Fiat Money in 17th Century Castile

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Introduction

The Castilian Monetary System before 1597

After a turbulent medieval history, the monetary system in Castile was firmly established by a Pragmatic Sanction of 1497, and remained essentially unchanged during the 16th century (and even until the 19th century, insofar as gold and silver were concerned). A three-tier system of gold, silver and alloy was established. The metallic content of the coins was set by royal decisions and their face value expressed in *maravedis* (mr), an abstract unit of value.

The standard gold coin was initially the *ducat*, and later the *escudo* with its multiples.[1] The silver coins were the *real*, whose silver content was changed once in 1686, and its multiples and fractions.[2]

The third tier consisted of coins made of an alloy called billon (*vellón* in Spanish), copper with a few percent silver (between 1566 and 1572, coins were minted in *rico vellón* or rich vellón, with 21.5% silver). Table 1 summarizes the specifications of 16th century vellón coinage.[3]

The three tiers of the Castilian monetary system are represented in Table 2 with an indication of the purchasing power of each coin. This system is like those which prevailed in most of Europe in the 16th century: large denomination gold and silver coins and small denomination coins in billon. As in most of Europe, the small coins in Castile were made by the mint almost at cost: in the blancas made between 1566 and 1597 silver, copper and coinage costs each represented about 30% of face value (Motomura 1994, Table 2).

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[1] The ducat disappeared as a coin in 1537 but remained as a unit of account, representing 375 *maravedis*. Henceforth the word "ducat" will be used in the sense of 375 maravedis.

[2] The real was minted at 67 to the marc of silver 93.06% fine, or 3.195g of silver. The real's value in units of account was 34 maravedis, so that a silver ducat represents 35.24g of silver.

[3] Monetary ordinances prior to 1566 do not mention minting anything but half-maravedi coins or *blancas*, but according to Gil Farrés (1976, 376–8), *cuartos* (4mr) and half-cuartos or *ochavos* (2mr) were first minted sometime between 1480 and 1497, and continued to be issued until Philip II; Fontecha (1968) shows pictures of these coins. According to Ulloa (1986, 441–3), coinage of rico vellón stopped in 1572 but coinage of vellón at 1.4% silver continued until the 1590s.

Date	Coin Name	Silver Fine (%)	coins per marc	Silver Content (mg)	Face Value (mr)	Silver Content (mr)
1497–1552	blanca	2.4	192	29.1	0.50	0.31
1552–66	blanca	1.9	192	22.9	0.50	0.24
1566–72	ochavo	21.5	340	145.7	2.00	1.55
	cuarto	21.5	170	291.3	4.00	3.10
	cuartillo	21.5	80	619.0	8.50	6.59
1566–96	blanca	1.4	220	14.5	0.50	0.15

Table 1: Changes in billon coinage, 1497–1596.

Coin Name	Face Value (mr)	Weight (g)	Purchasing Power
Gold			
4 escudos	1600	13.6	1450mr = minimum weekly
2 escudos	800	6.8	middle class income
1 escudo	400	3.4	350mr = 1 bushel wheat
Silver			
8 reales	272	27.2	200mr = 1 ga. olive oil
4 reales	136	13.6	
2 reales	68	6.8	80mr = 1 day skilled labor
1 real	34	3.4	50mr = 1 spring chicken
1/2 real	17	1.7	15mr = 1 bottle wine
Vellón			
cuarto	4	1.4	4mr = 1/2 lb bread
ochavo	2	0.7	
blanca	0.5	1.0	1mr = 1 quince

Table 2: Castilian monetary system, ca. 1590 (before the onset of vellón inflation).

The Beginning of Pure Copper Coinage and Currency Restampings

The Spanish monarchy's ambitious policies in under the Habsburg dynasty (16th and 17th centuries) proved to be costly. The defense of its overstretched empire required much more than the precious metals it was collecting from its American colonies. Several conflicts were a particular drain on its finances: the long war with the Netherlands from 1566 to

1648, the European conflict of the Thirty Years War from 1618 to 1648, and the rebellion of Catalonia from 1640 to 1658. This long century of warfare only ended with the treaty of the Pyrenees in 1659. As a measure of the cost of these wars, it is enough to note that the sums spent in the conflict with Netherlands alone were twice the sums collected by the monarchy on American gold and silver.

In the face of such spending commitments, one would have expected a typical European monarchy to resort to a variety of fiscal measures, and time-honored traditions in the matter included currency manipulations. Indeed, the 15th century Castilian kings debased the currency with gusto (MacKay 1981). Yet, as noted above, the currency was left untouched from 1497 to 1596, aside from minor adjustments to the petty coinage.

The turning point came on December 31, 1596, when king Philip II of Spain issued the following decree (Maria del Rivero 1918–19, document 14):

"The laws of this kingdom dispose and order the manner in which the mints produce billon coins, and the proportion of silver to be added in every mark and all other details necessary for their execution. But we have been advised by people of great experience, that the silver which is put in those billon coins is lost forever and no profit can be drawn from it, except in their use as money, and that the quantity of silver which is put to that use for the necessities of ordinary trade and commerce in this kingdom is large. We have also been advised that, since we have established a new machine (*Ingenio*) in the city of Segovia to mint coins, if we could mint the billon coinage in it, we would have the assurance that it could not be counterfeited, because only a small quantity could be imitated and not without great cost if not by the use of a similar engine, of which there are none other in this kingdom or the neighboring ones. And it would thus be possible to avoid putting the silver; having considered this very thoroughly and consulted, I have allowed that in this Ingenio will be struck all the billon which will be made henceforth in this kingdom of Castile without adding or putting any silver, and that be struck in this manner until otherwise advised each year 100,000 ducats of billon coins (that is 340,000 marks), of the same value and

weight as those current at present in this kingdom; and half be coined in pieces of 4 maravedis, 1/3 in pieces of 2 maravedis and 1/6 in 1-maravedi coins; and, so as to avoid any excess of billon in the kingdom which would be an inconvenience, it is ordered that the same quantity of current coinage be retired as is being newly minted until it is all absorbed and the billon coinage in our kingdom of Castile is uniform."

The "engine" (Ingenio) to which Philip II was alluding represented a major technological breakthrough which had made the medieval coining method obsolete and mechanized the process, using water-power. The new machines produced coins which were round, well-centered, and uniformly imprinted. In 1581, Philip II had asked his cousin the archduke of Tirol, where the invention originated, to send him engineers who could import the technology, and the archduke obliged. The new machines were set up in the Segovia mint and produced the first reales in 1586.[4]

As the text of the decree makes clear, Philip II and his advisers considered that this new technology, which could not be duplicated easily by the private sector or neighboring princes, gave them a decisive cost advantage and allowed them to remove the silver content (about 30% of face value) from the billon coinage. The output envisaged was moderate: at a rate of 0.1m D per annum it would take 30 years to exchange the outstanding stock of small coinage (Domínguez Ortiz 1983, 239). Moreover, to avoid any adverse consequence, the new coinage was to be issued only to retire old coinage.

The decree of December 31, 1596 was not well received, and the king modified it on February 1, 1597 by putting back a symbolic 0.3% silver, worth 7mr, in the new coinage.[5] The Cortes nevertheless protested on July 29, arguing that the new mintage would result in an inflation which would violate debt contracts; and that this inflation would be worsened by counterfeiting abroad, because of the huge incentive offered by the difference between intrinsic value (which they estimated at 20mr) and a face value of 144mr (Rivero 1918). Philip II ignored those protestations and minting proceeded, at the moderate pace which had been announced. In spite of the warnings of the Cortes, no inflation ensued.

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[4] The story of the Segovia Ingenio is told in Rivero (1918) and Durán (1955).

[5] A decree of July 19, 1597 set the weight of coins at 35 coins per marc for cuartos of 4mr, 63 for medios cuartos of 2mr and 126 for maravedis.

Philip II was succeeded in 1598 by his son Philip III, who initially continued his father's policy, but was induced to go a step further by pressing spending needs. The king fulfilled the plan of his father in 1602 and removed the remaining half-percent of silver from the coinage. At the same time, since the coins' value seemed to be unconnected to their intrinsic content, he decided to halve their copper content. He also departed from the earlier moderate pace of issue: whereas 0.5m D had been issued between 1597 and 1602, 3m D were issued from 1602 to 1608.

As a result of the reform, two currencies circulated side by side: the pre-1602 coinage (called *calderilla*) 2mr and 4mr coins with some silver, and the post-1602 coinage of same size but twice the tale and of pure copper. To make the currency uniform, the king decided in 1603 to have the calderilla coins restamped at twice their original value. The mechanism was as follows: owners of calderilla would bring their coins to the mint, the mint would stamp them, and return to the owners the same number of maravedis that they brought in. As an inducement, a small premium was given to compensate for transportation costs (about 0.02% of face value per mile). This amounted to nearly 50% net seigniorage rate, since the costs of restamping were small.

The premium was apparently sufficient to induce people to bring their coinage, since it fact the transportation of coinage to the mint became a business in its own right, and two thirds of the outstanding coinage was brought in (see Table 3). The restamping added 2.3m D to the nominal money stock.

Thus, in 1602 and 1603 the Spanish monarchy had carried out two monetary operations to generate large revenues: issue of token coinage, and mandatory restampings. Over the next sixty years, it used both methods repeatedly to extract resources from the money stock. Minting a currency with market value far above intrinsic value (see Figure 3) was used from 1602 to 1626, and again briefly from 1660 to 1664. Restamping the currency, alternatively the calderilla and the pure copper coinage, was used five times in-between (1636, 1641, 1651, 1654, 1658). The restampings were interspersed with overnight deflations, whereby the tale of all coinage was brought down to either pre-1602 levels or even to intrinsic content. Appendix 1 contains a detailed chronology of these operations, and Table 5 summarizes them. Appendix 2 provides details and sources for the data series.

	Existing Stock (m D)	Amount Stamped (m D)	Ratio (%)
1603	3.6	1.9–2.3	53–64
1636	2.4	2.1	88
1641-2	11.9	9.3	78
1651	5.8	2.8	48
1658	5.6	0.9	16

Table 3: Extent of Restampings. See Appendix 2 for sources.

Some Sense of Magnitudes

How extensive were the recoinages? Did people really find an incentive to bring their copper coinage for restamping? In the 1651 restamping, coins were quadrupled in tale, which meant that the government, which continued its policy of returning the same nominal amount, kept 3 coins out of 4. Table 3 shows that the restampings were effective, in the sense that large shares, if not the entirety, of the affected money stock was brought in to the mints for restamping.

How large were the revenues collected by the Spanish government? The stampings of 1636, 1641 and 1654 (the most successful, as shown in Table 3) each provided 5m ducats on average. From 1621 to 1626, minting of pure copper coinage earned 2m ducats per year. By way of comparison, total expenditures in 1598 and 1621 (both war years) were 12.3m and 12.7m ducats respectively, of which 6 to 7m ducats for defense. In 1608, a peacetime year, expenditures were 10.8m D of which 4.2m for defense.[6] The sums raised in seigniorage were therefore considerable.

There are other ways to appreciate the size of the currency issues, which is in terms of the amount of copper consumed by Castile. From 1602 to 1626, about 8,300 tons of copper were turned into Spanish coins; and in the years between 1618 and 1626, the annual average was 700 tons. This is a considerable amount: Sweden was at the time the major supplier of copper in Europe: its output in that period was about 1,500 tons per year.[7]

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[6] Domínguez Ortiz (1960, 262) , Thompson (1976, 288-9).
[7] Wolontis (1936, 221).

In fact, the conjunction of Spanish demand for currency purposes and of military use of copper (for cannons) due to the Thirty Years War of 1618–48 brought about a noticeable rise in the international price of copper, as shown in Figure 1. It is no surprise that, when Spain stopped its copper emissions in 1626, the Swedish government was very concerned, and tried to convince its French ally to launch a copper currency. When this failed, the government decided to put the country on a (full-bodied) copper standard to enhance the demand for copper.[8]
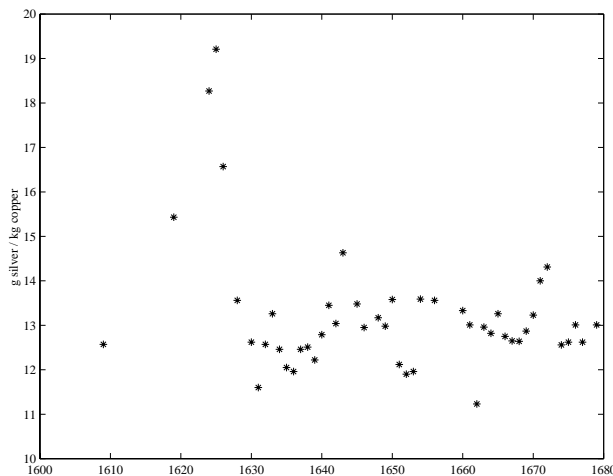

Figure 1: Price of Hamburg copper in Amsterdam, 1609–1680. Source: Posthumus (1934, 1:371–2).

There is another way to judge the size of copper emissions in that period, by comparing their value to the total money stock before they began. By our estimates, the value of the stock of copper coinage peaked in 1626, at about 23m D (in silver value), as shown in Figure 2. We wish to compare this with the total money stock before 1597. We do not have any estimates for Castile, but we have estimates of per capita money holdings in France and England in the same period, shown in Table 4, expressed in ducats for convenience.

The population of Castile was about 5.6m in 1591 (Nadal Oller 1988), and about 4.5m in 1625 (Yun 1994). Per capita money balances at the time in England and France

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[8] Spooner (1972), Heckscher (1954).

	England		France
1561	1.58	1580	1.87
1600	2.79	1600	1.84 to 2.95
1643	6.20	1650	4.28
1670	7.58	1680	3.74 to 4.88

Table 4: Estimates of money holdings per capita for France and England, in silver ducats.

Sources: England: Mayhew 1995. France: Riley-McCusker 1983, Glassman-Redish 1985 for money stocks, Dupâquier 1988 for population.

were in the range of 1.8 to 3D, so that a plausible range for the Spanish money stock in 1590 would be 10m to 17m ducats if we assume identical per capita balances in Castile. It was also known at the time that metal was more abundant in Castile than elsewhere (and prices higher: see the economists cited in Grice-Hutchinson). Even if we allowed that metal was 50% more abundant in Castile, the range would be 20 to 30m ducats. At 23m ducats, it is apparent that the real holdings of copper in 1626 were probably close to total holdings of metallic currency prior to the beginning of the copper experiment.

Another approach would be to find an upper bound on the money stock by cumulative summing up prior minting. Summing the known minting in the various Spanish mints (Ulloa 1986, 430–40), total minting from 1566 to 1598 was a minimum of 69.4m ducats. It must be remembered that most of the gold and silver minted in Castile left that country quickly.

These considerations weaken the interpretation put forward by Motomura (1994) that the Spanish experience with copper was the result of a price discrimination policy by the government, taxing more heavily petty coinage, whose demand was much more inelastic. Not only were the demands for copper and silver not necessarily distinct (since one could replace the other), but the demand for copper expanded dramatically even as it was being "taxed" more heavily.
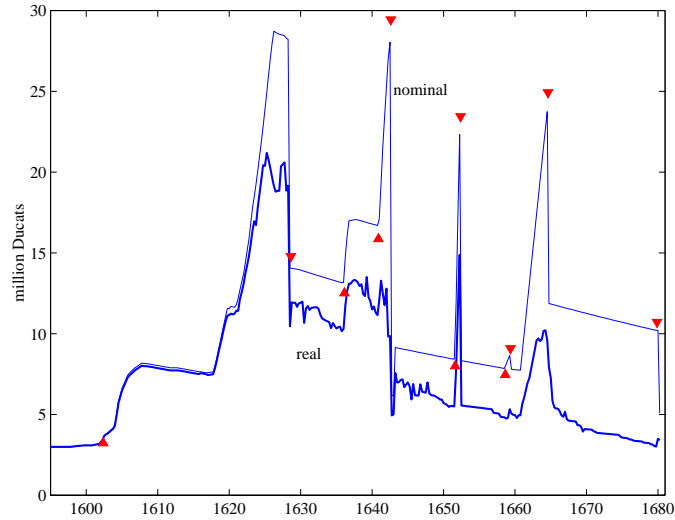
Figure 2: Nominal value (in copper ducats) and real value (in silver ducats) of the vellón stock, 1595–1690. Source: see Appendix 2.
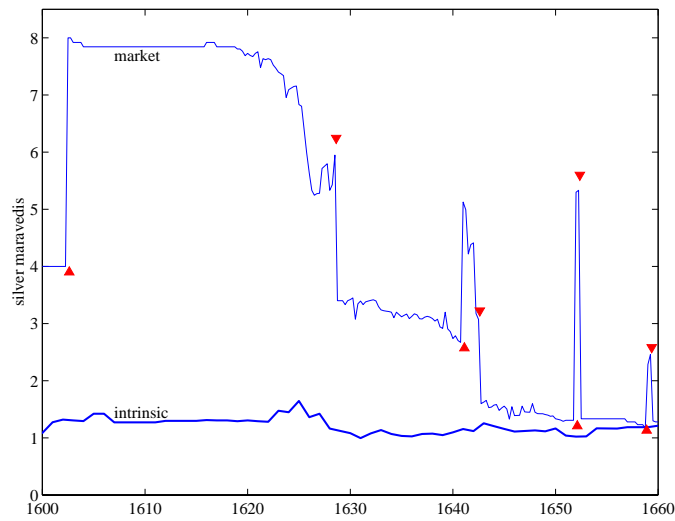

Figure 3: Market value and intrinsic value (in silver mr) of a vellón *cuarto* coin, 1597–1659. Source: see Appendix 2.

Appendix 1: A Chronology

This appendix presents a chronology of monetary operations on copper coinage in Castile

Figure 4: Indices of the price of silver and the price of commodities (in copper mr), Log scale; 1600–1700. Source E. J. Hamilton 1936, 1947.
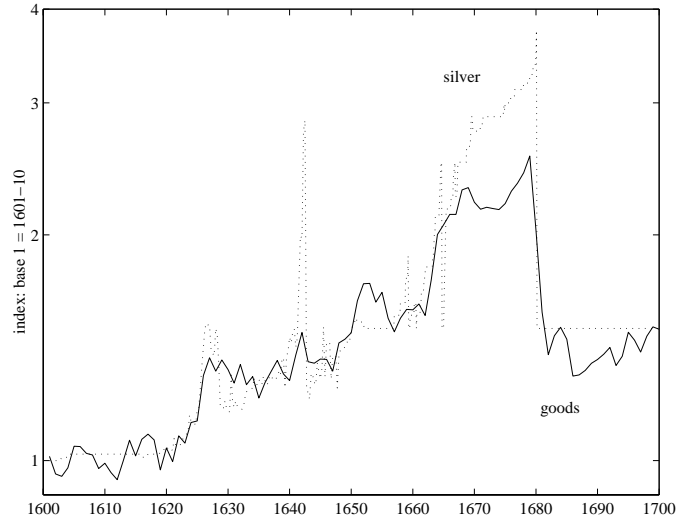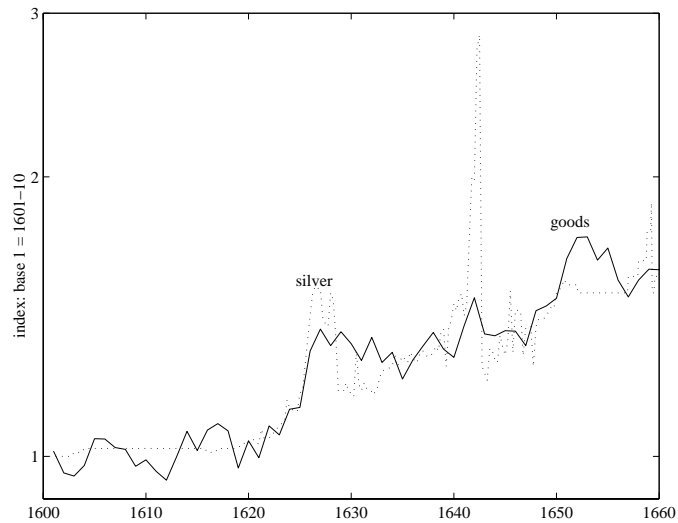

Figure 5: Indices of the price of silver and the price of commodities (in copper mr), Log scale; 1600–1660. Source E. J. Hamilton 1936, 1947.

between 1597 and 1680. The main events are summarized in Table 5. It is important to maintain throughout this chronology a distinction between *calderilla*, that is, coins

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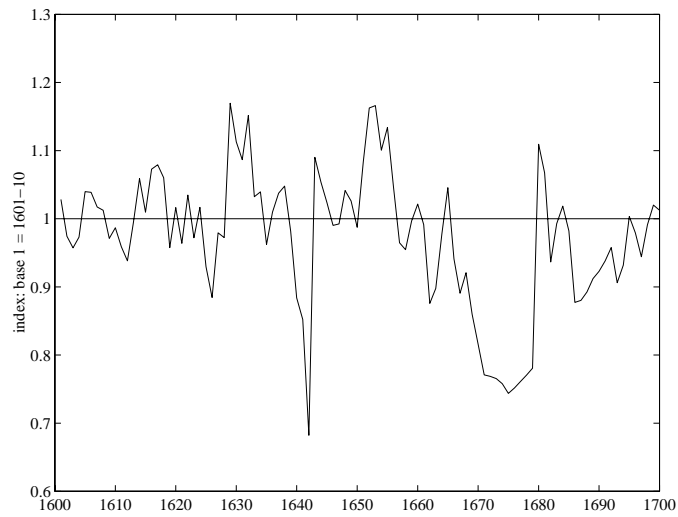
Figure 6: Silver price of commodities, 1600–1700. Source E. J. Hamilton 1936, 1947.

made any time before 1602 and containing some silver; and the pure copper coinage which followed. Monetary ordinances and reforms treated those two types of coins differently.[9]

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[9] This chronology is pieced together from various sources. The account in Hamilton (1936) is useful but incomplete and erroneous at times. It needs to be complemented with Domínguez Ortiz (1960). A good study of the Valladolid mint (Pérez García 1990) is very helpful as well. See also Carrera Pujal (1943). Numismatists provide precious information: in particular Fontecha (1968).

	Billon				Pure Copper		
Year	Silver Content	Face Value			Face Value		
1471–97	3.5%	103	*calderilla*				
1497–52	2.4%	96					
1552–66	1.9%	96					
1566–97	1.4%	110					
1597–02	0.4%	140					
1603		280	restamped	×2			
1602-08					280	minting	
1617–26					280	minting	
1628		140	cried-down	÷2	140	cried-down	÷2
1636–38		420	restamped	×3			
1641					420	restamped	×3
1642		70	cried-down	÷6	70	cried-down	÷6
1643		280	cried-up	×4			
1651					280	restamped	×4
1652		0	demonetized		70	cried-down	÷4
1654		280	remonetized				
1658					140	restamped	×2
1659					70	cried-down	÷2
1660					204	minting	
1660–64	6.9%	816	*vellón rico*		0	demonetized	
1664	6.9%	408	cried-down	÷2			
1680		204	cried-down	÷2			
1680		0	demonetized				
1680–99					76	new *vellón*	
1684		408	remonetized				

Table 5: Chronology of billon coinage (calderilla, vellón rico) and pure copper coinage (vellón grueso, segovianos) in Castile, 16th and 17th c. Face value is expressed in maravedis (mr) per marc (230g) of coins.

Vellón of 1597

A decree of December 31, 1596 prescribed that all vellón coinage in Castile would henceforth be of pure copper but unchanged face value, and would all be minted in the Ingenio in Segovia (Maria del Rivero 1918, document 14). The quantity to be minted was 340,000 marcs per year (equivalent to 10m ducats), in denominations of 1mr, 2mr and 4mr, with output shares of 1/6, 1/3 and 1/2 respectively. A decree of February 1, 1597 changed the content of the coinage by adding 0.3% silver to the copper. A decree of July 19, 1597 set the weight of coins at 35 coins per marc for cuartos of 4mr, 63 for half-cuartos of 2mr and 126 for maravedis.

Vellón of 1602 and Restamping of 1603

A decree of June 3, 1602 decided that the vellón coins would henceforth contain no silver, and their copper weight would be reduced by half, with 1 marc producing 280mr. The mints would now produce coins of 1mr, 2mr, 4mr and 8mr.[10] A decree of September 18, 1603 allowed holders of the pre-1602 coinage to have it restamped: 2mr coins were stamped "IIII" and 4mr coins were stamped "VIII"; anyone bringing coins for restamping would receive the same number of maravedis as he had brought in, plus a small compensation for transportation costs to the mint.[11]

Minting was halted by a decree of November 2, 1608 for a period of 20 years, after renewed complaints from the Cortes and petitions from Castilian cities. It was nevertheless resumed soon after: there is a decision of March 15, 1612 authorizing the minting of left-over stocks of copper (80,000 marcs) in the Segovia mint, and coins of that period from other mints are known to numismatists. The Cortes officially agreed to a resumption of minting in 1617, but a decision of 1619 renewed the prohibition of vellón coinage without the assent of the cities represented in the Cortes, decision which was ignored (Fontecha 1968, 54). In fact, minting in Segovia was uninterrupted from 1612 to 1626 (Rivero 1918, 30). Minting finally stopped with a decree of May 8, 1626.

Deflation of 1628

To deal with the inflation which developed in 1625 and 1626, the Spanish government tried several measures, including very detailed price and wage controls in 1627, and a large-scale open market operation. A bank was created, whose purpose would be to buy back vellón coinage. In exchange for 100mr, the bank returned the vellón perforated and now worth 25mr (roughly its intrinsic value), and 80mr in 4-year bonds, payable in silver with 5% interest. The bank's operations were financed by giving it the right (or

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[10] The new 8mr coin was exactly the same size as the old 4mr, but the new coins were recognizably different in type from the earlier coins, in particular bearing indication of their face value for the first time. All vellón coins were inscribed with a date since 1597.

[11] Hamilton (1936, 76); Domínguez Ortiz (1960, 254); Vicenti (1976, 93–4). It is not clear if 1mr coins were also restamped: Vicenti does not mention any coins bearing a "II" mark. The compensation for transportation costs was between 4 and 6mr per arroba of coins (equivalent to 50 marcs or 7000mr) and per league (3.5 mi) traveled (Pérez García 1990, 59). This works out to roughly 0.1% of face value per 5 miles traveled. The restamping costs were about 10mr per marc (Pérez Sindreu 1992, 234).

even monopoly) to engage in a wide range of financial activities such as foreign exchange, mortgage loans, demand deposits, and the like.[12]

Both projects failed, and on Aug, 7, 1628 all the vellón money (that minted before 1602 and restamped, as well as that minted from 1602 to 1626) was reduced to half of its legal tender value. The same decree abolished the bank and repealed the price controls (Domínguez Ortiz 1960, 257).

Restamping of 1636

A decree of March 11, 1636 ordered the restamping at treble tale of the calderilla (pre-1602 coinage), arguing that its silver content entitled it to circulate at higher value than pure copper coinage.[13] A decree of Jan 29, 1638 ordered the melting down of all unstamped vellón, but it seemed to have little effect.

Restamping of 1641

A Decree of February 11, 1641 ordered that the largest coins issued at mints other than the Segovia Ingenio, currently circulating for 4mr, be restamped at double tale within 30 days and henceforth circulate for 8mr. These coins, which were poorly hammered out of rather thick blanks, was called *vellón grueso* or thick vellón; another name for these coins was *pechelingue*, and in accounts they are called *moneda de Cuenca* (Pérez García 1990, 148). Were not included in the restamping the 1mr and 2mr coins of all mints, nor the 4mr coins minted in Segovia; but, since almost no 1mr and 2mr coins were minted

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[12] Hamilton (1936, 81–2), but he implies that the silver was paid immediately. Domínguez Ortiz (1960, 256) states that the bank issued 4-year bonds. Fontecha (1968, 69) states that only the calderilla (pre-1597 coinage) was being bought back.

[13] Domínguez Ortiz (1960, 258). The literature does not explain very well what calderilla might be (Domínguez Ortiz calls it vellón rico). We conclude that the term covers all coins minted before 1602 and still in circulation, whose silver content varied between 0.4 and 3.5%, depending on its age. The diary cited by Bonilla y San Martín (1910) calls the coins "cuartos antiguos llamados de calderilla ó del Emperador." This indicates that the calderilla in fact consists of the half-cuarto and cuarto coins (worth 2mr and 4mr respectively) coined under Charles V. We have seen a vellón coin from the reign of Ferdinand and Isabel, which was stamped in 1603. Whether the vellón rico minted between 1566 and 1572 still circulated at the time is doubtful, given its high silver content, and the fact (Fontecha 1968, 34) that it consisted mostly of cuartillos of 8.5mr which are not mentioned in the decree. Numismatic evidence also suggests that coinage from 1597 to 1602 was also treated like calderilla and stamped in 1636. Indeed, Pérez García's quote of the decree mentions "todo la moneda de vellón resallada," and Fontecha says that the decree applied to "la moneda de vellón resallada, o sea, la calderilla resallada en 1602 al duplicar el valor de la moneda."

outside Segovia, the only category excluded was in fact coins minted in the Segovia mills, also called *segovianos*. The decree also ordered the melting of the calderilla restamped in 1636 with compensation at face value to the owners.

Another decree of October 22, 1641 ordered the restamping of the 2mr and 4mr coins minted in Segovia (the *segovianos* hitherto excluded) at triple tale to 6mr and 12mr.[14]

Deflation of 1642

A decree of September 15, 1642 reduced the face value of the 8mr and 12mr coins (restamped in February and October 1641 respectively) to 2mr, and the 4mr and 6mr to 1mr, the remaining (unstamped) 1mr coins to 0.5mr. This brought all vellón (both calderilla and pure copper) to a uniform mint equivalent of 70mr per marc, half of what prevailed before 1602, and roughly intrinsic value (Domínguez Ortiz 1960, 263).

Crying-up of 1643

A decree of March 12, 1643 quadrupled the value of the calderilla to 4mr and 8mr, again justifying this measure by its higher silver content.[15] No restamping was involved.

Restamping of 1651

On November 11, 1651 it was ordered that all vellón return to its condition before the deflation of 1642, except for the "old money coined before 1597 called calderilla currently circulating for 4 and 8mr." In other words, the vellón exempted in the crying-up of 1643 was restamped to four times its tale.[16] It was also ordered that 0.1m ducats in 2mr coins be minted, with weight consistent with the mint equivalent reached after the restamping. The operation ended with a decree of June 21, 1652, which reversed the effect of the restamping, but ordered that the vellón grueso cease to be current at the end of 1652, and reduced the 2mr coins just minted to 1mr only. The calderilla remained at its cried-up value of 4mr

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[14] There is some confusion on these decrees, worst of all in Hamilton (1936). We follow the actual texts quoted in Pérez García (1990), as well as the entries from contemporary diaries quoted by Bonilla y San Martín (1910).

[15] Domínguez Ortiz (1960, 263). Fontecha (1968, 73) seems confused.

[16] Pérez García (1990, 61). Although the text of the edict does not seem to mentions restamping, Fontecha (1968, 73) provides examples of the stamps used in 1651 and 1652.

and 8mr. On November 14, it was decided instead to demonetize the calderilla and order its melting, and keep the vellón grueso as currency.

Restamping of 1654 and 1658

By decree of October 21, 1654, the calderilla was remonetized, to values of 4mr and 8mr. Those who still owned the coins could have them legalized by restamping them, subject to a 50% withholding.

On September 24, 1658, it was the turn of the vellón grueso to be restamped to 2mr and 4mr and the owners receiving the nominal value in new coins.[17] This decision was rescinded on May 6, 1659 and the vellón grueso returned to its prior value. On September 11, 1660 it was decided that the vellón grueso would be melted and a new pure copper coinage would be minted in coins of 8mr, at 204mr per marc. Very little was coined, since the decree was rescinded on October 29.

The New Billon Coinage of 1660

The same decree of October 29, 1660 ordered the minting of a new form of vellón, containing 7% silver, and coined at 816mr to a marc. This *moneda ligada* or alloyed coinage was issued in 2mr, 4mr, 8mr and 16mr denominations. The coins were initially rather easy to counterfeit, and it was decided in October 1661 to extend the mechanized method of minting to all mints outside of Segovia. This new vellón was nevertheless widely counterfeited, to the point that even obvious fakes circulated. On October 14, 1664 the tale of the new vellón was reduced by half and minting halted. The coinage circulated for a while still until its tale was reduced again by half on February 10, 1680, and demonetized on May 22. It was remonetized in 1684 at half of its original, pre-1664 tale.

The Copper Coinage of 1680

A new copper coinage (without silver alloy) was ordered by the same decree of

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[17] Fontecha (1968, 75–6) is rather confusing, since he states that the decree ordered the minting of a new money with same weight as the calderilla, and that this new money was in fact restamped vellón grueso; but this cannot lead to the vellón grueso having the same mint equivalent as the calderilla, since the new denominations were 2 and 4mr.

May 22, 1680. It was struck at 76mr to the marc, which put it close to intrinsic value plus production costs. At the same time, mechanized minting was abandoned for all mints (except the original Ingenio in Segovia) and minting was hammered as previously. This coinage marked the end of the vellón inflation in Castile.

Appendix 2: The Data

Money Stock

The vellón stock has been reconstructed as follows. Two separate money stocks were estimated, one for calderilla (pre-1602 coinage) and one for pure copper coinage. The starting point for both series is in 1596: the initial stocks are 3m D for calderilla (Domínguez Ortiz 1983, 239) and 0 for pure copper.[18] The time series for the nominal stocks are then constructed by accounting for increases due to minting of new coins, crying-up and restamping, and decreases due to by crying-down and depreciation. We set depreciation at 1% per annum. This rather arbitrary choice is consistent with what is known about wear and tear of coinage. This depreciation rates do not change the estimates much but allow us to try and match contemporary estimates of the money stock. Motomura (1997) makes the same assumption.[19]

The figures for minting and restampings from 1597 to 1642 are taken from Motomura (1997, Tables 5A–K).[20] For the restamping of 1603, however, his sources seem incomplete or ambiguous (see Tables 5D and 5E), so we adjust the total amounts of restamped coins to agree with the figure cited in Pulido Bueno (1996, 150) of a profit to the Crown of 2.335m D, corresponding to an equal increase in the money. For 1652 we use 14m figure for the addition to the money stock.[21] For 1658 a figure of 0.85m D turned in for restamping is

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[18] D stands for ducats.

[19] We compare our estimates with the contemporary estimates of money stocks which Domínguez Ortiz cites: 30m D in 1626, 4 or 5m D calderilla and total 20 or 21m D in 1641, 3.7m D in calderilla and 5.3m D in copper in 1649, 3.6m D in calderilla in 1652, 5m D in copper in 1658, 7m D total in 1660. We come within 25% of all these estimates.

[20] An earlier version of this paper, based on Motomura (1994), used other information (Pulido Bueno 1996, 150–3; Pérez García 1990, 165; Domínguez Ortiz 1983, 243–62) to estimate the minting and restamping volumes.

[21] Of which 11m D from official restamping (Domínguez Ortiz 1960, 262) and 1m D from private counterfeit restamping, according to García de Paso (2000).

given by Domínguez Ortiz (ibid.). Minting in 1661–4 is estimated at 16m (García de Paso (2000).

The data is estimated on a quarterly basis, and Hamilton's quarterly series for silver prices is used to deflate the nominal stock into a real stock.

Date	calderilla	copper	total	Date	calderilla	copper	total
1597		3.00	3.00	1612	2.62	5.27	7.89
1598		3.05	3.05	1613	2.59	5.22	7.81
1599		3.09	3.09	1614	2.57	5.17	7.73
1600		3.08	3.08	1615	2.54	5.11	7.65
1601		3.17	3.17	1616	2.52	5.06	7.58
1602		3.28	3.28	1617	2.63	5.01	7.64
1602:2	0.00	3.40	3.40	1618:1	3.02	4.99	8.01
1602:3	0.14	3.53	3.67	1618:2	3.51	4.97	8.49
1602:4	0.25	3.52	3.77	1618:2	4.03	4.96	9.00
1603:1	0.35	3.51	3.86	1618:2	4.55	4.95	9.50
1603:2	0.46	3.50	3.96	1619:1	5.10	4.94	10.04
1603:3	0.57	3.49	4.06	1619:2	5.64	4.93	10.57
1603:4	0.67	3.49	4.16	1619:3	6.18	4.91	11.10
1604:1	0.77	3.61	4.38	1619:4	6.67	4.90	11.57
1604:2	0.87	4.19	5.06	1620:1	6.66	4.89	11.55
1604:3	1.07	4.76	5.84	1620:2	6.81	4.88	11.69
1604:4	1.15	5.06	6.21	1620:3	6.80	4.86	11.66
1605:1	1.26	5.37	6.62	1620:4	6.79	4.85	11.64
1605:2	1.42	5.45	6.87	1621:1	6.94	4.84	11.78
1605:3	1.59	5.54	7.13	1621:2	7.38	4.83	12.21
1605:4	1.77	5.63	7.39	1621:3	7.89	4.82	12.70
1606:1	1.94	5.61	7.55	1621:4	8.41	4.80	13.21
1606:2	2.06	5.60	7.66	1622:1	8.87	4.79	13.66
1606:3	2.18	5.58	7.76	1622:2	9.60	4.78	14.38
1606:4	2.30	5.57	7.87	1622:3	10.34	4.77	15.10
1607	2.63	5.54	8.18	1622:4	11.06	4.76	15.82
1608	2.64	5.49	8.13	1624:1	12.01	4.74	16.75
1609	2.62	5.43	8.05	1623:2	13.02	4.73	17.75
1610	2.59	5.38	7.97	1623:3	13.77	4.72	18.49
1611	2.57	5.32	7.89	1623:4	14.53	4.71	19.23

Table 6: Estimates of stocks of *calderilla*, pure copper and total *vellón* coinage, 1597–1680.

Prices

There are two price series. One records the premium on silver coinage over vellón

Date	calderilla	copper	total	Date	calderilla	copper	total
1624:1	15.42	4.70	20.12	1639	10.64	6.18	16.82
1624:2	16.29	4.68	20.98	1640	10.54	6.17	16.70
1624:3	17.22	4.67	21.89	1641:1	10.94	6.15	17.09
1624:4	18.17	4.66	22.83	1641:2	13.18	6.14	19.32
1625:1	19.21	4.65	23.86	1641:3	15.42	6.12	21.54
1625:2	20.28	4.64	24.92	1641:4	17.35	6.10	23.45
1625:3	21.35	4.63	25.97	1642:1	19.23	6.09	25.32
1625:4	22.41	4.61	27.03	1643:2	20.93	6.07	27.00
1626:1	23.35	4.60	27.95	1643:3	21.98	6.06	28.04
1626:2	24.13	4.59	28.72	1643:4	5.16	1.01	6.17
1626:3	24.07	4.58	28.65	1643:1	5.15	1.00	6.15
1626:4	24.01	4.57	28.58	1643:2	5.14	4.01	9.15
1627	23.89	4.55	28.43	1643:3	5.12	4.00	9.12
1628:1	23.77	4.52	28.29	1643:4	5.11	3.99	9.10
1628:2	23.71	4.51	28.22	1644	5.06	3.95	9.01
1628:3	23.65	4.50	28.15	1645	5.01	3.91	8.92
1628:4	11.80	2.24	14.04	1646	4.96	3.87	8.83
1629	11.74	2.23	13.97	1647	4.91	3.83	8.74
1630	11.62	2.21	13.83	1648	4.86	3.79	8.65
1631	11.50	2.19	13.69	1649	4.81	3.76	8.57
1632	11.39	2.17	13.56	1650	4.76	3.72	8.48
1633	11.27	2.15	13.42	1651:1	4.75	3.71	8.46
1634	11.16	2.12	13.29	1651:2	4.74	3.70	8.44
1635	11.05	2.10	13.15	1651:3	4.73	3.69	8.42
1636:1	10.99	2.17	13.17	1651:4	8.22	3.68	11.90
1636:2	10.97	3.86	14.82	1652:1	13.45	3.67	17.12
1636:3	10.94	5.08	16.02	1652:2	18.66	3.66	22.33
1636:4	10.91	6.08	16.99	1652:3	4.68	3.65	8.33
1637	10.86	6.21	17.07	1652:4	4.67	3.64	8.31
1638	10.75	6.20	16.95	1653	4.62	3.61	8.23

Date	calderilla	copper	total	Date	copper
1654	4.58	3.57	8.15	1664:3	23.74
1655	4.53	3.54	8.07	1664:4	11.87
1656	4.49	3.50	7.99	1665	11.75
1657	4.44	3.47	7.91	1666	11.63
1658:1	4.43	3.46	7.89	1667	11.52
1658:2	4.42	3.45	7.87	1668	11.40
1658:3	4.41	3.44	7.85	1669	11.29
1658:4	4.69	3.43	8.12	1670	11.17
1659:1	4.97	3.42	8.39	1671	11.06
1659:2	5.25	3.41	8.66	1672	10.95
1659:3	4.39	3.41	7.80	1673	10.84
1659:4	4.39	3.40	7.79	1674	10.73
1660	4.37	3.36	7.74	1675	10.63
1661			12.00	1676	10.52
1662			16.27	1677	10.41
1663			20.54	1678	10.31
1664:1			21.60	1679	10.21
1664:2			22.67	1680	5.10

coinage. The other is a commodity price index for a basket of goods, whose prices are

denominated in vellón maravedis.

The silver premium series, which is quarterly before 1650 and monthly after 1650, comes from in Hamilton (1934, 93, 96) and Hamilton (1947, 28).

The commodity price series is annual. It also comes from Hamilton (1934, 1947), but the series come in two pieces: 1601–50 and 1651–1700. Not only does each index have its own base; the basket of goods is not the same. We spliced the two series as follows. First, we identified the goods which appeared in both series: $i = 1, \ldots, n$. Then we computed factors $q_t = 1/N_t \sum_i p_{i,t}/p_{i,t_0}$ for $t = 1651$, and choosing $t_0 = 1649$. Finally, we extended the index series P as $P_t = P_{t_0} q_t + P_{t_0+1} q_t / q_{t-1}$ (this to take account that the set N is smaller than the complete basket).

Date	Index	Date	Index	Date	Index	Date	Index
1601	1.013	1626	1.299	1651	1.633	1676	2.287
1602	0.960	1627	1.371	1652	1.721	1677	2.343
1603	0.953	1628	1.316	1653	1.723	1678	2.420
1604	0.978	1629	1.362	1654	1.627	1679	2.548
1605	1.045	1630	1.322	1655	1.676	1680	2.027
1606	1.044	1631	1.268	1656	1.548	1681	1.577
1607	1.022	1632	1.343	1657	1.485	1682	1.384
1608	1.018	1633	1.262	1658	1.548	1683	1.467
1609	0.976	1634	1.295	1659	1.591	1684	1.505
1610	0.992	1635	1.212	1660	1.588	1685	1.451
1611	0.964	1636	1.270	1661	1.618	1686	1.296
1612	0.943	1637	1.315	1662	1.562	1687	1.301
1613	1.000	1638	1.360	1663	1.741	1688	1.319
1614	1.064	1639	1.305	1664	2.002	1689	1.348
1615	1.015	1640	1.278	1665	2.063	1690	1.364
1616	1.068	1641	1.383	1666	2.130	1691	1.386
1617	1.085	1642	1.482	1667	2.130	1692	1.415
1618	1.065	1643	1.355	1668	2.296	1693	1.339
1619	0.972	1644	1.349	1669	2.312	1694	1.377
1620	1.040	1645	1.366	1670	2.211	1695	1.483
1621	0.997	1646	1.364	1671	2.164	1696	1.447
1622	1.079	1647	1.316	1672	2.177	1697	1.395
1623	1.055	1648	1.435	1673	2.168	1698	1.465
1624	1.124	1649	1.452	1674	2.161	1699	1.508
1625	1.129	1650	1.480	1675	2.202	1700	1.496

Table 9: Commodity Price Index, $1 = 1601$–10. Source: Hamilton (1934, 1947).

For Figure 4, the value of copper (in silver maravedis) is taken from Motomura (1994) until 1626 and deflated by Hamilton's silver premium. After that date, we use the price of Swedish copper in Amsterdam from Posthumus (271–2), with a 30% mark-up. The copper weight and face value of the cuarto is taken from the chronology. The "intrinsic" value of the cuarto is the value of its copper weight. The "market" value of the cuarto is its face value deflated by Hamilton's silver premium.

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