


# RESOURCE ENDOWMENTS, AGENCY PROBLEMS, AND MONETARY OUTCOMES IN TWO COLONIAL AMERICAN MINTS, 1600-1700

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## ABSTRACT

This paper examines the role that resource endowments played in the performance of two New World coinages. Massachusetts Bay and the Viceroyalty of Peru provide a useful study in contrasts, having markedly different institutions and resource endowments. Both colonies originally emphasised the provision of «good» money, that is, the provision of a uniform coin (in weight and fineness) and of a sensible mix of large and small denomination coins that would support the domestic economy. Their outcomes, however, differed. We suggest that in Potosi, the sheer volume of the resource endowment (silver) incentivised fraud and the neglect of the provision of fractionary coinage in the viceroyalty. In contrast, in Massachusetts Bay, the scarcity of the resource produced incentives better aligned with the production of «good» money. The northern colony produced a trustworthy coinage that provided small denomination coins for the domestic market.

**Keywords:** monetary history, institutions, colonial legacy

**JEL code:** N22, N26

## RESUMEN

Este artículo contribuye a la literatura sobre la gestión de políticas monetarias en la Edad Moderna. El contraste del caso del virreinato

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peruano con el de Massachusetts Bay es de particular utilidad para ilustrar este tema, dados sus enormes contrastes en la disponibilidad del recurso natural. Las dos colonias originalmente enfatizaron el interés público: la producción de una moneda confiable, compuesta por altas y bajas denominaciones, que satisficiera al mercado doméstico. Sin embargo, sus resultados fueron marcadamente diferentes. En Potosí, la abundancia de la plata, y la consecuente enorme escala de las operaciones de la fábrica de monedas, incentivaron el fraude y la producción de monedas de alta denominación, lo que llevó al descuido del mercado interno. En el caso de Massachusetts Bay, la escasez de la plata generó incentivos mejor alineados con la producción de una moneda confiable que respondiera de manera más efectiva a las demandas del público.

**Palabras clave:** historia monetaria y financiera, instituciones, herencia colonial

## 1. INTRODUCTION

An important function of early modern states was to provide for an adequate supply of «good» money: money that reliably transferred value, large and small from place to place and over time. Results varied widely, as shown by the monetary history of Western Europe in the early modern period. Currency depreciation in one form or another was widespread. In some cases, governments depreciated their clipped and worn currency to keep the legal value of coin in line with its market value, while in others, governments depreciated their currency to generate new tax (seigniorage) revenues<sup>1</sup>. At the end of his detailed study of the 16<sup>th</sup> century English coinage, Challis concluded that it was marked by periods of government failure, when «...events were allowed to conspire so that either no coinage at all was produced or that which was did not have the full confidence of the community...»<sup>2</sup>.

This paper aims to contribute to our understanding of how well states managed commodity money in the early modern period. We focus on two American colonies: the Viceroyalty of Peru and Massachusetts Bay. At a time when commodity moneys were dominant (silver and gold coin and bullion), the Spanish American colony had what would appear to be an advantage in the form of a very large endowment of the metallic commodity resource—silver. Massachusetts Bay had none. A comparison of the path followed by these two colonies allows us to highlight the effect

<sup>1</sup> By currency depreciation we mean a reduction in the intrinsic precious-metal value of the unit of account, either by the monetary authorities or private individuals.

<sup>2</sup> Challis (1978, p. 301). Also, see Glassman and Redish (1988), Motomura (1994) and Munro (2010).

that the resource endowment had on monetary outcomes. This is an issue that has been largely understudied in the theoretical and empirical literature on money production, particularly with respect to its impact on the incentives that key players (coinage producers and monetary authorities) faced. The key questions we aim to address in this paper are: Did the availability of the silver endowment matter for the production of good quality coinage and small change? And if so, how?

Interestingly, both colonies chose to establish a mint as a profit-making semiprivate venture that could share profits with the state, while also delivering a public service in the form of providing an adequate supply of good coinage for the domestic economy. Although the original monetary purposes of these two colonial coinages were similar, their outcomes were not. We identify two critical characteristics of «good» money. First, whether it consistently had the weight and fineness required by law. Such a coinage would not have to be tested for weight or fineness before being accepted in payment, and it would be hard to counterfeit. Second, whether it included the smaller denomination coins needed for petty commerce, wage payment and some tax payments. At mid-century, and despite its early success in world markets, the Potosi coinage fell short on both fronts, having been illegally debased for decades and consisting mostly of the large peso coin. In Massachusetts Bay, merchants responded by establishing their own mint and recoining Potosi pesos into New England shillings. Importantly, the Bay shillings passed the «honesty» and petty coinage tests, and circulated as money, largely in the foreign trade sector, both at home and abroad.

Given the complexity of the issue at stake and the limitations of this venue, we do not aim to discuss all factors that might have shaped the observed outcomes. We mostly focus on how the relative abundance—or scarcity—of the resource endowment affected the incentives of coin producers and monetary authorities. Undeniably, the relative scarcity of silver in Massachusetts Bay shaped key monetary policies, for example, the reliance on a light coin, and the scale of the mint operations. Indeed, the Boston mint processed an estimated 1,200 troy pounds at its peak, a meager output compared to the 315,540 troy pounds of silver processed by the Potosi mint. Potosi had a large workforce and a well-developed internal division of labour, while the Boston mint was essentially a silversmith's shop. The paper suggests that the abundance of the resource, and the consequent sheer size of the mint operation in the Viceroyalty of Peru, produced a perverse mix of incentives that favoured the underproduction of small change and fraudulent activities at the mint. In contrast, in Massachusetts Bay, the scarcity of the resource was associated with incentives better aligned with the production of good money.

The rest of the paper is organised as follows. The next section describes our basic analytical framework. Section 3 discusses the Potosi mint and

section 4 takes on the Massachusetts Bay coinage. The final section concludes.

## 2. EARLY MINTS, RESOURCE ENDOWMENTS AND INCENTIVES

Both Massachusetts Bay and the Viceroyalty of Peru contracted with, or instituted, a profit-making semiprivate venture to provide an adequate supply of good coinage for the domestic economy. In the case of the Viceroyalty of Peru, the office of the mintmaster was auctioned off (as well as those of lower officials at the mint), and seigniorage was shared according to a pre-determined rate. In the Massachusetts Bay colony, in contrast, John Hull, the mintmaster, was the only silversmith in town, and the only candidate to take over the mint<sup>3</sup>. As a consequence, the contract between the mintmaster and the colonial state was delineated through a bargaining process between the two parties.

In both, North and South, the Crown or the state (the principal) sought a certain outcome—good money or seigniorage—in its coinage legislation and executive rulings but depended on its agent(s) to carry out its policy. Only the producer of the money (the agent) knew exactly what was going on inside the mint. He controlled mint production and his incentives and opportunity set were such that he could potentially increase his net income from the coinage by lowering the quality of the coin.

Importantly, the labour-intensive technology of coinage production before full-mechanisation created a tradeoff between the profitability of the coinage and the quality of the coinage, heightening the principal-agent problem. The basic steps in coin production were assaying of silver to determine its fineness; melting it; refining it or adding alloy as needed; pouring the melted silver into moulds to create strips with the right thickness for the legislated weight of the coin; cutting the strips into planchets and striking images onto the planchets by hand. If the production team worked more quickly and less carefully, with fewer quality controls, their coins would be less uniform, but their daily productivity and net profit would be greater<sup>4</sup>. Or, if the team produced a coinage with fewer low denomination coins, its quality would be lower by being less responsive to all levels of money demand in society, but it would be a more profitable coinage as the team could produce more coinage, valued in the unit of account, in a given period of time. By setting the gross margin of coin

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<sup>3</sup> The industry expanded somewhat in the following decades. The evidence shows that an offer from an alternative silversmith was rejected by the State in the early 1660s.

<sup>4</sup> Over time, the productivity of the team could increase through learning by doing (human capital formation) or through the adoption of new labour-saving technology. The tradeoff discussed here holds constant the level of capital investment, broadly defined.

value over silver bullion (the gross seigniorage rate) and the state's share of revenue from coinage, the principal influenced the profitability of minting and therefore the strength of the incentive to compromise on quality.

The gross seigniorage rate was set by the monetary authority (the Spanish Crown in the case of the Viceroyalty of Peru, and the colonial state in the case of Massachusetts Bay). The mint equivalent (ME) was the amount of unit-of-account money or unit of account value in pesos or pounds produced from a given physical quantity of silver with the required fineness. The mint price (MP) was the amount of unit-of-account money (pesos or pounds) returned for each physical quantity of silver with the required fineness consigned by an individual to be coined. While the state set all of the variables in the gross seigniorage rate:  $(ME - MP)/ME$ , net seigniorage revenue depended on the volume of silver that the public brought to the mint to be coined and the mint's operating efficiency. Net seigniorage revenue was split between the state and the mintmaster, typically in shares as defined in coinage legislation.

Given the principal-agent nature of the organisation of coinage production, and the technological constraints discussed above, the mintmaster had strong incentives to compromise on quality. One way to do this was to produce fewer small coins, or to produce lower-quality small coins<sup>5</sup>. The mintmaster could also boost his returns through fraud: he could illegally reduce the silver content (weight and/or fineness) below that required by law, assuming he had a good chance of evading detection. Producing an illegally debased coin had more serious ramifications for the monetary authority, as it endangered long-term seigniorage if the public rejected the monetary authority's coin.

Cheating on the fineness of the coin, as opposed to the weight of the coin, was particularly tempting at the time. Weight could be evaluated relatively simply using scales and with relatively good precision. But fineness was much harder for the users of the coin to assess, especially on the periphery of the emerging global monetary system<sup>6</sup>. To assess the fineness of silver coins, special instruments and expertise were required (touchstones or, for greater accuracy, assay by fire), and these instruments were not widely owned in Massachusetts Bay, although they were relatively accessible

<sup>5</sup> The mints in England grappled with different solutions to the problem of high production cost of smaller coins. In the early 16<sup>th</sup> century, an inspection of the coinage revealed that «many English groats have by the coiners been mistryken» as a «moneyer, out to swell piece-work earnings», would not «bother whether every successive blank was placed exactly at the centres of the dies ...» Groats were four pence coins. In the 14<sup>th</sup> century, King Edward reduced the legal weight of the halfpence and farthing (quarter-pence) coins to cover the extra cost of production (Craig 1953, pp. 64, 99).

<sup>6</sup> Ironically, it was easier to accurately produce hammered coin at the required fineness than at the required weight (Challis 1978, p. 24). This meant that it was also technically easier to cheat on fineness than on weight.

in Spanish America<sup>7</sup>. The problem was compounded by the fact that the naked eye could not distinguish the difference between a broad range of alloys down to 80 per cent fineness<sup>8</sup>. Thus, the level of fineness of Massachusetts Bay and Potosi's coins, 92.5 and 93 per cent respectively, allowed ample room for debasement practices that went unnoticed at first sight.

In sum, the technology and the principal-agent nature of coinage production incentivised agents in both colonies to produce a relatively low-quality coinage. We now turn to the discussion of how the relative abundance or scarcity of the resource endowment (silver) affected these basic incentives.

## 2.1. Resource Endowments and Incentives

Massachusetts Bay followed largely the English monetary regulations (more on this later). An important point to highlight, however, is that the relative scarcity of the silver endowment called for a relatively light coin to attract silver to the mint. Its coins followed the English standard for sterling fineness (92.5 per cent) but weighed around 75 per cent of their English counterparts. Massachusetts Bay defined its coinage in terms of pence and troy ounces (1 troy ounce = 31.10 g). It sanctioned the shilling as its largest denomination coin, and it originally incorporated two additional denominations to its coinage mix: the 6 pence coin and the 3 pence coin. Consigners of silver to the mint received 74 pence per troy ounce of sterling silver and the mint was authorised to produce coins valued at 80 pence for each troy ounce consigned, making the gross seigniorage rate (6 pence/80 pence), or 7.5 per cent.

The Viceroyalty of Peru defined its coinage according to Spanish law and in terms of *reales* and marks (1 mark was equivalent to 230.05 g, or 7.4 troy ounces). For every mark a consigner of silver brought to the mint, they received 64 *reales*, and the mint produced 67 *reales*, for a gross seigniorage rate of (3 *reales*/67 *reales*) or 4.4 per cent. Potosi *reales* were minted to 93 per cent fineness. The original monetary regulations did not sanction the production of the silver peso of 8 *reales*. Its production in the colonies was vaguely contemplated for the first time in the *Real*

<sup>7</sup> The touchstone test consisted of rubbing a coin on a special stone and comparing the colour of the trace left to those of coins of known fineness. Touchstones were also specialised instruments, but more widely owned than assaying equipment. Assays by fire required expertise and special tools that only silversmiths generally possessed. On the different technologies for assessing the fineness of gold and silver, see Redish (2000, p. 22) and Sussman (2003). We thank an anonymous referee for underscoring the fact that alternative techniques to assess the fineness of silver coins were accessible in Spanish America.

<sup>8</sup> Triangular diagram representing the colours of alternative combinations of gold silver and copper, at Gallery 1, The Working of Metals, Permanent Exhibit, Gold Museum, Bogota, Colombia.

*Cédula* of 1537, but it only started to be consistently produced in the 1570s<sup>9</sup>. Importantly, the reality on the ground at Potosi was shaped by the sheer amount of silver available at the Cerro Rico mines. Indeed, we show below that producing primarily pieces of eight was the only way that Potosi could have kept up with the large and continuous flow of silver to its mint. In contrast to the intermittent operations of the Massachusetts mint, the Potosi mint operated virtually all the time.

The Potosi and Massachusetts Bay mints had to cover their operating costs with their share of gross seigniorage revenue. In the case of Potosi, the Spanish Crown viewed as its prerogative to collect seigniorage from its mints and reserved 1.4 per cent for itself, leaving 3.0 per cent as the gross seigniorage rate for the coin producers. Massachusetts Bay, in contrast, did not collect seigniorage from its coinage (more on this in section 4). Although the gross seigniorage rate was lower in Potosi than in Massachusetts Bay, its gross seigniorage revenue was many orders of magnitude larger than in Massachusetts, given the sheer size of its coinage.

Given the technology, the principal-agent nature of the mint organisation, and the basic monetary regulations described above, minting the largest coin boosted mint productivity and profitability in both areas. In Table 1 we show the coins' denominations and their respective weights for both colonies. As mentioned earlier, the largest coin sanctioned in Massachusetts Bay was the 1 shilling, which weighed 4.66 g; the smallest coin was the 2 pence of 0.78 g. Thus, a day of minting 1 shilling coins processed six times the amount of silver, and produced six times the amount of money, of a day of minting the 2 pence coin. In Potosi, the productivity difference was much larger, as the largest coin, the piece of eight, weighed 27.4 g and the smallest coin, the quarter-real (*cuartillo*), weighed only 0.85 g. A day of minting the large peso coin processed thirty-two times the amount of silver and produced thirty-two times the amount of money, of a day of producing only *cuartillos*. Because the difference in weight between the largest and smallest coin was so much larger in Potosi than in Massachusetts, the opportunity cost of producing small coin was much larger in the former than in the latter.

With respect to the weight or the fineness of the coins, because the legal fineness of the coin was essentially the same in the two places (0.925 in Massachusetts and 0.93 in Peru), cheating yielded similar potential returns per unit of silver consigned in the two colonies, 13.5 per cent in Massachusetts Bay and 14 per cent in the Viceroyalty of Peru. However, when scale of production is factored in, the returns to cheating diverge by several orders of magnitude. Converting our lower-bound estimates of the return to cheating in Potosi and in Boston to troy ounces of silver,

<sup>9</sup> Muñoz Serulla (2015, pp. 132, 135).

**TABLE 1.**  
COIN DENOMINATIONS AND WEIGHTS IN GRAMS

	<b>Massachusetts Bay</b>	<b>Potosi</b>
Mint equivalent	1 troy ounce 80 pence or 6.66 shillings	1 mark is equivalent to 67 <i>reales</i> or 8.375 <i>pesos</i>
Coin denominations	1 shilling = 4.66 g 6 pence = 2.32 g 3 pence = 1.16 g 2 pence = 0.78 g	8 reales = 27.4 g 4 reales = 13.72 g 2 reales = 6.86 g 1 real = 3.43 g ½ real = 1.71 g ¼ real = 0.85 g

*Note:* 1 troy ounce = 7.4 marks.

we find that Potosi's return to cheating was around 300 times that of Boston's (roughly 250,000 compared with 850 troy ounces, per decade).

In sum, the incentives to cheat on weight or fineness were markedly affected by the availability of silver in the two colonies. The following sections elaborate further on these basic insights.

### 3. THE POTOSI COINAGE

Shortly after the conquest of America, the Spanish Crown attempted to support trade in the colonies with Spanish coinage, but these attempts were unsuccessful<sup>10</sup>. At the time, commerce in Spanish America rested on a number of local produce like coca, cacao, cotton and textiles<sup>11</sup>. Silver circulated as a means of payment, particularly after the discovery of silver deposits in Potosi (Alto Peru) in 1545, and in New Spain, shortly after; but irregular silver bars did not help much with the reduction of transaction costs, and were particularly unhelpful for small-scale domestic transactions.

The Spanish American *cabildos* (municipal governments) repeatedly lobbied the Crown for the institution of local mints<sup>12</sup>. Their key concern was the lack of a trusted currency<sup>13</sup>. As a response to mounting requests, Phillip II issued a Royal Order (*Real Cedula*) for the establishment of a

<sup>10</sup> See Céspedes Del Castillo (1996, pp. 31-35).

<sup>11</sup> Quiroz (2016, p. 202).

<sup>12</sup> Lazo García (1992, vol. 1, p. 158).

<sup>13</sup> Viceroy Marqués de Cañete communicated to the Crown the dire situation in the viceroyalty and the need for a minting house in 1556: «I understand that the first task to accomplish to advance public order is for Your Majesty to order the establishment of a local mint, because the silver bars currently in circulation are not reliable and one is required to have a scale at all times to avoid being robbed (...).» Quoted in Lazo García (1992, p. 159).



minting house in Lima, in 1565. Shortly after, in 1572, Viceroy Toledo instituted the Potosi mint<sup>14</sup>. The latter became the main producer of silver coinage in the viceroyalty in the Habsburg period<sup>15</sup>.

The monetary institutions that regulated coinage production in Spanish America were directly informed by the Castilian monetary system instituted in the *Pragmática de Medina del Campo* of 1497<sup>16</sup>. Minting houses in Spanish America operated through a similar system that ruled in the peninsula: concessionaires were in charge of the mint, and the minting process was regulated and supervised by royal officials. The key offices at the mint included the office of the mintmaster (*tesorero*), the assayer (*ensayador*), engraver (*tallador*), the weight specialist (*balanzario*), the scribe (*escribano*) and the guards. The head of each office received a specified compensation for their work (per mark of silver) and were in charge of operating costs within their respective offices<sup>17</sup>.

The Royal Order of 1565, that instituted the early colonial mint, deviated somewhat from the *Pragmática de Medina del Campo* with respect to the denominational mix. It dictated the precise percentages of each denomination to be produced: 25 per cent coins of 4 and 2 reales, 50 per cent coins of 1 *real* and 25 per cent fractionary coins of  $\frac{1}{2}$  and  $\frac{1}{4}$  *reales* (*cuartillos*). The Castilian regulations contemplated only the production of *reales*,  $\frac{1}{2}$  *reales*, *cuartillos* and  $\frac{1}{2}$  *cuartillos*<sup>18</sup>. Neither the *Pragmática de Medina del Campo* nor the Royal Order contemplated the production of the *peso* of 8 *reales*<sup>19</sup>.

The regulations established the silver content of the real at 3.19 g of pure silver (93 per cent fineness), which remained the official silver content until the 1720s. The mint equivalent for each silver mark brought to the mint was set at 67 *reales*. The mint price (the amount of money returned to the supplier of silver) was 64 *reales* per mark. The three remaining *reales* were divided in the following manner: 1 *real* for the king, and 2 *reales* for operating costs (brassage costs)—this amount was divided among the

<sup>14</sup> We note that the Mexico City mint was established in the 1530s and served as an experimental space for the management of the Potosi mint. We thank an anonymous reviewer for this reference.

<sup>15</sup> The Lima mint was closed shortly after its inauguration. The Potosi mint had the advantage of being located near the rich Cerro Rico silver mines. The latter dominated coinage production from 1592 until the Lima mint reopened in 1684. See Dargent Chamot (2011, p. 75).

<sup>16</sup> Céspedes (1996, p. 20.)

<sup>17</sup> See Lazo García (1992, vol. II, p. 207).

<sup>18</sup> The Castilian system encompassed the production of gold, silver and copper coins. In contrast, the Potosi mint was dedicated to the production of silver coins exclusively. It is only in 1675 that the Crown authorised the Spanish American mints to engage in the production of gold coins. See Muñoz Serulla (2015, p. 141).

<sup>19</sup> Interestingly, the first coins weighing 30 g of silver appear in Central Europe in the early 16<sup>th</sup> century. The first one was the guldiner antecedent of the thaler. Charles V followed this lead to create the silver peso of 8 of 27.45 g in the 1530s. Casillas Rollón (2012, pp. 68–69).

heads of all offices at the mint, including the *tesorero* or mintmaster. The latter received around 0.64 *reales*<sup>20</sup>. Gross seigniorage, therefore, was 4.4 per cent, and net seigniorage was divided between the mintmaster (1 per cent), and the king (1.4 per cent).

### 3.1. Monetary Outcomes

#### 3.1.1. *The Potosi coinage denominational mix*

As mentioned above, the abundance of silver at the Cerro Rico mines allowed for large consignments of silver at the Potosi mint. In Table 2, we present silver output in Upper Peru, as well as silver brought to the mint for 1581-1700. Upper Peru's silver production was astounding, although, as it is well known, it decreased considerably starting in the 1640s. Silver merchants brought sizable amounts of silver to the mint. The latter received an average of around 3 million silver marks per decade. Since the 1640s, minting dominated other options. At its peak, in the 1640s, the Potosi mint processed over 5 million silver marks. It is apparent that it would have been challenging, if not impossible, to process such high volumes of silver relying primarily on small denominations, let alone fractional coinage.

As mentioned earlier, the denominational mix sanctioned in the Peruvian viceroyalty implied a relatively high opportunity cost of producing the small denomination coins. To illustrate, a standard silver consignment consisted of twenty-four bars of about 140 marks each or 3,360 marks. Each consignment would have yielded a total of around 28,140 peso coins in around 2 weeks (recall that the mint equivalent dictated the production of 67 *reales* or 8.375 pesos per mark)<sup>21</sup>. Surely, we can estimate the upper-bound of the opportunity cost of producing smaller denominations. For example, coining one standard silver consignment into *cuartillos* would have required the production of 900,480 coins, which would have been at the very least thirty-two times more costly to produce than coining pesos of 8, and would have taken around 64 weeks to complete. Another way to express such tradeoff: for every *cuartillo* produced in lieu of the peso coin, the coinage producer would give up the production of 7.75 *reales*. As we discussed in section 2, the opportunity cost should have been even higher than the latter figure, given the well

<sup>20</sup> One important change with respect to the system in the Peninsula was higher *derechos de braceaje*, due to higher prices and living costs in the colonies (Céspedes 1996, p. 197).

<sup>21</sup> «Descripción del proceso de acuñación de una partida de plata (Potosi)», primary document reproduced in Lazo García (1992, vol. 2, p. 351).

**TABLE 2.**  
UPPER PERU SILVER MINING OUTPUT AND SILVER BROUGHT TO THE MINT  
1581-1700

Decade	Silver mining output (in marks)	Silver brought to the mint (in marks) (% of total silver production)
1581-1590	7,055,743	1,027,517.85 (14.5)
1591-1600	7,699,326	742,610.25 (9.6)
1601-1610	7,726,122	1,653,413.25 (21.4)
1611-1620	7,664,091	2,007,451.05 (26.1)
1621-1630	7,633,728	2,090,514.3 (27.3)
1631-1640	8,114,577	3,194,131.05 (39.35)
1641-1650	6,721,881	5,121,585.6 (76.2)
1651-1660	5,450,767	3,740,212.65 (68.6)
1661-1670	5,046,304	3,612,596.7 (75.9)
1671-1680	4,770,645	3,079,430.25 (64.5)
1681-1690	5,098,461	3,840,332.25 (75.3)
1691-1700	4,076,428	2,927,067.15 (71.8)

Source: Data from TePaske and Brown (2010, pp. 258-259). We converted the data from kg to marks.

documented evidence on the higher costs of producing smaller denominations with the technology available at the time.

Thus, perhaps not surprisingly, the production process at the Potosi mint was tailored to produce the peso of 8 up-front. Lower denominations were coined with the remnants of silver that the production process of the large peso coin left behind. After the melted metal was poured into moulds to create strips of silver of the right thickness, it was cut into pieces close to the weight of a peso and hammered until the individual pieces enjoyed the width of a peso. Any faulty pieces were set aside to be coined into pieces of 4 *reales*, and the metal remnants from these processes were used for the production of the lower denominations<sup>22</sup>.

Hence, we suggest that the Potosi coinage producers were heavily incentivised to produce the larger denomination coins and acted accordingly. In Table 3 we present the denominational mix produced at the Potosi mint in our period of study. The official reports show that the peso coin largely dominated coinage production in the 1600s. The proportion of silver pesos was never lower than 75 per cent of the value produced,

<sup>22</sup> From «Descripción del proceso de acuñación de una partida de plata (Potosi)» primary document reproduced in Lazo García (1992, vol. 2, pp. 347-352).

**TABLE 3.**  
POTOSI MINTAGE 1620-1700 (COINAGE PRODUCTION IN PESOS OF 272 MARAVEDIS)

Decade	Total coinage produced	Total coinage peso of 8 reales (% of total production)	Total coinage 4 reales (% of total production)	Total coinage 1 and 2 reales (% of total production)	Total fractional coinage ½ real (% of total production)
1621-1630	18,801,220	15,605,010 (83)	1,692,210 (9)	940,061 (5)	–
1631-1640	28,722,788	24,127,140 (84)	2,585,050 (9)	1,723,367 (6)	35,380 (0.12)
1641-1650	46,061,423	40,534,050 (88)	2,926,764 (6)	2,550,874 (5)	85,235 (0.2)
1651-1660	33,637,932	26,910,350 (80)	2,691,034 (8)	4,036,551 (12)	27,525 (0.08)
1661-1670	32,940,211	26,681,570 (81)	2,305,814 (7)	3,952,825 (12)	54,701 (0.16)
1671-1680	27,695,119	21,325,240 (77)	2,215,609 (8)	3,600,365 (13)	222,199 (0.8)
1681-1690	34,538,367	26,249,160 (76)	3,453,836 (10)	4,835,371 (14)	244,460 (0.7)
1691-1700	26,324,829	19,743,620 (75)	2,632,482 (10)	3,685,476 (14)	158,456 (0.6)

Source: Elaborated from Potosi mint accounts. The values provided in the table do not add to the total figures because of «otras monedas» (other coins) whose denomination is not specified in the accounts. The accounts are reproduced in Lazo (1992).

and in terms of volume (or the number of coins) it was between 41 and 65 per cent of the total—see Table 4. Table 4 also shows that the number of coins of 4 *reales* produced was above 10 per cent, and that the production of 2 and 1 *reales* combined reached a level close to 40 per cent of the total in the second half of the 1600s.

These production levels were seemingly a function of the production process itself (as the smaller denominations were produced with silver remnants from the production of the large denomination coins). After the large coins were accounted for (first and foremost the peso, and then the 4 *reales* coins), the 2 and 1 *reales* took precedence. In contrast to the former, which were heavily destined to international markets, the latter circulated domestically and were used to address a number of expenditures of the *Real Hacienda*, including «typical payments», and war expenditures<sup>23</sup>. The 1 and 2 *reales* coins were still relatively large, however, and above the value of small transactions, such as hourly wages, wage goods, etc.<sup>24</sup>. Fractionary coinage, the ½ reales and *cuartillos*, which were the

<sup>23</sup> Lazo García (1992, vol. 2, pp. 139-140). Taxes like the Indian tribute were also paid in specie since the government of Viceroy Toledo in the 1570s. See Quiroz (2016, p. 206).

<sup>24</sup> For example, an Indian labourer at a textile workshop (*obraje*) received a salary of 1 *real* per day in the 1670s. Lazo García (1992) highlights the scarcity of small denominations to pay the salaries of Indian labourers, who were often paid in overvalued goods. See Lazo García (1992, Tomo II, pp. 139). Also, see Quiroz (2016, pp. 213, 217).

**TABLE 4.**  
 POTOSI MINTAGE 1620-1700 (PERCENTAGE OF TOTAL NUMBER OF COINS  
 PRODUCED)

Decade	Total coinage of peso of 8 reales	Total coinage 4 reales	Total coinage 1 and 2 reales	Total coinage ½ real
1621-1630	65	14	20	–
1631-1640	62	13	23	2
1641-1650	66	10	22	3
1651-1660	50	10	40	1
1661-1670	50	9	39	2
1671-1680	43	9	38	10
1681-1690	41	11	40	8
1691-1700	41	11	41	7

Source: Based on the Potosi mint accounts. The accounts are reproduced in Lazo (1992). We note that according to Lazo, the entry for 1 and 2 reales was mostly composed of 2 reales coins although he does not give the specific relative weights. The numbers have been rounded up, and they do not necessarily add up to 100.

ones needed by the poor for most domestic transactions, were limited or all together absent—see Table 3 and Table 4<sup>25</sup>.

This result was not consistent with the original ordinances. So, why the laxity of the Spanish Crown in enforcing its original regulations? First, the evidence suggests that the Crown’s interests and goals shifted over time. To be sure, over the years, the Spanish monetary system became increasingly dependent on the quality and reliability of the Spanish American large denomination coins<sup>26</sup>. By the late 16<sup>th</sup> century, the silver peso was already largely accepted as a medium of exchange in the world economy<sup>27</sup>. Moreover, by the first decades of the 17<sup>th</sup> century, the peso became essential to finance the Spanish wars in Europe, particularly of armies in north-central Europe<sup>28</sup>. As the silver peso gained ascendancy in international markets, the Crown’s incentives became increasingly aligned with those of coinage producers.

An additional issue that might have played a role in the Crown’s apparent leniency in enforcing its regulations, is its fiscal incentives as a

<sup>25</sup> Quiroz (2016) discusses the relevance of *cuartillos* for domestic transactions. The latter was not produced in the viceroyalty until 1792, and even then, its production was minimal. See Quiroz (2016, pp. 201-202).

<sup>26</sup> On the importance of long-term seigniorage and the silver peso for the Spanish Monarchy, see Motomura (1994). Also see Menzel (2004, p. 302).

<sup>27</sup> Marichal (2006, p. 35).

<sup>28</sup> Marichal (2006, p. 37).

collector of seigniorage. As discussed in section 2, the higher the amount of small coinage produced, the lower the volume of silver processed into money and the lower the gross seigniorage produced per unit of time. In Table 5 we present estimates of the Crown's seigniorage from the Potosi mint and the Royal Fifth in the 1600s. Seigniorage as a source of revenue was relatively modest compared to the Royal Fifth and other sources of revenues<sup>29</sup>. Notwithstanding, in the context of the major financial pressures the Spanish Crown experienced in the period, any losses on this front would not have been taken lightly<sup>30</sup>.

All in all, our findings support the general perception that the coinage denominational mix advanced mostly the interests of the elite. Notwithstanding, we want to highlight the fact that the abundance of silver, and the technological constraints of coinage production at the time, largely shaped the observed outcomes.

### 3.1.2. *Fraud at the Potosi mint*

As discussed in section 2, the coinage producers were not only incentivised to produce large denomination coins, but they also faced incentives to cheat on the weight or fineness of the coinage. Indeed, several sources document that Potosi coins were lacking in fineness in the first half of the 1600s. Detection of fraud occurred early on in Seville, where bars and silver coins were found not to comply with basic standards<sup>31</sup>. The main mechanism was to alter the fineness of the coins with the addition of an excessive amount of copper<sup>32</sup>.

Detection of debasement by the public was, in principle, more likely in the Peruvian viceroyalty than in Massachusetts Bay. The suppliers of silver to the mint, the silver merchants, were relatively well-versed in basic silver-smithing technologies, thus fraud might have been easily detected by these individuals. Notwithstanding, as we discuss below, the evidence suggests that a good number of them colluded with mint officers and supervisors, sharing in the profits from fraudulent activities and assisting with the «passing» of the fraudulent coin in global markets. There is evidence of the silver merchants' vast network of financial and personal relationships with

<sup>29</sup> To illustrate, seigniorage revenue was around 680,000 pesos in the 1640s and total remissions from Potosi to the *Caja the Lima* was 12.7 million pesos in the same decade. See Andrien (1985, p. 62).

<sup>30</sup> See Andrien (1985), for an in-depth discussion of the financial challenges in the viceroyalty at the time.

<sup>31</sup> Several contemporary documents attest to the problem. See, for example, Suárez (2016, p. 172) and Giraldez (2008, p. 34).

<sup>32</sup> In 1633, the Council of the Indies sent a letter to the Peruvian viceroy stating that there was no one silver peso coin that didn't have at least 2 reales worth of copper (Giraldez 2008, p. 34).

**TABLE 5.**  
CROWN'S SEIGNIORAGE AND ROYAL FIFTH FROM POTOSI 1581-1700  
(SILVER PESOS)

Decade	Seigniorage	Royal Fifth plus 1.5% Covos tax
1581-1590	137,926	13,729,514
1591-1600	99,682	14,458,169
1601-1610	221,941	13,656,754
1611-1620	269,465	11,952,947
1621-1630	280,615	10,597,777
1631-1640	428,698	10,870,269
1641-1650	687,483	9,391,835
1651-1660	502,058	7,971,173
1661-1670	491,644	6,356,070
1671-1680	413,359	6,180,309
1681-1690	515,498	5,976,490
1691-1700	392,907	4,940,884

Source: Seigniorage estimates based on figures from Table 2 and the seigniorage rate derived in the text. Royal Fifth figures from Moreyra (1980, pp. 264-268).

key local judicial and executive authorities, which perhaps gave them a somewhat overblown sense of impunity, despite the harsh stipulated sanctions<sup>33</sup>.

In Table 6 we show rough calculations of the potential returns to altering the fineness of the coinage in the 1640s—at the peak of the fraud scandal. To estimate these returns we use as a benchmark the maximum possible level of debasement that would have eluded detection by the general public (20 per cent copper content, or 14 per cent debasement—see section 2). The large supply of silver that the Potosi mint enjoyed would have allowed the mintmaster, or those who colluded to defraud the public, to enjoy large returns. The upper bound (20 per cent copper content per coin and debasement of 100 per cent of coinage) would have produced 1,135,864 additional pesos in 10 years, or around 113,586 pesos per year. The lower bound (20 per cent copper content per coin and a debasement of 25 per cent of coinage production) would have produced a return equal to 283,966 additional pesos in 10 years, or around 28,396 pesos per

<sup>33</sup> The ordinances stipulated sanctions that included the death penalty for a number of offenses of the sort. For evidence on the silver merchants political and economic links see, for example, Lane (2019).

**TABLE 6.**  
RETURN TO CHEATING IN POTOSI 1641-1650 (PESOS)

	<b>Return to cheating accumulated over 1641-1650</b>	<b>Return to cheating (average per year)</b>
100% Coinage debasement at 14%	1,135,864	113,586
25% Coinage debasement at 14%	283,966	28,396

Source: Data from Table 2 and a complementary data on mint price, mint equivalent and labour costs provided in the text.

year<sup>34</sup>. Thus, cheating in fineness would have produced large returns that would have allowed officials at the mint to profit handsomely. Interestingly, Nestares Marín's investigation (more details on this below) estimated the total amount produced by fraudulent activities at the mint to be 472,000 pesos<sup>35</sup>. For comparison, Table 7 presents estimates of the mintmaster or *tesorero*'s legal returns from 1580s to 1700<sup>36</sup>. We see meager returns in the late 1500s, but a positive trend that reaches its peak in the 1640s. The returns to cheating (Nestares Marín's and our average estimates) are above the *tesorero*'s legal income in that decade.

Given the large returns to cheating, and the apparent relatively low subjective probability of being sanctioned, fraud at the Potosi mint flourished. In contrast to denominational mix violations, this offense was of great concern for the Spanish Crown. Indeed, the debased peso coin threatened to upend the strategic role of the silver peso in the Spanish monetary and commercial system. Thus, the Council of the Indies appointed Don Francisco Nestares Marín as *visitador* of Potosi with broad powers to investigate fraudulent activities at the mint<sup>37</sup>. Nestares Marín arrived in Potosi

<sup>34</sup> The benchmark for our lower bound is given just for comparison, and it is arbitrary. All evidence suggests that debasement was much more extensive than altering such a low percentage of the coinage. Also, our procedure likely underestimates the potential returns to cheating. We are unable to consider the returns on cheating from silver that might have been brought to the mint but that was not included in the official records.

<sup>35</sup> See Dargent Chamot (2011, p. 76). We do not know the precise methodology followed by Nestares Marín, but we note that it rests within our estimated range.

<sup>36</sup> The estimations are based on the official reports on coinage production (Table 2) and the seigniorage rate assigned to the mintmaster (0.64 reales per mark of silver). These estimates are not precise, we simply mean to give a general sense of the returns to the *tesorero*. It is not unlikely that his precise share changed at one point or another in our period of study.

<sup>37</sup> Nestares was a priest, a doctor in civil and canon law and a former Inquisitor. Among one of the special powers granted to Nestares was the presidency of the *Audiencia de Charcas*, which had



**TABLE 7.**  
**POTOSI MINT SEIGNORAGE THAT ACCRUED TO THE TESORERO**  
**(MINTMASTER) 1581-1700 (SILVER PESOS)**

Decade	Tesorero's returns
1581-1590	88,273
1591-1600	63,796
1601-1610	142,042
1611-1620	172,457
1621-1630	179,593
1631-1640	274,366
1641-1650	439,989
1651-1660	318,738
1661-1670	314,652
1671-1680	264,550
1681-1690	329,918
1691-1700	251,461

Source: Based on Table 2 and return to *tesorero* per mark of silver presented in the text.

in 1648. Shortly after his arrival, he uncovered a huge debasement scam that involved a number of silver merchants, mint officials and employees, along with the city's *corregidor* (most important executive authority in the area) and many town councilmen. Many members of the *Audiencia de Charcas* were involved on the fraud as well. They were not direct participants, but they had been corrupted by the debasement's perpetrators<sup>38</sup>. Nestares conducted further inquiries into the affairs of some of the most prominent silver merchants in Potosi, finding Captain Francisco Gómez de la Rocha as the main orchestrator of the debasement scam<sup>39</sup>. The investigation detected that three consecutive assayers were to be blamed for the Potosi debacle. They apparently had debased the coinage progressively from modest amounts to such high levels as to require a mandate that the coins produced by the latest assayer (Ramírez de Arellano) circulate

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jurisdiction over the village of Potosi. An *Audiencia* was somewhat equivalent to a judicial branch (with executive powers). As the newly appointed *visitador* his judgement and decisions about how to proceed in Potosi, could only be overruled by the viceroy or an order from Spain (Bakewell 1988, p. 38). See also Lane (2017, 2019) for an extensive discussion of the *visita*.

<sup>38</sup> Lane (2019, p. 157) (e-book pagination).

<sup>39</sup> Gómez de la Rocha was one of the most prominent men in Potosi. He was highly regarded for his wealth and for his «generosity». He was a supplier of interest-free loans to the Treasury and had directly contributed to war expenses in southern Chile.

at half their value<sup>40</sup>. Gómez de la Rocha and Ramírez de Arellano were sentenced to death as were a few other individuals involved.

Several Royal Orders instructed the colonial authorities how to proceed with the Potosi coinage in circulation. The new ordinances sanctioned the birth of the famous «columnaria» coin, called *columnaria* because of the two columns engraved on its tail<sup>41</sup>. Shortly after, in 1653, a Royal Order divulged to the public that the Potosi peso would be accepted in all of the Spanish empire. There is evidence that under Nestares' guidance the mint produced an improved coinage<sup>42</sup>. It seems that by the early 1660s the Dutch already carried the new Peruvian coin with renewed confidence<sup>43</sup>.

### 3.1.3. *The Potosi coinage: conclusion*

The sheer volume of silver that was delivered to the Potosi mint created an attractive opportunity for the Crown's agents, the mint officials, to collaborate with silver merchants and local officials to extract larger returns from the coinage by deviating from the standards set by the law. The Crown enforced its silver-fineness standard, but not its denominational-mix standard, in both cases protecting and enhancing its long-term interest in supplying a trustworthy, well-sized and ample global currency.

## 4. THE MASSACHUSETTS BAY COINAGE

Between 1620 and 1629, a series of charters were granted to the Massachusetts Bay Company, a private company. These charters evolved into the charter of the Massachusetts Bay Colony, which was governed by a limited-franchise representative assembly called the General Court. The charters provided that one-fifth of all gold and silver (of which, it turned out, there was none) was reserved for the Crown. From the beginning, the Colony of Massachusetts claimed monetary powers for itself, initially by defining what would «pass current» and/or serve as «lawful money» in payments to the colony.

<sup>40</sup> Dargent Chamot (2011, p. 77).

<sup>41</sup> Dargent Chamot (2011, p. 79).

<sup>42</sup> Menzel (2004, p. 316).

<sup>43</sup> Giraldez (2008, pp. 37-38). In 1683, the City of New York rated «all peeces of eight being Sevil Mexico, or pillar, not weighing lesse than fiveteen penny weight» at six shillings and «all Peru of the same weight (provided they be good silver) pass for five shillings ...». Proposals for rating silver developed by Massachusetts merchants in 1686-1687 placed the Mexico, Seville and Pillar pieces of eight on an equal footing, but not the (old) «Peru». On Massachusetts, see Davis (1901, pp. 32-38); Crosby (1978, pp. 106-107) and Barnes (1960, pp. 162-167). On New York, see Solomon (1976, p. 27).

In the 1640s, Boston saw an influx of foreign silver, particularly Peruvian «cob» coinage, after Boston merchants developed markets for New England products in Southern Europe and the West Indies<sup>44</sup>. Cob coins were easily clipped, allowing the owner to pass the coin at tale (or face value) and sell the clipped-off pieces of silver. As discussed earlier, at mid-century the Potosi coinage was fraudulently issued at lower fineness than required. Records from the period reflect a concern in Massachusetts with potential losses to individuals and the Colony from «light» and irregular Spanish coin in particular<sup>45</sup>.

The Assembly's hand was forced when the marketplace rejected all of the cob coinage; according to Hull, trade came to a stop in Boston<sup>46</sup>. The Court then established a mint to supply a colonial coinage that would replace the «cob» coinage with a «better» Massachusetts coinage. The Court «took advantage of the political ambiguities» after the execution of Charles I to assume the authority to coin<sup>47</sup>. Under the Mint Act of 1652, only New England shillings and English shillings were legal tender; Spanish silver coin would not «pass current», overriding Massachusetts law from 1642.

#### 4.1. The Massachusetts Bay Mint

Massachusetts contracted with John Hull to mint coin with a specified weight and fineness. Hull recommended Robert Sanderson, an experienced English silversmith, to be his partner, and the Court accepted. Sanderson migrated and joined Hull in a partnership for both minting and silversmithing. Hull and Sanderson employed between two and five apprentices and journeymen at any one time over the life of the mint<sup>48</sup>.

Massachusetts provided a public subsidy for the mint in its start-up period in the form of funds to construct the mint house and to acquire the necessary equipment<sup>49</sup>. The Colony initially took no seigniorage but did

<sup>44</sup> According to Chalmers (1893, p. 97), Jamaica was «the bullion-center of the British possessions in the New World» and constantly received large supplies of coin. In Jamaica and Barbados, where most trade with New England was conducted, the peso was valued below its accepted sterling value in England. Clipping it was a way to bring the coin weight in conformity with the value of the coin as money. Clipped Spanish silver coin circulated widely in the West Indies and British North America.

<sup>45</sup> Jordan (2002, p. 150). The literature, typified by Sylla (1982), sees a shortage of silver coin as the motivator of monetary innovation, as opposed to the quality of the stock of silver coin as stressed here.

<sup>46</sup> Crosby (1978, p. 31).

<sup>47</sup> Barth (2014, p. 495).

<sup>48</sup> Kane (1998, pp. 567, 882); Jordan (2002, pp. 135-139).

<sup>49</sup> It seems clear that in 1652 the «mint house» was the silversmithing shop that already existed on Hull's property in Boston, so the public investment was limited to any equipment needed for

secure a nominal lump-sum fiscal contribution in the renewals of the mint contract in 1660 and 1667<sup>50</sup>. By taking no or little seigniorage, Massachusetts increased the probability that the mint would be economically viable and an attractive proposition for the mintmaster. However, given the very modest scale of its coinage, it is hard to credit the leaders of Massachusetts with being virtuously willing to sacrifice revenue in order to provide for the liquidity needs of the local economy. If the Colony had negotiated a one-fourth share of the gross seigniorage revenue (the Spanish Crown's share), it would have received an estimated 1,031 shillings annually, or around 50 pounds. This would have made a marginal contribution to its annual budget; the Colony's annual expenses in 1650-1675 averaged between 1,800 and 2,000 pounds<sup>51</sup>.

The initial technology of the Boston mint was very simple. Jordan (2002) has a careful and detailed discussion of the production process that was likely used, based on numismatic and other evidence. At first, Hull made coins essentially by hand, much as a silversmith would fashion individual spoons and cups. These coins were easily counterfeited, leading quickly to a new directive from the General Court about the coin's physical features. As a result, Hull adopted the more mechanised, but still simple technique of rocker dies and a rocker press for stamping the prepared silver with images. This was an appropriate technology for a mint with intermittent activity and smaller production runs.

As mentioned above, one troy ounce of sterling silver was to be coined into 80 MA pence (compared with the English ratio of 1 oz troy sterling = 62 pence), with 74 pence being returned to the customer and 6 pence retained by Hull to cover minting costs and wastage (silver loss during minting), with any residual going to the «shop» (Hull and Sanderson's silversmith business)<sup>52</sup>. The Massachusetts coin would be light, by English standards, but at least it would be regularly and reliably light—assuming the Colony could trust the mintmaster. Trust was essential, as the colonial

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minting that was not already available in the silversmithing workshop (Crosby 1878, p. 40; Jordan 2002, pp. 9-14).

<sup>50</sup> Interestingly, Hull insisted that the payment to the Colony not be defined as a share of the returns.

<sup>51</sup> Judd (1976, pp. 198-199). Estimated seigniorage based on coin volume estimates is discussed in online Appendix A.

<sup>52</sup> The Act started in the upper house, the Magistrates, where the mint fee was set at 18 pence per 20 shillings (18/240 pence = 7.5 per cent). When the bill moved to the lower House of Deputies, the mint fee was reduced to 15 pence per 20 shillings, or 6.25 per cent. The Act was passed at 6.25 per cent. Over the subsequent months, Hull convinced the Mint Committee that 6.25 per cent was not enough. The Committee agreed to add 3 pence per 20 shillings for «wastage», which brought the overall gross return to the mint masters back up to 7.5 per cent. This adjustment was confirmed by both houses of the Court and was the first of several successful bargains struck by Hull. See Crosby (1878, pp. 37-39). The Massachusetts gross seigniorage rate was about twice that of England's at the same time (Jordan 2002, p. 153).

government was unable to independently verify the fineness of the coin with assays.

Unlike the Potosi mint, which could count on a large and regular flow of locally mined silver, Massachusetts Bay had to attract and retain silver from abroad in order to have a coin of its own. It accumulated silver through its trade surpluses with southern plantation colonies, net in-migration, and piracy, and retained this silver by setting a mint price that made coining the silver a better option than using it to make remittances to London, spending it in the local market, or exporting it to a foreign market. Table 8 shows that during the period 1652-1672, it was usually better to make payments in London with a sterling bill of exchange instead of pesos. As the lower panel of Table 8 shows, if Massachusetts Bay had set its mint price equal to England's, shipping specie would have been the lower-cost option, so that all of the coin that entered from southern markets would have been exported to pay for imports from England.

At the same time it established its mint, Massachusetts maintained the 1642 official rating of the «full weight» piece of eight at 60 pence and, as mentioned above, it suspended its «current money» status (effectively, its legal tender status)<sup>53</sup>. Over time, pesos may still have been accepted in trade by choice, but the high mint price ensured that owners of pesos would be better off bringing their pesos to the mint than using them in local trade.

## 4.2. Monetary Outcomes in Massachusetts Bay

### 4.2.1. *The denominational mix*

The 1652 Mint Act authorised the production of coins of 1 shilling (12 pence), 6 pence and 3 pence, coins with markedly smaller denominations than the peso<sup>54</sup>. In 1662, a new denomination was added: not a larger coin, but a smaller one, a 2-pence coin<sup>55</sup>. Clearly, Massachusetts established its mint to do more than provide a reliable and uniform-quality substitute for the problematic Peruvian piece of eight, which was comparable, based on the 1642 official rating of the piece of eight, to a 5 shilling Massachusetts coin. In establishing the mint, the General Court was also responding to the need to transform the large peso coin into smaller

<sup>53</sup> Similarly, wampum was phased out as a form of «current money» as Hull's coin came on line. The Colony had set the price in pence of differently coloured shells (in 1650, eight pieces of white were worth one pence, and four pieces of black) (Crosby 1878, p. 27).

<sup>54</sup> For comparison, one shilling was equivalent to approximately 1.6 *reales*, and the 2 pence coin was approximately the value of a *cuartillo*. Only the 1 shilling coin was greater in value than Potosi's fractionary coinage.

<sup>55</sup> Crosby (1878, pp. 73-74).

**TABLE 8.**  
**COST OF REMITTING WITH SILVER VS. COST OF REMITTING WITH BILLS, 1660-1680**

	<b>Boston silver price (MA shillings per troy oz)</b>	<b>Market price of silver in London (English shillings per troy oz)</b>	<b>Cost of remitting with silver (no. of MA pounds per 100 English Pounds)</b>	<b>Cost of remitting with sterling bills of exchange (no. of MA pounds per 100 English Pounds)</b>	<b>Better to remit with bills or silver?</b>
1660	6.17	5.25	118	112	Bills
1670	6.17	5.29	117	125	Silver
1672	7	5.29	132	125	Bills
1680	6.67	5.25	127	120.25	Bills
Counterfactual	Boston silver price if MA mint price = London mint price	Market price of silver in London (English shillings per troy oz)	Counterfactual cost of remitting with silver (no. of MA pounds)	Cost of remitting with sterling bills of exchange (no. of MA pounds)	Better to remit with bills or silver?
1660	5	5.25	95	112	Silver
1670	5.17	5.29	98	125	Silver
1672	5.17	5.29	98	125	Silver
1680	5.17	5.25	98	120.25	Silver

*Notes and sources:* The Boston silver price is the mint price for 1660 and 1670, and the implicit market price based on the official rating of a 17 pennyweight piece of eight for 1672 and 1680. London silver prices are from Chaudhuri (1978, Table 2, column 1). Prices of sterling bills of exchange in Boston from McCusker (1978, Table 3.1, annual average). Transactions costs (shipping and insurance, commissions) are assumed equal for the two options.

coins to pay for humble goods, wages, transportation services and some kinds of taxes. The largest coin that the Massachusetts mint was authorised to produce was small enough to be a useful coin for trade and taxes, and there is no evidence that Hull ever minted a coin larger than 1 shilling<sup>56</sup>.

The key question to address here is whether Hull actually produced small-denomination coins as required by law and demanded by the market. Unfortunately, in contrast to Potosi, we have no direct evidence on the denominational mix produced at Massachusetts Bay, whether official or private. The General Court did not closely monitor coin production despite the physical proximity of the seat of government to the mint<sup>57</sup>. Numismatic evidence from private collections allows us only to confirm that some coins of each denomination were produced in the Massachusetts mint, it does not allow us to infer how many coins of each denomination were struck<sup>58</sup>.

However, the circumstances of the Massachusetts mint suggest that Hull followed the Mint Act rather closely. First, as a member of the Boston merchant elite, Hull himself was interested in the production and circulation of small denomination coins for the advancement of his own businesses (more on this below). Furthermore, Hull faced no significant economic incentive to non-compliance. The intermittent and often limited supply of silver to the mint meant that there was no pressure on the mint driving it to mint only, or primarily, the largest possible coin simply to keep up with consignments. When silver consignments were low, Hull could likely afford the additional time per coin required to produce the 2 and 3 pence coins. Hull's opportunity cost would have been the difference between the gross seigniorage on the small coins and the income the workers could have produced if they had alternative remunerative work to do (i.e. jobs in the silversmith shop). Most importantly, even when the mint was busy, because of the relatively small difference in weight between the largest and smallest coins, and the modest size of the coinage, the impact of small coin production on Hull's income would not have been significant.

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<sup>56</sup> Importantly, Boston merchants did not need coin to settle larger transactions and debts among themselves; these payments were recorded, tracked and executed with entries to the ledger. Instead, their manifest interest was in small denomination coins that would support domestic trade. See Peterson (2019, particularly pp. 96-100).

<sup>57</sup> Jordan (2002, pp. 9-14); Map of the Town of Boston 1676. In 1652, when the Mint Act was adopted, Edward Rawson, the Secretary of the Magistrates, the Upper House of the General Court, lived two doors down from Hull.

<sup>58</sup> See Knodell and Vizcarra (2021) for more details on the numismatic evidence.

#### 4.2.2. *John Hull and the honesty test*

Alternatively, as discussed in section 2, John Hull, as the primary decision-maker in the firm, could have boosted his personal income from the mint by illegally reducing the silver content (weight or fineness) of the coins below that required by law. The likelihood of local detection by the authorities or private individuals was slim<sup>59</sup>. However, his potential return from producing a debased coin must be assessed within a larger context. Coining money was just one small part of a complex of silversmithing, transatlantic trade, shipping, banking, lending and real-estate investments, all conducted by Hull or by Hull with one or more partners<sup>60</sup>. He also held numerous elected and appointed public offices in Massachusetts over the years<sup>61</sup>. In what follows, we discuss Hull's income from coin production and estimate by how much it could have been boosted if he had produced debased coin. We then discuss how Hull's other businesses and activities affected his incentives as mintmaster.

In contrast to Potosi, there are no records of the volume of coin produced at the Massachusetts mint, or of production costs. However, based on our estimate of annual average coinage of 55,000 shillings, we estimate Hull's net income from coining money over 1652-1682 at between 616.5 shillings and 1,695 shillings, depending on how high production costs were in relation to gross seigniorage income (see online Appendix A for a detailed discussion of how we arrived at these estimates, and Table A.1). Interestingly, Hull's net income as mintmaster ranged between 10 and 28 per cent of his personal wealth at death. Even at the high end of this estimate, Hull accumulated most of his wealth from his other business activities.

Hull's potential return to cheating over the life of the Massachusetts mint ranged between 849 and 3,396 pounds (see online Appendix A for method and Table A.2 for estimates). Hull's potential returns to cheating were significantly constrained by the small scale of the silver consignments to the Massachusetts mint. Even at the upper estimate, Hull's potential return to cheating would have still been significantly less than the wealth he actually accumulated, and would have likely put at risk his returns from honest minting and a host of other enterprises.

Indeed, at about the same time Hull became mintmaster, he started building a transatlantic trade business. Like other Boston merchants,

<sup>59</sup> The Mint Act did not contemplate any sanctions for no compliance, and Hull and Sanderson, as mentioned above, were the only silversmiths in town for a good part of our period or study.

<sup>60</sup> Clarke (1936) and Valeri (2008).

<sup>61</sup> These included selectman for the town of Boston (1657-1667), town treasurer for Boston (1658-1667), deputy to the General Court for (Wenham in 1668, Westfield in 1672-1674, Concord in 1676 and Salisbury in 1679), magistrate for Boston (1680-1683) and treasurer of Massachusetts during King Phillip's War (Wall 1990, pp. 353-355).



Hull exported furs and masts to England; fish, lumber, horses, flour, salt beef and pork to the West Indies and barrel staves and hoops to Portugal and Spain. He purchased sugar, tobacco, rum, salt, wine, indigo and cocoa from the West Indies and Wine Islands, and sold some on the Boston market and shipped the rest to England, creating credits used to import cloth and clothing, hats, writing paper and hardware. In partnership with other merchants, Hull invested in commercial infrastructure: shipping vessels, a lumber mill, warehouses and wharves. Hull's business relationships with ship captains and merchants in Massachusetts, the Wine Islands and London are recorded in his account books from the 1670s<sup>62</sup>. Importantly, these accounts show that Hull himself made many «mony» payments to and on behalf of ship captains for wages, customs payments and «frait» (freight)<sup>63</sup>.

By the 1670s, as a result of Hull's mercantile, banking and lending ventures, coins that he produced were circulating widely among merchants in Boston, London and the West Indies. Hull's business relationships with other transatlantic merchants were based, in no small measure, on trust. In a letter to Daniel Allin in 1672, Hull observed that «...rectitude proved a business asset in an international trade network, ... where a good reputation assured access to credit»<sup>64</sup>. Certainly, if Hull's coins were found to be fraudulent, it would have compromised each of his other businesses. Furthermore, had Hull cheated, it may well have been detected—not in Boston, where no one other than Hull had the required skill and instruments until the early 1670s, but in London. Although it was usually better to meet a London obligation with a bill of exchange rather than silver, bills were not always available in the spotty Boston market. Whenever New England shillings were presented to London creditors, the creditors would take them to a silversmith to be weighed, assayed and converted into English shillings. Any «bad» coins would only be accepted at a discount, imposing a loss on the Boston merchant. News of such an event would have spread quickly within Boston, fostering a crisis of confidence in the mint and its likely closure<sup>65</sup>.

<sup>62</sup> John Hull's Colony Journal, vol. I, New England Historic Genealogical Society, MS Cb110.

<sup>63</sup> The only two forms of «current money» in Massachusetts Bay, at the time, were New England shillings and English shillings. After the early 1670s, when Spanish money was reintroduced as «current money» in Massachusetts, Hull referred to it as «Span mony». English shillings would not have been used in local transactions but would have been reserved for making English-shilling payments in London when bills of exchange were unavailable or too costly. Merchants incurred melting and minting costs (before 1666) when they paid London creditors with New England shillings.

<sup>64</sup> Newell (1994, pp. 303-304). The quote is Newell's paraphrasing of Hull's letter.

<sup>65</sup> We want to note that the Massachusetts Bay coins were literally Hull's coins, which contrasts with the Potosi case. There were many opportunities for «anonymous» fraud in Potosi. In addition, the silver merchants in Potosi were not the direct producers of the coin (except for those that had bought top offices at the mint). Thus, the reputation mechanism pertaining to «passing» fraudulent

One last point that we would like to highlight is that non-economic considerations were also critically important. As an upstanding member of the Puritan political elite, Hull cared about his reputation in his (Puritan) community, the leading members of which were users of his coin. Social regard and religious identity further aligned the mintmaster's private interest with the public purpose<sup>66</sup>. Violation of the law would have put Hull's social standing at risk. Hull's compliance with the law was, in this sense, overdetermined.

In sum, given the way Hull's coinage was embedded in his other business activities, given the real possibility of detection in London and the meaningful return on the «honest» coin which would have also been sacrificed in event of detection, and considering the importance of his reputation within the Puritan elite, we suggest that cheating was not an attractive option.

#### 4.2.3. *Evidence on the quality of the Massachusetts shilling coin*

Several sources support the contention that Hull did not cheat on fineness. In fact, there is evidence that the Massachusetts Bay coins improved over time, and that by the 1670s were considered well-made coins by contemporary standards. Three separate assays, taken over 150 years, confirmed the trueness of Massachusetts coins. The New England coin was to be minted to the English standard of fineness, 0.925. In 1660, an assay in Massachusetts of the shilling, sixpence and threepence coins showed that they «were equal in <allay> <to his majesty's silver coin of England>». In 1685, the Commissioners of the Royal mint reported that they had examined the shilling, sixpence and threepence coins and «found them to be of sterling alloy». Finally, the U.S. mint (established in 1792) assayed Pine Tree money (the last variant of New England coins) and found a fineness of 0.926<sup>67</sup>.

The Massachusetts Bay shillings circulated outside of New England. Merchants in West Indian ports accepted Bay shillings in payment for rum, sugar and other exports; in 1670-1672, the governments of Montserrat, Antigua and Nevis acknowledged the prevalence of Bay shillings in their local economies by granting them «current money» or

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coins in domestic or international markets was much less pronounced in Potosi than in Massachusetts.

<sup>66</sup> According to Bailyn (1955, p. 108), Hull «... managed to maintain the delicate balance between the total acceptance of social Puritanism and an active participation in commerce...».

<sup>67</sup> See Mossman (1993, pp. 52-53), on the 1660 and U.S. mint assays. For the 1685 Royal mint assay, see Jordan (2002, p. 67) and Crosby (1978, pp. 104-105). At the time of the U.S. mint assay, the coins had an average weight of between 65 and 67 grains. When minted in 1667-1682, over a 100 years earlier, these coins were to weigh 72 grains; see Mossman (1993, p. 61), on the period of Pine Tree coin production. The 1660 and 1685 tests showed that the coins weighed what they were supposed to weigh.

«lawful money» status<sup>68</sup>. In effect, a currency area based on the New England shilling was in formation by the 1670s, extending beyond Massachusetts to include the British West Indies and beyond. Overall, the evidence shows that New England produced a trustworthy coinage throughout the period.

#### 4.2.4. *The Massachusetts Bay coinage: conclusion*

The lack of the resource (silver) endowment and the consequent small scale of the Massachusetts mint helped create the right incentives to produce a high-quality stock of coin. Because his coinage production was relatively small, Hull faced no significant tradeoff between following the colony's coinage laws and the accumulation of private wealth. Similarly, Massachusetts Bay faced no meaningful tradeoff between drawing revenue from the mint and achieving its monetary—or any other—objectives.

## 5. CONCLUSION

In both the North and the South, improving the quality and availability of small change for the colonial economy was a concern that led to the Crown's (or state's) decision to establish a colonial mint. Notwithstanding the somewhat similar original purposes of the two coinages, the outcomes were markedly different.

In the Viceroyalty of Peru, the abundance of silver created the possibility of an adequate local money supply but given the organisational and technological realities of commodity money at the time, it also generated attractive opportunities for coinage producers to enrich themselves at the expense of the public. The abundance of silver was at the heart of the inflated production of the silver peso coin, which had become an extremely popular export good thanks, in no small measure, to its abundant supply. The Crown, mint officials and silver merchants alike, were incentivised to produce the silver-rich pieces of eight and, consequently, neglected the production of fractionary coinage. In Massachusetts Bay, the relative scarcity of silver was a blessing in this respect, as it set a limit to the mintmaster opportunity cost of producing small change.

Officials at the Potosi mint were also incentivised to enrich themselves through sustained fraud. The ordinances established serious sanctions for such crimes, but these mechanisms were not sufficient to prevent extended illegal debasement. Indeed, the Potosi mint was a large multi-office shop

<sup>68</sup> Chalmers (1839, p. 64). Montserrat explicitly made the «Boston» or «Bay» shillings, which were received in payment for rum and other products, «current ... in all payments, for the like value as the same is in New England».

with many opportunities for fraud. De la Rocha (and others) had reasons to believe that the blame would fall elsewhere, even when fraudulent activities at the mint were revealed. At the Boston's small workshop, in contrast, the mintmaster's reputation was on the line<sup>69</sup>. Hull stood to gain very little and potentially lose a lot. His losses would have been significant, as his mint was embedded into his other, more lucrative, enterprises and the trustworthiness of «his» coins was critical for their success. In contrast, De la Rocha and his accomplices, stood to gain a lot and potentially never lose. But De la Rocha's bet went wrong, he was executed, and the Potosi's coinage reformed.

In the end, neither 17<sup>th</sup>-century coinage survived the turn of the century. In both cases, the imperial power stepped in. England imposed the principle of a uniform, and uniformly strong coinage in its domain. Massachusetts could not continue to attract silver to its mint under these conditions and adopted a paper money instead. The lack of the silver endowment, undoubtedly, posed a limit to Massachusetts Bay's ambitions. Bourbon Spain, on the other hand, instituted—although progressively—a complete reform of its monetary system, including the taking over of the administration of the colonial mints, stripping the merchants of their previous responsibilities and rights. Although silver production volumes and colonial state revenues revived under the colonial state's direct management, it is not clear whether Bourbon monetary institutions managed more effectively the viceroyalty's monetary needs, particularly with respect to the circulation of small change. We note, however, that the reputation of the Peruvian peso coins improved, and that Spanish American pesos, more generally, were coveted in the 1700s. The evidence so far suggests that technological change (the adoption of the milled coin), combined with the administrative changes instituted by the Bourbons, helped curb some of the pernicious incentives associated with the abundance of the resource endowment.

## SUPPLEMENTARY MATERIAL

The supplementary material for this article can be found at <https://doi.org/10.1017/S0212610922000076>.

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<sup>69</sup> It is unlikely that Hull valued his personal reputation as a businessman more highly than Gomez de la Rocha valued his. Rather, it is that any debasement, once discovered, would lead directly to him. We thank an anonymous referee for underscoring the fact that De la Rocha had far-reaching investments and close ties in Spain.

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## SOURCES AND OFFICIAL PUBLICATIONS

John Hull's Colony Journal (1669-1687), vol. I, New England Historic Genealogical Society, MS Cb110.

## REFERENCES

- ANDRIEN, K. J. (1985): *Crisis and Decline. The Viceroyalty of Peru in the Seventeenth Century*, Albuquerque: University of New Mexico Press.
- BAILYN, B. (1955): *The New England Merchants in the Seventeenth Century*, Cambridge: Harvard University Press.
- BAKEWELL, P. (1988): *Silver and Entrepreneurship in Seventeenth-Century Potosí. The Life and Times of Antonio López de Quiroga*, Albuquerque: University of New Mexico Press.
- BARNES, V. F. (1960): *The Dominion of New England: A Study in British Colonial Policy*, New York: Frederick Ungar Publishing Co.
- BARTH, J. E. (2014): «A Peculiar Stampe of Our Owne»: The Massachusetts Mint and the Battle over Sovereignty, 1652-1691». *The New England Quarterly* 87 (3), pp. 490-525.
- CASILLAS ROLLÓN, A. (2012): «Medina del Campo 1497: Análisis de la reforma monetaria de los Reyes Católicos». *Ab Initio: Revista Digital Para Estudiantes de Historia*. 2, pp. 57-89.
- CÉSPEDES DEL CASTILLO, G. (1996): *Las casas de moneda en los reinos de indias. Las cecas indianas en 1536-1825 (vol. 1)*. Madrid: Museo Casa de la Moneda.
- CHALLIS, C. E. (1978): *The Tudor Coinage*, New York: Manchester University Press.
- CHALMERS, R. (1893): *A History of Currency in the British Colonies*, London: Her Majesty's Stationery Office, Eyre and Spottiswoode, Printers to the Queen's Most Excellent Majesty.
- CLARKE, H. F. (1936): «John Hull—Colonial Merchant, 1624-1683», *Proceedings of the American Antiquarian Society*.
- CRAIG, S. J. (1953): *The Mint; A History of the London Mint from A.D. 287 to 1948*, Cambridge: Cambridge University Press.
- CROSBY, S. S. (1978): *The Early Coins of America; and the Laws Governing their Issue*, Boston: Estes and Lauriat.
- DARGENT CHAMOT, E. (2011): «La ceca de Potosí y la circulación de monedas de plata falsificadas en el virreinato peruano (siglos XVI-XVII)». *Diálogo Andino* (38), pp. 75-84.

- DAVIS, A. M. (1901): *Currency and Banking in the Province of the Massachusetts-Bay, vol. I*, New York: American Economic Association by Macmillan Company.
- GIRALDEZ, A. (2008): «China and Counterfeiting in 1650 Potosí», in THOMAS HIRZEL and NANNY KIM (eds). *Metals, Monies, and Markets in Early Modern Societies: East Asian and Global Perspectives*, Berlin: Lit Verlag, pp. 15-43.
- GLASSMAN, D., and REDISH, A. (1988): «Currency Depreciation in Early Modern England and France». *Explorations in Economic History* 25, pp. 75-97.
- JORDAN, L. (2002): *John Hull, the Mint, and the Economics of Massachusetts Coinage*, Hanover: University Press of New England.
- JUDD, S. (1976): *The History of Hadley, Massachusetts*, Somersworth: New Hampshire Publishing Company.
- KANE, P. E. (1998): *Colonial Massachusetts Silversmiths and Jewelers*, New Haven: Yale University Art Gallery, distributed by University Press of New England.
- KNODELL, J., and C. VIZCARRA (2021): «Resource Endowments and the Problem of Small Change: Insights from two American Mints, 1600-1700.» *Financial History Review* 28 (3), pp. 344-363.
- LANE, K. (2017): «From Corrupt to Criminal: Reflections on the Great Potosi Mint Fraud of 1649», in CHRISTOPH ROSENMULLER (ed.), *Corruption in the Iberian Empires: Greed, Custom, and Colonial Networks*, Albuquerque: University of New Mexico Press, pp. 33-62.
- LANE, K. (2019): *Potosí. The Silver City that Changed the World*, California: University of California Press.
- LAZO GARCÍA, C. (1992): *Economía colonial y régimen monetario Perú: Siglos XVI-XIX*. Tomos 1-3. Lima, Perú: Banco Central de Reserva.
- MARICHAL, C. (2006): «The Spanish-American Silver Peso: Export Commodity and Global Money of the Ancient Regime, 1550-1800», in FRANK, ZEPHYR, CARLOS MARICHAL and STEVEN TOPIK (eds), *From Silver to Cocaine. Latin American Commodity Chains and the Building of the World Economy, 1500-2000*, Durham and London: Duke University Press, pp. 25-52.
- MCCUSKER, J. J. (1978): *Money and Exchange in Europe and America, 1600-1755*, Chapel Hill: The University of North Carolina Press.
- MENZEL, S. (2004): *Cobs, Pieces of Eight and Treasure Coins. The Early Spanish-American Mints and their Coinages, 1536-1773*. New York: The American Numismatic Society.
- MOREYRA PAZ SOLDÁN, M. (1980): *La moneda colonial en el Perú. Capítulos de su historia*. Lima Perú: Banco Central de Reserva del Perú.
- MOSSMAN, P. L. (1993). *Money of the American Colonies and Confederation*. New York: American Numismatic Society. Digital edition, 31 August 2016.
- MOTOMURA, A. (1994): «The Best and Worst of Currencies: Seigniorage and Currency Policy in Spain, 1597-1650». *The Journal of Economic History* 54 (1), pp. 104-127.
- MUNÓZ SERRULLA, M. T. (2015): *La moneda castellana en los reinos de indias durante la Edad Moderna*. Madrid: Universidad Nacional de Educación a Distancia.
- MUNRO, J. H. (2010): «The Coinages and Monetary Policies of Henry VIII (r. 1509-1547): Contrasts between Defensive and Aggressive Debasements». University of Toronto Working Paper 417.
- NEWELL, M. E. (1994): «Merchants and Miners: Economy and Culture in 17<sup>th</sup> Century Massachusetts and Potosí». *Revista de Indias* 54 (201), pp. 299-311.
- PETERSON, M. (2019): *The City-State of Boston; The Rise and Fall of an Atlantic Power, 1630-1865*. Princeton: Princeton University Press.

- QUIROZ, F. (2016): «La moneda en el mercado colonial peruano», in CARLOS CONTRERAS (ed.) *Historia de la Moneda en el Perú*. Lima, Perú: Banco Central de Reserva del Perú and Instituto de Estudios Peruanos, pp. 199-226.
- REDISH, A. (2000): *Bimetallism: An Economic and Historical Analysis*. Cambridge: Cambridge University Press.
- SOLOMON, R. E. (1976): «Foreign Specie Coins in the American Colonies», in ERIC P. NEWMAN, and RICHARD G. DOTY (eds), *Studies on Money in Early America*. Associate ed. New York: The American Numismatic Society, pp. 25-42.
- SUÁREZ, M. (2016): «Metales preciosos, moneda y comercio. La participación del Perú en el mundo ultramarino, siglos XVI-XVIII», in CARLOS CONTRERAS (ed.) *Historia de la moneda en el Perú*. Lima, Perú: Banco Central de Reserva del Perú and Instituto de Estudios Peruanos, pp. 155-198.
- SUSSMAN, N. (2003): «Inflation Tax», in JOEL MOKYR (ed.), *Oxford Encyclopedia of Economic History*, Oxford University Press.
- SYLLA, R. (1982): «Monetary Innovation in America». *The Journal of Economic History* 42 (1), pp. 21-30.
- TEPASKE, J., and BROWN, K. W. (ed.) (2010): *A New World of Gold and Silver*, Leiden: Brill.
- VALERI, M. (2008): «Providence in the Life of John Hull: Puritanism and Commerce in Massachusetts Bay, 1650-1680», *Proceedings of the American Antiquarian Society*.
- WALL, R. E. (1990): *The Membership of the Massachusetts Bay General Court, 1630-1686*, New York: Garland Publishing.