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COLONIAL AMERICAN PAPER MONEY AND THE QUANTITY THEORY OF MONEY: AN EXTENSION

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ABSTRACT

The quantity theory of money is applied to the paper money regimes of seven of the nine British North American colonies south of New England. Individual colonies, and regional groupings of contiguous colonies treated as one monetary unit, are tested. Little to no statistical relationship, and little to no magnitude of influence, between the quantities of paper money in circulation and prices are found. The failure of the quantity theory of money to explain the value and performance of colonial paper money is a general and widespread result, and not an isolated and anomalous phenomenon.

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Colonial American Paper Money and the Quantity Theory of Money: An Extension

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The quantity theory of money is applied to the paper money regimes of seven of the nine British North American colonies south of New England. Individual colonies, and regional groupings of contiguous colonies treated as one monetary unit, are tested. Little to no statistical relationship, and little to no magnitude of influence, between the quantities of paper money in circulation and prices are found. The failure of the quantity theory of money to explain the value and performance of colonial paper money is a general and widespread result, and not a rare and isolated phenomenon.

1 Introduction

The British North American colonies were the first Western economies to emit sizable amounts of paper money—called *bills of credit*. Colonial legislatures printed bills and placed these bills in their treasuries. They directly spent these bills on soldiers' pay, military provisions, salaries, and so on. Some colonies at various times loaned bills to their subjects who pledged their lands as collateral. Prior to emitting paper money, the media of exchange used in domestic transactions consisted of barter, typically involving book-credit or tobacco; personal bills of exchange and promissory notes; and foreign specie coins. The composition of this media is unknown, though specie coins were considered scarce (Grubb 2012). Legislature-issued paper monies became an important part of the circulating medium of exchange in many colonies. No public or private incorporated banks issuing banknote monies existed in colonial America (Brock 1975; Grubb 2016a; Hammond 1991, pp. 3-67; Newman 2008).

What explains the value and performance of these paper monies and, with it, the inferred political and monetary intentions of colonial legislature? An important economic tool of

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explanation is the quantity theory of money. The spending and loaning into circulation of sizable quantities of paper money by colonial legislatures should have affected local prices, and thus the real value of the paper monies so emitted, through a quantity-theory-of-money mechanism.

The quantity theory of money, at least a prominent version, takes the equation-of-exchange identity, $MV \equiv PY$, as expressed in growth rates, $\ln M + \ln V \equiv \ln P + \ln Y$, and by assuming that $\ln V$ and $\ln Y$ are long-run constants, transforms it into the quantity "theory" of money [$\ln P$ = some constant + $\ln M$]; where M = the money supply, V = the velocity of that money's circulation, P = prices in that money, and Y = traded real output (Bordo 1987, Fisher 1912). West (1978) applied this theory separately to four colonies, namely Massachusetts, New York, Pennsylvania, and South Carolina. He set M equal to the paper money placed in circulation by each colony and estimated $\ln P_t$ = some constant + $\ln M_t$, including one- and two-year lags of M to capture delayed transmission effects of M on P. The price index (P) was expressed in that respective colony's paper money unit-of-account and was taken from data on local prices in that respective colony. In the colonies south of New England, he found no systematic relationship between prices and the quantities of paper monies in circulation—a puzzling result for the quantity theory of money.

One question that has not been previously addressed is whether these findings are indicative of a general and widespread condition or are limited to a few isolated locations. West (1978) only tested the quantity theory of money on 3 of the 8 mainland colonies south of New England, comprising only 38.5 percent of the white (free) population therein—as measured in 1770 (Carter, *et al*. 2006, V, p. 652). In addition, the price indices used by West (1978) were from the port cities of New York City, Philadelphia, and Charleston, whereas the paper money used by West (1978) circulated at least throughout the colonies of New York, Pennsylvania, and

South Carolina.

West (1978) confined his study to New York, Pennsylvania, and South Carolina because, at that time, price indices were only available in the secondary literature for these colonies. Since his study in 1978, commodity and exchange rate price information has become available for other colonies. I use these price data to test the quantity theory of money in the mainland colonies south of New England where it has not been previously tested, namely in New Jersey, Maryland, Virginia, and North Carolina. I also retest the quantity theory of money for New York and Pennsylvania, because I use these colonies in regional grouping tests. My applications, along with those by West (1978), cover 7 of the 8 of the mainland colonies south of New England, comprising 95.8 percent of the white (free) population therein. The results show whether the failure of the quantity theory of money, when applied to the paper monies issued by the American colonies, is a widespread and general phenomena or just an isolated and odd outcome.

In the process, I construct more geographically diverse price indices for Maryland and Virginia than the single-port price indices used by West (1978). I also use prices for sterling bills of exchange drawn on London to create purchasing power parity (PPP) consistent price measures for each colony, thus providing an additional and alternative specification vehicle. For New Jersey and North Carolina, PPP prices are the only price measures currently available. I also provide improved data on the quantities of paper money in circulation for several colonies, namely for New Jersey, Maryland, and Virginia. Finally, I test the quantity theory of money for regional groupings of contiguous colonies, treating them as one monetary unit. Such has never been done before. Whether colonial borders mattered to paper money circulation in a quantity-theory-of-money framework can be explored with these regional-grouping tests.

2 Data Limitations

Statistical testing is limited by the availability of annual data on the amounts of paper money in circulation and on commodity prices. Paper money emissions began in 1709 in New Jersey and New York, 1712 in North Carolina, 1723 in Pennsylvania, 1733 in Maryland, and 1755 in Virginia. Once initiated, with minor exceptions, each colony maintained some amount of its paper money in circulation through 1774. Annual data on the amounts in circulation, however, currently exist for New York only after 1745 and for North Carolina only after 1747. For North Carolina, this evidence ends in 1768 rather than in 1774 as it does for the other colonies. Finally, commodity price evidence for New York only begins in 1748. Thus, the annual data useable for New York span from 1748 to 1774, for New Jersey from 1709 to 1774, for Pennsylvania from 1723 to 1774, for Maryland from 1735 to 1774, for Virginia from 1755 to 1774, and for North Carolina from 1748 to 1768. Out of 308 colony-years when paper money was in circulation, usable annual data for testing the quantity theory of money on a colony-specific level exist for 74 percent of these years—a reasonably comprehensive coverage. The useable data span for various colonial groupings, however, is further limited by the extent of their data overlap.

Besides local commodity price indices, PPP price indices are constructed for each colony. PPP implies that $EX_{XX} = P_{XX}/P_{UK}$, namely the exchange rate (EX) of colony XX's paper money to pounds sterling must equal the ratio of prices in colony XX, expressed in colony XX's paper money (P_{XX}), to prices in England expressed in pounds sterling (P_{UK}). Taking the natural log of both sides and rearranging terms yields $\ln(P_{XX}) = \ln(EX_{XX}) + \text{in}(P_{UK})$. Data on EX_{XX} are taken from McCusker (1978) and Grubb (2015b), and data on P_{UK} are taken from Schumpeter (1938, p. 35). A PPP version of $\ln(P_{XX})$ is constructed for each colony. It is denoted as $\ln(PX_{XX})$ in all tables and figures hereafter, see the notes to Appendix Table 1.

Using the above price and exchange rate data, PPP has been shown to hold for all colonies where colony-specific commodity price indices exist between that colony and England and between that colony and all other colonies with commodity price indices, namely for Massachusetts, New York, Pennsylvania, Maryland, Virginia, South Carolina, Montreal, and Quebec (Grubb 2003, p. 1786; 2005a, p. 1346; 2010, pp. 132-135). If PPP holds for these colonies, then it is reasonable to assume that it holds for New Jersey and North Carolina when using the same data sources. Using PPP price indices in the quantity-theory-of-money framework provides an alternative check on the results using commodity price indices for the colonies of New York, Pennsylvania, Maryland, and Virginia. The exchange rates for constructing PPP prices come from the prices in local paper money for purchasing sterling bills of exchange drawn on London (McCusker 1978). As such, PPP prices can be considered as the local prices of sterling bills of exchange drawn on London, i.e. not that different conceptually from using local wheat or tobacco prices to create a commodity price index.

The commodity price indices for New York and Pennsylvania are the same as used by West (1978), namely from Bezanson, Gray, and Hussey (1935, pp. 6, 433) and Cole (1938, pp. 11, 120-121). These price indices consist of the unweighted averages of 20 commodities for Pennsylvania and 15 commodities for New York. These commodities are import and export goods in the port cities of Philadelphia and New York City, respectively.

For Maryland and Virginia, I construct unweighted price indices from annual data on the prices of wheat, corn, and tobacco. While these indices involve fewer commodities than the indices for Pennsylvania and New York, these three commodities are the most ubiquitously traded local goods in Maryland and Virginia. In addition, I take the raw price data from several counties spanning each colony. Thus, they represent a more colony-wide price effect than the

single-port price indices West (1978) used for Pennsylvania and New York.[2]

3 Data Patterns and Estimation Procedures

The data are presented in Appendix Table 2 and displayed by individual colony in Figures 1, 2, 3, 4, 5, and 6. The figures show that movements in the quantities of paper money are not small. If these movements were only, say, 5, 10, or 20 percent up or down over time, then finding a systematic relationship between paper money and prices might be difficult given noisy price data. The movement in the quantities of paper money in all six colonies, however, are large—doubling, tripling, or even quadrupling up or down over short spans of time. Even given noisy price data, applying the quantity theory of money should reveal substantial positive relationships between movements in paper money and prices. However, the figures also show that paper money and prices do not track each other well. A poor statistically fit seems likely.

[Place Figure 1 Here]

[Place Figure 2 Here]

[Place Figure 3 Here]

[Place Figure 4 Here]

[Place Figure 5 Here]

[Place Figure 6 Here]

The quantity theory of money is a theory about magnitudes. When estimating relationships between paper money and prices, focusing solely on statistical significance is misplaced. At best, statistical significance is a necessary, but not a sufficient condition, for the theory to be a useful explanatory tool. When estimating $\ln P_t = a + b\ln M_t$, the quantity theory of

[2] They are also superior to the price indices used by West (1978, pp. 3-5) for Massachusetts (Boston), where he found statistically significant and reasonably large associations between paper money and prices.

money holds perfectly if $b = 1$ and doesn't hold at all is $b = 0$. No one expects the theory to hold perfectly. Systematic short-run, business cycle-like movements in V and Y, namely deviations from their assumed constant growth values of lnV and lnY, are expected (Fisher 1912; Lucas 1980). Such movements, however, are limited, especially in the face of large changes in M. Resource, technological, and production constraints limit how much Y can move, and transactions costs limit how much V can move. Y or V doubling or tripling over a short span of years stretches credulity. Given sizable movements in M, *b* should be relatively large, much closer to 1 than to 0 for the quantity theory of money to be a useful theory for explaining the value and performance of M. Therefore, the magnitude of *b*, and whether it is unbiased and consistently estimated, is the key concern.[3]

To have comparable results, I use the econometric specifications in West (1978, p. 4), namely $\ln P_t = a + b\ln M_t$, including regressions with one- and two-year lags of M, where M = the paper money supply. See also comparable specifications in Grubb (2004, p. 349) and Rousseau (2007, p. 267). Out of the 90 regressions run on the six individual colonies and their various groupings, 77 exhibit serial correlation, see Appendix Table 1. Statistical theory establishes that coefficients are unbiased and consistently estimated in the presence of serial correlation, but the standard errors are biased down, thus overstating statistical significance. Because the focus of the quantity theory of money is on estimating the magnitude of *b* as an unbiased and consistent coefficient, regressions uncorrected for serial correlation still have a valid interpretation regarding *b*. If *b* is close to zero, it doesn't matter whether serial correlation is corrected or not,

[3] The price indices and exchange rates used here are stationary series, see Grubb (2003, pp. 1784, 1786; 2016a, p. 182). From the figures, the money series appear to be non-stationary. If so, then using OLS to regress M on P might yield spurious results—meaning a non-trivial *b* where in fact no relationship exists. Therefore, if the OLS estimates in fact show that *b* is zero or trivial in magnitude, then we can still be confident that no relationship in fact exists. Adding a trend to the quantity-theory-of-money specification would by itself invalidate the theory, so none is added.

the quantity theory of money is not telling us much about the value and performance of colonial paper monies. In addition, if *b* is not statistically significant, then we can be certain that it is not statistically significant whether or not serial correlation is corrected. Regressions uncorrected for serial correlation still have a valid interpretation for statistically insignificant coefficients.

Correcting for serial correlation is only relevant to the quantity theory of money if *b* is both relatively large and statistically significant. In such cases, correcting for serial correlation is required to avoid erroneously finding statistical significance where it is not. The regressions in Appendix Table 1 show that these conditions are not manifest in any of the regressions.

In any event, for the 77 regressions that exhibit serial correlation, I report regressions that correct that serial correlation by adding lags of the dependent variable until Durbin's Alternative Test for serial correlation fails to reject the hypothesis of no serial correlation. These regressions are reported immediately below the uncorrected regressions in Appendix Table 1. The effect of lagged P on these quantity-theory-of-money regressions has an interesting interpretation for the colonial economy that is explored in section 5 below.

4 Regression Results

Table 1 summarizes the results from the regressions reported in Appendix Table 1 that are uncorrected for serial correlation. For individual colony-specific tests, only 7 of the 30 regressions have statistically significant coefficients on M—again a biased high count. Only Pennsylvania and North Carolina have these statistically significant coefficients. Thus, the lack of any relationship between P and M for New York, New Jersey, Maryland, and Virginia can be accepted with confidence. For Pennsylvania and North Carolina, the magnitude of the relationship between P and M for the statistically significant coefficients is trivial. A 10 percent

increase in M corresponds to a 1.1 and 2.1 percent increase P, respectively.

[Place Table 1 Here]

On the individual colony level among the mainland colonies south of New England, the lack of positive statistical significant and quantitatively meaningful relationships between the quantities of paper monies in circulation and prices are a general and widespread phenomena, and not just confined to the port cities of New York City, Philadelphia, and Charleston. As such, the quantity theory of money is not a useful tool for explaining the value and performance of individual colony's paper money regimes for the colonies south of New England. Correcting for serial correction cannot change this conclusion.

Colonies south of New England did not make the paper money of their neighboring colonies a legal tender within their own jurisdictions. The paper money of each colony was uniquely and easily distinguishable (Newman 2008). Nevertheless, some scholars have asserted that paper monies circulated across colonial borders, particularly between New York, New Jersey, and Pennsylvania, and between Maryland and Pennsylvania.[4] One explanation for the lack of a statistical association between paper money and prices at the individual colony level, as summarized in Table 1, is that the paper money supply is incorrectly measured. The relevant paper money supply might be the combination of the paper monies of contiguous colonies. Such a combination of paper monies *could* yield a positive statistically significant association of relevant magnitudes between prices and the quantity of paper money in circulation.

Table 1 summarizes the results from the regressions in Appendix Table 1 for the combined paper money supplies of various groupings of colonies. All contiguous pairs of

[4] For example, see Brock (1975, pp. 87-89, 92-93, 398; 1992, pp. 89-90, 111-113); Michener (1987, pp. 236, 275). For a debate on the evidence involved, see Grubb (2006a, pp. 46-47, 63-66; 2006b, pp. 487-489, 491-497, 504-505); Michener and Wright (2006a, pp. 13, 24-30, 34-37; 2006b, pp. 260-264, 251).

colonies in the sample are tested as through the pairs are one monetary unit. The same is done for all contiguous triplets of colonies in the sample, and for four and five contiguous groupings running from New York south. The price variables are the unweighted average of the commodity price indices, and the unweighted average of the PPP price indices, available for each grouping. Paper money values are converted to be in comparable units, namely Proclamation values, and price indices are set to 100 in the same year for the colonies so grouped together, see the notes to Appendix Table 1.

For contiguous pairs of colonies treated as single monetary units, 9 out of 30 regressions have statistically significant coefficients on M—again a biased high count. All but one are due to including Pennsylvania or North Carolina, with their individual colony level statistically significant coefficient on M, in the pair. As such, little is gained by treating neighboring colonies as one monetary unit. Only the New York-New Jersey pair adds a new statistically significant positive coefficient on M beyond what exists on the individual colony level.

The magnitude of the relationship between P and M for the statistically significant coefficients among the colonial pairs is trivial. A 10 percent increase in M corresponds to an average increase in P of between 1.3 and 1.9 percent—the maximum being only 2.8 percent. The hypothesis that contiguous pairs of colonies formed one monetary unit, and that such mattered to prices, finds little support in the evidence. As such, the irrelevance of cross-border circulation of paper monies among contiguous pairs of colonies cannot be rejected with confidence.

Table 1 also summarizes the results from the regressions in Appendix Table 1 for contiguous triplet colonial groupings, under the hypothesis that the monetary unit might be larger than just neighboring colonies. Out of 18 regressions, only 3 have statistically significant coefficients on M—again a biased high count. All three are due to including Pennsylvania or

North Carolina, with their individual colony level statistically significant coefficient on M, in their grouping. Thus, nothing is gained by treating contiguous triplets of colonies as one monetary unit. In addition, the magnitude of the relationship between P and M for the statistically significant coefficients among the triplets is trivial. A 10 percent increase in M corresponds to an average increase in P of 2.1 percent—the maximum being only 3 percent.

Lastly, Table 1 summarizes the results from the regressions in Appendix Table 1 for contiguous four and five colonial groupings, spanning from New York to Maryland and from New York to Virginia, under the hypothesis that the monetary unit might be even larger than just contiguous triplet colonial groupings. Out of 12 regressions, only 3 have statistically significant coefficients on M—again a biased high count. All three are due to including Pennsylvania, with its individual colony level statistically significant coefficient on M, in their grouping. Thus, nothing is gained by larger contiguous groupings of colonies as one monetary unit. In addition, the magnitude of the relationship between P and M for the statistically significant coefficients among these larger groupings is trivial. A 10 percent increase in M corresponds to an average increase in P of 0.9 percent—the maximum being only 1.8 percent. The hypothesis that the relevant monetary unit extends across numerous contiguous colonies, and that such mattered to prices, finds little support in the evidence. Again, the irrelevance of cross-border circulation of paper monies among the colonies south of New England cannot be rejected with confidence.

The classical quantity of money assumes that lnV and lnY are long-run constants. The constant term in the regressions in Appendix Table 1 estimates the difference in these long-run constants, namely [lnV – lnY]. In all 90 regressions this constant term is positive, relatively large, and statistically significant. In 35 out of the 77 regression that were corrected for serial correlation this constant term remains positive and statistically significant—the biggest exception

being for New York and for any group that includes New York. Therefore, the conclusion that lnV > lnY in terms of their long-run growth rates can be accepted with confidence. This is an important outcome of applying the quantity theory of money to colonial paper money regimes as it bares on interpretative issues discussed in the next section.

Finally, the magnitude of the constant term creates an accounting problem. The long-run growth of colonial Y per capita per year for the relevant period is thought to be between 0 and 0.6 percent (Egnal 1998, p. 43; Mancall and Weiss 1999, pp. 18, 36; McCusker and Menard 1985, pp. 53-58). Thus, the long-run yearly growth rate in Y is approximately the same as the long-run yearly growth rate of the population. Yearly population growth rates for the relevant period are approximately 6 percent for New York, 8 percent for New Jersey, 14 percent for Pennsylvania, 3 percent for Maryland, 5 percent for Virginia, and 7 percent for North Carolina (derived from Carter, *et al* 2006, v. 5, pp. 682-687). Using these numbers for lnY and setting [lnV – lnY] equal to the constant terms in the regressions in Appendix Table 1 yields what might be considered impossibly high values for lnV. This observation raises the possibly of an accounting problem in the equation of exchange identity, and thus the possibility that M or P are incorrectly measured. Such issues are taken up next.

5 Interpretations, Discussions, and Directions for Future Research

After West (1978) reported his results a number of studies presented alternative approaches to account for the lack of a meaningful relationship between paper money and prices in the colonies south of New England.[5] Given the above results, these studies are not irrelevant exercises. They are addressing a widespread and general phenomenon and not some minor and

[5] See Grubb (2004, 2005b); Hanson (1979); McCallum (1992); Michener (1987, 1988, 2015); Michener and Wright (2005, 2006a, 2006b); Rousseau (2006, 2007); Smith (1985a, 1985b, 1988); Wicker (1985).

localized events. I briefly assess these alternative approach to determine the best direction for future research into what explains the value and performance of colonial paper monies.

The classical quantity theory of money assumes that lnV and lnY are long-run constants. Thus, a natural place to start is to relax that assumption and let either lnV or lnY vary in the short-run to account for changes in M not accounted for by changes in P. Given shocks to M, the classical quantity theory of money allows for short-run variation in Y and V through a business cycle-like transition process (Fisher 1912). For the colonies south of New England, increases in M could be accounted for by short-run increases in Y or short-run decreases in V, such that P is left unchanged.

The problem with applying this approach to colonial paper money regimes is one of magnitudes. The equation of exchange is an identity. The magnitudes must sum up. Finding statistically significant positive relationships between M and Y, or negative relationships between M and V, are unimportant if the magnitudes are trivial in the face of large movements in M. For example, the growth rate of M for New York between 1754 and 1759 averages 47 percent per year, for New Jersey between 1732 and 1762 it averages 66 percent per year, for Pennsylvania between 1723 and 1760 it averages 83 percent per year, for Maryland between 1764 and 1774 it averages 39 percent per year, and for Virginia between 1755 and 1760 it averaged 116 percent per year. From the estimates in Appendix Table 1, the growth rate of P in Pennsylvania is at best 1.4 percent per year, and is zero for New York, New Jersey, Maryland, and Virginia. To make the equation of exchange identity sum up, the positive growth rates in Y (or negative growth rates in V) would have to be in the 40 to 116 percent per year range during these periods in these colonies—an absurd outcome.

Measuring Y in colonial economies is difficult. Some direct evidence on imports and

exports is available, but the rest of Y has to be conjectured. Using real exports as a proxy for Y for Pennsylvania, Rousseau (2007) found a statistically significant positive relationship between M and Y, thus accounting for some of the gap between changes in M and changes in P in the equation of exchange for Pennsylvania. Given the size of the accounting gap, the amount accounted for, however, is relatively trivial. Developing better measures of Y, and exploring to what extent changes in M could increase Y by reducing transactions costs, are in themselves important pursuits. However, the likelihood that movements in Y can add much to explaining the value and performance of paper money is doubtful. The magnitudes are too small.

A similar problem exists when focusing on changes in V as the solution to the lack of a relationship between M and P. Some scholars have hypothesized that, given how colonial legislatures structured their paper money, citizens were induced to hold and not spend their paper money (reduce V) as a direct reaction to increases M, and vice versa. Therefore, $\ln M = -\ln V$. Because the M spent by the legislature would have to be paid back to the legislature in taxes in the near future, and because M borrowed by citizens from the treasury would have to be paid back to the treasury with interest in the near future, citizens being paid in M or borrowing M would not spend it, but simply hold it in order to make these future payments. This possibility is only a hypothesis because direct evidence on V does not currently exist (Grubb 2005b; Smith 1985a, 1985b, 1988; Wicker 1985).

Indirect evidence on V, however, indicates that this avenue of research is problematic. No literary or anecdotal evidence has been found that shows large-scale hoarding of M in the face of large expansions in M in any of the colonies south of New England. In fact, paper money suffered substantial wear and tear from excessive hand-to-hand circulation as judged by the amounts of paper money held in reserve by colonial treasuries to replace worn and torn bills that

could not continue in circulation (Grubb 2016a, pp. 155-156; Hanson 1979). The logic of such hoarding behavior is also questionable. In many of the colonies, M was put into circulation by citizens borrowing it from the treasury. That citizens would borrow M and just hold it because they knew they would have to repay the loan with interest in the near future would be an irrational act. Finally, the size of hypothesized movements in V needed to fully offset movements in M is inconsistent with the large positive lnV estimated in the regressions in Appendix Table 1. How legislatures structured their paper money may matter. Legislatures did spent substantial amounts of time and legal space detailing how their paper money was to perform. That structure, however, does not matter in term of changing V in a way to make the equation of exchange sum up when there is little relationship between M and P.

Another possible explanation for the lack of relationship between M and P in the classic quantity theory of money estimation is that M or P are erroneously measured. The recent demonstration that PPP holds between colonies, and also holds between England and each colony, indicates that poorly measured prices and exchange rates are likely not the problem (Grubb 2003, p. 1786; 2005a, p. 1346; 2010, pp. 132-135). While the price data are somewhat noisy, the market arbitrage that makes PPP hold is consistent with reliable measures of prices and exchange rates.

Mismeasurement of M is another issue. For example, equating M with only paper money misses the possibility that other monies, namely foreign specie coins, were in use. If exchange rates between paper money and foreign specie coins were fixed, and enough specie monies were present in the economy, then as paper money increased, specie money would exit the colony in a perfect one-for-one displacement. This action would leave the total money supply, and thus P, constant. As a result, increases and decreases in the paper money supply would be unrelated to

changes in prices (McCallum 1992; Michener 1987, 1988, 2015; Michener and Wright 2005, 2006a, 2006b).

This explanation is problematic for several reason. First, reliable and direct quantitative data on specie monies do not currently exist, and so the hypothesized effect cannot be systematically tested. Second, the institutional apparatus needed to execute a fixed exchange rate regime was not present, and the exchange rate evidence is more consistent with a flexible than a fixed exchange rate regime. Third, the literary and anecdotal evidence is ubiquitous and overwhelming in its insistence that specie monies were scarce, and that it was the absence of specie monies that led to paper money being emitted and not the emission of paper money that led to specie monies becoming scarce. Finally, efforts to indirectly estimate the level and change in specie monies for Pennsylvania finds no systematic displacement of specie money by paper money, and sometimes the opposite, namely that paper money and specie monies moved together (Grubb 2004, 2006a, 2006b. 2012).

Mismeasurement of M, however, may still be the culprit, but in a more fundamental way than just unmeasured components of the money supply. The equation of exchange and the quantity theory of money assumes a fully monetized economy. Yet, the colonial economy was far from fully monetized. Many transactions were executed via barter structures, book credits, personal promissory notes, etc., with no "money" changing hands. These transactions were priced in the paper money's unit of account, but with no paper money changing hands to consummate the trade (for examples see Baxter 1965, *Callister Papers*, and *William Fitzhugh Ledgers, 1761-1774*). Thus, Y and P contain a lot of activity that is not captured by M. The equation of exchange as an accounting identity is broken at this juncture.

Increases in M may simply displace barter transactions with little net gain in economic activity, thus causing little change in P. The small gains in transaction costs that accompany using M rather than barter structures to execute trades may explain the small increases in Y associated with increases in M found in some studies (Rousseau 2007). If P is being determined primarily in trades taking place without the use of M in an economy with little technological or productivity changes, then P this year should be strongly determined by P from prior years, with M having little influence.

This outcome can be seen by comparing the uncorrected with the corrected regressions for serial correlation reported in Appendix Table 1. Adding lagged values of P as independent variables until serial correlation is eliminated substantially improves the regression fit in terms of R^2 and F-statistic measures. Adding lagged values of P also biases the coefficients on the other independent regressors down, in effect lagged P absorbs their influence (Achen 2000). Prices through time appear to be determined largely by the constancy of the barter part of the economy. This view implies that the quantity theory of money, and even more generally the equation of exchange, are not useful tools for explaining the value and performance of colonial paper monies. No improvement in the measurements of M, P, Y and V, or adding specie monies to M, will change this. A different evaluative approach is needed.

Colonial legislature structured their M to be more like a barter asset than a money (that is as we typically think of money today). Most often M was structured like a zero-coupon bond with variable and fuzzy maturity dates (Grubb 2016a). M competed with other barter assets and credits in the economy for how transactions would be executed. As such, explaining M's value and performance requires a different approach than that derived from the equation of exchange. One such approach is to use M in an asset pricing model to track it present value over time as a

real barter asset, and then to measure its market performance against its expected risk-free present value baseline. This approach has shown promise when applied to the colonial paper monies of New Jersey, Virginia, and post-Seven Year's War Maryland (Celia and Grubb 2016; Grubb 2015b, 2016a, 2016b). Application of this approach to other colonies will have to be completed before this approach can be considered as a generally superior method for determining the value and performance of colonial paper monies.

6 Conclusions

For the British mainland colonies south of New England, using a quantity-theory-of-money framework derived from the equation of exchange, I show that the lack of a statistical and relevant quantitative relationship between paper money and prices is a general and widespread phenomena, and not just a limited or rare event. I show this for individual colonies, as well as for contiguous colonies treated as a single monetary unit.

These results have several implications regarding the direction of future research. First, why the British government, as well as some pamphleteers and essayists, failed to grasp that colonial legislatures, at least those south of New England, could emit more or less paper money without systematically effecting prices or exchange rates needs to be better explained. Was it just a case where simplistic and inapplicable theoretical notions trumped the facts on the ground, or was the information available at the time just not sufficient to see what we see in our quantitative estimates? Second, what explains the difference in the relationship between paper money and prices in New England compared with the rest of the colonies south of New England (Officer 2005; West 1978, p. 4)? Were the paper monies structured differently? Did the economies perform differently? Could an asset-pricing model explain the value and performance of New

England paper money just as well as the quantity theory of money does? Finally, the results here indicate that the quantity theory of money, and more generally the equation of exchange, are poor tools for evaluating the value and performance of colonial paper monies. Developing other approaches, such as asset-pricing models applied to M, would seem warranted. Clearly there are many puzzles still to solved and room for more research into colonial paper money regimes.

[Place Appendix Table 1 Here]

[Place Appendix Table 2 Here]

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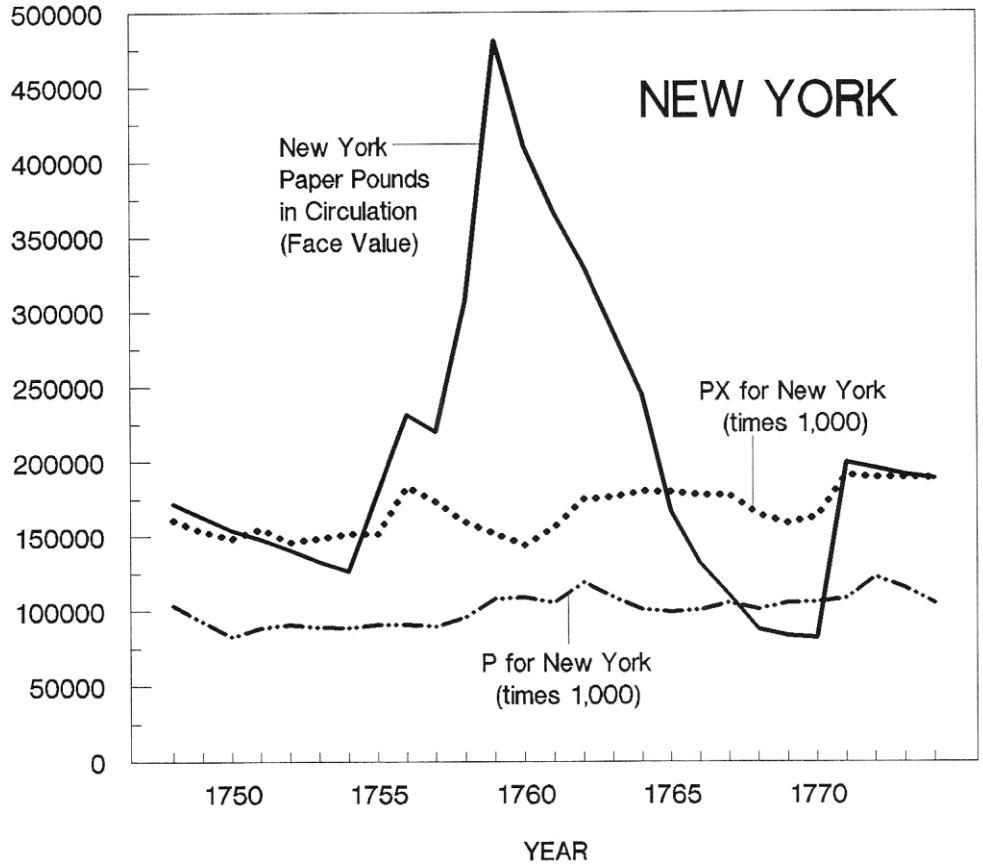

Fig. 1 New York paper money in circulation and New York prices

Sources: Appendix Table 2 and text.

Notes: P = commodity price index and PX = purchasing power parity price index. These price indexes are rescaled to fit on the same vertical axis as the quantity of paper money in circulation.

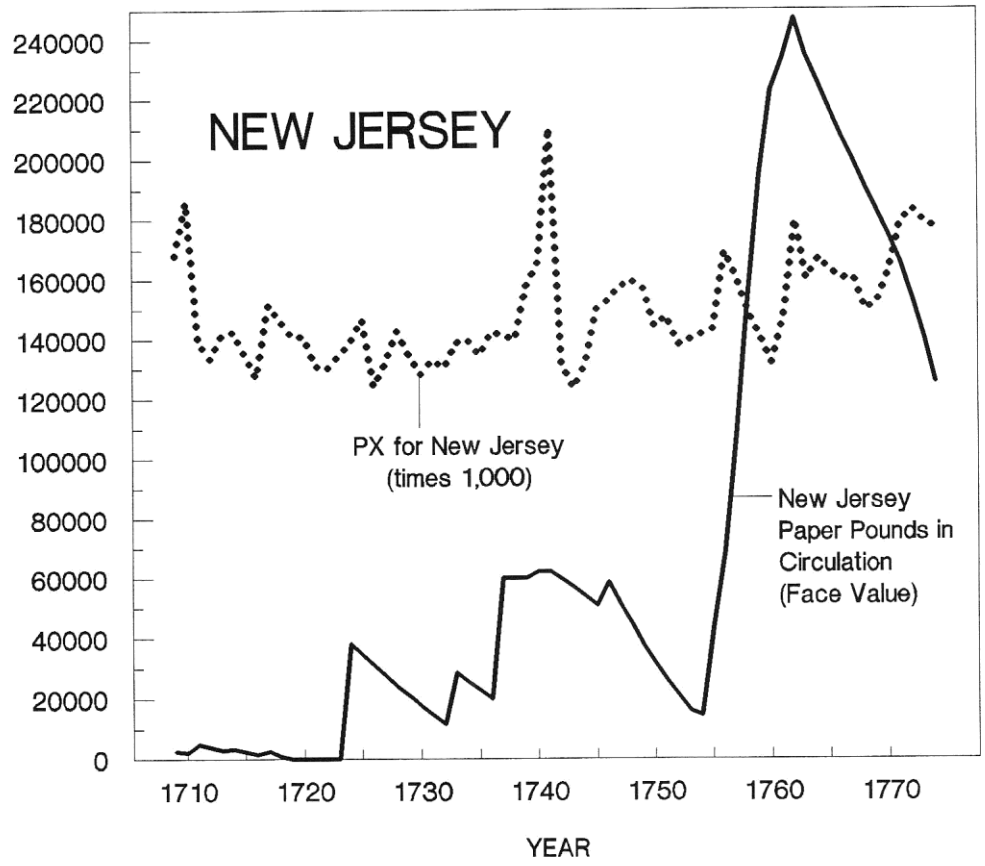

Fig. 2 New Jersey paper money in circulation and New Jersey prices

Sources: Appendix Table 2 and text.

Notes: See the notes to Figure 1.

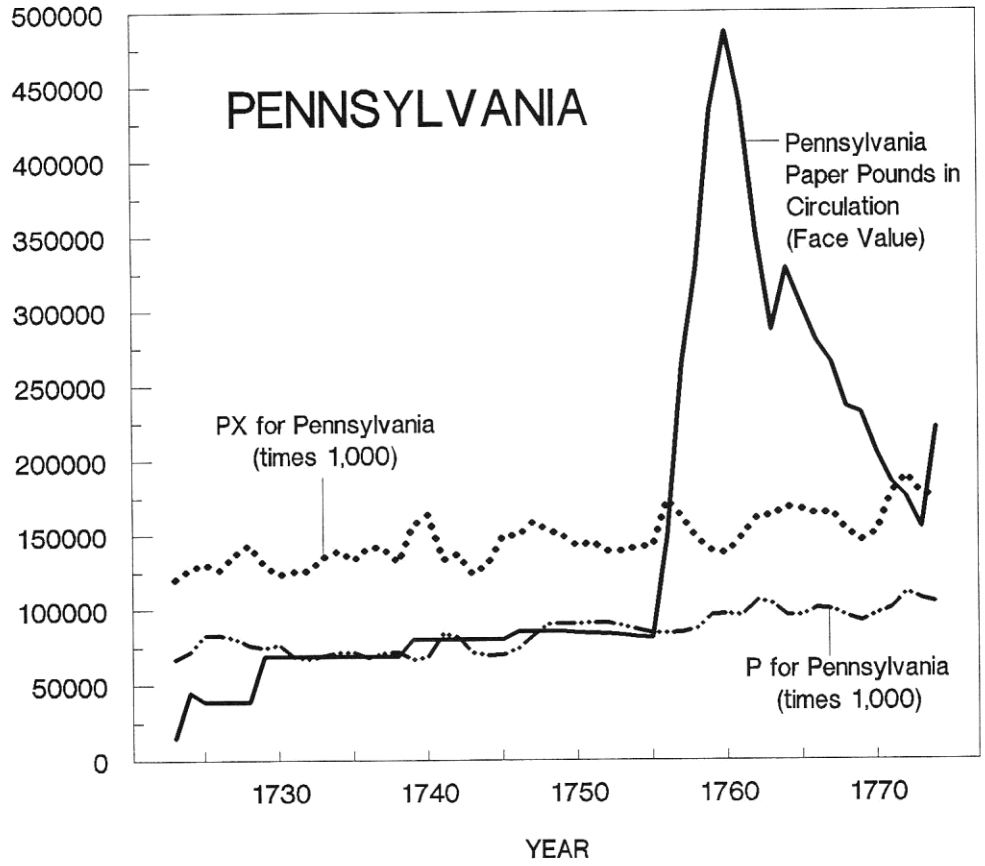

Fig. 3 Pennsylvania paper money in circulation and Pennsylvania prices

Sources: Appendix Table 2 and text.

Notes: See the notes to Figure 1.

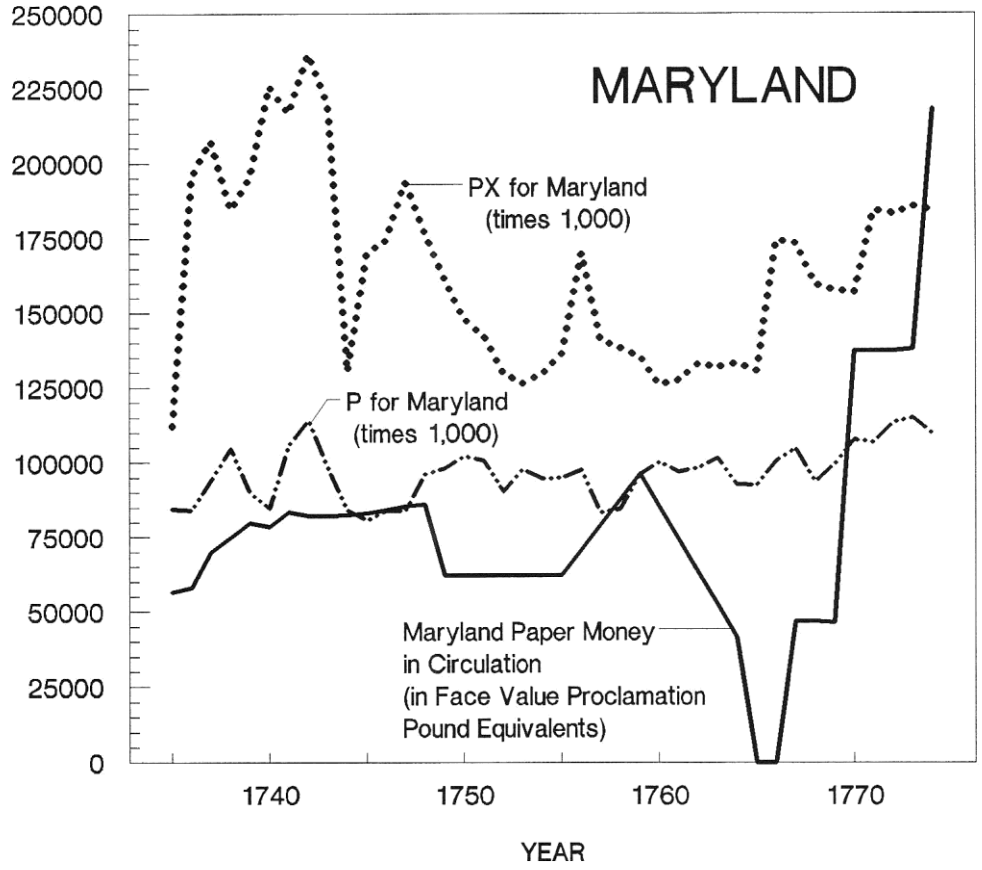

Fig. 4 Maryland paper money in circulation and Maryland prices

Sources: Appendix Table 2 and text.

Notes: See the notes to Figure 1. Proclamation value was 1.33 paper pounds being equal to 1 pound sterling, see the notes to Appendix Table 1.

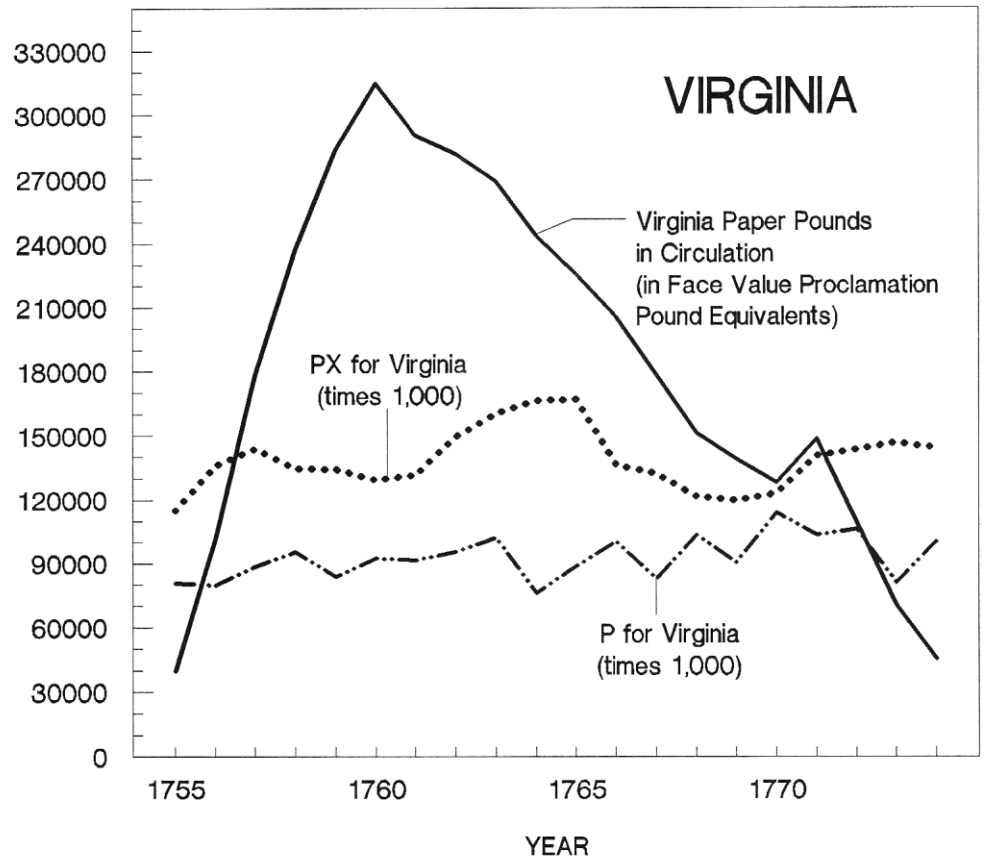

Fig. 5 Virginia paper money in circulation and Virginia prices

Sources: Appendix Table 2 and text.

Notes: See the notes to Figure 4.

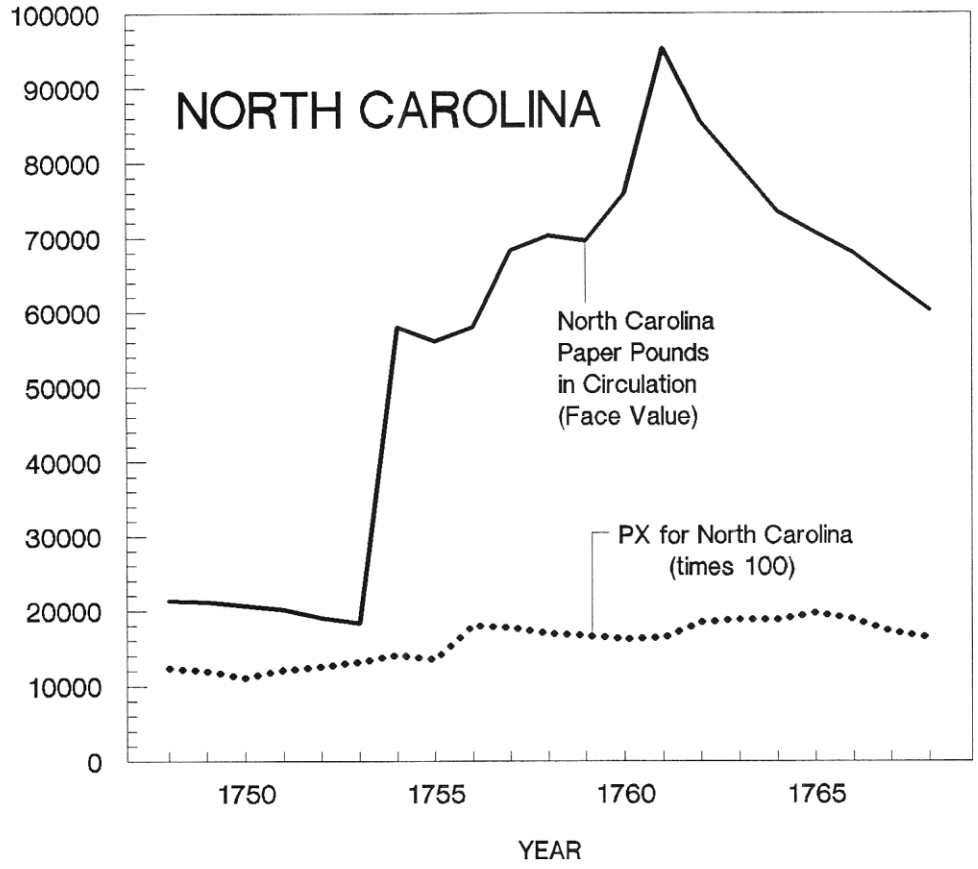

Fig. 6 North Carolina paper money in circulation and North Carolina prices

Sources: Appendix Table 2 and text.

Notes: See the notes to Figure 1.

Table 1 Regression Results Uncorrected for Serial Correlation

Colony or Colonies	Regressions with Statistically Significant Positive Coefficients on M	Coefficients on M that are Positive and Statistically Significant	Percentage Increase in P Given a 10 Percent Increase in M among the Statistically Significant Coefficients on M	
			Average	*Maximum*
NY	0 out of 6	0 out of 12	----	----
NJ	0 out of 3	0 out of 6	----	----
PA	4 out of 6	4 out of 12	1.1	1.4
MD	0 out of 6	0 out of 12	----	----
VA	0 out of 6	0 out of 12	----	----
NC	3 out of 3	4 out of 6	2.1	2.7
NY & NJ	1 out of 6	1 out of 12	1.5	1.5
NJ & PA	4 out of 6	4 out of 12	1.3	2.2
PA & MD	3 out of 6	3 out of 12	1.9	2.8
MD & VA	0 out of 6	0 out of 12	----	----
VA & NC	1 out of 6	1 out of 12	1.4	1.4
NY & NJ & PA	2 out of 6	2 out of 12	1.6	2.2
MD & VA & NC	1 out of 6	1 out of 12	3.0	3.0
MD & PA & NJ	0 out of 6	0 out of 12	----	----
MD & PA & NJ & NY	2 out of 6	2 out of 12	1.3	1.8
VA & MD & PA & NJ & NY	1 out of 6	1 out of 12	0.0	0.0
Totals	22 out of 90	23 out of 180		

Sources: Appendix Tables 1.
Notes: See the notes to Appendix Table 1. NY = New York, NJ = New Jersey, PA = Pennsylvania, MD = Maryland, VA = Virginia, and NC = North Carolina. Statistically insignificant coefficients on M are evaluated as zeros.

Appendix Table 1 Regression Results

Dependent Variable: $\ln_t$	Constant Coefficient	(SE)	$\ln(M_t)$ Coefficient	(SE)	$\ln(M_{t-1})$ Coefficient	(SE)	$\ln(M_{t-2})$ Coefficient	(SE)	*Lags*	*N*	Adjusted R^2	*F*
New York, 1747-1774												
P_{NY}	3.87***	(0.49)	0.06	(0.04)					0	27	0.05	2.3
P_{NY}	0.77	(0.63)	0.03	(0.03)					1	26	0.59	18.8***
PX_{NY}	5.07***	(0.46)	0.00	(0.04)					0	28	0.00	0.0
PX_{NY}	1.02	(0.85)	0.02	(0.03)					1	27	0.49	13.5***
P_{NY}	3.81***	(0.53)	0.04	(0.08)	0.03	(0.08)			0	26	0.01	1.1
P_{NY}	0.72	(0.64)	0.08	(0.05)	-0.05	(0.05)			1	26	0.59	12.8***
PX_{NY}	5.11***	(0.50)	0.02	(0.07)	-0.02	(0.07)			0	27	0.00	0.1
PX_{NY}	0.95	(0.83)	0.08	(0.05)	-0.07	(0.05)			1	27	0.51	10.0***
P_{NY}	3.98***	(0.58)	0.01	(0.09)	0.10	(0.13)	-0.06	(0.09)	0	25	0.02	0.9
P_{NY}	0.83	(0.61)	0.05	(0.05)	0.03	(0.08)	-0.07	(0.05)	1	25	0.64	11.5***
PX_{NY}	5.18***	(0.56)	0.01	(0.08)	0.01	(0.12)	-0.03	(0.08)	0	26	0.00	0.1
PX_{NY}	0.87	(0.91)	0.09	(0.06)	-0.09	(0.09)	0.02	(0.06)	1	26	0.49	6.9***
New Jersey, 1709-1774												
PX_{NJ}	12.29***	(0.06)	0.01	(0.01)					0	66	0.00	0.0
PX_{NJ}	3.86***	(1.07)	0.00	(0.00)					1	65	0.50	32.9***
PX_{NJ}	12.26***	(0.05)	-0.00	(0.01)	0.01	(0.01)			0	65	0.00	1.1
PX_{NJ}	3.88***	(1.07)	-0.00	(0.01)	0.01	(0.01)			1	65	0.49	21.8***
PX_{NJ}	12.23***	(0.05)	0.00	(0.01)	0.01	(0.02)	-0.00	(0.01)	0	64	0.03	1.6
PX_{NJ}	4.92***	(1.05)	0.00	(0.01)	0.01	(0.01)	-0.01	(0.01)	1	64	0.49	14.2***
Pennsylvania, 1723-1774												
P_{PA}	2.81***	(0.22)	0.14***	(0.02)					0	52	0.50	52.7***
P_{PA}	0.30	(0.26)	0.03**	(0.02)					3	49	0.88	85.6***
PX_{PA}	3.98***	(0.18)	0.09***	(0.02)					0	52	0.37	30.6***
PX_{PA}	1.50***	(0.49)	0.03	(0.02)					1	51	0.57	34.2***
P_{PA}	2.79***	(0.26)	0.03	(0.07)	0.11*	(0.06)			0	51	0.50	26.5***
P_{PA}	0.64**	(0.26)	-0.02	(0.05)	0.06	(0.05)			2	50	0.85	70.8***
PX_{PA}	4.00***	(0.20)	0.06	(0.06)	0.02	(0.05)			0	51	0.31	12.5***
PX_{PA}	1.51***	(0.50)	0.02	(0.05)	0.01	(0.04)			1	51	0.56	22.4***
P_{PA}	2.74***	(0.24)	-0.03	(0.09)	0.13	(0.12)	0.04	(0.07)	0	50	0.50	17.6***
P_{PA}	0.33	(0.28)	-0.00	(0.05)	0.04	(0.08)	-0.00	(0.05)	3	49	0.87	55.5***
PX_{PA}	4.05***	(0.20)	0.11	(0.07)	-0.14	(0.10)	0.11**	(0.05)	0	50	0.34	9.3***
PX_{PA}	1.63***	(0.51)	0.03	(0.06)	-0.08	(0.08)	0.07*	(0.04)	1	50	0.56	16.8***
Maryland, 1735-1774												
P_{MD}	4.55***	(0.07)	0.00	(0.01)					0	40	0.00	0.1
P_{MD}	2.85***	(0.70)	-0.00	(0.01)					2	38	0.34	7.3***
PX_{MD}	4.98***	(0.14)	0.01	(0.01)					0	40	0.00	0.5
PX_{MD}	1.86***	(0.62)	-0.00	(0.01)					1	39	0.40	13.8***
P_{MD}	4.58***	(0.08)	0.01	(0.01)	-0.01	(0.01)			0	39	0.00	0.6
P_{MD}	2.85***	(0.71)	0.00	(0.01)	-0.00	(0.01)			2	38	0.33	5.5***
PX_{MD}	5.05***	(0.15)	0.02	(0.01)	-0.01	(0.01)			0	39	0.00	0.7***
PX_{MD}	1.93***	(0.62)	0.00	(0.01)	-0.01	(0.01)			1	39	0.40	9.4***
P_{MD}	4.56***	(0.09)	0.01	(0.01)	-0.01	(0.01)	0.00	(0.01)	0	38	0.00	0.4
P_{MD}	2.70***	(0.72)	0.00	(0.01)	-0.01	(0.01)	0.01	(0.01)	2	38	0.33	4.7***
PX_{MD}	5.00***	(0.18)	0.02	(0.02)	-0.02	(0.02)	0.01	(0.02)	0	38	0.00	0.5
PX_{MD}	1.20**	(0.58)	0.00	(0.01)	-0.02	(0.01)	0.01	(0.01)	1	38	0.55	12.3***

Virginia, 1755-1774												
P_{VA}	4.39***	(0.52)	0.01	(0.04)					0	20	0.00	0.1
PX_{VA}	4.30***	(0.46)	0.05	(0.04)					0	20	0.04	1.9
PX_{VA}	1.97*	(0.92)	0.01	(0.03)					2	18	0.53	7.4***
P_{VA}	4.64***	(0.63)	-0.10	(0.09)	0.09	(0.08)			0	19	0.00	0.7
PX_{VA}	4.63***	(0.57)	-0.01	(0.08)	0.04	(0.07)			0	19	0.00	0.2
PX_{VA}	2.74**	(1.07)	-0.12	(0.11)	0.19	(0.15)			2	17	0.56	5.0**
P_{VA}	5.22***	(0.81)	0.07	(0.23)	-0.20	(0.40)	0.07	(0.17)	0	18	0.00	0.3
PX_{VA}	4.41***	(0.76)	-0.09	(0.21)	0.18	(0.38)	-0.04	(0.16)	0	18	0.00	0.2
PX_{VA}	2.02**	(0.91)	0.12	(0.14)	-0.23	(0.25)	0.15	(0.11)	2	18	0.54	5.1**
North Carolina, 1748-1768												
PX_{NC}	2.11***	(0.37)	0.27***	(0.03)					0	21	0.76	63.0***
PX_{NC}	1.00*	(0.48)	0.12**	(0.06)					1	20	0.82	45.0***
PX_{NC}	2.03***	(0.37)	0.12	(0.08)	0.16**	(0.07)			0	20	0.78	34.5***
PX_{NC}	1.16**	(0.51)	0.08	(0.07)	0.07	(0.08)			1	20	0.82	30.0***
PX_{NC}	1.99***	(0.32)	0.11*	(0.06)	-0.02	(0.08)	0.19***	(0.06)	0	19	0.85	34.7***
PX_{NC}	1.83***	(0.51)	0.09	(0.06)	-0.02	(0.08)	0.19**	(0.07)	2	19	0.86	22.6***
New York and New Jersey, 1748-1774												
P_{NY}	2.77***	(0.41)	0.15***	(0.03)					0	27	0.42	19.9***
P_{NY}	0.93*	(0.63)	0.08**	(0.03)					1	26	0.67	26.8***
$PX_{NY+NJ}/2$	4.35***	(0.48)	0.06	(0.04)					0	27	0.05	2.3
$PX_{NY+NJ}/2$	1.17	(0.79)	0.03	(0.03)					1	26	0.47	12.2***
P_{NY}	2.59***	(0.41)	0.04	(0.08)	0.12	(0.08)			0	26	0.47	12.2***
P_{NY}	0.84	(0.57)	0.11	(0.07)	-0.03	(0.08)			1	26	0.66	17.3***
$PX_{NY+NJ}/2$	4.29***	(0.51)	0.01	(0.10)	0.05	(0.10)			0	26	0.02	1.2
$PX_{NY+NJ}/2$	1.12	(0.82)	0.06	(0.08)	-0.04	(0.08)			1	26	0.45	7.9***
P_{NY}	2.59***	(0.46)	0.05	(0.10)	0.09	(0.16)	0.02	(0.10)	0	25	0.43	7.2***
P_{NY}	0.82	(0.58)	0.09	(0.08)	0.01	(0.13)	-0.04	(0.08)	1	25	0.66	12.5***
$PX_{NY+NJ}/2$	4.25***	(0.57)	0.03	(0.12)	-0.01	(0.20)	0.04	(0.12)	0	25	0.00	0.7
$PX_{NY+NJ}/2$	1.09	(0.86)	0.07	(0.09)	-0.08	(0.15)	0.03	(0.09)	1	25	0.43	5.5***
New Jersey and Pennsylvania, 1725-1774												
P_{PA}	2.85***	(0.21)	0.13***	(0.02)					0	52	0.52	55.5***
P_{PA}	0.61**	(0.26)	0.04***	(0.01)					2	50	0.85	96.3***
$PX_{PA+NJ}/2$	4.06***	(0.17)	0.08***	(0.01)					0	52	0.35	28.8***
$PX_{PA+NJ}/2$	2.14***	(0.55)	0.04**	(0.02)					2	50	0.58	24.0***
P_{PA}	2.78***	(0.23)	0.05	(0.05)	0.09*	(0.05)			0	51	0.53	28.8***
P_{PA}	0.66**	(0.26)	0.00	(0.05)	0.04	(0.05)			2	50	0.85	71.7***
$PX_{PA+NJ}/2$	4.03***	(0.19)	0.06	(0.05)	0.02	(0.04)			0	51	0.32	12.9***
$PX_{PA+NJ}/2$	2.17***	(0.56)	0.01	(0.06)	0.03	(0.06)			2	50	0.58	17.8***
P_{PA}	2.72***	(0.23)	-0.09	(0.09)	0.22*	(0.11)	0.01	(0.05)	0	50	0.54	20.3***
P_{PA}	0.40	(0.27)	-0.03	(0.05)	0.13**	(0.06)	-0.06**	(0.03)	1	50	0.85	72.9***
$PX_{PA+NJ}/2$	4.04***	(0.20)	0.07	(0.08)	-0.03	(0.10)	0.04	(0.04)	0	50	0.30	8.1***
$PX_{PA+NJ}/2$	2.24***	(0.57)	0.02	(0.06)	-0.00	(0.08)	0.03	(0.03)	2	50	0.57	14.2***
Pennsylvania and Maryland, 1735-1774												
$P_{MD+PA}/2$	2.91***	(0.38)	0.13***	(0.03)					0	40	0.31	18.2***
$P_{MD+PA}/2$	0.59	(0.52)	0.03	(0.02)					3	37	0.68	20.2***
$PX_{MD+PA}/2$	5.30***	(0.50)	-0.02	(0.04)					0	40	0.00	0.2
$PX_{MD+PA}/2$	2.67**	(0.81)	-0.03	(0.03)					1	39	0.30	9.2***
$P_{MD+PA}/2$	2.87***	(0.38)	-0.03	(0.09)	0.16*	(0.09)			0	39	0.32	9.9***
$P_{MD+PA}/2$	0.62	(0.51)	-0.04	(0.06)	0.09	(0.06)			3	37	0.69	17.0***
$PX_{MD+PA}/2$	5.61***	(0.50)	0.05	(0.12)	-0.10	(0.12)			0	39	0.00	0.8
$PX_{MD+PA}/2$	2.74***	(0.83)	0.02	(0.10)	-0.04	(0.10)			1	39	0.28	6.0***

$P_{MD+PA}/2$	2.81***	(0.36)	0.07	(0.09)	-0.21	(0.16)	0.28***	(0.10)	0	38	0.41	9.6***
$P_{MD+PA}/2$	0.89	(0.53)	0.00	(0.07)	-0.06	(0.12)	0.12	(0.08)	3	37	0.70	15.0***
$PX_{MD+PA}/2$	5.48***	(0.52)	0.10	(0.13)	-0.27	(0.23)	0.13	(0.15)	0	38	0.00	0.7
$PX_{MD+PA}/2$	1.79**	(0.87)	0.07	(0.10)	-0.2	(0.18)	0.14	(0.11)	1	38	0.38	6.7***
Maryland and Virginia, 1755-1774												
$P_{MD+VA}/2$	4.10***	(0.70)	0.04	(0.06)					0	20	0.00	0.4
$P_{MD+VA}/2$	2.36	(1.39)	0.01	(0.07)					1	19	0.12	2.2
$PX_{MD+VA}/2$	5.32***	(0.76)	-0.03	(0.06)					0	20	0.00	0.2
$PX_{MD+VA}/2$	3.92**	(1.39)	-0.11*	(0.06)					1	19	0.44	8.0***
$P_{MD+VA}/2$	4.66***	(0.95)	-0.06	(0.12)	0.05	(0.09)			0	19	0.00	0.2
$PX_{MD+VA}/2$	7.09***	(0.83)	-0.21*	(0.10)	0.04	(0.08)			0	19	0.20	3.3*
$PX_{MD+VA}/2$	3.87**	(1.48)	-0.10	(0.10)	-0.01	(0.07)			1	19	0.40	5.0**
$P_{MD+VA}/2$	4.78***	(1.12)	0.07	(0.15)	-0.22	(0.20)	0.14	(0.11)	0	18	0.00	0.6
$PX_{MD+VA}/2$	7.03***	(1.06)	-0.17	(0.14)	-0.04	(0.19)	0.04	(0.10)	0	18	0.14	1.9
$PX_{MD+VA}/2$	0.71	(2.06)	-0.03	(0.11)	0.00	(0.14)	0.05	(0.08)	1	18	0.50	5.3***
Virginia and North Carolina, 1755-1768												
P_{VA}	3.36***	(0.83)	0.09	(0.07)					0	14	0.06	1.9
$PX_{VA+NC}/2$	3.34***	(0.76)	0.14**	(0.06)					0	14	0.24	5.0**
$PX_{VA+NC}/2$	-0.55	(1.88)	0.13	(0.09)					2	12	0.54	5.3**
P_{VA}	4.05**	(1.51)	-0.09	(0.22)	0.12	(0.15)			0	13	0.00	0.6
$PX_{VA+NC}/2$	4.92***	(1.27)	-0.04	(0.19)	0.05	(0.12)			0	12	0.00	0.1
$PX_{VA+NC}/2$	0.70	(1.85)	-0.09	(0.15)	0.21	(0.13)			2	12	0.63	5.6**
P_{VA}	4.96**	(2.07)	-0.05	(0.84)	-0.02	(1.43)	0.03	(0.64)	0	12	0.00	0.0
$PX_{VA+NC}/2$	4.04**	(1.59)	0.84	(0.64)	-1.47	(1.10)	0.71	(0.49)	0	12	0.00	0.9
$PX_{VA+NC}/2$	-0.78	(2.08)	0.66	(0.48)	-0.94	(0.83)	0.43	(0.38)	1	12	0.44	3.2**
New York, New Jersey, and Pennsylvania, 1748-1774												
$P_{NY+PA}/2$	3.27***	(0.36)	0.10***	(0.03)					0	27	0.32	13.4***
$P_{NY+PA}/2$	0.76	(0.50)	0.05**	(0.02)					1	26	0.71	31.2***
$PX_{NY+NJ+PA}/3$	4.42***	(0.45)	0.05	(0.03)					0	27	0.04	2.1
$PX_{NY+NJ+PA}/3$	1.21	(0.79)	0.02	(0.03)					1	26	0.47	12.1***
$P_{NY+PA}/2$	3.13***	(0.32)	-0.11	(0.08)	0.22***	(0.07)			0	26	0.49	13.1***
$P_{NY+PA}/2$	0.91	(0.60)	0.02	(0.07)	0.04	(0.07)			1	26	0.70	20.2***
$PX_{NY+NJ+PA}/3$	4.39***	(0.48)	0.02	(0.11)	0.03	(0.11)			0	26	0.00	1.0
$PX_{NY+NJ+PA}/3$	1.19	(0.80)	0.04	(0.08)	-0.02	(0.08)			1	26	0.45	7.8***
$P_{NY+PA}/2$	3.05***	(0.37)	-0.05	(0.11)	0.08	(0.20)	0.08	(0.11)	0	25	0.47	8.1***
$P_{NY+PA}/2$	0.87	(0.63)	-0.01	(0.09)	0.10	(0.15)	-0.04	(0.09)	1	25	0.68	13.9***
$PX_{NY+NJ+PA}/3$	4.14***	(0.53)	0.18	(0.16)	-0.32	(0.28)	0.21	(0.16)	0	25	0.03	1.2
$PX_{NY+NJ+PA}/3$	1.08	(0.80)	0.17	(0.12)	-0.31	(0.31)	0.18	(0.12)	1	25	0.48	6.5***
New Jersey, Pennsylvania and Maryland, 1735-1774												
$P_{MD+PA}/2$	3.68***	(0.71)	0.24	(0.20)					0	40	0.01	1.4
$P_{MD+PA}/2$	0.66	(0.52)	0.03	(0.02)					3	37	0.68	20.2***
$PX_{MD+PA+NJ}/3$	4.77**	(0.70)	0.08	(0.20)					0	40	0.00	0.2
$PX_{MD+PA+NJ}/3$	2.14**	(0.80)	-0.03	(0.15)					1	39	0.34	10.0***
$P_{MD+PA}/2$	3.71***	(0.51)	0.19	(0.24)	0.04	(0.24)			0	39	0.00	0.5
$P_{MD+PA}/2$	0.73	(0.51)	-0.06	(0.07)	0.09	(0.07)			3	37	0.69	17.0***
$PX_{MD+PA+NJ}/3$	5.13***	(0.78)	0.11	(0.22)	-0.13	(0.22)			0	39	0.00	0.2
$PX_{MD+PA+NJ}/3$	2.35**	(0.87)	0.03	(0.18)	-0.11	(0.18)			1	39	0.33	7.3***
$P_{MD+PA}/2$	3.09***	(0.99)	0.28	(0.24)	-0.20	(0.28)	0.33	(0.24)	0	38	0.00	0.9
$P_{MD+PA})/2$	0.98*	(0.49)	0.00	(0.09)	-0.05	(0.16)	0.10	(0.10)	3	37	0.69	14.3***
$PX_{MD+PA+NJ}/3$	4.79***	(1.00)	0.16	(0.24)	-0.22	(0.28)	0.14	(0.24)	0	38	0.00	0.2
$PX_{MD+PA+NJ}/3$	1.22	(1.00)	0.11	(0.18)	-0.24	(0.21)	0.22	(0.18)	1	38	0.41	7.3***

Maryland, Virginia, and North Carolina, 1755-1768												
$P_{MD+VA}/2$	3.99***	(0.66)	0.04	(0.05)					0	14	0.00	0.7
$PX_{MD+VA+NC}/3$	4.84***	(0.87)	0.01	(0.07)					0	14	0.00	0.0
$P_{MD+VA}/2$	4.47***	(0.86)	-0.15	(0.12)	0.15	(0.09)			0	13	0.07	1.5
$PX_{MD+VA+NC}/3$	7.17***	(0.72)	-0.25**	(0.10)	0.08	(0.08)			0	13	0.37	4.6**
$P_{MD+VA}/2$	4.16***	(1.16)	0.00	(0.27)	-0.12	(0.44)	0.14	(0.21)	0	12	0.00	0.8
$PX_{MD+VA+NC}/3$	6.54***	(0.81)	0.07	(0.19)	-0.48	(0.31)	0.30*	(0.15)	0	12	0.49	4.5**
$PX_{MD+VA+NC}/3$	0.34	(3.49)	0.10	(0.17)	-0.24	(0.30)	0.20	(0.30)	1	12	0.60	5.2**
New York, New Jersey, Pennsylvania, and Maryland, 1748-1774												
$P_{MD+PA+NY}/3$	3.49***	(0.39)	0.08***	(0.03)					0	27	0.21	8.0***
$P_{MD+PA+NY}/3$	0.72	(0.56)	0.04*	(0.02)					1	26	0.65	24.3***
$PX_{MD+PA+NJ+NY}/4$	4.48***	(0.54)	0.04	(0.04)					0	27	0.01	1.1
$PX_{MD+PA+NJ+NY}/4$	1.01	(0.80)	0.02	(0.03)					1	26	0.49	13.2***
$P_{MD+PA+NY}/3$	3.35***	(0.37)	-0.09	(0.08)	0.18**	(0.08)			0	26	0.32	7.0**
$P_{MD+PA+NY}/3$	0.80	(0.62)	0.02	(0.06)	0.02	(0.07)			1	26	0.64	15.6***
$PX_{MD+PA+NJ+NY}/4$	4.42***	(0.58)	0.06	(0.13)	-0.01	(0.12)			0	26	0.00	0.6
$PX_{MD+PA+NJ+NY}/4$	1.01	(0.82)	0.06	(0.09)	-0.04	(0.09)			1	26	0.47	8.5***
$P_{MD+PA+NY}/3$	3.18***	(0.42)	0.01	(0.12)	-0.08	(0.21)	0.14	(0.12)	0	25	0.33	4.9
$P_{MD+PA+NY}/3$	0.84	(0.66)	0.03	(0.09)	0.00	(0.16)	0.02	(0.10)	1	25	0.61	10.6***
$PX_{MD+PA+NJ+NY}/4$	4.04***	(0.64)	0.25	(0.18)	-0.43	(0.32)	0.26	(0.18)	0	25	0.01	1.1
$PX_{MD+PA+NJ+NY}/4$	0.83	(0.81)	0.20	(0.13)	-0.36	(0.22)	0.20	(0.13)	1	25	0.51	7.3***
Virginia, Maryland, Pennsylvania, New Jersey, and New York, 1755-1774												
$P_{VA+MD+PA+NY}/4$	4.12***	(0.70)	0.03	(0.05)					0	20	0.00	0.5
$P_{VA+MD+PA+NY}/4$	1.35	(1.06)	0.01	(0.04)					1	19	0.43	7.8***
$PX_{VA+MD+PA+NJ+NY}/5$	5.98***	(0.79)	-0.07	(0.06)					0	19	0.02	1.4
$PX_{VA+MD+PA+NJ+NY}/5$	4.53***	(1.51)	-0.12*	(0.06)					1	19	0.44	8.1***
$P_{VA+MD+PA+NY}/4$	4.87***	(0.72)	-0.23**	(0.10)	0.21**	(0.08)			0	19	0.19	3.1*
$P_{VA+MD+PA+NY}/4$	1.88	(1.27)	-0.06	(0.10)	0.07	(0.09)			1	19	0.42	5.3**
$PX_{VA+MD+PA+NJ+NY}/5$	7.42***	(0.78)	-0.23*	(0.11)	0.06	(0.09)			0	19	0.29	4.8**
$PX_{VA+MD+PA+NJ+NY}/5$	4.57**	(1.62)	-0.12	(0.11)	0.01	(0.09)			1	19	0.40	5.1**
$P_{VA+MD+PA+NY}/4$	4.99***	(0.88)	-0.14	(0.18)	0.06	(0.27)	0.05	(0.14)	0	18	0.19	1.1
$P_{VA+MD+PA+NY}/4$	2.10	(1.43)	-0.08	(0.15)	0.10	(0.24)	-0.03	(0.13)	1	18	0.27	2.5*
$PX_{VA+MD+PA+NJ+NY}/5$	7.01***	(0.94)	-0.10	(0.19)	-0.19	(0.29)	0.14	(0.15)	0	18	0.27	3.1*
$PX_{VA+MD+PA+NJ+NY}/5$	1.47	(1.95)	0.07	(0.16)	-0.26	(0.23)	0.19	(0.12)	1	18	0.54	6.0***

Sources: Bezanson, Gray, and Hussey (1935, p. 433); Brock (1975, pp. 82-83, 346-347, 386-387, 436-437); Carter, *et al* (2006, v. 5, pp. 682-687); Celia and Grubb (2016); Clemens (1980, pp. 226-227); Cole (1938, pp. 120-121); Grubb (2005, p. 35; 2015a, pp. 15-16; 2015b; 2016b); McCusker (1978, pp. 163-165, 172-174, 184-186, 202-203, 211-212, 218-219); Schumpeter (1938, p. 35); West (1978, p. 4).

Notes: Data are annual. Standard errors (SE) are in parentheses. The regression specification is taken from West (1978, p. 4). All regressions were run in Stata. Linear interpolated values are used in the data where necessary. Colonies are designated by '$_{XX}$', where NY = New York, NJ = New Jersey, PA = Pennsylvania, MD = Maryland, VA = Virginia, NC = North Carolina. For Maryland, M is from the MMGp column in Appendix Table B of Grubb (2005b) and from Celia and Grubb (2016). For Virginia, M is taken from Grubb (2015b), and for New Jersey from Grubb (2015a). For New York, Pennsylvania, and North Carolina, M is taken from Brock (1975, pp. 82-83, 346-347, 386-387, 436-437). The M for colony groupings are the simple sum of the individual M for the colonies listed when converted to face value Proclamation equivalents. Proclamation value was 1.33 paper pounds equaled 1 pound

sterling. P_{XX} = that colony's commodity price index expressed in that colony's paper money unit of account, respectively. Colony-specific commodity price indices do not yet exist for New Jersey and North Carolina. For Maryland, P_{MD} is an unweighted price index composed of Talbot and Kent County tobacco, wheat, and corn prices. The raw data are taken from Clemens (1980, pp. 226-227). For Virginia, P_{VA} is an unweighted price index composed of York and Rappahannock River Basins tobacco prices, York River corn prices, and James River wheat prices. The raw data are taken from Carter, *et al* (2006, v. 5, pp. 682-687). The commodity price index for Pennsylvania is taken from Bezanson, Gray, and Hussey (1935, p. 433), and the commodity price index for New York is taken from Cole (1938, pp. 120-121). All price indices are converted to 1766 = 100. PX_{XX} are alternative purchasing power parity price indices. I construct them as $\ln(PX_{XX})_t = \ln(EX_{XX})_t + \ln(P_{UK})_t$ for each colony. P_{UK} = a price index of English consumer goods in pounds sterling taken from Schumpeter (1938, p. 35). EX_{XX} = the price of sterling bills of exchange drawn on London in each colony's paper money unit-of-account. EX is considered the exchange rate of a colony's paper money to pounds sterling. These exchange rates, divided by 100, are taken from McCusker (1978), and for New Jersey form Grubb (2015b). Using PX_{NY} adds one more observation year (1747) to the New York data compared with using P_{NY}. I converted Virginia's paper money to the face value of the other colonies' paper monies by multiplying its face value by 1.062—0.8 times the face value of Virginia's paper money equal pounds sterling which equals 0.7533 times the face value of the other colonies' paper monies at their Proclamation value. Proclamation value was 1.33 paper pounds being equal to 1 pound sterling. The same is done to Maryland's post-1765 exchange rate to pounds sterling (EX_{MD}) and to Virginia's exchange rate to pounds sterling (EX_{VA}). Maryland paper money post-1765 was denominated in Spanish silver dollars. I converted it into Maryland paper money pre-1766 that is denominated in Maryland pounds by multiplying the post-1765 money by 0.2987. One Maryland pound pre-1766 equaled 0.7533 pounds sterling at face value. A Spanish silver dollar equaled 0.225 pounds sterling. The complete grouping of New York through North Carolina was not estimated because of reduced degrees of freedom.

Regressions with zero lags are OLS results unadjusted for serial correlation. All regressions were tested using Durbin's Alternative Test for serial correlation. When the hypothesis of no serial correlation could not be rejected, lags of the dependent variable were added to the specification (coefficients not reported) until Durbin's Alternative Test for serial correlation failed to reject the hypothesis of no serial correlation above the 0.1 level. These corrected regressions are reported immediately below the zero-lag regression only for regressions where serial correlation could not be rejected. See text for discussion of what the lagged dependent variable is likely capturing.

*** Statistically significance above the 0.01 level.

** Statistically significance above the 0.05 level.

* Statistically significance above the 0.1 level.

Appendix Table 2 Data File

Year	MNJ	MPA	MMD	MVA	MNC	MNY	PPA	PNY	PMD	PVA	EXNJ	EXNC
1709	2,542										1.50	
1710	2,236										1.50	
1711	4,962										1.50	
1712	3,852										1.50	
1713	2,995										1.50	
1714	3,253										1.50	
1715	2,396										1.48	
1716	1,539										1.46	
1717	2,579										1.78	
1718	971										1.64	
1719	79										1.50	
1720	79						66.0				1.53	
1721	79						61.5				1.56	
1722	79						63.6				1.56	
1723	79	15,000					67.0				1.56	
1724	37,999	44,915					72.1				1.56	
1725	34,506	38,915					83.0				1.56	
1726	30,771	38,890					83.2				1.41	
1727	27,309	38,890					81.0				1.45	
1728	23,760	38,890					76.3				1.50	
1729	20,700	68,890					74.5				1.54	
1730	17,640	68,890					76.6				1.58	
1731	14,580	68,890					68.7				1.62	
1732	11,520	68,890					67.4				1.67	
1733	28,460	68,890					69.6				1.71	
1734	25,400	68,890					71.4				1.70	
1735	22,700	68,890	56,495				71.4		84.5		1.68	
1736	20,000	68,890	57,864				68.0		84.0		1.67	
1737	60,000	68,890	69,856				71.1		94.2		1.70	
1738	60,000	68,890	74,838				71.5		104.7		1.70	
1739	60,000	80,000	79,820				66.8		90.1		1.71	

1740	62,000	80,000	78,523				68.4		84.7		1.67	
1741	62,000	80,000	83,444				83.8		105.6		2.31	
1742	59,564	80,000	82,072				81.5		114.0		1.53	
1743	56,627	80,000	82,162				71.2		97.9		1.60	
1744	53,669	80,000	82,252				69.3		84.1		1.68	
1745	50,711	80,000	83,058				69.9		80.6		1.76	
1746	58,350	85,000	84,184				73.8		83.8		1.84	
1747	50,892	85,000	85,309			189,495	82.3		83.8		1.83	
1748	44,682	85,000	86,040		21,350	172,001	89.9	103.5	96.1		1.81	1.40
1749	37,224	85,000	62,000		21,160	163,016	90.4	92.7	97.9		1.80	1.37
1750	31,505	84,500	62,000		20,647	153,938	90.2	82.6	102.1		1.73	1.33
1751	26,037	84,000	62,000		20,119	148,214	90.8	88.8	100.5		1.73	1.42
1752	20,819	83,500	62,000		19,028	140,960	90.9	90.7	90.3		1.66	1.51
1753	15,808	82,500	62,000		18,289	132,531	88.6	89.2	97.5		1.68	1.59
1754	14,278	81,500	62,000		57,951	126,081	86.0	88.6	94.6		1.68	1.67
1755	42,748	81,000	62,003	39,484	56,054	179,076	83.9	90.5	94.8	80.6	1.70	1.60
1756	68,717	147,510	70,507	101,508	57,951	230,773	83.9	90.8	97.2	79.6	1.69	1.80
1757	107,187	262,466	79,011	177,997	68,255	219,281	84.5	89.4	83.2	88.3	1.65	1.82
1758	155,657	329,774	87,515	237,164	70,253	307,198	86.7	95.5	84.3	95.2	1.61	1.84
1759	194,127	433,562	96,018	283,500	69,512	481,186	95.7	108.0	95.9	83.5	1.56	1.85
1760	222,597	486,199	85,074	314,634	75,806	410,387	96.3	108.8	99.8	92.3	1.53	1.88
1761	233,566	438,104	74,130	290,464	95,335	366,158	95.6	105.2	96.8	91.5	1.71	1.90
1762	247,036	349,053	63,186	281,734	85,322	330,807	105.3	118.7	97.9	95.2	1.95	2.00
1763	234,672	286,312	52,242	268,813	79,350	287,163	103.3	108.6	101.1	101.9	1.70	2.00
1764	225,319	328,058	41,295	243,540	73,378	243,885	95.3	100.7	92.4	75.7	1.72	1.93
1765	216,419	302,400	1	225,540	70,589	166,502	95.3	99.0	92.2	88.3	1.66	2.00
1766	207,555	278,736	1	205,205	67,800	131,502	100.0	100.0	100.0	100.0	1.60	1.87
1767	199,281	263,860	46,677	177,857	63,953	109,799	99.5	104.8	104.5	82.5	1.62	1.73
1768	190,785	234,450	46,677	150,510	60,106	87,348	94.7	100.6	93.3	102.9	1.64	1.80
1769	182,828	230,496	46,240	138,779		82,858	91.7	104.8	99.1	90.2	1.65	
1770	174,273	204,468	136,869	127,584		81,591	96.5	105.2	107.1	113.6	1.66	
1771	165,506	184,494	136,869	147,822		198,571	100.1	108.0	106.3	102.9	1.67	
1772	153,006	174,643	136,869	108,993		194,440	110.6	121.9	112.9	105.8	1.68	

1773	140,000	154,151	137,430	70,164		190,400	106.3	114.5	114.4	80.6	1.69
1774	125,000	220,473	217,947	45,361		187,714	103.5	104.4	109.1	100.0	1.70
Average	70,508	146,358	76,862	171,217	55,819	204,031					
Standard Deviation	77,433	117,945	37,338	79,877	24,862	99,180					

Appendix Table 1--Continued. Data File

Year	PUK	EXNY	EXPA	EXMD	EXVA
1709	112	1.50			
1710	124	1.45			
1711	93	1.51			
1712	89	1.56			
1713	94	1.54			
1714	95	1.55			
1715	91	1.53			
1716	87	1.58			
1717	85	1.60			
1718	89	1.57			
1719	94	1.54			
1720	92	1.63			
1721	84	1.63			
1722	82	1.64			
1723	86	1.56	1.40		
1724	89	1.65	1.43		
1725	94	1.65	1.39		
1726	88	1.65	1.44		
1727	91	1.65	1.50		
1728	95	1.65	1.51		
1729	87	1.65	1.49		
1730	81	1.67	1.52		
1731	82	1.65	1.53		
1732	78	1.65	1.61		
1733	81	1.65	1.67		

1734	82	1.65	1.70		
1735	80	1.65	1.66	1.40	
1736	85	1.65	1.67	2.30	
1737	83	1.65	1.70	2.50	
1738	82	1.65	1.60	2.25	
1739	92	1.67	1.70	2.12	
1740	99	1.66	1.65	2.28	
1741	91	1.59	1.46	2.38	
1742	86	1.71	1.59	2.75	
1743	77	1.75	1.60	2.85	
1744	78	1.75	1.67	1.67	
1745	85	1.83	1.75	2.00	
1746	83	1.86	1.80	2.10	
1747	86	1.91	1.84	2.25	
1748	88	1.83	1.74	2.01	
1749	87	1.76	1.71	1.85	
1750	83	1.79	1.71	1.78	
1751	85	1.82	1.70	1.67	
1752	83	1.76	1.67	1.56	
1753	83	1.79	1.67	1.52	
1754	84	1.80	1.68	1.54	
1755	84	1.80	1.69	1.62	1.37
1756	100	1.83	1.73	1.70	1.36
1757	97	1.78	1.66	1.45	1.48
1758	92	1.73	1.59	1.50	1.46
1759	90	1.68	1.54	1.50	1.49
1760	86	1.67	1.59	1.46	1.50
1761	86	1.81	1.73	1.48	1.53
1762	92	1.90	1.76	1.44	1.62
1763	94	1.87	1.73	1.40	1.70
1764	97	1.85	1.73	1.37	1.71
1765	98	1.83	1.70	1.33	1.70
1766	100	1.77	1.63	1.74	1.36

1767	99	1.79	1.66	1.75	1.33
1768	91	1.80	1.67	1.75	1.33
1769	92	1.72	1.58	1.71	1.30
1770	98	1.66	1.54	1.60	1.25
1771	107	1.78	1.66	1.72	1.31
1772	109	1.73	1.61	1.68	1.31
1773	106	1.78	1.66	1.75	1.38
1774	104	1.81	1.69	1.77	1.38

Sources: See the source notes to Appendix Table 1.
Notes: See the notes to Appendix Table 1. Blank spaces indicate that no usable data are available. A one is substituted in place zero for MMD in 1765 and 1766 because ln(0) is undefined.