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**Abstract:** The Bank of Amsterdam, founded in 1609, was the first public bank to offer accounts not directly convertible to coin. As such, it can be described as the first true central bank. The debut of central bank money did not result from any conscious policy decision, however, but instead arose almost by accident, in response to the chaotic monetary conditions during the early years of the Dutch Republic. This paper examines the history of this momentous development from the perspective of modern monetary theory.

JEL classification: E420, E520, N130

Key words: money, central banks, coinage, debasement

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The Dutch Republic in its early years experienced monetary problems common to all states using a metallic system. For example, economic growth necessitated the acquisition of ever more monetary bullion. The Republic also suffered from what Adam Smith termed the “small-state” problem of incremental debasement. The Republic was awash in foreign coins and these were widely used as media of exchange.<sup>1</sup> A debasement in any coin could lead to uncertainty in the value of payments, creating transaction costs that hampered commerce.

The Dutch authorities attempted to deal with the debasement problem through laws and regulations, but these were often slow and ineffective. It took decades, for example, for the Republic to establish full control over its numerous independent mints. By contrast, laws assigning coin values were enacted early and often, but these did not solve the problem of debasement. While intended to simplify the use of coins by giving them a known value (tale) in terms of a unit of account, we argue that these laws, called *mint ordinances*, had the unintended consequence of making the situation worse. The disconnect between legal and intrinsic value encouraged people to bring old coins with high intrinsic, but low legal value to the mint in order to repay their debts with the new debased coins. The mints benefited as well from the consequent increase in business and their government owners benefited from the increase in seigniorage. Then as now, there was no free lunch, as the garnering of seigniorage through debasement imposed an onerous burden on the Dutch economy.

Another regulatory approach was the creation of an exchange bank or *Wisselbank*. Exchange banks were intended to address the debasement problem by effectively limiting deposits to coins above a certain quality. When debt was settled within the exchange bank, lenders were protected from repayment in debased coin. To generate participation, municipalities, starting with Amsterdam in 1609, required that commercial debts embodied in bills of exchange had to be settled through the

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<sup>1</sup> Eight hundred foreign coins were officially recognized by the end of the sixteenth century (Dehing and ‘t Hart 1997, 40).

city's exchange bank. Because bills of exchange were the dominant vehicle for international trade credit, merchants were compelled to open an account with the exchange bank.<sup>2</sup>

This paper argues that the creation of this exchange bank, known as the Bank of Amsterdam or *Amsterdamsche Wisselbank*, was effective at reducing debasement. Settlement of bills in bank money blunted debasement incentives by, ultimately, decoupling the connection between common coins and their ordinance value in the Dutch unit of account called the florin.<sup>3</sup> In shielding creditors—the beneficiaries (also called payees) of bills of exchange—from payment in debased coins, the exchange bank diminished mints' ability to extract profits from these beneficiaries.

The initial success of the *Wisselbank*, however, was less than complete because much of the Republic's payment system remained outside its control. The final stabilization of Dutch coinage required the emergence of effective control by the central government over the domestic mints. Also, the regulations controlling the exchange bank were initially adjusted in unhelpful ways, so the development of the payment system took unexpected turns. This paper tracks this institutional evolution of the *Wisselbank* within this nexus of regulations, coins, and bills of exchange in order to explain why the bank was founded, what effect it had, and how it evolved.<sup>4</sup>

One noteworthy, though unintended consequence of the *Wisselbank*'s success and peculiar regulatory changes was the creation of a new, parallel unit of account for major commercial transactions. A receipt for 10 florins held *in banco* (the term

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<sup>2</sup> Bills of exchange came to dominate short-run international finance in Northern Europe during the second half of the sixteenth century (de Vries and van der Woude 1997, 130). While bills of exchange dominated contracts for less than 3 months, bills obligatory (IOUs) were very important for 3 to 12 month borrowing (Gelderbloom 2003, 627)

<sup>3</sup> Synonymous with the guilder or *gulden*. The silver florin of Charles V was a coin set to be worth twenty stuiver coins, but the debasement of stuivers drove florins out of circulation in the sixteenth century (see Dehing and 't Hart (1997, 38); van Dillen (1934, 82). By the founding of the *Wisselbank* in 1609, the unit of account in most of the Dutch Republic remained the florin despite there no longer being florin coins.

<sup>4</sup> Our view of the Amsterdam *Wisselbank* agrees with Gillard (2004), but our focus is on the Republic's domestic monetary system rather than the Florin's international standing.

for exchange bank money) came to represent more money than 10 florins *current* (the term for local money). Though unwieldy to modern eyes, this system of parallel units of account seemed to have worked extremely well in practice.<sup>5</sup>

Another unintended consequence of the Wisselbank took even longer to evolve, but was ultimately even more revolutionary in nature. By the late seventeenth century, exchange bank money lost the right of redemption into coins altogether, and the Wisselbank came to have no obligation to redeem its deposits on demand. Anticipating today's fiat money regimes, the predominant unit of account, the bank florin, was then no longer bound to any particular coin. Instead, the value of balances held at the Wisselbank derived from their ability to discharge debts. This development represented a historic shift in the nature of money, one that leads us to characterize the Wisselbank as the first true "central bank." In its mature form, the Bank of Amsterdam allowed the inhabitants of the Dutch Republic to,

[R]eap the advantages of a fixed exchange rate for their international trade and finance, encouraging their own merchants as well as foreign merchants to use their financing facilities for long-distance trade and long-term finance. At the same time, they were able to maintain the shock absorber benefits of a flexible exchange rate for their domestic economic activity (Neal 2000, 122).

In a previous paper (Quinn and Roberds 2005) we set out a formal model of the problematic monetary situation in the early years of the Republic, and of the impact of the Bank of Amsterdam on this situation. Though stylized, the model allows for an examination of some (perhaps underappreciated) general-equilibrium aspects of the Dutch "debasement problem." The present paper reviews the narrative history of the early years of the Bank of Amsterdam. We show that our stylized model has strong explanatory power even as a number of the complexities that characterized the Dutch economic system are addressed.<sup>6</sup>

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<sup>5</sup> A modern analog might be the custom, common in some countries, of pricing large transactions in U.S. dollars and smaller ones in the local currency.

<sup>6</sup> Many of the original documents relevant to the history of the Wisselbank are available in a collection compiled by van Dillen (1925). Given our limited facility with seventeenth-century Dutch, we rely heavily on van Dillen's (1964a,b) account, which is largely based on these documents. An

## I. Debasement, the Underlying Problem.

Around 1600, the fundamental monetary problem for the Dutch Republic was that debtors (or their agents called cashiers) had an incentive to pass debased coins to their creditors. Why did this opportunity to profit from light coins exist? Because bills of exchange were debts denominated in the unit of account (florins). The florin did not correspond to any particular coin; the value of various coins in terms of florins was specified through mint ordinances. When a debtor had two coins with the same ordinance value (tale), he and/or his cashier had incentives to pass the lighter one on to his creditor in a “Gresham’s Law”<sup>7</sup> type decision.<sup>8</sup>

A key constraint in this story is that the debtor be willing to give his heavy coins to be debased into lighter coins. The debtor eventually profits only if the amount of silver (seigniorage) he pays the mint for the new, lighter coin is less than the amount of silver he avoids paying his creditor. In other words, a debasement is successful only if the mint and the debtor can share the silver that they are denying the creditor, in which case both mint and debtor have an incentive to “collude” against a creditor.<sup>9</sup>

Establishing the debtor’s incentive to participate in the debasement is important. Lacking this incentive, mints could offer debased coins, but no one would supply them the silver (Rolnick *et al.*, 1996). For example, an attempt to debase coins

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English-language summary of this account can be found in van Dillen (1934). Coinage data are from Polak (1998a, b).

<sup>7</sup> We use the term “Gresham’s law” with considerable caution, as our approach is inconsistent with some common interpretations of this “law.”

<sup>8</sup> For expositional convenience, our discussion will proceed “as if” a debt would always be repaid in coin. As discussed in more detail below, debts were more commonly repaid by either (a) transfer of balances held with an intermediary known as a *cashier*, or (b) assignment of a bill of exchange. Below we will argue that this institutional detail is inessential for our argument, since these forms of payment typically represented claims redeemable only in debased coin, or non-debased coin at a substantial premium above its legal value.

<sup>9</sup> Again this story should not necessarily be taken as literal description. Debasement might also occur at the hands of cashiers or moneychangers, who were in fact widely condemned for this practice (see below). Debtors holding undervalued coins could also “synthetically” subject these to debasement by using them to import goods which could then be sold for lighter coin.

could cause the market price of heavy coins to rise, so people lose their incentive to bring heavy coins to the mint, and the debasement would fail. In fact, the market price of coins commonly exceeded their legal value, and this helped keep heavy coins from vanishing entirely.

When retiring a debt, however, a creditor can insist on payment in coin valued at its ordinance value rather than its market value. A debtor can respond by finding some of the new, lighter coin that could discharge the debt at a legally set value. The point is not that heavy coins will not be used to settle debts; rather, that the threat of passing light coins establishes the debtor's best alternative to no agreement. If the creditor insists on heavier coin, then the creditor has to pay the debtor extra for it. The increase in the market price of heavy coins does not help the creditor if the debtor has light but legal coins with which to settle the debt.

The brake on the incentive to debase is the requirement that the debased coins retain some legal value. Too great of a debasement could cause creditors to challenge a coin's legal standing. For example, the Republic appears to have promulgated regulations stating that creditors had a right to insist that debt settlement use the coinage standards from when a debt was contracted.<sup>10</sup> The incentive to enforce such a right would increase with the rate of debasement and the size of the debt, so small debasements had a clear advantage. Moreover, the costs of legal action were substantial, and early modern merchants appear to have rarely resorted to formal legal procedures. Instead, problems that resisted the threat of legal action were dealt with using "amicable settlement" or the acceptance of a loss, "rather than engaging in endless litigation (Gelderbloom 2003, 634)."

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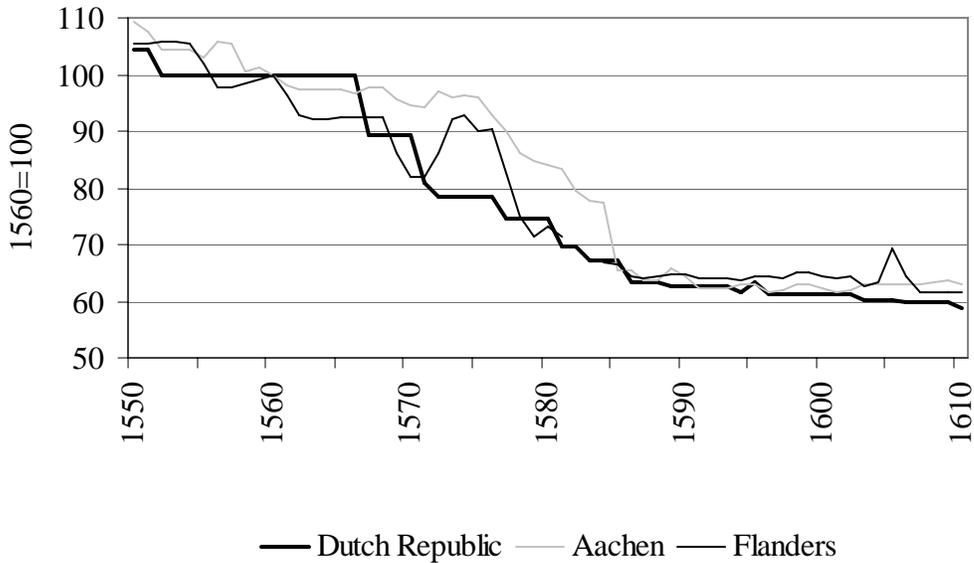
<sup>10</sup> Oscar Gelderbloom has kindly informed us that such a regulation is mentioned in a legal advice to the High Court of Holland that published in the mid-seventeenth century "Waerdije van eenige Munte veranderd zijde, moet men insien de Waardij, dieze hadde ten tijde van het contract ende niet ten tijde van de betalinge" Consultatiën, Advysen en Advertissemerten, gegeven ende geschreven bij bverscheyden Treffelijcke Rechts-Geleerden in Hollandt, zes delen (Rotterdam, J. Naeranus, 1645-1666; volume IV, page 69).

Each debasement tended to be relatively small—a drop in the silver content of a few percent at most.<sup>11</sup> As lighter coins became standard, however, the incentive redeveloped to debase again, leading to a pattern of mild but persistent debasement. Moreover, incentives to debase could be equally great at neighboring mints whose coins infiltrated the Dutch monetary stock (Dehing and 't Hart 1997, 37-8). Figure 1 shows the general pattern of official coin valuations for the Dutch Republic and two of its neighbors over the second half of the sixteenth century. Over this period, the fine-metal content of silver coins within the Republic fell by about 1 percent per year, on average. Most of the decline coincides with the pressures financing the Dutch Revolt (also called the Eighty Years War) that began in 1568, paused in 1609, resumed in 1621 and finally ended in 1648 (Fritschy 2003).

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<sup>11</sup> On the other hand, a debasement also had to be large enough to generate incentives to bring metal into the mint.

Figure 1. Indices of Silver per Coin



Source: Metz 1990.

Authorities could attempt to adjust minting-ordinance values quickly, but a move to raise ordinance values to match the market prices of heavy coins just locks in the losses to creditors. Again, debtors may be willing to give heavy coins, but the higher price per coin means that creditors still see less silver than they expected. In practice, ordinance adjustments lagged actual price changes.

Creditors could try to insulate themselves by adding a risk premium when agreeing to accept a bill of exchange denominated in florins. The result would weaken the Dutch exchange rate and reduce bill-financed trade.<sup>12</sup> This approach, however, does not discourage a debtor from participating in a debasement. Indeed, a debtor would need to participate in a debasement in order to cover the risk premium already contracted into the bill of exchange.

<sup>12</sup> In the words of Adam Smith “if foreign bills of exchange are paid in this currency [such as the florin], the uncertain value of any sum, of what is in its own nature so uncertain, must render the exchange always very much against [a country such as the Republic], its currency being, in all foreign states, necessarily valued even below what it is worth (*Wealth of Nations* IV.3.12).”

An important question is whether these problems could have been circumvented through purely private means (Rolnick et al. 1996). In his discussion of the events preceding the founding of the Wisselbank, van Dillen (1964a, 340-345) casts doubt upon the efficacy of private remedies. Settling debts in a specific coin or amount of metal would have been prohibitively expensive. In practice, debts were routinely settled through assignment of bills, or transfer of accounts on the books of cashiers (primitive banks); there was simply not enough coin to accommodate the payment needs of a commercial center such as Amsterdam. Attempts were made to outlaw the settlement of debts through assignment (1602) and to prohibit cashiers outright (1604 and again in 1608) but these were quickly abandoned. The “netting” function provided by these types of payment was deemed essential, particularly at times of year such as June and November, when bills of exchange traditionally came due.<sup>13</sup>

The activities of the cashiers and their fellow intermediaries, the moneychangers, were in turn quite difficult for the authorities to monitor.<sup>14</sup> Moneychangers were bound by oath to uphold the minting ordinances, but the availability of “illegitimate” moneychangers weakened adherence to these oaths. In discussions of this situation with the Dutch monetary authorities, the Amsterdam business community voiced a preference for settlement on the books of a municipal bank of “superior authority” to the private cashiers. The Amsterdam city council (*vroedschap*) favored a plan under which the Republic would establish an exchange bank in each commercial city,<sup>15</sup> but this plan was ignored by the governing body of the Republic, the States General. In response, the city council took unilateral action, creating the Wisselbank in January 1609 (van Dillen 1964a, 333).

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<sup>13</sup> This discussion obviously begs the even deeper question, which we cannot address here, of why debts were denominated in florin and not units of precious metal.

<sup>14</sup> Cashiers and moneychangers were legally distinct types of intermediaries, but this distinction was not always observed in practice.

<sup>15</sup> This proposal for a geographically dispersed system of central bank-like institutions anticipated (by about three centuries) similar proposals in late nineteenth-century U.S.

## II. Complications.

### A. Cashiers.

In our basic story, mints and debtors use debasement to take advantage of the rigid ordinance values of coins. Actual settlement appears to have more often involved the use of intermediaries known as cashiers or *kassiers*. We now provide a brief description of the cashiers' activities and their relevance for the monetary situation.

Like modern banks, cashiers held deposits and provided certain other financial services, most notably local payment by "giro" or book-entry.<sup>16</sup> As financial intermediaries, cashiers were in a stronger position than the typical merchant to have the numismatic sophistication to cull out heavy coins and knowingly accept and pass light coins. While the small percentages of silver involved with debasement may have seemed a minor issue for a merchant, the same silver would have been a substantial part of a cashier's income as that income was derived from processing other people's money.

Of course, cashiers could take a similar approach to withdrawals of deposits and other financial transactions. In this sense, cashiers played the role of the "debtor" benefiting from debasement, while anyone using a financial intermediary was a suffering creditor. At the time of the Wisselbank's founding, cashiers were under frequent condemnation for these practices. An attempt by Amsterdam in 1604 to ban cashiers noted that cashiers

allow for fraudulent activity, especially the removal of heavy gold and silver coins, and their transport to prohibited and other mints, in order to be converted into new (light) coins, which are then circulated within the community. (our translation of van Dillen 1964a, 344)

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<sup>16</sup> A crucial exception being international remittances, which were largely accomplished through bills of exchange.

## *B. Multiple Mints.*

Another institutional wrinkle that promoted debasement was the diffuse political structure of the Dutch Republic. 14 government mints and 40 private mints meant plenty of opportunities for mints to serve local revenue needs (Dehing and 't Hart 1997, 39; Korthals Altes 2001, 41). Because all were legally recognized and created a common pool of coin, debasement was a type of tragedy of the commons whereby the rewards went to the first to debase.

Another significant source of debased coins was the Southern Netherlands. Here, the twist is that Dutch heavy coins did not have to be melted down to produce light coins because the export of goods could finance debasement instead. A great deal of light coin was minted in the southern Netherlands and shipped to the Dutch Republic to finance the south's trade deficit with the Republic. Causation could clearly run both ways: the profitable export of light coins by the Southern Netherlands "pulled" extra export goods from the Republic, just as trade imbalances helped to "push" silver into the Republic, silver that happened to be light coins (e.g., Polak 1998a, 205).

A piece of evidence in favor of the "pull" interpretation is that the southern coins were not treated as bullion (a commodity) to be minted into Republic coin. Instead, the debased coins were adopted into circulation because merchants and cashiers wanted them in that form. Debased coins were in demand since these could be used to short change creditors. The incentive to use southern coins was substantially increased when the Mint Ordinance of 1622 gave them a favorable fixed value in the Republic.<sup>17</sup> The Spanish Netherlands minted massive quantities of light coin for export to the Dutch Republic because of a massive demand for the light coins in the Dutch Republic.<sup>18</sup> The inflow of light coins could have been financed by an outflow of Republic coins, but export goods were preferable. The

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<sup>17</sup> This occurred less than a decade after a failed 1613 attempt to ban the importation of "counterfeit Burgundian silver dollars" (Korthals Altes 2001, 51).

<sup>18</sup> We take the adjective *massive* from de Vries and van der Woude (1997), p. 83, "The enormous trade deficit that the Southern Netherlands ran with the North throughout the first half of the seventeenth century resulted in a massive flow of these coins into the Republic."

southern Netherlands already had access to plentiful Spanish silver, while the Republic had higher valued uses for silver in the Baltic and Asia.

### *C. Distance between Debasement and Creditors.*

Another feature of our story is that the instigating shock is not arbitrage. Instead, a well-timed debasement serves as a type of tax or taking, whereby legal recognition of light coins denies creditors expected silver. The debtors who accept the light coin need not be literally the parties who supply mints with silver. Indeed, the extraction of seigniorage from minting a light coin, and the taking of silver from creditors, could be spread out along a chain of transactions.

For example, a Flemish merchant could have silver gained through trade with Spain. The Flemish merchant has the silver minted into light coin that is the coinage standard of Flanders. The Flemish merchant then makes a local purchase using his local coin. The new holder of the light coin then passes it onto a Dutch merchant to pay for the importation Dutch manufactured goods. The Dutch merchant accepts the light coin at some discount to cover transportation expenses, but the Dutch merchant also expects his cashier in Amsterdam to accept the coin at tale. The cashier in Amsterdam accepts the light coin at tale because it can be used to satisfy creditors demand with less silver than other coins.

The chain could be much longer if light coin migrates north via numerous local transactions. The point is that the process only requires someone willing to supply a mint with silver at the start of the chain and someone having to pay creditors at the other.

### **III. Minting and Melting.**

Once the shock of debasement occurs, then arbitrage causes the monetary system to adjust, and it is this process of arbitrage that produces the dynamic process seen in the Netherlands. To analyze the interaction of multiple coins with legally fixed

exchange rates, this section uses a framework developed by Redish (1990), Sargent and Smith (1997), Sargent and Velde (2002), and Sussman and Zeira (2003). The conclusion is that persistent debasement gives rise to inflation, a weakening exchange rate, calls for adjustment of mint ordinance prices, and, if adjustment is too slow or insufficient, demonetization of heavy coins.<sup>19</sup>

The dynamics of adjustment in a monetary system under a metallic standard hinges on the fact that coins always have two values, the value of the metal in them (intrinsic value) and the value of their coined form (tale) as set out by regulations like mint ordinances. When the tale value is greater than the intrinsic value by enough to cover minting and seigniorage costs, people will bring precious metal to the mint to be converted into coins. In contrast, when the intrinsic value is greater than the tale value, people will melt coins into bullion or, equivalently, treat coins like bullion rather than as a circulating means of payment.

Taking into account ordinance prices, metallic content, minting costs and seigniorage, each coin has a minting point (which Redish calls the *mint price*) and a melting point (called the *mint equivalent*). The mint price is the value to someone of bringing precious metal to a mint so the metal can be converted into coin. The mint equivalent is the value to someone of melting a coin back into bullion. The difference between the two prices is the cost of the minting process, so the mint equivalent is higher than the mint price because the cost of minting has already been paid for a finished coin. Figure 2 gives the minting and melting points for a particular coin, the rixdollar or *Rijksdaalder*, at the time of the Wisselbank's founding in 1609. If the value of a mark<sup>20</sup> of pure silver was less than 22.621 florin, then one had an incentive to bring the silver to the mint. In contrast, if the

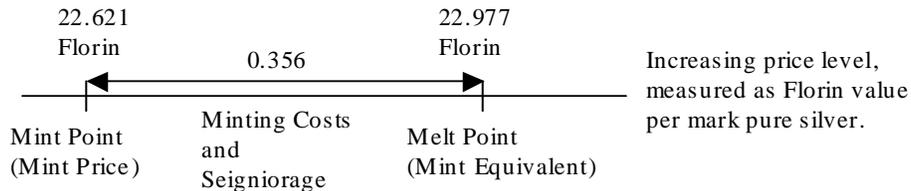
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<sup>19</sup> While bimetallic issues are also important, we focus on only silver, for silver appears to have been the focus of both debasement and specie flows.

<sup>20</sup> Eight troy ounces.

value of a mark of pure silver was greater than 22.977 florin, then one had the incentive to treat a rixdollar coin as bullion and so demonetize it.<sup>21</sup>

Figure 2. Mint Points for the Rixdollar in 1609

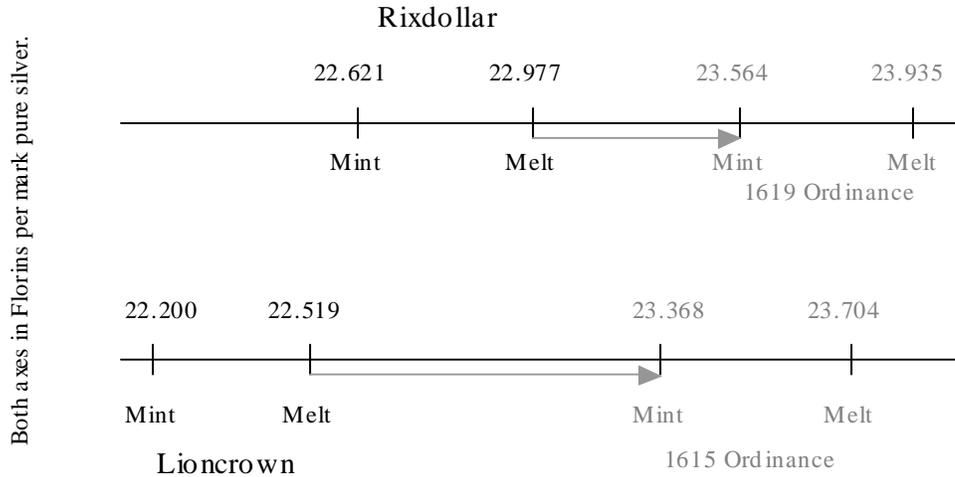


Source: Polak 1998a, 70.

When a system has two coins, then the mint-melt points of both coins can be placed on the same price continuum, but the mint and melt points are unlikely to match exactly. Smaller coins have relatively higher production costs, so their mint points tend to be lower than larger coins. Also, mint ordinances may not correctly relate prices to intrinsic values. For example, the lioncrown, or *Leeuwendaalder*, was a Dutch silver trade coin that was 95 percent of the weight of the rixdollar. Figure 2 gives the mint and melt points for both coins in 1609. At this time, the lioncrown's melt point is to the left of the rixdollar's mint point, so the incentive is to melt lioncrowns, and, if prices are low enough, mint rixdollars.

<sup>21</sup> The difference between mint price and mint equivalent of the rixdollar is approximately 1.5%, which is typical for silver coins of this period. Thus, even a relatively small debasement of one coin could demonetize or cause appreciation in the market values of competing coins.

Figure 3. Mint Points for the Rixdollar and Lioncrown, 1609 and 1615.



Source: Polak 1998a, 70-1.

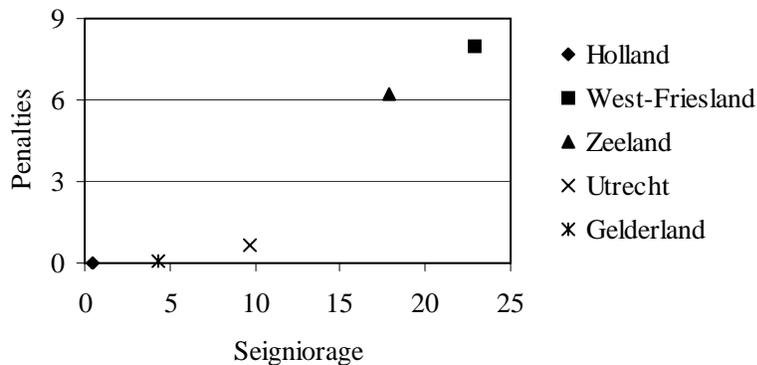
To maintain circulation, the market price of lioncrowns rose above the mint ordinance value, with the effect that the mint-melt points shifted to the right when market prices were used. In 1615, the rising price was recognized by a new ordinance, and the new mint-melt points are plotted in Figure 3 (van Dillen 1964a, 355). Now rixdollars were undervalued relative to lioncrowns, and the market price of rixdollars rose. In 1619, yet another ordinance raised the legal value of rixdollars, and now lioncrowns were discouraged.<sup>22</sup> The desire of authorities to have ordinance prices match market prices created a destabilizing process, and, however well intentioned, the ordinances provided creditors no assurance against future revaluations. Indeed, a sufficiently aggressive increase in a coin's legal value could itself amount to a backhanded sort of debasement.

Debasement also shifted mint-melt points for the same type of coin produced by different mints. The lighter coin will lie to the right of the heavier coin, so the

<sup>22</sup> The province of Holland unilaterally raised the legal valuation to 2.6 Florin (van Dillen 1964a, 355).

mint producing the lighter coin gets work and earns seigniorage. For example, Figure 4 shows the production of the rixdollar in 1607 for five provincial mints.<sup>23</sup> These mints are for the large provinces of Holland, Zeeland, Utrecht, West-Friesland and Gelderland. Mint output, measured as legitimate seigniorage income, was highly correlated with the amount of debasement per mint. Debasement income is an estimate by Republic officials of the income derived by each mint for coins falling below official tolerances of weight and fineness (Polak 1998a, 112-3). These numbers are available because Republic officials audited mint output using weighing and trial by fire.<sup>24</sup> In 1607, Holland had the most accurate rixdollar production (no assessments for light coins), but Holland also had the least demand for its minting services. In contrast, West Friesland had the most minting activity (seigniorage) and the most debasement.

Figure 4. Seigniorage and Penalties for Rixdollars in 1607, Both Axes in Florin per Day.



Source: Polak 1998b, 103-68.

<sup>23</sup> 1607 is used because it is just before the founding of the Wisselbank, and it is the year in this period for which the most mints are reported (Polak 1998b, 103-49)

<sup>24</sup> Details of how these data were collected are discussed in Polak (1998, 107-139).

#### IV. Systemic Adjustment.

To connect mint behavior with the general economy, Sargent and Velde (2002) convert the unit of measurement from the price of bullion to the price of a composite consumption good, i.e., the domestic price level. Consider the situation when an economy has only one type of coin. If domestic prices are too low (below the mint point), then people can increase their domestic purchasing power by exporting consumer goods to where their prices are higher, then importing the resulting silver, and finally have the silver minted into coin. High prices (above the melt point) reverse the incentives.

The advantage of viewing the process from the perspective of the price of goods instead of the price of silver is that a process of systemic adjustment emerges.<sup>25</sup> When people follow these incentives, the money supply and price level change until the incentive is eliminated, so minting and melting points create a self-adjusting process that is a type of specie-flow mechanism (Sargent and Velde 2002, 15-36). Minting coins increases the domestic money supply and can cause inflation. Enough inflation raises the price level above the melting point, and the process reaches an equilibrium. Melting works in reverse.

At first glance, debasement does not appear to trigger an international flow of metal because the existing metal stock is simply being re-minted into a new form with a higher nominal value, more coins, each worth the same number of florins as before. Consider this in terms of the equation of exchange  $MV=Py$  where  $M$  is the nominal monetary stock,  $P$  is the price level,  $y$  is real GDP and  $V$  is the velocity of money. In a frictionless world, the increase in  $P$  would be matched by an equal increase in nominal  $M$ . In other words, the real monetary stock remains unchanged, so no change in real income or velocity was necessary.

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<sup>25</sup> In practice, one can measure changes in domestic price level using price indices such as a consumer or commodity price index. For example, see Sargent and Velde (2002, 35, 159, 193-4). Alternatively, one can measure the international exchange rate to gauge the value of the local unit of account. For example, see Quinn (1996).

This does not hold, however, if mints siphon metal out of the money stock of the economy. Such a drain would have easily resulted from military expenditures by provinces and cities during the wars against Spain.<sup>26</sup> Another drain would have resulted from Dutch metal crossing the border to foreign mints specializing in rival coins or even counterfeits. In these situations, it can be shown algebraically that the increase in  $M$  stemming from a debasement is less than the minimum feasible increase in  $P$ .<sup>27</sup> Unless velocity ( $V$ ) can be increased, real GDP ( $y$ ) falls for the transitional period and the export of goods is required to “rebuild” the real money stock ( $M/P$ ) and return the economy to its previous level of activity.<sup>28</sup> We are not in a position to estimate the scale of this welfare loss, but the persistence of debasement and inflation in the Netherlands in this era suggests a substantial effect.<sup>29</sup>

It can also be shown that this systemic adjustment can be mitigated, if the market price of the heavy coin rises in response to a debasement, shifting its mint-melt points to the right. The coin develops a market price greater than its mint-ordinance price. While this keeps the heavy coin from being melted, it does not help creditors who face repayment in either lighter-than-expected coins or fewer-than-expected heavy coins. When a new mint ordinance eventually recognizes the higher price of old, heavy coins, it still does not compensate a creditor caught in the debasement. Only instantaneous adjustment of the minting ordinance that

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<sup>26</sup> An important component of military expenditure was the feeding of armies in the field, which in turn involved the importation of grain.

<sup>27</sup> Detailed calculations are given in Quinn and Roberds (2005).

<sup>28</sup> I.e., debasement served as a form of taxation, levied by coin holders on themselves. Given that coinage freely flowed across borders, debasement offered cash-strapped governments the possibility of taxing not only their own economy but simultaneously the economies of their neighbors.

<sup>29</sup> Of course, there is always the temptation of informed conjecture. Before the founding of the Wisselbank, the metallic content of the Republic’s coinage was dropping at a rate of about one percent per florin per year. The resultant welfare loss depends on the velocity of circulation, about which little is known. Available estimates suggest that in the eighteenth-century Republic velocity was extremely low, on the order of 1.5, based on money and income estimates reported in de Vries and van der Woude (1997, 86, 702). Taking a figure of 1.5 as a lower bound for velocity and 10 for an upper bound (the number for the late nineteenth-century U.S.), a velocity of 2-3 seems a reasonable “guesstimate” for the early Republic. This would then imply a annual loss of one-third to one-half percent of national income due to debasement, a considerable hindrance to the dynamic performance of the economy.

lowered the price of debased coins would have offered protection; obviously this was not practical.

## **V. The Wisselbank.**

If debasement, as described in the previous sections, was the monetary problem plaguing the Dutch Republic, then a solution was to end the incentives to debase. The most direct mechanism was to correctly value debased coins when those coins were used to discharge a debt. The Amsterdam city council partially achieved this goal when it created an exchange bank in 1609. Exchange banks (government-owned deposit banks) had developed in the Mediterranean as a substitute for private, fractional reserve banks (Usher 1943). In response to banking instability, cities like Venice created municipal exchange banks that did not lend reserves, so the system of payments based on bills of exchange had a stable monetary base (Mueller 1997). A public bank arose in Genoa as an adjunct to an institution that managed the public debt (Fратиanni and Spinelli 2005). The Bank of Amsterdam was modeled on the Venetian institution, but the primary focus was on stabilizing the coinage rather than the banking system.<sup>30</sup>

For Amsterdam, the key aspect of the exchange bank was that any deposit of illegal coins would be valued by the bank based solely on their metal content (intrinsic value). Withdrawals, in contrast, would be paid in certain types of coin, called trade coin or *negotiepenningen*), of a consistent weight and value. In this way, debts payable through the exchange bank would be protected from debasement because any deposit of debased coin would have its value at the Wisselbank proportionally reduced. The incentive to debase would be removed, so the thinking

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<sup>30</sup> De Vries and van der Woude characterize the motivation as, “The great concern of the city fathers was to protect and enlarge the supply of good, full-valued coin. This they regarded as far more important to the prosperity of a commercial economy than the proliferation of circulating bills (1997, 131).” We differ in asserting that the Wisselbank was designed to promote bills of exchange through the supply of heavy coin. We would add that the city prohibited bill assignment because bill circulation was seen as a means by which cashiers could hold back heavy coin (van Dillen 1964a, 345). Moving bill settlement to the Wisselbank solved this problem.

went, because debtors would no longer have the option of (however indirectly) settling debts in “overvalued” debased coin.

To put this in practice, the Wisselbank had to become the intermediary that paid creditors on behalf of debtors. Cashiers had been doing just this, but, unlike cashiers, the Wisselbank would not pass on light coin. To provide incentives to use the Wisselbank, the Amsterdam city council included two regulations on private finance, (1) bills of exchange over 600 guilders had to be settled through the Wisselbank and (2) cashiers were outlawed.<sup>31</sup> The limit was reduced to 300 guilders in 1643 (Korthals Altes 2001, 49). The enforcement of these restrictions was evidently less than perfect. Already in 1615, the city council felt the need to pass a resolution explicitly forbidding the settlement of bills outside of the Wisselbank (van Dillen 1964a, 349).

Despite these difficulties, settlement of bills through the Wisselbank became the norm. Merchants could open an account at the Wisselbank or purchase “bank funds” through an intermediary. The Wisselbank did not charge a fee for bill settlement, and the process was quick because settlement occurred as the transfer of funds from debtor to creditor account. The city guaranteed deposits and deposits these were secured against attachment by creditors (van Dillen 1964a, 349-353). The reduction in settlements costs for merchants was substantial, for “In the years leading up to the establishment of the Wisselbank in Amsterdam about 20 percent of the more than four hundred accounts in [an examined merchant’s] ledgers related solely to the settlement of bills of exchange (Gelderbloom 2003, 635).

The Wisselbank did not offer overdraft facilities, and having insufficient funds could lead to penalties being assessed (van Dillen 1964a, 350). In this way, the Wisselbank monitored debtors and disseminated news of default (Neal 1990, 7). The coordination of information needed to promote a reputation mechanism was particularly valuable for a city that was the intersection of different trading routes,

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<sup>31</sup> The prohibition on cashiers was reversed in 1621; however, strict regulations forbade cashiers from holding customer money for more than 3 days (van Dillen 1964a, 353). Still, cashiers played an active role as intermediaries who arranged for payments in Wisselbank funds or receipt of the same.

for reducing the need for sector specific information assisted the blending of bills into a unified secondary market. Such market depth increased the liquidity of bills payable through the Wisselbank.

## **VI. Regulatory Dilemma.**

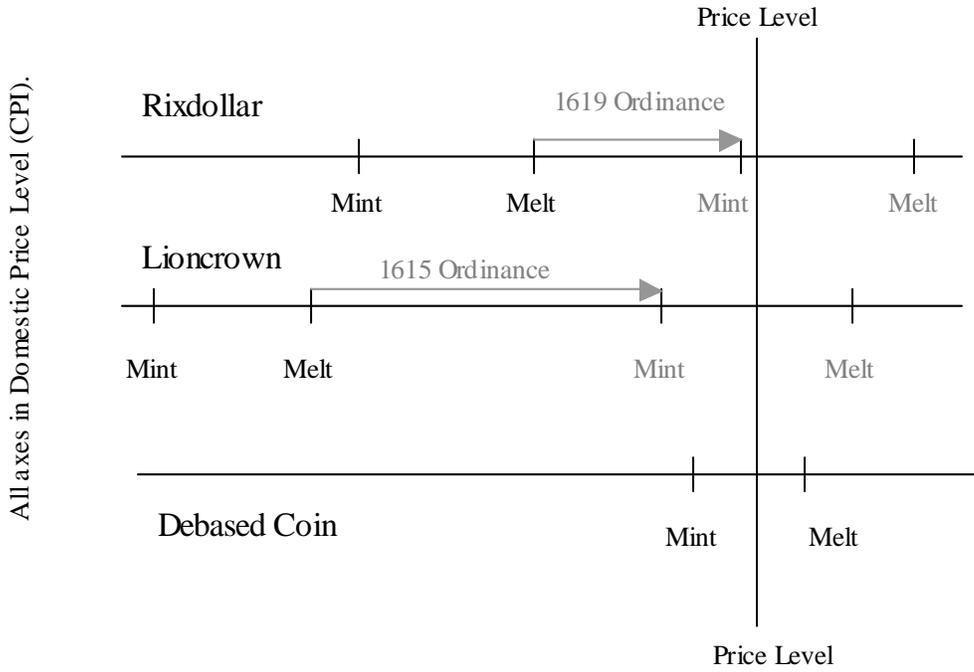
The initial structure of the Amsterdam Exchange Bank provided some protection to creditors who held bills payable through the Wisselbank; however, its reach was limited. Other cities (Middelburg 1614, and Delft 1621 subsequently moved to Rotterdam in 1635) eventually opened exchange banks also, but the rest of the Dutch economy remained outside the system, and debasement of Republic coins continued. Simultaneously, the flow of light coins from the southern Netherlands increased during the Twelve Years' Truce with Spain (1609-1621). As a result, the silver *patagon* and *ducatoon*, both coins from the southern Netherlands, became common in Amsterdam by 1612 (van Dillen 1964a, 355).<sup>32</sup>

Continued debasement meant that the market price of heavy coins had to rise in order to keep them in circulation. This can be clearly seen in Figure 5, which compares the relative mint-melt points for a debased coin to the mint-melt points for full-weight rixdollars and lioncrowns in the 1610's. We lack measures of actual metal content of debased coins, so the picture is an abstract. Also, the metric is the domestic price level, so the process of systemic adjustment is highlighted. With debased coins creating incentives to melt full-weight coins, the market price of rixdollars and lioncrowns increased, and that slid their de facto mint-melt points to the right. Again, the mint ordinances of 1615 and 1619 were simply official validation of the market prices of these coins.

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<sup>32</sup> These coins were expressly designed to compete with the Republic's coins, in retaliation against the ongoing debasement of coins within the Republic (Korthals Altes 2001, 50-51). The patagon was also known as the "cross rixdollar."

Figure 5. Mint Points for Heavy and Debased Coins, 1610 to 1620.



Source: See text.

The ordinances of 1615 and 1619 satisfied one regulatory goal, keeping ordinance prices in line with circulating prices; however, the ordinances also undercut the Wisselbank’s mission to protect creditors. The Wisselbank was obliged by statute to follow ordinance prices, so the official increase in lioncrown and rixdollar values reduced the value of a deposit at the bank because the same number of florins now purchased fewer coins upon withdrawal. The effects of debasement were visited on creditors despite all the efforts to insulate them, because regulators forced Wisselbank valuations to match those from the debased side of the economy. The situation was a consequence having one policy tool, mint ordinances, trying to achieve two policy goals, insulating creditors from debasement while adjusting official prices to the reality of debasement.

## VII. Regulatory Odyssey.

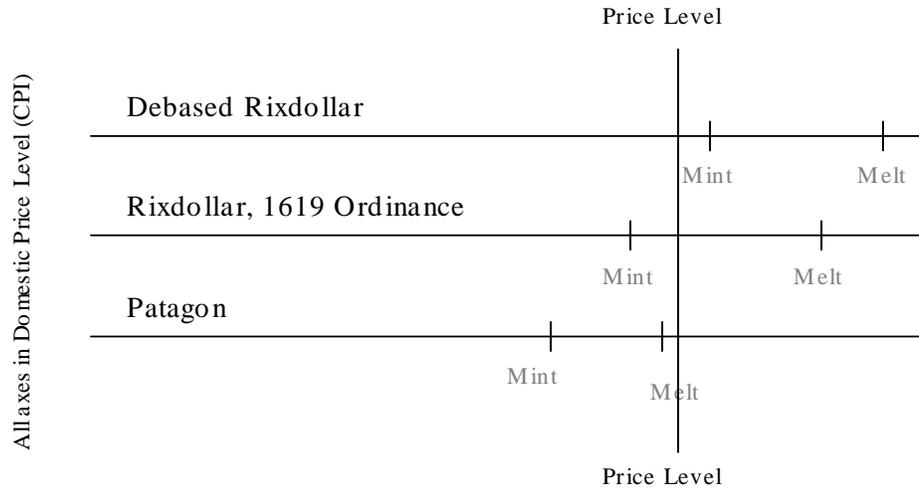
During its first fifty years, the Wisselbank was repeatedly caught between these two regulatory goals. The mint ordinances regulating the structure of the Dutch monetary system were repeatedly tweaked to either reflect debasement that had occurred or to undo the effects of debasement. Each change produced unintended consequences for both the Wisselbank and the monetary system. Eventually but erratically, regulators began to accept the solution to the dilemma, i.e., that the value of coins at the Wisselbank should differ from the value of the same coins in general circulation.

This section of our paper navigates this chaotic era to show how the mint ordinances were shocks to the monetary system, how the Wisselbank was thrown about, and how the Wisselbank ended the era in a new regulatory environment that would permit the Amsterdam exchange bank to evolve into a conceptually different institution, a central bank. Moreover, the pattern of evidence over these decades of regulatory change supports our focus on the Wisselbank as a solution to the problem of debasement.

### A. *The Mint Ordinance of 1619.*

The mint ordinance of 1619, which raised the official price of rixdollars, touched off a surge of minting. To show why this happened, we need to separate the coins depicted in Figure 5 above into domestic coins and the light coins moving up from the Spanish Netherlands. We focus on the Republic's primary trade coin, the rixdollar, and its mimicker from south, the *patagon*. By debasing rixdollars, Dutch mints could achieve mint points above the melt points on *patagons*. This situation produces seigniorage for the debasing mints.

Figure 6. Mint Points for the Rixdollar, the Debased Rixdollar and the Patagon, 1619-1621.



Source: See text.

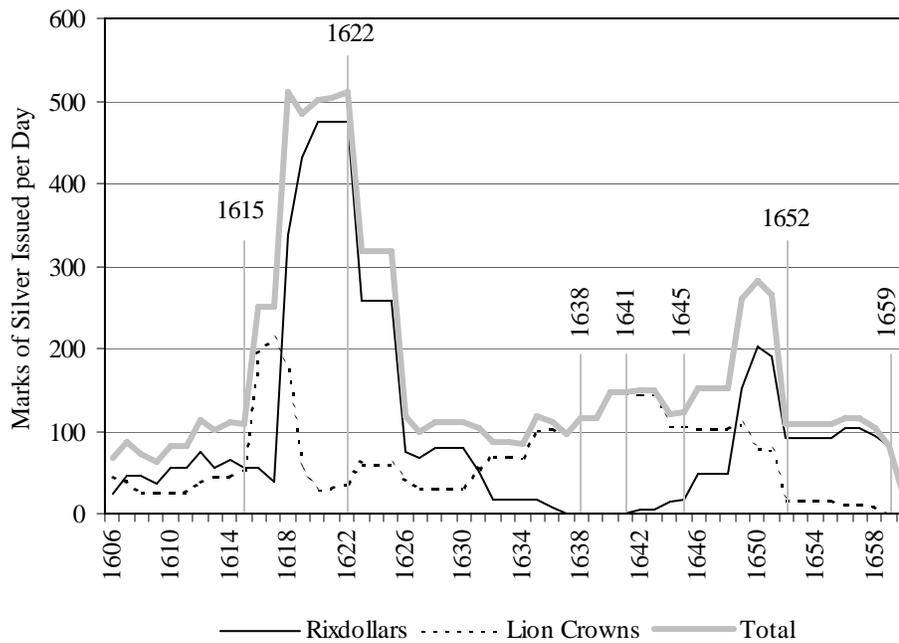
There is some indirect evidence that this is what actually happened. Figure 7 shows the amount of silver the minted as lioncrowns and rixdollars.<sup>33</sup> For later reference, the dates of major mint ordinances are superimposed. The measure of mint output is incomplete in that it only covers five provincial mints and has periods of missing observations.<sup>34</sup> The mints are Dordrecht in Holland; Hoorn, Enkhuizen and Medemblik in West-Friesland; Middelburg in Zeeland; Utrecht; and Harderwijk in Gelderland. The series are also lumpy, in that a mint's production total could encompass many years, so although all production levels have been converted into a per-day basis, the same value can run over many years. Lioncrown production spikes in 1617 as the 1615 ordinance value encouraged lioncrown production relative to rixdollars (see Section III, Minting and Melting

<sup>33</sup> The data are derived from Polak (1998b, 103-145). Mint periods of less than 60 days (of which there were 6) are excluded because they have insufficient denominators for reliable relative measures. If two observations included the same year, then the one with more days in that year was used.

<sup>34</sup> This is also a somewhat biased sample, as unfortunately there are no data during this period for the municipal mints, which were on the whole less inclined to hold to the minting ordinances.

above). The process was focused in Utrecht, the mint on the southern frontier with the Spanish Netherlands. The rise and fall of lioncrown minting in 1616-18 was evidently driven by a surge in Utrecht production of lioncrowns in 1616 and then Utrecht switching its high levels of production from lioncrowns to rixdollars as the next ordinance favored the minting of rixdollars.

Figure 7. Production of Heavy Silver Coins at Five Provincial Mints



Was the surge in minting driven by debasement? Figures 8 and 9 plot the amount of seigniorage that would have been earned by the five mints if they had produced full weight lioncrowns (Figure 8) and rixdollars (Figure 9). The figures also chart the penalties the mints were assessed for producing debased coin. These penalties were assessed by Republic mint officials in an effort to maintain the quality of the coinage. Interestingly, the penalties themselves were due from a mint's master to the owner of the mint, i.e., the province. In other words, monitoring and assessment of penalties by the national government created an incentive for provinces to condone debasement. We cannot speak to what other economic relationships ex-

isted between mint masters and their provinces, but the potential for mutual gain through debasement is obvious.

Figure 8. Lioncrown Seigniorage and Penalties, in Florins per Day.

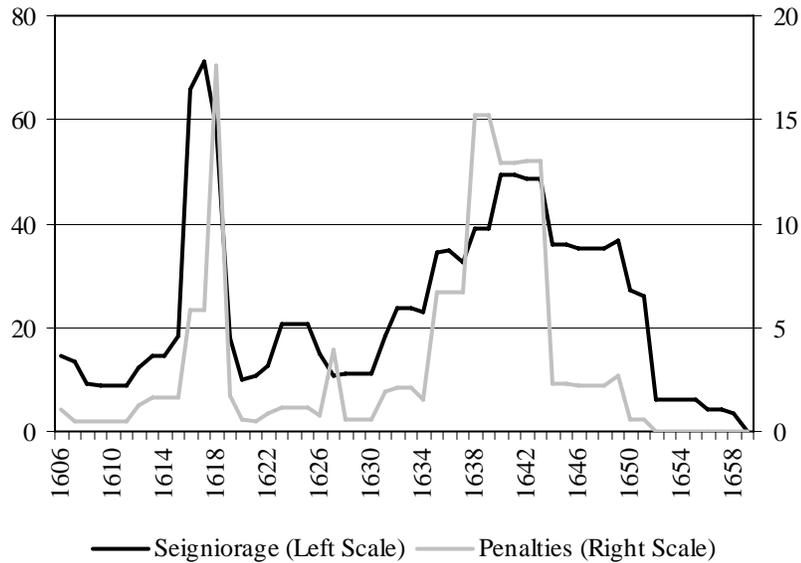
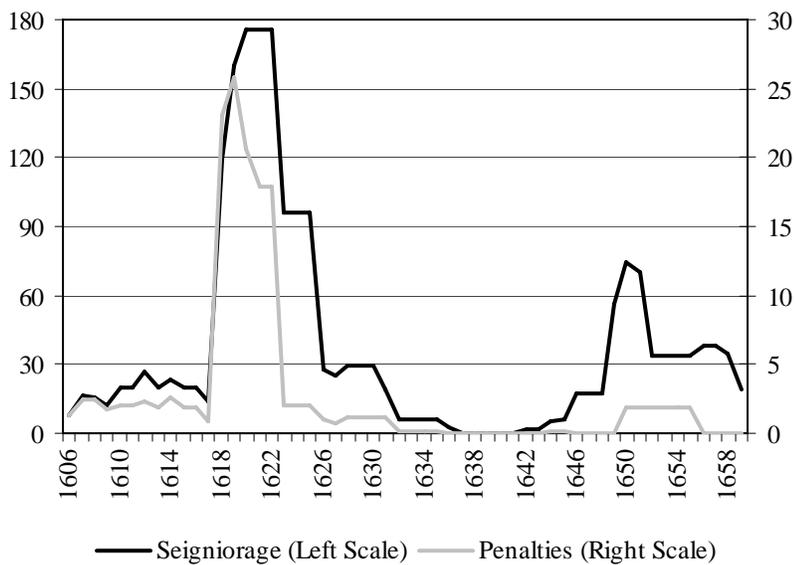
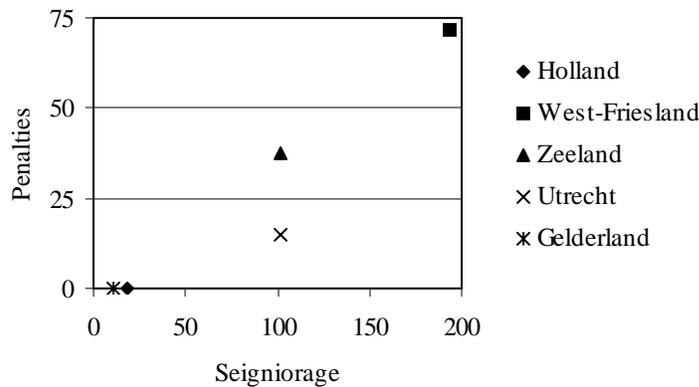


Figure 9. Rixdollar Seigniorage and Penalties, in Florin per Day.



For both coins, the relationship between demand for a coin (legitimate seigniorage) and penalties for debasement is striking. Again, the seigniorage values are for (hypothetical) full-weight coins, so the amount of additional seigniorage from coins being below tolerance is not known. Of course, the five mints varied in both the amount of minting they engaged in and the amount of debasement they were penalized for. Figure 10 plots the seigniorage and penalties for debasement by mint for the year 1620, the peak of rixdollar production. Again, demand for a mint's business is positively related to its readiness to debase.

Figure 10. Seigniorage and Penalties for Rixdollars in 1620, Both Axes in Florin per Day.

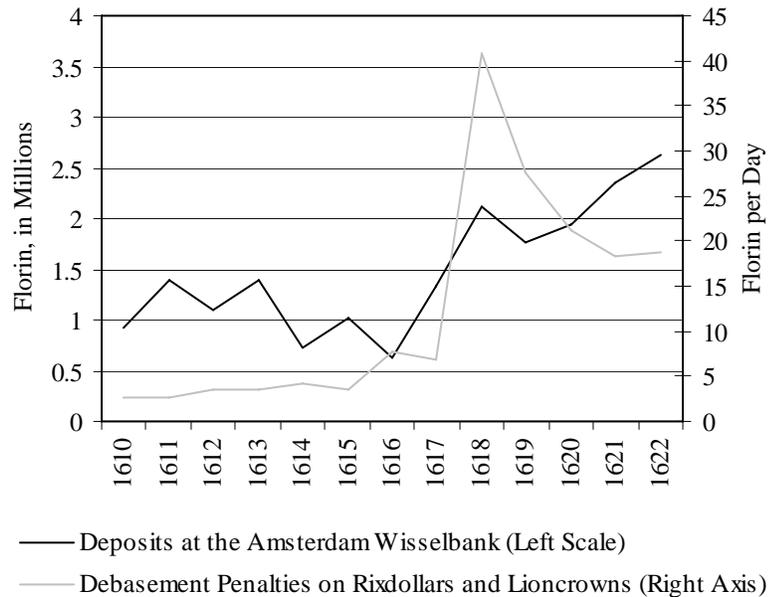


Source: Polak 1998b, 103-68.

What did the surge in debasement mean for the Amsterdam Wisselbank? It appears to have promoted deposits despite the revaluation of coins in 1615 and 1619. Figure 11 shows that deposits at the Wisselbank grew rapidly in 1617 and 1618 when debasement of the Wisselbank's primary silver coins, rixdollars and lioncrowns, peaked. Available evidence also suggests that the number of accounts held at the Wisselbank also grew over this time period; Van Dillen (1964b, 406) puts the number of accounts at 708 in 1611 and 1202 in 1620. As debasement continued in the following years, so did the growth in Wisselbank deposits.

Unlike the other mints, Holland abstained from debasement, so coin minted for the Wisselbank maintained content.

Figure 11. Wisselbank Deposits and Debasement



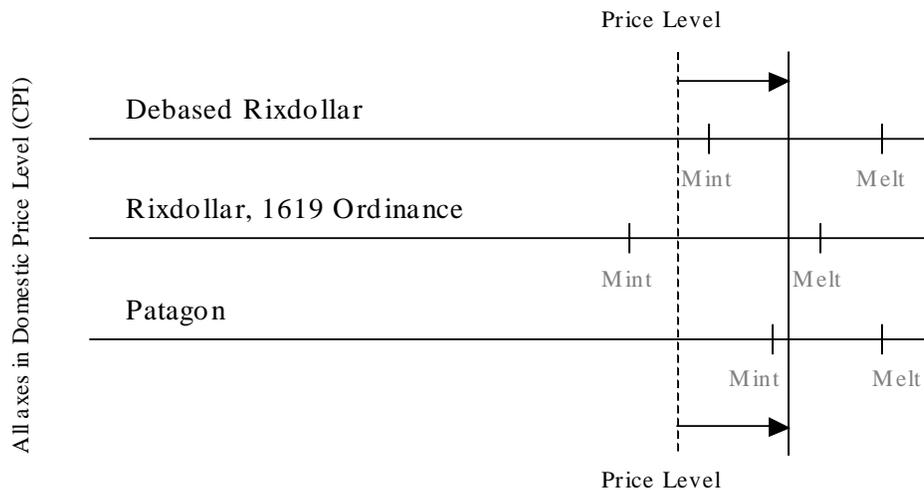
Source: Wisselbank deposits from van Dillen 1934, 117; penalties derived from Polak 1998b, 103-149.

Finally, we should stress that Figure 11 does not include debasement from other sources, for example, small silver coins from municipal mints, *patagons* from the southern Netherlands, etc., so ours is very incomplete measure of overall debasement. For example, the start of the Thirty Years’ War in Central Europe in 1618 lead to five years of severe debasement and inflation throughout the German states (Sargent and Velde 2002: 257-60). Rixdollars and lioncrowns, however, were the basic coins of the Wisselbank, so their debasement elsewhere was a direct threat to the creditors that used the Wisselbank.

B. The Mint Ordinance of 1622.

In 1622, the Dutch Republic changed its regulatory approach. Instead of increasing the official price of rixdollar and lioncrown coins, it instead created a legal value for the *patagons* “invading” from the southern Netherlands. The mint ordinance created a fixed legal exchange rate between the insurgent *patagons* and the Republic’s system of coins. The 1622 ordinance set a legal value for the *patagon* at 2.35 florins, and it rolled the rixdollar back to 2.5 florins, so the rixdollar-to-*patagon* ratio became 1.064 (van Dillen 1964a, 356).<sup>35</sup> The market values of the coins, however, were close to 2.6 florins for rixdollars and 2.5 florins for *patagons*, so the market’s ratio was 1.04 (van Dillen 1964a, 355-6). This corresponds with the finding that southern coins had, “silver contents 4 percent lower than those of comparable Dutch coins (de Vries and van der Woude 1997, 83). In short, official prices overvalued rixdollars relative to *patagons*, and Figure 12 draws the situation.

Figure 12. Mint Points for the Rixdollar, Lioncrown and *Patagon*, 1622-1638.



Source: See text.

<sup>35</sup> Holland had increased rixdollars to 2.6 florins the previous year.

One result was that people lacked an incentive to bring *patagons* to the Wisselbank or to the mints, so the minting of Dutch rixdollars declined precipitously.<sup>36</sup> Our characterization of the 1622 ordinance is that it shifted the Patagon rightwards, so that the incentive to mint rixdollars ended as domestic prices rose. Returning to Figure 9, the amount of rixdollars produced by the five mints returned to pre-1616 levels under the new ordinance.

At the same time, the ordinance increased incentives to import *patagons* into the Dutch Republic. The first half of the seventeenth century witnessed a surge in mint production in the southern Netherlands, and, from 1613 through 1656, the value of average annual mint output for the southern Netherlands was 4.2 million florin (de Vries and van der Woude 1997, 86). In contrast, the combined rixdollar and lioncrown production for these five mints only produces a rough estimate of 1.6 million florins.<sup>37</sup> While much of the southern coinage was then exported by the Dutch Republic to the Baltic, Levant and Asia, what remained, “became the dominant circulating currency” in the Republic (de Vries and van der Woude 1997, 83).

At an aggregate level, the inflow of light coin promoted inflation. Figure 13 plots both the level of combined rixdollar-lioncrown minting and a consumer price index (CPI). The price level situation is not a simple money supply story, for the Dutch Republic and Spain resumed war in 1621; however, the Mint Ordinance of 1622 also marked the beginning of a period of renewed fiscal, and hence, inflationary pressures.<sup>38</sup>

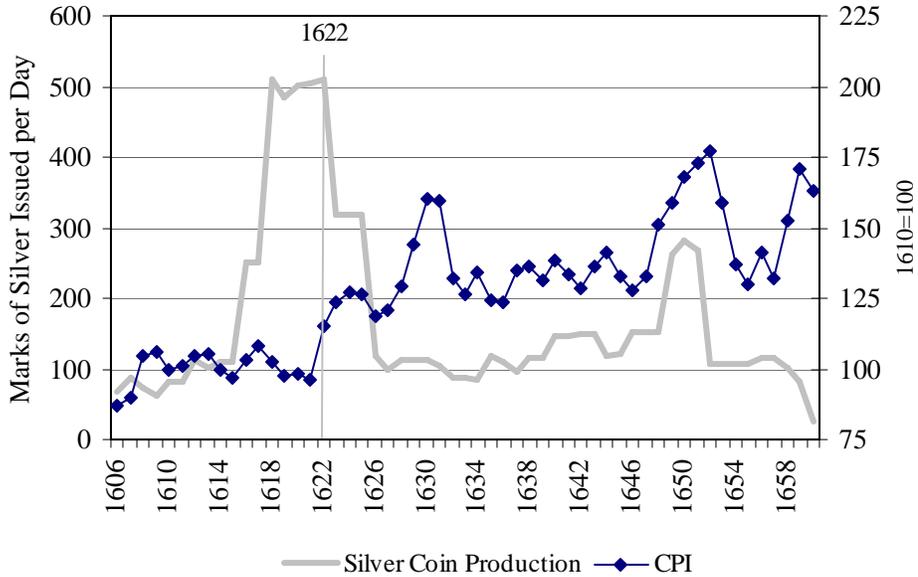
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<sup>36</sup> With the renewal of war with Spain in 1621, the loss of seigniorage from the decline in minting was particularly counterproductive for the Republic. 1621 begins an era of rapidly increasing long-term borrowing (Fritschy 2003: 66).

<sup>37</sup> Using a per-day output of 191 marks at 23.5 florin per mark.

<sup>38</sup> In 1621, military expenditures “immediately doubled, exceeding 20 million per year in the mid-1630s (de Vries and van der Woude 1997, 100).”

Figure 13. Dutch CPI and Production of Heavy Silver Coin.



Source: Mint numbers from Polak (1998b); prices from van Zanden (2004)

Was the Wisselbank able to protect creditors in this era? We answer “yes but only partially,” for the Wisselbank was able to limit declines in the external value of its deposits during an era of substantial domestic inflation. Table 1 contrasts changes in the exchange value of the florin, relative to the English pound, with changes in the Dutch domestic price level. Because the exchange rates are in averages for five-year periods, the other values have also been calculated as changes between five-year averages. The inflation from the early 1620s to the early 1630s corresponds with a much smaller decreases in the florin. At the same time Wisselbank deposits continued to grow rapidly. We take this as evidence that the Wisselbank succeeded in protecting bills of exchange in Amsterdam, yet the exchange bank could not fully control the aggregate price level.

Table 1. Changes in External and Internal Value of the Florin

	Change in Florin's Exchange Rate	Change in CPI	Change in Wissel- bank Deposits
1606-10 to 1611-15	-1%	2%	
1611-15 to 1616-20	+1%	0%	40%
1616-20 to 1621-25	-2%	16%	52%
1621-25 to 1626-30	-1%	14%	51%
1626-30 to 1631-35	-2%	0%	10%
1631-35 to 1636-40	+1%	-2%	50%
1636-40 to 1641-45	-6%	1%	31%
1641-45 to 1646-50	11%	10%	13%
1646-50 to 1651-55	-4%	5%	-8%

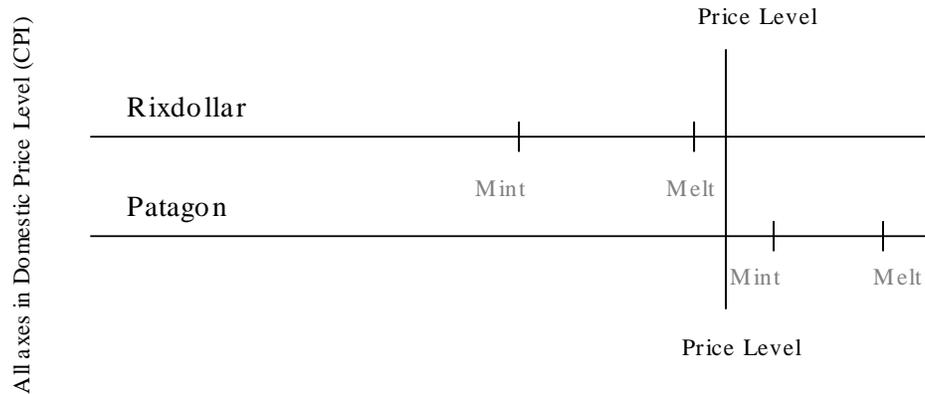
Source: Exchange rates from McCusker (1978, 55); price changes derived from van Zanden (2004); and Wisselbank changes from van Dillen (1934, 117-8).

### *C. The Toleration of 1638 and the Crisis of 1641.*

By the late 1630s, *patagons* were circulating above their ordinance value. The production of rixdollars had dwindled to only Holland and Zeeland, for both provinces had exchange banks. Lioncrowns were being minted primarily in West-Friesland and Gelderland, but those two mints were also being assessed for debasement. In 1638, a new effort was made to reconcile ordinance prices with circulating reality, so the value of *patagons* was raised by temporary “toleration” by over 6 percent from 2.35 to 2.5 florin each—the same as the official value for rixdollars. Not only did the official premium on rixdollars disappear, but *patagons* were lighter than rixdollars, so rixdollars swung to become undervalued (van Dil-

len 1964a, 360). In terms of mint-melt points (Figure 14), the toleration of 1638 pushed *patagons* far to the right.

Figure 14: Effects of the 1638 Toleration



Source: See text.

This created a strong incentive to withdraw heavy rixdollars from the Wisselbank. People complained that rixdollars were flowing out of the bank, not to finance trade, but to send to the mints in the southern Netherlands (van Dillen 1964a, 360). Production of rixdollars ceased (see Figure 9 above), and merchants complained that it was impossible to get good, heavy silver coins. In the process, “rixdollars and lioncrowns completely disappeared from circulation to be exclusively used as commercial coins for export (van Dillen 1934, 88).”<sup>39</sup>

The Wisselbank apparently ran out of rixdollars sometime in 1640-41, so the Wisselbank violated its governing ordinances and began to give out *patagons* and ducatoons, another “light” southern Netherlands coin, for withdrawals.<sup>40</sup> This change was subsequently recognized by municipal ordinance in October 1641 (van Dillen 1964a, 361). The change removed the incentive behind the with-

<sup>39</sup> Of course, coins exported to finance trade might easily reenter the Republic as *patagons*.

<sup>40</sup> In contrast, Rotterdam dealt with the shortage of heavy coin in 1639 by allowing English Merchant Adventurers (the primary debtors having bills payable there) to circumvent the Rotterdam exchange bank (van Dillen 1964a, 362).

drawal process, but it also marked a failure of the Wisselbank to defend creditors and the value of bills of exchange. Once Amsterdam had declared the southern coins to be bank money, the exchange banks in Middelburg and Rotterdam quickly followed (van Dillen 1964a, 361). In turn, the florin exchange rate dropped 6 percent from its average value in the late 1630s to the early 1640s (see Table 1). Deposits at the Wisselbank first surged by 44 percent from January 1638 to January 1640, then held steady for the year 1640, but then collapsed to below their 1638 levels.<sup>41</sup>

#### *D. The Agio and the Mint Ordinances of 1645.*

After the crisis of 1641, the Dutch Republic struggled with how to deal with the *patagons*, for they were now the standard circulating coin and the de facto standard for the Wisselbank. The process was chaotic, for regulators could not reconcile themselves to the same coin, the *patagon*, having a different value in the Wisselbank relative to outside the Wisselbank.

The regulatory mayhem began in March 1645, when the Republic passed a new mint ordinance that was a return to the old 1622 system. The change was wrenching, for it meant that *patagons* were no longer legal money for withdrawal despite *patagons* having become the basis of the monetary system. Not surprisingly, Amsterdam merchants complained to the city, for the regulation threatened the liquidity of the Wisselbank.

Two months later, in May 1645, the city relented and empowered the Wisselbank to defy the mint ordinance and again issue *patagons* for withdrawals, but the withdrawal rate was set at 2.4 florin (van Dillen 1964a, 362). While this change did allow withdrawals, it would also create a 2 percent “haircut” for depositors, for *patagons* were valued at 2.35 florin when deposited. Perhaps the price differential was a concession the Wisselbank had to make to gain regulatory relief, but

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<sup>41</sup> The five-year averages used in Table 1 miss this drop in 1641 because of a one-year surge in deposits in 1644.

it would have been another failure to protect depositors had not the Wisselbank sought a remedy.

The very next month, June 1645, the Wisselbank requested, and Amsterdam agreed, to raise the lawful value of *patagons* for deposit purposes, so deposit value equaled withdrawal value (van Dillen 1964a, 362). While the June rate adjustment protected new depositors, it did not help existing depositors. In August 1645, when the Wisselbank was again running out of heavy coins and expected to cover withdrawals in *patagons*, the exchange bank gained permission from the city to adjust the rate to reflect the lightness of the coin (van Dillen 1964a, 362). The adjustment was called the *agio*, and it meant that more *patagons* were given out than their ordinance value would dictate, so the intrinsic value of deposits was maintained.

Because the Wisselbank charged a small withdrawal fee, a market developed for buying and selling deposits on the Wisselbank. People had been contracting to avoid these fees from the opening of the Wisselbank, but now, for the first time since the decline of the rixdollar in 1622, the same coin was commonly on both sides of the exchange, so by the late 1640's the market deepened as a standard type of trade emerged. Buyers and sellers of Wisselbank funds against "current money" (that which circulated outside the bank) would meet every morning at the square in front of the Amsterdam Town Hall. Often these were cashiers, who had by now established themselves as intermediaries in Wisselbank funds (van Dillen 1964a, 366-7). The emergence of Wisselbank funds as a tradable commodity was a critical step in the evolution of the Wisselbank away from the medieval model of an exchange bank and towards something more closely resembling a central bank.<sup>42</sup>

The term "bank money" was already in use at this time, but initially this meant nothing more than "coin such as is kept at the Wisselbank." The only difference between a *patagon* in the bank (*banco*) and a *patagon* outside the bank (*current*)

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<sup>42</sup> We believe this market to be the world's first "open market" in central bank funds.

was the fee and the difference in official prices. The exchange rate that developed was also called the agio, but it was a market swap rate (current coins for deposit balances) rather than the actual rate used by the Wisselbank to calculate the amount of coins delivered upon withdrawal of a deposit. Indeed, arbitrage meant that the actual withdrawal rate created an upper limit on the market agio. The agio was measured as the ratio of current florin over bank florin. For example, if *pata-gons* circulated at 2.5 florin, then the agio would be  $[1-(2.5/2.4)]*100 = 4.166$ , less a small amount for a share of the withdrawal fee.

Table 2. The Agio (premium) on Wisselbank Deposits.

Year (* Mint Ordinance)	Agio
1645*	4 1/6 - 4.75%
1646	0.75 - 2%
1647	1.125 - 1.25%
1648	1.75 - 2%
1649	2.53%
1650	2.32%
1651	3.06%
1652*	3.38%
1653*	1.94%
1654*	2.10%
1655	2.42%
1656	2.20%
1657	3.00%
1658	No observation

Source: 1645-48 observations from van Dillen (1964a, 363); 1649-57 observations from McCusker (1978, 46).

The agio allows a direct measure of the current price of *patagons*, relative to the Wisselbank price, and Table 2 presents agio values from 1645 through 1657. Although unstable, the development of the agio was a crucial step in the protection of creditors, for the agio allowed systemic adjustment while keeping the metal value of Wisselbank deposits constant. Debasement of circulating coins could be met with a virtually simultaneous increase in the agio, so debtors gained no advantage. Similarly, authorities could adjust the legal price of circulating coins, via tolerations, without upsetting the Wisselbank. Part of the process was that Wisselbank customers were becoming comfortable with the distinction between bank prices and current prices, comfortable with an exchange rate between the two units of account, and comfortable with brokers and dealers managing the market between the two kinds of money.

#### *E. Period of Transition, 1646-1658.*

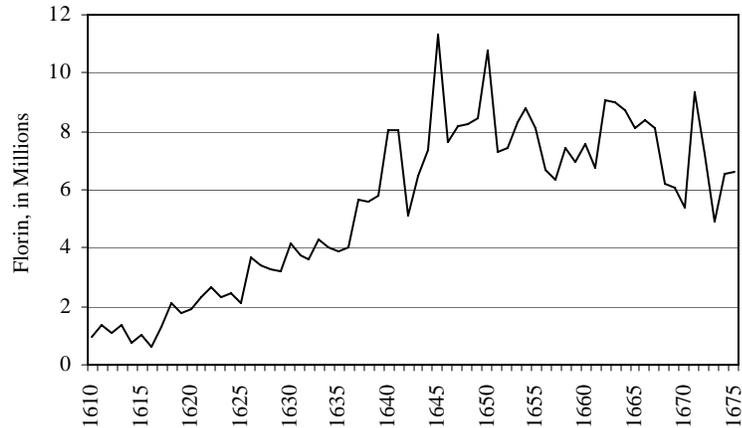
The agio of 1645 brought a new dynamic to the Dutch monetary system. For example, 1646 brought two new trends that lasted until 1651-2: (1) the production of rixdollars suddenly recovered, and (2) the CPI began to increase. Back in 1619-21, rixdollar production had surged while prices were steady. After 1622, prices surged while rixdollar production collapsed. Now, both were increasing, and the difference was that rixdollars were no longer part of the circulating monetary stock. Rixdollars were now only produced and used for export. The production reflects a boom in international trade between the end of Eighty Years War in 1648 and the First Anglo-Dutch war in 1652. Put another way, the mint-melt points for rixdollars used to describe earlier eras were no longer relevant.

What *was* relevant was the quality and quantity of coins circulating in, but not minted in, the Dutch Republic. We have no direct measure of either, but we do have the agio. The initial agio of 1645 disappears by 1646 (see Table 2). That dramatic change suggests that the Wisselbank stopped offering to supplement

withdrawals and that *patagons* were circulating at around 2.45 florin. The rise in the agio from 1646 through 1652 suggests that *patagons* were rising in current price towards 2.5 florin, so it took ever slightly more of them to purchase a deposit at the Wisselbank. The increase in domestic prices over the same period, however, was far more dramatic. If the agio tells us that if the florin value of *patagons* was not surging, then quantity of them in circulation was. Debasement may have contributed to the influx of *patagons*, but it would not have been the primary story. Instead, during this period “real-side” effects likely took precedence over monetary adjustments. The Dutch economy expanded strongly following the 1648 Treaty of Westphalia, which ended war with Spain. Prices rose with the recovery and *patagons* streamed in to finance the resumption of trade with the South, and the growth of the economy more generally.

During this same era, deposit levels at the Wisselbank stopped growing. Figure 15 plots annual deposit levels, and, despite one-year peaks in 1645 and 1650, a slowing of the Wisselbank’s growth is evident. Instead of viewing this as a sign of the Wisselbank failing, however, we view this as a sign that the campaign against debasement was succeeding, for less debasement reduced demand for Wisselbank balances. While we have no measure for the amount of debasement occurring over all the relevant mints, Figure 7, above, does show a decline in the debasement of lioncrown coins by the provincial mints in this era. Moreover, the surge in rixdollar production around 1650 was apparently accompanied by little debasement (Polak 1998b, 103-49).

Figure 15. Deposits at the Amsterdam Wisselbank



Source: van Dillen 1934, 117-9.

A number of factors were coming together to discourage Dutch debasement at mid-century. The development of the agio meant the successful protection of creditors and reduced incentives to debase. The 1645 mint ordinance reduced the number of coins holding official valuations, so fewer types of coins could be used to short-change creditors. The end of the Eighty Years' War in 1648 reduced government demand for seigniorage. Finally, rixdollars were now viewed as an export coin, so the surge in production suggests a recovery in international trade.<sup>43</sup>

Authorities eventually responded to this situation by adjusting their lawful price in 1652 and 1653 (van Dillen 1964a, 364). The adjustments, called tolerations, did

<sup>43</sup> Here we would be remiss not to mention the role of the “financial revolution” in the Dutch Republic. Effectively, this meant that war expenditures were financed through funded, long-term debt that bore relatively low interest rates (see ‘t Hart 1997). Debt levels (temporarily) stabilized following the cessation of hostilities in 1648. The Wisselbank was not directly impacted by these developments, since it was not concerned with the management of public debt, but it did ultimately benefit through the lessening of the provinces’ incentives to debase.

not apply to the Wisselbank, so the same coin, the patagon, was lawfully valued at 2.4 florin at the exchange bank but at a higher price in circulation.

Still, government authorities were not happy with the *patagons* and the agio, and van Dillen suggests that a spurt of ordinance tinkering occurred in the 1650s. The 1645 mint ordinance was renewed in 1652 and 1653, but tolerances for circulation coins were added. A mint ordinance of 1654 complains that the agio was high and uncertain. It was high because, as a moneychanger, the Wisselbank was only to charge a modest withdrawal fee, typically less than 0.5 percent. After 1645, the agio was greater than this, and it increased from 1646 to 1652. The agio was uncertain because it was a market price. In response, the Mint Ordinance of November 1654 increased the Wisselbank price of a patagon to 2.45 florin while the lawful circulating price was 2.5 (van Dillen 1964a, 364). This created another “hair-cut” for depositors, for there is no mention of a special withdrawal agio to compensate depositors. Less than two years later, the 1654 ordinance was revoked. The Amsterdam city council felt that the coins of the Wisselbank had fallen into “decadence.” To improve the situation, the value of *patagons* was reduced back to 2.4 florin and the withdrawal fee was set at 1/8 percent. All this is based on obscure references found by van Dillen, but the overall picture suggests that authorities just did not know what to do with the agio.

#### *F. The Mint Ordinance of 1659.*

The strangeness of the Dutch monetary situation derived from a monetary base built on foreign coin. The Republic was not receiving seigniorage from these coins, nor was it in control of their quality. Similarly, the Wisselbank was expected to defend the quality of coins available to depositors, but it could not mint high-quality versions of the coins used for withdrawal. To undo the situation, the Republic introduced new coins in 1659 that mimicked the coins from the southern Netherlands. The silver *dukaat* and the silver *rijder* were made slightly lighter than their respective southern substitutes, the *patagon* and the *dukaton*. The new

coins quickly replaced the old coins, and the change ushered in an era of stable coinage.<sup>44</sup>

To facilitate acceptance of the new coins, the existing pricing system was maintained, so a silver *dukaat* was officially made worth 2.4 florin at the Wisselbank and 2.5 florin as current money outside of the exchange bank. The distinction between the banco unit of account and current unit of account was codified at the national level, to the double pricing that had begun 15 years earlier was recognized and made a permanent part of the system. Another aspect of how the 1659 ordinance minimized disruption of the monetary system was that the new silver *dukaat* came to be called the *rixdollar* in everyday use. The old rixdollar came to be called the bank rixdollar. Similarly, the new *rijder* was called the *ducaton* in usage.

#### *G. Summary.*

To summarize this long section, from the 1610's to the 1650's, the Amsterdam Wisselbank was buffeted by a series of mint ordinances, for the exchange bank was caught in offsetting policy goals. Policy makers desired to stabilize both coin content and coin values. Unfortunately, each new fixed-price regime created unstable dynamics, and some directly undermined the Wisselbank's ability to protect creditors.

Ironically, the road to stability was to embrace flexible coin prices. This was managed by allowing a floating exchange rate, called the *agio*, to exist between deposits at the Wisselbank and money circulating outside the exchange bank. Official recognition of the *agio*, however, occurred only at the end of a bewildering chain of regulatory missteps. By 1659, just getting the Dutch Republic to again use its own coins was a greater concern than the cognitive dissonance of a coin

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<sup>44</sup>Complete victory remained elusive. A rise in the price of silver during the second Anglo-Dutch war (1665-1667) and during subsequent hostilities severely cut into the business of the mints. This resulted in a wave of marginal debasement by mints outside of Holland and a slight depreciation in the value of current money (Korthals Altes 2001, 54-59). The value of Wisselbank money was unaffected, however. A fully stable national coinage was finally achieved after passage of the mint ordinances of 1691 and 1694 (de Vries and van der Woude 1997, 83).

having two prices. Once the new set of Dutch coins was well established, the dual pricing structure of the agio was an accepted and, we assert, a beneficial part of the monetary system. Superficially the agio on bank money resembled the historically common “overvaluation” (*stygeringhe*) of heavy coin. But the key difference was that the unit of account for commercial transactions was unambiguously tied to the essentially non-circulating heavy coin in the vault of the Wisselbank.

### ***VII. Genesis of a Central Bank.***

From its inception the Wisselbank carried out one of the key functions of modern central banks, the operation of a “real-time gross settlement system,” i.e., a giro or book-entry payment system that allowed for efficient settlement of the high volume of commercial transactions flowing through Amsterdam (Neal 2000, 121-2). Total balances at the Wisselbank were relatively modest, always less than 20 million florin in the late seventeenth century, and less than 30 million in the eighteenth (van Dillen 1934, 117-123). By way of comparison, de Vries and van der Woude (1997, 90) estimate the total money (coin) stock of the Republic at 120 million florin in 1690 and 200 million a century later.

The low levels of Wisselbank deposits no doubt understate their importance to the Dutch economy, however, as the velocity of transactions in Wisselbank balances was probably quite high. Writing in 1766, Jacques Accarias de Sérionne (cited in Braudel 1984, 240) put the daily value of Wisselbank transactions at ten to twelve million florins per day. Given a mid-eighteenth century national income of around 250 million florin (de Vries and van der Woude 1997, 702), this would in turn imply that the Wisselbank “turned over” transactions equal to the annual value of the Republic’s GDP within a space of less than six weeks. This pace is not quite as frenetic as that of modern large-value payment systems, which routinely turn over their host countries’ annual GDP within a week or less (Committee on Payment and Settlement Systems 2006). It is nonetheless an astonishingly high figure for an economy that has often been described as “pre-industrial.”

The mint ordinance of 1659 set the stage for the Wisselbank to assume additional central-bank-like responsibilities. As guardian of a separate, privileged medium of exchange with its own unit of account, the Wisselbank was implicitly entrusted with a mission of maintaining price stability. This mission proved problematic as long as the value of Wisselbank deposits was rigidly bound to the value of the coins within its vault. The agio could and did fluctuate erratically with market conditions, and a sufficient drop in the agio could cause account holders to withdraw coin from the bank. The French invasion of 1672 saw an apparent negative agio (no precise figures are available) and a run on the Wisselbank ensued (van Dillen 1964a, 369-371; Korthals Altes 2001, 55). While the bank was able to withstand the run, ongoing fluctuations in the agio no doubt contributed to an appetite for institutional reform.

In 1683 a facility was created whereby Wisselbank account holders could “park” gold and heavy silver coins at the bank for a period of six months.<sup>45</sup> Anyone making use of this facility received a credit on the books of the bank as well as a receipt. When the six-month-period expired, the receipt holder could, in return for payment of a minuscule amount of interest, either renew the agreement or repurchase his coins. Coins not so reclaimed then fell to the bank (van Dillen 1964b, 394-395).<sup>46</sup>

The introduction of the “receipt” system transformed both Amsterdam financial markets and the Wisselbank itself. The receipts are recognizable to modern eyes as European call options on the deposited coin, or equivalently, put options on Wisselbank funds. The availability of these options, which were freely assignable, greatly improved the liquidity of the Amsterdam market in precious metals (van

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<sup>45</sup> Later on receipts were issued against uncoined precious metal and even current money (with a “haircut” reflecting the prevalent agio). Vault inventories reported in van Dillen (1925) suggest that the presence of this haircut discouraged the deposit of current money.

<sup>46</sup> Van Dillen (1964b, 395) suggests that these transactions were not in fact loans but repurchase agreements.

Dillen 1964b, 395).<sup>47</sup> Receipts were readily traded against Wisselbank funds, as described by Adam Smith:

The person who has a receipt ... finds always plenty of bank credits, or bank money to buy at the ordinary price; and the person who has bank money ... finds receipts always in equal abundance (*Wealth of Nations* IV.3.20).

Since it was generally cheaper to purchase an option than to withdraw funds (and so incur withdrawal fees), redemptions became uncommon. At some point, probably in the late seventeenth century, the Wisselbank quit redeeming deposits. Wisselbank money had become a “virtual currency.” Unfortunately for this change in policy, surely one of the most momentous in economic history, “no ordinance nor any precise date can be assigned (van Dillen 1934, 101).”

To us, such a story requires a remarkable indifference to the right of withdrawal. The end of withdrawal was, practically speaking, a termination of debt that affected thousands of wealthy people. Any collective or noisome response would have had a very strong position, so the threshold of perceived harm needed to trigger a response was likely low. The lack of a discernable response suggests that withdrawals were rare and that the expectation of ever wanting to make a withdrawal was rare. Such low expectations of withdrawal mean that developments in and out of the Wisselbank combined in a powerful way.<sup>48</sup>

Absent withdrawal, a way had to be found to maintain the value of Wisselbank balances. The hit-upon method, which would again seem quite natural to modern observers, was open market operations, meaning the sale and purchase of receipts against bank funds. By this means, the Wisselbank was able to keep the agio on bank money over current money in a very narrow range over most of the eighteenth century, between 4 1/4 and 4 7/8 percent (van Dillen 1964b, 404). Moreover, the Wisselbank could use the agio as a “sluice gate” to manage specie flows (Neal 2000, 122). Again this does not quite correspond to our modern day notion

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<sup>47</sup> Receipts against deposits were already required in 1654, suggesting some earlier experimentation with the post-1683 system.

<sup>48</sup> Gillard (2004) stresses the role of cashiers.

of “open market operations” as the sale and purchase of government securities, but is obviously quite close to modern practice, common in many countries, of pegging the value of a currency through intervention in markets for foreign exchange.

The Wisselbank’s use of open market operations marked a significant development in the evolution of central banks (Gillard 2004). Earlier public banks (in Barcelona, Genoa, and Venice) had operated giro payment systems. Separate, commercial units of account had existed both in cities with a public bank (e.g., Genoa; see Fratianni and Spinelli 2005) and in cities without (e.g., Florence; see Sargent and Velde 2003). Through its open market operations, the Wisselbank put the pieces together in a new way: by trading receipts, it could shore up the market’s confidence in its inconvertible money as settlement medium, while simultaneously enhancing the liquidity of the precious metal whose value underpinned the Republic’s monetary system.

In summary, by the end of the seventeenth century, the Bank of Amsterdam was performing three functions that are routinely carried out by central banks today: operating a large-value payment system, creating a form of money not directly redeemable for coin, and managing the value of this money through open market operations. Ironically, the Bank of Amsterdam may be best remembered for what it did *not* do, i.e., take on what are now viewed as the definitive central-bank functions of circulating note issue, operation of a discount window, and the purchase of government securities.<sup>49</sup> Even so, the activities of the Wisselbank set a strong precedent. As the seventeenth century came to a close, the idea of a central bank was a proven concept, and ready for its now-famous voyage across the North Sea.

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<sup>49</sup> We are abstracting from the relative minor amounts lent on occasion to the Amsterdam city treasury and the Municipal Loan Chamber. Also, the receipts were arguably banknote-like in some respects, as they circulated freely and had value in exchange.

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