

NBER WORKING PAPER SERIES

A NEW APPROACH TO SOLVING THE COLONIAL MONETARY PUZZLE:
EVIDENCE FROM NEW JERSEY, 1709-1775

Farley Grubb

Working Paper 19903
<http://www.nber.org/papers/w19903>

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
February 2014

Previously circulated as "A New Approach to Explaining the Value of Colonial Paper Money: Evidence from New Jersey, 1709-1775." Preliminary versions were presented at Harvard Law School, National Bureau of Economic Research (NBER) Summer Institute program on the Development of the American Economy, Cambridge, MA, 2014; Wake Forest University, the Paris School of Economics, University of Delaware, and the 2013 meetings of the American Studies Association. The author thanks the participants for helpful comments. Research assistance from Changqing Mu and Lucero Pizano and editorial assistance from Tracy McQueen are gratefully acknowledged. The views expressed herein are those of the author and do not necessarily reflect the views of the National Bureau of Economic Research.

NBER working papers are circulated for discussion and comment purposes. They have not been peer-reviewed or been subject to the review by the NBER Board of Directors that accompanies official NBER publications.

© 2014 by Farley Grubb. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

A New Approach to Solving the Colonial Monetary Puzzle: Evidence from New Jersey, 1709-1775
Farley Grubb
NBER Working Paper No. 19903
February 2014, Revised September 2014
JEL No. E31,E42,E51,N11,N21,N41

ABSTRACT

The market value of colonial New Jersey's paper money is decomposed into its real asset present value and its liquidity premium. Its real asset present value accounted for over 80 percent, whereas its value as money per se accounted for under 20, percent of its market value. Colonial paper money was not a fiat currency. Its liquidity premium was driven by the quantity of paper money in circulation and the method of injection. The quantity theory of money performs poorly when using prices and exchange rates, but performs well when using real asset present values, to measure paper money's expected value.

Farley Grubb
University of Delaware
Economics Department
Newark, DE 19716
and NBER
grubbf@udel.edu

A New Approach to Solving the Colonial Monetary Puzzle: Evidence from New Jersey, 1709-1775

[9/8/14]

Farley Grubb¹

The market value of colonial New Jersey's paper money is decomposed into its real asset present value and its liquidity premium. Its real asset present value accounted for over 80 percent, whereas its value as money *per se* accounted for under 20, percent of its market value. Colonial paper money was not a fiat currency. Its liquidity premium was driven by the quantity of paper money in circulation and the method of injection. The quantity theory of money performs poorly when using prices and exchange rates, but performs well when using real asset present values, to measure paper money's expected value.

The British North American colonies were the first western economies to emit sizeable amounts of colony-specific paper money, also called *bills of credit*. These bills were emitted directly by their respective colonial legislatures and not by banks. No specie-based commercial banks issuing paper banknotes exchangeable for specie on demand existed in British North America in this era.² Colonial legislatures had paper money printed and placed in their respective colonies' treasuries. They directly spent this money on soldiers' pay, military provisions, government salaries, and so on. In some cases, they loaned it out on interest to their respective subjects who secured these loans by pledging their lands as collateral. This legislature-issued paper money formed an important part of the circulating medium of exchange in many colonies (Brock 1975; Newman 2008).

Explaining how colonial paper money regimes performed has proven controversial.

Scholars have found that the statistical relationships between the quantity of paper money in

¹ Professor and NBER Research Associate, Economics Department, University of Delaware, Newark, DE 19716. Email: grubbf@udel.edu. Website: <http://www.lerner.udel.edu/faculty-staff/faculty/farley-grubb>. Preliminary versions were presented at Harvard Law School, National Bureau of Economic Research (NBER) Summer Institute program on the Development of the American Economy, Cambridge, MA, 2014; Wake Forest University, the Paris School of Economics, University of Delaware, and the 2013 meetings of the American Studies Association. The author thanks the participants for helpful comments. Research assistance from Changqing Mu and Lucero Pizano and editorial assistance from Tracy McQueen are gratefully acknowledged.

² Banks successfully emitting paper banknotes backed by fractional specie reserves would not appear in English-speaking North America until near the end of the American Revolution. The first joint-stock specie-based bank was the *Bank of North America* chartered by Congress and by various states in 1781 (Hammond 1957, pp. 3-64).

circulation, prices, and exchange rates are weak, especially in the colonies south of New England. This finding challenges the applicability of the classical quantity theory of money. Alternative explanations of how colonial paper money regimes perform have been difficult to empirically verify. When empirical confirmation is lacking, hypotheses proliferate and views calcify. Heated debates over how to characterize colonial monetary behavior are the result.³

A new approach to explaining the market value of colonial paper money is offered here. It relies on the distinctive character of colonial paper money as *bills of credit*. The market value of a bill is decomposed into its real asset present value when used as just another barter good or non-money tradable bond, and its liquidity premium or “moneyness” value, namely its unique value as a medium of exchange. Bills of credit had legally defined future redemption dates when they would be paid off at face value in specie equivalents by the issuing government. Their real present value, under certainty of redemption as just another barter asset, can be calculated. The difference between these present values and the bills’ valuations in the marketplace measures their liquidity premium.

This approach addresses how economies make the transition from commodity to fiat money (Redish 1993). If the market value of commodity money is dominated by its value as a real barter good or asset, and the market value of fiat money is dominated by its liquidity premium, then how does an economy transition from one type of money to the other? Does the transition necessitate separate money “things” or can one type of money transition from commodity to fiat money?

The scholarly literature has assumed that colonial paper monies were fiat currencies. This

³ See Grubb (2003, 2004, 2005a, 2005b, 2006a, 2006b, 2010, 2012b, 2013b); Hanson (1979); McCallum (1992); Michener (1987, 1988); Michener and Wright (2005, 2006a, 2006b); Officer (2005); Perkins (1988, pp. 163-86); Rousseau (2006, 2007); Rousseau and Stroup (2011); Smith (1985a, 1985b, 1988); Sumner (1993); Weiss (1970); West (1978); Wicker (1985).

assumption has permeated past modeling of colonial monetary performance, regardless of monetary ideology. Even scholars who have focused on the fiscal backing of colonial paper money have treated that money as a fiat currency in their empirical applications.⁴ Poor modeling performance in past studies, therefore, may be due to the non-applicability of this assumption. While the analysis here directly addresses whether this assumption is warranted, it also estimates what determined the size and influenced the variance of the liquidity premium attached to this paper money, thus explaining the process and extent by which this money transitioned from a real asset money toward being a fiat currency.

I chose colonial New Jersey to illustrate this approach for several reasons. First, this approach requires information on the redemption and removal of bills from circulation. Present value calculations require knowing the maturity dates of the bills issued. The data sets currently in use focus only on the amount of bills in circulation and provide, at best, an incomplete accounting of redemption (Carter 2006, v. 5, pp. 692-6). These data sets were also created long ago, mostly before 1941, from outdated and poorly documented sources. Poor data can lead to poor modeling performance.

Fortunately, a recent data reconstruction establishes the redemption of New Jersey's bills along with an updated measure of the amount of bills in circulation (Grubb 2013a). This new data mitigates, as much as possible, the problem of poor data affecting modeling performance. This data reconstruction also provides the longest continuous paper money time series for a North American colony operating under the same legal tender regime. The longer the time span, the more confidence can be placed in time-series statistical tests. Figure 1 shows this new data

⁴ See the studies cited in fn. 3. The main advocates of applying the fiscal backing theory to colonial paper money initially state that colonial paper monies were not fiat currencies but asset monies. They also use the terms "present value" and "discounting" in their initial discussions. However, in their empirical applications they forget all this. They fail to incorporate time-discounting, fail to account for money-asset present values, and fail to treat colonial paper monies conceptually as anything other than fiat currencies. See Smith (1985a, 1985b, 1988); Wicker (1985).

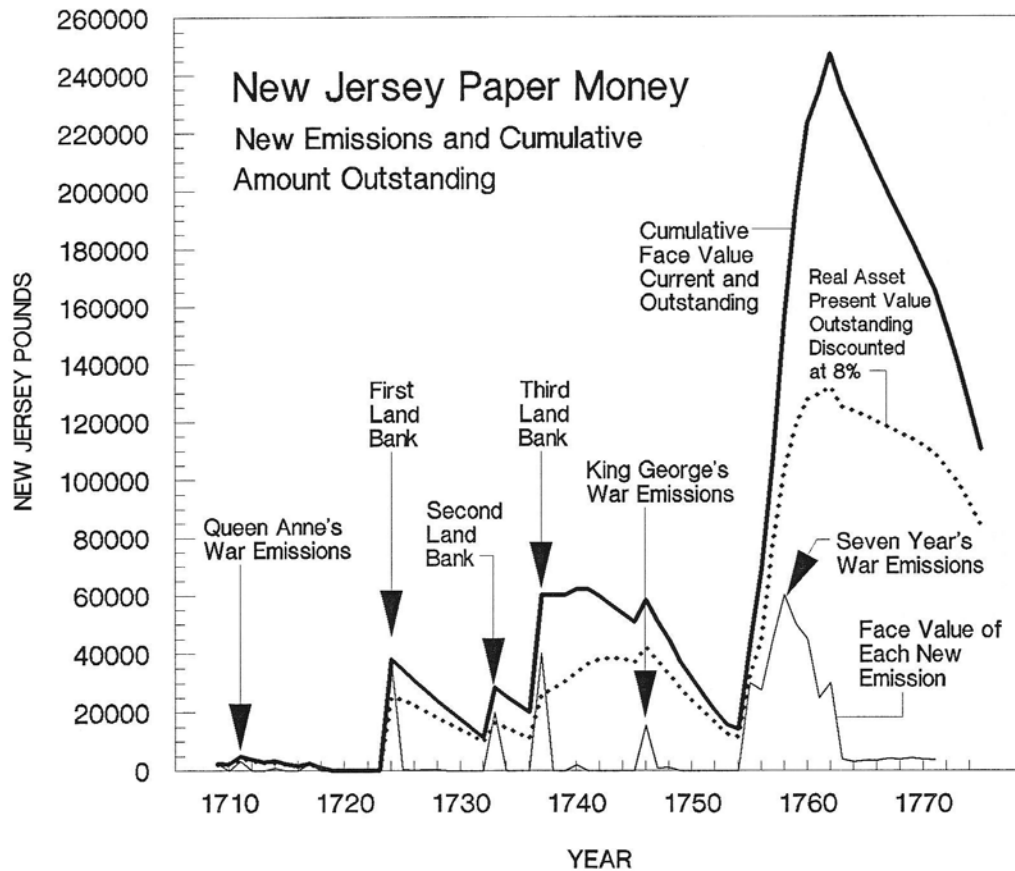


Figure 1 New Jersey Paper Money, 1709-1775: New Emissions and Cumulative Amounts Outstanding

Source: Grubb (2013a).

Notes: The Real Asset Present Value Outstanding takes the Cumulative Face Value Current and Outstanding and multiplies it by the 8 percent Expected Asset Present Values in Table 2 below. This is what the cumulative value would be if the paper money was treated as just tradable bonds under certainty of redemption. See the text for explanation. Pre-1724 par values are converted into post-1723 par values for comparability across time, see Grubb (2013a, notes to Table 1).

series for New Jersey paper money in circulation, along with the sequence of new emissions that added to the current amounts outstanding. The amounts outstanding are shown in face value and in present value terms discounted at 8 percent.

Second, New Jersey printed the face value equivalence of New Jersey paper pounds to silver plate on the face of each bill.⁵ This action established the specie value of the nominal face

⁵ The term “plate” printed on New Jersey bills referred to silver plate or specie. 20 penny-weight, of 24 grains each, equaled one troy ounce of silver plate. For example, a six shilling New Jersey bill in 1763 (expressed in New Jersey

value of a New Jersey bill at redemption. New Jersey was the only colony to print the redemption specie value on the face of each bill for every emission of their paper money (Newman 2008). Knowing the specie value of bills upon redemption is needed to estimate their real asset present values when treated as tradable non-money bonds or barter assets.

Third, New Jersey redeemed its bills at face value on time, for the most part, as legislatively promised. The New Jersey assembly deliberately kept taxes for redeeming its paper money within historically acceptable and feasible limits, thus giving its paper money emissions fiscal credibility. For example, during the period with the most per capita emissions, from 1755 through 1764 during the Seven Years War, the New Jersey legislature spread the redemption of these emissions to even out per-year redemptions and to keep taxes within historically acceptable and feasible limits. Between the last wartime emission in 1764 and 1773, redemptions ended up being exactly 12,500 New Jersey pounds per year and from 1774 to 1782 ended up being exactly 15,000 New Jersey pounds per year. This put the average redemption tax per white-capita per year for New Jersey residents between \$0.37 and \$0.45 Spanish silver dollars. By comparison, the average tax per white-capita per year across all 13 colonies for all taxes between 1770 and 1774 was \$0.41 Spanish silver dollars.⁶ This track record of on-time redemption at face value as legislatively promised, and of maintaining the fiscal credibility of its redemption taxes, eliminates, or at least substantially reduces, any default risk discount above the time discount associated with the non-money asset value of New Jersey's bills of credit. This feature is needed for the empirical analysis because this risk discount cannot be measured independently.

pounds or £_{NJ}) equaled 0.3£_{NJ} which was set equal to 0.875 ounces of silver, or 0.3429£_{NJ} equaled one ounce of silver, at face value. One pound sterling (£_S) equaled 3.8715 ounces of silver, or one ounce of silver equaled 0.2583£_S. Therefore, by equating both to one ounce of silver, 0.3429£_{NJ} at face value equaled 0.2583£_S, or 1.3275£_{NJ} at face value equaled 1£_S. See Grubb (2013a); McCusker (1978, pp. 8-10); Newman (2008, pp. 249-58).

⁶ Derived from Carter (2006, v. 1, p. 36; v. 5, pp. 82, 652); Grubb (2013a, 2013b); Rabushka (2008, pp. 796, 825, 862-3); with currency conversion rates taken from McCusker (1978, pp. 8-10); and using linearly interpolated values for population between reported decadal estimates.

The next section provides a brief history of the colonial monetary puzzle. This section is followed by the presentation of a new approach for decomposing the value of colonial paper money. That section is followed by the development of the data needed for applying this new approach to colonial New Jersey. The next section provides a statistical analysis of that data. That section is followed by a statistical analysis of the liquidity premium attached to this paper money. The penultimate section reassesses the classical quantity and fiscal backing theories of colonial paper money as applied to New Jersey. A conclusion ends the paper.

BACKGROUND: THE COLONIAL MONETARY PUZZLE

The colonial monetary puzzle in the modern era begins with West (1978). He applied the classical quantity of money to colonial paper money and found no statistically significant relationships between the growth of paper money (M) and prices (P) in the colonies south of New England. This finding led scholars to consider other components of the equation-of-exchange identity ($MV = PY$) as possible forces that could explain colonial monetary behavior.⁷

Smith (1985a, 1985b, 1988) and Wicker (1985) argued that because issuances of paper money were institutionally tied to their redemption and removal via explicitly legislated taxes and sinking funds, colonists could perfectly forecast the future paper money supply. Thus, they could engage in inter-temporal shifts in savings and consumption that could undo current monetary policy (Barro 1977; Sargent and Wallace 1981). In quantity-theory-of-money terms, changes in V could fully offset changes in M, and so changes in M would be statistically unrelated to P. As M increased, colonists increased their paper money holdings (decreased V) in anticipation of being required to pay that M back to the government in the near future. They also

⁷ The classical quantity theory of money, at least a prominent version, takes the equation-of-exchange identity, $MV = PY$, as expressed in growth rates, $\ln(M) + \ln(V) = \ln(P) + \ln(Y)$, and by assuming that $\ln(V)$ and $\ln(Y)$ are long-run constants transforms it into the quantity “theory” of money [$\ln(P) = \text{some constant} + \ln(M)$]; 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, Rousseau 2007). West (1978) set M equal to the paper money supply in each colony.

anticipated that the increased M would raise P , and so they put off spending their M in anticipation that P would fall in response to the government withdrawing that M from circulation in the near future.⁸ This reaction smoothed the P time path relative to the M time path.

While such behavior is theoretically possible and consistent with the estimated lack of a statistical relationship between M and P , direct empirical evidence of this behavior is lacking. Most peacetime injections of M were through subjects borrowing M from the treasury through a land-bank loan mechanism. The proposition that subjects borrow M only to hold onto it in anticipation of having to pay it back stretches credulity. In addition, the exchange of worn bills for new, a contingency addressed in most paper money acts, is consistent with substantial circulation of these bills soon after emission.

Finally, the growth and contraction of M across the Seven Years War, 1753-1773, are large, i.e. by multiple factors, see Figure 1. The changes in V needed to offset these changes in M would be fantastical. The lack of contemporary commentary on such changes indicates that this postulated behavior was, in fact, not occurring. Therefore, the proposition that changes in V completely countered changes in M , and so eliminated any statistical relationship between M and P , seems empirically unlikely.

Michener (1987) argued that the solution to the colonial monetary puzzle involved currency substitution between M and specie money. He asserted that paper money was not the only money in the colonies and that, in fact, specie money dominated. Changes in M could be perfectly offset by counter flows of specie into and out of the colonies. Perfect currency substitution would hold the total money supply (paper plus specie) constant which, in turn, would hold P constant. As such, perfect currency substitution is theoretically consistent with no

⁸ See also fn. 4 and Grubb (2005a). Interpretive liberties are taken here as the mechanisms articulated in Smith (1985a, 1985b, 1988) and Wicker (1985) are obscure. See also Sumner (1993).

statistical relationship between changes in M and P.⁹

Again, while such behavior is theoretically possible, direct empirical evidence of this behavior is lacking. The institutional structures needed to make perfect currency substitution possible, namely a fixed exchange rate regime between paper and specie money actively defended by colonial governments through exchanging paper money for specie at that fixed rate on demand, simply did not exist. Colonial treasuries did not maintain sufficient reserves of specie to engage in such behavior. That colonial merchants purchased sterling bills of exchange to consummate cross-border trades is also inconsistent with the perfect currency substitution hypothesis (McCusker 1978, p. 208).

The weight of the literary evidence is that specie money was scarce, too scarce to offset changes in M. Plausible conditions under which chronic specie money scarcity could theoretically exist were present in colonial America (Grubb 2012b), and evidence indicates that there was no systematic correlation between M and specie money (Grubb 2004; Rousseau and Stroup 2011). Finally, the evidence here of a positive liquidity premium to New Jersey paper money falsifies the perfect currency substitution hypothesis. Therefore, the proposition that changes in specie money perfectly countered changes in M seems empirically unlikely.

If changes in Y perfectly mirrored changes in M, then no statistical relationship between M and P would exist. Numerous scholars have suggested that changes in M may have positively influenced Y, either through traditional Keynesian stimulus, transactions cost efficiencies, or financial institution and monetization efficiencies (Hanson 1979; Labaree 1959, v. 1, pp. 141-57;

⁹ This is not an original argument to Michener (1987). That the emission of paper money drove specie money out of the economy and vice versa was a frequent claim made by colonial contemporaries who opposed the emission of paper money. Colonial legislatures and other contemporary writers typically rejected such claims. They noted that specie money was already absent from the local economy before paper money was ever emitted (Davis 1964; Grubb 2012b; Labaree 1970, v. 14, pp. 77-87; Rotwein 1970, p. 69; Smith 1937, pp. 307-9). For debates over these propositions see Grubb (2005b, 2006a, 2006b); Michener and Wright (2005, 2006a, 2006b).

Lester 1939, pp. 56-141; Rousseau 2007; Rousseau and Stroup 2011). Measuring the effect of M on Y, given that data on Y are sketchy, is difficult. While some effect on Y appears to be related to changes in M, the magnitudes of these effects are too small to fully absorb changes in M and so hold P unchanged.

For example, the growth and contraction in M across the Seven Years War, 1753-1773, by many hundreds of percent would require comparable percentage movements in Y to leave P constant, see Figure 1. Such large changes in Y stretch credulity. The lack of contemporary commentary on such changes indicates that this postulated behavior was, in fact, not occurring. Therefore, the proposition that changes in Y completely absorbed changes in M seems empirically unlikely.

Besides looking at V, Y, and the composition of M as possible resolutions to the colonial monetary puzzle, erroneous P and/or exchange rate measurements could be responsible for the lack of a statistical relationship between M and P. This possibility, however, seems unlikely. Grubb (2003, p. 1786; 2005b, p. 1346; 2010, pp. 132-5) shows that P and exchange rates are well behaved time series, i.e. that purchasing power parity holds for all colonies (where colony-specific price indices and exchange rates exist) between that colony and England and between that colony and all other colonies. If purchasing power parity holds for these colonies, then it is reasonable to assume that it holds for New Jersey even though no New Jersey price index currently exists. He also shows that exchange rates for these colonies are stationary, and that prices in these colonies expressed in their respective paper monies are stationary with no trend inflation in excess of the trend inflation in the polities using specie money.

Finally, Grubb (2005a, 2013a) speculates that erroneously measured M may account for the lack of a statistical relationship between M and P. The data on the amount of M in circulation

used in the modern literature was gathered before 1941 from outdated and poorly documented sources. For example, this data for New Jersey is missing observations for 22 percent of the years when positive amounts of M were in circulation. In addition, the magnitudes of M reported in this data for some years are off by as much as 22 percent (compare Carter 2006, v. 5, pp. 692-6 with Grubb 2013a and Figure 1). Whether updated and corrected measures of M solve the colonial monetary puzzle, at least for New Jersey, will be tested below.

Having exhausted all the components in the equation-of-exchange identity as possible resolutions to the colonial monetary puzzle, what is left? I will argue here that the problem lies with M, but not in a currency substitution or measurement of multiple monies sense. The problem lies deeper in our concept of money, in how we measure the value of that money, and in how that money functioned in these colonial economies.

A NEW APPROACH TO DETERMINING THE VALUE OF COLONIAL MONEY

An inside money “thing” is created to facilitate local transactions when the supply of outside money, such as specie coins and barter, prove inadequate. The focus here is on a physical money “thing” to distinguish it from non-physical monetary units-of-account used in book-credit barter. The extent that this local money “thing” fills the transaction-liquidity need, above that of its next best alternative, is its liquidity premium (LP). Colonial New Jersey created a local inside money “thing” in the form of bills of credit issued by the New Jersey legislative assembly. The preamble to colonial New Jersey’s paper money act of 1723 illustrates the rationale for creating an inside paper money (Bush 1977, p. 301, italics in the original),

Whereas Many Petitions and Applications have been made to his Excellency the Governour of this Province, by the Free-holders, Merchants and Inhabitants of the same, setting forth That the Silver and Gold formerly Current in this Province, is almost entirely Exported to *Great Britain* and elsewhere, and thereby the many Hardships which his Majesty’s good subjects, within this Colony, lie under, for want of a Currency of Money... ..for want of a Medium of Trade or Currency of Money; And...to pay the small

Taxes for Support of this Government they have been obliged to cut down and pay in their Plate, Ear-Rings and other Jewels; And that many Law-Suits and Differences have arisen, and do daily arise amongst them, which will be the Ruin of a great Number of the said Inhabitants, if some Method be not found out for their Relief. And this Assembly...by a *Paper Currency*,...finding no other Way to Remedy the Grievances aforesaid, of his Majesty's good Subjects here.

The preamble asserts that using barter, e.g. plate, ear-rings, and other commodities, to transact local trade was inefficient, and that an outside money, such as gold and silver coins, could not be retained in sufficient quantities within the colony to transact the colony's internal trade. A money "thing" was lacking that had enough liquidity and universality of acceptance to transact local trade without substantial disputes over value. Paper money issued by the New Jersey assembly was seen as a remedy to this collapse of local trade into barter-only transactions.

The primary goal of this paper is to measure the determinants of the market exchange value (MEV) of this local inside money "thing" by decomposing it into its component parts, see equation (1).¹⁰ MEV equals its expected commodity or asset present value (APV), i.e. its value as just another non-money barter good or barter asset, minus a risk discount (RD) that captures any expected default risk regarding the APV of the money "thing," plus its liquidity premium (LP) that encompasses its "moneyness," i.e. its extra value as a transacting medium. Positive values for LP measure the willingness of the public to pay a premium above the money "thing's" expected real commodity or real asset present value, because it serves as a more convenient transacting medium than the next best barter alternative.

$$(1) \quad \text{MEV} = (\text{APV} - \text{RD}) + \text{LP}$$

For a pure fiat currency, by definition, $\text{MEV} \approx \text{LP}$ and its $\text{APV} \approx 0$. Whereas, for a pure outside commodity money produced within an open-access competitive market, such as specie in

¹⁰ This decomposition is consistent with the model of paper money laid out by Benjamin Franklin in a tract written in Philadelphia in 1729 (Labaree 1959, v. 1, p. 153), by Gouverneur Morris in a tract written in Philadelphia in 1778 (Barlow 2012, pp. 73-6), and by James Madison in a tract written in 1779 (Hutchinson and Rachal 1962, v. 1, pp. 305-6). As such, it can be considered consistent with how colonial contemporaries thought about their paper money.

the form of bullion or plate in the eighteenth-century transatlantic economy, arbitrage yields $MEV \approx APV$, leaving its $LP \approx 0$ in long-run equilibrium. Somewhere between these pure cases resides the actual local monies used by societies. If the long-run development of a society is thought of as transitioning from a pure commodity toward a pure fiat money, measuring where that society's money is on that evolutionary spectrum informs us about the level of that society's development and the state of its monetary institutions (Redish 1993). The extent that colonial paper money functioned as a commodity or asset money (APV/MEV) versus as a fiat currency (LP/MEV) is disentangled by the decomposition in equation (1).

The difficult part of applying this approach is the empirical measurement. While MEV can be easily measured using data on exchange rates and price indices, RD and LP cannot be independently measured. In addition, APV does not have an obvious data construct. Conceptually, measuring APV entails constructing a counterfactual value of the money "thing," i.e. its value when not used as a money. Given that it is being used as money, constructing this counterfactual and disentangling it from MEV is difficult.

Fortunately, colonial bills of credit were structured as zero-coupon bonds, similar to today's U.S. savings bonds, except they were transferable (Grubb 2012a). Given expected maturity dates, payoff values, and an appropriate interest rate, the APV of these bills as non-money tradable bonds can be calculated independent of their MEV . Unfortunately, no time-series of market generated interest rates for any class of assets currently exists for colonial America. Thus, some clever empirical analysis must be employed to make the decomposition model in equation (1) operational. Two different methods are used here.

The first method assumes that $LP = 0$ so that MEV measures the current spot market value of these bills as non-money bonds. Given the expected redemption structure of the bills,

the interest rate (r^*) that makes $MEV = [APV - RD]$ is calculated. If in fact $LP = 0$, then r^* represents the first time-series of market generated interest rates created for any asset class in colonial America. If r^* is within the normal range of interest rates mentioned in the colonial literature, then the proposition that the bills are simply barter assets with no special “moneyness” value or fiat currency attributes cannot be rejected. If r^* is relatively high, then nothing changes from the above conclusion except that now $RD > 0$, namely the bills are also relatively risky non-money bonds. If, however, r^* is relatively low, then the proposition that $RD \approx 0$ and $LP > 0$, namely that the bills have some “moneyness” value and are functioning to some degree as a fiat currency, cannot be rejected. The extent that r^* is outside the normal range measures the extent that $RD > 0$ when r^* is relatively high, and the extent that $LP > 0$ when r^* is relatively low.

The second method takes a range of long-run normal interest rates (r) gleaned from the colonial literature and assumes they hold for assessing the present value of assets net of default risk. These interest rates are used to calculate the APV of colonial paper money independent of MEV. Moving the variables that can now be independently measured to the left-hand side and the variables that cannot be independently measured to the right-hand side yields equation (2).

$$(2) \quad MEV - APV = LP - RD$$

In terms of proportions, the ratio APV/MEV shows how much of MEV is accounted for by APV with the residual share being accounted for by $(LP - RD)$. The gap between MEV and APV, under certainty of redemption at face value on time as legislated, i.e. given $RD \approx 0$, measures the magnitude of the LP of colonial paper money. Finding $LP > 0$ in this method is the same as finding a below normal r^* in the first method.

One reason for applying this second method to colonial New Jersey is that, a priori, that colony’s paper money should experience no RD. Colonial New Jersey established a track record

of redeeming its bills at face value on time as legislatively promised. It also maintained a fiscally credible redemption tax structure (Grubb 2013a, 2013b). There was little default risk to holding New Jersey bills of credit. Therefore, the present value of a bill, unadjusted for expected default risk, should capture all its current non-money real asset value. Because RD is expected to be minimal, equation (2) primarily measures LP.

DATA ON MEV, APV, AND r^*

To apply this framework to colonial New Jersey, three data sets are required. First, a current spot market value (MEV) of New Jersey bills of credit is required. Second, calculating the expected real asset present value (APV) of New Jersey bills as just barter assets or non-money bonds is required. Finally, the interest rate (r^*) that makes $MEV = [APV - RD]$ must be calculated. This section provides these data constructions.

a. The Current Spot Market Value (MEV) of Colonial New Jersey Paper Money

Colonial New Jersey printed the par value (redemption value at maturity) in silver plate (specie) on the face of each bill (Newman 2008, pp. 249-58). For most colonies, assertions about the par value of their respective bills of credit in specie at redemption are debatable, often being hard to track down and verify in the surviving original records. This is not the case for colonial New Jersey paper money. Its par value at redemption in specie was always printed on the face of each bill. This rate for silver plate is easily converted to pounds sterling.¹¹

The market exchange rate (EX) between colonial New Jersey bills of credit and British pounds sterling, adjusted for transactions cost and time-discounting, and calculated as a percentage of par, is used as the MEV measure. In the absence of commodity price indices and other exchange rates to real assets and monies, this exchange rate is the only candidate to

¹¹ See fn. 5.

represent the MEV of New Jersey paper money. Pounds sterling is a specie commodity money. MEV measures the spot-market conversion in New Jersey of paper New Jersey pounds into a standard specie (silver) commodity money.¹²

Table 1 presents the data needed to create MEV. It starts with the work of McCusker (1978, pp. 172-3) and consults all the original sources listed therein. Errors in the McCusker data are corrected based on what was found in these original sources. Some additional exchange rates found in other original sources were also added to the baseline McCusker data.

The exchange rates (EX) in Table 1 report how many New Jersey pounds were needed to buy one pound sterling in the form of bills of exchange payable in London. Thus, the spot exchange rate of New Jersey pounds for specie in New Jersey has to be adjusted downward for the amount of time and the transactions cost of getting a bill of exchange to London and getting it liquidated into sterling or other specie coins usable in New Jersey. The cost of doing this is estimated to be 7.09 percent, derived from the exchange rates quoted in 1703-4 before bills of credit were issued.¹³ Thus, the realized par exchange rate using this evidence is $1.2334\text{£}_{\text{NJ}} = 1\text{£}_{\text{S}}$ rather than the rate indicated on the face of the bill ($1.3275\text{£}_{\text{NJ}} = 1\text{£}_{\text{S}}$). MEV is derived by dividing this number (1.2334) by the exchange rates (EX) in Table 1. This last manipulation is done to have values for MEV in the same metric as the data on APV presented in Table 2 below.

b. Real Asset Present Value (APV) of New Jersey Bills of Credit as Non-Money Tradable Bonds

Colonial governments could not create money *per se*. That was the exclusive prerogative

¹² All that is needed is a rate at which paper money can be exchanged for real commodities in the marketplace. Whether that rate is measured by a price index for a basket of real goods or an exchange rate to some other real commodity or asset, such as silver or pounds sterling, should not matter, as long as the measured rate is not subject to large relative price shifts.

¹³ *The Boston Evening Post*, 25 October 1773, estimated the cost of shipping specie between the colonies and London at 6 percent, which was comprised of 2.5 percent for insurance and brokerage, 2.5 percent commissions, and 1 percent for freight (Brock 1992, pp. 74, 124). Adding the opportunity cost of time, i.e. time-discounting, to his 6 percent estimate raises that cost to approximately the rate estimated here of 7.09 percent.

Table 1 **Current Market Exchange Rate Data (EX): The Number of Colonial New Jersey Pounds Needed to Buy a One Pound Sterling Bill-of-Exchange Drawn on London, 1709-1775**

| Year | High | Average | Low | N ^a | Year | High | Average | Low | N ^a |
|------|---------------------|---------------------|---------------------|----------------|------|--------|---------------------|--------|----------------|
| 1709 | | 1.5000 ^b | | 1 | 1746 | 1.8500 | 1.8375 | 1.8250 | 2 |
| 1710 | | 1.5000 ^b | | 1 | 1749 | 1.8964 | 1.7982 | 1.7000 | 2 |
| 1711 | | 1.5000 ^b | | 1 | 1750 | 1.8000 | 1.7292 | 1.6500 | 3 |
| 1712 | | 1.5000 ^b | | 1 | 1751 | | 1.7250 | | 1 |
| 1713 | | 1.5000 ^b | | 1 | 1752 | 1.6750 | 1.6625 | 1.6500 | 2 |
| 1714 | | 1.5000 ^b | | 1 | 1753 | 1.7000 | 1.6750 | 1.6500 | 3 |
| 1716 | 1.5000 ^b | 1.4643 ^b | 1.4286 ^b | 2 | 1754 | 1.7000 | 1.6817 | 1.6700 | 3 |
| 1717 | | 1.7800 ^b | | 1 | 1755 | 1.7500 | 1.7006 | 1.6650 | 8 |
| 1719 | 1.5518 ^b | 1.5009 ^b | 1.4500 ^b | 2 | 1756 | 1.7300 | 1.6888 | 1.6000 | 4 |
| 1721 | | 1.5555 ^b | | 1 | 1757 | 1.6900 | 1.6544 | 1.6100 | 8 |
| 1724 | | 1.5618 | | 1 | 1758 | 1.6250 | 1.6125 | 1.6000 | 4 |
| 1725 | | 1.5618 | | 1 | 1759 | 1.5750 | 1.5625 | 1.5500 | 2 |
| 1726 | | 1.4122 | | 1 | 1760 | 1.5500 | 1.5330 | 1.5200 | 5 |
| 1733 | 1.7700 | 1.7147 | 1.6594 | 2 | 1761 | 1.7250 | 1.7125 | 1.7000 | 2 |
| 1736 | | 1.6667 | | 1 | 1762 | 2.3175 | 1.9475 ^c | 1.7500 | 3 |
| 1737 | | 1.7000 | | 1 | 1763 | 1.7150 | 1.6983 | 1.6800 | 3 |
| 1739 | 1.8182 | 1.7136 ^c | 1.6500 | 5 | 1764 | 1.7500 | 1.7214 | 1.7000 | 3 |
| 1740 | 1.8182 | 1.6712 | 1.6000 | 4 | 1766 | | 1.6000 | | 1 |
| 1741 | 4.0000 | 2.3057 ^c | 1.4286 | 5 | 1768 | 1.6667 | 1.6357 | 1.6047 | 2 |
| 1742 | 1.5618 | 1.5309 | 1.5000 | 2 | 1774 | | 1.6950 | | 1 |
| 1743 | | 1.6000 | | 1 | | | | | |

Sources: Documents Relating to the Colonial History of the State of New Jersey (1881-1905, v. 3, p. 21; v. 4, p. 241; v. 5, pp. 153-5, 190, 193, 287, 417; v. 6, pp. 62, 68, 82-3, 132-5; v. 7, pp. 246, 393, 398-9; v. 10, pp. 50-1; v. 12, pp. 19, 31, 64); Kemmerer (1956, pp. 111-2, 118-9, 121, 123); "Letters of Joseph Sherwood," Proceedings of the New

Jersey Historical Society (1851, v. 5, p. 147); McCusker (1978, pp. 172-3); Morris (1852, pp. 49, 103-4, 133, 157); Tanner (1908, p. 556).

Notes: See Grubb (2013a, notes to Table 1). Par (face value) throughout is $1.3275\text{£}_{\text{NJ}} = 1\text{£}_s$. Missing years indicate no observations could be found for those years.

^a Many “observations” are not single market transaction observations, but statements by officials as to what the typical or average exchange rate was that year.

^b These rates were taken from retrospective statements by officials from the era when par was fixed at $1.3275\text{£}_{\text{NJ}} = 1\text{£}_s$. Thus, these rates should be evaluated at that par rate rather than at the rate that was established for the pre-1724 period, see Grubb (2013a, notes to Table 1).

^c Rates listed in McCusker (1978, pp. 172-4) for 1739, 1741, and 1762 that could not be verified in the original sources cited were dropped, and those that were at odds with the original sources cited were changed to be consistent with those original sources.

of the sovereign, namely the British Crown. What colonial governments could do was create “transaction-able” or “exchangeable” debt in the form of *bills of credit*. The notion of money as 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 the face of the bills. These redemption exercises were embedded in each paper money act or in an ancillary contemporaneous revenue act passed by colonial legislatures. For a given emission of bills, redemption was legislated to take place over a window of years. A multi-year redemption window was used to keep the amount of annual redemption payments within historically feasible limits, thus giving the redemption exercise fiscal credibility. However, no mechanisms were legislated to determine which bills would be redeemed in which years within the redemption window legislatively designated for those bills (Grubb 2012a, 2013a, 2013b).

The debt nature of colonial New Jersey paper money and the argument that these bills of credit should pay no interest are illustrated in a speech made by Jeremiah Bass, assemblyman from Salem County, to the New Jersey legislative assembly on 16 January 1717,

To lay a Tax to be paid immediately is impractical and impossible. shall we then borrow Money at Interest, and pass an Act for the Re-payment as the Taxes come in? This would be like the Ass laden with Wool, that lay down in the River to alleviate his Burthen. What then remains but that we borrow of our selves without interest? I mean, that we establish

a proper credit, strike so many Bills as will pay the Arrearage, and change the outstanding Bills, and provide an Indubitable Fund for the annual sinking of them. Of all Expedients, I am sure, this will be the most sure, facile and acceptable to the Province. It will furnish us with a current Stock of Money for carrying on our Trade, and payment of our Taxes, give the People Time to make the best Market of their Provisions; and that will render the payment of these Debts of the Province less Injurious to the People. Let me then propose, That this House do Resolve to raise a sufficient Sum of Paper Money to pay the Debts and defray the Charges of the Government. (Bass 1717, p. 19).

Bass argued that paper money was a debt, i.e. a borrowing from ourselves that had to be repaid.

He also argued that, because paper money was a borrowing from ourselves, paying interest was unnecessary. Paying interest also produced an unattractive tax burden. The New Jersey assembly adhered to such reasoning throughout its history of issuing paper money. New Jersey bills of credit were zero-coupon bonds throughout their history (Grubb 2012a; Smith 1937, pp. 310-2).

Subjects understood the zero-coupon bond structure of this paper money and understood that time-discounting was necessary to assess its real asset present value. For example, in the New Jersey provincial council in 1758, Lewis M. Ashfield based his objection to a proposed paper money act on the time-discounting properties of these bills and the effect that a lengthy redemption would have on their present value. He said, “...as the whole Credit of a Paper Currency depends upon its Sinking [redemption], which by being put off to a long day will he Conceives greatly Contribute to Lessen it’s Value for which reasons and many Others he Conceives he Cannot in duty Consent to the Passing the said Bill [this paper money act].” (Ricord 1892, v. 17, p. 159).

A more obvious statement of the necessity of time-discounting was made by Benjamin Franklin. In 1764, in the longest speech of his career among his surviving texts, Franklin explained to the Pennsylvania assembly how bills of credit issued as zero-coupon bonds worked in terms of discounting and present value. In reference to an emission of 50,000 pounds in Pennsylvania paper bills of credit (£_{PA}) proposed in late 1763, Franklin pointed out “The true

Way in my Opinion to preserve a Value in our Paper Bills nearly equal to the nominal Sums we stamp on them....” He argued that the method of redemption at future dates at face value with no interest paid in the interim, while a method often relied on in the past, nevertheless could not achieve this outcome because of time-discounting. He stated,

At present every Bill that I receive tells me a Lie, and would cheat me too if I was not too well Acquainted with it. Thirty Shillings in our Bills, according to the Account they give of themselves should be worth *five* Dollars; and we find them worth but *four*: They should be worth 22*s.* 6*d.* Sterling, and we find them worth scarce 17*s.* 2*d.* Sometimes indeed more or less... When we sit here in Legislation, we have great Power, but we are not almighty. We cannot alter the Nature of Things. Values will be as they are valued or valuable, and not as we *call* them. We may stamp on a Piece of Paper, This is *Ten Shillings*, but if we do not make some other Provision that it always be worth *Ten Shillings*, the *Say-so* of our Law will signify little. Experience in other Colonies as well as in ours, have demonstrated this.

...we propose to found the Credit of these Bills [the new emission of 50,000£_{PA} proposed for 1764] on a Tax to be raised, which is to sink them as I understand in Six Years at one Sixth Part per Annum, for the due punctual Performance of which there is to be the Sanction of a Law. If this be the Case, and allowing the Security to be good, of which I make not the least Doubt, (tho’ some Colonies have by subsequent Laws postpon’d the Payments they had engaged to make, for much longer Terms) I say, supposing the Law punctually executed, it is not difficult...to compute what real Value that Fund [the proposed tax redemption] gives the Bills. When you pay them out, it is instead of so much *real Money* which you owe and ought to pay immediately, but not having the Money to pay, these are your Promisory Notes, obliging you to pay the whole Sum, not upon Demand, but in Six Years by annual Quotas; they are therefore in the nature of things, and between honest Men, really worth no more than the Sum that remains, when Interest for the Time is deducted; and allowing that publick Security is something better than private, I shall state that Interest at 5 per Cent only; then

| | | |
|---|-------------|------------|
| The Interest of £50,000 for the first Year is | | £2500: 0:0 |
| Do of 41,666: 13:4 | 2d Year is | 2083: 6:8 |
| Do of 33,333: 6:8 | 3d Year is | 1666: 13:4 |
| Do of 25,000: 0:0 | 4th Year is | 1250: 0:0 |
| Do of 16,666: 13:4 | 5th Year is | 833: 6:8 |
| Do of 8,333: 6:8 | 6th Year is | 416: 13:4 |
| Total of Interest | | £8750: 0:0 |

This Sum, £8750, taken from £50,000
8,750

leaves £41,250 for the *true Value* of the promisory Notes, or we call them, Bills of Credit, which is always 20 per Cent less than their nominal

Value; and if People should compute the Interest at 6 per Cent instead of 5, and have withal any reason to doubt the Punctuality of the Government as to the Time of Payment, their Value would be proportionally lower.

We have thus considered the Fund of our intended Bills, the full real Value that Fund can give them, and how much less that real Value is than the nominal Value we mark upon them. (Labaree 1967, v. 11, pp. 13-15, italics in the original).

While this statement was made in Philadelphia in reference to Pennsylvania paper money, New Jersey subjects, just across the Delaware River from Philadelphia, were acquainted with these speeches. They knew that Pennsylvania and New Jersey paper monies were structured the same, namely as zero-coupon bonds.¹⁴

Finally, bills of exchange were a familiar and commonly used private payment instrument within the transatlantic merchant community, especially for long-distant trade. The face value of a bill of exchange was its payment at some designated future date at some designated distant location. The present value of a bill of exchange was, therefore, less than its face value due to time-discounting, transaction costs, and the risk of nonpayment. Bills of exchange were discounted, i.e. sold at below their face value, with the difference between the face value and the sale price capturing the implicit interest, transactions, and risk costs of carrying the bill to execution. Everyone understood this. Bills of credit were structured the same way, and so the public would have been familiar with how to assess their present value and that this present value differed from their face value due to time-discounting and risk of nonpayment.

New Jersey subjects are assumed to act as if they understood their paper money to be zero-coupon bonds requiring time-discounting to ascertain their present value, and to act as if they knew how to calculate this expected present value. The public is also assumed to know the quantity of New Jersey bills actually in circulation each year and the amounts actually redeemed each year as shown in Grubb (2013a). Finally, the public is assumed not to know in which year a

¹⁴ Benjamin Franklin also designed and printed paper money for New Jersey between 1728 and 1746 (Newman 2008, pp. 249-50). See also Smith (1937, p. 311).

given bill currently outstanding would be redeemed within its legislatively designated redemption window. Thus, the public is assumed to respond only to the expected redemption of a bill currently outstanding.

The amount of New Jersey paper money outstanding in a given year (M_t) is assumed to be redeemed by all bills actually redeemed in the immediately following years until the year when that original amount of M_t is fully redeemed. The redemption amount in each year of this period is divided by the initial amount outstanding from the given year chosen to assign a yearly weight to its contribution in the redemption process. The time discounts between the initial year and the redemption year, namely e^{-rt} where t is the time-span in years and r is the interest rate, are multiplied by the contribution-weights for their respective years. The time-discount-weight values for each year are then summed to get the expected present value of a representative bill outstanding for that chosen year in terms of a percentage of that bill's par value.

This redemption structure was the simplest for the public to calculate and comprehend. It is justified by the fact that New Jersey law made its paper money a legal tender throughout its history of new emissions. Legal tender laws did not fix the market value of paper money to its face value, e.g. see Table 1. Instead, their practical function was to make bills from different emissions that were concurrently outstanding fungible across the separately legislated redemption windows for each concurrently outstanding emission (Grubb 2012a, 2013a). This procedure is also justified by the fact that New Jersey law set limits on how long each emission would be accepted for redemption (e.g. see Bush 1977, pp. 311, 432, 480-1; 1980, pp. 350, 376, 419, 551, 574, 633, 676). The bills from each emission were dated (Newman 2008, pp. 249-58). Thus subjects had an incentive to redeem the oldest bills in their possession first. This feature yields the discounting calculation explained above, as opposed to using a discounting calculation

that links bills from each emission only to their own respective redemption window.¹⁵

Appropriate market generated data on r for doing present value calculations are lacking. Two methods are used to overcome this lack of data. First, under the assumption that $LP = 0$, an imputed r^* is calculated, namely the interest rate that makes $MEV = (APV - RD)$. This calculation entails selecting r^* such that $MEV_i = \sum_{t=i}^T (RED_t/M_i)e^{-r^*t}$, where RED_t = the New Jersey bills redeemed at face value and retired from circulation each year, with RED_T being the amount in the last year of redemption that satisfies $\sum_{t=i}^T (RED_t/M_i) = 1$. The r^* so calculated for years when data on MEV is available from Table 1 are reported in Table 2.

Second, given the long-run interest rates considered to be normal in the colonial literature, the counterfactual expected asset present value of a New Jersey bill as just a non-money tradable bond net of default risk, expressed as a percentage of its face value, is calculated as: $APV_i = \sum_{t=i}^T (RED_t/M_i)e^{-rt}$; where RED_t = the New Jersey bills redeemed at face value and retired from circulation each year, with RED_T being the amount in the last year of redemption that satisfies $\sum_{t=i}^T (RED_t/M_i) = 1$, and with r being the long-run interest rate or opportunity cost of capital. These number for an r of 6, 8, and 10 percent are presented in Table 2. See the notes to Table 2 for an example of these calculations for the year 1725.

The long-run interest rates considered to be normal, i.e. rates somewhere between 6 and 10 percent, are taken from legislative acts and infrequent statements about what the common rate was. For example, in 1719 the New Jersey legislature set a 10 percent interest rate on unpaid tax

¹⁵ A more sophisticated calculation was performed that assumed the public could perfectly forecast the future emission of new bills that could compete with current bills for redemption within the yearly redemption quotas as shown in Grubb (2013a, Table 1). The probability that a current bill would be redeemed in each year of its redemption window could be reduced, and the length of the redemption window for current bills could be lengthened, by this competition. It seems unlikely, however, that contemporaries could calculate at this level of complexity. As such, this alternative was not used in the rest of the paper. Besides, the yearly APV for this alternative calculation was on average only one percentage point less than that reported for the simpler method used to construct Table 2. All calculations in Tables 1 and 2 were done by hand to make sure they were within the capabilities of contemporaries.

Table 2 **Expected Asset Present Values (APV) of New Jersey Bills of Credit at Various Discount Rates Expressed as a Percentage of Face Value, and the Discount Rates (r^*) that make (APV – RD) = MEV, 1709-1775**

| <i>Discount Rates</i> | | | | | <i>Discount Rates</i> | | | | | <i>Discount Rates</i> | | | | |
|-----------------------|-------|-------|-------|-------|-----------------------|-------|-------|-------|-------|-----------------------|-------|-------|-------|-------|
| <i>Year</i> | 6% | 8% | 10% | r^* | <i>Year</i> | 6% | 8% | 10% | r^* | <i>Year</i> | 6% | 8% | 10% | r^* |
| | % | % | % | % | | % | % | % | % | | % | % | % | % |
| 1709 | 84.87 | 80.40 | 76.21 | 7.17 | 1732 | 89.41 | 86.27 | 83.30 | ----- | 1755 | 81.47 | 76.20 | 71.34 | 9.50 |
| 1710 | 90.11 | 87.10 | 84.22 | 11.43 | 1733 | 65.24 | 57.50 | 51.86 | 4.50 | 1756 | 81.01 | 75.68 | 70.77 | 9.06 |
| 1711 | 84.59 | 80.20 | 76.17 | 7.05 | 1734 | 65.31 | 57.76 | 51.58 | ----- | 1757 | 78.61 | 72.87 | 67.67 | 7.39 |
| 1712 | 87.96 | 84.46 | 81.21 | 9.35 | 1735 | 64.90 | 57.05 | 50.55 | ----- | 1758 | 72.96 | 66.30 | 60.53 | 5.04 |
| 1713 | 89.70 | 86.65 | 83.76 | 11.10 | 1736 | 64.49 | 56.26 | 49.37 | 4.06 | 1759 | 68.23 | 60.99 | 54.90 | 3.58 |
| 1714 | 89.83 | 86.79 | 83.88 | 11.20 | 1737 | 53.11 | 43.29 | 35.39 | 3.01 | 1760 | 64.72 | 57.16 | 50.95 | 2.84 |
| 1715 | 92.94 | 90.75 | 88.65 | ----- | 1738 | 56.41 | 46.90 | 39.12 | ----- | 1761 | 63.00 | 55.22 | 48.91 | 4.12 |
| 1716 | 96.00 | 94.72 | 93.47 | 26.43 | 1739 | 59.88 | 50.79 | 43.22 | 3.81 | 1762 | 61.35 | 53.24 | 46.86 | 5.53 |
| 1717 | 94.46 | 92.77 | 91.14 | 47.40 | 1740 | 63.02 | 53.78 | 47.12 | 3.90 | 1763 | 61.10 | 53.09 | 46.48 | 3.70 |
| 1718 | 97.06 | 96.17 | 95.32 | ----- | 1741 | 66.90 | 58.92 | 52.06 | 9.56 | 1764 | 62.71 | 54.72 | 48.24 | 4.16 |
| 1719 | 97.88 | 97.31 | 96.79 | # | 1742 | 71.05 | 63.82 | 57.54 | 3.73 | 1765 | 63.99 | 56.11 | 49.67 | ----- |
| 1720 | 78.66 | 72.61 | 67.03 | ----- | 1743 | 74.18 | 67.55 | 61.67 | 5.20 | 1766 | 65.28 | 57.56 | 51.15 | 3.53 |
| 1721 | 83.52 | 78.66 | 74.08 | 7.74 | 1744 | 77.37 | 71.34 | 65.94 | ----- | 1767 | 66.62 | 59.06 | 52.72 | ----- |
| 1722 | 88.69 | 85.21 | 81.87 | ----- | 1745 | 80.82 | 73.00 | 70.81 | ----- | 1768 | 67.94 | 60.51 | 54.24 | 4.29 |
| 1723 | 94.18 | 92.31 | 90.48 | ----- | 1746 | 77.67 | 72.07 | 67.16 | 10.02 | 1769 | 69.41 | 62.13 | 55.97 | ----- |
| 1724 | 72.40 | 65.54 | 59.56 | 4.32 | 1747 | 78.77 | 73.38 | 68.65 | ----- | 1770 | 70.82 | 63.77 | 57.76 | ----- |
| 1725 | 76.53 | 70.58 | 65.36 | 5.25 | 1748 | 79.27 | 73.98 | 69.32 | ----- | 1771 | 72.42 | 65.62 | 59.76 | ----- |
| 1726 | 78.09 | 72.45 | 67.44 | 3.18 | 1749 | 80.52 | 75.46 | 70.94 | 11.15 | 1772 | 74.11 | 67.63 | 61.95 | ----- |
| 1727 | 79.44 | 74.06 | 69.22 | ----- | 1750 | 81.47 | 76.41 | 71.99 | 10.31 | 1773 | 76.45 | 70.40 | 65.02 | ----- |
| 1728 | 80.75 | 75.59 | 70.96 | ----- | 1751 | 82.77 | 78.13 | 73.93 | 11.26 | 1774 | 78.84 | 73.28 | 68.26 | 8.19 |
| 1729 | 82.25 | 77.38 | 72.93 | ----- | 1752 | 84.06 | 79.66 | 75.65 | 10.78 | 1775 | 81.02 | 75.89 | 71.24 | ----- |
| 1730 | 84.56 | 80.20 | 76.19 | ----- | 1753 | 85.01 | 80.76 | 76.87 | 11.78 | | | | | |
| 1731 | 86.94 | 83.17 | 79.64 | ----- | 1754 | 85.22 | 80.90 | 76.84 | 11.85 | | | | | |

Sources: Derived from the “As Executed” columns in Table 1 of Grubb (2013a).

Notes: See the text for construction. Dashed lines indicate missing MEV values, see Table 1. # indicates that no

discount rate makes $[APV - RD] = MEV$. In that year subjects must have been discounting redemption within the current year in which they were received, thus yielding an imputed discount of over 100 percent.

The following illustrates the calculation process for 1725. From Grubb (2013a, Table 1) the bills in circulation in 1725 amount to 38,566£_{NJ}. All bills redeemed in the current and immediately subsequent years are assumed to be applied to extinguishing this 1725 sum (redemption data are taken from Grubb 2013a, Table 1). The last year's redemption amount cannot exceed what is needed to extinguish the sum from the chosen year (in this case the 1725 sum of 38,566£_{NJ}). t = the years from 1725. The illustration shows the results for $r = 6$ percent and for r^* .

| Year | Redemptions Each Year | Weight in the Redemption | Time Discount Factor $e^{-0.06t}$ from 1725 | Weighted Time Discount at 6% | Weighted Time Discount Using e^{-r^*t} , with $r^* = 5.25$ |
|------|--------------------------|-----------------------------|--|---------------------------------|---|
| 1725 | 4,060£ _{NJ} | 0.1053 * | 1.0000 = | 0.1053 or * | 1.0000 = 0.1053 |
| 1726 | 4,060 | 0.1053 * | 0.9418 = | 0.0992 or * | 0.9489 = 0.0999 |
| 1727 | 4,060 | 0.1053 * | 0.8869 = | 0.0934 or * | 0.9003 = 0.0948 |
| 1728 | 4,060 | 0.1053 * | 0.8353 = | 0.0880 or * | 0.8543 = 0.0900 |
| 1729 | 3,060 | 0.0794 * | 0.7866 = | 0.0625 or * | 0.8106 = 0.0644 |
| 1730 | 3,060 | 0.0793 * | 0.7408 = | 0.0587 or * | 0.7691 = 0.0610 |
| 1731 | 3,060 | 0.0793 * | 0.6977 = | 0.0553 or * | 0.7298 = 0.0579 |
| 1732 | 3,060 | 0.0793 * | 0.6570 = | 0.0521 or * | 0.6925 = 0.0549 |
| 1733 | 3,060 | 0.0793 * | 0.6188 = | 0.0491 or * | 0.6570 = 0.0521 |
| 1734 | 3,060 | 0.0794 * | 0.5827 = | 0.0463 or * | 0.6234 = 0.0495 |
| 1735 | 2,700 | 0.0700 * | 0.5488 = | 0.0384 or * | 0.5916 = 0.0414 |
| 1736 | 1,266 | 0.0328 * | 0.5169 = | 0.0170 or * | 0.5613 = 0.0184 |
| | 38,566£ _{NJ} | 1.0000 | | 0.7653 | MEV = 0.7896 |

$0.7653 * 100$ = the present value of a representative bill in 1725 as a percentage of its face value when discounted at 6 percent from its expected future redemption years. This is the value placed in the table for 1725 under 6%. r^* is selected such that $[APV - RD]$ for 1725, given the redemption structure, = $MEV = 1.2334/1.5618 = 0.7897$ for 1725 (MEV is derived from Table 1). 5.25 percent satisfies this condition for 1725 and is the number placed in the table for 1725 under r^* .

arrears (Bush 1977, v. 2, pp. 241-3). In 1724, New Jersey Governor Burnet stated that “the common Interest of money is 8 per Cent” (*Documents Relating to the Colonial History of the State of New Jersey*, v. 5, p. 91). In 1729, Benjamin Franklin mentioned 10, 8, and 6 percent as the range of normal interest rates in nearby Pennsylvania (Labaree 1959, v. 1, p. 142).

From 1719 to 1739, the New Jersey legislature set the maximum legal interest rate at 8 percent and, from 1739 to 1775, at 7 percent. An effort by the New Jersey legislature to lower the maximum legal rate to 6 percent in 1775 was disallowed by the Crown (Bush 1977, v. 2, pp. 266-7, 502-4; 1986, v. 5, pp. 235-7). From the 1770s through the 1790s, an interest rate of 6 percent in mid-America appears most common.¹⁶ As such, the estimates of APV in Table 2 use

¹⁶ On 17 January 1777, Robert Morris said that 6 percent was the opportunity cost of capital placed in private securities (Smith 1980, v. 6, p. 117). Six percent was also the rate used by the national government for loans between 1776 and 1790, and the most common rate mentioned throughout this period, see Barlow (2012, pp. 110,

a range of interest rates between 6 and 10 percent. The single best-guess average interest rate for the entire period is taken as 8 percent, with 6 percent being the second best-guess alternative.

Normal rates were typically within one percentage point of the legal rate.

STATISTICAL ANALYSIS OF MEV, APV, AND r^*

a. Imputed r^ for MEV = (APV – RD) with LP = 0*

Figure 2 displays r^* from 1709 through 1774 along with the range of normal interest rates gleaned from the colonial literature. In 54 percent of the years with r^* data, r^* is within or above the normal range of interest rates. These years include 1709 through 1721, 1741, 1746 through 1757, and 1774. For a majority of the period covered, therefore, the proposition that New Jersey bills were simply barter assets with no special “moneyness” value or fiat currency attributes cannot be rejected. New Jersey paper money functioned predominantly as an asset “money,” and not as a fiat currency. In fact, for a few years, namely 1710 through 1719, 1741, and 1746 through 1756, New Jersey bills must have experienced a positive RD. From 1716 through 1719, this RD was quite substantial. In the other years, RD was not more than 4 or 5 percentage points. The forces driving these positive RDs are discussed in the next section.

In 46 percent of the years with r^* data, r^* is below the normal range of interest rates. These years include 1724 through 1743 (except 1741) and 1758 through 1768. Therefore, the proposition that $RD \approx 0$ and $LP > 0$, namely that New Jersey bills had some “moneyness” value

125, 128); Elliot (1843); Ferguson (1988, v. 7, p. 547); Homer and Sylla (1991, pp. 274-313); Hutchinson and Rachel (1962, v. 1, p. 308); *Journals of the Continental Congress* (v. 2, pp. 25-6; v. 6, p. 1037; v. 7, pp. 102-3, 158, 168; v. 8, pp. 725-6; v. 9, pp. 955, 989; v. 10, p. 59; v. 11, p. 416; v. 12, pp. 929-30, 932, 1074, 1256; v. 13, pp. 112, 141, 146-7, 441, 497; v. 14, pp. 717, 720, 731-2, 783, 820, 901; v. 15, pp. 1147, 1197, 1210, 1225, 1245-6, 1288, 1319, 1405; v. 16, pp. 264-5, 288; v. 17, pp. 464, 568, 804; v. 18, p. 1017; v. 19, pp. 6, 167; v. 21, p. 903; v. 23, p. 831; v. 24, p. 39; v. 26, p. 32; v. 27, pp. 395-6); *Pennsylvania Gazette* (30 April; 21 and 28 May; 25 June; 2, 16, and 23 July 1777); Puls (2008, p. 181); Smith (1979, v. 4, p. 295; 1980, v. 6, pp. 117-8, 212-3, 228-9, 238-9, 245, 252, 259-62, 270, 277, 295, 346, 368, 372, 386, 400-1, 404; 1981, v. 7, pp. 524, 581, 617, 623, 635, 642-3; 1981, v. 8, p. 25; 1983, v. 10, p. 205; 1985, v. 11, pp. 94, 137-8, 361; 1986, v. 13, pp. 132, 604-5; 1987, v. 14, pp. 51, 463, 500; 1988, v. 15, pp. 377, 396; 1989, v. 16, pp. 307-8, 490, 531; 1990, v. 17, p. 365; 1992, v. 19, p. 139; 1994, v. 21, p. 467). On 6 percent being a common rate in eighteenth-century America, see Brock (1975, pp. 260, 328, 332, 435, 462); Davis (1964, v. 1, p. 326; v. 2, pp. 38, 68, 83, 99-100, 315, 321; v. 3, p. 168; v. 4); Nettels (1934, p. 267).

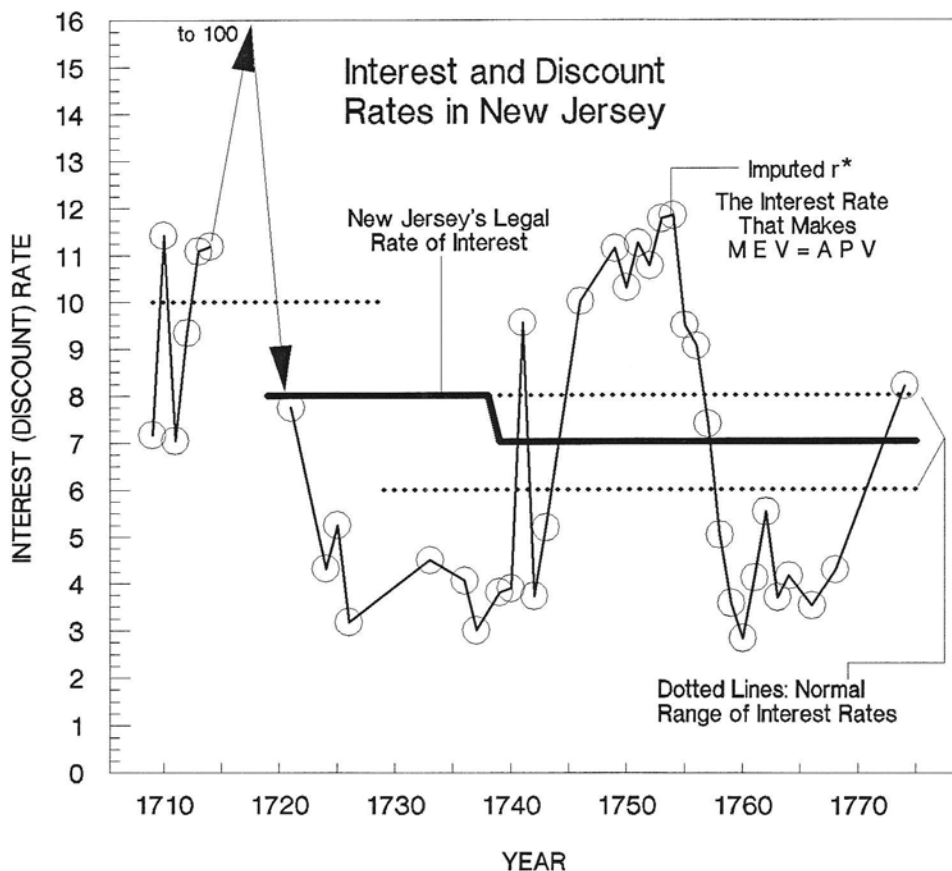


Figure 2 Interest Rates for Discounting New Jersey Bills of Credits, 1709-1774: The Imputed r^* Rate Versus the Normal Range of Interest Rates

Sources: Table 2 and the text.

Notes: Circles represent data points for r^* with linear interpolative lines connecting them. The range of normal market interest rates is taken from comments of respected contemporaries and/or are the rates within one percentage point of the legal rate set by the New Jersey assembly. The arrows indicate that r^* rose to 26 in 1716, 47 in 1717, and 100 in 1719 (the only three data point years between 1715 and 1720), before returning to 7.7 in 1721.

and were functioning to some degree as a fiat currency, cannot be rejected in these years. For just under half the period covered, New Jersey bills possessed some LP. They were transitioning from being a pure asset money toward being a fiat currency. For most of these years with a positive LP, while r^* is only a few percentage points below normal, in percentage terms it averaged around a 32 to 49 percent reduction from normal.

The below-normal r^* rates in 1724 through 1743 and 1758 through 1768 do not represent

the market rate being driven down by the emission of New Jersey paper money. In the first period, the emission of New Jersey paper money was almost exclusively through a land-bank mechanism where subjects borrowed paper money from the colonial treasury at 5 percent interest, see Figure 1; Grubb (2013a). It would be irrational for subjects to continue borrowing new paper money to put into circulation at 5 percent when the market rate was well below 5 percent. The second period was during the concluding years of the Seven Years War and its immediate aftermath. No contemporary writer or any other evidence indicates that interest rates were as low as r^* in these calamitous years. Therefore, the below-normal r^* rates in 1724 through 1743 and 1758 through 1768 represent something other than a relatively low opportunity cost of capital in these years driven by the emission of paper money. In other words, the proposition that $LP > 0$ cannot be rejected in these years. The relative size and determinants of this LP will be addressed in the following sections.

The fact that r^* is sometimes substantially above and sometimes substantially below what were considered normal interest rates in the colonial economy indicates that r^* is not measuring the opportunity cost of capital in that economy. Instead, r^* is measuring the presence and magnitude of the RD and the LP embedded in the particular asset being measured. As such, r^* cannot be used to directly calculate APV, which requires the opportunity cost of capital to calculate its present value. Thus, the second method that uses the range of normal long-run interest rates in the colonial economy will be used to calculate APV. This second method is used throughout the rest of the paper. The gap between MEV and APV found in the second method has the same interpretation as abnormal r^* values in the first method, namely above and below normal r^* values in the first method are the same as $(LP - RD) < 0$ and $(LP - RD) > 0$ in the second method, respectively.

b. Tracking the Levels of MEV and APV of New Jersey Paper Money

Figure 3 compares the levels over time, as a percentage of face value, of MEV and APV when discounted at 6 and 8 percent. For the entire period from 1709 through 1774, Figure 3 shows that the levels of MEV and APV are strikingly similar. Using the 8 percent discount rate, MEV and APV start at approximately the same value in 1710 and end at the same value in 1774. The possibility that MEV and APV are closely associated is hard to ignore.

Over the entire period from 1709 through 1774, using only the years with existent exchange rates (41 out of 66 years) and the best-guess 8 percent discount rate, APV accounts for 95 percent of MEV, leaving (LP - RD) to account for only 5 percent of MV. Using the second best-guess 6 percent discount rate, $APV \approx MEV$ and $(LP - RD) \approx 0$. If $RD \approx 0$, LP accounts for at best 5 percent of MEV when APV is discounted at 8 percent, and none of MEV when APV is discounted at 6 percent.¹⁷

In some years $APV > MEV$, implying that $(LP - RD) < 0$, which is the same as r^* being above normal. Given that LP cannot be negative, $RD > 0$ in the years 1710 through 1719, 1741, and 1746 through 1756. For 1710 through 1719, a positive RD is consistent with these bills being an innovation and with New Jersey experiencing difficulty redeeming them on time as promised. In 1711, the New Jersey assembly admitted that in the act to emit the bills “...several Mistakes have been committed, by which the Currency of the said Bills hath hitherto been very much Obstructed.” (Bush 1977, p. 97) In 1714, the assembly noted that “...there are considerable Sums of money [from bill redemption taxes] remaining due and unpaid...”, and that “...Taxes, ...not

¹⁷ Between 1709 and 1774 the long-run normal opportunity cost of capital appears to have declined from around 10 percent to around 6 percent. Given this fact, a hybrid measure of APV was constructed using a 10 percent discount rate before 1720, an 8 percent discount rate between 1720 and the end of the Seven Years War (1764), and a 6 percent discount rate after 1764. This hybrid measure yields the same results as using a constant 8 percent discount rate throughout. If the alternative APV calculation from fn. 15 is used, then APV is reduced by one percentage point and LP is increased by one percentage point from that reported elsewhere here.

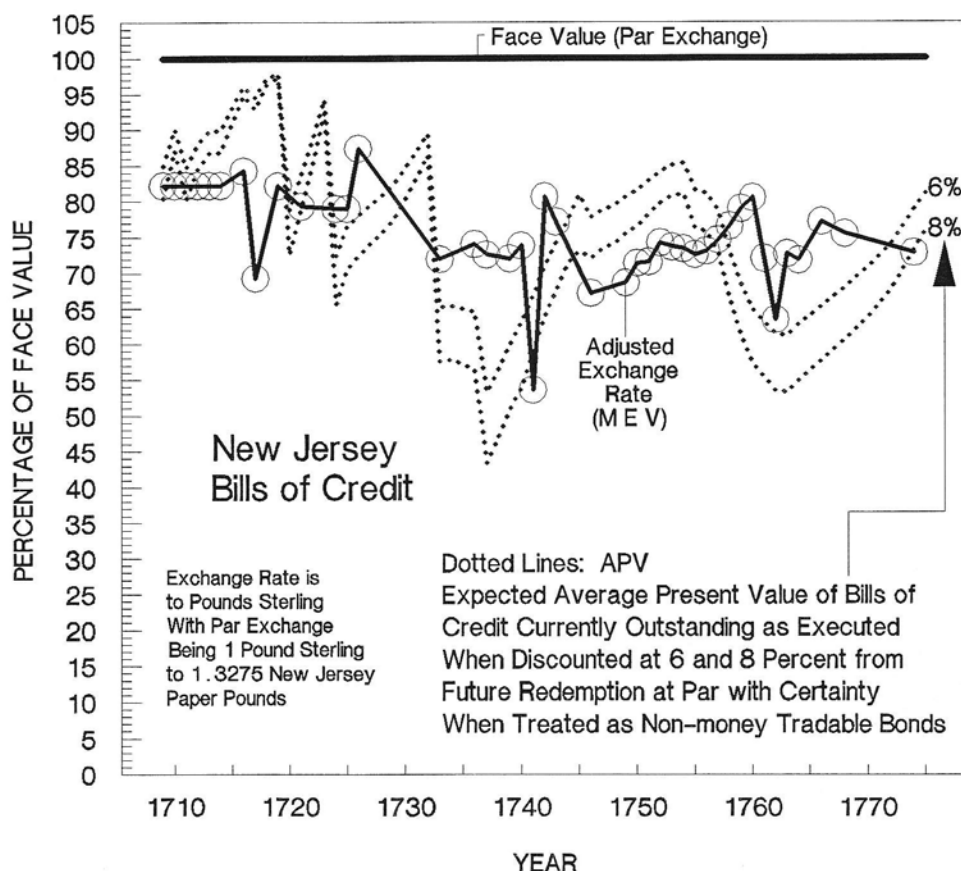


Figure 3 Average Adjusted Exchange Rate (MEV) and Average Expected Present Values (APV) for New Jersey's Bills of Credit, 1709-1774

Sources: See the text and Tables 1 and 2.

Notes: Circles represent data points for MEV with linear interpolative lines connecting them.

being fully paid, the said Bills cannot be sunk according to the true intent and meaning of the said Act.” (Bush 1977, pp. 125, 129) The r^* analysis in the prior section shows that the RD for this period was quite substantial, which is consistent with the concerns just quoted. In 1719, the legislature moved to enforce tax payments, and most of the bills issued in the prior years, over 95 percent, were finally redeemed by 1719. The last were eventually redeemed in 1724 (Grubb 2013a; Kemmerer 1940, pp. 107-13).

War panic is associated with a brief collapse in MEV in 1741, see Figure 3, which likely

explains the positive RD in that year.¹⁸ The positive RD in the years 1746 through 1756 can be explained by two events. First, in 1746 the New Jersey assembly emitted 10,000£_{NJ} in new bills to support King George's War, see Figure 1; Grubb (2013a). They made no explicit provisions to redeem these bills, hoping that the British Crown would reimburse the colony post-war. This expectation went unrealized (Bush 1980, pp. 109-11). Explicit provisions to redeem these bills via taxes were not enacted by the assembly until 1753. That year, the assembly noted, in the preamble to its act designed to resolve this redemption oversight,

[that the] Bills of Credit, issued by Virtue of several Acts of General Assembly for aiding His Majesty in the late War, against the Powers of *France* and *Spain*; and the Funds at first design'd by the Legislature for sinking the said Bills have failed; by Reason whereof not only the Public Credit in general, but also the Possessors of those Bills in particular may greatly suffer unless Provisions be made for sinking the same in a convenient Time some other way. (Bush 1980, pp. 21-8, 219-33)

The delay between emission and enactment of redemption structures likely increased the RD of the bills emitted in 1746, a situation which lasted through 1753.

Second, in 1749 the Crown disallowed a 40,000£_{NJ} paper money act passed by the New Jersey assembly in 1748. This was the first overt disallowance by the British Crown of a paper money act passed by the New Jersey assembly. New Jersey did not succeed in emitting new paper money until 1755 (Grubb 2013a; Kemmerer 1940, pp. 211-21). Crown-induced uncertainty over the paper money powers exercised by the New Jersey assembly along with redemption uncertainty over the 1746 war-support emission may have produced a positive RD in the years between 1746 and 1756. The r^* analysis in the prior section, however, shows that the $RD > 0$ associated with paper money emissions in these years, net of any positive LP, was relatively minor, being only a few percentage points above the normal market interest rate.

¹⁸ The range of exchange rates in 1741 is greater than in any other year, see Table 1. This observation is consistent with atypical uncertainty in the marketplace over what MEV should actually be in 1741. The r^* analysis in the prior section, however, shows that RD in 1741 was only a few percentage points above normal.

If the years when $(LP - RD) < 0$ are dropped from the calculation because they are years when RD cannot be safely assumed to be zero, then the sample falls from 41 years to 19 and 24 years for the 6 and 8 percent discounts, respectively. For these years APV accounts for 92 and 86 percent of MEV when discounted at 6 and 8 percent, respectively. Under the assumption that $RD \approx 0$ in these years, then LP accounts for 8 and 14 percent of MEV, respectively. Lastly, LP peaks from 1724 to 1740 and from 1758 to 1768. In both periods, LP averages about 9 and 17 percent of MEV when APV is discounted at 6 and 8 percent, respectively. In these two periods of maximum LP, APV still accounts for 91 and 83 percent of MEV when discounted at 6 and 8 percent, respectively. At its best, LP accounts for only 9 to 17 percent of MEV.¹⁹

In conclusion, colonial New Jersey paper money was not predominantly a fiat currency. It was overwhelmingly a real asset or commodity money. Its real asset present value explains the vast majority of its market value. In addition, Figure 3 shows no overall depreciation of New Jersey paper money, depreciation here meaning a loss of asset principal as measured in present value terms. The fact that New Jersey paper money traded below its face value, i.e. that its MEV was less than 100 percent of face or par value, does not mean that it had depreciated or that inflation had eroded its real asset value. The difference between the bills' face value and their MEV was overwhelmingly due to time-discounting and not depreciation. In fact, the existence of an overall positive LP indicates that the bills actually traded at an appreciated value, namely at a value above their real asset present value. Scholars, both past and present, have largely confused time-discounting with depreciation. This confusion springs, in part, from the erroneous assumption that colonial paper monies were fiat currencies. They simply missed the fact that these bills were zero-coupon bonds with MEV closely tracking their non-money real asset

¹⁹ See also fns. 15 and 17.

present value. This finding radically changes most of the received history of colonial monetary performance regarding the presumed inflationary tendencies of these paper monies.

c. Time Series Properties: Tracking the Variance in MEV and APV

Table 3 statistically analyzes the time series properties of MEV and APV, as well as their co-movements, through time. Linear-interpolated values are used to fill in years with missing values in Table 1 to generate a continuous series for MEV. Table 3 shows that MEV is a trend stationary series, but that APV is not a stationary series. However, Table 3 also shows that MEV and APV are co-integrated. Thus, estimating the relationship between MEV and APV is a valid exercise. Table 3 also reports that relationship. There is a statistically significant positive association between contemporaneous values of MEV and APV. MEV tracks movements in APV over time. Not only are the levels of MEV and APV closely associated, but so are their movements through time.

LIQUIDITY PREMIUM DETERMINANTS

Figure 3 showed that colonial New Jersey paper money possessed some liquidity premium. It was not a pure commodity or real asset money. The public was willing to pay something over and above its real asset present value to acquire and use it. Determinants of the LP to New Jersey's paper money are estimated in Table 4, where $[LP - RD]$ is measured by $[MEV - APV]$, see equation (2). Because $[LP - RD]$ cannot be decomposed empirically, determining whether changes in $[LP - RD]$ are being driven primarily by increases in LP versus decreases in RD, and vice versa, require careful interpretation of the independent variables used. One important independent variable can be ruled out, namely war (Smith 1985a, Wicker 1985). No consistent pattern of $[LP - RD]$ being larger or smaller across the three major wars can be discerned in the data. The three wars were Queen Anne's War (1702-1713), the War of

Table 3 Stationarity and Co-Integration Tests: New Jersey Paper Money, 1709-1774

| | | | | Half- Life | N | Adjusted R ² | F |
|--|--|--|--|-------------------|----|----------------------------|----------------------|
| a. Stationarity of Average Adjusted Exchange Rate [MEV], 1709-1774 | | | | | | | |
| [MEV _t - MEV _{t-1}] | = 194.8603 ^{***} (65.8647) | - 0.6141(MEV _{t-1}) ^{***} (0.1172) | - 0.0853(YEAR) ^{**} (0.0350) | 0.73 | 65 | 0.29 | 13.75 ^{***} |
| b. Stationarity of Real Asset Present Values Discounted at 8% [APV8] and 6% [APV6], 1709-1774 | | | | | | | |
| [APV8 _t - APV8 _{t-1}] | = 122.5921 (98.0947) | - 0.1921(APV8 _{t-1}) (0.0779) | - 0.0626(YEAR) (0.0544) | 3.25 ^a | 65 | 0.06 | 3.10 [*] |
| [APV8 _t - APV8 _{t-1}] | = 9.8424 (4.5861) | - 0.1401(AV8 _{t-1}) (0.0636) | | 4.59 ^a | 65 | 0.06 | 4.85 ^{**} |
| [APV6 _t - APV6 _{t-1}] | = 100.5139 (81.8354) | - 0.1850(AV6 _{t-1}) (0.0768) | - 0.0496(YEAR) (0.0449) | 3.39 ^a | 65 | 0.06 | 2.97 [*] |
| [APV6 _t - APV6 _{t-1}] | = 10.3516 ^{**} (4.8579) | - 0.1360(AV6 _{t-1}) (0.0628) | | 4.74 ^a | 65 | 0.05 | 4.70 ^{**} |
| c. Average Adjusted Exchange Rate [MEV] Versus Real Asset Present Value Discounted at 8% [APV8], 1709-1774 | | | | | | | |
| MEV _t | = 35.0134 ^{***} (7.8392) | + 0.09328(APV8 _t) [*] (0.0477) | | | 65 | 0.30 | 14.91 ^{***} |
| Co-integration test: | [e _t - e _{t-1}] | = -0.1034 (0.5801) | - 0.5618(e _{t-1}) ^{***} (0.1125) | 0.84 | 65 | 0.27 | 24.95 ^{***} |
| d. Average Adjusted Exchange Rate [MEV] Versus Real Asset Present Value Discounted at 6% [APV6], 1709-1774 | | | | | | | |
| MEV _t | = 33.1152 ^{***} (4.5636) | + 0.1095(APV6 _t) [*] (0.0570) | | | 65 | 0.30 | 14.83 ^{***} |
| Co-integration test: | [e _t - e _{t-1}] | = -0.1039 (0.5799) | - 0.5584(e _{t-1}) ^{***} (0.1123) | 0.85 | 65 | 0.27 | 24.74 ^{***} |

Sources: Data are taken from Tables 1 and 2; and Grubb (2013a). Linear extrapolations between years with missing values in Table 1 for MEV, as depicted in Figure 3, are used.

Notes: Data are annual. Standard errors are in parentheses under their respective coefficients. Dickey-Fuller critical values are used for the (t-1) independent variables, see Enders (1995, p. 419). For regression group a. and b., Durbin's Alternative Tests for autocorrelation failed to reject the hypothesis of no serial correlation above the 0.1 level in all regressions. In addition, lagged dependent variables were also tried, but were found to be statistically insignificant in every regression and so were dropped from all specifications. For regression group c. and d., the presence of serial correlation was corrected by including one lag of the dependent variable (coefficients not reported). These corrected regressions were then retested with Durbin's Alternative Test for autocorrelation which failed to reject the hypothesis of no serial correlation above the 0.1 level. The co-integration regressions use the error terms from the MEV regressions uncorrected for serial correlation (regressions not reported). For the co-integration tests, Durbin's Alternative Test for autocorrelation failed to reject the hypothesis of no serial correlation above the 0.1 level. The half-life to shocks are calculated using the following equation: $[-\ln(2)/\ln(1 + a_1)]$, where a_1 is the coefficient on the (t-1) independent variable. See Mark (2001, p. 32).

^{***} Statistical significance above the 0.01 level.

^{**} Statistical significance above the 0.05 level.

^{*} Statistical significance above the 0.1 level.

^a What the half-life would be if the coefficient on the (t-1) independent variable was statistically significant.

Jenkin's Ear and King George's War (1739-1748), and the Seven Years War (1754-1763), see Figure 3. Therefore, war dummy variables are not included in the specification.

The regressions in Table 4 explain between 65 and 68 percent of the variance in [LP - RD]. This is a better modeling fit, by leaps and bounds, than what has been found in prior studies of colonial monetary performance for colonies south of New England.²⁰ The regressions show that the trend is negative and statistically significant. Increasing the [LP - RD] share of MEV was not a matter of experience. Other variables were more important and swamped any learning-by-doing gains over time. Increasing British interference with New Jersey's power to emit new paper money late in the colonial era may also explain some of this negative trend (Grubb 2013a, Kemmerer 1940).

Two variables have a strong positive and statistically significant impact on [LP - RD], namely the per capita amount of paper money in circulation and the method of injecting paper money into the economy. Under the land bank injection method, subjects borrowed newly printed paper money from the colony's treasury on interest and then paid back (redeemed) their loans on a fixed schedule (Thayer 1953). Under the direct spending method, future taxes were set to redeem the spent bills. Bills redeemed under either method were removed from circulation and destroyed. The land bank method predominated between 1724 and 1753, see Figure 1; Grubb (2013a). Land- bank borrowings by the public were limited. No subject could borrow more than a fraction of the assessed value of his land holdings. A maximum of 100£_{NJ} and a minimum of 12.50£_{NJ} were also placed on loans to any single person. In addition, bills to be loaned out were

²⁰ See the studies cited in fn. 3.

Table 4 **Determinants of the Liquidity Premium for New Jersey Paper Money, 1709-1774**

$$[LP8_t - RD_t] = 189.7532^+ + 10.2439(\text{per capita } M_t)^{***} - 0.1140(\text{YEAR})^{++} + 3.9617(\text{Land Bank Emissions})^{**}$$

(120.5796) (2.1019) (0.0700) (1.9011)

N = 63; Adjusted R² = 0.68; F = 23.35^{***}

$$[LP6_t - RD_t] = 204.1975^* + 8.9709(\text{per capita } M_t)^{***} - 0.1234(\text{YEAR})^* + 2.7666(\text{Land Bank Emissions})^{++}$$

(110.5964) (1.8802) (0.0629) (1.669)

N = 63; Adjusted R² = 0.65; F = 19.89^{***}

Sources: Data are taken from Tables 1 and 2; Figure 3; Grubb (2013a). Linear extrapolations between years with missing values in Table 1 for MEV, as depicted in Figure 3, are used. Population estimates are taken from Carter (2006, v. 5, p. 652) with interpolations used between decadal benchmark numbers. M_t is in face value and is taken from Grubb (2013a), adjusted to keep par at post-1723 values.

Notes: Data are annual. Standard errors are in parentheses under their respective coefficients. $[LP8_t - RD_t] = [MEV_t - APV8_t]$, where $APV8_t$ is the real asset present value discounted at 8 percent, and $[LP6_t - RD_t] = [MEV_t - APV6_t]$, where $APV6_t$ is the real asset present value discounted at 6 percent, see Table 2. Land Bank Emissions are the years when the primary paper money issued was through land bank borrowings by the public, coded as one for the years 1724 through 1753 and zero otherwise. For the other years, the primary method of issuing paper money was through direct spending by the legislature. Both regressions were corrected for the presence of serial correlation by adding three lags of the dependent variable to the specification (coefficients not reported). These corrected regressions were then retested with Durbin's Alternative Test for autocorrelation which failed to reject the hypothesis of no serial correlation above the 0.1 level. Regressions using M_t in place of per capita M_t , while still statistically significant, were a poorer fit. $[LP_t - RD_t]$ is a stationary series, which should not be surprising given that MEV is a stationary series and MEV and APV are co-integrated, see Table 3. As such, the regressions reported above are valid exercises. The Augmented Dickey-Fuller tests are:

| | | | | |
|---|-----------|----|-------------------------|---------------------|
| $[(LP8_t - RD_t) - (LP8_{t-1} - RD_{t-1})] = 1.0840 - 0.2427(LP8_{t-1} - RD_{t-1})^{**}$ | Half-life | N | Adjusted R ² | F |
| (1.0680) (0.0825) | 2.49 | 65 | 0.11 | 8.65 ^{***} |
| $[(LP6_t - RD_t) - (LP6_{t-1} - RD_{t-1})] = -0.3603 - 0.2704(LP6_{t-1} - RD_{t-1})^{**}$ | | | | |
| (0.8868) (0.0865) | 2.20 | 65 | 0.12 | 9.77 ^{***} |

Dickey-Fuller critical values are used for the (t-1) independent variables, see Enders (1995, p. 419). Durbin's Alternative Test for autocorrelation failed to reject the hypothesis of no serial correlation above the 0.1 level in both regressions. In addition, lagged dependent variables were tried in both regressions, but were found to be statistically insignificant and so were dropped from the specification. Time trends were tried, but were found to be statistically insignificant and so were dropped from both regressions. The half-life to shocks are calculated using the following equation: $[-\ln(2)/\ln(1 + a_1)]$, where a_1 is the coefficient on the (t-1) independent variable. See Mark (2001, p. 32).

*** Statistically significant above the 0.01 level.

** Statistically significant above the 0.05 level.

* Statistically significant above the 0.1 level.

++ Statistically significant above the 0.11 level.

+ Statistically significant above the 0.13 level.

distributed among the counties based on fixed-quota allotments (Bush 1977, pp. 301-19, 427-38, 474-87).

As such, land-bank emissions were broadly spread among the populace and initially placed in the hands of active entrepreneurs engaged in local commerce. Thus, paper money

would experience familiarity and universality of usage as a medium of exchange, thereby gaining general acceptance as “money.” These features added value or LP to New Jersey’s bills of credit above their real asset present value as just non-money tradable bonds. In addition, the land pledged to back the borrowing of these bills, and the aggressiveness of the colonial administration in enforcing repayment of loans and foreclosing on the property of delinquent borrowers, may have reduced the RD associated with New Jersey paper money compared with the alternative money-injection method. As such, the positive association of land-bank emissions with [LP - RD] may be through both an increase in LP and a decrease in RD.

By contrast, the non-land bank emission method entailed the legislature directly spending paper money on soldiers’ pay and government salaries, and then redeeming the bills through future taxes. The public may have considered the APV of bills backed by the promise of future tax collection to require a higher RD than bills backed by land pledges. In addition, such injections were more narrowly based and less likely to penetrate as quickly or as far into local trading networks compared with emissions through land bank borrowings. Lacking universal familiarity as a medium of exchange, relative to land-bank emissions, New Jersey’s bills of credit gained relatively less LP under non-land bank emission methods, other things equal.

It is interesting to note that the two paper money emissions disallowed by the Crown, 40,000£_{NJ} in 1748 and 100,000£_{NJ} in 1769, were both land-bank emissions (Bush 1982, pp. 523-47; 1986, pp. 441-56; Grubb 2013a). The New Jersey assembly may have wanted to continue the land bank emission method after its last land-bank emission was finished in 1753, in part, because this method enhanced the LP and/or reduced the RD associated with its bills of credit.

Either way, the expected outcome was to raise the MEV of its paper money.²¹

The most interesting variable in Table 4 is the positive and statistically significant effect of the per capita amounts of paper money in circulation on [LP - RD]. Placing more paper money in circulation, regardless of the method of injection, would increase the strain on executing redemptions as promised. As such, RD should not fall when the amount of paper money in circulation is increased. Therefore, increases in LP must account for the positive association between the amount of paper money in circulation per capita and [LP - RD].

The more paper money in circulation per capita, the more that paper money gained the quality of “moneyness” for which people were willing to pay. More money in circulation per capita increased its ubiquity and familiarity of usage, which in turn led the public to increasingly treat this money less as a pure barter asset and more like a fiat currency. This process was accomplished by the public increasingly not time-discounting these bills of credit when used in trade as much as would be required if they were just non-money bonds. This outcome is also shown in Figure 2 where r^* falls below normal during periods of large M emissions and when land-bank emissions were prevalent. If the public stopped time-discounting bills altogether, that action would drive the MEV of the bills to 100 percent of their face value, assuming RD = 0. While colonial New Jersey paper money was far from that level of fiat “moneyness,” it was beginning that transition. This is especially true from 1758 to 1771, which saw the highest per capita amounts of bills put into circulation, by multiple factors over prior years, and also saw some of the highest [LP - RD] values, and lowest r^* values, for New Jersey paper money during the colonial era, see Figures 1, 2, and 3; Grubb (2013a).

The effect can be explained with the following thought experiment: suppose the

²¹ Benjamin Franklin was a strong advocate of using the land bank method for injecting bills of credit into the economy. He saw that method as the best for enhancing the use and value of such bills (Labaree 1959, v. 1, pp. 141-57; 1961, v. 4, pp. 344-50, 496-8). See also Smith (1985a).

government issued only one bill of credit, similar to a U.S. saving bond. Most of the public would have no encounters with it or know if others were using it for trade. Under such circumstances, a person offered this unusual bill might only value it at its real asset worth and only take it in trade at its non-money bond present value. Some threshold of familiarity and universality of usage would need to be crossed for the public to begin to pay a premium over its real barter asset present value to acquire this money “thing”— because it now serves as a valuable medium of exchange for transacting local trade above its next best barter alternative.

For example, between 1709 and 1718, the average amount of New Jersey paper money in circulation per white capita was only 0.13 New Jersey pounds in face value. By contrast, between 1757 and 1770 that average was 2.16—a 16.5 fold increase. Average worker income per year was 25 to 40 New Jersey pounds in face value. Thus, the chance of running across a New Jersey bill between 1709 and 1718 was low relative to this chance between 1757 and 1770.²² The results in Table 4 are consistent with putting enough paper money into circulation to cross that threshold of rarity to familiarity, thereby generating some LP for New Jersey paper money.

This last finding is also an indirect test of the applicability of the classical quantity theory of money to New Jersey’s paper money regime. Other things equal, and with $\ln(Y)$ and $\ln(V)$ assumed to be long-run constants, the classical quantity theory of money implies that $\Delta M_t = a\Delta P_{NJ}$ (where $a > 0$ and P_{NJ} = a price index expressed in New Jersey paper pounds).²³ Purchasing power parity implies that $\Delta P_{NJ} = b\Delta EX$ (where $b > 0$).²⁴ By construction, $\Delta EX = -\Delta MEV$. Other things equal, and by construction in equation (2), $\Delta MEV = \Delta LP$, because under the quantity

²² New Jersey paper money in circulation at face value (M_t) is taken from Grubb (2013a), adjusted to keep par at post-1723 values. Population estimates are taken from Carter (2006, v. 5, p. 652) with interpolations used between decadal benchmark numbers. Yearly income estimates are taken from the Philadelphia market for laborers and artisans circa 1771 (Grubb 1988, p. 588). Market values in Pennsylvania pounds are converted to New Jersey pounds at face value following $1.6667\text{£}_{PA} = 1\text{£}_S = 1.3275\text{£}_{NJ}$, see fn. 5 and McCusker (1978, p. 177).

²³ See fn. 7.

²⁴ See the discussion of purchasing power parity in the Background section above.

theory of money [APV - RD] doesn't matter. Thus, by substitution, $\Delta M_t = -c\Delta LP$ (where $c > 0$). Therefore, a testable hypothesis under the classical quantity theory of money is that the sign on the variable *per capita* M_t in Table 4 should be negative. The statistically significant positive signs on that coefficient in Table 4, therefore, falsifies the application of the classical quantity theory of money to New Jersey's paper money regime.

Finally, the results in Table 4 resolves the colonial monetary puzzle. Putting more paper money in circulation per capita could increase its MEV relative to its APV by causing an increase in its LP. Emitting more paper money typically drove down its APV, under the assumption of maintaining a fiscally credible tax redemption structure, but when it also increased its universality and familiarity of usage it could drive up its LP and so enhance its MEV. Rising LP siphoned off the inflationary effects (currency depreciation effects) emanating from a fall in APV caused by an increase in the paper money supply.

THE CLASSICAL QUANTITY THEORY OF MONEY REASSESSED

How the classical quantity theory of money performs when applying the standard tests to colonial New Jersey paper money is presented in Table 5. The specifications are selected to be comparable with those reported in the prior literature for other North American colonies (Grubb 2004, p. 349; Rousseau 2007, p. 267; West 1978, p. 4). Thus, the results for New Jersey can be easily compared with the results reported for these other colonies. This is the first time such specifications have been applied to colonial New Jersey. It has not been done previously because no price index in New Jersey paper pounds (P_{NJ}) currently exists, thus scholars have been stymied in applying the quantity theory of money to colonial New Jersey. A purchasing power parity construct of P_{NJ} is substituted here in place of this missing price index, namely $\ln(EX) + \ln(P_{UK}) = \ln(P_{NJ})$. Given that purchasing power parity holds for all other colonies where exchange

Table 5 Performance of the Quantity Theory of Money for New Jersey Paper Money, 1709-1774

| | Half-Life | N | Adjusted R ² | F |
|--|-------------------|----|-------------------------|----------------------|
| a. Classical Quantity Theory of Money Tests with $[\ln(EX_t) + \ln(P_{UKt})] = \ln(P_{NJt})$: | | | | |
| $\ln(P_{NJt}) = 2.8841^{***} + 0.0131\ln(M_t)^{**}$ (0.5729) (0.0055) | | 65 | 0.27 | 12.65 ^{***} |
| $\ln(P_{NJt}) = 2.8605^{***} + 0.0152\ln(M_t) - 0.0024\ln(M_{t-1})$ (0.5924) (0.0132) (0.1346) | | 65 | 0.26 | 8.31 ^{***} |
| $\ln(P_{NJt}) = 2.9210^{***} + 0.0172\ln(M_t) - 0.0144\ln(M_{t-1}) + 0.0127\ln(M_{t-2})$ (0.5829) (0.0130) (0.0182) (0.0129) | | 64 | 0.28 | 6.98 ^{***} |
| b. Classical Quantity Theory of Money Tests with MV_t replacing $\ln(P_{NJt})$: | | | | |
| $MEV_t = 49.0981^{***} - 0.6291\ln(M_t)^{**}$ (10.0071) (0.2925) | | 65 | 0.31 | 15.48 ^{***} |
| $MEV_t = 48.6506^{***} - 0.7533\ln(M_t) + 0.1399\ln(M_{t-1})$ (10.3135) (0.6678) (0.6747) | | 65 | 0.30 | 10.17 ^{***} |
| $MEV_t = 49.6421^{***} - 0.7698\ln(M_t) + 0.5452\ln(M_{t-1}) - 0.4181\ln(M_{t-2})$ (10.5026) (0.6782) (0.9510) (0.6764) | | 64 | 0.28 | 7.10 ^{***} |
| c. Stationarity tests for per capita real money demand with $[\ln(M_t) - \ln(P_{NJt}) - \ln(\text{Population}_t)] = m_t$ and $[\ln(EX_t) + \ln(P_{UKt})] = \ln(P_{NJt})$: | | | | |
| $[m_t - m_{t-1}] = -0.7428^* - 0.1316(m_{t-1})$ (0.3775) (0.0618) | 4.92 ^a | 65 | 0.05 | 4.53 ^{**} |
| $[m_t - m_{t-1}] = -20.7264 - 0.2076(m_{t-1}) + 0.0112(\text{YEAR})$ (12.9177) (0.0784) (0.0072) | 2.98 ^a | 65 | 0.07 | 3.52 ^{**} |

Sources: Tables 1 and 2; Carter (2006, v. 5, p. 652); Grubb (2013a); Schumpeter (1938, p. 35).

Notes: EX_t is the average exchange rate reported in Table 1. $MEV_t = 1.2334/EX_t$, which is the estimated exchange rate of New Jersey paper pounds for pound sterling in New Jersey expressed as a percentage of the face value of New Jersey paper pounds, see the text for discussion and construction. P_{UKt} is the British consumer price index taken from Schumpeter (1938, p. 35). M_t is the face value of New Jersey paper pounds currently outstanding and in circulation taken from Grubb (2013a) and adjusted to keep par at post-1723 values. All data are annual. Linear interpolations between years with missing values are used for the exchange rate and population data. Standard errors are in parentheses under their respective coefficients. For the a. and b. regressions, each regression was corrected for the presence of serial correlation by adding one lag of the dependent variable to the specification (coefficients not reported). These corrected regressions were retested with Durbin's Alternative Test for autocorrelation which failed to reject the hypothesis of no serial correlation above the 0.1 level. For the c. unit-root regressions, Dickey-Fuller critical values are used for the (t-1) independent variables, see Enders (1995, p. 419). In these regressions, Durbin's Alternative Test for autocorrelation failed to reject the hypothesis of no serial correlation above the 0.1 level. In addition, lagged dependent variables were tried, but were found to be statistically insignificant in all of these regressions and so were dropped from these specifications. The half-life to shocks are calculated using the following equation: $[-\ln(2)/\ln(1 + a_1)]$, where a_1 is the coefficient on the (t-1) independent variable. See Mark (2001, p. 32).

*** Statistical significance above the 0.01 level.

** Statistically significant above the 0.05 level.

* Statistically significant above the 0.1 level.

^a What the half-life would be if the coefficient on the (t-1) independent variable was statistically significant.

rates and price indices exist, it is reasonable to assume that it holds for New Jersey as well.²⁵

The exchange rate (EX) is taken from Table 1, and the English price index (P_{UK}) is taken from Schumpeter (1938, p. 35).

Under the assumption that $\ln(Y)$ and $\ln(V)$ are long-run constants, the standard West (1978, p. 4) style classical quantity theory of money short-run estimating equation is $\ln(P_{NJt}) = \text{constant} + \ln(M_t) + e_t$.²⁶ This regression, along with regressions using one- and two-year lagged values of M_t to capture the time it took M_t to penetrate into the economy, are reported in Table 5. The results are relatively weak. There is a positive contemporaneous association between prices and the paper money supply, but the magnitude is small, i.e. a 10 percent increase in M_t is associated only with a 1.3 percent rise in P_t . Adding one or two-year lagged values of the paper money supply eliminates the statistical significance of the association between paper money and prices. While no one expects the short-run effect of M on P to be 1-to-1, the results here are weak enough to question the usefulness of the classical quantity of money as applied to colonial paper money regimes (Friedman 1956; Lucas 1980, p. 1007; McCallum 1992, p. 157). That said, the results are marginally better, especially for contemporaneous effects, than those found by West (1978, p. 4), Grubb (2004, p. 349), and Rousseau (2007, p. 267) for other colonies south of New England.²⁷

Given that $\ln(P_{NJt})$ is a constructed variable that depends on P_{UK} , the market value of New

²⁵ See Grubb (2003, p. 1786; 2005b, p. 1346; 2010, pp. 132-5) and the discussion of purchasing power parity in the Background section above.

²⁶ See fn. 7.

²⁷ This finding may also be due to using sterling exchange rates for measuring the value of New Jersey paper money in quantity-theory-of-money tests rather than commodity price indices which were used to measure the value of the other colonies' paper monies in their respective quantity-theory-of-money tests. Given the nature of colonial commodity price indices, sterling exchange rates may suffer less from relative price contamination.

Jersey paper money (MEV_t) was also tried in place of $\ln(P_{NJt})$ in Table 5.²⁸ The results from these regressions are similar to those using $\ln(P_{NJt})$ in terms of relatively poor fit, weak statistical significance, and small coefficient magnitudes. The quantity of paper money does not explain the market value of paper money well, whether the market value is measured by MEV_t or $\ln(P_{NJt})$.²⁹

Table 5 also presents a long-run test of the classical quantity theory of money applied to colonial New Jersey paper money. It rearranges the equation-of-exchange identity so that what can be measured, namely real paper money balances, are on the left-hand side, i.e. $\ln(M_t)/\ln(P_t) = \ln(Y)/\ln(V)$, (Grubb 2004, p. 350).³⁰ Over time, if the classical quantity theory of money holds, then $\ln(M_t)/\ln(P_t)$ should be a stationary series. The results in Table 5 indicate that real paper money balances per white capita were neither a stationary nor a trend stationary series.

Restricted to the paper money supply, it is hard to get the classical quantity theory of money to explain much in either the short- or long-run. At best, a weak contemporaneous association between paper money and prices, and between paper money and exchange rates exists, with no lagged paper money supply effects on either prices or exchange rates. Lagged paper money effects eliminate even these modest contemporaneous associations. In addition, real paper money balances per white capita are not stable over time, indicating that white per capita $\ln(Y)/\ln(V)$ is not stable over time.³¹

²⁸ See fn. 12.

²⁹ The coefficient signs are reversed in the MEV_t regressions from the $\ln(P_{NJt})$ regressions in Table 5 because, by construction, $EX_t = -aMEV_t$, where $a > 0$. Thus, $\ln(P_{NJt}) = -cMEV_t$, where $c > 0$. Alternative data specifications, namely using the M_t reported in Brock (1975, 1992) and the present value of M_t constructed from Table 2 and Grubb (2013a) were tried in place of those reported in Table 5. The results yielded no relevant differences to those reported in Table 5. Thus, the speculation in Grubb (2013a) that the failure of the classical quantity theory of money when applied to the colonies south of New England was due to the poor data quantity and quality of M_t used in these past studies is not borne out, at least for New Jersey.

³⁰ See also fn. 7.

³¹ This assessment is for the paper money supply only. The assumption throughout is that the specie money supply in colonial New Jersey was zero for local transactions, or correlated with the paper money supply so as to have no independent effect on the quantity theory of money either under a currency substitution effect or a straight quantity effect (Smith 1937, p. 307; Grubb 2012b). See Grubb (2004) for a heroic effort to combine specie and paper money

Under the classical quantity theory of money, an increase in the paper money supply should cause price inflation or, what is the same thing, depreciation of the paper currency. Under the fiscal backing theory of paper money as zero-coupon bonds, maintaining fiscally credible redemption tax structures should cause the time to redemption to be extended when paper money supplies are increased which in turn should cause the contemporaneous real present value of the paper money asset to fall. The outcome is the same in both theories. An increase in the supply of paper money causes the current value of paper money to fall. The difference is that in the first case it falls because money is being valued only in fiat terms, whereas in the second case it falls because money is being valued only in real asset/commodity terms.

Contemporary writers realized this. For example, in 1779, James Madison explained, in reference to the Continental dollar, the problem of disentangling quantity-theory-of-money effects from time-discounting effects when money is structured as zero-coupon bonds. The Continental dollar and the colonial New Jersey pound were structured the same way (Grubb 2013b). Madison reasoned,

If the circulating medium be a municipal one, as a paper currency [an inside money composed of bills of credit], still its value does not depend on its quantity. It depends on the credit of the state issuing it, and on the time of its redemption; and is no otherwise affected by the quantity, than as the quantity may be supposed to *endanger* or *postpone* the redemption

It has indeed happened, that a progressive depreciation of our currency [the Continental dollar] has accompanied its growing quantity; ... When the fact however is explained, it will be found to coincide perfectly with what has been said. ... as every addition made to the quantity in circulation, would naturally be supposed to remove to a proportionally greater distance the redemption of the whole mass, it could not happen otherwise than that every additional emission would be followed by a further depreciation [in this context Madison explicitly means by depreciation only time-discounting]. (Hutchinson and Rachal 1962, v. 1, pp. 305-6; italics in the original)

This conflation of effects can be seen in Figure 3 for colonial New Jersey paper money. If MEV perfectly followed APV, namely if $(LP - RD) = 0$, then the fiscal theory of money as a real

for colonial Pennsylvania and reassess the classical quantity theory of money for this combined money supply.

asset would hold perfectly because the MEV of money would perfectly equal its real asset present value under certainty of redemption. This outcome in Figure 3, however, is also consistent with the classical quantity theory of money. An increase in the paper money supply would typically lengthen the period of redemption, given the requirement of maintaining a fiscally credible redemption tax structure, and so lower APV and hence MEV. As such, a decrease in the current value of paper money is associated with an increase in the quantity of paper money in both theories in the colonial setting.

Table 6 shows this result. Suppose MEV perfectly equals APV, i.e. perfect fiscal backing yields a pure real asset money, i.e. one with no LP. If Madison's reasoning is correct, then ΔM_t should be associated with $-\Delta APV_t$, given that ΔP_{NJ} yields $-\Delta APV$ when $MEV = APV$. Substituting APV in place of $\ln(P_{NJ})$ in the West (1978, p. 4) style classical quantity-theory-of-money regressions in Table 5 yields the specifications in Table 6. These are counterfactual specifications. They ask what would happen if the value of money, as measured by price indices and exchange rates, perfectly followed the money's APV measure instead.

The results in Table 6 are a better modeling fit, by leaps and bounds, than what has been found in prior studies of colonial monetary performance.³² They show a strong association between M_t and APV_t , much stronger than the association shown in Table 5 between M_t and P_{NJt} , and between M_t and MEV_t . In Table 6, the quantity theory of money holds well, with a tight fit and high R^2 . That ΔM_t explains ΔAPV_t , a counterfactual construct, better than it explains changes in prices and exchange rates is telling. It indicates that the failure of the quantity theory of money to explain colonial paper money's effect on prices is not a failure of the quantity theory of money *per se*, but a failure of how we define and understand the dynamics of what money is.

³² See the studies cited in fn. 3.

Table 6 A Counterfactual Quantity Theory of Money for New Jersey Paper Money, 1709-1774

| | | | N | Adjusted R ² | F |
|--|-------------------------------------|--|----|----------------------------|-----------------------|
| a. With APV8 _t replacing ln(P _{NJt}): | | | | | |
| APV8 _t = | 34.6010 ^{***} (10.2304) | - 1.3704ln(M _t) ^{***} (0.5118) | 65 | 0.76 | 103.82 ^{***} |
| APV8 _t = | 16.9381 [*] (8.8909) | - 4.9189ln(M _t) ^{***} (0.7495) | 65 | 0.84 | 115.14 ^{***} |
| | | + 4.4450ln(M _{t-1}) ^{***} (0.7803) | | | |
| APV8 _t = | 22.6074 ^{**} (8.6601) | - 5.4088ln(M _t) ^{***} (0.7022) | 64 | 0.87 | 84.76 ^{***} |
| | | + 7.9015ln(M _{t-1}) ^{***} (1.1652) | | | |
| | | - 3.3359ln(M _{t-2}) ^{***} (0.8951) | | | |
| b. With APV6 _t replacing ln(P _{NJt}): | | | | | |
| APV6 _t = | 32.8436 ^{***} (9.7538) | - 1.1063ln(M _t) ^{***} (0.4218) | 65 | 0.77 | 107.05 ^{***} |
| APV6 _t = | 16.2947 [*] (8.4781) | - 4.0397ln(M _t) ^{***} (0.6217) | 65 | 0.86 | 117.88 ^{***} |
| | | + 3.6666ln(M _{t-1}) ^{***} (0.6471) | | | |
| APV6 _t = | 21.6686 ^{**} (8.2654) | - 4.4347ln(M _t) ^{***} (0.5836) | 64 | 0.87 | 85.99 ^{***} |
| | | + 6.4642ln(M _{t-1}) ^{***} (0.9665) | | | |
| | | - 2.7084ln(M _{t-2}) ^{***} (0.7432) | | | |

Sources: Data are taken from Table 2; Grubb (2013a).

Notes: See the notes to Table 5 and the text for construction discussions. Data are annual. Standard errors are in parentheses under their respective coefficients. New Jersey paper money in circulation at face value (M_t) is taken from Grubb (2013a), adjusted to keep par at post-1723 values. Each regression was corrected for the presence of serial correlation by adding one or two lags of the dependent variable to the specification (coefficients not reported). Two lags were used in both M_{t-2} regressions, and one lag in all the other regressions. These corrected regressions were then retested with Durbin's Alternative Test for autocorrelation which failed to reject the hypothesis of no serial correlation above the 0.1 level.

*** Statistical significance above the 0.01 level.

** Statistical significance above the 0.05 level.

* Statistically significant above the 0.1 level.

The transition of colonial paper money from a real asset commodity money toward being a fiat currency siphoned off enough of the inflationary (depreciation) effects of increases in the paper money supply to weaken the standard tests of the classical quantity theory of money when applied to colonial paper money regimes.

The results in Tables 5 and 6 do not imply that the fiscal backing theory of colonial paper money performs better. Disentangling the fiscal backing and classical quantity theories of money

hinges on the assumption that APV_t and M_t are independent, i.e. on whether paper money can be increased without extending the redemption time window in such a way that does not threaten fiscal credibility. This would be possible only when taxes are perceived to be well below historically acceptable and feasible levels, leaving room to increase paper money and increase yearly redemption taxes without extending the redemption window timeframe. This possibility would allow an increase in M_t with no change in APV_t , thus creating a testable distinction between the classical quantity theory and the fiscal backing theory of money. However, it is impossible to find an episode that is empirically rich enough to make this distinction testable in the colonial New Jersey data. As Table 6 shows, M_t and APV_t are not independent.

While the classical quantity theory of money and the fiscal backing theory of money may perform well when the money “thing” is a pure commodity or a pure fiat money in a fully monetized economy, these theories may not perform well when the money “thing” is fluid, transitioning from these states in an under-monetized economy. It is the existence of a fluctuating LP or (MEV - APV) gap produced by monetary supply effects in an under-monetized developing colonial economy that weakened the ability of the classical quantity theory and fiscal-backing theory of money to explain colonial paper money regimes. Modeling the market value of colonial paper money as being composed of its real asset present value plus a liquidity premium performs better empirically.

CONCLUSIONS

The preceding has taken the analysis of colonial paper money far beyond its cumulative current state in the economics literature. A new viable theoretical approach and verifiable empirically strategy were employed to resolves the colonial monetary puzzle, at least for New Jersey. The analysis provides a template for reevaluating the colonial paper money regimes of

other colonies. This approach is applicable to under-monetized colonial economies dominated by open external trade with a periphery-versus-core political economy trading structure.³³ Thus, besides the American colonies, it may prove useful for studying the monetary regimes of other under-monetized, developing, and colonially constrained economies both past and present.

Colonial New Jersey's paper money were bills of credit structured as zero-coupon bonds. It functioned predominantly as a real asset money and not a fiat currency. Between 80 and 100 percent of its market value was accounted for by its real asset present value, whereas only 0 to 20 percent was accounted for by its liquidity premium. New Jersey's paper money did not depreciate. It traded below face value due to time-discounting, not depreciation. Past scholars have simply confused depreciation with time-discounting. The presence of a small liquidity premium indicates this money was beginning a transition from being a real asset money toward being a fiat currency. This transition was positively associated with the method of injection and the quantity of paper money in circulation. The penetration of this money into the economy enhanced its familiarity and universality of usage thereby increasing the premium the public was willing to pay to acquire this money "thing" above its non-money real asset present value.

The enhanced market value of New Jersey's paper money coming from the positive liquidity premium was produced by the public reducing the amount of time-discounting imposed on the bills as the bills became a more familiar and trusted medium of exchange, relative to their next best barter alternative. This nascent liquidity premium masked the statistical association between the amount of paper money in circulation, prices, and exchange rates such that the classical quantity theory performed poorly when using traditional tests, but performed well when the paper money is valued at its non-money real asset present value.

³³ Rousseau (2006) argues that even with paper money the colonies remained under-monetized.

References

- Barlow, J. Jackson, ed. (2012). *To Secure the Blessings of Liberty: Selected Writings of Gouverneur Morris*. Indianapolis, IN: Liberty Fund.
- Barro, Robert J. (1977). "Unanticipated Money Growth and Unemployment in the United States," *American Economic Review* 67, no. 2, pp. 101-115.
- Bass, Jeremiah (1717). "Speech Made Before the New Jersey General Assembly, 16 January 1717," in *A Journal of the Votes of the House of Representatives of His Majesty's Province of New-Jersey*. New York: William Bradford Printer, pp. 17-19.
- Bordo, Michael D. (1987). "Equation of Exchange," in Eatwell, John, Milgate, Murray, and Newman, Peter, eds., *The New Palgrave: A Dictionary of Economics*. London: Macmillan, v. 2, pp. 175-177.
- Brock, Leslie V. (1975). *The Currency of the American Colonies, 1700-1764: A Study in Colonial Finance and Imperial Relations*. New York: Arno [original 1941, PhD dissertation, University of Michigan].
- _____. (1992). "The Colonial Currency, Prices, and Exchange Rates," *Essays in History* 34, pp. 70-132 [posthumously published].
- Bush, Bernard (1977). *Laws of the Royal Colony of New Jersey, 1703-1745*. Trenton, NJ: New Jersey State Library, Archives and History Bureau. [*New Jersey Archives*, Third Series, 2.]
- _____. (1980). *Laws of the Royal Colony of New Jersey, 1746-1760*. Trenton, NJ: New Jersey State Library, Bureau of Archives and History. [*New Jersey Archives*, Third Series, 3.]
- _____. (1982). *Laws of the Royal Colony of New Jersey, 1760-1769*. Trenton, NJ: New Jersey State Library, Bureau of Archives and History. [*New Jersey Archives*, Third Series, 4.]
- _____. (1986). *Laws of the Royal Colony of New Jersey, 1770-1775*. Trenton, NJ: Division of Archives and Records Management, New Jersey Department of State. [*New Jersey Archives*, Third Series, 5.]
- Carter, Susan. B., et al., eds. (2006). *Historical Statistics of the United States: Earliest Times to the Present, Millennial Edition, Volume 1 and 5*. New York: Cambridge University Press.
- Davis, Andrew McFarland (1964). *Colonial Currency Reprints, 1682-1751, vols. 1-4*. New York: Augustus M. Kelley.
- Documents Relating to the Colonial History of the State of New Jersey* 3-27, (1881-1905).
- Elliot, Jonathan (1843). "Funding System of the United States and Great Britain," *House of Representatives Document No. 15* (Vol. II. Executive Documents), 28th Congress, 1st Session,

Read on Dec. 16, 1843. [Reprinted 1971. New York: Burt Franklin].

Enders, Walter (1995). *Applied Econometric Time Series*. New York: John Wiley & Sons, Inc.

Ferguson, E. James, *et al.*, eds. (1988). *The Papers of Robert Morris, 1781-1784, Vol. 7*. Pittsburgh, PA: University of Pittsburgh Press.

Fisher, Irving (1912). *The Purchasing Power of Money*. New York: Macmillan.

Friedman, Milton (1956). "The Quantity Theory of Money—A Restatement," in Milton Friedman, ed., *Studies in the Quantity Theory of Money*. Chicago: University of Chicago Press.

Grubb, Farley (1988). "The Auction of Redemptioner Servants, Philadelphia, 1771-1804: An Economic Analysis," *Journal of Economic History* 48, no. 3, pp. 583-603.

____ (2003). "Creating the U.S.-Dollar Currency Union, 1748-1811: A Quest for Monetary Stability or a Usurpation of State Sovereignty for Personal Gain?" *American Economic Review* 93, no. 5, pp. 1778-1798.

____ (2004). "The Circulating Medium of Exchange in Colonial Pennsylvania, 1729-1775: New Estimates of Monetary Composition, Performance, and Economic Growth," *Explorations in Economic History* 41, no. 4, pp. 329-360.

____ (2005a). "Two Theories of Money Reconciled: The Colonial Puzzle Revisited with New Evidence." NBER Working Paper #11784, Nov., <http://www.nber.org/papers/w11784>

____ (2005b). "State 'Currencies' and the Transition to the U.S. Dollar: Reply—Including a New View from Canada," *American Economic Review* 95, no. 4, pp. 1341-1348.

____ (2006a). "Theory, Evidence, and Belief—The Colonial Money Puzzle Revisited: Reply to Michener and Wright," *Econ Journal Watch* 3, no. 1, pp. 45-72.
<http://www.econjournalwatch.org/pdf/EJWCompleteIssueJanuary2006.pdf>

____ (2006b). "Benjamin Franklin and Colonial Money: A Reply to Michener and Wright—Yet Again," *Econ Journal Watch* 3, no. 3, pp. 484-510.
<http://www.econjournalwatch.org/pdf/EJWCompleteIssueSeptember2006.pdf>

____ (2008). "Creating Maryland's Paper Money Economy, 1720-1739: The Role of Power, Print, and Markets." NBER Working Paper #13974, April, <http://www.nber.org/papers/w13974>

____ (2010). "Testing for the Economic Impact of the *U.S. Constitution*: Purchasing Power Parity across the Colonies Versus across the States, 1748-1811," *Journal of Economic History* 70, no. 1, pp. 118-145.

_____ (2012a), "Is Paper Money Just Paper Money? Experimentation and Local Variation in the Fiat Paper Monies Issued by the Colonial Governments of British North America, 1690-1775: Part I," NBER Working Paper #17997, Apr., <http://www.nber.org/papers/w17997>

_____ (2012b). "Chronic Specie Scarcity and Efficient Barter: The Problem of Maintaining an Outside Money Supply in British Colonial America," NBER Working Paper #18099, May, <http://www.nber.org/papers/w18099>

_____ (2013a). "Colonial New Jersey's Paper Money Regime, 1709-1775: A Forensic Accounting Reconstruction of the Data," NBER Working Paper #19710, Dec., <http://www.nber.org/papers/w19710>

_____ (2013b). "The Continental Dollar: How the American Revolution was Financed with Paper Money—Initial Design and Ideal Performance," NBER Working Paper #19577, Oct., <http://www.nber.org/papers/w19577>

Hammond, Bray (1957). *Banks and Politics in America from the Revolution to the Civil War*. Princeton, NJ: Princeton University Press.

Hanson, John R. II (1979). "Money in the Colonial American Economy: An Extension," *Economic Inquiry* 17, no. 2, pp. 281-286.

Homer, Sidney, and Sylla, Richard (1991). *A History of Interest Rates*. New Brunswick, NJ: Rutgers University Press, 3rd edn.

Hutchinson, William T., and Rachal, William M. E., eds. (1962). *The Papers of James Madison, Vol. 1*. Chicago: University of Chicago Press.

Journals of the Continental Congress, 1774-1789, Vols. 1-34. (1904-1937). Washington D.C.: Government Printing Office.

Kemmerer, Donald L. (1940). *Path to Freedom: The Struggle for Self-Government in Colonial New Jersey, 1703-1776*. Princeton, NJ: Princeton University Press.

_____ (1956). "A History of Paper Money in Colonial New Jersey, 1668-1775," *Proceedings of the New Jersey Historical Society* 74 (April), pp. 107-144.

Labaree, Leonard W. ed. (1959-1967). *The Papers of Benjamin Franklin, Vols. 1-11*. New Haven, CT: Yale University Press.

Lester, Richard A. (1939). *Monetary Experiments: Early American and Recent Scandinavian*. Princeton, NJ: Princeton University Press.

Lucas, Robert E., Jr. (1980). "Two Illustrations of the Quantity Theory of Money," *American Economic Review* 70, no. 5, pp. 1005-1014.

Mark, Nelson C. (2001). *International Macroeconomics and Finance: Theory and Econometric Methods*. Malden, MA: Blackwell Publishers Inc.

McCallum, Bennett T. (1992). "Money and Prices in Colonial America: A New Test of Competing Theories," *Journal of Political Economy* 100, no. 1, pp. 142-161.

McCusker, John J. (1978). *Money and Exchange in Europe and America, 1600-1775*. Chapel Hill, NC: University of North Carolina Press.

Michener, Ronald W. (1987). "Fixed Exchange Rates and the Quantity Theory in Colonial America," *Carnegie-Rochester Conference Series on Public Policy* 27, pp. 233-308.

_____. (1988). "Backing Theories and Currencies of Eighteenth-Century America: A Comment," *Journal of Economic History* 48, no.3, pp. 682-692.

_____, and Wright, Robert E. (2005). "State "Currencies" and the Transition to the U.S. Dollar: Clarifying Some Conclusions," *American Economic Review* 95, no. 3, pp. 682-703.

_____, and Wright, Robert E. (2006a). "Miscounting Money of Colonial America," *Econ Journal Watch* 3, no. 1, pp. 4-44.

<http://www.econjournalwatch.org/pdf/EJWCompleteIssueJanuary2006.pdf>

_____, and Wright, Robert E. (2006b). "Farley Grubb's Noisy Evasions on Colonial Money: A Rejoinder," *Econ Journal Watch* 3, no. 2, pp. 251-274.

<http://www.econjournalwatch.org/pdf/EJWCompleteIssueMay2006.pdf>

Morris, Lewis (1852). *The Papers of Lewis Morris, Governor of the Province of New Jersey, from 1738 to 1746*. New York: George P. Putnam. [*Collections of the New Jersey Historical Society*, First Series, 4]. Newark, NJ: New Jersey Historical Society, 1852.]

Nettels, Curtis Putnam (1934). *The Money Supply of the American Colonies before 1720*. Madison, WI: University of Wisconsin Press.

Newman, Eric P. (2008). *The Early Paper Money of America*. Iola, WI: Krause Publications, 5th edition.

Officer, Lawrence H. (2005). "The Quantity Theory in New England, 1703-1749: New Data to Analyze an Old Question," *Explorations in Economic History* 42, no. 1, pp. 101-21.

Perkins, Edwin J. (1988). *The Economy of Colonial America*. New York: Columbia University Press, 2nd edn.

Proceedings of the New Jersey Historical Society, First Series, 4-5, (1850-1851).

Puls, Mark (2008). *Henry Knox, Visionary General of the American Revolution*. New York: Palgrave Macmillan.

Rabushka, Alvin (2008). *Taxation in Colonial America*. Princeton, NJ: Princeton University Press.

Redish, Angela (1993), "Anchors Aweigh: The Transition from Commodity Money to Fiat Money in Western Economies," *Canadian Journal of Economics* 26, no. 4, pp. 777-795.

Ricord, Frederick W. (ed.) 1892. *Documents Relating to the Colonial History of the State of New Jersey, Vol. XVII*. Trenton, NJ: John L. Murphy Publishing [*Archives of the State of New Jersey, First Series, vol. XVII*].

Rotwein, Eugene (1970). *David Hume Writing on Economics*. Madison, WI: University of Wisconsin Press.

Rousseau, Peter L. (2006). "A Common Currency: Early US Monetary Policy and the Transition to the Dollar," *Financial History Review* 13, no. 1, pp. 97-122.

____ (2007). "Backing, the Quantity Theory, and the Transition to the U.S. Dollar, 1723-1850," *American Economics Review* 97, no. 2, pp. 266-70.

____, and Stroup, Caleb (2011). "Monetization and Growth in Colonial New England, 1703-1749," *Explorations in Economic History* 48, no. 4, pp. 600-13.

Sargent, Thomas J., and Wallace, Neil (1981). "Some Unpleasant Monetarists Arithmetic," *Quarterly Review, Federal Reserve Bank of Minneapolis* 5, pp. 1-17.

Schumpeter, Elizabeth Boody (1938). "English Prices and Public Finance, 1660-1822," *Review of Economics and Statistics* 20, no. 1, pp. 21-37.

Sherwood, Joseph (1851). "Letters of Joseph Sherwood (agent for New Jersey in Britain, 1761-1766)," *Proceedings of the New Jersey Historical Society, First Series*, 5, no. 3, p. 147 [original 1764].

Smith, Adam (1937). *The Wealth of Nations*. New York: Modern Library [original 1776].

Smith, Bruce D. (1985a). "American Colonial Monetary Regimes: The Failure of the Quantity Theory of Money and Some Evidence in Favor of an Alternative View," *Canadian Journal of Economics* 18, no.3, pp. 531-565.

____ (1985b). "Some Colonial Evidence on Two Theories of Money: Maryland and the Carolinas," *Journal of Political Economy* 93, no. 6, pp. 1178-1211.

____ (1988). "The Relationship Between Money and Prices: Some Historical Evidence Reconsidered," *Quarterly Review, Federal Reserve Bank of Minneapolis* 12, pp. 18-32.

Smith, Paul H. (1976-1994). *Letters of Delegates to Congress, 1774-1789, Vols. 1-21*. Washington, DC: Library of Congress.

Sumner, Scott (1993). "Colonial Currency and the Quantity Theory of Money: A Critique of Smith's Interpretation," *Journal of Economic History* 53, no. 1, pp. 139-145.

Tanner, Edwin P. (1908). *The Province of New Jersey, 1664-1738*. New York: Columbia University.

Thayer, Theodore (1953). "The Land-Bank System in the American Colonies," *Journal of Economic History* 13, no. 2, pp. 145-159.

Weiss, Roger W. (1970). "The Issue of Paper Money in the American Colonies, 1720-1774," *Journal of Economic History* 30, no. 4, pp. 770-784.

West, Robert Craig (1978). "Money in the Colonial American Economy," *Economic Inquiry* 16, no. 1, pp. 1-15.

Wicker, Elmus (1985). "Colonial Monetary Standards Contrasted: Evidence from the Seven Years' War," *Journal of Economic History* 45, no. 4, pp. 869-884.