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Working Paper Series  
Department of Economics  
Alfred Lerner College of Business & Economics  
University of Delaware

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Working Paper No. 2004-05

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Testing for the Economic Impact of  
the U.S. Constitution:  
Purchasing Power Parity across Six British Colonies  
Versus across the Same Six U.S. States, 1748-1811\*  
(With a View from Canada and Louisiana Thrown In)

Farley Grubb

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October 24, 2004  
(still preliminary and under constant revision)

[Scholars are recommended to contact the author directly for the most up-to-date version.]

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## **Testing for the Economic Impact of the U.S. Constitution: Purchasing Power Parity across Six British Colonies Versus across the Same Six U.S. States, 1748-1811\* (With a View from Canada and Louisiana Thrown In)**

For the six major British North American colonies, five of whom independently issued their own fiat paper money, exchange rates between these colonies are constructed and combined with price indices to test purchasing power parity between these colonies. Purchasing power parity is then tested between these same six locations after they became states united politically and monetarily under a common currency with no internal trade barriers established by the U.S. Constitution. Even when using short spans of data and low powered tests, purchasing power parity cannot be rejected in either period, and if anything, holds with more confidence prior to political and monetary unification.

In 1787, three years after the Treaty of Paris ended the Revolution, the Founding Fathers crafted a new constitution. This *U.S. Constitution*, ratified by the states and then adopted by Congress in 1789, was intended to unite the states into one country both politically and economically, and to do so to a far greater degree than what had existed either under British colonial rule prior to 1776 or under the subsequent intervening *Articles of Confederation*. In 1787, crafting this new *U.S. Constitution* was as much about economic reorganization and removing economic conflicts between the states as about political reorganization.

With regard to economic unification, the *U.S. Constitution* required that individual states relinquish their sovereign power to levy tariffs on trade and regulate commerce between states and with foreign nations (Article 1, Sections 8 and 10), relinquish their sovereign power to emit their own individual state fiat paper monies (Article 1, Section 10), and relinquish their sovereign power to deny the full faith and credit of their laws to the citizens of other states (Article IV, Section 1). The new Constitution also required tariffs on imports from outside the U.S. to be similar across the states—national import tariff were allowed but not separate state tariffs, and prohibited export tariffs of any kind on goods shipped outside the union (Article 1, Sections 8 and 9).<sup>1</sup> In short, the new *U.S. Constitution* eliminated trade barriers, both real and monetary, between the states. As such, state economies should have been more integrated in the years shortly after the Constitution's adoption than they were previously. However, little is known about the net impact or extent of this Constitutionally-manufactured economic integration. Exactly how much economic integration was gained by adopting the *U.S. Constitution*—a lot, a little, or next to nothing? In other words, did adopting *U.S. Constitution* represent a structural break in the economic integration of the nation?

One test of economic integration is purchasing power parity (PPP)—which is a simple measure of how well the prices of goods in two markets approximate the “law of one price” after accounting for exchange rates between the two markets. Across the states, does PPP hold to a greater degree, or to what degree do shocks to PPP mean

revert faster, in the years shortly after the adoption of the *U.S. Constitution* than across these same locations when these states were separate British colonies? In other words, as measured by PPP, was adopting the *U.S. Constitution* a major institutional break in market integration with the colonial past? As such, the primary emphasis of this study will be to 1) construct the data needed to test PPP across the colonies in the decades prior to the Revolution and then across the same locations for the decades shortly after the adoption of the *U.S. Constitution*, 2) use this data to test PPP in these two time periods, and 3) evaluate the results of these tests. While PPP may not be the definitive test, especially given the data limitations of the period, and certainly isn't the only test of the economic impact of adopting the *U.S. Constitution*, it is an interesting and instructive place to start an economic investigation given the modern and contemporaneous presumptions about what adopting the *U.S. Constitution* achieved economically.

This application of PPP has certain aspects of a natural experiment. It historically isolates certain effects not easily controlled otherwise. As such, the results may be of broader interest. For example, scholars have been interested in trying to isolate the effects that changes in sovereign borders, changes in exchange rate regimes, changes in productivity shocks, changes in the mix of tradable versus non-tradable goods, changes in formal versus informal trade barriers, changes in transportation, transaction, and information costs, and changes in monetary institutional arrangements have had on empirical measures of PPP (Stephen G. Cecchetti, et al. 2002; Charles Engel and John H. Rogoff, 1996; Kenneth A. Froot and Kenneth Rogoff, 1995; Nelson C. Mark, 2001, pp. 164-177; David C. Parsley and Shang-Jin Wei, 1996; Kenneth Rogoff, 1996).

The transition from colonies to states was accompanied by fundamental changes in some institutional arrangements, such as changes in border-sovereignty, changes in the fixity of exchange rate regimes, and changes in monetary institutions—how paper money was issued and backed. At the same time the transition from colonies to states did not change physical borders or market distances nor were there major changes in real productivity shocks or in transportation, information, and transactions costs over this transition (James F. Shepherd and Gary M. Walton, 1972, p. 159). In some ways the transition from British colony to U.S. state under the *U.S. Constitution* was similar to the transition accompanying European monetary unification, i.e. moving from a loose customs union type arrangement to an arrangement that represented fuller monetary unification with very low real trade barriers. As such, the results here may add some comparative insights about PPP measures before versus after European monetary unification.

Finally, scholars have been interested in how well PPP holds within large polities, such as across major U.S. and across major Australia cities during the 20<sup>th</sup> century, where formal trade barriers and exchange rate volatility caused by differential currencies are not an issue, in part to use as a benchmark for international PPP measures (Cecchetti, et al. 2002; Kausik Chaudhuri and Jeffrey Sheen, 2004; Engel and Rogers, 1996; Parsley and Wei, 1996). How well PPP held within the U.S. at the very beginning of the period of common currency and no formal internal trade barriers, i.e. at the beginning of the 19<sup>th</sup> century, may serve as a comparative reference for these modern studies.

The outline of the rest of the studies is as follows: Section I discusses PPP and its applications. Section II discusses the data needed—its composition and construction—to test PPP across the colonies and across the same locations after they became states under the *U.S. Constitution*. Sections III through V presents the econometric results on the tests for PPP. Section VI compares the results found here with those in modern studies, compares the results found here from before versus from after the transition from colonies to states, and discusses the importance of these comparisons. Finally, Section VII offers some tentative conclusions and suggestions for future research.

### **I. Purchasing Power Parity (PPP)**

PPP is an arbitrage condition based on the “law of one price.” It links the prices of tradable goods in two market locations in their respective currencies to the exchange rate between those currencies. Given that data on prices often involves using price indices between two locations that are seldom composed of the same exact basket of goods, and given that some cost barriers of unclear magnitude, such as those related to information and distance, exist between two market locations, the currency adjusted prices in the two markets may not be absolutely identical in levels. Assuming that these cost wedges are stable over time and that price indices reflect true general price movements, PPP involves looking at *relative* deviations. As such, and in order to mitigate the impact of the above concerns, PPP is usually expressed in terms of percentage changes, i.e. the difference in the log of prices between the two markets being equal to the log of the exchange rate between the currencies used in the two markets (Walter Enders, 1995, pp. 234-235; Engel and Rogers, 1996, pp. 1113-1114; Froot and Rogoff, 1995, pp. 1649-1651; Mark, 2001, pp. 62-65; Rogoff, 1996, pp. 647-651).

Even in relative terms, PPP is not expected to hold instantaneously, or in the very short run, due to the likely existence of unforecastable real and monetary shocks. In the longer run, however, deviations from PPP should be arbitrated away.<sup>2</sup> Thus, a standard test of PPP is to determine if deviations from PPP, the residuals of the PPP

equation, are stationary over the long run. Non-stationary deviations from PPP over the long run, i.e. permanent or non-mean-reverting shocks to PPP (implying that PPP does not hold), indicate the existence of, and changes in, substantial frictions—transaction, information, transportation, and/or institutional costs—between these two markets that may be thwarting the profitability of arbitrage and the free flow of goods. Alternatively, they may indicate that non-synchronized and not-easily-transferable real productivity shocks across locations are imparting non-stationarity to exchange rates. Even if deviations from PPP are found to be stationary in the long run (implying that PPP holds), the time it takes these shocks to mean-revert—typically measured as the “half-life” of a shock or the time it takes a one-time shock to adjust halfway back to zero—can also be used as a measure of the relative size of the barriers to arbitrage that prevent two markets from being fully integrated (Cecchetti, et. al., 2002, p. 1082; Froot and Rogoff, 1995; Mark, 2001, pp. 32-33, 170-177; Rogoff, 1996, pp. 648, 656).<sup>3</sup> As such, whether or not deviations from long-run PPP are permanent and, when they are not permanent, how long it takes shocks to mean-revert can be considered one test of how well two economies are integrated.

In the modern era it has been difficult not to reject PPP using standard univariate tests, both in international comparisons—especially for floating exchange rate regimes—and in intra-national comparisons, such as across U.S. cities where tariff barriers and exchange rate volatility do not exist. These findings have set off a search for the sources of PPP rejection that has exercised considerable scholarly effort. A major focus has been on increasing the power of statistical tests by increasing the number of observations in the data studied, either by getting longer time series for univariate tests or, more popularly of late, by using the panel data approach. Recently, panel data approaches have led to the failure to reject PPP, i.e. PPP is found to hold, in most cases, both internationally and intra-nationally, in the modern era. However, the failure to reject PPP using the panel data approach is less than intellectually satisfying because it does so as a kind of “on average” outcome across a large group of locations. For example, PPP might not be rejected in a panel approach even when PPP does not hold across the majority of pairings in the group as long as where it does hold it has sufficient “outlier” weight in the panel. Finally, while panel studies typically fail to reject PPP, the mean-reversion process seems long in many cases, maybe too long to account for simple arbitrage costs. Deviations from PPP may on average be stationary in the long run, but shocks appear to be stubbornly persistence in a way that is difficult to explain. For example, the half-life of shocks to PPP across 19 major U.S. cities between 1918 and 1995 has been recently estimated to be nearly nine years

(Cecchetti, et. al. 2002; Enders, 1995, pp. 234-250; Engel and Rogers, 1996; Froot and Rogoff, 1995; Mark, 2001, pp. 62-67, 170-78; Rogoff, 1996).<sup>4</sup>

Given that with standard univariate tests PPP has been difficult not to reject (PPP often does not hold) in the modern era for the U.S., both in inter-national and intra-national comparisons, and where it has not been rejected the persistence of shocks appears to be excessively long, it would be interesting to know if this difficulty was always the case historically for the U.S. In other words, does PPP hold more easily in the distant past, such as during the colonial and early national periods? During the colonial and early national period transactions, information, and transportation costs were significantly higher, institutional price stickiness was lower, the complexity of goods on average was lower, monetary institutions were simpler, and technical change was substantially lower than during the modern era. Thus, if PPP holds easily in the colonial and early national periods relative to the modern era, then it may be the complexity of modern goods and the complexity of modern institutional arrangements, both monetary and real, that complicate trade costs and make it more difficult to find that PPP holds and/or causes PPP shock-persistence to be relatively higher in the modern era.

For the modern era some interest has been taken in estimating PPP over different institutional arrangements, particularly with regard to exchange rate regimes and national border issues, in part to see how differing institutional arrangements might impact the arbitrage or economic integration process. Typically, PPP is seen as being more easily rejected during periods of floating exchange rates, and is seen as being greatly affected by the sovereignty of borders, more so than by issues of distance, PPP being more easily rejected when sovereign borders intrude (Engel and Rogers, 1996; Froot and Rogoff, 1995; Mark, 2001, pp. 166-174; Rogoff, 1996).

More dramatic institutional differences in monetary and political arrangements exist historical, such as between the colonial and early national periods for the U.S. One of the burning questions of U.S. history is whether the political and monetary unification, and elimination of internal trade barriers, manufactured by the *U.S. Constitution* improved economic integration among the states. The *U.S. Constitution* eliminated tariff barriers between states and eliminated separate state fiat paper currencies, i.e. lead to a reduction in the sovereignty of borders and increased the fixity of exchange rates among the states. Other things equal, this should have improved economic integration by reducing transactions and information costs.

However, the accompanying dramatic change in monetary institutions, described below, may not have made “other things equal”. For example, a common unit of account was created, the U.S. dollar, but not necessarily

a common paper currency. A plethora of private banknotes that could trade at varying discounts off their face value replaced individual colony/state bills of credit as the country's paper medium of exchange. As such, the net effect wrought by the *U.S. Constitution* on economic integration is not theoretically obvious. Comparing PPP between the colonial and early national periods is one test of what the true net effect was. For example, if PPP holds in the colonial period relatively better than in the early national period, then the argument that monetary unification as laid out in the *U.S. Constitution* was a fundamentally important part of political unification, i.e. that monetary unification as laid out in the *U.S. Constitution* would substantially reduce transactions and information costs in cross-state trade net of other institutional/constitutional changes and so help better knit the union together, becomes harder to sustain.

In this study, standard univariate tests will be applied to PPP across the six major British North American colonies from 1748 to 1775 and then across the same six locations from 1796 to 1811 after these locations became united politically and monetarily under a common currency with no internal trade barriers as established by the *U.S. Constitution*. The six locations are South Carolina, Virginia, Maryland, Pennsylvania, New York, and Massachusetts. These six colonies/states comprised two-thirds of the U.S. population and an even higher share of U.S. output and exports. The periods tested precede the large real productivity shocks associated with the industrial revolution, and each period spans a fundamentally different political and monetary institutional regime.

In addition, arguably the best natural-experiment test of the economic impact of the *U.S. Constitution* on market integration would be to compare PPP between the British colonies that became U.S. States with that of nearby British colonies that did not eventually become U.S. States but stayed under British control and within the British Empire. This comparison will be done here using prices and exchange rates for Upper Canada (Montreal and Quebec) to test PPP between Upper Canada, after it comes under British control after 1761, and the British colonies that became U.S. States both for the period before the American War of Independence (1761-1775) and for the period after the U.S. adopts its new *Constitution* (1796-1811). As measured by PPP, did American independence and the adoption of the *U.S. Constitution* reduce market integration with other nearby markets that choose to stay within the British Empire? Do we see the rise of a wedge in market integration, i.e. the rise in two identifiable market zones as measure by PPP—the U.S. States as one zone and what remains of the British Empire in America as the other zone? In other words, do changes in sovereign borders, as opposed to distance, on this larger scale matter to PPP measures of market integration? Data construction and estimation issues, however, need to be addressed first.

## II. The Data

For the late colonial period (1748-1775), the colonial legislatures of five of the six colonies under study that would eventually become U.S. States issued, independently, their own separate fiat paper money—Virginia only did so after 1755. The one full exception was Massachusetts that after 1748 reverted to a specie monetary standard for the rest of the colonial period. Colonial legislatures directly issued paper money to pay for government expenses and as mortgage loans to subjects who pledged their lands as collateral. Typically this paper money was denominated in pound units, e.g. New York pounds and so forth, earned no interest (they were not government bonds), came in small denominations, and could only be exchanged in the market place for specie or pounds sterling at market-negotiated rates. Colonial legislatures backed their paper money not with specie reverses, but with future taxes and mortgage loan payments designed to withdraw it from circulation in a timely fashion. Colonial legislatures did not enter the market to buy and sell their paper money for specie to defend any fixed exchange rate nor did they exchange their paper money for specie on demand in the colony. By the middle of the 18<sup>th</sup> century, this colony-specific “inside” paper money comprised a substantial portion of the money supply and the government revenue within each respective colony issuing its own paper money. For example, Pennsylvania paper pounds accounted for roughly 78 percent of cash money transactions in Pennsylvania between the Seven Years’ War and the Revolution. Prices in each colony were typically quoted in their respective fiat paper pound monetary units (Leslie V. Brock, 1975; Farley Grubb, 2003; Farley Grubb, 2004a; Edwin J. Perkins, 1988, pp. 168-183; Edwin J. Perkins, 1994, pp. 39-55). Finally, after the British won control of Upper Canada (Montreal and Quebec) shortly after 1760, that colony officially did not issue its own fiat paper money, though some private merchant paper money may have circulated as cash. Instead, they stayed on a specie monetary standard as expressed in local unit-of-account monies, such as the Halifax pound (A. B. McCullough, 1984, pp. 67-85; R. Craig McIvor, 1961, pp. 11- 23).

The data used to test PPP are extended from 1775 back to the end of King George’s War (1748) for New York, Pennsylvania, and South Carolina, and as far back as they are available for the other colonies. The end of King George’s War is a good starting point because data are fewer and less reliable before 1748 (the New York price index does not go back before 1748), and because 1748 is arguably a turning point in colonial monetary behavior. The wartime inflation prior to 1748 caused Massachusetts to go off paper money after 1748 and led the British Parliament to pass the Currency Act of 1751 which allowed colonies to issue paper money as long as it met two conditions: (1) that it not be legal tender, and (2) that ample provisions (taxes) be put in place to redeem each

issue “within as short and reasonable a time as may be, not exceeding five years as the farthest” (Danby Pickering, 1765, Vol. 20, pp. 306-09). This Act only applied to New England, but was later extended to all colonies by the Currency Act of 1764, though Maryland, Pennsylvania, and New York had instituted such policies on the own accord well before 1760 (Grubb, 2003; Grubb, 2004a; Perkins, 1994, pp. 46-55). Upper Canada did not fall under British administration until after 1761—and yearly price indices and exchange rates are not available before then. Finally, the price indices available and used for Massachusetts and Maryland only go back to 1750 and 1756, respectively, and Virginia did not start to issue paper money until after 1755 with Virginia prices and exchange rates arguably not reflecting said until 1757, which explains the data termination years for these three colonies. In short, the period 1748 to 1775 was selected because it represents, as best as can be selected, a relatively constant and homogeneous institutional regime within each colony and so between the colonies prior to the American Revolution.

Direct exchange rates between the various paper currencies of the colonies—or their money of account currencies where paper money was not issued—based on continuous and thick data do not currently exist in the literature. Indirect exchange rates, however, can be constructed using each colony’s known exchange rate with England (John J. McCusker, 1978; McCullough, 1984, pp. 266-68). These colonial pound to pound sterling exchange rates are shown in Figure 1 for the years that PPP will be estimated between each colony. These exchange rates are clearly neither constant nor fixed, and they certainly are not identical in scale. They do, however, appear to exhibit some degree of co-movement.<sup>5</sup>

[Place Figure 1 Here]

Indirect exchange rates between colonies can be constructed from the evidence in Figure 1 as follows: The desired (but unknown) exchange rate [ $EX_{ab}$ ] between Colony A and Colony B equals the number of Colony A pounds needed to buy a given amount of Colony B pounds, namely  $EX_{ab} = (\# \text{Colony A pounds} / \# \text{Colony B pounds})$ . The known exchange rates between pounds sterling and Colony A pounds and between pounds sterling and Colony B pounds equals the number of Colony A pounds and the number of Colony B pounds needed to buy a given amount of pounds sterling, namely  $EX_{sa} = (\# \text{pounds sterling} / \# \text{Colony A pounds})$  and  $EX_{sb} = (\# \text{pounds sterling} / \# \text{Colony B pounds})$ , respectively. It follows from simple algebra that the unknown exchange rate between Colony A and Colony B [ $EX_{ab}$ ] equals the ratio of the two known sterling exchange rates [ $EX_{sb}/EX_{sa}$ ], namely  $[EX_{sb}/EX_{sa}] = [(\# \text{pound sterling} / \# \text{Colony B pounds}) / (\# \text{pounds sterling} / \# \text{Colony A Pounds})] = (\# \text{Colony A}$

pounds / #Colony B pounds) =  $EX_{ab}$ . These indirectly calculated exchange rates between each pair of colonies are what are used in the subsequent PPP tests.<sup>6</sup> They are also listed in the Appendix Table 1A.

The colonial price indices for Massachusetts, Pennsylvania, New York, and South Carolina are taken from the long-established indices created by Winifred B. Rothenberg (1979, pp. 983-84); Anne Benzanson et al. (1936, p. 388); and Arthur Harrison Cole (1938, pp. 120-22, 135, 155-56), respectively. The Massachusetts series is an annual weighted arithmetic index of rural prices on tradable farm goods. The Pennsylvania (Philadelphia) series is a 20-commodity unweighted geometric wholesale price index, the New York (New York City) series is a 15-commodity arithmetic wholesale price index, and the South Carolina (Charleston) series is a weighted all-commodity arithmetic wholesale price index. The last three series, reported monthly, were averaged into annual data here. The colonial Maryland price index is constructed as an unweighted nine-commodity geometric price index by the author using the raw price data reported by Donald R. Adams Jr. (1986, p. 643). The nine commodities are corn, wheat, oats, rye, salt, beef, pork, sugar, and rum. The colonial Virginia index is constructed as an unweighted three-commodity geometric price index by the author from original raw data on the prices of corn, wheat, and tobacco provided by Lorena Walsh (personal communication, 1999). Finally, the price indices for Upper Canada, one for Montreal and two for Quebec, are taken from the recent work of Gilles Paquet and Jean-Pierre Wallot (1998, pp. 314-15). The Montreal and Quebec (1) price indices are unweighted 10-commodity indices using prices for oats, butter, wood, wheat, beef, flour, hay, eggs, peas, and chickens. The Quebec (2) price series is an unweighted 20-commodity index using prices for the same commodities as in Quebec (1) index plus prices for coffee, candles, coal, burning oil, molasses, straw, potatoes, rum, salt, and tobacco. Most of these price indices are heavily weighted toward tradable good, thus the issue of PPP possibly failing to hold because of the presence of non-tradable goods in the indices is largely removed (e.g. see Michael D. Bordo and Ivan A. Marcotte, 1987).<sup>7</sup> These colonial price indices for locations that would eventually become U.S. States are displayed in Figure 2 for the years for which PPP will be tested (the Upper Canada price indices are displayed below in Figures 4 and 5). These price indices are clearly neither constant nor fixed, though they appear to exhibit some degree of co-movement.<sup>8</sup>

[Place Figure 2 Here]

After 1775, evidence for individual U.S. States through and shortly after the Revolution, the period spanned by the *Articles of Confederation*, is too scanty to test PPP across these U.S. States with confidence. The adoption of the *U.S. Constitution* in 1787, along with Congress' 1785 declaration of the dollar as the official monetary unit of

the U.S., and the establishment of the *First Bank of the U.S.* (1791) and the U.S. mint (1792), altered monetary institutions in the new nation, as well as in each U.S. State, from what went before. The Constitution prohibited state governments and the national government from issuing fiat paper money. The paper medium of exchange fell to U.S. dollar denominated banknotes issued by government chartered, but privately run, banks who aimed to exchange paper dollars for specie dollars at par. The transition from state currencies to U.S. dollars (coins and banknotes), however, was not instantaneous with the adoption of the *U.S. Constitution*. It took a number of years before prices in the marketplace were quotes in U.S. dollars—in most cases not until 1796 (Max Farrand, 1966, Vol. 3, pp. 349-350; Grubb, 2003, pp. 1782-1782; Farley Grubb, 2004b; Perkins, 1994, p. 247). In addition, the *First Bank of the U.S.* did not establish its branch offices or get significant operations under way in all the U.S. States tested here instantaneously. For example, the Norfolk, Virginia branch was not opened until 1799 (Edward S. Kaplan, 1999, p. 28; John Thom Holdsworth, 1910, p. 38). Finally, if the beginning of the U.S. dollar era is assumed to start earlier than 1796, in say the late 1780s or early 1790s, then PPP will likely fail due to the substantial permanent price spike that occurs across the prices indices by various degrees during the early to mid-1790s (Grubb, 2003, pp. 1782-1782; Figures 4 and 5 below). As such, 1796 is taken as the starting point for testing PPP in the early national period across U.S. States. The year 1811 is taken as the end testing point because the War of 1812 produced a substantial liquidity crisis and one of the largest price inflations between the Revolution and the Civil War. The charter for the *First Bank of the U.S.* was also allowed to lapse in 1811 and so 1811 marks a monetary institutional transition point and thus an appropriate data end point. In short, the period 1796 to 1811 was selected because it represents, as best as can be selected, a relatively constant and homogenous institutional regime across U.S. States for the immediate post-*U.S. Constitution* period.

The exchange rate between any two U.S. States from 1796 through 1811 is assumed to be one. Being a specie coin, a U.S. dollar is a U.S. dollar regardless of location. And while the medium of exchange used by participants in the market was comprised of a plethora of U.S. dollar denominated private (non-legal tender) banknotes, foreign specie coinage, and U.S. dollar specie coins, all prices and price indices were recorded in U.S. specie dollars (the legal tender). In a sense, testing how well PPP holds across U.S. States in the early national period is a test of whether the assumption of a unitary exchange rate in U.S. dollars across states is a reasonable approximation once market participants had converted whatever other monies were in use into U.S. specie dollar units, in other words, a test of how well the *U.S. Constitution* led to a common currency. Failure of PPP to hold

might then imply that the elimination of government paper money by the *U.S. Constitution* and its replacement by other monies (private banknotes) that rushed in to fill the vacuum may have increased the costliness of cross-state arbitrage relative to cross-colony arbitrage.<sup>9</sup> The exchange rate between Upper Canada and any U.S. State between 1796 and 1811 is calculated indirectly in the same way that pre-1776 colonial exchange rates across colonies were calculated, namely the Halifax pound-to-U.S. dollar exchange rate is calculated as the *ratio* of the Halifax pound-to-pounds sterling exchange rate and the U.S. dollar-to-pounds sterling exchange rate.

The price indices for each U.S. States and for Upper Canada from 1796 through 1811 are taken and constructed from the same sources and in the same manner as what was done for the colonial period above with the following exceptions: because the Adams (1986, p. 643) Maryland raw price data do not extend past the Revolution, the Maryland price index is constructed in the same manner as the Virginia price index using raw price data on corn, wheat, and tobacco provided by Walsh (personal communication, 1999); the New York series after 1795 becomes an all-commodity arithmetic wholesale price index; and the South Carolina series becomes far more heavily weighted by cotton prices after 1795 than before 1776 (Cole, 1938, pp. 57-58, 120-22, 135, 154, 159-60). These price indices for the U.S. States are displayed in Figure 3 for the years in which PPP will be tested. They are clearly neither constant nor fixed, though they appear to exhibit some degree of co-movement.<sup>10</sup> The price indices for Upper Canada along with the price indices for the U.S. colony/states in a longer-view format, 1748-1811, are displayed in Figures 4 and 5.

[Place Figures 3, 4, and 5 Here]

### III. PPP Test Results for British Colonies that Became U.S States

Table 1 presents standard univariate *Augmented Dickey-Fuller* tests for unit roots in PPP for the late colonial period (1748-1775) across the British North American colonies of South Carolina, Virginia, Maryland, Pennsylvania, New York, and Massachusetts (future U.S. States), and for unit roots in PPP across the same six locations during the early national period (1796-1811) after these locations became united politically and monetarily under a common currency with no internal trade barriers as established by the *U.S. Constitution*. Overall, even when using short spans of data and low-powered univariate tests, PPP cannot be rejected in the vast majority of cases in either period and, if anything, holds with more confidence prior to political and monetary unification and the Constitutional elimination of internal trade barriers.

[Place Table 1 Here]

For the colonial period, PPP as reported in Table 1 holds for 14 of the 15 pairings of colonies, rejected only for the Maryland-New York pairing. But even for this last pairing, if one lag of the dependent variable is added to the specification—which lag in itself is statistically insignificant at the 0.1 level—a unit root can be rejected and so PPP holds. In addition, only Virginia exhibits some structural break issues. For the entire sample, 1757-1775 for all colonies paired with Virginia, a unit root cannot be rejected (PPP does not hold). However, as shown in Table 1, once a structural break is added so that 1757-1765 is different from 1766-1775, then a unit root can be rejected (PPP holds). This makes sense for Virginia, because unlike the other colonies, Virginia had no experience issuing paper money before 1755. Virginia's behavior was also inconsistent with that specified in the 1751 Currency Act. Initially, Virginia redeemed old bills with new bills rather than with taxes, and failed to adequately redeem and destroy bills of credit so earmarked. Complaints about Virginia's behavior were, in part, responsible for the passage of the 1764 Currency Act (Brock, 1975, pp. 465-508; Joseph Albert Ernst, 1973, pp. 43-88). After being faced with the new currency act (1766-1775), a unit root in Virginia's PPP with every other colony can be rejected (PPP holds).<sup>11</sup>

Given the indirect method of calculating the exchange rate between these colonies, it might be possible that PPP across colonies holds only as a statistical artifact of data construction when in fact little direct trade or market arbitrage occurred between these colonies to foster market integration. In other words, if each colony traded, for example, primarily with England, and its price index and pound sterling exchange rate behaved so as to keep it integrated with markets in England in terms of PPP (Grubb, 2003, p. 1786), this would produce the appearance of active market integration between colonies as the by-product of data construction when in fact little active or direct market arbitrage may have taken place between the colonies. This possibility, however, seems unlikely given the substantial amount of direct shipping between colonies.<sup>12</sup>

Table 2 shows inter-colony trade as a percentage of the distribution of shipping tonnage by origin and destination between 1768 and 1772. This table underestimates the extent of inter-colony ship movements because separate colonies are aggregated into regional groups. Thus, for example, the movement of a ship from Annapolis, Maryland to Norfolk, Virginia would be missed in by the data. In addition, overland trade is excluded. Given the above caveat, the direct movement of shipping tonnage, and so by inference direct trade, between colonies shown in Table 2, excepting the Upper South, rivals and in some cases exceeds that going directly to and arriving directly from Great Britain and Ireland. As such, substantial direct trade between colonies occurred, or at least the potential for substantial direct trade between colonies was present. Add to this the fact that most colonial newspapers that

published local price currents were issued weekly, or at worst monthly, and were carried from port to port along the American east coast by ships in the coasting trade, suggests that shippers may well have had ample and timely information to arbitrage price differences across ports such that sizable price differentials could not persist long. Therefore, the non-rejection of PPP in Table 1 for the colonial period would appear to be consistent with a strong degree of direct market integration between colonies produced by direct arbitrage between colonies.

[Place Table 2 Here]

For the early national period (1796-1811), Table 1 shows that PPP among U.S. States holds for 10 of the 15 pairings. PPP fails to hold for the Maryland-Pennsylvania pairing (just barely missing the 10 percent statistical significance level) and for 4 of the 5 South Carolina pairings. Overall, applying the same methods and test criteria, PPP appears to hold relatively better across these six colonies (future U.S. States) in the late colonial period than it does across the same locations as U.S. States in the early national period.

The half-life of shocks to PPP in the colonial sample in Table 1 is approximately one-half to one year. The half-life in the state-to-state sample in Table 1 for the stationary series is approximately one-third to two-thirds of a year. These are relatively short half-lives which helps explain why a unit root can be rejected here even when using short time series. Standard univariate *Augmented Dicky-Fuller* tests have a difficult time distinguishing between unit roots and slow convergence (long half-lives). These relatively short half-lives are also consistent with colonial and early national markets being reasonably well integrated. Finally, abstracting from issues of statistical significance, the half-lives in the state sample for when South Carolina is paired with a northern state, i.e. where a unit root cannot be rejected, would be roughly between 4 and 16 years if the coefficients were statistically significant. Some decrease in market integration (increase in the cost of arbitrage) between South Carolina and northern states appears to have materialized soon after political and monetary unification.

#### **IV. The South Carolina and New Orleans Anomalies in the Early National Period**

The failure of PPP to hold for most South Carolina pairings with other U.S. States in the early national period compared with PPP holding for all South Carolina pairings in the colonial period does not appear to be primarily due to changes in the composition of goods in the South Carolina price index between the colonial and early national period, though this change does have some minor impact on PPP measures. Between 1748 and 1775 the South Carolina price index is heavily weighted toward rice and indigo, roughly 51 and 22 percent of the index, respectively. Cotton received zero weight. Between 1796 and 1811 the South Carolina price index becomes heavily

weighted toward cotton, i.e. 32 percent of the index (Cole, 1938, pp. 52, 57-58). The patenting of Eli Whitney's new-style cotton gin in 1794 and the subsequent explosion in cotton growing and exports after 1795 dramatically drove down cotton prices over time (Lakwete, 2003, pp. 47-48, 71). Because this technical change did not affect the other states in the sample because they did not grow cotton—and with cotton's heavy weight in South Carolina's price index—South Carolina's price index fell over time relative to the other states. As such, this cotton shock could explain the South Carolina anomaly on PPP along the line of a Balassa-Samuelson model of how relative productivity shocks might lead to PPP failure (Mark, 2001, pp. 168-70). In Figure 6, the South Carolina price index is decomposed into several subcomponents, namely cotton prices only, rice prices only, the prices of export staples only, and the prices of all commodities except export staples. It shows that indeed cotton prices declined precipitously between 1796 and 1811, more so than for other goods and, given cottons weight in the index, thus dragging the whole South Carolina price index down relative to the price indices of other states.

[Place Figure 6 Here]

As such, removing cotton, or export staples in general, from the South Carolina price index might improve the estimates of PPP for South Carolina pairings in the early national period. Table 3 compares *Augmented Dickey-Fuller* tests for PPP between South Carolina and the other U.S. States and with Upper Canada for when the South Carolina price index is restricted to export staples only, to excluding export staples only, to cotton prices only, and to rice prices only. The results show that the behavior of export staples prices, in particular cotton prices, in South Carolina is a substantial contributor to the failure of PPP for South Carolina pairings. However, removing export staples or just using rice prices from the South Carolina price index, while moving the estimate toward PPP holding, i.e. in all pairings the absolute magnitude of the coefficients and the *t* statistics increase, it does not improve enough in any pairing to statistically reject PPP failure at the 10 percent level. Finally, even when restricting the Pennsylvania price index in Table 3 to be as close to South Carolina's cotton only price index and the South Carolina rice only price index in terms of measuring the same products, the Pennsylvania *Textile Fiber Price Only Index* and the Pennsylvania *Grain Price Only Index*, respectively, PPP failure still cannot be statistically rejected. The failure of PPP to hold for most South Carolina pairings in the early national period would appear to be a relatively robust result, especially considering that in comparison PPP holds for most all other state-to-state pairings and holds for all South Carolina pairings in the colonial period.

[Place Table 3 Here]

Finally, while Louisiana was not one of the original British colonies that became a U.S. State, it came under American authority after 1802, and price indices for New Orleans exist for 1800-1811 and 1804-1811 (Cole, 1938, pp. 65-70, 170-71). The 1800-1811 index is based on few commodities and relies more heavily on price evidence derived from “up-stream” sources compared with the 1804-1811 index. PPP between New Orleans and all the other U.S. States, including the subcomponents of the South Carolina price index, as well as for Upper Canada, including for the domestic versus foreign subcomponents of the New Orleans price index, were estimated for the two separate periods of 1800-1811 and 1804-1811. Given that the data span is very short, not too much should be expected from these estimates. They are reported here, in Appendix Table 2A, for completeness.

If the results showed that PPP could not be rejected for New Orleans in reference to the other U.S. State in the sample, then this might be taken as strong evidence of market integration within the U.S. under the auspices of the integrating effect of the *U.S. Constitution*. If the results show that PPP failure cannot be statistically rejected, then it is likely that this result is just an outcome of too short a data span, and so not much can be concluded from this statistical exercise. The results in Appendix Table 2A show that either PPP failure cannot be statistically rejected in most cases, or in a few cases where PPP failure can be rejected the coefficient magnitudes suggest that the process is highly volatile and unstable. As such, the data span here is probably too short to yield much conclusion regarding PPP in the national period between New Orleans and the other U.S. States.

#### **V. The View from Canada**

American independence and the economic integrating effects of adopting the *U.S. Constitution* does manifest itself among U.S. States, not as an *improvement* in PPP or market integration in a before (1748-1775) versus after (1796-1811) sense as tested in Tables 1 and 3, but as an inside versus outside the British Empire effect. Table 4 tests PPP between Upper Canada (Montreal and Quebec) and the U.S. States both before U.S. independence (1761-1775) and after (1796-1811). The long-view of price indices between Upper Canada and the U.S. as both colonies and then states are shown above in Figures 4 and 5. Upper Canada, while experiences dislocation and inflation during the American Revolution especially during the northern campaigns early in the war remained within the British Empire after the war. The PPP estimates reveal a clear increased separation, less market integration as measured by PPP, between Upper Canada and U.S. locations before versus after the U.S. left the British Empire.

[Place Table 4 Here]

In all pairings between colonies for the period, 1761-1775 (1762-1775 in two cases), PPP failure can be rejected with confidence. The British colonies from South Carolina through Montreal appear to be strongly integrated as measured here by PPP, and the integration of Upper Canada with the lower colonies appears as strong, in term of statistical significance and the relatively low persistence rate of shocks, as was market integration among the lower colonies. As measured by PPP, Upper Canada cannot be distinguished from the lower colonies before the American Revolution. The only exception occurs when using the Quebec (2) price index. For this index PPP never holds with any other location in any period, even with Montreal and even with its own index subcomponents, i.e. PPP does not hold between Quebec (1) and Quebec (2). As such, it seems likely that expanding the Quebec (1) index into the Quebec (2) index for this period involved adding commodities of intermittent and insufficient sample sizes and/or with non-homogeneous quantity measures (Paquet and Wallot, 1998). While reported in Tables 3, 4, and 2A for completeness, the Quebec (2) price index may simply be too unreliable to put much confidence in.

For the post-*U.S. Constitution* period, 1796-1811, PPP continues to hold between Montreal and Quebec (1), but now fails to hold between Montreal and all other U.S. States and now fails to hold between Quebec (1) and all other U.S. States. Comparing the results in Table 1 with those in Table 4 for the period 1796-1811 indicates a clear separation of market integration, as measured by PPP, into two zones, namely those remaining within the British Empire (Upper Canada) and those grouping together as States under the *U.S. Constitution*. In this sense, adopting the *U.S. Constitution* fostered market integration among the States in that it allowed them to chart a more-or-less group course separate from that charted by Upper Canada as a member of the British Empire. Upper Canada, remaining part of the British Empire, was more likely to be tied to following the course of the British economy through the Napoleonic Wars with Britain suffering inflation and going off of a gold standard in 1797 through 1811. The U.S. States were able to decouple their economies from Britain, not go to war with the French, not go off a specie monetary standard, and so not suffer as much inflation relative to the British and Canadians during 1796-1811.

This comparison, however, should not be taken too far in terms of praising U.S. performance relative to Canadian or British performance during 1796-1811. If the U.S. had stayed within the British Empire or not fought for independence the resulting course of the French troubles may have been very different, i.e. maybe no French Revolution or Napoleonic Wars would have occurred and thus the strains on British and Canadian finances relative to U.S. finances would not have been manifest in the same way. The most that can be said here is that the *U.S.*

*Constitution* recreated the level of market integration, as measured by PPP, among U.S. States that they had enjoyed as among themselves as colonies within the British Empire, but that it clearly separated them as a group market-integration-wise from their geographically nearest trade partners who remained within the British Empire. As such, these results are consistent with the relative importance of the sovereign borders compared with simple distance as an impediment to PPP holding that has been found in recent studies of the modern era (Engel and Rogers, 1996; Froot and Rogoff, 1995; Mark, 2001, pp. 166-174; Rogoff, 1996).

## **VI. Discussion of Results for the U.S.**

### *A. Late Colonial and Early National PPP versus Long-Run Historic and Modern Era PPP*

When using standard univariate tests, PPP has been difficult not to reject in the modern era. In addition, when using higher powered panel data approaches which are more likely to fail to reject PPP, shocks to PPP still exhibit high persistence, i.e. half-lives of typically 3 to 5 years, and in some cases, such as between major U.S. cities from 1918 to 1995, a half-life of almost 9 years (Cecchetti, et. al. 2002; Enders, 1995, pp. 234-250; Froot and Rogoff, 1995; Mark, 2001, pp. 62-67, 170-78; Rogoff, 1996). An exception is Parsley and Wei (1996, pp. 1232-1233) who, using a panel data approach, estimated a half-life of deviations from PPP of 1.0 to 1.24 years between major U.S. cities from 1975 to 1992. In the colonial and early national periods, even when using low-powered univariate tests and short spans of data, for the most part PPP holds and the shocks to PPP have low persistence, i.e. half-lives of 1 or less years. Transactions, information, and transportation costs are presumably much higher, and differential non-transferable real productivity shocks are lower (Shepherd and Walton, 1972, p. 159) in these periods than in the modern era. These comparisons suggest that it is the complexity of modern monetary institutional arrangements, informal non-tariff trade barriers, the complexity of modern goods, and differential non-transferable real productivity shocks that may be the culprits behind the relative failure of PPP to hold and higher persistence of deviations from PPP in the modern versus the colonial and early national eras.

For the modern era, scholars have found that the degree to which PPP holds is affected by sovereign borders and by exchange rate regimes. Typically, PPP is more difficult not to reject and the persistence of deviations to PPP are higher under floating exchange rates and where national borders intrude (Engel and Rogers, 1996; Froot and Rogoff, 1995; Mark, 2001, pp. 166-174; Rogoff, 1996). The results in Table 1 here, the relative weakening of PPP from the colonial into the early national period, goes in the opposite direction of these modern era findings. The colonies had less fixity to their exchange rates than did the states, and the colonies had more sovereign political and

economic power over their borders than did the states. These observations again appears to point to the increasing complexity of modern monetary institutional arrangements, informal non-tariff trade barrier institutions, the complexity of modern goods, and differential non-transferable real productivity shocks as the culprits behind the relative failure of PPP and higher persistence of deviations from PPP in the modern era.<sup>13</sup>

The colony to state transition witnessed the adoption of modern monetary institutions in the U.S., namely a banking substructure and banking money multiplier to the money supply as well as a quasi central bank in the *First Bank of the U.S.*, none of which existed in the colonial institutional framework. This transition also involved a move from an “inside” non-specie linked paper money on a floating exchange rate to a specie-linked fixed exchange rate-like system.<sup>14</sup> Thus this story—the weakening of PPP from the colonial into the early national period—may also be consistent with the increased complexity of the modern monetary institutions that accompanied the transition from colonies to states making cross-state arbitrage more difficult than cross-colony arbitrage—more than offsetting gains in the ability to arbitrage differences that were created by moving away from floating exchange rates and by removing sovereignty between state borders.

Finally, a few long-data-series pre-modern tests of PPP using European data, such as for wheat prices between England and France from 1630 to 1789, have also rejected unit roots using standard univariate tests and found low persistence to deviations to PPP, i.e. half-lives of about one year (Froot and Rogoff, 1995, p. 1672)—close to that found here in Table 1. As such, the modern era versus pre-modern era comparisons offered here, being before versus after the industrial revolution, might also be seen as broadly consistent with the interpretation of PPP failure (or the high persistence of shocks) in the modern era as being possibly due to the rise in the complexity of modern goods and non-easily transferable real productivity shocks imparting non-stationarity to exchange rates.

#### *B. Late Colonial PPP versus Early National PPP*

Comparing the PPP results from the late colonial period with that in the early national period is also very interesting because the late colonial and early national periods were fundamentally different with regard to monetary and political institutional arrangements. The colonial economy had no banks and, for five of the six colonies tested, operated with a monetary regime where individual colonial legislatures issued fiat paper money backed by future taxes and not by specie. These colonial monetary arrangements entailed a non-fixed exchange rate regime between colonial paper “inside” money and specie “outside” monies. Colonial legislatures did operate with some degree of regulation and oversight by the British Parliament and Board of Trade. For example, the Currency Acts of 1751 and

1764 allowed colonial legislatures to issue paper money as long as it was not made a legal tender and as long as taxes were put in place to redeem the issues in a timely fashion. Beyond this, colonial legislatures had a fair amount of latitude in the issuance of fiat paper money and this prerogative was exercised independently and differentially across the colonies (Brock, 1975; Grubb, 2003; Grubb 2004a; Perkins, 1988, pp. 168-183; Perkins, 1994, pp. 39-55).

In the early national period (post-*U.S. Constitution*), legislatures at all levels constitutionally lost the power to issue paper money. Instead, both national government- and state government-chartered, but privately run, banks were the main monetary institutional arrangement. They issued non-legal tender paper banknote money backed by fractional reserves of specie with banknotes exchanged for specie at a fixed (par) exchange rate, except during liquidity crises. The U.S. mint also issued specie dollar-denominated coins. Overall, the U.S., and the U.S. dollar, was part of a fixed exchange rate specie foreign trade world. There was little regulation direct or indirect of this system in terms of required reserve ratios or specie-to-paper money loan ratios, etc. In addition, neither the Treasury Department nor the *First Bank of the U.S.* was really well designed to manage this system in terms of being a macro-monetary-authority, though they may have tried in an unsystematic and piecemeal fashion to do so (Cowen, 2000, pp. 137-179; Grubb 2003; Kaplan, 1999, pp. 28-29; Perkins, 1994, pp. 235-265).

The Founding Fathers argued that this Constitutional change, banning the colonial-style state currency system, would help economically integrate the states to a greater degree than they had been previously. For example, James Madison during the ratification debates over the *U.S. Constitution* argued in Federalist Paper #44, “Had every State a right to regulate the value of its coin [and issue its own paper money], there might be as many different currencies as States; and thus the intercourse among them would impeded...” (Bernard Bailyn, 1993, p. 94) At the Constitutional Convention in 1787, Charles Pinckney even concluded that “...the *States* are more one nation now, than the *Colonies* were...” (Max Farrand, 1966, Vol. 1, p. 164) In 1787, in a roundabout way, the Founding Fathers at the Constitutional Convention debated whether to adopt a monetary system akin to the colonial monetary system—replacing British oversight and regulatory rules (the Currency Acts of 1751 and 1764) with oversight and regulation by the national legislature (Farrand, 1966, Vol. 1, pp. 26, 162-173, 288-327; Vol. 2, pp. 52, 75-76, 299; Vol. 3, pp. 150, 214, 607; Vol. 4, pp. 44-45). For example, they debated whether to allow state legislatures to issue fiat paper money, as during the colonial period, but only if the national legislature was also given the power to approve or veto such state actions. In the end, however, they opted instead for a complete no-exceptions ban on anything resembling the colonial monetary system.

The other economic differences affecting market integration and arbitrage between the colonies prior to 1776 versus the states shortly after the adoption of the *U.S. Constitution* were either minor or go in the opposite direction to that measured in Table 1. For example, rates of technical change appear to have remained relatively low (Shepherd and Walton, 1972, p. 159). In addition, *internal* and unsynchronized real trade shocks that might directly disrupt market arbitrage and so possibly impart some non-stationary to PPP *among* the colonies/states would appear to have been greater during the late colonial era (1748-1775) than during the early national era (1796-1811). The differential impact across the colonies and disruptions to cross-colony trade caused by the Seven Years' War and by the commercial protests against the Stamp Act, the Townsend Duties, the 1769 importation boycotts, the Boston Massacre, the Tea Act, and so forth, makes the period from 1796 to 1811 look comparatively uneventful in terms of internal and unsynchronized real shocks to cross-state trade. Based solely on internal real trade shocks, PPP should have performed worse during the late colonial era compared with the early national era.

The *U.S. Constitution's* elimination of formal trade barriers (tariffs) between states and the requirement that any import tariffs on goods from outside the union apply uniformly across the states (export tariffs were not allowed) largely reestablished among the states what had existed among the British North American colonies. Under British imperial trade policy and the navigation acts the British North American colonies faced by and large the same uniform application of trade and shipping restrictions within versus outside the empire, particularly among each other.<sup>15</sup> Because trade policy varied by product, the impact could differ by colony, but in principle no different than a national import tariff on iron could have a differential impact across states. There were, however, exceptions. For example, colonies enacted different import taxes on convict labor, on slave labor, on non-British immigrants, etc., and enacted different taxes on their exportable produce, such as on tobacco. In general, however, while colonies had somewhat more sovereign power over their borders regarding trade than post-*U.S. Constitution* states did, cross-border trade appears to have been relatively free and unencumbered among the British North American colonies. The fear that once freed from British oversight and regulation post-Revolution states would enact substantial formal trade barriers and be embroiled in interstate trade disputes was clearly one of the immediate driving forces leading to the 1787 *Constitutional Convention*.<sup>16</sup> However, prior to 1787 no substantial barriers to interstate commerce had actually developed (Gary M. Walton and James F. Shepherd, 1979, p. 188). Finally, non-monetary transportation, information, and transactions costs had not changed, nor were differential real productivity shocks important (except on cotton as noted above), between the late colonial and early national periods. The primary effective change to

economic and market arbitrage conditions brought on the adoption of the *U.S. Constitution* across the states versus across the colonies was in monetary institutions.<sup>17</sup>

The fact that PPP holds well in the colonial period and, if any thing, holds better than in the early national period, undercuts the argument that monetary unification as laid out or intended by the *U.S. Constitution* was a fundamentally important part of the political unification achieved by the new Constitution, i.e. that this monetary unification would substantially reduce transactions costs in cross-state trade net of other institutional/constitutional changes. This fact also suggests that late-colonial fiat paper monetary regimes were managed reasonably well or at least were not the disasters that the political rhetoric offered for adopting the Constitution suggests that they were (Farrand, 1966; Grubb, 2003; Grubb, 2004b). And it is consistent with the argument that rent seeking rather than efficiency issues were the primary motivation behind the monetary unification clauses put into the *U.S. Constitution* by the Founding Fathers (Grubb, 2003).

The apparent relative weakness of PPP, especially for South Carolina, in the early national period versus the late colonial period may indicate that the new institutional system of state and Federal government-chartered but privately run fractional reserve banking increased transactions costs relatively more in the cross-state arbitrage process than what existed in the late colonial era of floating exchange rates between the issuances of fiat paper money by individual colonial legislatures. In part, this may have been due to the effect of a greater plethora of different and unregulated state and Federal paper banknotes replacing a relatively smaller number of colonial paper currencies as the paper money medium of exchange within the 13 colony/states (Perkins, 1994, pp. 39, 235-281). The *U.S. Constitution* led to a uniform unit of account and denomination of paper money—U.S. dollars—but it didn't create a common paper medium of exchange, and in fact occasioned a greater number of paper mediums of exchange (private banknotes) than what had existed during the late colonial era. As such, monetary unification as laid out and intended by the *U.S. Constitution* may have yielded few gains over the “uncoordinated” colonial system, as measured by PPP, during the first decades of its operation.

## VII. Conclusions

Why has it been difficult to not reject PPP with standard univariate tests, and why have the persistence of shocks to PPP been so high, for the modern era? Comparison with the results here, that PPP holds in pre-modern early America even when using short spans of data and standard low-powered univariate tests and that the persistence of shocks to PPP in this data is relatively low compared with studies for the modern era, are instructive.

In addition, PPP appears to hold marginally better, or at least no worse, among locations where exchange rates were less fixed and borders had more political and economic sovereignty (during the colonial era, albeit within the British Empire umbrella)—the opposite of what has been found for the modern era. These results suggests that the modern PPP arbitrage problem may not be about transportation or information costs, which were typically higher in the late 18<sup>th</sup> century than in the 20<sup>th</sup> century, but may be more about the complexity of modern national monetary and non-tariff informal trade barriers and/or the complexity and lower cross-market transferability of modern productivity shocks and product complexity compared with what was experienced in the pre-modern era.

That PPP holds marginally better among the colonies than among the same locations once they became states under the *U.S. Constitution* also suggests that politically manufactured common currency zones may do little to increase market integration, as measured by PPP, once the added complexities of the new monetary institutions accompanying the said adoption are taken into account. In short, adopting the *U.S. Constitution* does not appear to represent a fundamental structure break in market integration within the new nation. At best, it represented a constraint on potential future market disintegration between states that could have occurred in its absence. In a sense it at best merely returned the U.S. to a level of market integration that it had enjoyed within the British Empire.

The particular results for early America obtained here, however, are partly determined by what prices indices and exchange rate series have been collected in the past and so exist currently in the literature. While this study was able to test PPP across arguably the six major colony/states that would eventually become U.S. States, it would be interesting to know if these findings generalize to other lesser colony/states, particularly to those that some scholars claim acted less responsibly, such as North Carolina and Rhode Island. Such PPP tests, however, will have to await future research, i.e. wait until work is completed on constructing price and exchange rate data series for these other colonies.

[Place Appendix Table 1A Here]

[Place Appendix Table 2A Here]

### References

- Adams, Donald R., Jr.** "Prices and Wages in Maryland, 1750-1850." *Journal of Economic History*, September 1986, 46(3), pp. 625-45.
- Bailyn, Bernard.**, ed., *The debate on the constitution*. New York: Literary Classics, Vols. 1-2, 1993.
- Bezanson, Anne; Gray, Robert D. and Hussey, Miriam.** *Wholesale prices in Philadelphia, 1784-1861*. Philadelphia: University of Pennsylvania Press, 1936.
- Bordo, Michael D., and Ivan A. Marcotte.** "Purchasing Power Parity in Colonial America: Some Evidence for South Carolina 1732-1774, A Comment." *Carnegie-Rochester Conference Series on Public Policy*, 1987, 27, pp. 311-324.
- Brock, Leslie V.** *The currency of the American colonies, 1700-1764*. New York: Arno Press, 1975.
- Cecchetti, Stephen G., Mark, Nelson C., and Sonora, Robert J.** "Price Index Convergence Among United States Cities." *International Economic Review*, Nov. 2002, 43(4), pp. 1081-1099.
- Chaudhuri, Kausik, and Sheen, Jeffrey.** "Purchasing Power Parity across States and Goods within Australia." Working Paper, University of Sidney, February, 2004.
- Cole, Arthur Harrison.** *Wholesale commodity prices in the United States, 1700-1861*. Cambridge, MA: Harvard University Press, 1938.
- Cowen, David Jack.** *The origins and economic impact of the First Bank of the United States, 1791-1797*. New York: Garland, 2000.
- Engel, Charles, and John H. Rogers,** "How Wide Is the Border?" *American Economic Review*, Dec. 1996, 86(5), pp. 1112-1125.
- Enders, Walter.** *Applied econometric time series*. New York: John Wiley & Sons, 1995.
- Ernst, Joseph Albert.** *Money and politics in America, 1755-1775*. Chapel Hill, NC: University of North Carolina Press, 1973.
- Farrand, Max.**, ed., *The records of the federal convention of 1787*. New Haven, CT: Yale University Press, Revised Edn., Vols. 1-4, 1966.
- Froot, Kenneth A., and Kenneth Rogoff.** "Perspectives on PPP and Long-Run Real Exchange Rates," in Gene M. Grossman and Kenneth Rogoff, eds., *Handbook of international economics, Volume 3*. Amsterdam: North-Holland, 1995, pp. 1647-1688.

- Holdsworth, John Thom.** *The first bank of The United States*. Philadelphia [?]: National Monetary Commission, Senate Document, No. 571, 61<sup>st</sup> Congress, 2<sup>nd</sup> Session, 1910 [?].
- Grubb, Farley.** “Creating the U.S. Dollar Currency Union, 1748-1811: A Quest for Monetary Stability or a Usurpation of State Sovereignty for Person Gain?” *American Economic Review*, Dec. 2003, 93(5), pp. 1778-1798.
- \_\_\_\_\_. “The Circulating Medium of Exchange in Colonial Pennsylvania, 1729-1775: New Estimates of Monetary Composition, Performance, and Economic Growth.” *Explorations in Economic History*, Oct. 2004, 41, pp. 329-360.
- \_\_\_\_\_. “The Constitutional Creation of a Common Currency in the U.S., 1748-1811: Monetary Stabilization Versus Merchant Rent Seeking,” in Jurgen Nautz and Lars Jonung, eds., *Conflict potentials in monetary unions*. Stuttgart: Steiner Verlag, 2004b, *forthcoming* .
- Kaplan, Edward S.** *The bank of the United States and the American economy*. Westport, CT: Greenwood Press, 1999.
- Lakwete, Angela.** *Inventing the cotton gin: machine and myth in Antebellum America*. Baltimore: Johns Hopkins University Press, 2003.
- Mark, Nelson C.** *International macroeconomics and finance: theory and econometric methods*. Oxford, UK: Blackwell Publishers Inc., 2001.
- McCullough, A. B.** *Money and exchange in Canada to 1900*. Toronto: Dundurn Press, 1984.
- McCusker, John J.** *Money and exchange in Europe and America, 1600-1775*. Chapel Hill, NC: University of North Carolina Press, 1978.
- McGuire, Robert A.** *To form a more perfect union: a new economic interpretation of the United States Constitution*. New York: Oxford University Press, 2003.
- McIvor, R. Craig.** *Canadian monetary, banking and fiscal development*. Toronto: Macmillan, 1961.
- Officer, Lawrence H.** *Between the dollar-sterling gold points*. New York: Cambridge University Press, 1996.
- Paquet, Gilles, and Jean-Pierre Wallot.** “Some Price Indexes for Quebec and Montreal (1760-1913).” *Histoire sociale / Social History*, Nov. 1998, 62, pp. 281-320.
- Parsley, David C., and Shang-Jin Wei.** “Convergence to the Law of One Price Without Trade Barriers or Currency Fluctuations.” *Quarterly Journal of Economics*, Nov. 1996, 111(4), pp. 1211-1236.

- Perkins, Edwin J.** *The economy of colonial America*. New York: Columbia University Press, 2<sup>nd</sup> edn., 1988.
- \_\_\_\_\_. *American public finance and financial services, 1700-1815*. Columbus, OH: Ohio State University Press, 1994.
- Pickering, Danby.** *The statutes at large from the Magna Charta to the end of the eleventh parliament of Great Britain, anno 1761*. Cambridge, UK: in 46 vols., 1762-1807.
- Rogoff, Kenneth.** "The Purchasing Power Parity Puzzle." *Journal of Economic Literature*, June 1996, 34(2), pp. 647-668.
- Rothenberg, Winifred B.** "A Price Index for Rural Massachusetts, 1750-1855." *Journal of Economic History*, Dec. 1979, 39(4), pp. 975-1001.
- Rutland, Robert A.,** ed. *Papers of George Mason*. Chapel Hill, NC: University of North Carolina Press, Vol. 2, 1970.
- Schlesinger, Arthur Meier.** *The colonial merchants and the American Revolution, 1763-1776*. New York: Frederick Ungar, 1966.
- Shepherd, James F., and Gary M. Walton.** *Shipping, maritime trade, and the economic development of colonial North America*. London: Cambridge University Press, 1972.
- Thomas, Robert Paul.** "A Quantitative Approach to the Study of the Effects of British Imperial Policy upon Colonial Welfare: Some Preliminary Findings." *Journal of Economic History*, Dec. 1965, 25(4), pp. 615-638.
- Walsh, Lorena.** Personal communication, 1999.
- Walton, Gary M.** "New Evidence on Colonial Commerce." *Journal of Economic History*, Sept. 1968, 28(3), pp. 363-389.
- Walton, Gary M., and James F. Shepherd.** *The economic rise of early America*. New York: Cambridge University Press, 1979.

TABLE 1. Augmented Dickey-Fuller Tests for Purchasing Power Parity, 1748-1775 &amp; 1796-1811

$$[\ln(y_t) - \ln(y_{t-1})] = a_0 + a_1 \ln(y_{t-1}) + a_2 D + k \text{ lags of } [\ln(y_t) - \ln(y_{t-1})] + e_t$$

Period				Period			
Colony-to-Colony	$k$	$a_1$	$a_2$	State-to-State	$k$	$a_1$	
<b>1749-1775</b>				<b>1797-1811</b>			
New York-Pennsylvania	0	-0.505** (0.168)		New York-Pennsylvania	1	-0.607** (0.193)	
New York-South Carolina	0	-0.613** (0.180)		New York-South Carolina	0	-0.087 (0.127)	
Pennsylvania-South Carolina	0	-0.657** (0.192)		Pennsylvania-South Carolina	0	-0.150 (0.195)	
<b>1751-1775</b>							
Massachusetts-New York	0	-0.783** (0.208)		Massachusetts-New York	0	-0.995** (0.250)	
Massachusetts-Pennsylvania	0	-0.762** (0.183)		Massachusetts-Pennsylvania	0	-0.591* (0.211)	
Massachusetts-South Carolina	0	-0.608** (0.173)		Massachusetts-South Carolina	1	-0.043 (0.174)	
<b>1757-1775</b>							
Maryland-Massachusetts	0	-1.065** (0.292)		Maryland-Massachusetts	0	-0.912* (0.288)	
Maryland-New York	0	-0.515 (0.202)		Maryland-New York	0	-0.670* (0.253)	
Maryland-Pennsylvania	0	-0.576* (0.217)		Maryland-Pennsylvania	0	-0.637 (0.247)	
Maryland-South Carolina	0	-0.601* (0.215)		Maryland-South Carolina	0	-0.283 (0.165)	
<b>1758-1775</b>							
Virginia-Massachusetts	0	-0.698* (0.236)	-0.133* (0.064)	Virginia-Massachusetts	0	-0.704* (0.257)	
Virginia-New York	0	-0.956** (0.220)	-0.192** (0.052)	Virginia-New York	0	-0.872** (0.276)	
Virginia-Pennsylvania	0	-0.678** (0.218)	0.128** (0.050)	Virginia-Pennsylvania	0	-1.042** (0.270)	
Virginia-Maryland	0	-0.747** (0.180)	-0.155** (0.050)	Virginia-Maryland	0	-0.836* (0.285)	
Virginia-South Carolina	0	-0.917** (0.255)	0.064 (0.060)	Virginia-South Carolina	0	-0.874* (0.290)	

\* indicates, and \*\* indicates, that the coefficient is statistically greater than zero above the 0.1, and the 0.05, significance levels, respectively. *Dickey-Fuller* critical values are used for  $a_1$ .

*Notes:* The data are yearly. While **Period** refers to the years spanned by the  $y_t$  values, the existence and use of a  $y_{t-1}$  value is also implied for the initial year listed. Standard errors are in parentheses.  $y$  for the colonial period equals [(Colony A's sterling exchange rate  $\times$  Colony B's Price Index) / (Colony B's sterling exchange rate  $\times$  Colony A's Price Index)] for each colony-colony pairing, respectively. All cross-colonial exchange rates are derived by combining the respective colony's exchange rates with England, i.e. the number of each colony's pounds per 100 pounds sterling (see text for explanation).  $y$  for the U.S.-dollar national period equals [State A's Price Index / State B's Price Index] for each state-state pairing, respectively. All cross-state exchange rates are assumed to be 1 (a U.S. dollar is a U.S. dollar). Lags of the dependent variable were added to the specification until the  $k+1$  lag was statistically insignificant at the 0.1 level.  $D$  for Virginia is a structural break dummy variable coded as one for the years 1766-1775 and zero otherwise (see text for the explanation). For the 1757-1775 Maryland-New York regression a unit root can be rejected at the 0.1 level if a  $k = 1$  lag—which in itself is statistically insignificant—is added to the regression. For the 1797-1811 Maryland-Pennsylvania regression, a unit root is just barely rejected at the 0.1 significance level ( $t = 2.58$ ). While *Augmented Dickey-Fuller* tests are not always reliable with short spans of data, they are useful confirmation of the visual impressions given in the figures.

*Sources:* Bezanson, *et al.* (1936, p. 388); Cole (1938, pp. 120-21, 135, 155-56); McCusker (1978, pp. 141-42, 164-65, 185-86, 198-99, 211-12, 223-24); Rothenberg (1979, p. 983-84). The Maryland price index for 1756-75 is constructed as an unweighted nine-commodity geometric index by the author using the raw price data reported in Adams (1986, p. 643). The nine commodities are corn, wheat, oats, rye, salt, beef, pork, sugar, and rum. The author constructed the Virginia index and the post-1775 Maryland index from original raw price data provided by Walsh (personal communication). They are unweighted geometric indices combining corn, wheat, and tobacco prices.

**TABLE 2. Inter-Colony Trade: Percentage Distribution of Shipping Tonnage by Origin and Destination, 1768-1772**

	<i>New England</i>		<i>Middle Colonies</i>		<i>Upper South</i>		<i>Lower South</i>	
	Entered from	Cleared to	Entered from	Cleared to	Entered from	Cleared to	Entered from	Cleared to
New England			13.4%	11.2%	10.0%	7.6%	12.8%	8.7%
Middle Colonies	11.2%	10.4%			6.7	4.1	8.1	6.8
Upper South	5.8	7.0	4.0	6.5			1.1	0.9
Lower South	6.0	7.6	5.7	6.9	0.7	1.0		
Sub- Total	23.0%	25.0%	23.1%	24.6%	17.4%	12.7%	22.0%	16.4%
Great Britain And Ireland	14.6%	14.1%	23.6%	20.0%	51.1%	55.4%	36.1%	42.0%
Average Tonnage Per Year	96,000	107,285	70,038	69,821	74,905	78,809	61,742	63,330

*Notes:* New England includes Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. The Middle Colonies include New York, New Jersey, Pennsylvania, and Delaware. The Upper South includes Maryland and Virginia. The Lower South includes North Carolina, South Carolina, and Georgia. Tonnage refers to registered tonnage—an approximate measure of vessel carrying capacity.

*Source:* Derived from Walton (1968, p. 366).

**TABLE 3. Augmented Dickey-Fuller Tests for Purchasing Power Parity Using Alternative South Carolina Price Indices, 1796-1811**

$$[\ln(y_t) - \ln(y_{t-1})] = a_0 + a_1 \ln(y_{t-1}) + k \text{ lags of } [\ln(y_t) - \ln(y_{t-1})] + e_t$$

Period:	<i>South Carolina Export Staples Only Price Index 1797-1811</i>		<i>South Carolina Excluding Export Staples Price Index 1797-1811</i>		<i>South Carolina Cotton Only Price Index 1797-1811</i>		<i>South Carolina Rice Only Price Index 1797-1811</i>	
	<i>k</i>	<i>a</i> <sub>1</sub>	<i>k</i>	<i>a</i> <sub>1</sub>	<i>k</i>	<i>a</i> <sub>1</sub>	<i>k</i>	<i>a</i> <sub>1</sub>
<b>Full Price Index for (unless otherwise indicated):</b>								
Massachusetts	1	0.102 (0.160)	1	-0.294 (0.239)	1	-0.004 (0.168)	2	-0.746* (0.263)
New York	0	-0.047 (0.158)	0	-0.287 (0.189)	0	-0.052 (0.134)	0	-0.367 <sup>a</sup> (0.213)
Pennsylvania	0	-0.082 (0.214)	0	-0.509 (0.241)	0	-0.079 (0.172)	0	-0.355 <sup>a</sup> (0.211)
Maryland	0	-0.155 (0.162)	0	-0.475 (0.219)	0	-0.109 (0.131)	1	-0.572* (0.216)
Virginia	1	0.051 (0.376)	0	-1.156** (0.262)	0	-0.236 (0.224)	0	-0.428 <sup>a</sup> (0.225)
Pennsylvania <i>Textile Fiber Price Only Index</i>	0	-0.320 (0.193)	0	-0.695 (0.311)	0	-0.194 (0.150)	0	-0.412 <sup>a</sup> (0.224)
Pennsylvania <i>Grain Price Only Index</i>	0	-0.124 (0.242)	0	-0.571 (0.253)	0	-0.041 (0.176)	0	-0.335 (0.210)
Montreal	0	-0.137 (0.174)	0	-0.245 (0.171)	0	-0.128 (0.159)	0	-0.346 (0.202)
Quebec (1)	0	-0.013 (0.125)	0	-0.087 (0.097)	0	-0.037 (0.120)	0	-0.311 (0.194)
Quebec (2)	0	-0.028 (0.126)	0	-0.127 (0.096)	0	-0.050 (0.121)	0	-0.365 (0.203)

\* indicates, and \*\* indicates, that the coefficient is statistically greater than zero above the 0.1, and the 0.05, significance levels, respectively, using *Dickey-Fuller* critical values.

<sup>a</sup> If one or two statistically insignificant lags are added to the specification then the coefficients on  $a_1$  become statistically significant above the 0.1 using *Dickey-Fuller* critical values (a unit root can be rejected).

*Notes:* See the notes to Tables 1 and 4 and to Figure 6. The data are yearly.  $y_t$  values span 1797-1811 and  $y_{t-1}$  values span 1796-1810. Standard errors are in parentheses.  $y$  equals [State A's Price Index / State B's Price Index] for each state-state pairing, respectively. All cross-state exchange rates are assumed to be 1. For the construction of  $y$  for the U.S. to Canadian pairings see the notes to Table 4. Lags of the dependent variable were added to the specification until the  $k+1$  lag was statistically insignificant at the 0.1 level. While *Augmented Dickey-Fuller* tests are not always reliable with short spans of data, they are useful confirmation of the visual impressions given in the figures.

*Sources:* See the source notes to Figure 6 and Tables 1 and 4; Bezanson, *et al.* (1936, pp. 13-16, 388, 394-95); Cole (1938, pp. 57-58, 120-22, 135, 154-60); McCullough (1984, pp. 266-68); Officer (1996, pp. 51-57, 80-84); Paquet and Wallot (1998, pp. 314-15); Rothenberg (1979, p. 983-84). The author constructed the Virginia and Maryland indices from original raw price data provided by Walsh (personal communication). They are unweighted geometric indices combining corn, wheat, and tobacco prices. *South Carolina Export Staples Only Price Index* included cotton, indigo, rice, tar, tobacco, and turpentine, and received weights of 65, 7, 15, 3, 7, and 3 percent in the index, respectively. *South Carolina Excluding Export Staples Price Index* included bacon, beeswax, corn, flour, pork, American rum, cognac brandy, foreign molasses, Jamaican rum, Liverpool salt, and muscovado sugar, and receive weights of 6, 2, 16, 15, 7, 14, 3, 7, 2, 10, and 18 percent in the index, respectively. The *Pennsylvania Textile Fiber Price Only Index* is an unweighted arithmetic index of cotton, flax, hemp, and wool prices. The *Pennsylvania Grain Only Price Index* is an unweighted arithmetic index of corn, oats, rice, rye, and wheat prices. For construction of the Canadian price indices and the related  $y$  for the respective PPP estimate, i.e. for estimates involving Montreal, Quebec (1), and Quebec (2), see the notes to Table 4.

**TABLE 4. The View from Canada: Augmented Dickey-Fuller Tests for Purchasing Power Parity, 1761-1775 & 1796-1811**

$$[\ln(y_t) - \ln(y_{t-1})] = a_0 + a_1 \ln(y_{t-1}) + k \text{ lags of } [\ln(y_t) - \ln(y_{t-1})] + e_t$$

Period			Period		
Colony—Colony	<i>k</i>	<i>a</i> <sub>1</sub>	Colony—State or Colony	<i>k</i>	<i>a</i> <sub>1</sub>
<b>1762-1775</b>			<b>1797-1811</b>		
Montreal—Quebec (1)	0	-1.072** (0.145)	Montreal—Quebec (1)	0	-0.719* (0.275)
Montreal—Quebec (2)	0	-0.928** (0.157)	Montreal—Quebec (2)	0	-0.821** (0.266)
Quebec (1)—Quebec (2)	0	-0.429 (0.234)	Quebec (1)—Quebec (2)	0	-0.212 (0.206)
Montreal—Massachusetts	0	-0.917** (0.103)	Montreal—Massachusetts	0	-0.414 <sup>b</sup> (0.234)
Montreal—New York	0	-0.900** (0.105)	Montreal—New York	0	-0.285 (0.198)
Montreal—Pennsylvania	0	-0.882** (0.098)	Montreal—Pennsylvania	0	-0.250 (0.170)
Montreal—Maryland	1	-0.674* (0.253)	Montreal—Maryland	0	-0.324 <sup>b</sup> (0.222)
Montreal—Virginia	0	-0.753** (0.101)	Montreal—Virginia	0	-0.275 <sup>b</sup> (0.191)
Montreal—South Carolina	0	-0.770** (0.118)	Montreal—South Carolina	0	-0.180 (0.167)
Quebec (1)—Massachusetts	0	-0.709** (0.203)	Quebec (1)—Massachusetts	0	-0.173 (0.189)
Quebec (1)—New York	0	-0.417* (0.153)	Quebec (1)—New York	0	-0.065 (0.120)
Quebec (1)—Pennsylvania	0	-0.473** (0.151)	Quebec (1)—Pennsylvania	0	-0.076 (0.085)
Quebec (1)—Maryland	0	-0.598** (0.163)	Quebec (1)—Maryland	0	-0.103 (0.170)
Quebec (1)—Virginia	0	-0.312 <sup>a</sup> (0.135)	Quebec (1)—Virginia	0	-0.162 (0.156)

Quebec (1)—South Carolina	0	-0.403 <sup>a</sup> (0.169)	Quebec (1)—South Carolina	0	-0.041 (0.106)
Quebec (2)—Massachusetts	0	-0.344 (0.215)	Quebec (2)—Massachusetts	0	-0.290 (0.213)
Quebec (2)—New York	0	-0.210 (0.137)	Quebec (2)—New York	0	-0.138 (0.130)
Quebec (2)—Pennsylvania	0	-0.118 (0.198)	Quebec (2)—Pennsylvania	0	-0.139 (0.086)
Quebec (2)—Maryland	0	-0.386 <sup>a</sup> (0.157)	Quebec (2)—Maryland	0	-0.124 (0.172)
Quebec (2)—Virginia	0	-0.161 (0.105)	Quebec (2)—Virginia	0	-0.199 (0.159)
Quebec (2)—South Carolina	0	-0.300 (0.165)	Quebec (2)—South Carolina	0	-0.067 (0.106)

\* indicates, and \*\* indicates, that the coefficient is statistically greater than zero above the 0.1, and the 0.05, significance levels, respectively, using *Dickey-Fuller* critical values.

<sup>a</sup> If **Period** is contracted one year to 1763-1775, then the coefficients on  $a_1$  become statistically significant above the 0.1 level using *Dickey-Fuller* critical values (a unit root can be rejected).

<sup>b</sup> A unit root can be rejected if statistically insignificant lags ( $k = 3$ ) are added to the specification (although given that this reduces the degrees of freedom by half—to just seven—caution should be exercised in interpreting these results). In all cases, just the first lag ( $k = 1$ ) is statistically insignificant at the 0.1 level. In all cases, when adding up to three lags ( $k = 3$ ) the last lag remains statistically insignificant. These specifications also generated coefficients on the  $\ln(y_{t-1})$ s that are less than  $-1.0$ , suggesting the presence of oscillatory overshooting or excess volatility in the mean reversion process.

*Notes:* The data are yearly. While **Period** refers to the years spanned by the  $y_t$  values, the existence and use of a  $y_{t-1}$  value is also implied for the initial year listed. Standard errors are in parentheses.  $y$  for the early colonial period (1762-1775) equals  $[(\text{Colony A's pounds sterling exchange rate} \times \text{Colony B's Price Index}) / (\text{Colony B's pounds sterling exchange rate} \times \text{Colony A's Price Index})]$  for each colony-

colony paring, respectively. All cross-colonial exchange rates are derived by combining the respective colony's exchange rates with England, i.e. the number of each colony's pounds per 100 pounds sterling (see text for explanation).  $y$  for the U.S.-dollar national period (1796-1811) equals [Canadian Colony A's Price Index / Canadian Colony B's Price Index] for each Canadian colony to Canadian colony comparison (a Halifax pound is a Halifax pounds, so exchange rates equal 1), and equals [(Canadian Colony A's Halifax pound to pounds sterling exchange rate  $X$  U. S. State B's Price Index) / (the U.S. dollar to pounds sterling exchange rate  $X$  Canadian Colony A's Price Index)] for each Canadian colony to U. S. state paring, respectively. Lags of the dependent variable were added to the specification until the  $k+1$  lag was statistically insignificant at 0.1 levels. While *Augmented Dickey-Fuller* tests are not always reliable with short spans of data, they are useful confirmation of the visual impressions given in the figures.

*Sources:* McCullough (1984, pp. 266-68); Paquet and Wallot (1998, pp. 314-15). For Canadian exchange rates linear extrapolations were inserted for missing values (4 in total). The Montreal and Quebec (1) price indices are unweighted 10-commodity indices using prices for oats, butter, wood, wheat, beef, flour, hay, eggs, peas, and chickens. The Quebec (2) price series is an unweighted 20-commodity index using prices for the same commodities as in Quebec (1) index plus prices for coffee, candles, coal, burning oil, molasses, straw, potatoes, rum, salt, and tobacco. For Massachusetts, New York, Pennsylvania, Maryland, Virginia, and South Carolina prices see the notes to Table 1. The U.S. dollar to pound sterling exchange rate is the Baltimore-White banknote adjustment to the true mint parity (Officer, 1996, pp. 51-57, 80-84). Alternative U.S. dollar to pound sterling exchange rates were tried, e.g. the true mint parity and the official legal exchange rates, but neither improved the results in terms of PPP holding more strongly over that reported here, see also Grubb (2003, p. 1795).



1749	0.2363									
1750	0.2429									
1751	0.2427									
1752	0.2384									
1753	0.2393									
1754	0.2405									
1755	0.2411									
1756	0.2418		0.2312							
1757	0.2372	1.1777	0.2350	0.1995						
1758	0.2271	1.1384	0.2243	0.1970						
1759	0.2193	1.0985	0.2196	0.1200						
1760	0.2266	1.0930	0.2208	0.2020						
1761	0.2467	1.1730	0.2408	0.2053	0.7994	0.6173	0.6484	0.6643	0.7792	0.1600
1762	0.2518	1.1198	0.2438	0.2177	0.7868	0.5902	0.6354	0.6563	0.7348	0.1600
1763	0.2414	1.0460	0.2334	0.2231	0.8671	0.6316	0.6817	0.7052	0.7376	0.1646
1764	0.2408	1.0376	0.2323	0.2239	0.8370	0.6056	0.6476	0.6713	0.6965	0.1559
1765	0.2395	1.0392	0.2349	0.2261	0.7936	0.5797	0.6237	0.6359	0.6608	0.1494
1766	0.2305	1.2764	0.2320	0.1817	0.7516	0.5643	0.6136	0.6097	0.7783	0.1414
1767	0.2372	1.3111	0.2351	0.1793	0.8385	0.6247	0.6734	0.6792	0.8905	0.1597
1768	0.2380	1.3195	0.2356	0.1796	0.8449	0.6263	0.6761	0.6831	0.9013	0.1609
1769	0.2224	1.3174	0.2268	0.1722	0.8619	0.6490	0.7104	0.6966	0.9177	0.1580
1770	0.2147	1.2799	0.2106	0.1646	0.8531	0.6496	0.7001	0.7135	0.9132	0.1503
1771	0.2174	1.3094	0.2124	0.1622	0.8157	0.6095	0.6564	0.6720	0.8799	0.1427
1772	0.2369	1.2835	0.2336	0.1820	0.8260	0.6245	0.6728	0.6822	0.8756	0.1594
1773	0.2284	1.2727	0.2268	0.1782	0.8264	0.6147	0.6570	0.6615	0.8419	0.1501
1774	0.2421	1.2824	0.2387	0.1861	0.8235	0.6169	0.6575	0.6668	0.8551	0.1592
1775	0.2124	1.3057	0.2065	0.1582	0.9077	0.6215	0.6617	0.6804	0.8884	0.1405

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*Notes:* CA equals the Canadian locations of Montreal and Quebec where the Halifax pound was used as the unit of account money. Indirect exchange rates between colonies are calculated as [(Exchange rate of Colony A to pounds sterling) / (Exchange rate of Colony B to pounds sterling)] for each colony-to-colony pairing. Rates are reported only for the years used for the PPP estimates reported in Tables 1 and 4.

*Sources:* McCullough (1984, pp. 266-68); McCusker (1978, pp. 141-42, 164-65, 185-86, 198-99, 211-12, 223-24).

**APPENDIX: TABLE 2A. Augmented Dickey-Fuller Tests for Purchasing Power Parity For New Orleans, 1800-1811**

$$[\ln(y_t) - \ln(y_{t-1})] = a_0 + a_1 \ln(y_{t-1}) + k \text{ lags of } [\ln(y_t) - \ln(y_{t-1})] + e_t$$

Period:	<i>New Orleans Full Price Index</i> 1801-1811		<i>New Orleans Full Price Index</i> 1805-1811		<i>New Orleans Domestic Price Index</i> 1805-1811		<i>New Orleans Foreign Import Price Index</i> 1805-1811	
	<i>k</i>	<i>a</i> <sub>1</sub>	<i>k</i>	<i>a</i> <sub>1</sub>	<i>k</i>	<i>a</i> <sub>1</sub>	<i>k</i>	<i>a</i> <sub>1</sub>
<b>Full Price Index for (unless otherwise indicated):</b>								
Massachusetts	0	-0.241 (0.285)	0	-0.015 (0.417)	0	-0.083 (0.364)	1	-1.907** (0.274)
New York	0	-0.129 (0.231)	1	-0.155 (0.227)	0	-0.054 (0.286)	1	-1.892** (0.478)
Pennsylvania	0	-0.115 (0.270)	1	-0.102 (0.206)	1	-0.299 (0.182)	1	-3.094** (0.115)
Maryland	0	-0.439 <sup>a</sup> (0.246)	0	-1.127* (0.375)	0	-1.006* (0.384)	0	-0.854 (0.421)
Virginia	0	-0.834 (0.397)	0	-1.216* (0.447)	0	-1.095 (0.456)	0	-1.167* (0.438)
South Carolina	0	-0.578 (0.327)	0	-0.719 (0.361)	0	-0.591 (0.341)	0	-0.683 (0.406)
South Carolina <i>Export Staples Only Price Index</i>	0	-0.469 (0.332)	0	-0.469 (0.332)	0	-0.572 (0.344)	0	-0.403 (0.352)
South Carolina <i>Excluding Export Staples Price Index</i>	0	-0.514 (0.616)	0	-0.514 (0.616)	0	-0.284 (0.510)	1	-2.309** (0.521)
South Carolina <i>Cotton Price Only Index</i>	0	-0.475 (0.244)	0	-0.353 (0.424)	0	-0.419 (0.469)	0	-0.349 (0.377)
South Carolina <i>Rice Price Only Index</i>	0	-0.477 (0.287)	0	-0.530 (0.352)	0	-0.536 (0.348)	0	-0.520 (0.368)
Montreal	0	-0.219 (0.268)	2	-1.641** (0.171)	2	-1.740** (0.126)	0	-0.372 (0.469)
Quebec (1)	1	-0.193 (0.312)	1	-0.164 (0.180)	1	-0.237 (0.196)	0	0.198 (0.365)
Quebec (2)	0	-0.029 (0.215)	1	-0.125 (0.127)	1	-0.196 (0.168)	0	0.094 (0.435)

\* indicates, and \*\* indicates, that the coefficient is statistically greater than zero above the 0.1, and the 0.05, significance levels, respectively, using *Dickey-Fuller* critical values.

<sup>a</sup> If one or two statistically insignificant lags are added then the coefficients on  $a_1$  become statistically significant above the 0.1 using *Dickey-Fuller* critical values.

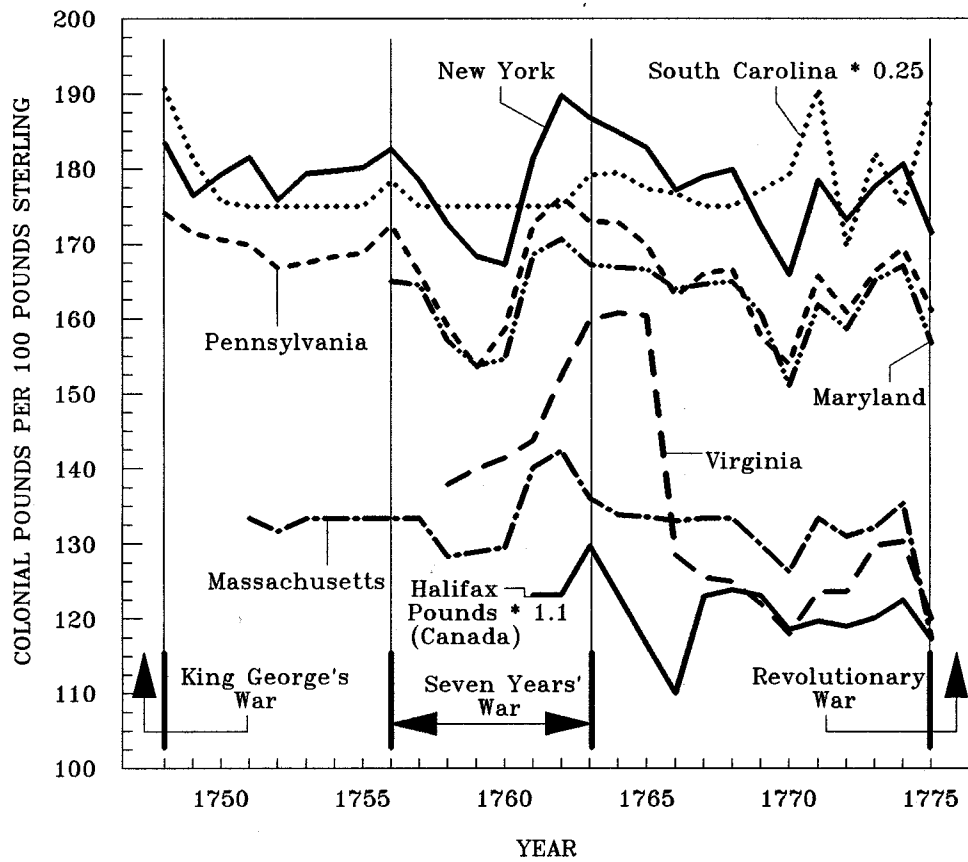
*Notes:* The data are yearly. While **Period** refers to the years spanned by the  $y_t$  values, the existence and use of a  $y_{t-1}$  value is also implied for the initial year listed. Standard errors are in parentheses. The construction of  $y$  follows that outlined in the notes to Tables 1, 3, and 4 for the respective pairings. Lags of the dependent variable were added to the specification until the  $k+1$  lag was statistically insignificant at 0.1 levels. While *Augmented Dickey-Fuller* tests are not always reliable with short spans of data, they are useful confirmation of the visual impressions given in the figures.

*Sources:* See the source notes to Tables 1, 3, and 4; Cole (1938, pp. 65-70, 170-71). The *New Orleans Full Price Index* for 1800-1811 is an 8-commodity index using prices for cotton, flour, sugar, tobacco, whiskey, pork, corn and bacon weighted at 35, 20, 13, 8, 8, 7, 5, and 4 percent, respectively. The *New Orleans Full Price Index* for 1804-1811 is a 44-commodity weighted arithmetic index, with domestically produced cotton receiving the largest weight at 21.6 percent. This 1804-1811 44-commodity price index is decomposed into a 29-commodity weighted arithmetic *New Orleans Domestic Price Index* and a 15-commodity weighted arithmetic *New Orleans Foreign Import Price Index*.

**FIGURE 1. Exchange Rates Between Colonial Pounds and Pounds Sterling, 1748-1775**

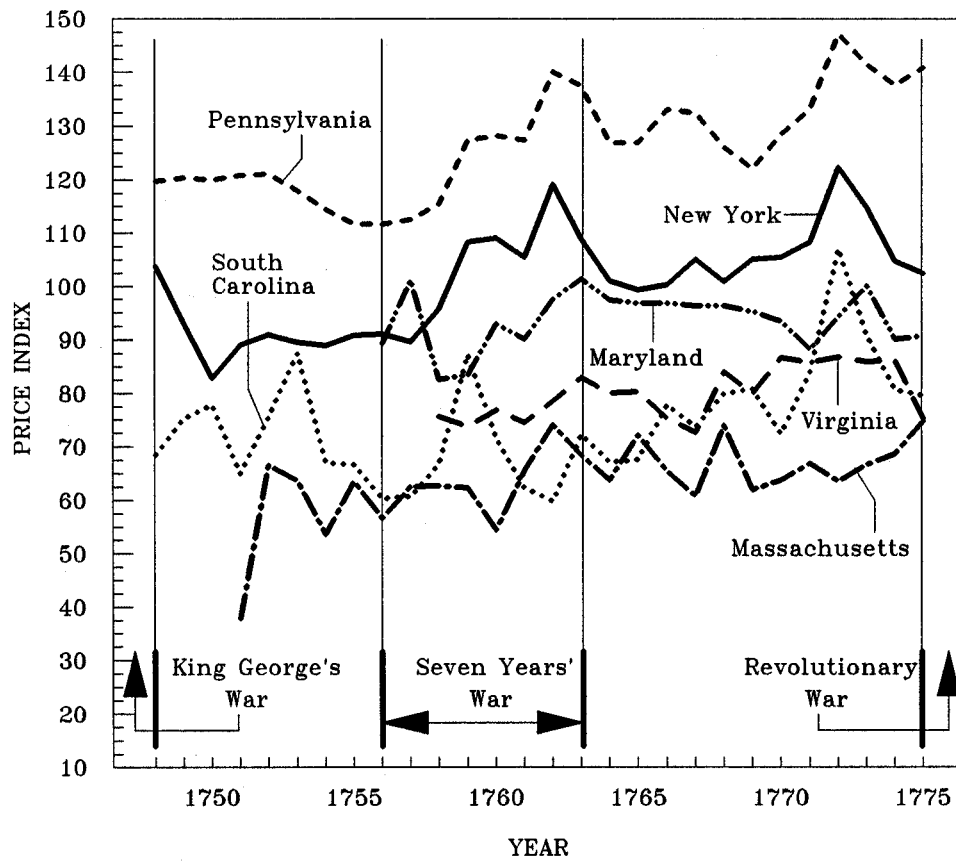
*Notes:* Except for Upper Canada (Montreal and Quebec) where the unit of account money was called “Halifax pounds”, each Colony refers to the exchange rate between in that Colony’s pounds and pounds sterling, e.g. “New York” refers to New York pounds to pounds sterling.

*Source:* McCullough (1984, pp. 266-68); McCusker (1978, pp. 141-42, 164-65, 185-86, 198-99, 211-12, 223-24).



**FIGURE 2. Price Indices for Six Colonies, 1748-1775**

Sources: See the source note to Table 1.



**FIGURE 3. Price Indices for Six States, 1796-1811**

Sources: See the source note to Table 1.

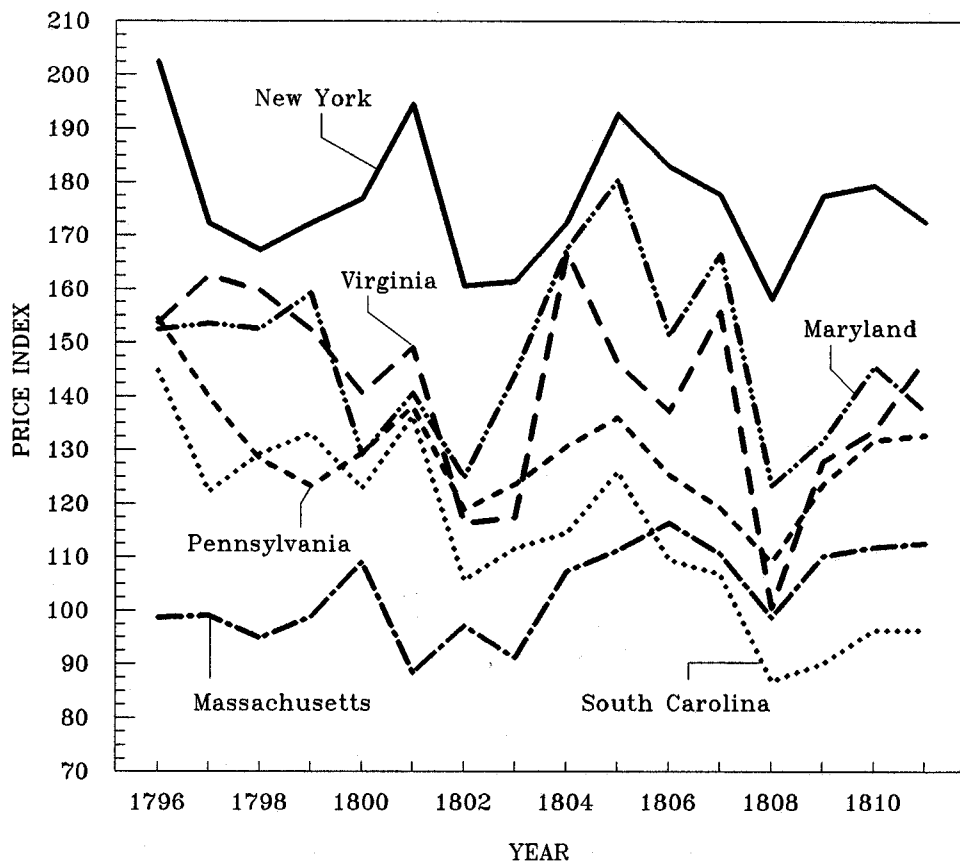


FIGURE 4. Price Indices: Long-View for Three U.S. Colonies/States and Montreal, 1748-1811

Sources: See the source notes to Tables 1 and 4.

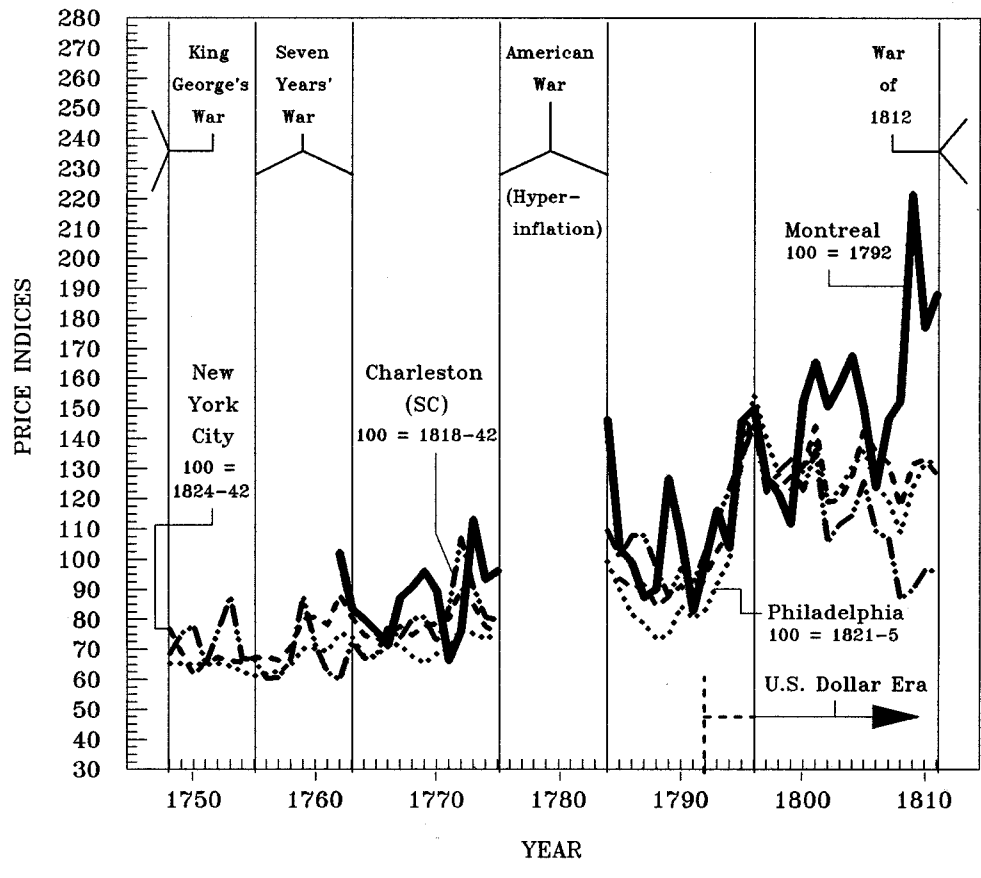
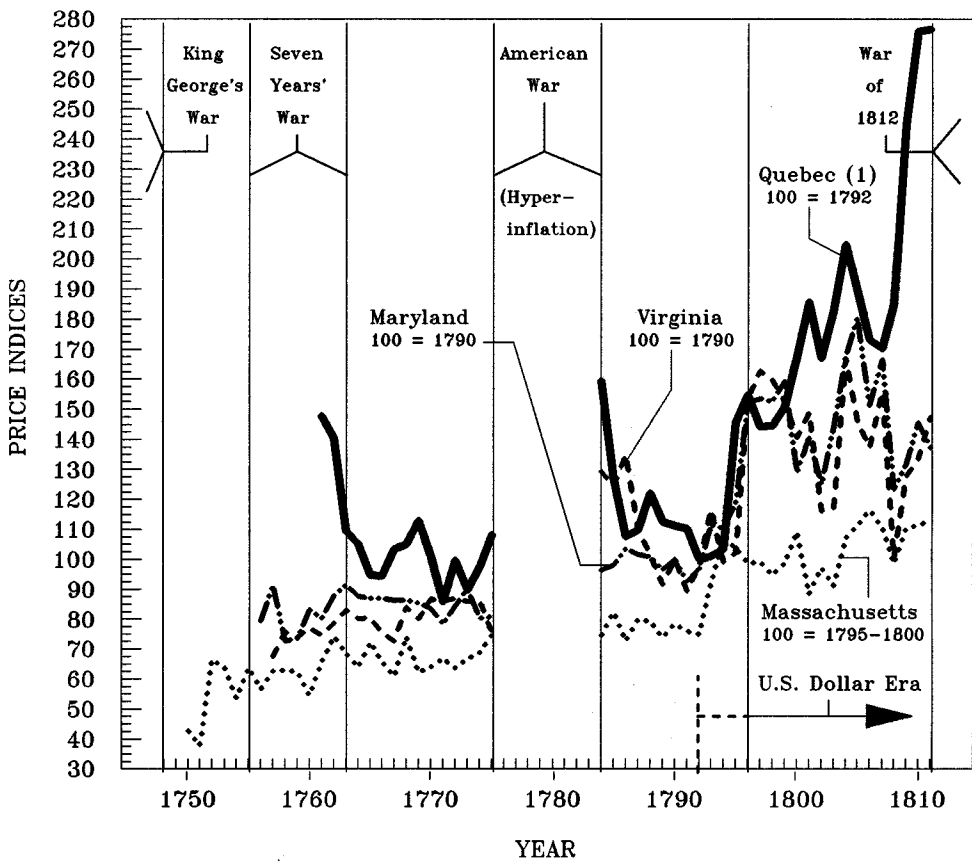


FIGURE 5. Price Indices: Long-View for Three U.S. Colonies/States and Quebec (1), 1748-1811

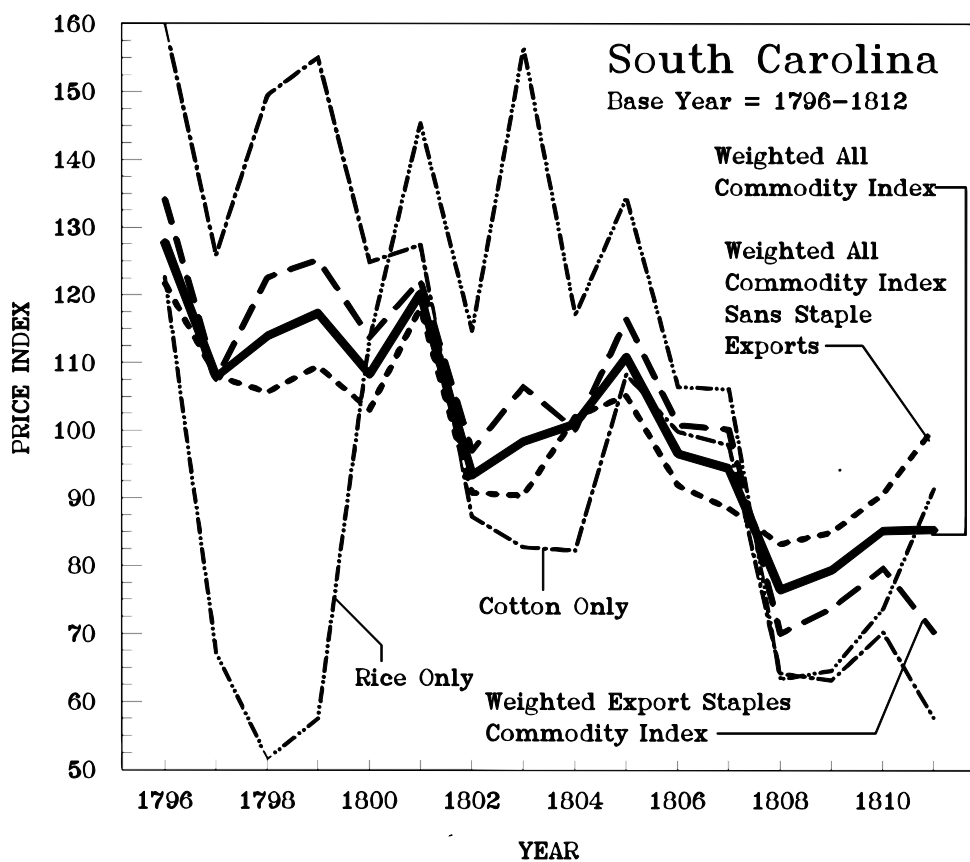
Sources: See the source notes to Tables 1 and 4.



**FIGURE 6. Component Price Indices for South Carolina, 1796-1811**

*Notes:* In the “All Commodity Index,” the export staple cotton was weighted 32.5 percent and rice 7.5 percent (out of 100 percent). Among the non-export staples in the “All Commodity Index,” the seven most heavily weighted goods, out of 100 percent, were sugar (9 percent), corn (8 percent), flour (7.5 percent), American Rum (7 percent), Liverpool Salt (5 percent), foreign molasses (3.5 percent), and pork (3.5 percent).

*Sources:* Derived from Cole (1938, pp. 57-58, 154, 159-160).



**Footnotes:**


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<sup>1</sup> For an economic analysis based on estimating an empirical voting model of delegate choices regarding these specific constitutional clauses at the 1787 Constitutional Convention, see Robert A. McGuire (2003, pp. 49-127).

<sup>2</sup> If nothing else, given that price level movements are dominated by monetary factors and that money is neutral in the long run implies that PPP should hold in the long run (Froot and Rogoff, 1995, pp. 1650-1651).

<sup>3</sup> For the half-life for the regression specification used here equals  $-\ln(2)/\ln(1 + a_1)$  where  $a_1$  refers to the coefficients in Tables 1, 3, 4, and 2A.

<sup>4</sup> Recently, Chaudhuri and Sheen (2004), using the panel approach, failed to reject PPP across the major Australian cities from 1972 to 1999. They also estimated a low persistence of deviations compared with other studies, namely a half-life of only 5 to 10 quarter-years. Parsley and Wei (1996), using the panel approach, failed to reject PPP across 48 U.S. cities from 1975 to 1992. They also estimated a low persistence of deviations compared with other studies, namely a half-life of only 1.0 to 1.25 years for tradable goods. Finally, Froot and Rogoff (1995, p. 1648) and Rogoff (1996, pp. 648, 656) conclude that the consensus now is that exchange rates and PPP are not random walks, and tests based on long-horizon data exhibit a remarkable consensus in that the persistence of shocks to PPP and exchange rates have a similar half-life of three to five years.

<sup>5</sup> With the exception of the Halifax pound that was not tested, Grubb (2003, p. 1786) rejected a unit root for the colonial pound to pound sterling exchange rates as displayed here in Figure 1 with the exception of that for Massachusetts. Except for Upper Canada that was not tested, Grubb (2003, p. 1786) also rejected a unit root in PPP between each of these colonies and England, separately, with the exception of between Maryland and England. He did not, however, test PPP between each of these colonies directly, presumably because data on exchange rates between the colonies did not exist in the current literature. Finally, Michael D. Bordo and Ivan A. Marcotte (1987) also found that PPP held between South Carolina and England for the period spanning from 1732 through 1774.

<sup>6</sup> This three-way indirect exchange rate calculation likely introduces additional noise or measurement

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error into what the true underlying colony-to-colony exchange rate is. This possibility implies that the standard errors are likely biased high (the statistical significance is biased low) on the PPP estimates for the colonial period in Tables 1 and 3. Therefore, it seems likely that the failure to reject PPP (i.e. that PPP holds) can be taken with even more statistical confidence than indicated by the estimates in Tables 1 and 3 for the pre-1776 period.

<sup>7</sup> Recently, Cecchetti, et al. (2002, pp. 1091-1093) and Parsley and Wei (1996, pp. 1219-1220) showed that the distinction between tradable and non-tradable goods in PPP tests for major U.S. cities is not strong.

<sup>8</sup> Grubb (2003, p. 1784) rejected a unit root for each of these indices separately, as displayed in Figure 2, with the exception of that for New York.

<sup>9</sup> It should be noted that this is a relative argument, i.e. how well PPP holds in the early national versus the late colonial period. In the colonial period, the medium of exchange used by participants in the market also was comprised of monies other than the bills of credit (paper money) issued by the separate colonial legislatures, namely a plethora of foreign specie coinage (Grubb 2004a). Colonial prices and price indices were recorded in the paper money units of each colony, respectively, with the exception of Massachusetts which recorded prices in specie accounting unit equivalents having gone off paper money after 1749. Thus, testing how well PPP holds across colonies is a test of whether the indirectly measured exchange rates across colonial paper monies is a reasonable approximation once market participants had converted whatever other monies were in use into their respective colony's paper money units.

<sup>10</sup> Grubb (2003, p. 1793) rejected a unit root for each of these indices separately, as displayed in Figure 3. However, Grubb (2003, p. 1795) fails to reject a unit root in PPP between each of these states and England, separately. He did not, however, test PPP between each of these states directly. Finally, Grubb (2003, pp. 1794-1795) also reports that he failed to reject a unit root both in the legal and in the true-mint parity U.S. Dollar-British Pound Sterling exchange rate series spanning from 1796 through 1811.

<sup>11</sup> Grubb (2003, p. 1786) found a similar outcome for Virginia's exchange rate and PPP with England.

<sup>12</sup> Was inter-colony/state trade extensive enough to provide direct arbitrage pressure on deviations from PPP? While data on the exact volume of inter-colony/state trade do not yet exist for this period, the amount of registered ship tonnage entering and clearing four colonial/state regions by the ships' origins and

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destinations between 1768 and 1772 may provide a sense of the potential extent of inter-colony/state trade (Gary M. Walton, 1968, p. 366). This is a biased-low measure of inter-colony/state trade. It does not measure inter-colony trade that crossed borders overland and by river, nor does it count the inter-colony trade within each regional grouping of colonies. Table 2 shows that a substantial amount of ship tonnage went directly between the colonies. In many cases, this trade, as measured by shipping tonnage entered and cleared, rivaled and often exceeded that going directly to and from Britain and Ireland. Based on this evidence there certainly appears to have been enough cross-colony/state trade or at least the unconstrained potential for said that would be consistent with a substantial direct arbitrage pressure potential being brought against PPP deviations through inter-colony/state trade in goods.

<sup>13</sup> The colonial and early national economies were primarily agriculture. Unexpected non-wartime shocks were, therefore, more climate-o-logical than technological. Harvest short-falls in one location could be easily made up my imports from another location. As such, as long as shipping costs and other standard trade barriers were not too high, PPP should hold relatively easily in such economies compared with modern economies where shocks were relatively more technologically based, given that technological transfer is a more complex and costly endeavor than the shipping of agricultural goods.

<sup>14</sup> If price level differences across locations in the colonial and early national periods were dominated by relative real productivity shocks rather than by relative monetary shocks, then PPP would not be expected to hold, or shock to PPP should exhibit much higher persistence than estimated.

<sup>15</sup> For discussions of British imperial and colonial trade regulatory policy, see Perkins (1988, pp. 19-44); Arthur Meier Schlesinger (1966, pp. 15-49); Robert Paul Thomas (1965, pp. 618-621, 632).

<sup>16</sup> The principle topics at the 1785 Mount Vernon Conference and at the 1786 Annapolis Convention, the precursors to the 1787 Constitutional Convention—which was actually proposed by the 1786 Annapolis Convention, were non-monetary interstate trade and navigation disputes, especially between Virginia and Maryland (Farrand, 1966, Vol. 3, pp. 544-545, 559; Robert A. Rutland, 1970, Vol. 2, pp. 814-822).

<sup>17</sup> The issue of monetary powers and the effects of said powers came up frequently at the Constitutional Convention and in the subsequent debates over ratifying the Constitution, see the passages in Bailyn (1993) and Farrand (1966) referenced in their respective indexes under paper money and bills of credit.