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CHRONIC SPECIE SCARCITY AND EFFICIENT BARTER:  
THE PROBLEM OF MAINTAINING AN OUTSIDE MONEY SUPPLY IN BRITISH COLONIAL AMERICA

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Supply in British Colonial America

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**ABSTRACT**

Colonial Americans complained that gold and silver coins (specie) were chronically scarce. These coins could be acquired only through importation. Given unrestricted trade in specie, market arbitrage should have eliminated chronic scarcity. A model of efficient barter and local inside money is developed to show how chronic specie scarcity in colonial America could prevail despite unrestricted specie-market arbitrage, thus justifying colonial complaints. The creation of inside fiat paper monies by colonial governments was a welfare-enhancing response to preexisting chronic specie scarcity, not the cause of that scarcity.

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# **Chronic Specie Scarcity and Efficient Barter: The Problem of Maintaining an Outside Money Supply in British Colonial America**

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Colonial Americans complained that gold and silver coins (specie) were chronically scarce. These coins could be acquired only through importation. Given unrestricted trade in specie, market arbitrage should have eliminated chronic scarcity. A model of efficient barter and local inside money is developed to show how chronic specie scarcity in colonial America could prevail despite unrestricted specie-market arbitrage, thus justifying colonial complaints. The creation of inside paper monies by colonial governments was a welfare-enhancing response to preexisting chronic specie scarcity, not the cause of that scarcity.

## **INTRODUCTION**

### *The Disagreement*

Colonists in British North America complained often of a scarcity of specie (gold and silver coins) for executing domestic transactions. Their complaints were ubiquitous and insistent.<sup>1</sup> Specie was the universal money—the outside money. It was the money the rest of the world used to consummate transactions that crossed polity borders, and it was the money often used by Europeans to consummate domestic transactions within their respective polities. The colonists did not produce specie, as gold and silver were not yet mined there; besides the British Crown did not allow them to mint coins. They acquired specie coins by importing them, mostly from Spanish America, in exchange for exported goods. Colonists complained that as quickly as specie was imported, it was re-exported, mostly to England, to buy imported goods. In the absence of specie, domestic transactions were executed using barter, which was less efficient and more costly than using specie coins. Using barter reduced the quantity of domestic transactions thereby constraining economic development. Eventually, colonial assemblies issued paper monies to ameliorate the domestic effects of this chronic specie scarcity.

On the other hand, scholars have argued that chronic specie scarcity in colonial America

is a myth.<sup>2</sup> People always complain about not having enough money. Thus, ubiquitous complaints about a lack of specie do not mean that specie was scarce. The colonies were small open economies. If specie were needed to execute domestic transactions, more would be imported and less exported. Globally, specie flowed to where it was in short supply (more highly valued). Chronic specie scarcity, absent government intervention, was not possible. In 1752, David Hume summarized this position by stating, "Before the introduction of paper-money into our colonies, they had gold and silver sufficient for their circulation. Since the introduction of that commodity, the least inconveniency that has followed is the total banishment of the precious metals. And after the abolition of paper [money], can it be doubted but money [specie] will return..." (Rotwein, 1970, 69).

Under the quantity theory of money in an open economy with an operative specie-flow mechanism, if specie is scarce domestically, then domestic prices will decline to accommodate the smaller money supply. As domestic prices fall, the locale's exports become more competitive abroad, and imports to the locale look less attractive relative to domestic goods. Exports increase which brings in more specie, and imports decrease which reduces specie outflow. This replenishes the locale's money supply to desired levels. As such, chronic specie scarcity cannot exist. Temporary specie scarcity is possible, such as during a war, due to unexpected disruptions to the balance of trade, but market forces in an open economy would eventually correct these imbalances. Ocean tides and storms exist, but sea level is sea level everywhere.

Colonial complaints of chronic specie scarcity were, in part, an outcome of currency substitution. When a colony emitted a local fiat money with a fixed exchange rate to specie, that fiat money displaced specie for use in domestic transactions. Specie scarcity occurred when enough fiat money was produced to completely displace specie for executing domestic

transactions, causing all the specie coins to be exported to purchase imported goods. In other words, the colonists themselves caused the specie scarcity of which they complained. If they stopped issuing fiat money, specie would return and be plentiful enough to execute all domestic transactions.

While specie can be driven out by currency substitution, money *per se* is not made scarce by this mechanism. Being held in a fixed exchange rate with specie, the fiat money emitted is the same as specie (a perfect substitute). Domestic transactions do not resort to barter. Thus, the colonists have no cause to complain about a lack of specie. Chronic specie scarcity, if produced by currency substitution, does not impact the real economy. As such, the colonists were misguided. Their complaints of chronic specie scarcity should not be taken seriously. Either chronic specie scarcity did not exist or it did not matter.

#### *Modeling the Disagreement*

For a small open economy that does not produce its own specie or inside paper money, and engages in no foreign trade and specie-money-supply controls, under what conditions is chronic specie scarcity for executing domestic transactions possible? In other words, under what conditions will imported specie be retained for executing domestic transactions rather than being immediately exported to pay for more imported goods?

If credence is to be given to the colonial writers who asserted that specie was chronically scarce, then the quantity theory of money, specie-flow mechanism's denial that such is possible must be addressed. The model developed here does this by relaxing two implicit assumptions embedded in that theory's characterization of the colonial economy, namely the assumptions that all goods are tradable goods and that all transactions are monetized. Instead, the colonial economy will be assumed to produce and consume both tradable and non-tradable goods, e.g.

tobacco and horse racing, respectively. Only some goods can be exported for specie (tobacco, flour, rice), and only some goods can be obtained through imports bought with specie (tea, sugar, Madeira wine). These imports are assumed to have no domestically produced near-substitutes. Finally, many domestic goods cannot be cost-effectively exported nor can imports be cost-effectively substituted in their place, e.g. hay, firewood, and horse racing. These goods are produced and traded only within the domestic economy (Davis, 1964, v. 1: 353; v. 3: 376-8).

In addition, it will be assumed that the colonial economy engages in both monetized and non-monetized transactions. Barter with varying degrees of transaction-cost efficiency can be used to execute domestic transactions. This assumption makes using the simple quantity theory of money within a specie-flow mechanism problematic. In particular, barter alternatives put a price floor under which the specie price of non-tradable goods cannot fall. If all the specie money leaves the economy then, under the quantity theory of money, prices must be bid down to zero. This cannot happen when barter has some efficiency in executing domestic transactions.

Export and import prices are set in world markets and so cannot respond to local specie scarcity. When specie in a colony becomes scarce, specie prices for domestic transactions of non-tradable goods fall toward their barter price alternative. The relative price of that colony's non-tradable to tradable goods falls, but only so far—the fall constrained by the barter price floor. Therefore, as long as the elasticity of substitution between non-tradable and tradable goods is low, the consumption of the two types of goods will not change enough to overcome the lack of specie for transacting domestic non-tradable goods. The specie price of non-tradable goods can only fall to its barter price alternative, which is not low enough to draw specie into executing domestic transactions instead of buying imports. As such, domestic transactions shift to barter. The fall in the specie price of non-tradable goods, compared with tradable goods, pushes the

colonists toward export goods production, i.e. the staples or vent-for-surplus thesis, with the specie earned from exports being immediately re-exported to purchase new imports (Labaree, Oberg, and Willcox, 1959, v. 1: 144-5; McCusker and Menard, 1985). Increased specie "pass-through," keeping specie scarce for executing domestic transactions, is the result.

### *Taking the Colonists Seriously*

The modeling that follows is an exercise in taking colonial complaints about chronic specie scarcity seriously. Benjamin Franklin will be used to illustrate this colonial position. He makes an excellent representative because he holds the two positions in question, namely that 1) specie was chronically scarce, and 2) this scarcity pre-dates the issuance of paper monies by colonial assemblies. Franklin was recognized as the preeminent American of his generation in science, statesmanship, and letters. He wrote pamphlets, treaties, and correspondences on paper money. He designed and printed paper money for various colonies. As an assemblyman for Pennsylvania he was involved in the debates over, and management of, that colony's paper money. Later, as a lobbyist at the British court, he addressed conflicts over paper money between Britain and her colonies. As such, Franklin's views should carry weight.<sup>3</sup> The modeling exercise here is thus an exercise in taking Franklin seriously.

The next section explains the institutional and market constraints facing the colonists regarding their monetary powers, as well as how the colonists understood and articulated these constraints. The last section uses these constraints to build a series of graphical models to show under what conditions chronic specie scarcity is possible and when this scarcity is, and is not, welfare maximizing. While the model is constructed with the American colonies in mind, it applies to many other small open economies in history.<sup>4</sup>

## INITIAL CONDITIONS: INSTITUTIONAL AND MARKET CONSTRAINTS

### *Institutional and Regulatory Constraints*

Colonial governments could not create money *per se*. That was the prerogative of the sovereign, namely the British Crown (Davis, 1964, v. 1: 271; v. 4: 206, 219). Even if the colonies possessed gold and silver bullion—either mined or imported—the Crown prohibited them from minting their own coins. Colonial governments could, however, create transactionable or exchangeable debt in the form of paper *bills of credit*. The notion of money as tradable debt was closely tied to what the colonies were allowed to create (Newman, 2008, 10). As such, a colony's paper money—its bills of credit—had a bearer-bond quality that required an explicit redemption exercise to extinguish the principal expressed on its face (Grubb, 2012a).

The British government through the Board of Trade and the proprietors of some colonies exercised oversight of colonial paper money legislation (Brock, 1975; Grubb, 2008). The British Parliament also constrained colonial paper money creation. In 1741, Parliament extended the 1720 Bubble Act to the colonies. This made joint-stock corporations, except those chartered by the Crown, illegal (Harris, 1994; Newell, 1998, 228-30; Priest, 2001, 1379; Smith, 1937, 304). Thus, banking operations in the colonies were made prohibitively costly in terms of being able to adequately raise capital and spread risk among stockholders. Joint-stock banks emitting paper banknotes backed by fractional specie reserves would not appear until the American Revolution ended British rule.<sup>5</sup>

Problems with New England's paper money led Parliament to pass the Currency Act of 1751 (Brock, 1975, 168-243; Newell, 1998, 231-3; Priest, 2001, 1383-4). This act applied only to New England. It outlawed making bills of credit a legal tender in private transactions. It also restricted the emission-to-final-redemption interval to a maximum of two years in peacetime and

five years during wartime. Problems with Virginia's bills of credit in the early 1760s led Parliament to pass the Currency Act of 1764 (Brock, 1975, 465-528; Ernst, 1973, 77-88). This Act applied to all the colonies and outlawed making bills of credit a legal tender. It did not, however, restrict the emission-to-final-redemption interval as was done to New England by the Currency Act of 1751. After colonial protests, Parliament in 1773 amended the Currency Act of 1764 to allow bills to be made a *de jure* legal tender for public debts, i.e. for paying the taxes and fees levied by the issuing government (Ernst, 1973, 282-311).

Finally, the British government did not allow the colonies to implement capital-trade controls that would inhibit the exportation of specie from the colonies. By contrast, the British government restricted the free exportation of specie from Britain (Perkins, 1994, 13). Colonial treasuries never held specie reserves in any meaningful quantities. They functioned primarily as intermediaries between local tax revenue inflows and colonial assembly spending outflows.

### *Market Constraints*

Alongside these governmental constraints, the colonies operated within market forces that circumscribed their money creation abilities. For the most part, the colonists understood these market forces. They had a crude notion of the quantity theory of money and how it constrained their monetary actions. A simple version of the quantity theory of money is presented in equation (1) and transformed into its rate-of-change expression in equation (2).

$$(1) \quad M * V = P * Y$$

$$(2) \quad \% \Delta M + \% \Delta V = \% \Delta P + \% \Delta Y$$

Where:

M = the nominal amount of money

V = the velocity of circulation of M (how fast M changes hands per unit time)

P = the nominal price of Y

Y = the volume of real good and services traded in the economy

Typically, the rates of change of V and Y are assumed to be constant in the long-run, i.e.

determined by real factors in the economy such as production technology and commercial trading institutions that change slowly over time. Thus, equation (2) comes close to being equation (3) in the long-run and often in the short-run.

$$(3) \quad \% \Delta P \approx \% \Delta M + \text{a constant}$$

Emitting more paper money should drive prices up (drive the value of money down, i.e. cause currency depreciation), and retiring paper money from circulation should drive prices down (drive the value of money up, i.e. cause currency appreciation).<sup>6</sup>

How colonists described the quantity theory of money with regard to emitting bills of credit, however, differed from equation (3). Colonists thought bills could be emitted to some threshold before prices would be affected causing the currency to depreciate. This threshold was the point where more bills were outstanding at their face value than what were needed to transact the volume of real trade ( $Y$ ) in the economy (Davis, 1964, v. 2: 57; v. 4: 55). In February of 1765, Benjamin Franklin explained (Labaree, Oberg, and Willcox, 1969, v. 12: 52-3),

It was difficult to know before hand, what Quantity [of bills] would be sufficient for a Medium of Exchange proportion'd to the Trade of the Colony [of Pennsylvania], and not exceed the Occasions.

To prevent the Mischiefs attending an Over Quantity, the Government of Pensilvania began with a small Sum, £15000 in 1723, proceeded to encrease it gradually in following Years, and thus prudently *felt* for a Proportion they could not previously *calculate*. And as they never exceeded a moderate Sum, the Depreciation was never so great as to be attended with much Inconvenience.

In February of 1767, Franklin observed (Labaree, Oberg, and Willcox, 1970, v. 14: 34-5),

Where the Sums so emitted [of paper bills of credit] were moderate and did not exceed the Proportion requisite for the Trade of the Colony, such Bills retain'd a fix'd Value when compar'd with Silver without Depreciation for many Years.... The too great Quantity has, in some Colonies, occasioned a real depreciation of these Bills, tho' made a legal Tender.... ...[this] Injustice...is avoided by keeping the Quantity of Paper Currency within due Bounds.

Circa 1780, Franklin still held this view, writing (Labaree, Oberg, and Willcox, 1998, v. 34:

230),

It has been long & often observed, that when the current Money of a Country is augmented beyond the Occasions for Money, as a Medium of Commerce, its Value as Money diminishes, its Interest is reduced, and the Principal sinks if some Means are not found to take off the surplus Quantity. Silver may be carried out of the Country that produces it, into other Counties, and thereby prevent too great a Fall of its Value in the Country....

Paper Money not being easily receiv'd out of the Country that makes it, if the Quantity becomes excessive, the Depreciation is quicker & greater.

In other words, equation (3) is not a continuum. There must have been alternative ways to execute transactions other than using bills of credit. When no bills were outstanding, that did not mean that money prices were zero or that no Y was transacted. Exchange still took place, and most often local prices were approximately the same before versus after bills were first emitted, see Figures 1 and 2. Colonists recognized that there were multiple monies or transacting methods, and that substitution or displacement occurred between them. They were aware that currency substitution factored into how the quantity theory of money constrained their money creation abilities.

Price series for a few years before, versus a few years after, bills of credit were first emitted for goods that were not used as commodity monies have only been found (so far) for Pennsylvania, Maryland, and Virginia. Pennsylvania first emitted bills in 1723, expressed in Pennsylvania pounds units of account. Maryland first emitted bills in 1733, expressed in Maryland pounds units of account. Virginia first emitted bills in 1755, expressed in Virginia pounds units of account. Figures 1 and 2 show that prices in these colonies, expressed in their respective local units of account (an imaginary money before physical bills expressed in that unit of account were issued), were not zero before paper money was first emitted. Nor were prices substantially different after paper money was first emitted—being slightly higher in Pennsylvania, slightly lower in Virginia, and about the same in Maryland, after setting aside the

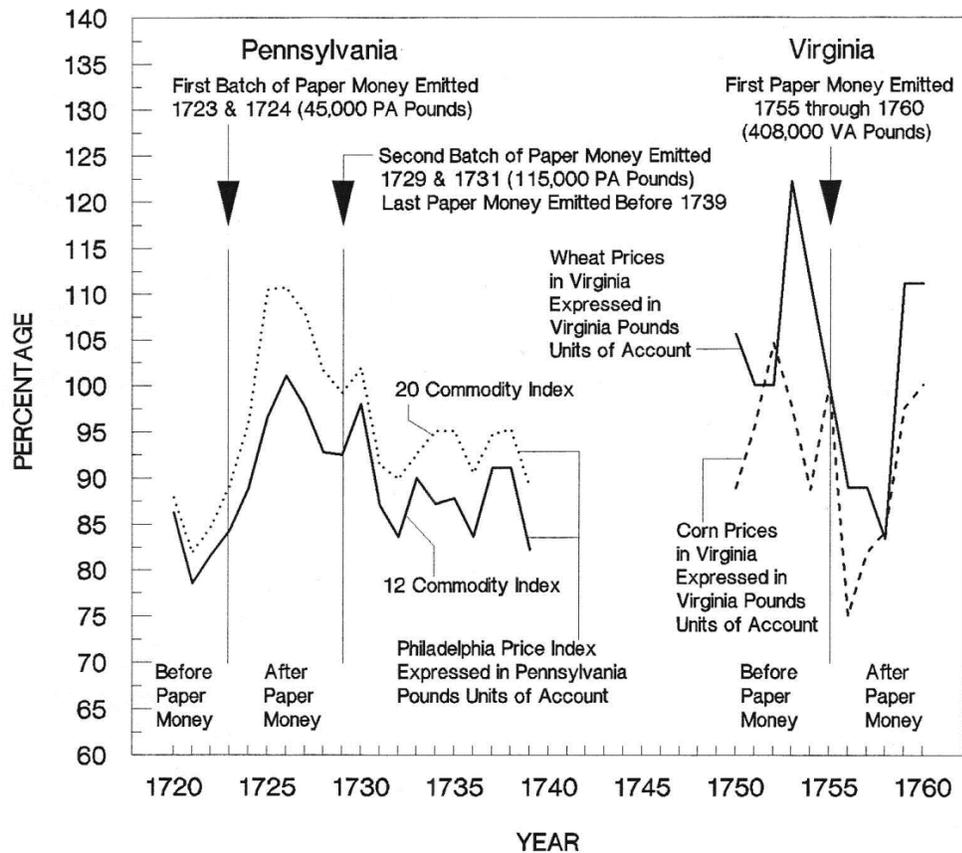


Figure 1. Prices Before and After the First Emissions of Bills of Credit in Pennsylvania and Virginia

Sources: Carter (2006, v. 5: 685, 687); Bezanson, Gray, and Hussey (1935, 433); Grubb (2012a).

Notes: The Philadelphia data are arithmetic un-weighted price indices with a base year 100 = 1741-45. The Virginia price data are expressed as the percentage of the price listed for 1755.

War of the Austrian Succession. Sufficient local trade took place to support comparable pricing even when bills of credit as a medium of exchange for that trade had not yet been created.<sup>7</sup>

Colonists thought of money as being made up of specie coins (outside money) and colonial assembly-issued paper bills of credit (inside money), though they often referred to specie coins as *real money* and everything else, even bills of credit, as barter.<sup>8</sup> A frequent argument made by contemporaries was that when bills were emitted they displaced specie coins

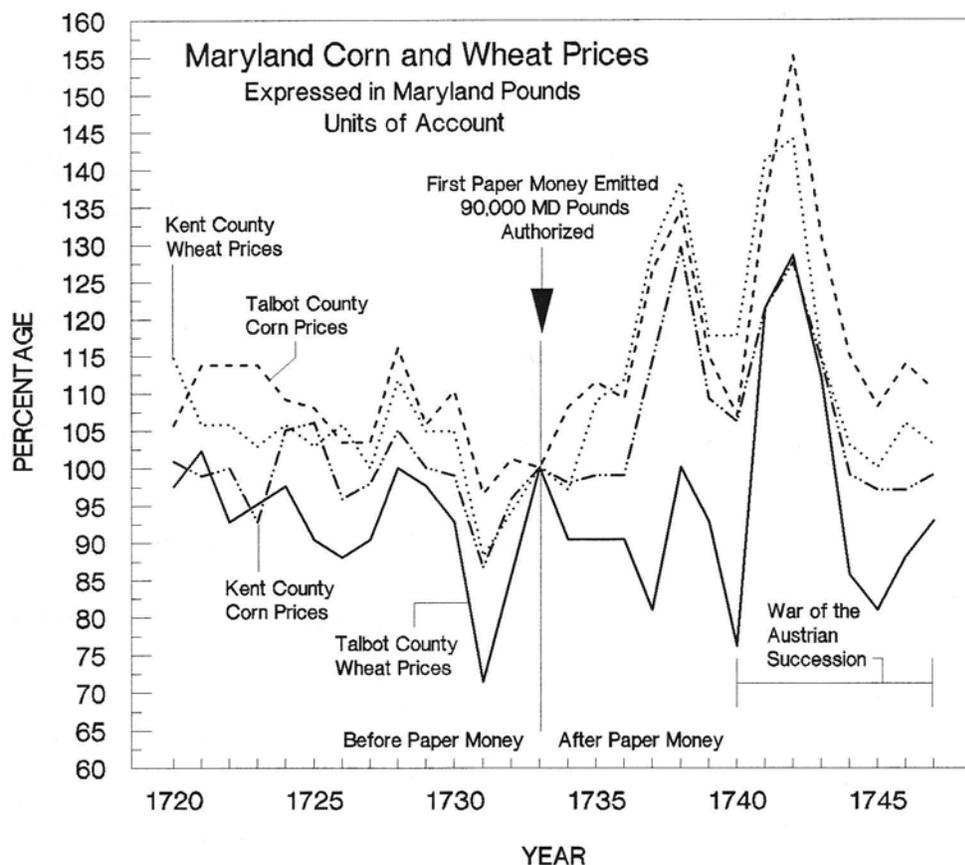


Figure 2. Prices Before and After the First Emissions of Bills of Credit in Maryland

Sources: Clemens (1980, 226-7); Grubb (2012a).

Notes: All prices are expressed as the percentage of the price listed for 1733.

for internal transactions and thus allowed specie to be exported to buy foreign goods. Only after all the specie had been displaced by bills would emissions of additional bills cause prices to rise (cause the bills to depreciate).<sup>9</sup>

This thinking is illustrated in equations (4) and (5) where paper and specie monies are concurrently used with one perfectly substituting for the other in local transactions at a fixed rate.

$$(4) \quad M = M_p + \bar{e}M_s$$

$$(5) \quad \Delta M_p = -\Delta \bar{e}M_s \text{ up to some threshold } \alpha M_s \text{ where } 1 \geq \alpha > 0$$

Where:

$M_p$  = the colony's paper bills of credit (inside money)

$M_s$  = specie coins and tradable bills of exchange expressed in specie units (outside money)

$\bar{e}$  = the fixed exchange rate  $M_p/M_s$

Changes in the emission of bills up to some threshold  $\alpha$  are absorbed by exports of specie thereby holding  $M$  constant and thus  $P$  constant in equation (3). Typically,  $\alpha$  is thought to be near

1. Only when an increase in bills goes beyond that absorption threshold will  $M$  increase and so  $P$  increase, thereby depreciating the value of the paper bills in circulation.

Adam Smith in the *Wealth of Nations* and David Hume in his writings on money articulated these currency substitution effects filtered through the quantity theory of money (Rotwein, 1970, 33-46, 60-77; Smith, 1937, 276-313). Their discussions, however, dealt explicitly with paper banknote monies backed by specie reserves and their connection to the specie-flow mechanism for stabilizing the money-price nexus, and not to the type of bills emitted by colonial assemblies. These writers saw the displacement of specie money by paper banknotes as welfare enhancing, allowing a country to consume the foreign goods that only specie could buy without locking the specie up as a local transacting medium. Fractional backing of banknotes with specie reserves, and the exchangeability of banknotes for specie on demand at their specie face value by the issuing bank ( $\bar{e} = 1$ ), supported the value of the banknotes.

In 1776, Smith (1937, 276-310) explained,

The substitution of Paper in the room of gold and silver money, replaces a very expensive instrument of commerce with one much less costly, and sometimes equally convenient....

There are several different sorts of paper money; but the circulation of notes of banks and bankers are...the best known, and which seems best adapted for this purpose....

The whole paper money of every kind which can easily circulate in any country never can exceed the value of the gold and silver, of which it supplies the place... Should the circulating paper at any time exceed that sum, as the excess could neither be sent abroad nor be employed in the circulation of the country, it must immediately return upon the banks to be exchanged for gold and silver.... There would immediately, therefore, be a run upon the banks to the whole extent of the superfluous paper...

A paper money consisting in bank notes, issued by people of undoubted credit, payable on demand [in specie] without condition, and in fact always readily paid as soon as presented, is, in every respect, equal in value to gold and silver money; since gold and silver money can at any time be had for it....

The increase of paper money, it has been said, by augmenting the quantity, and consequently diminishing the value of the whole currency, necessarily augments the money price of commodities. But as the quantity of gold and silver, which is taken from the currency, is always equal to the quantity of paper which is added to it, paper money does not necessarily increase the quantity of the whole currency....

[However] The paper currencies of North America consisted, not in bank notes payable [at face value in specie] to the bearer on demand, but in a government paper...

This banknote paper money system was held in equilibrium by the specie-flow mechanism. If local prices rose, people would take whatever specie reserves they had and export them to buy lower-priced foreign goods. This would contract the local money supply, both specie and paper banknotes because the banknotes were linked fractionally to the amount of specie reserves held against them. This contraction would reduce local prices, via equation (3), until foreigners would send specie into this economy to purchase the locale's now lower-priced goods. This process held economies in a monetary price level equilibrium. In this Hume-Smith world, chronic specie scarcity is impossible (Rotwein, 1970, 33-46, 60-77).

Benjamin Franklin pointed out that this Hume-Smith monetary price level equilibrium among trading economies was not applicable to the colonial setting. First, no one stood ready to exchange colonial bills of credit at face value for specie on demand in the way that banks exchanged their banknotes at face value for specie on demand. Neither colonial legislatures nor colonial treasuries nor consortiums of colonial merchants were capable or willing to do such on a consistent basis. There was no fixed exchange rate ( $\bar{e}$ ) between colonial bills of credit and specie that colonial treasuries defended by buying and selling their colony's bills of credit for specie. Colonial treasuries simply did not have the specie reserves to defend a fixed exchange rate. Specie-to-bill equivalencies were set for tax-receipt purposes only. In the marketplace, exchange

rates between bills and specie were free and flexible. As such, equation (5) did not function as a currency substitution mechanism in the colonies because flexible exchange rates ( $\Delta e$ ) between  $M_p$  and  $M_s$  could absorb changes in one without altering the amount of the other.

Second, Franklin pointed out that specie had fled local exchange long before the colonies issued bills of credit. The margin of displacement was not between bills of credit and specie.

According to Franklin, before 1723 Pennsylvania had no specie money and no paper money. Yet Figure 1 shows prices were not all that different immediately before compared with immediately after paper bills were first created as a medium of exchange. Similar observations hold for Maryland before versus after 1733 and Virginia before versus after 1755.<sup>10</sup> In other words, even without specie monies and paper bills of credit, local exchange still took place and prices were not all that different than when specie and paper bills of credit were present, see Figures 1 and 2.

In March of 1767, Franklin explained (Labaree, Oberg, and Willcox, 1970, v. 14: 77-9),

In Report of the [British] Board of Trade, dated February 9, 1764, the following Reasons are given for restraining the Emission of Paper Bills of Credit in America, as a Legal Tender....

To consider these Reasons in their Order. The first is, *That Paper Money carries the Gold and Silver out of the Province, and so ruins the Country, as Experience has shewn in every Colony where it has been practised in any great Degree.* This seems to be mere speculative Opinion, not founded on Fact in any of the Colonies. The Truth is, that the Balance of Their Trade with Britain being generally against them, the Gold and Silver is drawn out to pay that Balance; and then the Necessity of some Medium of Trade has induced the making of Paper Money, which could not be carried away. Thus, if carrying out all the Gold and Silver ruins a Country, every Colony was ruined before it made Paper Money.

...Pennsylvania, before they made any Paper Money, was totally stript of its Gold and Silver,...

The Balance of Trade carry'd out the Gold and Silver as fast as it was brought in,...

In the absence of specie and paper monies, local exchange was transacted with barter but not barter as is commonly articulated by economists. It was not the crude barter that requires a double coincidence of wants for exchange to be consummated. Colonists did not go door to door

with piglets under their arms searching for neighbors who had and were willing to trade boxes of candles for said piglets. The high transactions cost of this kind of barter explains why it was not commonly observed. The barter that colonists developed was what will be termed *efficient barter*. Efficient barter entailed exchange organized around shop-notes, store book-credit accounts, and tradable individual bonds with local goods priced in common units of account which allowed easy relative pricing and account clearing across multiple trades and traders.<sup>11</sup> Centralized clearing of credits and debts obviated the double-coincidence-of-wants problem. These efficient barter structures for executing domestic transactions had already displaced specie monies before colonies turned to issuing paper monies.

Efficient barter is illustrated by Henry Callister, a merchant storekeeper in Townside [Crumpton], Maryland. Located on Maryland's eastern shore, Callister was shipping wheat to Philadelphia sold to him by local planters, and importing goods from Philadelphia to sell back to these same planters. In 1762, Callister's store manager, Nathan Wright, asked what Callister would accept in payment of the goods he had sold, namely how local customers could clear their store credit accounts. Was only Maryland paper money acceptable or would any money do; was corn, wheat, or tobacco acceptable as payment; were bills of exchange acceptable as payment; and so on? Callister's response to Wright was that he would accept almost anything, i.e. any monies, bills, or goods (*Callister Papers*, material just prior to the letter dated 18 January 1762; Tyler, 1978). The clearing of store credit accounts was relatively flexible with indifference between the means used—either monies or barter goods.

When colonial governments issued bills of credit, the margin of currency substitution was efficient barter, not specie money. If efficient barter is thought of as sponge-like, possessing plasticity, then the scope for expanding and contracting the quantity of bills in circulation

without affecting prices is large. Only when the quantity of bills emitted rose to some threshold replacement of efficient barter would further emissions drive up prices and lead to currency depreciation. This hypothesis is depicted in equations (6) and (7).

$$(6) \quad M = EB + Mp + (eMs \approx 0)$$

$$(7) \quad \Delta Mp = -\Delta EB \text{ up to some threshold } \gamma EB \text{ where } 1 \geq \gamma > 0$$

Where:

$M$  = all transacting mediums, with  $M > M$ , namely  $M = M + EB$

EB = efficient barter, e.g. store book credit transacted in a common unit of account

$Ms \approx$  zero due to prior displacement by EB

In other words, the link between money ( $M$ ) and prices in the quantity theory of money is spongier given the nature of EB than that expressed in equations (3) and (4).<sup>12</sup>

The importance of equation (6) is that it creates room for endogenous inside "monies."<sup>13</sup>

These endogenous monies were barter-debt exchange structures possessing a hierarchy of efficiencies or transacting costs. The meaning of equation (7) is that the excess utility value or the transactions opportunity cost of using specie, or even bills of credit, for executing domestic transactions was not infinite. In other words, money ( $M$ ) *per se* cannot be assumed, i.e.  $M \neq M$  when  $EB \neq 0$ .

### **A TRANSACTIONS COST MODEL OF CHRONIC SPECIE SCARCITY**

What follows is a transactions cost model of monetary choice. It takes the colonists, e.g. Benjamin Franklin, seriously in their claims that 1) specie was chronically scarce in the colonies, and 2) this scarcity occurred before colonial assemblies emitted paper monies. Efficient barter as "money" for executing domestic transactions, and the fact that imports can only be purchased with specie, are used to demonstrate that chronic specie scarcity in colonial America was possible, despite unrestricted specie-market arbitrage. The welfare ramifications of this scarcity are also addressed. The model proceeds through four figures that follow the historical sequence

of monetary and trade development in colonial America.

### *Modeling Assumptions and Terminology*

The model assumes a small open economy/polity, e.g. an individual American colony, with  $n$  people. All people are assumed to have identical demands for domestic transactions, i.e.  $Demand_i = Demand_j = \dots = Demand_n$  with each being a normal downward sloping curve. The first actor is  $i$ , and the last is  $n$ . Domestic transactions are trades between people within this polity for goods produced and consumed within this polity.

Specie money ( $sm$ ) is exogenous or outside money. It is the money the rest of the world uses to consummate transactions that cross polity borders. Specie is not produced or minted in this polity. In exchange for exported goods, specie is imported in the form of bullion, foreign-minted gold and silver coins, or specie-denominated bills of exchange. No barriers to foreign trade or specie flows exist. Imported goods can only be purchased with specie. Domestically produced goods cannot be easily substituted for imported goods. Domestically produced goods can be purchased within this polity with specie or barter exchange ( $b$ ). The transaction cost ( $TC$ ) of using barter to consummate an exchange is always higher than when using specie ( $TC_b > TC_{sm}$ ).

Specie money has a separate opportunity cost ( $OC_{sm}$ ) when used for domestic transactions, namely the imported goods that could have been purchased with that specie.<sup>14</sup> When specie is not used, the alternative to using barter is autarky ( $Y_{autarky}$ ), i.e. an individual produces and consumes his own goods without trading with others in the polity. Barter has no separate opportunity cost ( $OC_b = 0$ ). It cannot be used to purchase imported goods, and the demand curve for domestic transactions captures the autarky alternative to barter.<sup>15</sup>

Individuals are price-takers in the market. Thus  $TC_b$ ,  $TC_{sm}$ , and  $OC_{sm}$  are perfectly elastic.

Individual economies/polities are small compared with their respective global markets and so are price-takers with regard to imports and exports that cross their borders. Different barter structures are assumed to have a hierarchy of transaction-cost efficiencies relative to specie. While  $TC_b > TC_{sm}$  is always true, the gap between them can vary. Barter is endogenous “money” for executing domestic trades.

Three different barter structures are used.<sup>16</sup> Figures 3 and 4 assume relatively inefficient *crude barter* (cb), i.e. domestic trade via a double coincidence of wants. A man with a pig who wants to trade that pig for a particular box of candles searches for a man with the desired box of candles willing to trade it for that exact pig. Figure 5 assumes *efficient barter* (eb), such as domestic trade organized around a third-party storekeeper who uses book credit or shop-notes to clear domestic transactions. Unlike crude barter, efficient barter possesses some localized credit-money characteristics with store debits and credits transferable across store customers. Figure 6 assumes *efficient enhanced barter* (eeb), such as when a polity creates an inside paper money or credit/debt instrument that can be used for domestic transactions throughout the polity. These paper monies cannot be directly used to acquire imported goods. They were transaction-able or exchangeable local government debt instruments or paper claims that could satisfy future local government tax liabilities (Grubb, 2012a).

An initial stock of specie acquired from prior-period exports in the hands of Demander<sub>i</sub> is exogenously given, i.e. the starting point in the model. Will Demander<sub>i</sub> use this specie to execute domestic transactions or export it to acquire imported goods, thereby removing this specie from society so that it cannot serve as a medium of exchange in subsequent domestic transactions?

*Baseline Model: Figures 3 and 4*

Figure 3 presents the baseline position upon which subsequent figures are built. It graphs

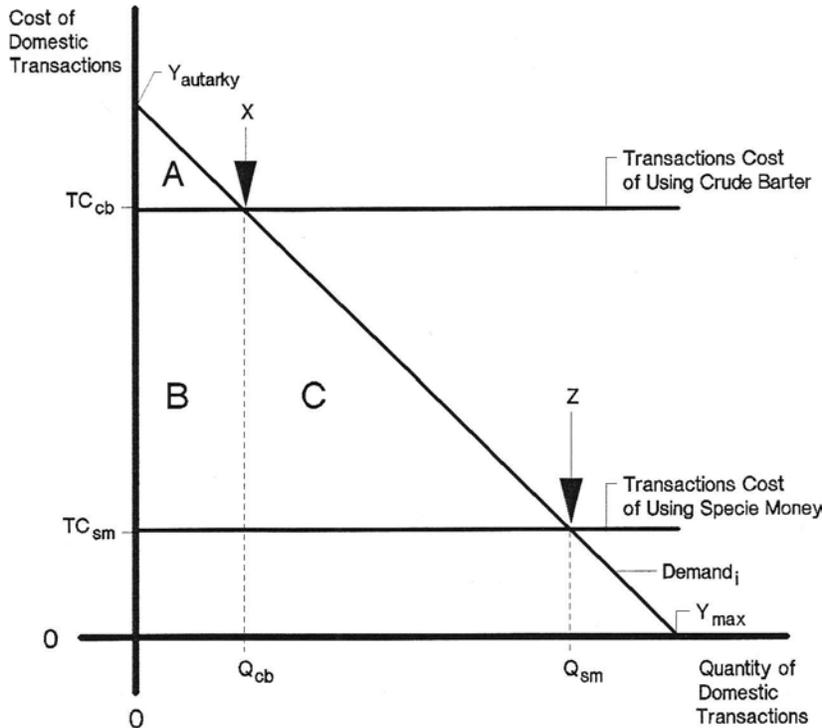


Figure 3. The Preliminary Baseline Model of Domestic Transactions in a Closed Economy

the cost of domestic transactions against the quantity of domestic transactions. A standard downward sloping demand curve for a given individual ( $Demand_i$ ) is drawn. If costs are too high, no domestic transactions are demanded. The result is autarky ( $Y_{autarky}$ ). An individual produces and consumes his own goods without trading with others in the polity.

If the cost of domestic transactions is zero,  $Y_{max}$  is demanded. Constraints to domestic production, namely exogenously given resource and technology constraints in the production function and the gains to specialization across individuals in the polity, determine  $Y_{max}$ . The summation of  $Y_{max}$  across people in this economy approximates the maximum potential gross domestic product attainable. The transactions costs of executing domestic trades are always positive and so the quantity of domestic transactions demanded is less than  $Y_{max}$ .

The transactions cost of crude barter ( $TC_{cb}$ ) is substantially greater than the transactions

cost of using specie money ( $TC_{sm}$ ) which, in turn, is somewhat greater than zero ( $TC_{cb} \gg \gg TC_{sm} > 0$ ). Several factors keep  $TC_{sm}$  above zero. Identifying counterfeit coins is costly, e.g. is that a silver dollar or a pewter dollar? Carrying heavy metallic substances is costly. Determining whether specie coins have been debased, clipped, cut, worn, or otherwise adulterated in a way that might reduce their value, or make them harder to identify, is costly. Making change using specie coins may be difficult if small denominations are not minted. Finally, many foreign coins are in circulation. Determining the relative value of different coins is costly, e.g. what is the value of a gold Spanish pistole compared with a gold English crown?

The high value of  $TC_{cb}$  in absolute terms, as well as relative to  $TC_{sm}$ , comes from the double coincidence of wants underlying crude barter. The cost of this kind of barter is so absurdly high that no one would engage in it except in the most isolated and limited capacity. Assuming that crude barter is the only alternative to money is a standard trope used by economists to justify the existence of money and its absolute primacy in trade.<sup>17</sup> Barter is so costly that domestic transactions will only take place using money. No transaction can take place without money, and no money can change hands without it being part of a transaction. In other words, the opportunity cost of using money is assumed to be nearly infinite. Assuming money rather than explaining it allows economists to do money-price-output analysis without caveats.

Positing crude barter as the only alternative to money, however, assumes people are willfully stupid—a position anathema in economics. The crude barter examples economists concoct are never observed, but barter of some type nevertheless occurs. People search for and develop cost-minimizing barter structures superior to crude barter. The subsequent models in Figures 5 and 6 relax this stupid-crude-barter assumption and explore what happens when cost-minimizing forms of efficient and enhanced barter are used.

The outcome of the baseline model illustrated in Figure 3 is straightforward. Comparing the equilibrium for using specie money, point Z, with the equilibrium for using crude barter, point X, shows that the quantity of domestic transactions is greater using specie money, i.e.  $Q_{sm} > Q_{cb}$ . More importantly, it shows that the consumer surplus (the area under demand that is above cost) is larger when using specie money than when using crude barter, i.e.  $\text{area } (A + B + C) > \text{area } A$ . The net welfare gain from using specie money instead of crude barter is the area  $(B + C)$ .

This outcome is true for the initial Demander<sub>i</sub>, as well as for each subsequent Demander<sub>j</sub> through <sub>n</sub>. Demander<sub>i</sub> starts with an initial stock of specie. His incentive is to use it, rather than crude barter, to execute domestic transactions. His net gain from doing so is area  $(B + C)$ . The person in the economy with whom he transacts now has that stock of specie and faces the same conditions that Demander<sub>i</sub> faced in Figure 3. This person will thus make the same decision, i.e. use his newly acquired stock of specie to buy domestic goods instead of barter for them.

As such, chronic specie scarcity for executing domestic transactions will not exist, and this use of specie is welfare enhancing for the society. Each individual gains area  $(A + B + C)$  when using specie to execute domestic transactions compared with area  $A$  when using crude barter. No matter how many individual demanders ( $n$ ) participate in domestic transactions, it will always be true that  $n(A + B + C) > n(A)$ .

Figure 3 assumes a closed economy. Yet specie initially entered this economy in exchange for exported goods. The presence of specie assumes an open economy. Figure 4 adds an open economy to Figure 3 by adding an opportunity cost of using the initial stock of specie for domestic transactions ( $OC_{sm}$ ), namely the loss of the imported goods that could have been purchased by Demander<sub>i</sub> with that specie. The total cost of using specie money to execute domestic transactions is  $(TC + OC)_{sm}$ .

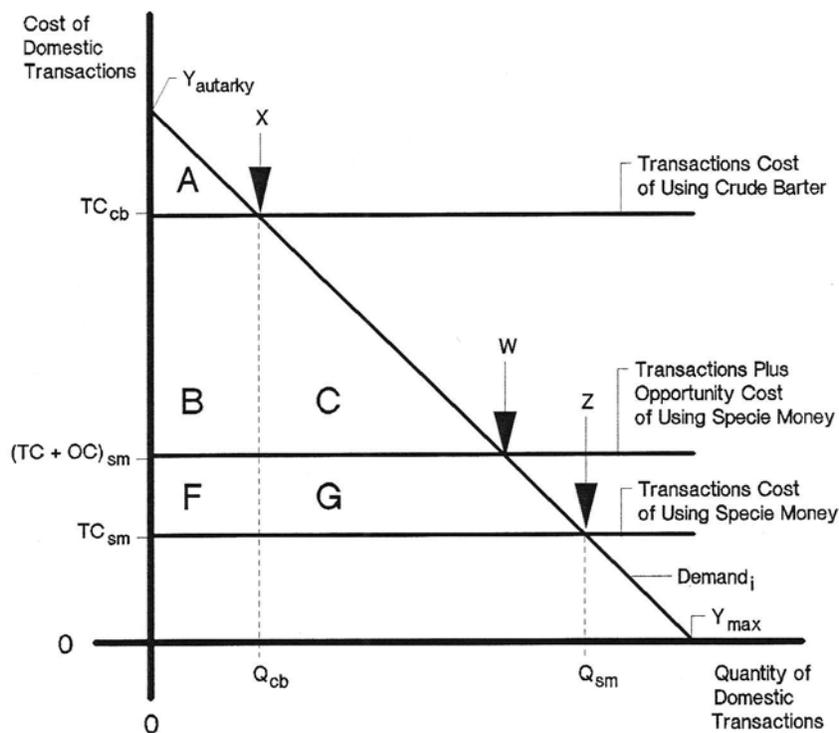


Figure 4. The Preliminary Baseline Model of Domestic Transactions in an Open Economy

Adding an open economy does not change the outcomes in Figure 3 as long as  $OC_{sm}$  is small compared with the gap between  $TC_{cb}$  and  $TC_{sm}$ . Comparing the equilibrium in Figure 4 for using specie money, point Z, with the equilibrium for using crude barter, point X, shows that the quantity of domestic transactions is greater using specie money, i.e.  $Q_{sm} > Q_{cb}$ . Figure 4, however, alters the welfare assessment of using specie for consummating domestic transactions.

In Figure 4 the consumer surplus from using specie to execute domestic transactions for Demander<sub>i</sub> must be assessed at point W rather than at point Z, because there is an additional cost to using specie for executing domestic transactions, namely the imported goods foregone that the specie could have purchased. If Demander<sub>i</sub> uses his specie to buy imported goods, and so must use crude barter to execute his domestic transactions, he gains area (A + F + G), e.g. the value of bartered domestic goods plus the value of imported goods. Alternatively, if Demander<sub>i</sub> uses

specie to execute his domestic transactions and so foregoes buying imported goods, he gains area  $(A + B + C)$ , namely  $[(A + B + C + F + G) - (F + G)]$ . Comparing the welfare gains from using crude barter, area  $(A + F + G)$ , with the welfare gains from using specie money to execute domestic transactions, area  $(A + B + C)$ , hinges on comparing area  $(B + C)$  with area  $(F + G)$ .

As long as area  $(B + C) > \text{area } (F + G)$  the choice of what to use to execute domestic transactions and the welfare outcome from Figure 3 will not change. Demander<sub>i</sub> has an incentive to use his initial stock of specie, rather than crude barter, to execute domestic transactions. His net gain is area  $[(B + C) - (F + G)] > 0$ . The person with whom he exchanges his specie for local goods now has that stock of specie and faces the same conditions as Demander<sub>i</sub>. This person will thus make the same decision. The outcome that is true for the initial Demander<sub>i</sub> is also true for each subsequent Demander<sub>j</sub> through  $n$ .

Under the condition in Figure 4, when area  $(B + C) > \text{area } (F + G)$ , chronic specie scarcity will not exist, and the use of specie for executing domestic transactions, rather than crude barter, will be welfare enhancing. Each individual gains area  $(A + B + C)$  using specie to execute domestic transactions compared with area  $(A + F + G)$  when using crude barter. No matter how many individual demanders ( $n$ ) participate in domestic transactions, it will always be true that  $n(A + B + C) > n(A + F + G)$ . This outcome seems to be what some scholars have in mind when they assert that chronic specie scarcity is an absurdity, an impossibility, a myth, an irrationality, and so cannot possibly be true in colonial America.

#### *Efficient Barter: Figure 5*

Figure 5 replaces the stupid-crude-barter assumption with a more efficient barter structure. This *efficient barter* (eb) can be thought of as domestic trade organized around a third-party central storekeeper who uses book credit or shop-notes as a kind of endogenous inside

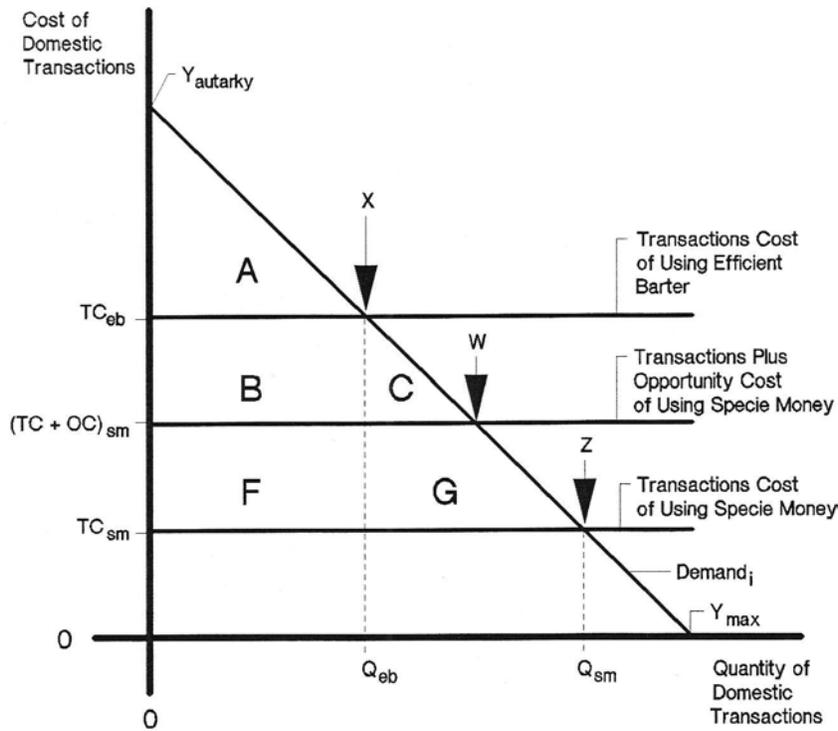


Figure 5. Adding Efficient Barter Structures to the Model

"money" for clearing transactions. Unlike crude barter, efficient barter has some localized transferable credit-money characteristics, e.g. store debits and credits transferable among regular store customers.

$TC_{eb}$ , while lower than  $TC_{cb}$ , still exceeds that of the transactions and opportunity cost of using specie money for executing domestic trades, namely  $TC_{cb} > TC_{eb} > (TC + OC)_{sm}$ .

However, Figure 5 assumes that  $(TC_{eb} - TC_{sm}) > OC_{sm} \geq (TC_{eb} - TC_{sm})/2$ . In other words, Figure 5 assumes that  $area(F + G) > area(B + C)$ .<sup>18</sup> While the quantity of domestic transactions is still greater when using specie, i.e. point Z is to the right of point X so that  $Q_{sm} > Q_{eb}$ , the choice of the domestic transacting medium and the welfare outcome of this choice are different in Figure 5 compared with that in Figures 3 and 4.

If Demander<sub>i</sub> uses his initial stock of specie to execute domestic transactions, his consumer surplus is  $area(A + B + C)$ , namely  $area[(A + B + C + F + G) - (F + G)]$  because he

has to subtract the opportunity cost of the foregone imported goods that the specie could have purchased ( $F + G$ ) from his net gain at point Z. Alternatively, if Demander<sub>i</sub> uses his specie to buy imported goods and uses efficient barter to execute domestic transactions, his consumer surplus is area ( $A + F + G$ ), i.e. the gain from having the imported goods ( $F + G$ ) plus the gain from the barter of domestic goods ( $A$ ). Given the assumption above that  $OC_{sm} \geq (TC_{ob} - TC_{sm})/2$ , the area ( $F + G$ ) is always greater than the area ( $B + C$ ). Therefore, Demander<sub>i</sub> comes out ahead using his specie to buy imported goods and using efficient barter to execute domestic transactions. Any specie that enters the polity will be immediately exported to buy imported goods and not be used to execute subsequent domestic transactions. Chronic specie scarcity for executing domestic transactions is the result.

While immediately exporting one's specie to buy imported goods is the optimal behavior for each individual, it is not the welfare maximizing outcome for society as  $n \rightarrow \infty$ . If Demander<sub>i</sub> follows his individual welfare maximizing choice, then his specie is no longer available for Demander<sub>s<sub>j</sub> through n</sub> to use for executing domestic transactions. Only Demander<sub>i</sub> gets the benefit of the imported goods that his specie purchased. Each individual with an initial stock of specie faces this situation. They cannot see nor capture the positive externality of having their specie available for executing all subsequent future domestic transactions by others in the polity.

If Demander<sub>i</sub> follows his individual welfare maximizing choice, he receives area ( $A + F + G$ ). Because the specie was exported, it is not available for Demander<sub>s<sub>j</sub> through n</sub> to use. Thus, Demander<sub>s<sub>j</sub> through n</sub> can only use efficient barter to execute domestic transactions, with each receiving area ( $A$ ) only. Thus, the total social welfare for all demanders in this polity is area ( $A + F + G$ ) for Demander<sub>i</sub> and area  $(n - 1)A$  for the rest of society, i.e. for Demander<sub>s<sub>j</sub> through n</sub>. As such, total social welfare under this outcome is area  $[nA + (F + G)]$ .

By contrast, suppose each demander goes against his individual welfare maximizing choice and uses his initial stock of specie to execute domestic transactions, foregoing the purchase of imported goods with his specie. Because specie is passed from one demander to the next, it circulates through the polity executing all domestic transactions. As such, each demander receives a welfare gain of area  $(A + B + C)$ . Because each demander in society gets this individual welfare, total social welfare is area  $n(A + B + C)$  or  $[nA + n(B + C)]$ .

Comparing the two outcomes shows that even when  $n$  is not large, and certainly as  $n \rightarrow \infty$ , social welfare is maximized by retaining specie to execute domestic transactions and foregoing using the specie to purchase imported goods, i.e.  $[nA + n(B + C)] > [nA + (F + G)]$ . The one-off benefit to Demander<sub>*i*</sub> of exporting his specie for imported goods  $(F + G)$  is exceeded by the subsequent foregone benefit of  $n(B + C)$  for all subsequent Demanders<sub>*j*</sub> through  $n$  of not having that specie available to execute their domestic transactions. In other words, while area  $(B + C) < \text{area}(F + G)$ ,  $\text{area } n(B + C) > \text{area}(F + G)$  as  $n \rightarrow \infty$ .

Figure 5 shows plausible conditions under which chronic specie scarcity, despite unrestricted specie-market arbitrage, can occur even when such is sub-optimal in terms of social welfare. Optimal individual actions lead to sub-optimal social outcomes (Davis, 1964, v. 2, 77). These conditions were present in British North America during the late seventeenth and early eighteenth centuries. As such, chronic specie scarcity before any colony had issued its own fiat paper currencies is plausible—an outcome produced by individual rational maximizing behavior.

The sub-optimal welfare outcome in Figure 5 can be fixed by policies such as banning specie exports, raising import tariffs, or encouraging import substitution so that  $OC_{sm}$  is reduced until  $\text{area}(B + C) > \text{area}(F + G)$ . Such policies could eliminate the incentive individuals have to export their specie to purchase imported goods. Given that British regulations largely prohibited

the colonies from imposing tariffs on British imports, banning specie exports, systematically encouraging import substitution, and creating banks that issued banknotes fractionally backed by specie reserves, some other colonial policy was needed to overcome the sub-optimal social welfare outcome in Figure 5.

### *Enhanced Efficient Barter: Figure 6*

Figure 6 modifies Figure 5 by assuming that barter structures can be enhanced to create a broadly accepted way to clear transactions throughout the polity, called here *enhanced efficient barter* (eeb). Figure 6 assumes that this enhancement is sufficiently large enough to cause  $(TC_{eeb} - TC_{sm}) \leq OC_{sm}$ . While the pure transactions cost of using specie money is always lower than the transactions cost of using barter to execute domestic transactions, no matter how efficient the barter structure, i.e.  $TC_{sm} < TC_{eeb}$ , the full cost of using specie to execute domestic transactions is now greater than the pure transactions cost of barter for executing domestic transactions, i.e.  $(TC + OC)_{sm} \geq TC_{eeb}$ . The transactions-cost gap is narrowed enough by enhanced efficient barter to make the opportunity cost of not using specie to purchase imported goods the dominant cost consideration for society. The failure to achieve significant import substitution via domestic production is an important determinant of the outcome in Figure 6.

Enhanced efficient barter was accomplished by colonial legislatures creating their own paper monies, monies accepted throughout the polity but not outside that polity. Colonial paper money functioned as transaction-able debt instruments or bearer-bonds. They were anchored to real values in the economy that could be claimed with that money. The most ubiquitous real-value anchors were to the future taxes levied by the colonial government issuing said money (Grubb, 2012a). These anchors gave the money general acceptance within the issuing polity. This general acceptance was a step beyond efficient barter structures which were confined to

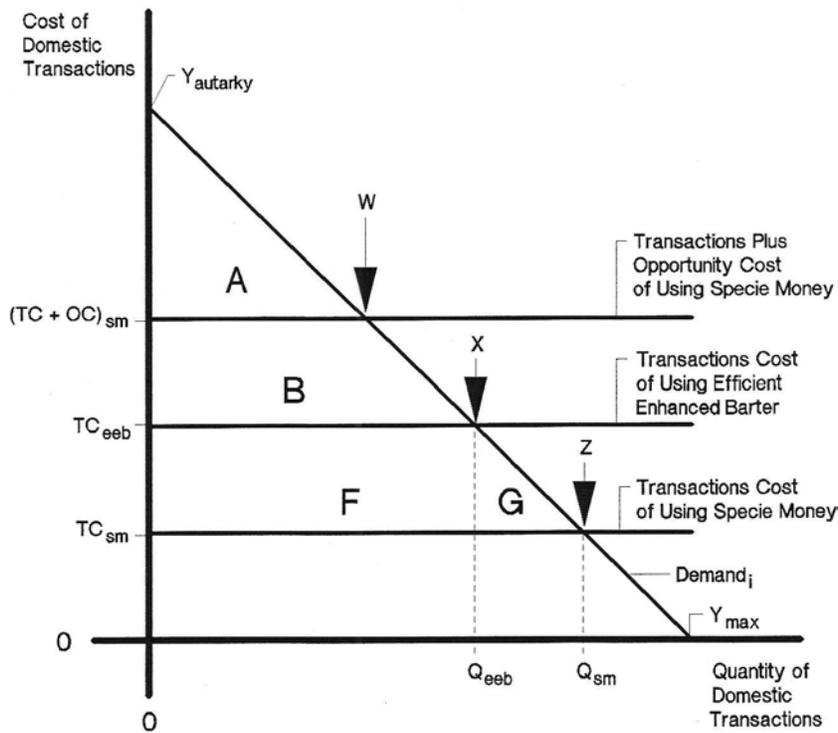


Figure 6. Adding Enhanced Efficient Barter Structures to the Model

local exchangeable store book-credits or shop-notes that required repeat transactions and reputation development among the store participants to sustain that barter structure's efficiency.

Figure 6 is similar to Figures 3, 4, and 5 in that equilibrium point Z is to the right of point X with  $Q_{sm} > Q_{eeb}$ . The choice of the domestic transacting medium and the welfare outcome of this choice, however, differ. In Figure 6, the cost assessment point for using specie money to execute domestic transactions, point W, is to the left of that point for using barter, point X, whereas in Figures 3, 4, and 5 the reverse is true. This difference comes from the assumption in Figure 6 that  $OC_{sm}$  exceeds the transactions-cost differential between using specie and barter for executing domestic transactions, a condition not present in Figures 3, 4, and 5.

In Figure 6, if Demander<sub>i</sub> uses his initial stock of specie to execute domestic transactions, his consumer surplus is area A, i.e. area  $[(A + B + F + G) - (B + F + G)]$  because he

has to subtract the opportunity cost of the foregone imported goods that the specie could have purchased ( $B + F + G$ ) from his net gain at point Z. Alternatively, if Demander<sub>i</sub> uses his specie to buy imported goods and uses enhanced efficient barter to execute domestic transactions, his consumer surplus is area ( $A + 2B + F + G$ ), i.e. the gain from having the imported goods ( $B + F + G$ ) plus the gain from the barter of domestic goods ( $A + B$ ). Given the assumption in Figure 6 that  $OC_{sm} \geq (TC_{ceb} - TC_{sm})$ , the area ( $A + 2B + F + G$ ) is always greater than the area A. Therefore, Demander<sub>i</sub> comes out ahead by using his specie to buy imported goods and using enhanced efficient barter to execute domestic transactions. The outcome for Demander<sub>i</sub> in Figure 6 is the same as in Figure 5. In both cases, Demander<sub>i</sub> has a personal welfare maximizing incentive to export his initial stock of specie rather than use it to execute domestic transactions. The only difference for Demander<sub>i</sub> is that his welfare gain is larger in Figure 6 than in Figure 5. In both cases, chronic specie scarcity for executing domestic transactions is the result.

While immediately exporting one's specie to buy imported goods is the optimal behavior for each individual in both Figures 5 and 6, it is not the welfare maximizing outcome for society as  $n \rightarrow \infty$  in Figure 5 but is the welfare maximizing outcome for society as  $n \rightarrow \infty$  in Figure 6. This is the key difference between Figures 5 and 6, between efficient and enhanced efficient barter. Figure 6 eliminates the sub-optimal social welfare outcome in Figure 5. The development of enhanced efficient barter structures in Figure 6 aligns individual welfare maximizing behavior with social welfare maximizing outcomes.

In Figure 6, if Demander<sub>i</sub> follows his individual welfare maximizing choice and exports his specie to acquire imported goods, then this specie is no longer available for Demanders<sub>j</sub> through <sub>n</sub> to use for executing domestic transactions. Each individual who has an initial stock of specie faces this situation. Demander<sub>i</sub> receives area ( $A + 2B + F + G$ ) from this choice. Because the

specie was exported, it is not available for Demanders<sub>j through n</sub> to use. Thus, Demanders<sub>j through n</sub> can only use enhanced efficient barter to execute domestic transactions, with each receiving area (A + B) only. Thus, the total social welfare for all demanders in this polity will be area (A + 2B + F + G) for Demander<sub>i</sub> and area (n - 1)(A + B) for the rest of society, i.e. for Demanders<sub>j through n</sub>. As such, total social welfare under this outcome is area [nA + nB + (B + F + G)].

By contrast, suppose each demander goes against his individual welfare maximizing choice and uses his specie to execute domestic transactions, foregoing the purchase of imported goods with that specie. Because specie is continuously passed from one demander to the next, it circulates throughout the polity executing all domestic transactions. As such, each demander receives a welfare gain of area A. Because each demander in society gets this individual welfare, total social welfare is area n(A).

Comparing these two outcomes, for any n, even  $n \rightarrow \infty$ , social welfare is maximized by not retaining specie to execute domestic transactions, i.e.  $nA < [nA + nB + (B + F + G)]$ . The one-off benefit to the initial demander of exporting his specie for imported goods (B + F + G) always exceeds the subsequent foregone net benefit to all subsequent demanders of not having that specie for executing their domestic transactions. This is because for each subsequent demander who has specie, the net welfare gain from using that specie to execute domestic transactions is negative. The opportunity cost of using specie to buy imported goods dominates the welfare assessment both for the individual and for society. Figure 6 shows plausible conditions under which chronic specie scarcity, despite unrestricted specie-market arbitrage, can occur and be welfare enhancing for the society.

### *Evolution of Colonial Regimes*

The British North American colonies can be characterized as evolving from Figure 4 to

Figure 5 to Figure 6. Early on, colonial societies developed efficient barter structures. This induced chronic specie scarcity that was socially sub-optimal. To eliminate this sub-optimal welfare outcome, colonial societies created viable inside paper monies that allowed them to capture the value of the imported goods that only specie could buy, while also being able to efficiently execute domestic transactions.

The evolution from efficient to enhanced efficient barter did not eliminate chronic specie scarcity, but it did ameliorate the sub-optimal welfare outcome that efficient barter caused and so may have encouraged domestic economic development. The incentive to move from Figure 5 to Figure 6 increases as a colony's population increases, because the social welfare loss in Figure 5 increases with population growth, and population growth itself will not overcome the sub-optimal social welfare outcome in Figure 5. Moving toward enhanced efficient barter ameliorated the sub-optimal social welfare outcome in Figure 5. As colonies grew, they systematically moved from a Figure 5 to a Figure 6 regime.

## **CONCLUSIONS**

American colonists believed that gold and silver coins were chronically scarce for executing domestic transactions despite unrestricted trade in specie. Chronic specie scarcity was not caused by currency substitution between fiat paper and specie monies. It was caused by the prior development of locally efficient barter structures. This led welfare maximizing individuals to export all their specie causing a socially sub-optimal welfare outcome in domestic transactions. Subsequent creations of inside paper monies by colonial governments mitigated the socially sub-optimal welfare outcomes of this efficient-barter-induced chronic specie scarcity.

The driving force behind the evolution of monetary transaction regimes modeled here is the relative size of the opportunity cost of using specie (outside) monies to execute domestic

transactions, namely the foregone imports that specie monies could purchase compared with the transactions cost gap between using that specie versus the next best inside barter "money" for executing domestic transactions. As this opportunity cost is driven toward zero via domestic economic development that yields import substitution, namely as domestic goods and imports become closer substitutes, chronic specie scarcity disappears (all the models collapse to the outcome in Figure 3 as  $OC_{sm} \rightarrow 0$ ). As such, chronic specie scarcity is more prevalent in small underdeveloped colonial "export" driven economies with limited domestic production sectors than in large modern developed economies. The model of chronic specie scarcity developed here is also consistent with, and makes sense of, contemporary colonial commentators who saw the lack of import substitution as contributing to specie scarcity.<sup>19</sup> These commentators considered policies that encouraged import substitution as a potential solution to chronic specie scarcity.

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## Footnotes

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<sup>1</sup> See Baxter (1965, 11-12); Breen (2004, 98); Brock (1975, 1-18, 25-9, 70-6, 86-7, 92, 106-8, 113-5, 137, 141-5, 150-1, 154, 165-6, 169, 176, 230, 240-1, 267-8, 283, 324, 333, 350-1, 353-6, 361, 386-8, 413, 438-9, 443, 447, 456, 462, 464, 466, 468, 497, 524, 529, 532, 536, 550); Davis (1964, v. 1: 55, 62, 70-1, 113-4, 123, 131, 144, 155, 177, 183-7, 189, 192-3, 200-4, 210-2, 233-4, 254-5, 259, 270, 298, 310-1, 320, 336-7, 352-61, 379, 387, 398, 401-3, 407-8, 418-35; v. 2: 7-9, 23, 27, 67, 69-89, 98, 101, 112-3, 150-5, 165-9, 174-6, 184, 234-5, 237, 280, 293-4, 307, 312, 321, 379, 396, 433-4, 449, 453-4; v. 3: 3-4, 35-6, 67, 80-7, 94-6, 130-3, 145-6, 152-6, 160-7, 172-4, 193-5, 198-200, 203-4, 207, 211-3, 225-6, 256, 276, 289, 297, 314, 339, 341, 370-2, 386-7, 391, 406-7, 412, 430, 439-40, 446-7, 450-2, 456, 462-7, 474; v. 4: 4, 22-3, 33-4, 56, 110, 120, 150, 193-8, 211, 234, 380-2, 390-1, 416-7, 437-42, 452); Grubb (2004, 2006a, 2006b, 2008); Hammond (1957, 11); Labaree, Oberg, and Willcox (1959-1974, v. 1: 14, 152; v. 4: 345-8; v. 5: 194-5, 244, 246; v. 7: 123; v. 9: 147; v. 11: 13; v. 13: 449, 466-7; v. 14: 33-4, 38, 77-87, 232, 286-7; v. 16: 2, 254; v. 18: 135); McCusker and Menard (1985, 338-41); Nettels (1934, 8, 11, 13, 20, 59, 79-80, 84-5, 91-4, 99, 120, 126-7, 144-6, 151, 157, 160, 162-78, 202-28, 231-49, 253-5, 276, 279-83); Newell (1998, 116, 118, 120, 135, 173); Perkins (1994, 13, 17, 19-23, 26, 51-5, 78); Redish (1984, 713, 727-8); Wallace and Zhou (1997, 556).

<sup>2</sup> See Brock (1975, 83, 114-5, 166, 268-9, 286-7, 304-5, 313, 322, 354-5, 362, 386-8, 395, 439, 447, 457, 485-6, 503-4, 523, 529, 536, 561-2); Davis (1964, v. 1: 34-5, 351, 401-2, 418; v. 2: 8, 25-6, 32, 49-51, 78, 82, 282, 321-3, 326-30, 379; v. 3: 235-6, 246, 259-60, 313-4, 341-2; v. 4: 8, 55-6, 62, 85, 157, 200-01, 380, 387, 391, 400-02, 416-9); Grubb (2006a, 2006b); Labaree, Oberg, and Willcox (1962, v. 5: 245; 1970, v. 14: 77); McCusker and Menard (1985, 338-41); Nettels (1934, 88-9, 203-5, 207, 249, 280-2); Perkins (1994, 18-9, 22-8, 53-5, 81); Redish (1984, 713-4, 727-8); Rotwein (1970, 69); Wallace and Zhou (1997, 556).

<sup>3</sup> On Franklin, see Grubb (2006b, 2006c, 2012b); Labaree, Oberg, and Willcox (1959-1998); Morgan (2002); Spiegel (1987); Talbot (2005).

<sup>4</sup> See Redish (1984); Redish and Weber (2008); Wallace and Zhou (1997). These studies explain specie scarcity by the low quality and indivisibility of the coins in use. By contrast, the model here assumes that people are smart enough to figure out how to create change and evaluate coins (as embedded in the model's specie transactions cost function). See Davis (1964, v. 2: 453-4).

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<sup>5</sup> The first joint-stock specie-based bank in America was the Bank of North America chartered by Congress and by various states in 1781 (Hammond, 1957).

<sup>6</sup> This model simply assumes money (M), i.e. assumes that the transaction opportunity cost of M is infinite. No alternatives to M for executing exchanges of Y exist. The non-applicability of this assumption, however, is at the heart of comprehending initial money creation in colonial America. For applications of the quantity theory of money to colonial America, see Grubb (2004); McCallum (1992); Smith (1985a, 1985b, 1988); West (1978); and Wicker (1985).

<sup>7</sup> The maximum amount of bills per white capita in these initial emissions for Pennsylvania was 1.2 Pennsylvania pounds in 1724 and 2.3 in 1731. For Virginia this number was 2.0 Virginia pounds for 1760. These amounts represent only 4 to 7.5 percent of the yearly income of laborers in Philadelphia (Carter, 2006, v. 5: 652; Grubb, 2011, 260-1; 2008; 2012a). As such, they were insufficient to transact all the internal trade within these colonies. Many domestic transactions had to be executed using other means.

<sup>8</sup> For example, Hume called bills a "commodity," i.e. a barter good, and called specie "money" (Rotwein, 1970, 69). See also Baxter (1965, 14); Brock (1975, 107, 113-4, 120); Davis (1964, v. 1: 163, 245, 259, 310, 376, 380, 382; v. 2: 101, 178-9, 193-4, 396, 429; v. 3: 369-74, 384, 398-9; v. 4: 100); Labaree, Oberg, and Willcox, (1970, v. 14: 34). I follow this usage in the modeling section below, calling all transacting mediums, other than specie, barter—highlighting the outside versus inside dichotomy in colonial monies. This money-versus-barter language is somewhat arbitrary. All that is needed is terminology that expresses a hierarchy or degree of money-ness.

<sup>9</sup> See footnote 2.

<sup>10</sup> From 1727 to 1733, the Maryland assembly debated passing its first paper money act. In 1728, London merchants dealing in Maryland tobacco wrote to Maryland colonists, published in the *Maryland Gazette*, 15 April 1729, encouraging them to change how trade took place within their colony (Gould, 1915, 70). They said, "Indeed, we think it will be the interest of your province, that all debts be contracted in money, it is now time to leave off the old way of barter." On specie being scarce before paper bills were issued, see Brock (1975, 141-5, 165, 169, 240-1, 350-1, 361, 365, 462, 466, 468, 550); Davis (1964, v. 1: 200, 336; v. 2: 69, 170, 174-6, 237, 307, 396; v. 3: 94, 198-200, 456); Nettels (1934, 8, 13, 20, 59, 126, 144, 160, 162-78, 202-8, 231-49, 253-5, 280-3); Newell (1998, 120).

<sup>11</sup> See Baxter (1965, 14, 16-38); Brock (1975, 430-1, 466, 509, 532); Davis (1964, v. 1: 113, 204, 400, 435-7; v. 2: 48, 70-1, 75, 80, 236, 368, 373, 375-6, 453-4; v. 3: 189, 204, 229, 406-7, 424, 430, 447, 450, 458, 474; v. 4: 57, 107, 109, 137); Nettels (1934, 59, 99, 120, 126, 157, 160, 162-78, 185, 195, 208-28, 250-5); Newell (1998, 118); Perkins (1994, 57-62, 67, 381-2); footnote 8.

<sup>12</sup> A more sophisticated version has  $\Delta M_p = -\Delta\phi EB$  where  $\phi$  is a continuous nonlinear function with  $1 \geq \phi \geq 0$ . Most likely  $\phi$  would start near 1 and decline toward zero as the proportion of monetized exchange neared 100%. In other words,  $M_p$  would have some excess utility value or

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positive transactions opportunity cost advantage as a medium of exchange over EB, an advantage that declined toward zero as  $\phi$  declined toward zero. This idea is behind the assertion that increasing  $M_p$  could increase  $Y$  by making transacting more efficient. However, given that long-run growth in real output per year per capita was at best 0.5%, it is hard to see much room for this effect, see Grubb (2004, 351-6; 2012a).

<sup>13</sup> To the extent that colonial governments would not accept EB in place of either  $M_p$  or  $M_s$  for paying taxes and government fees,  $M_p$  would have some excess utility value or positive transactions opportunity cost as a media of exchange in the local economy, see footnote 12. However, given that colonial tax payments were under a few percentage points of colonial income (Rabushka, 2008), this effect was small and so will be ignored. Fiscal disruptions via tax changes to accommodate paper money creation are assumed to be small enough and handled credibly enough not to alter  $Y$ .

<sup>14</sup> More precisely, the opportunity cost of specie as a medium of exchange for making current transactions involving domestic non-tradable goods is the value of the imported goods that the specie could have purchased, i.e. the amount by which the utility value of the imported goods exceeds the utility value of the domestic goods purchased with the same amount of specie. This gap exists because domestic goods cannot be easily substituted for imported goods. The focus here is on money's use as a medium of exchange rather than a store of value. This focus is relevant when alternative means of executing domestic transactions are present. Economists typically use the interest rate to measure the opportunity cost of money. This application assumes that there are no transacting alternatives to money (see footnote 6), thus making money-holding sensitive only to the returns on non-money assets. As late as 1774, colonists held only 2 percent of their wealth in cash, thus making money's asset-holding function less relevant than its medium-of-exchange function (Perkins, 1994, 55). If there are no alternatives to specie for executing domestic transactions, and/or if domestic goods are perfect substitutes for imports, then the medium-of-exchange opportunity cost of using specie is zero, and the only relevant opportunity cost to holding specie is the interest rate. These conditions, however, do not hold here.

<sup>15</sup> The model requires only that  $OC_{sm} > OC_b$  so that "net"  $OC_{sm} > 0$ .

<sup>16</sup> See footnote 8.

<sup>17</sup> For examples from eighteenth-century writers, see Davis (1964, v. 1: 113-4, 122, 154-5, 212, 378, 403); Labaree, Oberg, and Willcox (1959, v. 1: 144-5, 148); and Smith (1937, 22-3, 32).

<sup>18</sup> All that is required is that  $\text{area}(F + G) > \text{area}(B + C)$ . This can be met by  $(OC_{sm} - \psi) \geq [(TC_{eb} - TC_{sm})/2]$  where  $\psi > 0$  by some amount depending on the elasticity of demand.

<sup>19</sup> See Brock (1975, 1, 230, 240-1, 523, 561-2); Davis (1964, v. 1: 177, 233-4, 357-61, 378, 388, 402, 430; v. 2: 14-5, 40, 50-1, 155, 282-3, 369, 401, 434; v. 4: 33, 62, 93); Labaree, Oberg, and Willcox (1969, v. 13: 467; 1970, v. 14: 38, 232; 1972, v. 16: 2); Nettels (1934, 8-9, 46-7, 67-8, 98, 137-41, 151, 158, 280-3).