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DEBT, DEFAULT AND REVENUE  
STRUCTURE: THE AMERICAN STATE  
DEBT CRISIS IN THE EARLY 1840S

Arthur Grinath, III  
John Joseph Wallis  
Richard E. Sylla

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### **ABSTRACT**

During the 1820s and 1830s, American state governments made large investments in canals, banks, and railroads. In the early 1840s, nine states defaulted on their debts, four ultimately repudiated all or part of their debts, and three went through substantial renegotiations. This paper examines how the states got into the debt crisis and, as a result of their earlier history, how they responded to fiscal pressure in the debt crisis. The explanation is built around revenue structures. States along the developed eastern seaboard were able to avoid politically costly property taxes, while states along the frontier were forced to rely heavily on property taxes. When faced with fiscal pressures, two of the defaulting states -- Maryland and Pennsylvania -- were able to resume debt payments, with back interest, as soon as a property tax was enacted. The other defaulting states, however, already had high property taxes. Without access to new revenue sources, these states were forced to default, and then either renegotiate or repudiate their debts.

Arthur Grinath, III  
MICRA  
1155 Connecticut Avenue, NW  
Suite 900  
Washington, DC 20036-4306

John Joseph Wallis  
Department of Economics  
University of Maryland  
College Park, MD 20742

Richard Sylla  
Department of Economics  
Stern School of Business  
New York University  
44 West 4th Street  
New York, NY 10012-1126  
and NBER  
RSYLLA@STERN.NYU.EDU

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Arthur Grinath, III

John Joseph Wallis

Richard E. Sylla

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The U.S. state defaults of the 1840s, an era of fiscal crisis following a decade of fiscal exuberance, were one of the most spectacular episodes in the history of American public finance. Following the early success of the Erie canal in New York, Pennsylvania and Ohio began construction of their canal works in 1826, followed by Maryland's Chesapeake and Ohio canal in 1828. As the Erie prospered, the Ohio canals began returning tolls, and the boom of the 1830s swelled, states further west, buoyed by rapidly advancing land sales and migration, embarked on ambitious internal improvements programs, both canals and railroads in the mid 1830s: Ohio expanded its canal network in 1837, Indiana in 1836, Illinois in 1836, Michigan in 1837. New York which had been constructing an extensive network of feeder canals since the late 1820s, began a project to widen and deepen the Erie in 1838. Less appreciated, but equally important in terms of public finance, was the success of several states at tapping into the fiscal potential of banks. By the early 1830s over half of Massachusetts state revenues came from the tax on bank capital, and the Rhode Island tax on bank capital had allowed it to eliminate its property tax in 1826. States throughout the country were extensively involved in banks, but none more so than the southern states of Alabama, Mississippi, Louisiana, Arkansas, and the territory of Florida, all of which borrowed extensively to establish banks.

By 1841, the combined debt of state governments stood at \$193 million, of which roughly 60 percent was for canals and railroads and 30 percent for banks (Ratchford, 79, 88). In 1841 and 1842, Florida, Mississippi, Arkansas, Indiana, Illinois, Maryland, Michigan, Pennsylvania, and Louisiana defaulted on their interest payments. Other states, including Alabama, New York, Ohio, and Tennessee narrowly avoided default. Mississippi, Florida, Arkansas, and Michigan ultimately repudiated approximately \$13,770,000 of their debts (Ratchford, 114). Illinois and Indiana resumed payments later in the decade, after renegotiating their debts. Maryland and

Pennsylvania ultimately repaid their obligations with only minor adjustments.

The historiography of the debt crisis has looked primarily at the process of default and repudiation.<sup>1</sup> That less emphasis was put on explaining why states defaulted is understandable in light of Table 1, which lists state debts per capita in 1841, and whether a state defaulted subsequently. There is little to puzzle over. States with high debts per capita defaulted, states with lower debt per capita did not. Since all of the defaulting states borrowed to finance investments in transportation or banking, the reason states borrowed so much was equally apparent. They expected these investments to provide substantial revenues in the form of tolls and dividends and, when they did not, these states found themselves in financial difficulties. But several interesting and unanswered questions remain. One puzzle is why investors, particularly foreign investors, were willing to invest so much in states that ultimately defaulted or repudiated. Another is why, in an era when most states were engaged in internal improvement investments, some states borrowed much more than others. A third is why, in the face of the business depression and deflation after 1839, some states met their obligations, other states defaulted on but ultimately repaid their debts, and some states simply repudiated their debts outright.

Answers to these questions can be found in a careful analysis of state fiscal behavior in the early nineteenth century, particularly the way the states raised their revenues. After New York's successful experience with the Erie canal (by 1826 canal tolls not only exceeded maintenance costs and interest payments on canal bonds, but also returned a profit to the state) other states and investors began to anticipate that similar investments would yield comparable financial returns. But states in different parts of the country were not equally well placed to make these investments. States in the east had been able to build up sources of investment income, including bank stock and U.S. Treasury bonds, and to tax business activities to an extent that allowed them

to reduce or eliminate property taxes as a source of revenue. States in the west and south, lacking banks to invest in or businesses to tax, were forced to rely heavily on property taxes. The state property tax was very unpopular politically, and aversion to property taxes plays an important role in our story. Eastern states without property taxes in 1841 were, of course, in a much better position to raise revenues in the developing crisis, while frontier states in the west and south had no place to turn for additional revenues. While eastern states invested to augment their already substantial investment incomes and business taxes, frontier states invested in hopes of reducing their high and politically costly property taxes.

We argue that all states were interested in investments in transportation and banking in the early nineteenth century. In the late 1820s and early 1830s expectations about the profitability of these investments on the part of states and investors began to change, a change we can trace in bond prices and state taxing patterns. After 1839, however, the experience of the states diverged. Among the defaulting states, Pennsylvania and Maryland should really be compared to the non-defaulting states of New York and Massachusetts. Neither state had a property tax, and their defaults were ended when an effective property tax was imposed. New York and Massachusetts avoided default by imposing property taxes more rapidly and effectively. The remaining defaulters, however, already relied heavily on property taxation for revenues. They had no other revenue source to turn to. These states defaulted and later either renegotiated or repudiated their debts.

To support our argument we need to demonstrate four things. First, that the property tax was the most costly tax for states to levy. Second, that property taxes were a more important source of revenue for western than eastern states. Third, that expectations about the profitability

of investments began to change in the 1820s. Finally, that the experience of the defaulting states followed the patterns we have suggested.

The 1830s were a critical period in American political and economic history. Although the debt crisis comes at the end of the period, the events that precipitated the crisis built gradually throughout the decade. Perhaps the defining political and economic question of the time was the appropriate role of government in the economy. One could regard the ultimate failure of state involvement in infrastructure investment as compelling evidence for a *laissez faire*, Jacksonian policy of limited government involvement in the economy. That such a policy did not follow on the 1830s has been demonstrated by many scholars: nineteenth century governments did not cease to be actively involved in promoting economic development.<sup>2</sup> Understanding why the debt crisis did not end government involvement in these types of investments requires a deeper understanding of what governments were doing in the 1830s and the constraints they faced. We return to these issues at the end of the paper.

This analysis is of more than historical interest. Sovereign debt crises are a recurrent theme in international finance. This is particularly true for developing countries with limited tax bases, similar to frontier states in the 1830s. The 1995 default of Orange County, California was caused by exactly the same financial issues as we discuss here. Although it was investments in modern financial derivatives that got Orange County in trouble, the expectation was that income from its investments would enable the county to avoid politically costly taxation. Finally, the current debate about infrastructure investment, beginning with Aschauer, recreates the debates of the 1830s. Back then canals, railroads, and banks were viewed as investments that would return enormous benefits to society at large, as well as tidy profits to the states. Perhaps we should be

less hopeful, based on the 1840s experience, that investments in roads and bridges in the 1990s will yield large financial returns.

### I. A model of revenue structure

We begin with a theoretical, rather than historical, discussion for several reasons. First, revenue structure is a central part of our story. We present a simple model of revenue structure that explains why states chose certain revenue instruments. This provides a framework for establishing that the property tax was politically costly. Second, the decision to borrow rather than tax is intimately concerned with expectations about future revenue sources and costs of taxation. With a clear picture of how expectations affect the decision to tax and borrow, we can work backwards from the actual patterns of taxation and borrowing that we observe in the 1820s and 1830s to make some inferences about what states expected would happen.

Our model of revenue structure is a simple extension of the optimal taxation model.<sup>3</sup> First we assume that the government, however constituted, is a net benefit maximizer. Politicians take into consideration all kinds of things, and we will not try to list them. Politicians are better off when they spend a dollar and are worse off when they raise a dollar of taxes. Their maximization problem is to increase the size of the government's budget until the marginal cost of an additional dollar in tax revenue is equal to the marginal benefit of another dollar of expenditure. This involves choosing between revenue sources in a way that minimizes the political cost of raising a given amount of revenue. States received four basic types of revenue: investment income (bank dividends, land revenues, canal tolls, etc.); indirect taxes (licenses, fees, fines, excises, duties, and other taxes on business); direct taxes (property taxes, poll taxes, and income related taxes); and



borrowed funds. The mix of these revenue sources is what we mean by revenue structure.

Figure 1 represents the decision facing the politicians. The "quantities" on the graph are dollars. Marginal benefits and marginal costs are "political," meaning they are whatever motivate politicians, and are fundamentally unobservable. Our concern is primarily with the revenue side of government. The figure shows the aggregate marginal cost curve,  $MC_R$ , which is the horizontal summation of the marginal cost curves for three individual revenue instruments. These are investment income,  $MC_{inv}$ , indirect taxes,  $MC_{id}$ , and direct taxes,  $MC_d$ . On the expenditure side we show only the aggregate marginal benefit curve,  $MB_X$ , as we are not particularly concerned with the composition of expenditures.

Maximizing net benefits requires that marginal benefits equal marginal costs, and that the marginal costs of each revenue source are equated. The equilibrium size of government is  $R^*=X^*$  (total revenues equal total expenditures), with  $R_{inv}$ ,  $R_{id}$ , and  $R_d$  collected from investment income, indirect taxes, and direct taxes. The marginal cost of a dollar of revenue is  $PC^*$ .

The graph has several assumptions built into it. First, and most important for our explanation of the debt crisis, is the hierarchy of revenue sources. The height of the individual marginal cost curves shows that investment income is the least expensive revenue source, followed by indirect business taxes, and the most expensive tax is direct property taxes. As the size of government, defined by the size of the budget, expands states should systematically add revenue sources.

We have ranked the costs of the three revenue sources for several reasons. Taxpayers may view investment income as essentially free revenue. Investment income carries a positive opportunity cost since income earning assets could be sold, as many were in the 1830s and

1840s.<sup>4</sup> But the cost of collecting the revenue is very low, since no taxpayers are required to pay the tax.

Indirect business taxes fall directly on businesses, so they are more costly than investment income, but non-business owning voters may feel that the tax falls disproportionately on businessmen. These voters may suffer from fiscal illusion or they may want to tax businesses at a higher rate for equity or ethical reasons. Businessmen will prefer not to be taxed, but many businesses rely on government services such as roads, police, and courts and, therefore, may be willing to be taxed to insure adequate provision of services. Businesses are also likely to be primary beneficiaries of internal improvements.

Property and other direct taxes fall directly on voters, particularly on farmers who made up the bulk of the voting population in most of the states we are studying. There was some attempt to mitigate the anti-farmer bias of the property tax by taxing personal as well as real property and assessing town lots separately from land, but land clearly bore the brunt of the tax. Opposition to the tax was related to its “directness.” It was a highly visible tax. It was also well understood, as it had been the mainstay of local government finance since the colonial period. As we will show empirically, states tried to minimize the use of property taxes relative to the use of other taxes. Politically, it was the most expensive tax for state governments to levy.<sup>5</sup>

Two other aspects of the model are important for our explanation of the debt crisis, fixed costs and the decision to borrow. In Figure 1, new taxes are brought on line as revenues and expenditures rise. In reality, this is unlikely to occur without significant “fixed costs.” Voters have to be convinced that a new tax is necessary, and a tax collection mechanism may need to be established. If there are significant fixed costs in establishing a new tax, then politicians will

impose the tax only if those fixed costs can be covered. We have represented this in Figure 1 as the dotted portion of  $MC_R$ . Around the scallop in the aggregate marginal cost curve, it would only pay to bring the new revenue source on line if the state expected revenues to be permanently large enough to amortize the fixed costs. Although we do not test for the presence of fixed costs, the behavior of Maryland and Pennsylvania suggests that starting up a property tax in the late 1830s was a costly process.

The last issue is the decision to borrow, a more complicated issue to model. Barro (1979) developed a model of government borrowing to smooth out random fluctuations in revenues and/or expenditures. As in Figure 1, assume that the expected size of government is  $R^*=X^*$ , but that actual annual expenditures vary by a random amount  $\epsilon$ , where  $E(\epsilon) = 0$ . The political cost of raising revenue,  $C(R)$ , has the usual convexity properties  $C_R > 0$  and  $C_{RR} > 0$ . For a random fluctuation of a given  $\epsilon$ , costs rise by more when  $\epsilon$  is positive than they fall when  $\epsilon$  is negative. As a result, governments can minimize the costs of raising taxes over the long run by borrowing in years when  $\epsilon$  is positive and repaying debt in years when  $\epsilon$  is negative.

We can make use of this result in a different way. If governments anticipate that revenues and expenditures will be  $R^*=X^*$  on average, then the expected marginal cost of future taxes will be  $PC^*$ . If we make the simplifying assumption that all debt is consol debt, then the cost of debt service is the net present value of the interest payments. If the government's rate of time preference is equal to the community's rate of time preference as measured by the market interest rate, then for any given amount of debt issued,  $B$ , the net present value of the political costs of servicing the annual interest payments,  $Br$ , are:

$$(1) \sum C_R(R_t)Br/(1+r)^t \quad (\text{for } t = 1, \dots, \text{infinity})$$

where  $C_R(R_t)$  is the anticipated marginal cost of revenues in year  $t$ . If the government anticipates that revenues will always be  $R^*$  in the future, then

$$(2) \quad C_R(R_t) = PC^* \quad (\text{for all } t)$$

and it follows that

$$(3) \quad \sum C_R(R_t)Br/(1+r)^t = (PC^*)Br/r = (PC^*)B$$

The present value of the interest payments to finance one dollar of debt,  $B = 1$ , is simply the marginal cost of another dollar of taxes,  $PC^*$ . This assumes, of course, that the government will, on average, have no debt.<sup>6</sup>

Figure 2 illustrates what happens when the zero long run debt assumption is relaxed. The case of borrowing for revenue smoothing is represented by the  $MCR_{\text{present}}$  and  $MCX_{\text{present}}$  curves, with a marginal cost of taxation of  $PC_0$  and revenues of  $R_0$ . The marginal cost of borrowing, assuming that expected revenues will be  $R_0$ , is the horizontal line  $MCB_0$ .

If the government decides to finance a permanent expenditure with debt, the situation is different. Suppose the government wants to build an internal improvement, which costs  $K$  and is financed at an interest rate  $r$ . The government has already decided that the expected benefits of the investment exceed the expected costs. Financing the debt requires annual expenditures on interest of  $K*r$ , shown in figure 2 as a shift in the marginal benefit curve from  $MBX_{\text{present}}$  to  $MBX_{\text{future}}$ .<sup>7</sup> The expected equilibrium level of revenues and expenditures rises to  $R_1$  and the marginal cost of revenue needed to meet those expenditures rises to  $PC_1$ . Because expenditures will be permanently higher in the future, the marginal cost of borrowing a dollar is  $PC_1$ . The expected cost of borrowing an additional dollar is simply the marginal cost of financing the interest payments on that debt at a level of expenditure necessary to service the debt. The

marginal cost curve of borrowing is the line  $MCB_1$ . Since current taxes are collected at  $R_0$  and a cost of  $PC_0$ , we expect that current taxes collected will rise from  $R_0$  to  $R_1$  when the debt is issued.

This plays an important role in our story. When New York built the Erie Canal, the state set aside the revenue from two taxes, auction duties and the salt tax, to fund the debt. The state anticipated that tax revenues would need to be higher in the future to service the debt, and as a result, it increased current taxes for that purpose. Raising current taxes to finance debt service was a signal of New York's expectations about future revenues. As it turned out, however, the canal produced substantial revenues of its own and the marginal cost of future taxes was not as high as the state had anticipated.

Figure 2 also models what happens when a state makes an investment that it believes will produce revenue in the future. The marginal benefit curve shifts out as before, but since the investment is expected to lower the cost of raising revenue in the future, because of the anticipated investment income, the marginal cost curve expected in the future shifts from  $MCR_{\text{present}}$  to  $MCR_{\text{future}}$ . Whether the expected marginal cost of revenue in the future rises or falls depends on which shift dominates. When the state expects new revenues to offset debt servicing, the marginal cost of expected revenue stays constant at  $MCB_0$ , and the state does not raise current taxes to service the debt. This situation arose in the mid-1830s when states came to believe that investments in internal improvements would ultimately produce substantial revenues.

The third scenario in Figure 2 is one where the states expect the internal improvement investment to produce future tax revenues, without an increase in interest payments. For example, the state might purchase stock in a bank with state bonds, if the bank agrees to pay interest on the bonds. In this case the cost of collecting future revenues falls to  $MCR_{\text{future}}$  because

of expected dividends from the stock, while the benefits stay constant at  $MBX_{\text{present}}$ .<sup>8</sup> Since future taxes are expected to be less costly to collect because of dividends from the stock, the marginal cost of borrowing has fallen to  $MCB_2$ . It makes sense for the government not only to finance the internal improvement using debt, but to finance some current expenditures out of debt. Current tax collections fall to  $R_4$ , borrowing for current expenses is  $R_1 - R_4$  and total revenues are  $R_1$ .<sup>9</sup>

As we will show, expectations about the returns from internal improvement projects changed in the late 1820s and early 1830s, based on the success of the Erie and the Ohio canals and northeastern banks. These changing expectations were reflected in the changes in revenues structures adopted by the states as they began to accumulate debts. The expectations were not self-fulfilling; indeed they tended to be self-defeating. States that borrowed expecting that future investment income would not cover interest payments would raise current tax revenues and, therefore, be in a better position to service their debts. States that expected future revenues to cover interest payments would not raise current taxes, and, when the future revenues failed to materialize, would be in a much weaker position. Rosy optimism about the fiscal benefits of internal improvement investments did more than generate lots of borrowing. It also produced a kind of rational fiscal irresponsibility in which it made sense to borrow for current expenditures as well as capital expenditures.

## II. The History

We will make our argument about the causes of the debt crisis in several steps. The first step is to show that states behaved as if the property tax were the most costly source of revenue. That is, we want to show that the shape of the aggregate marginal cost curve as depicted in

Figure 1 is an accurate reflection of the costs facing states. The War of 1812 illustrates how property tax revenues varied with expenditures, and we use that experience to trace out how states responded to exogenous increases in expenditures.

The second step is to show that states on the frontier relied more heavily on property taxes than developed eastern states.

The third step is to show that expectations about the impact of internal improvements on revenues, based on the successful attempts at investing in banks and canals, began to change in the late 1820s. We show that *expected* returns from internal improvements in the earliest projects in New York and Ohio were low (or uncertain). Both New York and Ohio, therefore, raised taxes as they implemented their investment programs. Subsequent to the success of the Erie, and the early success of the Ohio system, states after 1830 expected that internal improvement investments would prove profitable. After that date states typically borrowed without raising current taxes. A similar story is found with respect to banks.

The final step is to show how, when the financial crisis began in 1839, Maryland and Pennsylvania got caught in the fixed cost problem that made it difficult for them to implement a property tax quickly. And similarly, we show why the frontier states responded to the crisis not by raising their already high taxes, but by default, renegotiation, and repudiation.

Figure 3 is a guide to the explanation. It represents two "typical" states, one an eastern state and the other a frontier state. This graph is scaled by population to control for state size effects, the horizontal axis is dollars per capita,  $\$/P$ . The eastern state faces a marginal cost curve of  $MC_{east}$ , while the frontier state faces a marginal cost curve of  $MC_{frontier}$ . The frontier state can command much smaller amounts of investment income and indirect tax revenue.<sup>10</sup> The graph

indicates the difference in revenue structure when both states collect the same level of per capita revenue,  $R^*$ . The frontier state collects a substantial share of its non-loan revenues in property taxes. The eastern state is near the revenue level where property taxes will be collected, and if revenues need to increase substantially, a property tax will have to be imposed.

#### Ila. Revenue Structure, Property Taxes, and the War of 1812

Before there were states or a United States of America in America, government was colonial and local (town and county). The mainstays of local government revenue were direct taxes, namely the property tax and the poll tax, two taxes that were aimed at the chief economic resources of the colonial America, land and people. Colonial government was financed by imposts (taxes on imports and exports), by a variety of indirect taxes (excises, licenses, auction and lottery taxes), by land sales, and by issues of bills of credit that conveniently circulated as money.

To our knowledge, no one has systematically studied the relative revenue levels of local and colonial governments. Some students of colonial taxation have noted in passing, that local collections usually were in excess of colony collections (Becker 1980, *passim*). In 1796 Treasury Secretary Oliver Wolcott observed in his report on direct taxation by states, in connection with proposals for a U.S. direct tax, that local direct taxes ranged from being well in excess of state taxes in several New England states to being roughly equal to state taxes in southern states. Moreover, several states were not collecting any direct taxes in the 1790s. The property tax base was a local tax base which the colony or state might tax, but only if other sources of revenue were inadequate for colony and state needs.



Independence did little to disturb local government, which carried on as in colonial times, but it had profound effects on the revenue structure of state government. States lost much of their land revenues through cessions to the national government, lost the right to levy imposts on interstate and international trade, and were prevented from issuing their own currencies. In return, the states received generous assistance in the form of Treasury bonds and assumptions of state debts (see Perkins 1994, Ch. 9). Alexander Hamilton also encouraged, both personally and officially as Treasury Secretary, state governments to charter banks, institutions that immediately provided the states with a variety of new revenue sources (Sylla, Legler, and Wallis 1987; Wallis, Sylla, and Legler 1994).

With their debt obligations diminished and with so many new sources of revenue, many original states found that they could dispense with most or all direct taxes. New York, Pennsylvania, Maryland, and New Hampshire managed to eliminate their state property taxes completely by 1810. These states were able to substitute investment income or business taxes for property taxes. The property tax remained, as it had always been, primarily a local tax. In the states formed after the original 13, however, these options were much more limited or unavailable; hence, these states had to rely to a greater extent on property taxation for revenue.

When hostilities began between the United States and Britain, all states were asked to contribute to the War effort and some states were under immediate physical threat. The national government imposed a war tax, allocated among the states on the basis of population.<sup>11</sup> Some states, like Maryland and Massachusetts, spent substantial amounts of their own money on military preparation including militia training and fortification construction. Some of these expenses would ultimately be reimbursed by the national government. Increased state

expenditures during the war were financed by a combination of debt issue and rising taxation. As a result, many states were still paying for war related expenditures in the early 1820s.

Table 2 gives annual average per capita revenues, net of loans, for the periods 1808-1812, 1813-1817, and 1818-1824, as well as period averages (both simple and weighted by state population). The table also gives property tax shares of all non-loan revenues for each period, and their simple and weighted averages. The level of annual tax revenues almost doubled between the first two periods (about a third of the increase is attributable to inflation) and remained high after the war was over. The evidence supporting relatively high political costs of property taxation is reflected in several ways. New York, which had a property tax for only three years after 1799, was forced to levy a property tax in 1815. The share of property taxes rose from 3 percent just before the war to 23 percent after the war. The tax remained in effect, at gradually lower millages, until the War debt was finally retired in 1826 (Sowers, p. 115; Gunn, p. 139). New Hampshire had been able to avoid the property tax because of a combination of dividends from its United States stock (federal government bonds) and dividends from the New Hampshire Bank. As expenditures rose during the war, however, the state finally began collecting a property tax in 1816.<sup>12</sup> The share of property taxes in total revenue rose from 0 to 43 percent in New Hampshire. Property tax revenues rose substantially, both in levels and as a share of revenue in Vermont and South Carolina, and in levels but not in shares in Connecticut and Rhode Island.<sup>13</sup>

The overall increase in the property tax varies according to its measure. Ohio and Delaware were unusual. In Ohio the property tax share fell only because it had been 100 percent of state revenues in the early period. Delaware property taxes actually rose during the war, but fell sharply after 1817 as the state turned to new sources of revenue, including dividends on bank

stock.<sup>14</sup> When Ohio and Delaware are excluded, the property tax share of state revenues increased from 10 percent of state revenues between 1808 and 1812, to 17 percent during the war, and to 18 percent from 1818 to 1824 (using the population weighted averages). The increase is smaller when Delaware and Ohio are included, but the property tax share still rises by 50 percent during the war years.

Pennsylvania and Maryland were able to squeak through the war by borrowing rather than imposing property taxes. Hanna describes Maryland's wartime public finance:

Early in 1813 the Secretary of War asserted the doctrine that the United States would pay the expenses of all militia called out or recognized by that government. But, as the Chesapeake Bay immediately became, and continued to be, a centre of British aggression, the state was, in many cases, unable to wait upon the tardy action of the National Government, and was forced to raise troops, and even equip a small navy, upon its own initiative. Ultimately, the state was reimbursed in part for the resulting expenditure; but in the meantime such expense had to be met by the local treasury. The method by which the necessary war funds were raised presents few points of interest. At the outset, the Legislature adopted, and thereafter steadily adhered to, the policy of temporary loans. No new taxes were laid during the whole course of the war; nor was any other effort made to increase the ordinary receipts of the treasury. p. 37-8.

Maryland clearly felt that the political costs of taxation would be lower after the War, and borrowed in 1813 rather than raising taxes.

The war experience demonstrates how the shape of the marginal cost curve for revenues affected state finance. Two of the four states with no property taxes, New York and New Hampshire, imposed property taxes to cover war expenditures. The states with property taxes relied more heavily on property taxes during the war, and the share of property tax revenues in total revenues increased in most states. Maryland and Pennsylvania managed to negotiate the war years without imposing or increasing the property tax, but only by borrowing.

Consistent with our emphasis on the high political cost of state property taxes, the reverse

occurred after the war. As expenditure levels returned to normal levels, several states eliminated with their property taxes altogether. Massachusetts suspended the tax in 1826 and, after a brief resumption from 1829 to 1831, dispensed with the property tax after 1832. Rhode Island imposed a tax on bank capital and stopped collecting its property tax in 1826. New York phased out the war time property tax in 1826 as well. Delaware steadily reduced its reliance on the tax until it was eliminated in the 1840s. Maryland faced financial stringencies in the early 1820s, brought on by the high level of debt service; it briefly levied a lump sum property tax on the counties in 1821, then repealed it in 1825 after the crisis had passed.<sup>15</sup> Every state for which we have data shows a pattern of increased reliance on the tax through the 1810s and early 1820s, followed by a reduction in the importance of the tax. Moreover, the rise in property tax revenues during the war exceeded the rise in total, non-loan revenues in almost every state. By 1835, property taxes in almost every state were lower than they had been in the early 1820s, as we will discuss in Table 3 shortly.

Between 1800 and 1840 New York, Massachusetts, Maryland, Pennsylvania, Delaware, Rhode Island, and South Carolina had all eliminated their property taxes. As Ratchford described public finances in the mid-1820s, "Evidently the states at this point were in a fair way to realize the Cameralist ideal -- a situation in which the state derives a major part of its income from state-owned properties rather than from taxation." (Ratchford, 78.)

#### I**l**b. Property taxation in the frontier states:

As a natural experiment, the War of 1812 and its aftermath confirm that property taxes were the most politically expensive tax for states to levy in the early nineteenth century. When

possible, states stopped collecting it. When expenditures rose, so did the share of property taxes in total revenue, but the share fell when expenditures returned to normal. Settled, urbanized states in the east were able to draw on commerce and trade as a source of both investment income and indirect taxation.

The frontier states, on the other hand, lacked alternative sources of revenues and were stuck with the property tax. Table 3 shows how much higher property taxes were in frontier regions than in the older, more settled areas. The table reports average annual property taxes in per capita terms and as a share of total revenue, as well as per capita revenues net of loans for the six years preceding the debt crisis and the six years following the debt crisis. The upper panel reports on settled eastern states that managed to eliminate their property tax for some substantial period after 1820. The second panel shows three New England states that relied substantially on the property tax in both periods: Connecticut, New Hampshire, and Vermont. The bottom panel shows frontier states in the west and south. The table indicates simple averages and population weighted averages for each panel (separate averages for the frontier group are presented with and without Michigan, which had a small population and large per capita figures as a result).

The most striking feature of the table is the significantly higher absolute level of property taxes per capita in the frontier regions of the country. If we consider that Vermont and New Hampshire, while long settled, were less developed commercially and therefore more like frontier states, distinction is clear cut. The frontier states all have high absolute levels of property taxation and they all (with the exception of Ohio, with its substantial canal revenues by 1835) receive a large share of their revenues from property taxes. High property taxes were not the result of their having larger, or smaller, governments on the frontier. Indeed the frontier states had roughly

average per capita revenues, falling between the large, urban and small, rural states of the northeast.

There is a simple test that populous, urbanized, commercial states with strong financial sectors were capable of providing substantial revenues (of one type or another) without direct taxation. The independent variable in the following regression is the share of direct taxes in all tax revenue.<sup>16</sup> The dependent variables are total tax revenues and the percentage of the population living in urban areas in 1840.<sup>17</sup>

$$\text{Direct Tax Share} = .00042\text{Total Taxes} - 1.43\text{Percentage Urban} \quad R^2 = .36$$

(t-stat)                      (3.18)                      (5.18)

A percentage point increase in urbanization lowered the share of direct taxes in total revenues by 1.4 percentage points. Property tax revenues, and reliance on the property tax, was inversely related to settlement and commercial development, as measured by urbanization.

### IIC: Expectations and Revenue Structure; New York, Ohio, and Massachusetts

One of the key elements in explaining the borrowing behavior of states is expectations, particularly expectations about the future revenues from internal improvement investments. A puzzle in regard to the 1830s is why investors, particularly foreign bondholders, were willing to invest in a large number of states that ultimately defaulted or repudiated. One possibility is that the investors were misled, that states knew that the investments were riskier than the lenders believed. Another is that the states and the investors had the same information, but that they were both wrong. In this section we demonstrate that both states and investors shared a common perception that internal improvement projects were good investments. Indeed, their expectations

may have been growing increasingly optimistic at just the time when the states began engaging in particularly risky projects.<sup>18</sup>

One way to get a handle on the expectation of states is by looking at their taxing behavior as they borrow. As discussed earlier, if states anticipate that bonds will have to be serviced out of existing tax sources, they will raise current taxes as they borrow. If they feel that bonds can be serviced from new revenue streams in the future they will raise taxes by a smaller amount, perhaps even lower them, in anticipation that revenue will be less costly to collect in the future.

New York in 1817 and Ohio in 1825 were the first two states to borrow for canals. When New York created the canal fund, it set aside revenues from auction duties and the salt tax for the benefit of the fund. Revenues from these sources were substantial. As of Dec. 31, 1820, the Canal fund had total receipts of \$2,226,326.94, of which \$1,493,500 was from loans, \$451,976.54 from auction duties, \$173,159.91 from the Salt tax, and the remainders from bond premiums, a steam boat tax, and miscellaneous sources.<sup>19</sup> Revenue from these two sources were large enough that, as Trotter noted in 1839, “The auxiliary funds must, according to this statement, have produced a sum greater than the whole amount of interest for twenty years on all the money borrowed.” (82-3)

New York anticipated that it would have to repay its bonds out of current tax revenues, not out of canal tolls. When it became clear that canal tolls were large enough that the canal would pay for itself, New York began on a second phase of canal investment in the late 1820s, spending more money to expand their canal system than they had originally spent to build the Erie. In the second phase, the state did not appropriate new taxes for debt service. Indeed, as the 1830s progressed the state became more optimistic. In 1835 the state returned the salt tax and

auction duties to the General Fund.<sup>20</sup> In 1838 the state began a massive expansion of the canal, resulting in a doubling of the state debt from \$14 to \$28 million.

Ohio presented a variation on the same theme. Prior to 1825 the fiscal mainstay of the Ohio revenue system was a land tax, levied on a per acre basis. On February 3, 1825 "The Ohio system of taxation was put on an *ad valorem* basis, with a state board of equalizers appointed to review assessments by local officials." The next day, the "canal law" of 1825 authorized the construction of two canals, the Miami and the Ohio. As Schieber put it:

Also, Ohio was nearly unique among American states in providing for direct taxation to support its debts for public works. The original 1825 canal law had given the state auditor discretionary power to levy canal taxes, at an annual level sufficient to cover interest on the state debt. The auditor had not increased taxes commensurately with need in the mid-thirties, but in the early 1840s he did levy progressively higher canal taxes each year. (p. 156-7.)

The switch to *ad valorem* rather than a straight per acre land tax, was key in getting support for the canal bill in areas where the canal would not go. The beneficiaries of canal construction would pay for the benefits through increased assessments. The discretion given to the Auditor would prove important later.

The original Ohio canal system was a success. By 1832 the system was generating net revenues of \$200,000 to \$300,000 annually. This success was reflected in the prices realized from bond sales, which occurred regularly up to 1832. Amounts and prices taken from Schieber are given in Table 4. The last issue of bonds in 1832 sold for a premium of 24 percent.

Like New York, however, Ohio's initial success stimulated a second wave of canal building in 1836. The set of projects undertaken in that year were widely spread throughout the state and not so well planned (see the lengthy discussion in Scheiber). This borrowing was not accompanied by increasing property tax rates. As the state returned regularly to the bond market,



it paid progressively higher rates of interest. At the worst times, in 1842, the state was paying nearly 10 percent interest on its loans. It was able to continue borrowing through the crisis year because of support from Barings, from the Ohio banks, and because the state was willing to raise property tax rates in the early 1840s. The willingness to raise tax rates in Ohio was aided substantially by the original tax law, which gave the state Auditor authority to raise tax rates to cover debt payments on his own authority.

In both New York and Ohio, borrowing for initial canal construction was accompanied by substantial increases in taxation to service the canal debt. As it turned out, canals in both states were financially successful. Subsequent canal construction was again funded by the issue of debt, but without a corresponding increase in taxation. Expectations that further canal construction would prove as profitable as the original construction, enabled the states to follow this fiscal policy.

The experience of New York and Ohio in canals was mirrored by other states in banking. States with growing urban centers began accumulating bank stock which paid dividends, and were able to impose duties, licenses, and taxes on various business activities. In Massachusetts after 1812 and in Rhode Island after 1826, it was the tax on bank capital, in Pennsylvania and Maryland it was bank charters, bank dividends, bank taxes, and business taxes, in New York it was bank dividends, auction duties, and ultimately canal tolls. Table 5, taken from Wallis, Sylla, and Legler 1994, shows the percentage of all state revenues derived from bank sources in 1830. By that year, Massachusetts was receiving over half its revenue from the tax on bank capital, and other states were receiving substantial amounts from bank sources. Banks and bank stock were well received in Europe. When Louisiana granted a charter to the Union Bank in 1832, and issued

\$7,000,000 in state bonds assignable to the bank, the entire issue was taken up by Barings at a price of 106 1/4.<sup>21</sup> Louisiana did not raise taxes when it issued \$7,000,000 in bonds.

This pattern of debt and taxation was repeated everywhere in the late 1830s. Neither Pennsylvania in the 1820s or Maryland after 1830 raised tax rates when they began issuing bonds.<sup>22</sup> Pennsylvania initially paid interest out of accumulated bond premiums. By 1831 expectations in Pennsylvania were so optimistic that the state was running a current account deficit of over \$200,000 a year.<sup>23</sup> Neither Indiana, Michigan, or Mississippi would significantly raise taxes when they began borrowing in earnest after 1835, although Illinois did increase property taxes after 1839.<sup>24</sup> Expectations were that investments in canals and banks would pay, as canals had been paying for almost twenty years and banks for even longer.

These expectations were apparently the same on both sides of the Atlantic and, importantly, both sides of the Appalachians. Figure 4 presents an index of monthly bond yields for the 1830s and 1840s, taken from average of New York, Ohio, and Kentucky bonds constructed by Ayres. There is little evidence that investors, foreign or domestic, were demanding significantly higher returns as states began engaging in investment projects that would ultimately prove unproductive after 1835. Yields actually declined from 1831 to 1834. They rose between June of 1835 and the end of 1836, a period of rapid inflation. Interest rates then stabilized, and actually declined in 1837 through to the end of 1838. After November of 1838 bond yields began to rise substantially, and bond prices declined steadily from then until 1842. Initial bond issues for canals and banks had been placed on the market well before interest rates began to rise. It was only in 1839 that investors began to worry about their safety. Ratchford reports that \$107,824,000 was borrowed between 1835 and 1838. Given the substantial increase

in the amount of bonds issued in those years, it would appear that investors, both domestic and foreign, were as sanguine about the prospects of internal improvements as the states issuing the bonds.

Much has been made of the commercial rivalry between eastern cities, stimulated by the Erie (see Rubin and Goodrich, for example), but states were interested in the fiscal benefits as well. Pennsylvania and Maryland clearly anticipated that canals would be a paying proposition.<sup>25</sup> Frontier states saw canals and banks as a way to achieve the financial independence that had been enjoyed by the voters in Maryland, Pennsylvania, New York, and Massachusetts, for thirty five years. The War of 1812 had been a brief interruption in the march towards the "millennial condition of a government supported without taxation." (Hanna, p 41). Hanna captures the spirit of early nineteenth century tax payers:<sup>26</sup>

Absence of taxation and of revenue legislation was the mark of the first quarter-century of the state's history - a thing fortunate in itself, but productive of much later evil. At first, exemption from taxation had been accepted by the people as a happy relief from the burdens of the Revolution. Then a feeling was bred that such was the normal condition of things, until finally, with a new generation, taxation, especially direct taxation, became to the popular mind a thing intolerable. "Capital stock" was made a fetish of. The main endeavor was to preserve "the capital of the state which had been accumulated by the economy and foresight of our ancestors.""

This was the ideal that the frontier states were trying to achieve. English and American investors were willing to help.

### III. The Debt Crisis: Pennsylvania and Maryland

In February, 1826 the Pennsylvania internal improvement commission was authorized to contract for the construction of the Pennsylvania Canal. In April 1826 the Internal Improvement Fund Act was passed. "The act fairly inaugurates Pennsylvania's financial disgrace."

(Worthington, p. 25) Pennsylvania had a history of financing internal improvements and budget shortfalls with debt. In 1826 the existing state debt was \$2,457,915.44, and the state held roughly \$4,000,000 in assets, primarily bank stocks. In 1831 the debt had reached \$12 million, annual interest payments were \$616,850, and revenues available to pay the debt, after ordinary expenses, were only \$420,000. The state was running a current account deficit of almost \$200,000 a year. There was concern over deficit finance, and the state enacted an ineffective property tax to be administered by the counties in 1831. Repealed in 1836, it brought in about \$20,000 annually. Pennsylvania continued to borrow, and the funded debt increased by an additional \$15 million between 1831 and 1835.

In 1836 the state chartered the United States Bank of Pennsylvania and the state entered into a close financial relationship with the bank. The large charter fee paid by the bank, combined with the receipt of almost \$3 million from the national government in surplus revenue payments in 1837, appeared to bring the states finances into balance.<sup>27</sup> But by 1839 repeated suspensions by the bank, growing interest payments, the ongoing business depression, and disappointing toll revenues on the State Works had created a crisis. Pennsylvania's response?

The legislature, accordingly, authorized the governor to contract permanent loans amounting to \$6,154,000, in addition to temporary loans, and with these resources various obligations, amounting to \$2,204,750.08, were discharged. The actual deficit for 1839 was \$1,087,743.63; the ordinary revenue amounted to \$1,621,119.84 and the interest on the state debt to \$1,296,010.24. The total ordinary expenditures was \$2,708,863.47... In 1839 loans, aggregating \$6,309,750 were paid into the treasury. (Worthington, p. 47).

Almost \$4 million was borrowed in 1840, bringing the total funded debt to near \$36 million. A tax law passed in 1840 imposed low taxes on a limited number of items: taxes on bank capital, certain personal property, household furniture, pleasure carriages, watches, and on the salaries of state officials. It was hoped that the tax would produce \$600,000 in revenues. Even

had the \$600,000 been realized, which it was not, the tax would have made a small dent in a deficit approaching \$4 million a year. The law was meant to assure creditors that the state would raise taxes if necessary, rather than raising enough taxes to service the debt.

Pennsylvania's excellent credit had allowed the state to borrow at a substantial premium in the early 1830s; indeed, loan interest was often paid out of bond premiums. By 1839 the loans sold only at par, and in 1841 the state was unable to sell any bonds at all (the governor was authorized to borrow up to \$3,100,000). Still the state legislature, despite repeated recommendations from the governor and its own committees, refused to implement a realistic tax. In 1841, \$2,220,265 of "relief notes" were issued, and unable to borrow again in early 1842, in August the state "issued to the debt holders, certificates of stock, bearing interest at five percent., for the amount of interest due, and payable on the first of August, 1843." (Worthington, p. 57.) Pennsylvania was in default. For the next two years scrip bearing 6 percent interest was issued for interest payments. In 1845 the debt was close to \$40 million.

It was not until April 1844 that the state passed a comprehensive property tax law taxing all real estate not exempt by law, all personal property, shares of stock, incomes from professions, and bank capital. A board of revenue commissioners was established and triennial assessments were called for. In April 1845, the governor was authorized to issue 10 year, 5 percent bonds in exchange for the scrip. The state met its interest payments thereafter. The substitution of 5 percent bonds for 6 percent scrip was the only downward adjustment that Pennsylvania made in its debt.

Pennsylvania borrowed initially to build an internal transportation system. The state continued to borrow in the early 1830s, when tolls from the system were slow to materialize.

That the state expected future tolls to materialize and that loans would be paid back with cheap investment income, is revealed in Pennsylvania's persistent borrowing to finance current expenditures. The state compounded its problems by continuing to borrow in 1839 and later, when interest rates were rising sharply. But the state, its citizens, and its politicians were adamantly opposed to a permanent property tax with an effective administration capable of generating the revenue necessary to service the debt. "But if we feel called upon comment upon the crisis in state finance, which culminated in 1842, we must remember that it was brought about through ignorance, rather than deliberate dishonesty. Speculation and hatred of all forms of direct taxation were the causes of the downfall in Pennsylvania's credit." (Worthington, p. 38). Overcoming that opposition was a fixed cost that Pennsylvania would not subject itself to until 1844, after two years of default.

Maryland's history was similar, although the absolute scale was smaller.<sup>28</sup> Maryland borrowed a total of \$15 million, \$7 million for the Chesapeake and Ohio canal, almost \$4 million for the Baltimore and Ohio Railroad, and the balance for smaller canals and railroads. Unlike Pennsylvania in the 1830s, Maryland did not borrow continuously to finance projects and to meet current expenditures. But like Pennsylvania, it found itself pressed to complete its projects and several times had to extend its borrowing, most critically in 1839 when the state borrowed \$6 million. The loan of 1839, however, brought on the crisis in the next year. Interest payments jumped from \$290,000 to \$585,000 in 1840. Default was prevented in 1841 by raiding the school fund established with the surplus revenue distribution by the national government in 1837, and in 1842 the state went into default.

As in Pennsylvania, the crisis did not immediately bring about a change in tax structure

capable of producing the needed revenue. Again the problem was public and political aversion to the property tax. Maryland had imposed a lump-sum tax on the counties in the early 1820s, just as Pennsylvania had instructed the county collectors to add an additional mill to their rates from 1831 to 1835.<sup>29</sup> But neither state participated in the collection of the revenue, the making of assessments, or the adjudication of disputes. Both states imposed similarly weak property taxes as the crisis developed, Pennsylvania in 1840 and Maryland in 1841. In neither case did the tax raise anywhere near the needed revenue. In Maryland three counties refused to remit their share of the tax the first year, and seven the second year. It was not until 1844 that Maryland passed an effective tax law, amended several times in 1845, that allowed the governor to appoint assessors and collectors and provided appropriate punishments for violations. By 1846 the collection of the tax was in effective operation, and the state resumed payments, with back interest, on its debts.

Neither Maryland nor Pennsylvania had ever had a real property tax before the debt crisis. They were the only two states to escape the War of 1812 without imposing a new tax or increasing the existing tax. Their politicians faced considerable popular opposition to the tax, and even after they decided to impose the tax they had to learn how to do it. By contrast, New York and Massachusetts had also engaged in internal improvements, although per capita debts were lower in those states. While both states had eliminated their property taxes in the 1820s, the states remained active in the administration and collection of the county taxes. Popular opposition to the tax, therefore, was based on experience rather than imagination. When New York passed its "Stop and Tax" law in 1842, it was relatively easy for the state to impose a 1 mill tax on top of the existing county tax. By way of contrast, Pennsylvania's attempts to levy a 1 mill property tax in 1841 produced revenues of \$20,000, whereas New York's tax produced \$400,000

in the first year. It was not an easy law to pass, however. Debate over the reimposition of the property tax and stopping construction of the canal system was the central political issue in New York politics in the early 1840s.<sup>30</sup> Massachusetts had a similar debate, but was able to reimplement its property tax quickly in 1842.

The experience of New York, Massachusetts, Maryland, and Pennsylvania suggests that initiating a property tax was a costly act for state legislatures. Borrowing was one way to postpone or avoid those costs, and while each of these four states utilized it to some extent, Maryland and Pennsylvania relied more heavily on borrowing. That a state without a property tax is more likely to borrow more than state with a property tax is tested in Table 6. The dependent variables in the first regression is per capita debt in 1841, and the dependent variable in the second regression is per capita debt in 1841 as a percentage of per capita income in 1840 as estimated by Easterlin. The critical independent variable is the “Property Tax Frequency” which measures the percentage of years prior to 1841 (for which we have data), that per capita direct tax revenues were 5 cents or greater.<sup>31</sup> Since this variable measures the frequency with which a state levies a direct tax rather than the level of the tax, the average share (level) of per capita direct taxes levied over the years for which we have data (Property Tax share) is also included. Two control variables, a dummy for “Western States” and “Year of Statehood” capture aspects of frontier states. State age seems to be more important than geographic location. The percentage of all debt incurred for bank investments, Bank Share, is also included. States that borrowed to invest in banks tended to borrow more heavily. All of the coefficients are reported as elasticities, with t-statistics in parenthesis.

The elasticity of debt per capita and the debt/income ratio with respect to the property tax



frequency is roughly one and statistically significant.<sup>32</sup> States that had property taxes were less likely to borrow than states that did not have property taxes. Not only did inexperience with property tax administration and voter opposition to property tax enactment hamper Pennsylvania and Maryland, their lack of a property tax also contributed to the high levels of debts they accumulated.

#### IV. The Frontier States:

The frontier states were in a different position from the eastern states. Direct tax revenues per capita were higher in the frontier states and they placed a greater reliance on the property tax, as shown in Table 3. Many frontier states also had higher debts per capita, as shown in Table 1. Frontier states were composed of highly mobile, rapidly growing populations. Interstate competition for businesses and settlers was acute, and property taxes may have played an important role in the choice of agricultural settlement. The political costs of raising additional tax revenues via the property tax were rising rapidly. Migrants were flowing into the west, and interstate competition for migrants was fierce. Banks, canals, and railroads were important ways to attract new settlers, to raise the value of land for existing citizens, and to speed the agricultural surpluses of these states to market. But these social overhead services cost money. The sharp increase in frontier state borrowing in the mid-1830s appears to be based on the anticipation of substantial revenues in the near future -- substantial enough that the state need not bother with raising significant taxes to cover the interest payments in the interim.

The internal improvement investments of these states were made very close to, or after, the Panic of 1837: Illinois in 1835, Michigan in 1837, Florida (still a territory) in 1835, and

Arkansas in 1836.<sup>33</sup> Indiana began borrowing in 1832, but the "Mammoth bill" authorizing \$10 million in loans was passed in 1836. Louisiana borrowed to buy stock in its first bank in 1824 and Mississippi in 1830, but the bonds that got both states in trouble were issued in the mid-1830s. Mississippi issued state bonds to the Union bank that were placed on the market in 1838. Louisiana issued bonds to the Union Bank in 1832 (a different Union Bank than in Mississippi) and the Citizens bank in 1836.

Alabama is an interesting case, since it invested earlier than other states, and the state bank initially was a great success. Dividends from bank stock enabled the state to suspend the property tax in the early 1830s. But the Panic of 1837 forced suspension of specie payments and threw the state into fiscal distress. Alabama reinstated the property tax and narrowly avoided default on its substantial debts.

The other southern states chartered "land" banks. Stock in these banks could be purchased by a mortgage on the lands of the stockholders; usually the stock purchased was limited to half the value of the lands. The state purchased its share of stock by issuing its own bonds or by guaranteeing the bonds of the individual banks. These banks were thought to be safe investments, since the value of the mortgaged lands stood as security for the bonds. Unfortunately, land valued at the peak of the 1830s land boom was often worth much less after the Panic of 1837 and the economic depression that began in earnest after 1839. States responded to fiscal pressure by default and repudiation. Mississippi and Florida repudiated in February of 1842. Arkansas stopped paying interest in 1841 and ultimately repudiated its bonds after the Civil War. Louisiana, while it never officially repudiated, managed to evade the debt to an unmeasured amount, and the controversy was not settled until the twentieth century.<sup>34</sup>

These southern states had extended state credit and corporate franchise to banks whose primary beneficiaries were a small group of wealthy landowners (many of whom didn't even live in the state) who had mortgaged land for bank stock. They did not pay cash. In return, the landowners received generous loans with which to purchase more lands. The citizens of the state were to receive bank dividends. When the dividends did not appear and the creditors, rather than going after the mortgaged lands, went after the citizens of the state, the citizens found themselves with an enormous debt. They had never contemplated even paying interest on the debt, much less the debt itself (the banks were supposed to service the loans). In the end, there was nothing to show for the debts, not even a partially dug ditch or graded roadbed. These bank related debts were repudiated.

The northern states of Indiana, Illinois, and Michigan had been more involved in transportation projects than banks. When the crisis came these states were in the middle of building their projects and, like the Pennsylvanians, they remained optimistic about future revenues. Michigan went through a prolonged process of negotiation between 1843 and 1846 which effectively repudiated bonds for which the state had never received any money. Illinois and Indiana renegotiated their obligations and resumed payments in the late 1840s.

The seven frontier states differ markedly from the eastern states. Not only did some repudiate, but none of them were willing to raise property taxes substantially to deal with the debt crisis. As one can see in Table 3, most of defaulting states did not raise property tax revenues significantly between the period 1835-1841 and the period 1842-1848 (the exception is Mississippi, which clearly did not raise property taxes to repay its debts). In comparison, Pennsylvania and Maryland raised property taxes substantially, as did New York, Ohio, and

Massachusetts.

Some of the defaulters actually moved in the opposite direction. Arkansas reduced per capita property taxes after 1840. Indiana reduced its property tax rate from 3 mills to 1.5 mills in 1841. Illinois reduced its tax rate from 3 mills to 2 mills in 1842, and although it raised rates again after 1845, per capita tax burdens were not much higher than they had been in the early 1830s.<sup>35</sup> Apparently, politicians in these states could not raise property taxes to service the debt. As McGrane notes,<sup>36</sup>

There was, of course, the bare possibility that a rigorous system of taxation might yield a sum sufficient to pay interest for a single year. The governor warned creditors, however, that "such a tax could not be repeated. The apprehension of it would spread consternation and alarm throughout the breadth of the land. Our citizens would sell their property at any sacrifice and leave us for some happier home. The whole world would avoid our shores, as they would avoid certain destruction. We would depopulate the state of its present inhabitants, and prevent any future accession by alarming strangers abroad."

The frontier states had gambled, and lost. Their creditors lost too, and whether the creditors received anything at all depended on the ability of the creditors to negotiate a politically viable reduction in the outstanding debt.

#### V. Lessons and a Longer Perspective

When the dust finally settled at the end of the 1840s, creditors of Maryland and Pennsylvania had suffered a short-term loss in debt service flows, but their capital values had essentially been preserved. Creditors of Arkansas, Florida, Michigan, Mississippi, and Louisiana lost all or a substantial part of their investments. Creditors of Indiana and Illinois entered into negotiations with the states which ultimately resulted in a reduced debt burden for the states and a resumption of debt service.<sup>37</sup> As we have argued, there was a good reason for this. Maryland and

Pennsylvania both possessed untapped fiscal resources in the form of an unlevied property tax. When the political will was found to impose the tax, debt service was restored. The other seven states had no fiscal backup. Rather than raising their already high property taxes, these states chose default and either renegotiation or repudiation.

Perhaps creditors should have been more careful. But there is no evidence that defaulting states paid higher *ex ante* interest on their bond issues.<sup>38</sup> Indeed, as we have argued here, both the states and the investors appear to have shared a common perception that these investments would pay off. The perception was well grounded in experience up through the early 1830s, but experience was not a good predictor of the future.<sup>39</sup>

Since the level of debt per capita is such an excellent predictor of whether a state defaulted, it appears that constraints placed on the states by their fiscal resources determined whether they defaulted. William English suggests that states were making a decision between the short-term benefits of repudiation against the long-run benefits of continued access to capital markets. Our analysis is consistent with English. We have focused on how states got into the debt crisis; his focus is on how states got out of the debt crisis. States that borrowed primarily for bank investments were more likely to repudiate (four of the five repudiators borrowed primarily to finance banks). We have not investigated that in depth. It provides a simpler explanation than the one advanced by English.<sup>40</sup>

Ultimately the debt crisis forced a change in the structure of state public finance. Beginning with New York in 1846, states began systematically to limit, by constitutional provisions, the issue of state and local debt. Article 7 of the New York State Constitution of 1846 not only specified, in dollar amounts, how the Canal debt and General Fund debt were to be

repaid, but laid out detailed conditions under which future debts could be incurred. A debt ceiling of \$1 million was placed on debts to meet “casual deficits or failures in revenues.” The state could borrow to “repel invasions, suppress insurrection, or defend the state in war.” More significantly “no other debt could be incurred unless it was authorized by law, limited to a single objective, *included provision for a direct annual tax sufficient to pay interest as it came due and to retire the principal within eighteen years*, and was approved a general election.”(emphasis added).<sup>41</sup> Many other states initiated constitutional reforms between the late 1840s and 1860 which limited and controlled debt issue.<sup>42</sup>

Debt reform was only one issue addressed in the new state constitutions, but it was integral to the central issue posed by the Jacksonians and debated throughout the antebellum period: who should decide what the government should do? Was it a function of legislatures or was it a responsibility of the “people”? Should the decision to tax and borrow require popular approval? Should legislatures alone be allowed to commit the state to incur debts lasting for a generation or more? These questions were, and still are, at the heart of the American political debate.

Of critical importance to subsequent economic history, and one that we have tried to illuminate in our study of the debt crisis, were constitutional restrictions like the one we highlighted in the New York constitution. As we argue in this paper, if states (rightly or wrongly) expect that investments will lead to substantial future tax revenues, it makes sense for them not to raise current taxes when bonds are issued. This does not inevitably lead to default, but it significantly increases the probability that states will find themselves in a fiscal crisis if the expected revenues do not materialize or other adverse and unexpected events occur. If states are

required to set aside current revenues sufficient to service the debt, then when expected revenues do not materialize the state is less likely to be caught in a crisis. By requiring current taxes to be raised, the constitutional restriction forced the electorate to consider the full cost of funding the debt immediately.

A growing literature suggests that constitutional limitations on debt issue hinder, but do not absolutely limit, state and local government debt issue.<sup>43</sup> With the exception of the southern defaults after the Civil War, there has not been another state debt crisis on the magnitude of the 1830s. States have finessed debt limits by creating special government agencies with limited powers to tax and repay debt, or by making (as New York did) new debt issue contingent on raising current taxes to service the debt. Local governments have continued to experience default crises, right up to the current period, while states have largely avoided them. Local governments have a more mixed history with default and repudiation, in part because they have often evaded constitutional limits, and in part because those limits do not work as effectively on local revenue structures as they do at the state level.<sup>44</sup> Constitutional restrictions on state debt have not prevented the issue of state debt, but have closed off an avenue where excessively optimistic expectations can create a subsequent crisis.

Constitutional restrictions on debt issue, in other words, have prevented default crises not because they limit the amount of debt issued, but because they change the revenue structure associated with debt issue. Had New York not allocated the salt and auction taxes to the canal fund, the Erie canal would have been on a much more precarious footing. Had Pennsylvania been required to levy property taxes sufficient to service the public works debt after 1826 (instead of waiting until 1844), not only would the overall debt issued have probably been smaller but the

state would have been in a much better position to weather adverse events after 1839. Had frontier states been required to raise even higher property taxes to finance investments, they might have delayed or postponed their investments. Note that the effect of the constitutional restrictions on the amount of debt issued over the long run is far from clear. If the restrictions substantially reduce default risk and encourage the perceptions on the part of voters that governments are financially responsible, the aggregate amount of debt issued could easily increase.

In the 1830s, states had more options. How much they borrowed, and how much of the debt was financed by a rise in current tax revenues determined, in large part, how the states behaved during the fiscal crisis from 1839 to 1842. How much they borrowed and how they financed debt was a function of revenue structure. As we have tried to show, the revenue structure of state governments was, in large part, a result of the level of economic development in the state. It is tempting to view the individual states of the United States as part of a homogenous institutional environment. Perhaps that was the view of foreign investors in the 1830s. But in the early nineteenth century, fiscal development was contingent on structural economic development, specifically commercial development. Understanding the limits on revenue structure facing individual states in the 1830s goes a long way to explaining how and why they borrowed for investments, and whether they defaulted and repudiated after 1842.



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## Endnotes

- 1 . See Ratchford, "American State Debts," McGrane, "Foreign Bondholders," Scott "Repudiation of State Debts," and English "Understanding the Costs of Sovereign Default." See Eaton and Gersovitz, "Debt with Repudiation," Bulow and Rogoff, "Sovereign Debt," and Grossman and Van Huyck, "Sovereign Debt as a Contingent Claim," for a discussion of theoretical issues regarding default and repudiation.
- 2 . This fundamental issue is addressed by Hartz, "Economic Policy and Democratic Thought;" Dorfman, "The Economic Mind;" Handlin and Handlin, "Commonwealth;" and Goodrich, "Government Promotion." The point of Goodrich's ironically titled "The Revulsion Against Internal Improvements" was that states did *not* stop investing in internal improvements after the 1830s. For a more recent investigation of state and local involvements in railroad construction, see Heckelman and Wallis, "Railroads and Property Taxes."
- 3 . Note the optimal tax literature here.
- 4 . John Majewski, in a personal communication, pointed out that some sources of investment income may carry some political costs if the source of the income is itself a matter of controversy. For example, dividends from bank stock may carry political costs in states with large anti-bank constituencies.
- 5 . Slaughter provides an extended discussion of popular opposition to direct taxes in chapter one of his book on The Whiskey Rebellion. In his history of the property tax in Kansas, which became a state in 1861, Fisher noted "The weakness of the property tax administration did not result from lack of critical attention. Almost every governor from the beginning of statehood until the end of the century denounced the tax or its administration The state auditor's reports often contained even longer and more detailed criticism, and sometimes the state treasurer joined in with a word or two denouncing some aspect of the tax." (p. 113). Popular dissatisfaction with the property tax continues to the present day.
- 6 . This is a simple example of Ricardian equivalents.
- 7 . In figure 2 the amount of the service, is equal to the horizontal shift in the expenditure curve, in this case  $K*r = R_2 - R_0$  .
- 8 . The increase in dividends is the horizontal shift in the revenue curve, in this case  $R_2 - R_0$  .
- 9 . Total borrowing for the current year will be  $K + (R_1 - R_4)$ : the internal improvement investment plus borrowing for current expenses.
- 10 . The frontier state probably faces a less elastic source of property tax revenue as well, because of its more mobile population and the importance of property taxes to farmers.

11 . States willing to pay their share promptly in cash received a 15 percent discount. New York, for example, borrowed money to make their contribution.

12 . Higher expenditures after the war prevented New Hampshire from removing the tax.

13 . We don't have good numbers for Massachusetts in the period, see Bullock.

14 . Property tax revenues in Delaware were roughly \$13,000 before 1814, but averaged \$16,000 from 1816 to 1818. Property taxes fell sharply after that, reaching \$288 in 1821.

15 . This accounts for the 2 percent share of property taxes in the 1818-1824 period. The state chose simply to assess counties a fixed amount and left the collection up to the counties. See Hannah, pp. 46-48.

16 . Poll taxes were a very small percentage of direct tax revenues.

17 . The sample includes all the states for which we have data between 1820 and 1850.

18 . There is a substantial literature on sovereign default. English's work applies this to the debt crisis and concludes that reputation effects were important deterrents to default. See English, Eaton and Gersovitz, Bulow and Rogoff, and Grossman and Van Huyck.

19 . Taken from New York Comptroller's Report for 1821.

20 . Gunn discusses this period and the problems of levying a property tax, or any direct tax, in his chapter 4, particularly pp. 138-141.

21 . "It was the largest single block of American bonds marketed by Baring Brothers & Company up to 1861." (Hidy, p. 110). Hidy believed that the Union bank scheme was not only underwritten by Baring Brothers and Company, it was their idea: "That new bank in New Orleans apparently was a brain-child of both London and Louisiana." (p. 110) Barings was interested in improving its position in the New Orleans market. And the day that the contract for the bond issue was signed "... Ward [the Baring's American agent] agreed that the Union Bank should have an uncovered revolving credit of L40,000 with Baring Brothers & Company for exchange operations." (p. 112)

22 . Hartz, p. 144, notes that Pennsylvania did raise taxes as it issued debt: "This was 1832. The state had already begun to feel the pinch of public works expenditures, and a taxation program had been initiated, but the situation was far from calamitous." This was in reference to the ill-fated tax increase of 1831, which imposed a one mill tax on top of the existing county tax. It was repealed in 1836. See Worthington, pp. 37-39.

Revenues did rise in the mid 1830s, but this was the result of the sale of bank charters and the Surplus Revenue distribution in 1837.

23 . Hartz, p. 138, is eloquent in his summary of the persuasion used to support internal improvements “Not only was it believed that tolls would produce sufficient revenue to meet the cost of the works, but it was also believed that they would provide a great surplus of revenue which would eliminate the necessity of taxation and support the public school system. The Pennsylvania Society declared: “These tolls will, at no distant day, form a sinking fund for the redemption of the debt created from the completion of canals, and ultimately support the government, and relieve the state from the burden of taxation.”“ (Quote from the United States Gazette, Feb. 11, 1825).

And on page 142, “...the publicists favoring the program were perennially faced with the job of justifying it before the people of the state. The job became harder as the years went by.... The financial problem became one of the most important: expenditures for public works helped plunge Pennsylvania into bankruptcy. How to justify this situation, when the most roseate visions of an overflowing treasury had been presented at the outset, became the toughest job of the indefatigable public works theorists.

Actually there was no justifying it.”

24 . As Krenkel “Internal Improvements in Illinois” notes, p. 126: “ The advocates of internal improvements had no doubt but that the system would pay for itself. They assumed that the state bonds would sell at a premium of about ten percent and the dividends would not only pay the interest on the bonds but would even yield a surplus.” The state levied no new taxes when the improvements were begun.

25 . “When it was contended that the construction of the works would create a dangerous debt, three arguments were presented in reply: tolls and profits would be so abundantly forthcoming in later years that the debt could be paid off easily; the increase of trade which would attend the execution of the works would produce a large amount of new taxable resources; and even if the works projects should be a failure financially, it was not in the last analysis to be judged in financial terms.” Hartz, p. 138.

26 . The quote within this quote is from the Proceedings of the House of Delegates, 1813, pp. 37-39.

27 . See Worthington, p. 44 and Bourne.

28 . For a detailed description of events in Maryland, see Grinath, 1993, pp. 195-233.

29 . See Hanna, pp. 46-48 for a discussion of the 1821 tax and pp. 105-125 for events after 1841.

30 . See Gunn, chapter 5, “The Crisis of Distributive Politics,” p. 144-169 for a discussion of the laws passage.

31 . Similar results are obtained with a limit of 1 cent or 10 cents per capita.

22. Several alternative specifications yield very similar results. The coefficient on Property Tax Frequency is always significant in the per capita debt regressions, and its coefficient is stable.

33. McGrane provides a well organized summary of each defaulting states debt history from which these dates were taken.

34. Louisiana never officially repudiated its debt. A portion of it the debt was repaid by the state. The debt was not officially retired until the beginning of the 20th century. See Ratchford, p. 120 and Caldwell, pp. 105-110.

35. Illinois vacillated between annual and biennial reports in this period. In 1834 annual per capita property tax revenues were \$.44, in 1835 \$.41; the biennial revenues in 1846 were \$.89, and in 1848 \$.83, equivalent to annual revenues of \$.45 and \$.41. State property tax rates increased in 1839, reduced in 1842, and raised again in 1845. Illinois struggled to pay off its debts, despite the default. Ultimately what enabled it to do so was rising property values, which increased tax collections, even at constant rates. See the discussion in Krenkel, "Illinois Internal Improvements" pp. 127-99.

36. McGrane (1935), the quote within the quote is from the Governor of Illinois, p. 116; for similar sentiments in other states see Indiana, pp. 134-5; Michigan, p. 158 "No one dreamed of increasing taxes at that time"; Mississippi, p. 200; Arkansas, pp. 253-61; and in general, p. 383.

37. Illinois ultimately did better at repaying its loans than Indiana. English "Understanding the Costs of Sovereign Debt" classifies the Illinois debt as "virtually complete repayment," although a substantial part of the Illinois debt was redeemed by exchange for bank stock and through purchase of state lands and is difficult to value as a result, see Krenkel "Internal Improvements in Illinois" pp. 177-180. In Indiana, the state acknowledged responsibility for the "state" debt, and the "canal" debt was extinguished by transferring the canal to the bondholders. Since the canal ultimately failed, bondholders in Indiana lost.

38. To establish this definitively would require a much larger study of bond prices than we have been able to undertake for this study. State bond issues before 1839 typically paid interest rates of 5, 6 or 7 percent and there appeared to be no tendency for defaulting state to issue 7 percent bonds. Of course, without the sales prices, simply knowing the bond rate doesn't tell us the yield in any case.

39. Investors had also seen the federal government completely pay off its debt by 1835, and there was certainly some reason to hope that the federal government would step in a bail out the defaulting states. See the discussion in Ratchford, pp. 100-104.

41. The banking explanation is not inconsistent English. The Michigan repudiation is easy to understand. The state only defaulted on that portion of their bonded debt for which they received no funds. They issued the bonds to an investment banker, who placed the bonds in London, neglecting to remit his payment to the state. See McGrane.

41 . See Gunn, chapter 6, "The Constitution of 1846 and the Democratic Strategy of Legitimacy," pp. 170-197, quotes from page 185.

42 . The following state adopted new constitutions between 1840 and 1860 (excluding new states): Illinois, 1848; Indiana, 1851; Iowa, 1857; Kentucky, 1850; Louisiana, 1842, 1852; Maryland 1850-51; Michigan, 1850; New Jersey, 1844; New York, 1846; Ohio, 1851; Rhode Island, 1842; and Virginia, 1851. Taken from Sturm, pp. 10-11.

43 . There is a series of papers on this topic. See the working papers by Poterba, "Do Budget Rules Work?"; Bohn and Inman, "Balanced Budget Rules and Public Deficits: Evidence from the U.S. States"; Alesina and Perotti, "Budget Deficits and Budget Institutions"; and Kiewit and Szakaly, "The Efficacy of Constitutional Restrictions on Borrowing, Taxing, and Spending: An Analysis of State Bonded Indebtedness, 1961-90."

44 . See Monkonen for an in depth discussion of local debt issue and default.



Table 1

Total Debt, Per Capita Debt, and  
Whether a State Defaulted

ST	Total Debt 1841	Debt PC 1841	Default?
FL	4,000,000	74.07	Y
LA	23,985,000	68.14	Y
MD	15,214,761	32.37	Y
IL	13,527,292	28.42	Y
AK	2,676,000	27.31	Y
MI	5,611,000	26.47	Y
AL	15,400,000	26.06	N
PA	33,301,013	19.32	Y
MS	7,000,000	18.62	Y
IN	12,751,000	18.59	Y
NY	21,797,267	8.97	N
MA	5,424,137	7.35	N
OH	10,924,123	7.19	N
WI	200,000	6.45	N
SC	3,691,234	6.21	N
TN	3,398,000	4.10	N
KY	3,085,500	3.96	N
ME	1,734,861	3.46	N
VA	4,037,200	3.23	N
MO	842,261	2.19	N
GA	1,309,750	1.90	N
NH	0	0.00	N
CT	0	0.00	N
VT	0	0.00	N
RI	0	0.00	N
NC	0	0.00	N
NJ	0	0.00	N
DE	0	0.00	N

Source: Tenth Census

Table 2

Annual Averages

Per Capita Revenues, Non-Loan

	1808 to 1812		1813 to 1817		1818 to 1824		Property Tax Share in Total Revenue			
	1808 to 1812	1813 to 1817	1818 to 1824	1808 to 1812	1813 to 1817	1818 to 1824	1808 to 1812	1813 to 1817	1818 to 1824	1818 to 1824
CT	0.32	0.61	0.29	0.56	0.66	0.59	0.56	0.66	0.59	0.59
DE	0.38	0.40	0.27	0.48	0.45	0.10	0.48	0.45	0.10	0.10
MD	0.11	0.41	0.39	0.00	0.00	0.02	0.00	0.00	0.02	0.02
NH	0.10	0.23	0.21	0.00	0.00	0.43	0.00	0.00	0.43	0.43
NY	0.44	0.93	0.98	0.03	0.20	0.23	0.03	0.20	0.23	0.23
OH	0.17	0.37	0.22	1.00	0.87	0.84	1.00	0.87	0.84	0.84
PA	0.47	0.59	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RI	0.13	0.33	0.20	0.51	0.43	0.50	0.51	0.43	0.50	0.50
SC	0.72	1.04	1.02	0.34	0.62	0.49	0.34	0.62	0.49	0.49
VA	0.42	1.00	1.05							
VT	0.19	0.22	0.18	0.52	0.55	0.73	0.52	0.55	0.73	0.73

Simple Average 0.31 0.56 0.48 0.34 0.38 0.39

Population Weighted Average 0.38 0.72 0.67 0.16 0.24 0.26

Population Weighted Average w/o Ohio & Delaware 0.28 0.68 0.64 0.10 0.17 0.18

Source: Various State Reports

Table 3

## Annual Averages

	Per Capita Property Tax Revenues		Property Tax Share of Total Revenues		Per Capita Revenues Net of Loans	
	1835 to 1841	1842 to 1848	1835 to 1841	1842 to 1848	1835 to 1841	1842 to 1848
MA	0.00	0.03	0.00	0.04	1.26	1.02
MD	0.00	0.87	0.00	0.52	1.49	1.65
NY	0.01	0.14	0.00	0.08	1.45	1.72
PA	0.02	0.53	0.01	0.33	1.60	1.51
RI	0.00	0.01	0.00	0.01	0.56	0.59
DE	0.01	0.00	0.02	0.00	0.39	0.43
NC	0.03	-	0.19	-	0.18	-
SC	0.00	0.00	0.00	0.00	0.58	0.54
Average	0.01	0.20	0.03	0.12	0.94	0.93
Weighted	0.01	0.25	0.02	0.15	1.22	1.28
CT	0.14	0.13	0.47	0.47	0.29	0.27
NH	0.19	0.19	0.63	0.52	0.21	0.25
VT	0.21	0.23	0.56	0.60	0.60	0.30
Average	0.18	0.18	0.55	0.53	0.37	0.27
Weighted	0.18	0.18	0.55	0.53	0.37	0.27
IL	0.14	0.22	0.33	0.81	0.54	0.53
IN	0.22	0.15	0.69	0.26	0.40	1.00
OH	0.21	0.25	0.11	0.38	1.80	1.11
AK	0.66	0.37	0.45	0.28	0.75	1.29
MS	0.28	0.62	0.64	0.71	0.54	1.41
KY	0.25	0.27	0.40	0.63		
MI	0.76	0.40	0.28	0.27	4.92	2.34
Average	0.36	0.33	0.41	0.48	1.49	1.28
w/o Michigan	0.29	0.31	0.44	0.51	0.80	1.07
Weighted	0.25	0.28	0.35	0.48	1.08	0.93
w/o Michigan	0.23	0.27	0.35	0.50	0.90	0.84

Table 4  
Ohio Bond Sales

Year	Amount	Price	Interest Rate
1825	\$400,000	97.5	5
1826	\$1,000,000	101	6
1827	\$1,200,000	107	6
1828	\$1,200,000	104	6
1830	\$600,000	118	6
1832	\$100,000	124	6
1837	\$500,000	112.6	6
1838	\$700,000	106	6
	\$1,300,000	bank loans	
1839	\$2,400,000	90	6 see note
1840	\$400,000	95	6
	\$1,060,000	bank loans	
1842	???	68 to 71	6
1843	\$1,500,000	100	7

Note: In several years loans were made to Ohio banks which were allowed to purchase the loans in depreciated paper of various types, making it difficult to determine the actual price of the bond issue.

In 1839, the original bonds were sold at or close to par, but sales arrangements with the North American Trust & Banking Company allowed for installment payments which the company ultimately defaulted on. The state realized \$2,000,000 on the \$2,400,000 issue. By late 1839 State bonds were selling in New York for 90, the price I have given in the table

All information taken from Scheiber, pp. 36-54 and 140-158.

Table 5  
Revenues from Bank Sources  
As share of Total State Revenues  
Annual Average 1825 to 1834

State	Revenue Share
CT	0.27
DE	0.43
MA	0.61
NH	0.03
NY	0.01
PA	0.23
RI	0.24
VT	0.08
MD	0.09
NC	0.34
SC	0.01
VA	0
IL	0.03
IN	0.03
OH	0.01
MS	0.04

Table 6

Debt Per Capita, and Debt as a Percentage of Income  
Coefficients Reported in Elasticities  
(t-statistics)

Variable	PER CAPITA DEBT	DEBT/INCOME RATIO
Property Tax Frequency	-1.49 (-3.75)	-0.97 (-2.26)
Property Tax Share	0.24 (0.92)	0.19 (0.73)
Western Dummy	-0.18 (1.34)	-0.03 (0.19)
Year of Statehood	66.07 (3.22)	86.18 (4.12)
Bank Share	0.28 (2.14)	-0.01 (0.07)
R-sqr	0.76	0.69

# Figure 1

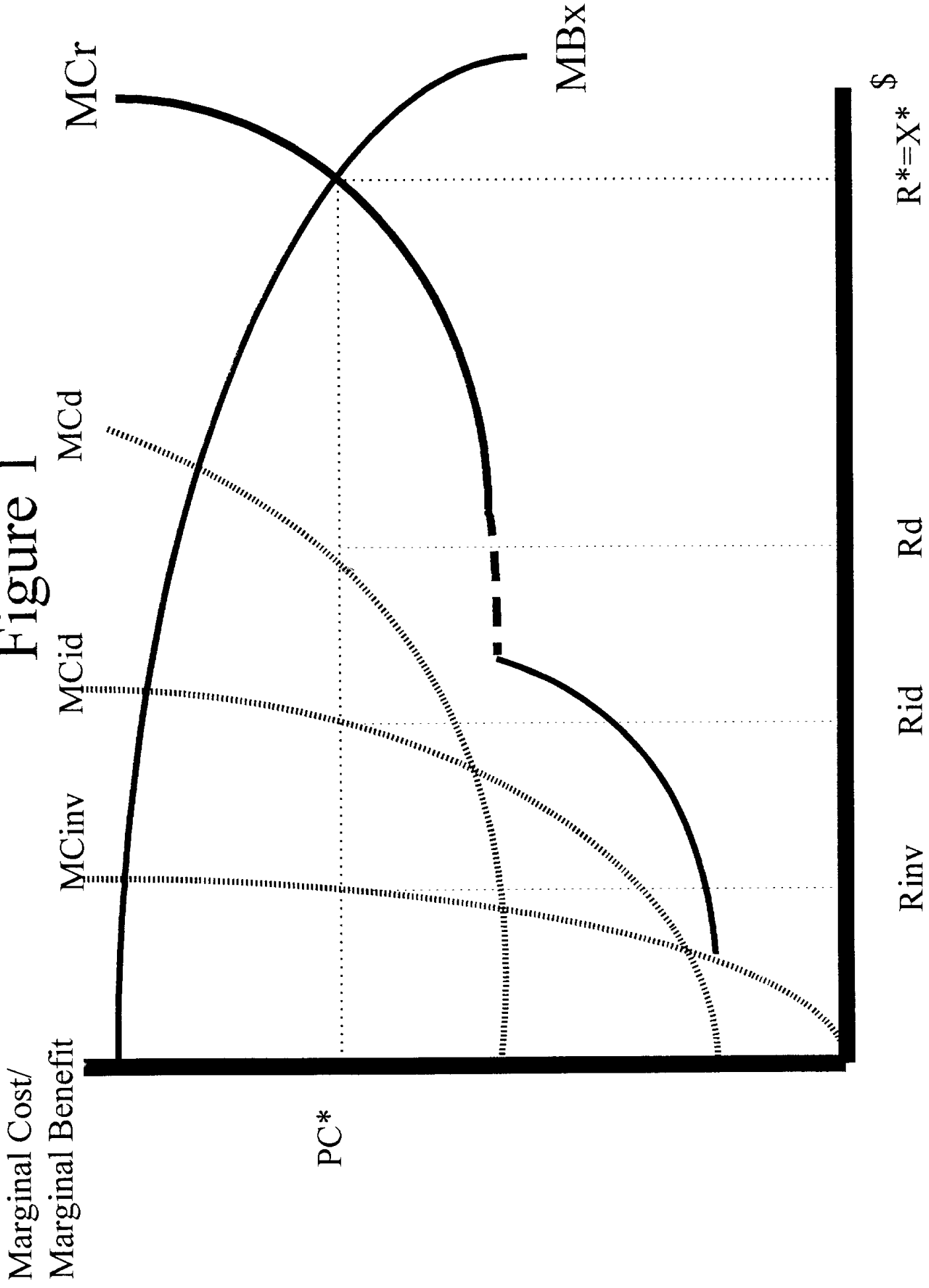
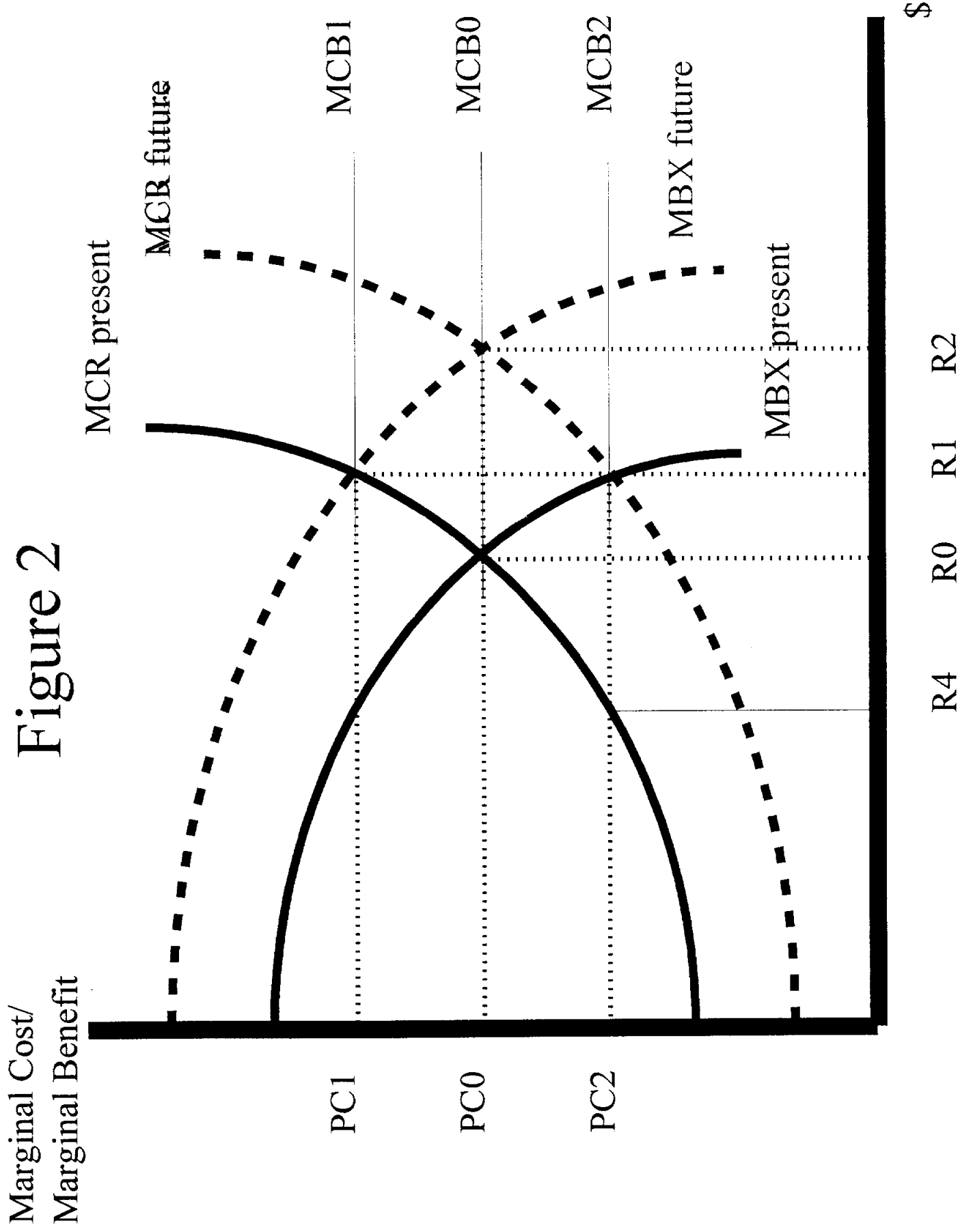


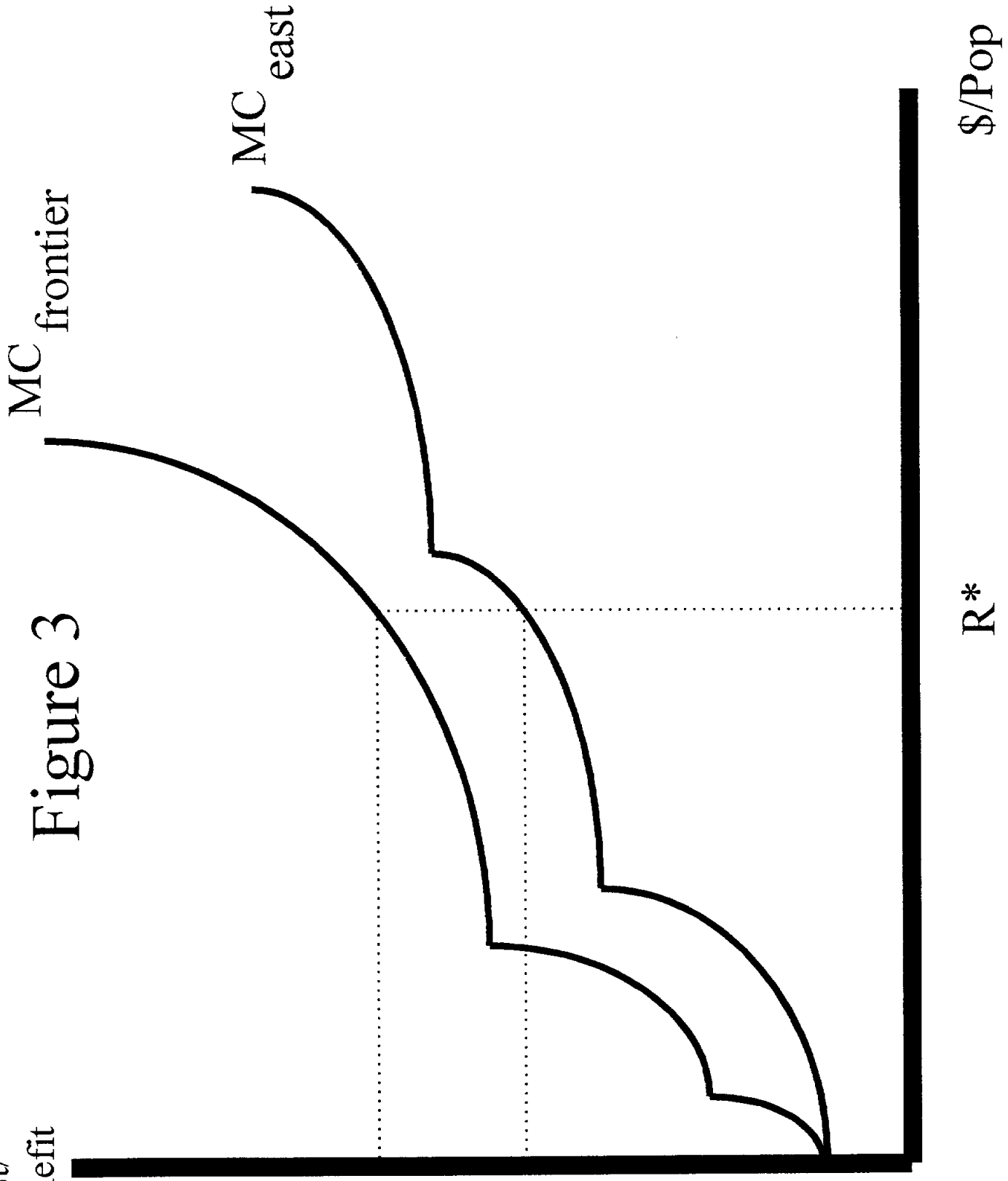
Figure 2





Marginal Cost/  
Marginal Benefit

Figure 3



# Figure 4

Bond Yields, 5 Month Moving Average

