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# *Interest Rates and Crowding-Out During Britain's Industrial Revolution*

CAROL E. HEIM AND PHILIP MIROWSKI

Available evidence on interest rates and government borrowing during Britain's industrial revolution, while limited, does not support the idea that war spending crowded out private investment. This article demonstrates the importance of using data on net receipts from borrowing, rather than changes in government debt. Weaknesses of the crowding-out model concerning capital markets and investment, openness of the economy, and full employment are identified for the historical case. The case raises broader issues of whether conceptions of saving and investment based in neoclassical supply-constrained models are as appropriate as theories of capital accumulation.

**R**ecent research in British and American economic history seeks to identify a saving constraint upon long-run economic growth. Jeffrey Williamson, for example, in his article on the British industrial revolution, attributes relatively slow economic growth and industrialization between the 1760s and the 1820s to a crowding-out effect caused by the British government's debt financing of the French Wars.<sup>1</sup> In addition to posing important empirical questions—in this case the impact of war on economic development—such research implicitly raises key theoretical issues. Should the economy be conceived of as engaged in a process of capital accumulation, in which business firms are the central agents, investment demand the driving variable in the economy, and saving largely a consequence of investment decisions? Or is the economy, as in the neoclassical view, primarily a mechanism for allocating scarce factors, in which saving limits long-run growth and in which utility-maximizing household decisions figure prominently in the supply of saving to the rest of the economy?<sup>2</sup>

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<sup>1</sup> Jeffrey G. Williamson, "Why Was British Growth So Slow During the Industrial Revolution?" this *JOURNAL*, 44 (Sept. 1984), pp. 687–712. See also the relevant discussion in his book, *Did British Capitalism Breed Inequality?* (London, 1985). In American economic history, see Roger L. Ransom and Richard Sutch, "Domestic Saving as an Active Constraint on Capital Formation in the American Economy, 1839–1928: A Provisional Theory," The University of California Project on the History of Saving, Working Paper No. 1, Institute of Business and Economic Research, University of California, Berkeley (Dec. 1984).

<sup>2</sup> The neoclassical model includes, of course, an investment demand function as well as a saving

The crowding-out argument is based, of course, on the second theoretical perspective. Two key links in the argument demand close historical scrutiny before its conclusions concerning Britain's industrial revolution can be accepted. First, did the British government's issuance of debt to finance the French Wars result in higher real interest rates? Second, did higher real interest rates negatively influence firms' investment decisions? Evidence that either of these links did not function in the manner suggested will cast doubt upon the crowding-out argument, and upon the theoretical framework in which it is rooted.

The most direct empirical approach to these questions would be to attempt to estimate the aggregate saving and investment model depicted in Williamson's figure 1 (p. 691), to determine whether observed interest rate behavior is consistent with the explanation proposed. As is depicted in the figure, real interest rates should rise. Williamson does refer to the possibility of credit rationing (pp. 693–94) but primarily in the context of usury laws, whose effective enforcement is open to question. Moreover, if credit rationing were sufficiently important to eliminate any rise in the interest rate, the implications for the market-clearing assumptions of Williamson's general equilibrium model would need to be considered.

An alternative aggregate theory of accumulation, in which investment generates saving, might then be examined empirically to see whether it provides a better explanation of the period. Unfortunately our attempts to take this direct approach were thwarted by the unavailability of annual data for key variables such as saving or income. Annual data do exist, however, for both long- and short-term interest rates and for government borrowing, and they allow examination of the first link in the crowding-out argument. Shedding any new empirical light on the second link will require firm-level research on the relationship between interest rates and investment behavior.

#### INTEREST RATES AND GOVERNMENT BORROWING, 1780–1825

To examine the crowding-out argument it is important to use the most appropriate time-series among the several available on interest rates and government borrowing. In the case of the interest rate relevant for government long-term borrowing, most commentators identify the interest rate on British consols as the chief representative of a whole collection of interest rates.<sup>3</sup> Unlike most private debt instruments, the

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function. But both in full employment models and in more Keynesian models where the interest rate and income level are simultaneously determined, households pursuing utility-maximization (rather than firms engaged in the accumulation of value) are the central agents in the theory. For references on the theory of accumulation, see fn. 44.

<sup>3</sup> See for example T. S. Ashton, *Economic Fluctuations in England, 1700–1800* (Oxford, 1959), p. 88.

consols were not subject to the usury laws, and thus they were free to reflect conditions of stringency in the debt market. Modern historians who employ the implicit yield on consols in their work tend to take these data from one of two secondary sources: T. S. Ashton's *Economic History of England* or John Sinclair's *History of the Public Revenue of the British Empire*.<sup>4</sup>

We find these secondary sources inadequate for many reasons. Most important, they do not describe the primary sources from which they derive the prices of the consols or the sampling techniques used in arriving at a representative interest rate. There is reason to believe that a smoothing procedure was employed in their construction, which would influence the statistical properties of the series. Rather than using such secondary sources, we have chosen to take our sample directly from the primary information source for the eighteenth- and nineteenth-century London money market, *The Course of the Exchange*.<sup>5</sup> For reasons of statistical consistency we have extracted the price of consols on the first Wednesday of April for each year. The nominal yield is defined as the coupon yield divided by the price of the consol on that date. Table 1 presents nominal yields for the years 1780 to 1825.

Next, it is important to recognize that the neoclassical conception of supply and demand is framed in terms of "real" variables, corrected for changes in the price level. A problem immediately arises, one which undermines the dichotomy between real and nominal variables such as the interest rate: no one is certain what the actual price level was during the British industrial revolution. A number of price indices have been calculated, which show somewhat different price movements over the period. Since we doubt there is an unambiguous answer to the question of which index is the correct one to use in calculating a "real" interest rate, we decline to prejudge the issue. Instead we employ several price indices in the statistical examination of the relationship between government borrowing and interest rates: two of the Schumpeter-Gilboy indices, and one of the Gayer-Rostow-Schwartz indices.<sup>6</sup>

Any correction of the interest rate for changes in the price level entails an implicit theory of learning and expectations. There does not

<sup>4</sup> T. S. Ashton, *An Economic History of England: The 18th Century* (London, 1955), p. 251; and Sir John Sinclair, *The History of the Public Revenue of the British Empire* (London, 1803), vol. 2, appendix 1, pp. 28–46.

<sup>5</sup> For further description of *The Course of the Exchange* as a source of financial data, see Philip Mirowski, "The Rise (and Retreat) of a Market: English Joint Stock Shares in the Eighteenth Century," this JOURNAL, 41 (Sept. 1981), pp. 559–77.

<sup>6</sup> Price indices are taken from B. R. Mitchell and P. Deane, *Abstract of British Historical Statistics* (Cambridge, 1962), pp. 468–71. Our Schumpeter-Gilboy consumer price index is from column (a), 1780–1823 (p. 469). Our Schumpeter-Gilboy producer price index is from column (c), 1780–1801 (p. 469), linked with suitable benchmarking to the Rousseaux index, column (c), 1802–1825 (p. 471). Our Gayer-Rostow-Schwartz index is the "domestic and imported commodities" column (p. 470), which runs from 1790 to 1825.

TABLE I  
NOMINAL AND REAL INTEREST RATES, 1780–1825

	Nominal Consol Yield <sup>a</sup>	Real Consol Yield <sup>a</sup>	Nominal India Bond Yield	Real India Bond Yield <sup>a</sup>
1780	4.89		3.94	
1781	5.33		3.98	
1782	5.25	4.38	3.99	3.12
1783	4.48	-6.73	5.01	-6.20
1784	5.16	7.49	5.04	7.37
1785	5.15	9.91	4.99	9.75
1786	4.26	5.09	4.82	5.65
1787	3.87	5.55	3.87	5.55
1788	4.02	0.60	3.86	0.44
1789	3.98	7.29	3.84	7.15
1790	3.94	-2.04	3.91	-2.07
1791	3.79	6.21	3.83	6.25
1792	3.32	2.49	3.80	2.97
1793	3.90	-1.84	4.04	-1.70
1794	4.44	-0.99	3.44	-1.99
1795	4.82	-3.27	4.16	-3.93
1796	4.34	-0.42	4.21	-0.55
1797	6.04	9.94	5.20	9.10
1798	6.09	6.09	5.10	5.10
1799	5.55	-2.56	4.80	-3.31
1800	4.72	-27.78	4.46	-28.04
1801	5.22	-2.33	4.90	-2.65
1802	3.87	27.55	4.76	28.44
1803	4.72	15.06	4.67	15.01
1804	5.30	2.09	5.05	1.84
1805	5.18	-10.97	5.37	-10.78
1806	4.98	6.58	5.43	7.03
1807	4.82	3.73	5.32	4.23
1808	4.63	-5.05	5.05	-4.63
1809	4.42	0.50	4.54	0.62
1810	4.38	6.74	4.58	6.94
1811	4.63	5.11	4.03	4.51
1812	5.03	-10.02	4.90	-10.15
1813	5.10	2.57	5.15	2.62
1814	4.47	18.46	4.95	18.94
1815	5.25	13.86	4.90	13.51
1816	4.94	14.89	5.10	15.05
1817	4.10	-5.78	3.49	-6.39
1818	3.78	1.13	2.67	0.02
1819	4.02	5.05	2.91	3.94
1820	4.35	19.98	3.47	19.10
1821	4.13	18.33	2.73	16.93
1822	3.77	13.84	2.48	12.55
1823	4.03	1.63	3.20	0.80
1824	3.14		3.36	
1825	3.24		3.36	

<sup>a</sup> Real yields are derived using the Schumpeter-Gilboy consumer price index.

Source: *The Course of the Exchange* (microfilm of copy at Goldsmiths' Library, Senate House, University of London). Readings are taken from the first Wednesday in April of each year, or the nearest available date.

appear to exist a canonical neoclassical model which can claim widespread allegiance in this area and thus be taken to represent fairly the theory underlying crowding-out arguments. In its absence we choose to adopt a simple version widely employed in the economics literature, and implicitly adopted in other discussions of crowding-out during the Napoleonic Wars: the actual *ex post* observed rate.<sup>7</sup> Thus the real interest rate will be defined as the nominal yield minus the percentage rate of change of the chosen price index. Column 2 of Table 1 presents the real consol rate, using the Schumpeter-Gilboy consumer price index.

To avoid being bound by the assumption that a single interest rate can be used to represent the whole spectrum of interest rates—long and short term, public and private—we extracted from *The Course of the Exchange* the yield on a short-term semi-private debt instrument, the India bond. These bonds were issued for six-months maturities by the East India Company to finance its local efforts to sell its products. India bonds' nominal yields were also exempt from the usury laws and, at least in the eighteenth century, they were the short-term instrument of choice for many investors because of their liquidity.<sup>8</sup> The yield on these semi-private India bonds *may*, therefore, reflect conditions in the short-term private bond market. To the extent possible we have extracted our readings of the prices and coupon yields of India bonds from the same day as the readings for the prices of consols so that we can also present the first available estimates of the term structure of interest rates for the period. The last two columns of Table 1 present our estimates of the nominal yield of India bonds at an annual rate, as well as an estimated real yield using the Schumpeter-Gilboy consumer price index.

A preliminary look at Table 1 suggests there may be reason to doubt a crowding-out argument for this period. For both long- and short-term nominal yields, the yields generally are higher during the years of the Napoleonic Wars (1793–1815) than during the years of peace immediately preceding and following. But in the neoclassical conception of crowding-out one would expect real interest rates to be higher during the war years, and the data do not clearly show such a pattern. Table 2

<sup>7</sup> It is not our purpose in this paper to attempt to model expected prices, although clearly a range of possibilities exists. One approach which could be pursued would be to construct forecasting equations, arriving at predicted inflation by regressing the inflation rate on past inflation rates and lagged values of other variables. See Frederic S. Mishkin, "The Real Interest Rate: An Empirical Investigation," *Carnegie-Rochester Conference Series on Public Policy*, 15 (Autumn 1981), pp. 151–200; and his *A Rational Expectations Approach to Macroeconomics: Testing Policy Ineffectiveness and Efficient-Markets Models* (Chicago, 1983).

<sup>8</sup> See P.G.M. Dickson, *The Financial Revolution in England: A Study in the Development of Public Credit, 1688–1756* (London, 1967), p. 410; William Fairman, *An Account of the Public Funds* (7th edn., London, 1824), pp. 134–36; and Thomas Mortimer, *Every Man His Own Broker; or, A Guide to the Stock-Exchange* (13th edn., London, 1801), pp. 172–73.

TABLE 2  
MEAN INTEREST RATES IN WAR AND PEACE YEARS, 1784–1823

		Nominal Consol Yield	Real Consol Yield	Nominal India Bond Yield	Real India Bond Yield
Means					
Peace	1784–1792	4.15	6.57	3.77	6.18
	1816–1823				
War	1793–1815	4.87	2.31	4.74	2.18
Peace	1784–1792	4.14	7.73	3.82	7.42
	1802				
	1816–1823				
War	1793–1801	4.91	1.16	4.74	0.99
	1803–1815				
<i>t</i> -statistics <sup>a</sup>					
Peace	1784–1792	5.14	-1.48	4.41	-1.39
	1816–1823				
War	1793–1815				
Peace	1784–1792	5.50	-2.27	4.18	-2.21
	1802				
	1816–1823				
War	1793–1801				
	1803–1815				

<sup>a</sup> *t*-statistics test the null hypothesis of no difference in the mean yields for war versus peace years. Notes: Means and *t*-statistics are computed treating 1802 (the Peace of Amiens) first as a war year, then as a peace year.

Source: See Table 1.

presents the means of each of the yield series during periods of war versus peace, and the results of *t*-tests of the hypothesis that the yields are on average higher during years of war than years of peace. The results show that the null hypothesis of no difference between mean nominal yields is clearly rejected, but the null hypothesis of no difference between mean real yields is not rejected at the 0.01 level.

Turning to the data on government borrowing, it again is important to select the most appropriate time-series. Crowding-out, and the scarce-factor-constrained vision of the economy generally, require measures of real resource flows. In the case of government borrowing, the appropriate measure should capture the real resource transfer to the government that results from the borrowing operations. The nominal debt figures must be deflated, which Williamson does. But as E. B. Schumpeter pointed out, there is another reason why debt figures can be seriously misleading as an indicator of these flows.

It will be observed that the increase or decrease in the national debt by no means agrees with the amount of money actually available each year as a result of borrowing operations (net receipts from loans in Table 6). This is shown in Chart 4. The differences are especially striking in 1711, 1712, 1720, 1780 to 1783, and after 1794. . . . The principal reason for discrepancies from 1780 to 1783 and after 1794 may be attributed to the system of selling consols bearing a low rate of interest at a considerable discount.

Usually the debt was increased by more than the increase in net receipts from borrowing because bonds were issued bearing less than the prevailing rate of interest. Sometimes, however, the operation of Pitt's Sinking Fund brought about just the opposite result. The fund would buy up at a considerable discount consols bearing 3 per cent interest and retire them. Simultaneously the government might issue a smaller volume of new bonds at 4 or 5 per cent. The retiring and funding operations during the French Wars are most confusing and difficult to understand. In contemporary discussions of the financing of a given year, it is almost never clear as to whether the writer's figures are for (a) gross receipts from borrowing, (b) net receipts from borrowing, (c) the increase in the funded debt, or (d) the increase in the total debt, funded and unfunded.<sup>9</sup>

Schumpeter provides in her table 6 a time-series for the appropriate measure, net receipts from borrowing (column 3, net receipts from loans). The series is derived from the annual income and expenditure accounts, broken down into various categories, in the British Parliamentary Papers (see P.P. 1868–1869, vol. 35, pt. 1, pp. 432–33, 440–41). However, as O'Brien has described in detail, these figures contain a number of errors and omissions, particularly concerning the treatment of funding operations to convert unfunded short-term debt into funded long-term debt; discounts for prompt payment and management fees connected with loans; redemption of debt raised by the British government for the Irish administration; and the calculation of total unfunded debt.<sup>10</sup> For our net receipts from borrowing series we therefore have used the unpublished figures constructed and kindly provided by O'Brien for 1793 to 1815; for the remaining years we have used the Parliamentary Papers 1868–1869 figures, correcting where possible for the errors cited.<sup>11</sup> Table 3 shows the real net receipts from borrowing series, using the Schumpeter-Gilboy consumer price index to deflate. For purposes of comparison Table 3 also includes the series on change in the real debt, using the same price index. Change in the real debt is calculated as the difference between the real debt in a given year (nominal debt divided by the price index) and the real debt in the preceding year.

Ordinary least squares regressions were run to examine the relationship between real net receipts from borrowing and 1) the real long-term yield on British government consols, and then 2) the real short-term yield on India bonds. Separate regressions were run using the three different price indices (the Schumpeter-Gilboy consumer and producer price indices and the Gayer-Rostow-Schwartz index of domestic and imported goods) to deflate the net receipts from borrowing and the

<sup>9</sup> E. B. Schumpeter, "English Prices and Public Finance, 1660–1822," *The Review of Economic Statistics*, 20 (Feb. 1938), p. 37, fn. 3.

<sup>10</sup> P. K. O'Brien, "Government Revenue, 1793–1815—A Study in Fiscal and Financial Policy in the Wars against France" (D.Phil. thesis, University of Oxford, 1967), esp. pp. 6–16.

<sup>11</sup> *Ibid.*, p. 9, table 4, column 11; and Parliamentary Papers 1868–1869, vol. 35, pt. 1, pp. 182–207, 390–91. The unfunded debt figures in the corrected data are less complete than O'Brien's.



TABLE 3  
 REAL NET RECEIPTS FROM BORROWING AND CHANGE IN REAL DEBT, 1782–1816  
 (in £ millions)

	Real Net Receipts from Borrowing	Change in Real Debt
1782	£13.10	£19.18
1783	8.84	-5.05
1784	3.89	13.09
1785	0.92	11.81
1786	0.42	2.31
1787	-1.20	3.19
1788	0.08	-7.52
1789	-0.34	6.24
1790	-0.40	-12.03
1791	-0.08	4.22
1792	-1.72	-2.96
1793	5.19	-9.74
1794	9.12	-4.77
1795	15.51	-1.62
1796	20.78	19.65
1797	19.12	41.14
1798	10.34	21.62
1799	12.31	2.30
1800	11.08	-58.42
1801	9.91	-8.16
1802	7.47	86.51
1803	6.79	44.47
1804	9.19	-5.68
1805	9.47	-36.79
1806	5.98	18.18
1807	6.02	6.76
1808	6.13	-23.64
1809	5.47	-7.31
1810	4.73	10.88
1811	7.18	2.49
1812	9.32	-31.79
1813	12.47	4.30
1814	18.90	78.69
1815	9.74	42.87
1816	-2.73	62.50

*Note:* Figures are deflated using the Schumpeter-Gilboy consumer price index.

*Source:* Net receipts from borrowing figures are taken from O'Brien and corrected data in Parliamentary Papers 1868–1869 (see text). Annual total nominal debt figures are taken from Mitchell and Deane, *Abstract of British Historical Statistics*, pp. 401–2.

interest rate data, the appropriate procedure for an argument based on real resource constraints.

Table 4 reports results of the regressions. In each case, the *t*-statistics fail to indicate a significant relationship between real net receipts from borrowing and either the real long-term or the real short-term interest rate. Thus the first link in the crowding-out argument is not supported by the limited test which can be implemented given the available data.<sup>12</sup>

<sup>12</sup> Paul Evans argues that in the U.S. case, large deficits during the Civil War and the two World

TABLE 4  
REGRESSION RESULTS: INTEREST RATES AND GOVERNMENT BORROWING

	Coefficient ( <i>t</i> -statistic)		
	F-statistic, Durbin-Watson Statistic		
	Number of Observations		
A: Independent Variable: Real Net Receipts from Borrowing			
	Consumer Price Index	Producer Price Index	Gayer-Rostow-Schwartz Price Index
Dependent Variable			
Real consol yield (long rate)	-0.19 (-0.69) 0.48, 1.51 35	-0.26 (-1.22) 1.48, 1.69 35	-0.07 (-0.26) 0.07, 1.50 25
Real India bond yield (short rate)	-0.22 (-0.80) 0.64, 1.49 35	-0.28 (-1.34) 1.80, 1.70 35	-0.09 (-0.34) 0.12, 1.48 25
B: Independent Variable: Change in the Real Debt			
	Consumer Price Index	Producer Price Index	Gayer-Rostow-Schwartz Price Index
Dependent Variable			
Real consol yield (long rate)	0.26* (13.93) 194.08, 1.64 42	0.21* (10.91) 119.04, 1.85 44	0.16* (12.57) 158.04, 1.69 34
Real India bond yield (short rate)	0.26* (13.23) 175.04, 1.45 42	0.21* (10.64) 113.22, 1.77 44	0.17* (12.14) 147.36, 1.74 32

\* Significant at 0.01 level.

Source: See text.

The six regressions were also run using the annual change in the real debt (deflating by each of the three price indices) rather than real net receipts from borrowing. Williamson uses versions of change in the real debt, although a less adequate variable for the reasons described above in estimating his general equilibrium results.<sup>13</sup> In these cases the

Wars were not associated with high interest rates. See his "Do Large Deficits Produce High Interest Rates?" *American Economic Review*, 75 (Mar. 1985), pp. 68-87.

<sup>13</sup> Annual total nominal debt figures are taken from Mitchell and Deane, *Abstract of British Historical Statistics*, pp. 401-2. These data are for the United Kingdom rather than Great Britain.

*t*-statistics do show a significant positive relationship between the change in the real debt and real interest rates, both long- and short-term (see Table 4). Why this results, and why it differs from the results using the more appropriate measure of real net receipts from borrowing, is not immediately clear.

One possibility stems from the practice of selling bonds at a discount, which may occur if the current interest rate is higher than the quoted interest rate on new bonds issued.<sup>14</sup> In this case the nominal value of bonds issued to raise any given amount of resources for the government will be positively correlated with the current interest rate, and a regression of the interest rate on change in the debt may suffer from simultaneity bias. An increase for any reason in the current interest rate could result in a positive change in the total debt, while net receipts from borrowing remained constant and uncorrelated with the interest rate.

Conversion operations, such as the very large one begun in 1808, may also account for the discrepancy.

Since 1808, a very large amount of Capital Stock of Funded Debt has been converted into Life and Terminable Annuity Debt. This last description of Debt has always been held to be Funded Debt, and it has never been the practice to include in the Balance Sheet the Amounts of one description of Funded Debt converted into another. It must be obvious that the immediate result of such a conversion of Capital Stock of Fund Debt into Annuity Debt is to reduce by a very large sum the Nominal Amount of the Capital of the National Debt, and at the same time to add largely to the annual charge of the Debt.<sup>15</sup>

This conversion operation is reflected in the series on change in the real debt, which with each price index falls dramatically in 1808—in the case of the producer price index, to its minimum for the entire time period—and remains low in 1809. The exact figures, using the producer price index, are £17.73 million in 1807, –£57.58 million in 1808, –£31.54 million in 1809, and £49.40 million in 1810. Real net receipts from borrowing, by contrast, remain fairly steady in each case over this period: £6.87 million in 1807, £6.35 million in 1808, £5.20 million in 1809, and £5.13 million in 1810 (using the producer price index).

Thus an important element in the variance of the stock of debt, absent from the series on net receipts from borrowing, is a result of operations converting one type of debt into another. Since the consolidated annuities (consols) represent only one particular debt instrument, it is

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We have interpolated the figure for 1800. This is the source from which Williamson constructed his five-year centered averages of funded and unfunded government debt of the United Kingdom, and his two estimates of real annual increase in government debt. To deflate he used an index based on a combination of a cost-of-living index (to 1800) and a wholesale commodity price index (from 1801 on). See notes to his table 1, p. 695.

<sup>14</sup> This explanation was proposed by Barry Eichengreen, who also initially suggested investigating the selling of bonds at a discount.

<sup>15</sup> P.P. 1868–1869, vol. 35, pt. 2, p. 6.

possible that what our regressions have identified is the impact of relative price changes within a portfolio of government debt rather than an overall rise in the real rate of interest. In this interpretation the real consol rate is an index of changes in the stock of *consols* rather than of changes in the aggregate flow of government borrowing and its impact upon a given aggregate pool of savings.<sup>16</sup>

The measure of government borrowing appropriate for a crowding-out argument—real net receipts from borrowing—does not appear on the basis of the simple test possible with available data to be systematically related to long- or short-term interest rates. This suggests the possibility that interest rates, whatever they may be in this period, are not a scarcity index for capital conceived as a factor of production, and suggests that further discussion of the theoretical and institutional basis of the crowding-out argument is needed.<sup>17</sup>

<sup>16</sup>A more general problem with the total debt figures is the possibility that the figures for a portion of the debt were constructed using current interest rates. This procedure would introduce a spurious correlation between total debt and interest rate data. Mitchell and Deane (the source used by Williamson and others for nominal debt figures) arrive at their total debt data by adding together a series of unfunded debt from the 1868–1869 Parliamentary Papers (vol. 35, part 2, appendix 12, pp. 298–311), and a series on funded debt (by far the bulk of the total debt) from a different Parliamentary Paper (P.P. 1890–1891, vol. 48, pp. 71–81). The funded debt figures in the latter P.P. 1890–1891 are the total nominal amount of funded debt remaining at the close of each financial year, calculated by adding the total capital stock created and subtracting the total capital stock redeemed, paid off, and cancelled during each year, beginning from an estimate of the total debt outstanding at 1 August 1786. The potential problem arises from the need to value the stock of government debt at any point in time and the possibility that the interest rate itself was used to do so. If contemporary annual interest rates were used to produce the debt figures, a correlation might appear between government debt and the interest rate; this apparent relationship would not exist with net receipts from borrowing, which are taken from the income and expenditure accounts and involve no use of the interest rate in their construction.

While it appears that consols (perpetual annuities) were recorded in debt figures simply as the face value of the bonds at the time they were issued, the public debt also included terminable annuities, which *may* have been valued using current interest rates. J. J. Grellier describes such a procedure in his contemporary account, *The Terms of all the Loans* (London, 1799), p. 45. To determine and compare the terms on which various loans were raised, he argues that:

The least objectionable mode appears to be to convert the terminable annuities into perpetual annuities, according to the current rate of interest at the time when the annuities were granted; as it is upon the rate of interest that the proportionate value of an annuity for a certain term, to the perpetuity, depends; and, in forming the following statement, the conversion has been made at the interest produced by money invested in the 3 per Cents. [consols] according to the price of this stock, at the times when the terms of the respective loans were settled. . . .

As Grellier points out, terminable annuities form a relatively small part of the total debt. A systematic relationship with current interest rates, however, would create at least some cause for concern that any use of Mitchell and Deane's figures in models including the interest rate will be problematic. See J. J. Grellier, *The History of the National Debt, from the Revolution in 1688 to the Beginning of the Year 1800* (London, 1810), pp. 343–44, 367–68 for accounts of the composition of the national debt in 1786 and 1793.

<sup>17</sup>By “scarcity index for capital” we refer to the fact that in neoclassical theory prices, including the interest rate, are viewed as ultimately reflecting supply and demand for scarce physical factors of production. Prices and interest rates can be conceptualized quite differently. Prices can be

## THE CROWDING-OUT ARGUMENT AND THE HISTORICAL CONTEXT

One reason to study economic history is its contribution to a deeper understanding of the adequacy of alternative theoretical frameworks. In the case of crowding-out and the British industrial revolution, examination of the historical context throws into bold relief several flaws and drawbacks of existing orthodox theory, particularly as applied to the period of early industrialization. In this section we move from showing that the historical evidence does not bear out predicted results to providing reasons why evidence of crowding-out should not have been expected in the first place. We argue that key assumptions of the crowding-out argument are not plausible in the historical circumstances of Britain during the industrial revolution. At a deeper level, we question the basic conception of the economy as a mechanism for allocating scarce resources. We suggest an alternative, although we do not develop it in detail here, in which saving is a consequence of growth rather than a constraint and in which the analysis focuses on limitations to the rate of market expansion. This conception, grounded in theories of the accumulation of value, is distinct from both neoclassical and Keynesian approaches.<sup>18</sup>

The first set of problems with the crowding-out argument concerns capital markets and the relationship between interest rates and investment. The argument assumes the existence of a capital market which can channel funds from savers to alternative uses, including both purchases of government debt and industrial investment. (The individuals or organizations who save may also do the investing, of course, in which case the problem of market coordination is simpler.) The argument also assumes that industrial investment is influenced by an interest rate determined at least partially by government borrowing.

The conventional historiographical wisdom concerning this period does not portray a unified capital market in which saving initially generated by households flowed freely among alternative uses. Entre-

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viewed (as in markup models) as the means by which firms assure themselves funds for continued accumulation. See for example David P. Levine, "Aspects of the Classical Theory of Markets," *Australian Economic Papers*, 19 (June 1980), pp. 1-15; and Nai-Pew Ong, "Target Pricing, Competition, and Growth," *Journal of Post Keynesian Economics*, 4 (Fall 1981), pp. 101-16.

<sup>18</sup> The following discussion of the crowding-out argument focuses primarily upon the neoclassical one-for-one version supported by Williamson in *Did British Capitalism Breed Inequality?* Williamson does consider (pp. 179-83) the possibility of less than one-for-one crowding-out, but appears ultimately to remain with the view expressed on p. 177 that the one-for-one assumption is adequate. We recognize that there exists a variety of possible crowding-out stories, ranging from the pure neoclassical version to variants of the "neoclassical synthesis," IS-LM systems, and life-cycle models. (For a discussion of the interest rate theories associated with some of these variants, see Axel Leijonhufvud, "The Wicksell Connection: Variations on a Theme," in his *Information and Coordination: Essays in Macroeconomic Theory* (Oxford, 1981), pp. 131-202). We cannot do justice to each of these variants within this paper. But to the extent that they share the assumptions and overall conceptual basis we do discuss, they are subject to the same critique.

preneurs of the industrial revolution did not rely heavily upon financial instruments or banks to fund long-term investment; they did not resort to the corporate form or issue marketable instruments other than short-term bills of exchange. Capital needs were largely met locally by family, friends, and neighbors, and through reinvestment of profits.<sup>19</sup>

The fact that much investment was financed locally or by reinvested profits does not itself invalidate a crowding-out argument. The latter requires only that some additional funds which could have been invested in industry were placed in government bonds instead. But little historical evidence has been provided to justify the assumption that integrated capital markets existed in the sense that funds were potentially or actually mobile between uses, as opposed to the view that government debt and industrial investment drew upon separate pools of finance. The idea that “the economy” consists of a unified pool of potentially mobile resources—rather than distinct and possibly nonintersecting sets of economic relationships—is so standard in neoclassical theory that many economists take it for granted. In our view the assumption that funds were sufficiently mobile to produce significant crowding-out must be defended with evidence from the historical period in question. The issue of mobility of funds is not simply one of “frictions” impeding flows; it also concerns the motivations of different groups in the economy. For example, saving generated by entrepreneurs with the long-run objective of building up a family business may not move in response to annual changes in the interest rate on government bonds, and such entrepreneurs may not hold a large share of bonds in their portfolios even if the rate of return on the bonds is high. For funds originating elsewhere in the economy it must be demonstrated that such funds would in fact have been invested in industry—rather than supporting luxury consumption, for example—if they had not been used to purchase government bonds.

Implicit in the conventional historical view of capital markets in the period is the notion that these markets were at an early point in a process of development towards markets more capable of functioning to allocate scarce savings. For some, the undeveloped institutions reflect a lack of demand for long-term financial instruments during the industrial revolution, and a number of authors have argued explicitly that fixed

<sup>19</sup> See for example S. D. Chapman, “Fixed Capital Formation in the British Cotton Industry, 1770–1815,” *Economic History Review*, 2nd ser., 23 (Aug. 1970), pp. 235–66; Francois Crouzet, ed., *Capital Formation in the Industrial Revolution* (London, 1972); Charles Kindleberger, *A Financial History of Western Europe* (London, 1984), pp. 92–93; M. Miles, “The Money Market in the Early Industrial Revolution: The Evidence for West Riding Attorneys c.1750–1800,” *Business History*, 23 (June 1981), pp. 127–46; Joel Mokyr, “The Industrial Revolution and the New Economic History,” in Joel Mokyr, ed., *The Economics of the Industrial Revolution* (Totowa, 1985), pp. 33–38; S. Pollard, “Fixed Capital in the Industrial Revolution in Britain,” this JOURNAL, 24 (Sept. 1964), pp. 299–314; and L. S. Pressnell, *Country Banking in the Industrial Revolution* (Oxford, 1956).

capital requirements were small. Machinery was simple, buildings often were rented, and inputs could be bought with credit.<sup>20</sup>

A more recent view, however, questions both the idea that fixed capital requirements were small and the idea that markets improve linearly over time.<sup>21</sup> While financial markets were present by the early eighteenth century, they were suppressed later in the century by measures such as the Bubble Act, not repealed until 1825. The restrictions were due to the conviction that the corporate form was responsible for the politically and economically destabilizing effects of recurring speculation. In either case, whether capital markets were suppressed or merely undeveloped, the crowding-out argument loses some of its institutional underpinnings.

Moreover, it is not clear that what is commonly called the capital market—but is more accurately referred to as the market for financial instruments—*ever* functions to ensure allocative efficiency.<sup>22</sup> Even if the market is integrated, in the sense that prices in different geographical areas move together, it may or may not be performing neoclassical allocation functions efficiently or even adequately. Allocative efficiency requires that the market equate present asset prices with expected future returns through present value calculations. Empirical tests of both modern and eighteenth-century financial markets suggest that asset prices are too volatile to represent discounted expected future returns.<sup>23</sup> If the current interest rate in the asset market is not in fact a reliable guide to the present value of those financial assets, the comparison of returns which occurs in the crowding-out story cannot be made accurately.

To establish that crowding-out actually impeded Britain's industrial revolution, it also must be shown that the relevant industrial investment was sensitive to movements in an interest rate influenced by government borrowing. Much detailed historical work remains to be done to demonstrate exactly what the borrowing requirements of early entrepreneurs were, and how they were satisfied. But as we have indicated, evidence in published business histories suggests that they did not very frequently borrow long term, and that when they did the activity did not

<sup>20</sup> See fn. 19. One of us has argued that the conventional wisdom concerning fixed capital requirements is not firmly founded upon the historical record. See Philip Mirowski, *The Birth of the Business Cycle* (New York, 1985), chap. 8.

<sup>21</sup> See Mirowski, *The Birth of the Business Cycle*, chaps. 8–9, and his “What Do Markets Do?” (forthcoming, *Explorations in Economic History*).

<sup>22</sup> Mirowski, “What Do Markets Do?”

<sup>23</sup> Robert J. Shiller, “Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?” *American Economic Review*, 71 (June 1981), pp. 421–36; Robert J. Shiller, “The Use of Volatility Measures in Assessing Market Efficiency,” *Journal of Finance*, 36 (May 1981), pp. 291–304; and Philip Mirowski and Ken Weiller, “Rates of Interest in 18th Century England,” paper presented to the Harvard Economic History Workshop (Apr. 1984).

occur within an organized market of publicly traded claims to wealth.<sup>24</sup> Assuming that firms mainly borrowed short term, if at all, a case would need to be made that the long-term rate of interest in the government debt market directly influenced short-term local interest rates, and that these in turn substantially influenced the investment behavior of early entrepreneurs. While neoclassical theory tends to collapse this long sequence of causation into a simple supply-and-demand diagram, there is much room in the sequence for slips between cup and lip.

Ignoring the distinction between long- and short-term interest rates is especially problematic if the two did not move in tandem. In fact there were significant changes in the term structure of interest rates in the eighteenth century.<sup>25</sup> Examination of Table 1 reveals that if we define an inversion of the term structure in this period as years in which the nominal yield on short-term India bonds is greater than on the infinitely lived consols, there were 8 such inversions in 46 years, 4 in years of peace and 4 in years of war or transition from war to peace (the latter including, in 1802, the very short-lived Peace of Amiens). The temporal structure of interest rates thus cannot simply be assumed to have been fixed in regimes of either war or peace, and movements in long-term interest rates on government debt are not necessarily a reliable guide to movements in the interest rate which might be relevant for industrial investment.<sup>26</sup>

Finally, the overall question of the determinants of industrial investment must be raised. Given that the interest sensitivity of investment remains an unresolved controversy in twentieth-century economics, it seems heroic to inscribe an investment demand schedule with appreciable elasticity for the eighteenth century without comment or justification.<sup>27</sup> Other factors such as the expected rate of expansion of the market may be far more important in both periods. Williamson indicates

<sup>24</sup> See for example C. H. Lee, *A Cotton Enterprise, 1795–1840: A History of M'Connel & Kennedy, Fine Cotton Spinners* (Manchester, 1972), p. 147; W. G. Rimmer, *Marshalls of Leeds: Flax-Spinners, 1788–1886* (Cambridge, 1960), pp. 36–37, 46–47; Mary B. Rose, "The Role of the Family in Providing Capital and Managerial Talent in Samuel Greg and Company 1784–1840," *Business History*, 19 (Jan. 1977), pp. 37–54; and F. A. Wells, *Hollins & Viyella: A Study in Business History* (Newton Abbot, 1968), p. 43.

<sup>25</sup> Mirowski and Weiller, "Rates of Interest in 18th Century England."

<sup>26</sup> David Ricardo, who as a financier was well placed to be a credible witness, insisted that "the price of funded property is not a steady criterion by which to judge the rate of interest," by which he meant private loan rates. See David Ricardo, *On the Principles of Political Economy and Taxation*, vol. 1 in P. Sraffa, ed., *The Works and Correspondence of David Ricardo* (Cambridge, 1951), p. 298.

<sup>27</sup> Williamson, "Why Was British Growth So Slow?" p. 691. Surveys of problems with estimating the interest elasticity of investment can be found in J. W. Elliott, "Theories of Corporate Investment Behavior Revisited," *American Economic Review*, 63 (March, 1973), pp. 195–207; and J. F. Helliwell, ed., *Aggregate Investment* (Harmondsworth, 1976). A more recent study expressing skepticism about the importance of interest rates for investment is Peter Clark, "Investment in the 1970's: Theory, Performance, and Prediction," *Brookings Papers*, 1 (1979), pp. 73–113.



that the relationship between the interest rate and industrial investment might be weak, in that he suggests “building and construction were the victims of crowding-out. . . .”<sup>28</sup> His suggestion is based both on Ashton’s discussion in *Economic Fluctuations in England* and on recent work on twentieth-century investment functions which indicates that monetary policy may have some of its strongest impact on the construction sector. While plausible for the twentieth century, in part because of the particular institutions which have developed as the primary source of finance for house-building, the thesis is much more questionable in an eighteenth-century context. Buildings generally were financed by mortgages arranged in local areas by money scriveners and attorneys in markets segmented by local ties, tradition, and provincial prejudice.<sup>29</sup>

More importantly, however, buildings and structures are not thought to comprise a significant proportion of *business* investment in that period, and many businesses made use of existing structures, particularly in their early development. Even if some interest-sensitivity of house-building and construction were to be established, this would not account for retardation of Britain’s *industrial* revolution. Two crucial aspects of the industrial revolution are the eventual dominance throughout the economy of a new organizational form—the capitalist enterprise employing wage-labor in pursuit of the expansion of value—and the increasing importance of new industrial sectors. The organizational distinctions tend to be submerged in neoclassical theory, which sees the problem to be explained in terms of the industrial revolution primarily as a quantitative change in rates of output growth rather than a qualitative transformation.

Housebuilding and construction at the time of the industrial revolution remained in many respects a form of craft production rather than capitalist enterprise, and to that extent are not components of the industrial investment we argue should be the focus of attention. They represent, however, a very large share of commonly used investment figures. As Williamson observes (*Did British Capitalism Breed Inequality?*, p. 170), building and construction constitute 60 percent of the Feinstein figures for total gross domestic fixed capital formation in the 1760s and 68 percent in 1801–1810. (A portion of the building and construction, moreover, is public rather than the private spending subject to crowding-out.) Indirect effects of an interest-rate-induced drop in building or construction on the relevant industrial investment—through raising the cost of living and wages for industrial workers, or

<sup>28</sup> Williamson, “Why Was British Growth So Slow?” p. 693.

<sup>29</sup> Miles, “The Money Market in the Early Industrial Revolution”; B. L. Anderson, “Provincial Aspects of the Financial Revolution of the Eighteenth Century,” *Business History*, 11 (Jan. 1969), pp. 11–22; and B. L. Anderson, “Money and the Structure of Credit in the Eighteenth Century,” *Business History*, 12 (July 1970), pp. 85–101.

impeding the development of transportation networks that would extend markets—are conceivable but remain to be demonstrated.

The neoclassical focus on aggregate growth rates is related to the theory's underlying vision of the economy (after as well as before the industrial revolution) as a system of consuming household units rather than a system of accumulating firms. In an alternative view of the economy, the most significant phenomena to be explained in the late eighteenth and early nineteenth centuries are not macroeconomic growth rates of output of goods and services as conventionally measured, but magnitudes relating to processes of accumulation of value, and the qualitative changes in organizational forms reflecting the emergence during the period of a system of units of industrial capital dedicated to the expansion of value. By value we mean the abstract property of a commodity which makes it exchangeable with all other commodities, and only exists in the context of an ongoing system of exchanges in which it is socially recognized and reproduced. Forms of value such as merchant and financial capital preceded the late eighteenth century, but that period witnessed significant changes including the rise of industrial capital.

The most relevant magnitudes for understanding these processes include rates of profit and sales and their determinants. Long-run accumulation of value is constrained, if at all, primarily by limits to the expansion of the market—which generates the funds for ongoing investment—rather than by availabilities of physical factors of production. In early capitalist development, an important means by which capitalist producers expand their markets is competitive destruction of domestic, craft, or petty producers. In our view, aggregate growth rates which combined a rapidly growing capitalist sector and a declining noncapitalist sector would obscure key aspects of the development process.

The second major category of problems with the crowding-out argument concerns the fact that it represents very much a closed-economy story imposed upon an historical milieu where international considerations were critical. The supply-and-demand curves for saving and investment are predicated upon a crucial *ceteris paribus* condition that aggregate resources are fixed from the vantage point of the actors. But in a number of ways this was not true of eighteenth-century Britain. Most importantly, the source of funds which the British government could tap was not restricted to Great Britain (or the United Kingdom). British government instruments were purchased all over Europe. This was a cause of concern to many eighteenth-century writers, because they feared the power that debt ownership might confer upon other nations, especially the Dutch. While Dutch holdings of English bonds were often exaggerated, Alice Carter in a painstaking examination of the issue has estimated the proportion held by the Dutch as roughly

one-quarter of the total English debt at the end of the Seven Years' War.<sup>30</sup> There is some indication that the Dutch fled from the English bonds in the 1780s, but this is all the more significant for the crowding-out argument, as it suggests that movements in the interest rate were as much the product of international political realignments as of British government borrowing in a resource-constrained context. The closed-economy vision underlying the argument is further undermined by the fact that the British not only sold but bought debt instruments internationally.<sup>31</sup>

Even within the domestic economy, the neoclassical conception of closure is problematic and raises a third set of objections to the crowding-out argument. The economy is viewed as a fixed (or smoothly increasing) pool of resources which in the normal operations of the economy will be maintained at full employment by the price mechanism. Williamson asserts that "the full employment assumption is the best description of Britain during the industrial revolution, certainly when attending to a period as long as three to six decades."<sup>32</sup> This assumption, in one form or another, is present in most neoclassical models, and little effort generally is made to make the assumptions of such models "realistic." The issue here, however, is not merely the realism of particular assumptions, but the methodology employed. One could certainly point to historical evidence which at the least bears further consideration, such as the provision of poor relief to unemployed workers (among others) or the Luddite riots during the period. The crowding-out arguments, however, rule out the very evidence that would falsify them; they (and the models constructed to "test" them) are premised upon a fixed pool of resources which then is subject to optimization calculations on the part of the actors. In other words, the actors find it impossible to alter equilibrium levels of aggregate output through their actions. This, of course, is what has long been referred to as Say's Law.

Once this premise is accepted, the economy is portrayed as a zero-sum game; if the government uses the resources, the business sector cannot. The entire theory is contained in the initial assertion that the economy consists of a pool of resources which is fully utilized. But aggregate economic activity, and especially activity by the agents of the

<sup>30</sup> Alice Clare Carter, *Getting, Spending and Investing in Early Modern Times* (Assen, 1975), p. 39. See also William Fairman, *An Account of the Public Funds*, pp. 227, 229–31, on foreign holdings of British public debt. According to Fairman, foreign holdings decreased considerably between 1762 and 1824.

<sup>31</sup> Williamson does mention the possibility of net foreign investment in *Did British Capitalism Breed Inequality?* (p. 179), but the brief discussion there does not satisfactorily resolve the question. For further treatment of international factors during the period, see Larry Neal, "Integration of International Capital Markets: Quantitative Evidence from the Eighteenth to Twentieth Centuries," this JOURNAL, 45 (June 1985), pp. 219–26.

<sup>32</sup> Williamson, "Why Was British Growth So Slow?" p. 699.

industrial revolution, may well have been influenced by the level of government spending and by indirect effects of the war upon commerce.<sup>33</sup> Henry Thornton, the leading expert on the debt in the Napoleonic War period, was mindful of these possibilities as early as 1802. In contrast to many contemporaries, Thornton did not believe in a strict quantity theory of money (and therefore would have been sceptical of Say's Law). He also understood that bank loans which augment the means of payment may stimulate output rather than raise prices if they are increased in the context of unemployment.<sup>34</sup> His assessment of the first phase of the French Wars was as follows:

War, on the contrary, may be supposed to lessen the amount of general payments, or, at least, to check their growth, so far as it obstructs the accumulation of wealth and the natural progress of commerce. We know, however, that during the late war, the amount of our exported and imported articles continued greatly to increase. This happened, no doubt, partly through the general tendency of trade to enlarge itself, partly from the advantages resulting from some new colonial acquisitions, and partly from the circumstances of the commerce of our competitors having been still more interrupted than our own. . . . If we take into consideration all the points which have been touched upon, there will appear sufficient reason to believe, that, during the late war, a very considerable and progressive augmentation of the payments of the metropolis must have taken place.<sup>35</sup>

At the very least, then, a more careful consideration of employment and labor markets, as of financial markets, during the period is warranted. The period in question is precisely when the industrial labor force was in the process of being constituted and institutions resembling modern labor markets were evolving. As Pollard has emphasized, "the vast sectoral shifts in employment and the absorption of millions of additional workers between 1750 and 1850 took place in a multitude of related markets, some only very tenuously related, rather than in a single labour market."<sup>36</sup> In such an historical context, where both labor

<sup>33</sup> For a Keynesian argument emphasizing utilization of unemployed resources, see J. L. Anderson, "A Measure of the Effect of British Public Finance, 1793–1815," *Economic History Review*, 2nd ser., 27 (Nov. 1974), pp. 610–19. This argument is criticized by Joel Mkooy and N. Eugene Savin, whose view of the period emphasizes the impact of supply-side shocks upon an economy with less than perfectly adjustable resources and nonfarm prices. See their "Stagflation in Historical Perspective: The Napoleonic Wars Revisited," in Paul Uselding, ed., *Research in Economic History*, vol. 1 (Greenwich, 1976), esp. pp. 208–9.

<sup>34</sup> This interpretation is summarized in Joseph Schumpeter, *A History of Economic Analysis* (Oxford, 1954), p. 723. Note also the general disbelief in real-resource theories of the interest rate during the industrial revolution: "The refusal to link the rate of real saving with the rate of interest is the outstanding feature of the interest theory of the Eighteenth Century"; see also J. M. Low, "The Rate of Interest: British Opinion in the Eighteenth Century," *Manchester School*, 22 (May 1954), p. 137.

<sup>35</sup> Henry Thornton, *An Enquiry into the Nature and Effect of the Paper Credit of Great Britain* (London, 1802), p. 237.

<sup>36</sup> Sidney Pollard, "Labour in Great Britain," in Peter Mathias and M. M. Poston, eds., *The Cambridge Economic History of Europe*, vol. 7: *The Industrial Economies: Capital, Labour, and Enterprise* (Cambridge, 1978), part 1, p. 105.

supply and labor demand are far from homogeneous, a crowding-out argument requires some evidence that the types of workers employed as a consequence of government spending (for example, adult male soldiers) would otherwise have been employed by private industrialists (many of whom were hiring women and juveniles).

The composition of government spending is relevant as well as its aggregate level. In a general equilibrium model whose assumptions (rather than analysis) assert that government spending cannot influence the current level of output, tracing what the government does with the money it borrows does not assume major importance, except perhaps for welfare and equity considerations.<sup>37</sup> But this question could be critical for understanding the dynamics of an industrial revolution entailing changes in the sectoral composition of output as well as its aggregate level. The government might be extracting funds from an economy mired in spending patterns heavily weighted toward Adam Smith's "unproductive" pursuits, and spending them on armaments, uniforms, and other products of the fledgling industrial sector.<sup>38</sup> Government spending may replace, if anything, capitalist (or perhaps landed rentier) consumption rather than private investment. Recent "pessimistic" evidence on consumption during the late eighteenth and early nineteenth centuries could reflect this phenomenon.<sup>39</sup> The intention here is not to argue that war in general is "good" for the economy, or that the historical evidence has been analyzed sufficiently to assess its various impacts in this particular case.<sup>40</sup> But any theoretical framework

<sup>37</sup> Williamson raises the issue of the composition of final demand in *Did British Capitalism Breed Inequality?* (p. 188) but argues that the evidence is sufficiently tentative that he is "forced to assume in what follows that military and civilian expenditures generated pretty much the same distribution of final demand for agriculture, manufacturing, mining and services." In his discussion of the effects of the method of financing the war (pp. 171–72) government spending unlike civilian capital formation is considered to have a zero social rate of return.

<sup>38</sup> Cf. Eric Hobsbawm, "The Crisis of the Seventeenth Century," in *Past and Present*, 5, 6 (1954); and Maurice Dobb, *Studies in the Development of Capitalism* (New York, 1963), esp. pp. 177–86.

<sup>39</sup> N.F.R. Crafts, "British Economic Growth, 1700–1831: A Review of the Evidence," *Economic History Review*, 2nd ser., 36 (May 1983), p. 198. These estimates are for real private consumption per head, not specifically for capitalists' consumption. O'Brien argues in his "The Impact of the Revolutionary and Napoleonic Wars, 1793–1815, on the Long Run Growth of the British Economy" (unpublished manuscript, 1983) that consumption (again, of the population at large) bore a major share of the burden of the wars (pp. 12–14). See also, however, G. N. von Tunzelmann, "The Standard of Living Debate and Optimal Economic Growth," in Mokyr, ed., *The Economics of the Industrial Revolution*, pp. 207–26, whose model assumes that saving is equal to profits and who points out that sacrifices in luxury consumption can allow simultaneously higher wages and higher growth.

<sup>40</sup> See O'Brien, "The Impact of the Revolutionary and Napoleonic Wars," for a balance-sheet approach to assessing the effects of the war in terms of major sectors, industries, and variables in the growth process (e.g., capital formation and labor supplies). Effects of war taxation are considered in Peter Mathias and Patrick O'Brien, "Taxation in Britain and France, 1715–1810: A Comparison of the Social and Economic Incidence of Taxes Collected for the Central Governments," *Journal of European Economic History*, 5 (Winter 1976), pp. 601–50.

which claims to assess the impact of war upon the economy should make room for the possibility—suggested in the historical literature—of government having positive as well as negative impacts upon the growth and transformation of the economy.

At issue, however, is not simply the empirical question of whether full employment is a realistic assumption; nor is the only alternative a more Keynesian model which dispenses with the full-employment assumption but retains the same basic conceptions of saving, investment, and economic growth. As John James points out in his recent essay, “CGE [computable general equilibrium] models have not been particularly successful in modeling the dynamics of economic growth.”<sup>41</sup> The treatment of saving and investment is recognized to be weak: “Even in quite sophisticated models, the savings-investment sector is not very well developed.”<sup>42</sup> One could point to the lack of theoretical coherence entailed in combining Walrasian endogenous saving-investment relations with Solow-style growth models. Moreover, as James goes on to observe:

Strictly speaking, this is not a full general equilibrium system because there is no direct feedback between the endogenous savings-investment rate determined in the simultaneous equations and the exogenous rate of increase of the capital stock in the Jones-style model or between the endogenously determined factor incomes in the Jones model and the exogenous shift in the savings rate due to changes in relative factor shares.<sup>43</sup>

Alternative conceptions of saving and investment exist, in which savings result from an accumulation process governed principally by the profit-seeking activities of capitalist firms rather than by the decisions of utility-maximizing households in a context of exogenously determined tastes, endowments, and technology.<sup>44</sup> Accumulation-based models incorporate feedback links which provide a better basis for analyzing economic development over long historical periods. At present, theories of accumulation share with neoclassical growth theory a tendency to focus upon the aggregative quantitative dimension (though in most

<sup>41</sup> John James, “The Use of General Equilibrium Analysis in Economic History,” *Explorations in Economic History*, 21 (July 1984), p. 234.

<sup>42</sup> *Ibid.*, p. 234, fn. 5.

<sup>43</sup> *Ibid.*, p. 243. The particular model to which James is referring is the Williamson-Lindert model in their *American Inequality* (New York, 1980). Similar points can be made concerning the model employed by Glenn Hueckel in his “War and the British Economy, 1793–1815: A General Equilibrium Analysis,” *Explorations in Economic History*, 10 (Summer 1973), pp. 365–96.

<sup>44</sup> See for example Donald J. Harris, *Capital Accumulation and Income Distribution* (Stanford, 1978); M. Kalecki, *Theory of Economic Dynamics* (1952; New York, 1968 printing of rev. 2nd edn.); David P. Levine, “Determinants of Capitalist Expansion,” *Economic Development and Cultural Change*, 30 (Jan. 1982), pp. 299–320, and his “The Theory of the Growth of the Capitalist Economy,” *Economic Development and Cultural Change*, 24 (Oct. 1975), pp. 47–74; Stephen A. Marglin, *Growth, Distribution, and Prices* (Cambridge, Mass., 1984); Joan Robinson, *The Accumulation of Capital* (London, 1956); and Josef Steindl, *Maturity and Stagnation in American Capitalism* (Oxford, 1952).

cases attempting to explain the determinants of a different magnitude—value rather than GNP). Much work remains to be done to incorporate qualitative change and uneven development into the theory. Such considerations are especially important for understanding periods such as the Napoleonic Wars, characterized above all by structural transformation in the economy.

#### CONCLUSION

The question of crowding-out during Britain's industrial revolution, and long-run supply-constrained arguments more generally, raise important questions concerning economic history, economic theory, and the interplay between them. This article is a first attempt both to examine available evidence concerning the historical record of Britain's economic growth and to explore some of the implications of different theoretical approaches. A simple test of the relation between government borrowing and interest rates does not support the crowding-out argument, and examination of the data sources reveals reasons for caution in the use of some of the readily available figures for British government debt during the industrial revolution. The crowding-out argument is rooted in one theoretical vision of the economy, the factor-allocation rather than the accumulation vision. But as we have argued, there are many institutional and theoretical reasons for finding the factor-allocation vision implausible, particularly at the time of the British industrial revolution.

Our aim is not merely to raise questions about some particular assumptions of neoclassical models. Indeed we wish to stress that there will never be a satisfactory direct test of the crowding-out hypothesis, due to the lack of aggregate annual time-series on saving and investment. Any indirect test would be accompanied by so many auxiliary hypotheses that the question of crowding-out could never be satisfactorily isolated on the level of the economy described by a general equilibrium model. Augmentation of the model with more detailed sectors would merely lead to the same situation one finds in the theory of demand when one allows all permutations of income and substitution effects: the theory then allows all possible outcomes. Neoclassical general equilibrium theory puts few restrictions upon, and therefore has little specific to say about, entire systems.<sup>45</sup>

We would like to propose an alternative research program, which among other things will allow more direct examination of the second link in the crowding-out argument, that between interest rates and business investment. Rather than attempting to use aggregative indices such as "capital stocks" or "national income," which for many series

<sup>45</sup> See Michio Morishima, "The Good and Bad Uses of Mathematics," in P. Wiles and G. Routh, eds., *Economics in Disarray* (Oxford, 1984), pp. 51–74.

are unavailable in any case, we propose the use of microeconomic records kept by the historical actors. In particular, while remaining mindful of the hazards, we would examine firm investment records in business accounts, posing the question as one of the specification of the sources of firm finance and its uses of funds. This alternative approach both focuses on the business firms which are the primary agents of accumulation and requires investigation of monetary and financial factors, which have never been well integrated into neoclassical models where money mediates consumption-oriented exchanges rather than being a central institution in the process of capital accumulation. Firms may be constrained by the amount of finance they can appropriate at any given time, and such liquidity crises may play an important role in investment and accumulation, particularly during war periods. In no sense, however, are such liquidity constraints the same as a zero-sum game with firms (and potentially the government) dividing up a fixed pool of physical resources. Moreover, the government's war financing could be *both* an obstacle *and* an opportunity for firms. It would not surprise us to find that during the Napoleonic Wars positive consequences resulted from the exigencies of the Income Tax, large international transfers of funds, and the need to create a broad and deep market for public debt. If so, disruptive financial events may have been offset not only by the aggregate demand effects of the wars but by the induced development of financial markets and of firms' organizational structures and accounting practices.