

GLOBAL QUANTIFICATION AND INVENTORY DEMAND FOR SILVER IN CHINA

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ABSTRACT

This article provides an initial (partial) estimate of silver quantities held within China around mid-18th century, utilising archival evidence related to wealth confiscations. Better future estimates for overall Chinese silver holdings could also facilitate more accurate estimation of Chinese silver (legal plus illegal) imports. Similar analyses for other world regions could eventually yield estimates for global silver stock holdings, useful in turn for improving global silver mining and trade flow estimates. Extensive contraband silver mining and silver trade are known to have escaped official recordation, by definition. If methodologies suggested herein prove successful, then parallel non-silver-trade-good estimates could follow. Current exclusive focus upon production and trade flows should be reevaluated in the context of linkages with accumulations of goods (wealth components). Economic history could someday provide a prominent stage for the historical study of wealth holdings, thereby furnishing context for increasing wealth concentrations observable worldwide today.

Keywords: global silver history, inventory demand, inventory supply

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RESUMEN

Este artículo proporciona una estimación inicial (parcial) de las cantidades de plata retenidas en China hacia mediados del siglo XVIII, utilizando evidencias de archivo relacionadas con las confiscaciones de riqueza. La tenencia de plata estimada es útil para calcular las importaciones de plata (legal e ilegal) en China. Mediciones similares en otros lugares podrían arrojar una estimación sólida de las tenencias mundiales de plata y, por lo tanto, cálculos mejorados de la producción de plata global (legal e ilegal) y los flujos comerciales. Las metodologías aplicadas a la plata también podrían aplicarse a la producción, el comercio y la acumulación de productos no mineros. La estimación de las existencias acumuladas de bienes (es decir, los componentes de riqueza) se vinculan conceptualmente a mediciones sobre la producción y el flujo comercial de esos bienes. La historia económica podrá algún día proporcionar una plataforma esencial para el estudio de la creación y concentración de la riqueza, un problema global crucial en el debate historiográfico actual.

Palabras clave: historia global de la plata, demanda de existencias, oferta de existencias

1. INTRODUCTION

In response to the challenge of quantifying massive smuggling of silver (both in coin and bullion forms) in addition to unrecorded overland transportation of silver, Patrick Manning and Dennis Flynn organised a session at the Boston 2018 World Economic History Congress intended to initiate a collaborative effort to estimate (1) global silver production, (2) global silver trade and (3) end-market accumulations of silver worldwide over the past five centuries. Some participating researchers plan to focus upon the quantitative estimation of silver mine production worldwide since 1500.¹ A second group (including authors of this essay) will estimate accumulated stocks of silver at end-markets around the world. Progress on these two sets of estimates—global silver mine outputs and accumulated

¹ For initial estimates of worldwide silver production and accumulations between 1500 and 1900—based upon published official records only—see Manning *et al.* (2017). Penetration of silver throughout global trade generated impacts far beyond quantification issues *per se*; for instance, see Ma (2017) regarding creation of the novel in China, Europe, and Japan during the 16th century. Silver flows into China were also accompanied by profound environmental/ecological implications. See Marks (2017, especially Chapter 5) and Flynn and Giráldez (2008). Yun-Casalilla (2012, p. 6) connects silver flows to the rise of fiscal states: «During the seventeenth century, wars, the expansion of oceanic trade and colonisation continued to be decisive for the evolution of fiscal regimes throughout Eurasia.»

end-market silver stocks—should eventually facilitate increasingly accurate estimation of global (legal plus illegal) silver trade flows that are compatible with estimated mining quantities and estimated end-market concentrations. Interactions among these three branches of research are perhaps easiest to explain through the provision of a fanciful example (discussed in Sections 2 and 3) that illustrates how theoretical mechanisms (to be discussed in the concluding section) can guide archival research efforts described in the body of this essay.

2. ACAPULCO-MANILA GALLEONS

Quantification of New World silver flows via Acapulco-Manila galleons and onward to destinations within China may seem straightforward at first glance, yet the task is in fact complicated. Contraband flows of silver—as well as contraband Chinese exports for which silver exchanged—do not appear in official documents, even though smuggled items often dominated silver and silk flows. For this reason, Pierre Chaunu's quantitative estimates of trans-Pacific Spanish-American silver, based upon his archival survey of *almojarifazgo* tax records for Chinese silks exchanged via Manila, are subject to challenge. Chaunu (1951, 460-61; 1960, 250) argued that doubling of the *almojarifazgo* tax rate between 1612 and 1640 precipitated a 90 per cent drop in Chinese silk imports into New Spain via Manila. He dismissed claims of mass smuggling of silks by other scholars, arguing that New World silver production had likewise declined dramatically by the 1630s. Chaunu reasoned that declining mine output should have reduced American silver exports, thereby providing circumstantial evidence in favour of collapse in imports of Chinese silks into the New World.²

Subsequent research indicated that American silver production declined more gradually than previously thought, on the other hand, and that sharp decline in mine output did not occur until the late-17th century.³ Furthermore, a dramatic decline in Japanese silver production (a global supply-side competitor) during the second half of the 17th century likely would have encouraged trans-Pacific silver flows. While *almojarifazgo* tax records do indeed indicate a decline in *official* silver exports via Acapulco, other evidence suggests that smuggling came to dominate commerce across the Pacific. Boxer (1958, p. 545) provided evidence that actual silk

² Flynn and Giráldez (1996) reversed this argument by Chaunu, pointing to robust imports of Chinese silks into (and through) Manila in support of the contention by Chuan (1969) that at least 2 million pesos of China-bound American silver continued to flow through Manila throughout the 17th century. For broader context, see Flynn et al. (2001).

³ For an eye-opening analysis of silver mining history in New Spain/Mexico, including fresh perspectives on geological conditions (far different from European mines), technological innovations, and environmental legacies, see Guerrero (2017).

shipments were nearly five times greater than statutory limits and labelled official bills of lading for silk shipments via Manila «an elaborate farce». In addition, private silk-filled chests (excluded from official records) dangerously overloaded galleons; silks in waterproof containers were even towed on rafts behind galleons. During his triumphant sail up the Thames, Cavendish displayed 2 million pesos worth of cargo (mostly Chinese silks) captured from the *Santa Anna* in 1587, quadruple the legal *permiso* quantity of 1593. The *Santo Tomas* in 1601 carried five times (2,500,000 pesos worth) the legal limit of 500,000 pesos worth. Moreover, studies of Chinese silks shipped to Manila, prior to loading aboard galleons bound for Acapulco, are revealing; Macao alone exported six times more silks to Manila than legally permitted transshipment of silks to New Spain in 1633. Numerous other reports/studies fortify the view that two million pesos worth of silver (and more) was transferred via the Pacific Ocean throughout the 17th century, eight times greater than the legal limit (Chuan 1969).

Although at least 2 million pesos worth of silver per year were carried aboard Manila galleons throughout the 17th century, most American silver was shipped via the Atlantic Ocean, including an estimated average of 2 million pesos worth per year (+50 tons of silver) smuggled 2,000 miles down the so-called «Back Door» of the Andes via Atlantic ports Buenos Aires and Sacramento (Moutoukias 1991).

Quantities of silver left the New World through the ports of Buenos Aires and Sacramento and through the Manila Galleons. At the peak of these activities, perhaps as much as 6 million pesos per year (159,000 kg), or half the output of Peru, was diverted to these channels from the Seville trade (Cross 1983, 420).

Notwithstanding relentless smuggling via Atlantic and Pacific Oceans, the Spanish Crown was reasonably successful in controlling/taxing legal shipments of silver from Peru and New Spain, motivated by Crown profits generated through legal trade that essentially financed the Spanish Empire. Once imported silver had passed through legal controls in Spain, however, smuggling of silver via multiple maritime and overland routes was ubiquitous. Unknown quantities of American silver meandered eastward via land and sea via the Baltic, the Mediterranean, Russia, Ottoman territories, silk roads, the Red Sea, Persian Gulf, Persia and India without taxation or appearance in official records. Nor should it be assumed that smuggling declined over time. Bonialian (2014, p. 244) reports that Castilian, European and Chinese products re-exported via Acapulco to Peru equaled in value total arrivals aboard the Manila Galleons between May 1782 and July 1783. Just thirty Mexican merchants entering Acapulco between 25 January and 16 March 1784 brought a surprising total of 4.2 million

pesos worth of silver, far more than previously estimated by scholars, in addition to a parallel flow of silver from San Blas to the Philippines. Although this offers a partial view of complex commercial exchanges, Bonialian makes clear that silver flows across the Pacific far exceeded quantities recorded in official government documents. Suárez Espinosa (2018) adds considerable documentary support for the existence of powerful and persistent bidirectional commercial connections between Peru and China. The same can be said about global silver flows worldwide: official records capture only a portion of actual quantities of silver produced, traded, and accumulated. The purpose of this essay is to illustrate non-standard analytical tools that can facilitate quantitative estimates of total silver stocks and silver flows (both legal and illegal) at a global level.

3. ESSAY ORGANISATION

This essay touches upon the theme of Manila Galleons, but the connection is indirect in that our analysis applies to all routes that carried silver to Chinese end-markets; it is not limited to trade across the Pacific. In order to explain our unconventional approach in non-technical terms, we turn first to a theoretical simulation, an exercise based upon a fabricated assumption that the total stock of silver held within China in about 1750 CE equalled 15,000 metric tons of silver. In fact, no one knows how much silver existed within Chinese borders in 1750 CE. Our imaginary assumption is invoked to illustrate model logic. Establishment of model mechanisms is necessary in order to explain why we choose to investigate specific types archival evidence that we feel will lead to improved estimates of quantities of silver actually held within Chinese markets at specific points in time.

While the empirical portion of this article aspires to furnish preliminary archive-based estimates for select types of silver stocks held within China, we are unable to provide estimates of silver holdings by ordinary citizens, nor by many institutions. Partial information provided represents merely a tentative first step. A more thorough inventory analysis would require documentation of quantities held, and market values of those quantities, *at specific points in time*. We are aware that archive-based inventory estimates presented in this essay are drawn from various time periods, leading to problems such as possible double-counting of silver holdings. Silver held by a government entity at one point in time, for instance, could be counted a second time as a private holding at a later date, thereby misrepresenting overall silver holdings for both time periods. In sum, substantial future research—along lines suggested by archival research cited below—would be required in order to venture even a preliminary estimate of a silver stock for all of China at any point in time. Sources for this task are not

abundant, but thorough analysis of archival materials on holdings of provincial treasuries, of the Imperial Household Department (*Neiwufu* 內務府), as well as of private households could represent first steps in a fruitful direction. A massive analytical investment would be required to do a proper job.

For now, our arbitrary and fanciful assumption of 15,000 metric tons of accumulated silver within China in 1750 is designed to simply illustrate how model dynamics suggest the collection of specific types of empirical evidence. Proper estimations of region-by-region silver stocks at various points in time can only be achieved through detailed archival research in the future. Hence, the following hypothetical example is merely designed to demonstrate the application of a conceptual framework that we hope archival historians will find useful. In collaboration with other researchers, our hope is to eventually build—from the bottom up via archival sources—solid estimates of global silver stocks and silver flows over centuries.

4. THEORETICAL OVERVIEW AND POTENTIAL ARCHIVAL EVIDENCE

Since estimation of silver stocks within China represents a formidable challenge for future historical researcher teams, construction of parallel estimates of silver accumulations elsewhere throughout the world would obviously require formidable collective efforts. Improved estimates of silver stocks distributed globally are necessary, however, for progress in estimating (a) worldwide silver mine production, as well as (b) global silver trade flows that connected mine production flows to end-market destinations for silver stocks worldwide. Successful quantification of these three facets together—production flows, trade flows and end-market accumulations—would represent the first quantitative compilation for any commodity at a global history level. This exercise could then create a research template applicable to any regionally or globally traded good. Moreover, given that goods are assets that accumulate as wealth components owned by someone, this effort could be viewed as initiating investigation of wealth and wealth-distribution history at a global scale.

Returning to our fanciful assumption that the total stock of silver held in China by all individuals, businesses and levels of government was 15,000 metric tons around 1750 CE, quantities of imported silver necessary to simply maintain such a stock of accumulated silver can be approximated. Relative to silver coin holdings alone, monetary historians have estimated rates of coin wear and tear for various regions and times. To render calculations simple, assume 2 per cent silver coin stock attrition each year through wear and tear, as well as loss under land and sea. Two per cent attrition applied to a 15,000-ton stock implies that 300 metric tons

(12 million pesos worth) of silver would have to have been imported into China each year in order to simply maintain this hypothetical Chinese silver stock at 15,000 tons. Importation of 300 tons of silver per year would have necessitated Chinese exports of silks, ceramics, teas and other items valued at approximately 12 million pesos annually as well:

... the Chinese monetization of silver... contributed to the huge development of the Japanese and the American silver mining, directly or indirectly... The major characteristic of Chinese silver demand was the absorption of silver from all over the world; as a consequence, Chinese products were exported throughout the world. The market had been expanded to a global scale (Wan 2017, p. 287).

Wan (2017, pp. 288-289) estimates that 7,500 tons of Japanese silver entered China between 1540 and 1644, and that «half of American silver production flowed into China...» Given Barrett's (1990, p. 237) conservative estimate that Spanish American mines produced over 100,000 tons of silver over three centuries, half of American output implies Chinese imports of more than 50,000 tons of American silver through the end of the 18th century, an amount that dwarfs our imaginary 15,000-ton silver stock assertion for China around 1750 CE.

Circumstances are known to have been far more complicated than suggested by any static assumption of a fixed silver stock over time, of course, given that the landmass of China doubled and its population more than doubled over the 18th century. Vast new territories were conquered, and sparsely-settled borderlands became destinations for intense internal migrations. Silver stocks held within China toward the end of the 18th century were presumably far greater than silver stocks held within China at the outset of the 18th century, so required silver imports must have increased over time. Quantities of silver actually held at either end of the 18th century are unknown, of course, because there exists no proper estimate of China's silver stock for any base-year reference point. Our contention is that proper estimation of silver stocks over time requires empirical evidence based upon archival documentation of silver held by various groups. Our theoretical model outlines relationships among variables, but archival (and archaeological) research alone can yield reliable empirical evidence. Economic theory can guide empirical research, but the estimation of actual silver quantities held lies beyond the scope of any theory by itself.⁴

⁴ Explanation for the Laws of Supplies and Demands model that guides this essay can be found in Flynn (2019). For application of this model to monies specifically, see Flynn (2018).

5. DESTINATION: GOVERNMENT TREASURY PRIVATE SILVER HOLDINGS

Relentless absorption of silver within China since the 1430 CE collapse of the Ming paper money system is widely recognised by scholars, and especially unprecedented imports of silver from the 16th century onward.⁵ Our long-term goal is to estimate silver quantities accumulated within the entirety of China year by year, yet our modest initial aim here must be restricted to estimation of individual and institutional silver holdings for limited regions and times for which documentation currently exists. We admit openly that we are unable at this time to estimate silver holdings for ordinary Chinese people, who collectively surely held the lion's share (small per capita holdings, but multiplied by hundreds of millions); we hope that other researchers will help address this crucial task in the future. Thus, empirical evidence provided next represents modest first steps that pertain to portions of the Chinese economy: namely, accumulated silver stocks by the central government treasury, Chinese emperors, select influential officials and a sample of rich merchants and their families. (Chen and Liu 2010) We believe that archival information must be assembled piece-by-piece, from the bottom up, in order to someday offer reasonable estimates of silver stocks held within all of China over several centuries.

While estimates of silver holdings constructed by Grand Secretary Agui 阿桂 (1717-1797)⁶ and Quan 全漢昇⁷ certainly contain important insights, we rely on extensive evidence assembled by Shi (Table 1 and Figure 1 below) that currently provides the most complete assessment available for silver inventories held by the central government between 1666 and 1843.

Table 1 figures indicate that a mean-average of 784 metric tons of silver were held by the central government during the second half of the 17th century (six observations), increasing to an average of 1,405 metric tons of silver during the first half of the 18th century (eleven observations), 2,110 metric tons during the second half of the 18th century (eleven observations), before finally declining to an average of 846.5 metric tons held during the first half of the 19th century (ten observations). Given strict administrative rules concerning calculations, we assume that seasonality did not affect annual numbers recorded.

⁵ Von Glahn (1996) remains a classic account of monetary history and the history of monetary thought in China between 1,000 and 1,700 CE. For recent treatment of broad issues surrounding silver, see von Glahn (2016, Chapter 8).

⁶ See Agui 阿桂 (1717-1797)'s memorial which is entitled «On increasing troops and procuring funds» (*Lun zengbing chouxiang shu* 論增兵籌餉疏) in *Qing jingshi wenbian* 清經世文編 (Collected essays about statecraft of the Qing), printed in 1827, vol. 36, p. 647.

⁷ Quan (1972, pp. 440-446) estimated that the American silver inflow to China from 1700 to 1830 was about 600 million pesos, where one Mexican silver coin equalled about 0.72 tael,

TABLE 1
SILVER HOLDINGS BY THE CENTRAL GOVERNMENT

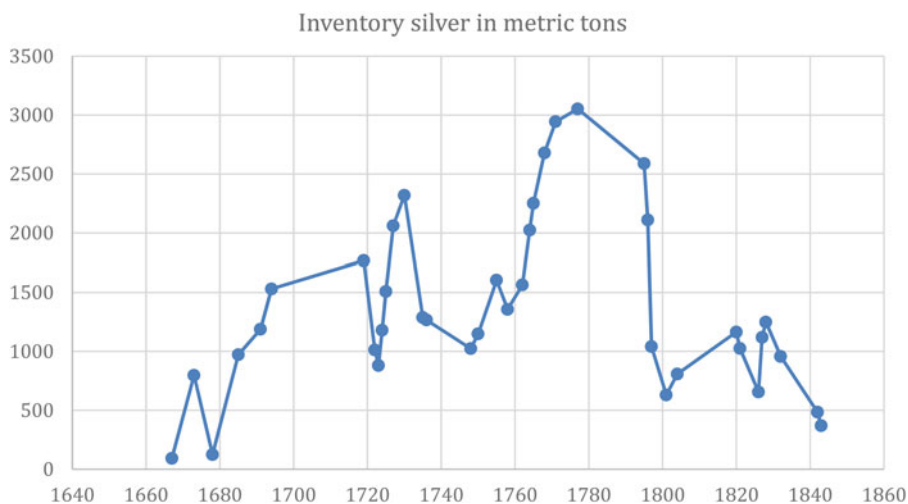
Year	Inventory silver (in 10,000 taels)	Inventory silver in metric tons
1667	249	93
1673	2,136	797
1678	334	125
1685	2,605	972
1691	3,185	1,188
1694	4,101	1,530
1719	4,737	1,767
1722	2,716	1,013
1723	2,361	881
1724	3,163	1,180
1725	4,043	1,508
1727	5,525	2,061
1730	6,218	2,319
1735	3,454	1,288
1736	3,396	1,267
1748	2,746	1,024
1750	3,080	1,149
1755	4,300	1,604
1758	3,638	1,357
1762	4,193	1,564
1764	5,427	2,024
1765	6,034	2,251
1768	7,182	2,679
1771	7,894	2,944
1777	8,182	3,052
1795	6,939	2,588
1796	5,658	2,110
1797	2,792	1,041
1801	1,693	631
1804	2,165	808
1820	3,121	1,164
1821	2,749	1,025
1826	1,758	656

TABLE 1 (Cont.)

Year	Inventory silver (in 10,000 taels)	Inventory silver in metric tons
1827	3,001	1,119
1828	3,348	1,249
1832	2,569	958
1842	1,301	485
1843	993	370

Sources: Shi (2014, pp. 83-84).

FIGURE 1
SILVER INVENTORIES (METRIC TONS) OF THE CENTRAL GOVERNMENT



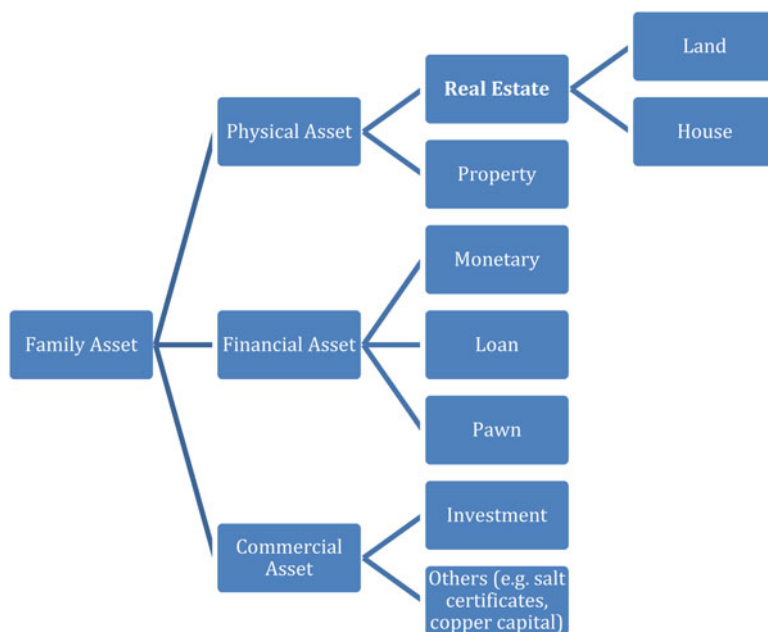
Sources: Shi (2014, pp. 83-84).

6. OTHER DESTINATIONS: PRIVATE SILVER HOLDINGS AND CONFISCATION ARCHIVES

Documents regarding crimes by (mainly) wealthy subjects are contained in so-called «confiscation archives.» Officials responsible for confiscations issued reports that specified family properties, including detailed lists of assets owned (see Figure 2) and information concerning disposal of those assets.

Wei (1982) examined more than 300 confiscation archives between the 17th and 19th centuries. He observed that values of property owned were

FIGURE 2
CONCEPTUAL ORGANISATION OF ASSET HOLDINGS



generally proportional to rank and length of term in office, as well as whether posts had been lucrative. Property ownership was also closely linked to positions/ranks of the official's father and grandfather. Confiscation archive records certainly fail to reflect all property owned in reality, however, due to frequent concealment and prior dispersal. As expected, those who held the same position accumulated different levels of property wealth, but a general range of property holdings is identifiable. Wei (1982) suggests that confiscated silver currency of provincial governors typically ranged from 20,000 taels of silver (740 kgs) to several hundred thousand taels, and a few cases where silver accumulations exceeded several million taels; in addition, land, houses and slaves were also confiscated. Limited by the information available to him in the 1980s, Wei's research should be viewed as a preliminary project of limited reach. In essence, Wei reported contents of archives that he accessed, but he did not furnish additional calculations.

A limited number of rich and powerful individuals held enormous silver stocks. To cite an extreme example, Feng 冯佐哲 (2011) estimates that the infamous corrupt official Heshen 和珅 (executed in 1799) held 3 million taels [about 112 metric tons] in silver ingots, not including silver household utensils. Heshen no doubt represents an unusual case, of course, that should by no means be considered representative of other Chinese

TABLE 2
CHRONOLOGICAL DISTRIBUTION OF 185 SAMPLES

1700-1749	1750-1799	1800-1849	1850-1899
8%	72%	16%	3%

Sources: Yun *et al.* (2018, p. 64).

officials in the 18th century. The Heshen case indicates possible dimensions that could potentially be uncovered through further systematic analysis of confiscation archives, which offer detailed and trustworthy information concerning properties owned by numerous corrupt officials. While analysis of confiscations from corrupt officials cannot be assumed to represent typical wealth holdings for officials in general, they nonetheless provide clues that could lead to «educated guesstimation» of wealth profile ranges for an important group within Chinese society.

Taking advantage of recent digitalisation and availability of archives, Yun (2017) reveals a far deeper level of detail than hitherto possible. Among 2,573 cases examined, 185 samples of officials and other gentry members⁸ contain explicit lists of confiscated household assets during 18th and 19th centuries, permitting Yun *et al.* (2018) to collect valuable data on currencies, land/house ownership, roles of loans and pawn shops and finally asset portfolios of households in Qing China.⁹ Private silver holdings based upon her data and analysis can be estimated.

Spatially, samples cover almost all provinces in China, with Beijing, Jiangsu, Zhejiang, Zhili and Shanxi the most frequent occurrences.

Government officials comprised 85 per cent of individuals subject to confiscation (158 of 185 total cases). People affiliated with these officials—such as relatives, private secretaries and regular attendants—comprised another 5 per cent (nine cases). Others were either «official businessmen» (such as salt or copper merchants) closely related to the Imperial Household Department (*Neiwufu* 內務府), or businessmen associated with funds directly related to officials (or individuals entrusted by officials) comprised 8 per cent (fifteen cases). The final three cases involved lower-level gentry persecuted as «Literary Inquisition» intellectuals for unacceptable writings about Qing China.

⁸ The term gentry in the context of late imperial China refers to examination degree holders of all levels and their families, which together formed the elite strata of Chinese society. Chang (1962) estimates the size of the gentry in late imperial China at about 1 million or 1.3 per cent of the entire population. See also Esherick and Rankin (1990, p. 4 ff).

⁹ In fact, the research group collected 215 cases with detailed confiscation lists; since their focus was investigation of officials and members of the gentry, however, thirty cases labelled 'others' were not considered.

These 158 officials appear to represent all official ranks from the first to ninth degree. When grouped into senior (first to third degree), middle and high (fourth to sixth degree) and low (seventh degree and below) categories, senior and middle/high officials account for approximately 70 per cent (110) of 158 cases. Thus, the distribution summarised in Table 3 seems to mainly reflect the fact that we are looking at household assets structures of middle- and upper-rank bureaucrats during the second half of 18th-century China.

Yun (2017) classify asset contents as follows:

- (1) Assets are first divided into «physical assets» and «financial assets,» while business activities (such as pawnshops, trade, etc.) form a third category labelled «commercial assets»;
- (2) Under «physical assets», land and houses are classified as «real estate», while a separate category «property» includes daily necessities, satin cloth, leather clothes, gold, pearls and jewellery, jade, porcelain, antiques, books, calligraphies, paintings and other «non-real estate» goods;
- (3) «Financial assets» are sub-divided into three categories: monetary assets, loan assets and pawn money. Monetary assets refer to silver bullion, copper coins, gold ingots, gold leaves, gold bars, gold beans, etc. that could be used for trading. Loan assets refer to loans that earn income at a specific interest rate, as well as «debts/loans» that do not stipulate interest. Pawnshop and money shop holdings, popular in traditional society, were also classified as financial assets.
- (4) In terms of «commercial assets», Qing Dynasty officials often entrusted personal attendants and merchants to conduct business or investment projects, while providing capital, sometimes in the form of shareholding investments (e.g. partnership in shops or trade ventures). These entrusted investments are labelled «commercial assets», a category that includes «salt certificates» and «copper capital» as merchant assets and also large commercial inventories.

Yun (2017) denominate all asset price estimates in terms of a single unit of accounting—in this case, a quantity of fine silver (tael)—to facilitate quantitative analysis. The reader should keep in mind that valuation of diverse assets in terms of unit-of-accounting silver need not imply actual holding of physical silver in that quantity. That is to say, evaluation of asset values in terms of silver does not suggest alchemy that transformed those assets into silver itself.¹⁰ Calculations by Yun indicate that the top 5 per cent of family confiscations contained assets *valued at* more than

¹⁰ For distinctions among six monetary functions—three involving tangible monies and another three involving intangible monies (including intangible unit of accounting monies)—see Flynn (2018).

TABLE 3
DISTRIBUTION OF OFFICIAL RANKINGS

Senior	First degree	16
	Second degree	36
	Third degree	17
Middle and high	Fourth degree	21
	Fifth degree	13
	Sixth degree	7
Low	Seventh degree	26
	Eighth degree	2
	Ninth degree	5
Unidentified officials or class undetermined		15

Sources: Yun *et al.* (2018, p. 66).

400,000 taels silver. The next wealthiest group of families (7 per cent) owned assets valued between 200,000 and 400,000 taels. Families holding wealth in the 100,000 to 200,000 taels range represented 5 per cent. Almost half (48 per cent) owned assets valued at between 10,000 and 100,000 taels, and another 35 per cent owned assets worth less than 10,000 taels (see Tables 4 and 5 below).

Actual silver holdings for some families were sufficiently low that they were omitted, while silver represented a very high percentage of wealth for others (Lin and Yun 2018, p. 144).

For purposes of initial estimation, let us assume that these top eight families held 500,000 taels per family (the minimum), the next richest two families held 450,000 taels each (mid-point between 400,000 and 500,000 taels), six families held 350,000 taels, eight families held 250,000 taels each, nine families held 150,000 each, eighty-eight families held 55,000 each and sixty-four families at 5,000 taels (based upon Table 4 above). In sum, the total value of assets held by this sample of 185 families collectively amounts to 15,510,000 taels. In other words, this group of families surrendered approximately 15.5 million taels worth of assets. If this sample of 185 families reflects holdings in all 2,573 cases analysed by Yun *et al.* then estimated collective assets owned by all 2,573 families would sum to approximately 215.45 million taels total value. It is unfortunate that we do not know the percentage of total assets held in silver form, although we suspect that future empirical work in archives could provide provisional answers. If we tentatively assume that silver comprised, say, 10 per cent of overall wealth holdings, then these 2,573 families collectively would have held 21.545 million taels worth of silver: approximately 800 metric tons of fine silver (or about 32 million pesos).

TABLE 4
DISTRIBUTION OF TOTAL ASSET VALUES IN TAEELS

	<10,000	10,000-100,000	100,000-200,000	200,000-300,000	300,000-400,000	400,000-500,000	>500,000
# Families	64	88	9	8	6	2	8
Percentage	35%	48%	5%	4%	3%	1%	4%

Sources: Yun *et al.* (2018, p. 75).

TABLE 5
ASSET STRUCTURE (PER CENT ACCORDING TO ASSET TYPE, 185 CASES)

	Land	House	Physical objects	financial assets	commercial assets	population
Mean	23.6	18.8	20.8	29.5	6.7	0.6
Median	15.4	12.0	13.0	23.9	0	0
Maximum	96.6	100	98.3	95.7	89.1	27.5
Minimum	0	0	0	0	0	0

Sources: Yun *et al.* (2018, p. 76).

Inventory stocks are measured *at a point in time*, whereas numbers in the previous paragraph refer to estimated values of inventories spread over a period of 2 centuries. Adding together stocks measured at different points in time, of course, cannot be considered evidence that these 2,573 families held 800 tons of fine silver *at a point in time*. On the other hand, 72 per cent of these confiscations occurred between 1750 and 1799, and silver is a durable good (see Table 2). Furthermore, most families of equivalent wealth-rank were presumably not subject to legal confiscations. While we are unable to estimate point-in-time volumes of silver held by these sorts of families, we believe that estimates for such wealth holdings could be made, if future researchers were to dig sufficiently deep into archival records in order to uncover empirical information that presumably exists. Our goal here is to suggest principles to guide this type of empirical, archive-based research.

7. DESTINATIONS: SILVER HOLDINGS OF SHANXI MERCHANT FAMILIES

Confiscation archives reveal substantial merchant holdings of silver. Shanxi merchant families affiliated with salt taxation and foreign trade in products such as tea and copper generated huge fortunes, and they were particularly notorious for holding silver. One source cites an excavation in a cellar at the Qu 渠 family house in Qi District 祁县 in the early

20th century that yielded more than 3 million *taels* of silver. (Huang 2002, p. 779) A superficial overview of Shanxi merchant properties gleaned from figures for the Guangxu reign-period (1871–1908) reveals:

TABLE 6
SHANXI MERCHANT PROPERTIES

Family	District	Property of silver in 10,000 <i>taels</i> (ca. 373 kg)
Kang 亢	–	Several thousand?
Hou 侯	Jiexiu District	700-800
Cao 曹	Taigu District	600-700
Qiao 喬	Qi District	400-500
Qu 渠	Qi District	300-400
Chang 常	Yuci District	More than 100
Liu 劉	Taigu District	ca. 100
Hou 侯	Yuci District	80
Wu 武	Taigu District	50
Wang 王	Yuci District	50
Meng 孟	Taigu District	40
He 何	Yuci District	40
Yang 楊	Taigu District	30
Ji 冀	Jiexiu District	30
Hao 郝	Yuci District	30

Sources: Xu K. (1984, p. 2307)

Keep in mind that information contained in Table 6 is rough, given rounded numbers (and we also do not know how this information was obtained). It is nonetheless clear that significant concentrations of merchant wealth are worthy of further investigation. Mindful of these limitations, Table 6 offers at least approximate estimates of silver holdings by fifteen Shanxi merchant families, ranging from 300,000 *taels* (11.19 tons) up to over 10 million *taels* (373 tons) per family. Just these fifteen merchant families alone are estimated to have collectively held a total 1,324.15 metric tons (based upon minimum figures for each range).

8. DESTINATIONS: MOUNTAINOUS HINTERLANDS AND SILVER HOLDINGS

Chen and Liu (2010, p. 79) examine wood exports as a point of departure to demonstrate that indigenous peoples in mountainous Southwest

border regions of China provided important end-market destinations for American silver. Demand for wood for building and fuel purposes had grown along with urbanisation, leading to long-term deforestation in areas surrounding the Yangtze delta. Timber cut in Southwest China (i.e. Sichuan, Yunnan and Guizhou provinces) therefore increasingly supplied wood required by cities and towns. Connected to upper regions of the Yangtze River, new timber producing areas were mostly inhabited by indigenous peoples such as the Miao 苗, Dong 侗, Tujia 土家 and Yi 彝 (Zhang 2006). Copper and zinc mines in southwest China also provided intrinsic content for bronze/brass coins that were legal tender under the Qing, so copper and zinc were also exported to other regions of China, partially in exchange for silver (Theobald and Cao 2017). In other words, large quantities of silver gravitated to end-markets in the upper reaches of the Yangtze and its tributaries, where silver was often considered a symbol of power, etiquette and art, appreciated perhaps more for its natural product value than for its monetary function. Indigenous people, especially women, held silver in the form of clothing and jewellery. Local gazetteers since the 18th century in the Southwest discussed the phenomenon of silver in costumes and jewellery of indigenous women as a kind of «custom». Virtually all researchers engaged in ethnographic investigations have noticed this in modern times. The tradition of silver holdings by southwestern minorities is supported by observing that the Hani 哈尼 language still retains a unique ancient word *phju⁵⁵du³¹du³¹*, which means «embedding silver» or «digging money», that reflects the custom of silver storage by Hani people through history (Duan 2015). Estimation of silver stocks accumulated within these regions in monetary and non-monetary forms would, of course, be a highly speculative endeavour, but would be an interesting topic to be further investigated. A first idea can be gained by considering the fact that the silver costume of a regular Miao woman weighed between 8.5 and 11.5 kg of silver. (Yang 2015) Girls were provided with silver costumes around age ten, and costumes could be inherited as family heritage. It is evident in the context of this tradition that silver must have comprised the largest share of every family's assets. It is difficult to estimate how much silver accumulated in this fashion, however, since it is unclear how many people participated in this tradition.

9. DESTINATIONS: *ROUGH* CALCULATIONS FOR PORTIONS OF CHINA

Summarising tentative findings discussed above, we find that:

- (1) The Central Government of China held on average 2,110 metric tons of silver during the second half of the 18th century.

- (2) One individual alone, Heshen, is alleged to have held 112 metric tons of silver in 1799.
- (3) Based upon a sample of 185 families by YUN et al. extrapolation for all 2,573 family confiscations suggests silver holdings of about 800 metric tons of silver for all 2,573 families.
- (4) Fifteen Shanxi merchant families alone held at least 1,324 metric tons of silver (although in the late-19th and early-20th centuries).

We are fully aware that documented Shanxi merchant holdings occurred a century later than the other three estimates. Still, these figures collectively total 4,346 metric tons of fine silver, a sum that certainly excludes most silver held within China. Ordinary Chinese families no doubt held the bulk of silver contained within China, given that many taxes were specifically payable in silver and regular people numbered in the hundreds of millions. No one has estimated silver holdings of typical Chinese residents, to our knowledge, yet future progress on this front is essential.

Spotty evidence for imports of silver has been offered. For instance, Quan has estimated Chinese imports of silver between 1700 and 1830 at 600 million pesos, a total of 16,113 metric tons over 130 years. Yet, Quan's estimated 4.62 million pesos per year (124 tons) import average strikes us as rather conservative, as is the 5 million pesos per year estimate by Dermigny (1964, 2, p. 754) for China throughout the 18th century. On the other hand, Bonialian (2014, p. 244) points out that just thirty Mexican merchants brought 4.2 million pesos worth of silver (about 113 tons) to Acapulco over a 2-month period in 1784, silver that was presumably destined for China via the Manila galleons. Moreover, European trading companies are estimated to have collectively transferred only 15.5 tons of silver per annum via the Cape Route to Asia between 1600 and 1650 (de Vries 2003, p. 80), whereby «European trading companies supplied between 7 and 12 per cent of the specie entering 'continental Asia' (that is, everywhere east of Latin Christendom) in this period» (de Vries 2003, p. 77). If 15.5 tons of silver via the Cape Route represented just 12 per cent of silver flows from Europe to Asia, however, this implies overall silver flows from Europe to Asia of 129 tons annually during the first half of the 17th century. If 15.5 tons of Cape Route silver comprised only 7 per cent, on the other hand, then total European exports to Asia had to total 221 tons of silver per annum. Flows of between 129 and 221 tons of American silver to South and East Asia via Europe make sense because from «the 1630s through the 1670s, a large majority of all specie available to the VOC in Asia for the purpose of 'return goods' (goods for shipment to Europe) was secured via trade internal to Asia» (de Vries 2003, p. 75). Thus, Dutch purchases of Asian products utilised American silver previously shipped via non-Cape trade routes (in addition

to Japanese silver). Once Japanese silver production dried up late in the 17th century, silver flows via the Cape Route alone exploded to 160 tons per annum between 1725 and 1750 (de Vries 2003, p. 81). In addition, over 100 tons of silver seems to have entered China via the Manila Galleons during the 18th century. Europeans meanwhile continued to channel American silver eastward via traditional non-Cape trade routes via land and sea.

While admitting that much controversy exists regarding volumes of legal and illegal silver flowing via land and sea worldwide, Quan's estimate of 124 metric tons of Chinese silver imported per annum between 1700 and 1830 seems to us much too low. Nevertheless, his conservative claim is that over 16,000 tons of silver entered China between 1700 and 1830. Of course, this 16,000-ton number excludes accumulations of silver within China prior to the 18th century. Thus, our imaginary 15,000 metric tons of silver accumulated throughout all of China in 1750—a postulate used simply to explain mechanics of our theoretical model—probably falls well short of actual silver holdings. We believe that solid empirical evidence, however, can only arise from archival (alongside archaeological) sources.

10. SUMMARY AND CONCLUSIONS

Flynn and Giráldez (2002a) have labelled the period 1540-1640 the «Japan-Potosí Cycle of Silver» because silver from these two mining regions (along with Mexico) dominated global flows of the white metal into end-market China (and to a lesser extent, into India). Direct Manila galleons trade across the Pacific and Japanese-Chinese trade were similar (and unlike Asia-Europe trade) in that trade in both cases essentially boiled down to swapping of silver in exchange for Chinese silks. Europeans played key middlemen roles in each case.

Clandestine trade presumably became more difficult after Japanese unification under the Tokugawa shogunate around 1600 but the smuggling of silver was a global phenomenon and must have occurred across Japanese islands. Smuggled silver and silks are known to have been rampant across the Pacific Ocean, as indicated earlier in this essay. Evidence for smuggling exists on both the silk-side and the silver-side of the equation. Flynn and Giráldez (1996) utilised evidence of large silk shipments to Manila in support of the claim by Chuan (1969) that 2+ million pesos (about 50 tons) worth of silver annually crossed the Pacific into China throughout the 17th century. Bonialian (2014) points out that just thirty Mexican merchants brought 4+ million pesos worth of silver (100 tons) to Acapulco in 1784, while Suárez Espinosa (2018) documents powerful bidirectional trade between Peru and China. Mention has already been made of millions of pesos worth of unrecorded silver that passed annually down the «Back

Door» of the Andes through the ports of Buenos Aires and Sacramento on the Atlantic (exchanging in large part for African slaves, although much of the silver was destined for China). In short, official records clearly fail to capture significant migrations of silver, even where trade routes were supposedly under official control.

Contraband silver was by no means limited to trade across the Pacific. Contraband trade throughout the Americas was the rule, rather than exception:¹¹

If American imports of European goods remained constant or increased in this [17th] century, even for Spanish made products, then the key factor was the development of a significant contraband trade of alternative ships and foreign merchants, a trade which included even minted silver coins as well as unminted silver and gold. All this was occurring as there was a dramatic decline in royal silver arrivals from America, especially in the post 1650 period. Yet this was a period when private unregistered silver imports appeared to be booming (Klein and Serrano Hernández 2019, p. 50).

Once American silver had passed through Spain after official declaration, much of it continued eastward via numerous land and sea trade routes without having been entered into official records. Attman (1983, pp. 12, 103) estimated that 50 tons of silver (in coin form) passed annually eastward via the Baltic, then via Russia, the Ottoman Empire and silk roads. It is important to keep in mind that «[n]o adequate sources are available in relation to the trade between East and West along the Continental land routes before the year 1700.» (Attman 1983, p. 10), and that bullion was normally considered a special tax-exempt commodity unrecorded even at major ports (Attman 1983, pp. 21-22). Quantities of unofficial silver traversing the Mediterranean are also unknowns (Flynn and Giráldez 2002b), as are continuing transfers eastward via Ottoman lands, the Red Sea, Persian Gulf, Persia, Southeast Asia and India.

Silver mine production is better documented than worldwide silver trade, but unrecorded silver mining *flows* also pose quantification challenges. The most promising path forward in terms of silver quantification at a global scale, we believe, involves investigation of end-market silver stocks worldwide. In this essay, we offer preliminary, tentative and incomplete empirical evidence for end-market accumulations of silver within China, mostly over the second half of the 18th century. Some of our

¹¹ Indeed, these authors use evidence of the underground economy in support of their contention that Latin America did not participate in the global crisis of the 17th century described by Parker (2013).

procedures exhibit obvious faults: for instance, silver held by Shanxi merchants during the late 19th century could involve double-counting, since that same silver may have been previously held by silver holders we list during the second half of the 18th century. It is legitimate to list the same piece of silver from one time period to the next since it is a durable product, but it is not okay to add a lump of silver at one point in time to that same lump of silver at a later point in time. If late-19th-century Shanxi merchant silver holdings were to have been owned by earlier merchant groups (c 1750 and excluded from our calculations), then our shorthand procedure becomes less problematic. In any case, we openly acknowledge that preliminary estimates of silver stocks for 18th-century China presented in this essay are inaccurate. The point of our exercise is simply to suggest source types that researchers might consult in order to generate better point-in-time estimates of silver stocks in the future. In addition, we wish to encourage similar archive-based studies of end-market silver stocks everywhere across Africa, the Americas, Asia, Europe and Oceania. To cite just one interesting set of cases—the Americas themselves—it should be possible to utilise archival records to estimate actual silver holdings retained/held within the New World, a matter that is understandably perplexing to historians who view things through the prism of conventional economic theory:

Given such mining riches, it might be presumed that the colonies would have enjoyed widespread circulation of silver and gold currency... In fact, however, the actual circulation of metallic currency within both Spanish America and Brazil was fairly limited, a fact so paradoxical that it has provoked considerable debate among historians, hard put to explain the scarcity of cash in circulation within what were eminently silver- and gold-producing economies (Marichal 2006, p. 34).

We believe that archival sources could reveal quantities of silver held—what we call Inventory Supplies—everywhere, rather than focusing solely upon silver *flows* (which were frequently unrecorded). Similarly, the right kind of archival sources could be used to estimate quantities of silver held—Inventory Supply determined by Inventory Demand—within various European jurisdictions. As things stand, emphasis upon silver flows is unlikely to reveal much:

According to the historians Carlos Malamud, Zacarías Moutoukias, and Michel Morineau, the French took over the bulk of the illegal trade in that period [second half of the 17th century] and drained off huge sums of American silver, which never passed through the

Iberian Peninsula. One estimate is that in the 1680s France provided some 40 per cent of the products destined for Spanish America, being followed in importance by Genoa, England, the Low Countries, and Hamburg. The Dutch and British also participated actively in many of these transactions through their *entrepôts* in the Caribbean (Marichal 2006, pp. 37-38).

Rampant unrecorded «smuggling» activity, a worldwide phenomenon, renders accurate estimation of global trade flows almost impossible using traditional techniques in most cases. We argue that it is sensible to delve into archival sources in order to estimate actual holdings region-by-region. Successful estimates would provide benchmarks against which proposed trade statistics could be cross-checked to determine which numbers (if any) make sense vis-à-vis estimated silver holdings and silver production numbers.

If scholars were to collectively construct reasonable estimates of silver stocks in end-markets worldwide, while also estimating attrition rates for each type of silver held (e.g. coin vs. jewellery), these estimated stocks could provide useful gauges for cross-checking whether mining and trade-flow estimates are compatible with accumulation and sustenance of estimated end-market silver stocks. Inventory stocks by region must be viewed in dynamic context; that is, inventory stocks form a coherent whole in combination with production and trade flows (plus attrition).

It is understandable that economic historians do not currently analyse end-market inventory stocks in the manner suggested in this essay: this is the case because foundational building blocks of modern economic theory—the Laws of Supply and Demand—fail to accommodate inventory stocks (i.e. wealth components). The explanation for why conventional Laws of Supply and Demand cannot accommodate Inventory Supply/Demand concepts is easiest to visualise through comparison of regular supply-demand with the unconventional Laws of Supplies and Demands model that underlies the (background) logic of this essay.¹² This behind-the-scenes supplies-demands model that guides us yields three distinct supply functions and three distinct demand functions:

- Production Supply (a flow): new units per time (increase stock of the good)
- Inventory Supply (a stock): existing unit of the good owned at a point in time
- Sales Supply (a flow): units sold per time (decrease seller stock of the good)

¹² Application of the Laws of Supplies and Demands model to non-monies can be found in Flynn (2019).

- Purchase Demand (a flow): units purchased per time (increase in purchaser stock)
- Inventory Demand (a stock): units owner wishes to hold at a point in time
- Consumption Demand (a flow): units consumed per time (decrease in holdings of the consumer)

Given the existence of three supply functions that interact with three demand functions—as opposed to one supply function that interacts with one demand function under conventional microeconomic theory—our system can be accurately labelled «Laws of Supplies and Demands» (plural).

Without entering into technicalities here, the reader can observe how this Supplies and Demands theory conforms to the global history of silver discussed throughout this essay. On the supply side, other things equal, mines yield new silver flows (production supply) that augment end-market silver stocks (inventory supplies) over time. On the demand side, other things the same, a buyer (purchase demand) augments her/his silver holdings (inventory supply); the supplier in this transaction, on the other hand, depletes her/his stock of silver holdings (inventory supply) via sale (sales supply). And while silver is not a «consumable» product (in our inventory-depleting sense), physical attrition (e.g. wear and tear) depletes the stock of silver. The important thing for purposes of this discussion, however, is that Inventory Supply (a stock) occupies centre stage in this model; and it turns out (for reasons unexplored here) that the quantity of each good held (i.e. its Inventory Supply, a wealth component) is determined by Inventory Demand (the stock the holder is willing and able to hold). Ignoring technicalities, the model essentially explains why and how an owner goes about optimising her/his particular mix of goods (assets). Unlike conventional economic theory, focus shifts to goods as wealth components, and therefore to the study of wealth in general. Silver is the focus of this essay, yet the model is applicable to any good/wealth-component. Global silver history is but one topic under the umbrella of global wealth history.

Basic Laws of Supply and Demand can be viewed as a special case of the broader Laws of Supplies and Demands framework. Invocation of one simple assumption—that the item in question cannot be held in inventory—yields broad philosophical implications. First, items that cannot be stocked in inventory are ‘services’ by definition: goods can be stocked, while services cannot be stocked. Inventory Supply and Inventory Demand functions disappear for non-storable services. Non-storability also causes Production Supply and Sales Supply functions to merge; non-storability likewise causes Purchase Demand and Consumption Demand to merge. In short, for all services, our Laws of Supplies and Demands model turns into a special case with one supply function and one demand function: the conventional Laws of Supply and Demand. Since conventional

Laws apply exclusively to non-storable services, not to storable goods, wealth components are necessarily ignored; thus, conventional economic theory cannot provide analytical tools required for the study of wealth accumulation. Economics should become a physical science, but cannot do so while providing tools designed for analysis of flows alone. Wealth components are stocks of goods that have accumulated. Analysis of wealth and wealth distributions require new theoretical tools.

Everything that can be touched, seen, smelled or measured has accumulated from the past, including inputs, outputs, environmental enhancement/degradation and humans themselves. History involves accumulations over time. Failure to confront accumulations renders modern economic theory ahistorical and therefore largely irrelevant. The Laws of Supplies and Demands model confronts accumulations directly through the exploration of mechanisms that describe accumulations over time. Our initial attempt to estimate accumulations of silver within (portions of) China during the 18th century (roughly) is preliminary and admittedly subject to criticisms on several levels. We nonetheless aim to provoke thinking about wealth history in global terms through reconsideration of global silver holdings as wealth components. Creation and distribution of wealth worldwide, including social liabilities (claims on wealth) of an environmental nature, is surely a pressing concern worldwide today. Development of analytical tools expressly designed to describe and analyse processes of accumulation are necessary for wealth history to progress, and the global history of silver represents an appropriate case study.

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