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Demand, Supply, and Elasticity in the Copper Trade at Early Jamestown

Seth Mallios & Shane Emmett

Introduction

General economic principles of exchange govern interrelated aspects of supply and demand. These rules model ways in which alterations in supply, production, and accessibility transform demand and value. Application of these principles to specific contexts often reveals how economic factors influence other social and political aspects of human interaction. In this particular study, recently uncovered archaeological evidence and pertinent passages from various primary historical accounts suggest a pattern of events similar to those illustrated by established exchange models. This confluence fuels a multidisciplinary analysis of the copper trade at early Jamestown. Copper, the pre-eminent spiritual good of the Chesapeake and Carolina Algonquians, drastically dropped in significance during the first 50 years of the 17th century as a direct result of inundant English trade practices. This devaluation and the likely transformation in demand elasticity had immediate and lasting impacts on the social and political situation at Jamestown and beyond.

The following analysis begins with an overview of economic principles used to track the flow of goods produced and consumed in and between cultures. It then discusses the importance of copper for the indigenous population of the Middle Atlantic during protohistoric and early historical times. Following this summary, attention turns to documentary evidence detailing the nature of the English/Algonquian copper trade during the early years at James Fort. Recent archaeological discoveries broaden this discussion, adding a more representative temporal sample and a spatial appreciation for Jamestown and its surrounding areas. The archaeological analysis also provides a valuable dating tool for early colonial sites in the Chesapeake.

Economic Principals

Tracking fluctuations in the distribution of a society's scarce resources is a mainstay of the discipline of economics. Analyses of economic decisions frequently start with comparisons between a buyer's demand for certain goods and a seller's supply of those items. Identifying market equilibrium, the economic moment at which demand and supply are the same for a given good, often hinges on the responsiveness of demand and supply to price alterations. *Elasticity* refers to this phenomenon; demand and supply are price inelastic when they are not responsive to price changes and price elastic when they are.

Regardless of elasticity, the law of demand expresses an inverse relationship between an item's price and quantity demanded. Increases in the price of an item results in a decrease in the quantity demanded. The law of supply maintains that a rise in the price of an item motivates a seller to increase the quantity supplied of that good. Surges in supply regularly lead to decreases in price. Likewise, dwindling supplies usually lead to increase in price.

Copper's Significance in the Middle Atlantic at Contact

The value of copper in protohistoric Carolina and Chesapeake Algonquian society cannot be overstated. It was no ordinary universal equivalent. These Native Americans publicly demonstrated their status by the copper they wore. Pierced copper pieces hung around the neck or on the arms and distinguished indigenous "Noble Men" from the "meaner sort" (Quinn 1955:103). Elite Algonquian warriors received copper from their superiors in return for exceptional military service. Many of these tribes also frequently offered copper to their deities (Rountree 1989:133). In addition, the presence of copper in Chesapeake Algonquian burials served as a hierarchical distinction separating those individuals whose spirits were believed to live forever from others whose souls would expire following their corporeal death. Copper acquisition, display, and tribute ensured hegemonic gains and prevented the squandering of a person's spiritual essence (Mallios 1998). It both reflected and created status. There was no material good in Algonquian society that was superior or even equal in value to copper.

The English learned quickly at Roanoke Island in the 1580s of the supreme value the local natives placed on copper alloys. Roanoke's Ralph Lane reported to the Reverend Richard Hakluyt in a 1585 correspondence that for the local Algonquian population, "copper carieth ye price of all" (Quinn 1955:209). Thirty years later, Jamestown's John Smith noted that, "for a copper kettle…[the Powhatans] will sell you a whole Countrey" (Barbour 1986 III:276). Contemporary playwrights George Chapman, Ben Johnson, and John Marston immortalized the value of copper as a trade good in early 17th-century America in their 1605 *Eastward Ho*. They wrote, "for as much red copper as I can bring [to North America] I'll have thrice the weight in gold" (27-28). Lessons learned from the failed English attempts at colonizing the Carolinas led the outfitters of the Jamestown venture to insist that those aboard the *Discov-*

ery, the *Godspeed*, and the *Susan Constant* bring copper to the Americas in the form of "10 seven-inch squares and 5 seven-inch circles, 20 six-inch circles and 10 six-inch circles, 40 four-inch squares and 20 four-inch circles, [and] 100 three-inch squares" (Quinn 1977:432-34).

The Monacans, an indigenous group to the west of the Powhatan chiefdom, played an important role in the copper exchange of the Chesapeake. Although historical records chronicled little of Powhatan/Monacan relations during the 16th and 17th centuries, they indicated that when the English arrived at Jamestown Island the Powhatans and Monacans were adversaries. With no indigenous copper source in his own territory, Chief Powhatan relied on exchange with natives in the Great Lakes region, western North Carolina, and nearby Monacan territory, all of whom tapped copper sources. In 1607, the arrival of the English and of their many copper goods gave Chief Powhatan an opportunity to rid himself of his "political dependence" on antagonistic Monacan neighbors (Hantman 1990:685). Abundant English copper could free him from being indebted to the Monacans along his western border. Powhatan could potentially bolster his intra-chiefdom power as well by controlling the flow of copper within his territory.

Chesapeake Algonquians likely allowed English intrusions into their homeland because of access to copper from apparently amicable sources. The Europeans' plentiful copper stores gave the natives an opportunity to exchange with individuals other than antagonistic neighbors. Coincidentally, one of England's goals in settling the Americas was to free itself from material dependence on nearby European rivals. Hakluyt discussed in his writings an English desire to avoid economic restraints in 1578. He asserted that, "[England] should not depend on Spain for oil, sacks, resins, oranges, lemons, Spanish skins, c. Nor upon France for woad [wood],

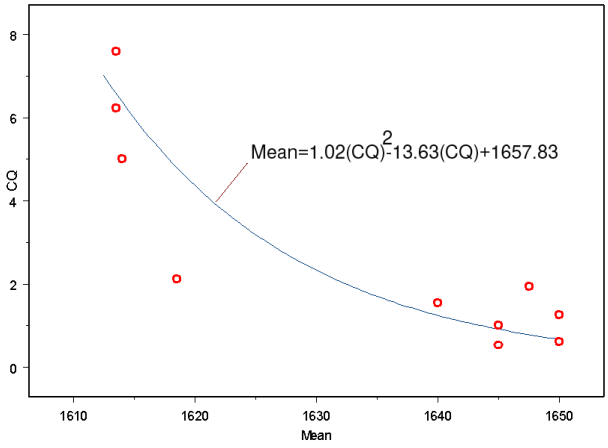

Figure 1. Jamestown copper supply scatter plot modeled with quadradic dependence.

Master Context	Copper quotient ((copper alloy artifacts/total artifacts) x 100%)	Feature mean date
Pit 3	7.59	1613.50
Pit 1	6.23	1613.50
Structure 165	5.01	1614.00
SE Bulwark Trench	2.13	1618.50
Ditch 7	1.55	1640.00
Ditch 1	1.01	1645.00
Structure 163	0.54	1645.00
Midden 1	1.94	1647.50
Ditch 6	1.27	1650.00
Ditch 3	0.62	1650.00

Table 1. Copper percentages for Jamestown Rediscovery features.

basalt, and Gascoyne wines, nor on Eastland for flax, pitch, tar, masts, &... we should, by our own industries and the benefits of the soil there [the Americas], cheaply purchase oils, wines, salt, fruits, pitch, tar, flax, hemp, masts, boards, fish, gold, silver, copper, tallow, hides, and many commodities" (Jehlen and Warner 1997:58). During this time, England was economically a colony of the European continent (Wallerstein 1974 I:228). Just as the English came to America in the hopes of freeing themselves from economic dependence on political adversaries, they unknowingly offered the Algonquians a chance for the same sort of relief.

Historical and Archaeological Insights

There are historical accounts of the English inundation of Powhatan society with copper. Primary documents offer qualitative and quantitative evidence of this phenomenon. John Smith, who initially celebrated the exchange value of European goods in Algonquian society, later acknowledged that "those at the fort so glutted the Salvages with their commodities as they became regarded not" (Barbour 1986 I:211). He noted the specific devaluation of copper as well, emphasizing that, "[what now] could not be had for a pound of copper . . . before was sold for an ounce" (Barbour 1986 I:215). Even Chief Powhatan acknowledged the loss of value for copper in Algonquian society following repeated English inundations, telling Captain Smith that he now found "a Basket of Corne more precious then a Basket of Copper" (Barbour 1986 I:245-46). An inventory and statistical analysis of all of the intercultural exchanges during the first decade of English settlement at Jamestown Island revealed a significant drop over time in the number of reciprocal copper-based transactions between the colonists and Algonquians and the diminished value of the metal scraps (Mallios 1998). Historical records show little evidence of the copper trade ever rebounding.

The archaeological evidence presented a similar picture. Fort-Period features, those pits, cellars, bulwarks, and structures used and filled during the first 17 years of English settlement, contained proportionately more copper than the ditches, buildings,

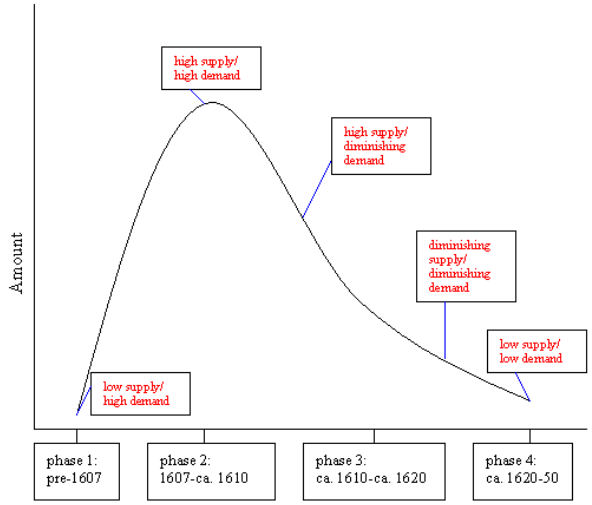

Figure 2. Jamestown copper supply timeline.

and middens filled during the Post-Fort Period from 1625-50 (Table 1). These percentages were based on the total number of copper alloy items in a context divided by the total number of artifacts in that context. Certain items that *Jamestown Rediscovery* quantified by weight and not count—brick, glass cullet, and slag—did not register on the tally. Plotting the percentage of copper in a feature versus the mean date of the context revealed a strong curvilinear relationship (Figure 1). The coefficient of multiple determination or analagous r-squared value was over 80%, indicating that at least four-fifths of the variation in the amount of copper in a feature was due to fluctuations in time. Not only did the relationship between copper quantities and time at the site of the original 1607 James Fort offer insight into intercultural trade between European colonists and indigenous Powhatans in the 17th-century Chesapeake, it also formed the basis of a predictive temporal model (Mean =1.02(CQ)^2-13.63(CQ)+1657.83) Established on findings from the fort site's most reliably dated features, copper-quotient predictions were then successfully extended to nearby sites in Jamestown's hinterland (Table 2).

Site	Context	Copper artifacts	Total artifacts	Copper Quotient	CQ Mean	Context date range	CQ in date range?	Context mean	|CQ mean-context mean|
44JC802	All	695	40624	1.71	1637.52	1620-50	yes	1635	2.52
44JC802	Storage Pit 1	63	1851	3.40	1623.31	1620-50	yes	1635	11.69
44JC802	Well 1	34	2739	1.24	1642.49	1620-50	yes	1635	7.49
44JC802	Daub Pit 1	15	2170	0.69	1648.90	1620-50	yes	1635	13.90
44JC568	All	93	12422	0.75	1648.20	1630-50	yes	1640	8.20
44JC568	Well 3	43	3624	1.19	1643.11	1630-50	yes	1640	3.11
44JC568	Well 1	23	2087	1.10	1644.06	1630-50	yes	1640	4.06
44JC568	Well 2	11	1385	0.79	1647.66	1630-50	yes	1640	7.66
Totals							(8/8) 100%		avg.=7.33

Table 2. Copper percentages and calculations for sites and features in Jamestown's hinterland.

This dating technique offered mean dates within the occupation range at each of the different sites tested and, in addition, placed three closely dated yet exclusively used features at one particular site in correct chronological order (Mallios and Fesler 1999; Mallios 2000; Mallios and Straube 2000; Mallios 2001).

Details from historical records and archaeological assemblages regarding the copper supply at early Jamestown can be assembled into a general economic timeline with four phases (Figure 2). Before the colonists arrived in 1607, there was a very high indigenous demand for copper but a limited supply that was made even more difficult to attain because of Powhatan/Monacan animosity. The first few years at James Fort witnessed a dramatic surge in the English supply of copper in the area and a high Algonquian demand for the prestigious good. However, repeated inundation of English copper into native society resulted in a significantly diminished demand from ca. 1610 to ca. 1620. The copper trade never recovered from this glut, and after ca. 1620 both the demand for and supply of copper were minimal.

Multiple mathematical models correspond with the copper supply data for the ca. 1610-1650 timeframe. Certain undulating trigonometric functions, like sine and cosine, mimic the observed supply fluctuations were they to have continued at Jamestown in a cyclical manner (Figure 3). A hyperbolic model of exponential decay matches the asymptotic initial surge of English copper and ultimate debasement following economic inundation as well (Figure 4). However, the model that most united accuracy and simplicity for the actual Jamestown data during the first half of the 17th century was based on a gentle curve of quadratic dependence (see Figure 1). It is worth noting that in making time the dependent variable, an inherent step in constructing a temporally predictive model, the parabola generated by the quadratic equation is on its side, and only the lower arm of the rounded vee is showcased. Due to this 90° rotation, this parabola does not mirror the one presented in Figure 2.

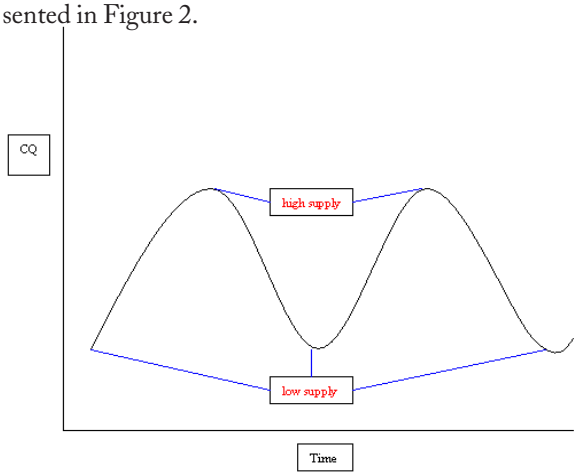

Figure 3. Jamestown copper supply modeled with sinusoidal dependence.

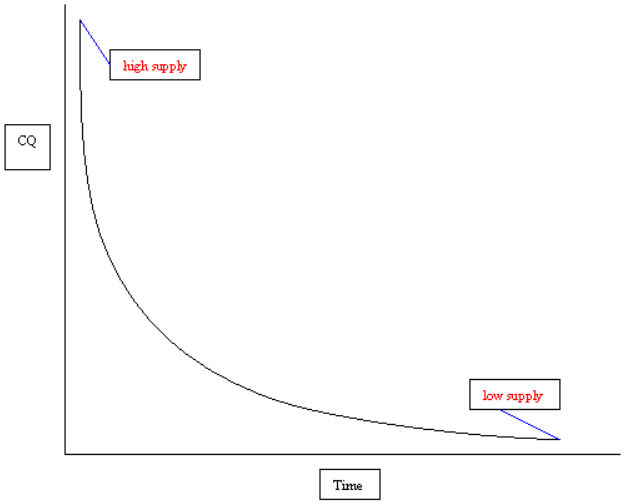

Figure 4. Jamestown copper supply modeled with logarithmic dependence.

Previously discussed economic principles maintain that the copper trade should have rebounded from the English inundation. The remarkably low supply in the years following 1620 should have increased indigenous demand, yet it did not. This is because the devaluation of copper in Algonquian society transformed the elasticity of demand. Native demand for copper became price inelastic; it remained minimal even though supply decreased drastically. Whereas the copper trade consistently followed the principles of supply and demand through the 1607-24 Fort Period at Jamestown Island, the subsequent low supply/low demand of the Post-Fort Period reflected the utter debasement of copper.

Conclusions

Separate economic, historical, and archaeological lines of evidence detail transformations in the copper trade at early Jamestown. These confluent analyses also reflect overall changes in English/Powhatan relations as intercultural amicability paralleled the success of the copper trade. Likewise, disruptions in the copper trade both impacted and mirrored the deterioration of peaceful relations between the two groups. Glutting the Powhatans with copper items simultaneously devalued the metal and wreaked havoc on the native social order (Potter 1989; Mallios 1998; Mallios and Straube 2000; Mallios 2001). Since copper distinguished the different classes of Powhatan society, determined access to the afterlife, and secured the employ of the most able and fiercest native warriors, English trade practices that saturated Powhatan society with copper regardless of indigenous rank undermined the authority of the elite Powhatans. Paramount and lesser chiefs could no longer control access to the most important item in their society. Repeatedly flooding Powhatan society with copper eroded the Algonquian hierarchy from within, upsetting the indigenous social, political, and economic hierarchy. The demand elasticity for copper was thus transformed, preventing it from rebounding according to traditional economic practices governed by laws of supply and demand.

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