# The Descent of Central Banks (1400–1815)

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# Introduction

As works of financial engineering, modern central banks are at once both audacious and unremarkable. Their audacity stems from a routine degree of leverage, which, if observed in any other type of financial institution, might be described as "eye-popping." To give a familiar example, the Federal Reserve recently announced that it earned quite substantial profits ($79.5 billion) in 2013 from its $4 trillion debt portfolio, all against a capital of only $55 billion (Board of Governors of the Federal Reserve System 2014a, b). Yet such is the popularity of the Fed's own obligations, packaged as circulating notes or deposit accounts, that the publication of these figures generated only light interest in the financial press. In the twenty-first century, the near-universal acceptance of central banks' debt as money has made such leverage a commonplace, if not always uncontroversial phenomenon (Fawley and Neely 2013).

The history of central banking shows that this was not always so. Proto-central banks (often operating as privileged private institutions) struggled to balance leverage (then as now, necessary in order to provide income for the banks and their sponsoring governments) with acceptance by the public (necessary in order to build a revenue base). A celebrated and decisive engineering breakthrough was provided by the Bank of England (founded in 1694), which, through its winning formula of restrained note issue and adroit management of government debt, was able to thrive as no other public bank had before it. The Bank of England's success was neither immediate nor inevitable, however, and the Bank itself represented but one chapter in a long process of experimentation and "natural selection" that shaped the structure of modern central banks.

This essay will review the history of early European public banks from an evolutionary perspective. We will use the evolutionary metaphor as a narrative device to organize a dozen countries over four centuries and invoke this profusion of observations as our defense when we appear to ride the metaphor too hard.

Our essay begins with the emergence of the first of these institutions, circa 1400 and ends approximately in 1815. The latter year marks the end of the Napoleonic Era, which as will be seen, served as an "extinction event" for many of these early banks. To extend the Darwinian metaphor, our essay will collect specimens (life histories of individual institutions), propose a taxonomy, and

offer some hypotheses concerning the origin of today's species of central bank.[1]

Our conclusions depend crucially on the set of institutions that we review. We have tried to be comprehensive, or at least inquisitive, and avoid survivor bias.[2] The nature of the sources makes this difficult: short-lived experiments leave less of a trace in the record (unless their failure is spectacular, like the French bank of 1716–20). In addition, while it may be clear that these institutions were forerunners of modern central banks, they often did not look like them. Under the term "public bank" we include government-owned and operated banks, but also purely private institutions with unique legal privileges, as well as a range of intermediate entities whose governance structures sometimes resist taxonomic classification. The set of specimens examined is somewhat arbitrary, but all institutions studied shared the goal of creating a legally privileged, previously unavailable type of monetary asset.

All metaphors have limits, including ours. We are aware that blind forces are not at work here, but human beings grappling for solutions to problems they perhaps do not fully understand. Nor do we necessarily think that all hill-climbing algorithms find the global optimum: where one arrives often depends on initial conditions and on the path followed. So we will also use another metaphor: central banking involves a sort of alchemy, and what we see in our history is a search for the right formula. We do not conclude that it has been found; if anything, we are left with a sense that the search continues.

# 1 The primordial soup: medieval and early modern money

The magic glue that binds together modern central banks' balance sheets is a factor known as "money demand": the widespread willingness of firms and individuals to hold central bank claims, bearing little or no interest, as a medium of exchange or store of value. Money demand enables central banks to generate income and to pursue policy goals while operating with little or no conventional equity. The importance of money demand can be grasped from estimates of modern central banks' "comprehensive net worth" (Archer and Moser-Boehm

[1]This review draws on the survey of the secondary literature in Roberds and Velde (2014).

[2]In terms of our guiding metaphor, if we only look for mammal fossils we will miss the dinosaurs.

2013), which attempt to adjust central bank equity by incorporating the off-balance sheet asset of discounted future seigniorage. Performing this adjustment for the Federal Reserve, for example, yields estimates of comprehensive net worth of $1 trillion or more.[3] Such figures reflect the value of the liquidity services rendered by central banks.

Reduced to its most elemental terms, the challenge of early public banks was to create a money demand where none existed. In one sense, this should not have been a difficult task, as medieval and early modern forms of money and near-money were beset with numerous problems.

Even transactions with coin were rarely straightforward. After economic exchanges had evolved out of barter, prices were expressed and debts were settled in coined metal—and, since Roman times at least, the right to define and produce (or have someone produce) coins was a prerogative of the State. But with debasements and the introduction of coins of different sizes and contents in medieval times, coinage could not provide an unambiguous and litigation-free means of settling debts. Different coins could and did have different values over time, a fact which increasing attempts at regulation could never satisfactorily eliminate. Debasements, undertaken for both fiscal and monetary reasons, kept the stock of circulating coins in constant flux. Fluctuations in exchange rates, competition from neighboring mints, variations in the market price of different metals plagued exchanges and made it difficult to establish a stable unit of account. A coin regarded as highly desirable tended to disappear from circulation, often to reappear as a "ghost money," i.e., a unit of account tied to the seldom-circulated coin at a historic rate. The problem of instability in units of account persisted throughout our period of interest, and was not fully resolved until the nineteenth century (Sargent and Velde 2002).

A commodity money system was inherently wasteful. Metal stocked in the form of coinage represents resources that are not used to satisfy economic wants. Hence a pressure has always existed to find ways to economize on the stock of coined metals to execute exchanges and settle debts.

These two problems, the multiplicity of coins and the desire to avoid their use, lie at the origins of banking. Medieval banking began with the *campsores* or money-changers who dealt with the first problem. In response to the second problem, the moneychangers' *depositum regulare* (a deposit claim on a specific

[3]Archer and Moser-Boehm (2013, 11), Del Negro and Sims (2013, 42). These estimates assume that the Fed would retain all future seigniorage.

coin) evolved into the *depositum irregulare* (a claim on fungible coin). The latter allowed fractional reserve banking, payments occurring as book-entry transfers of deposit claims. Over time a payment by book-entry transfer became accepted as a valid discharge of debt, that had the additional advantage of providing legally admissible evidence of payment. This form of payment by transfers of deposits is variously called "in bank," "transfer," or "giro."

Such payment economized on resources and reduced transactions costs but also faced problems. As well documented for Venice by Mueller (1979, 1997), private banking was fragile, because commercial and merchant banking were integrated, properly diversifying risk was difficult, and enterprises that were tied to individuals had limited life-spans in the absence of the legal form of commercial corporations.[4] The fragility manifested itself in waves of bankruptcies that seriously disrupted the industry. In response to this fragility banks were regulated heavily by local governments, either as a matter of regalian rights (as in Germany) or as a matter of public policy. To interpret the regulations in modern terms, they could take the form of capital requirements by defining the pool of assets that could be seized in case of bankruptcy (the banker's own head being an extreme form of "skin in the game"). They also placed restrictions on the assets that the banker could hold, notably on the basis of their perceived risk. The liabilities were also regulated, and making deposits demandable on very short notice appears to have emerged to discipline bankers (Diamond and Rajan 2001). Of course, given the problem with fluctuating values of coins, governments also imposed on bankers the obligation of abiding legal valuations of coins. These regulations were often ineffective, either in curtailing bank failures, or in maintaining a predictable exchange rate between *moneta in obligatione* (the money owed) and *moneta in solutione* (the money repaid). Dissatisfaction with private banks led many localities to found public banks.

Private debts (or orders to pay) were also used in transactions between merchants, but these too were subject to difficulties. Full transferability of these instruments did not become possible until the development of negotiable and later bearer instruments, and even then there remained problems of settlement. In many cities, obligations could be periodically canceled through the quasi-netting process of *rescontre* (Börner and Hatfield 2010). Customs regarding

[4]Of course, non-commercial corporations could and did enter the banking business. But the Knights Templars' success as a bank may ironically have led to its early demise.

the transfer and settlement of such instruments were eventually codified into widely understood "laws merchant," but the formality of these customs limited the use of private debt as money.

Another common problem was that overuse of endorsement could lead to uncomfortably long chains of indebtedness. Merchants who advocated the founding of a public bank complained of sometimes receiving bills with as many as ten or twenty signatures (see Lattes 1869, 172 for Venice, Van Dillen 1964b for Amsterdam). As trading expanded and endorsement became more prevalent, this problem became more resistant to solution through the traditional method of *rescontre.*

Government debt, often thought of as a near-money in the modern world, was in most cases less liquid than private obligations. The traditional form of government debt was long or perpetual annuities, often secured by specific tax revenues. In areas of Roman law annuities were considered as a form of real estate and the costs of transferring ownership could be onerous. Secondary markets could be thin or nonexistent, and the threat of default made the value of government debt uncertain, even in well-run municipal governments (as the case of Genoa will show).

# 2 Life Histories

### *The first generation of public banks*

Into this world were born the first public banks, from 1400 to circa 1650. Banks in this "first generation" issued obligations that were transferable only as book entries, just like those of the private banks. From 1650, a "second generation" of note issuers becomes increasingly predominant.

While the early public banks differed in many details they all were charged with the task of creating claims of a more stable and liquid character than existing monies or near-monies. There were many challenges involved. At the theoretical level, the Modigliani-Miller benchmark suggests that special factors are required in order for such repackaging of assets to be relevant. At a more practical level, a public bank needed to persuade a sufficient number of typically skeptical merchants to adopt its claims as a monetary asset.

To this end, funds held in accounts at public banks were invariably given legal privileges, e.g., an elevated status in the settlement of certain debts and

freedom from attachment or taxation. The historical record indicates, however, that such privileges were by themselves insufficient to attract a critical mass of users to a public bank. Success instead depended on the existence of credible mechanisms for limiting the asymmetric information and enforcement frictions that hindered the use of alternative assets (which themselves were the backing assets for the public banks). There as yet was no standard technique for doing this, which led to a degree of institutional experimentation. Below we briefly sketch the approaches taken by some of the first generation of public banks.

One recurrent feature in the history of this first generation is the "agio," which is simply the market exchange rate between balances in the bank and "current money," meaning the current stock of coinage as valued by legal tender laws in terms of a unit of account. Current money was unstable because legal tender laws changed, and because which coin currently circulated at its legal value changed with debasements, imports of foreign coins, and wear.

*Barcelona and Catalonia*

To Barcelona is usually given the honor of the first public bank in Europe (Usher 1934, Sánchez Sarto 1934, Riu 1979, Passola 1999). The *Taula de Canvi* was founded in 1401 as a city agency fore one main purpose: to provide the city with alternate means of funding itself. To this effect the Bank, whose solvability was guaranteed by the city, received deposits and even had a monopoly on certain types of deposits (conditioned, that is, payable when certain stipulated conditions were met). It did not keep 100% reserves. It provided short-term financing to the city and served as fiscal agent, and sometimes as fiscal enforcer, for example in the 1412 reform of municipal finances that tasked the Bank with applying new budgetary rules (Ortí Gost 2007). In principle it could not lend to private parties although it appears that overdrafts were common in the 15th century. Its relation with the private banking sector were tense throughout its history: private bankers were repeatedly prohibited from having accounts at the Bank. At various times special privileges were given to the Bank, such as a monopoly on settling bills of exchange from 1446 to 1499, and (briefly) all transactions above a certain size. From 1468 balances at the Taula were exempt from seizure.

The Bank, like its counterparts in Europe, had to deal with periodic debasements and disruptions in rates of exchange between coins. In 1453,

following a debasement of the currency of Aragon, deposits were revalued but to a lesser extent than the currency's debasement (Usher 1943, 376). In the early 17th century monetary disorders prompted the creation of a separate bank, the *Banch de la Ciutat*, to accept deposits in all sorts of coinage (even clipped and worn) at its discretion. The Bank of the City was kept separate from the Taula although it was possible to transfer balances between the two. Usher (1943, 433–58) claims that the Banch's losses on exchange were subsidized by the city.

The Bank's initial purpose as funding vehicle for the city was severely put to the test in the 1460s when the city rebelled against the crown of Aragon. Pressed to make loans to finance the war the Bank was forced to suspend convertibility of its balances in 1463. In 1468 the Bank was reorganized; new ledgers were opened while existing depositors were given a choice between receiving annuities or waiting for full redemption out of the city's future surpluses, a process that took decades. After the reorganization the Bank was prohibited from lending to the city, and abided the rule for nearly two centuries.

The next major crisis occurred when Catalonia tried to secede from the Spanish monarchy in 1640. The two Banks were pressed into service to lend to the principality of Catalonia; payments were again suspended, from 1641 to 1653. At the same time large issues of essentially fiat copper currency brought substantial inflation. After Barcelona was retaken in 1653 a lengthy and complex process began to convert existing balances: in essence, depositors were again given a choice between annuities (in amounts indexed on the depreciation of the currency at the time deposits were made) and transferring balances to the new accounts and convert therein old balances at a small fraction of face value.

The final episode of Catalonia's struggle against the Spanish monarchy, during the War of Spanish Succession, ended in 1714 with a complete loss of autonomy. The Banks were reorganized as pure transfer banks and survived uneventfully until absorption into the Bank of Spain in 1853.

It is noteworthy that the Taula inspired a series of imitations throughout Catalonia (Passola 1999), in cities including Valencia (1407–14, 1519–1649, 1649–1720), Saragossa (1550–1707), Mallorca (several in the fifteenth century, and 1507–1833), Perpinyà (from 1404), Girona (1443, 1567–1711), Tarragona (1585–1741), Lleida (1585–1707), Manresa (1603–late eighteenth century),

Tortosa (1587–late seventeenth century), Olot, Cervera, Vic (1582–1760s). This proliferation is remarkable for the small size of some cities: Olot, the smallest, numbered less than 2,000 inhabitants in the early 16th century. These banks were all more or less modeled on their counterparts in Barcelona, designed to accept deposits, make transfers, lend to their municipalities and act as fiscal agents; they also endured the same vicissitudes as their counterparts in Barcelona.

*Genoa*

The city of Genoa had issued debt backed by specific tax revenues since the 12th century; in 1404 the *Casa di San Giorgio* was created to consolidate various issues, represent the creditors, and ensure the collection of their claims. This remarkable corporation, whose main task was monitoring tax collection and managing payments to creditors of the City, lasted as long as the Republic itself and grew into a powerful non-governmental organization.

The Casa's involvement in banking occurred in two phases, the first from 1408 to 1444 and the second from 1530, or more clearly from 1675 on. The intentions behind the creation of the bank were stated clearly: to reduce the debt (implying that banking would be a source of profit) and to enforce the legal tender laws. The bank accepted deposits, which not demandable but payable at term (Sieveking 1906, 87, fn2). It made loans only to the city and to the tax farmers and collectors, on collateral. It dealt in foreign exchange only in relation to the collection of revenues from Genoese territories in the Eastern Mediterranean. Business developed quickly, but the Bank was unable to fulfill the city's mandate of maintaining stable exchange rates between coins. A monetary reform in 1437 (during which the Bank's balances were made legal tender) failed to stem the rise in the market price of the gold coin, and when the city gave the Casa the choice between abiding the legal valuation of the gold coin and relinquishing its banking license, the Casa chose the latter (1444).

The Casa did not formally reopen a bank until 1530, but in the meantime its ledgers provided giro services, in the following way. Payments of tax revenues were often delayed and as a convenience accrued interest became transferable between creditors on the Casa's books. These sums were actively used for a wide range of transactions. A secondary market developed for these credits,

which were bought up by tax farmers to discharge their obligations. The Casa thus gradually acquired expertise in the banking business. The archives show that a new banking ledger was opened in 1530, probably for the Casa's own business at first, but soon private deposits were accepted. The mode of operation is not well known for the early years, but loans were granted sparingly. Operations become clearer when the Casa opened several banks in succession, each dedicated to a specific coin: gold (1586), Genoese silver (1606), Spanish silver (1625). Clearly the Casa was avoiding the pitfalls of the 15th century and protecting itself from the risks of abiding legal valuations of coins.

By the mid-17th century there was a consensus that a broader form of bank was needed, and after some debate it was decided to entrust it to the Casa rather than the city. In 1675 the Casa was allowed to open a ledger in current money, for which all sorts of coins were accepted in deposit. While the bank was to obey legal valuations, it had the right to choose which coin to repay. It was denied the right to operate a Lombard facility (offering small collateralized loans to individuals), loans to the city were restricted to short terms and subject to approval by a general assembly. The new bank copied several features from foreign counterparts: the settlement of bills of exchange was mandated through the bank as in Venice and Amsterdam. It also copied from Neapolitan banks the use of circulating deposit certificates (*fede di credito*).

The agio on the bank's money was fairly stable until the early 18th century. The bank faced a serious crisis during the 1740s. It had been helping the city with the cost of keeping its restive Corsican possession. In addition the city abandoned its neutrality in the ongoing War of Austrian Succession but was soon occupied by Austria in 1746 and saddled with a large war indemnity. The bank was forced to suspend payments. Existing depositors were repaid in bonds and a new bank was opened. The city eventually repaid its debt to the Casa which was able to redeem its bonds.

The end of the bank came with the end of the Casa. The French-sponsored Republican regime, established in 1797, regarded the very nature of the Casa as unacceptable: the government, not a private corporation, ought to control public revenues.[5] The Casa was eventually abolished and its creditors (including creditors of the bank) became creditors of the State. When the Republic of

[5]There is an interesting parallel with the arguments used during the French Revolution to reject the creation of a central bank (Sargent and Velde 1995).

Genoa was briefly recreated in 1814, an attempt was made to recreate the Casa and the bank, but the attempt ended when Piedmont annexed Genoa.

*Venice*

The history of Venice provides two quite distinct examples of public banks.

The first, called the *Banco della Piazza di Rialto* or *Banco di Rialto*, was founded only in 1587, but had been preceded by several plans or attempts to remedy what seemed to be persistent shortcomings of the private banks. Venetian banks were few (less than a half-dozen) and as elsewhere held deposits and invested in a variety of assets, restricted in various ways over time by regulations. In 1526, when bank money stood at a 20% discount to cash, banking supervisors were created and bankers were required to pay deposits in cash without delay when demanded. Yet by 1584 the last private bank in Venice went bankrupt, and the Senate resolved, not without dissent, to license a strictly regulated, 100%-reserves, privately owned bank. The banker to be chosen to operate it was to liquidate the bank after three years (a radical form of supervision) and to be held responsible for any losses.

The bank performed reasonably well, and in 1593 it was required that all foreign bills of exchange be cleared on the books of the bank, apparently to improve their settlement. Nevertheless, as the bank was founded amidst continuing movements in exchange rates between coins an agio developed on bank money relative to current money. The bank had to make decisions continually on which coins to accept and pay out.

Quite different was Venice's second public bank, the *banco del Giro*, founded in 1619 while the Banco di Rialto was still operating. Here the motivation was to make liquid a public debt. Not long before, the Grain Office had kept a ledger of its creditors (grain merchants) and allowed them to make transfers between themselves. Although that debt was redeemed within a few years, a similar debt arose from a purchase of bullion by the mint from one merchant, who proposed a similar arrangement. As a temporary measure the Senate created an office at the mint to allow the merchant to pay his own creditors by transfers on a ledger; the credits were made legal tender for large payments, and ten years later accepted in payment of taxes. Some of the bullion, minted, was kept as a reserve, and the Senate authorized regular payments to the office at the mint to meet redemptions. By trial and error an appropriate level

of reserves emerged and the City found it convenient to issue more debt by creating credits on the ledger.

This new bank was so successful that the Banco di Rialto withered and was shut down in 1638. At the same time, as the agio on bank money rose, pressure increased to have the Banco di Giro accept deposits (i.e., sell its liabilities), which it did from 1645. By 1651, bank money had become the sole tender for large payments including foreign exchange (although, as is often the case with such provisions, it is not clear that it was enforced).

Its origin a fiscal tool exposed the Banco di Giro more directly to the vicissitudes of Venetian public finance. Throughout the seventeenth century, Venice fought expensive wars against the Ottoman Empire; heavy issues of Giro balances led to a suspension of convertibility from 1648 to 1666. When convertibility was resumed the bank's balances were effectively devalued by 20%, and the bank gained full discretion in the choice of which coins to pay out. Another suspension took place from 1714 to 1739; during that time the bank offered demand depositors the option to convert their balances to interest-bearing time deposits. The bank was eventually bailed out by tax revenues and convertibility restored. The rest of the eighteenth century brought no major disruptions: proposals to have the bank issue paper liabilities were rejected several times. When the French invasion of 1797 brought down the Republic the bank closed for a while and did not resume full convertibility after reopening. The new Austrian authorities refused to assume the city's debt to the bank, but the government of Napoleon did in 1805 and depositors became bondholders.

*Early German municipal banks (15th-16th centuries)*

In the German Empire, money-changing like minting was a regalian right. Both activities were originally delegated to guild-like organizations (*Hausgenossenschaften*) in most localities, but as commerce developed, city governments began to take more direct control. Public banks (*Stadtwechsel*) arose in many cities, including Augsburg, Basel, Bremen, Cologne, Erfurt, Frankfurt, Konstanz, Lübeck, Merseburg, Strasbourg, and Wismar. These were often temporary operations, in some cases structured as joint ventures with private bankers, in other cases delegated entirely to the latter. The original focus of these banks was moneychanging, but over a time they expanded into other

banking activities, including book-entry payments, making Lombard loans, and offering interest-bearing (time) deposits. Generally speaking, however, these were modest institutions of only local significance (Hallauer 1904, Günther 1932).

Similar institutions (*stadswissel*) existed in the Low Countries during this time, but banking activity there, especially giro payment, soon came to be dominated by private bankers known as cashiers. In the Dutch Republic, the cashiers were eventually displaced to a large extent by the Bank of Amsterdam and similar institutions (see next section). By contrast, in the Southern Low Countries, giro payment activity continued to be dominated by cashiers until the end of the Napoleonic period. Interestingly, from the mid-seventeenth century onward the dominant unit of account for the Southern Low Countries' transactions was the "bank florin," i.e., the units of the ledger-money of the Bank of Amsterdam (Aerts 2011).

*The Dutch Republic*

In 1609 the city of Amsterdam founded the Bank of Amsterdam (*Amsterdamsche Wisselbank*). At the time, commerce in Amsterdam was hindered by a unit of account based on an obsolete silver coin, and by irregularities in the settlement of bills of exchange. The initial design of the Bank borrowed heavily from Venice's Banco di Rialto The Bank's charter granted it extensive legal privileges. Bills of exchange for large amounts were to be settled exclusively through the Bank. Private bankers (cashiers) were simultaneously outlawed, though these soon returned in a secondary role. To promote confidence in the Bank, it was to accept only recognized coins at legal value, and other coins by weight only. Lending activity was prohibited. Instead, the Bank was to be funded by fee income, principally 1.5% charges on deposit withdrawals, which were generally restricted to full-weight Dutch domestic coins (Van Dillen 1934, 1964b). Over its lifetime the Bank enjoyed considerable success (see Figure 1) and initiated a number of significant innovations.

The first innovation was to gain control over Amsterdam's (and de facto, the Republic's) unit of account. This occurred around 1641 when the Republic assigned too high a value to a coin from the Spanish Netherlands, the patagon, in effect debasing the currency. The Bank chose to ignore this valuation and to "haircut" the patagon, a move that was applauded by Amsterdam merchants

and later legally sanctioned by the Republic. This gave rise to a separate unit of account for Bank funds and a domestic exchange rate (or agio) between Bank funds and circulating coin. Bank funds became the dominant unit of account for commercial transactions (Van Dillen 1964b, Quinn and Roberds 2009).

A second major innovation came in 1683 when the Bank began to issue negotiable receipts for deposits of coin, which allowed the bearer of the receipt to reclaim the deposited coin within six months at a much smaller fee (usually 0.25% of the deposit) than the traditional fee on withdrawal. Bank deposits then became de facto inconvertible, and someone with Bank funds who wished to withdraw would then buy a receipt on a market that was operated by cashiers (Van Dillen 1964c). This reduction in the user costs increased both Bank deposits and velocity of giro payments made through the Bank (Dehing 2012, Quinn and Roberds 2014).

The Bank also successfully innovated in response to two late eighteenth-century financial crises. In the first (1763) it sold balances against bullion rather than coin (Quinn and Roberds 2012); in the second (1772–73) it funded a city-operated loan facility for distressed merchants (Breen 1900).

This indicates that the Bank did not fully adhere to the prohibition against lending in its charter. Over its history the Bank regularly lent to privileged parties, especially the Dutch East India Company (VOC). Profits from lending were returned to the city. For much of the Bank's history, the extent of such lending was well controlled, as evidenced by the Bank's lifetime reserve ratio of 82% (Dehing and 't Hart 1997). Eventually, however, extensive wartime (1781–83) loans to the VOC undermined market confidence in the Bank, and collapse followed in 1795 .(Van Dillen 1964a)

The success of Amsterdam's bank encouraged the founding of similar institutions in other cities of the Republic (Delft, Middelburg, and Rotterdam). These did not achieve the success of Amsterdam. A common problem was that these banks's credit activities were less disciplined than those of Amsterdam, resulting in too many suspensions. Nor were these institutions able to establish a unit of account distinct from the "current guilder" that was applied to circulating coins. After Dutch domestic coinage stabilized in the eighteenth century, much local business was conducted in current money terms, undermining the rationale for the banks' existence. These institutions did not survive beyond the early nineteenth century with the exception of Middelburg, which persisted

until 1861 (Mees 1838, Sneller 1938a,c,b).

*Hamburg*

The Bank of Hamburg (Hamburger Bank) was founded in 1619 during a period of intense coin debasement in much of Germany, known as the *Kipper- und Wipperzeit*. Following Amsterdam, the Bank of Hamburg's charter granted deposits freedom from attachment and required all bills of exchange drawn on parties in Hamburg to be payable through the Bank. Differently from Amsterdam, the Bank's charter allowed it lend to the city government of Hamburg, and to private parties against collateral. Partial balance sheets compiled by Sieveking (1934b) suggest that by the mid-17th century, over half the Bank's assets consisted of loans.

The Bank was successful from its beginning, but suffered many bouts of instability over the first 150 years of its existence. The 1672 French invasion of the Netherlands caused a run and forced the Bank to suspend withdrawals and to restrict eligible collateral for its loans to metal. Lengthy suspensions occurred again in 1755–61 and 1766–68 (Levy von Halle 1891, Sieveking 1934b).

As in Amsterdam, Bank of Hamburg money had its own unit of account (*mark banco*) and enjoyed a premium or agio over current money. Unlike Amsterdam, instability in locally prevalent current money made the Hamburg agio fluctuate wildly. By 1726, the discount on current money reached 34% and the city attempted to stabilize the situation by requiring the Bank to operate a "current money bank" (a parallel set of accounts kept in current marks, at fixed exchange rates). This was a money-losing operation and had to be given up in 1737 (Sieveking 1934b, Schneider et al. 1991).

The Bank enjoyed more lasting success from 1770, when it began to allow deposits in silver bullion rather than coin. Deposits of coin were largely abolished by 1790 in favor of the "pure silver currency" (*Reinsilberwährung*) of bullion-backed ledger-money. The popularity of the Bank increased in the wake of Amsterdam's difficulties in the 1780s, and the Bank was heavily used by Hamburg merchants until its activities were taken over by the Reichsbank in 1876 (Levy von Halle 1891, Sieveking 1934b).

*Nuremberg*

The city of Nuremberg founded its Public Bank (*Nürnberger Banco Publico*) in 1621. As in Hamburg, impetus for the Bank's founding was provided by the rampant debasement of the Kipper- und Wipperzeit (Schnabel and Shin 2006). The Public Bank was a deposit-based, fee-funded institution modeled on the Bank of Amsterdam. Use of the Bank was encouraged by freedom of attachment for bank funds, a formal requirement to settle all debts in bank, hefty fines for non-compliance, and the death penalty for anyone caught using debased coinage (Denzel 2012, White 2012).

Initially these measures seem to have worked. However, the Bank's popularity was soon undermined by a 1623 coinage reform and the city's policy of borrowing virtually all the Bank's reserves of coin. Although the Bank had been repaid by 1634, confidence had been lost. A renewed wave of debasements in the 1660s was poorly handled, via a partial suspension and a restriction of withdrawals to light coins. Accounts were moved to a current-money basis in 1691, and the city's adoption of a stable coinage standard in 1765 reduced the Bank's business to frictional levels. It was liquidated in 1831 (Denzel 2012).

*Common themes*

Several themes are prominent in the life-histories of the first generation of public banks. One is experimentation: there were as yet no accepted norms for the creation and operation of public banks. Accordingly, some institutions were publicly owned while others operated as privileged private entities. The capitalization and the legal status of bank obligations also varied. The banks' backing assets consisted of differing mixtures of metal, private obligations, and the debt of their sponsoring governments.

A related theme is instability. The experimental nature of the first-generation banks often led to loss of public confidence and runs. Lengthy suspensions of withdrawals were common, and outright closure not unheard of (e.g., Genoa 1444, Venice 1638). Ultimately, the successful public banks tended to be characterized by a high degree of conservatism in their design and operation (e.g., Amsterdam and Hamburg).

And even when successful, first-generation public banks were seen as highly specialized institutions, more akin to today's financial market utilities than

today's central banks. Their clientele was seen as limited to wealthy merchants in commercial cities. Statistics compiled by Dehing (2012) for the Bank of Amsterdam support this view: about two percent of Amsterdam's population held accounts at the Bank, and the average Bank giro payment was equal to about ten times the annual income of a typical Amsterdam resident. Moreover, because a principal mission of many first-generation public banks was to discourage the circulation of debased coin, the operation of public banks was thought to conflict with the financial interests of monarchical governments that depended heavily on seigniorage as revenue source. Summarizing the accepted wisdom of the time, Frederick the Great's counselor Calzabigi wrote in 1765 that "a ledger-money bank is not allowed under a monarchy because it makes most coin payments unnecessary, and therefore reduces the income from seigniorage" (Niebuhr 1854, 183).

### *Second-generation banks*

Views about the political prerequisites for maintaining a public bank changed with popularization of the bearer banknote. Compared with ledger-money, payment by banknote was convenient, (usually) anonymous, and free from transfer fees, so was practical for smaller sums. Seen at first an experimental product, circulating notes became more accepted following their adoption by the Bank of England; see the discussion below. Banknotes were popular with governments, too, as England's example opened many Continental monarchs' eyes to the capabilities of public banks as engines of government finance.

This generational shift in public banks' product mix (from ledger money to circulating notes), customer base (from more to less wealthy), and habitat (from merchant-dominated commercial cities to monarchical states) also increased the potential for their fiscal abuse. Fiscal demands on public banks became acute during the Napoleonic period, leading to suspension of convertibility and paper-money inflations in many of the cases we study. Some degree of postwar restructuring was necessary before public banks could return to their full prewar functionality. And, for many of the early public banks, liquidation was by that point the more practical alternative.

*The counterexample of Naples*

The banks of Naples do not meet our definition of public banks. We nevertheless include them in the survey, not because they have often been mistaken for public banks, but for the interesting counter-example that they offer (Demarco 2000b,a, Balletta 2009).

Naples, the second-largest city in Europe after Paris in the sixteenth and seventeenth centuries, was ruled in the name of the Spanish king by a viceroy. As elsewhere private sector banking was unreliable, but the solution that emerged was different. From 1584 to 1597 a total of seven charitable institutions obtained from the viceroy permission to open banks. An eighth bank was created in 1661 by the administrators of the wheat tax. Until 1815 this set of banks, unchanged except for one failure, accepted deposits and provided banking services to the general public. Their specialization was geographic, except for the eighth bank which catered to the government and the court. The banks were owned by non-profit organizations (hospitals, confraternities, and charitable Lombard facilities), long-lived corporations with strict governance. Their assets combined loans to the public and private sector as well as shares in tax farms, but their high level of reserves, well above 50%, allowed them to survive two monetary disturbances in the seventeenth century as well as the rebellion of 1648–49 against Spain. When one bank did fail in 1702 the viceroy leaned on the other banks to take over the deposits at full value.

Conservatively managed, the Neapolitan banks were nevertheless financially innovative. Naples became well-known for the *fede di credito*, originally a certificate of the sums deposited that became negotiable: a simple endorsement was sufficient proof for the assignee to be credited with the funds at the bank.

*Sweden*

Sweden saw extensive experimentation with banknote issue over the 17th and 18th centuries. One factor influencing the use of banknotes, unique to Sweden over this time period, was its adherence to a copper standard for long intervals (Edvinsson 2010b). Notes were favored since the weight of copper coins made them impractical for large-value transactions. Note issue began as early as 1657 with the founding of the *Stockholms Banco*, a privileged private

institution inspired by the exchange banks of Hamburg and Amsterdam. The Stockholms Banco granted credit not through its accounts, but through the issue of pre-printed redeemable notes in round denominations. Despite or perhaps due to this innovation, Stockholms Banco soon became overextended and was closed in 1664 (Heckscher 1934).

A second attempt to set up a public bank came in 1668 with the founding of the Bank of the Parliament (*Riksen Ständers Bank*). The Bank, formally divided into separate lending and exchange operations, was overseen by an appointed commission and initially forbidden to issue notes. The Bank's operations were dominated by the lending bank, whose main asset consisted of mortgages made at legally fixed interest rates (Fregert 2012).

The Bank began to issue notes in 1701, at first in only minor amounts. Fiscal demands of the Great Nordic War (1700–1718) caused the Bank to venture into government finance, eventually leading to a drain on reserves and a 25-year suspension of deposit withdrawals (1710–1735). Notes issued by the Bank became increasingly popular from 1726, when they became legal tender for tax payments. Additional wars began in 1740 and forced the Bank to suspend convertibility by 1745, due to extensive credits granted to both the government and the private sector (through mortgages). Convertibility was not restored until 1777, with the introduction of a new, silver-based unit of account (Riksdaler) that effectively reduced the metallic value of Bank money by half (Heckscher 1934, Edvinsson 2010a, Fregert 2012).

With the renewed outbreak of war in 1788–90, the Bank's refusal to engage in inflationary finance caused the Treasury to issue its own inconvertible paper, leading to parallel units of account. Resumption of war in 1808 led the Bank to issue its own paper which itself soon became inconvertible, leading to a confusing situation of three competing units of account (on Treasury notes, the Bank's notes, and silver; see Edvinsson 2010c). A definitive monetary reform could not occur until 1834. In 1865, the Bank received its current name, the *Sveriges Riksbank* (Fregert 2012).

*England*

The Bank of England was founded in 1694 soon after a revolution. However glorious it may have become in retrospect the regime it established was far from secure. A legitimate king had been expelled by a foreign invasion and

the new rulers took England into a war against France that turned out to be prolonged, costly, and dangerous for the new regime. The Bank's foundation was in fact the floatation of a government loan: in return for lending money for the war effort creditors received a 8% annuity and a banking license. The new institution would practice on a larger, corporate scale, what goldsmiths had been doing for decades in London: receiving deposits, keeping accounts, discounting bills, and circulating negotiable notes.

Since the Bank's foundation was really a securitization of government debt (Quinn 2008) the Bank was tied to government finances from birth. It ran into difficulties very early: the government pressed it for help in delivering funds to its troops on the Continent, and a badly needed but ill-conceived general recoinage reduced the available silver currency. Both drains, one external and the other internal, led to a suspension of convertibility in 1696. But further demands from the government allowed the Bank to bargain for further privileges, in particular a commitment not to charter another bank. During the following war the Bank negotiated another important privilege, a partial monopoly on note issue in England.

Trading government debt for a risky but potentially lucrative monopoly seemed to be a successful technique and it was used again when the South Sea company was created in 1711. The South Sea Company proved less adept at exploiting its trading monopoly but nevertheless convinced the government to apply the technique more generally to most of the public debt. The Bank felt compelled to come up with a competing offer but was fortunate enough to see it turned down. It came out of the South Sea fiasco unscathed and helped to government's clean-up operation by buying more debt.

The Bank's position as a key element of British public finance was consolidated over the rest of the eighteenth century. Its role was to be the government's bank, service the long-term debt, and ensure the liquidity of the short-term debt issued during wars until it was funded. Although a majority of its assets was public debt it was also a classic bank, holding deposits and discounting bills, and was a dominant player in the money market. As such it played a role in mitigating the financial crises of the late eighteenth century (1763, 1782, 1793) although the example of Amsterdam shows that it was not unique in this role.

The Revolutionary and Napoleonic Wars of 1793–1802 and 1803–15 presented for Britain as for many other countries unprecedented fiscal demands.

The government, however, did not use the Bank as a main fiscal tool: the Bank never held more than 5% of the public debt in its portfolio. The Bank did play its now traditional role of easing the Exchequer's financing, and the accidental suspension of convertibility in 1797 (initially due to an external drain prompted by France's remonetization after the collapse of its paper money) was extended for the duration of the war as a matter of convenience. As the Bank continued both to support government issues of short-term debt and to discount private bills, but freed of any convertibility constraint, the outstanding stock of money grew considerably. As a result Britain experienced what was now familiar to other countries, namely a paper-money inflation, but a mild one compared with France's earlier experience, or with Austria's contemporaneous experience. After the war the Bank gradually contracted its balance sheet and the government raised the revenues needed to redeem its debt to the Bank, and convertibility was restored in 1819.

*France*

Two banks make their apparition in France in our survey. The first, short-lived but spectacular, was the *Banque générale* (renamed *Banque Royale*) from 1716 to 1720. The second was the *Caisse d'Escompte* founded in 1776; abolished during the Revolution, it was nevertheless the forerunner and in many ways the ancestor of the *Banque de France* founded in 1800.

*Law's Banque (1716–20)*

France's first note-issuing bank was the brainchild of an itinerant Scotsman named John Law. Law's original plan, as he advertised it, was in some ways close too traditional public banks: it was to be publicly controlled and the main purpose of its notes, initially backed by 100% reserves, was to serve as a payments system for the numerous receivers and paymasters of the French monarchy. The government of the time was weary: it had just seen the end of the costly War of Spanish Succession which had required large tax increases and partial defaults on the debt; it was still in the process of liquidating the unfunded debt and considered that a public bank would never gain credibility. A few months later Law was allowed to open the *Banque générale*, a private venture based on securitized debt after the model of the Bank of England: shares in the initial offering could be bought with government bonds, the

bank was allowed to issue notes redeemable on demand in a specific coin, hold deposits, discount bills, but could not engage in any trade except precious metals. Over the next two years, a series of government decrees conferred on the bank distinct advantages: bearer notes other than those of the bank were outlawed, tax collectors were obliged to accept the notes in payment of taxes and to redeem them on demand, and later to use them in all their transactions with the State.

The bank's success and the popularity of its notes were enhanced when, in 1718, a compulsory reminting replaced the coin in which the notes were denominated. The seigniorage tax imposed on coin-holders was partly waived for note-holders. Within a few months the private shareholders were bought out by the State and the *Banque générale* became *Banque royale*.

Law's ambitions went beyond banking; he chartered a trading company which progressively bought out existing privileged companies to become the French Indies Company and monopolize foreign trade. It also acquired other monopolies and eventually bought out the tax farms and mint leases. By August 1719 Law's company, financed by new issues of shares at increasing nominal prices, offered to refinance the whole national debt. A new, final issue of shares financed this last deal, effectively converting bondholders into shareholders of a private company in charge of collecting nearly all the taxes in France. The ensuing market frenzy drove the price of Indies shares to new heights and Law to the position of finance minister. In February 1720 the Bank, whose notes were progressively replacing gold and silver as sole legal tender, was merged with the Company. Law's extraordinary creature began like the Bank of England but mutated into the Casa di San Giorgio, but on the scale of an absolute monarchy of twenty million rather than a city-republic of sixty thousand.

While Law's debt-to-equity conversion, unlike the South Sea scheme which derived from it, was based on a fixed-price offering, the conversion itself was to take place through a sequence of payments, each of which bondholders had to be induced to make. Law had to prop up the price of his shares and eventually used his Bank's notes to do so, pegging the price of shares in terms of notes. The resulting increase in money supply drove down the foreign exchange and Law had to backtrack and find ways to reduce it; he tried to devalue the notes, but this prompted a run on the Bank in May 1720. Law's efforts to salvage the scheme at one point drew on yet another model, that of Amsterdam, creating

bank accounts and requiring all bills of exchange to clear on the bank's books. In the end the Indies Company went into receivership and Law into exile. The debt conversion was undone and the long-term debt painstakingly recreated, the old tax-farming system restored, and the Indies Company returned as a pure trading company.

*From the Caisse d'Escompte (1776–93) to the Banque de France (1800–present)*

At the conclusion of the Seven Years War, the French Indies Company, deprived of its Indian territories, was edging once again toward bankruptcy. Proposals to turn it into a bank that would fund overseas trade went nowhere and the company was shut down, its debt assumed by the State. The proponents succeeded a few years later in convincing the new finance minister (and distinguished economist) Turgot of the advantages of a note-issuing bank to fund trade. Turgot chartered the *Caisse d'Escompte* in 1776 as a private bank. No government debt was involved (a plan to have the company post bond in the form of a loan was soon dropped) and the government at first adopted a hands-off approach to the bank. Its business was to discount bills its management comprised experienced merchants and bankers. By the early 1780s it had turned into a bankers' bank and succeeded in bringing money market rates down in Paris. A clumsy attempt by a finance minister to secure a secret loan in 1783 prompted a near-run that was skillfully avoided, and although the relations with a government always able to rewrite the charter remained fraught with ambiguity, the Caisse did well, with rising note circulation and solid dividends.

The life of the Caisse was cut short by the Revolution; in 1788, when the monarchy was running out of sources of funds, it forced the Caisse to provide loans and made its notes legal tender. Within two years the Bastille had been torn down, a national assembly was writing a constitution, and a new currency managed directly by the government was backed by the value of confiscated church lands. The Caisse was repaid its loan and allowed to return to its business, but the course of political events changed rapidly. The French Revolutionary Wars started in 1792 and within a year the monarchy was overthrown, France was invaded from all sides, and the new currency was in free-fall. To prop up the currency the revolutionary government eliminated

all alternative forms of holding wealth (aside from land), shutting down the stock-market and all joint-stock companies. The Caisse was thus forced to close in 1793, but a few years later, many of shareholders and employees regrouped to form the *Caisse des Comptes Courants*, closely patterned on the Caisse. Within a few years an expanded coalition of major bankers, including close supporters of the new First Consul of the Republic, Bonaparte, founded the *Banque de France*, with which the Caisse was merged within weeks.

*Prussia*

Prussia's Royal Main Bank (*Königliche Hauptbank*) was founded by Frederick the Great in 1765. A motivation for the founding of the Main Bank was the "proof of concept" provided by the Bank of England, that a public bank could be compatible with both stable money and a monarchical appetite for revenue. The initial design of the Main Bank however more closely followed the Bank of Hamburg, combining a traditional ledger-money exchange bank with a lending bank. The Main Bank in its initial implementation was a complete failure, due to both management corruption and to the decision to tie the value of the Bank's money to a favored gold coin rather than the more widely circulating silver coinage (Niebuhr 1854).

The Main Bank was completely reorganized in 1766, and after an unsuccessful attempt at note issue, evolved into essentially a state-run savings institution. Accounts bore interest and the majority of these were redeemable at a week's notice. Loans were primarily long-term, fixed-rate mortgages. The risks inherent in this business model became apparent after 1806, when military setbacks at the hands of Napoleon led to a loss of territory and to disruptions to mortgage payments. One-third of the Main Bank's asset had to be written off, and operations were suspended until 1817 (Niebuhr 1854).

During the final years of the Napoleonic Era (1806–1813), Prussia resorted to the emission of notes. These were not issued through the Main Bank, but through a rival state-sponsored institution, the Maritime Enterprise (*Königliche Seehandlung*), probably because the Enterprise was seen as a stronger credit than the Main Bank. Convertibility of the Enterprise's notes was nonetheless soon suspended, and by 1808, their market value had collapsed to 23 percent of par (Conrad et al. 1901, Schleutker 1920).

At the conclusion of the Napoleonic wars, the Enterprise's notes were made

convertible at their original face value and gradually retired. The Main Bank cautiously resumed note issue, at first only with 100 percent metallic backing. Following the Bank's nationalization in 1847, this was reduced to a one-third backing requirement, with the remainder of the assets consisting of obligations of the Prussian state. In 1876, the nationalized bank was merged into the Reichsbank (Lichter 1999).

*Austria*

Austria's first attempt to set up a public bank came with the founding of the *Banco del Giro* in 1703, in response to a crisis in Imperial finance. This institution failed within a year, leading to the founding of a second bank in 1705, the Viennese Municipal Bank (*Wiener Stadtbank*), nominally under control of the City of Vienna. The Municipal Bank was only lightly used for payment purposes. The Bank instead emphasized interest-bearing time deposits, which it used to fund loans to the Imperial Treasury. Income was provided by tax and other dedicated Imperial revenue streams (Bidermann 1859). Fuchs (1998) emphasizes that the Stadtbank came into existence partly as a way of addressing creditors' fears of selective default by the Imperial treasury.

While the Municipal Bank achieved some success in reducing Austria's borrowing costs, its operations were hampered by an ever-growing portfolio of government debt and by constant infighting with the Treasury. After 1759 the Municipal Bank was increasingly dominated by the Treasury, and the bank was effectively nationalized in 1782 (Fuchs 1998).

In 1762, the Municipal Bank experimented with its first, modest issue of banknotes, which were given special advantages in transactions with the state and were soon retired from circulation. Additional, tentative emissions followed in 1770 and 1785. Following the outbreak of the Napoleonic wars, the stock of notes expanded sharply, growing at an average 23.6% annual rate over 1796–1811. Redeemability of the notes was soon suspended and they were given full legal tender status. As Imperial finances continued to deteriorate, an 1811 Imperial decree reduced the metallic equivalent of the notes by 80% from their original value. Even with this extreme devaluation, the notes did again not become redeemable until 1817, and then only partly in government bonds and partly in the notes of the newly chartered *Österreichische Nationalbank*.

The Viennese Municipal Bank was formally abolished in 1818 (Raudnitz 1917).

# 3 Taxonomy

Table 1 is a rough attempt at comparing the institutions we surveyed along certain key dimensions. In constituting this table we have tried to be "non-parametric." The characteristics that we chose consist of features that we see appear repeatedly in our historical survey.

Some features are very broad, based on the simple fact that these are all, in a modern sense, corporations: not individuals but legal entities that can hold and issue claims and therefore can sue and be sued.[6] Some form of ownership can be ascertained, although the language of the time may not be very clear: one way to think of ownership is to search for the residual claimant to profits but also losses (who is implicitly responsible for saving the entity if it runs into trouble).

Since they are financial corporations whose main business is creating claims, we can then distinguish the asset and liability side and see if any restrictions or on the contrary certain freedoms are given on the types of claims that can appear on either side.

We consider what type of services they provide. By "fiscal agent" we mean providing banking services to the State, such as managing current accounts and servicing the debt (distributing payments on interest and principal). Finally we consider two privileges that we find repeatedly conferred on the liabilities of the public banks. One is a monopoly on foreign exchange clearing: foreign bills of exchange were required to be settled on the books of the bank. The other is exemption from seizure in judicial proceedings, perhaps intended to make bank balances more competitive with cash.

The entries are arranged in chronological order of creation.

An important dimension which we have not studied is the form of governance and oversight over the public banks. A detailed study of the statutes would be required, but it is noteworthy that they are typically replete with detailed prescriptions on these matters. We also did not collect information on legal

[6]In the absence of a standard legal framework to create commercial corporations until the 19th century, any such creation involved some kind of derogation to current law, granted by the legislator, which might be called in the language of the time "privilege" without necessarily implying monopoly or exclusive rights.

tender status beyond the requirement to clear foreign bills of exchange because it was not commonly conferred, aside from a few cases (Genoa between 1437 and 1444, France in 1719–20, Vienna after 1797, England after 1810).

Some observations can be made.

There is no clear pattern regarding public or private ownership over time: although private ownership tends to be more common among second generation banks, it is not the norm. Profit-making is the norm in the second generation, but it occurs earlier. The goal of stabilizing coin values is dominant among the first generation and diminishes in importance in the eighteenth century, although it is still present in the Northern banks. Having 100% reserves is the exception, but an important one, since it is present in the first Venice bank and its immediate progeny in Amsterdam. Although the Amsterdam bank was a great success and an important model, that feature was not generally retained (although Northern banks sometimes operated an exchange department distinct from the lending department). The reserves that were held were normally in the form of coin, of ascertained and typically high quality (although some banks, like the Barcelona bank of 1609, were established explicitly to handle a wide variety of poor-quality coinage; we do not know much about the way in which those were handled).

Holding government debt is prevalent, although with many asterisks, as lending to government was often done in violation of the bank's statutes (as in Amsterdam). The loans might be made to the bank's owner, or to privileged entities or favored individuals; typically they were not collateralized, although there is some variance in practice. Holding private debt is much less common: the public banks were generally not designed to compete with or replace the private sector's intermediation activities. When it did take place it was typically collateralized, although again with varying practices. Note issue is the characteristic of second generation banks, but emerges first with the "counter-example" banks of Naples. Demandable deposits are common, savings deposits (offering interest) much less so. The function of fiscal agent is not prevalent early on, although we must confess a large measure of uncertainty as shown by the blank entries. Monopoly on foreign exchange clearing and freedom from seizure are recurrent privileges bestowed on the banks' liabilities.

Our distinction between first and second generation is in some ways technical, based on the way the payments system is handled, via transfers of circulating notes. At a deeper level we can tentatively identify three basic mod-

| | | | objectives | | assets | | | liabilities | | | services | | privileges | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | owner | profit | stable coin values | 100% reserves | govt debt | private debt | circ. paper | deposits: demand | saving | govt fiscal agent | giro | FX clearing | safe from seizure |
| Barcelona Taula | 1401 –1853 | pub | Y | Y | N | Y* | N* | N | Y | Y | Y | Y | Y* | Y* |
| Genoa I | 1404 –1444 | priv | Y | Y | N | Y | N | N | N | | Y | Y | | Y* |
| German cities | 1400s–1700s | mix | | Y | N | Y | Y | N | Y | Y | | Y | | |
| Naples | 1580s–1815 | priv | Y* | N | N | Y | Y | c1650 | Y | | | Y | | |
| Venice Rialto | 1587 –1638 | priv | N | Y | Y | N | N | N | Y | | | Y | Y | Y |
| Barcelona Ciutat | 1609 –1853 | pub | | Y | Y? | N* | N | N | | | | Y | | |
| Amsterdam | 1609 –1820 | pub | N | Y | Y* | Y* | Y* | N | Y | N | | Y | Y | Y |
| Dutch cities | 1616 –1861 | pub | N | Y | N | Y* | Y | N | Y | N | N | Y | Y* | Y |
| Venice Giro | 1619 –1800 | pub | | Y* | N | Y | N | N | Y* | | | Y | Y | Y |
| Hamburg | 1619 –1875 | pub | N | Y | N* | Y | Y | N | Y | N | | Y | Y* | Y |
| Nürnberg | 1621 –1836 | pub | | Y | N | Y | N | N | Y | N | N | Y | Y* | Y |
| Stockholm Banco | 1657 –1664 | priv | Y | N | N | ? | Y | Y | | | | | | |
| Sweden Ständers | 1668 – | pub | Y | | N | Y | Y | 1701 | Y | Y | Y | Y | Y* | Y |
| Genoa II | 1675 –1815 | priv | Y | Y | N | Y* | N | 18th c. | | | | Y | Y* | Y |
| England | 1694 – | priv | Y | N | N | Y | Y | 1694 | Y | | Y | | N | N |
| Vienna Giro | 1703 –1705 | pub | Y | Y | N | Y | N | N | Y | Y | Y | Y | Y | Y |
| Vienna Stadtbank | 1705 –1816 | pub | | Y | N | Y | N | 1762 | Y | Y | Y | Y | N | Y |
| France B. Royale | 1716 –1720 | priv* | Y | N | N | Y | Y | 1716 | Y | N | Y | Y* | Y* | N |
| Prussia K. HauptB. | 1765 –1847 | pub | Y | Y* | N | Y | Y | Y* | Y* | Y | Y | Y | Y* | Y |
| Prussia Seehandlung | 1806 –1824 | pub | Y* | N | N | Y | Y* | Y* | N | | Y | | N | |
| France C d'Escompte | 1776 –1793 | priv | Y | N | N | r | Y | 1776 | Y | N | | | N | |

Table 1: Characteristics of early public banks.

Y = yes, N = no, r = rare. Notes: Taula: Overdrafts forbidden but allowed in practice. FX clearing required from 1446 to 1499. Balances safe from seizure from 1468. Taula, Ciutat: From mid-15th c., prohibition on lending to the city, observed except in severe circumstances. Genoa I: safe from seizure from 1437. Naples: the banks were expected to make money, but were owned by charitable institutions. Circulating paper from mid-17th c. Amsterdam: 80% reserves in practice. Government debt sporadically held. Private debt: that of a privileged entity (the East India Company). Dutch cities: FX clearing not enforced. Hamburg: FX clearing widely evaded after 1630. Hamburg, Stockholm banco: giro banking formally separate from lending. Venice Giro: stabilizing coin values not part of the design but became one role. Deposits accepted from the 1630s and balances became fully convertible in the 1660s. Sweden, Ständers: giro banking formally separate from lending. FX clearing never viable. Notes from 1701. Genoa II (from the opening the *banco di moneta corrente* in 1675): loans to government strictly limited. Circulating paper: certificates of deposits were circulated. Vienna, Stadtbank: government debt with pledged revenue stream. Notes: from 1762, legal tender from 1797. France, Banque royale: founded as a private bank, nationalized in 1718. Notes legal tender from 1719. FX clearing and giro: briefly in 1720. Prussia, Hauptbank: ineffective in stabilizing coin values. Demand deposits unimportant in practice. Note issue sporadic until Napoleonic wars. FX clearing never viable. Prussia, Seehandlung: profit in addition to support of trading monopolies. Private debt: loans to favored industries. Circulating notes: wartime issues in 1806–24. Savings accounts: debt and instruments resembling preferred stock. France, Caisse d'Escompte: notes briefly legal tender in 1789.

els that transcend this technical distinction: a public version of a private bank accepting deposits and making loans mostly to the State (Barcelona's Taula, Stockholm Banco), a "narrow bank" holding 100% reserves (Venice's Rialto and Amsterdam), a "special purpose vehicle" designed to make government debt more liquid (Venice's Giro, England).

# 4 Understanding the Evolution

Above we have seen that the history of early public banks offers a diverse array of institutional designs and empirical outcomes. In the usual trade-off between clarity and precision we will tilt toward the former and try to discern broad patterns at the expense of institutional detail.

## *A quantitative overview*

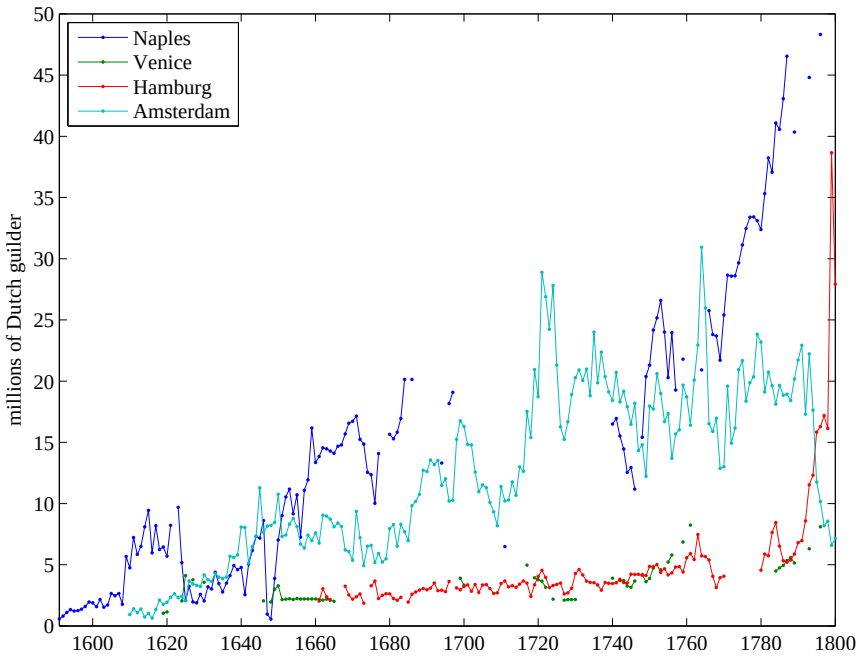


Figure 1: Bank balances of various banks, converted at Dutch guilder at current exchange rates (1591–1800). Source: Roberds and Velde (2014).

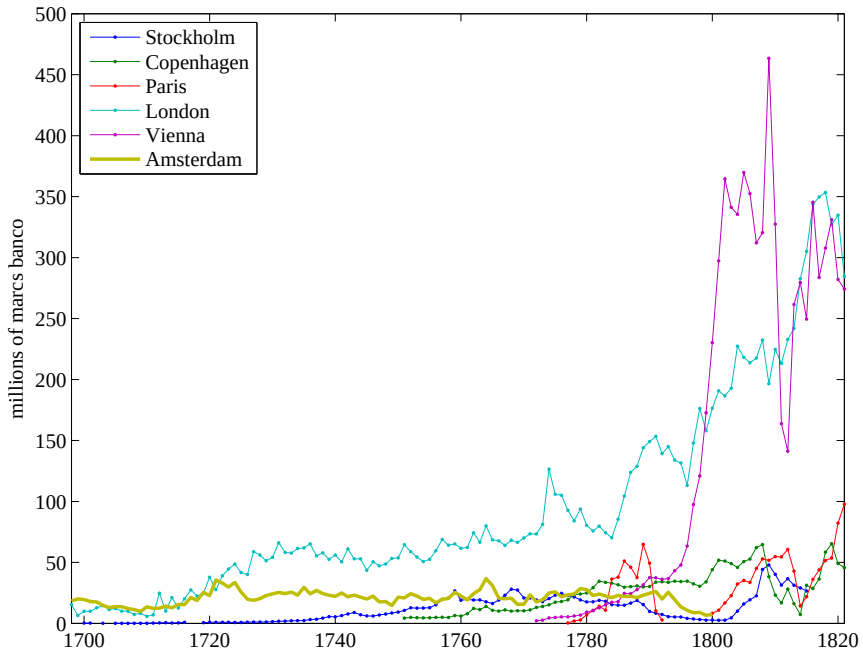


Figure 2: Note circulation of various banks, converted into Hamburg marcs banco at current exchange rates (1700–1821). The balance sheet of the Amsterdam Wisselbank is plotted for comparison purposes. Paris consists of the Caisse d'Escompte (1776–93) and the Banque de France (from 1800). Source: Roberds and Velde (2014).

Figures 1 and 2 offer quantitative perspectives on the evolutionary process. In the figures, the size of the banks is measured by balance sheet for the first-generation banks and by note circulation (and/or deposits) for the second generation. The format of these comparisons was dictated by data availability. Current exchange rates were used to convert all amounts to a common currency.[7] Table 2 supplements the figures by comparing balance sheets at specific points in time also dictated by data availability.

The time series begin in the late 16th century, but Table 2 indicates that, even as early as 1433, Barcelona's Taula was comparable with the public banks of 1600. Figure 1 shows the Bank of Amsterdam's rapid rise to dominance within the first generation. After 1640 it surpasses Venice and Hamburg and continues to grow through the early eighteenth century, while Venice and

[7]The units were chosen so as to use direct foreign exchange quotations as much as possible. To compare the two figures, note that during the eighteenth century the Dutch guilder averages 1.2 marcs banco.

Hamburg remain stagnant, and almost equal to each other. Table 2 suggests that Genoa probably fit in between Amsterdam and Venice, and also shows that Nuremberg was, for its brief existence, on a par with Hamburg. Also noteworthy is the combined size of the Neapolitan banks, comparable to Amsterdam for much of the sample and surpassing it by the late eighteenth century.

Figure 2 shows that around 1720, a mere quarter-century after its founding, the Bank of England surpassed the Bank of Amsterdam in size, and was more than double the size of its rival by the mid-eighteenth century. Moreover the Bank of England continues to grow throughout the Napoleonic era, though it is eclipsed for a short time by the aggressive note issues of Vienna's Stadtbank. Figure 2 also captures the brief period of success of the Caisse d'Escompte before the Revolution, the fall of the Bank of Amsterdam, and the emergence of the Banque de France.

## *Origins*

Why were public banks created? To formulate this question more narrowly, what did their founders think they were doing?

To collect all our histories under a single formulation, we can say that the underlying impetus for the founding of the bank was essentially the same: a desire to introduce a new and safe (or at least reliable) type of asset. No asset is truly risk-free, but the intent was to find one that was sufficiently reliable or safe to serve as means of payment and basis for valuation.

The impetus arose from two possible directions: payments issues, stemming from failures (real or perceived) in the private sector, and fiscal issues. In the first instance, dysfunctions or failures of a private system of payments are remedied by the creation of a public bank. In the second instance, an illiquid government liability is improved by being transformed into the liability of a public bank.

### *Private failings*

The first, payments-related, impetus is itself divisible into collapses of the banking sector or its incapacity to maintain stable units of account. The first set of concerns is exemplified by the Banco del Giro in Venice and the

| | year | thousand ducats | ducats /capita |
|---|---|---|---|
| Barcelona | 1433 | 477 | 13 |
| Naples | 1597 | 611 | 2 |
| Venice | 1597 | 950 | 6 |
| Genoa, c. oro | 1586 | 179 | 3 |
| Hamburg | 1621 | 339 | 8 |
| Amsterdam | 1631 | 1,646 | 30 |
| Nuremberg | 1631 | 462 | 11 |
| Venice | 1631 | 1,462 | 15 |
| Naples | 1631 | 1,450 | 5 |
| Venice | 1666 | 876 | 6 |
| Genoa, c. moneta corrente | 1675 | 967 | 15 |
| Amsterdam | 1675 | 2,731 | 13 |
| Naples | 1675 | 5,147 | 17 |
| Venice | 1721 | 1,722 | 12 |
| Genoa, c. banco | 1721 | 7,531 | 116 |
| Amsterdam | 1721 | 13,610 | 68 |
| Naples | 1721 | 4,298 | 14 |
| London | 1719 | 46,545 | 72 |

Table 2: Total assets/liabilities of various public banks. The amounts are converted to Venetian ducats (a gold coin containing about 3.5g) at current exchange rates taken from Spufford (1986, 145) and Denzel (2010). Per capita balances are computed using the cities' populations (Bairoch et al. 1988). The figure for London excludes the exchequer bills circulated by the Bank. Sources: Balletta (2009, 286–9) (Naples); Tucci (1973, 370) (Venice); (Sieveking 1934a, 29,33) (Genoa); Sieveking (1934b, 131-2, 139-41, 152-3, 156) (Hamburg); Van Dillen (1934, 117–23) (Amsterdam); Bank of England archives General Ledger 6, f. 665, ADM7/8 (kindly communicated by Stephen Quinn).

remarkable debates in the Senate (reported by Lattes 1869) that surrounded its creation, the payments problem arises from the persistent failing of the private banking sector. Medieval banks had risky portfolios and maturity mismatch. Public authorities, concerned about fraud and more generally wishing to make the bankers accountable to their clients, imposed demandable deposits as a general rule, setting the stage for bank runs.[8] Further regulations restricting bankers' choices of assets and increasing their equity stake were apparently

[8]The ultimate origin of the demand deposit, either as a prevalent form of contracting among private parties or a government regulation imposed on them, is still unclear to us.

insufficient to restore stability.

Why did it matter? Interestingly, in the eyes of the Venetian Senators, the key function (from their perspective) provided by banks was not maturity transformation or matching lenders and borrowers, but providing a payments system. The public policy issue was that banks provided an essential payments function: that function had to be provided somehow, by the State if need be and however reluctantly. The first sentence of the resolution founding Venice's public bank states that "It has been the most ancient and almost natural custom of this city to trade, and to complete mercantile and all other activities by means of *banchi di scritta*, whose convenience and ease of making payments is necessary in so many businesses and of such importance."

The Senators were aware that other commercial centers did well without a public bank and used multilateral netting mechanisms to facilitate payments. The mechanisms, originating in the medieval fairs of Champagne, survived in Lyon and Antwerp, but they relied on private trust that could not be depended upon in Venice. Venice created a public bank, but one that could not create credit: in fact, the possibility of creating credit was seen as dangerous. The main function was to provide payments services to merchants.

Venice provides the clearest example of this motivation, although the history of Catalonian public banks (in particular the disappearance of private banking in Barcelona in the early 17th century) may well provide another example of the potential of public banks to replace private banks in the payments arena.

The second possible failure of the private sector is a more subtle one. We analyze it in terms of the Sargent and Velde (2002) model, according to which inherent features of the multiple-coin commodity money system led to recurrent episodes of instability in the rate of exchange between various coins. Yet societies needed a predictable unit of account. The fact that the bouts of exchange rate fluctuations occurred intermittently and infrequently (a generation or more) let private parties grow accustomed to stable parities between coins of different size. Then fluctuations started again, and private parties had to decide to which coin they should peg their preferred unit of account. The result of both repeated episodes of fluctuations and lack of agreement on which coin to follow led in the first case to successive "ghost monies," units tied to coins at some long-obsolete (ghost) rate of exchange, and the second to multiple units of account tied to different coins being used at the same time.

Authorities perceived the problem but misdiagnosed its cause, and blamed specific private agents for an equilibrium phenomenon. If certain coins rose unexpectedly in value, they reasoned, it must be the fault of people who most handle these coins, bankers. And if bankers drive up the value of some coins, it must be because they have an interest in doing so. Thus, if banking were entrusted to a party that has no such interest, the problem would disappear.

This motivation for creating public banks is exemplified in Genoa's 1408 creation of the Banco di San Giorgio, as well as in the flurry of public bank creations in the early 17th century: not only Amsterdam and Hamburg, but also Barcelona's Bank of the City.

*Public failings*

Another, a priori unrelated motivation, can be discerned in the foundation of Barcelona's Taula in 1401, and much more evidently in most second-generation public banks. The concern here is to provide banking/financing services, broadly construed, to the State. In Table 1 we included services as fiscal agent to indicate that deficit financing was not the sole consideration: banking and accounting services were part of the package. Of course such services could and were provided by the private sector, but the history of Barcelona's Taula show that the unreliability of private banks (mentioned in the previous section) also affected the State, and also that the services provided could go farther than mere book-keeping. In fifteenth century Catalonia (as in other eras) clear accounting was not just a convenience but also a means to enforce clarity, accountability, and the respect of budgetary rules.

But our table show a number of early public banks that were allowed to hold government debt and that were profit-making institutions. In Genoa and Barcelona, the profit was intended to help extinguish the public debt. In Barcelona, as in the second-generation public banks, the motive was also to provide the State with better ways to market its debt. The transformation that a public bank could provide from an illiquid bond to a money-like instrument is transparent in the Venetian Banco del Giro, but is also at the core of the Bank of England's foundation. How exactly the alchemy works will be taken up in more detail below. For now let us note the widespread resort to legal properties of the new liability, particularly the requirement to clear foreign exchange through the bank, and the common privilege from seizure of the

bank's balances. Both aspects clearly had as outcome, if not as intention, the enhancement of the liability's desirability.

One motivation that we do not see is a concern for financial stability. The foundation of the first Venetian bank was prompted by failures of private banking, but the solution was not to replace private bankers in their intermediating function, nor was it to provide a recourse or lender of last resort. That concern emerges much later, in the crises of the late eighteenth century. The crisis of 1763, in the aftermath of the Seven Years War, prompted the first use of the public bank's liquidity creation powers. If anything, bail-outs came to the public banks (from the State) rather than from them.

## *Evolution*

### *General features*

Our overview of early public banks provides the following insights.

Before 1820 people did not have very firm idea of what a public bank should do or how it should be structured. Generally, it was thought that a government-sponsored financial intermediary could improve on outcomes. Whether it should be private or public was not clearly settled, and no single model emerged. The two basic impulses that we outlined above, providing a reliable payments system and making government debt more liquid, interacted continuously throughout the banks' history.

Various countries experimented with various models. For all their stumbles and failures, public banks were an enduring genus, as governments rarely gave up on them. One can discern a process of natural selection, in which many designs failed to gain acceptance and flopped right from the start (e.g., Austria), but once a public bank was up and running, selective pressure from war-driven fiscal crises forced it to evolve in new ways. One can also see a process of mutation and propagation at work, with direct evidence and indirect suggestion for cross-border imitations.

Finally, we have one big extinction: the Napoleonic Wars left only a few public banks left intact, and even T. Rex (the Bank of Amsterdam) had succumbed by 1795.

*Three eras*

We observe three broad phases in the process. The first phase begins with founding of the earliest public banks around 1400 in Barcelona and Genoa. Imitations of these banks then arose in other (quasi-)independent city-states. Generally these banks were municipally owned, were often supposed to be fully backed by a metallic reserve, and were geared towards a payments function. This first phase culminated with emergence of the Bank of Amsterdam (founded 1609) as a preeminent payments institution.

The second phase begins in the late 17th century, with beginnings of note issue (tentatively by banks in Naples and Sweden, then famously in England). The second-generation public banks differ from the first generation along multiple dimensions: they tended to operate in monarchical states, were often privately owned, held only fractional metallic reserves, and were geared towards the securitization of public debt. Yet the second generation of banks was undoubtedly inspired by the success of the first generation, and by debt-management institutions such as Genoa's Casa di San Giorgio. But, although the Bank of England dominates its peers in terms of size within a few decades, just as Amsterdam had, the first generation banks coexist with it, and the model of Amsterdam and Hamburg continues to inspire new bank creations in the eighteenth century.

The third phase in the evolution comes at the end of the Napoleonic Wars, with the Bank of England's successful integration of the payment and debt management functions of earlier generations of public banks. The Bank of England's structure becomes the basis for future mutations in central bank design, but it is worth noting that this is not a spontaneous development of the early 19th century, but the outcome of more than 400 years of institutional evolution.

The extinction event of 1815 is a complex one. It may be tempting to see it in Darwinian terms as the triumph of a superior species over weaker ones, although the eighteenth century shows that there was no immediate or absolute advantage to the English model. It was copied, unsuccessfully at first, in France only; and it is worth noting that John Law, in his efforts to save his bank, turned belatedly to the Amsterdam model. Although note-issue became prevalent among the newly created banks, those of Northern Europe often included at their origin an exchange bank copied from Hamburg, even if that

function tended to play a minor role.

Clearly the transformation of Europe's map, and the disappearance of the autonomous municipalities (earlier in Catalonia, then in Amsterdam, Venice, and Genoa) deprived the oldest public banks of the political structures that had created them. Perhaps the attempt by the Genoese to recreate their bank, in the brief months of 1814 when they thought it possible to restore their ancient constitution, reflected only misguided nostalgia. But the example of Hamburg shows that the nineteenth century had not made first-generation banks obviously obsolete.

It also remains an open question, in our eyes, whether the Bank of England model was obviously superior. The nineteenth century is outside the scope of our survey, but we suspect the various countries continued to experiment while facing new political constraints.

*Internal and external evolution*

The difference between first-generation, ledger banks and second-generation, note-issuing banks can probably be ascribed in part to a technological innovation, the emergence of transferable bearer liabilities. At a physical level this required innovations like the replacement of parchment with cheaper paper, and the ability to produce counterfeit-proof, verifiable claims (printing). From a legal perspective, the evolution was more difficult. A claim has to be actionable in court, and people sue people, pieces of paper don't. A transferable claim requires a legal system that permits in a simple fashion the transfer of one person's claims to another. The need for such a system was felt early on in the Middle Ages but it took a long time for the law to develop the proper mechanisms. It is interesting in this respect to notice that the innovation developed fully outside of the public banks proper, in the city of Naples and among the London goldsmiths. In this, as in the provision of payments by transfer, the public banks were not adding anything to what was available in the private sector: the public bank's alchemy used existing technologies.

One can distinguish between two forms of evolution, internal and external. Internal evolution is reflected in the process of reform in response to local failures, while external evolution, perhaps more readily observed at the creation of a new institution, involves observation and imitation of best practices from other places (and at times, conscious improvement, for example in John Law's

attempt to improve on the Bank of England model). The model of the Venice Banco di Rialto, via the Bank of Amsterdam, proved very influential. It is striking to see how the Hamburg Bank (1619), Stockholm Banco (1657), the Riksen Ständers Bank (1668), Vienna Giro (1703), Prussian Hauptbank (1765) all started from or included an exchange or giro function. Yet, in an instance of mutation or "genetic drift," the key ingredient of the Venice Giro, 100% reserves, was (formally) retained by the bank of Amsterdam, but was gradually lost in the later imitations. External evolution also involved learning from others' mistakes, for example the failure of Law's bank.

We reach here one of the many limits of our metaphor, but an interesting one: the biological model of evolution has no room for any ingredient of foresight and design.

*The invention of fiat money*

We have highlighted the provision of a stable unit of account as a key impetus in the creation of public banks. This goal also provided a key force in their evolution, pushing them toward the invention of fiat money, which we identify as a key moment in central banking alchemy.

A simple marker of success in this dimension can be found by perusing Denzel (2012): in this wide-ranging collection of exchange rate quotations for early and late modern Europe, one notices that quotations on certain cities (Amsterdam, Venice, Genoa, Hamburg) are expressed in terms of a "banco" unit. This was not a simple outcome of the requirement to clear foreign exchange bills through the public bank: it could be and was evaded or ignored. Merchants found it useful to use banks' liabilities to denominate and settle their obligations, because those liabilities were more reliable than current money. This outcome was by no mean pre-ordained, and it required a lot of learning on the part of the public banks.

One of the key aspects of the evolution was public banks' acquisition of the right to decide in which coin a deposit could be redeemed. Governmental insistence that a public bank maintain a non-market exchange rate could lead to failure of the bank (as occurred with Genoa's *Banco di San Giorgio* in 1444) or its reorganization (as with Prussia's *Königliche Hauptbank* in 1766). The Bank of Amsterdam was also restricted to paying out full-weight coins at fixed values, but was able to manage this issue by charging substantial withdrawal

fees (1.5%) and then applying its own discounts to lighter-weight coins at deposit (from 1641). These policies maintained the liquidity of the bank, but their expense provided a disincentive to use bank money. Amsterdam did not gain full control of the situation until 1683, when it began issuing redeemable receipts for specific coins deposited. Since a depositor holding a receipt could now only withdraw the coins listed on the receipt, coin-to-coin arbitrages were limited, and withdrawal fees could be reduced to almost negligible levels (0.25% for most coins).

Perhaps the ultimate expression of public bank control of redeemability, Hamburg's *Reinsilberwährung*, appears near the end of our period (1790). Beginning in 1770, the Bank of Hamburg started accepting deposits of silver bullion in addition to coin. Coin deposits were eliminated altogether in 1790 in favor of bullion, and depositors paid only a small fee (0.45%) at withdrawal. But the creation of such a "virtual coin" was only possible in a city-state like Hamburg that was politically dominated by commercial interests.[9]

The history of Genoa also provides a clear case of a public bank slowly, perhaps reluctantly, venturing into the business of providing a stable unit of account. The bank at first kept separate ledgers for each type of coin, but by the mid-seventeenth century it was generally felt that Amsterdam's success needed to be emulated. The Bank formally obtained the freedom to choose the coins in which to repay, a phenomenon that also emerges in Barcelona.

Coins made of metal had failed to provide a satisfactory anchor for a monetary system based on units of account. Replacing coins while somehow retaining the anchor of intrinsic value involved substituting a new asset linked to, in a flexible way, to precious metal. Modern central banks actively manage the value of their liability: that is what we call monetary policy, and it turns out to have a much longer history than generally suspected. Open market operations go back to Amsterdam in the 1660s and were the endpoint of a long process goes back another few centuries.

*State and bank: finding the right distance*

A second key element of the public bank alchemy was finding a "gentlemanly distance" between the institution and its sponsor.

[9]David Ricardo, who must have known the precedent, proposed a similar currency in 1816.

Our survey by design has considered only institutions with a corporate charter, assets and liabilities, thus excluding the early German municipal exchange offices. We have also excluded from our survey instances of currency issued directly by the State, as in Sweden and France in the 1790s.

The early public banks were thus distinct from the State, but never far from it, because the State chartered them, gave them privileges, and often owned them or eventually stepped in to bail them out when needed.

Success of a public bank required some distance from the sponsor: Law's first bank proposal was rejected by the king's advisers because it was too closely tied to the State, whose bad credit they knew would taint the bank from birth. But success led to new tensions. The higher the perceived quality of a public bank's claims, the higher the private-sector demand for these claims, and the greater the potential for fiscal abuse. Managing fiscal temptation required an appropriate degree of distance between government and bank, and a flawed mechanism for maintaining such distance might cause a bank to collapse in the face of war-driven fiscal demands.

The search for the right distance went in new directions with the second generation of banks created in monarchies. Again, Law's experience is interesting in this regard: to his objectors who claimed that a public bank could never be safe in an absolute monarchy he offered the example of Naples and also pointed out the ruler's self-interest in preserving a well-functioning bank. Law's bank was created as a privately-owned company with no government control, like the Bank of England and the later Caisse d'Escompte. Vienna's Stadtbank offers another model, relying on the relative independence (and better credit) of the city relative to the crown. The Swedish bank's history reflects directly the complex tensions between crown and parliament. Prussia's experiments are also shaped by the same imperative. It is naturally tempting to see the Bank of England's dominance in the nineteenth century as partly based on it having met that imperative.

*Stumbles and adaptations*

From our vantage point, survival is success. In this respect most public banks we survey did well; indeed, the durability is almost astonishing. Failure, or rather stumbles, can be defined either as suspension of payments (for those banks with demand liabilities) or sharp drops in the market value of the

liabilities. Nearly all banks experienced some form of stumble; indeed, the emergence of the Bank of England as model in the 19th century is partly due to its twenty-year suspension of convertibility.

How were stumbles handled? The outcomes differ widely. At one extreme the Bank of England's suspension ended with a return to convertibility of its notes at the original parity, without any help from the State. At the other extreme the Banque Royale's collapse in 1720 ended with a conversion of its notes into government liabilities at varying haircuts, as high as 95%; likewise the public banks of Catalonia had their deposits converted into government debt at severe discounts in the 1650s. In-between the extremes one finds various models, with conversion of liabilities into either new liabilities of the bank or into liabilities of the State, with varying haircuts in either case. Such are the suspensions of Genoa and Venice, during which deposits were converted more or less at par in long-term annuities, and the Barcelona Taula's conversion of old deposits into new deposits and Sweden's and Vienna's conversion of notes. Amsterdam's only serious difficulties, as measured by the most violent movement in its agio, were also fatal.

Just as in the case of the Bank of England, prolonged periods of suspension were not necessarily fatal: the suspensions in Venice and Genoa lasted several decades before convertibility was resumed. Although the record is scant, it is plausible to think that, just as Amsterdam had learned to manage a fiat currency (via a pre-emptive suspension of convertibility), so Venetian and Genoese merchants learned to live with, and tolerated, a payments system based on inconvertible balances, as long as they could hold reasonable expectations that the currency would be well managed.

# 5 Conclusion

This essay has argued an evolutionary model can be usefully applied to the history of central banks. The key idea is one of path dependence, i.e., that the structure of today's highly-levered, note-issuing, government-debt-backed central banks preserves a record of the successes and failures of past institutions. Put another way, the resemblance of today's central banks to the 18th-century Bank of England is due more to inheritance rather than to random coincidence.

Pushed to its logical extreme, the biological metaphor also has some implica-

tions for the future of central banks. One implication is that in central banking, as in nature, there are no true steady states. Hence, the present structure of modern banks does not represent a convergence. In fact the history of early public banks confirms nearly the opposite view, i.e., that the unorthodox ideas of one generation of central banks may become the orthodoxy of the next. Above we have seen, for example, that banknotes began as a fringe payments instrument, and that early attempts at note issue were catastrophic failures in most implementations. Yet today circulating notes are the most widely accepted transactions medium, not to mention a profit center for the central banks that issue them.

In 2014, one does not have to look far for unorthodox ideas that could have some staying power. To give one example, many central banks implemented "unconventional" policies such as quantitative easing in the wake of the 2008 crisis. But as such policies persist, the unconventional is becoming increasingly conventional. A second example is in the area of cross-border cooperation. The debut of a global large-value payment system (CLS, in 2002) and of a major supranational currency (the Euro, in 1999) represent significant concessions of monetary responsibility by national central banks to international institutions. Such cross-border institutions may become increasingly important in the future, as commerce becomes increasingly globalized. A final and more speculative example is provided by arrangements such as Bitcoin and Ripple, which are essentially trying to offer online versions of banknotes, via online versions of ledgers; it is easy to imagine that at some point, central banks may want in on this act.

The biological metaphor also suggests, and the history confirms, that the course of central banks' evolution is unlikely to be a linear or predictable one. Both new and experimental structures will be tested by acute fiscal demands, market crises, and financial innovation. History likewise indicates that under the pressure of extreme events, even established institutions may quickly become irrelevant or extinct, as occurred with many public banks during the Napoleonic period. What can be guaranteed is continuing pressure for structural innovation, and the survival of the fittest. To anticipate otherwise is to ignore 600 years of historical experience.

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