SUSTAINABILITY OF FISCAL DEBT THEORY

In History Of Thought; An Examination of the States;
And a Comparative Analysis of Panel Estimation

by

Erik M. Bell

Abstract: The over-all themes for this collection of papers is the sustainability of fiscal debt theory. Paper One examines a debate amongst classical economic theorists on 18th-century United Kingdom's use of public credit and links those arguments for use of public credit with modern day sustainable fiscal debt theory; Paper Two examines the U.S. States as one public sector in a federal system of government and tries to ascertain under what circumstances the States implement sustainable fiscal policies with respect to their level of debt; Paper Three compares estimating a times-series–cross-section panel data set with three estimation techniques: fixed-effect generalized least squares, two-stage feasible generalized least squares, and ordinary least squares using panel corrected standard errors.

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Dedication

In loving memory of Narvell Bell. Betty and Karen Bell without whom support and words of encouragements this would not have been possible. Elizabeth, I am forever grateful for your kindness and generosity. MissEy and Petey my four-legged friends, you have provided me with much needed relief and entertainment. And to my neighbors in 2407 who showed kindness and generosity when it was most needed, I thank you all from the bottom of my heart.

PREFACE

The classical theorists Adam Smith and David Ricardo were successful in overthrowing the then perception that surplus was only generated from the land and the imposition of mercantilistic trade policies through their use of rational applied analytical models. When they were in discussions on issues of public finance with proponents of the use of state credit in which 18th-century England was used as a successful case and point, the English classical theorists in the first paper of this series of papers on sustainability of public debt theory will be shown to be unable to approach this subject rationally and in the course of their discussions mistaken the proponents arguments of sustainability as one proposing invariance between tax and borrowing finance by the public sector. This classical discussion is linked to modern day development of sustainability of public debt theory that arose from modern day invariance theory. The second paper in this series examines the U.S. States' governments as one sector and tests whether or not this public sector implements sustainable fiscal policies with respect to its level of debt. The U.S. has a unique federal system in which the federal government neither assumes responsibility for the debts contracted by the states nor guarantee the states a set level of income. Analyzing the States' governments as one sector has implications for how the two largest public sectors in the economy behave in the economy. The last paper in this series compares the empirical results from 3-types of regression estimating techniques analyzing times-series–cross-section panel data. This paper contributes to the discussion of how best to approach the modeling of panel data given the limits and theoretical drawbacks of the various regression approaches.

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Chapter 1

SUSTAINABILITY THEORY IN A HISTORY OF THOUGHT DEBATE

> . . . The topic of public debts, though interesting from the standpoint of economic sociology and also from the standpoint of financial technique, is of little moment for us, because judgment and advocacy greatly prevailed over analysis. Therefore it will suffice to say that many authors tried hard to discover desired effects that might be attributed to public borrowing. Some indeed went so far as to make them a factor in national prosperity.[Footnote: This was done, e.g., by Isaac de Pinto, *Traité de la circulation et du crédit*, 1771. But this line of thought had many adherents, especially in France.] – Joseph A. Schumpeter

1.1 Introduction

Upon the 1974 publication of Robert Barro's seminal work: "Are government Bonds Net Wealth" in the *Journal of Political Economy*, a long-debate on the effects of government borrowing on the private- and household-sectors of the economy that had been simmering on the back-burners was moved to the fore. With the new found attention of all the top academic and practitioner economists, recent developments in analytical models such as Paul Samuelson's over-lapping generations model[1], and the application of numerous empirical techniques aided by the development of the microcomputer, all these developments were used to investigate and test the effects or consequences stemming from public borrowing on the household and private sectors. A direct result from this investigation was the development of

[1] Samuelson, Paul A. "An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money," *Journal of Political Economy*, Vol. 66, No. 6 (December 1958), 467-482.

sustainability theory with its central tenant being "when a government runs a deficit, is it making an implicit promise to creditors that it will run offsetting surpluses in the future?"[2]

Returning to the initial reception of Barro's article, Buchanan (1976) criticized Barro for the lack of acknowledgment to some of the previous scholars who articulated a theory of invariance between tax and debt finance. Barro, in trying to correct this lack of over sight, decided to pay homage to whom he believed to be its rightful creator, David Ricardo, and thus named invariance theory after him calling it the Ricardian Equivalence Theory. This attempted acknowledgment then lead to two more debates but this time only in the field of history of economic thought. The lesser known of these debates is the conference of the title of originator of invariance theory. As noted by Buchanan (1958) and, in direct response to Barro, Hakes and McCormick (1996), Adam Smith had articulated a theory of invariance in the Wealth of Nations (1776). Even though Ricardo's presentation of invariance theory was much more align with Barro's theoretical presentation of invariance theory and thus easier to comprehend than Smith's, the intimate association of Ricardo's name with invariance theory had two implications: one implications is that Smith's work on invariance theory was to go largely unacknowledged in modern day economic discourse on invariance theory, and the second implication leading to a more popular debate in the field of history of economic thought is whether Ricardo himself believed in invariance theory and on what grounds would he have disagreed as found in Ricardo (1819), Buchanan (1976), and O'Driscoll (1977).

In light of the mid- to late-1970s' debates on who to properly cite as the originator of invariance theory and whether Ricardo would wish his name to be unappended to invariance theory, an important coincidence had not been appreciated. This coincidence would not have been appreciated at the time of these debates be-

[2]Hamilton, James D. and Marjorie A. Flavin, "On the Limitations of Government Borrowing: A Framework for Empirical Testing," American Economic Review, Vol. 76, No. 4 (Sept, 1986), pg.808

cause the subfield of sustainability theory had yet to (re-)emerge. The coincidence and focus of this paper is that both Smith and Ricardo articulated invariance theory as only a mere acknowledgement to a facet of the arguments put forth mainly by Continental European theorists and by a few English theorists that public borrowing is a valid means of financing public expenditures. One Continental theorist in particular went even so far as to articulate what he then considered to be sound guidelines for the management of public debt based on certain measurements. In today's economics terminology this 18th century theorist's guidelines it will be argued should be considered as the foundation of sustainability of debt theory, and this paper will demonstrate that it is this representative theorist's arguments that both Smith's and Ricardo's arguments were inadequate in critiquing the then new practices in debt management as illustrated by England's management of its national debt through out the 18th century .

Central to this discussion on this debate taking place between the English classical school and the Continental European theorists is the state of the United Kingdom's public finances in the 18th century as the English point to it as a disaster in the making and the Continetalists point to it as a new era in state fiscal management. The first-half of this paper will examine England's public borrowing in the 18th century because there exist two diametrically opposed opinions on England's use of debt: the Continentalists pointed to England as being a textbook case in how to manage a nations debt; while the English classicals believed England public finances was stressed to the maximum and that future commerce would be severely hampered if or when England defaulted on its debt. In the first part trends in the contraction/expansion of public debt will be examined; the over all debt burden as well as yearly charges to public revenue will be examined; and, the issuance, term structure of debt, and the how the composition of debt issued changed over the 18th century will also be examined, as well as any innovation in institutional arraignments that handled debt.

The second-half will examine the actual debate between the English classical and their continental rivals and the arguments they put to one another. On the side of the English classicals will be both Smith and Ricardo who it will be demonstrated were very much in conversation with continentalists and directly or indirectly addressed the arguments they put forth. Although Jean François Melon and George Berkley at that time and currently were the most famous theorists espousing the use of debt as a means of financing public expenditures, a lesser known theorist then but at that time a well known international financier, Isaac de Pinto, arguments and theories will be used to articulate the Continentalists' point of view. It is Isaac de Pinto's theory on the management of state debt that will be used to demonstrate the Continentalists were thinking along the lines of sustainability theory while the English theorists tacitly acknowledge the Continentalists point about the use of credit as oppose to tax finance of the state's expenditures.

1.2 18th Century National Debt in United Kingdom

1.2.1 Debt and Empire Building

There are many competing claims as to why England rose to empire status in the 18th century which this essay wishes not to address. An important aspect and the present focus of this discussion on the United Kingdom's ascendancy to empire status is its use and management of its national debt to finance its war time expenditures. England was neither the only European state to go into debt to finance its war time expenditures over the 17th and 18th centuries, nor was it the lone state to find itself from time to time unable to meet its financial obligations to creditors throughout this period. However, because of England's physical isolation from Continental Europe, increased reliance on trade with its trading partners and established colonies, and its ever increasing obligation to provide regimented soldiers in the battles or skirmishes on the Continent, England was compelled to maintain its

credit at home and abroad more so than its Continental rivals. England, respectfully, could and did loose in battles militarily but it could not loose a battle due to insufficient funding on one day and turn around the next and expect contracted mercenaries, for which it was heavily reliant upon, to sign on to the next military campaign. The period of ascendancy started with the Nine Years War (1689-97) and ended with the first of the Napoleonic Wars (1793-1800). In between these wars England fought several others: War of Spanish Succession (1702-13), War of Austrian Succession (1739-48), the Seven Years War (1756-63), and the American Revolutionary War (1775-84). Based on these several wars the United Kingdom incurred large debts at above market interest rates, became ever more reliant on debt financing to run the day to day functions of government, and managed its debt burden. The management and/or consequences of the United Kingdom's debt burden became the impetus for the formulation of many theories on the use and role of the national debt.

The first step or stumble forward to erecting a more stable system of borrowing came in response to the Nine Years War. England raised in borrowing from 1693 to 1698 an accumulative amount of £6,900,000.[3] The interest charges on various portions of this debt ranged from as low as 6.3 per cent to as high as 14 percent depending not only on the going market rate, but also on investors belief in either how well the war was being prosecuted or the government's perceived ability to meet its obligation. "None the less, the state was borrowing well above the legal maximum for private individuals of 6%. Furthermore, it had to concede substantial privileges to the new Bank of England and East India Company to get a rate as low as 8%."[4] The life or term of the various obligations issued ranged from one-, two-, and/or three-life spans. In most cases interest payments were guaranteed through out the life of the loan. During this time frame total debt reached its climax in

[3]P.G.M. Dickson, *The Financial Revolution in England: a study in the development of public Credit 1688-1756* (New York:St. Martin's Press, 1967) 49.

[4]Dickson 47-50

1698 exceeding total net income by a magnitude of 1.4 and would not fall below net income until nine-years afterwards (1707). But before the English government could observe increases in its revenues to a level that would meet its debt obligations, England would find itself in the War of Spanish Succession. However, in the accumulation of debt from the Nine-Years War, two loans were made that founded the Bank of England and the New East India Company. Later on both institutions would have to share in some of the blame in the South Sea Bubble Crash, the Bank of England would later become the primary issuer of debt, however, the East India Company, diverted from its initial mission by all to eager government administrations, was an unnecessary cog in the contracting of national debt. The role of these two institutions in establishing a stable system for the contracting of national debt will later on be discussed further.

In all eight loans were made that make-up the £6,900,000 of accumulated debt. These loans came in either the form of tontines, lotteries, or life annuities. In either case the loans, with the exception of the ones establishing the Bank of England and East India Company, were securitized at the loans initial inception by a stream of state revenue, e.g. excise taxes and duties on imports/exports, set aside for the sole purpose of servicing and/or retiring a particular loan. The various taxes levied for the loans were to last as long as the term of the obligations for which they were created. Hence, taxes levied for a 99-year annuity issuance would be repealed after 99-years. This practice would then lead to portions of major streams of revenue being rendered effectively untouchable.

The top line in Figure 1.1 is the ratio of both excise and customs taxes to total net revenue. Although Figure 1.1 graphs revenue streams for the period of the Nine Years War, the combination of both customs and excise taxes form the backbone of state revenue for England throughout the 18th century.

Even though England was victorious in the Nine Years War, in part because of its ability to mobilize resources on a scale it had prior not done before, the gov-

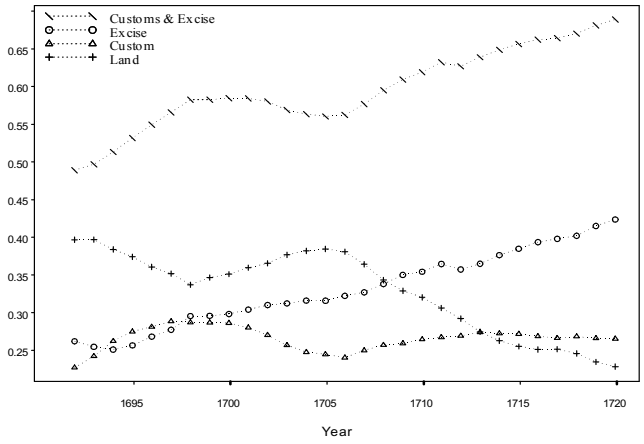

FIGURE 1.1. Ratio of various revenue streams to total net revenue for England in the 9-Years War, 1691-1720 (adapted from Mitchell, B.R. *Abstract of British Historical Statistics* 1971: 386-388)

ernment placed itself on a road to self-ruin. It was through the use of credit by the issuance of long-term annuities securitized by customs and excise taxes that guaranteed payments of the annual interest charges and principles that enabled England to mobilize resources at home and from investors abroad. However, in the span of six-years England saw its debt obligations increase six-fold. The English government found itself in the uncomfortable position of having total debts and interest payments being greater than incoming state revenue, and that portions of the main source of revenue to the state was placed off limits as they were used to securitize loans.

As previously noted, the New East India Company and Bank of England were founded during the Nine Years War and would become instrumental in England developing a system to handle the public debt. However, a more systematic approach to handling the public debt did not arise until after the crash of the Great South Sea Bubble in 1720. The discussion on the development of the English system to handle debt will be delayed until after the discussion of England's accumulated debt from the next four wars in the 18th century. It should be noted that only long-termed

debt has and will continue to be discussed immediately. Short-term debt issued by various department of the English government to cover day to day expenses which also had been accumulating will later be discussed.

The cost of each war succeeding the Nine Years War would exceed the costs of its predecessors thus pushing the level of the national debt to its highest levels. At the end of the Nine Years War the English Parliament had issued some £6.8-million in long-term annuities with a median annual interest charge of £426-thousand; at the end of the first Napoleonic War England had issued £95.0-million in long-term annuities with a median annual charge of £11.8-million. In between these two Wars there were several others, here are the sums of debt issued and median interest charges on that debt issuance: War of Spanish Succession a total of £8.0 million in long-term annuities issued with a median annual charge of £0.51 million; War of Austrian Succession a total of £20.7 in long-term annuities issued with a median annual charge of £0.79 million; Seven-Years War a total of £47.6 million in long-term annuities issued with a median annual charge of £1.47 million; and the American Revolutionary War a total of £45.1 million in long-term annuities issued with a median annual charge of £6.19 million.

The cumulative amount of directly issued long-term annuities at the end of the First Napoleonic War was over £220 million. Even though the use of long-term annuities allowed administrations time to put off dealing with the over-all accumulated debt, the cost of maintaining directly issued annuities annually became ever more of a burden especially when one considers that at the end of the 17th century annual public net income was just over £5 million and at the end of the 18th century annual public net income was around £31.6 million. It should be noted that an income tax was not put in place until the 19th century .

The cost of maintaining the debt accumulated from the wars, as Figure 1.2 illustrates, began to consume sizable amounts of government resources. The Seven Years War (1762) would see annual charges amount to over thirty-percent of net

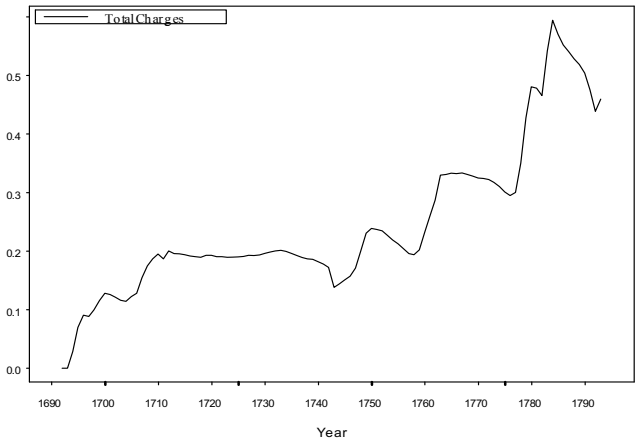

FIGURE 1.2. Ratio of total charges on English long-term debt to 9-year moving average of net public income, 1691-1793 (adopted from Dickson, P.G.M. *The Financial Revolution in England* 1967 and Greillier, J.J. *The History of the National Debt* 1971)

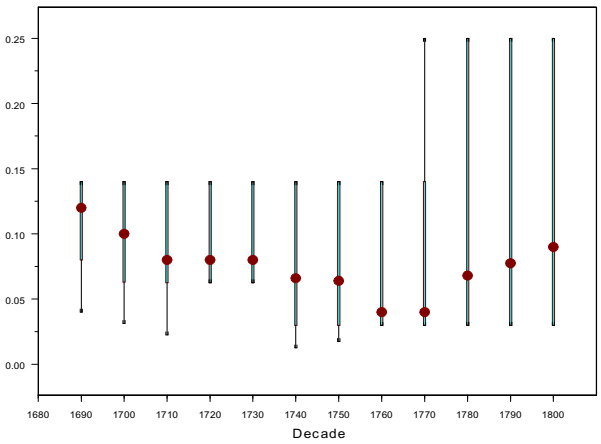

FIGURE 1.3. Direct, issued long-term annuities interest-rate charge spreads with the decade's median charge indicated (adopted from Dickson, P.G.M. *The Financial Revolution in England* 1967 and Greiller, J.J. *The History of the National Debt* 1971)

public income. At the height of the Revolutionary War charges would consume sixty-percent of incoming state revenues. As previously noted the government was paying interest rate charges greater than what the average individuals would pay. Figure 1.3 shows the range of interest rate charges the government paid on long-term annuities with the horizontal slashes indicating the median interest rate charge for that year. The important trend to notice in Figure 1.3 is that during the Nine-Years War and the War of Spanish Succession the interest rate charges oscillates considerable but then reaches a plateau for some 30 years. Afterward the trend in interest rate charges begins to decline during the War of Austrian Succession and declines further more to its lowest levels during the Seven-Years War. Towards the end of Figure 1.5 the trend in interest rate charges is upwards with a sizable-step increase three-years into the American Revolutionary War reaching a plateau after this War and with step increases during the First Napoleonic War. Even though the English government was able to receive favorable interest rate charges for some of its newly issued long-term annuities, the vast sums it had to borrow would prove taxing on the then current revenue streams.

A snapshot of the English debt due to direct long-term borrowing to finance its battles has just been presented. Only the direct, issue of long-term annuities has been covered in order to examine developments in state borrowing practices. Several developments can be seen to take place with respect to the debt: as time progressed throughout the 18th century and the amounts of long-term annuities issued increased from war to war and year to year creditors were willing to loan the government money even though there had been no significant increase in public revenue; due to the issuance of long-term annuities guaranteed by taxes set aside the most important streams of state revenue were automatically and increasingly being diverted to make payments on the costs of the debt; interest rate charges started out at sporadically levels but then as time went on interest rate charges began to level out with decreases in charges being witnessed while England was at war.

1.2.2 Institutional Forms and Structures

The following section examines the framework which the UK government operated its debts through and institutional developments or obstacles that occurred as a result of the government facing pressure to manage its debt burden. The first section examines the main departments of the government that had debt issuance power; the second section examines public chartered companies such as the Bank of England and their role in helping the government to manage the debt burden; the last section examines various schemes put into place to ameliorate the debt burden. It is the aim of this section to investigate whether or not by the end of 18th- century the U.K. government had in place a system that could handle public debt.

The organization of 18th- century English government finances as far as the debt issuance is concerned can be described as being decentralized or compartmentalized. At this time there did not exist a single department responsible for the overall government budget. That is neither the expenditure side nor the revenue side was controlled by any one department. The system of procurement was that each department was promised a set amount of money appropriated out of the general fund by parliament but until that money arrived, each department was responsible for coming up with its own stop-gap financing measures. Each department along with the two military branches was then forced into issuing some type of debt instrument with the intention of immediate repayment once secured funds had been received. This stop-gap finance system can be characterized as short-term debt financing as each department's issued instrument was supposed to be redeemed within a year. In addition, each department had its own set of preferred lenders, not all instruments were easily transferrable to second parties, and only Exchequer Bills in the 18th- century came to be accepted as payment of one's tax obligations. Often times this thatched network of debt issuance allowed many crisis to develop in which the department's debt would have to be taken over by the Treasury and rolled into long-term issued debt securities or annuities.

The various departments of the government found themselves needing assistance from time to time in maintaining their debt levels that they had accumulated from being forced into issuing short-term securities in the form of either tallies, debentures, or orders of payments. Even though, as discussed in the previous section, the English government undertook sizable amounts of loans to finance its war efforts that occurred in the 18th-century, the armed services found themselves often at times short on funds due either to underestimated expenses, unforeseen events and expenses, or willful under-appropriations of funds by the Treasury, and having to maintain a debt level in the form of short-term borrowing. Often times this short-term borrowing led to crisis as the military departments had to delay or push-back payments on its short-term issued debt. Usually, a crisis occurred when creditors no longer or refused to accept short-term issued debt, or the cost of issuing such debt was so great that it started to affect the price of debt issued by other departments. There are several reasons for creditors, especially as the military is concerned, refused to extend credit: the outlook for cessation of a current battle looked intractable or a long ways off, as creditors were paid in sequential order a high disbursement number would mean years or months before the chance of repayment for services or products rendered would occur, or both combined together, that is an attempted cessation failed and creditors upon receiving the news no longer extended credit.

There appears to be several crisis in short-term borrowing by the armed services occurring in 1711, 1746, 1763, and the final one in 1784. Here, a crisis occurring means that another government body, usually the Exchequer, had to step in and take over or subsume payment of short-term dated securities issued by the various branches of the military that had short-term debt issuance capabilities. The first crisis occurring in 1710 lead directly to the formation of the South Sea Company. Even though this crisis resulted in the formation of a public company, it is the only time such a corporation was formed but it also set the precedent for how future crisis would be handled. First, a formal recognition was made that the military

short-term borrowing had become untenable as its problems caused costs of short-term borrowing for the other departments to increase or the military faced ever increasing discounts of their own short-term issued debt securities.

> "..Just as in the 1690s the volume of tallies of fictitious loan had increased out of proportion to the money-market's capacity to absorb them, so the floating departmental debt, accumulating with every year of war, came after 1708 to imperil the structure of credit which Godolphin had so carefully built up. ..By Michaelmas 1710 the debt amounted to well over £6m., about a year's revenue. ..In 1709-10 the bankruptcy rate rose sharply in London and Amsterdam.
>
> These shocks to the delicate spider's web of European commerce were bound to affect the credit of the English government, particularly as rumors grew in the early months of 1710 that Godolphin was about to be dismissed. Six per cent Navy bills, a principal item in the floating debt, were already at 12% discount at the end of 1708. This discount increased to between 13% and 20% in 1709, to 26%-30% in 1710, and to 33% in the following year. Victualling bills, also at 6%, had gone to 45% discount by March 1711."[5]

Second,the English government would put together some type of bailout package consisting of issuing interest bearing notes, in most cases Exchequer bills, in exchange for the Navy, Victualling, or Transportations bills that were in default on their interest payments. The amount in interest payments in arrears and the principal amount would then be appropriated into the next offering of long-term issued annuities. In the case of the 1710 short-term debt crisis, instead of Exchequer bills being issued in replace of the defaulted military bills and then the whole amount being rolled into a long-term issued annuities, holders of the defaulting military

[5]Dickson 361-2

bills were offered in exchange for their bills stock paying dividends in the South Sea Company. Given that all of this was occurring as the War of Spanish Succession was nearing to an end and the negotiations of the Peace of Utrecht could not have been known to the general public, there could and would have to be an expectation held by the general public that the stock of the South Sea Company would appreciate were trade with the Spanish colonies permitted.

> "The situation was retrieved by subscription of the greater part of the Navy Debt into the South Sea Company during the summer and autumn. A statement of the debt at Michaelmas 1711 in the *Commons Journals* shows that the total Navy Debt was then £7,231,788. Of this, £4,256,932 had been 'discharged by the South Sea Stock'. Included in this were £3.4m. Navy and Victualling Bills. [Footnote: *HCf* xvii (1711-14),20-21.] ..With the old bills cleared off, it was possible to begin a new Course of the Navy at Michaelmas 1711, and a new victualling Course in April 1712."[6]

The 1746 crisis in short-term borrowing by the military occurs much like its predecessor towards the end of the War of Austrian Succession. Here, much like the 1710 crisis, there is first an acknowledgement of a problem and then steps are made by the government to ameliorate the crisis, but with two important differences from the first crisis' bailout.

> "..The outbreak of war with France in 1744 immediately changed this situation. By the end of 1746 the Navy Debt was once more – for the first time since 1709 – causing ministerial alarm. Not inappropriately, on 28 November 1746 Henry Bilson Legge, one of the Admirialty Commissioners, wrote to the First Lord, the Duke of Bedford, suggesting a repetion of the solution adopted in 1711."[7]

[6]Dickson 404-5
[7]Dickson 405

After the War of Spanish Succession and prior to the War of Austrian Succession the military was able to manage its floating debt. A few years after the outbreak of the War of Austrian Succession the military found itself unable to manage its short-term debts and looked to the other branches of government for help. Although the South Sea bubble occurred in 1720, taking down the South Sea Company and the government's scheme to have its debt piggy-backed to the fortunes of the South Sea Company's stock, the military and other branches realized that a similar bailout could take place but the South Sea Company would not be involved this time.

> "The Navy creditors, who included some of the most powerful financial houses of the City of London, would not have been flattered at the chance of acquiring South Sea stock, particularly in view of the Spanish government's intransigence towards the company's claims. Pelham [Chancelor of the Exchequer] must have known this, and he knew, too, that the Bank of England could be relied on to help."[8]

The government in 1746 had a lack of resources so it was unable to wrap up in one action the consolidation of the military's debts:

> "As the navy-debt, notwithstanding the grants of a million in the last two years towards payment thereof, had become too considerable to be paid off in the usual course, the plan of funding the principal part of was adopted."[9]

In both 1746 and 1747 the Exchequer made two payments of £1-million to pay down the military short-term debts. Afterwards the Government was then able to coordinate a package to consolidate the military's short-term debts.:

[8]Dickson 405-6
[9]Grellier 214

> "...an act was accordingly passed for converting into 4 per cent. [footnote: On the 20th March, 1749, when the House passed the resolutions for this purpose, 4 per cents 1746 were $101\frac{1}{2}$, and 4 per cents. 1748 $102\frac{1}{4}$: they had been about these prices for several weeks.] perpetual redeemable annuities, bills payable in the course of the navy and victualling offices, and for transports, which were made out between 1st January, 1747 and 31st December, 1748, to the amount of £3,000,000; and ordnance-debentures made out on or before the 31st December, 1748, amounting to £230,382:5:1. Many of these debts carried 5 per cent. interest, and what was due thereon to 25th March, 1749, was added to the principal and converted with it into stock. The interest on the capital of £3,072,472:0:10, which was thus created, was charged upon the Sinking Fund,.." [10]

A few important developments in the handling of this crisis are the Exchequer's making two payments to pay-down the military's short-term debt before a full bail-out package could be put together, the involvement of the Bank of England in putting together the bail-out package, and, finally, the direct incorporation of the military short-term debt securities into long-term government issued debt paying lower interest-rates. The handling of the 1746 military short-term debt crisis became then the framework for how future military debt crisis would be handled, "This method was to be used in every future war up to 1815."[11]

An examination of the 1763 and 1784 military short-term debt crisis coming on the backs of the Seven-Years and the American Revolution Wars reveals no new development in the government's handling of short-term debt other than the ease in which the government was able to implement a bailout. Therefore, no further detail analysis of these last two crisis will be given.

[10] Grellier 214-5
[11] Dickson 406

The analysis of the military bills, e.g. navy bills, victualling bills, and ordnance debentures, was given with the underlying reason being that the military bills was one of the main components of the floating debt or departmental floating debt. In today's terms this floating-debt is considered short-term debt. Even though the military bills did not go at first to the money markets but rather to military contractors, it is shown that the government developed over time a system to ease this part of the floating debt into the markets and eventually into its long-term borrowing processes. Once it was recognized or no longer could be ignored by other departments in government that military bills were in such arrears that it started to effect the prices of the other short-term dated securities issued by the government, the government was then forced to make retirement of the Military bills a priority and give it its full attention. Finally, after the 1784 crisis in Military bills in which the government itself came close to going bankrupt, one branch, the Exchequer, assumes responsibility or control for the entire government's short-term loan borrowing by assuming control over the military's short-term borrowing.

> "In the details of financial policy Pitt's chief success was achieved in his treatment of that part of the floating debt which was composed of Navy and Victualling Bills: his chief difficulty was encountered in his dealings with the Bank of England.
>
> Hitherto the methods employed in the treatment of the floating debt had been such as to add considerably to the costs of financing a war. No definite provision had been made, for example, for the repayment of Navy Bills nor was interest on these Bills paid until several months after they were issued. Hence the Bills were normally at a considerable discount and borrowing in them was extremely expensive. Pitt put an end to this system by making definite provision for the repayment of the Bills within a fixed period from their issue and by securing the immediate payment of interest upon them.

> He also showed his intention of abolishing the practice of permitting the floating debt to accumulate unchecked until the close of war. In former wars borrowing had taken place continuously in Navy and Ordnance Bills, and it had been left for the Government in power at the end of the war to carry out a vast system of funding operations. During the war of 1793-1802, however, a different principle was established, and on four occasions large portions of the floating debt were funded. Hence the outstanding volume of floating debt in 1802 was only slightly larger than it had been in 1793."[12]

Were a mother to be accused of favoring one child over another: Exchequer bills, in terms of sibling rivalries, would be that favored son when compared to the treatment of convenient-negelect showed by the English government towards the military bills. Even though the Exchequer- and the military-bills came to comprise the major components of the floating or short-term debt, as both functioned as a means of stop-gap financing, the Exchequer Bills importance increased as it became a dependable tool or instrument enabling the English government to gain control over its finances through out the 18th century . Unlike the previous analysis of military short-term debt where the focus was on the evolution of how the military bills came to be managed on a sound basis, this analysis will investigate why the Exchequer Bills were on a stable basis enabling them to become the government's preferred method of short-term financing and enabling the government to reestablish its credibility even as the finances for the English government from time to time were found to be near breaking-points.

The Exchequer Bills introduced in 1696/7 predecessor was the tallies of pro. In the 19th century Exchequer bills became the antecedent of the Treasury bills. In between their introduction and replacement, Exchequer bills proved to be a resilient workhorse. This resilience is in part due to several reasons: the Treasury viable the

[12]Hargraves 117-8

Exchequer was directly responsible for the Exchequer bills management, shortly after their introduction the Bank of England would play an instrumental role in bills management on the open market, and, in addition to bearing interest, Exchequer bills had a short shelf-life expectancy, or, could truly be considered short-term dated securities.

After the 1688 Restoration all debts were no longer considered to be that of the sovereign but that of the whole State. At this time Parliament began to flex increasing power over the state finances. The first order of business was to find a means to raise cash until tax receipts had been received in the State's coffers. Although the tally system proved some what efficient in providing the government with needed private or commercial services up until the State finances came into a state of near ruin towards the end of the Nine Years War in which the government had lost control over incoming tax revenues due in part to over-drawn tallys being drawn on the various streams of revenue that were in themselves in arrears. Although the Exchequer bills had been used one time prior to the Restoration, this introduction would afford the government needed operating space while it tried to set its fiscal matters in order.

For reason beyond the scope of this discussion and the small amount involved, the issuance of Exchequer bills in 1697 and not 1696 will be considered the starting point. The 1697 Exchequer bills were introduced as a means to provide the government with much needed cash. It was thus important that if the Exchequer bills were to be introduced into the money market without being heavily discounted like their counterpart, the tallys of pro, purchasers of Exchequer bills would need to be guaranteed that their bills could easily be converted into cash and that the market would not suddenly be awash with the newly created bills.

> ...In January 1697 a new statute authorized the creation of a further £1,500,000 Exchequer bills. They could be used to pay current (1697) taxes, except the Land Tax, and might be redeemed either at the

> Exchequer or by presenting them to a Crown revenue collector (like tallies of Pro). Deficiencies were to be provided for in the following year. Nothing was said about interest. ...Already, however, the Treasury had taken an important step towards improving the bills. In April 1697 a statute empowered the Board to make arrangements with private financiers for the advance of sums to encash them after they were paid out from the Exchequer. Interest was to be payable at the rate of 5*d*.% a day (7.6% p.a.). Care was taken that it did not accrue while bills were in the hands of revenue collectors or the Exchequer, by providing that the date at which either of these acquired or paid bills was to be endorsed on them..
>
> This statute, which was part of the general settlement in spring 1697 of the government's desperate financial situation, was followed by a third, also in April, authorzing the creation of a further £1.2 m. bills, but stipulating that not more than £2m. were to be outstanding at a time. By dint of yearly cancellations this limit was observed.[13]

Even though the historical record is unclear on how widely disbursed throughout the public the initial offering of Exchequer bills became, the arrangement of private financiers to encash the Exchequer bills was crucial in establishing the Exchequer bills convertibility into cash. This new found system for raising short-term loans hinged on the guarantors not immediately turning around and demanding reimbursement for sums paid-out in encashing Exchequer bills. "The persons who thus agreed to exchange the Bills were to "have as a further Encouragement an Interest not exceeding ten per cent. per Annum for the Sums by them agreed to be advanced.""[14] The arrangement by the Treasury to ensure the convertibility of Exchequer bills with private financiers helped to establish the credibility of the bills

[13]Dickson 368-9
[14]Hargraves 12

and the government. In addition to the arrangement entered into with private financiers, a second important factor in helping the Exchequer bills establish credibility was the timely- or yearly- or punctual-efforts made at retiring outstanding Exchequer bills from their initial introduction.

An important fact that should not be overlooked is that the Exchequer was the sole issuer of the Exchequer bills. Unlike tallies and the various military bills issued by each individual departmental paymaster who may or in many cases may not have been competent in their record keeping and in dealing with the money markets, the Exchequer was competent and implementing lessons learned from the issuance of fictitious tallys towards the handling of Exchequer bills.

> From his experience of the 1690s, Godolphin might have drawn the lesson that the tally of fictitious loan was a dubious instrument, and should be suppressed. Correctly, he drew the different lesson that it was potentially extremely useful, but had been misused. Under his intelligent direction it became an important part of a successful short-term borrowing policy. The change was primarily due to two factors. First, Treasury management was remarkably prudent. The annual total of such tallies was kept within a limit of £1.5m. except in the difficult years 1709-11, and their volume was accurately recorded in the Treasury account books for the first time.[15]

With the issuance of Exchequer bills came a close attention paid to the retirement of outstanding short-term debt. It is unclear whether this new found attention to short-term debt retirement was due or enabled in-part to the economy picking-up after the Nine Years War or because of the close proximity the issuance of Exchequer bills was to the seat of power in the government or because the government from the members of Parliament down to the Treasury Secretary began to realize

[15]Dickson 360

that the maintenance of credit was as an integral part in the execution of a war. Regardless of the reason(s), the Exchequer bills were prudently managed, and became even more prudently managed when the Bank of England became involved in their management starting in 1707.

With the issuance of Exchequer bills in 1707 two important arrangements were implemented with respect to the management of the Exchequer bills that would last through out the 18th century.

> A further stage in the development of these measures occurred in 1707, when an arrangement was made with the Bank for "circulating" £1,500,000 of Bills. In other words, the Bank undertook to cash the Bills when they were presented, fixed the rate of interest which should be paid upon them, and received for its services from the Government payment at the rate of $4\frac{1}{2}$ per cent. on the Bills issued. (Footnote: The payment was to be made out of the proceeds of the house duty, but as this duty was already charged with a loan, further Bills were issued to cover the allowance.) ...[16]

The Bank of England would from this time on be responsible for managing the Exchequer bills on the open market. Basically, the Bank would advance the government the amount of money for which the Exchequer bills were drawn-up and ensure their convertibility. The second important step in the 1707 offering was that payment of Exchequer bills were tied to the revenues coming in from at first tax duties and later on from more secured streams of revenues.

> "The government's next innovation after introducing Exchequer offices for handling the creation and discharge of bills was to issue bills in 1725-6 charged on the annual Land and Malt taxes and redeemed when these came in, besides small additional amounts for supply."[17]

[16]Hargraves 18
[17]Dickson 380-1

With the payment of Exchequer bills and their management costs being intricately tied to tax revenues, they became the key source for advancing cash to the government on short-term basis.

The English government thus nearing the end of the Nine Years War was near financial ruins. The chief financial instruments for raising short-term loans through out the War, ex. tallys of pro and the various departmental bills, were being severely discounted by creditors. In order to restore the credit and faith of the English government with its creditors and in the money markets, the government introduced a financial instrument, Exchequer bills, with properties that the then current short-term cash-/service-raising instruments did not posses. The Treasury department was behind the issuance of the Exchequer bills in name and management. Its prestige was thus on the line. By arrangement, first by private financiers and later by the Bank of England, Exchequer bills were made encashable upon presentation. The duration and amount of Exchequer bills issued were not allowed to lapse or amass without deficiences immediately being made-up the following year. The success the English government had with the floating of the Exchequer bills helped the English to develop the handling of its debts.

1.2.3 Debt Payment

The first two sections examined the unprecedented accumulation of long-term debt in England's history, post Restoration, and the institutional development in handling short-term debt. This last section will examine long-term debt remediation and the institutions assigned towards that task. It appears that this section will be brief in length and scope as the establishment of debt remediation mechanism in the 18th century is well documented, however, the amounts actually redeemed pales in comparison with the total amount of public debt accumulated by the beginning of the First Napoleonic Wars.

On the eve of the First Napoleonic War from 1691 to 1790 total unredeemed-

funded debt, long-term debt, was £234-million.[18] Taking the first difference and summing only those negative-values of unredeemed funded debt for the same period , a total sum of -£27-million is derived for a rough estimate of the amount of long-term debt remediated. Out of one-hundred observation only thirty-five observations indicated a reduction in outstanding long-term debt with a median value of £700-thousand.[19] True-debt-remediation would not occur well into the latter part of the 19th century, however, a more systematic approach to debt remediation began in 1715 with the establishment of the aggregate funds and then followed the succeeding year by the establishment of the sinking fund.

The establishment of the sinking fund and the several aggregate funds is the first attempt at consolidating what was a decentralized income revenue system. No one single department was in charge of collecting tax revenue, meaning, that each department responsible or assigned the task of collecting and administering a tax had its own set of accounts with few if any accounts kept at the Bank of England.

> "In October 1711 the directors [of the Bank of England] complained to the Treasury Board that not more than five or six Receivers of the Land Tax kept their cash with the Bank, and that the departmental paymasters mostly lodged their balances 'in goldsmiths' hands', that is with private bankers.[footnote: Papers and memoranda of the Duke of Newcastle on taxation and finance 1688-1756, Add. MS. 33038, f. 362 one of a series of anonymous papers on public finance evidently written late in 1754, see f. 358 *dorso*, Exchequer balances, 5 September 1754]"[20]

Thus repatriation of funds back to the central government in London could and often did take a long time. Each long-term loan as discussed in the first section

[18]B.R. Mitchell and Phyllis Dean, *Abstract of British Historical Statistics*, (New York: Syndics of the Cambridge University Press, 1962), 402.

[19]Mitchel, 402

[20]Dickson, 388

that was eventually made on secured funds (tax revenues), guaranteeing payment of annual charges and eventually in theory the principal, would be paid back in installments as soon as the funds were received in the government's coffers. At the time each payment charge would be made after each tax revenue had been received and public notice had been given. As a matter of expediency and cost effectiveness it made logical sense to have all tax revenues paid into one of several accounts, the three aggregate funds, and from these accounts annual payments on debts would be made. Given this line of reasoning, it would make ontological sense to establish a fourth fund, the sinking fund, in which all excess tax receipts from the aggregate accounts would be deposited into and then used to make further payments on the debt, ignoring for the moment the fact that many of the long-term securities were irredeemable. Then the funds from this account would be used to pay down the debt.

> By this "funding" policy the public debt came to consist of many small loans, each bottomed on its own petty item of revenue. ..In 1716, the many little items of revenue, mortgaged to some particular debt, were grouped into four large funds, the Aggregate, South Sea, General, and Sinking funds. The first three were composed of permanent taxes and secured the interest on three great blocks of public debt. The fourth was made up of the surpluses of the first three left over after satisfying all charges upon them, and was called the "Sinking Fund," because it was appropriated to the sinking of the national debt, "and to no other purpose."[21]

What seems a prudent administrative reform in dealing with long-term debt remediation by the establishment of the several funds, was further more followed-up by Parliament's passage of laws guaranteeing the flow of tax receipts directly into the accounts.

[21] Ross, Edward A. *Sink Funds*, (Baltimore, Md: Guggenheimer, Weil & Co. 1892), 9 - 10

> The Act of 1716, in which these provisions were contained, prescribed a rigid adherence to the purpose for which the sinking fund had been established. The surpluses were to be "appropriated, reserved and employed to and for discharging the Principal and Interest of such National Debts and Incumbrances as were incurred before the five and twentieth day of December, 1715. . . and to and for none other Use, Intent or Purpose whatsoever."[22]

A discussion of the sinking fund and aggregate funds and their role in the debt reduction process, ipso facto, leads to the next institutions for discussion, the public companies, in particular, the South Sea Company. Even though the Bank of England and the East India Company fit into this category, it is the South Sea Company that is the primary focus because of its inadvertent role in inducing holders of irredeemable government securities in the form of one- to three-life time annuities, and/or long-term annuities to convert their holdings to redeemable securities with lower interest rates.

A major (long-term) stumbling block to the English government gaining control over its debt finances, be it remediation of the principal or reduction of the charges there upon, is the fact that a substantial amount of the long-term debt was in the form of some type of irredeemable annuities: by 1716 the total accumulated debt was over £48-million with 26% in some form of long-term annuities.[23] In addition to the problem of the structure of the long-term debt, the government was in serious arrears on its short-term debts, for example, military bills and debentures and various departmental issued bills, and annual charges on its long-term debt obligations. Around the same time the sinking funds were established and disadvantageous settlement was negotiated at Utrecht after the War of Spanish Succession (1713), an immediate push was made by the English government to deal with its debts.

[22]Hargraves, 25
[23]Grellier 94-5

The South Sea Company, established in 1710, was from its initial inception a vessel for the government to consolidate out standing debts under the auspices or exclusive charter of establishing trade with the Spanish-American colonies. After the Peace of Utrecht (1713) though, the future prospect of establishing profitable trade routes with the Spanish colonies in the Americas looked less and less promising. Despite this outlook, a plan was hatched by the directors of the South Sea Company and agreed to by officials of both the Exchequer and Treasury departments to allow the South Sea Company to manage some of the outstanding public debt. Whether the public officials agreed to the South Sea Company's scheme because they were holders of its stock and would benefit personally from its artificial appreciation, or because the scheme proved to be to irresistible for a government in severe arrears on its debt payments, the unintended consequence at the end of the whole scheme did move people holding irredeemable debt with fixed rate interests to holding public debt that was redeemable.

The holders of various government debt instruments would some how have to be induced into exchanging their holdings for equity in the South Sea Company. So while holding government debt that may or may not have been in arrears with a fixed rates of interests, many instruments bearing interest rates much above the officially allowed rate of interest, and feeling pressured by the government to accept lower rates of interests, holders of debt were presented with the opportunity to own equity in a publicly chartered firm with the possibility of seeing their holdings appreciate –presented with an opportunity can be read as coarsed This South Sea Company proposal was not without precedent. Its founding was based on a similar arrangement but only military debts in arrears were exchanged. Even when the government borrowed from either one of the public charted companies prior to 1720, the companies would issue additional equities and receive a fee from the government for managing the loan as well as an annual payment that went directly to paying the annual interest charges. In the case of the South Sea loan, several

important differences must be noted: one, the exchange of irredeemable annuities for redeemable perpetuities, two, the sums involved, and, three, without any further prospect for trade routes opening-up managing the government debt would almost certainly become the sole business prospectus of the firm.

In order to get an idea of what was being exchanged, in 1693, several loans were arranged with one being a tontine loan for a little over £124-thousand with interest ranging from the start date at 10 percent to seven percent for the remaining years of the loan which would last until the last subscriber was deceased, several other loans made totaling over £800-thousand entitled subscribers to single life annuities paying 14 percent annual interest.[24] Of those who subscribed to the tontine loan, over £75-thousand were exchanged for South Sea Stock with £1.5-million being added to the South Sea Company's capital; of those who subscribed to the loan and received life time annuities, over £8-thousand were exchanged for South Sea Stock with over £177-thousand added to the South Sea Company's capital.[25] In total, a sum close to £14-million in long- and short-term debts were exchanged for South Sea Stock with close to £14-million being added to the South Sea Company's capital.[26] In order to win the concession to manage the government's debts the South Sea Company agreed to advance the government £7-million.[27] Prior to the proposed exchange of debt scheme, "The "South Sea Company's nominal capital at the start of 1720 was £11,746,844."[28] Were the whole proposal to have been completed the South Sea Company's portfolio would have been:

> These were the chief particulars of this celebrated scheme, by which, had it been completely executed, the total capital of the Company would have been £43,451,399:6:11$\frac{1}{4}$; the interest received by them from government, £2,124,901:14:11$\frac{1}{4}$ per annum; and the allowance for man-

[24]Dickson, 48-9
[25]Dickson, 522
[26]Dickson, 553
[27]Grellier, 119
[28]Dickson, 525

agement, £34,761:2:4 per annum.[29]

It is not the intention of this analysis of the South Sea Company to present a detailed accounting of how the South Sea Company came to collapse. This analysis is provided to show that at the end of the South Sea debacle the government got what it needed, many loans that entitled subscribers to irredeemable annuities at above market interest rates were exchanged for stocks in the South Sea Company.

1.3 Theoretical Debate

1.3.1 Introduction

The first half of this paper analyzed the public sector's debt situation for the latter-part of the 17th- and the 18th-Centuries. It is this same time period that the English classical economists often point to as a reference to the then current practices when discussing public finance theory. Much like their analysis on trade theory based on historical knowledge, observation of the then present day emerging business trends or transformation, and all of this coupled with the ability for abstract theorizing based on logical models, the English classical economists tried doing the same with respect to public finance theory and practices. Their analysis of public finance theory and practice was directly born out of their critique of impediments to free trade as later it will be demonstrated. The UK government was, for most of this time period, controlled by the landed aristocracy, steeped in mercantilist's theory, and marred in conflicts with its Continental rivals. The English classical economists, for example, Adam Smith, David Ricardo, and Thomas Malthus, did not receive much recognition for their writings in public finance theory not until the last thirty-years in which Ricardo's name resurfaced.

The resurfacing of Ricardo's name in public finance circles was due to Robert Barro's acknowledgement of Ricardo as being invariance theory's creator as far

[29]Grellier, 121-3

as public finance is concerned. This acknowledgement touched-off a few debates but the one important to this paper's discussion is whether Adam Smith or David Ricardo articulated invariance theory and the lack of acknowledgement of Smith's contribution. Whether Smith or Ricardo is the rightful heir to invariance theory is a bit besides the point because as will be discussed later they both held strong antithetical views to the role of the state in the economy. What is important though is that when both theorized about how to finance public expenditures, or, to be more exact, the use of debt to finance public expenditures, it is the coincidence that they both articulated the proposition of invariance between tax- and debt-financing, and as will be discussed in greater detail later on, their out right dismissal of the proposition.

The cause of both Smith and Ricardo to articulate a proposition of invariance theory and thus the focus of the remainder of this paper is their discussions or debates that they had with fellow theorists at the time of their writing who held contrarian views about the use of debt to finance public expenditures and pointed to the English Empire as a case in point. Two of the 18th century 's leading theorists who held and articulated contrary views were Jean François Melon (1738) and George Berkley (1735). Another proponent of debt financing is Isaac de Pinto (1774) who, much like Smith and Ricardo, proposed analytical models to study states' debt finances when making his arguments for its use. It is for this inquiry that Isaac de Pinto's views on debt financing found in his *An Essay on Circulation and Credit* (1774) will be compared and contrasted with Smith's views found in the *Wealth of Nations* (1776) and Ricardo's views found in the *Principles of Political Economy* (1951). de Pinto's analytical model on assessing the burden of state debt it will be demonstrated are the first inception of what today is considered sustainability theory.

1.3.2 Classical and Modern Invariance Theory

Today's invariance theory posits that taxes and public borrowing is equal, provided that national output is unaffected by either method that is selected to pay for public expenditures. In order for this theory to hold a few assumptions must hold. The following example illustrates just one assumption that must hold in order for this theory to hold. Voters in a county are presented with two options for financing a local municipal project: Option 1. pay for the project by levying a one time extra-ordinary tax; or, Option 2. issue municipal bonds with interest payments and the principal paid out of a moderate increase in taxes. However, in order for each individual voter to make an informed decision she would have to estimate her present value of expected future tax liabilities if Option 2 is to be properly assessed against Option 1 – Robert Barro's contribution was to show using in a simple over-lapping generations model how two generations could be made to select deficit financing.

When invariance theory or Ricardian Equivalency Theory is presented today, it is presented has if the voter has a choice between different types of financing options, as presented in the previous example. However, Smith's presentation of invariance theory rules out any other options except for Option. 2 as being the only political attainable way of raising revenues when faced with extraordinary expenses such as a war.

> The ordinary expence of the greater part of modern governments in time of peace being equal or nearly equal to their ordinary revenue, when war comes, they are both unwilling and unable to increase their revenue in proportion to the increase of their expence. They are unwilling, for fear of offending the people, who by so great and so sudden an increase of taxes, would soon be disgusted with the war; and they are unable, from not well knowing what taxes would be sufficient to produce the revenue wanted. The facility of borrowing delivers them

> from the embarrassment which this fear and inability would otherwise occasion. By means of borrowing they are enable, with a very moderate increase of taxes, to raise, from year to year, money sufficient for carrying on the war, and by the practice of perpetual funding they are enable, with the smallest possible increase of taxes, to raise annually the largest possible sum of money. In great empires the people who live in the capital, and in the provinces remote from the scene of action, feel, many of them, scarce any inconveniency from the war; but enjoy, at their ease, the amusement of reading in the newspapers the exploits of their own fleets and armies. To them this amusement compensates the small difference between the taxes which they pay on account of the war, and those which they had been accustomed to pay in time of peace. They are commonly dissatisfied with the return of peace, which puts an end to their amusement, and to a thousand visionary hopes of conquest and national glory, from a longer continuance of the war.[30]

Ricardo, through a mathematical examples, demonstrates how invariance theory could hold for three possible methods of financing public expenditures and indicates his funding mechanism preference.

> Suppose a country to be free from debt, and a war to take place, which should involve it in an annual additional expenditure of twenty millions, there are three modes by which this expenditure may be provided; first, taxes may be raised to the amount of twenty millions per annum, from which the country would be totally freed on the return of peace; or, secondly, the money might be annually borrowed and funded; in which case, if the interest agreed upon was 5 per cent., a perpetual charge of one million per annum taxes would be incurred for the first year's

[30]Smith, [pg996]

expence, from which there would be no relief during peace, or in any future war; of an additional million for the second year's expence, and so on for every year that the war might last. At the end of twenty years, if the war lasted so long, the country would be perpetually encumbered with taxes of twenty millions per annum, and would have to repeat the same course on the recurrence of any new war. The third mode of providing for the expences of the war would be to borrow annually the twenty millions required as before, but to provide, by taxes, a fund, in addition to the interest, which, accumulating at compound interest, should finally be equal to the debt. In the case supposed, if money was raised at 5 per cent., and a sum of 200,000*l.* per annum, in addition to the million for interest, were provided, it would accumulate to twenty millions in 45 years; and, by consenting to raise 1,200,000*l.* per annum by taxes, for every loan of twenty millions, each loan would be paid off in 45 years from the time of its creation; and in 45 years from the termination of the war, if no new debt created, the whole would be redeemed, and the whole of the taxes would be repealed.

Of these three modes, we are decidedly of opinion that the preference should be given to the first. The burthens of the war are undoubtedly great during its continuance, but at its termination they cease altogether. When the pressure of the war is felt at once, without mitigation, we shall be less disposed wantonly to engage in an expensive contest, and if engaged in it, we shall be sooner disposed to get out of it, unless it be a contest for some great national interest. In point of economy, there is no real difference in either of the modes; for twenty millions in one payment, one million per annum for ever, or 1,200,000*l.* for 45 years, are precisely of the same value; but people who pay the taxes never so estimate them, and therefore do not manage their private affairs accord-

ingly.[31]

Other than expressing doubts about individuals being linked through altruistic motives, Ricardo makes no other direct comments concerning needed assumptions in his discussion on invariance theory. Ricardo's other writings on public finance must then be relied upon to tease-out any understanding he had of the assumptions or acceptance of any the assumptions. The same effort that has to be made in understanding Ricardo's views about the assumptions made has to be applied to Adam Smith's writings on invariance theory as well because his formulation of invariance theory indicates his unwillingness to accept the assumption that whatever choice is selected does not effect the political process

Both Smith and Ricardo have expressed in each of their formulation of invariance theory at least one skepticism they had with one of several needed assumptions. There is one of three conclusions that can be reached when reading each individuals' writings for the acceptance of invariance theory's other assumptions: 1, either one or both have supplied sufficient evidence to conclude they would accept the remaining assumptions; 2, either one or both have supplied insufficient evidence for a conclusion to be made about their acceptance or ambivalence towards the remaining assumptions; and 3, either one or both have supplied evidence to conclude they would not accept the remaining assumptions that would have to be made in order for invariance theory to hold.

It is not without coincidence then that both Smith and Ricardo for similar reasons would not accept a key assumption that would have to be made in order for the equivalence theory to hold: debt financing of public expenditures could have no effect on national output. Their hostile views to this assumption stems from them holding negative views towards the war time expenditures financed by borrowing as presented in the first-half of this paper.

Adam Smith's closely associates his hostile views on public expenditure and his

[31] Ricardo, [pg185-6]

negative view of the public sector's contribution to the general output of the whole economy with his view on how the surplus generated in the economy is squandered when placed at the public sector's disposal.

> Great nations are never improverished by private, though they sometimes are by public prodigality and misconduct. The whole, or almost the whole public revenue, is in most countries employed in maintaining unproductive hands. Such are the people who compose a numerous and splendid court, a great ecclesiastical establishment, great fleets and armies, who in time of peace produce nothing, and in time of war acquire nothing which can compensate the expence of maintaining them, even while the war lasts. When multiplied, therefore, to an unnecessary number, they may in a particular year consume so great a share of this produce, as not to leave a sufficiency for maintaining the productive labourers, who should reproduce it next year. The next year's produce, therefore, will be less than that of the foregoing, and if the same disorder should continue, that of the third year will be still less than that of the second. Those unproductive hands, who should be maintained by a part only of the spare revenue of the people, may consume so great a share of their whole revenue, and therefore oblige so great a number to encroach upon their capitals, upon the funds destined for the maintaenance of productive labour, that all the frugality and good conduct of individuals may not be able to compensate the waste and degradation of produce occasioned by this violent and forced encroachment.
>
> This frugality and good conduct, however, is upon most occasions, it appears from experience, sufficient to compensate not only the private prodigality and misconduct of individuals, but the public extravagance of government. The uniform, constant, and uninterrupted effort of every man to better his condition, the principle from which

> public and national, as well as private opulence is originally derived, is frequently powerful enough to maintain the natural progress of things toward improvement, in spite both of the extravagance of government, and of the greatest errors of administration. Like the unknown principle of animal life, it frequently restores health and vigour to the constitution, in spite, not only of the disease, but of the absurd prescriptions of the doctor.[32]

Adam Smith does not recognize that through the public sector's purchases and salary payments it makes a contribution to national output or helps to generate a surplus in the private sector. It is interesting that Smith's reference when discussing the public sector is that of a monarchy even though there had been by the time of his writing *The Wealth of Nations* for some time a professionalization of the UK government's civil service – it must be noted that when Smith refers to "Great nations" most nations at this time had a monarch form of government unlike the UK.

Ricardo, like Adam Smith, held equally strong antithetical views towards public expenditure's role in the national economy. However, Ricardo's arguement is more analytically in its approach.

> ... It is not, then, by the payment of the interest on the national debt, that a country is distressed, nor is it by the exoneration from payment that it can be relieved. It is only by saving from income, and retrenching in expenditure, that the national capital can be increased, nor the expenditure diminished by the annihilation of the national debt. It is by the profuse expenditure of Government, and of individuals, and by loans, that the country is improverished; every measure, therefore, which is calculated to promote public and private economy, will relieve

[32] Smith pg372-3

> the public distress; but it is error and delusion to suppose, that a real national difficulty can be removed, by shifting it from the shoulders of one class of the community, who justly ought to bear it, to the shoulders of another class, who, upon every principle of equity, ought to bear no more than their share.
>
> From what I have said, it must not be inferred that I consider the system of borrowing as the best calculated to defray the extraordinary expenses of the State. It is a system which tends to make us less thrifty–to blind us to our real situation. If the expenses of a war be 40 millions per annum, and the share which a man would have to contribute towards that annual expense where 100*l*., or 5*l*. per annum, and considers that he does enough by saving this 5*l*. from his expenditure, and then deludes himself with the belief, that he is as rich as before. The whole nation, by reasoning and acting in this manner, save only the interest of 40 millions, or two millions; and thus, not only lose all the interest or profit which 40 millions of capital, employed productively, would afford, but also 38 millions, the difference between their savings and expenditure.[33]

Here, national capital means private funds for investment purposes. The economy according to Ricardo, and like Smith, can only grow through the private sector's efforts and will only be hampered by "profuse expenditure of Government, and of individuals, and by loans,.."[34] The qualification of public expenditure with the word "profuse" is taken here to mean the government's increased expenditures over the 18th century directly as a result of the wars it fought as detailed in the first-half of this paper. In the example Ricardo gives of the borrowed 40 millions, Ricardo's analysis only focuses on the supply-side of loanable funds and fails to recognize

[33]Ricardo, 246-7
[34]Ricardo, 246

that borrowed funds by the public sector from the private sector is being used to purchase products that is produced from the private sector.

The conclusion that both Smith and Ricardo did not support public expenditure was also reached by James M. Buchanan in 1958.

> Hume, Smith, and Ricardo were in agreement in predicting the consequences of public loans. Their attitudes on this point stemmed from their implicit assumptions concerning the usage to which governments would put revenues. All government expenditure was considered to be wasteful and unproductive; therefore, the real evil of public debt lay in the destruction of capital which it facilitated, not in the debt itself. Thus, we find this group of writers condeming public debt for reason of the public expenditures which it finances as opposed to the post-Keynesian writers who praise debt issue for the same reason.[35]

As previously stated, it was not a coincidence that both Smith and Ricardo, and in general the English classical school, looked disfavourablely on public expenditure in the economy. This coincidence is born out of the fact that both at the time were writing against government policies that obstructed the free flow of trade and the unencumbered development of industry. It was when addressing the issue of government borrowing that their attention as Buchanan correctly pointed out was directed towards both public expenditures and arguments put forth by theorists who argued in favor of the state's use of debt financing and pointed to the U.K. as a prime example.

1.3.3 Sustainability in a Historical Debate

The U.K. classical economists such as Smith and Ricardo must have saw something in the arguments of the proponents of state debt financing that when summarizing

[35] Buchanan, 104

the proponents argument both invariably characterized the proponents arguments as expressing invariance between tax and debt financing, and then each one dismissed the proposition for their individual own reason and then both went on to dismiss the proposition for the same reason.

One notable theorists who was a proponent of state borrowing and championed public expenditure in the 18th century is Isaac de Pinto. Among other theorists at the same time holding similar opinions to his own were "[Bishop George] Berkeley, [Jean Francis] Melon"[36], and Robert Wallace. Isaac de Pinto's writings on public debt and public expenditure stand out on their own from the other like minded theorists because de Pinto, like Smith and Ricardo, provides analytical models to support his theories, something lacking to various degrees in the aforementioned theorists' works. A recently published 2005 article on de Pinto with a brief biography gives insight into why de Pinto was able to elaborate in greater details than other theorists he held in high esteem.

> He was director as well as a shareholder of both the Dutch East India Company and the Dutch West India Company. He attained the directorships in 1748 and 1749, respectively, thanks to the prestige that he had achieved as an adviser and supporter in financial matters to the Stadholder William IV of Orange. Pinto also made a colossal loan to England from his own resources for the sum of 6.6 million pounds (representing roughly 22 percent of the total English public debt). Pinto had first-hand knowledge, then, of the practices followed in the creation of public debt through government securities, which was certainly of great use to him in developing his arguments in the 1771 *Traité de la circulation et du crédit*.[37]

[36]Cardoso, José Luís and Nogueira, António de Vasconcelos, "Isaac de Pinto (1717-1787): An Enlightened Economicst and Financier," *History of Political Economy*, vol. 37, No. 2 (Septermber 2005), 263-292.

[37]Cardoso and Nogueira, 266

Using de Pinto writings to represent the proponents of state borrowing and public expenditure is not only warranted because of his well laid-out and constructed arguments, but also because the arguments he made were either directly or indirectly being refuted by the U.K.'s classical economists. Adam Smith is an example of someone who was directly in contact with de Pinto's arguments as it was recently pointed out that Smith had in his library collection a copy of de Pinto's *Traité de la circulation et du crédit*,[38] and the *Traité de la circulation* is cited in the *Wealth of Nations* as a source for an advantageous point of view on England's public debt,[39] and de Pinto debated the issue of public debt and expenditures with David Hume[40] –a friend of Adam Smith[41]. Ricardo is someone considered to be arguing indirectly with de Pinto as Ricardo cites Melon as being the source for which he is arguing against public expenditure and debt.[42]

The first argument to be examined of Adam Smith's is directly aimed at de Pinto's perception of the national debt.

> The public of the different indebted nations of Europe, particularly those of England, have by one author been represented as the accumulations of a great capital superadded to the other capital of the country, by means of which its trade is extended, its manufactures multiplied, and its lands cultivated and improved much beyond what they could have been by means of that other capital only. He does not consider that the capital which the first creditors of the public advanced to government, was, from the moment in which they advanced it, a certain portion of the annual produce turned away from serving in the function of a capital, to serve in that of a revenue; from maintaining productive

[38] Mizuta, Hiroshi *Adam Smith's Library: A Supplement to Bonar's Catalogue with a Checklist of the whole Library*, (New York: Cambridge University Press, 1967), p.14
[39] Smith, 1002
[40] Cardoso, 284
[41] Smith, v
[42] Ricardo *1996*, 244

> labourers to maintain unproductive ones, and to be spent and wasted, generally in the course of the year, without even the hope of any future reproduction. In return for the capital which they advanced they obtained, indeed, an annuity in the public funds in most cases of more than equal value. This annuity, no doubt, replaced to them their capital, and enabled them to carry on their trade and business to the same or perhaps to a great extent than before; that is, they were enabled either to borrow of other people a new capital upon the credit of this annuity, or by selling it to get from other people a new capital of their own, equal or superior to that which they had advanced to government. This new capital, however, which they in this manner either bought or borrowed of other people, must have existed in the country before, and must have been employed as all capitals are, in maintaining productive labour. When it came into the hands of those who had advanced their money to government, though it was in some respects a new capital to them, it was not so to the country; but was only a capital withdrawn from certain employments in order to be turned towards others. Though it replaced to them what they had advanced to government, it did not replace it to the country. Had they not advanced this capital to government, there would have been in the country two capitals, two portions of the annual produce, instead of one, employed in maintaining productive labour.[43]

There are three critiques of de Pinto's views on the national debt Smith provides in this passage. Smith accuses de Pinto of double accounting when considering the national debt as a 'great capital', "though it was in some respects a new capital to them, it was not so to the country;.."[44] Another accusation Smith launches at de Pinto is of being short-sighted in failing to recognize the diversion of the nation's

[43] Smith, 1002-3
[44] Smith, 1003

capital from productive uses to one of unproductive use as a revenue stream. The last point Smith brings up against de Pinto view on public debt concerns the over all loss of capital to the nation when holders of the state issued annuities exchange them or use them for collateral in securing a loan.

Here is de Pinto's actual view on how the public debt should be viewed which Smith criticized.

> I shall first prove, that the national debt has increased the numerary wealth of the nation; that is necessary to the support of circulation, by which it was produced, and of the excentric commerce which Europe, and particularly of that which England carries on in the other quarters of the world; in short, that it is highly useful, up to a certain point; that taxes, in a great measure, return into the hand that pays them, and, instead of injuring, are favoriable to industry; that the advantages arising from stockjobbing are far superior to the mischief it occasions; that, without the game carried on in the stocks, England would not have had the means of making the efforts she has done; and that this last article has never been well understood by those who have treated of it. ..
>
> Let us come to the fact. I affirm that the national debt has enriched the nation, and I prove it thus. On every new loan the government of England mortgages a portion of taxes to pay the interest, which becomes permanent, fixed and solid, and by means of credit circulates to the advantage of the public, as if it were in effect so much real treasure, that had enriched the kingdom. Let us take for an example the twelve millions borrowed in the year 1760, and see what became of them. Is it not true, that the greatest part of that money was spent within the nation? Nothing but the subsidies, and a part of the sums expended in Germany, can be considered as lost. I say a part, for, even in a war upon the continent, the nation profits by furnishing a variety of articles,

as well as by the individuals who are employed there. When they water Germany, they only fertilise a soil, of which their commerce reaps the benefit. The riches of Germany always turn to the account of trading nations. But I content myself with observing, that it is indisputable that a great part of the above loan was employed and circulated within the nation. England then will have preserved a considerable share of these twelve millions, dispersed and absorbed in the nation itself; at the same time that the numerary riches of her creditors, who are chiefly English, are augmented by twelve millions, which did not exist before. [footnote: It is evident then, that in the year 1761, there must have been many people in England, who had enriched themselves by the expenditure made by government of the twelve millions borrowed in 1760, and who in return were able to lend money to the same government by whom they were enriched; and this is actually the case. They lend back the same money they received, and the creditors of the preceding year acquire a new fund of credit, under the protection of which they procure fresh supplies of money, (either from foreigners or their own countrymen) which they again engage in the new subscriptions. This proves, First, the augmentation of the numerary wealth by loans. Secondly, that the new loans are almost always made with the same money. Thirdly, that the old loans favor the new one; and, Fourthly, that they have enriched the nation.]

If another still more sensible proof be required, that the numerary of about a hundred and thirty millions sterling, which the English nation possesses in annuities, and other factitious funds, would, in a great measure, not have existed, without the creation of these funds, one need only imagine in what would this numerary wealth have constituted, if the funds had never been in being? Could it have been in

> money? Exclusive of plate, there is not so much specie in Europe. Could it have been in land? The limits of Great-Britian are not to be extended. Land has already risen greatly in value, and, without an increase of population, will not admit of further improvement. Could it have been in ships and commerce? These two objects also have their limits, relative to the number of inhabitants. You cannot amass commodities beyond your consumption; and too many merchants are frequently a prejudice to commerce. When once there is as much money employed as the demands of trade call for, the rest is useless. ..[45]

There is clearly a misunderstanding on Adam Smith's behalf towards de Pinto's perception of the national debt when Smith states, "accumulations of a great capital superadded to the other capital of the country.. ."[46] De Pinto believes that the national debt can, overall, be viewed as a national asset. The criticism Smith raises if it were to stand would mean that de Pinto's perception is built on hollowed grounds. That is, there never existed what Smith terms, "great capital super added", de Pinto terms, "numerary wealth", if the initials moneys advanced to the public sector through borrowings is diverted from either current production or current productive investments.

Adam Smith is speaking to the issue of the origination of the borrowed funds. In viewing the national debt or public borrowing as an asset, de Pinto is arguing that prior to the creation of the national debt or each time the government borrows as in the £12-million example he provides, there did not exist that quantity of credit prior to the government borrowing that amount. If one were to draw a set of t-accounts for purchasers of government issued annuities in this case and a t-account for the government, the sum of £12-million would be entered in the government's credits while at the same time each purchaser will have entered into their debits

[45]de Pinto, 16-9
[46]Smith, 1002

the amount the individual loaned the government. This transaction at its simplest is what de Pinto refers to as an increased in the numerary wealth of the country as the government is now free to spend up to the amount it has taken in loans. The £12-million existed dispersed throughout the country and aboard, however, de Pinto is arguing that not until the government borrowed the collected funds did the £12-million as one set piece of credit as well as the entire national debt and the power it brings for purchases come into existence. Furthermore, de Pinto argues that the borrowed funds are mostly spent at home thus nullifying Smith's argument, "...a certain portion of the annual produce turned away from serving in the function of a capital, and to be spent and wasted, generally in the course of the year, without even the hope of any future reproduction." Also, de Pinto broaches this issue from a different direction when he sets up the two-period model of investors and demonstrates that the providers of loanable funds in the 2nd period, 1761, receive their moneys from selling products or services to the government that in turn the funds loaned to it by investors in the first period, 1760.

Like Adam Smith, Ricardo was equally hostile to the view that public expenditure through borrowing could have a positive effect on the overall economy. Ricardo's criticism is directed mainly at the principal amount borrowed and less about the interest payments made to service the borrowed funds.

> Taxes which are levied on a country for the purpose of supporting war, or for the ordinary expenses of the State, and which are chiefly devoted to the support of unproductive labourers, are taken from the productive industry of the country; and every saving which can be made from such expenses will be generally added to the income, if not to the capital of the contributors. When, for the expenses of a year's war, twenty millions are raised by means of a loan, it is the twenty millions which are withdrawn from the productive capital of the nation. The million per annum which is raised by taxes to pay the interest of

> this loan, is merely transferred from those who pay it to those who receive it, from the contributor to the tax, to the national creditor. The real expense is the twenty millions, and not the interest which must be paid for it. Whether the interest be or be not paid, the country will neither be richer nor poorer. Government might at once have required the twenty millions in the shape of taxes; in which case it would not have been necessary to raise annual taxes to the amount of a million. This, however, would not have changed the nature of the transaction. An individual instead of being called upon to pay 100*l*. per annum, might have been obliged to pay 2000*l*. once for all. It might also have suited his convenience rather to borrow this 2000*l*., and to pay 100*l*. per annum for interest to the lender, than to spare the larger sum from his own funds. [47]

The "cost" as Ricardo sees it to public borrowing is the withdrawal of funds, in his example the £20-million, from the "productive capital of the nation." When the government goes into the money markets to borrow private funds, de Pinto sees the government as being one of any borrowers who must attract lenders.

> It is common mistaken notion that, when stocks fall, it is owing to want of credit. It is absurd and ridiculous to say that credit fails, while government can borrow several millions sterling; but it is natural enough that stocks should fall at a time when very considerable sums are demanded for new loans, and when it appears that, from the continuance of the war, the same operation must be repeated for several years. As money becomes scarce, it becomes more valuable, and rises in price, like any other commodity, in proportion to the demand. The state, having occasion for money, is obliged to give a greater interest.

[47] Ricardo, *Principals*, 245-6

> This, for a moment, sinks the old stocks, because every man finds his account in selling out, in order to invest his capital in the new loan, or subscription, which offers him a higher rate of interest. Other accidents make money scarce for a time, and sink the stocks, without its being any way a sign of a defect of credit. When credit really fails, it is impossible to borrow large sums upon any terms; and then, the more we offer, the less we find.[48]

There are implications for the price of the other traded stocks when the government borrows funds offering higher rates of interest, but unless the government borrows considerable amounts for prolonged periods of time there should only be a temporary drop in prices. In addition, there must exist excess liquidity in the funds money market if would be purchasers of government issued debt are able to liquidate their stockholding and with the proceeds purchase the government issued debt.

If the nation is paying the cost for borrowing as Ricardo alleges, then the nation must receive something in return which Ricardo is relatively silent on but de Pinto addresses.

> From what I said it follows, 6○. That the treasury restores to the public the money it receives, increasing the contributive faculty by the annuities and pensions it pays. The retribution, however, is not always exactly equal, with respect to individuals, but must be taken in gross. 7○. The public funds increase riches, commerce, industry, consumption, and the contributive faculty. They are necessary in themselves, and differ widely from the idea hitherto conceived of them. 8○. That nevertheless the public debt should be redeemed to a certain point, in order to diminish taxes, which always appear to be an evil, constantly

[48] de Pinto, 9-11

> magnified by opinion; otherwise, if they were multiplied to far too far, some great difficulties would arise in the course of those fatal wars, which recur too often. 9○. That the true and exact distribution of all the branches of finance is a science, all the principles of which are not yet understood.[49]

Even though the borrowed funds may be taken out of as Ricardo says, "the productive capital of the nation." de Pinto points out that the borrowed funds are in sum total redistributed back into the whole national economy by the many different payments the government makes.

Ricardo's criticism of public borrowing is directed at what he believes to be its greatest cost to the nation, permanent removal of capital investment funds. It is acknowledged by de Pinto that prolonged and over borrowing by government can have negative repercussions in the capital markets as well as for future tax bills. However, to say that public borrowing permanently depletes investment capital over looks the implications that public expenditures has on the overall economy and which de Pinto here points out.

The criticisms both Adam Smith and David Ricardo, the U.K. School, had lodged at de Pinto's theory on public debt have been examined and thus far have been shown not to be valid criticisms or lacking in substance. The view that the national debt or loans can and should be viewed as the creation of wealth of which Smith labeled as false or double-bookkeeping, de Pinto has shown to be valid based on simple bookkeeping accounting or in today's economic terminology, liquidity preference theory. It is not until the government and only the government in this time period has borrowed the vast sums at one time or over time, de Pinto argues, is there the creation of such purchasing power amassed in one place and in turn the government's expenditures of this amassed purchasing power has enabled the English economy to grow. The criticism that public borrowing would divert invest-

[49]de Pinto, 136

ment funds from productive investments is demonstrated by de Pinto to be based on a false premise when the capital markets are demonstrated to be coming up with liquidity allowing for stockholders to unload their holdings and purchase government securities. Furthermore, when the total sum of public expenditure is taken into consideration along side public borrowing they cancel out.

de Pinto was not as characterized by the U.K. theorists articulating a theory for the existence of invariance between tax and debt financing of public expenditures, instead, it now will be demonstrated, de Pinto was arguing that government could debt finance itself for a period of time given adherence to certain checks and balances. The check and balances de Pento specifies are prescribed indicators for examining the fiscal soundness in modern economic terms, sustainability theory. It will also be demonstrated that de Pinto established a formal link between monetary theory and public finance theory.

The idea that there is a limit to government borrowing was briefly hinted at in de Pinto's discussion on the withdrawal of funds from productive investment.

> 8○. That nevertheless the public debt should be redeemed to a certain point, in order to diminish taxes, which always appear to be an evil, constantly magnified by opinion; otherwise, if they were multiplied to far too far, some great difficulties would arise in the course of those fatal wars, which recur too often.[50]

Here de Pinto is pointing out the natural benefit from the public debt being reduced, otherwise, there might be dire consequences if the government does not get its fiscal house in order. Then de Pinto offers a more detailed analysis as to what the limits of public borrowing are and ways to possible quantitatively determine these limits in what can be characterized as de Pinto's specification of sustainability theory or tests.

[50]de Pinto, 136

It is possible to accumulate the national debt to a point that would greatly distress the kingdom. There is a *maximum* of two sorts to be equally avoided. One is the amount of the interest provided for by taxes. The other concerns the mass of paper in circulation. I believe we are at a greater distance from the first than the second. It will appear in the course of this work, that all the resources of England, with respect to taxation, are not yet exhausted; whereas it has been believed, that representative signs in paper could not circulate beyond a certain proportion with the current specie. Speculative calculators have limited this proportion to three to one. But uniform experience in England has proved to a demonstration that it may be carried much farther. Still, however, it demands a limitation. ..In circulation there is a maximum of power, which cannot be exceeded. The public funds are a realised alchemy; but we must not pierce the crusible. Every thing has it bounds; every thing requires limitation. What the limits of the national debt should be, is more than I can say. Perhaps we already touch the border; perhaps we are still at a distance from it. Yet we wish to ascertain this maximum, this point, which cannot be passed without danger. It is, I think, a difficult problem. The following principles may however lead to the solution of it.

A variety of principles must be combined with exactness, and the result of them considered. I speak of England only. The application may afterwards be made to other powers. We should first compare the mass of gold and silver, with which America annually enriches Europe, with the quantity sunk in Asia. If, by an augmentation of specie, the balance inclines in favor of Europe, we are so much the farther from the maximum. The progress of commerce forms the second combinations; particularly that with America, in the consumption of European manu-

> factures and commodities. The more the English improve this branch, the less their debt will be a burthen to them. The third essential article is population and agriculture, which form the natural strength of every state. ..The result of these combinations determines whether England be still able to support an augmentation of the public revenue by taxation, without overwhelming the nation, or going beyond its intrinsic power, so that the harmony of credit and circulation may subsist. This equilibrium is not so strictly exact, but that it may bear a considerable weight before it gives way.[51]

In determining the limit of public borrowing, de Pinto proposes two directly measurable ratios: portion of tax revenue used to pay annual debt charges and available credit ("representative signs in paper") to money in circulation. Either one of these measurements could function as a dependent variable in an equilibrium frame of analysis. de Pinto then goes to specify what independent variables could be used in the analysis of an economy with a metallic based currency and agriculture is a major sector in the economy: net flow of metals, the rate of growth in output of goods, and the population growth rate of a country. These proposed measurements at the time of their conception were innovative. Today these measurements or some similar variation there of are used in performing sustainability test on public debt or incorporated into macroeconomic growth models.

An interesting link here has been established by de Pinto between public finance theory and monetary theory when de Pinto specifies the second ratio, credit to money in circulation, for measuring the limit of public borrowing. The importance of this connection is brought to light when one considers its fifty-years since the establishment of the Bank of England and it and for that matter no previously established central bank in the western world had been charged formally with the responsibility of maintaining the amount of money or credit in circulation. This

[51] de Pinto, 42-7

does not mean that de Pinto is specifying the role the central bank plays in the circulation of currency and/or the effects that control has on the amount of credit made available. However, de Pinto does articulate the link between the money in circulation and the amount of credit made available.

> Take one example more. It is certain that there are a hundred lords in France and England, whose united property exceeds, in numerary value, the current coin of the kingdom. It nevertheless obtains its value by circulation, and the fortune of every individual, taken separately, is real and solid, although the whole together, that is, the equivalent for it in money, does not appear to exist. Successive loans then are always made with the same identical specie, which, through the medium of these loans, communicates its own value to the new funds or paper created by credit, and returning into general circulation increases the power of lending again.
>
> All the millions paid to the king of France, are poured back into the gulph of the nation. The ocean, from whence they sprung, receives them in return, although there may be some basons in the cascade, which, not being in their proper place, may prevent a more useful distribution. But if they were to stagnate at their source, a beneficial circulation would be lost to the public.[52]

When the government borrows, it is the capital markets that are extending credit for the government to use. The amount of credit is based on the amount of money in circulation. Public expenditure derived from public borrowing is funneling stagnating money back into circulation.

Where did the U.K. theorists get their perception that de Pinto and like minded theorists were advocating the existence of invariance between tax and debt financ-

[52]de Pinto, 22

ing? Here, de Pinto gives an example of how to measure the use of public borrowing against the levying of taxes to service the loans.

> The island of Grenada, and the Grenadillas, must in time make a rich return to England. But, besides the treasures which it cost to conquer them during the war, the English have purchased them a second time at the peace, having paid large sums to France for the planation and improvements already made there. ..France had gained a real and solid increase of its numerary wealth returned into the kingdom, while the profits of the English were yet in expectation. These islands at present make a great return to England. ..I question whether the English government will, for a long time, receive an increase of revenue proportioned to the load of interest due on the new loans; or whether the nation in general will soon receive a compensation more than sufficient to balance the newurthen of taxes, and the interest paid to foreigners concerned in the public funds. In an abstract view, the kingdom must be a loser, if a part, or rather the whole of its taxes, did not return again into the hands of the nation; and if its numerary wealth were not augmented by the increase of the national debt, as I have demonstrated elsewhere. Without this compensation, and the security of their former settlements, the advantage of England in the last peace would have been very inconsiderable.[53]

It must be made clear that de Pinto is not making a comparison between debt and tax financing of England's payment to France for the Grenada Islands. As documented in the first-half of this paper and as with the borrowed funds just to pay France over the settlement of the Grenada Islands, the UK in seeking subscribers to this particular loan promised the subscribers that a certain tax revenue stream

[53] de Pinto, 195

would be set aside just for payment to these subscribers. The proposed framework of analysis is static in nature and specifies the comparison of two computed measurements. The first measurement is calculated from the revenue the government receives from a project over the interest charges on the debt it cost to fund the project. It is unclear whether de Pinto means direct revenue that is returned to the government from, for example a public corporation such as the East India Company that would pay an annual fee to the government, or increased revenues from increased earnings through say trade with this new found colony. The second figure is calculated by looking at whether the increase in national income offsets increases in the tax burden and interest charges paid to foreigners who subscribed to the government's issued debt. De Pinto's concern or caution is that if foreign subscribers take their interest payments that are directly paid out of a tax revenue stream repatriate their earnings to their home country without say purchasing English produced goods, then the UK could find itself poorer through this leakage of directly repatriaited funds to foreigners home countries.

1.4 Epistemology Placed in its Historical Context

Neither Adam Smith nor David Ricardo believed in debt financing of government expenditures whether it be in general as with Smith and/or with specific reference to 18th–century UK with respect to Ricardo. Although both of these paragons of classical economic theory went very far in developing theories, models, and thus the understanding of how trade and commerce worked to benefit an economy –effectively wrestling control of the development of economic theory from the physiocrats such as F. Quesnay and J.B. Say as well as proponents of mercantilism, when they examined or critiqued fiscal matters of the state though, they brought with them one perception inherited from the physiocrats that colored their perception of the role the public sector in the economy.

[referring to the physiocrats] Agriculutre, in their view, was 'alone'

> productive; and why? Because it produced what the experience of the ages had shown to be the taxable surplus (or so it seemed to them). Non-agricultural workers were a 'sterile class' – because, in the same experience, they seemed to be supported out of the expenditure of this surplus and did not contribute to it. Even in France of their day was outgrowing this pattern, but they had not outgrown it in their thinking. Their 'impot unique' was a recommendation of a return to it.[54]

Both Smith and Ricardo believed that state borrowing through the capital markets was siphoning off the surplus generated by commerce and that this surplus would never come back into circulation again. Further more, as discussed in the first part of this paper, the UK's state finances in the early- to mid-part of the 18th-century was almost always in a precarious state of collapse because of insufficient revenues coming in on one side and uncontrollable costs due to the financing of several wars on the other side. This scenario was seen occurring several times in the capitals of the UK's two greatest rivals: Spain and France.

> The State, in the Middle Phase, was as a rule not creditworthy. This was only in part a consequence of the inelasticity of tax revenue, which made it difficult to repay when the time came for repayment. It was only too easy, when that time came, to rationalize default. These people say that they have lent the money; but why did they not pay it over in tax? They had shown, by lending, that they had the money; so it was easy for the King and his servants to persuade themselves, when the time came, that it was money which ought to have been contributed outright.[55]

When Smith and Ricardo entered the debate about the use of credit in public finance with this debate's focus on the 18th-century UK because it was the only major

[54]Hicks J, *A Theory of Economic History*. (Oxford Press, 1969) 24.
[55]Hicks, 86

empire not to have repudiated its debts, they held such strong antithetical views as to the role of the state in the economy that their characterization of the proponents' argument as they saw it was merely an articulation of invariance between tax and credit finance which both believed to have little or no merit. Ironically, even though Robert Barro had dismissed Smith's articulation of invariance theory as being confused, it was only Smith in his qualified articulation of invariance theory who was willing to entertain the thought that the state would have to borrow or use credit in times of a national crisis such as a war. Ricardo, who Barro saw as articulating an invariance theory more in line with his very own model, on the contrary to Adam Smith, would not allow the practice of state borrowing funds and specifically called for the nation's leaders to seek the people's permission to levy an extraordinary tax when they wanted to take the nation to war.

The proponents of state borrowing were able to look at the UK's management of its debts through out the 18th-century and draw a far different conclusion than the ones reached by both Smith and Ricardo. The proponents were neither all foreigners standing on the outside looking in, for example, George Berkley, Sir James Steuart, and Archibald Hutcheson, were just a few UK theorists espousing the merits of debt financing, nor, it would be safe to assume, did they all hold strong views against the constant wars the UK found itself fighting throughout the 18-century which both Smith and Ricardo shared. A possible characteristic that proponents of debt financing shared and Isaac de Pinto indirectly addressed in his Grenada example is that they saw the UK established colonies through out the world and was enjoying to various extent trade with these new found colonies.

There may have been a tinge of mercantilistic tones in the arguments put forth by proponents of state borrowing which Smith and Ricardo's writings were strongly aimed at uprooting. De Pinto was an international financier who was directly involved in raising international funds borrowed by the UK government in the early- to mid-parts of the 18th-century and he was certainly aware of the UK govern-

ment's struggles to meet its debt obligations as he had troubles himself getting paid for services he rendered to the UK government for raising borrowed funds. Yet, since the UK government did not repudiate its debts, even when the government's finances were at their most unstable point that culminated in the South Sea Bubble, de Pinto was able to rationalize that as long as the United Kingdom was able to meet its interest payments on its debts, the State would remain soluble given certain boundaries were respected.

In the first chapter of *Economic Theory in Retrospect*, Mark Blaug connects mercantilist theory with some of the first monetary theories and those theorists such as John Locke and Bishop Berkley concerns over the re-channeling of idle funds to productive uses.[56] Clearly, de Pinto marries mercantilist's concern for idle funds with liquidity preference theory when he lays-out how the government's higher rate of returns attracts investors who liquidate their holdings in stock and purchase government debt subscriptions, thus tieing up their funds for longer periods of time, and with loanable funds theory when he points out prior to the government borrowing the quantities it did, the quantities as one purchasing block did not exist prior to government borrowing the aggregated sums.

Even though many of Isaac de Pinto's arguments were along and/or may have originated from mercantilist thought, his innovative analysis as to the effects of state borrowing were not given the proper open reception by the UK's leading theorists of those times because of their own infatuation with dismissing mercantilists and physiocratic ways of thinking how to make the home economy prosperous, and replacing these theories with one that incorporated the on going changes in the economy at that time.

[56]Blaug M. 20

1.5 Conclusion

Any U.K. classical economist writing during the 17th- and 18th-Centuries would have several good reasons to hold such negative views towards borrowing and thus towards public expenditure: any learned person could point to the disastrous state of financial affairs of England's biggest rivals, France and Spain, and feel that England would arrive at such a state by its ever increasing reliance on public borrowing to finance its ever increasing war expenditures; any attempts at paying down the debt such as the establishment of the sinking-fund meet with little if any success because of ministers' inability to keep prior made promises or their constant redirecting of funds intended for paying down the debt towards current expenditures or maintaining newly incurred debts; although the government was able to lower its interest payments by negotiating lower interest rates, the South Sea Bubble and the effects it had on holders of government debt had to make an ever lasting impression amongst theorists as to the government's ability to continue to manage its debts in a sound manner. In addition to these reasons and many more here not discussed, the U.K. writers were hostile towards anyone espousing the ideas that public expenditure was a good in and of itself and that there may be very cogent reasons other then in the case of war for the public sector to borrow private funds.

When Robert Barro tried rightfully to connect his modern day inception of invariance theory with classical economic theory, he made two sins of omission. The first was Adam Smith's qualified articulation of invariance theory. Although Smith's articulation only allowed the public sector to borrow private funds in the case of national emergencies, it was simply the only time Smith was prepared to recognize the use of borrowed funds by the public sector from the private sector. Barro's articulation of invariance theory is unrestricted in that the government can and does borrow year to year. The second sin of omission is that even though Ricardo's articulation of invariance theory is theoretically more in line with Barro's articulation, Ricardo did not see the role of the government as a contributing sector

in the economy and thus any borrowed funds from the private sector by the public sector would only retard or hamper growth in national output.

On the other side of the public finance debate were proponents of state borrowing like Isaac de Pinto which recognized the importance of the public sector in the economy and were able to grasp the idea that through borrowing from the private sector the government was able to funnel money back into the economy through the wages it paid or purchases it made from the private sector. In addition, there was a recognition that the state, the United Kingdom, expenditures increased as the state took on more responsibilities and the economy enjoyed the benefits from this increased activity.

How does the public sector affect the economy has long been theorized and debated. The field of public finance is solely devoted to this endeavor. Robert Barro's greatest contribution to this field may have not been his initial inquiry into the invariance between tax and debt finance of public expenditures but the spin-off it lead to in the topic of sustainability of fiscal policy with respect debt levels and its measurements. It is models that test for sustainability of public debt that yield more relevant information to policymakers, analysts, and the public. At the time of his writing, Issac de Pinto envisioned that in the future the information needed to calculate his specified measurements as to the impact of state borrowing on the rest of the economy would become available.

Joseph Schumpeter's comment on Isaac de Pinto is to the development of economic theory as Oscar Wilde's "A poet can survive everything but a misprint" is to life itself.

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Chapter 2

SUSTAINABILITY OF PUBLIC DEBT: AN EXAMINATION OF THE U.S. STATES

2.1 Introduction

Do states governments run sustainable fiscal debts with and without federal assistance? Henning Bohn's (1998) test for the sustainability of public debt will be used on a cross-panel data set of the U.S. states to investigate this question.

The U.S. States are a laboratory for the field of public finance theory and practice, be it the individual state(s) (Braunstein 2003 and Lauth 2003) or taken collectively together as a whole (Gramlich 1991). Many of the seminal studies on states public finance (Bohn and Inman 1996, Gramlich 1978, and Poterba 1994) focus on the institutional arrangements that bring about fiscal policy decisions. This study wishes not to follow in that vein, but one that examines the states government as a sector and examines those expenditures and sources of revenues for which it has direct control (Dye and McGuire 1992; Sorenson et al 2000; Hou 2003) as well as that when federal transfers are considered also as a source.

Almost all states have some type of law governing balanced budgets and/or a state constitutional amendment governing the issuance of debt.[1] The public perception then is that their state or local governments can not or are unable to run deficits. Gramlich addresses the public's discernment and by implication the relevancy of this study to public finance by pointing out:

> "These constraints are typically in stock terms, not flow terms. In other words, they usually do not prohibit state or local deficits; they only prohibit balances from falling below a certain level. A state or

[1] ACIR. Significant Features of Fiscal Federalism 1976. 1st ed. Washington, DC: Advisory Commission on Intergovernmental Relations; 1976. Table 2.

> locality could run a deficit if it had previously saved enough to cover the deficit."[2]

The aim of this study is to ascertain or to determine whether states have effectively become dependent on debt financing as means of financing expenditures contrary to rules and regulations already emplace limiting their use of debt financing? And to what extent are states' finances dependent on federal assistance?

Where Bohn's test was developed and has been applied to national economies (Bohn 1998 and Semmler et al 2005), with the appropriate substitution of state figures for national figures, Bohn's test should be applicable to the United States' states' governments where (or at the sub-national government level), unlike its OECD counterparts, they can and do run consistent deficits for periods of time.

Section II will layout the Bohn test and the estimating procedure. Section III will discuss the data set and proposed tests for time-breaks and parameter consistency over the sample period. Sections IV presents and discusses the results for the whole sample period while Section V examines consistency in the parameter estimates. Section VI presents known changes in federal/states aid policies along with any national trends in the economy and reconciles these shifts with this study's findings. And Section VII concludes. The tables in the various sections are summaries of the more detailed tables found in the Appendix.

2.2 Model for Empirical Analysis

The model that is used to investigate whether states run sustainable fiscal debts is Bohn's test testing for responses in the budget surplus to the mean-reversion of the debt-gdg ratio controlling for counter-cyclical fluctuations in both government expenditures and state (national) output.

Using Bohn and Inman's definition, the general fund surplus:

[2]Gramlich, E. The 1991 State and Local Fiscal Crisis. Brookings Paper on Economic Activity. 1991; 2: 253

$$\begin{aligned} surgf_t = \; & intrev_t \; + taxes_t \; + fees_t \; + aid_t \\ & - wages_t \; - main_t \; - other_t \\ & - trans_t \; - gfcpf_t \; - gfctf_t \\ & - int_t \; - ld_t \end{aligned} \tag{2.1}$$

where aid_t: federal aid, $intrev_t$: revenue earned from interest, $trans_t$: financial assistance transfers, $main_t(other_t)$: general current operation (other not classified elsewhere), $gfcpf_t$: contributions to pension fund, $gfctf_t$: contributions to workers compensation, ld_t : long-term debt redeemed. In the calculation of the general fund surplus for Bohn's test, $intrev_t$, ld_t, and int_t are dropped from the calculation because $intrev_t$ is not directly controlled by the legislative body, ld_t is used as independent variable, and the over all model is setup so no discounting has to take place thus int_t is dropped.

The regression model to be estimated:

$$surgf_t = \alpha_0 + \rho_0 b_t + \beta_1 GVAR_t + \beta_2 YVAR_t + \epsilon_t \tag{2.2}$$

where b_t : total outstanding debt which includes ld_t, $GVAR_t$:detrended government expenditure, and $YVAR_t$: detrended states output. It will be determined that the states are running sustainable fiscal debt policy if $\rho > 0$ and significant.

$GVAR_t$ measures of the effect of random government expenditures on the general fund budget surplus and $YVAR_t$ measures the effect downs turn in states (national) output have on the general fund budget surplus. The detrending process for the derivation of these two variables follows Robert Barro's specification[3]:

$$GVAR_t = \frac{wbtom_t - wbtom_t^*}{gsp_t} \tag{2.3}$$

and

$$YVAR_t = \frac{gsp_t^* - gsp_t}{gsp_t^*} \frac{wbtom_t^*}{gsp_t} \tag{2.4}$$

[3]Barro RJ. U.S. Deficits Since World War 1. The Scandinavian Journal of Economics.1986 Mach; 88: 204

where $wbtom_t$: general fund expenditures on salaries, benefits, transfers, and maintenance; $wbtom_t^*$: detrended general fund expenditures using a simple OLS technique; gsp_t: gross state product; and, gsp_t^* : detrended gross state product using a simple OLS technique. The regressions for the detrending process are in the Appendix Table 2.8.

Both the general fund surplus and the states' outstanding debt will not be tested for unit-roots because as Bohn (1998) argued the acceptance of a unit-root is wrong because of the inability of unit-root tests to distinguish between a unit-root processes which is almost to be certainly present in the budget-gdp ratio or whether a variable reverts back to a mean value. Even though Bohn is referring to national debt when talking about the presence of a unit root, The same should be true for the states given the stricter regulation with regard to their issuance of debt.

The initial estimating procedure was going to be two-stage feasible generalized least squares as this estimating procedure directly incorporats known serial correlation that arise in panel data estimation. However, when confronted with this estimating technique short-comings, two-stage feasible generalized least squares still looked to be the lesser of two-evils when using a cross-section panel data set as oppose ordinary least squares with reported panel-corrected standard errors that corrects known defencies after the fact.[4] Fortunately, further research uncovered Frederico Podesta's timely recommendation that given the drawbacks of using either methodology with a cross-panel data set, the properties of a fixed-effect model render it a preferable method.[5] The estimating equation:

$$surgf_{nt} = \alpha_n + \alpha_t + \rho b_{nt} + \beta_1 GVAR_{nt} + \beta_2 YVAR_{nt} + \epsilon_t \qquad (2.5)$$

where α_n: fixed-effects accounting for differences between the states; α_t : is

[4]Beck N, Katz JN., What to Do (and Not to Do) with Time-Series Cross-Section Data. The American Political Science Review 1995 Sept; 89(3): 634-647

[5]Podesta F. Recent Developments in Quantitative Comparative Methodology: The Case of Pooled Times Series Cross-Section Analysis. McDonough School of Business (Georgetown University), DSS Papers 3-02

a time-effect accounting for differences that occur over time. The regressions are estimated with and without the time-effect, most of the time the presence of the time-effect adds as a confirmation of the finding with only the fixed-effect, however, when the sample period is split or the states are grouped according to some criteria, the presence of the time-effect variables has a greater impact on the other estimated coefficients. Even though the results are not reported in this paper, the results of these regressions were cross-checked with results obtained from both ordinary least squares and two-stage generalized least squares. The third-paper of this series will compare the results from all three types of estimated regressions.

ρ measures whether a positive or negative co-movement exist between the budget surplus and the total level of debt, holding everything else constant. If ρ is positive this means that there tends to be on average surpluses in the general budget fund such that the total level of debt is brought down or offset; if ρ is negative this means that on average there tends to be deficits in the general budget fund such that increases in debt levels or decreases are not being offset. It is because ρ can take on negative and/or positive values over time, it can and should be expected that ρ will be insignificant from time to time. Also, because Bohn's model is usually applied at the national level where the budget cycles are consistent over time, ρ here may have a different meaning as various states begin and end at different times in the year.

2.3 Data Set

The data set for this study is replicated from Bohn and Inman's 1996 study on state public finances. The source of public expenditures and revenues for this study and Bohn and Inman is the U.S. Bureau of Census' database (Rex-Dac), for 1972 and 1976 - 2004. The published U.S. Census Bureau's *Annual Survey of State and Local Government Finances and Census of Government* is used for the years: 1970-71 and 1973-75. This study updates the Bohn and Inman study's data set (1970-91)

with an additional 13-years (1992-2004) due to the use of a more recent updated Rex-Dac database, for a total of 35 annual observation points for each state.

The states: Hawaii, Alaska, and Wyoming are excluded from the Bohn and Inman analysis because taxes from mineral wealth is directly deposited into the latter two states's general fund. Hawaii is also excluded because the state is responsible for its only school district. Although this study will initially report its findings for all 50-states, 48-states (upon visual examination of the general budget surplus fund and a graph of residuals verses fitted values for all the states it is difficult to conclude Wyoming being systematically dropped form this study's analysis. The primary focus will be on the 48-states and any tests carried out will be reported on these states. An additional state or two may be dropped when tests are carried-out on groups of states in order to keep the numbers in groups equal. The number of observations for each variable is then 1750 for all 50-states and 1680 for 48-states.

The expenditures and revenues are deflated by their irrespective price index. The source for these indexes is the Bureau of Economic Analysis' NIPA (2007) Table 3.10.4 on government expenditures and services. In order to cross-check this data set with Bohn and Inman's data set the base year is set to 1990 and this data set's means and standard deviations for expenditures and revenues was compared with the ones reported in Bohn and Inman's Table 3. The last column of Table 2.1: '47-States 1970-1991', reports the means and standard deviations for the same number of states and time period as in Bohn and Inman. Two discrepancies arose during the cross-checking: 1) Bohn and Inman's calculation of revenues (TAF: $taxes + aid + fees$) is under-estimated when compared with this study's; and 2) this study's standard deviation for the general fund surplus is over-estimated when compared with that of Bohn and Inman's reported figure. These discrepancies are easily explained.

Differences in revenues occur because the Rex-Dac data base for some reason does not include in its final tabulation for total federal aid to the states aid for natural

resources. It does, however, have federal aid disaggregated into several individual categories in which natural resources is one. Even though Bohn and Inman and this study's reported values for total federal aid alone is correct, that is each study aggregated the individual categories of federal aid for total aid from the federal government, in order to achieve their final calculation for revenues aid for natural resources would have to been excluded as this was the amount in discrepancy. The difference in this study's reported over-estimated standard deviation of the general fund surplus is due to Bohn and Inman's reporting of the standard deviation for the general fund surplus as a calculation from the net deposits in several various accounts that when aggregated constitute the general fund surplus. There is no significant difference in means and standard deviations of expenditures and revenues between this data set and Bohn and Inman, however, because Bohn and Inman's focus is on balanced budget rules they build several additional accounts in which the budget surplus is deposited. It is from the mean sum total of these net deposits that they report the standard deviation. Although the means of the budget surplus for this study and Bohn and Inman are not significantly different, the standard deviation for this study's budget surplus is assumed to be correct as the means and standard deviations reported for expenditures and revenues that determine the budget surplus are insignificantly different from those reported by Bohn and Inman.

TABLE 2.1. Means and Standard Deviations of States' Expenditures and Revenues per capita,1970-2004

	$50-States$		$48-States$		$47-States$		$47-States_{1970-1991}$	
$taxes$	1163.67	471.44	1113.57	284.53	1107.40	280.13	998.35	224.48
$fedaid$	594.5	252.2	573.6	214.8	560.1	187.7	466.6	112.1
$intrev$	129.4	326.2	90.6	92.9	82.5	64.5	72.0	66.3
TAF	2086.9	992.5	1964.6	526.6	1944.6	506.2	1681.9	338.0
$WBTOM$	1840.6	847.8	1712.5	501.1	1703.6	499.8	1453.4	327.3
$gfcpf$	53.0	43.8	49.6	36.2	49.8	36.3	47.2	31.3
$gfctf$	3.1	16.4	3.2	16.8	1.7	4.6	1.3	2.8
$expint$	84.4	107.7	72.3	59.1	72.0	59.2	61.5	55.6
$expld$	115.0	170.7	100.2	112.7	99.1	111.5	59.7	61.6
$surgf.org$	120.4	600.7	117.5	291.0	101.0	263.2	130.8	223.6
$surgf$	−404.1	558.2	−374.2	292.7	−370.4	286.6	−286.6	230.7
$surgf.w.aid$	75.3	553.8	99.2	264.8	90.5	254.0	120.3	215.1
$surgf.w.aid.n.ben$	131.3	550.5	151.9	257.4	141.9	244.7	168.9	212.3
inc	17214.0	4195.8	17079.2	4172.0	17069.5	4187.1	14977.7	3157.9
$realgsp$	19583.2	9298.5	19471.9	9171.7	19423.3	9121.4	16595.2	8219.0
$rain$	980.1	3012.3	623.4	768.7	553.6	549.2	428.2	386.8
$ldoff$	717.6	879.3	648.0	647.6	636.9	643.5	443.5	513.4
$sdout$	17.4	47.2	16.0	45.2	16.3	45.6	20.6	54.3
$ldout$	1264.5	1219.2	1121.6	851.5	1120.5	857.1	952.0	750.6
	$N = 1750$		$N = 1680$		$N = 1645$		$N = 1034$	

In Bohn (1998), Semmler et al (2005), and Greiner et al (2007) gross domestic product for each individual country modeled is used as a scaling variable. For this study, the Bureau of Economic Analysis' (2007b) Gross Domestic Product (GSP) by State and its corresponding quantity index is used. An immediate problem arises in that the BEA changed its methodology for calculating GSP after 1996 and cautions against appending the two-series together in order to make one continuos series. According to the BEA's website gross domestic product by states prior to 1997 is equivalent to gross domestic income and afterwards it is equivalent to gross domestic product as calculated on the national level. An F-test comparing the variance of real gsp for the whole-sample data set, 1970 - 2004, with the variance of gsp for the sub-period, 1997 - 2004, was performed and the alternative hypothesis of the variances being unequal was rejected at a 0.10 significant level – for the 50-states, and a 0.20 significant level – for the 48-states (see Appendix for details of results).

Several various test are performed for model and time consistency. The first test of the 48-states is to investigate whether states run sustainable fiscal policies with respect to their level of debt given control over their own sources of revenue and expenditures. For this test, federal aid is subtracted from the general fund expenditures so any state matching expenditures induced by federal programs will be removed (columns' titled: $y_{it} : surgf_{it}$), this model will be tested against a model in which federal aid enters in only as a source of revenue in the general surplus fund (columns' titled: $y_{it} : surgf.w.aid$). Federal aid is the second largest source of revenue for states governments which they do not control directly as they do with say income taxes or fees charged. Although states have prior knowledge to how much federal aid they will receive, do they on a whole have sufficient resources on their own to meet expenditures and cover their debts for which they are directly responsible. Thus when federal aid removed from the budget surplus it is also at the same removed from $wbtom^*$ which figures into the calculation of both $GVAR_t$ and $YVAR_t$ is re This is why it is important to test whether states implement

sustainable policies with and without federal aid considered as a source of revenue. A second set of tests investigates whether there is parameter consistency among groups of states when they are grouped according to historical debt levels. The last set of tests performed examine the consistency of parameter estimates over time.

2.4 Empirical Findings

The results of the regression for the full-data set, 1970-2004, is shown in Table 2.2. All of the signs of coefficients are as expected: GVAR and YVAR are negative and significant. ρ can be either negative or positive. The magnitude of the coefficients for all of the regressions are in order not only when a regression without a time-effect (top-half of Table 2.2) is compared with its counter-part, a regression with a time-effect (bottom-half of Table 2.2), but when also compared with results for similar studies done on a national level and states level – discussed in greater detail in Section 2.6.

TABLE 2.2. Fixed-Effect GLS weighted Regression of Full-Sample Data Set

$$y_{it} = \alpha_i\,(+v_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

		$50-States$ 1970–2004		$48-States$ 1970–2004		$47-States$ 1970–1991	
	$y_{it}:$	$surgf.w.aid$	$surgf$	$surgf.w.aid$	$surgf$	$surgf.w.aid$	$surgf$
	ρ_0	-0.03	-0.01	-0.02	0.01	-0.04	-0.01
		(-3.14)	(-.62)	(-2.09)	(1.17)	(-3.48)	(-1.26)
Without Time −Fixed Effect	β_1	-0.41	-0.59	-0.42	-0.43	-0.42	-0.37
		(-30.92)	(-28.66)	(-27.03)	(-20.87)	(-22.19)	(-16.99)
	β_2	-0.19	-0.49	-0.17	-0.41	-0.16	-0.37
		(-21.38)	(-34.76)	(-18.40)	(-28.89)	(-13.82)	(-23.70)
	ρ_0	-0.03	-0.01	-0.02	0.01	-0.04	-0.04
		(-3.60)	(-.77)	(-2.54)	(1.09)	(-4.45)	(-3.84)
With Time− Fixed Effect	β_1	-0.38	-0.64	-0.37	-0.46	-0.39	-0.60
		(-26.56)	(-30.10)	(-23.40)	(-21.02)	(-21.47)	(-29.80)
	β_2	-0.17	-0.52	-0.15	-0.42	-0.16	-0.45
		(-18.57)	(-36.57)	(-15.68)	(-29.35)	(-14.28)	(-34.95)
L.Ratio P−Value		$P < .00$		$P < .00$	$P < .0.01$		

The coefficients are to be read as a percentage decrease or increase in the following year's general fund surplus. Looking at the first regression for all of the states from 1970 to 2004, if states' government random expenditures increased by \$100, the general fund budget surplus would decrease by \$41. YVAR, read as tax revenues from states's output, indicates that a \$100 down-turn in states output leads to a \$19 decrease in next year's tax revenues or reduction in general fund surplus. The ρ of -0.03 suggest that an increase of states' debt of \$100 would lead to a decrease in the general fund surplus by \$3. Although a log-likelyhood ratio test indicates that the model with a time-effect is significantly different from the regression without one, the coefficients do not substantially vary neither when a time effect variable is included (ex. $\rho = -0.03,\ GVAR = -0.38,$ and $YVAR = -0.17$) nor when both Alaska and Hawaii are excluded from the sample period, Table 2.2 column titled: 48-States. It appears that the states on a whole do not implement sustainable fiscal debt policies when federal is considered as a source of revenue for the entire sample period, however, this finding will be investigated further in the next section for consistency through out the sample period.

An opposite conclusion is reached when considering only the revenues and expenditures the states have direct control over (columns titled: $y_{it} : surgf$). In this set of regressions in which federal aid is subtracted from states' expenditures, removing expenditures induced by federal programs, the results very considerably when Alaska and Hawaii are dropped from the sample. It is better to focus on the sample of 48-States as GVAR fluctuates less than YVAR when both are compared with their counterparts in the model that has federal aid as a source of revenue (column titled: $surgf.w.fedaid$). Remembering that GVAR measures random government expenditures, it is expected that without federal aid as a source of revenue an increase in random expenditures would have a greater effect on the budget surplus. Likewise, one expects to see that a down-turn in states' output has a more pronounced effect on states' revenue $(YVAR)$. The regression of the sample of

the 48-States shows both $GVAR$ and $YVAR$ having increased effects of -0.43 and -0.41 (from column titled: $y_{it} : surgf$) when compared with their counterparts -0.42 and -0.17 (column titled: $y_{it} : surgf.w.aid$). There is no increase in $GVAR$ but the the increase in $YVAR$ is two-fold. However, when a time-effect variable is included in both models, $GVAR$ has an increased effect going from -0.37 to -0.46 while the increased effect in $YVAR$ does not substantial change, going from -0.15 to -0.42.

As a whole, states do not run sustainable fiscal debt policies when only considering revenues and expenditures for which they have direct control. ρ, for both models with and without a time-effect, is 0.01 and not significant at a meaningful level for the sample of 48-States. The last set of regressions in Table 2.2, column titled: $47 - States,$ is for the same set of states and time period, 1970 - 1991, as in the Bohn and Inman (1996) study. These results unfortunately have no comparable set of figures for comparison in the Bohn and Inman study. The next section examines the reported findings in this section for consistency across the entire sample period and in between states.

2.5 Consistency of Parameter Estimates

The results reported in the previous section will be examined for consistency over the entire sample period, 1970 - 2004, and for consistency in estimation between the states. Figures 2.1 and 2.2, graphs of the first-difference of states' median real long-term debt as a percentage of gsp, indicate several years in which states' debt reached a maximum. Of particular interest is the year 1978 which figure 2.2 indicates to be the year the States had the highest accumulated debt level and is often mentioned in the literature on states public finance.[6] Graph 2.1 indicates that the accumulated debt-level for 1978 to be important, but not as important as the years 1974 and 1996.

[6]Sorenson BE, Wu L, Yosha O. Output Fluctuations and Fiscal Policy: U.S. States and Local Governments 1978-1994. Federal Reserve Bank of Kansas City 2000 Dec: RWP 99-05

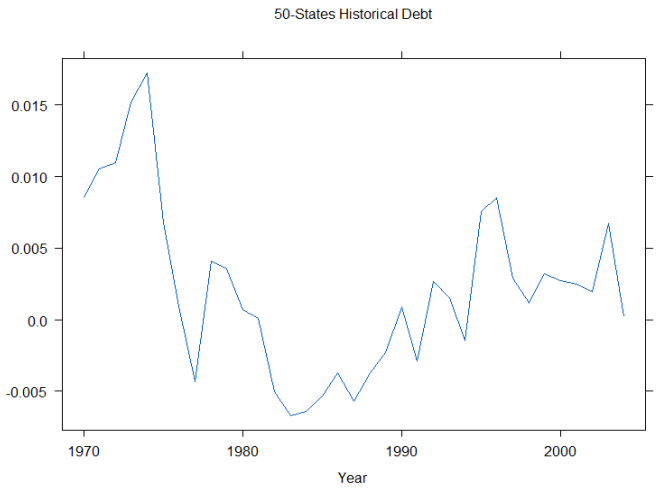

FIGURE 2.1. First-Difference of Real Long-term State Debt as a Percentage of Gross State Product.

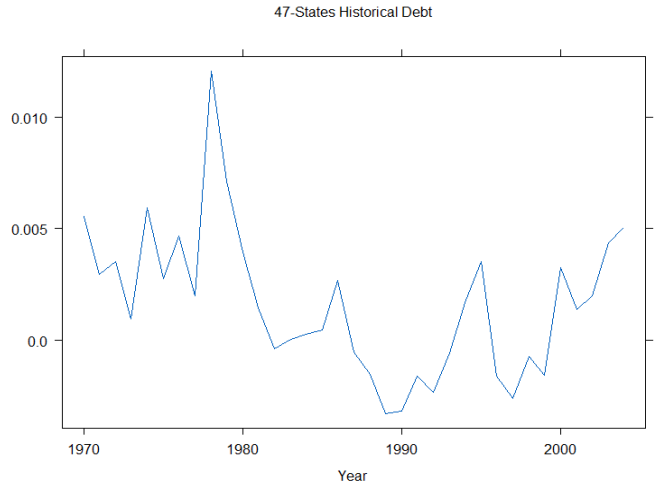

FIGURE 2.2. First-Difference of Real Long-term States Debt as a Percentage of GSP. GSP Index based on 47-States.

The discrepancies between Figures 2.1 and 2.2 is due to the calculation of the index for GSP. Index numbers had to be imputed for the years 1970 to 1976. As previously mentioned in the prior sections, almost all studies examining a cross-section of the States omit several states for various reasons. The imputed GSP index numbers for figure 2.2 was generated from a data set that systematically omitted the states: Alaska, Hawaii, and Wyoming; the imputed GSP index numbers for figure 2.1 was generated from a data set that included all 50-States and all estimates in this study use the latter generated index numbers. As a result of these graphs, the sample is divided into three sub–sample periods: 1970-76, 1980-94, and 1998-04. Unfortunately, there is not enough observation points prior to 1974 in order to test for a break in 1974. The results are reported in Table 2.3.

TABLE 2.3. Fixed-Effect GLS Weighted Regression, Tests for Breaks in Time

$$y_{it} = \alpha_i\,(+v_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

	y_{it} :	*surgf.w.aid*			*surgf*		
		1970 − 76	1980 − 94	1998 − 04	1970 − 76	1980 − 94	1998 − 04
	ρ_0	0.03	0.01	−0.02	−0.06	−0.03	−0.14
		(1.29)	(.50)	(−1.08)	(−3.19)	(−2.87)	(−5.42)
Without Time −Fixed Effect	β_1	−0.50	−0.45	−0.78	−0.47	−0.33	−0.45
		(−22.48)	(−15.05)	(−16.78)	(−18.87)	(−8.93)	(−8.36)
	β_2	−0.21	−0.23	−0.27	−0.44	−0.33	−0.04
		(−15.79)	(−12.24)	(−9.63)	(−24.66)	(−14.10)	(−1.56)
	ρ_0	0.05	0.01	0.07	−0.09	−0.02	0.00
		(2.15)	(.95)	(3.04)	(−3.99)	(−2.66)	(−.03)
With Time− Fixed Effect	β_1	−0.58	−0.39	−0.75	−0.78	−0.38	−0.83
		(−15.61)	(−12.29)	(−18.75)	(−20.35)	(−9.40)	(−17.70)
	β_2	−0.26	−0.21	−0.39	−0.56	−0.34	−0.61
		(−12.18)	(−10.91)	(−16.12)	(−22.03)	(−14.45)	(−21.10)

The estimation for the three-separate time periods indicates that there exist structural changes occurring over the entire time period. First, all three-estimates to varying degrees have parameters significantly different from the parameters for the estimate of the entire sample period for the 48-States in Table 2.2 with and without federal aid considered as a source of revenue. This finding is not unexpected as various Administrations have sought to help states' governments in down-turns in the national economy or in order to rein-in their own expenditures cutback or curtailed the federal government's financial assistance and/or commitments to the states – changes in federal aid programs will be discussed in greater detail in the next section. Second, the parameters of the estimates for the three sub-periods are different from one another.

Examining how states did with federal aid considered as a source of revenue over the three-different time periods ($y_{it} : surgf.w.aid$), leading up to the second peak in states debt, 1978 (Table 2.3: column titled: $1970-76$), both $GVAR$ and $YVAR$ with and without a time fixed-effect are greater than their counterparts for the estimate of the over all sample period. The same is true with $GVAR$ and $YVAR$ being the greatest in magnitude for the latter period after the third peak in states debt, 1996 (Table 2.3: column titled: $1998-04$). For the middle-period (Table 2.3, column titled: $1980-94$), both $GVAR$ and $YVAR$ with and without a time fixed-effect are just slightly greater than their counterparts for the over-all sample period (Table 2.2, column titled: $48-States, 1970-2004$). Interestingly, ρ for all three-periods is positive when a time fixed-effect is present in the regression. Only ρ for 1980-96 is not significant at a meaning level while ρ for both end periods is significant, meaning, states ran sustainable fiscal debt policies with federal aid considered as a source of revenue.

When examining how the states fared given control over their own resources and expenditures (Table 2.3, column titled: $y_{it} : surgf$) over the three sub-periods, the first and third sub-periods containing the least amount of observations ($N = 336$)

estimated parameters are sensitive to the presence of the time fixed-effect variable and thus only this set of estimates will be used for comparison of results for the three two sub-periods. Unlike in the estimation for the entire sample period for the 48-States where ρ is positive and not significant at a meaningful level, in none of the sub-period estimations is there a sign that states implement sustainable fiscal policies with $\rho's$ of $-0.09,\ -0.02,$ and 0.00, and significant at a meaningful level for the first and second periods and insignificant for the last period. For the two end sub-periods, both $GVAR$ and $YVAR$ are significantly greater than their counter-parts for the whole estimated sample period. While $GVAR$ and $YVAR$ for the sub-period, 1980 - 1994, are less than their counter-parts for the whole estimated sample period.

Following Sorenson et al's (2000) example, this section on the Consistency of Parameter Estimates will examine the parameters' estimates with states grouped together according to their debt-levels held in 1974. At first this exercise of grouping the states was going to use the year 1978 as in Sorenson et al's (2000), these findings are reported in Appendix Table 2.17, however, due to the sensitivity of the states included when imputing the index for GSP as indicated in Graphs 2.1 and 2.2, an experiment was performed to see if the estimates using 1974 as oppose to 1978 was performed. It is the results using 1974 to group the states that will be presented here. Table 2.4 present the estimates for the entire sample period with states divided into two-groups and Table 2.5 with the states divided into three groups.

The results from splitting the states in to two-groups according to their 1974 level of debt would be contrary to expectations if ρ for highly-debted states increased in value and level of significance when a time fixed-effect was added to the regression (Table 2.4, columns' titled: $y_{it}\ :\ surgf.w.aid,\ Hi-Debt$). Instead, ρ becomes zero and insignificant, indicating that states known to have high-debt levels do not implement sustainable fiscal debt policies. States known to have low-debt levels do not implement sustainable fiscal debt policies when federal aid is

TABLE 2.4. Fixed-Effect GLS Weighted Regression, States Placed into 2-Groups by Historical Debt-Levels in 1974

$$y_{it} = \alpha_i\,(+v_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

	y_{it} :	*surgf.w.aid*		*surgf*	
		$Hi-Debt$	$Lo-Debt$	$Hi-Debt$	$Lo-Debt$
	ρ_0	0.02	-0.10	-0.04	0.08
		(1.43)	(-7.01)	(-3.44)	(5.09)
Without Time −Fixed Effect	β_1	-0.47	-0.41	-0.54	-0.40
		(-21.48)	(-17.84)	(-18.31)	(-12.73)
	β_2	-0.20	-0.17	-0.44	-0.40
		(-14.80)	(-12.08)	(-22.20)	(-18.78)
	ρ_0	0.00	-0.07	-0.04	0.08
		(.28)	(-4.48)	(-2.70)	(5.10)
With Time− Fixed Effect	β_1	-0.45	-0.35	-0.55	-0.39
		(-19.18)	(-14.81)	(-17.69)	(-11.93)
	β_2	-0.18	-0.14	-0.44	-0.39
		(-13.36)	(-9.93)	(-21.87)	(-18.51)

considered as a source of revenue. On the other hand, the opposite conclusion is reached for low-debted states when federal aid is removed from the states revenue stream (Table 2.4, columns' titled: $y_{it} : surgf,\ Lo - Debt$). With control over their own resources, low-debted states implement sustainable fiscal debt policies while high-debted states do not. This finding is contrary to expectations and will be investigated further. Both $GVAR$ and $YVAR$ are as expected in magnitude for both high- and low-debted states whether federal assistance is considered as a source of revenue or not and/or whether a time fixed-effect variable is present or not, when compared with $GVAR$ and $YVAR$ for the over all sample period (Table 2.2, columns' titled: $48 - States$, $1970 - 2004$).

TABLE 2.5. Fixed-Effect GLS Weighted Regression, States Placed into 3-Groups by Historical Debt-Levels in 1974

$$y_{it} = \alpha_i\,(+v_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

	y_{it} :	*surgf.w.aid*			*surgf*		
		$Hi-Debt$	$Med-Debt$	$Lo-Debt$	$Hi-Debt$	$Med-Debt$	$Lo-Debt$
	ρ_0	0.08	-0.03	-0.14	-0.02	-0.02	0.05
		(5.40)	(-1.92)	(-8.48)	(-1.26)	(-1.18)	(2.87)
Without Time −Fixed Effect	β_1	-0.48	-0.48	-0.38	-0.57	-0.56	-0.25
		(-16.58)	(-16.55)	(-13.80)	(-15.34)	(-14.62)	(-7.01)
	β_2	-0.23	-0.19	-0.15	-0.48	-0.44	-0.29
		(-13.57)	(-10.55)	(-8.72)	(-19.96)	(-15.91)	(-12.34)
	ρ_0	0.05	-0.04	-0.09	-0.01	-0.02	0.02
		(3.24)	(-2.44)	(-4.77)	(-.78)	(-1.22)	(1.41)
With Time− Fixed Effect	β_1	-0.44	-0.46	-0.34	-0.57	-0.51	-0.29
		(-14.17)	(-15.28)	(-12.51)	(-14.79)	(-13.08)	(-7.91)
	β_2	-0.21	-0.18	-0.13	-0.48	-0.42	-0.31
		(-11.24)	(-9.78)	(-8.20)	(-19.41)	(-15.17)	(-13.04)

As part of the investigation into the unexpected results for states historically known to have low-debt levels, Table 2.5 presents the states divided into three-groups: High-, Medium-, and Low-Debt States. This exercise is performed in order that the grouped states are more homogeneous in expenditure and revenue patterns. A clear trend is developing for states regarding their implementation of sustainable fiscal debt policies when federal aid is treated as a source of revenue (column titled: $y_{it} : surgf.w.aid$). ρ is positive and significant for high-debted states and negative and significant for medium- to low-debted states with and without a time fixed-effect present. Again, states known to have low-debt levels implement sustainable fiscal debt policies with respect to having full control over their own revenue sources and expenditures while both high- and medium-debted states do not with $\rho's < 0$ and not meaningful at significant levels. $GVAR$ and $YVAR$ for both high- and medium-debted states (Table 2.5) are the same in magnitude as those estimated for high-debted states found in Table 2.4, with and without federal aid treated as a revenue source, and with or without a time fixed-effect present; $GVAR$ and $YVAR$ for low-debted states (Table2.5, column titled: $y_{it} : surgf.w.aid$) is in magnitude on the same order as its counter part for low-debted states in Table 2.4 with and without a time fixed-effect variable present. When federal aid is removed from the low-debted states' revenue stream , $GVAR$ and $YVAR$ with and without a time fixed-effect present are the lowest in magnitude than any $GVAR$ and $YVAR$ over the various sub-periods and sub-groups estimated in this study. A more detailed explanation will be given in the next section as to why unexpected results are being found for low-debt levels states reported in this section.

The last examination for consistency of estimates presented here will divide the sample period according to decades: 1970-79, 1980-89, 1990-99, and 2000-04. Federal aid policy towards the states is in public finance literature characterized by decades which for the most part coincides with changes in Presidential Administrations. Table 2.6 presents these estimates.

TABLE 2.6. Fixed-Effect GLS Weighted Regression, Sample Period Divided into Sub-Periods by Decades

$$y_{it} = \alpha_i\,(+v_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

		1970 − 1979		1980 − 1989		1990 − 1999		2000 − 2004	
	y_{it} :	*surgf.w.aid*	*surgf*	*surgf.w.aid*	*surgf*	*surgf.w.aid*	*surgf*	*surgf.w.aid*	*surgf*
	ρ_0	0.01	-0.03	0.05	-0.01	0.06	-0.03	-0.02	-0.02
		(.59)	(-1.46)	(2.74)	(-.78)	(2.68)	(-1.86)	(-.78)	(-.90)
Without Time −Fixed Effect	β_1	-0.51	-0.46	-0.35	-0.26	-0.41	-0.59	-0.88	-0.65
		(-24.82)	(-16.58)	(-8.41)	(-6.02)	(-10.50)	(-16.12)	(-20.81)	(-14.92)
	β_2	-0.22	-0.43	-0.16	-0.34	-0.20	-0.45	-0.20	-0.08
		(-16.41)	(-19.01)	(-6.20)	(-12.11)	(-8.58)	(-19.63)	(-8.53)	(-3.73)
	ρ_0	0.01	-0.06	0.05	-0.03	0.07	-0.07	0.01	-0.08
		(.91)	(-3.64)	(2.69)	(-2.55)	(3.08)	(-5.37)	(.28)	(-3.0)
With Time− Fixed Effect	β_1	-0.57	-0.72	-0.35	-0.46	-0.42	-0.66	-0.79	-0.95
		(-23.62)	(-29.82)	(-8.37)	(-10.52)	(-11.18)	(-18.60)	(-18.51)	(-20.98)
	β_2	-0.25	-0.53	-0.16	-0.40	-0.21	-0.47	-0.26	-0.63
		(-16.54)	(-30.63)	(-6.03)	(-14.79)	(-9.28)	(-21.61)	(-8.85)	(-15.54)

There are clear differences in the estimated coefficients for the different decades. Both $GVAR$ and $YVAR$ for the 1980s with and without federal aid as a source of revenue and a time fixed-effect variable present are the closest to reported coefficients for the overall sample period reported in Table 2.2 for the 48-States. However, the ρ's for the 1980s $0.05_{w.aid}$ and -0.03 have the opposite signs of their counterparts for the overall estimated sample and are significant. The decades 1970s and 1990s have $GVAR$s and $YVAR$s with and without federal aid as a revenue source greater than those reported for the overall sample period. Like the sample period for the 1980s, ρ's for the 1970s and 19990s are opposite their counterparts for the overall sample period with only ρ for 1970s being insignificant when federal aid is treated as a source of revenue and a time fixed-effect is included. Interesting, $\rho's$ for 1990s are exact opposites of each other, $0.07_{w.aid}$ and -0.07. The differences between coefficients estimated over the various decades will be discussed in great detail in the next section along with the various characterization of federal-state fiscal policies corresponding to the same decade.

When the sample period is dived into sub-periods according to logical breaks in time, or the set of states are divided into groups according to historical debt levels, and/or the sample period is divided into sub-periods coinciding with decades and Presidential Administrations, discernible patterns in the estimates for the sub-periods and sub-groups arise showing results significantly different from the results for the over-all sample period with all 48-States included. The next section will examine shifts in federal aid policy and shifts in Federal-States relationships that may yield insight into some of the findings reported in this section along with any relevant stylized-facts.

2.6 Reconciliation of Findings with Other Studies, Known Shifts in Policies and National Trends

The first part of this section will compare the findings of this study with other studies that examine the U.S. States' fiscal finances in order to ascertain whether these findings are line with other reported findings. The second-part will examine changes in federal aid programs and stylized facts concerning federal/states relations that can explain the inconsistencies in estimates discussed in the previous section.

A cautionary note must be made when comparing this studies' findings with other studies on states' finances as many studies use total states' revenues and expenditures as oppose to using only those revenues and expenditures that enter the general operating fund. As previously stated, many studies on states' finances examine institutional arrangements and the results these institutional arrangements bring about in fiscal practices. These studies, as are the two that are about to be discussed, focus is broader in scope and as a result must consider other states' payments, for example payment into the states' employees' retirement pension fund, as they are a part of a mired list of options from which policymakers have to choose. It is expected that this studies' findings should be smaller than those estimates from studies when comparing similar variables. Also, it will be pointed out when the causality in a study to be compared is different from this study's, for example, this study has $GVAR$ (random public expenditures) as an explanatory variable of $surgf$ (general budget surplus fund) where similar studies that estimate an expenditure equations has GSP (gross state product) as an explanatory variable of government expenditure. Also, focusing just on the general operating fund as oppose to say the total budget fund allows for a more homogeneous aggregation of expenditures and revenues to take place across the states. However, the cost of focusing on such a narrowly defined portion of the budget is that the increased exercise of moving certain expenditures off-budget through the use of quasi-public companies

are not picked-up in this study at all. On the other hand, these off-budget transactions in general have their own sources of revenue which do not come under the direct control of the states' legislative bodies.

Alt and Lowry use "Barro's (1979, 1986) tax-smoothing model of optimal fiscal policy to incorporate parties and divided constitutional government."[7] Their data set covers the years 1968 to 1987 and both Alaska and Hawaii are excluded from their data set. In addition, they use total revenue and total expenditures in their budget calculations. The model they use contains two structural equations: a revenue equation with a lagged budget surplus as one of several explanatory variables and an expenditure equation that also contains a lagged budget surplus as one of several explanatory variables. Unfortunately, the results they report in Table 1 are divided according to the party in control of the different branches of government and whether the states are southern or non-southern. In order to obtain an estimates equivalent to this study's $GVAR$ and $YVAR$, the mean of the coefficients for their budget surplus in both equations was calculated: $-.494375$ for their expenditure equation and $-.27275$ for revenue their equation.

Comparing Alt and Lowry's results with those in Table 2.2 where federal aid is considered as a source of revenue ($y_{it} : surgf\ w/\ aid$) for the 48-States, 1970 - 2004, and the 47-States, 1970 - 1991, $GVAR$ ($\approx -.42_{48} \sim -.37_{48,TFE}$ and $\approx -.42_{47} \sim -.39_{47,TFE}$) and $YVAR$ $\left(\approx -.17_{48} \sim -.15_{48,TFE} \text{ and } \approx -.16_{47}\right)$ for this study are in magnitude on order with Alt and Lowry's, remembering that they use total expenditures and total revenues as dependent variables in their calculations.

Yilin Hou constructs a variable, General Fund Expenditure Gap (GFE Gap)[8], that is similar to this study's $GVAR$ in his investigation into the impact of budget

[7] Alt JE, Lowry RC. Divided Government, Fiscal Institutions, and Budget Deficits: Evidence from the States. The American Political Science Review 1994 Dec; 88(4): 812

[8] Hou Y. What Stabilizes State General Fund Expenditures in Downtown Years–Budget Stabilization Fund or General Fund Unreserved Undesignated Balance. Public Budgeting & Finance 2003 Fall; 23(3): 72.

stabilization funds and unreserved undesignated balances on states' expenditures. As this study uses expenditures and revenues that only enter the general fund account, Hou does the same over the sample period 1979 - 1999. However, GFE Gap is the dependent variable, current as well as several lags of GSP are the independent variables, and in addition to Alaska being excluded several other states are excluded as well. Hou reported values on Current GSP: -0.25 and -0.27 for Prais-Winston autocorrelated corrected variables and -0.47 and -0.63 for OLS estimated variables (the latter figure of both reported sets of figures is for an estimated regression equation that contains a Year-Fixed Effect variable). Comparing Hou's OLS estimate without the Year-Fixed Effect $(-0.47)$with $GVAR$ reported in Table 2.3, columns titled: $y_{it} : surgf.w.aid$, $1980 - 1994$, this study's $GVAR$ $(\approx -0.45 \sim -0.40_{TFE})$ is in order in magnitude and sign with Hou's. It must be noted that Hou expresses concern about the sign being negative.[9]

This part reconciles this studies' findings with known shifts in federal aid policies and programs towards the states. This part is made more informative stemming from a conversation with former New York State Budget Director, Hall Forsythe, who revealed that through the federal government's Forward Funding notification system the states actually know a year in advance how much federal aid they will receive. Federal aid to the states for the three-decades this study's sample data set covers: 1970s, 1980s, and 1990s, can be characterized as expansionary, qualified-contractionary, and expansionary. The Seventies saw federal aid to the states expand not only with the Nixon Administration's "New Federalism" with its signature piece being the implementation of revenue sharing in 1972, but also with the rate of growth of federal aid as part of federal outlays increasing every year from around 12 percent in 1970 to as high as "... 17 percent of federal spending in 1974 and was almost as high in 1979."[10] In Quigley and Rubinfeld's Figure 2, they document a

[9]Hou, 69

[10]Quigley JM, Rubinfeld, DL. (U.C. Berkeley) Federalism as a Device for Reducing the Budget of the Central Government. 1996 Feb. Burch Center Working Paper Series No. B96-11: 22

drop in federal grants between 1974 and 1979 with federal grants being at its lowest in 1976 at 15 per cent of total Federal Outlays.[11] This decline in federal aid coincides with this study's findings of a break to exist in 1978.

The Eighties' is characterized as a period of qualified-contractionary because "While neither direct federal domestic spending nor federal aid to states and localities declined dramatically during the 1980s, neither category of federal spending increased at the pace the states had become used to in the previous two decades."[12] "Qualified-" is a term used because one area that saw and sees ever increasing growth in federal aid to the states, even in the 1980s, is health care.[13] The Nineties is characterized as expansionary because the growth rate of federal aid to the states increased as percentage of federal outlays.[14]

Section 2.5: Consistency of Parameter Estimates, documents changes in the estimated parameters over both the sample period when it is divided into sub-periods and in between states when they are grouped according to historical debt-levels. The parameters in Table 2.6, Sample Period Divided by Decades, for each estimated sub-periods match the characterized explanation of federal aid policy for that decade with federal aid considered as a source of revenue and when it is not. Referring to the regressions with the Time-Effect only, of the three sub-periods divided according to decades, both $GVAR$ and $YVAR$ are the greatest in value for the 1970s and then for the 1990s. $GVAR$ and $YVAR$ are the lowest in value for the 1980s. In both periods in which federal aid is characterized as being expansionary, the parameter estimates are the greatest in value for both sets of regressions ($y_{it} : surgf.w.aid$ and $y_{it} : surgf$) for the same two time periods. A word of caution would be in order when reasoning that the states expenditures was greater for both the 1970s and 1990s because the $GVAR$ coefficient was greater

[11] Quigley JM, Rubinfeld, DL 22

[12] Dye RF, McGuire TJ. Sorting Out State Expnediture Pressures. National Tax Journal 1992 Sept; 45(3): 315.

[13] Quigley JM, Rubinfeld, DL 22

[14] Quigley JM, Rubinfeld, DL 22

for these decades than for either the 1980s or for the over all sample period (Table 2.2, column titled: $48 - States, 1970 - 2004$). A more robust interpretation is that budgetary decisions made in either the 70s or 90s had greater effect on the fiscal situation the states found themselves in during these decades.

The low $GVAR$ and $YVAR$ for the 1980's support the ideal that State officials made fiscal decision such that any increase in random public expenditures had less impact on the states fiscal situation and any down turn in the states' output would have less effect on the states revenues. Also, any new debt incurred in the 1980s had less of an impact on states' finances when ρ of the 1980s ($y_{it} : surgf$) is compared with its counter parts for the 1970s and 1990s.

The primary focus of Dye and McGuire's (1992) investigation is the 1980s' trends in states expenditures and revenues: they propose several stylized assertion and through examination of growth rates of states' expenditures, incomes, and demographics they uncover a set of stylized facts. Unfortunately, their stylized facts are very expenditure specific with regards to trends in growth rates of, for example, law enforcement, primary- and secondary-education, and services for the elderly. However, in laying-out background information Dye and McGuire's description in the shifts in the states' fiscal situation between the 1980s and the 1990s provides important information as to why $YVAR$ increases in magnitude from the 1980s' to the 1990s' sub-periods.

> "Beginning in 1989 in some states and 1990 in others, the state economies began to falter. The media were full of stories in 1991 of one state after another needing to address budget shortfalls –estimated revenues not keeping pace with expected expenditures. What was unusual was that the cast of characters contained the mighty as well as the weak. In the previous recession in the early 1980s, it was not surprising that the industrial states of the Rust Belt suffered greatly, while the Sun

> Belt states weathered the storm relatively unscathed. "[15]

Several studies on states' expenditure and revenue's findings have been compared with this studies' and this study's findings are found to be in line with these studies. Known shifts in federal aid to the states is detected in this studies findings when the sample period is divided into sub-sample periods, with special attention be drawn to the sample period being divided into decades (Table 2.6).

An unexpected result occurred in the previous section when the states were aggregated according to known historical debt-levels: states known to have low-levels of debt whether the states were grouped into two groups or three were found to not implement sustainable fiscal policies with their level of debt when federal aid was considered a source of revenue. Further investigation revealed that the results for the low-level grouped states to be heavily influenced by outliers which does not occur in the high-debt level grouped states. What is of interest is why these outliers exist in the low-debt level grouped states and not the high-debt level grouped states.

In Paul Peterson's investigation into states' fiscal decisions being explained by political fiscal theories, his findings on which states provide the minimum and maximum funds for the redistribution of incomes corroborate how this study grouped the states according to their historical debt-levels.[16] This coincidence would almost be meaningless except that Peterson points out a major shift in federal-state fiscal policy occurring early in the 1970s.

> In 1972 the variability among the states shot dramatically upward to 0.65 [referring to Coefficient of Variance]. This short-term phenomenon was due to the uneven implementation among the states of the federal medicaid and food stamp programs.[17]

[15]Dye RF, McGuire TJ. Sorting Out State Expenditures Pressures. National Tax Journal 1992 Sept; 45(3): 315.

[16]Peterson PE, *The Price of Federalism*, Harrisonburg, VA: RR Donnelley & Sons Co; 1995. 88-89

[17]Peterson, 89

Using one of Peterson's analytical tool of analysis: coefficient of variance (cv), where the mean is divided by the standard deviation and in this case it is that of the general fund budget surplus with federal aid divided by its standard deviation, a similar exercise was performed in order to ascertain the dispersion within a group of states for each of the three decades. The low-debt states for the 1970s and 1980s had the highest cv values of the three-grouped states of -1.51 and -.99 while the high-debt states had the lowest values of -.405 and -.309 (these values are calculated from Appendix Table 2.25). This finding shows that although the low-debt states may have at one point in time shared a similar characteristic in time with respect to their level of debt the amount of federal aid received by the individual states in this group of states makes it difficult to draw any inference about this group of states.

The next and last section will be concluding remarks in which fiscal policy theory and this studies findings are discussed.

2.7 Conclusion

Do the States of the United States implement sustainable fiscal debt policies with and without federal aid? The findings presented in this study indicate that for the period, 1970 - 2004, states on a whole did not implement sustainable fiscal debt policies whether federal aid is considered as a source of revenue or not. The sample data for this study covers 35-years in which federal aid policies toward the states changed due in part to different administrations' ideology on federalism or in response to national economic trends such as the 1974 recession or uncontrollable budget deficits at the national level allowing for little of no increase in federal aid programs to the States.

When the sample data is divided into sub-periods such as where the data suggests that breaks occur (Fig. 2.1 and Fig. 2.2) in Table 3 and/or by logical breaks in time such as decades which coincide with changes in Administrations as in Table 6, sustainable fiscal debt policies implemented by the states only occurred with federal

aid considered as a source of revenue. In none of the sub-periods is there meaningful evidence to suggest that the states as a group using only their own resources implemented sustainable fiscal debt policies.

There is evidence suggesting that when the states are divided into groups according to historical debt levels held in 1974 as in Tables 2.4 and 2.5, states that were considered to be known to have low-levels of debt consistently implemented sustainable fiscal debt policies when only those expenditures and revenues they directly control is considered. These states as a group have through out the sample period a mean average general surplus fund of $174 per capita (including interest revenue) when compared with the states known as having histories of high-debt levels with a mean average general surplus fund of -$12. Unfortunately, the results for the low-debt level group when federal aid was added as a source of revenue was contrary to expectations. Further investigation revealed that the states in this group was less homogeneous in terms of receipt of federal transfers and thus any conclusion drawn about this group of states implementing sustainable fiscal policies when federal aid is considered as a source of revenue would be highly suspect. On the other hand, states considered to have had high-levels of debt in 1974 only implement sustainable fiscal debt policies when federal aid is considered as a source of revenue.

In the case of a national economic down turn such as the one that is currently taking place in which the federal government takes the lead in propping up demand in the economy, the states governments are forced to contract there presence in the economy through forced cuts in expenditures. On the other hand, this study does show that groups of states do implement sustainable fiscal policies with respect to their level of debt with the assistance of federal transfers and some states without the assistance of federal transfers. It is this study policy recommendation that it is time to examine the relationship between federal and states' governments and maybe some type of arrangement could be made in which the federal government provide

loan guarantees to the states. This need not be an every year on going program but in the future when another shock occurs that effects the national economy in which it can be expected that states' revenues will severally drop-off in that current fiscal year or the next, as part of a future fiscal stimulus plan some type of federal loan guarantee program for the states should be considered as part of the package.

Appendix 2.A Technical Appendix

TABLE 2.7. F-Test for Change in Variance

Test of Real GSP for 50-States:

F test for variance equality

data: gsp.real[1997:2004] and gsp.real[1970:2004]

$F = 0.88,\ numdf = 399,\ denomdf = 1749,\ p - value = 0.10$

Test of Real GSP for 48-States:

F test for variance equality

data: gsp.real[1997:2004] and gsp.real[1970:2004]

$F = 0.90, numdf = 383, denomdf = 1679, p - value = 0.20$

TABLE 2.8. OLS Detrending of gsp and wbtom to formulate YVAR and GVAR

	50-States				48-States			
$gsp^*_{tit}=\beta+\rho_0 Debt_{it}+\beta_1 obsvn+\beta_2 obsvn^2_{it}+\varepsilon_{it}$								
	Value	SE	T-Stat	P	Value	SE	T-Stat	P
Const	7537.10	590.99	12.75	0.00	7533.94	588.92	12.79	0.00
obsvn	1017.27	75.70	13.44	0.00	985.65	75.43	13.07	0.00
$obsvn^2$	-14.71	2.04	-7.21	0.00	-13.62	2.03	-6.70	0.00
df=1747		R^2=0.30	J-B=610.47	AIC=36324.43	df=1677	R^2=0.30	J-B=489.42	AIC=34791.21
		$\overline{R}^2$=0.30	L-B=4800.38	BIC=36340.83		$\overline{R}^2$=0.32	L-B=4622.20	BIC=34807.49
		SSE=7774.56	LL=-18159.21			SSE=7774.56	LL=-17392.60	
		DW-Stat=0.26	F-Stat=377.43			DW-Stat=0.26	F-Stat=387.09	
$wbtom^*_{tit}=\beta+\rho_0 Debt_{it}+\beta_1 obsvn+\varepsilon_{it}$								
	Value	SE	T-Stat	P	Value	SE	T-Stat	P
Const	1202.70	37.55	32.03	0.00	1089.72	17.91	60.85	0.00
obsvn	35.44	1.82	19.48	0.00	34.60	0.87	39.87	0.00
df=1748		R^2=0.18	J-B=40218.32	AIC=28224.91	df=1678	R^2=0.49	J-B=177.84	AIC=24539.43
		$\overline{R}^2$=0.18	L-B=15618.30	BIC=28235.85		$\overline{R}^2$=0.49	L-B=11331.49	BIC=24550.28
		SSE=7774.56	LL=-14110.46			SSE=7774.56	LL=-12267.71	
		DW-Stat=0.08	F-Stat=379.31			DW-Stat=0.14	F-Stat=1589.71	
$wbtom^*_{tit}$-$fedaid^*_{tit}=\beta+\rho_0 Debt_{it}+\beta_1 obsvn+\beta_2 obsvn^2_{it}+\varepsilon_{it}$								
	Value	SE	T-Stat	P	Value	SE	T-Stat	P
Const	823.67	30.89	26.67	0.00	812.72	21.94	37.04	0.00
obsvn	23.47	1.50	15.68	0.00	10.05	2.81	3.58	0.00
$obsvn^2$	—	—	—	—	0.34	0.08	4.50	0.00
df=1748		R^2=0.12	J-B=45926.95	AIC=27540.95	df=1677	R^2=0.30	J-B=716.65	AIC=23736.77
		$\overline{R}^2$=0.12	L-B=15894.74	BIC=27551.88		$\overline{R}^2$=0.39	L-B=14344.64	BIC=23753.05
		SSE=7774.56	LL=-13768.47			SSE=7774.56	LL=-11865.39	
		DW-Stat=0.09	F-Stat=245.86			DW-Stat=0.15	F-Stat=543.96	

TABLE 2.9. Fixed-Effect GLS weighted Regression of Full-Sample Data Set

$$y_{it} = \alpha_i\,(+\upsilon_t) + \rho_0 \text{Debt}_{it} + \beta_1 \text{GVAR}_{it} + \beta_2 \text{YVAR}_{it} + \varepsilon_{it}$$

50-States	y_{it}:			surgf.w.aid				surgf	
1970-04		Value	SE	T-Stat	P	Value	SE	T-Stat	P
	ρ_0	-0.03	0.01	-3.14	0.00	-0.01	0.01	-0.62	0.54
N=1750	β_1	-0.41	0.01	-30.92	0.00	-0.59	0.02	-28.66	0.00
df=53	β_2	-0.19	0.01	-21.38	0.00	-0.49	0.01	-34.76	0.00
			R^2=0.40	SSE=0.01			R^2=0.43	SSE=0.01	
R^2			LL=5782.97	BIC=-10796.81	AIC=-11359.95		LL=5551.61	BIC=-10334.08	AIC=-10897.22
	Time	0.00	0.00	-6.27	0.00	0.00	0.00	8.34	0.00
	ρ_0	-0.03	0.01	-3.60	0.00	-0.01	0.01	-0.77	0.44
	β_1	-0.38	0.01	-26.56	0.00	-0.64	0.02	-30.10	0.00
	β_2	-0.17	0.01	-18.57	0.00	-0.52	0.01	-36.57	0.00
			R^2=0.41	SSE=0.01			R^2=0.44	SSE=0.01	
			LL=5796.84	BIC=-10817.08	AIC=-11385.69		LL=5572.28	BIC=-10367.95	AIC=-10936.55
48-States	ρ_0	-0.02	0.01	-2.09	0.04	0.01	0.01	1.17	0.24
	β_1	-0.42	0.02	-27.03	0.00	-0.43	0.02	-20.87	0.00
	β_2	-0.17	0.01	-18.40	0.00	-0.41	0.01	-28.89	0.00
N=1680.00			R^2=0.36	SSE=0.01			R^2=0.38	SSE=0.01	
df=51.00			LL=5650.34	BIC=-10565.44	AIC=-11102.67		LL=5415.15	BIC=-10095.07	AIC=-10632.30
	Time	0.00	0.00	-11.21	0.00	0.00	0.00	3.42	0.00
	ρ_0	-0.02	0.01	-2.54	0.01	0.01	0.01	1.09	0.27
	β_1	-0.37	0.02	-23.40	0.00	-0.46	0.02	-21.02	0.00
	β_2	-0.15	0.01	-15.68	0.00	-0.42	0.01	-29.35	0.00
			R^2=0.40	SSE=0.01			R^2=0.39	SSE=0.01	
			LL=5695.28	BIC=-10647.90	AIC=-11190.56		LL=5418.40	BIC=-10094.14	AIC=-10636.79

TABLE 2.10. Fixed-Effect GLS weighted Regression of Full-Sample Data Set (continued)

$$y_{it} = \alpha_i\,(+v_t) + \rho_0 \text{Debt}_{it} + \beta_1 \text{GVAR}_{it} + \beta_2 \text{YVAR}_{it} + \varepsilon_{it}$$

	y_{it}:	surgf.w.aid				surgf			
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
47-States	ρ_0	-0.04	0.01	-3.48	0.00	-0.01	0.01	-1.26	0.21
1970-1991	β_1	-0.42	0.02	-22.19	0.00	-0.37	0.02	-16.99	0.00
	β_2	-0.16	0.01	-13.82	0.00	-0.37	0.02	-23.70	0.00
			R^2=0.35	SSE=0.01			R^2=0.41	SSE=0.01	
N=1034			LL=3569.72	BIC=-6466.14	AIC=-6945.43		LL=3456.49	BIC=-6239.69	AIC=-6718.99
df=50	Time	0.00	0.00	-12.32	0.00	0.00	0.00	27.14	0.00
	ρ_0	-0.04	0.01	-4.45	0.00	-0.04	0.01	-3.84	0.00
	β_1	-0.39	0.02	-21.47	0.00	-0.60	0.02	-29.80	0.00
	β_2	-0.16	0.01	-14.28	0.00	-0.45	0.01	-34.95	0.00
			R^2=0.41	SSE=0.01			R^2=0.59	SSE=0.01	
			LL=3620.18	BIC=-6560.12	AIC=-7044.36		LL=3645.74	BIC=-6611.25	AIC=-7095.48

TABLE 2.11. Fixed-Effect GLS Weighted, Testing for 1978 and 1996 Breaks

$$y_{it} = \alpha_i\ (+\upsilon_t) + \rho_0 \text{Debt}_{it} + \beta_1 \text{GVAR}_{it} + \beta_2 \text{YVAR}_{it} + \varepsilon_{it}$$

	y_{it}:	surgf.w.aid				surgf			
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
1970-76	ρ_0	0.03	0.02	1.29	0.20	-0.06	0.02	-3.19	0.00
N=336	β_1	-0.50	0.02	-22.48	0.00	-0.47	0.02	-18.87	0.00
	β_2	-0.21	0.01	-15.79	0.00	-0.44	0.02	-24.66	0.00
	df=51		R^2=0.52	SSE=0.01			R^2=0.53	SSE=0.01	
			LL=1236.56	BIC=-1897.22	AIC=-2275.11		LL=1226.27	BIC=-1876.65	AIC=-2254.55
	Time	0.00	0.00	2.66	0.01	0.00	0.00	11.00	0.00
	ρ_0	0.05	0.02	2.15	0.03	-0.09	0.02	-3.99	0.00
	β_1	-0.58	0.04	-15.61	0.00	-0.78	0.04	-20.35	0.00
	β_2	-0.26	0.02	-12.18	0.00	-0.56	0.03	-22.03	0.00
	df=52		R^2=0.53	SSE=0.01			R^2=0.62	SSE=0.01	
			LL=1238.84	BIC=-1895.96	AIC=-2277.67		LL=1259.12	BIC=-1936.53	AIC=-2318.24
1980-94	ρ_0	0.01	0.01	0.50	0.62	-0.03	0.01	-2.87	0.00
N=720	β_1	-0.45	0.03	-15.05	0.00	-0.33	0.04	-8.93	0.00
	β_2	-0.23	0.02	-12.24	0.00	-0.33	0.02	-14.10	0.00
	df=51		R^2=0.23	SSE=0.01			R^2=0.38	SSE=0.01	
			LL=2734.60	BIC=-4817.85	AIC=-5271.20		LL=2758.19	BIC=-4865.04	AIC=-5318.39
	Time	0.00	0.00	-4.97	0.00	0.00	0.00	2.80	0.01
	ρ_0	0.01	0.01	0.95	0.34	-0.02	0.01	-2.66	0.01
	β_1	-0.39	0.03	-12.29	0.00	-0.38	0.04	-9.40	0.00
	β_2	-0.21	0.02	-10.91	0.00	-0.34	0.02	-14.45	0.00
	df=52		R^2=0.25	SSE=0.01			R^2=0.39	SSE=0.01	
			LL=2743.72	BIC=-4829.51	AIC=-5287.44		LL=2760.45	BIC=-4862.97	AIC=-5320.90

TABLE 2.12. Fixed-Effect GLS Weighted, Testing for 1978 and 1996 Breaks (continued)

$$y_{it} = \alpha_i\ (+\upsilon_t) + \rho_0 \text{Debt}_{it} + \beta_1 \text{GVAR}_{it} + \beta_2 \text{YVAR}_{it} + \varepsilon_{it}$$

	y_{it}:	surgf.w.aid				surgf			
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
1998-04	ρ_0	-0.02	0.02	-1.08	0.28	-0.14	0.03	-5.42	0.00
N=336	β_1	-0.78	0.05	-16.78	0.00	-0.45	0.05	-8.36	0.00
	β_2	-0.27	0.03	-9.63	0.00	-0.04	0.03	-1.56	0.12
	df=51		R^2=0.39	SSE=0.00			R^2=0.10	SSE=0.01	
			LL=1328.70	BIC=-2081.50	AIC=-2459.40		LL=1273.66	BIC=-1971.43	AIC=-2349.32
	Time	0.00	0.00	-16.81	0.00	0.00	0.00	-31.71	0.00
	ρ_0	0.07	0.02	3.04	0.00	0.00	0.02	-0.03	0.97
	β_1	-0.75	0.04	-18.75	0.00	-0.83	0.05	-17.70	0.00
	β_2	-0.39	0.02	-16.12	0.00	-0.61	0.03	-21.10	0.00
	df=52		R^2=0.56	SSE=0.00			R^2=0.63	SSE=0.00	
			LL=1385.99	BIC=-2190.26	AIC=-2571.97		LL=1422.10	BIC=-2262.49	AIC=-2644.20

TABLE 2.13. Fixed-Effect GLS Weighted, States Grouped by 1974 Historical Debt Levels

$y_{it}=\alpha_i\ (+\upsilon_t)+\rho_0 Debt_{it}+\beta_1 GVAR_{it}+\beta_2 YVAR_{it}+\varepsilon_{it}$

	y_{it}	surgf.w.aid							
	Group:	High-Debt				Low-Debt			
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
	ρ_0	0.02	0.01	1.43	0.15	-0.10	0.01	-7.01	0.00
	β_1	-0.47	0.02	-21.48	0.00	-0.41	0.02	-17.84	0.00
	β_2	-0.20	0.01	-14.80	0.00	-0.17	0.01	-12.08	0.00
	df=26		R^2=0.38	SSE=0.01			R^2=0.40	SSE=0.01	
			LL=2648.20	BIC=-4968.54	AIC=-5198.39		LL=2777.23	BIC=-5226.60	AIC=-5456.45
	Time	0.00	0.00	-3.64	0.00	0.00	0.00	-7.42	0.00
	ρ_0	0.00	0.01	0.28	0.78	-0.07	0.02	-4.48	0.00
	β_1	-0.45	0.02	-19.18	0.00	-0.35	0.02	-14.81	0.00
	β_2	-0.18	0.01	-13.36	0.00	-0.14	0.01	-9.93	0.00
23 States in	df=27		R^2=0.39	SSE=0.01			R^2=0.43	SSE=0.01	
Each Group			LL=2653.85	BIC=-4973.15	AIC=-5207.69		LL=2797.50	BIC=-5260.47	AIC=-5495.01
N=805	y_{it}	surgf							
-AZ,-ID	ρ_0	-0.04	0.01	-3.44	0.00	0.08	0.01	5.09	0.00
-AK,-HI	β_1	-0.54	0.03	-18.31	0.00	-0.40	0.03	-12.73	0.00
	β_2	-0.44	0.02	-22.20	0.00	-0.40	0.02	-18.78	0.00
	df=26		R^2=0.46	SSE=0.01			R^2=0.36	SSE=0.01	
			LL=2542.94	BIC=-4758.02	AIC=-4987.88		LL=2661.89	BIC=-4995.93	AIC=-5225.78
	Time	0.00	0.00	1.68	0.09	0.00	0.00	-1.21	0.23
	ρ_0	-0.04	0.01	-2.70	0.01	0.08	0.02	5.10	0.00
	β_1	-0.55	0.03	-17.69	0.00	-0.39	0.03	-11.93	0.00
	β_2	-0.44	0.02	-21.87	0.00	-0.39	0.02	-18.51	0.00
	df=27		R^2=0.46	SSE=0.01			R^2=0.36	SSE=0.01	
			LL=2544.00	BIC=-4753.47	AIC=-4988.01		LL=2662.23	BIC=-4989.92	AIC=-5224.47

TABLE 2.14. Fixed-Effect GLS Weighted, States Grouped by 1978 Historical Debt Levels

$y_{it}=\alpha_i\ (+\upsilon_t)+\rho_0 Debt_{it}+\beta_1 GVAR_{it}+\beta_2 YVAR_{it}+\varepsilon_{it}$

	y_{it}								
	Group:			High-Debt				Low-Debt	
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
	ρ_0	0.00	0.01	0.04	0.97	-0.07	0.02	-3.95	0.00
	β_1	-0.45	0.02	-18.88	0.00	-0.41	0.02	-18.10	0.00
	β_2	-0.19	0.01	-13.23	0.00	-0.17	0.01	-11.75	0.00
	df=26		R^2=0.34	SSE=0.01			R^2=0.40	SSE=0.01	
			LL=2574.15	BIC=-4820.45	AIC=-5050.30		LL=2822.32	BIC=-5316.78	AIC=-5546.64
	Time	0.00	0.00	-7.15	0.00	0.00	0.00	-7.82	0.00
	ρ_0	-0.03	0.01	-3.07	0.00	-0.02	0.02	-0.91	0.36
	β_1	-0.39	0.02	-15.72	0.00	-0.37	0.02	-16.91	0.00
	β_2	-0.15	0.01	-10.26	0.00	-0.16	0.01	-11.87	0.00
23 States in	df=27		R^2=0.36	SSE=0.01			R^2=0.44	SSE=0.01	
Each Group			LL=2592.14	BIC=-4849.74	AIC=-5084.28		LL=2845.42	BIC=-5356.30	AIC=-5590.84
N=805	y_{it}				surgf				
-AZ,-IA	ρ_0	0.00	0.01	-0.16	0.87	0.08	0.02	3.73	0.00
-AK,-HI	β_1	-0.66	0.03	-21.72	0.00	-0.31	0.03	-10.45	0.00
	β_2	-0.52	0.02	-26.04	0.00	-0.35	0.02	-16.51	0.00
	df=26		R^2=0.47	SSE=0.01			R^2=0.34	SSE=0.01	
			LL=2549.60	BIC=-4771.35	AIC=-5001.20		LL=2655.04	BIC=-4982.23	AIC=-5212.08
	Time	0.00	0.00	-1.57	0.12	0.00	0.00	5.13	0.00
	ρ_0	0.00	0.01	-0.31	0.75	0.03	0.02	1.25	0.21
	β_1	-0.65	0.03	-21.20	0.00	-0.36	0.03	-11.37	0.00
	β_2	-0.52	0.02	-25.89	0.00	-0.36	0.02	-16.94	0.00
	df=27		R^2=0.47	SSE=0.01			R^2=0.35	SSE=0.01	
			LL=2550.39	BIC=-4766.23	AIC=-5000.77		LL=2662.28	BIC=-4990.01	AIC=-5224.55

TABLE 2.15. Fixed-Effect GLS Weighted, States Placed into 3-Groups by Historical Debt Levels in 1974

Groups of 15	$y_{it}=\alpha_i\ (+\upsilon_t)+\rho_0 Debt_{it}+\beta_1 GVAR_{it}+\beta_2 YVAR_{it}+\varepsilon_{it}$								
N=525	y_{it}:			surgf.w.aid				surgf	
AZ,-ID,MT		Value	SE	T-Stat	P	Value	SE	T-Stat	P
-AK,-HI	Debt	0.08	0.01	5.40	0.00	-0.02	0.02	-1.26	0.21
	GVAR	-0.48	0.03	-16.58	0.00	-0.57	0.04	-15.34	0.00
	YVAR	-0.23	0.02	-13.57	0.00	-0.48	0.02	-19.96	0.00
	df=18.00		R^2=0.33	SSE=0.01			R^2=0.50	SSE=0.01	
High-Debt			LL=1666.95	BIC=-3127.21	AIC=-3267.90		LL=1616.92	BIC=-3027.16	AIC=-3167.85
	Time	0.00	0.00	-3.28	0.00	0.00	0.00	1.03	0.30
	Debt	0.05	0.02	3.24	0.00	-0.01	0.02	-0.78	0.43
	GVAR	-0.44	0.03	-14.17	0.00	-0.57	0.04	-14.79	0.00
	YVAR	-0.21	0.02	-11.24	0.00	-0.48	0.02	-19.41	0.00
	df=19.00		R-sq=0.35	SSE=0.01			R-sq=0.50	SSE=0.01	
			LL=1671.38	BIC=-3129.80	AIC=-3274.75		LL=1617.34	BIC=-3021.73	AIC=-3166.68
	Debt	-0.03	0.02	-1.92	0.06	-0.02	0.02	-1.18	0.24
	GVAR	-0.48	0.03	-16.55	0.00	-0.56	0.04	-14.62	0.00
	YVAR	-0.19	0.02	-10.55	0.00	-0.44	0.03	-15.91	0.00
	df=18.00		R-sq=0.44	SSE=0.01			R-sq=0.36	SSE=0.01	
Med-Debt			LL=1770.99	BIC=-3335.29	AIC=-3475.98		LL=1714.46	BIC=-3222.24	AIC=-3362.93
	Time	0.00	0.00	-3.36	0.00	0.00	0.00	-2.82	0.00
	Debt	-0.04	0.02	-2.44	0.01	-0.02	0.02	-1.22	0.22
	GVAR	-0.46	0.03	-15.28	0.00	-0.51	0.04	-13.08	0.00
	YVAR	-0.18	0.02	-9.78	0.00	-0.42	0.03	-15.17	0.00
	df=19.00		R-sq=0.45	SSE=0.01			R-sq=0.37	SSE=0.01	
			LL=1775.81	BIC=-3338.67	AIC=-3483.62		LL=1716.68	BIC=-3220.41	AIC=-3365.37

TABLE 2.16. Fixed-Effect GLS Weighted, States Placed into 3-Groups by Historical Debt Levels in 1974 (continued)

Groups of 15	$y_{it}=\alpha_i\ (+\upsilon_t)+\rho_0 Debt_{it}+\beta_1 GVAR_{it}+\beta_2 YVAR_{it}+\varepsilon_{it}$								
N=525	y_{it}:			surgf.w.aid				surgf	
AZ,-ID,MT		Value	SE	T-Stat	P	Value	SE	T-Stat	P
-AK,-HI	Debt	-0.14	0.02	-8.48	0.00	0.05	0.02	2.87	0.00
	GVAR	-0.38	0.03	-13.80	0.00	-0.25	0.04	-7.01	0.00
	YVAR	-0.15	0.02	-8.72	0.00	-0.29	0.02	-12.34	0.00
	df=18.00		R-sq=0.45	SSE=0.01			R-sq=0.35	SSE=0.00	
Low-Debt			LL=1904.94	BIC=-3603.20	AIC=-3743.89		LL=1796.78	BIC=-3386.86	AIC=-3527.56
	Time	0.00	0.00	-6.53	0.00	0.00	0.00	3.36	0.00
	Debt	-0.09	0.02	-4.77	0.00	0.02	0.02	1.41	0.16
	GVAR	-0.34	0.03	-12.51	0.00	-0.29	0.04	-7.91	0.00
	YVAR	-0.13	0.02	-8.20	0.00	-0.31	0.02	-13.04	0.00
	df=19.00		R-sq=0.48	SSE=0.01			R-sq=0.36	SSE=0.00	
			LL=1920.67	BIC=-3628.38	AIC=-3773.33		LL=1800.32	BIC=-3387.68	AIC=-3532.64

TABLE 2.17. List of States Grouped According to 1978 Historical Debt Levels

High-Debt		Low-Debt	
CONNECTICUT	NEWYORK	ALABAMA	NEBRASKA
DELAWARE	OKLAHOMA	ARKANSAS	NEVADA
ILLINOIS	OREGON	CALIFORNIA	NEWMEXICO
KENTUCKY	PENNSYLVANIA	COLORADO	NORTHCAROLINA
LOUISIANA	RHODEISLAND	FLORIDA	NORTHDAKOTA
MAINE	SOUTHCAROLINA	GEORGIA	OHIO
MARYLAND	SOUTHDAKOTA	IDAHO	TEXAS
MASSACHUSETTS	TENNESSEE	INDIANA	UTAH
MINNESOTA	VERMONT	KANSAS	VIRGINIA
MISSISSIPPI	WESTVIRGINIA	MICHIGAN	WASHINGTON
NEWHAMPSHIRE	WISCONSIN	MISSOURI	WYOMING
NEWJERSEY		MONTANA	

TABLE 2.18. List of States Grouped According to 1974 Historical Debt Levels

High-Debt	Low-Debt
ALABAMA	ARKANSAS
CALIFORNIA	COLORADO
CONNECTICUT	FLORIDA
DELAWARE	ILLINOIS
GEORGIA	INDIANA
KENTUCKY	IOWA
LOUISIANA	KANSAS
MAINE	MICHIGAN
MARYLAND	MINNESOTA
MASSACHUSETTS	MISSOURI
MISSISSIPPI	MONTANA
NEWJERSEY	NEBRASKA
NEWYORK	NEVADA
OHIO	NEWHAMPSHIRE
OKLAHOMA	NEWMEXICO
OREGON	NORTHCAROLINA
PENNSYLVANIA	NORTHDAKOTA
RHODEISLAND	SOUTHDAKOTA
SOUTHCAROLINA	TENNESSEE
VERMONT	TEXAS
WASHINGTON	UTAH
WESTVIRGINIA	VIRGINIA
WISCONSIN	WYOMING

High-Debt	Medium-Debt	Low-Debt
CONNECTICUT	ALABAMA	ARKANSAS
DELAWARE	CALIFORNIA	COLORADO
KENTUCKY	FLORIDA	INDIANA
LOUISIANA	GEORGIA	IOWA
MAINE	ILLINOIS	KANSAS
MARYLAND	MICHIGAN	MISSOURI
MASSACHUSETTS	MINNESOTA	NEBRASKA
MISSISSIPPI	NEWHAMPSHIRE	NEVADA
NEWJERSEY	OHIO	NEWMEXICO
NEWYORK	OREGON	NORTHCAROLINA
OKLAHOMA	SOUTHCAROLINA	NORTHDAKOTA
PENNSYLVANIA	TENNESSEE	SOUTHDAKOTA
RHODEISLAND	WASHINGTON	TEXAS
VERMONT	WISCONSIN	UTAH
WESTVIRGINIA	WYOMING	VIRGINIA

TABLE 2.19. Means and Standard Deviation of High-Debt States, 1970-2004

	TAF		WBTOM		fedaid		surgf		surgf.w.fedaid		inc		real.gsp	
CT	2280.0	707.0	2125.0	701.0	528.0	166.0	-487.0	255.0	-248.0	275.0	23534.0	5766.0	24065.0	11966.0
DE	2862.0	608.0	2555.0	643.0	577.0	140.0	-368.0	264.0	-84.6	274.1	19413.0	3448.0	23968.0	8723.0
KY	1962.0	434.0	1743.0	459.0	589.0	150.0	-434.0	207.0	49.5	131.2	14562.0	2957.0	15486.0	6537.0
LA	2024.0	339.0	1830.0	422.0	637.0	200.0	-531.0	328.0	-29.0	251.0	14588.0	2832.0	14274.0	5507.0
MA	2275.0	545.0	1979.0	431.0	559.0	125.0	-347.0	113.0	18.3	160.6	20951.0	5326.0	20517.0	7812.0
MD	2002.0	304.0	1727.0	392.0	473.8	99.6	-292.0	215.0	68.4	157.9	20574.0	4425.0	19471.0	10938.0
ME	2119.0	532.0	1997.0	481.0	685.0	201.0	-678.0	231.0	-137.0	171.0	15541.0	3493.0	17685.0	7668.0
MS	1851.0	413.0	1467.0	414.0	672.0	202.0	-322.0	224.0	282.0	111.0	12617.0	2743.0	11584.0	4116.0
NJ	2042.0	571.0	1656.0	535.0	490.0	127.0	-166.0	176.0	185.0	154.0	22052.0	5057.0	23300.0	13372.0
NY	2438.0	469.0	1805.0	580.0	783.0	255.0	-183.0	356.0	466.0	215.0	20879.0	4237.0	23795.0	10357.0
OK	1833.0	313.0	1643.0	293.0	510.0	129.0	-395.0	152.0	38.0	131.0	15393.0	2691.0	16108.0	7040.0
PA	1877.0	401.0	1617.0	390.0	504.0	144.0	-298.0	152.0	138.0	104.0	18027.0	3517.0	15241.0	5390.0
RI	2216.0	449.0	2341.0	487.0	711.0	205.0	-899.0	284.0	-509.0	303.0	17962.0	3669.0	20746.0	8817.0
VA	1735.0	338.0	1550.0	283.0	398.5	59.7	-244.0	74.2	83.2	68.1	18535.0	4231.0	22193.0	9685.0
WV	2149.0	499.0	1990.0	527.0	733.0	213.0	-632.0	261.0	0.1	131.8	13805.0	2500.0	11093.0	3837.0

TABLE 2.20. Means and Standard Deviation of Medimum-Debt States, 1970-2004

	TAF		WBTOM		fedaid		surgf		surgf.w.fedaid		inc		real.gsp	
AL	1779.0	352.0	1638.0	389.0	580.0	153.0	-501.0	194.0	21.6	97.7	14397.0	3228.0	12754.0	4730.0
CA	2188.0	366.0	1583.0	290.0	608.0	116.0	-53.3	145.2	491.0	132.0	19883.0	3384.0	23632.0	8190.0
FL	1469.0	312.0	1165.0	293.0	350.0	105.0	-77.9	106.7	236.0	68.9	17530.0	3492.0	21785.0	7105.0
GA	1637.0	302.0	1357.0	275.0	505.0	94.1	-290.0	109.0	167.8	71.7	16157.0	3706.0	22277.0	10477.0
IL	1720.0	252.0	1414.0	263.0	453.9	84.3	-209.0	177.0	140.0	270.0	19612.0	3419.0	21609.0	10612.0
MI	2123.0	443.0	1745.0	255.0	551.0	131.0	-230.0	173.0	252.0	216.0	18153.0	3109.0	19375.0	7944.0
MN	2357.0	441.0	1801.0	517.0	556.0	102.0	-33.1	198.0	444.0	143.0	18612.0	4152.0	22762.0	10597.0
NH	1414.0	363.0	1538.0	296.0	474.0	133.0	-625.0	203.0	-341.0	203.0	18773.0	4765.0	27188.0	8017.0
OH	1685.0	480.0	1593.0	470.0	467.0	173.0	-432.0	211.0	-30.8	129.9	17512.0	3045.0	17514.0	6640.0
OR	1954.0	469.0	1938.0	457.0	651.0	180.0	-687.0	262.0	-152.0	197.0	17048.0	3180.0	24413.0	10419.0
SC	1794.0	382.0	1773.0	494.0	535.0	169.0	-562.0	298.0	-101.0	166.0	14395.0	3216.0	16860.0	8705.0
TN	1553.0	364.0	1345.0	323.0	551.0	184.0	-393.0	150.0	121.5	72.7	15467.0	3597.0	19679.0	7280.0
WA	2178.0	322.0	2077.0	364.0	540.0	95.0	-510.0	201.0	-30.4	157.2	18697.0	3762.0	20853.0	8469.0
WI	2176.0	362.0	1562.0	330.0	537.0	121.0	36.6	146.5	493.0	120.0	17292.0	3364.0	21932.0	8789.0
WY	2903.0	613.0	2130.0	373.0	1211.0	386.0	-549.0	474.0	509.0	407.0	17535.0	3409.0	21753.0	11208.0

TABLE 2.21. Means and Standard Deviation of Low-Debt States, 1970-2004

	TAF		WBTOM		fedaid		surgf		surgf.w.fedaid		inc		real.gsp	
AR	1772.0	479.0	1498.0	426.0	582.0	160.0	-354.0	104.0	177.2	78.7	13668.0	2761.0	13117.0	4363.0
CO	1719.0	234.0	1580.0	236.0	487.0	74.4	-384.0	107.0	50.4	101.9	18823.0	4228.0	26785.0	10715.0
IN	1699.0	402.0	1305.0	340.0	425.0	143.0	-80.3	123.5	280.4	77.6	16599.0	2953.0	16243.0	5599.0
KS	1734.0	380.0	1494.0	291.0	469.0	134.0	-269.0	132.0	178.0	138.0	17311.0	2933.0	19004.0	8294.0
MO	1532.0	397.0	1297.0	342.0	472.0	167.0	-268.0	162.0	143.9	78.9	16758.0	3106.0	17111.0	6599.0
MS	1851.0	413.0	1467.0	414.0	672.0	202.0	-322.0	224.0	282.0	111.0	12617.0	2743.0	11584.0	4116.0
NC	1788.0	391.0	1433.0	377.0	498.0	158.0	-199.0	158.0	263.8	84.7	15740.0	3646.0	20717.0	9576.0
ND	2424.0	449.0	2188.0	444.0	769.0	234.0	-547.0	267.0	104.0	197.0	15557.0	2773.0	13613.0	5379.0
NE	1727.0	444.0	1516.0	407.0	489.0	147.0	-289.0	146.0	141.7	96.1	17048.0	3185.0	17464.0	7950.0
NM	2440.0	378.0	2092.0	511.0	684.0	193.0	-386.0	376.0	172.0	287.0	14221.0	2635.0	17672.0	6023.0
NV	1809.0	125.0	1597.0	104.0	417.3	69.6	-260.0	170.0	93.8	142.9	19311.0	3149.0	29592.0	12545.0
SD	1703.0	294.0	1596.0	226.0	690.0	149.0	-600.0	115.0	-66.5	130.9	15373.0	3257.0	15042.0	5521.0
TX	1495.0	281.0	1227.0	295.0	431.0	136.0	-213.0	169.0	191.6	69.9	16731.0	3322.0	22838.0	9566.0
UT	1948.0	308.0	1795.0	318.0	595.0	62.0	-473.0	125.0	27.9	119.4	14528.0	2679.0	17633.0	4762.0
VA	1735.0	338.0	1550.0	283.0	398.5	59.7	-244.0	74.2	83.2	68.1	18535.0	4231.0	22193.0	9685.0

TABLE 2.22. Means and Standard Deviation of States Not Grouped, 1970-2004

	TAF		WBTOM		fedaid		surgf		surgf.w.fedaid		inc		real.gsp	
AK	7028.0	3170.0	6082.0	1137.0	1505.0	306.0	-706.0	3191.0	80.2	3291.0	21739.0	3242.0	28734.0	12490.0
AZ	1695.0	197.0	1363.0	179.0	411.0	130.0	-98.0	127.0	276.1	83.9	16014.0	2757.0	22885.0	8500.0
HI	3017.0	413.0	3749.0	456.0	686.0	126.0	-1541.0	380.0	-1077.0	296.0	19155.0	3113.0	15778.0	5993.0
ID	1797.0	328.0	1525.0	266.0	542.5	93.9	-305.0	155.0	179.0	129.0	14809.0	2706.0	21805.0	6768.0
MT	2061.0	406.0	1969.0	333.0	799.0	175.0	-748.0	146.0	-51.5	156.1	14992.0	2293.0	14791.0	6389.0

TABLE 2.23. Fixed-Effect GLS Weighted, Sample Period Divided by Decade

Sub-Period Decade	$y_{it}=\alpha_i\ (+\upsilon_t)+\rho_0 Debt_{it}+\beta_1 GVAR_{it}+\beta_2 YVAR_{it}+\varepsilon_{it}$								
	y_{it}:	surgf.w.aid				surgf			
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
	ρ_0	0.01	0.01	0.59	0.55	-0.03	0.02	-1.46	0.14
	β_1	-0.51	0.02	-24.82	0.00	-0.46	0.03	-16.58	0.00
	β_2	-0.22	0.01	-16.41	0.00	-0.43	0.02	-19.01	0.00
	df=51		R^2=0.51	SSE=0.01			R^2=0.49	SSE=0.01	
1970s			LL=1751.29	BIC=-2891.37	AIC=-3304.57		LL=1667.16	BIC=-2723.11	AIC=-3136.31
N=480	Time	0.00	0.00	4.37	0.00	0.00	0.00	23.22	0.00
	ρ_0	0.01	0.01	0.91	0.36	-0.06	0.02	-3.64	0.00
	β_1	-0.57	0.02	-23.62	0.00	-0.72	0.02	-29.82	0.00
	β_2	-0.25	0.01	-16.54	0.00	-0.53	0.02	-30.63	0.00
	df=52		R^2=0.52	SSE=0.00			R^2=0.69	SSE=0.01	
			LL=1756.66	BIC=-2895.93	AIC=-3313.31		LL=1781.35	BIC=-2945.31	AIC=-3362.69
	ρ_0	0.05	0.02	2.74	0.01	-0.01	0.01	-0.78	0.43
	β_1	-0.35	0.04	-8.41	0.00	-0.26	0.04	-6.02	0.00
	β_2	-0.16	0.03	-6.20	0.00	-0.34	0.03	-12.11	0.00
			R^2=0.14	SSE=0.01			R^2=0.42	SSE=0.01	
1980s	df=51		LL=1902.06	BIC=-3192.91	AIC=-3606.12		LL=1931.92	BIC=-3252.64	AIC=-3665.85
N=480	Time	0.00	0.00	0.33	0.74	0.00	0.00	12.83	0.00
	ρ_0	0.05	0.02	2.69	0.01	-0.03	0.01	-2.55	0.01
	β_1	-0.35	0.04	-8.37	0.00	-0.46	0.04	-10.52	0.00
	β_2	-0.16	0.03	-6.03	0.00	-0.40	0.03	-14.79	0.00
	df=52		R^2=0.14	SSE=0.01			R^2=0.51	SSE=0.00	
			LL=1902.10	BIC=-3186.82	AIC=-3604.20		LL=1971.11	BIC=-3324.83	AIC=-3742.21

TABLE 2.24. Fixed-Effect GLS Weighted, Sample Period Divided by Decade (Continued)

Sub-Period Decade	$y_{it}=\alpha_i\ (+\upsilon_t)+\rho_0 Debt_{it}+\beta_1 GVAR_{it}+\beta_2 YVAR_{it}+\varepsilon_{it}$								
	y_{it}:	surgf.w.aid				surgf			
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
	ρ_0	0.06	0.02	2.68	0.01	-0.03	0.01	-1.86	0.06
	β_1	-0.41	0.04	-10.50	0.00	-0.59	0.04	-16.12	0.00
	β_2	-0.20	0.02	-8.58	0.00	-0.45	0.02	-19.63	0.00
	df=51		R^2=0.21	SSE=0.00			R^2=0.35	SSE=0.00	
1990s			LL=1972.78	BIC=-3334.36	AIC=-3747.56		LL=2042.32	BIC=-3473.44	AIC=-3886.64
N=480	Time	0.00	0.00	5.96	0.00	0.00	0.00	-9.93	0.00
	ρ_0	0.07	0.02	3.08	0.00	-0.07	0.01	-5.37	0.00
	β_1	-0.42	0.04	-11.18	0.00	-0.66	0.04	-18.60	0.00
	β_2	-0.21	0.02	-9.28	0.00	-0.47	0.02	-21.61	0.00
	df=52		R^2=0.26	SSE=0.00			R^2=0.42	SSE=0.00	
			LL=1987.69	BIC=-3358.00	AIC=-3775.38		LL=2070.29	BIC=-3523.21	AIC=-3940.59
	ρ_0	-0.02	0.02	-0.78	0.44	-0.02	0.02	-0.90	0.37
	β_1	-0.88	0.04	-20.81	0.00	-0.65	0.04	-14.92	0.00
	β_2	-0.20	0.02	-8.53	0.00	-0.08	0.02	-3.73	0.00
	df=51		R^2=0.57	SSE=0.00			R^2=0.32	SSE=0.00	
2000-04			LL=1018.27	BIC=-1493.95	AIC=-1838.54		LL=1014.20	BIC=-1485.81	AIC=-1830.39
N=240.00	Time	0.00	0.00	-6.96	0.00	0.00	0.00	-22.42	0.00
	ρ_0	0.01	0.03	0.28	0.78	-0.08	0.03	-3.00	0.00
	β_1	-0.79	0.04	-18.51	0.00	-0.95	0.05	-20.98	0.00
	β_2	-0.26	0.03	-8.85	0.00	-0.63	0.04	-15.54	0.00
	df=52		R^2=0.61	SSE=0.00			R^2=0.57	SSE=0.00	
			LL=1031.91	BIC=-1515.76	AIC=-1863.82		LL=1069.37	BIC=-1590.67	AIC=-1938.73

TABLE 2.25. Means and Standard Deviations of States' General Funds Budget Surplus per Capita by Decades

		1970				1980			
		fedaid	surgf.org	surgf	surgf.w.aid	fedaid	surgf.org	surgf	surgf.w.aid
High Debt	Min:	235	-387	-987	-353	351	-592	-1006	-651
	Mean:	489	74	-319	102	516	48	-330	68
	Median:	471	69	-292	84	502	48	-310	66
	Max:	863	955	388	978	826	477	146	560
	TotalN:	150	150	150	150	150	150	150	150
	StdDev.:	120	250	273	252	100	210	226	220
Low Debt	Min:	228	-77	-727	-124	264	-265	-834	-343
	Mean:	442	199	-254	175	437	192	-246	140
	Median:	424	184	-246	175	413	169	-227	135
	Max:	741	684	101	548	754	860	109	591
	TotalN:	150	150	150	150	150	150	150	150
	StdDev.:	112	126	158	116	100	178	172	142
Medium Debt	Min:	210	-509	-906	-490	242	-382	-660	-376
	Mean:	457	168	-267	159	482	238	-217	200
	Median:	440	148	-248	149	457	152	-266	147
	Max:	1077	1026	293	898	1154	1923	543	1479
	TotalN:	150	150	150	150	150	150	150	150
	StdDev.:	150	289	267	276	165	385	223	302

TABLE 2.26. Means and Standard Deviations of States' General Funds Budget Surplus per Capita by Decades (continued)

		1990				2000			
		fedaid	surgf.org	surgf	surgf.w.aid	fedaid	surgf.org	surgf	surgf.w.aid
High Debt	Min:	436	-1184	-1355	-1159	506	-1132	-1625	-1125
	Mean:	717	-84	-561	-69	899	-164	-773	-148
	Median:	708	-22	-466	-14	835	-77	-774	-57
	Max:	1119	559	-183	548	1389	379	-142	422
	TotalN:	150	150	150	150	75	75	75	75
	StdDev.:	160	310	257	307	209	362	333	352
Low Debt	Min:	312	-314	-960	-378	379	-433	-1361	-545
	Mean:	585	169	-351	126	763	98	-564	63
	Median:	569	187	-299	158	726	125	-562	93
	Max:	1095	553	-6	505	1237	450	108	415
	TotalN:	150	150	150	150	75	75	75	75
	StdDev.:	151	173	196	172	201	180	266	190
Medium Debt	Min:	313	-844	-1072	-844	466	-1395	-1521	-1337
	Mean:	646	169	-406	126	828	91	-607	67
	Median:	613	145	-412	131	768	117	-541	106
	Max:	1512	1226	248	745	2497	1312	104	947
	TotalN:	150	150	150	150	75	75	75	75
	StdDev.:	220	354	314	305	330	426	377	380

CHAPTER 2 BIBLIOGRAPHY

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Chapter 3

THREE-ESTIMATING TECHNIQUES FOR SUSTAINABILITY OF PUBLIC DEBT OF THE U.S. STATES: PANEL DATA (TIMES-SERIES CROSS-SECTION) USING OLS WITH PCSE, FEASIBLE GLS, AND FIXED-EFFECT GLS.

3.1 Introduction

The motivation for this paper stems from an initial investigation into the sustainability of public debt on the sub-national government level. To investigate, a panel data set – economic terminology, or a times-series cross-section (TSCS) – political science terminology, data set of the 50-U.S. States pooled: expenditures, revenues, and debt levels, was constructed. The questioning of how to estimate the regression that tests for sustainability of public debt using panel data did not arise until the planned estimating technique, Weighted Generalized Least Square (GLS), produced contrary results when a corrective correlation matrix was applied. In order to ascertain an idea of what the results from 2-Stage Feasible GLS should be, it was determined that although Ordinary Least Squares (OLS) lost some of its desired properties such as efficiency, it would none the less provide correct results.

Further research into 2-Stage Feasible GLS and panel data estimating techniques revealed Beck and Katz's (1995) damning critique of Kmenta's and Parks' 2-Stage Feasible GLS estimating procedures. Beck and Katz provide what seemed to be a way out, Panel Corrected Standard Errors (PCSE), to their much acknowledge criticism. However, as Maddala (1997) noted, and Beck and Katz (199?) acknowledge, their PCSE is not a solution for what ostensible is a mis-specification on the modeler's part.

The interchangeable use of the terms panel data and TSCS for the economist

poses little of no problem with the latter term adding a bit more clarity than the former. For the political scientist and researchers in other fields using regression analysis, the two terms have distinctive meaning and approaches when carrying-out analysis on pooled data with the former term usually referring specifically to survey data. What is an elementary tool in the political scientist's analytical toolbox for comparative political analysis using pooled data, is, for the economist, uncovered territory unless their advanced econometric methodology covered topics other than GLS. Although there were hints and clues along the way, Podest$\tilde{a}$ (2000) opened the political scientist toolbox in language easily understood by the economist but also mindful that between the dismantled Kementa and Parks method for analyzing panel data and the less than satisfactory option of using Beck-Katz's panel corrected standard errors, a considerable void as how to proceed with analyzing panel data for the economist went unfulfilled.

Podest$\tilde{a}$ (2000) fills this void by pulling-out of the political scientist's toolbox another method for analyzing times-series cross-section data, Fixed-Effect estimating procedure.

Does OLS with PCSE, 2-Stage Feasible GLS, and Fixed-Effect Feasible GLS allow the same inference to be drawn when examining the States for implementation of sustainable fiscal debt policies? A comparison of results from OLS, 2-Stage (2-S), and Fixed-Effect (FE) of a pooled data set of the 50-states' expenditures, revenues, and total debt levels will be presented in this paper. Section II presents the model to be regressed by the three estimation techniques, Section III detail the construction of the data set used in the comparison, and Section IV addresses the issue of whether or not the data is poolable. Section V presents and compares the results from the various estimation techniques for the over all sample data set while Section VI examines the parameters for consistency through out various subsets of the sample data set. Finally, Section 7 examines how well the three regression models fit the data, and the last Section presents concluding remarks.

3.2 Model for Empirical Comparison

The model that is used to compare estimates of sustainable fiscal debts is Bohn's test for mean-reversion of the ratio of debt to gdg, controlling for both counter-cyclical fluctuations in both government expenditures and national (in the case of this study, state) output, against the general budget fund surplus.

Using Bohn and Inman's definition, the general budget surplus fund:

$$\begin{aligned} surgf_t = \; & intrev_t \; + taxes_t \; + fees_t \; + aid_t \\ & - wages_t \; - main_t \; - other_t \\ & - trans_t \; - gfcpf_t \; - gfctf_t \\ & - int_t \; - ld_t \end{aligned} \tag{3.1}$$

where $intrev_t$: revenue earned from interest, aid_t: federal aid to the states, $trans_t$: financial assistance transfers, $main_t(other_t)$: general current operation (not classified elsewhere), $gfcpf_t$: contributions to pension fund, $gfctf_t$: contributions to workers' compensation, ld_t : long-term debt redeemed. In the calculation of the general fund budget surplus for Bohn's test, $intrev_t$, ld_t, and int_t are dropped from the calculation as well as contributions to both the pension fund and workers' compensation.

The regression model used for the comparison:

$$surgf_{it} = \alpha_0 + \rho b_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \epsilon_{it} \tag{3.2}$$

where b_{it} : total outstanding debt for state i at time t, $GVAR_{it}$:detrended government expenditure, and $YVAR_{it}$: detrended states output. The detrending process for the derivation of these two variables follows Robert Barro's specification[1]:

$$GVAR_t = \frac{wbtom_t - wbtom_t^*}{gsp_t} \tag{3.3}$$

[1]Barro RJ. U.S. Deficits Since World War 1. The Scandinavian Journal of Economics.1986 Mach; 88: 204

and

$$YVAR_t = \frac{gsp_t^* - gsp_t}{gsp_t^*} \frac{wbtom_t^*}{gsp_t} \tag{3.4}$$

where $wbtom_t$: general fund expenditures on salaries, benefits, transfers, and maintenance; $wbtom_t^*$: detrended general fund expenditures using a simple OLS technique; gsp_t: gross state product; and, gsp_t^* : detrended gross state product using a simple OLS technique. The regressions for the detrending process are in the Appendix.

β_1 measures the effect of random increases in government expenditures on the general surplus budget fund and should enter negatively in any regression. β_2 measures the effect down turns in national (states) output have on the general surplus budget fund and should also enter negatively in any regression. If ρ is positive and significant, states will be determined to have implemented sustainable fiscal debt policies; if ρ is negative and/or insignificant regardless of if it is positive or not, states it will have been determined implemented unsustainable fiscal debt policies.

The fact that ρ can be negative or positive and significant or not, the pooled data introduces ambiguity as to what the estimated value of ρ will be as oppose to a priori expected value, and the application of a corrective correlation matrix to a weighted Feasible GLS regression produced ρ's with opposite and significant values from just the weighted Feasible GLS regression, made the search for finding a correct estimating procedure more imperative.

Both the general fund budget surplus and the states' outstanding debt are not tested for unit-roots because as Bohn (1998) points out the acceptance of a unit-root is wrong because of the inability of unit-root tests to distinguish between a unit-root processes which is almost certainly to be present in the budget-gdp ratio or whether a variable reverts back to a mean value as in the debt-to-gdp ratio. Even

though Bohn is referring to national debt when talking about the presence of a unit root, the same should be more true for the states given the stricter regulation with regard to their issuance of debt.

Equation 3.2 will be estimated by both OLS and 2-Stage Feasible GLS estimating techniques. The estimating equation for the Fixed-Effect GLS is similar to Equation 3.2 but with two major differences:

$$surgf_{nt} = \alpha_n + \alpha_t + \rho b_{nt} + \beta_1 GVAR_{nt} + \beta_2 YVAR_{nt} + \epsilon_t \qquad (3.5)$$

Where α_n: Fixed-Effects accounting for differences between the states; α_t : is a time-effect accounting for differences that occur over time. The Fixed-Effect regressions are estimated with and without the time-effect, most of the time the presence of the time-effect adds as a confirmation of the finding with only the Fixed-Effect included, however, when the sample period is split or the states are grouped according to some criteria, the presence of the time-effect variables has a greater impact on the other estimated coefficients.

3.3 Data Set

As previously stated, the data set for this comparative analysis was born out of an initial investigation into whether the U.S. States implement sustainable fiscal debt policies. This data is a replication of one from Bohn and Inman's 1996 study on state public finances. The source of public expenditures and revenues for this study and Bohn and Inman is the U.S. Bureau of Census' database (Rex-Dac), for 1972 and 1976 - 2004. The published U.S. Census Bureau's *Annual Survey of State and Local Government Finances and Census of Government* is used for the years: 1970-71 and 1973-75. This study updates the Bohn and Inman study's data set (1970-91) with an additional 13-years (1992-2004) due to the use of a more recent updated Rex-Dac database, for a total of 35 annual observation points for each state.

Most studies as in the Bohn and Inman (1996) remove two states (for example, Alaska and Wyoming) because taxes from mineral wealth is directly deposited into these states's general fund, and/or Hawaii is also removed because of its unique responsibility for its public education system. This study will initially compare the results of all three estimating techniques for all 50-states, however, further comparisons will only be done on the 48-states because upon visual examination of graphs of the general fund budget surplus and fitted values for all the states it was difficult to conclude Wyoming being removed from further comparative analysis. An additional state or two may be dropped when tests are carried-out on groups of states in order to keep the numbers in groups equal. The number of observations for each variable is then 1750 for all 50-states and 1680 for 48-states, for the time period: 1970 - 2004.

The expenditures and revenues are deflated by their irrespective price index. The source for these indexes is the Bureau of Economic Analysis' NIPA (2007) Table 3.10.4 on government expenditures and services. In order to cross-check this data set with Bohn and Inman's data set the base year is set to 1990 and this data set's means and standard deviations for expenditures and revenues was compared with the ones reported in Bohn and Inman's Table 3. The last column of Table 2.1: '47-States 1970-1991', reports the means and standard deviations for the same number of states and time period as in Bohn and Inman. Two discrepancies arose during the cross-checking: 1) Bohn and Inman's calculation of revenues (TAF: $taxes + aid + fees$) is under-estimated when compared with this study's; and 2) this study's standard deviation for the general fund surplus is over-estimated when compared with that of Bohn and Inman's reported figure. These discrepancies are easily explained.

Differences in revenues occur because the Rex-Dac data base for some reason does not include in its final tabulation for total federal aid to the states: aid for natural resources. It does, however, have federal aid disaggregated into several

individual categories in which natural resources is one. Even though Bohn and Inman and this study's reported values for total federal aid alone is correct, that is each study aggregated the individual categories of federal aid for total aid from the federal government, in order to achieve their final calculation for revenues aid for natural resources would have to not been included.

The difference in this study's reported over-estimated standard deviation of the general fund surplus is due to Bohn and Inman's reporting of the standard deviation for the general fund surplus as a calculation from the net deposits in several various accounts that when aggregated constitute the general fund surplus. There is no significant difference in means and standard deviations for expenditures and revenues between this data set and Bohn and Inman, however, because Bohn and Inman's focus is on balanced budget rules they build several additional accounts in which the budget surplus is deposited. It is from the mean sum total of these net deposits that they report the standard deviation. Although the means of the budget surplus for this study and Bohn and Inman are not significantly different, the standard deviation for this study's budget surplus is assumed to be correct as the means and standard deviations reported for expenditures and revenues that determine the budget surplus are insignificantly different from those reported by Bohn and Inman.

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TABLE 3.1. Means and Standard Deviations of States' Expenditures and Revenues,1970-2004

	$50-States$		$48-States$		$47-States$		$47-States_{1970-1991}$	
$fedaid$	594.5	252.2	573.6	214.8	560.1	187.7	466.6	112.1
$intrev$	129.4	326.2	90.6	92.9	82.5	64.5	72.0	66.3
TAF	2086.9	992.5	1964.6	526.6	1944.6	506.2	1681.9	338.0
$WBTOM$	1840.6	847.8	1712.5	501.1	1703.6	499.8	1453.4	327.3
$gfcpf$	53.0	43.8	49.6	36.2	49.8	36.3	47.2	31.3
$gfctf$	3.1	16.4	3.2	16.8	1.7	4.6	1.3	2.8
$expint$	84.4	107.7	72.3	59.1	72.0	59.2	61.5	55.6
$expld$	115.0	170.7	100.2	112.7	99.1	111.5	59.7	61.6
$surgf.org$	120.4	600.7	117.5	291.0	101.0	263.2	130.8	223.6
$surgf$	−404.1	558.2	−374.2	292.7	−370.4	286.6	−286.6	230.7
$surgf.w.aid$	75.3	553.8	99.2	264.8	90.5	254.0	120.3	215.1
$surgf.w.aid.n.ben$	131.3	550.5	151.9	257.4	141.9	244.7	168.9	212.3
inc	17214.0	4195.8	17079.2	4172.0	17069.5	4187.1	14977.7	3157.9
$realgsp$	19583.2	9298.5	19471.9	9171.7	19423.3	9121.4	16595.2	8219.0
$rain$	980.1	3012.3	623.4	768.7	553.6	549.2	428.2	386.8
$ldoff$	717.6	879.3	648.0	647.6	636.9	643.5	443.5	513.4
$sdout$	17.4	47.2	16.0	45.2	16.3	45.6	20.6	54.3
$ldout$	1264.5	1219.2	1121.6	851.5	1120.5	857.1	952.0	750.6
	$N = 1750$		$N = 1680$		$N = 1645$		$N = 1034$	

In Bohn (1998), Semmler et al (2005), and Greiner et al (2007) gross domestic product for each individual country modeled is used as a scaling variable. For this study, the Bureau of Economic Analysis' (2007b) Gross Domestic Product (GSP) by State and its corresponding quantity index is used. An immediate problem arises in that the BEA changed its methodology for calculating GSP after 1996 and cautions against appending the two-series together in order to make one continuos series. According to the BEA's website gross domestic product by states prior to 1997 is equivalent to gross domestic income and afterwards it is equivalent to gross domestic product as calculated on the national level. An F-test comparing the variance of real gsp for the whole-sample data set, 1970 - 2004, with the variance of gsp for the sub-period, 1997 - 2004, was performed and the alternative hypothesis of the variances being unequal was rejected at a 0.10 significant level – for the 50-states, and a 0.20 significant level – for the 48-states (see Appendix for details of results).

The three-estimation techniques will be compared over several various exercises examining the models for consistency and magnitudes of the estimated coefficients and whether the same over all inference can be drawn from all three models. The first exercise will be to examine the poolability of the data set under OLS and Fixed-Effect. A second exercise will exam how well the models perform estimating all 50-States verses only 48-states, removing the most common States found most often in such comparative exercises on fiscal matter of the States. Through out the various exercises presented in this paper one comparison that will continually be made is how the States do when federal aid is considered as a source of revenue, and how well the States do with only the use of their own resources over which they have direct control. For this on going exercise, federal aid is subtracted from the general fund expenditures so any state matching expenditures induced by federal programs will be removed (columns' titled: $y_{it} : surgf_{it}$), this model will be compared a model with one in which federal aid enters in only as a source of revenue in the general fund surplus (columns' titled: $y_{it} : surgf.w.aid$). Other exercises

will examine whether there is parameter consistency among groups of states when they are grouped according to historical debt levels and consistency of parameter estimates when the data sample is divided into sub-periods.

3.4 To Pool or Not to Pool

Does a restricted regression model account for the various differences across units (in this study it will be the 50-States) as oppose to an unrestricted regression model that directly incorporates the differences across the units? Does OLS and Fixed-Effect draw the same conclusion for poolability of the data set?

$$\text{Restricted Model} \quad y_{it} = \alpha_0 + \rho \sum^{1750} b_{it} + \beta_1 \sum^{1750} GVAR_{it} + \beta_2 \sum^{1750} YVAR_{it} + \epsilon_{it} \quad (3.6)$$

$$\approx$$

$$\text{Unrestricted Model:} \quad y_{it} = \begin{matrix} \alpha_{0.1} & +\rho_1 \sum^{35} b_t & +\beta_{1.1} \sum^{35} GVAR_t & +\beta_{2.1} \sum^{35} YVAR_t & +\epsilon_1 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \alpha_{0.50} & +\rho_{50} & +\beta_{1.50} & +\beta_{2.50} & +\epsilon_{50} \end{matrix} \quad (3.7)$$

OLS is used to regress the Unrestricted Model Eq. 3.7, the Restricted Model Eq. 3.6 is estimated by both OLS and Fixed-Effect, an F test is performed on the coefficients of both the Unrestricted and Restricted Models. A Hausman Test for consistency of the estimated parameters is performed on the Restricted Model estimated by both OLS and 2-Stage Feasible GLS. It should be pointed out that two similar sets of software are being used to carry-out this comparative analysis: most reported results are performed using S-Plus, and PCSEs[2] for OLS and most of the diagnostic tests for panel data[3] are performed using R.

[2] Bailey D, Katz JN. California Institue of Technology. Panel-Corrected Standard Error Estimation in R. 2007 Sept.

[3] Croissant Y, Millo, G. Introduction to PLM. 2008 February.

A word of caution is in order about the necessity or relevance of performing a poolability test before proceeding with this analysis.

> "The problem with the two usual estimation methods of either pooling the data or obtaining separate estimates for each cross-section is that both are based on extreme assumptions. If the data are pooled, it is assumed that the parameters are all the same. If separate estimates are obtained for each cross-section, it is assumed that the parameters are all different in each cross-section. The truth probably lies somewhere in between."[4]

The F tests, in Appendix 3.1, indicates that the Restricted Model, Eq. 3.6, when estimated by Fixed-Effect is not significantly different from the Unrestricted Model, however, the F test does indicate that the Restricted Model when estimated by OLS is different from the Unrestricted Model. The Hausman Test indicates that the coefficients estimated for the Restricted Model by OLS and 2-Stage Feasible GLS are not inconsistent with a significant value of 0.87 . Although, these tests are not required to proceed with pooling the data, they were performed as a basis for carrying-out the comparison of the three estimating techniques.

The Unrestricted model was also tested for time and individual effects using a Lagrange Multiplier test. These tests were performed to help in the specification of the weights for both the Feasible GLS and the Fixed-Effect. Both tests indicate the presence of individual and time effects.

The Restricted Model (Eq.3.6) estimated by OLS and 2-Stage Feasible GLS are not different from one another, and Fixed-Effect is not different from the Unrestricted Model (Eq. 3.7). This forms the bases for the comparison of the three estimating techniques. The next section will compare the findings of the three estimating techniques for the entire sample data set.

[4]Maddala, G.S. Estimation of Short-Run and Long-Run Elasticities of Energy Demand from Panel Data Using Shrinkage Estimators, Journal of Business & Economic Statistics, 1997 January; 15(1), 91

TABLE 3.2. Estimation of 50-States, 1970-2004

$y_{it} = \alpha_0 + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$

	OLS	$2-S$	FE	OLS	$2-S$	FE
y_{it} :	$surgf.w.aid$			$surgf$		
α_0	-0.01	-0.02	—	-0.02	-0.02	—
	(-2.01)	(-21.15)	-	(-6.01)	(-28.38)	-
ρ_0	-0.02	-0.03	-0.03	0.04	-0.04	-0.01
	(-0.46)	(-5.55)	(-3.60)	(1.07)	(-5.32)	(-.77)
β_1	-0.31	-0.34	-0.38	-0.56	-0.55	-0.64
	(-4.14)	(-31.17)	(-26.56)	(-7.22)	(-31.93)	(-30.10)
β_2	-0.14	-0.15	-0.17	-0.56	-0.48	-0.52
	(-3.17)	(-19.51)	(-18.57)	(-11.04)	(-37.37)	(-36.57)

3.5 Empirical Comparison

For this comparative analysis, both 2-Stage Feasible GLS and Fixed-Effect Feasible GLS are estimated using the same variance identity weighted structure. Individual weights are formed for each state minus one which is set to unity. The T-Stat for the original ran OLS regressions are reported in the appendices as well as the results of the Fixed-Effect without a time-effect variable, both may be referred to from time to time.

Tables 3.2 and 3.3 report the regressions estimates for the sample data set for all 50- and for 48-States. All of the coefficients for all three regressions, leaving aside ρ_0s for the moment, have the correct signs, statistically significant, and are almost the same in magnitude with β_1 and β_2 for the Fixed-Effect having the largest values and OLS having the smallest. Even though ρ_o in the OLS for the 50-States is insignificant when federal aid is considered as a source of revenue (column titled: $surgf.w.aid$) and ρ_o is positive and insignificant when federal aid is withdrawn from the revenue streams (column titled: $surgf$) , these finding are still in line with ρ_0s for both 2-Stage and Fixed-Effect because they all have the same interpretive meaning: for the over all sample period states implemented unsustainable fiscal debt policies.

When Alaska and Hawaii are dropped from the analysis, Table 3.3, ρ_0 for OLS

TABLE 3.3. Estimation of 48-States, 1970-2004

$y_{it} = \alpha_0 + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$

	OLS	$2-S$	FE	OLS	$2-S$	FE
$y_{it}:$	$surgf.w.aid$			$surgf$		
α_0	-0.01	-0.01	—	-0.02	-0.02	—
	(-4.80)	(-17.59)	-	(-9.85)	(-21.42)	-
ρ_0	-0.05	-0.03	-0.02	-0.01	-0.03	0.01
	(-5.30)	(-4.44)	(-2.54)	(-0.89)	(-3.59)	(1.09)
β_1	-0.29	-0.33	-0.37	-0.50	-0.41	-0.46
	(-11.84)	(-27.21)	(-23.40)	(-13.93)	(-21.57)	(-21.02)
β_2	-0.09	-0.12	-0.15	-0.49	-0.40	-0.42
	(-6.30)	(-15.75)	(-15.68)	(-21.66)	(-29.54)	(-29.35)

TABLE 3.4. Estimation of 47-States, 1970-1991

$y_{it} = \alpha_i\,(+v_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$

	OLS	$2-S$	FE	OLS	$2-S$	FE
$y_{it}:$	$surgf.w.aid_{it}$			$surgf_{it}$		
α_0	-0.01	-0.01	—	-0.02	-0.01	—
	(-5.76)	(-12.68)	-	(-8.49)	(-17.76)	-
ρ_0	-0.04	-0.05	-0.04	-0.01	-0.04	-0.04
	(-3.37)	(-7.09)	(-4.45)	(-0.61)	(-5.11)	(-3.84)
β_1	-0.34	-0.31	-0.39	-0.53	-0.38	-0.60
	(-12.00)	(-22.30)	(-21.47)	(-11.46)	(-19.28)	(-29.80)
β_2	-0.12	-011	-0.16	-0.49	-0.38	-0.45
	(-6.42)	(-11.51)	(-14.28)	(-15.73)	(-26.24)	(-34.95)

is still negative but becomes significant when federal aid is considered as a source of revenue. While the coefficients for both 2-Stage and Fixed-Effect decrease slightly in value when federal aid is considered as a source of revenue, all coefficients decrease dramatically for all three estimation techniques when only states' revenues and expenditures are considered (Table 3.3, column titled: $y_{it} : surgf$). Interestingly, model selection criteria: Log-likelihood, Bayesian Information Criterion, and Akiake Information Criterion, for both 2-Stage and Fixed-Effect indicate that both regressions ($y_{it} : surgf.w.aid$ and $y_{it} : surgf$) for the 48-States are better than for the 50-States while the opposite conclusion is reached for the OLS regressions, please refer to Appendix Tables: 3.13, 3.14, and 3.15 .

Table 3.4 compares all three estimation results for the same States and years as in the Bohn and Inman (1996) study. The coefficients are in magnitude around the same values when federal aid is considered as a source of revenue (columns titled:$surgf.w.aid$). There is a wider variation for both β_1 and β_2 between the three-estimating techniques when only States' resources and expenditures are considered (columns titled: $surgf$). It should be pointed out, though, that when the Fixed-Effect regression is estimated without a Time-Effect, both β_1 and β_2 equal -0.37 which is statistically insignificant for the same variables estimated by Feasible GLS (see Appendix Table 3.14).

For the 50- and 48-States sample data, the coefficients for all three estimation techniques are in magnitude around the same order and because an insignificant value of ρ has the same meaning as a negative and significant value of ρ the same conclusion is reached by all three estimation techniques: states do not implement sustainable fiscal debt policies whether federal aid is considered as a source of revenue or not for the entire sample period. The model selection criteria for both 2-Stage and Fixed-Effect indicated the estimations without the states Alaska and Hawaii to be better fits. While model selection criteria for OLS indicated estimation of the data sample consisting of all 50-States to be the better estimate.

The next section will exam the parameter estimates for consistency when the data sample is split according to increments in time.

3.6 Consistency of Parameter Estimates

The compared estimated coefficients in the last section was for the whole sample data set, 1970 - 2004. This section is going to compare the estimated parameters and model fits from the three estimating techniques over various sub-periods of the sample data set. The first part will divide the sample data set in to four decades: 1970s, 1980s, and 1990s (results for 2000 to 2004 can be found in the Appendix Tables: 3.16, 3.17, and 3.18). Splitting the sample data set by decades coincides

TABLE 3.5. Sub-Periods by Decades with Federal Aid

$surgf.w.aid_{it} = \alpha + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$

	1970 − 1979			1980 − 1989			1990 − 1999		
	OLS	$2-S$	FE	OLS	$2-S$	FE	OLS	$2-S$	FE
α	-0.01	-0.01	—	0.01	-0.01	—	0.00	-0.01	—
	(-5.76)	(-13.90)	–	(2.03)	(-3.99)	–	(-1.22)	(-7.61)	–
ρ_0	-0.03	-0.01	0.01	-0.10	-0.08	0.05	-0.11	-0.01	0.07
	(-3.37)	(-0.89)	(.91)	(-6.59)	(-8.34)	(2.69)	(-5.85)	(-1.10)	(3.08)
β_1	-0.35	-0.37	-0.57	-0.05	-0.20	-0.35	-0.24	-0.25	-0.42
	(-12.00)	(-24.08)	(-23.62)	(-0.92)	(-9.25)	(-8.37)	(-5.88)	(-12.58)	(-11.18)
β_2	-0.11	-0.16	-0.25	0.04	-0.05	-0.16	-0.09	-0.10	-0.21
	(-6.42)	(-14.67)	(-16.54)	(0.98)	(-3.88)	(-6.03)	(-4.09)	(-8.28)	(-9.28)

with shifts in Presidential Administrations leading to shifts in federal - state aid policies and practices as well as shifts in over all national economic trends. The second part will divide the sample data set according to breaks in time based upon the total accumulation of states' debt. The last part of this section will divide the states into groups according to historical debt levels and compare the results of the three estimating techniques.

3.6.1 Decades Sub-Period Estimation

The estimated coefficients for the three-estimation techniques vary considerably amongst themselves in each of the sub-periods, Table 3.5 . For the 1970s, all of the estimated coefficients for both OLS and 2-Stage do not substantially deviate from their counter parts estimated for the entire sample period (Table 3.3). Although ρ for Fixed-Effect is insignificant, both coefficients for $GVAR_{it}$ and $YVAR_{it}$ are significantly greater than their counter parts estimated for the over all sample period by Fixed-Effect and for those estimated for the same period (1970s) by OLS and 2-Stage.

Both OLS and 2-Stage produce troubling results for the 1980s and the 1990s while Fixed-Effect produce result that are in line with known shifts in Federal - State Aid policies. The coefficients β_1 and β_2 for OLS_{1980s} are insignificant with

TABLE 3.6. Sub-Periods by Decades without Federal Aid

$$surgf_{it} = \alpha_i\,(+\upsilon_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

	$1970-1979$			$1980-1989$			$1990-1999$		
	OLS	$2-S$	FE	OLS	$2-S$	FE	OLS	$2-S$	FE
$const$	-0.03	-0.03		-0.01	-0.01		-0.01	-0.01	
	(-9.98)	(-23.14)		(-5.07)	(-8.35)		(-3.59)	(-8.51)	
ρ_0	0.06	-0.04	-0.06	-0.09	-0.09	-0.03	-0.07	-0.06	-0.07
	(4.54)	(-3.76)	(-3.64)	(-7.87)	(-12.80)	(-2.55)	(-4.61)	(-5.36)	(-5.37)
β_1	-0.77	-0.47	-0.72	-0.25	-0.31	-0.46	-0.29	-0.27	-0.66
	(-13.39)	(-19.10)	(-29.82)	(-6.08)	(-12.30)	(-10.52)	(-6.28)	(-10.25)	(-18.60)
β_2	-0.66	-0.39	-0.53	-0.29	-0.33	-0.40	-0.38	-0.36	-0.47
	(-18.40)	(-22.06)	(-30.63)	(-10.04)	(-20.03)	(-14.79)	(-14.80)	(-20.56)	(-21.61)

and without panel corrected standard errors and β_2 has the wrong sign $(+)$ thus any conclusion drawn from this regression based on a ρ_0 of -0.10 is highly suspect. For 2-Stage, β_1 and β_2 are significantly below their counter-parts estimated for the entire sample period (Table 3.2). Setting $\beta_{1,1980}$ to its estimated value for the entire sample data set produces both ρ and β_2 for 2-Stage estimated over the 1980s equal to their counter-parts estimated by OLS for the same period. Thus any conclusion based on 2-Stage for the 1980s is also suspect. Although β_1 and β_2 are significant and have the correct signs for the 1990s, again, both sets of coefficients are significantly below their counter parts estimated for the entire sample period, and when β_1 is set to its over-all sample period value, both OLS and 2-Stage produce β_2 with signs opposite expected values. Thus $\rho's$ for OLS and 2-Stage are negative and for OLS significant, contradicting Fixed-Effect estimated value of ρ for the 1990s, the former two-estimated values for ρ's are questionable.

When federal aid is removed from the revenue stream as in Table 3.6, OLS, for the 1970s, produces a ρ that is positive and significant. Both 2-Stage and Fixed-Effect produce ρ's negative and significant. Diagnostic tests: setting $GVAR_{it}$'s coefficient and then $YVAR_{it}$'s coefficient to their values estimated for the entire sample period, for OLS produced contradictory results when $YVAR_{it}$'s coefficient was set to its counter-part value estimated for the entire sample period. For the

1980s and 1990s, all three estimation techniques produce $\rho's$ with the same signs and significant values. Even though β_1 and β_2 for OLS and 2-Stage are much lower than the reported values for Fixed-Effect for the 1980s in Table 3.6, Fixed-effect produces similar values when a time-effect is not included in the estimation (refer to Appendix Table 3.16).

When the sample data-set is split according to decades and federal aid is considered as a source of revenue, estimation by both OLS and 2-Stage techniques for the 1980s and 1990s sub-periods are highly questionable as both β_1 and β_2 are significantly below the values of those estimated for the entire sample period. Fixed-Effect performs well according to a priori expectations. However, when federal aid is removed from the states's revenue stream, both OLS and 2-Stage perform reasonable well for the 1980s and 1990s sub-periods. OLS estimation for the 1970s is suspect as its ρ is significant and of opposite signs than for those estimated by 2-Stage and Fixed-Effect. The next section will hopefully provide insight into the problems OLS had with estimating the Decade sub-periods as the sample period will be split according to breaks in time based upon times-series properties of the data.

3.6.2 Sub-Period Estimations Based on Beaks in Time

This section will examine how the three-estimation techniques perform when the sample data period is split according to breaks in time based on the states' total debt levels. Figure 3.1 plots the first derivative of total debt over the entire sample period. It is hoped that by splitting the sample data period according to the data's suggested breaks in time, any ambiguity raised in the previous section by opposite and significant values of ρ being found for the various estimation techniques for the separate decades will be removed or shown to be consistent.

The plotting of the first-difference of states' debt is based on a suggestion made to Sorenson et al (2000). Although the year 1974 looks to be a global maximum

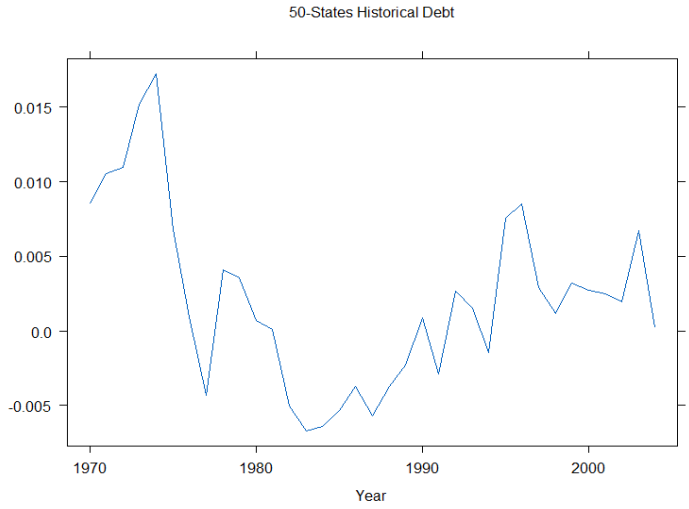


FIGURE 3.1. First-Difference of Real Long-Term State Debt as a Percentage of Gross State Product.

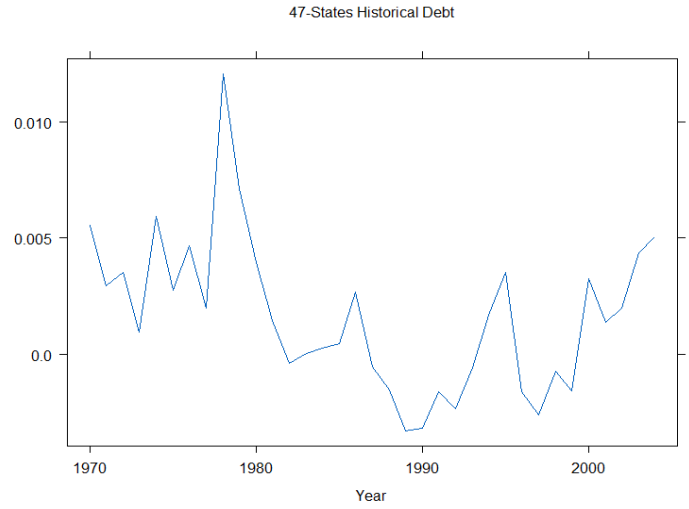


FIGURE 3.2. First-Difference of Real Long-Term State Debt as a Percentage of Gross State Product.

TABLE 3.7. Testing for Breaks in Time with Federail Aid

$surgf.w.aid_{it} = \alpha + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$

	1970 − 76			1980 − 94			1998 − 04		
$method:$	OLS	$2-S$	FE	OLS	$2-S$	FE	OLS	$2-S$	FE
α	-0.01	-0.01	-	0.00	-0.01	-	-0.02	-0.02	-
	(-6.12)	(-14.78)	-	(0.40)	(-6.67)	-	(-7.64)	(-13.29)	-
ρ_0	-0.02	0.00	0.03	-0.11	-0.06	0.01	0.01	0.02	-0.02
	(-2.31)	(0.54)	(1.29)	(-7.27)	(-6.60)	(0.50)	(0.71)	(1.04)	(-1.08)
β_1	-0.37	-0.39	-0.50	-0.15	-0.25	-0.45	-0.30	-0.38	-0.78
	(-10.70)	(-24.88)	(-22.48)	(-3.34)	(-12.78)	(-15.05)	(-11.34)	(-16.82)	(-16.78)
β_2	-0.12	-0.17	-0.21	-0.03	-0.10	-0.23	-0.10	-0.15	-0.27
	(-5.63)	(-16.57)	(-15.79)	(-1.13)	(-7.71)	(-12.24)	(-5.84)	(-10.38)	(-9.63)

for the states' debt in Figure 3.1, this findings is a bit misleading because the index for GSP for 1970-1975 was imputed using all 50-States thus making 1974 a global maximum. Where in Figure 3.2 the index for GSP was only imputed for 47-States, the year 1978 is a global maximum which is in line with Sorenson et al (2000) and the general public finance literature on states finances. This leads to both 1978 and 1996 being tested for breaks in time.

All three estimating techniques in Table 3.7 draw the same conclusion with respect to the sustainability of public debt (ρ_0) when the sample data set is divided into sub-periods according to shifts in the states' total debt levels: in neither of the three sub-periods are states found to be implementing sustainable debt policies. When each estimation technique is compared with its counter-part estimated for the whole sample period (Table 3.3), only OLS for the sub-period, 1980-94, has estimated coefficients substantial different from their counterparts estimated for the entire sample period. Where the estimated ρ by Fixed-Effect for 1980-94 is 0.01 and insignificant (with and without a time-effect variable), ρ estimated for the 1980s (Table 3.5) was positive and significant with a value of 0.05 .

The Table 3.8 summarizes the estimated coefficients for the sample data set divided by the two breaks in time with federal aid not considered as a source of revenue. Here, more so than when federal aid was considered as a source of rev-

TABLE 3.8. Testing for Breaks in Time without Federal Aid

$surgf_{it} = \alpha + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$

$method:$	$1970-76$			$1980-94$			$1998-04$		
	OLS	$2-S$	FE	OLS	$2-S$	FE	OLS	$2-S$	FE
α	-0.04	-0.03	—	-0.01	-0.01	—	-0.02	-0.02	—
	(-10.35)	(-29.69)	–	(-5.95)	(-9.94)	–	(-6.80)	(-9.13)	–
ρ_0	0.07	0.01	-0.06	-0.09	-0.08	-0.03	-0.02	-0.10	-0.14
	(4.73)	(0.58)	(-3.19)	(-8.24)	(-9.83)	(-2.87)	(-1.00)	(-6.19)	(-5.42)
β_1	-0.80	-0.56	-0.47	-0.27	-0.27	-0.33	-0.40	-0.31	-0.45
	(-13.41)	(-25.60)	(-18.87)	(-8.40)	(-10.61)	(-8.93)	(-9.60)	(-7.64)	(-8.36)
β_2	-0.67	-0.47	-0.44	-0.32	-0.30	-0.33	-0.43	-0.34	-0.04
	(-19.16)	(-29.69)	(-24.66)	(-13.92)	(-17.89)	(-14.10)	(-12.13)	(-12.76)	(-1.56)

enue, Table 3.7, the three-estimation techniques produce similar estimated coefficients for the three time periods with the initial exception of OLS for 1970-76. The Durbin-Watson Statistic of 0.52 indicates (see Appendix Table 3.23) the presence autocorrelation, however, since ρ_o is sensitive to the correction for autocorrelation, it was decided that all OLS regressions would not be corrected were autocorrelation of the residuals found to be present. The diagnostic check for OLS estimated for the sub-period, 1970-76, holding first β_1 and then β_2 equal to their estimated value for the over all sample data set, produced some interesting results such that for only this exercise it was decided to correct for autocorrelation in the OLS regression and then calculate the Panel Corrected Standard Errors (Appendix Table 3.24). The use of an autocorrelation corrected matrix by maximum likelihood caused produced a ρ_0 similar to those estimated by 2-Stage and Fixed-Effect for the same sub-period.

When the sample data set is divided into sub-periods according to breaks in time for states' total debt, Figure 3.1, the three estimation techniques produce similar conclusion for the three-time periods with respect to ρ_0. The estimated coefficients for Fixed-Effect in the summary tables for this section were reported without the time-effect variable included in the regressions (please refer to Appendix Table 3.21 for Fixed-Effect with Time-Effect) so the estimated coefficients from all three regressions are similar in magnitude. However, when the time-effect is in included

TABLE 3.9. Summary of Regressions for States Grouped According to 1974 Net Debt Levels

$$surgf.w.aid_{it} = \alpha_i + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

	$Hi-Debt$			$Med-Debt$			$Low-Debt$		
	OLS	$2-S$	FE	OLS	$2-S$	FE	OLS	$2-S$	FE
α	-0.03	-0.02	—	0.00	-0.02	—	0.00	-0.01	—
	(-12.77)	(-15.18)	–	(1.12)	(-11.63)	–	(0.09)	(-7.13)	–
ρ_0	0.07	0.07	0.05	-0.13	-0.04	-0.04	-0.18	-0.15	-0.09
	(4.85)	(6.30)	(3.24)	(-5.75)	(-2.97)	(-2.44)	(-9.52)	(-11.32)	(-4.77)
β_1	-0.59	-0.48	-0.44	-0.06	-0.38	-0.46	-0.12	-0.25	-0.34
	(-20.28)	(-20.68)	(-14.17)	(-1.10)	(-16.20)	(-15.28)	(-3.85)	(-12.69)	(-12.51)
β_2	-0.28	-0.22	-0.21	0.06	-0.15	-0.18	0.02	-0.07	-0.13
	(-13.72)	(-15.44)	(-11.24)	(2.00)	(-10.09)	(-9.78)	(0.97)	(-5.28)	(-8.20)

in the Fixed-Effect estimation, its estimated values for β_1 and β_2 are greater than those estimated by both OLS and 2-Stage. The next section will exam how well the three-estimation techniques perform estimating states grouped according to historic debt levels.

3.6.3 Estimation of Grouped States according to Historic Debt Levels

The grouping of states according to their historical net debt levels held in 1974 is directly attributed to the same suggestion made to Sorenson et al (2000). The states were divided into three-groups of 15-states in each group: high-, medium-, and low-debt states. In addition to Alaska and Hawaii being excluded, three additional states were excluded in order to keep the number of observation per groups equal (refer to Appendix Table 3.25).

Table 3.9 summarizes the three-estimation techniques for the three separate groups with federal aid considered as a source of revenue. All three-estimation techniques produce similar estimated coefficients for high-debt states, and significant ρ_0's with the same signs for both medium- and low-debt states. OLS produces troubling results for the medium- and low-debt states indicated by the considerable low value for β_1 when it is compared to its counter-part estimated for the over all

TABLE 3.10. Summary of Regressions for States Grouped According to 1974 Net Debt Levels

$$surgf_{it} = \alpha_i + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

	$Hi-Debt$			$Med-Debt$			$Lo-Debt$		
	OLS	$2-S$	FE	OLS	$2-S$	FE	OLS	$2-S$	FE
α	-0.03	-0.02	—	-0.02	-0.02	—	-0.01	-0.01	—
	(-10.97)	(-12.94)	–	(-7.94)	(-13.64)	–	(-7.92)	(-11.11)	–
ρ_0	0.08	0.04	-0.01	-0.06	-0.11	-0.02	-0.13	-0.06	0.02
	(4.35)	(2.93)	(-.78)	(-2.84)	(-5.74)	(-1.22)	(-4.42)	(-2.81)	(1.41)
β_1	-0.71	-0.63	-0.57	-0.47	-0.58	-0.51	-0.26	-0.27	-0.29
	(-16.49)	(-18.00)	(-14.79)	(-10.48)	(-17.93)	(-13.08)	(-7.17)	(-9.03)	(-7.91)
β_2	-0.65	-0.59	-0.48	-0.43	-0.44	-0.42	-0.27	-0.30	-0.31
	(-22.22)	(-23.27)	(-19.41)	(-15.63)	(-18.41)	(-15.17)	(-10.72)	(-13.88)	(-13.04)

sample period and β_2 is positive and is insignificant for the low-debt states.

When federal aid is removed from each group of states' revenue stream, Table 3.10, the three estimation techniques reach the same conclusion with respect to implementing sustainable fiscal debt policies with one exception. Both OLS' and 2-Stage's $\rho_0's$ are positive and significant, indicating that states with a historical high-debt level implemented sustainable fiscal policies with respect to their debt levels. However, when further diagnostic tests (holding β_1 equal to its estimated value for the entire sample data set) were performed on these two-estimating techniques, ρ_0 dropped in value and significance. Out of all the comparison made until now, if OLS produced results opposite to Fixed-Effect, 2-Stage estimates were closer to Fixed-Effect's, indicating OLS was having trouble with autocorrelation. The Fixed-Effect estimate of ρ_0 for low-debt states without the time-effect is troubling because of its positive and significant value of 0.05 (Appendix Table 3.26). However, the inclusion of the time-effect, last column of Table 3.10, has the affect of lessening the value of ρ_0 and it becoming insignificant in value.

The three-estimation techniques when the states are grouped according to historic debt levels, produce similar conclusions with respect to the sign and significance of ρ_0 and coefficients β_1 and β_2 roughly of the same magnitude. Of the three-estimation techniques, OLS is the one estimation technique that produces any

troubling estimation usually made evident by positive values and low values being produced for the estimated coefficient, β_2. However, as autocorrelation was not corrected in the OLS estimates 2-Stage results were closer to Fixed-Effect's results. The one time it looked as if OLS and 2-Stage (Table 3.10, columns titled: Lo-Debt) reached an opposite conclusion from that of Fixed-Effect without a time-effect (Appendix Table 3.26), the inclusion of a time-effect in the Fixed-Effect estimation saw a decrease in value of ρ_0 and it becoming insignificant.

3.7 Fitting the Data

In order to ascertain how well the three-estimating techniques fit the data a Bootstrap estimating procedure was performed on the estimated coefficients for all three-estimation procedures using the full data set, Alaska and Hawaii included. The Bootstrap estimating procedure looks at the distribution of the estimated coefficients from replicating the sample data set a thousand times. This then allowed for an estimated bias and standard errors to be calculated of the original estimated coefficients. Tables 3.11 present the results from the Bootstrap estimating procedure and Table 3.12 presents histograms of the estimated coefficients from all three-estimation techniques.

Although the Biases in Table 3.11 are very small, the standard errors for OLS estimated coefficients β_1 and β_2 is more than doubled their estimated counterparts using 2-Stage and Fixed-Effect. The values of the coefficients from the Fixed-Effect are closer to their corresponding 5% Empirical and Bias Corrected (BC) Percentiles than both 2-Stage and OLS. Appendix Table 3.30 compares the histograms of the Bootstrap generated coefficients from all three estimation techniques. Of the three-estimation techniques the estimated coefficients by Fixed-Effect look to have a smaller distribution. In other words, Fixed-Effect looks to have a tighter fit and/or is more robust in its estimation of the coefficients.

TABLE 3.11. Summary of Bootstrap Results, 50-States, 1000 Replications

$surgf.w.aid_{it} = \alpha_i + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$						
	Summary Statistics :		*BC Percentiles*			
	Values	*SE*	2.5%	5%	95%	97.5%
			FE			
Time	0.00	0.00	0.00	0.00	0.00	0.00
ρ_0	−0.03	0.01	−0.06	−0.05	−0.01	0.00
β_1	−0.38	0.02	−0.42	−0.42	−0.34	−0.33
β_2	−0.17	0.01	−0.20	−0.20	−0.15	−0.14
			$2-S$			
α	−0.02	0.00	−0.02	−0.02	−0.01	−0.01
ρ_0	−0.03	0.02	−0.07	−0.06	−0.01	−0.01
β_1	−0.34	0.02	−0.39	−0.38	−0.31	−0.31
β_2	−0.15	0.01	−0.18	−0.17	−0.12	−0.12
			OLS			
α	−0.01	0.01	−0.02	−0.02	0.01	0.01
ρ_0	−0.02	0.02	−0.06	−0.06	0.02	0.03
β_1	−0.31	0.09	−0.42	−0.40	−0.01	0.03
β_2	−0.14	0.05	−0.20	−0.20	0.02	0.05

The spikes or 'waffling'[5] seen through out the histograms of the three-coefficients from all three estimation techniques is due to the inclusion of Alaska in the Bootstrap analysis. This lends further support for the exclusion of Alaska from any analysis in a panel or times-series cross-section analysis.

3.8 Lessons Learned

When a former professor at the end of presenting a microeconomics course centered around the Cambridge Debates or capital critique was asked why do textbooks still present the materials as if these debates had never taken place, this professor's response was simple, "Textbooks can be wrong." In the case of the economist it is not necessarily that the textbooks are wrong so much as it is where emphasis is placed in modeling panel data. In general this is due to a pedagogic approach in teaching econometrics in which panel data estimation is one of several topics that is

[5] Daniel Kocis, PhD

covered usually when discussing violations of the assumption about the distribution of error terms occurs. In learning what is occurring when the spherical distribution of error terms is violated it is then logical to present estimation methods that directly incorporate the violation with the two-stage feasible gls being the method most commonly focused upon and fixed-effect estimation mentioned as a possible estimation technique. As panel data estimation is increasingly becoming more important in economic research witnessed by the publication of several econometric textbooks that focus only on cross-panel data analysis, so it is hoped that a spill-over occurs and that the general econometric textbook start to incorporate the changes in panel data estimation techniques.

For this study, 2-Stage Feasible GLS reduced to a weighted least squares when an error correction matrix was applied and the regressions produced spurious results. Here, spurious results meant that not only would ρ change signs but one of the other coefficients (usually β_1) unexpectedly changed signs and was significant in value and the estimation technique is known to produce standard errors that allows acceptance of what should be a false hypothesis. As previously mentioned, ρ could a priori take on both negative and positive values when estimating the whole sample data set. OLS then with the knowledge of it being inefficient became the preferred estimating technique as it would still produce correct estimates of the coefficients. However, a tautological problem appeared as to use OLS with panel corrected standard errors would mean estimating the model using OLS and correcting for deficiences in OLS estimation after the fact. Finally, Fixed-Effect with and without a time-effect estimated using weighted-least squares is then the only estimating technique for panel data that incorporates directly the violations of the assumptions about the distribution of the error terms when using panel data.

Appendix 3.A Technical Appendix

TABLE 3.12. Poolability and Other Diagnostic Tests

	Restricted Model Eq.3.6						Unrestricted Model Eq.3.7	
	OLS		2-S		FE		OLS	
	Value	T-Stat	Value	Z-Stat	Value	T-Stat	Median	Mean
(Intercept)	-0.01	-4.62	-0.01	-16.91	-	-	-0.02	-0.02
Debt	-0.02	-1.01	-0.01	-1.97	-0.02	-0.83	-0.05	-0.03
GVAR	-0.31	-12.02	-0.33	-48.70	-0.51	-13.68	-0.49	-0.55
YVAR	-0.14	-7.36	-0.16	-34.50	-0.23	-9.22	-0.22	-0.25
$\bar{R}^2$	0.15		0.42		0.33		0.36	

Pool Test for OLS Model Eq.3.6 and OLS Model Eq.3.7

F=2.50 df1=196 df=1550 p-val=2.2e-16

AlternativeH_0: unstability

Pool Test for Fixed-Effect Model Eq.3.6 and OLS Model Eq.3.7

F=0.68 df1=147 df=1550 p-val=0.9987

AlternativeH_0: unstability

Hausman Test of OLS and Feasible GLS Coefficients

data:surgf.w.aid~$\alpha+\rho_0$ total.debt+β_1 GVAR+β_2 YVAR

chisq=1.22, df=4, p-val. 0.87

alternative hypothesis:one model is inconsistent

Lagrange Multiplier Test-time effects (Honda)	Lagrange Multiplier Test-individual(Honda)
OLS Model Eq.3.7	OLS Model Eq.3.7
normal=4.27,p-val. 4.733e-06	normal=25.67,p-value<2.2e-16
alternative hypothesis:significant effects	alternativehypothesis:significanteffects

TABLE 3.13. Fixed-Effect GLS Estimation of Full Data Set

$$y_{it} = \alpha_i\ (+\upsilon_t) + \rho_0 \text{Debt}_{it} + \beta_1 \text{GVAR}_{it} + \beta_2 \text{YVAR}_{it} + \varepsilon_{it}$$

	y_{it}:		surgf.w.aid				surgf		
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
50-States 1970-2004 N=1750 df=53	ρ_0	-0.03	0.01	-3.14	0.00	-0.01	0.01	-0.62	0.54
	β_1	-0.41	0.01	-30.92	0.00	-0.59	0.02	-28.66	0.00
	β_2	-0.19	0.01	-21.38	0.00	-0.49	0.01	-34.76	0.00
			R^2=0.40	SSE=0.01			R^2=0.43	SSE=0.01	
			LL=5782.97	BIC=-10796.81	AIC=-11359.95		LL=5551.61	BIC=-10334.08	AIC=-10897.22
	Time	0.00	0.00	-6.27	0.00	0.00	0.00	8.34	0.00
	ρ_0	-0.03	0.01	-3.60	0.00	-0.01	0.01	-0.77	0.44
N=1750 df=54	β_1	-0.38	0.01	-26.56	0.00	-0.64	0.02	-30.10	0.00
	β_2	-0.17	0.01	-18.57	0.00	-0.52	0.01	-36.57	0.00
			R^2=0.41	SSE=0.01			R^2=0.44	SSE=0.01	
			LL=5796.84	BIC=-10817.08	AIC=-11385.69		LL=5572.28	BIC=-10367.95	AIC=-10936.55
48-States 1970-2004 -AK,-HI N=1680.00 df=51.00	ρ_0	-0.02	0.01	-2.09	0.04	0.01	0.01	1.17	0.24
	β_1	-0.42	0.02	-27.03	0.00	-0.43	0.02	-20.87	0.00
	β_2	-0.17	0.01	-18.40	0.00	-0.41	0.01	-28.89	0.00
			R^2=0.36	SSE=0.01			R^2=0.38	SSE=0.01	
			LL=5650.34	BIC=-10565.44	AIC=-11102.67		LL=5415.15	BIC=-10095.07	AIC=-10632.30
	$Time$	0.00	0.00	-11.21	0.00	0.00	0.00	3.42	0.00
	ρ_0	-0.02	0.01	-2.54	0.01	0.01	0.01	1.09	0.27
N=1680 df=52	β_1	-0.37	0.02	-23.40	0.00	-0.46	0.02	-21.02	0.00
	β_2	-0.15	0.01	-15.68	0.00	-0.42	0.01	-29.35	0.00
			R^2=0.40	SSE=0.01			R^2=0.39	SSE=0.01	
			LL=5695.28	BIC=-10647.90	AIC=-11190.56		LL=5418.40	BIC=-10094.14	AIC=-10636.79

TABLE 3.14. Fixed-Effect GLS Estimation of Full Data Set (continued)

$$y_{it} = \alpha_i\ (+\upsilon_t) + \rho_0 \text{Debt}_{it} + \beta_1 \text{GVAR}_{it} + \beta_2 \text{YVAR}_{it} + \varepsilon_{it}$$

	y_{it}:	surgf.w.aid				surgf			
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
47-States 1970-1991 -AK,HI -WY N=1034 df=50	ρ_0	-0.04	0.01	-3.48	0.00	-0.01	0.01	-1.26	0.21
	β_1	-0.42	0.02	-22.19	0.00	-0.37	0.02	-16.99	0.00
	β_2	-0.16	0.01	-13.82	0.00	-0.37	0.02	-23.70	0.00
			R^2=0.35	SSE=0.01			R^2=0.41	SSE=0.01	
			LL=3569.72	BIC=-6466.14	AIC=-6945.43		LL=3456.49	BIC=-6239.69	AIC=-6718.99
	Time	0.00	0.00	-12.32	0.00	0.00	0.00	27.14	0.00
N=1034 df=51	ρ_0	-0.04	0.01	-4.45	0.00	-0.04	0.01	-3.84	0.00
	β_1	-0.39	0.02	-21.47	0.00	-0.60	0.02	-29.80	0.00
	β_2	-0.16	0.01	-14.28	0.00	-0.45	0.01	-34.95	0.00
			R^2=0.41	SSE=0.01			R^2=0.59	SSE=0.01	
			LL=3620.18	BIC=-6560.12	AIC=-7044.36		LL=3645.74	BIC=-6611.25	AIC=-7095.48

TABLE 3.15. Two-Stage Feasible GLS Estimation of Full Data Set

$$y_{it} = \alpha + \rho_0 \text{Debt}_{it} + \beta_1 \text{GVAR}_{it} + \beta_2 \text{YVAR}_{it} + \varepsilon_{it}$$

	y_{it}:		surgf.w.aid				surgf		
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
50-States	α	-0.02	0.00	-21.15	0.00	-0.02	0.00	-28.38	0.00
1970-2004	ρ_0	-0.03	0.01	-5.55	0.00	-0.04	0.01	-5.32	0.00
N=1750	β_1	-0.34	0.01	-31.17	0.00	-0.55	0.02	-31.93	0.00
df=4	β_2	-0.15	0.01	-19.51	0.00	-0.48	0.01	-37.37	0.00
			R^2=0.42	SSE=0.01			R^2=0.48	SSE=0.02	
			LL=5350.26	BIC=-10297.29	AIC=-10592.53		LL=5026.25	BIC=-9649.26	AIC=-9944.50
48-States	α	-0.01	0.00	-17.59	0.00	-0.02	0.00	-21.42	0.00
1970-2004	ρ_0	-0.03	0.01	-4.44	0.00	-0.03	0.01	-3.59	0.00
-AK,-HI	β_1	-0.33	0.01	-27.21	0.00	-0.41	0.02	-21.57	0.00
N=1680	β_2	-0.12	0.01	-15.75	0.00	-0.40	0.01	-29.54	0.00
			R^2=0.39	SSE=0.01			R^2=0.44	SSE=0.02	
			LL=5250.33	BIC=-10114.47	AIC=-10396.65		LL=4919.19	BIC=-9452.20	AIC=-9734.38
47-States	α	-0.01	0.00	-12.68	0.00	-0.01	0.00	-17.76	0.00
1970-1991	ρ_0	-0.05	0.01	-7.09	0.00	-0.04	0.01	-5.11	0.00
-AK,HI -WY	β_1	-0.31	0.01	-22.30	0.00	-0.38	0.02	-19.28	0.00
N=1034	β_2	-0.11	0.01	-11.51	0.00	-0.38	0.01	-26.24	0.00
			R^2=0.40	SSE=0.01			R^2=0.45	SSE=0.01	
			LL=3266.06	BIC=-6178.13	AIC=-6430.13		LL=3087.55	BIC=-5821.11	AIC=-6073.11

TABLE 3.16. OLS Estimation of Full Data Set with PCSE in Paranthesis

$$y_{it} = \alpha + \rho_0 \text{Debt}_{it} + \beta_1 \text{GVAR}_{it} + \beta_2 \text{YVAR}_{it} + \varepsilon_{it}$$

	y_{it}:	surgf.w.aid				surgf			
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
50-States 1970-2004 N=1750	α	-0.01	0.00(0.01)	-4.62(-2.01)	0.00(0.04)	-0.02	0.00(0.00)	-12.23(-6.01)	0.00(0.00)
	ρ_0	-0.02	0.02(0.04)	-1.01(-0.46)	0.31(0.64)	0.04	0.02(0.04)	2.40(1.07)	0.02(0.28)
	β_1	-0.31	0.03(0.07)	-12.02(-4.14)	0.00(0.00)	-0.56	0.03(0.08)	-18.65(-7.22)	0.00(0.00)
	β_2	-0.14	0.02(0.04)	-7.36(-3.17)	0.00(0.00)	-0.56	0.03(0.05)	-22.18(-11.04)	0.00(0.00)
		R^2=0.16	J-B=4.05e7	AIC=-7033.90		R^2=0.33	J-B=2.46e7	AIC=-7151.03	
		$\overline{R}^2$=0.15	L-B=757.09	BIC=-7012.03		$\overline{R}^2$=0.33	L-B=404.27	BIC=-7129.16	
		SSE=0.03	LL=3520.95			SSE=0.03	LL=3579.51		
		DW=1.51	F=107.24			DW=1.51	F=289.89		
48-States 1970-2004 -AK,-HI N=1680	α	-0.01	0.00(0.00)	-7.61(-4.80)	0.00(0.00)	-0.02	0.00(0.00)	-18.15(-9.85)	0.00(0.00)
	ρ_0	-0.05	0.01(0.01)	-5.66(-5.30)	0.00(0.00)	-0.01	0.01(0.01)	-1.15(-0.89)	0.25(0.37)
	β_1	-0.29	0.02(0.02)	-16.38(-11.84)	0.00(0.00)	-0.50	0.02(0.04)	-21.38(-13.93)	0.00(0.00)
	β_2	-0.09	0.01(0.01)	-8.28(-6.30)	0.00(0.00)	-0.49	0.02(0.02)	-29.74(-21.66)	0.00(0.00)
		R^2=0.25	J-B=2523.42	AIC=-9375.53		R^2=0.49	J-B=817.77	AIC=-9189.65	
		$\overline{R}^2$=0.25	L-B=6930.37	BIC=-9353.82		$\overline{R}^2$=0.48	L-B=4918.79	BIC=-9167.94	
		SSE=0.03	LL=4691.76			SSE=0.03	LL=4598.82		
		DW=0.40	F=189.72			DW=0.30	F=527.61		

TABLE 3.17. OLS Estimation of Full Data Set with PCSE in Paranthesis (continued)

$$y_{it} = \alpha + \rho_0 \text{Debt}_{it} + \beta_1 \text{GVAR}_{it} + \beta_2 \text{YVAR}_{it} + \varepsilon_{it}$$

	y_{it}:	surgf.w.aid				surgf			
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
47-States 1970-1991 -AK,HI -WY N=1034	α	-0.01	0.00(0.00)	-7.70(-5.76)	0.00(0.00)	-0.02	0.00(0.00)	-15.02(-8.49)	0.00(0.00)
	ρ_0	-0.04	0.01(0.01)	-3.53(-3.37)	0.00(0.00)	-0.01	0.01(0.01)	-0.76(-0.61)	0.44(0.55)
	β_1	-0.34	0.02(0.03)	-16.22(-12.00)	0.00(0.00)	-0.53	0.03(0.05)	-18.61(-11.46)	0.00(0.00)
	β_2	-0.12	0.01(0.02)	-8.95(-6.42)	0.00(0.00)	-0.49	0.02(0.03)	-24.17(-15.73)	0.00(0.00)
		R^2=0.32	J-B=622.08	AIC=-5843.45		R^2=0.48	J-B=964.87	AIC=-5587.23	
		$\overline{R}^2$=0.32	L-B=3101.39	BIC=-5823.69		$\overline{R}^2$=0.48	L-B=2939.02	BIC=-5567.47	
		SSE=0.01	LL=2925.73			SSE=0.02	LL=2797.62		
		DW=0.42	F=161.61			DW=0.32	F=321.46		

TABLE 3.18. Fixed-effect GLS Estimation of Decade Sub-Periods

Sub−Period Decade	$y_{it} = \alpha_i\,(+\upsilon_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$								
	y_{it} :	*surgf.w.aid*				*surgf*			
		Value	*SE*	$T-Stat$	*P*	*Value*	*SE*	$T-Stat$	*P*
	ρ_0	0.01	0.01	0.59	0.55	-0.03	0.02	-1.46	0.14
	β_1	-0.51	0.02	-24.82	0.00	-0.46	0.03	-16.58	0.00
	β_2	-0.22	0.01	-16.41	0.00	-0.43	0.02	-19.01	0.00
	$df = 51$		R^2=0.51	SSE=0.01			R^2=0.49	SSE=0.01	
1970*s*			LL=1751.29	BIC=-2891.37	AIC=-3304.57		LL=1667.16	BIC=-2723.11	AIC=-3136.31
$N = 480$	*Time*	0.00	0.00	4.37	0.00	0.00	0.00	23.22	0.00
	ρ_0	0.01	0.01	0.91	0.36	-0.06	0.02	-3.64	0.00
	β_1	-0.57	0.02	-23.62	0.00	-0.72	0.02	-29.82	0.00
	β_2	-0.25	0.01	-16.54	0.00	-0.53	0.02	-30.63	0.00
	$df = 52$		R^2=0.52	SSE=0.00			R^2=0.69	SSE=0.01	
			LL=1756.66	BIC=-2895.93	AIC=-3313.31		LL=1781.35	BIC=-2945.31	AIC=-3362.69
		Value	*SE*	$T-Stat$	*P*	*Value*	*SE*	$T-Stat$	*P*
	ρ_0	0.05	0.02	2.74	0.01	-0.01	0.01	-0.78	0.43
	β_1	-0.35	0.04	-8.41	0.00	-0.26	0.04	-6.02	0.00
	β_2	-0.16	0.03	-6.20	0.00	-0.34	0.03	-12.11	0.00
			R^2=0.14	SSE=0.01			R^2=0.42	SSE=0.01	
1980*s*	$df = 51$		LL=1902.06	BIC=-3192.91	AIC=-3606.12		LL=1931.92	BIC=-3252.64	AIC=-3665.85
$N = 480$	*Time*	0.00	0.00	0.33	0.74	0.00	0.00	12.83	0.00
	ρ_0	0.05	0.02	2.69	0.01	-0.03	0.01	-2.55	0.01
	β_1	-0.35	0.04	-8.37	0.00	-0.46	0.04	-10.52	0.00
	β_2	-0.16	0.03	-6.03	0.00	-0.40	0.03	-14.79	0.00
	$df = 52$		R^2=0.14	SSE=0.01			R^2=0.51	SSE=0.00	
			LL=1902.10	BIC=-3186.82	AIC=-3604.20		LL=1971.11	BIC=-3324.83	AIC=-3742.21

TABLE 3.19. Fixed-effect GLS Estimation of Decade Sub-Periods (continued)

Sub−Period Decade	$y_{it} = \alpha_i\,(+\upsilon_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$								
	y_{it} :	*surgf.w.aid*				*surgf*			
		Value	*SE*	$T-Stat$	*P*	*Value*	*SE*	$T-Stat$	*P*
	ρ_0	0.06	0.02	2.68	0.01	-0.03	0.01	-1.86	0.06
	β_1	-0.41	0.04	-10.50	0.00	-0.59	0.04	-16.12	0.00
	β_2	-0.20	0.02	-8.58	0.00	-0.45	0.02	-19.63	0.00
			R^2=0.21	SSE=0.00			R^2=0.35	SSE=0.00	
1990*s*			LL=1972.78	BIC=-3334.36	AIC=-3747.56		LL=2042.32	BIC=-3473.44	AIC=-3886.64
$N = 480$	*Time*	0.00	0.00	5.96	0.00	0.00	0.00	-9.93	0.00
	ρ_0	0.07	0.02	3.08	0.00	-0.07	0.01	-5.37	0.00
	β_1	-0.42	0.04	-11.18	0.00	-0.66	0.04	-18.60	0.00
	β_2	-0.21	0.02	-9.28	0.00	-0.47	0.02	-21.61	0.00
			R^2=0.26	SSE=0.00			R^2=0.42	SSE=0.00	
			LL=1987.69	BIC=-3358.00	AIC=-3775.38		LL=2070.29	BIC=-3523.21	AIC=-3940.59
		Value	*SE*	$T-Stat$	*P*	*Value*	*SE*	$T-Stat$	*P*
	ρ_0	-0.02	0.02	-0.78	0.44	-0.02	0.02	-0.90	0.37
	β_1	-0.88	0.04	-20.81	0.00	-0.65	0.04	-14.92	0.00
	β_2	-0.20	0.02	-8.53	0.00	-0.08	0.02	-3.73	0.00
			R^2=0.57	SSE=0.00			R^2=0.32	SSE=0.00	
2000			LL=1018.27	BIC=-1493.95	AIC=-1838.54		LL=1014.20	BIC=-1485.81	AIC=-1830.39
$N = 240$	*Time*	0.00	0.00	-6.96	0.00	0.00	0.00	-22.42	0.00
	ρ_0	0.01	0.03	0.28	0.78	-0.08	0.03	-3.00	0.00
	β_1	-0.79	0.04	-18.51	0.00	-0.95	0.05	-20.98	0.00
	β_2	-0.26	0.03	-8.85	0.00	-0.63	0.04	-15.54	0.00
			R^2=0.61	SSE=0.00			R^2=0.57	SSE=0.00	
			LL=1031.91	BIC=-1515.76	AIC=-1863.82		LL=1069.37	BIC=-1590.67	AIC=-1938.73

TABLE 3.20. 2-Stage Feaseible GLS Estimation of Decade Sub-Periods

Sub−Period *Decade*	$y_{it} = \alpha + \rho_0 + Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$								
	y_{it} :	*surgf.w.aid*				*surgf*			
		Value	*SE*	$T-Stat$	*P*	*Value*	*SE*	$T-Stat$	*P*
	α	-0.01	0.00	-13.90	0.00	-0.03	0.00	-23.14	0.00
1970*s*	ρ_0	-0.01	0.01	-0.89	0.37	-0.04	0.01	-3.76	0.00
$N = 480$	β_1	-0.37	0.02	-24.08	0.00	-0.47	0.02	-19.10	0.00
	β_2	-0.16	0.01	-14.67	0.00	-0.39	0.02	-22.06	0.00
			R^2=0.48	SSE=0.01			R^2=0.42	SSE=0.02	
			LL=1483.39	BIC=-2645.75	AIC=-2862.79		LL=1378.21	BIC=-2435.39	AIC=-2652.43
	α	-0.01	0.00	-3.99	0.00	-0.01	0.00	-8.35	0.00
1980*s*	ρ_0	-0.08	0.01	-8.34	0.00	-0.09	0.01	-12.80	0.00
$N = 480$	β_1	-0.20	0.02	-9.25	0.00	-0.31	0.03	-12.30	0.00
	β_2	-0.05	0.01	-3.88	0.00	-0.33	0.02	-20.03	0.00
			R^2=0.26	SSE=0.01			R^2=0.52	SSE=0.01	
			LL=1668.57	BIC=-3016.10	AIC=-3233.14		LL=1660.30	BIC=-2999.57	AIC=-3216.61
	α	-0.01	0.00	-7.61	0.00	-0.01	0.00	-8.51	0.00
1990*s*	ρ_0	-0.01	0.01	-1.10	0.27	-0.06	0.01	-5.36	0.00
$N = 480$	β_1	-0.25	0.02	-12.58	0.00	-0.27	0.03	-10.25	0.00
	β_2	-0.10	0.01	-8.28	0.00	-0.36	0.02	-20.56	0.00
			R^2=0.28	SSE=0.01			R^2=0.45	SSE=0.01	
			LL=1704.28	BIC=-3087.53	AIC=-3304.56		LL=1641.82	BIC=-2962.61	AIC=-3179.65
	α	-0.02	0.00	-12.29	0.00	-0.02	0.00	-12.53	0.00
2000*s*	ρ_0	0.00	0.02	0.07	0.95	-0.04	0.02	-2.25	0.03
$N = 240$	β_1	-0.37	0.02	-15.62	0.00	-0.42	0.04	-10.65	0.00
	β_2	-0.14	0.01	-9.71	0.00	-0.42	0.02	-18.00	0.00
			R^2=0.41	SSE=0.00			R^2=0.37	SSE=0.01	
			LL=837.69	BIC=-1390.40	AIC=-1571.39		LL=767.59	BIC=-1250.19	AIC=-1431.18

TABLE 3.21. OLS (PCSE) Estimation of Decade Sub-Periods

Sub−Period *Decade*	$y_{it}=\alpha+\rho_0+Debt_{it}+\beta_1 GVAR_{it}+\beta_2 YVAR_{it}+\varepsilon_{it}$								
	y_{it} :		*surgf.w.aid*				*surgf*		
1970*s*		*Value*	*SE*	$T-Stat$	*P*	*Value*	*SE*	$T-Stat$	*P*
$N=480$	α	-0.01	0.00(0.00)	-3.75(−5.76)	0.00(0.00)	-0.03	0.00(0.00)	-14.76(−9.98)	0.00(0.00)
	ρ_0	-0.03	0.02(0.01)	-2.00(−3.37)	0.05(0.00)	0.06	0.02(0.01)	3.39(4.54)	0.00(0.00)
	β_1	-0.35	0.03(0.03)	-11.29(−12.00)	0.00(0.00)	-0.77	0.04(0.06)	-17.60(−13.39)	0.00(0.00)
	β_2	-0.11	0.02(0.02)	-5.72(−6.42)	0.00(0.00)	-0.66	0.03(0.04)	-20.93(−18.40)	0.00(0.00)
			R^2=0.28	J-B=185.02	AIC=-2461.77	R^2=0.53	J-B=84.94	AIC=-2404.10	
			$\overline{R}^2$=0.28	L-B=1205.51	BIC=-2445.07	$\overline{R}^2$=0.53	L-B=691.52	BIC=-2387.40	
			SSE=0.01	LL=1234.88		SSE=0.02	LL=1206.05		
			DW=0.39	F=63.17		DW=0.44	F=177.75		
1980*s*		*Value*	*SE*	$T-Stat$	*P*	*Value*	*SE*	$T-Stat$	*P*
$N=480$	α	0.01	0.00(0.00)	2.38(2.03)	0.02(0.04)	-0.01	0.00(0.00)	-4.47(−5.07)	0.00(0.00)
	ρ_0	-0.10	0.02(0.01)	-5.93(−6.59)	0.00(0.00)	-0.09	0.01(0.01)	-6.45(−7.87)	0.00(0.00)
	β_1	-0.05	0.04(0.05)	-1.34(−0.92)	0.18(0.36)	-0.25	0.04(0.04)	-6.73(−6.08)	0.00(0.00)
	β_2	0.04	0.02(0.04)	1.60(0.98)	0.11(0.33)	-0.29	0.02(0.03)	-11.68(−10.04)	0.00(0.00)
			R^2=0.17	J-B=2034.75	AIC=-2832.74	R^2=0.17	J-B=52.11	AIC=-2952.42	
			$\overline{R}^2$=0.16	L-B=887.14	BIC=-2816.05	$\overline{R}^2$=0.49	L-B=800.30	BIC=-2935.72	
			SSE=0.01	LL=1420.37		SSE=0.01	LL=1480.21		
			DW=0.48	F=32.45		DW=0.43	F=153.65		

TABLE 3.22. OLS (PCSE) Estimation of Decade Sub-Periods Continued

Sub−Period *Decade*	$y_{it} = \alpha + \rho_0 + Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$								
	y_{it} :	*surgf.w.aid*				*surgf*			
		Value	*SE*	$T - Stat$	*P*	*Value*	*SE*	$T - Stat$	*P*
1990*s*	α	0.00	0.00(0.00)	-1.65(−1.22)	0.10(0.22)	-0.01	0.00(0.00)	-4.77(−3.59)	0.00(0.00)
$N = 480$	ρ_0	-0.11	0.01(0.02)	-7.68(−5.85)	0.00(0.00)	-0.07	0.02(0.02)	-4.92(−4.61)	0.00(0.00)
	β_1	-0.24	0.03(0.04)	-7.16(−5.88)	0.00(0.00)	-0.29	0.04(0.05)	-6.47(−6.28)	0.00(0.00)
	β_2	-0.09	0.02(0.02)	-4.87(−4.09)	0.00(0.00)	-0.38	0.03(0.03)	-13.34(−14.80)	0.00(0.00)
			R^2=0.37	J-B=143.72	AIC=-2973.61	R^2=0.61	J-B=14.49	AIC=-2875.51	
			$\overline{R}^2$=0.36	L-B=843.54	BIC=-2956.92	$\overline{R}^2$=0.61	L-B=742.58	BIC=-2858.81	
			SSE=0.01	LL=1490.81		SSE=0.01	LL=1441.75		
			DW=0.57	F=91.48		DW=0.40	F=250.26		
		Value	*SE*	$T - Stat$	*P*	*Value*	*SE*	$T - Stat$	*P*
2000*s*	α	-0.02	0.00(0.00)	-6.90(−10.04)	0.00(0.00)	-0.03	0.00(0.00)	-8.77(−13.19)	0.00(0.00)
$N = 236$	ρ_0	0.03	0.02(0.02)	1.02(1.33)	0.31(0.18)	0.01	0.03(0.01)	0.23(0.47)	0.82(0.64)
	β_1	-0.31	0.04(0.03)	-7.68(−10.02)	0.00(0.00)	-0.44	0.06(0.04)	-7.29(−10.53)	0.00(0.00)
	β_2	-0.10	0.03(0.02)	-3.90(−5.17)	0.00(0.00)	-0.45	0.04(0.04)	-10.42(−11.49)	0.00(0.00)
			R^2=0.32	J-B=113.72	AIC=-1471.11	R^2=0.32	J-B=9.92	AIC=-1381.57	
			$\overline{R}^2$=0.31	L-B=170.16	BIC=-1457.19	$\overline{R}^2$=0.43	L-B=303.66	BIC=-1367.65	
			SSE=0.01	LL=739.56		SSE=0.01	LL=694.79		
			DW=0.84	F=36.85		DW=0.71	F=61.47		

TABLE 3.23. Fixed-Effect GLS Weighted, Testing for 1978 and 1996 Breaks

$$y_{it} = \alpha_i\,(+\upsilon_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

	y_{it} :			*surgf.w.aid*				*surgf*	
		Value	*SE*	$T-Stat$	*P*	*Value*	*SE*	$T-Stat$	*P*
1970–76 N=336	ρ_0	0.03	0.02	1.29	0.20	-0.06	0.02	-3.19	0.00
	β_1	-0.50	0.02	-22.48	0.00	-0.47	0.02	-18.87	0.00
	β_2	-0.21	0.01	-15.79	0.00	-0.44	0.02	-24.66	0.00
	$df = 51$		R^2=0.52	SSE=0.01			R^2=0.53	SSE=0.01	
			LL=1236.56	BIC=-1897.22	AIC=-2275.11		LL=1226.27	BIC=-1876.65	AIC=-2254.55
	Time	0.00	0.00	2.66	0.01	0.00	0.00	11.00	0.00
	ρ_0	0.05	0.02	2.15	0.03	-0.09	0.02	-3.99	0.00
	β_1	-0.58	0.04	-15.61	0.00	-0.78	0.04	-20.35	0.00
	β_2	-0.26	0.02	-12.18	0.00	-0.56	0.03	-22.03	0.00
	$df = 52$		R^2=0.53	SSE=0.01			R^2=0.62	SSE=0.01	
			LL=1238.84	BIC=-1895.96	AIC=-2277.67		LL=1259.12	BIC=-1936.53	AIC=-2318.24
1980–94 N=720	ρ_0	0.01	0.01	0.50	0.62	-0.03	0.01	-2.87	0.00
	β_1	-0.45	0.03	-15.05	0.00	-0.33	0.04	-8.93	0.00
	β_2	-0.23	0.02	-12.24	0.00	-0.33	0.02	-14.10	0.00
	$df = 51$		R^2=0.23	SSE=0.01			R^2=0.38	SSE=0.01	
			LL=2734.60	BIC=-4817.85	AIC=-5271.20		LL=2758.19	BIC=-4865.04	AIC=-5318.39
	Time	0.00	0.00	-4.97	0.00	0.00	0.00	2.80	0.01
	ρ_0	0.01	0.01	0.95	0.34	-0.02	0.01	-2.66	0.01
	β_1	-0.39	0.03	-12.29	0.00	-0.38	0.04	-9.40	0.00
	β_2	-0.21	0.02	-10.91	0.00	-0.34	0.02	-14.45	0.00
	$df = 52$		R^2=0.25	SSE=0.01			R^2=0.39	SSE=0.01	
			LL=2743.72	BIC=-4829.51	AIC=-5287.44		LL=2760.45	BIC=-4862.97	AIC=-5320.90

TABLE 3.24. Fixed-Effect GLS Weighted, Testing for 1978 and 1996 Breaks (continued)

$$y_{it} = \alpha_i\,(+\upsilon_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

	y_{it} :			*surgf.w.aid*				*surgf*	
		Value	*SE*	$T-Stat$	*P*	*Value*	*SE*	$T-Stat$	*P*
1998–04 *N*=336	ρ_0	-0.02	0.02	-1.08	0.28	-0.14	0.03	-5.42	0.00
	β_1	-0.78	0.05	-16.78	0.00	-0.45	0.05	-8.36	0.00
	β_2	-0.27	0.03	-9.63	0.00	-0.04	0.03	-1.56	0.12
	$df = 51$		R^2=0.39	SSE=0.00			R^2=0.10	SSE=0.01	
			LL=1328.70	BIC=-2081.50	AIC=-2459.40		LL=1273.66	BIC=-1971.43	AIC=-2349.32
	Time	0.00	0.00	-16.81	0.00	0.00	0.00	-31.71	0.00
	ρ_0	0.07	0.02	3.04	0.00	0.00	0.02	-0.03	0.97
	β_1	-0.75	0.04	-18.75	0.00	-0.83	0.05	-17.70	0.00
	β_2	-0.39	0.02	-16.12	0.00	-0.61	0.03	-21.10	0.00
	$df = 52$		R^2=0.56	SSE=0.00			R^2=0.63	SSE=0.00	
			LL=1385.99	BIC=-2190.26	AIC=-2571.97		LL=1422.10	BIC=-2262.49	AIC=-2644.20

TABLE 3.25. 2-Stage Feasible GLS, Testing for 1978 and 1996 Breaks

$$y_{it} = \alpha_i + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

	y_{it} :		*surgf.w.aid*				*surgf*		
1970 – 76 N=336		*Value*	*SE*	*T – Stat*	*P*	*Value*	*SE*	*T – Stat*	*P*
	α	-0.01	0.00	-14.78	0.00	-0.03	0.00	-29.69	0.00
	ρ_0	0.00	0.01	0.54	0.59	0.01	0.01	0.58	0.56
	β_1	-0.39	0.02	-24.88	0.00	-0.56	0.02	-25.60	0.00
	β_2	-0.17	0.01	-16.57	0.00	-0.47	0.02	-29.69	0.00
			R^2=0.51	SSE=0.01			R^2=0.47	SSE=0.02	
			LL=1023.83	BIC=-1745.17	AIC=-1943.66	N=336	LL=972.65	BIC=-1642.81	AIC=-1841.30
1980 – 94 N=720		*Value*	*SE*	*T – Stat*	*P*	*Value*	*SE*	*T – Stat*	*P*
	α	-0.01	0.00	-6.67	0.00	-0.01	0.00	-9.94	0.00
	ρ_0	-0.06	0.01	-6.60	0.00	-0.08	0.01	-9.83	0.00
	β_1	-0.25	0.02	-12.78	0.00	-0.27	0.03	-10.61	0.00
	β_2	-0.10	0.01	-7.71	0.00	-0.30	0.02	-17.89	0.00
			R^2=0.28	SSE=0.01			R^2=0.49	SSE=0.01	
			LL=2450.74	BIC=-4559.36	AIC=-4797.49	N=720	LL=2416.19	BIC=-4490.25	AIC=-4728.37
1998 – 04 N=336		*Value*	*SE*	*T – Stat*	*P*	*Value*	*SE*	*T – Stat*	*P*
	α	-0.02	0.00	-13.29	0.00	-0.02	0.00	-9.13	0.00
	ρ_0	0.02	0.02	1.04	0.30	-0.10	0.02	-6.19	0.00
	β_1	-0.38	0.02	-16.82	0.00	-0.31	0.04	-7.64	0.00
	β_2	-0.15	0.01	-10.38	0.00	-0.34	0.03	-12.76	0.00
			R^2=0.41	SSE=0.01			R^2=0.38	SSE=0.02	
			LL=1162.50	BIC=-2022.52	AIC=-2221.01	N=336	LL=1049.85	BIC=-1797.22	AIC=-1995.71

TABLE 3.26. OLS (PCSE), Testing for 1978 and 1996 Breaks

$$y_{it} = \alpha_i + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

	y_{it} :		*surgf.w.aid*				*surgf*		
		Value	*SE*	$T-Stat$	*P*	*Value*	*SE*	$T-Stat$	*P*
1970-76 N=336	α	-0.01	0.00(0.00)	-4.20(−6.12)	0.00(0.00)	-0.04	0.00(0.00)	-13.56(−10.35)	0.00(0.00)
	ρ_0	-0.02	0.02(0.01)	-1.14(−2.31)	0.26(0.02)	0.07	0.02(0.01)	3.13(4.73)	0.00(0.00)
	β_1	-0.37	0.03(0.03)	-10.60(−10.70)	0.00(0.00)	-0.80	0.05(0.06)	-16.05(−13.41)	0.00(0.00)
	β_2	-0.12	0.02(0.02)	-5.50(−5.63)	0.00(0.00)	-0.67	0.04(0.04)	-18.69(−19.16)	0.00(0.00)
			R^2=0.32	J-B=74.50	AIC=-1681.91	R^2=0.48	J-B=52.10	AIC=-1637.76	
			$\overline{R}^2$=0.31	L-B=527.17	BIC=-1666.64	$\overline{R}^2$=0.54	L-B=356.12	BIC=-1622.49	
			SSE=0.01	LL=844.95		SSE=0.02	LL=822.88		
			DW=0.52	F=52.34		DW=0.51	F=133.76		
1980-94 N=716	α	0.00	0.00(0.00)	0.57(0.40)	0.57(0.69)	-0.01	0.00(0.00)	-5.95(−5.95)	0.00(0.00)
	ρ_0	-0.11	0.01(0.01)	-8.62(−7.27)	0.00(0.00)	-0.09	0.01(0.01)	-7.54(−8.24)	0.00(0.00)
	β_1	-0.15	0.03(0.04)	-5.15(−3.34)	0.00(0.00)	-0.27	0.03(0.03)	-8.33(−8.40)	0.00(0.00)
	β_2	-0.03	0.02(0.03)	-1.84(−1.13)	0.07(0.26)	-0.32	0.02(0.02)	-14.92(−13.92)	0.00(0.00)
			R^2=0.24	J-B=2932.74	AIC=-4266.83	R^2=0.54	J-B=84.43	AIC=-4377.29	
			$\overline{R}^2$=0.24	L-B=1480.13	BIC=-4248.52	$\overline{R}^2$=0.54	L-B=1277.09	BIC=-4358.98	
			SSE=0.01	LL=2137.42		SSE=0.02	LL=2192.65		
			DW=0.49	F=75.44		DW=0.40	F=279.21		
1998-04 N=332	α	-0.02	0.00(0.00)	-6.68(−7.64)	0.00(0.00)	-0.02	0.00(0.00)	-8.20(−6.80)	0.00(0.00)
	ρ_0	0.01	0.02(0.02)	0.59(0.71)	0.56(0.48)	-0.02	0.02(0.02)	-0.68(−1.00)	0.49(0.32)
	β_1	-0.30	0.04(0.03)	-8.56(−11.34)	0.00(0.00)	-0.40	0.05(0.04)	-7.51(−9.60)	0.00(0.00)
	β_2	-0.10	0.02(0.02)	-4.76(−5.84)	0.00(0.00)	-0.43	0.04(0.04)	-11.81(−12.13)	0.00(0.00)
			R^2=0.28	J-B=137.50	AIC=-2066.69	R^2=0.46	J-B=5.27	AIC=-1936.07	
			$\overline{R}^2$=0.28	L-B=309.77	BIC=-2051.42	$\overline{R}^2$=0.46	L-B=456.23	BIC=-1920.80	
			SSE=0.01	LL=1037.35		SSE=0.02	LL=972.03		
			DW=0.75	F=43.44		DW=0.59	F=95.30		

TABLE 3.27. 2-Stage Feasible GLS with PCSE and an Error Correction Matrix

$surgf_{it} = \alpha_i + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$					
		$Value$	SE	$T-Stat$	P
1970–76 N=336	α	-0.03	0.00(0.00)	-8.03(−7.39)	0.00(0.00)
	ρ_0	-0.03	0.03(0.04)	-1.08(−0.68)	0.28(0.27)
	β_1	-0.72	0.04(0.07)	-17.25(−10.08)	0.00(0.00)
	β_2	-0.60	0.03(0.05)	-18.46(−11.70)	0.00(0.00)
		R^2=0.58	SSE=0.02		
		LL=966.23	BIC=-1897.56	AIC=-1920.46	

TABLE 3.28. List of States Grouped According to 1974 Historical Debt Levels

1974 *Grouped States*		
High – Debt	*Medium – Debt*	*Low – Debt*
CONNECTICUT	*ALABAMA*	*ARKANSAS*
DELAWARE	*CALIFORNIA*	*COLORADO*
KENTUCKY	*FLORIDA*	*INDIANA*
LOUISIANA	*GEORGIA*	*IOWA*
MAINE	*ILLINOIS*	*KANSAS*
MARYLAND	*MICHIGAN*	*MISSOURI*
MASSACHUSETTS	*MINNESOTA*	*NEBRASKA*
MISSISSIPPI	*NEWHAMPSHIRE*	*NEVADA*
NEWJERSEY	*OHIO*	*NEWMEXICO*
NEWYORK	*OREGON*	*NORTHCAROLINA*
OKLAHOMA	*SOUTHCAROLINA*	*NORTHDAKOTA*
PENNSYLVANIA	*TENNESSEE*	*SOUTHDAKOTA*
RHODEISLAND	*WASHINGTON*	*TEXAS*
VERMONT	*WISCONSIN*	*UTAH*
WESTVIRGINIA	*WYOMING*	*VIRGINIA*

TABLE 3.29. Fixed-Effect GLS Weighted, States Placed into 3-Groups by Historical Debt Levels in 1974

15 *States in Group*
N=525 per Group
−AZ,−ID,MT
−AK,−HI

$$y_{it} = \alpha_i\,(+v_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

	y_{it} :	*surgf.w.aid*				*surgf*			
		Value	*SE*	*T − Stat*	*P*	*Value*	*SE*	*T − Stat*	*P*
	ρ_0	0.08	0.01	5.40	0.00	-0.02	0.02	-1.26	0.21
	β_1	-0.48	0.03	-16.58	0.00	-0.57	0.04	-15.34	0.00
	β_2	-0.23	0.02	-13.57	0.00	-0.48	0.02	-19.96	0.00
			R^2=0.33	SSE=0.01			R^2=0.50	SSE=0.01	
High − Debt			LL=1666.95	BIC=-3127.21	AIC=-3267.90		LL=1616.92	BIC=-3027.16	AIC=-3167.85
	Time	0.00	0.00	-3.28	0.00	0.00	0.00	1.03	0.30
	ρ_0	0.05	0.02	3.24	0.00	-0.01	0.02	-0.78	0.43
	β_1	-0.44	0.03	-14.17	0.00	-0.57	0.04	-14.79	0.00
	β_2	-0.21	0.02	-11.24	0.00	-0.48	0.02	-19.41	0.00
			R^2=0.35	SSE=0.01			R^2=0.50	SSE=0.01	
			LL=1671.38	BIC=-3129.80	AIC=-3274.75		LL=1617.34	BIC=-3021.73	AIC=-3166.68
		Value	*SE*	*T − Stat*	*P*	*Value*	*SE*	*T − Stat*	*P*
	ρ_0	-0.03	0.02	-1.92	0.06	-0.02	0.02	-1.18	0.24
	β_1	-0.48	0.03	-16.55	0.00	-0.56	0.04	-14.62	0.00
	β_2	-0.19	0.02	-10.55	0.00	-0.44	0.03	-15.91	0.00
			R^2=0.44	SSE=0.01			R^2=0.36	SSE=0.01	
Med − Debt			LL=1770.99	BIC=-3335.29	AIC=-3475.98		LL=1714.46	BIC=-3222.24	AIC=-3362.93
	Time	0.00	0.00	-3.36	0.00	0.00	0.00	-2.82	0.00
	ρ_0	-0.04	0.02	-2.44	0.01	-0.02	0.02	-1.22	0.22
	β_1	-0.46	0.03	-15.28	0.00	-0.51	0.04	-13.08	0.00
	β_2	-0.18	0.02	-9.78	0.00	-0.42	0.03	-15.17	0.00
			R^2=0.45	SSE=0.01			R^2=0.37	SSE=0.01	
			LL=1775.81	BIC=-3338.67	AIC=-3483.62		LL=1716.68	BIC=-3220.41	AIC=-3365.37

TABLE 3.30. Fixed-Effect GLS Weighted, States Placed into 3-Groups by Historical Debt Levels in 1974 (continued)

15 States in Group N=525 per Group −AZ,−ID,MT −AK,−HI	$y_{it} = \alpha_i (+v_t) + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$								
	y_{it} :	*surgf.w.aid*				*surgf*			
		Value	*SE*	*T − Stat*	*P*	*Value*	*SE*	*T − Stat*	*P*
	ρ_0	-0.14	0.02	-8.48	0.00	0.05	0.02	2.87	0.00
	β_1	-0.38	0.03	-13.80	0.00	-0.25	0.04	-7.01	0.00
	β_2	-0.15	0.02	-8.72	0.00	-0.29	0.02	-12.34	0.00
			R^2=0.45	SSE=0.01			R^2=0.35	SSE=0.00	
Low − Debt			LL=1904.94	BIC=-3603.20	AIC=-3743.89		LL=1796.78	BIC=-3386.86	AIC=-3527.56
	Time	0.00	0.00	-6.53	0.00	0.00	0.00	3.36	0.00
	ρ_0	-0.09	0.02	-4.77	0.00	0.02	0.02	1.41	0.16
	β_1	-0.34	0.03	-12.51	0.00	-0.29	0.04	-7.91	0.00
	β_2	-0.13	0.02	-8.20	0.00	-0.31	0.02	-13.04	0.00
			R^2=0.48	SSE=0.01			R^2=0.36	SSE=0.00	
			LL=1920.67	BIC=-3628.38	AIC=-3773.33		LL=1800.32	BIC=-3387.68	AIC=-3532.64

TABLE 3.31. 2-Stage Feasible GLS, States Placed into 3-Groups by Historical Debt Levels in 1974

15 *States in Group*
N=525 per Group
−AZ,−ID,MT
−AK,−HI

$$y_{it} = \alpha_i + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

	y_{it} :	*surgf.w.aid*				*surgf*			
		Value	*SE*	*T − Stat*	*P*	*Value*	*SE*	*T − Stat*	*P*
	α	-0.02	0.00	-15.18	0.00	-0.02	0.00	-12.94	0.00
High − Debt	ρ_0	0.07	0.01	6.30	0.00	0.04	0.01	2.93	0.00
	β_1	-0.48	0.02	-20.68	0.00	-0.63	0.03	-18.00	0.00
	β_2	-0.22	0.01	-15.44	0.00	-0.59	0.03	-23.27	0.00
			R^2=0.46	SSE=0.02			R^2=0.48	SSE=0.01	
			LL=1582.75	BIC=-3046.50	AIC=-3127.51		LL=1475.91	BIC=-2832.81	AIC=-2913.82
		Value	*SE*	*T − Stat*	*P*	*Value*	*SE*	*T − Stat*	*P*
	α	-0.02	0.00	-11.63	0.00	-0.02	0.00	-13.64	0.00
Med − Debt	ρ_0	-0.04	0.01	-2.97	0.00	-0.11	0.02	-5.74	0.00
	β_1	-0.38	0.02	-16.20	0.00	-0.58	0.03	-17.93	0.00
	β_2	-0.15	0.02	-10.09	0.00	-0.44	0.02	-18.41	0.00
			R^2=0.34	SSE=0.01			R^2=0.43	SSE=0.02	
			LL=1560.29	BIC=-3001.57	AIC=-3082.57	N=525	LL=1526.70	BIC=-2934.39	AIC=-3015.40
		Value	*SE*	*T − Stat*	*P*	*Value*	*SE*	*T − Stat*	*P*
	α	-0.01	0.00	-7.13	0.00	-0.01	0.00	-11.11	0.00
Low − Debt	ρ_0	-0.15	0.01	-11.32	0.00	-0.06	0.02	-2.81	0.01
	β_1	-0.25	0.02	-12.69	0.00	-0.27	0.03	-9.03	0.00
	β_2	-0.07	0.01	-5.28	0.00	-0.30	0.02	-13.88	0.00
			R^2=0.48	SSE=0.01			R^2=0.44	SSE=0.01	
			LL=1836.33	BIC=-3553.65	AIC=-3634.66	N=525	LL=1671.26	BIC=-3223.51	AIC=-3304.51

TABLE 3.32. OLS (PCSE) States Placed into 3-Groups by Historical Debt Levels in 1974

15 States in Group N=525 per Group −AZ,−ID,MT −AK,−HI	$y_{it}=\alpha_i+\rho_0 Debt_{it}+\beta_1 GVAR_{it}+\beta_2 YVAR_{it}+\varepsilon_{it}$								
		surgf.w.aid				surgf			
		Value	SE	T-Stat	P	Value	SE	T-Stat	P
$High-Debt$	α	-0.03	0.00(0.00)	-13.26(-12.77)	0.00(0.00)	-0.03	0.00(0.00)	-13.49(-10.97)	0.00(0.00)
	ρ_0	0.07	0.01(0.01)	4.62(4.85)	0.00(0.00)	0.08	0.02(0.02)	4.57(4.35)	0.00(0.00)
	β_1	-0.59	0.03(0.03)	-20.57(-20.28)	0.00(0.00)	-0.71	0.04(0.04)	-18.15(-16.49)	0.00(0.00)
	β_2	-0.28	0.02(0.02)	-15.31(-13.72)	0.00(0.00)	-0.65	0.03(0.03)	-22.68(-22.22)	0.00(0.00)
			R^2=0.50	J-B=111.56	AIC=-2997.30	R^2=0.56	J-B=25.49	AIC=-2856.24	
			$\overline{R}^2$=0.50	L-B=1131.03	BIC=-2980.25	$\overline{R}^2$=0.56	L-B=1450.18	BIC=-2839.19	
			SSE=0.01	LL=1502.65		SSE=0.02	LL=1432.12		
			DW=0.43	F=174.28		DW=0.32	F=225.49		
$Med-Debt$	α	0.00	0.00(0.00)	1.49(1.12)	0.14(0.26)	-0.02	0.00(0.00)	-8.75(-7.94)	0.00(0.00)
	ρ_0	-0.13	0.03(0.02)	-5.24(-5.75)	0.00(0.00)	-0.06	0.02(0.02)	-2.82(-2.84)	0.01(0.00)
	β_1	-0.06	0.04(0.06)	-1.50(-1.10)	0.14(0.27)	-0.47	0.05(0.04)	-9.54(-10.48)	0.00(0.00)
	β_2	0.06	0.03(0.03)	2.45(2.00)	0.01(0.05)	-0.43	0.03(0.03)	-12.60(-15.63)	0.00(0.00)
			R^2=0.50	J-B=340.80	AIC=-2733.11	R^2=0.56	J-B=46.23	AIC=-2850.25	
			$\overline{R}^2$=0.12	L-B=2494.26	BIC=-2716.06	$\overline{R}^2$=0.36	L-B=1632.63	BIC=-2833.19	
			SSE=0.01	LL=1370.55		SSE=0.02	LL=1429.12		
			DW=0.31	F=25.59		DW=0.26	F=97.71		
$Low-Debt$	α	0.00	0.00(0.00)	-0.02(0.09)	0.99(0.93)	-0.01	0.00(0.00)	-9.59(-7.92)	0.00(0.00)
	ρ_0	-0.18	0.01(0.02)	-12.08(-9.52)	0.00(0.00)	-0.13	0.02(0.03)	-7.35(-4.42)	0.00(0.00)
	β_1	-0.12	0.02(0.03)	-6.27(-3.85)	0.00(0.00)	-0.26	0.03(0.04)	-8.58(-7.17)	0.00(0.00)
	β_2	0.02	0.01(0.02)	1.38(0.97)	0.17(0.33)	-0.27	0.02(0.02)	-12.68(-10.72)	0.00(0.00)
			R^2=0.38	J-B=170.01	AIC=-3434.99	R^2=0.46	J-B=30.53	AIC=-3203.69	
			$\overline{R}^2$=0.38	L-B=534.94	BIC=-3417.94	$\overline{R}^2$=0.46	L-B=1284.39	BIC=-3186.64	
			SSE=0.01	LL=1721.50		SSE=0.02	LL=1605.85		
			DW=0.74	F=106.85		DW=0.37	F=147.35		

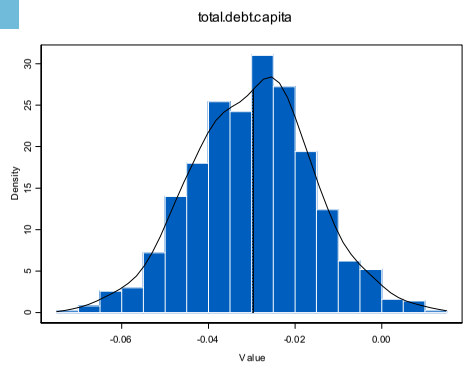
TABLE 3.33. Bootstrap Results, 50-States, 1000 Replications

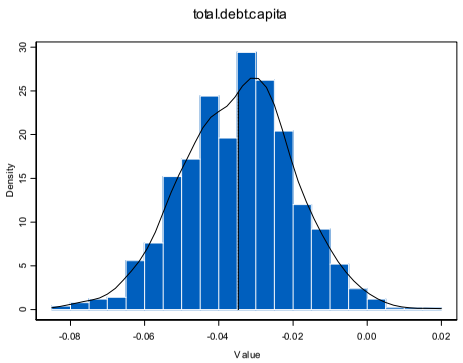
$$surgf.w.aid_{it} = \alpha_i + \rho_0 Debt_{it} + \beta_1 GVAR_{it} + \beta_2 YVAR_{it} + \varepsilon_{it}$$

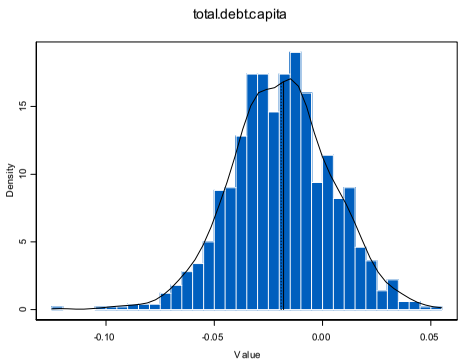
	Summary Statistics :				*Empirical Percentiles :*				*BC Percentiles*			
	Values	*Bias*	*Mean*	*SE*	2.5%	5%	95%	97.5%	2.5%	5%	95%	97.5%
					FE							
Time	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ρ_0	-0.03	0.00	-0.03	0.01	-0.06	-0.05	-0.01	0.00	-0.06	-0.05	-0.01	0.00
β_1	-0.38	0.00	-0.38	0.02	-0.42	-0.42	-0.34	-0.33	-0.42	-0.42	-0.34	-0.33
β_2	-0.17	0.00	-0.17	0.01	-0.20	-0.20	-0.15	-0.14	-0.20	-0.20	-0.15	-0.14
					$2-S$							
α	-0.02	0.00	-0.02	0.00	-0.02	-0.02	-0.01	-0.01	-0.02	-0.02	-0.01	-0.01
ρ_0	-0.03	0.00	-0.04	0.02	-0.07	-0.06	-0.01	-0.01	-0.07	-0.06	-0.01	-0.01
β_1	-0.34	0.00	-0.34	0.02	-0.39	-0.38	-0.31	-0.31	-0.39	-0.38	-0.31	-0.31
β_2	-0.15	0.00	-0.15	0.01	-0.18	-0.17	-0.12	-0.12	-0.18	-0.17	-0.12	-0.12
					OLS							
α	-0.01	0.00	-0.01	0.01	-0.02	-0.02	0.00	0.00	-0.02	-0.02	0.01	0.01
ρ_0	-0.02	0.00	-0.02	0.02	-0.06	-0.06	0.02	0.03	-0.06	-0.06	0.02	0.03
β_1	-0.31	0.00	-0.31	0.09	-0.44	-0.42	-0.13	-0.06	-0.42	-0.40	-0.01	0.03
β_2	-0.14	0.00	-0.14	0.05	-0.22	-0.21	-0.04	-0.01	-0.20	-0.20	0.02	0.05

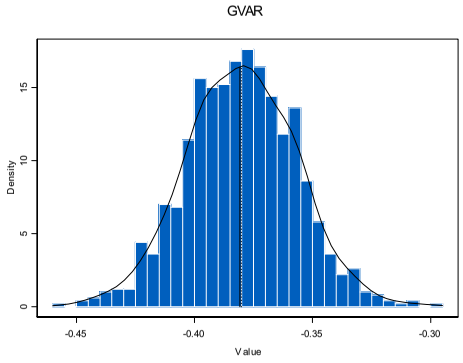
TABLE 3.34. Histogram of Bootstrapped Coefficients

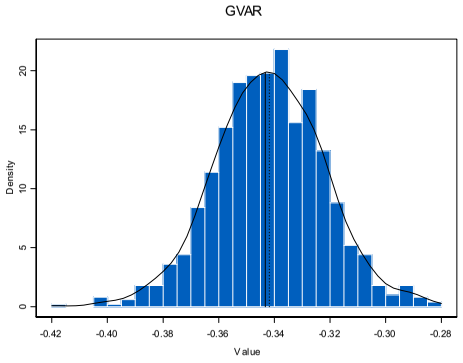
FE | $2-S$ | OLS











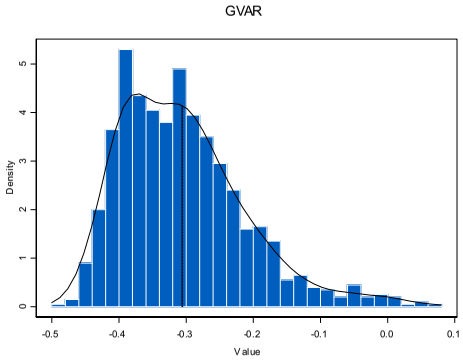
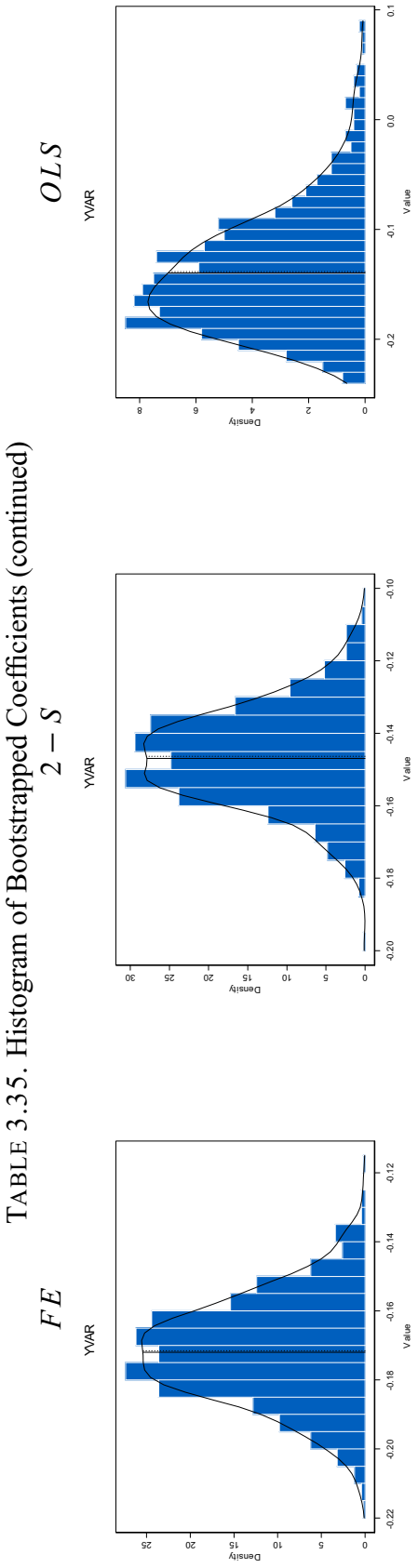


TABLE 3.35. Histogram of Bootstrapped Coefficients (continued)



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