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Infinite Money and Infrastructural Power: Analyzing the Fiscal Determinants of English State Building, 1689-1789

Infinite Money and Infrastructural Power

ANALYZING THE FISCAL DETERMINANTS OF ENGLISH STATE BUILDING, 1689-1789

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Geographically limited with a small population and few resources, how did England achieve great power status by the close of the 18th century? Scholars have debated whether debt or taxes were the primary determinants of English state building. Using data from the European State Finance database this paper provides a systematic statistical study designed to disentangle the causal relationship between war, debt and taxes as determinants of English state building. The paper finds that debt not taxes best predicts English military expenditures. After demonstrating that war exhibits a strong positive correlation to increases in public debt the paper shows that debt increases provide the most robust indicator of future changes in taxation indicating the causal relationship: war → debt → taxes.¹

“The sinews of war are infinite money”
-Cicero

“War has but one certain and that is to increase taxes.”
-Thomas Paine

It has been assumed that Cicero's reference to “infinite money” referred to Roman taxing power, but in many early modern states taxing power was constrained by limited resources. Geographically limited with a small population and few natural resources how did the English overcome their finite resources to achieve great power status by the close of the 18th century? Scholars of early modern England such as P.M. Dickson, J. F. Wright, and P.K. O'Brien argued

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heavy borrowing best accounts for the development of the English state (Dickson 1967; O'Brien 2012; O'Brien 1983; Wright 1999). In contrast, John Brewer argued that increases in taxing capacity best explains the process of state building in early modern England (Brewer 1989). Using regression analysis the paper seeks to resolve the controversy by offering the first systematic statistical study designed to disentangle the causal relationship between war, debt and taxes as determinants of English state building.

The findings show that the English financial revolution which gave the state the ability to access near “infinite money” in the form of public debt allowed England to compete in great power war. Fiscal pressures from the debt burden in turn forced the English state to develop and maintain its extractive capacity (Dickson 1967; Wright 1999). The results demonstrate that the following causal relationship of War → Debt → Taxes best explains the process of English state building.

In the period following the Glorious Revolution to the start of the Napoleonic Wars, the English state was involved in an “almost continuous war with France” (Brewer 1989, 167; Dupuy and Dupuy 1977; Kiser, Drass, and Brustein 1993; Kiser and Linton 2001). At any given time the state possessed fixed resources and population from which to extract revenues. An outbreak of war often brought unexpected fiscal shocks that exceeded state extractive capacity. In England, wartime expenditures often exceeded the state's ability to tax its population (Dickson 1967, 10; Wright 1999). Brewer noted, “if the state were not to be driven into bankruptcy,” it was necessary, “that the administrative apparatus successfully obtain the vast sums necessary to cover the escalating costs of war” (Brewer 1989). In his pioneering 1967 study, The Financial Revolution, P.M. Dickson argued that a “system of public borrowing... [which] enabled England to spend on war out of all proportion to its tax revenue” was a primary cause of English

ascendancy in the 18th century (Dickson 1967, Storrs 2009, Wright 1999). A seemingly limitless borrowing capacity increased the war time capabilities of the English state.

Brewer challenged Dickson's claim that borrowing capacity determined British success in international politics, and instead argued, "that borrowing only paid for 30–40 percent of war costs across the long eighteenth century" (Brewer 1989; Neal 2000; Storrs 2009, 1-2; Wright 1999). Brewer's assertion of the primacy of taxes in explaining England's success in international conflict has not gone unchallenged. Recently many scholars have defended Dickson's focus on borrowing capacity. A recent outpouring of new scholarship on early modern England has provided greater nuance to the debate by examining the relationship between public debt and state building (North and Weingast 1989; Strasavage 2011; 2003; Yun-Casilla and O'Brien 2012). These scholars have sought to explain England's extraordinary 18th century borrowing capacity in terms of credible commitment; or the expectation that a state will make good on its fiscal promises.

North and Weingast, expanding on Dickson's original work, used the quantity of English public debt as an indicator that England's post-Glorious revolution constitutional structure increased the state's capacity to make credible commitments (North and Weingast 1989). Strasavage continued to investigate the relationship between perceptions of credible commitments and yields on government debt (Strasavage 2011). Offering a comparison of English borrowing capacity to that of pre-revolutionary France, as well as systematically measuring the impact of shifts in party control in the English parliament, Strasavage's findings convincingly supported the notion that England's borrowing capacity was strongly determined by its political institutional structure (Strasavage 2002; 2003, 72-84, 92-98). Placing England in a comparative perspective, Yun-Casilla and O'Brien (2012) have compiled a comprehensive

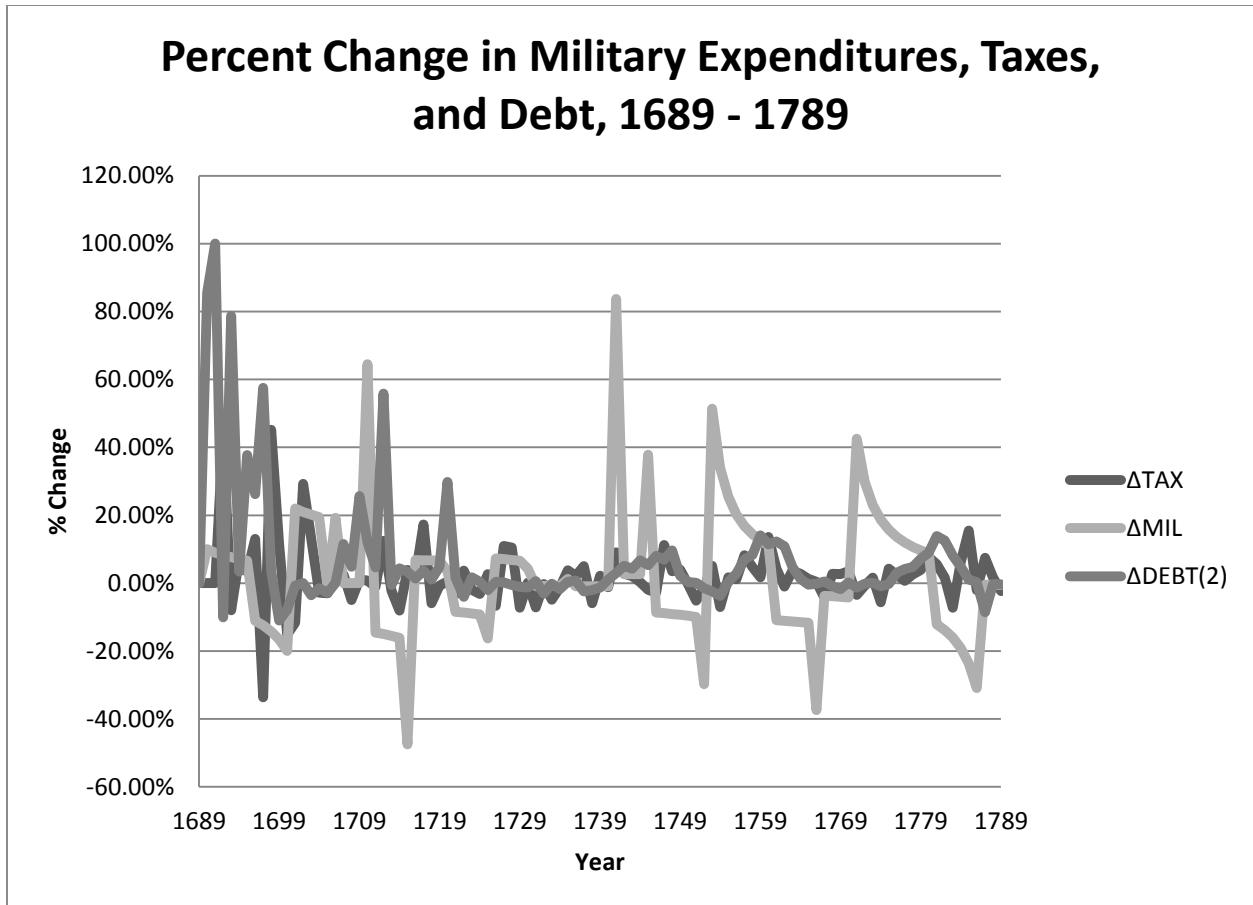
collection of scholarship on the global development of the fiscal-state from 1500-1914 (Yun-Casilla and O'Brien 2012). Their work confirmed England's comparative advantage in public finance during the early modern period.

While much of the scholarly work on early modern England focused on the state's capacity to make credible commitments, fewer studies have sought to measure the impact of public debt on the process of state building. Charles Tilly's hypothesis that "states make wars, and wars make states" has long stimulated the comparative state building research agenda (Ertman 1997; Spruyt 1994; Tilly 1990; Van Creveld 1999). An extensive literature has confirmed the positive relationship between war and state building (Brewer 1989; Downing 1992; Mann 1986; Porter 1994; Tilly 1985; Tilly 1990). Following Tilly, Michael Mann differentiated between the "despotic and "infrastructural" components of state power. Despotic power indicates the state's ability to exercise unchecked coercive authority. Infrastructural power denotes the ability of the state to penetrate into society (Mann 1989). Social scientists seeking to capture the infrastructural power of the state view, "Taxation [as] the best measure of effective political authority and institutional development augmenting the strength of the state as measured by the capacity to enforce centralized rule on a territory and its population" (Centeno, 103). The debate between Dickson and Brewer's account of English ascendancy turns on the origin of English infrastructural power and its causal relationship to war.

Kiser and Linton (2001) published the first study using regression analysis to measure the impact of war on the infrastructural power of the English state (Kiser and Linton 2001). The authors supported Brewer's position and found that a war dummy had a statistically significant positive correlation with future tax revenues. However, their study did not include English public debt as an independent variable. This omission perhaps caused Kiser and Linton to inadvertently

discount a more important explanatory factor in the development of the English state – the public debt.

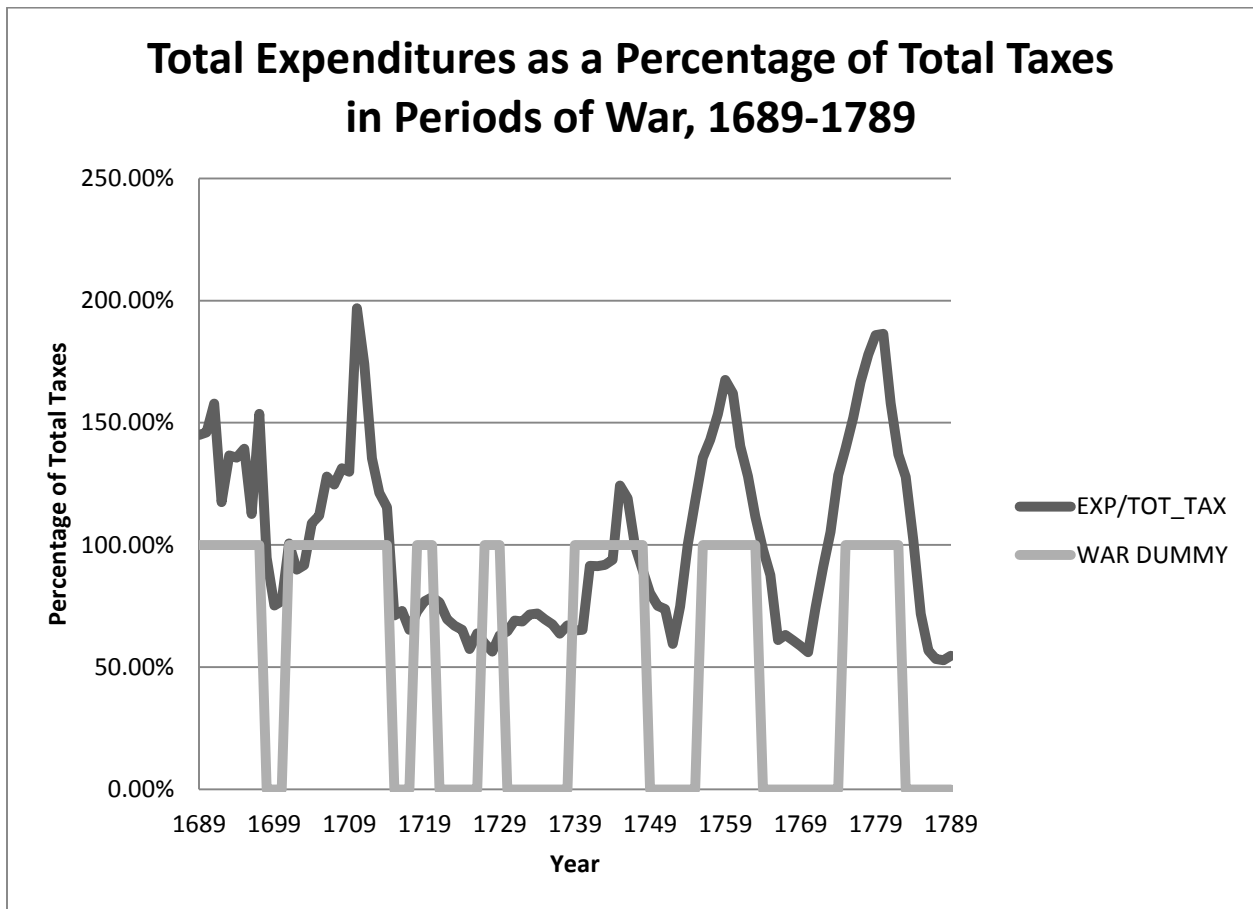
Increased military spending did not always produce subsequent tax increases. The following graph shows percent changes in military expenditures, taxes, and debt over the time series 1689-1789.



Taxing capacity took time to develop, and often lagged significantly behind spikes in military spending (Kiser and Linton 2001; Rasler and Thompson 1989; Wright 1999). Unlike most other European powers, the English state was not dependent upon taxation, “another way of extraction, viz. loans, was perhaps as consequential as taxes” (Wright 1999: 355-61). According to J.K. Wright, "Until 1799 Britain's eighteenth-century wars were financed by the incurring of debt:

and taxes were increased simply to pay the interest on the growing debt” (Wright 1999:355).² The nearly infinite supply of credit available to the English regime gave it a significant advantage in military mobilization and responsiveness.

In five of seven major conflicts during the period 1689-1789 expenditures well exceeded 100% of total tax revenues. The following graph shows English government expenditures as a percentage of total tax revenue in relation to major international conflicts.



Given that increased expenditures did not immediately cause tax increases, the growing public debt burden perhaps better explains the expansion of taxing capacity of early modern England; suggesting the following causal chain in the relationship between war and taxes: WAR → DEBT

² Wright 1999 concludes that to meet its demand for wartime borrowing “the British government was 90% dependent on British savings.”

→ TAXES. A closer look at the data suggests that England may have purchased its 19th century global dominance on its 18th century credit card.

The following sections of the paper will examine the impact of war on English public borrowing and taxation. The first section examines the “ratchet effect” in English public debt that coincided with increased borrowing during war. The second section of the paper utilizes regression analysis to demonstrate the effect of public borrowing on future tax returns.

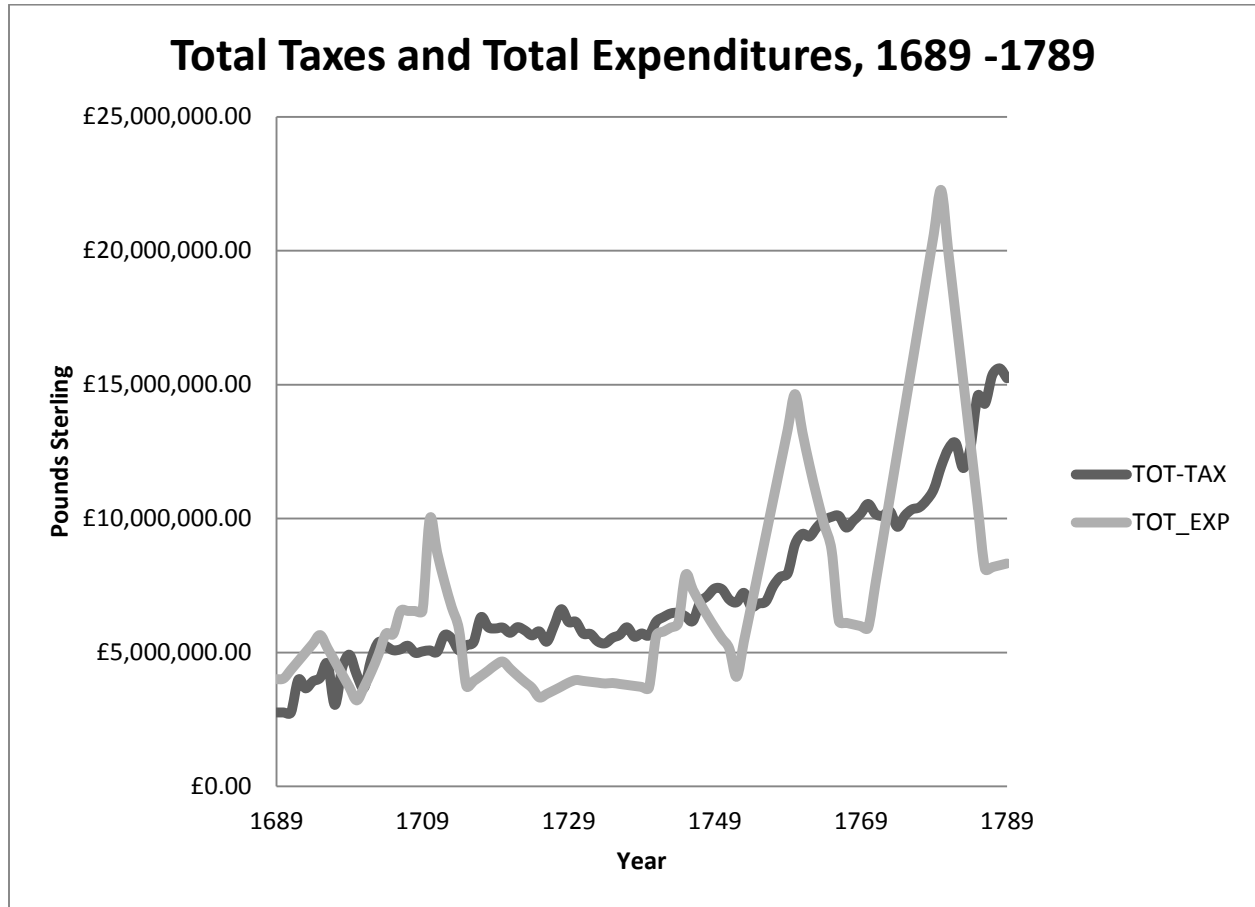
The Ratchet Effect:

Economists and political scientists studying the relationship between war and state building have identified 'ratchet effects' as important explanations of state growth (Ames and Rapp 1977; Higgs 1987; Porter 1994). The 'ratchet effect' hypothesis declares that after expanding to meet the increased demands of a war or crisis, the state does not return to its prewar levels. Cumulative years of conflict created long term fiscal pressures exacted by the demands for larger standing armies, more generous navies, and a more robust civil government capable of extracting larger shares a country's economic capacity.

Modern states possess only two legitimate means of financing current expenditures: [1] taxes, and [2] borrowing (Fisk 1920; Neal 2000).³ Previous quantitative studies of the relationship between war and state growth have found that “revenue increases lag behind expenditure increases in terms of magnitude and timing” (Rasler and Thompson 1989,144-45; Kiser and Linton 2001, 413). The following graph shows changes in total taxes as they relate to

³ It can be argued that early-modern states had three additional means of generating revenue, or evading financial obligations: [1] default [2] devaluation [3] sale of offices and lands. Default problems plagued early modern governments and damaged the credibility of many early European regimes including the English pre-1688. For a good treatment of the credit problems of the English Crown see: Harvey E. Fisk, *English Public Finance: From the Revolution of 1688*. (London: Bankers Trust Company, 1920)

changes in expenditures:



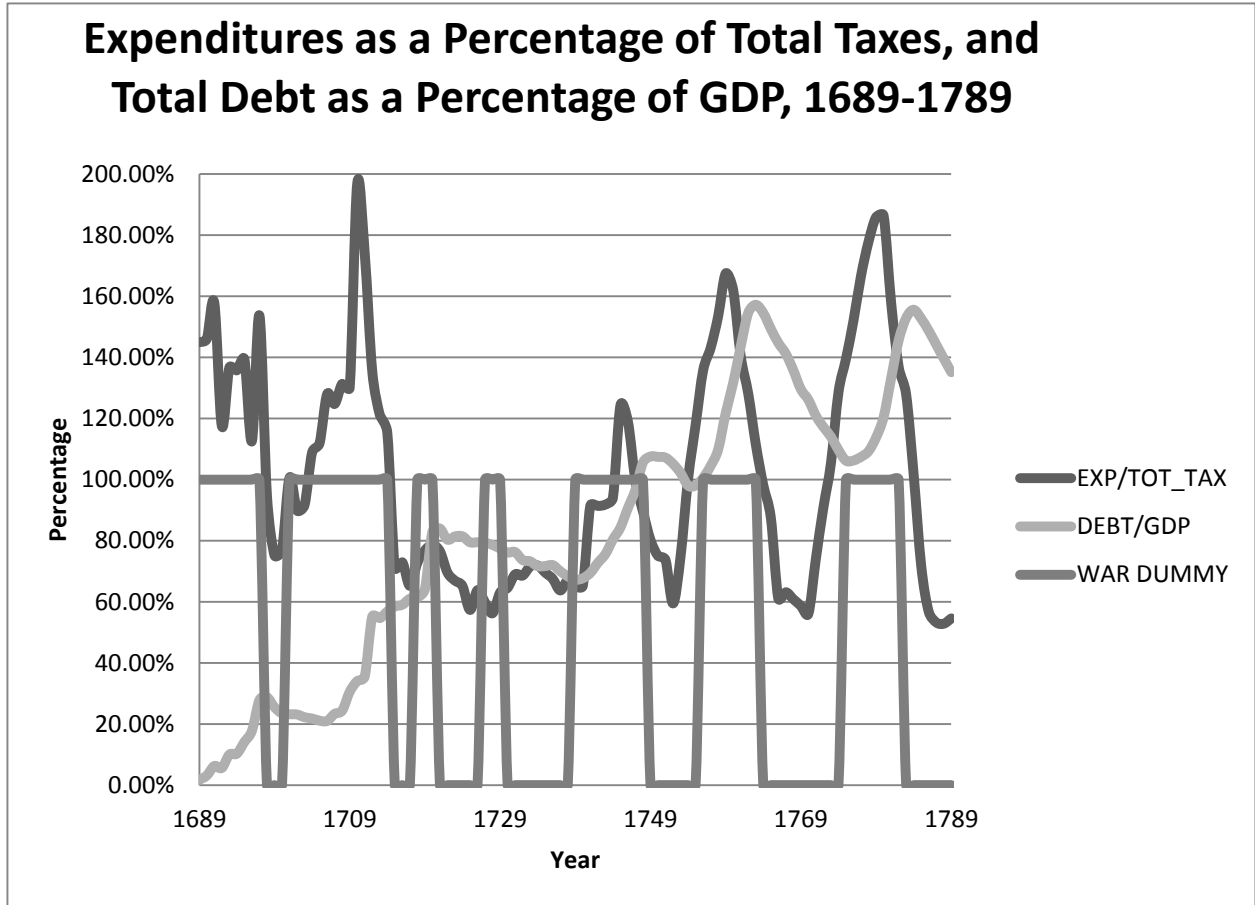
The graph shows that taxes increases often occurred well after expenditure increases, and never covered the full amount of deficit spending that correlated with periods of war.

War	Average Expenditures	Average Revenue	Average Deficit	Deficit/Revenue	Debt at Start	Debt at End
Nine Years	£5,456,555.00	£3,640,000.00	£1,816,555.00	50%	£0.00	£16,700,000.00
Spanish Succession	£7,063,923.00	£5,355,583.00	£1,708,340.00	32%	£14,100,000.00	£36,200,000.00
Austrian Succession	£8,778,900.00	£6,422,800.00	£2,356,100.00	37%	£46,900,000.00	£76,100,000.00
Seven Years	£18,036,142.00	£8,641,125.00	£9,395,017.00	109%	£74,600,000.00	£132,600,000.00
American Revolution	£20,272,700.00	£12,154,200.00	£8,118,500.00	67%	£127,300,000.00	£242,900,000.00

Source: O'Brien (1993); Mitchell and Deane (1962); Dickson (1967)

The preceding table demonstrates the relationship between war and public debt in five of England's major 18th century wars. The data shows that in each war England ran considerable budget deficits and relied heavily on debt financing. Fifty percent of the expenditures incurred during Nine Years War were financed by public debt instruments. The Wars of Succession forced England to finance about a third of government operations through the issuing of new debt. The Seven Years War represented the heaviest period of borrowing during the 18th century and the government deficits that were in excess of 100% of revenues.

It is not surprising that directly following the Seven Years War Parliament attempted to enact new excise taxes in its colonies. Attempts at tax increases following the Seven Years War had unintended political consequences which resulted in the costly operations of the War of American Independence. Fighting against the American rebellion forced the British Government to run large persistent budget deficits and led to a near doubling of the public debt over the course of the war. The data clearly shows that tax increases were related to war, but the more direct relationship between war and taxes was the increase of the public debt which occurred simultaneously with unexpected increases in military spending. The following graph shows the relationship between deficit spending and total levels of public debt.



A clear ratcheting of the public debt, as measured in terms of GDP can be seen as a direct consequence of unexpected wartime expenditure increases. At the end of the Nine Years War public debt levels reached less than 30% of GDP. Yet peace was brief, and the War of the Spanish Succession stimulated another round of extensive borrowing by the English Government. By 1714 public debt had climbed to over 50% of GDP. Spending following the war retreated to well under 100% of Tax revenues; and the debt to GDP ratio remained relatively stable until the 1740's. The War of the Austrian Succession once again forced the English to increase the public debt, and by the close of the conflict total public debt exceeded 100% of GDP.

By the end of the War of American Independence English public debt stood at over 140% of GDP (Mitchell and Deane 1962). The English tax burden stood at only around 8% of GDP, and the British government ran a budget deficit of approx. (-£4,700,000) or around 3% of

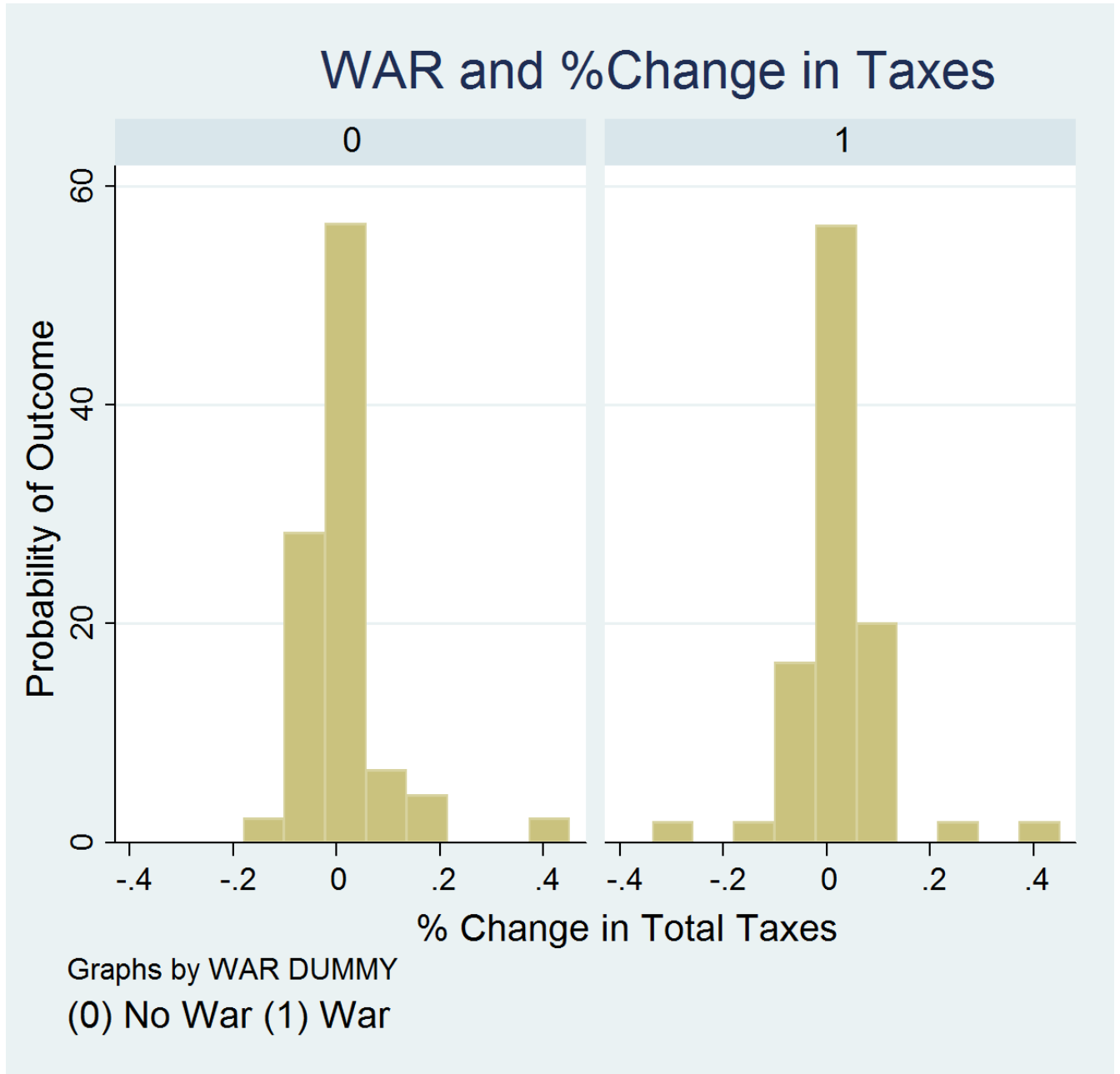
GDP (Michell and Deane 1962). England's ability to borrow “infinite money”, and thus increase expenditures independently of revenue constraints allowed the state to engage in major international wars for 55% of the period between 1689-1789. The next sections of the paper utilize statistical analysis and multivariate regression to examine the source of the observed ratchet effect.

The Direction of Causality: War → Debt → Taxes

Was England's success in war a result of taxing power or borrowing capacity? The previous section demonstrated the importance of borrowing to England's 18th century war efforts. Expenditures well exceeded tax revenues in five of the seven great power wars England participated in during the 18th century. In order to evaluate the mechanisms responsible for the ratchet effect and contributing to the growth of the English state this paper draws on previous quantitative studies of English state finances. Using tax and expenditure data from O'Brien and Hunt's (1992) data-set in the *European State Finance Database*, which includes revenue and expenditure data based on 11-year moving averages set against deflated index numbers (O'Brien and Hunt 1992). Estimates of military and civil government expenditures were taken from the same study (O'Brien and Hunt 1992). Public debt data was taken from Mitchell and Deane's (1962) *Abstract of British Historical Statistics*. The time-series extends from (1688-1789) bounded by two political revolutions that defined the 18th century, the Glorious Revolution of 1688 in England and the French Revolution in 1789.

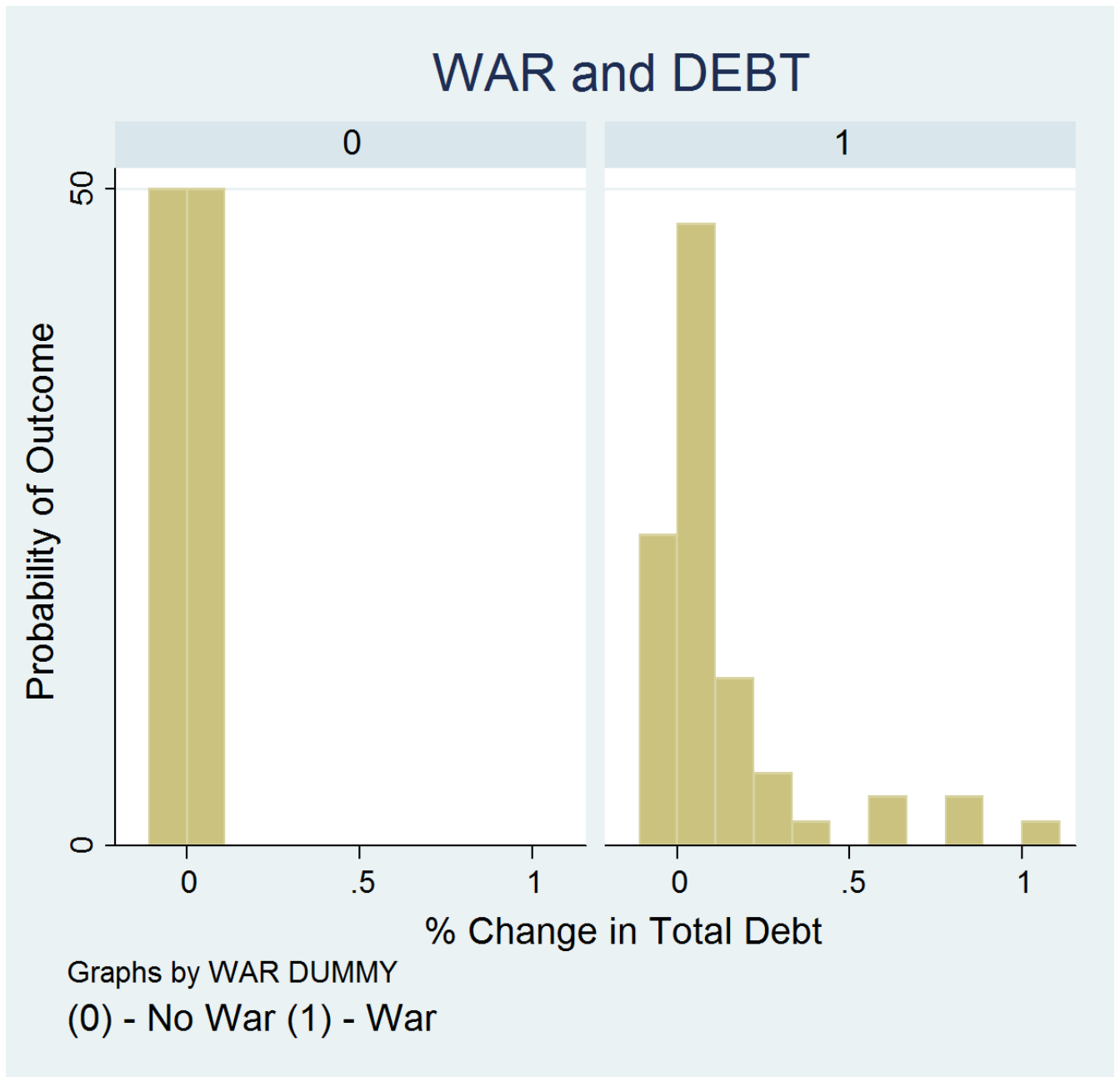
If taxation were responsible for English success, as Brewer has argued, we should expect taxation to increase with the outbreak of war to help cover the increase in military expenditures. The following graph shows the relationship between the percent change in tax revenues and war.

The graph shows that war seems to be uncorrelated with changes in English tax revenue.



In both periods of war and peace taxes increased slightly in over 50% of observations. In both periods there were large increases in tax revenue. During war taxes exhibited significant volatility, suggesting that the causal relationship between war and taxes may be the function of an intervening variable.

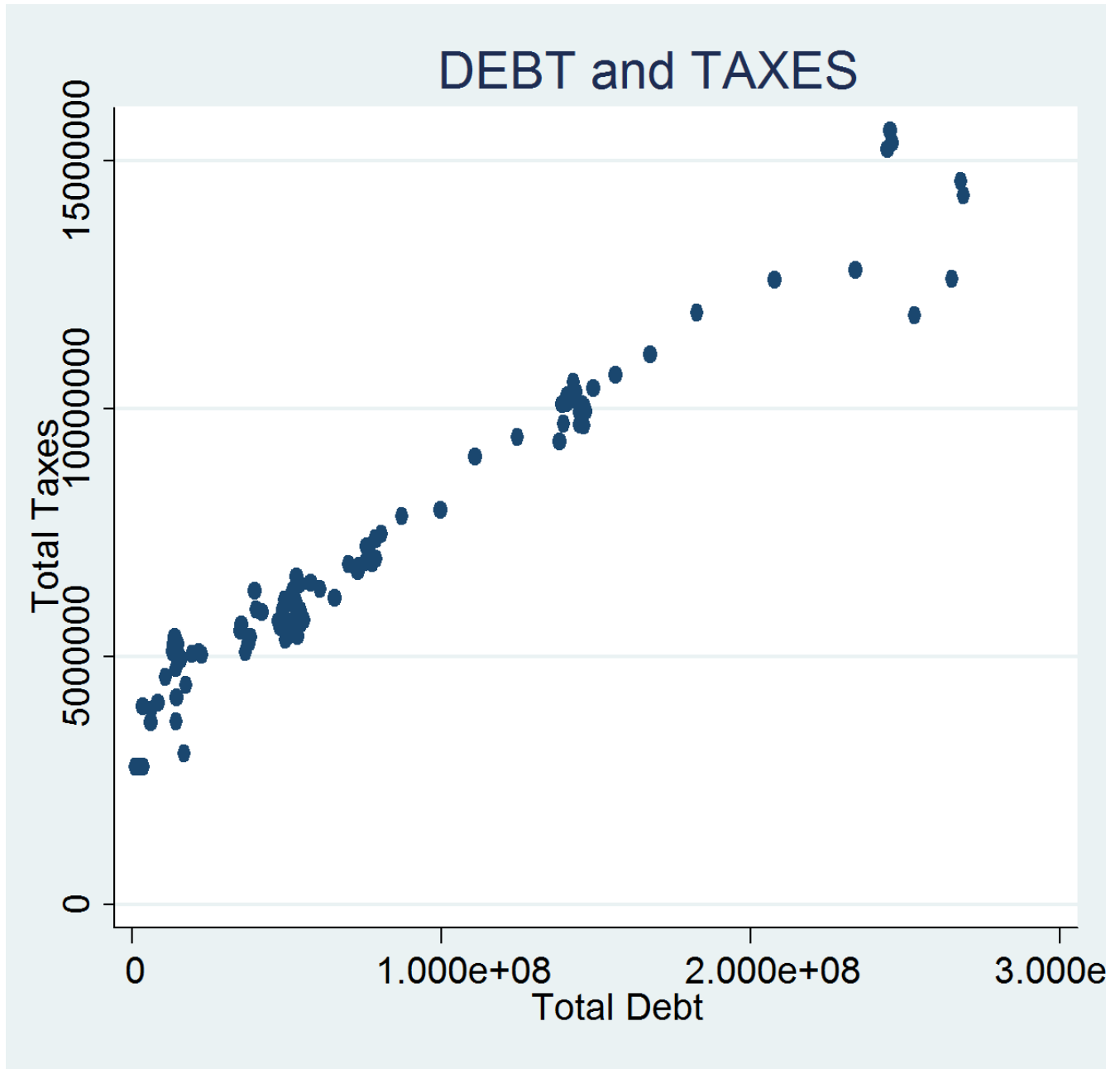
The next graph shows the relationship between war and percent changes in English public debt.



During periods of war public debt increased in over 70% of all observations, in some observations debt levels jumped by over 50%. During periods of peace the debt increased slightly for 50% of all observations, and decreased slightly for 50% of observations. The

distribution suggests that war had a direct causal effect on levels of public debt. During periods of war the English state borrowed heavily, and made only minimal efforts towards repayment in times of peace. War seems to be positively correlated with increases in debt, but uncorrelated with changes in taxation. Do higher levels of debt account for the subsequent increase in taxes?

The following graph shows the correlation between increases in public debt and increases in taxes.



The correlation between increases in public debt and increases in taxes is .96. This high correlation coefficient suggests a strong causal relationship between debt and taxes. These findings support the claim that, “taxes were increased simply to pay the interest on the increased debt” (Wright 1999, 355).

Regression Analysis: Disentangling the Causal Path

In order to further support the hypothesis that England's military capabilities were more strongly determined by borrowing than taxes the following regression used military expenditures as the dependent variable, and total taxes and total debt with a one year lead as the independent variables. Both total taxes and total debt are expected to have a positive statistical relationship with military expenditures. The following regression uses ordinary least squares (OLS) to measure the impact of total debt and total taxes on military expenditures.

Table 2: OLS Regression – Determinants of Military Spending					
Dependent Variable = Military Expenditures.			Independent Variables = Total Tax lead t_1 , Total Debt lead t_1		
OBS = 100		$R^2 = 0.43$	F = 36.13		Prob > F = 0
Variable	B	Std. Error	t-score	P>	t
Total Tax F1.	-0.24	0.51	-0.47	0.64	
Total Debt F1.	0.05	0.02	2.2	0.03**	
_cons	3549957	2031451	1.75	0.08	
Source: O'Brien (1993); Mitchel and Deane (1962)					

The results demonstrate that total debt increases were a significant predictor of military expenditure increases, while total tax revenues lacked statistical significance. Debt, not taxes, seemed to be the source of English military capability from 1688-1789 (Dickson 1969; Wright 1999).

To test the impact of war on taxes percent change in total taxes was used as the dependent variable. A war dummy variable that took dichotomous values when England was involved in major wars was used as an independent variable. The following wars were included: The Nine Years War (1689-97), The War of the Spanish Succession (1701-14), The War of the Quadruple Alliance (1718-20), The Anglo Spanish War (1727-30), The War of the Austrian Succession (1739-48), The Seven Years War (1756-63) The War of American Independence (1775-82)

(Dupuy and Dupuy 1977; Kiser, Drass, and Brustein 1993). Change in the level of public debt was used as the other independent variable. Both variables were lagged by one year to specify the causal ordering. Changes in debt were expected to correlate positively with change in taxes. The outbreak of war was expected to have a positive correlation with changes in taxes. The following table displays the results.

Table 3: OLS Regression – Determinants of Changes in Taxation					
Dependent Variable = Change in Total Tax Revenue			Independent Variables = War Dummy lag t ₁ , Change in Debt lag t ₁		
OBS = 100		R ² = 0.16	F = 9.14		Prob > F = 0.00
Variable	B	Std. Error	t-score	P>	t
War Dummy L1.	0.003	0.19	0.20	0.84	
ΔDebt L1.	0.208	0.05	3.90	0.00***	
_cons	0.005	0.01	0.40	0.69	
Source: O'Brien (1993); Mitchel and Deane (1962)					

The war dummy lacked statistical significance demonstrating that changes in taxes were not a direct consequence of international conflict. Changes in debt levels, however, were statistically significant at the .05 level, and increases in debt correlated positively with increases in the level of taxation. Changes in taxation did not predict levels of military spending, but changes in debt predicted changes in future levels of taxation. This provides further evidence to support the importance of public debt in the process of state building.

To test for the independence of debt and taxes the same model was run again. This time with percent change in debt serving as the dependent variable, and percent change in taxes and the war dummy as independent variables. Changes in taxes were expected to have no statistical relationship with changes in debt. War was expected to have a significant positive correlation with percent changes in debt. The following regression estimated changes in debt as a function of lagged war dummy and lagged tax changes.

Table 4: OLS Regression – Determinants of Changes in Debt					
Dependent Variable = Δ Debt			Independent Variables = War Dummy lag t_1 , Δ tax lag t_1		
OBS = 100		$R^2 = 0.17$	F = 10.03		Prob > F = 0.00
Variable	B	Std. Error	t-score	P>	t
War Dummy L1.	0.14	.03	4.07	0.00***	
Δ Tax L1.	0.28	0.17	1.59	0.12	
_cons	-.01	0.02	-.051	0.61	
Source: O'Brien (1993); Mitchel and Deane (1962)					

Here the war dummy was statistically significant with a strong positive correlation to increases in the level of public debt. Tax increases lacked statistical significance. War predicted debt. Debt predicted taxes. These findings strongly indicate the causal relationship: WAR→DEBT→TAXES.

A final multivariate regression analysis supports the general conclusion that public debt was the most important determinant of future English tax revenues. The dependent variable chosen was the level of tax revenues at time-t as expressed, because it is the best measure of the infrastructural power of the state, and of direct concern to the causal relationship investigated by the research. Independent variables include total expenditures, total debt, GDP, and the War Dummy. Total expenditures should have a positive relationship with total taxes. Total debt should also be a driver of increases in tax revenue. Increases in GDP should be positively correlated as should the War Dummy. All independent variables were lagged in order to specify the proper causal ordering. Of primary concern was measuring whether war or debt was a stronger determinant of future revenue extraction capacity. The following regression equation was estimated using OLS: Y (total taxes) = β_0 + β_1 [L1. Total Expenditures], + β_2 [L1. Total Debt] + β_3 [L1. GDP] + β_4 [L1. War Dummy].

Table 5: OLS Regression – Determinants of Total Taxation					
Dependent Variable = Total Tax Revenue			Independent Variables = Total Expenditures lag t ₁ , Total Debt lag t ₁ , GDP lag t ₁ , War Dummy lag t ₁		
OBS = 100		R ² = 0.96	F = 665.8		Prob > F = 0.00
Variable	B	Std. Error	t-score	P>	t
Total Expend L1.	0.24	0.02	1.01	0.32	
Total Debt L1.	0.04	0.00	13.06	0.00***	
GDP L1.	0.01	0.01	0.85	0.40	
War Dummy L1.	212849.80	152095.70	1.4	0.17	
_cons	3413273.00	294344.30	11.6	0.00	
Source: O'Brien (1993); Mitchel and Deane (1962)					

Total expenditures were not statistically significant indicating that the tax system was not perfectly responsive to increased fiscal demands. The lack of any significant correlation between total revenues and GDP suggests that increased taxing capacity was not simply a consequence of economic growth. While economic growth was certainly an important condition allowing the English populace to support a larger government, controlling for borrowing, and war, the growth of government did not occur as direct consequence of economic prosperity. War also failed to predict increases in tax revenue, as the war dummy was not statistically significant. Of all the independent variables only total debt served as a statistically significant predictor of future tax revenues. This confirms that debt was the primary driver of state building in the English case.

Conclusion

The ratchet effect observed by many scholars of early modern state building may be a result not of continuous exposure to war, but of continued pressure from mounting debts resulting from war. From the data it is clear that Britain used times of peace to engage in only minimal repayments of the public debt. Only between the War of Austrian Succession and the

Seven Years did the Exchequer engage in any significant debt reduction. Quantitative analysis of the relationship between tax revenues, war and public debt demonstrates that increases in debt may be the most significant determinant of long-run state growth as measured by the state's capacity to extract resources. England engaged in both near constant war and near constant borrowing throughout the 18th century.

Disentangling the causal relationship between these two contributory factors helps provide a broader understanding of the necessary conditions for state formation. The significance of public debt as an indicator of long-run tax increases suggests that bellicosity may not be a requisite characteristic for future state development. Incurring of debts for the purposes of internal improvements, or social welfare programs may also put similar pressures on states to develop more efficient means of revenue extraction, and promote the expansion of infrastructural power.

The ability to raise revenues independent of taxes allowed England to respond flexibly to exogenous political shocks. Greater borrowing capacity augmented infrastructural power helping the state overcome fiscal constraints. The nearly infinite supply of credit available to the English regime gave it a significant advantage in military mobilization and responsiveness. The government was always able to borrow more money. Access to '*infinite money*' may explain much of England's rise to dominance by the close of the 18th century.

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