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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 fiat 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.¹ 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, nor did the British Crown 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 legislatures issued fiat 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.² It was not economically possible and therefore could not exist. People always complain about not having enough money no matter their circumstances. 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 would be exported. Globally, specie flows to where it is in short supply, i.e. to where it is more highly valued. Chronic specie scarcity, absent government intervention, is simply not possible.

Under the quantity theory of money in an open economy with an operative specie-flow mechanism, if specie becomes scarce domestically and so the specie money supply is too low, 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, as well as re-inflates domestic prices, until equilibrium is reached—a re-balancing of exports and imports until the net flow of specie in and out of the locale is zero. As such, chronic specie scarcity cannot exist. Temporary specie scarcity is possible, such during a war, due to unexpected disruptions in foreign trade that alter the balance of trade. Ubiquitous trade shocks may have produced acute specie scarcity on occasion, but market forces in an open economy will correct these imbalances. Ocean tides and storms exist, but sea level is sea level everywhere.

Specie scarcity can be produced through currency substitution. If a colony produces a local fiat money with a fixed exchange rate to specie, then this fiat money could displace specie for use in domestic transactions. Specie scarcity will occur when enough of this fiat money is produced to completely displace specie for executing domestic transactions. As a result, all the

specie coins will be exported to purchase imported goods.

Some writers have argued that currency substitution caused colonial complaints of chronic specie scarcity.³ 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. There is enough substitute fiat money to execute all domestic transactions. Being held in a fixed exchange rate with specie, the fiat money is the same as specie money (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, colonists were simply misguided, and their complaints of chronic specie scarcity should not be taken seriously. In conclusion, 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 local fiat currency, 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 exported to pay for more imported goods? Can specie be chronically scarce even before local substitute fiat monies are created?

If credence is given to colonial writers, then the quantity theory of money, specie-flow mechanism's objection to chronic specie scarcity must be addressed. The simplifying assumptions embedded in that theory's characterization of the colonial economy need to be augmented. The model developed below uses two features of the colonial economy to alter the

simple quantity theory of money, specie-flow mechanism's characterization of that economy. First, the colonial economy is 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, barrel staves), and only some goods can be had through imports paid for with specie (tea, coffee, sugar, Madeira wine). These imported goods are assumed to have no domestically produced near-substitutes. The colonies are small open economies, so export and import prices are determined in the world market. In addition, many domestic goods cannot be cost-effectively exported nor can imports be cost-effectively substituted in their place, e.g. hay, firewood, potatoes, and horse racing. These goods are produced and traded only within the domestic economy.

Second, the colonial economy is assumed to possess a mixture of 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:

(a) The barter alternative puts a price floor under which the specie price of non-tradable goods cannot fall. If all the specie money leaves the economy and the money supply goes to zero, then under the quantity theory of money, prices must be bid down toward zero. This cannot happen when barter has some efficiency in domestic transactions.

(b) Export and import prices are set in the world market. They cannot be changed by a purely local specie scarcity. Specie prices for domestic transactions of non-tradable goods can fall to their barter price alternative, but that will not lower the specie price for imports and exports. As specie gets increasingly scarce in a colony, the relative specie price of non-tradable to tradable goods falls. As long as the elasticity of substitution between non-tradable and tradable

goods is low, the relative production, sale, and consumption of the two types of goods will not change enough to overcome the lack of specie for transacting domestic non-tradable goods. This relative price shift may lead colonists to move their production toward exportable goods compared with non-tradable goods, i.e. the staples or vent-for-surplus thesis (Labaree, 1959, v. 1, pp. 144-5; McCusker and Menard, 1985). The colonists, however, will immediately re-export the specie received to purchase new imports. Pure pass-through of specie, causing on-going specie scarcity for executing domestic transactions, results.

Taking the Colonists Seriously

The modeling that follows is an exercise in taking seriously colonial complaints about chronic specie scarcity and its detrimental effects on their domestic economies. 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 legislature, i.e. chronic specie scarcity led to the issuance of these monies and not the other way around.

Franklin also makes an excellent representative because no other American was involved over as long a period with so many different facets of colonial money. Franklin was recognized as the preeminent American of his generation in science, statesmanship, and letters. Franklin was also a keen observer of, and commented often on, colonial monetary systems. He wrote pamphlets, treaties, and correspondences on paper money. He designed and printed paper money for various colonies. He entertained ideas about and proposed alternative monetary systems. As an assemblyman for the colony of Pennsylvania he was involved in the debates over, and management of, that colony's paper money. Later, as a lobbyist for various colonies to the British court, he addressed conflicts over paper money between Britain and her colonies. Franklin's

extensive writings on money, commencing in 1729 and ending in 1788, are more scientific and less polemical than that of his contemporaries.⁴ As such, Franklin's views should carry weight.

The modeling exercise here is thus an exercise in taking Franklin seriously.

Relevance for Modern Times

Part of what lay behind the current twenty-first century financial crisis is the private sector's creation of unregulated highly-leveraged tradable debt positions, e.g. derivatives, credit swaps, synthetic securities, overnight electronic cash parks, etc. These positions functioned as a medium of exchange in the form of transaction-able debts that were liquid enough to execute domestic trades, i.e. a kind of endogenously created money. The existence of this endogenous money has allowed U.S. paper dollar bills to be exported without reducing the U.S. economy's ability to execute domestic transactions. Endogenous private sector responses to monetary constraints can be large and disruptive to social welfare. These modern developments may be little different from what unfolded in British North America during the eighteenth century, the difference being a matter of form rather than of concept.

The next section explains the institutional and market constraints facing the colonists, as well as how colonists understood and articulated these constraints, with respects to their monetary powers. The last section uses these constraints to build a series of models that show under what conditions chronic specie scarcity is possible and when this scarcity is, and is not, welfare maximizing. How issuing paper monies altered these welfare outcomes is addressed. While the model is constructed with the American colonies in mind, it applies to many other small open economies in history. Chronic shortages of outside monies and difficulties in maintaining an adequate outside money supply have been noted in numerous pre-nineteenth century locations, not just in the American colonies.⁵

INITIAL CONDITIONS: INSTITUTIONAL AND MARKET CONSTRAINTS

Institutional and Regulatory Constraints

Colonial governments could not create money *per se*. That was the exclusive prerogative of the sovereign, namely the British Crown. Even if the colonies possessed gold and silver bullion—either mined or imported—they were prohibited from minting their own coins. Colonial governments could, however, create transaction-able or exchangeable debt in the form of *bills of credit*. The notion of money as tradable debt was closely tied to what the colonies were allowed to create (Newman, 2008, p.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).

Oversight by the British government and the proprietors of some colonies constrained colonial money creation. Colonial paper money acts could be disallowed. Many of the debates with a colony's proprietor over the proprietor's resistance to colonial paper money were not about paper money *per se*, but about political rights and prerogatives. Typically proprietors didn't want to accept their colony's bills of credit in payment of the rents owed them, and proprietors also wanted a say in how bills could be spent. Colonial assemblies typically wanted the opposite. Wrangling over these issues often delayed paper money acts and shaped their structure (Brock, 1975, pp. 354-62; Grubb, 2008).

Colonial paper money legislation was also constrained by regulations passed by the British Parliament. 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, pp. 228-30; Priest, 2001, p. 1379; Smith, 1937, p. 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. Banks emitting paper banknotes backed by fractional specie reserves would not appear until the American Revolution ended British rule.⁶

Problems with New England's paper money led Parliament to pass the Currency Act of 1751 (Newell, 1998, pp. 231-33; Officer, 2005; Priest, 2001, pp. 1383-1384). 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 (Ernst, 1973, pp. 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, pp. 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 Britain government restricted the free exportation of specie from Britain. Colonies constantly complained that as fast as specie monies were imported from trade surpluses with Spanish America, they were exported to England to cover the colonies' chronic trade deficit with the mother country.⁷ Colonial treasuries were never able to effectively hold specie reserves in any meaningful quantities. Colonial treasuries functioned only as intermediaries between local tax 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 all monies used to transact Y

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

P = the nominal prices of Y

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

Typically, the rates of change of V and Y are assumed to be constants in the long-run, i.e. determined by real factors in the economy such as production technology and commercial trading institutions that typically change slowly over time. Thus, equation (2) comes close to being equation (3) under many circumstances in the long-run and often in the short-run.

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

Emitting more bills of credit should drive prices up (drive the value of money down, i.e. cause currency depreciation), and retiring bills from circulation should drive prices down (drive the value of money up, i.e. cause currency appreciation).⁸

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. For example, in February of 1765, Benjamin Franklin explained (Labaree, 1969, v. 12, pp. 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 went on to observe (Labaree, 1970, v. 14, pp. 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. In "Of the Paper Money of America," he wrote (Ober, 1998, v. 34, p. 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, which means there must have been alternative ways to execute transactions other than using bills of credit. When there were no bills 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.

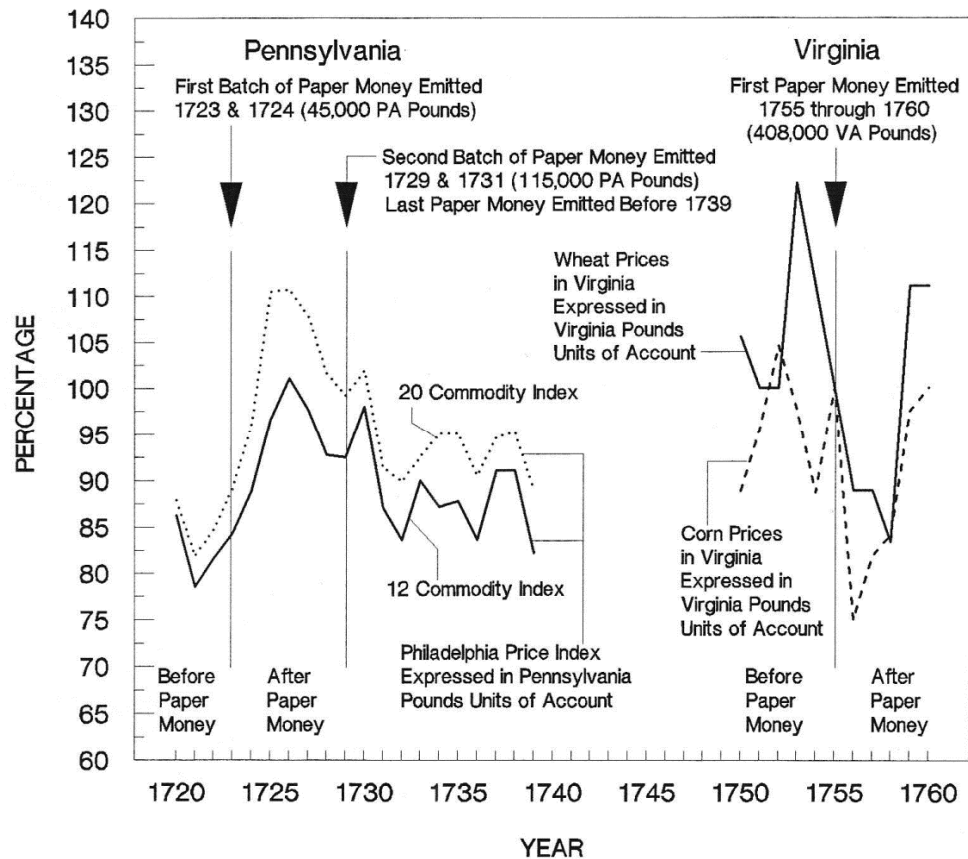


Figure 1. Prices Before and After the First Emissions of Bills of Credit in Pennsylvania and Virginia

Sources: Carter, et al. (2006, v. 5, pp. 685, 687); Bezanson, Gray, and Hussey (1935, p. 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.

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

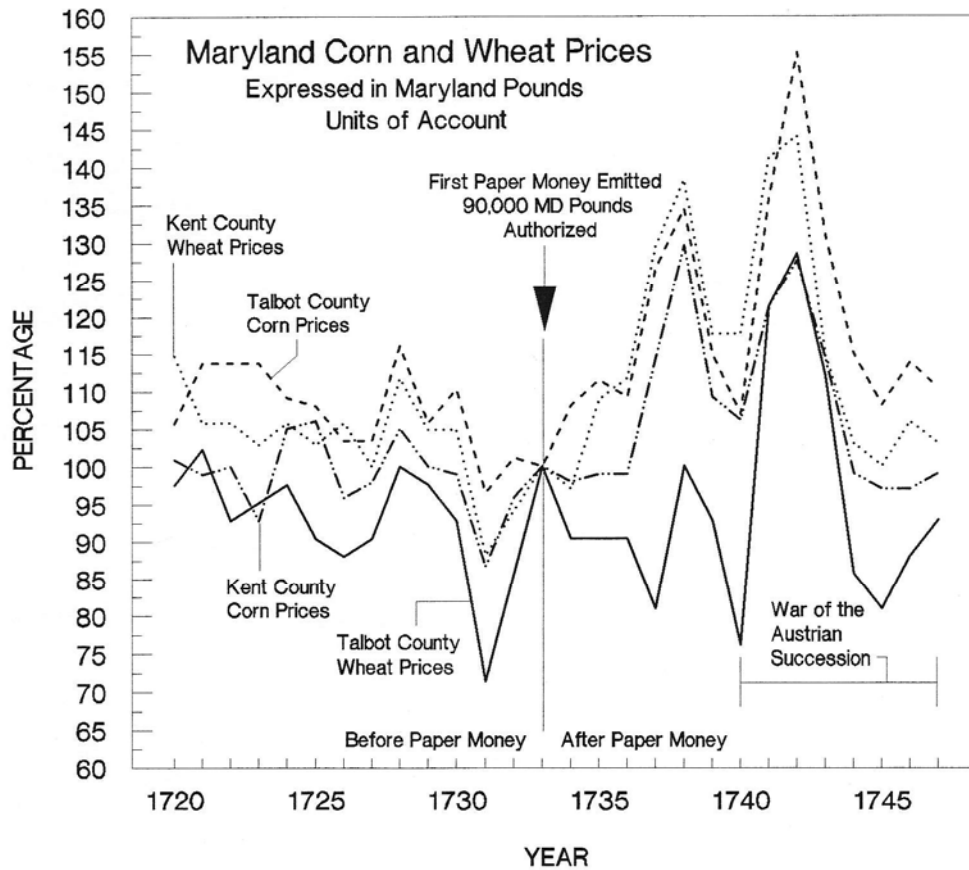


Figure 2. Prices Before and After the First Emissions of Bills of Credit in Maryland

Sources: Clemens (1980, pp. 226-227); Grubb (2012a).

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

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 War of the Austrian Succession, e.g. see Talbot county wheat prices in Figure 2. 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.⁹

Colonists thought of money as being made up of specie coins (outside money) and paper bills of credit (inside money), and often referred to specie coins as *real money*. A frequent argument made by contemporaries was that when bills were emitted they displaced specie coins for internal transactions and 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). Some contemporary writers blamed the scarcity of specie coins on the emission of bills of credit, the latter driving out the former (see Franklin's quotation below).¹⁰

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 bills of credit (its inside paper money)

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

\bar{e} = the fixed exchange rate M_p/M_s ; the bar over e indicating a fixed exchange rate regime

Changes in the emission of bills up to some threshold α are absorbed by exports of specie thereby holding M constant and thus P constant in equation (3). Typically, α 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, pp. 33-46; Smith, 1937, pp. 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 legislatures. These writers saw the displacement of specie money by paper banknotes

as welfare enhancing, allowing a country to consume the foreign goods that 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 banknotes.

In 1776, Smith (1937, pp. 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, then people took whatever specie reserves they had and exported them to buy lower-priced foreign goods. This contracted 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 reduced local prices, via equation (3), until foreigners would send specie into this economy to purchase the locale's lowered-priced goods. This process held economies in a monetary price level equilibrium. In this Hume-Smith world, chronic specie

scarcity is impossible (Rotwein, 1970, pp. 33-46).¹¹

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 (Δe) 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 1755.¹² 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, 1970, v. 14, pp. 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 through 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 store book-credit accounts with goods priced in common units of account. These common units allowed easy relative pricing and account clearing across multiple trades and traders. They consisted either of commodity money, such as tobacco, or imaginary pounds, such as the Pennsylvania pound (the accounting unit before Pennsylvania issued physical paper bills of credit expressed in that unit). 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 the colonies turned to issuing paper monies.¹³

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 issuing bills of credit, the margin of currency substitution was efficient barter, not specie money. If efficient barter is thought of as sponge-like, possessing some plasticity, then the scope for expanding and contracting the quantity of bills in circulation without affecting prices could be 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:

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

Ms \approx zero due to prior displacement by EB

In other words, the link between money and prices in the quantity theory of money is spongier given the nature of EB than that expressed in equations (3) and (4).¹⁴

The importance of equation (6) is that it creates room for endogenous inside "monies."¹⁵

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 *per se* cannot be assumed. It will vary in type and amount, depending on the circumstances, and it may have endogenous elements.

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 legislatures emitted paper monies. The ideas of efficient barter as a "money" for executing domestic transactions, and the observation that only specie can be used to buy imports, are used to demonstrate that chronic specie scarcity in colonial America was possible, despite unrestricted specie-market arbitrage, and show under what conditions this scarcity was welfare enhancing. The model proceeds through four figures that illustrate 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. Specie can be imported in exchange for exports in the form of bullion or foreign-minted gold and silver coins. No barriers to foreign trade or specie flows exist for this polity.

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 costs (TC) of using barter are 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. 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.¹⁶

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. Barter is assumed to have a continuum 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. 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 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 can be thought of as transaction-able or exchangeable local government debt instruments or paper claims that would satisfy future local government obligations (Grubb, 2012a).

An initial stock of specie acquired from prior-period exports in the hands of Demander_i is exogenously given, i.e. the starting point in the model. Will Demander_i 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 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 GDP attainable. The transactions cost of executing domestic trades is 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 ($TC_{\text{cb}} \gg \gg TC_{\text{sm}} > 0$). Several factors keep TC_{sm} above zero. Identifying counterfeit coins is costly, e.g. is that a

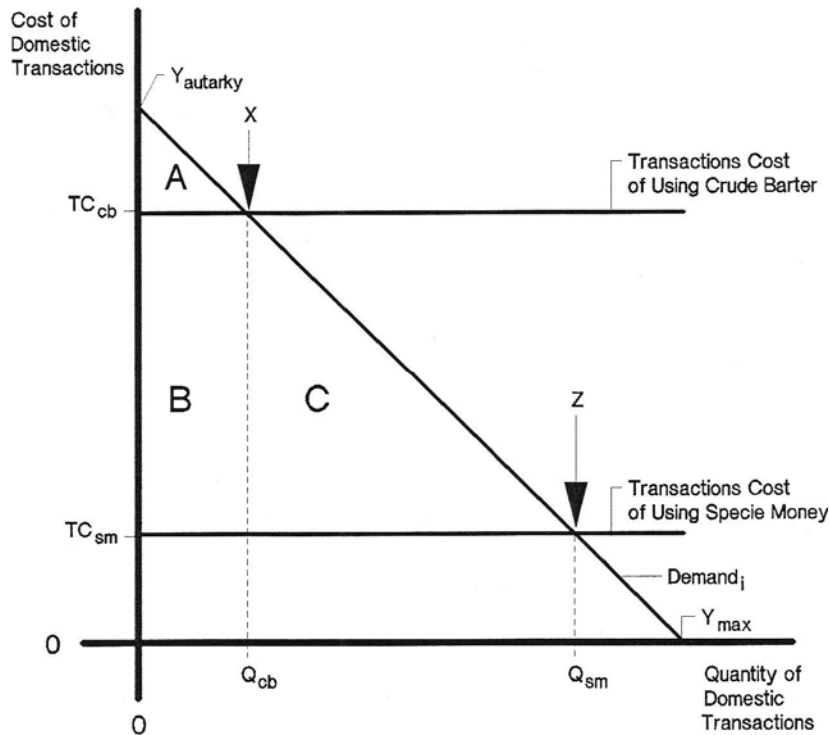


Figure 3. The Preliminary Baseline Model of Domestic Transactions in a Closed Economy

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. 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.¹⁷ 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. Economists use this trope to justify assuming the existence of money and its absolute primacy in trade. 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_i, as well as for each subsequent Demander_j through n. Demander_i 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_i 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 $n(A + B + C) > n(A)$. The conditions in Figure 3 are what some scholars have in mind when they blithely assert that chronic specie scarcity is an absurdity, an impossibility, a myth, an irrationality, and so cannot possibly be true in colonial America.

Figure 3 assumes a closed economy. Yet specie initially entered this economy, most likely in exchange for exported goods. The initial presence of specie in a colony 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_{*i*} with that specie. The total cost of using specie money for executing domestic transactions is $(TC + OC)_{sm}$. There is no opportunity cost to using crude barter because imported goods cannot be purchased with crude barter.

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 , still 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_{*i*} 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_{*i*} 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

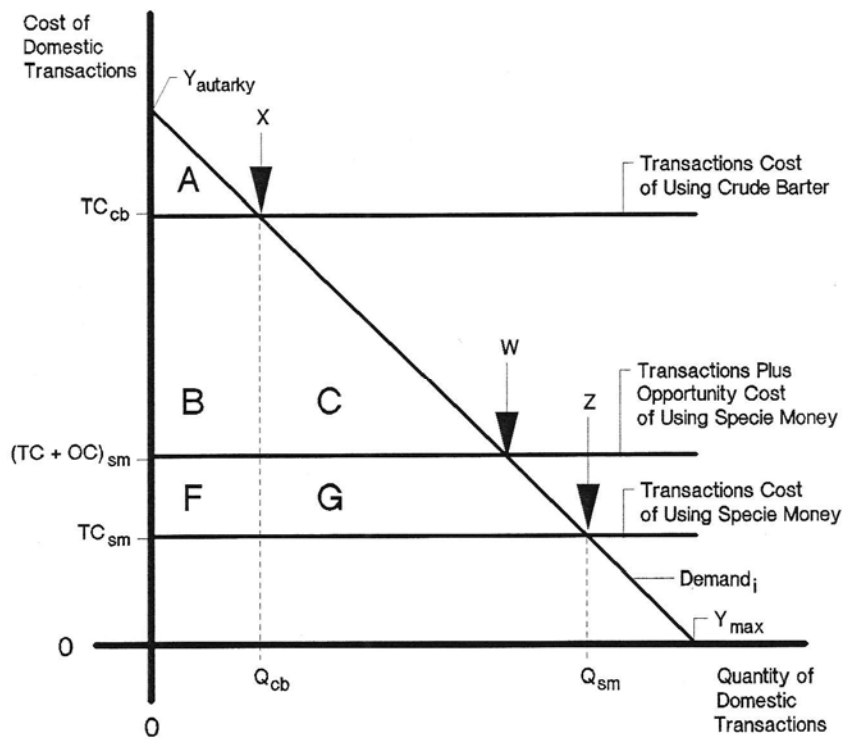


Figure 4. The Preliminary Baseline Model of Domestic Transactions in an Open Economy

bartered domestic goods plus the value of imported goods. Alternatively, if Demander_i 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 $\text{area } (B + C) > \text{area } (F + G)$ the choice of what to use to execute domestic transactions and the welfare outcome from Figure 3 will not change. Demander_i has an incentive to use his initial stock of specie, rather than crude barter, to execute domestic transactions. His net gain is $\text{area } [(B + C) - (F + G)] > 0$. The person with whom he exchanges his specie for local goods now has that stock of specie and faces the same conditions as Demander_i. This person will thus make the same decision. The outcome that is true for the initial Demander_i is also true for

each subsequent Demander_j through n.

Under the condition in Figure 4, when $\text{area}(B + C) > \text{area}(F + G)$, 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 $\text{area}(A + B + C)$ using specie to execute domestic transactions compared with $\text{area}(A + F + G)$ 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 open economy outcome seems to be what some scholars have in mind when they blithely assert that chronic specie scarcity is an absurdity, an impossibility, a myth, an irrationality, and so just 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 as a kind of endogenous inside "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 transactions, 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 $\text{area}(F + G) > \text{area}(B + C)$.¹⁸ 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_i uses his initial stock specie to execute domestic transactions, his consumer

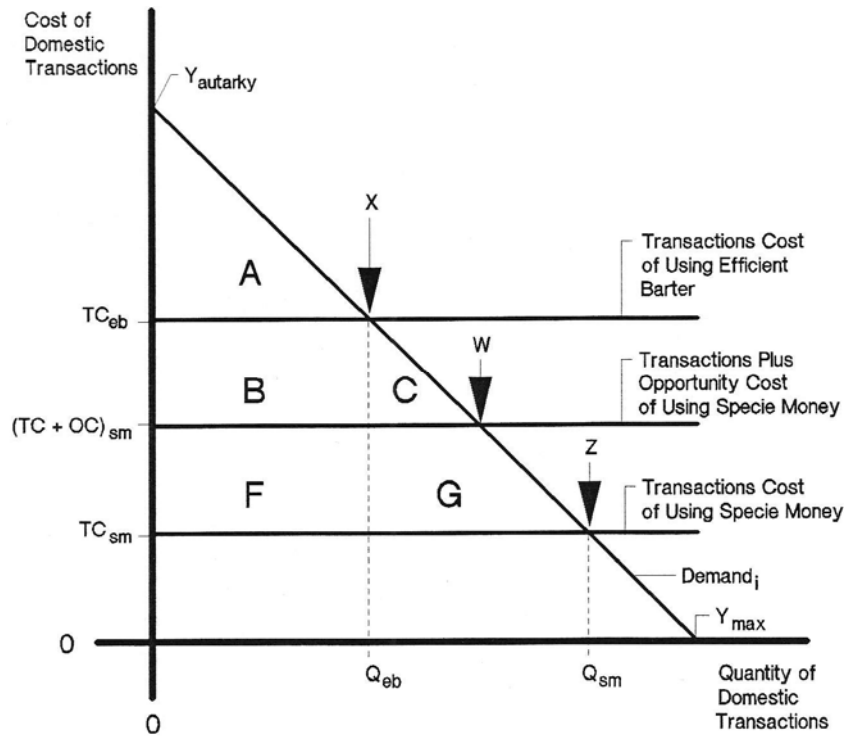


Figure 5. Adding Efficient Barter Structures to the Model

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_i 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 $OC_{sm} \geq (TC_{eb} - TC_{sm})/2$, the area $(F + G)$ is always greater than the area $(B + C)$. Therefore, Demander_i 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_i follows his individual welfare maximizing choice, then his specie is no longer available for Demander_{j through n} to use for executing domestic transactions. Only Demander_i 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_i follows his individual welfare maximizing choice, he receives area $(A + F + G)$. Because the specie was exported, it is not available for Demander_{j through n} to use. Thus, Demander_{j through n} 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_i and area $(n - 1)A$ for the rest of society, i.e. for Demander_{j through n}. 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_i of exporting his specie for imported goods $(F + G)$ is exceeded by the subsequent foregone benefit of $n(B + C)$ for all subsequent Demander_{j through n} of not

having that specie available to execute their domestic transactions. In other words, while area (B + C) < area (F + G), area n(B + C) > 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 term of social welfare. Optimal individual actions lead to sub-optimal social outcomes. These conditions were present in British North America during the late seventeenth and early eighteenth centuries. As such, colonial complaints of chronic specie scarcity before any colony had issued its own fiat paper currencies is a plausibly true reality—one produced by rational economic behavior.

The sub-optimal welfare outcome in Figure 5 could be fixed by policies such as banning specie exports, raising import tariffs, or encouraging import-substitution in domestic production so that OC_{sm} is reduced until area (B + C) > area (F + G). Such policies could eliminate the incentive individuals had 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

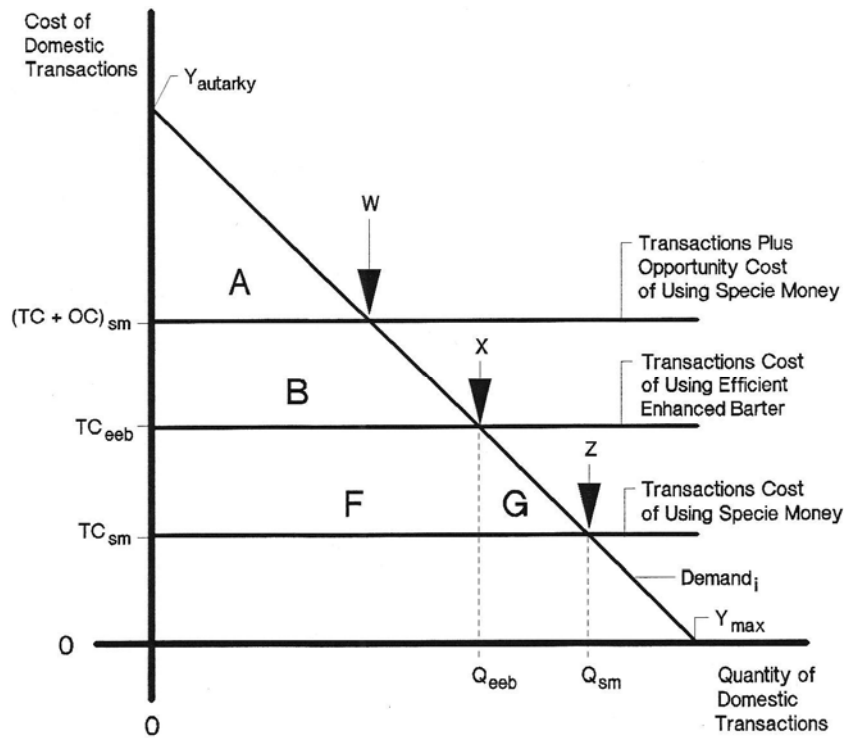


Figure 6. Adding Enhanced Efficient Barter Structures to the Model

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.

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 legislatures issuing the money (Grubb, 2012a). These anchors gave the money general acceptance within the issuing polity. This general acceptance was a step beyond efficient barter structures that were confined to local

exchangeable store book-credits 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 so that $Q_{sm} > Q_{eeb}$. 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_i 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_i 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 $OC_{sm} \geq (TC_{eeb} - TC_{sm})$, the area $(A + 2B + F + G)$ is always greater than the area A. Therefore, Demander_i comes out ahead by using his specie to buy imported goods and using enhanced efficient barter to execute domestic transactions. The outcome for Demander_i in Figure 6 is the same as in Figure 5. In both cases, Demander_i 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_i 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_{*i*} follows his individual welfare maximizing choice and exports his specie to acquire imported goods, then this specie is no longer available for Demanders_{*j* through *n*} to use for executing domestic transactions. Each individual who has an initial stock of specie faces this situation. Demander_{*i*} receives area $(A + 2B + F + G)$ from this choice. Because the specie was exported, it is not available for Demanders_{*j* through *n*} to use. Thus, Demanders_{*j* through *n*} 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_{*i*} and area $(n - 1)(A + B)$ for the rest of society, i.e. for Demanders_{*j* through *n*}. 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. $n_A < [n_A + n_B + (B + F + G)]$. 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. 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. Only moving to enhanced efficient barter can ameliorate 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. Many believed that this scarcity came about before the colonies created their own fiat paper monies. 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. With efficient barter, individual welfare maximizing choices led to socially sub-optimal outcomes. The creation of inside paper monies enhanced social welfare compared with the efficient barter alternative. With the creation of inside paper monies, the colonists could have their cake and eat it too, namely gain the imports that only exporting their specie could buy, while also being able to sufficiently execute domestic transactions without specie money in a way that was potentially welfare enhancing, compared with the next best alternative given British regulatory constraints.

The key 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 the specie (outside) monies could have purchased. As this opportunity cost is driven toward zero via import substitution, namely as domestic goods and imports become close or perfect substitutes, chronic specie (outside money) scarcity disappears. As such, chronic specie scarcity would be more prevalent in small pre-nineteenth century colonial economies than in larger modern developed economies.

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Footnotes

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¹ For examples, see Breen (2004, p. 98); Brock (1975); Davis (1964); Grubb (2004, 2006a, 2006b, 2008); McCusker and Menard (1985); Perkins (1994); and the quotations from Benjamin Franklin below.

² See Michener (1987, 1988); Michener and Wright (2006a, 2006b); footnote 1.

³ See footnotes 1 and 2.

⁴ On Franklin, see Grubb (2006b, 2006c, 2012b); Labaree (1966-1970); Morgan (2002); Oberg (1992-1998); Spiegel (1987). Regarding other contemporary writers on money, see Davis (1964); footnotes 1 and 2.

⁵ For example, see Redish and Weber (2008); Wallace and Zhou (1997). These studies model currency shortages caused by indivisibilities in specie monies. By contrast, the model here (in last section of the paper) assumes that the divisibility of specie money is merely one aspect of the transactions cost of using specie and not the determinant aspect of chronic specie scarcity.

⁶ The first joint-stock specie-based bank in America was the Bank of North America chartered by Congress and by various states in 1781.

⁷ See Benjamin Franklin's description written in February 1767 (Labaree, 1970, v. 14, pp. 33-4).

⁸ At this level of modeling abstraction, money (M) is simply assumed, and all transactions are assumed to be in M, i.e. a fully monetized economy is assumed. In other words, economic models assume that the transactions opportunity cost of M is infinite. The transactions cost of executing an exchange in Y using the next best alternative is so high that it will not exist and so no trades in Y that are not monetized will be observed. The non-applicability of this assumption, however, is at the heart of comprehending initial money creation in colonial America.

⁹ The maximum amount of bills of credit per white capita in these initial emissions for Pennsylvania was approximately 1.2 Pennsylvania pounds in 1724 and 2.3 Pennsylvania pounds in 1731. For Virginia this number was approximately 2.0 Virginia pounds for 1760. At their maximums, these amounts represented only about 4% to 7.5% of the estimated yearly income of poor laborers in Philadelphia, derived from Carter, et al. (2006, v. 5, pp. 652); Grubb (2011, pp.

260-61; 2008; 2012a). Unless wildly high velocities of circulation are posited, these amounts were insufficient to transact all the internal trade within these colonies. Thus, many domestic transactions must have involved some medium of exchange other than bills of credit.

¹⁰ See footnote 2.

¹¹ For discussions of the quantity theory of money with respect to money being an asset and efforts to apply such to colonial America, see Grubb (2004); Laidler (1987); McCallum (1992); Sargent and Wallace (1981); Smith (1985a, 1985b, 1988); West (1978); and Wicker (1985).

¹² From 1727 to 1733, the Maryland legislature debated passing its first paper money act. In 1728, London merchants dealing in Maryland tobacco wrote a letter to Maryland colonists, published in the *Maryland Gazette*, 15 April 1729, encouraging them to change how trade took place within their colony (Gould, 1915, p. 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*." [Italics added.]

¹³ See footnote 12.

¹⁴ A more sophisticated version would have $\Delta M_p = -\Delta\phi EB$ where ϕ is a continuous nonlinear function with ϕ ranging between $1 \geq \phi \geq 0$. Most likely, ϕ would start out near 1 and then decline toward zero as the proportion of monetized exchange nears 100%. In other words, M_p would have some excess utility value or positive transactions opportunity cost advantage as a medium of exchange over EB in a decreasing set of domestic transactions before reaching the ϕ threshold, not necessarily enough to completely displace EB in all trades. This idea is behind the assertion by some writers that M_p could affect Y by making transacting more efficient. The claim being that displacement of EB by M_p would induce more Y , i.e. produce real economic growth. Given that long-run growth in output per year per capita was at best around 0.5%, it is hard to see much room for this effect given that M_p went from zero to a lot of M_p in this era, see Grubb (2004, pp. 351-56; 2012a).

¹⁵ It also informs the experimentations by colonial legislatures to support the value of their paper bills of credit (Grubb 2012a). Fiscal disruptions via tax changes to accommodate money creation are assumed to be small enough and handled credibly enough not to alter Y . To the extent that colonial legislatures would not accept EB in place of either M_p or M_s for paying taxes and governmental fees, M_p would have some excess utility value or positive transactions opportunity cost as a media of exchange in the local economy. 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 here.

¹⁶ The model only required that $OC_{sm} > OC_b$ so that "net" $OC_{sm} > 0$.

¹⁷ For examples from the eighteenth century, see Benjamin Franklin, *A Modest Enquiry into the Nature and Necessity of a Paper-Currency*, written in 1729 (Labaree, 1959, v. 1, pp. 144-5, 148); and Adam Smith, *The Wealth of Nations*, written in 1776 (Smith, 1937, pp. 22-3, 32).

¹⁸ 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.