.5% (23,809.55 bf: 25,000 cg) per year. The Bank does not charge the City interest. The City pledges to use the obligation's interest to amortize the loan in 40 annual installments (5077/38). The Bank's accounting treats this annual payment as principal reduction and not as income.

Also, each year, the City creates an additional loan asset and special capital item varyingly named: "an addition for the treasury held among us (van Dillen 1925, 790)," and "kept among us for the redemption (*aflossing*) of capital (van Dillen 1925, 791)" using our translation. The result of this cumbersome process is to keep these incoming coins in the bank by converting them from interest income to capital income. The Bank does not surrender the coin at year's end as a dividend payment to the City. Table 3 shows how this loan and its amortization affected the Bank's balance sheet. When calculating net worth, we treat this as a term annuity (see Section 2.4 below).

Table 3. Balance Sheet Effects of the 1781 Loan

		<u>Origination: February 1781</u>		
ASSETS				
Unrestricted coins paid to the City	-952,381			
Loan secured by Holland bond	+952,381			
		<hr/>		
	+0		+0	Net Change
		<u>Amortization: Each year 1782 to 1791</u>		
ASSETS				
Unrestricted coins paid to the Bank*	+23,810			
Reduction of loan principal	-23,810			
Increase in City loan principal	+23,810			
	+23,810		+23,810	Non-income equity
		<hr/>		
	+23,810		+23,810	Net Change

*Replaced by a credit in 1782 (see Section 2.1.E below).

Note that we do not write-off this loan, as we do typical City loans, for they did have an amortization schedule.

2.1.C New Lending to the Municipal Loan Chamber (*Stads Beleen Kamer*) starting in 1782

In January 1782, the Bank opened a lending window for the Municipal Loan Chamber (Chamber). The Chamber acts as a holding account for diverse City lending. To lend, the Bank created account balances for the Chamber except for one loan on July 2, 1783 that was in coin. The Bank charged the Chamber 2% interest on borrowed balances. The Chamber repaid principal and interest with account. The Chamber continuously borrows and repays the Bank through our sample period. Table 4 shows how the Bank accounted for sample transactions of this facility. The total amount lent this way is reported by year in Table 1.

Table 4. Example of Balance Sheet Accounting of Routine Chamber Borrowing

ASSETS		LIABILITIES
	11 February, 1783	
New Chamber debt	+20,500	+20,500 Accounts
	4 March, 1783	
Chamber repayment	-20,000	-20,000 Accounts
	18 January, 1784 (end of fiscal year)	
		-41.6 Accounts
		EQUITY
		+41.6 Net income
		{ 383.8 due on 20,500 for 11 months, 18 days LESS 342.2 owed on 20,000 for 10 months, 8 days }
	+500	+500 Net Change

2.1.D New Lending to the City secured by Holland in 1782

In March/April 1782, the Bank made a new, two-part loan to the City of Amsterdam. The Bank gave the City 1,175,000 cg (1,119,047.65 bf) in coins that the City then lent to Holland. The City also credited Holland for that year's interest due (23,809.55 bf or 25,000 cg) on the 1781 Holland obligation. In return, Holland gave the city a new 1.2 million cg (1,142,857.15 bf) obligation paying 2.5% (30,000 cg or 28,571.45 bf) per year. The Bank loan to the city paid no interest.

The Bank loan to the City and the resulting 1782 Holland obligation then get caught up in the new Municipal Loan Chamber. The City assigned the 1782 obligation as the anchoring asset of the new Loan Chamber, so, each year, interest of 28,571.45 bf passed from Holland, through the Bank, to the Chamber. At the same time, the City recycled 80 percent of that 1782 Holland obligation (814,285.7 bf or 960,000 cg) back to the Bank. The resulting flow of interest back to the Bank (22,857 bf per year) was used to amortize the initial Bank loan to the City. Each year, the City also had the Chamber pay the Bank 0.25 percent of this 80 percent (2,285 bf) as if the Chamber had taken the coin and had to renew an enormous receipt.

Table 5. Balance Sheet Accounting for the 1782 Loan to the City

		<u>Origination: March and April 1782</u>		
ASSETS				
Unrestricted coins paid to the City	-1,119,048			
Loan secured by Holland bond	+1,119,048			
		+0	+0	Net Change
		<u>Amortization and Chamber Reconciliation: Each year 1783-1791</u>		
ASSETS		LIABILITIES		
Unrestricted coins paid to the Bank	+28,571	+28,571		Accounts due to the Chamber
Reduction of loan principal	-22,857	-22,857		Accounts due from the Chamber (2.5% of 814,286)
			-2,285	Accounts due from the Chamber (.25% of 814,286)
				EQUITY
		+2,285		Income
	+5,714	+5,714		Net Change

Note that we do not write-off this loan, as we do typical City loans, for they did have an amortization schedule.

2.1.E Amortization and Reconciliation in 1782

In 1782, the Bank was not paid the coin from the 1781 Holland bond (23,810), yet it still conducted the scheduled 1781 loan amortization. At the same time, the Bank also initiated the first Chamber reconciliation process, yet the City would not begin paying coin from the 1782 Holland bond (28,571) and would not begin amortizing the 1782 bank loan (22,857) until the next year. Table 5 gives the collection of balance sheet adjustments the Bank executed to produce a total liability-side increase of 29,524. This is the combined liability-side amortization and reconciliation adjustments from Table 3 and Table 5.

To bring the asset side into balance, the Bank made two accounting moves. It created a credit for 28,571. The credit was treated as if it was incoming coins: the credit resided in the Bank's coin room (*specie kamer*) accounts and was treated as a permanent part of the Bank's total metal stock. The bank also increased the principal of the 1782 loan by 953. In 1783, amortization in 1783 proceeded from this increased level.

Table 6. Balance Sheet Effects of the 1782 Credits

ASSETS		LIABILITIES	
Reduction of 1781 loan principal	-23,810	+28,571	Accounts due to the Chamber
Increase in City loan principal	+23,810	-22,857	Accounts due from the Chamber (2.5% of 814,286)
Credit	+28,571	-2,285	Accounts due from the Chamber (.25% of 814,286)
Added to 1782 Loan principal	+953		
			EQUITY
		+23,810	Non-income equity
		+2,285	Income
			Net Change
	<hr/>	<hr/>	
	+29,524	+29,524	

2.1.F New Lending to the Dutch East India Company

1. Anticipations

Table 7 reports annual Company borrowing using anticipations. From 1775 through 1778, the longest maturity of any anticipation was 4 months. 1779, however, saw increased borrowing, and 1.7 million of that was not repaid for over a year. 1780 saw more heavy borrowing that was not repaid at all. It was, instead, restructured in late 1782. We categorize the Company's anticipations as in partial performance in the years 1779-1782, for principal and interest payments were delayed.

Table 7. Company Anticipation Performance

Fiscal year	New anticipations in millions of bank florin	Principal was	Longest maturity in months	Interest paid	Performance
1775	1.0	repaid	4	at maturity	Full
1776	2.2	repaid	4	at maturity	Full
1777	1.5	repaid	2	at maturity	Full
1778	2.9	repaid	4	at maturity	Full
1779	4.7	repaid	14	at maturity	Partial
1780	4.8	restructured	33	January 1782, October 1782	Partial
1781	none				
1782	0.3	restructured	8	October 1782	Partial

2. Restructuring of 1782

In early 1782, the Company was in negotiations with creditors holding anticipations. During this period, the Bank lent the Company an additional 300,000. Why, we cannot say. The final proposal was to convert anticipations paying 3 percent into long-term obligations paying 3 percent but also backed by province of Holland. To participate, however, creditors had to lend an additional 50 percent. The City accepted these terms. Whether as a testament to its desperation or the social cohesiveness of Dutch institutions, we cannot say. From October 1782 through January 1783, the Bank lent the Company 2,550,000 in bank florin accounts. By the end of the fiscal year in mid-January 1783, the Company debt secured on obligations stood at 7,650,000.

At the end of 1782, the Bank also added 126,285.7 to the Company's tab. We suspect that this is accrued interest.

3. Evergreening

For the years 1783-1785, the Company debt remains frozen: or "evergreen". The Company makes not payments. The Bank accrues no interest.

4. Amortization: 1786-1792

Starting in 1786, the Company begins to make its annual interest payment of 229,500. It misses this payment in 1787, but it makes up for it in 1788. Instead of booking this as interest income, the Bank treats it as an amortization payment.

The amortization of the restructured Company debt is very similar to the 1781 and 1782 loans to City that were backed by Holland obligations. In what ways did they differ?

- At origination, the Bank gave money directly to the Company. For the other loans, the Bank gave the money directly to the City rather than Holland.
- Repayments to the Bank came directly from the Company while the other repayments came from the City.
- When the Bank lent to the Company on anticipations, it clearly expected the principal to be repaid at 3 percent. When the Bank “lent” to the City, it did not expect interest or even principal. For the 1781 loan, the Bank had a special volume that set out the schedule of amortization payments from the City and that recorded the actual payments.
- When the City recapitalized the Bank in 1791, it wrote down the 1781 and 1782 loans secured by the Holland obligations, but it did not write down any of the Company debts.

5. New Lending: 1787-1789.

In January 1788, the Company resumes new borrowing from the Bank. The Company borrows 991,150 in Spanish dollar coins from the Bank for one year. This loan is unusual because, normally, the Company borrows accounts. Also, these coins were encumbered (held under receipt). To free the coins, the necessary receipts are acquired (we assume without coercion). The Company also borrows the 2.5 basis points (2,477.875) needed to execute the receipt options. This loan is repaid with accounts and no interest.

In March 1788, the Company borrows 700,000 in accounts. This is repaid by June 1789 with interest of 3 percent.

Finally, in December 1789, the Company borrows 400,000 in accounts. This is repaid the next month with no interest.

2.1.G New Loans to the City

Besides collecting the previous year’s operating profit as a seigniorage dividend (908,249 over our sample), the City also frequently took extra money from the Bank and booked it as a loan. At Table 8 reports, the City borrowed 4,733,143 over the decade. Traditionally, such loans were accounting placeholders, and 1.2 million took that form: the city took coin, paid no interest, and returned no principle. Our adjustment of the Bank’s balance sheet treats these loans as takings.

Table 8. City takings and repayments from 1780 through 1791.

		Dividends	Loans	Recapitalization
Taken	Coin	-908,249	-3,333,143	-1,973,196
	Account		-1,400,000	
Repaid	Coin		471,429	85,714
	Account		800,000	6,076,893
<u>Net by Category</u>		<u>-908,249</u>	<u>-3,461,714</u>	<u>4,189,411</u>
Total Net Taken		-180,551		

The 1780s, however, introduced exceptions. In 1781 and 1782, the City set up amortization schedules using Holland bonds to repay 2 million in loan over four decades. We do not write-off these loans. We treat them as performing, zero-interest, amortizing debts. Also, in 1783, the City repaid 800,000 (with interest) of a 1.4 million line of credit. We treat the remaining 600,000 as takings.

Even with these exceptions, the City loans took a net 3.5 million over the decade, over three times dividend takings. The recapitalization of 1791 offset this net taking. In effect, the City returned what it had taken since 1780.

In March-May 1785, the Bank lent 247,619.05 bf in metal to the City in the name of Surinam. The principal was sporadically reduced to 210,476.20 by the end of 1791 when the principal is written off. The nature of this loan is unclear, so we do not write it off in 1785, and we do not include it in the restructuring. Doing either would not change our overall findings.

2.2 Bank “Rekeningen” 1783

Van Dillen 1925, page 872, does not include a profit and loss reckoning for fiscal year 1782 because the summary table is missing from the 1782 cash book (AMA 5077/1409). We have reconstructed it in table 9. Our information could not distinguish between Bank’s expenses and another entry known as *sakjesgeld*. *Sakjesgeld* averaged about 600 florin per year in our sample, so one could adjust *sakjesgeld* up (and expenses down) for such an amount.

Table 9. Changes in Balance Sheet Equity for Fiscal Year 1782
(17 January 1783 in bank florin)

EQUITY	
<u>Profit and Loss</u>	
+29,476.15	Receipt Fees
+8,260	Interest on old Holland Obligation
+113,408.3	Interest from East India Company
+2,285	0.25% from Loan Chamber
+9,676	Interest from Loan Chamber
+10,225.5	Partygeld
0	Sakjesgeld?
-1,702.375	Courant geld operations
-28,652	Expenses?
142,976.625	Total Net Profit
<u>Other Equity Actions</u>	
-20,000	City Loan Write-down
-238,492.6	To Treasury
-212,000	To Treasury
+85,714.3	From Treasury
+23,809.55	City Obligation
+126,285.7	Credit for missed interest
-91,706.425	Total Change in Equity

2.3 Accounting for Open Market Operations

When conducting open market operations in current guilder coins, the Bank of Amsterdam transacted in sacks of 600 guilder coins (6,366 grams at 91.7 percent fine at full ordinance: Dehing 1998, 76). The Bank booked these at 571.43 bank florin using an internal agio of 1.05 percent.

The Bank, however, did not buy or sell at that agio. When the Bank purchased coin, it booked the transaction as if it was at a 5 percent agio and then the Bank reimbursed the seller (out of the

Bank's stock of change called *restant*) the difference between the Bank's internal 5 percent and the actual rate used for the purchase. Table 10 gives an example from January 30, 1778. The Bank purchased 42,000 current guilders (70 sacks of 600 coins each) at an agio of 4 7/8. Instead of creating 40,047.7 bank florins, the seller got 40,000 bank florins in account and 50 coins worth 47.62 bank florins.

Table 10. Example of Balance Sheet Accounting of Open Market Operations

ASSETS		LIABILITIES	
<u>Purchase at 4 7/8: 30 January 1778</u>			
42,000 coins	+40,000	+40,000	Accounts
50 coins from Bank	-47.62	-47.62	EQUITY Loss on purchase
	+39,952.38	+39,952.38	
<u>Sale at 4 5/8: 11 February 1778</u>			
ASSETS		LIABILITIES	
42,000 coins	-40,000	-40,000	Accounts
150 coins to Bank	+142.86	+142.86	EQUITY Gain on sale
	-39,857.14	-39,857.14	
+100 unrestricted coins	+95.24	+95.24	Profit

When the Bank sold coin, it booked the transaction as if it was at a 5 percent agio and then the buyer reimbursed the Bank (into the Bank's stock of change called *restant*) the difference between the Bank's internal 5 percent and the actual rate used for the sale. Table 10 gives an example from February 11, 1778. The Bank sold 40,000 bank florin at an agio of 4 5/8. Instead of handing out 41,850 guilders coins, the Bank handed out 42,000 (70 sacks of 600 coins each) and collected back 150 coins. The Bank booked the 150 coins at 142.86 bank florin.

In effect, the Bank paid a discount on purchases and received a premium on sales. The premium rate exceeded the discount rate if the sale agio was less than the purchase agio. The Bank could make a profit if it bought guilders at a low price (high agio) and later sold them at a high price (low agio). In the Table 10 example, the Bank clears 95.24 bank florins (100 coins).

2.4 Details of Calculating Net Worth

The expected income to be added to the Bank's equity needs to be off-balance sheet. To avoid double counting, future annuity income that is already factored into the present value of assets needs to be excluded. Also, the asset values of multi-year debts need to accurately reflect expected future payments. A number of circumstances could cause the original principal lent to not match the expected stream of future payments. When needed, we have calculated present values for use figuring the Bank's balance sheet for purposes of calculating new worth. Table 11 lists the off balance sheet income sources that we include in net worth. The table also lists the multi-year debts held by the bank that we have adjusted so that their future payments are accurately reflected in their balance sheet values.

Table 11. Adjustments used to Calculate Net Worth

Off balance sheet items we include as future income

Receipt fees
Transfer fees
Operating expenses (negative effect)
Loan chamber interest
Company anticipation interest

On balance sheet items whose value we adjust

Perpetual Holland Annuity	The Bank held a perpetual annuity paying 8,260 bf per year. We value the asset as a perpetual annuity discounted at 3 percent (present value = 275,333).
1781 Holland Obligation	Scheduled to pay 23,810 bf per year for 40 years. Each year, we value it as a term annuity discounted at 3 percent.
1782 Holland Obligation	Scheduled to pay 22,857 bf per year for 40 years. Each year, we value its remaining years as a term annuity discounted at 3 percent.
1782 Restructured Company Debt	Scheduled to pay 229,500 bf per year for 33.3 years. Each year, we value its remaining years as a term annuity with a 76,500 end payment, discounted at 3 percent.