An Analysis of UI Trust Fund Adequacy

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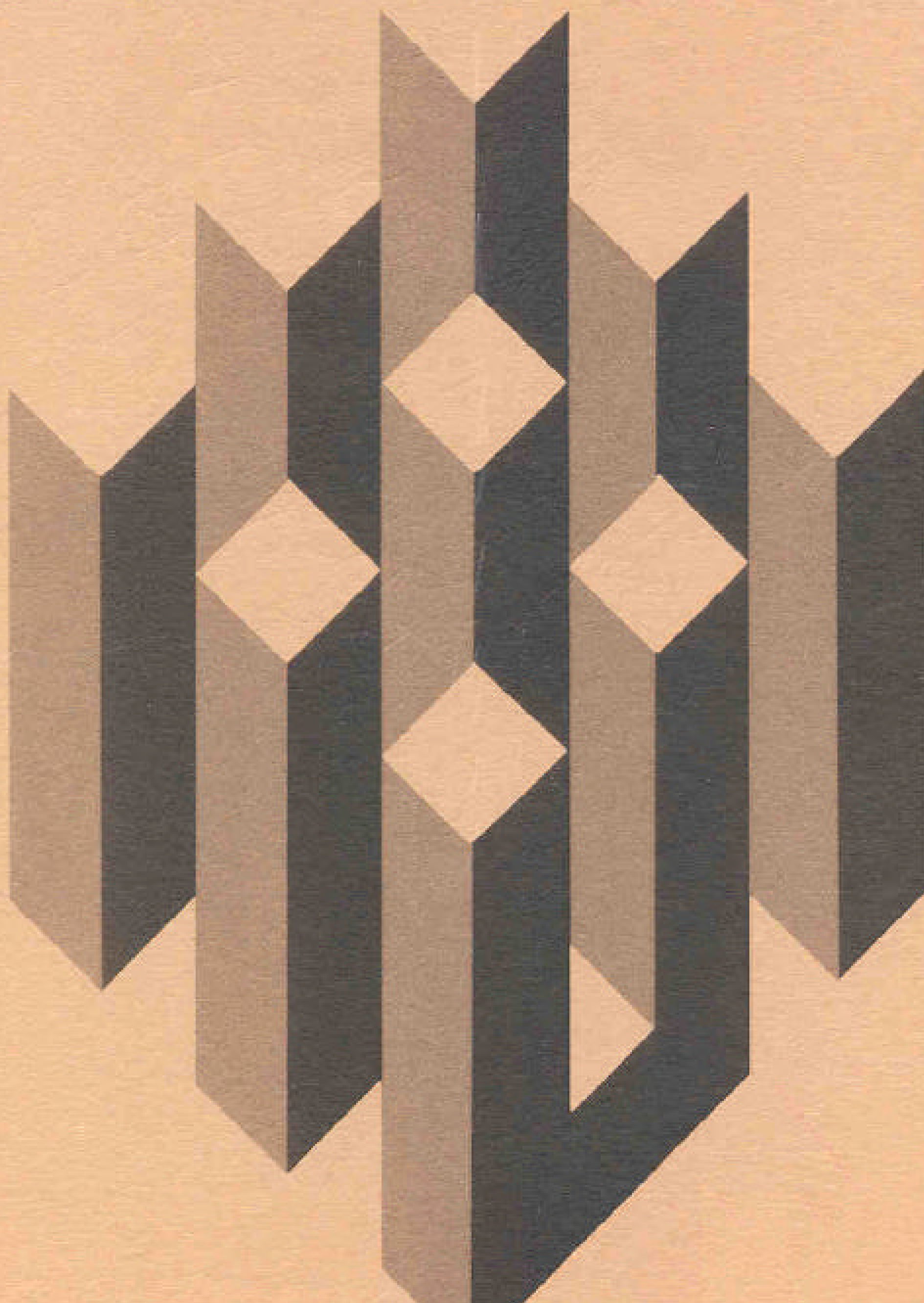

An Analysis of UI Trust Fund Adequacy

Final Report Submitted by
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*This report was prepared by Dr. Burt Barnow of ICF Incorporated and Dr. Wayne Vroman of the Urban Institute. Vroman had primary responsibility in preparing Sections I, II and III. Section IV was written jointly by the two authors. Barnow wrote the Fortran program for the simulation model which appears in Appendix D.

FOREWORD

This report was prepared by Dr. Burt Barnow of ICF Incorporated and Dr. Wayne Vroman of the Urban Institute. They are responsible for the contents of the report which does not necessarily represent the official position or policy of the Department of Labor.

The report analyzes the financing of State unemployment insurance benefit payment programs and particularly the 1.5 reserve multiple and other measures of trust fund adequacy and illustrates their strengths and weaknesses.

The authors conclude that it is inappropriate for State unemployment insurance benefit financing systems to focus on the trust fund alone when assessing financing adequacy as has been done previously. Their analysis indicates that tax capacity, tax responsiveness, and potential liability are also critical factors in assessing financing adequacy. The problem is therefore a complex one requiring the analysis of a system's cash flows under a variety of economic conditions. The authors' approach to dealing with the problem is to use a computer simulation model and they present a simple simulation model suitable for use on a personal computer, that can be used to study financing adequacy. While the results may be of interest to administrators, the content is primarily for the technician.

Executive Summary

This project analyzed the adequacy of unemployment insurance (UI) trust funds. The results of the analysis are contained largely in Sections II, III and IV of the report with a test for trust fund adequacy presented in Section IV. Section II discusses the analytic issues that are involved in defining trust fund adequacy. The section discusses the concept of acceptable risk and reviews the determinants of trust fund balances. In section III we review the history of measures of trust fund adequacy. The 1.5 reserve multiple rule (or as it is sometimes known, the reserve ratio multiple) is discussed first, followed by the results of discussions with a sample of states. This section also includes a summary of earlier literature on trust fund adequacy. In Section IV an annual simulation model (ASM) is described. The ASM requires projections of labor market variables, benefit/wage ratios, and tax/payroll ratios. Section IV also points out the limitations of the ASM. The report includes four appendices. Appendix A summarizes the high cost experiences of states. The derivation of the test for trust fund adequacy is presented in Appendix B. Appendix C presents analyses of tax and benefit relationships in two states. Appendix D provides a model computer program for implementing the ASM and an application of the program.

To know what levels of trust funds are needed in individual states there are two important issues: the variability of the benefit outflow and the response of the tax system to changes in benefit outflows. Both are examined in Section II. In discussing the linkage between benefit outflows and tax payments it is helpful to use two concepts; tax capacity and tax responsiveness. Both affect the likelihood of insolvency for a state that faces an uncertain future benefit outflow. Tax capacity is the full capacity of the present statutory tax structure to generate revenues when employers are taxed at the top tax rate. Tax capacity is determined by two factors; the fraction of covered wages that is taxable and the maximum effective statutory tax rate. Tax responsiveness has two elements; the length of the lag between the change in benefit outflows and the change in effective employer tax rates as well as the size of the tax rate response. The various factors that determine tax responsiveness are examined. For a given initial trust fund balance the probability of insolvency is lower if there is greater tax capacity and if there is greater tax responsiveness.

The review of the literature on UI trust fund adequacy of Section III reaches several conclusions. (i) The literature has not produced a major alternative to the 1.5 reserve ratio multiple (or reserve multiple) as a useful rule of thumb for assessing fund adequacy. (ii) Although the possible existence of excessive fund balances is a theoretical possibility emphasized by Bowes, Brechling and Utgoff (1980), the recent record of large scale and widespread borrowing by the states makes it clear that the real problem since the mid 1970s has been one of inadequate reserves. (iii) Maintaining adequate reserves is exclusively a state responsibility in the 1980s. Therefore an aggregative analysis with national data does not provide guidance at the level where fiscal responsibility now resides. (iv) The South Carolina analysis provides very conservative guidance on the target or required level of a state's fund balance. (v) The analysis of Baskin and Hite (1977) cannot readily be used by individual states because it incorporates information on future cost rates not known prior to specific downturns, and it ignores the response of UI taxes (and benefits) to reductions in the fund balance.

Two more positive observations are the following. (i) To help avoid insolvency problems states should apply indexing symmetrically to the tax and benefit sides of their programs. If the maximum weekly benefit is indexed then the tax base should also be indexed. (ii) The South Carolina analysis is useful for emphasizing the total amount of benefit outlays that a state must finance over a complete business cycle. This recognition of both business cycle duration and average annual costs is not incorporated into the 1.5 reserve multiple solvency guideline.

Assessments of UI trust fund adequacy are often made using econometric models. The most widely used model is the State Benefit Financing Simulation Model (SBFSM) first developed for the UI Service of the U.S. Department of Labor (See Mercer Associates (1977)) and then enhanced by the UI Service. This model has been implemented in more than half of the states and it is scheduled for adoption in other states. It is a quarterly model that can make projections of state benefit payments, tax receipts and trust fund balances for ten year periods. The model is a large scale model and not user friendly in all respects. For many detailed investigations, however, it is the best available tool for examining solvency issues.

Section IV of the report presents a simple method that states with positive trust fund balances can use to assess the adequacy of their trust fund balance. Our goal in developing the Annual Simulation Model (ASM) as an alternative to the existing methods is to furnish an approach that provides a trade-off between simplicity and accuracy. The rule of thumb that states should maintain a large enough balance so that the reserve ratio multiple is at least 1.5 is very easy to implement, but it does not provide sufficient guidance on the adequacy of the trust fund balance nor does it indicate the extent to which a state is overfunded or underfunded. On the other hand, the State Benefit Financing Simulation Models (SBFSM) are capable of providing states with a great deal of detail on the likely patterns of taxes and benefits for up to 10 years and permit states to simulate how the trust fund will behave if the benefit or tax structure is modified.

The approach presented in Section IV is much simpler and easier to implement than the SBFSM approach, but it is only applicable to states with positive trust fund balances, and it does not provide the flexibility of the SBFSM to simulate how changes in state law will affect the long-term financial outlook for a state's unemployment insurance system. The ASM can show how a state's UI tax receipts will respond to changes in the trust fund level and benefit outflows. The model's tax equations incorporate features of tax capacity and tax responsiveness implied by the state's current UI tax statute. The ASM can be used in states with either reserve ratio or benefit ratio systems of experiencing rating. Starting with the current trust fund balance and using assumptions about future unemployment and projections of future taxes collected and benefits paid, the model projects the year in which the fund balance will turn negative.

In the interests of simplicity, the ASM omits certain aspects of the UI program. Specifically, the payment of Federal-State Extended Benefits (EB) and the repayment of loans from the U.S. Treasury both fall outside the scope of the model. Thus, the model is designed for a limited set of investigations. It can, however, address one of the most fundamental questions that states often ask: given the current trust fund balance, are reserves adequate to last through a future recession without the need for borrowing from the U.S. Treasury? An application of the ASM is given in Appendix D of the report.

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I. Introduction

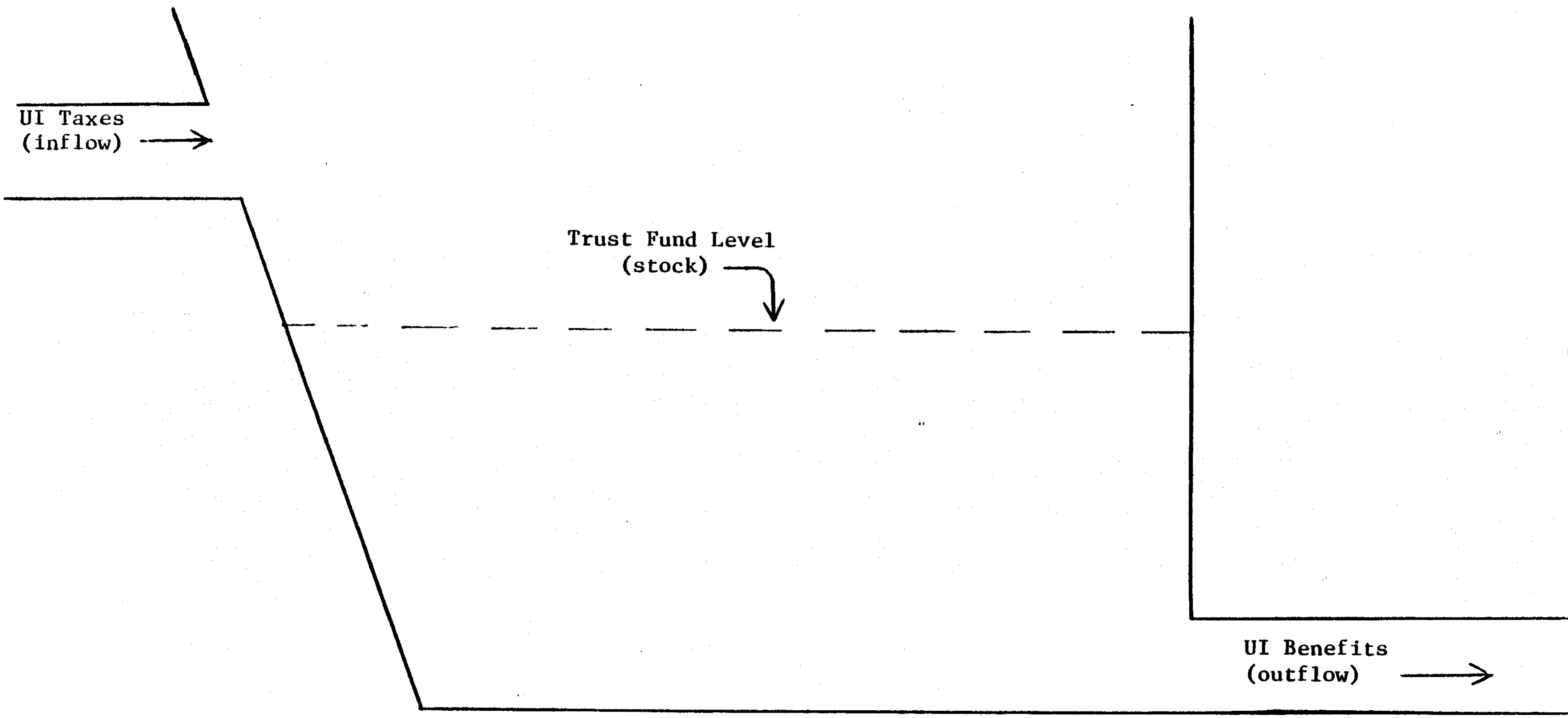
This report examines the question of trust fund adequacy in State Unemployment Insurance (UI). It is intended to provide both a general overview of UI trust fund management issues and specific observations on how the responsiveness of UI taxes affects the level of reserves needed by individual states. The discussion is initially presented at a general level and then in much more detail in later sections. The purposes of the report are to provide some tangible meaning to the term "adequate trust fund reserves" and to provide a relatively simple method that states with positive trust fund balances can use to assess the adequacy of their reserves under current state law.

The UI funding problem can be usefully analyzed as a stock-flow problem where the stock of trust fund reserves acts as a buffer between two flows: the inflow of tax payments and the outflow of benefit payments. Since the rates of inflow and outflow do not necessarily coincide, especially in short term periods, the trust fund is needed to ensure that benefits will continue to be paid in those periods when the benefit outflow exceeds the tax inflow.

Figure 1 gives a visual representation of the problem. It depicts the stock-flow relationship in a way that looks like a bathtub. The size of the trust fund is like the water level in a bathtub. This level changes whenever the size of the inflow does not equal the size of the outflow.

The reader will note that interest accruals arising from trust fund holdings have not been mentioned. Certain other institutional features of the funding problem will also be left out of the present discussion, namely penalty taxes that are assessed when states borrow from the U.S. Treasury and interest payments due after U.S. Treasury loans have been secured.

Figure 1. Stock-Flow Relationships in the UI Trust Fund



The bathtub analogy as depicted in Figure 1 is not perfect for two reasons. (1) The rate of outflow from UI trust funds is highly variable. Cyclical and seasonal factors cause the rate of outflow to be unstable from one month to the next. Thus the current fund outflow may be considerably smaller than the maximum (or capacity) outflow to be experienced in a period of severe recession. (2) There is a strong (but lagged) connection between the rate of outflow and the rate of inflow. Through experience rating there is a feedback effect from increased (reduced) benefit payments to increased (decreased) tax payments. Because of experience rating, initial changes in fund levels caused by a changed flow of benefit payments are followed by offsetting tax changes that (partially or fully) restore the fund balance to its previous level. Under a system of full or perfect experience rating, any outflow will be fully matched by a subsequent inflow.

Basically there are two types of experience rating systems. Stock-based systems determine employer tax rates completely on the basis of individual company account balances and the aggregate state trust fund reserve. In these systems (termed reserve ratio systems), employer account balances and the aggregate trust fund reserve as measured on a set date (often June 30th) determine employer payroll tax rates. The aggregate fund balance determines which among several tax rate schedules is to be used in the next year and the employer's balance determines which tax rate from that schedule is to be applied. Flow-based systems use actual benefit outflows over a recent time period (or a close proxy such as the base period wages of claimants or, in Alaska, recent declines in covered payrolls) to determine which tax rate from a tax schedule is to be paid by each employer. Typically the benefit outflow (or its proxy) is averaged for three years in determining individual tax rates in these systems. The three flow-based systems are termed the benefit ratio, benefit-wage ratio and payroll decline systems, and they are found in a total in nineteen states.[1]

Regardless of what system is used to determine employer taxes all experience rating systems have common objectives: to have the capacity and responsiveness to prevent insolvency during a recession and to replenish the trust fund after the state emerges from a recession.

Section II of the report describes the analytic issues that are involved in defining trust fund adequacy. The section discusses the concept of acceptable risk and reviews the determinants of trust fund balances. In Section III we review the history of measures of trust fund adequacy. The 1.5 reserve ratio multiple rule is discussed first, followed by the results of discussions with a sample of states. This section also includes a summary of other literature on trust fund adequacy. In Section IV an annual simulation model (ASM) is described. The ASM requires projections of labor market variables, benefit/wage ratios, and tax/payroll ratios. Section IV also points out the limitations of the ASM. The report also includes four appendices. Appendix A summarizes the high cost experiences of states. The derivation of the test for trust fund adequacy is presented in Appendix B. Appendix C presents analyses of tax and benefit relationships in two states. Appendix D provides a model computer program for implementing the ASM and an application of the program.

II. Analytic Issues in Defining Adequate Trust Funds

A. Acceptable Risk

Because the future liability to pay UI benefits has stochastic elements that are difficult to forecast, a state does not know with certainty how large its trust fund should be. The depth and duration of recessions are primary factors that cause variability in trust fund outflows. Funds must be adequate to cover the outflows until the revenue side responds.

One perspective on fund adequacy is to argue that fund balances must be adequate to ensure that no borrowing will occur regardless of the size of any future recession. Predicting the depth of a future recession and the size of the associated benefit outflow pose problems for UI programs. To guard against borrowing under any conceivable future contingency a state would need to have very large fund balances, excellent foresight, and/or a very responsive tax generation system.

Under present UI law the tax revenues deposited in state trust funds can have only one possible use: to pay cash benefits to UI claimants. Monies that potentially could be collected as UI taxes have several alternative (public and private) uses. These alternative uses are foreclosed once UI taxes have been levied and deposited in the trust fund. Since UI programs can borrow from the U.S. Treasury to pay benefits when trust funds are depleted, it would be irrational to build trust funds to levels that completely obviated the need for U.S. Treasury loans.

Most states have, in fact, resorted to U.S. Treasury loans in recent years. Between 1972 and 1985 thirty-seven states plus the District of Columbia, Puerto Rico and the Virgin Islands obtained loans. If the loans are small and indebtedness lasts for only short periods, the utilization of loans is a rational policy and a preferred alternative to the accumulation of needlessly large UI trust fund balances.

Much of the borrowing that occurred between 1972 and 1985 was small and short term (as the terms are to be defined below). Borrowing activities in these fourteen years fell into two major episodes, the first associated with the recession of the mid 1970s and the second associated with the back-to-back recessions of 1980 and 1981-82. Twenty-five jurisdictions borrowed in the 1970s and roughly half of these states completed their loan repayments by the end of 1980. In the 1980-85 period fifteen of the thirty-two jurisdictions that borrowed completed their debt repayments within the following two years. It is also clear that loan repayments have been much more rapid since April 1982 when new loans started to carry interest charges.

Define as "small" an amount of borrowing that is less than one percent of covered payroll (and that encompasses all borrowing that occurs during a recessionary episode). Although it is an arbitrary size designation, this scale of borrowing is usually small enough to permit full loan repayment during a subsequent economic recovery without the need to enact major legislation that raises taxes and/or reduces benefits. Nine of the jurisdictions that borrowed between 1972 and 1979 required "small" loans.[2] During the 1980 to 1985 period "small" loans were disbursed to fourteen jurisdictions.[3] Typically, these loans were needed for a short period at the end of the recession, and they were repaid promptly in the ensuing recovery, partly due to changes in UI tax and benefit statutes. Utilizing loans of this scale can be justified as a prudent policy. It would appear that a probability as high as .25 of needing such loans would be an acceptable risk for a state to take. The elements of the risk of short term insolvency are discussed in the next parts of the paper.

While many states have needed only "small" loans to help finance benefit payments in recent recessions, it is also obvious that the major share of U.S. Treasury loans have gone to states that have experienced large scale and long term indebtedness. At the end of March 1986 there were fourteen jurisdictions with outstanding debts.[4] These fourteen states accounted for $22.4 billion of the $26.1 billion (or 85.8 percent) in loans made between 1972 and 1985. Ten of these states had been continuously in debt for at least six years at the end of 1985, and six states had been continuously in debt for eleven or more years. Thus the bulk of the U.S. Treasury loans have gone to states with chronic problems in funding their UI programs. With the continuing economic expansion of 1986, four more programs (Connecticut, Minnesota, Vermont and the Virgin Islands) completed their loan repayments between March and November 1986.

Several identifiable factors contributed to funding problems in the states needing large scale loans.[5] (i) They experienced unusually high unemployment in the years when most of their borrowing occurred. Borrowing had a distinct regional concentration in both the mid 1970s (in the North East region) and the early 1980s (in the North Central region) that reflected the geographic locus of the most severe unemployment problems. (ii) The high inflation of the mid 1970s and early 1980s caused problems because most of these states had indexed their maximum weekly benefit but not their taxable wage base. (iii) The costs of the Federal-State Extended Benefits (EB) program were much greater than anticipated. (iv) The states entered their recessions with trust fund balances well below levels that satisfied recommended actuarial standards. Furthermore, the low fund balances had been present for several prior years.[6] (v) Many of the states had enacted important benefit liberalizations just prior to the recessions where they needed large loans. Thus, uncontrollable and unforseen economic events combined with policy inaction and errors caused several situations where benefit outlays exceeded taxes by such wide margins that trust funds were exhausted and large scale loans were required.

Not all states had to borrow during the 1972-1985 period. One analysis identified three important factors associated with debt avoidance.[7] (i) The states entered recessions with larger than average trust fund balances. (ii) When trust funds were drawn down these states enacted legislation promptly to raise taxes and (in some instances) reduce benefit outlays.[8] (iii) States avoiding the need to borrow typically experienced favorable economic circumstances such as low unemployment and a high rate of economic growth. In the past, active policies and favorable economic events have both contributed to debt avoidance.

Since new loans from the U.S. Treasury carry interest charges, the states now feel more political and economic pressure to avoid large scale indebtedness than they did prior to April 1982. On the other hand, the states must incur some risks of borrowing to avoid accumulating needlessly large trust fund balances. Thus, a state's problem can be stated as follows: it cannot completely avoid the risk of borrowing, but it wants to avoid large scale borrowing. One particular realization of the problem would be for a state to incur a 25 percent probability of needing a "small" loan, i.e., a loan equaling one percent of payroll. If this situation had prevailed during the 1980-85 period total loans would have fallen into the \$3-\$4 billion range rather than the \$20.5 billion that was required.[9] Achieving this level of acceptable risk would result in a greatly reduced volume of loans to insolvent UI programs.

B. The Trust Fund Balance

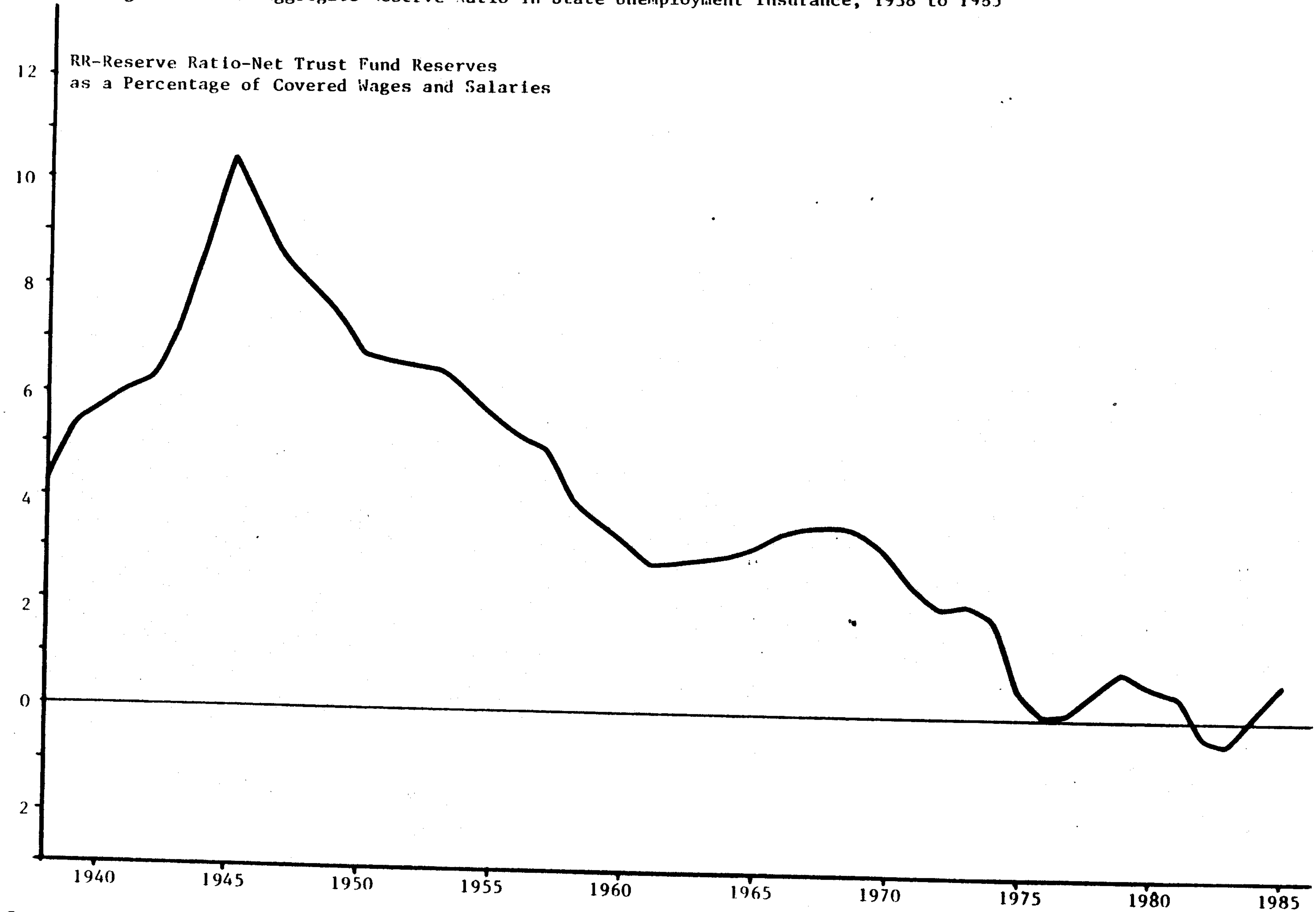
The most obvious element of insolvency risk is the current level of the state's UI trust fund. A larger balance gives a state more time to respond to large outflows without the need for borrowing. In an economy characterized by inflation and a growing labor force, trust fund balances must also grow from one year to the next in order to maintain a constant relationship with potential benefit outlays. In recognition of this needed growth, UI fund balances are often evaluated relative to covered payrolls rather than simply in absolute dollar amounts. Covered payrolls grow as a consequence of employment growth and increases in the level of money wage rates.

Economic growth in the state of Florida provides a good illustration of this point. Between 1955 and 1985 the state's fund balance grew from $83.8 million to $1385.2 million, a sixteen fold increase. During these same years, however, covered payrolls increased more than thirty fold so that reserves as a percent of payrolls actually declined from 4.29 percent to 2.35 percent.[10] Reserve ratios (reserves as a percentage of covered payrolls) are the commonly used actuarial measure of the size of UI trust fund balances.

State UI programs increased their reserve balances at a rapid rate during both 1984 and 1985. Net reserves across all UI programs grew by about $8 billion in each year. The aggregate reserve ratio rose by .63 percentage points in 1984 and by .53 percentage points in 1985. This two year gain in the aggregate reserve ratio of 1.16 percentage points was the largest recorded for all consecutive two year periods since World War II.[11]

Despite recent increases in the aggregate reserve ratio, it remains very low by historic standards. Figure 2 traces the aggregate reserve ratio for the forty-eight year period from 1938 to 1985. At the end of 1985 the reserve

Figure 2. The Aggregate Reserve Ratio in State Unemployment Insurance, 1938 to 1985



Source: Based on data in U.S. Department of Labor, Unemployment Insurance Financial Data, ET Handbook 394, (Washington, D.C.: GPO, 1983) and later updates.

ratio was .69 percent of covered wages. As can be seen from the figure the aggregate ratio was much higher in every single year between 1938 and 1974. The figure shows that large scale trust fund building occurred between 1938 and 1945 when the aggregate trust fund reserve ratio reached 10.38 percent of covered payrolls.

Since 1945 the reserve ratios have trended downward with major decreases occurring in the years 1946, 1947, 1950, 1958, 1961, 1971, 1975, and 1982. The only periods when reserve ratios increased were during the long expansion of 1961-1969 and later during the upturns of 1977-79 and 1983-85.[12] Viewed from a long term perspective the 1985 aggregate reserve ratio of .69 percent was very low.

Underlying the aggregate reserve ratio depicted in Figure 2 are the reserve ratios of the individual UI programs. At the end of 1985 there were nine jurisdictions (out of fifty-three) whose net reserves were negative, and an additional fourteen had balances that were smaller than one percent of covered payrolls. Only five state balances exceeded 2.5 percent of covered payrolls while six other reserve ratios fell into the 2.00-2.49 percent range. Since annual benefit outlays can easily exceed 2 percent of payrolls during a recession[13] it is obvious that reserve balances in most states at the end of 1985 were of modest size. Faced with a severe recession in 1986 many states would have to raise taxes and/or borrow from the U.S. Treasury, i.e., repeat the types of fiscal adjustments that were made by several states in the 1980-83 period. The widespread prevalence of low reserve ratios is an important factor that places many states at risk of insolvency in future years.

C. The Benefit Outflow

The biggest unknown that UI programs face in determining their trust fund reserve requirements is the future course of benefit outlays. This outflow is influenced not only by the business cycle but also by seasonal factors and (in states with indexed weekly benefit maxima) the recent rate of inflation.

Starting at a specific point in time there are at least three questions about future benefit payments that should be asked. (i) What is the maximum potential (or capacity) rate of benefit outflow? (ii) How close is the present rate of outflow to capacity outflow? (iii) If a serious recession occurs what would be the duration of the maximum rate of outflow? Note that all these questions refer to the flow of benefit payments and require answers that describe benefit flows measured over units of time. As the time unit for measuring benefit flows is shorter, seasonality becomes a more important consideration. In assessing the growth in benefit outlays between the third and fourth calendar quarters, for example, it is relevant to make comparisons with earlier years in judging whether or not the growth in fourth quarter outlays has been unusually large, possibly signifying the onset of a recession.

Table 1 presents summary data on maximum annual UI benefit outflows for the entire U.S. economy and by state for the period from 1948 to 1984. Over these thirty-seven years the economy experienced eight recessions. The state data cover the fifty-one programs (the fifty states plus the District of Columbia) that have paid benefits throughout the entire period.[14] To adjust for inflation and for changes in the level of employment, all the benefit flows are expressed as a percent of covered payrolls. The table summarizes individual high cost years and the highest cost three year period. The exact

Table 1. Maximum Benefit Outlays in National and State Data: 1948-84.

Annual Benefits as a Percent of Covered Payrolls											Median State Cost Percentage	National Cost Percentage
0-.49	.5-.99	1.0-1.49	1.5-1.99	2.0-2.49	2.5-2.99	3.0-3.49	3.5-3.99	4.0-4.49	4.5-4.99	5.0 and Above		
Highest Cost Year: 1948 to 1984												
0	0	5	8	9	11	12	2	2	1	1	2.68	2.24
Second Highest Cost Year: 1948 to 1984												
0	2	9	11	13	9	4	1	2	0	0	2.15	2.05
Highest Cost Year: 1980 to 1984												
0	2	14	15	7	5	6	1	1	0	0	1.83	1.83
Highest Average Cost Rate for Three Consecutive Years: 1948 to 1984												
0	3	9	13	17	6	2	1	0	0	0	2.03	1.69

Source: All data in this table are based on Table A of the Appendix.

years and cost rates by state are given in Table A of Appendix A. All cost data include the state share of the Federal-State Extended Benefits (EB) as well as the costs of the regular UI program.

Eighteen states experienced at least one year when benefit costs exceeded 3.0 percent of payroll while twenty-nine have had cost rates of 2.5 percent or higher. The top panel of Table 1 shows that only thirteen states, roughly one in four, did not experience an annual benefit cost rate of at least 2 percent of payroll sometime during the 1948-84 period. The median of the high cost rates was 2.68 percent. Note also that the median of the high cost rates was about 20 percent higher than the highest cost rate experienced by the overall economy (2.24 percent). This is to be expected as the national cost rate is a weighted average of cost rates experienced by individual states over one twelve month period[15] whereas the maximum cost rates in the states occurred in several different years.[16] Since the trust funds are maintained on a state-by-state basis, however, it is state (not national) cost experiences that determine the needed size of UI fund balances.

It might be argued that the maximum annual cost rate experienced by a state is unduly influenced by particular economic circumstances that rarely occur. For purposes of assessing trust fund needs it might be better to use the second highest year on the premise that its cost rate is less influenced by special or one-time developments. The second panel of Table 1 shows that the annual costs in the second highest cost years are considerably lower than in the highest cost years. The median of this distribution is an annual cost rate of 2.15 percent of payroll which is about eighty percent of the 2.68 percent median cost rate for the highest cost years. Even using the second highest cost year, however, observe that twenty-nine states experienced cost rates of at least 2.0 percent, while eleven had rates in the 1.5-1.99 percent range.

It could also be argued that recent cost experiences are more relevant than experiences in the 1950s, the 1960s, and even the 1970s due to recent cutbacks in UI benefit eligibility. In national and state data the ratio of insured unemployment to total unemployment has declined noticeably since 1979.[17] Therefore the older cost rates may be too high to be used in planning for future cost experiences. To give an idea of the practical import of this argument Table 1 also shows the distribution of high cost rates from the five year 1980-84 period. Twenty states had cost rates of 2 percent or higher, fifteen had rates of from 1.5 to 1.99 percent and the median state cost rate was 1.83 percent. Thus, even after restricting the focus to cost experiences of the 1980s, annual cost ratios of 2 percent or just below 2 percent remain relevant for the majority of states in considering their maximum benefit cost rate.

Persons familiar with UI financing problems might object that five years is too short a historic period for making reliable inferences about possible future benefit cost rates. Support for this objection can be found in recent cost data from states in two regions; the Northeast and North Central regions. States in the North Central region have experienced very high unemployment and very high UI benefit cost rates in the 1980s. Between 1980 and 1984 eleven of these twelve states experienced either their highest or second highest cost rate for the entire 1948-1984 period.[18] For these states cost experiences of the 1980s could be a reliable guide as to the possible future high cost experiences.[19]

The cost experiences of states in the Northeast during 1980-84 have been quite the opposite. Due to the strong economic recovery of this region in the 1980s, its nine states typically experienced their highest cost rates during the earlier recession years of 1975, 1958 and 1949.[20] In fact, only one of the nine (Pennsylvania) experienced either its highest or second highest cost rate during 1980-84. Recent costs would substantially understate potential future costs for states in this region. For such states their second highest cost year typically occurred in the 1970s or earlier. Still this would often be a more reliable guide than the highest cost rate from the 1980-84 period.[21] Since unemployment problems have a history of moving from region to region, cost data from recent periods must be used with care to avoid making erroneous judgments about possible future costs.

Table 1 also presents data on state experiences with sustained high benefit outflows. The table's bottom panel shows the distribution of annual cost rates for the three consecutive years of highest costs between 1948 and 1984.[22] The median cost rate was 2.03 percent or roughly 6.09 percent of payroll over three years. Half the states had average cost rates of 2.0 percent or higher and another one quarter experienced three year averages between 1.5 and 1.99 percent of payroll.

Comparing the bottom and top panels of Table 1 it is clear that states typically do not have high cost experiences that last for long periods. Although eighteen states experienced one or more years when benefit costs exceeded 3 percent of payroll (the top panel of Table 1), only three states had a three-year average cost rate as high as 3 percent (the bottom panel of Table 1). While only five states had a single year highest cost rate below

1.5 percent of payroll, twelve states had highest cost three year averages below this level.

To help illustrate the variability of benefit outflows within the three year highest cost period, consider a hypothetical state that experiences the median one-year highest cost rate and the median three year cost rate as shown in Table 1, i.e., 2.68 percent and 2.03 percent respectively. For such a state the three year average cost rate is .757 of the highest cost rate (2.03/2.68). When the three years are considered together total costs are about 6.09 percent of payroll. Since costs of 2.68 percent are experienced in the highest cost year that leaves 3.41 percent for the other two years or an annual average cost rate of 1.70 percent. Annual outflows in these two years average about 64 percent of the outflow in the highest cost year. Thus, even within a sustained three year high cost period the outflow in the other two years is typically about two thirds of the outflow in the highest cost year.[23] Rarely will the three-year cost rate be as much as 2.5 times the single year highest cost rate.[24]

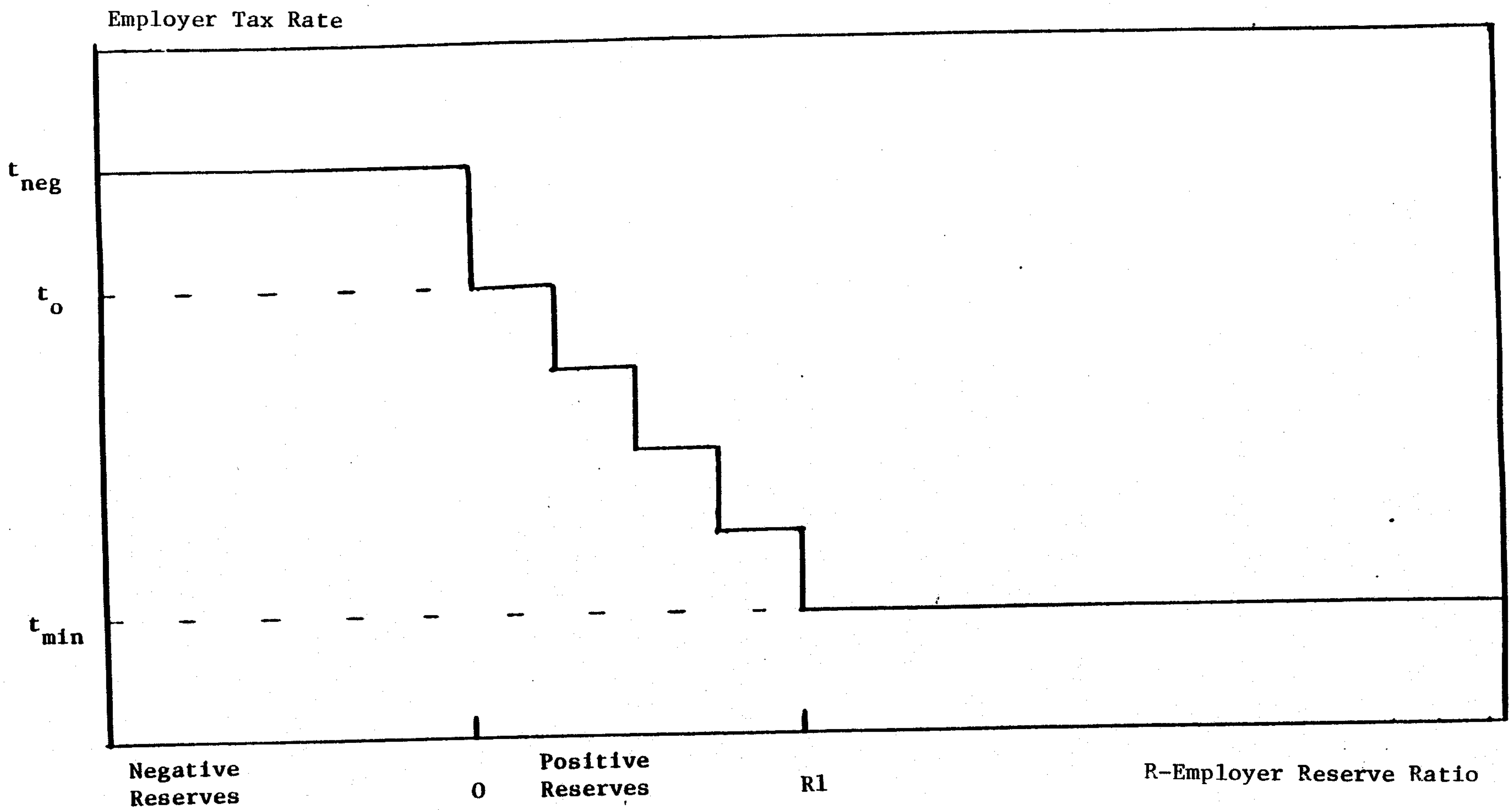
To summarize this discussion of benefit costs, four statements can be made. (i) States have had a very wide variety of benefit cost experiences during the 1948-1984 period. Three fourths of the states have had one or more years when benefit costs have exceeded 2 percent of covered payrolls. (ii) The absolutely highest cost period may not be the most appropriate indicator to use in planning for future UI cost contingencies. States may want to use the second highest cost year or the highest cost year from a recent period in judging the maximum future rate of annual benefit payments. A combination of changes in UI laws and structural changes in state economies would help to determine which states would now be facing potentially lower cost experiences. (iii) High rates of benefit outflows are not maintained at the highest annual rate of outflow. For planning purposes the three-year benefit cost rate can be assumed to be from 2.0 to 2.5 times the highest annual benefit cost rate. (iv) In selecting both the highest annual future rate of outflow to be expected and the ratio of three-year costs to one-year costs there is no substitute for the exercise of good judgment. The judgment that is required is most likely to be found in practitioners who combine knowledge of (international, national and regional as well as) state labor market developments with a knowledge of the recent UI legislation that affects benefit payments in their state.

D. Tax Receipts

All State UI programs use some form of experience rating to determine employer tax rates. After the onset of recession which causes the benefit outflow increase there is an automatic response of UI taxes that tends to replinish the trust fund balance. Following a recession a state may revise its tax and/or benefit statutes in order to improve the fiscal solvency of its UI program. Such discretionary changes help to restore the fund balance to higher future levels. The focus of this analysis, however, will be the automatic tax response that operates through existing UI tax provisions. To the extent that the revenue side of the UI program responds fully to an increase in benefit payments, the need for discretionary actions that raise taxes and/or lower benefits is reduced.

Figure 3 presents a graphic representation of the UI tax rate structure in a reserve ratio state. The stock of reserves measured at a specific point in time determines the employer's tax rate. The reserve ratio (the employer's trust fund balance expressed as a proportion of the employer's taxable wages) is measured horizontally in Figure 3 while tax rates are measured vertically.

Figure 3. Tax Rates in a Reserve Ratio System



t_{neg} - tax rate for negative balance employers

t_o - tax rate for employers with a zero trust fund balance

t_{min} - the minimum tax rate

R - the reserve ratio, the trust fund reserve as a fraction of taxable wages

The figure shows that a minimum tax rate (t_{min}) is charged when the fund balance exceeds a certain level (R1). Below this level, a decrease in the fund balance causes the tax rate to increase. The tax function in this range consists of a series of steps which increase until a tax rate of t_o is reached when the employer's account balance is zero. The figure also shows that a higher tax rate (t_{neg}) is levied on employers with negative balances.

Figure 3 should be viewed as illustrative of a reserve ratio tax rate structure, and many other variants are possible. For example, t_{neg} and t_o may be the same tax rate or the tax schedule may have a continuing progression of rates as negative balances become more negative. There may be few or many tax rates in the range between 0 and R1. The entire schedule of rates may automatically shift up or down when the state's overall trust fund balance changes. The thresholds that trigger upward and downward shifts in the tax schedule may be the absolute size of the state's trust fund, the state's reserve ratio (the fund balance as a proportion of either taxable or total covered payrolls), the state's reserve multiple (the reserve ratio divided by the benefit cost ratio for a recent high-cost period), or some other indicator.[25] Whatever the statutory arrangement may be in a particular state, for any given year there is a minimum and a maximum rate and a progression of intermediate rates.

The tax rates t_{min} and t_{neg} in Figure 3 are important to highlight. When the reserve ratio is between 0 and R1 an increase in layoffs (and associated UI claims) will reduce the employer's account balance in future periods and lead to higher employer taxes. If an employer is taxed at the rates t_{min} and t_{neg}, however, extra layoffs do not cause tax rates to change (unless employers taxed at the minimum rate have their balance fall below R1). When these tax rates apply, the employer is faced with a zero marginal (tax) cost of layoffs. Because many employers are taxed at the minimum and maximum rates, UI programs are described as having partial or imperfect experience rating.

The tax rate t_o is also important to highlight because it can strongly influence the fund's overall balance. If t_o is low the range of tax rates between t_o and t_{min} will be small. In such situations a sharp decline in the employer's reserve ratio produces only a small tax rate response. This might be popular with employers, but it would imply a small aggregate tax response when the overall fund balance declines and a tendency for the fund balance to remain at a low level. States with such a tax structure could easily require U.S. Treasury loans after experiencing a period of sustained high benefit outflows (unless tax surcharges are added to employer taxes).

The tax structure in flow based experience rating systems is somewhat simpler. Individual employer account balances are not recorded. Instead, there is a positive association between recent rates of benefit outflow (or its proxy in benefit-wage ratio and payroll decline experience rating systems) and individual employer tax rates. The association is constrained at the extremes by a minimum and a maximum tax rate. As in the case of stock-based systems, there are usually several schedules of rates in flow-based experience rating systems, and the individual tax schedules are activated by the overall level of the state trust fund (or the reserve ratio or the reserve multiple). Thus, a stock measure (such as the overall fund balance) determines which tax schedule is in effect while a flow measure determines the individual employer's tax rate within the specific tax schedule.[26] Because individual employer account balances are not recorded, there is more possibility in flow-based systems than in stock based systems for cross-subsidization of employers whose benefit payments systematically exceed their tax payments over extended time periods.

As the data processing capabilities of UI programs are enhanced their ability to keep records on exactly the dollar amount of benefit payments charged to individual employer account balances grows. Given this development it would seem that the rationale for the benefit-wage ratio and payroll decline systems of experience rating is becoming weaker. Direct measurement of benefit payments provides a more accurate way of gauging the experiences of individual employers than do their benefit wages or their payroll declines. Therefore, the degree of experience rating in these five states would be increased if their present experience rating systems were replaced by benefit ratio experience rating systems.[27]

In discussing the linkage between benefit outflows and tax payments it is useful to introduce two concepts; tax capacity and tax responsiveness. Both affect the likelihood of insolvency for a state that faces an uncertain future benefit outflow. Tax capacity is the full capacity of the present statutory tax structure to generate revenues when employers are taxed at the top tax rate. Tax responsiveness has two elements; the length of the lag between the change in benefit outflows and the change in effective employer tax rates as well as the size of the tax rate response. For a given initial trust fund balance the probability of insolvency is lower if there is greater tax capacity and if there is greater tax responsiveness.

Tax capacity is determined by two factors; the fraction of covered wages that is taxable and the maximum effective statutory tax rate. This can be expressed as a mathematical relationship.

$$TC = (TxP/TP) \cdot MTR$$

where TC = tax capacity (maximum tax receipts as a proportion of covered payrolls),

(TxP/TP) = the taxable wage proportion (taxable payrolls as a proportion of total covered payrolls), and

MTR = the maximum effective tax rate from the state's highest tax schedule

Note that tax capacity is expressed in the same units as a state's benefit cost rate, i.e., as a percent of covered payrolls. Since many states have multiple tax schedules, it may not be possible to tax any employer at the maximum statutory tax rate in the current year. Some questions that arise in trying to accurately measure the maximum effective tax rate will be addressed below.

There has been a long-run decline in the taxable wage proportion in almost all UI programs. The taxable wage base for the federal part of UI taxes was set at $3000 per worker in 1940.[28] It remained at $3000 until 1972 when it was increased to $4200. Subsequent changes raised it to $6000 in 1978 and to $7000 in 1983, where it remains in 1986. Because wages have grown at much more rapid rates than the UI tax base, the taxable wage proportion for the overall U.S. economy declined from .928 in 1940 to .428 in 1984. States can legislate their own tax bases to be higher than the federal tax base, but only in the last twenty years have many states taken such actions. Even when states have enacted higher tax bases, they have shown a reluctance to exceed the federal tax base by a wide margin. Consequently, in all years of the 1970s and 1980s less than half of covered wages have been taxable. The low taxable wage base has an important effect in restricting tax capacity in UI programs.

Table 2 presents data by state on the taxable wage proportion for the years 1982, 1984 and 1986. It shows the taxable wage base and the taxable wage proportion for each of the three years. Estimates of the latter for 1986 represent judgments made by one of the authors. Additionally, in states where the taxable wage base is indexed to average wages, the wage indexation percentage (the tax base as a percentage of the state's average annual wage) is shown. Finally, to give an idea as to the relative sizes of the states, each state's proportional share of covered payrolls is also shown.

Since the mid 1970s many states have adopted wage indexation. By 1986 the number had grown to seventeen. Indexation is clearly a western phenomenon. Only three states east of the Mississippi (New Jersey, North Carolina, and Rhode Island) have indexed their taxable wage base.[29] Indexation is also more likely to be present in smaller states. Combined, the seventeen only account for about 16 percent of all covered payrolls. The four largest states with indexation are New Jersey, North Carolina, Minnesota and Washington.

Although states could achieve high taxable wage bases through periodic discretionary tax base increases, it is obvious in Table 2 that high tax bases have been achieved through wage indexation. In 1984 thirty-one of the fifty-one "state" programs had a taxable wage base that exceeded the $7000 federal base. However, only ten states had a taxable wage base of $10,000 or higher, and all ten were states with indexed tax bases. Table 2 also shows that eleven states had taxable wage proportions that were smaller than .4 in 1984 while twelve had proportions of .55 or larger. All twelve in the latter group had indexed taxable wage bases. The highest taxable wage proportion was found in Hawaii (.701) which sets its tax base to 100 percent of the state's average annual wage.

Table 2. Taxable Wage Bases and Taxable Wage Proportions By State, 1982, 1984 and 1986

State	1982		1984		1986		Wage Indexation Percentage[f]	State Share of 1984 Covered Payrolls
	Taxable Wage Base	Taxable Wage Proportion	Taxable Wage Base	Taxable Wage Proportion	Taxable Wage Base	Taxable Wage Proportion		
U.S. Total	6000[a]	.405	7000[a]	.428	7000[a]	.418[e]		
Alabama	6600	.458	8000	.486	8000	.465[c]	NA	.0123
Alaska	14600	.471	21400	.678	21600	.678[b]	75	.0033
Arizona	6000	.410	7000	.433	7000	.410[d]	NA	.0118
Arkansas	6900	.509	7500	.504	7500	.483[c]	NA	.0067
California	6000	.363	7000	.368	7000	.363[d]	NA	.1273
Colorado	6000	.378	8000	.444	8000	.426[c]	NA	.0153
Connecticut	7000	.383	7100	.360	7100	.344[c]	NA	.0185
Delaware	6600	.364	8000	.401	8250	.392[c]	NA	.0031
Dist. of Col.	7500	.391	8000	.380	8000	.365[c]	NA	.0046
Florida	6000	.441	7000	.456	7000	.441[d]	NA	.0405
Georgia	6000	.415	7000	.424	7500	.428[c]	NA	.0242
Hawaii	13100	.696	14600	.701	15600	.701[b]	100	.0036
Idaho	13200	.688	14400	.684	15600	.684[b]	100	.0028
Illinois	7000	.386	8000	.396	8500	.398[c]	NA	.0542
Indiana	6000	.376	7000	.390	7000	.376[d]	NA	.0221
Iowa	8700	.515	10400	.554	12000	.554[b]	66.7	.0092
Kansas	6000	.396	8000	.507	8000	.464[c]	NA	.0103
Kentucky	8000	.495	8000	.463	8000	.450[c]	NA	.0112
Louisiana	6000	.380	7000	.407	7000	.380[d]	NA	.0162
Maine	6000	.459	7000	.475	7000	.459[d]	NA	.0036
Maryland	6000	.373	7000	.399	7000	.373[d]	NA	.0169
Massachusetts	6000	.414	7000	.414	7000	.397[c]	NA	.0310
Michigan	6000	.327	8500	.391	9500	.411[c]	NA	.0404
Minnesota	8300	.461	9800	.476	10700	.476[b]	60	.0184
Mississippi	6000	.465	7000	.491	7000	.465[d]	NA	.0066
Missouri	6600	.403	7000	.391	8000	.415[c]	NA	.0204
Montana	8000	.619	8400	.622	12200	.700[c]	80	.0027
Nebraska	6000	.418	7000	.443	7000	.419[d]	NA	.0051
Nevada	9300	.573	10700	.597	11400	.597[b]	66.7	.0045
New Hampshire	6000	.423	7000	.447	7000	.423[d]	NA	.0042
New Jersey	8200	.442	9600	.456	10700	.456[b]	53.8	.0388
New Mexico	8500	.541	9800	.557	10300	.557[b]	65	.0042
New York	6000	.341	7000	.351	7000	.341[d]	NA	.0875
North Carolina	6000	.444	8200	.511	9200	.511[b]	60	.0234
North Dakota	9240	.562	10400	.573	10800	.573[b]	70	.0019
Ohio	6000	.359	8000	.409	8000	.404[c]	NA	.0459
Oklahoma	6000	.372	7000	.399	8900	.450[c]	50	.0122
Oregon	11000	.595	13000	.624	14000	.624[b]	80	.0096
Pennsylvania	6600	.400	8000	.427	8000	.412[c]	NA	.0464
Rhode Island	8600	.551	10000	.559	11000	.559[b]	70	.0037
South Carolina	6000	.451	7000	.465	7000	.451[d]	NA	.0111
South Dakota	6000	.454	7000	.492	7000	.454[d]	NA	.0016
Tennessee	6000	.430	7000	.444	7000	.430[d]	NA	.0169
Texas	6000	.383	7000	.397	7000	.383[d]	NA	.0742
Utah	12000	.621	12100	.627	12600	.617[c]	75	.0053
Vermont	6000	.437	8000	.504	8000	.490[c]	NA	.0018
Virginia	6000	.407	7000	.422	7000	.407[d]	NA	.0216
Washington	10,800	.552	12000	.575	11500	.554[c]	86[g]	.0165
West Virginia	8000	.466	8000	.438	8000	.423[c]	NA	.0057
Wisconsin	6000	.341	9500	.493	10500	.518[c]	NA	.0187
Wyoming	6000	.382	9600	.504	9900	.504[b]	55	.0020

Source: All data for 1982 and 1984 were taken from U.S. Department of Labor, Unemployment Insurance Financial Data, ET Handbook 394, (Washington, DC: GPO, 1983) and the 1984 Handbook update. Data for the taxable wage base and the wage indexation percentage in 1986 were taken from National Foundation for Unemployment Compensation and Workers' Compensation, "Highlights of State Unemployment Compensation Laws, January 1986," (Washington, DC: National Foundation for U.C. and W.C., 1986). Taxable wage proportions for 1986 were estimated by the author.

[a] Taxable wage base for the Federal Unemployment Tax.
[b] Taxable wage proportion estimated to be the same in 1986 as in 1984 due to indexation.
[c] Estimated by the author based on state data from other years.
[d] Estimated to be the same in 1986 as in 1982 since the $7000 taxable wage base in 1986 is comparable to a $6000 taxable wage base in 1982.
[e] Estimated using 1984 state shares of covered payrolls.
[f] The taxable wage base is tied to a given percentage of the state's average annual wage.
[g] This is the maximum that the taxable wage base can be as a percentage of state average wages. The tax base increases by 15 percent annually when the tax base is less than 86 percent of average wages.

NA - Not applicable as the state does not have an indexed taxable wage base.

The strong link between indexation and high taxable wage bases is also observed in 1986. Thirty-four states have tax bases above $7000 but only fifteen have bases above $10,000. Fourteen of the fifteen have indexed tax bases. Wisconsin is the only state with a tax base above $10,000 that is not indexed.

Finally, note in Table 2 that the aggregate taxable wage proportion in 1986 (.418) is only slightly higher than it was in 1982 (.405) when the federal tax base was at the lower $6000 level. The low aggregate taxable wage proportion reflects the low tax bases in the largest states. Five of the ten largest states will base their taxes on less than 40 percent of covered wages in 1986, and four of the other five will tax no more than 45 percent of covered wages.[30] The low taxable wage proportion observed in so many UI programs has been one factor that contributed to UI financing problems in the 1970s and 1980s, particularly in states that have indexed their maximum weekly benefit but not their taxable wage base.

Table 3 presents data useful for assessing tax capacity in the states in 1986. The table shows maximum tax rates, actual tax rates, estimates of tax capacity and ratios of twelve-month high cost experiences to tax capacity. The maximum tax rate was taken from each state's top tax schedule and it includes maximum solvency and/or fund building tax rates in states where such taxes are also incorporated into the UI tax statute.[31] Tax capacity is defined here as the product of the midrange tax rate from the top tax schedule and the 1986 taxable wage proportion shown in Table 2. The final two columns of the table compare tax capacity with two measures of twelve month high cost benefit payout rates; the second highest cost rate ever experienced between

Table 3. Maximum Tax Rates and Estimates of Tax Capacity by State: 1986

State	Top Maximum Tax Rate (percent)	Top Midrange Tax Rate (percent)	Average Actual Tax Rate (percent)	Tax Capacity (percent of total payrolls)	Second Highest Cost Rate 1948-1984 / Tax Capacity	Highest Cost Rate 1980-1984 / Tax Capacity
Alabama	7.3	4.0	1.9	1.86	1.11	.91
Alaska	6.5	3.8	2.3	2.92[a]	1.48	.73
Arizona	5.4	4.15	1.6	1.70	.79	.79
Arkansas	6.6	3.65	2.4	1.76	1.06	1.06
California	6.2	3.85	2.4	1.40	1.67	1.19
Colorado	5.7	3.5	2.2	1.49	.83	.83
Connecticut	6.4	3.95	2.2	1.36	2.33	.75
Delaware	9.5	5.55	3.4	2.18	.89	.64
Dist. of Col.	6.3	4.0	3.1	1.46	1.25	1.00
Florida	5.4	2.75	.9	1.21	.96	.62
Georgia	8.6	4.35	1.6	1.86	.84	.63
Hawaii	5.4	4.0	1.6	2.80	.79	.59
Idaho	6.8	4.85	3.0	3.32	.63	.95
Illinois	7.3	4.05	4.1	1.61	1.38	1.66
Indiana	5.4	3.35	1.5	1.26	1.37	1.23
Iowa	9.0	4.75	3.3	2.63	.58	1.00
Kansas	6.4	3.23	2.5	1.50	.92	1.31
Kentucky	10.0	5.5	3.2	2.48	1.02	1.02
Louisiana	8.18	4.3	4.0	1.63	1.41	1.89
Maine	6.5	4.45	2.6	2.04	1.39	.87
Maryland	6.0	4.4	3.0	1.64	1.27	1.05
Massachusetts	8.2	6.1	2.0	2.42	1.26	.60
Michigan	12.0	6.5	5.5	2.67	1.36	1.36
Minnesota	7.5	4.25	2.5	2.02	.84	.97
Mississippi	6.4	5.34	1.9	2.48	.79	.73
Missouri	7.8	3.9	2.4	1.62	.86	.86
Montana	6.8	4.45	3.2	3.12	.76	.62
Nebraska	5.4	2.75	1.7	1.15	.92	.92
Nevada	5.4	2.85	1.8	1.70	1.51	1.18
New Hampshire	6.5	3.5	1.1	1.48	1.70	.68
New Jersey	7.7	4.51	3.2	2.28[a]	1.15	.85
New Mexico	5.4	4.05	2.0	2.26	.65	.65
New York	6.4	3.95	3.3	1.35	1.85	.91
North Carolina	8.0	4.06	1.9	2.07	.88	.88
North Dakota	7.0	3.85	2.9	2.21	.85	1.06
Ohio	7.0	4.4	3.7	1.78	1.37	1.74
Oklahoma	9.2	4.75	2.2	2.14	.61	.64
Oregon	5.4	3.8	3.1	2.37	1.11	1.35
Pennsylvania	9.7	5.85	4.7	2.51[a]	1.20	1.34
Rhode Island	8.4	5.35	3.8	2.99	1.46	.92
South Carolina	5.4	3.35	2.1	1.51	1.37	1.37
South Dakota	10.5	6.05	1.3	2.75	.36	.36
Tennessee	10.7	5.7	1.6	2.45	.87	.73
Texas	8.36	4.36	2.0	1.67	.58	.60
Utah	8.0	4.45	2.1	2.75	.60	.73
Vermont	8.4	4.85	4.1	2.38	1.11	.89
Virginia	6.5	3.45	1.3	1.40	.84	.72
Washington	5.4	3.95	4.1	2.19	1.33	1.32
West Virginia	9.5	6.0	4.5	2.54	1.26	1.57
Wisconsin	10.0	5.55	4.9	2.87	.78	.83
Wyoming	8.75	5.0	3.2	2.52	.88	1.20

Source: Top maximum tax rates taken from Commerce Clearinghouse (CCH), Volume VI, All State Charts, (Chicago, Ill.: Commerce Clearinghouse, 1986). Top midrange tax rates computed at the Urban Institute based on the same CCH volume. The average actual tax rates for 1986 are taken from U.S. Department of Labor, "Preliminary Estimates of 1985 and 1986 Average Employer Contributiion Rates," Unemployment Insurance Program Letter No. 44-86, (Washington, D.C.: U.S. Department of Labor, June 26, 1986). Tax capacity is the product of the top midrange tax rate of this table and the 1986 taxable wage proportion as shown in Table 2. The cost rates used in the numerators of the ratios in the final two columns are shown in Table A of the Appendix.

[a]Includes employee taxes as well as employer taxes.

1948 and 1984 and the highest cost rate in the period from 1980 to 1984. The comparisons are made as ratios with ratios greater than 1.0 showing the states where past costs exceed 1986 tax capacity.

Since 1985 all states have legislated a maximum employer tax rate of at least 5.4 percent because of federal law. It is interesting to observe in Table 3 that forty-one jurisdictions have a 1986 maximum rate that exceeds 5.4 percent, and in many instances the top maximum tax rate exceeds 5.4 percent by a wide margin. The median for the fifty-one programs is 7.0 percent, and in nine states the top maximum rate exceeds 9.0 percent.

In any given year actual rates will be spread out over the full range of one specific tax schedule. Even after a succession of years with high benefit outlays and low (or negative) trust fund balances, many employers will continue to be taxed at rates considerably below the maximum rate. Because of this "fact" about the distribution of employer tax rates, the average effective tax rate has seldom approached the global maximum tax rate.[32] An approximation for the maximum effective tax rate is the midrange from the top tax rate schedule, i.e., the simple average of the minimum rate and the maximum rate from that schedule. It is a rough measure, but it recognizes there is a distribution of employer tax rates in each year.

The top midrange tax rate for each state appears in the second column Table 3. It falls below 3.0 percent in just three states and it exceeds 6.01 percent in just three states. For thirty-seven jurisdictions this rate lies between 3.01 and 5.0 percent, while for eight it lies between 5.01 and 6.0 percent.

Estimates of average actual tax rates for 1986 also appear in Table 3. For most states these rates are considerably lower than the estimates of maximum effective tax rates. The ratios of the actual rate to the top midrange rate show wide variability. Seventeen are less than .5 while only ten are as high as .8. Most states in 1986 could impose much higher tax rates within the existing framework provided by their current tax rate structure. Of the ten states where the ratio of the actual rate to the top midrange rate is .8 or higher, six were major borrowers in the 1980s and two required small loans, i.e., less than 1 percent of 1979 total payrolls. Generally, the states where actual tax rates approach maximum effective tax rates in 1986 are states that have experienced UI financing problems in the 1980s.

Note also in Table 3 that the average actual tax rate exceeds the top midrange tax rate in only two states (Illinois and Washington). This may be evidence that the top midrange tax rate is a reasonably accurate estimate of a state's maximum effective tax rate. More work would need to be done to confirm this conjecture.

An estimate of tax capacity for each state appears in the fourth column of Table 3. This is the product of the top midrange tax rate from the second column and the 1986 taxable wage proportion from Table 2.[33] Tax capacity for most programs (thirty-seven of fifty-one) falls in the range of from 1.25 to 2.49 percent of total payrolls. It exceeds 3 percent of payrolls in just two programs (Idaho and Montana) and ranges from 2.75 to 2.99 percent of payrolls in six other states (Alaska, Hawaii, Rhode Island, South Dakota, Utah and Wisconsin). High tax capacity is achieved by varying combinations of high maximum effective tax rates and high taxable wage proportions. Six of the eight with tax capacity above 2.75 percent have taxable wage proportions that exceed .55 while maximum effective tax rates exceed 5.0 percent in three programs. The lowest estimates of tax capacity are found in Florida (1.21 percent) and Nebraska (1.15 percent).

Tax capacity is less important as an absolute measure than as a relative measure to be compared with the potential benefit outflow that a state could experience. Two benefit outflows discussed earlier have been selected; the second highest twelve month cost rate ever experienced between 1948 and 1984 and the highest cost rate during the 1980-1984 period. The former is viewed as a type of long-term historic high cost rate while the latter reflects only more recent cost experiences. Each of these cost rates has been divided by the tax capacity estimates and the ratios appear in the final two columns of Table 3. Higher ratios identify the states where historic cost rates exceed tax capacity.

Both sets of ratios display a wide range of variation. Almost exactly half of the ratios based on the 1948-84 costs (26 of 51) are 1.0 or larger but only eight are 1.4 or larger. Long term high-cost rates do not exceed 1986 tax capacity by wide margins in many states under this specific measure of long term high costs.

More interesting in light of recent insolvency problems is a comparison of high costs in 1980-84 with tax capacity. The highest cost rate in 1980-84 exceeded 1986 tax capacity in twenty states. In four states (Illinois, Louisiana, Ohio and West Virginia) the ratio of highest 1980-84 costs to tax capacity exceeded 1.5. All four required very large loans during the 1980-85 period, e.g., loans that exceeded 5 percent of total 1979 payrolls. The very high levels of these four ratios occur despite the fact that maximum tax rates and/or the taxable wage base were raised by solvency legislation of the 1980-83 period in each of these four states. Of the three states where the ratio ranged from 1.35 to 1.49 (Michigan, Oregon and South Carolina) two required loans during 1980-85, and in Michigan the loans exceeded 5 percent of total

1979 payrolls. Only six states have needed loans in excess of 5 percent of total 1979 payrolls during the 1980s. Five have (high cost to tax capacity) ratios greater than 1.35 in the final column of Table 3 and the sixth (Pennsylvania) has a ratio of 1.34. Thus, very high ratios of highest 1980-84 costs to tax capacity provide one reliable indicator of the states experiencing the most serious funding problems in the 1980s. Unless they make significant additions to tax capacity (or reduce benefit availability) they could well experience renewed solvency problems if they experience another serious recession in the late 1980s.

The final two columns of Table 3 also provide a vivid illustration of the improvement in economies of northeastern states during the 1980s. For all six New England states and two of three Middle Atlantic states (New Jersey and New York but not Pennsylvania), the ratios based on highest costs for 1980-84 are much smaller than the ratios based on second highest costs for the entire 1948-84 period. In fact, for eight of the nine states the ratio in the fifth column of Table 3 is larger than 1.0 while it is smaller than 1.0 in the sixth column. Tax capacity exceeds the high cost rate from the 1980s in all these states. Low unemployment and low benefit cost rates in the 1980s have allowed eight of the nine states to repay their earlier loans and to accumulate substantial trust fund reserves.

Problems of insolvency in State UI programs also depend on initial trust fund balances and the responsiveness of tax receipts to declining trust fund balances. From Table 3, however, it is obvious that the high cost to tax capacity ratios also provide useful information on the states that may experience problems of insolvency.

The responsiveness of UI taxes to benefit outflows can be viewed as having two elements, tax base responsiveness and tax rate responsiveness. There is almost a complete absence of institutional features in UI programs that cause the tax base to respond to low and/or declining trust fund balances. Missouri has a tax provision that automatically raises the taxable wage base by $500 in years when the fund balance falls below $100 million and reduces the tax base by $500 when the fund balance exceeds $250 million.[34]

The only widespread feature of automatic tax base responsiveness is the response to inflation that occurs in states with indexed tax bases. Indexation causes the taxable wage proportion to remain constant in those states when money wages increase. Elsewhere, inflation causes the taxable wage proportion to decline and places an increasing burden on the tax rate structure to ensure that tax revenues are sufficiently responsive to benefit outflows. On average, states with indexed tax bases tend to have more responsive tax systems. Because their taxable wage proportions are generally higher than average, a given change in the average statutory rate produces proportionally larger tax response in these states than in the states without indexation.

Several statutory features cause UI tax rates to respond to changes in the fund balance (or changes in the benefit outflow). Tax rates are determined at least once a year in all states. The most common arrangement is to use the trust fund balance as of June 30th to select the tax schedule that will apply for the twelve months starting on January 1st of the next year. In most states the tax statute provides for several tax rate schedules with a lower fund balance activating a higher schedule of rates. Individual employer rates are then fixed according to the employer's account balance (in reserve ratio states) or the rate of employer benefit payments (in flow-based experience rating systems).

Although the lag between tax schedule determinations and the implementation of the new tax schedules is typically six months, several states achieve shorter lags by evaluating trust fund balances at later points in the year, i.e., October 31st and even December 31st, for tax rates to be levied on the following January 1st. In 1986, for example, seven states had a three-month tax implementation lag while seven states had a zero lag.[35] Greater tax rate flexibility can also be achieved by changing tax rates more frequently than once every twelve months. Tennessee reviews its rates every six months, and New Hampshire can change rates every three months. Shorter tax implementation lags and more frequent tax rate changes both enhance tax responsiveness in UI programs.

Tax responsiveness is increased when the individual tax schedules are structured so that they cover a broader range of average effective tax rates. The broader range of average effective rates can be achieved by having the maximum tax rate be substantially higher for each adjacent tax schedule that is activated by successively lower overall trust fund balances. Although it works against experience rating at the micro level, greater responsiveness of average effective tax rates can also be achieved through setting successively higher minimum tax rates in the same progression of tax schedules. From the standpoint of assessing tax responsiveness, changes at both ends of the tax schedule must be considered. Individual states with multiple tax schedules follow a variety of practices in the determination of minimum and maximum rates. In many states the range of tax rates actually declines when a higher tax schedule goes into effect. This promotes greater responsiveness of average effective tax rates, but it works against experience rating for those employers with favorable experiences.

Tax responsiveness is also affected by way that the tax schedule triggers are denominated. In most states the triggers are given as absolute dollar amounts, as specific proportions of payrolls or as reserve multiples.[36] When a state economy experiences real economic growth and/or inflation, the potential liability to pay benefits will grow apace. Thus, to enhance the long term growth in the trust fund it is more appropriate to have these triggers denominated in terms of reserve ratios or reserve multiples rather than in absolute dollar amounts. In 1986 six states still used dollar amounts in their tax schedule triggers.[37]

Tax rate limiters and writeoffs of negative balances (in reserve ratio states) both inhibit tax responsiveness. Limiters constrain the maximum year-to-year change in an employer's tax rate. Wisconsin currently is the only state with a limiter. Tax rates in Wisconsin can change by no more than two percentage points per year for any employer. In the early 1980's Wisconsin and Michigan both had limiters, but solvency legislation of 1982-83 changed the limiters in both states.[38]

Writeoffs are a forgiveness feature applied to certain employers with very large negative trust fund balances. Negative balances above a certain size are reduced (written off) to a smaller size at the end of each tax year. This represents permanent forgiveness for a part of the excess of benefit payments over tax payments, and the difference is paid by other covered employers through a common tax. Ten states including six of the largest states still allow writeoffs.[39]

A final feature that affects tax responsiveness is the length of the averaging period used to set tax rates in flow-based experience rating systems. Typically, a benefit ratio state will use three prior years of benefit experiences to determine employer tax rates. High benefit payments in a recession year like 1982 will affect tax rates in three subsequent years (either 1983-85 or 1984-86). In general, the longer the averaging period the smaller the short run responsiveness of tax rates to benefit outflows. Florida and Alaska both use one year averaging periods and have the most responsive tax rates of all of the flow based experience rating systems. Illinois, which has a two-year averaging period, has the next most responsive tax structure. Tax rate structures of below average responsiveness are found in states with four-year averaging periods (Utah, Virginia and Washington). Least responsive are Michigan and Minnesota which use five-year averaging periods. Note that the flow based experience rating systems generally have longer lags between the time of benefit outflows and the full response of tax rates than the lags in reserve ratio systems where outflows lower fund balances and affect tax rates fully in the next tax computation year.

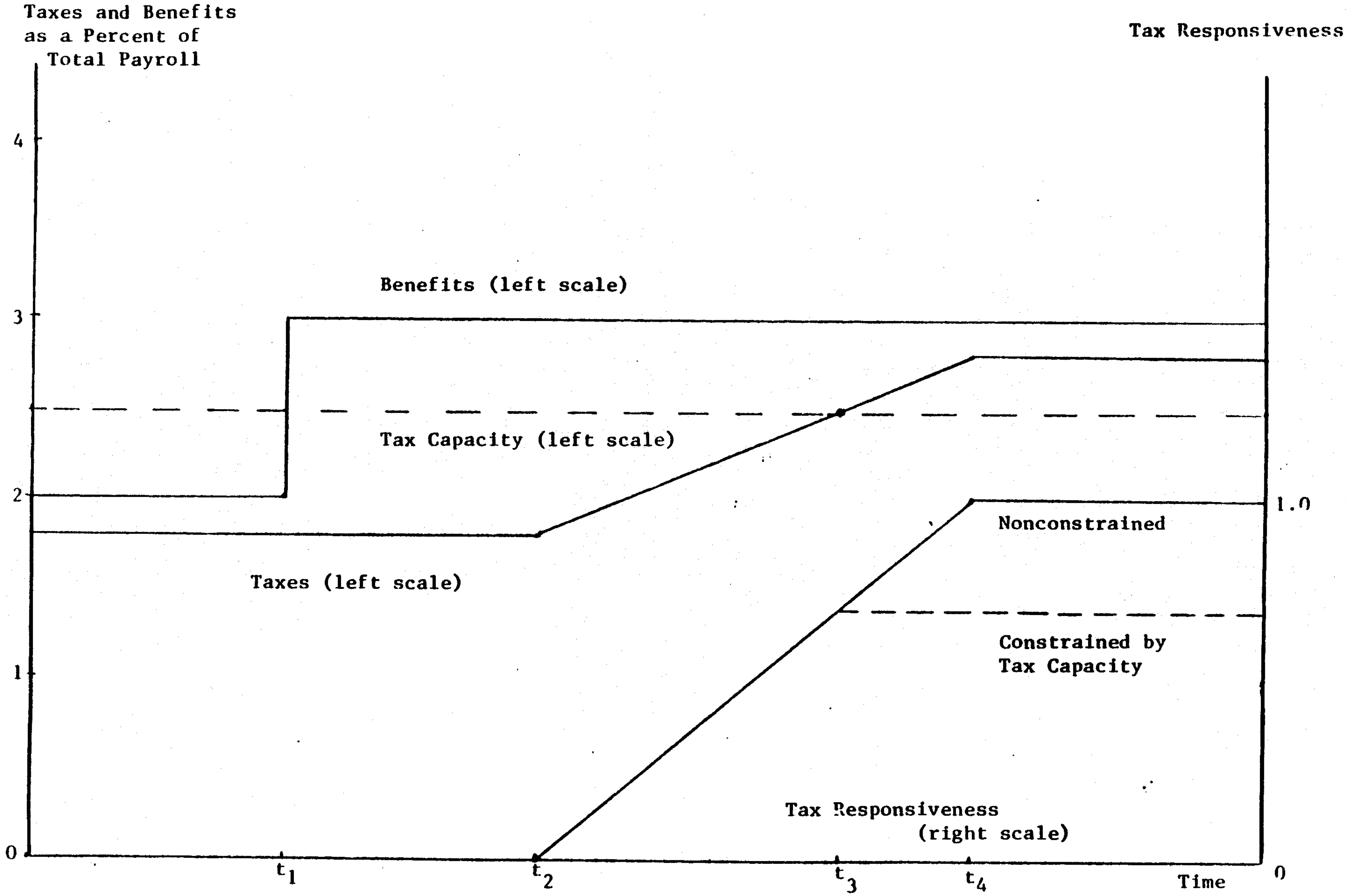
From the preceding it is clear there are many facets of tax responsiveness. More responsive tax structures are characterized by shorter lags in the implementation of tax rate schedules, higher taxable wage proportions, broader ranges of tax rates, an absence of writeoffs and (in flow based experience rating systems) shorter averaging periods.

Although there are several distinct facets of tax responsiveness, they all enter into one summary measure of responsiveness; i.e., the change in the effective tax rate in response to a change in the benefit outflow. Because of lags this tax responsiveness is not a single number but rather a measure with an important time dimension. Figure 4 gives a visual representation of tax responsiveness. The figure depicts a sustained change in the outflow of benefits (rising from 2 percent to 3 percent of covered payrolls at time t_1) as well as the time path of tax payments and the time path of the tax responsiveness elasticity. In the very short run this elasticity must be zero due to the lag in implementing the revised schedule of tax rates. A tax response starts to occur at time t_2 and eventually (at t_4) the tax payments in this hypothetical example respond fully to the change in the benefit outflow. The time path of the tax responsiveness elasticity is also depicted in Figure 4. It is zero from t_1 to t_2, gradually increases from zero to unity between t_2 and t_4 and remains at unity after t_4.

In individual states actual tax responsiveness will vary in three important ways. (i) The t_1-t_2 lag will be of differing duration. (ii) The time paths over the t_2-t_4 interval will have differing shapes (not necessarily a smooth and gradual increase as shown in the figure). (iii) The long run elasticity at t_4 will not necessarily equal unity. All three elements of tax responsiveness will be influenced by the various features of the state's tax system as discussed previously.

Tax responsiveness will not necessarily be the same in response to increases and decreases in the benefit outflow. Following an increase in benefit payments the capacity of the state's tax structure may limit the response of UI taxes. If, for example, tax capacity equal to 2.5 percent of payrolls were to be added to Figure 4, taxes could not respond as shown (by the solid lines) because tax capacity would be reached at time t_3 and further tax increases could not take place under the existing tax structure. This upper limit may be reached after a big increase in the benefit outflow leading

Figure 4. Tax Responsiveness for a Hypothetical State UI Program



to a sustained drain on a state's trust fund and necessitating a statutory change to increase tax capacity and/or to reduce the benefit outflow. Thus the constraint imposed by tax capacity may influence tax responsiveness causing it to be smaller for an increase than for a decrease in the benefit outflow.

The features of a state's tax system as illustrated by Figure 4 reflect the provisions of the state's current tax statute. The response of taxes to a change in benefit outflows occurs automatically. It is also possible for a state to enact additional changes in its tax statute as its fund balance changes. Although discretionary changes would also affect fund balances and solvency, they are much more difficult to model or to predict. The need for such discretionary changes is reduced when a state already has high levels of tax capacity and tax responsiveness.

Empirical evidence is needed in order to assess the relative importance of the various tax features that can affect tax capacity and tax responsiveness. One analysis of the project used a simulation model (See Chapter IV) to explore tax capacity and tax responsiveness in some detail.

III. Guidelines and Analyses of Fund Adequacy

A. The 1.5 Reserve Ratio Multiple

As a guideline for assessing the adequacy of trust fund reserves UI policy makers and practitioners frequently measure their fund balance in terms of a "reserve ratio multiple" or simply a reserve multiple. This measure provides a rule of thumb useful for gauging the size of reserves relative to the potential demand for benefits that could occur in a recession. The reserve multiple was first developed at the U.S. Department of Labor, but it became more widely known after being examined and publicized by a benefit financing committee of ICESA, the Interstate Conference of Employment Security Agencies (1959). The multiple is a quotient that is computed from two ratios. The denominator is UI benefit payments as a percentage of total covered payrolls in the highest cost twelve month period (not necessarily a calendar year) while the numerator is total net reserves at the end of the current year expressed as a percentage of total covered payrolls for the year. If, for example, a hypothetical state's highest cost year had benefit outlays equal to 2 percent of total payrolls and if current payrolls were $30 billion, it could expect as much as $600 million in benefit payments should the current year have a recession as serious as that of the high cost year.

The ICESA committee recommended that a reserve multiple of from 1.5 to 3.0 was needed for trust fund adequacy. Although neither ICESA nor the U.S. Department of Labor have formally adopted a specific numeric standard to be used by UI programs in judging fund adequacy, a 1.5 reserve multiple is often used as a guideline in assessments of minimum reserve adequacy. The state in the previous hypothetical example would need a trust fund balance of $900 million to meet this actuarial guideline.

In developing the 1.5 reserve multiple guideline the ICESA committee utilized benefit cost data from the recessions of 1949, 1954 and 1958. There were three important elements in the committee's analysis (ICESA (1959), p.22). (i) The cost rate measured benefits as a percentage of total payrolls, not as an absolute dollar amount or as a percentage of taxable payrolls. The committee reasoned that measuring benefits relative to total payrolls provides a more reliable cost indicator than the other two because it accounts for cost changes that arise from changing employment levels and changing levels of money wages. (ii) In the three recessions that were studied the heaviest drains on trust funds occurred over periods of about twelve months (periods that did not always coincide with given calendar or fiscal years), and total recession-related outlays were about one and one-half times the costs incurred in the highest cost twelve-month period. (iii) Under this analysis, if a state achieves a 1.5 multiple before the onset of a recession it would have sufficient reserves to last through the recession without exhausting the trust fund and without needing to increase taxes until the subsequent economic recovery has commenced. This level of reserves would allow the UI program to provide the greatest amount of countercyclical stimulus, i.e., benefits rise in the recession but taxes do not respond until the recovery has set in.

From the perspective of the mid 1980s three critical comments about the ICESA committee's reasoning can be offered. (i) The past may not provide useful guidance in planning for future high cost twelve-month periods. Future high cost years will deviate from previous high cost years if the level of state unemployment is different, if UI eligibility and/or potential benefit duration are different, or if the level of weekly benefits (relative to weekly wages) is different. (ii) The multiplier of 1.5 that relates total recession-related costs to costs in the high cost year may be incorrect. In both the mid 1970s and the 1980s recessions have been longer than they were prior to 1960. (iii) The 1.5 multiple ignores the responses of taxes to the decline in the UI trust fund balance. This response varies from state to state, and in all states it is larger in recessions of longer duration. These considerations imply that the 1.5 multiple can give misleading signals when applied to specific circumstances.

Other limitations of the 1.5 reserve ratio multiple guideline are suggested by the following example. Consider the hypothetical state of the earlier discussion with covered payrolls of $30 billion and a high cost rate equal to 2 percent of payrolls. If the UI fund satisfied the 1.5 multiple the current balance would be $900 million. Further, assume that the tax and benefit flows are initially equal at one percent of payrolls (and that interest accruals are small enough to be ignored).

If the state now experiences a serious recession and the benefit outflow from the trust fund increases to 2 percent of payrolls, the annual outflow would increase from $300 million to $600 million. Suppose further that the benefit outflow remains at this high cost rate for three years and that tax rates do not respond as the fund balance declines. Even though the benefit costs in this recession are three times (not 1.5 times) the single year's high costs, the fund balance does not reach zero until the end of the third year of recession. Any lessening of the benefit payout rate or any response of taxes would cause the fund balance to still be positive at the end of year three.

Obviously many other time paths of taxes and benefits could be hypothesized, and some would cause insolvency to occur before the end of year three. The point of the example is to show the importance of the initial inflow and outflow in determining the risk of insolvency. The fund balance must be large enough to cover the increment in the benefit outflow that occurs in the recession, not the total level of costs. Under the 1.5 multiple guideline the $900 million initial trust fund balance is large enough to cover three years of incremental costs (at $300 million per year) where each year has the full increment over base period costs.

The 1.5 multiple is a very conservative fiscal guideline. If a state satisfies the guideline it can experience a prolonged period of high costs and still avoid insolvency even when its tax structure responds only slowly to increased benefit outflows. Many UI practitioners regard the 1.5 reserve multiple as a desirable target to strive for but feel that insolvency can be avoided with fund balances of much smaller size. Since the mid 1970s very few states have achieved fund balances that satisfy the 1.5 reserve multiple guideline.

Despite its limitations the 1.5 reserve multiple is useful for identifying states that may experience insolvency. Table 4 presents data on the distribution reserve multiples at the end of 1969, 1979 and 1985. For both the 1972-79 and the 1980-85 period the table also shows the total number of states that borrowed and the number that were "major" borrowers, i.e., needing loans that exceeded one percent of covered payrolls. Because the UI program in the Virgin Islands started in 1978, the data from the 1970s refer to fifty-two programs while later data refer to all fifty-three programs.

The loss of reserve adequacy during the 1970s is clearly illustrated in Table 4. In 1969 only one state (Michigan) had a reserve multiple of less than 1.0, and only sixteen other programs had multiples between 1.0 and

Table 4. Distribution of Reserve Multiples 1969, 1979 and 1985 and State Borrowing in the 1970s and 1980s

	Reserve Ratio Multiple						
	<0	0-.49	.50-.99	1.00-1.49	1.50-1.99	2.00 & above	Total
Reserve Positions at the End of 1969							
Number of States	0	0	1	16	15	20	52
Number that Borrowed 1972-79	NA	NA	1	13	8	2	23
Major Borrower 1972-79[a]	NA	NA	1	8	4	1	14
Proportion that Borrowed	NA	NA	1.00	.81	.53	.10	.46
Proportion that were Major Borrowers	NA	NA	1.00	.50	.27	.05	.27
Reserve Positions at the End of 1979							
Number of States	12	11	17	11	2	0	53
Number that Borrowed 1980-85	11	9	10	2	0	NA	32
Major Borrower 1980-1985[a]	4	5	5	1	0	NA	15
Proportion that Borrowed	.92	.82	.59	.18	0	NA	.60
Proportion that were Major Borrowers	.33	.45	.29	.09	0	NA	.28
Reserve Positions at the End of 1985							
Number of States	9	15	18	10	1	0	53

Source: Reserve multiples at the end of 1969 and 1985 estimated at the Urban Institute. Data for 1979 taken from U.S. Labor Department Unemployment Insurance Financial Data (Washington, D.C.: GPO, 1984). Data refer to the fifty states plus the District of Columbia, Puerto Rico and (from 1979) the Virgin Islands.

[a]Major borrower defined as a state where loans during 1972-79 exceeded 1 percent of payrolls in 1975 and loans during 1980-85 exceeded 1 percent of payrolls in 1979.

NA Not applicable as there were no states whose reserve multiples fell in this range.

1.49. The remaining thirty-five had multiples of 1.5 or larger. By 1979 only two states (Kansas and Mississippi) had reserves that satisfied the 1.5 multiple guideline. Forty programs had multiples that fell below 1.0 in 1979 and of these twenty-three had multiples below .5.

The probability of insolvency is strongly associated with the level of the reserve ratio multiple in both the 1970s and the 1980s. Fourteen of the seventeen states with multiples below 1.5 in 1969 needed loans between 1972 and 1979 and nine were major borrowers. Note that eight of the fifteen with multiples from 1.5 to 1.99 also needed loans. Thus satisfying the 1.5 multiple guideline does not mean that solvency is assured over a ten year period when that period has high unemployment as in the 1970s.

The probability of insolvency and the probability of major borrowing in the 1980-85 period were both closely tied to the reserve ratio multiples as of the end of 1979. Both probabilities decline sharply as one moves from left to right in the indicated rows of Table 4. The probability of borrowing was .92 for states that entered the 1980s with negative net reserves but it was only .18 for states whose reserve multiples fell into the 1.0-1.49 range.

Two other aspects of Table 4 should also be noted. First, observe that for a given range of reserve multiples the probability of borrowing was much lower in 1980-85 than in 1972-79. In the 1.0-1.49 range, for example, the probability of insolvency was .81 in 1972-79 but only .18 in 1980-85. For a given reserve multiple states were much less likely to experience insolvency in the 1980s than in the 1970s. Much of the difference is due to the increased costs of indebtedness in the 1980s and increased certainty of incurring those costs in the 1980s. Because states face a certain prospect of paying interest on UI loans, they have been more willing to enact solvency legislation in the 1980s when fund balances have been reduced towards zero. Second, observe how similar the distribution of reserve multiples was at the end of 1985 compared to 1979. Despite the rapid trust fund building that took place in 1984 and 1985, the states are now in about the same overall reserve position as at the end of 1979. Another serious recession as in the early 1980s would undoubtedly be accompained by widespread insolvency and major borrowing activities by state UI programs.

Overall, the data in Table 4 show that reserve multiples provide a useful but far from in infallible guideline for assessing the probability of insolvency in individual states.

The 1.5 multiple guideline continues to be used at the U.S. Department of Labor in its assessments of reserve adequacy. An illustration of this is provided by an Unemployment Insurance Program Letter on reserve adequacy sent to the states in 1981. After noting there is no single definition of reserve adequacy, this document stresses that the 1.5 multiple provides "an indication of a base minimum of reserve adequacy" (U.S. Department of Labor (1981), p2). It is interesting to note that several states fell below this "base minimum" in 1979 but did not experience insolvency in the subsequent recessions of 1980 and 1981-82.

B. State Perspectives on Solvency

In the 1980s the states have increasingly come to realize that maintaining solvency is exclusively a state responsibility. Unlike the situation of the 1970s debtor states no longer have serious expectations of fiscal assistance from the federal government under cost sharing and/or cost reinsurance arrangements. Debtor states now pay interest on federal loans, and FUT penalty taxes (reduced tax credit offsets) are levied on outstanding loans more than two years old. The terms of these debt-related costs are not likely to change in the near future.

Given the increase in state fiscal accountability it would seem likely that the states would devote some resources to the development of their own solvency guidelines. Besides the 1.5 reserve ratio multiple there could be other solvency guidelines particularly suited to the circumstances of individual states. To investigate this question, an informal phone survey was conducted in eight states.[40] Professional staff from the actuarial offices and/or economic analysis offices in the UI agencies were asked to describe how their states make judgments regarding trust fund adequacy.

The phone interviews were unstructured, but several common themes did emerge. (i) All states were aware of the 1.5 reserve ratio multiple guideline and viewed it as providing a desirable target. If this level of reserves were achieved they felt their state would be able to remain solvent for any upcoming recession short of a recession of unprecedented magnitude. (ii) Although it provided a desirable target, the absolute level of the trust fund implied by the 1.5 multiple was too large to be politically attainable. Before that level of reserves could be achieved the pressures to cut taxes would be so strong as to make tax cuts a certainty. (iii) Most states felt that the level of reserves implied by the 1.5 multiple guideline was larger than would be needed in a recession. Many felt that their high cost base period would exceed the cost rate of future recessions by a sizeable margin and/or that their tax system was now more responsive than in the past. Achieving a reserve multiple of 1.0 was felt to be more realistic, i.e., it satisfied minimum actuarial needs and also was attainable within the constraints posed by states' political processes.

Note that all of the preceding comments center around the 1.5 reserve multiple. They do not raise fundamental questions about the usefulness of this basic construct, but rather argue for a number that is smaller than 1.5 in actual application. None of the phone interviews turned up an alternative type of solvency guideline currently being used in the eight states.

Only one of the states, New York, supplied any written material on solvency, and that was a two-page memo written in 1983. Two points in the memo have already been covered by the earlier discussion. First, recent cost experiences (the recessions of 1980 and 1981-82) are more relevant than are earlier (1975-76) cost experiences because the industrial structure of the New York economy now has a lower concentration of jobs in the cyclically sensitive manufacturing and construction industries. Second, to provide reasonable protection against insolvency in a recession like that of 1981-82 the fund should be capable of financing benefits for about 15 months. The level of reserves implied by these two considerations was $1.6 billion as opposed to $3.5 billion implied by a strict application of the 1.5 multiple applied to the earlier high cost experience from 1975.

In summary, discussions with the states did not turn up a major alternative to the reserve ratio multiple in providing a basic framework for assessing state solvency. Modifications of the 1.5 multiple guideline have been made by the states. The effect of the modifications is to yield lower targeted levels for trust fund balances than the levels implied by the 1.5 reserve multiple.

C. Earlier Literature on Fund Adequacy

Although it has been obvious since the mid 1970s that UI programs are having funding problems, this has not stimulated a substantial literature on trust fund adequacy. From research supported by the UI Service of the U.S. Department of Labor and by the National Commission on Unemployment Compensation, four analyses of fund adequacy have been selected for review. Because they followed contrasting methodologies, however, the four can not easily be compared. The approach taken here is to summarize the four and then offer some concluding comments.

One analysis of UI trust funds was conducted by Bowes, Brechling, and Utgoff (1980). They recognize three important components in a state's utility function for determining the optimal level of the trust fund balance. (i) Because of the opportunity cost of monies held as trust fund reserves utility falls as the average fund balance increases. (ii) An increase in the probability of insolvency lowers utility. This probability falls as the average fund balance is higher and as the variance in the fund balance is lower. (iii) States, even those that rely most heavily on experience rating, can choose to exercise a high degree of tax smoothing, i.e., maintaining year-to-year stability in their tax rates. As the degree of tax smoothing increases, the UI program exerts a greater countercyclical impact and utility is increased.

Key elements in this analysis are the parameters of the state's UI tax schedule (the minimum tax rate, the slope of the tax schedule, the range of experience rated tax rates and the penalty tax rate for employers with negative fund balances). Their research included theoretical and empirical analyses of how the parameters of the tax schedule can be altered to reduce inefficiencies in the UI system, i.e., to increase the utility of at least one of the arguments in the utility function without lowering utility in any of the other arguments. Their empirical analysis was conducted using three distinct types of models to characterize the behavior of actual and hypothetical UI programs. Unfortunately, they did not find many examples of tax parameter changes that unambiguously increased utility in all three models.

Although the framework and methodology of this research is founded in the neoclassical constrained maximization paradigm used by most economists there are three points to note. First, the mean and the variance of the trust fund balance each enter two different arguments in the utility function and with opposite signs. Thus, if a state changes its tax schedule in a way that reduces year-to-year changes in employer tax rates, the variance of the fund balance will rise and increase the probability of insolvency (lowering utility), but at the same time this change will also increase the UI program's degree of tax smoothing (raising utility). Because of these offsetting effects it is not possible in most situations to know how a change in the mean or the variance of the fund balance affects utility. Second, their research focused primarily on parameters of the tax schedule. Less attention was given to behavioral relationships determining insured unemployment, average weekly benefits and the taxable wage base. State laws can affect these variables as well as the parameters of the tax schedule. All are important for understanding the behavior of the average trust fund level and trust fund variability. Third, the empirical work was conducted using a data period that ended in 1977. Some aspects of state behavior have been changing since the mid 1970s, and these changes need to be recognized if future trust fund behavior is to be accurately modeled.

Freiman (1980) developed a model based on aggregate UI program data and used it to examine both trust fund financing problems of the mid 1970s and possible future financing problems in the 1980s and 1990s. He fitted multiple regressions to annual time series data for the years 1948 to 1974 to obtain parameters for the model's equations including the tax rate equation. The tax rate depended on the lagged tax rate, the lagged trust fund reserve ratio and a UI loan ratio (total loans as a percent of taxable payrolls). When the model was then used to simulate the years 1975-1977, he found that the tax equation made substantial overpredictions so that the simulated volume of UI loans was much less than actual loan disbursements of the three years. Freiman concluded that a major reason for the large loan volume of of 1975-1977 was the small response of UI taxes (both tax rate and tax base increases) to declining reserve balances of these years.

Freiman's analysis emphasized how high inflation causes financing problems for UI programs. In many states maximum weekly benefits rise with inflation while the taxable wage base does not respond. This causes tax revenues to grow more slowly than benefit payments in periods of high inflation.

He also used the model to conduct simulations of UI trust fund balances in the 1980s and 1990s. In each of his long run simulations the UI system eventually encountered problems of fund inadequacy, due largely to the fact that benefits grow automatically with inflation and productivity growth while the tax base lags behind. Occurrences of high unemployment and/or high inflation, however, caused the funding problems to arise sooner. Given the high unemployment and high inflation that the U.S. economy experienced in the early 1980s, the funding problem predicted by his simulations became real experiences for many states.

This analysis is useful both for showing how the funding problems of the mid 1970s arose and how UI was exposed to a repetition of these problems in the 1980s. Because it was an aggregative analysis, however, it could not provide guidance to individual states as to the level of reserves needed to avoid insolvency, and Freiman did attempt to provide aggregate solvency guideline. His analysis was most useful for showing the harmful consequences of having a dynamic (indexed) benefit structure coupled with a static (nonindexed) tax base.

An alternative to the 1.5 reserve ratio multiple for assessing trust fund adequacy was developed in the mid 1970s at the South Carolina Employment Security Commission (1976). Like the 1.5 multiple the South Carolina analysis yields a solvency standard against which a state's current trust fund balance can be compared. The South Carolina standard is easily understood and it can be computed from data routinely collected in a state's UI program.

There are three essential ideas in the South Carolina analysis of fund adequacy. (i) A UI program should strive to have stable tax rates. If the excess of taxes over benefits in prosperous periods matches the deficit of recession years, the state can cover its costs without needing to have fluctuating tax rates. Stable tax rates cause the UI program to impart the maximum countercyclical stimulus to the economy. (ii) The required level of reserves (termed maximum reserves in the South Carolina analysis) must be sufficient to cover all outlays that will occur over a business cycle. Required reserves are computed as the product of three factors; (1) business cycle duration (in years), (2) the average annual cost rate (benefits as a percent of total payrolls) over the business cycle and (3) the state's exposure to UI costs (the highest level of total payrolls). (iii) Fund adequacy is assessed by comparing the ratio of actual reserves to required (or maximum) reserves. If actual reserves equal or exceed required reserves the state knows it can pass through a recession without having to raise taxes.

Besides these three key elements there are certain other aspects of the South Carolina analysis to be noted. (i) They advocate a system of array allocation for assigning tax rates to individual employers. Under array allocation the cost experiences of individual employers are ranked relative to average experience, and employers are assigned to tax categories where each category contains a fixed percentage of overall taxable wages. Array allocation ensures that the aggregate ratio of tax receipts to taxable payrolls is stable from one year to the next. (ii) They advocate having a flexible (indexed) tax base. (iii) They stress the need for periodic reevaluation of the factors that contribute to UI benefit costs. This is done to ensure that historic cost rates remain appropriate for the current period. (iv) They recognize a tradeoff between the level of the fund balance and the stability of tax rates. A state may choose to maintain a lower average balance if it is willing to change rates during the business cycle, i.e., to raise rates following an economic downturn.

Questions can be raised regarding the reliability of the South Carolina procedures for estimating a state's reserve requirements. How long is the period for measuring the length of the business cycle? Do past cost experiences provide a reliable guide for assessing future costs? If a state experiences a longer and/or a deeper recession than in the past, its reserves may be inadequate even if they satisfy the level specified by the South Carolina guideline. Of course, the 1.5 reserve multiple would also give misleading signals as to reserve adequacy if a future recession were longer and/or deeper than past recessions.

To evaluate the South Carolina guideline relative to the 1.5 multiple multiple it is instructive to calculate the level of reserves deemed adequate under the two. In one analysis (South Carolina Employment Security Commission (1976), Chapter III) they estimate that required reserves for June 30, 1975 were $254.9 million. This calculation was made as follows, (i) business cycle duration--4 years, (ii) high cost rate for four consecutive years--1.08 percent (1955-1958) and (iii) exposure (1974 total payrolls)--$5.900 billion. The actual fund balance at the end of June 1975 was $130.9 million or 51 percent of its required balance. Under the 1.5 reserve multiple calculation the highest cost rate prior to 1975 was the rate in 1954 of 1.54 percent. Using the same $5.900 billion of total payrolls causes the target fund balance to be $136.3 million under the 1.5 reserve ratio multiple guideline.

Thus the South Carolina guideline yields much larger reserve requirements than does the 1.5 reserve ratio multiple. This is hardly surprising since the fund balance is to equal four years of benefits at a four year average cost rate rather than 1.5 years of benefits at a twelve month high cost rate. It should also be obvious that the difference in the two target levels for fund balances will be proportionally larger in states that have less severe cyclical cost experiences. Since the states do not now come close to meeting the 1.5 multiple guideline, the South Carolina guideline is even less attainable. It seems unlikely that any state would implement the South Carolina guideline and actually maintain a fund balance equal to four years of benefit outlays.

Baskin and Hite (1977) produced a lengthy report on fund adequacy under a U.S. Labor Department contract. Of the report's four chapters (I-Historical

Summary, II-The 1.5 Reserve Adequacy Rule, III-Alternative Reserve Adequacy Rules and IV-Recommendations) the analysis of their Chapter III is of most interest. They investigate the relative effectiveness of four rules that could determine trust fund balances. Relative effectiveness is judged by the ability of each rule to prevent insolvency during recessions, i.e., borrowing because the trust fund has been exhausted.

The study uses a simulation methodology where annual data from individual states for the 1951-1976 period are the units of observation. Historic data on state tax collections and benefit payments are used and downturns are defined as periods (of one or more conservative years) when the trust fund balance declines.[41] During the 1951-75 period they identify a total of 365 downturns across all programs.

At the start of each downturn the state's trust fund balance was set according to one of the following four rules: (i) the 1.5 reserve ratio multiple rule (where the high cost base year was the highest cost year actually experienced during the 1958-75 period), (ii) the highest cost rate experienced for two consecutive years, (iii) a reserve multiple rule where the multiple is the ratio of total covered wages to taxable wages in the preceding year (thus a multiple that rises between 1951 and 1975), and (iv) a combination rule. The latter allows the state to choose the most favorable from among the prior three rules for preventing insolvency in each downturn.

All rules were quite effective in preventing insolvency, but clear differences were found in their relative effectiveness. Respectively, the number of insolvencies under the four rules were 33, 10, 32 and 8. The percentage range of these numbers of insolvencies was from a high of 9.0 percent under the 1.5 reserve multiple rule to a low of 2.2 percent under the combination rule. Probably the most striking finding is that all four rules seem to be effective in preventing the need for borrowing by individual states.

The actual usefulness of the Baskin-Hite study can be questioned due to four methodological shortcomings. (1) Because the high cost year used was the highest one for the entire 1958-75 period the simulations assume a degree of foresight that the states could not be assumed to have. States could not reasonably be expected to set their reserves at the start of, say, 1954 on the basis of future high costs to be experienced in 1975. (2) In a similar vein, the combination rule is not really available to the states since it is determined in an ex post manner by the simulations and not on the basis of earlier state experiences. (3) There is no allowance for the possible responsiveness of tax collections (and benefit payouts) to reductions in trust fund balances. The initial trust fund balances, annual tax receipts and annual benefit payments are all treated as exogenous variables in the simulations. Among the most crucial research questions in determining appropriate fund balances, however, is the degree to which tax collections and benefit payments are endogenous, i.e., responsive to reductions in fund balances. (4) When the four rules are carefully compared they suggest one obvious conclusion. This conclusion is illustrated with data appearing in Appendix IIIA of their report. The appendix shows the cost rates for the base cost years underlying the 1.5 reserve ratio multiples and the two year cost ratios for each state as used in the simulations. In 42 of 51 states the latter is larger than the former by a ratio of more than 1.5 which means that the two year cost rule gives larger initial reserves in 42 of 51 jurisdictions. It is hardly surprising that use of the two year cost ratio produces fewer insolvencies, i.e., 10 as opposed to 33. A short summary of the study would be: larger reserves are more effective than smaller reserves in preventing UI fund insolvencies.

In conclusion, several final comments can be offered about the earlier literature on UI trust fund adequacy. First there are five critical comments. (i) The literature has not produced a major alternative to the 1.5 reserve ratio multiple as a useful rule of thumb for assessing fund adequacy. (ii) Although the possible existence of excessive fund balances is a theoretical possibility emphasized by Bowes, Brechling and Utgoff (1980), the record of large scale and widespread borrowing by the states makes it clear that the real problem is one of inadequate balances. (iii) Maintaining adequate reserves is exclusively a state responsibility in the 1980s. Therefore an aggregative analysis such as Freiman's (1980) does not provide guidance at the level where fiscal responsibility now resides. For example, his analysis does not show by how much the individual states should have raised their taxes in the mid 1970s to avoid insolvency. (iv) The South Carolina analysis provides needlessly conservative guidance on the target or required level of a state's fund balance. (v) The analysis of Baskin and Hite (1977) cannot readily be used by individual states because it incorporates information on future cost rates not known prior to specific downturns, and it completely ignores the response of UI taxes (and benefits) to reductions in the fund balance.

Two more positive observations are the following. (i) To help avoid insolvency problems states should apply indexing symmetrically to the tax and benefit sides of their programs. If the maximum weekly benefit is indexed then the tax base should also be indexed. This is stated explicitly by

Freiman and it is advocated by the South Carolina analysis. (ii) The South Carolina analysis is useful for emphasizing the total amount of benefit outlays that a state must finance over a complete business cycle. This recognition of both business cycle duration and average annual costs is not incorporated into the 1.5 reserve multiple solvency guideline.

IV. A Model of UI Trust Fund Balances

From the discussion of the preceding three chapters four conclusions can be drawn regarding the funding of UI programs in the states. (i) Funding inadequacy was a widespread problem in the recession of the mid 1970s and again in the downturn of the early 1980s. Borrowing to finance benefit payments was not only a common occurrence, but also the scale of the loans was large, i.e., frequently exceeding one percent of covered payroll by wide margins. (ii) There is no consensus as to what constitutes an adequate trust fund balance. (iii) Although the 1.5 reserve ratio multiple is widely recognized as a solvency guideline, the level of reserves implied by this guideline is rarely achieved. (iv) Finally, the 1.5 multiple has identifiable limitations that restrict its usefulness. The multiple does not recognize the pre-recession levels of tax receipts and benefit payments, the expected duration of the maximum benefit payout rate in a recession, and the automatic responsiveness of tax receipts to low and declining trust fund balances. As a result, it receives widespread lip service from UI practitioners, but it plays only a small role in actual UI policy decisions about taxes and benefit payments. Many feel that the 1.5 multiple is too conservative and too rigid as a solvency guideline. Solvency can be achieved with a smaller balance than suggested by the 1.5 multiple, but the size of the required balance depends on the specific features of the economies and the UI laws of individual states.

Assessments of UI trust fund adequacy can be made in more than one way. States may rely on rule-of-thumb solvency guidelines based on past experiences. The informal telephone survey of states summarized in Chapter III, however, failed to identify a major alternative to the 1.5 reserve ratio multiple as a solvency guideline. States may rely on projections from an econometric model to help assess fund adequacy. Reliance on econometric modeling is becoming increasingly widespread. The most widely used model is the State Benefit Financing Simulation Model (SBFSM) first developed for the UI Service of the U.S. Department of Labor (See Mercer Associates (1977)) and then enhanced by the UI Service. This model has been implemented in more than half of the states and it is scheduled for adoption in other states. It is a quarterly model that can make projections of state benefit payments, tax receipts and trust fund balances for ten year periods. The model is a large scale model and not user friendly in all respects. For many detailed investigations, however, it is the best available tool for examining solvency issues. (See Appendix C for a discussion of SBFSM model equations.)

This chapter presents a simple method that states with positive trust fund balances can use to assess the adequacy of their trust fund balance. Our goal in developing the Annual Simulation Model (ASM) as an alternative to the existing methods is to furnish an approach that provides a trade-off between simplicity and accuracy. The rule of thumb that states should maintain a large enough balance so that the reserve ratio multiple is at least 1.5 is very easy to implement, but it does not provide sufficient guidance on the adequacy of the trust fund balance nor does it indicate the extent to which a state is overfunded or underfunded. On the other hand, the State Benefit Financing Simulation Models (SBFSM) are capable of providing states with a great deal of detail on the likely patterns of taxes and benefits for up to 10 years and permit states to simulate how the trust fund will behave if the benefit or tax structure is modified.

The approach presented below is much simpler and easier to implement than the SBFSM approach, but it is only applicable to states with positive trust fund balances, and it does not provide the flexibility of the SBFSM to simulate how changes in state law will affect the long-term financial outlook for a state's unemployment insurance system. The ASM can show how a state's UI tax receipts will respond to changes in the trust fund level and benefit outflows. The model's tax equations incorporate features of tax capacity and tax responsiveness implied by the state's current UI tax statute. The ASM can be used in states with either reserve ratio or benefit ratio systems of experiencing rating. Starting with the current trust fund balance and using assumptions about future unemployment and projections of future taxes collected and benefits paid, the model projects the year in which the fund balance will turn negative.

In the interests of simplicity, the ASM omits certain aspects of the UI program. Specifically, the payment of Federal-State Extended Benefits (EB) and the repayment of loans from the U.S. Treasury both fall outside the scope of the model. Thus, the model is designed for a limited set of investigations. It can, however, address one of the most fundamental questions that states often ask: given the current trust fund balance, are reserves adequate to last through a future recession without the need for borrowing from the U.S. Treasury?

The ASM has three main parts or modules. In the first module the variables that characterize employment, unemployment, inflation and covered payroll in the state's economy are determined. The second module has the behavioral relations that describe the payment of annual UI benefits to unemployed workers. Finally, the third module contains the behavioral relations to characterize trust fund receipts, i.e., UI taxes and interest income. The next three major sections of the chapter respectively describe the three modules in more detail.

A key equation in the ASM is the trust fund identity shown as equation (1):

(1) $TF = TF_{-1} - Ben + Tax + Int$

where TF = the trust fund balance at the end of the current year,

TF_{-1} = the trust fund balance at the end of the last year,

Ben = UI benefit payments in the current year,

Tax = UI tax receipts in the current year, and

Int = interest receipts (from positive fund balances) in the current year.

This accounting identity holds in all years. A major focus of the model is to determine the exact future year when TF turns negative.

By making several simplifying assumptions and algebraic substitutions, an inequality can be developed to indicate if a state's current trust fund balance under current state law is large enough for the state to avoid borrowing for any number of years in the future. Because states most commonly use the reserve ratio or the reserve multiple as a time-invariant measure of trust fund size, we have expressed the inequality using these measures. Under the simplifying assumptions, which are described below, a state has an adequate trust fund through year t if either of the following two equivalent inequalities are met:

(2) $$RM_o > \Sigma\, IUR_t \frac{AWB_t\ (1+g)^t}{AWW_t\ (1+r)^t c} - \frac{TAX_t\ (1+g)^t}{TP_t\ (1+r)^t c},$$ or

(3) $$RR_o > \Sigma\, IUR_t \frac{AWB_t\ (1+g)^t}{AWW_t\ (1+r)^t} - \frac{TAX_t\ (1+g)^t}{TP_t\ (1+r)^t},$$ where

RM_o = the reserve multiple in the base year,
RR_o = the reserve ratio in the base year,
IUR_t = the insured unemployment rate in future year t adjusted to include only UI recipients,
AWB_t = the average weekly benefits paid in year t,

AWW_t = average weekly wages in year t,
c = the cost rate criterion (the denominator in the reserve multiple) for the state,
g = the annual growth rate in total covered payroll,
r = the interest rate paid on positive trust fund balances,
TAX_t = unemployment insurance taxes collected in year t, and
TP_t = total covered payroll in year t.

Appendix B shows how these inequalities are derived and the simplifying assumptions required for the inequalities to be used. Note that to make use of this approach, relatively few assumptions and projections are required. A state must project its adjusted IUR series, the ratio of average weekly benefits to average weekly wages (AWB/AWW), and the ratio of taxes collected to total covered payroll (TAX/TP). In addition, assumptions are required on the average growth rate of total covered payroll (g) and the interest rate paid on positive trust fund balances (r). To make use of the relationship in either inequality (2) or (3), a state would first substitute the appropriate values into the inequality for the first outyear (where t=1). If the reserve ratio or reserve multiple exceeds the expression on the right side of the inequality for the first year, the exercise is repeated for t=2 and so on, until the inequality is no longer met. Thus, a state using this procedure has the flexibility to assess its trust fund adequacy over as long a period as is desired. Of course, as in all simulations, the results are likely to be less valid as the time period covered increases or as the situation modeled differs significantly from past experience. The procedure can readily be implemented through a computer program, and Appendix D includes a sample program written in Fortran.

The accuracy of the procedure proposed here depends critically on the accuracy of the projections of the IUR, AWB/AWW, and TAX/TP series as well as the error introduced by the simplifying assumptions. We have made comparisons for one state using this approach and the SBFSM, and the simplified approach produced results that were reasonably close to the results obtained when the SBFSM is used. Using 1985 as the base year and assuming IUR's equal to those experienced between 1981 and 1985 for the state, the ASM projected that the state would be required to borrow in 1991. Using the same IUR's, the SBFSM projected that borrowing would be required in the second quarter 1993. We repeated the exercise using the higher IUR's experienced by this state in the 1970's. The ASM projected that the state would require a loan in 1987 while the SBFSM projected that borrowing would not be required until the quarter ending March 1988. We consider these differences to be reasonably small, and they suggest that the ASM's simplified approach to assessing trust fund adequacy is a useful interim measure for states that do not yet have an SBFSM and wish to develop a better assessment tool than the 1.5 reserve ratio multiple rule.

The remaining sections of this chapter provide guidance on how states might estimate the labor market variables, the benefit payments, and the trust fund receipts required to use the ASM. Following this discussion the major caveats and limitations of the approach are noted.

A. The Labor Market Variables

The level of a state's UI trust fund balance is very dependent on developments in the state's overall economy. Tax receipts depend on covered employment, as well as the UI tax base and the average tax rate, while benefit payouts reflect the level of unemployment. The first module of the ASM determines the key labor market variables in the state's economy and certain UI program variables that are linked to these labor market variables.

The starting point is the size of state's labor force which is assumed to grow at an annual rate of k percent per year. Thus the current year's labor force is linked to last year's by the following relationship.

(4) $LF = (1+k)\ LF_{-1}$

where LF = the current year's labor force,

LF_{-1} = last year's labor force, and

k = the annual percentage growth rate in the state's labor force.

The growth parameter k reflects both growth in the state's population aged 16 and older and changes in the average labor force participation rate. Nationally k now averages about 2 percent, but it is generally much higher in Southern and Western states than states in the Northeast and the Midwest. Although k can vary by year, the model treats this growth rate as a constant and not as a time-varying parameter. It can be approximated with information on past growth in the state and national labor force (to determine the state's labor force growth relative to the national average) and projections of future national labor force growth. Alternatively, a state may wish to estimate and project k in future years by using some more sophisticated technique.

The total labor force is the sum of employed plus unemployed persons. Equation (5) uses this identity but has the identity rewritten to focus on total employment.

(5) $ETO = LF - TU$

when ETO = total state employment (including self-employment, agricultural employment and other types of employment not covered by the UI program), and

TU = total unemployment (all job losers, job leavers, labor force reentrants and new entrants into the labor force).

Since LF is already determined by equation (4) it is only necessary to determine either ETO or TU to know all three variables in (5). The procedure used in the model is to determine TU, and this is done using one of two distinct approaches. The approaches are similar in that they focus on the determination of unemployment and treat employment as a residual. The approaches differ in the concept of unemployment which is viewed as more fundamental or important; total unemployment as shown in (5) or insured unemployment (IU) which measures the number of active UI claimants. Each approach for determining unemployment can be described in a few paragraphs. Both recognize that insured unemployment is smaller than total unemployment.

In the first approach insured unemployment is treated as the more fundamental unemployment variable. It begins by assuming that the insured unemployment rate can be taken as a known exogenous variable for the years to be simulated. The definition of the insured unemployment rate (IUR) is as follows:

(6) IUR = IU/EC

where IUR = the insured unemployment rate,

IU = insured unemployment (the weekly average of the number of UI claimants), and

EC = employment covered by the UI program.

This identity can also be rewritten in a form that can be used to solve for IU.

(7) IU = IUR·EC

Since EC is also determined later in this module, a simultaneity issue could arise as EC in the current year which appears on the right hand side of (4) and (5) is determined elsewhere in this module. The approach used in the model is to use EC_{-1} (last year's covered employment) in (6) and (7). Since most of the year-to-year variation in the IUR arises from changes in IU, the use of EC_{-1} in (7) does not introduce large errors into the estimate of IU for the current year.

The number of UI claimants is always much smaller than the total number unemployed in the state. Many factors contribute to the divergence between insured unemployment and total unemployment. Among the most important causes for the discrepancy are; (i) disqualifications for monetary reasons (insufficient prior earnings and/or work experience), (ii) disqualifications for nonmonetary reasons (voluntary job leaving, discharge for misconduct), (iii) exhaustions, (iv) failure to apply for benefits and (v) unemployment among entrants and reentrants, persons who would not be expected to collect UI benefits. Nationally, the ratio of insured to total unemployment has fallen into the .30-.35 range in the 1980s, and the ratio varies widely from state to state. The relationship between insured unemployment and total unemployment can be expressed as follows:

(8) $IU = a_1 \, TU$

where IU and TU are insured and total unemployment respectively, and a_1 is a proportion that links the two measures of unemployment.

The proportion a_1 lies in the range between 0 and 1. Its value depends on the nature of unemployment in the state, the state's statutes affecting UI eligibility and application behavior of unemployed workers. In the past a_1 has varied from year to year in both national data and in data from individual states. Users may want to make a_1 a time varying parameter.

In the approach to unemployment where IU and the IUR are taken as fundamental, relationship (8) can be turned around to determine total unemployment.

(9) $TU = (1/a_1) \, IU$

This equation requires an estimate of IU and of a_1 to make a prediction of TU for the year.

The second approach to unemployment determination treats the total unemployment rate (or TUR) as exogenously determined. The definition of the TUR is as follows:

(10) $TUR = TU/LF$

where TUR is the total unemployment rate, and LF and TU are as defined in (2) and (5) respectively.

With the TUR and LF determined exogenously in the model, relationship (8) can be rewritten to solve for TU:

(11) $TU = TUR \cdot LF$,

Once TU is known, relationship (8) can then be used to determine IU. Alternatively, TU may be estimated exogenously and then used directly in (8).

Whichever approach is used for unemployment determination, an estimate of TU is produced so that the labor force identity, i.e., (5), yields an estimate of total employment in the state. Employment in industries covered by the UI program is less than total state employment due to the exclusion of self-employed workers, workers in agriculture and certain other industries and workers employed in some very small firms. Equation (12) is designed to capture the coverage exclusions

(12) $EC = a_2 \, ETO$

where EC = employment covered by State UI, and

ETO = total employment as defined in (5), and

a_2 = the ratio of EC to ETO.

The parameter a_2 exceeds .9 in nearly all states. It will be quite stable except when there are major changes in coverage as in 1972 and 1978. For future years a_2 can be treated as a constant.

The UI programs of all states make a major distinction between taxable employers and reimbursable employers for purposes of assessing UI taxes.

Reimbursable employers pay their UI Financial obligations on an ex post basis. After a year, quarter, or even month, is ended they reimburse the state trust fund for benefits paid to present and former employees. Taxable employers, on the other hand, are required to make ex ante tax payments into the trust fund. Their tax rates are based only partly on experience. Thus for purposes of determining trust fund receipts and the trust fund balance, reimbursable employers can be ignored because their taxes equal their benefit obligations.

To determine trust fund receipts it is necessary to know the level of covered employment for taxable employers. This is done in two steps in the model. First, reimbursable employment is taken to grow exogenously.

(13) $ER = (1+h)\, ER_{-1}$

where ER = reimbursable employment, and

h = the annual growth rate in reimbursable employment.

Reimbursable employment accounts for a significant share of total covered employment. In 1984, for example, total reimbursable employment was 16.2 million while taxable employment was 75.2 million. Reimbursable employment is concentrated in the state and local and nonprofit sectors. Generally, these sectors have grown more rapidly than the average growth rate of the other sectors. Thus for most states the growth rate h will probably exceed the labor force growth rate (k). By treating reimbursable employment as exogenous, the model then determines taxable employment as a residual as in (14).

(14) $ETx = EC - ER$

where ETx = employment of taxable employers.

Average weekly wages grow at a rate that reflects inflationary forces present in the state's economy. For periods to be simulated, wage growth can be treated as an exogenous parameter as shown in (15).

(15) $AWW = (1+w)\ AWW_{-1}$

where AWW = the average weekly wage in covered employment, and

w = the annual percentage growth rate in average weekly wages.

When future wage inflation rates are expected to change in some predictable way, the wage growth rate w can be made a time-varying parameter. In many applications, however, a constant wage growth rate will be assumed.

Having determined both the employment of taxable employers (ETx) and the level of average weekly wages (AWW) in relations (14) and (15) respectively, the labor market module, then uses the identity shown as (16) to determine the total payroll of taxable employers.

(16) $TP = ETx \cdot 52\ AWW$

where TP = total payroll of taxable employers, and

52AWW = annual wages per worker.

In the long run TP will grow at an annual percentage rate that approximately equals (k+w=g). Year to year variation in TP, however, will be influenced by cyclical factors.

Although there are thirteen equations in the ASM's labor market module, i.e., relationships (4)-(16), note that eight of the equations are just identities. The labor market module has only two behavioral parameters (a_1 in (8) and a_2 in (12)) and three exogenous growth rate parameters (k in (4), h in (13) and w in (15). Thus, equations for the labor mark t module can be developed quite easily and do not require a large number of parameters to be estimated.

B. Benefit Payments

Two key determinants of UI benefit payments are the level of insured unemployment (IU) and the level of average weekly benefits (AWB). Along with the ratio of the number of beneficiaries to insured unemployment they combine to explain the dollar value of annual benefit payments. Of the three variables, the ratio of beneficiaries to insured unemployment is quite stable, while the explanation of IU and AWB presents more interesting challenges. This section examines the IUR and the (AWB/AWW) ratio.

1. Projecting the Insured Unemployment Rates

The quality of any procedure for assessing trust fund adequacy is likely to depend critically on the accuracy of the projections of insured unemployment over the period of interest. To illustrate how sensitive trust fund adequacy is to the assumed insured unemployment rates, simulations were conducted using the SBFSM for thirteen states with up-to-date models using the IURs experienced in the 1970s for one set of simulations and the IURs of the 1980s for a second set of simulations. There were differences in trust fund patterns in all 13 states, but in four of the states the differences were striking. In two states simulations conducted using IURs from the 1970s indicated stable trust fund balances over the simulation period, but simulations using IURs from the 1980s indicated that substantial and sustained borrowing was required. In two other states the opposite pattern emerged—the trust fund appeared stable if experience from the 1980s was used in the simulations, but significant borrowing was required when IURs from the 1980s were used in the SBFSM simulations. Thus, for many states trust fund adequacy depends critically on the future unemployment rates that will be experienced.

National forecasts of future economic activity can provide some guidance on the trend of unemployment rates, but there are serious limitations in their use. First, there is the obvious problem that economic forecasters frequently do not agree with one another, leading to the problem of deciding which forecast to believe. In addition, forecasts are almost always in terms of the total unemployment rate rather that the insured unemployment rate, which is the factor required for projecting unemployment insurance trust fund adequacy. The relationship between the two measures of unemployment have diverged in recent years, and efforts to date have been unsuccessful in estimating a stable relationship among the two measures. The Department of Labor has recently funded an effort to study the relationship between total and insured unemployment rates. For previous research on this topic, see the national analysis of Burtless (1983) and the state analysis of Vroman (1986b).

More important, however, is the great variation among states in their levels of unemployment and the degree to which they are affected by an economic downturn. Quarterly insured unemployment rates from 1979 through the first quarter of 1986 are provided in Table 5, and seasonally adjusted insured unemployment rates are shown in Table 6. To illustrate the variation among the states over this period, Figure 5 contains a plot of how the IUR varied over this period in South Dakota, one of the states least affected by the recession in the 1980s, and Figure 6 plots the experience of Idaho, one of the states most affected.

A comparison of the severity of the 1980s recession across states can be made by constructing a line segment from the starting and ending points of the recession for each state and computing the area between this line segment and

Table 5. Quarterly IUR's by State 1979 to 1985

STATE	1979				1980				1981				1982				1983				1984				1985				1986		
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	MEAN	STD
ALABAMA	4.16	3.20	3.40	3.31	4.21	4.20	5.12	4.22	4.65	3.63	3.70	4.03	5.55	4.80	5.40	5.80	6.31	4.50	3.98	3.46	3.80	3.02	3.20	3.56	4.20	2.92	2.07	3.02	3.58	4.06	0.890
ALASKA	10.99	8.07	5.81	7.13	9.31	7.94	6.07	7.30	9.42	6.66	5.34	6.70	9.16	7.12	5.35	6.76	9.31	7.01	4.58	6.10	8.23	5.86	4.34	5.90	9.04	7.29	5.44	6.59	9.71	7.19	1.641
ARIZONA	1.85	1.36	1.49	1.58	2.28	2.54	2.77	2.32	2.59	2.27	2.35	2.44	3.46	3.87	4.59	4.38	4.19	3.36	2.85	2.19	2.13	0.00	1.75	1.51	1.88	1.84	1.85	1.62	1.97	2.39	0.986
ARKANSAS	5.31	3.09	2.70	3.50	5.08	4.82	4.75	4.48	5.54	3.92	3.43	4.50	6.53	5.05	4.95	5.79	7.00	4.56	3.47	3.75	4.30	3.01	2.81	3.76	4.98	3.29	2.83	3.60	4.48	4.32	1.084
CALIFORNIA	4.09	3.15	2.81	2.93	4.10	3.86	3.89	3.69	4.30	3.55	3.38	3.84	5.12	5.03	4.83	5.22	5.94	5.03	4.05	3.86	3.90	3.21	2.99	3.34	3.93	3.52	3.33	3.44	4.05	3.94	0.753
COLORADO	2.04	1.38	1.13	1.25	2.01	2.03	1.94	1.90	2.58	2.09	1.68	1.96	2.95	2.83	2.86	3.30	4.31	3.30	2.48	2.60	2.93	2.01	1.59	1.84	2.89	2.24	1.97	[illegible]	[illegible]	2.30	0.701
CONNECTICUT	3.14	2.16	2.21	1.99	2.96	2.60	2.89	2.43	3.21	2.33	2.48	2.41	3.77	3.30	3.31	3.29	4.18	2.93	2.47	2.06	2.39	1.64	1.50	1.45	2.29	1.63	1.74	1.48	2.25	2.50	0.691
DELAWARE	3.87	2.29	2.21	2.31	3.63	3.05	3.71	3.01	4.82	2.74	3.11	3.34	4.93	2.98	3.20	3.06	3.87	2.70	2.17	2.01	2.51	2.07	1.83	1.42	2.27	1.36	1.43	1.18	2.52	2.74	0.935
D. OF COLUMBIA	2.98	2.45	2.57	2.40	2.79	2.63	2.87	2.57	2.67	2.58	3.18	3.07	3.65	3.59	3.70	3.80	4.01	3.27	3.17	2.55	2.75	2.43	0.00	2.08	2.31	2.03	2.18	1.98	2.35	2.71	0.745
FLORIDA	1.85	1.53	2.06	1.79	1.92	1.77	2.26	1.85	1.75	1.46	1.88	1.77	2.20	2.31	2.82	2.57	2.55	2.08	2.14	1.48	1.37	1.30	1.60	1.31	1.29	1.21	1.60	1.35	1.37	1.81	0.421
GEORGIA	2.63	1.84	1.86	2.00	2.55	2.53	2.76	2.24	2.73	2.12	2.36	2.80	3.92	3.19	3.21	3.34	3.56	2.50	2.11	1.91	1.93	1.52	1.63	1.78	2.23	1.76	1.72	1.55	2.01	2.35	0.621
HAWAII	2.67	2.81	2.55	3.12	2.60	2.48	3.00	2.90	2.86	2.85	3.11	3.27	3.74	3.41	3.28	3.50	3.43	3.58	3.51	3.13	2.83	2.67	2.88	3.27	2.79	2.51	2.43	2.21	2.32	2.96	0.399
IDAHO	6.06	3.01	2.59	3.40	6.18	5.47	4.35	4.03	6.08	4.39	4.08	5.45	8.97	6.90	5.90	6.43	8.28	5.33	4.49	4.64	5.79	3.56	3.36	3.63	6.15	4.09	3.70	3.96	6.51	5.06	1.518
ILLINOIS	4.23	3.12	2.67	3.06	4.46	4.55	4.65	4.24	5.11	4.10	3.80	3.96	5.50	5.07	5.13	5.72	6.62	5.28	3.97	3.61	4.04	2.94	2.51	2.83	4.09	3.20	2.80	2.85	3.87	4.07	1.017
INDIANA	2.49	1.73	2.13	2.63	4.19	4.59	4.61	3.28	4.01	2.74	2.38	3.48	5.52	4.39	4.00	4.95	5.72	3.83	2.67	2.63	3.27	2.25	2.08	2.38	3.37	2.22	1.83	1.97	2.89	3.25	1.110
IOWA	3.37	1.99	1.42	1.62	3.06	3.24	3.59	2.94	3.70	2.46	2.33	2.86	5.43	4.29	3.84	4.03	5.79	3.81	2.68	2.63	3.60	2.34	1.98	2.57	4.22	2.74	2.44	2.76	4.06	3.17	1.008
KANSAS	2.32	1.33	1.68	1.47	2.43	2.71	2.92	2.52	2.87	2.14	2.05	2.31	3.57	3.85	4.32	4.18	4.40	3.02	2.53	2.47	2.64	1.99	1.82	2.09	3.10	2.15	2.10	2.37	3.12	2.64	0.793
KENTUCKY	5.47	3.26	3.06	3.37	5.99	5.31	5.52	4.58	5.80	4.33	3.61	4.26	6.94	5.50	5.19	5.68	7.29	5.15	3.88	3.59	4.30	2.99	2.51	2.95	4.37	2.89	2.71	3.03	4.32	4.41	1.273
LOUISIANNA	0.00	2.38	2.12	2.11	3.13	3.05	2.68	2.46	3.04	2.60	2.44	2.65	3.83	4.07	4.68	5.27	6.23	5.78	4.93	4.22	4.45	3.68	3.48	3.77	4.64	4.19	4.19	4.32	5.21	3.64	1.296
MAINNE	5.54	3.48	3.31	3.43	5.24	4.29	4.14	3.98	5.61	3.83	3.61	3.78	5.93	4.58	4.01	4.28	6.13	4.69	3.55	3.78	5.01	3.31	2.87	3.22	5.07	3.47	2.75	2.81	4.24	4.14	0.921
MARYLAND	3.23	2.15	2.06	2.14	3.39	2.96	3.06	2.93	3.85	2.69	2.79	3.23	4.93	4.01	3.86	4.10	5.01	3.69	2.87	2.69	3.13	2.10	1.88	2.00	2.88	1.98	1.94	2.00	2.88	2.98	0.852
MASSACHUSETTS	4.36	2.89	2.77	2.69	3.66	3.09	3.23	3.02	3.88	2.83	3.45	3.26	4.58	3.60	3.67	3.73	4.71	3.23	2.67	2.48	2.98	2.13	1.99	2.04	2.92	2.20	2.21	2.17	2.96	3.08	0.724
MICHIGAN	4.97	3.76	5.22	5.69	8.80	9.12	8.53	6.00	7.16	5.08	5.04	6.18	9.03	6.78	5.95	7.25	7.48	4.75	3.41	3.39	4.25	2.97	2.84	3.23	4.57	2.98	2.63	2.70	4.23	5.31	1.992
MINNESOTA	3.25	1.78	1.23	1.68	3.71	3.19	2.68	2.58	4.02	2.65	2.02	2.64	4.71	3.88	3.77	3.83	5.07	3.15	2.08	2.56	3.52	1.95	1.53	2.14	3.84	2.31	1.94	2.44	3.90	2.90	0.968
MISSISSIPPI	3.40	2.45	2.38	2.40	3.74	4.03	4.44	3.76	4.47	3.56	3.50	3.93	6.24	5.34	5.70	5.90	7.05	5.31	4.33	3.63	4.09	3.45	3.42	3.52	4.58	3.62	3.49	3.13	4.11	4.10	1.107
MISSOURI	4.00	2.30	2.62	2.86	4.59	4.21	4.38	3.77	4.57	3.43	3.43	3.51	5.20	3.85	3.96	4.13	5.20	3.60	2.84	2.84	3.28	2.19	2.07	2.21	3.43	2.23	2.18	2.36	3.28	3.40	0.906
MONTANA	0.00	3.33	2.60	2.86	5.53	4.45	3.76	3.72	5.48	3.69	3.18	3.89	6.63	5.26	4.17	4.66	6.72	4.67	3.94	4.26	5.51	3.79	3.09	3.66	5.82	3.73	2.61	3.45	5.58	4.14	1.352
NEBRASKA	2.30	1.10	0.88	0.97	2.23	1.81	1.81	1.68	2.61	1.64	1.56	1.94	3.45	2.69	2.27	2.56	4.16	2.74	1.78	2.20	3.10	1.68	1.31	1.70	3.16	2.05	1.78	2.25	3.23	2.16	0.754
NEVADA	3.00	2.32	2.16	2.27	3.02	2.93	3.24	3.39	4.47	3.08	2.66	3.54	4.97	4.38	4.16	4.76	5.59	4.03	3.16	3.27	3.60	2.65	2.50	2.77	3.40	2.65	2.36	2.81	3.49	3.33	0.853
NEW HAMPSHIRE	1.86	1.27	1.29	1.34	2.29	2.24	2.26	1.85	2.72	2.05	1.88	1.89	3.09	2.81	2.69	2.69	3.43	2.33	1.75	1.45	1.67	1.68	1.25	1.02	1.30	0.96	0.90	0.78	1.06	1.86	0.691
NEW JERSEY	5.98	4.35	4.10	4.12	5.30	4.58	4.58	4.17	5.26	4.02	3.91	4.00	5.64	4.61	4.28	4.24	5.26	3.92	3.27	3.11	3.89	2.87	2.76	2.75	3.71	2.82	2.68	2.58	3.49	4.01	0.910
NEW MEXICO	2.92	2.09	1.80	2.01	2.71	2.76	2.80	2.83	3.18	2.72	2.40	2.51	3.48	3.75	3.98	4.03	4.97	4.27	3.58	3.22	3.41	2.83	2.63	2.72	3.32	2.91	2.57	2.59	3.50	3.05	0.692
NEW YORK	4.64	3.42	3.35	3.47	4.32	3.90	3.61	3.47	4.10	3.08	2.96	3.21	4.25	3.67	3.57	3.74	4.46	3.55	3.10	3.08	3.65	2.84	2.57	2.62	3.42	2.72	2.51	2.43	3.14	3.41	0.579
NORTH CAROLINA	2.73	1.69	1.68	1.74	2.88	2.73	3.19	2.79	3.76	2.45	2.38	3.22	5.75	4.35	4.21	4.29	5.08	3.07	2.15	2.21	2.49	1.87	1.85	2.28	3.15	2.19	1.95	1.84	2.59	2.85	1.030
NORTH DAKOTA	4.84	2.50	1.17	1.65	4.13	2.83	2.35	2.32	4.67	2.53	1.68	1.94	4.62	3.24	2.47	3.00	5.75	3.70	2.30	2.67	4.84	2.74	1.83	2.38	4.99	2.88	1.97	2.58	5.04	3.09	1.215
OHIO	3.22	2.38	2.48	3.24	4.82	5.12	5.31	4.31	5.05	3.57	3.22	4.47	6.80	5.58	5.15	5.83	6.42	4.37	3.18	3.21	3.83	2.69	2.39	2.89	3.99	2.76	2.53	2.82	3.73	3.98	1.245
OKLAHOMA	1.90	1.27	1.20	1.30	1.79	1.79	1.84	1.51	1.68	1.22	1.21	1.44	2.19	2.36	3.38	4.09	4.12	3.36	2.44	2.09	2.20	1.94	1.89	2.05	2.79	2.38	2.20	2.30	2.98	2.17	0.782
OREGON	4.87	3.37	2.79	3.50	5.38	6.13	5.10	4.88	6.24	5.39	5.04	6.32	8.42	7.07	5.92	6.40	7.57	5.58	4.38	4.81	5.32	4.23	3.34	4.11	5.68	4.60	3.79	4.24	5.64	5.18	1.276
PENNSYLVANIA	5.40	3.91	3.71	3.92	5.57	5.31	5.29	4.49	5.34	4.00	3.73	4.56	6.55	6.18	6.48	7.12	8.10	6.21	4.99	4.73	5.19	3.99	3.54	3.88	5.14	3.81	3.44	3.63	4.84	4.93	1.160
PUERTO RICO	10.98	8.26	9.21	9.14	7.63	6.60	7.90	7.90	7.91	7.60	8.71	8.75	8.72	8.36	9.39	9.10	8.20	7.17	7.17	6.63	6.31	5.50	6.57	6.49	7.36	6.72	7.49	6.68	6.33	7.72	1.107
RHODE ISLAND	6.06	4.44	5.09	4.26	6.20	4.83	5.62	4.16	6.13	4.18	4.98	4.50	7.20	5.66	5.69	4.94	6.56	4.48	4.39	3.53	4.63	3.26	2.85	2.99	4.94	3.70	3.14	2.78	4.30	4.67	1.129
SOUTH CAROLINA	2.52	1.97	2.04	2.32	3.04	3.09	4.01	3.58	4.12	3.27	3.24	4.05	5.98	5.03	5.48	5.32	5.51	3.62	2.79	2.67	2.65	2.19	2.31	2.80	3.52	2.83	2.60	2.45	2.83	3.37	1.113
SOUTH DAKOTA	2.95	1.33	0.90	1.02	2.44	1.98	1.90	1.99	2.95	1.63	1.35	1.53	2.69	2.11	1.99	2.08	3.12	1.79	1.06	1.19	1.78	0.94	0.80	1.14	2.31	1.35	1.14	1.42	2.34	1.77	0.649
TENNESSEE	4.36	2.75	2.79	3.15	4.37	4.07	4.47	3.80	4.69	3.29	3.08	3.93	5.97	4.97	4.43	4.53	5.34	3.80	2.76	2.51	2.94	2.09	2.09	2.54	3.47	2.44	2.38	2.40	3.29	3.54	1.014
TEXAS	1.51	1.16	1.14	1.18	1.46	1.33	1.49	1.52	1.60	1.11	0.84	0.95	1.36	1.66	2.18	2.82	3.06	2.55	2.16	1.88	1.91	1.39	1.32	1.45	1.76	1.52	1.51	1.66	2.17	1.64	0.518
UTAH	3.57	2.18	1.69	1.86	3.50	2.91	2.86	2.86	3.94	3.02	2.59	2.88	4.97	4.50	4.42	4.74	6.18	4.37	2.95	2.75	3.57	2.30	2.07	2.45	3.57	2.17	1.69	2.15	3.18	3.17	1.070
VERMONT	4.90	3.53	2.81	3.19	4.88	4.48	4.13	3.72	4.84	3.85	3.18	3.53	5.77	5.31	4.39	4.67	6.34	4.75	3.02	3.38	4.59	3.32	2.09	2.66	4.31	3.22	2.18	2.50	3.77	3.91	1.033
VIRGINIA	2.10	1.35	1.19	1.24	2.12	1.89	2.06	1.66	2.52	1.73	1.58	1.77	3.19	2.29	2.07	2.18	2.96	1.76	1.23	1.23	1.62	1.07	0.87	1.14	1.85	1.02	1.00	1.03	1.46	1.70	0.576
VIRGIN ISLAND	3.06	2.81	3.15	3.20	3.20	3.34	3.50	2.73	3.38	3.46	3.99	3.61	4.83	4.58	4.44	4.23	5.09	5.15	4.40	3.67	3.28	4.00	4.54	3.80	3.05	2.59	2.70	2.74	2.40	3.62	0.761
WASHINGTON	4.65	2.85	2.52	2.98	4.90	4.61	4.50	4.39	5.44	4.61	4.44	5.26	7.28	6.43	5.97	6.43	7.27	5.65	4.88	5.03	5.39	4.09	3.67	4.28	5.49	4.22	3.69	4.16	5.05	4.83	1.145
WEST VIRGINIA	6.10	4.20	3.73	2.77	6.30	5.14	5.49	5.30	6.87	7.44	4.21	4.37	7.03	6.21	6.84	8.33	10.52	8.07	6.39	5.25	6.16	4.21	3.59	0.00	6.64	4.22	3.59	4.00	5.61	5.47	1.966
WISCONSIN	4.45	2.53	2.20	2.91	5.31	5.34	5.15	4.77	6.30	4.22	3.55	4.57	6.92	5.79	5.15	5.44	7.65	4.66	3.22	3.93	4.75	2.98	2.39	3.11	5.01	3.18	2.54	3.11	4.58	4.33	1.367
WYOMING	1.65	0.78	0.49	0.76	1.87	1.33	1.13	1.32	2.61	1.83	1.26	1.64	3.11	3.34	3.59	4.36	6.30	5.37	3.14	3.10	3.70	2.15	1.37	1.65	3.06	2.46	1.65	2.33	4.25	2.47	1.381

Table 6. Quarterly IURs by State, 1979 to 1985, Seasonally Adjusted Data

	1979				1980				1981				1982				1983				1984				1985				1986		
STATE	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	MEAN	STD
ALABAMA	3.66	3.51	3.51	3.46	3.71	4.51	5.23	4.37	4.15	3.94	3.81	4.18	5.05	5.11	5.51	5.95	5.81	4.81	4.09	3.61	3.30	3.33	3.31	3.71	3.70	3.23	2.98	3.17	3.08	4.06	0.833
ALASKA	8.78	8.12	7.72	7.68	7.10	7.99	7.98	7.85	7.21	6.71	7.25	7.25	6.95	7.17	7.26	7.31	7.10	7.06	6.49	6.65	6.02	5.91	6.25	6.45	6.83	7.34	7.35	7.14	7.50	7.19	0.628
ARIZONA	1.78	1.29	1.44	1.76	2.21	2.47	2.72	2.50	2.52	2.20	2.30	2.62	3.39	3.80	4.54	4.56	4.12	3.29	2.80	2.37	2.06	0.00	1.70	1.69	1.81	1.77	1.80	1.80	1.90	2.39	0.980
ARKANSAS	4.23	3.45	3.46	3.62	4.00	5.18	5.51	4.60	4.46	4.28	4.19	4.62	5.45	5.41	5.71	5.91	5.92	4.92	4.23	3.87	3.22	3.37	3.57	3.88	3.90	3.65	3.59	3.72	3.40	4.32	0.825
CALIFORNIA	3.61	3.19	3.14	3.11	3.62	3.90	4.22	3.87	3.82	3.59	3.71	4.02	4.64	5.07	5.16	5.40	5.46	5.07	4.38	4.04	3.42	3.25	3.32	3.52	3.45	3.56	3.66	3.62	3.57	3.94	0.684
COLORADO	1.52	1.41	1.48	1.41	1.49	2.06	2.29	2.06	2.06	2.12	2.03	2.12	2.43	2.86	3.21	3.46	3.79	3.33	2.83	2.76	2.41	2.04	1.94	2.00	2.37	2.27	2.32			2.30	0.621
CONNECTICUT	2.62	2.29	2.34	2.33	2.44	2.73	3.02	2.77	2.69	2.46	2.61	2.75	3.25	3.43	3.44	3.63	3.66	3.06	2.60	2.40	1.87	1.77	1.63	1.79	1.77	1.76	1.87	1.82	1.73	2.50	0.605
DELAWARE	3.06	2.58	2.43	2.72	2.82	3.34	3.93	3.42	4.01	3.03	3.33	3.75	4.12	3.27	3.42	3.47	3.06	2.99	2.39	2.42	1.70	2.36	2.05	1.83	1.46	1.65	1.65	1.59	1.71	2.74	0.788
D. OF COLUMBIA	2.85	2.55	2.43	2.57	2.66	2.73	2.73	2.74	2.54	2.68	3.04	3.24	3.52	3.69	3.56	3.97	3.88	3.37	3.03	2.72	2.62	2.53	0.00	2.25	2.18	2.13	2.04	2.15	2.22	2.71	0.733
FLORIDA	1.87	1.67	1.82	1.87	1.94	1.91	2.02	1.93	1.77	1.60	1.64	1.85	2.22	2.45	2.58	2.65	2.57	2.22	1.90	1.56	1.39	1.44	1.36	1.39	1.31	1.35	1.36	1.43	1.39	1.81	0.396
GEORGIA	2.29	1.99	1.98	2.12	2.21	2.68	2.88	2.36	2.39	2.27	2.48	2.92	3.58	3.34	3.33	3.46	3.22	2.65	2.23	2.03	1.59	1.67	1.75	1.90	1.89	1.91	1.84	1.67	1.67	2.35	0.584
HAWAII	2.72	2.86	2.54	3.02	2.65	2.53	2.99	2.80	2.91	2.90	3.10	3.17	3.79	3.46	3.27	3.40	3.48	3.63	3.50	3.03	2.88	2.72	2.87	3.17	2.84	2.56	2.42	2.11	2.37	2.96	0.394
IDAHO	4.37	3.39	3.58	3.96	4.49	5.85	5.34	4.59	4.39	4.77	5.07	6.01	7.28	7.28	6.89	6.99	6.59	5.71	5.48	5.20	4.10	3.94	4.35	4.19	4.46	4.47	4.69	4.52	4.82	5.06	1.080
ILLINOIS	3.56	3.15	3.09	3.38	3.79	4.58	5.07	4.56	4.44	4.13	4.22	4.28	4.83	5.10	5.55	6.04	5.95	5.31	4.39	3.93	3.37	2.97	2.93	3.15	3.42	3.23	3.22	3.17	3.20	4.07	0.919
INDIANA	1.81	1.87	2.57	2.83	3.51	4.73	5.05	3.48	3.33	2.88	2.82	3.68	4.84	4.53	4.44	5.15	5.04	3.97	3.11	2.83	2.59	2.39	2.52	2.58	2.69	2.36	2.27	2.17	2.21	3.25	1.021
IOWA	2.38	2.17	1.97	2.01	2.07	3.42	4.14	3.33	2.71	2.64	2.88	3.25	4.44	4.47	4.39	4.42	4.80	3.99	3.23	3.02	2.61	2.52	2.53	2.96	3.23	2.92	2.99	3.15	3.07	3.17	0.793
KANSAS	1.90	1.51	1.83	1.62	2.01	2.89	3.07	2.67	2.45	2.32	2.20	2.46	3.15	4.03	4.47	4.33	3.98	3.20	2.68	2.62	2.22	2.17	1.97	2.24	2.68	2.33	2.25	2.52	2.70	2.64	0.750
KENTUCKY	4.32	3.46	3.69	3.86	4.84	5.51	6.15	5.07	4.65	4.53	4.24	4.75	5.79	5.70	5.82	6.17	6.14	5.35	4.51	4.08	3.15	3.19	3.14	3.44	3.22	3.09	3.34	3.52	3.17	4.41	1.045
LOUISIANNA	0.00	2.47	2.39	2.34	2.54	3.14	2.95	2.69	2.45	2.69	2.71	2.88	3.24	4.16	4.95	5.50	5.64	5.87	5.20	4.45	3.86	3.77	3.75	4.00	4.05	4.28	4.46	4.55	4.62	3.64	1.250
MAINNE	4.33	3.67	3.98	3.95	4.03	4.48	4.81	4.50	4.40	4.02	4.28	4.30	4.72	4.77	4.68	4.80	4.92	4.88	4.22	4.30	3.80	3.50	3.54	3.74	3.86	3.66	3.42	3.33	3.03	4.14	0.510
MARYLAND	2.55	2.33	2.40	2.39	2.71	3.14	3.40	3.18	3.17	2.87	3.13	3.48	4.25	4.19	4.20	4.35	4.33	3.87	3.21	2.94	2.45	2.28	2.22	2.25	2.20	2.16	2.28	2.25	2.20	2.98	0.738
MASSACHUSETTS	3.69	3.12	3.00	3.00	2.99	3.32	3.46	3.33	3.21	3.06	3.68	3.57	3.91	3.83	3.90	4.04	4.04	3.46	2.90	2.79	2.31	2.36	2.22	2.35	2.25	2.43	2.44	2.48	2.29	3.08	0.592
MICHIGAN	3.97	4.01	5.73	6.08	7.80	9.37	9.04	6.39	6.16	5.33	5.55	6.57	8.03	7.03	6.46	7.64	6.48	5.00	3.92	3.78	3.25	3.22	3.35	3.62	3.57	3.23	3.14	3.09	3.23	5.31	1.892
MINNESOTA	2.15	1.98	1.95	2.03	2.61	3.39	3.40	2.93	2.92	2.85	2.74	2.99	3.61	4.08	4.49	4.18	3.97	3.35	2.80	2.91	2.42	2.15	2.25	2.49	2.74	2.51	2.66	2.79	2.80	2.90	0.662
MISSISSIPPI	2.79	2.59	2.59	2.75	3.13	4.17	4.65	4.11	3.86	3.70	3.71	4.28	5.63	5.48	5.91	6.25	6.44	5.45	4.54	3.98	3.48	3.59	3.63	3.87	3.97	3.76	3.70	3.48	3.50	4.10	1.039
MISSOURI	3.20	2.58	2.95	3.16	3.79	4.49	4.71	4.07	3.77	3.71	3.76	3.81	4.40	4.13	4.29	4.43	4.40	3.88	3.17	3.14	2.48	2.47	2.40	2.51	2.63	2.51	2.51	2.66	2.48	3.40	0.761
MONTANA	0.00	3.49	3.55	3.36	3.92	4.61	4.71	4.22	3.87	3.85	4.13	4.39	5.02	5.42	5.12	5.16	5.11	4.83	4.89	4.76	3.90	3.95	4.04	4.16	4.21	3.89	3.56	3.95	3.97	4.14	1.164
NEBRASKA	1.43	1.30	1.41	1.23	1.36	2.01	2.34	1.94	1.74	1.84	2.09	2.20	2.58	2.89	2.80	2.82	3.29	2.94	2.31	2.46	2.23	1.88	1.84	1.96	2.29	2.25	2.31	2.51	2.36	2.16	0.515
NEVADA	2.39	2.50	2.60	2.34	2.41	3.11	3.68	3.46	3.86	3.26	3.10	3.61	4.36	4.56	4.60	4.83	4.98	4.21	3.60	3.34	2.99	2.83	2.94	2.84	2.79	2.83	2.80	2.88	2.88	3.33	0.754
NEW HAMPSHIRE	1.54	1.22	1.43	1.62	1.97	2.19	2.40	2.13	2.40	2.00	2.02	2.17	2.77	2.76	2.83	2.97	3.11	2.28	1.89	1.73	1.35	1.63	1.39	1.30	0.98	0.91	1.04	1.06	0.74	1.86	0.652
NEW JERSEY	5.17	4.48	4.45	4.56	4.49	4.71	4.93	4.61	4.45	4.15	4.26	4.44	4.83	4.74	4.63	4.68	4.45	4.05	3.62	3.55	3.08	3.00	3.11	3.19	2.90	2.95	3.03	3.02	2.68	4.01	0.753
NEW MEXICO	2.54	2.09	2.03	2.22	2.33	2.76	3.03	3.04	2.80	2.72	2.63	2.72	3.10	3.75	4.21	4.24	4.59	4.27	3.81	3.43	3.03	2.83	2.86	2.93	2.94	2.91	2.80	2.80	3.12	3.05	0.645
NEW YORK	4.05	3.52	3.66	3.73	3.73	4.00	3.92	3.73	3.51	3.18	3.27	3.47	3.66	3.77	3.88	4.00	3.87	3.65	3.41	3.34	3.06	2.94	2.88	2.88	2.83	2.82	2.82	2.69	2.55	3.41	0.443
NORTH CAROLINA	2.02	1.92	2.04	1.96	2.17	2.96	3.55	3.01	3.05	2.68	2.74	3.44	5.04	4.58	4.57	4.51	4.37	3.30	2.51	2.43	1.78	2.10	2.21	2.50	2.44	2.42	2.31	2.06	1.88	2.85	0.931
NORTH DAKOTA	3.07	2.67	2.29	2.38	2.36	3.00	3.47	3.05	2.90	2.70	2.80	2.67	2.85	3.41	3.59	3.73	3.98	3.87	3.42	3.40	3.07	2.91	2.95	3.11	3.22	3.05	3.09	3.31	3.27	3.09	0.416
OHIO	2.47	2.58	2.99	3.39	4.07	5.32	5.82	4.46	4.30	3.77	3.73	4.62	6.05	5.78	5.66	5.98	5.67	4.57	3.69	3.36	3.08	2.89	2.90	3.04	3.24	2.96	3.04	2.97	2.98	3.98	1.147
OKLAHOMA	1.61	1.39	1.35	1.36	1.50	1.91	1.99	1.57	1.39	1.34	1.36	1.50	1.90	2.48	3.53	4.15	3.83	3.48	2.59	2.15	1.91	2.06	2.04	2.11	2.50	2.50	2.35	2.36	2.69	2.17	0.761
OREGON	3.91	3.35	3.63	3.78	4.42	6.11	5.94	5.16	5.28	5.37	5.88	6.60	7.46	7.05	6.76	6.68	6.61	5.56	5.22	5.09	4.36	4.21	4.18	4.39	4.72	4.58	4.63	4.52	4.68	5.18	1.088
PENNSYLVANIA	4.57	4.07	4.19	4.23	4.74	5.47	5.77	4.80	4.51	4.16	4.21	4.87	5.72	6.34	6.96	7.43	7.27	6.37	5.47	5.04	4.36	4.15	4.02	4.19	4.31	3.97	3.92	3.94	4.01	4.93	1.042
PUERTO RICO	9.98	8.81	8.87	9.05	7.53	7.15	7.56	7.81	7.81	8.15	8.37	8.66	8.62	8.91	9.05	9.01	8.10	7.72	6.83	6.54	6.21	6.05	6.23	6.40	7.26	7.27	7.15	6.59	6.23	7.72	1.059
RHODE ISLAND	4.98	4.75	5.22	5.05	5.12	5.14	5.75	4.95	5.05	4.49	5.11	5.29	6.12	5.97	5.82	5.73	5.48	4.79	4.52	4.32	3.55	3.57	2.98	3.78	3.86	4.01	3.27	3.57	3.22	4.67	0.880
SOUTH CAROLINA	2.12	2.20	2.20	2.38	2.64	3.32	4.17	3.64	3.72	3.50	3.40	4.11	5.58	5.26	5.64	5.38	5.11	3.85	2.95	2.73	2.25	2.42	2.47	2.86	3.12	3.06	2.76	2.51	2.43	3.37	1.084
SOUTH DAKOTA	2.14	1.51	1.36	1.30	1.63	2.16	2.36	2.27	2.14	1.81	1.81	1.81	1.88	2.29	2.45	2.36	2.31	1.97	1.52	1.47	0.97	1.12	1.26	1.42	1.50	1.53	1.60	1.70	1.53	1.77	0.404
TENNESSEE	3.60	2.95	3.19	3.43	3.61	4.27	4.87	4.08	3.93	3.49	3.48	4.21	5.21	5.17	4.83	4.81	4.58	4.00	3.16	2.79	2.18	2.29	2.49	2.82	2.71	2.64	2.78	2.68	2.53	3.54	0.896
TEXAS	1.30	1.27	1.26	1.19	1.25	1.44	1.61	1.53	1.39	1.22	0.96	0.96	1.15	1.77	2.30	2.83	2.85	2.66	2.28	1.89	1.70	1.50	1.44	1.46	1.55	1.63	1.63	1.67	1.96	1.64	0.500
UTAH	2.68	2.28	2.25	2.22	2.61	3.01	3.42	3.22	3.05	3.12	3.15	3.24	4.08	4.60	4.98	5.10	5.29	4.47	3.51	3.11	2.68	2.40	2.63	2.81	2.68	2.27	2.25	2.51	2.29	3.17	0.904
VERMONT	3.88	3.37	3.60	3.72	3.86	4.32	4.92	4.25	3.82	3.69	3.97	4.06	4.75	5.15	5.18	5.20	5.32	4.59	3.81	3.91	3.57	3.16	2.88	3.19	3.29	3.06	2.97	3.03	2.75	3.91	0.746
VIRGINIA	1.57	1.46	1.46	1.47	1.59	2.00	2.33	1.89	1.99	1.84	1.85	2.00	2.66	2.40	2.34	2.41	2.43	1.87	1.50	1.46	1.09	1.18	1.14	1.37	1.32	1.13	1.27	1.26	0.93	1.70	0.470
VIRGIN ISLAND	3.14	2.72	2.95	3.39	3.28	3.25	3.30	2.92	3.46	3.37	3.79	3.80	4.91	4.49	4.24	4.42	5.17	5.06	4.20	3.86	3.36	3.91	4.34	3.99	3.13	2.50	2.50	2.93	2.48	3.62	0.747
WASHINGTON	3.80	3.04	3.11	3.16	4.05	4.80	5.09	4.57	4.59	4.80	5.03	5.44	6.43	6.62	6.56	6.61	6.42	5.84	5.47	5.21	4.54	4.28	4.26	4.46	4.64	4.41	4.28	4.34	4.20	4.83	1.004
WEST VIRGINIA	4.86	4.22	4.56	3.43	5.06	5.16	6.32	5.96	5.63	7.46	5.04	5.03	5.79	6.23	7.67	8.99	9.28	8.09	7.22	5.91	4.92	4.23	4.42	0.00	5.40	4.24	4.42	4.66	4.37	5.47	1.785
WISCONSIN	3.16	2.76	3.08	3.27	4.02	5.57	6.03	5.13	5.01	4.45	4.43	4.93	5.63	6.02	6.03	5.80	6.36	4.89	4.10	4.29	3.46	3.21	3.27	3.47	3.72	3.41	3.42	3.47	3.29	4.33	1.088
WYOMING	0.80	0.78	1.15	1.06	1.02	1.33	1.79	1.62	1.76	1.83	1.92	1.94	2.26	3.34	4.25	4.66	5.45	5.37	3.80	3.40	2.85	2.15	2.03	1.95	2.21	2.46	2.31	2.63	3.40	2.47	1.257

Figure 5

SEASONALLY ADJUSTED QUARTERLY INSURED UNEMPLOYMENT RATES, 1979-1986

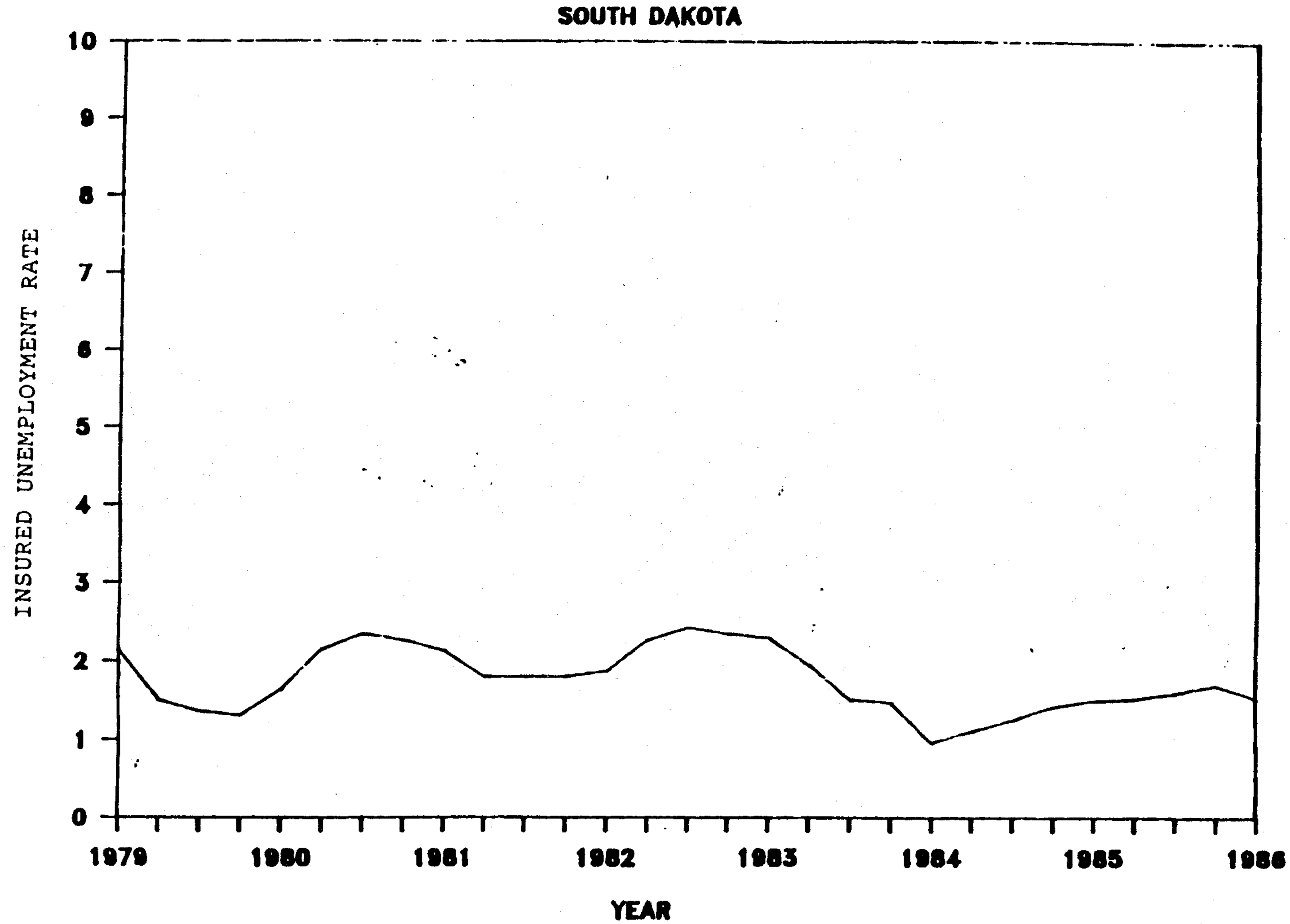
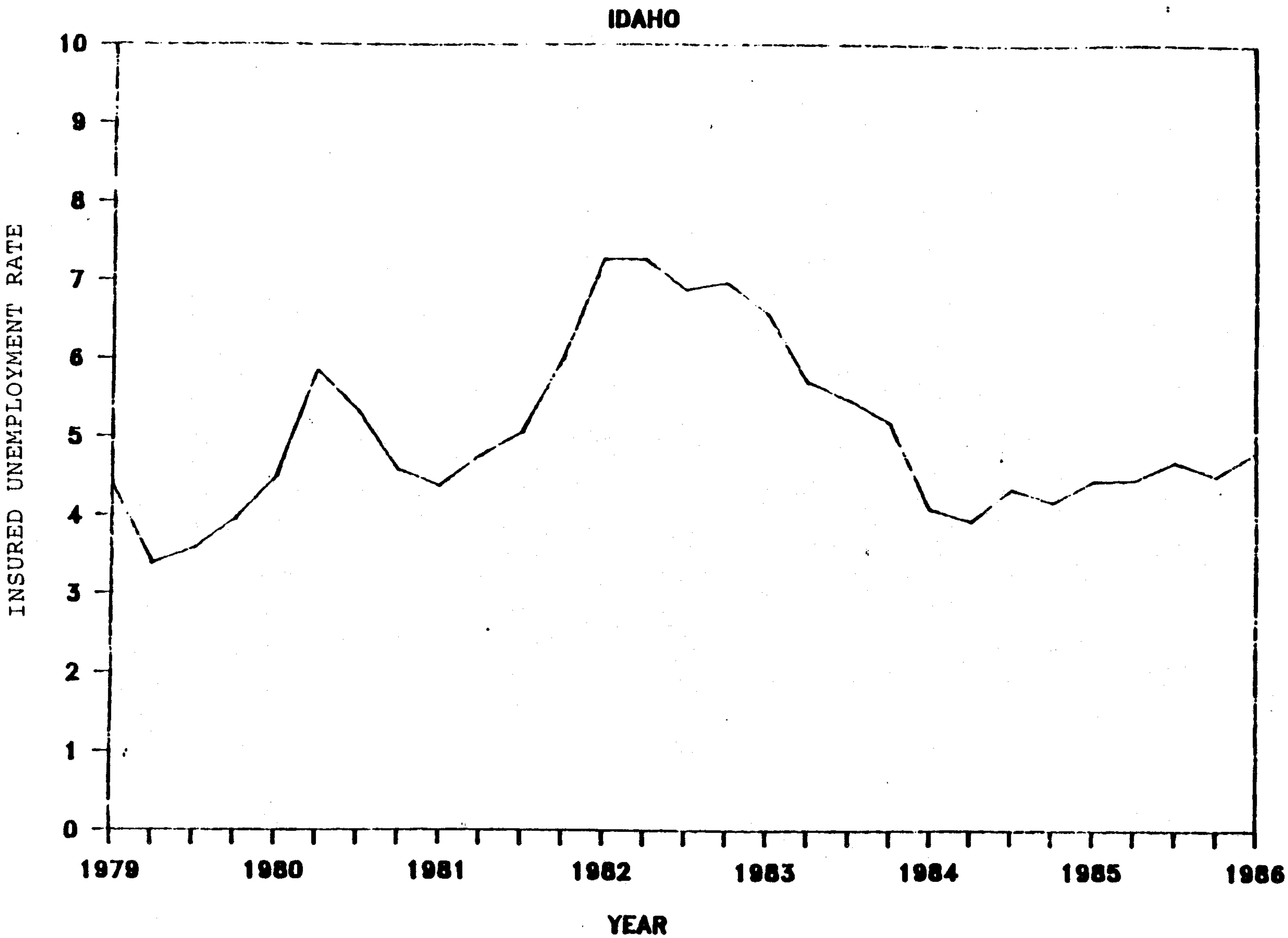


Figure 6

SEASONALLY ADJUSTED QUARTERLY INSURED UNEMPLOYMENT RATES, 1979-1986



the IUR curve. Table 7 ranks the 53 states and other jurisdictions by the severity of their recession and indicates the length of the recession and the severity for each state. For all states except Michigan, which never recovered fully from the previous recession, the downturn started in the first, second or third quarter of 1981 and ended in the first, second, or third quarter of 1984. With the exception of Michigan, the downturn lasted 10 to 13 quarters. Differential increases in the IUR rather than the duration of the recession was the major factor in determination of the severity of the recession across states. Note that the range among the states was quite large, with states such as Idaho, West Virginia, and Michigan affected approximately four times as much as states such as Hawaii, North Dakota, South Dakota, and Virginia.

Experience during the most recent downturn may not always provide the best guidance of what to expect in the future. For example, New York and Maine experienced significant downturns in the 1970s but were affected relatively lightly by the recession in the 1980s. On the other hand, Idaho and Louisiana had worse downturns in the 1980s than they experienced in the 1970s. Figures 7 through 10 contain plots of the IURs in these four states from 1970 through 1985 to illustrate how these states fared in the two most recent downturns. If states such as Idaho and Louisiana projected unemployment rates for the 1980s based on their experience in the 1970s they would have significantly understated the future unemployment levels. The recession in the 1970s tended to be more severe in the Northeast, while the more recent recession struck the Midwest and the Southwest more severely.

Because it is difficult to predict in advance which states will have the greatest unemployment, how much unemployment will increase over the recession,

Table 7

STATE	RECESSION START	END	AREA	RANK
HAWAII	80-3	84-2	5.35	1
NORTH DAKOTA	81-3	84-2	5.44	2
SOUTH DAKOTA	81-3	84-1	5.55	3
VIRGINIA	81-3	84-1	5.84	4
NEW YORK	81-2	84-3	5.96	5
NEW HAMPSHIRE	81-4	84-1	6.26	6
FLORIDA	81-3	84-1	6.36	7
MISSOURI	81-4	84-1	6.68	8
NEW JERSEY	81-2	84-2	7.00	9
ALASKA	81-2	84-2	7.10	10
MAINE	81-2	84-2	8.31	11
TEXAS	81-4	84-2	8.36	12
DELAWARE	81-2	84-1	8.57	13
NEBRASKA	81-1	84-3	9.06	14
MASSACHUSETTS	81-2	84-1	9.27	15
COLORADO	81-3	84-3	9.40	16
GEORGIA	81-1	84-1	9.62	17
NEW MEXICO	81-3	84-2	9.85	18
CONNECTICUT	81-2	84-3	9.93	19
MONTANA	81-2	84-1	10.08	20
MINNESOTA	81-3	84-2	10.35	21
OKLAHOMA	81-3	84-1	10.89	22
ILLINOIS	81-4	84-3	11.39	23
NEVADA	81-3	84-2	11.43	24
DIST. OF COLUMBIA	81-1	85-3	11.87	25
MARYLAND	81-2	84-2	12.07	26
ALABAMA	81-3	84-1	12.12	27
KANSAS	81-3	84-3	12.37	28
UTAH	81-4	84-2	12.44	29
IOWA	81-2	84-1	12.64	30
ARKANSAS	81-3	84-1	12.69	31
CALIFORNIA	81-2	84-2	12.75	32
VIRGIN ISLANDS	80-4	84-1	13.09	33
VERMONT	81-2	84-3	13.25	34
TENNESSEE	81-3	84-1	13.29	35
WISCONSIN	81-3	84-2	13.31	36
LOUISIANA	81-1	84-2	13.83	37
INDIANA	81-3	84-2	14.13	38
WASHINGTON	81-1	84-1	14.21	39
ARIZONA	81-2	84-3	14.33	40
OHIO	81-3	84-3	14.88	41
KENTUCKY	81-3	84-1	15.05	42
SOUTH CAROLINA	81-3	84-1	15.18	43
NORTH CAROLINA	81-2	84-1	15.19	44
RHODE ISLAND	81-2	84-3	15.45	45
MISSISSIPPI	81-3	84-1	15.60	46
OREGON	80-4	84-1	16.44	47
WYOMING	81-3	84-4	18.28	48
PENNSYLVANIA	81-3	84-3	18.71	49
PUERTO RICO	80-2	84-2	20.35	50
IDAHO	81-1	84-2	21.39	51
WEST VIRGINIA	81-3	84-2	22.78	52
MICHIGAN	79-1	84-2	51.72	53

Figure 7

IDAHO

ANNUAL INSURED UNEMPLOYMENT RATES, 1970-1985

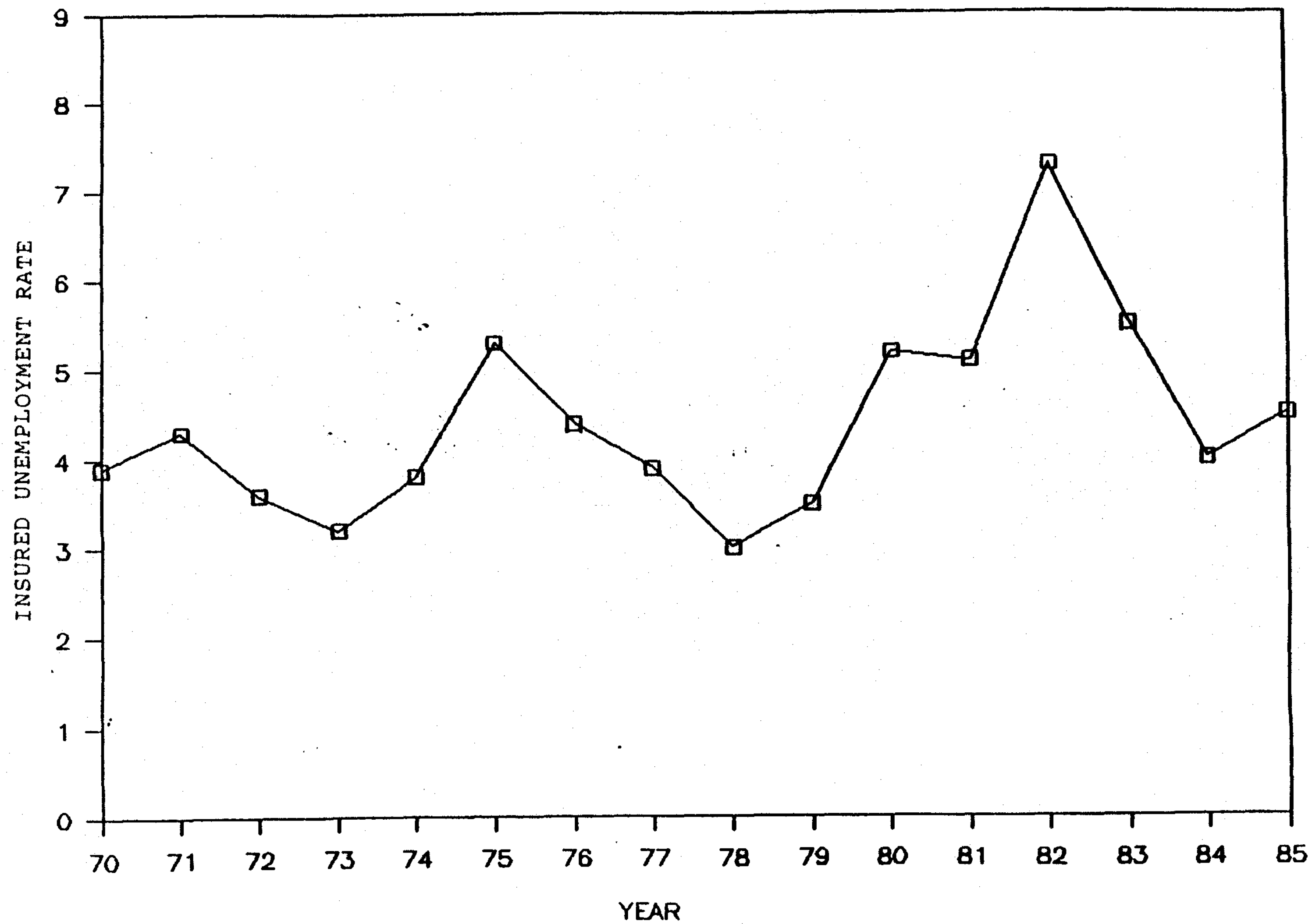


Figure 8

LOUISIANA

ANNUAL INSURED UNEMPLOYMENT RATES, 1970-1985

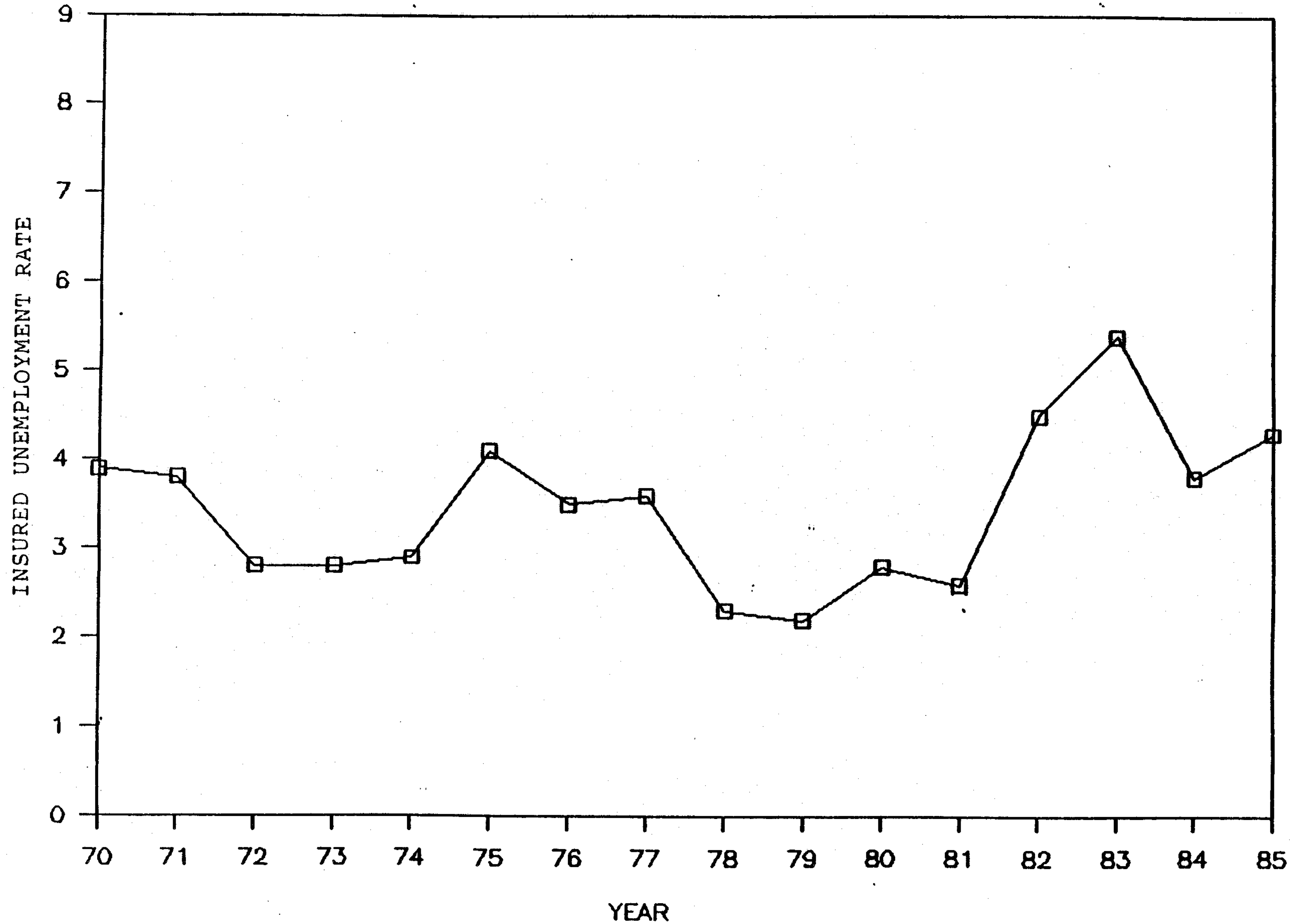


Figure 9

MAINE

ANNUAL INSURED UNEMPLOYMENT RATES, 1970-1985

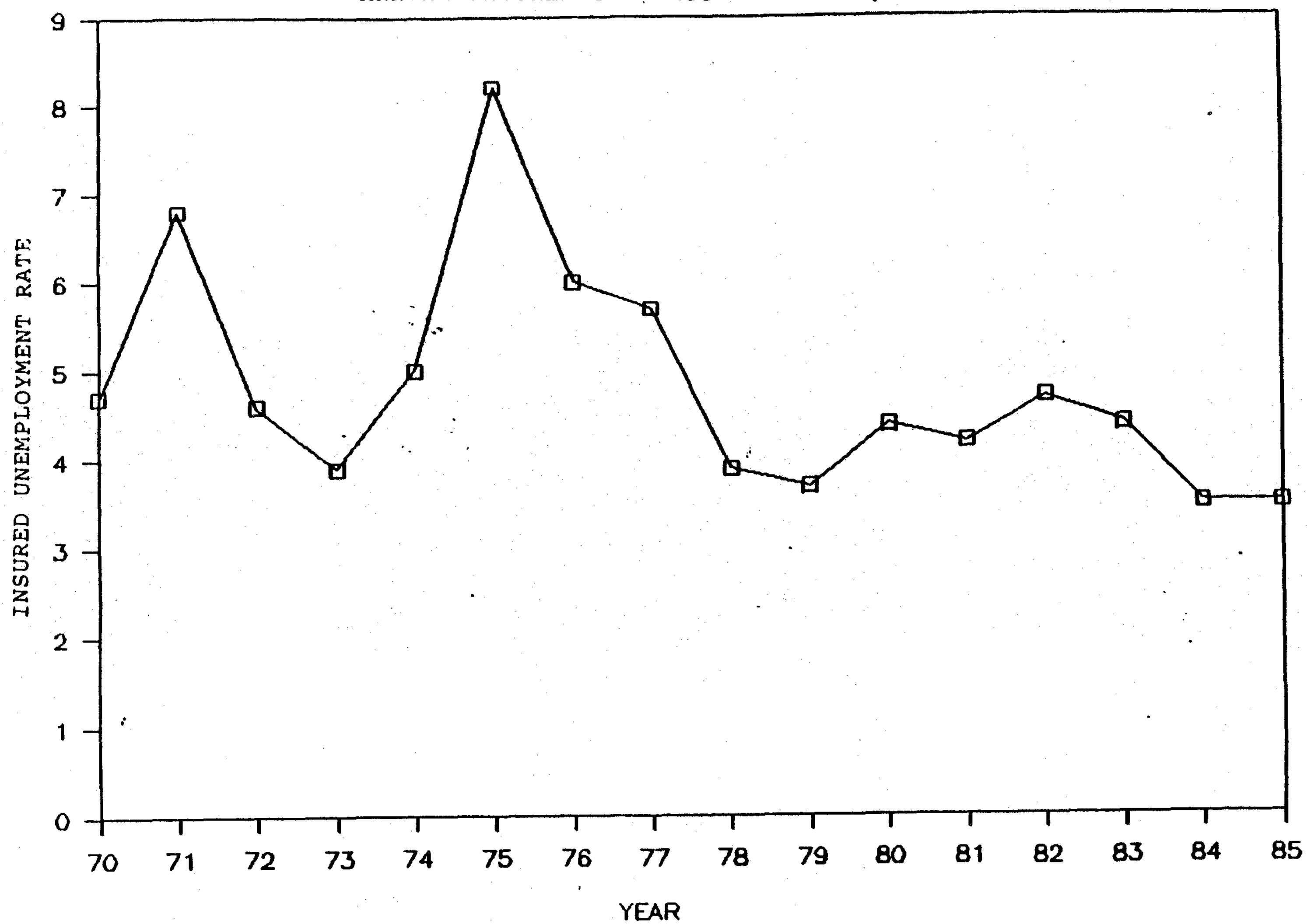
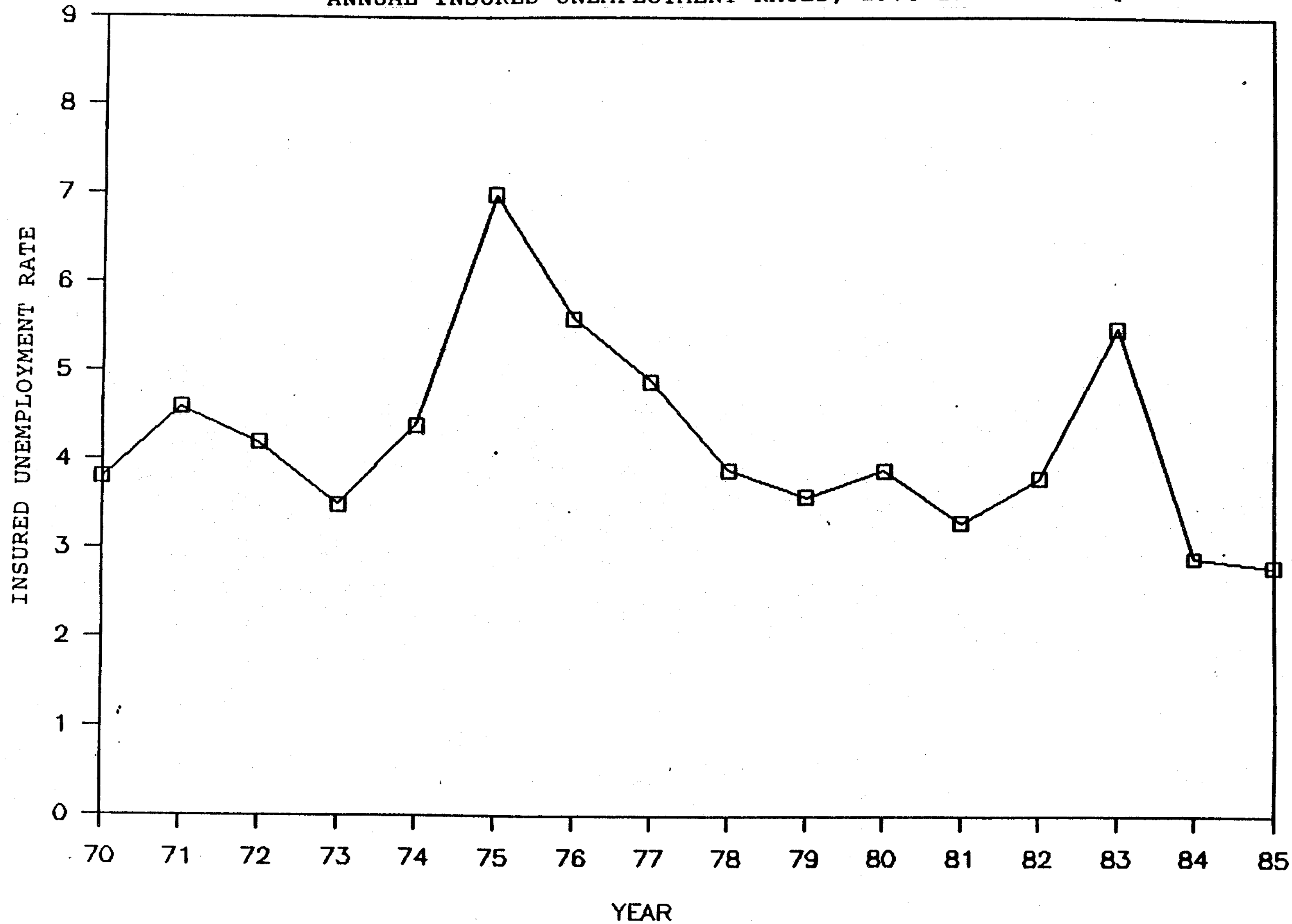


Figure 10

NEW YORK

ANNUAL INSURED UNEMPLOYMENT RATES, 1970-1985



and what the duration of the downturn will be, it is recommended that states consider how their unemployment insurance trust fund will be affected under several alternative scenarios. In addition to forecasting what is believed to be the most likely IUR scenario, strong consideration should be given to modeling what would occur in a worst-case scenario. In most states, one of the past two recessions has included the year with the highest ratio of benefits paid to annual payroll (the denominator for the reserve ratio multiple) and will serve will as a worst-case scenario. However, some states may have reason to believe that a long-term improvement in the state's economy has occurred or that economic conditions are likely to worsen, and alternative worst-case IUR projections may be appropriate.

2. Projecting the Ratio of Average Weekly Benefits to Average Weekly Wages

Projections of the ratio of average weekly benefits (AWB) to average weekly wages (AWW) are required to implement the ASM, and several techniques are available to develop the series. For states that index the maximum weekly benefit amount and retain the same statutory replacement rate, it will frequently be satisfactory to assume that the AWB/AWW ratio remains constant over time. This assumption ignores the potential relationship between the IUR and the AWB, but this omission may not create major distortions. (The user may find this to be a problem in a particular state.) In an effort to validate the use of this assumption, we computed the AWB/AWW series from simulations using the SBFSM for states that index the maximum weekly benefit. In the SBFSM, AWB is determined by a formula based on the maximum benefit and AWW.

When the maximum benefit amount is not indexed, the AWB/AWW ratio is not likely to remain constant over time. One possible approach to developing the

AWB/AWW series is to use regression analysis to estimate the ratio as a function of variables such as the IUR and a time trend. If there have been recent changes in the state's UI benefit provisions, e.g., the statutory replacement rate or the maximum benefit amount, the regression approach may lead to incorrect specifications of the AWB/AWW trend because the changes in the provisions may affect the relationship in ways not reflected in the regression model. However, if a state has been operating under the same benefit provisions for at least 10 years, regression analysis is more likely to provide reasonable estimates. A variation on this approach is to estimate AWB by regression analysis and make an appropriate assumption on the growth rate of AWW. The AWB/AWW ratio can then be estimated over time by combining the projections of the two variables. Appendix C contains some exploratory analysis along these lines for two states.

If there are too few years of data available to use regression analysis, a state can make use of some reasonable assumptions about the growth rates of AWB and AWW to develop a time trend for use in the simulations. For example, based on recent experience a state might observe that average wages grow at a rate of w percent per year and that benefits grow at a rate of b. Then the AWB/AWW series could be projected as:

(17) $(AWB/AWW)_t = AWB_o\,(1+b)^t / AWW_o\,(1+w)^t.$

If the AWB/AWW ratio was .500 in the first year and benefits increase at a rate of 1 percent per year and wages increase at a rate of 4 percent per year, then the AWB/AWW series would be .500, .486, .472, etc.

A final approach that can be used to estimate the AWB/AWW series when the maximum weekly benefit is fixed is to make use of the state's unemployment insurance wage records to simulate the effect of wage increases on average benefits. In any given year the AWB can be expressed as:

(18) AWB = $p.SRR.AWW_q + (1-p).MBA$, where

AWB = the average weekly benefit

p = the proportion of claimants who receive less than the maximum benefit amount

SRR = the statutory replacement rate, i.e., the percentage of wages that is replaced by UI benefits for claimants receiving less than the maximum

AWW_q = the average weekly wage of claimants who receive less than the maximum benefit

MBA = the maximum weekly benefit amount

To estimate AWB in the outyears, the wage distribution of claimants in the base year could be simulated to reflect increases in wages. New values of p and AWW_q could then be determined from the new data base and used to compute AWB for that year. Finally, AWB for the year would be divided by a projected value of AWW to arrive at the (AWB/AWW) ratio. While this approach to estimating the AWB/AWW series is likely to yield more precise estimates of the series, it requires a great deal sophisticated computer applications on a large data base, so it may not be a practical solution.

C. Trust Fund Revenues

The revenues that finance UI programs are derived from two sources: tax receipts and interest accruals. This chapter describes the relationship in the model that determine trust fund revenues. Because tax receipts account for the bulk of revenues they will receive most attention.

Total tax receipts are the product of total covered payrolls (of taxable employers) and the effective tax rate on covered payrolls. This identity is shown as relation (19):

(19) $Tax = TP \cdot TE$

where Tax = UI tax receipts,

TP = total payroll of taxable covered employers, and

TE = the effective tax rate on total payroll

The effective tax rate in turn can also be expressed as an identity, the product of the taxable wage proportion and the average tax rate on taxable wages, i.e.,

(20) $TE = (TxP/TP) \cdot \bar{T}$

where (TxP/TP) = the taxable wage proportion, the ratio of taxable payroll (TxP) to total payroll (TP), and

$\bar{T}$ = the average tax rate on taxable payroll.

Both right hand elements in (20) are determined by a behavioral relationship.

In general, the taxable wage proportion is a function of three factors; the taxable maximum per worker (TM), average wages in the state and the shape of the state's wage distribution. The latter can be assumed to be constant in the short run. Thus, changes in the taxable wage proportion depend on movements in the taxable maximum relative to movements in average wages. If the taxable maximum is constant for a series of years while average wages are rising the taxable wage proportion will decline, then the rate of decline will depend directly on the growth rate in average wages. If the taxable maximum is indexed to average wages, then the ratio of the two will remain constant as will the taxable wage proportion.

An econometric analysis of the determinants of the taxable wage proportion in Michigan and New York was conducted earlier in the present project. The proportion has an upper limit of 1.0, and this limit is reached only when the taxable maximum is removed, i.e., when the ratio of the taxable maximum to average wages is very high. The form of the relationship is shown in Figure 2 of Appendix C along with regression results for Michigan and New York. The regression analysis also tested for cyclical effects but found them to be of small quantitative importance.

A general functional form to explain the taxable wage proportion would be the following:

(21) $(TxP/TP) = c_1 + c_2\ (TM/52AWW) + c_3\ (TM/52AWW)^2$

where TM = the taxable maximum per employee,

52AWW = average annual wages per worker (fifty-two times the average weekly wage).

The parameters c_2 and c_3 in (21) respectively have positive and negative signs indicating that the proportion increases but at a decreasing rate as the (TM/52AWW) ratio continues to rise.

In actual situations using historic data, the range of variation in (TM/52AWW) may be too small for the curvature in (21) to be estimated with accuracy. This was the case in both Michigan and New York in regressions covering the 1970-1984 period. It is also clear that when the (TM/52AWW) ratio declines to low levels, i.e., below .4, that the taxable wage proportion is closely approximated by the relationships (TxP/TP) = (TM/52AWW). Finally, after examining historic data in several states for the 1970-1984 period, it was clear that the taxable wage proportion is closely linked to the (TM/52AWW) ratio. Thus, an accurate relationship to explain the taxable wage proportion can be derived in all states.

Determination of the average tax rate on taxable wages ($\bar{T}$) is treated as a two step process in the model. Nearly all states have a UI tax statute that contains several different schedules of statutory tax rates. Each schedule has a progression of rates from a minimum to a maximum. An indicator of the overall level of the state's trust fund balance is used as a trigger mechanism to activate one particular tax schedule in a given year. Lower fund balances activate schedules with higher maximum and/or minimum rates. The first step in estimating T, the average rate on taxable wages, is to determine which tax schedule is to be in effect. The second step uses variables taken from the tax schedule (and possibly other arguments) to predict $\bar{T}$.

Although the states have different ways of rating the experiences of individual employers, all experience rating systems (reserve ratio, benefit ratio, benefit-wage ratio and payroll decline) use an indicator of the fund balance to activate individual tax rate schedules. Table 8 shows statutory tax rates from the top and bottom tax schedules in four reserve ratio states (Maine, New York, Rhode Island and South Dakota). For each tax schedule four statutory rates are displayed: the minimum rate, the zero balance rate, the lowest negative balance rate and the maximum negative balance rate. The table also shows the tax schedule triggers and the number of tax schedules present in these states. Four of the most common triggering mechanisms are: the absolute level of the trust fund balance, the reserve ratio based on total payroll (the fund balance measured as a percentage of total payroll), the reserve ratio based on taxable wages (the fund balance measured as a percentage of taxable payroll) and the reserve multiple (the reserve ratio relative to the highest value of the ratio of total benefits to total payroll for a twelve-month period). Each of the four kinds of triggering mechanisms is represented in Table 8.

Table 8. Tax Schedules and Tax Schedule Triggers in Four Reserve Ratio States: 1986[a]

STATE	Tax Schedule Trigger (Dollars, RRTO, RRTX, RM or Other)[b]	Tax Schedule Number	Statutory Tax Rates: Minimum Tax Rate T_{MIN}	Zero Balance Rate T_{ZERO}	Lowest Negative Bal. Rate T_{NEG}	Maximum Negative Bal. Rate T_{MAX}
Maine	RM > 2.5	1	.5	2.8	3.0	5.4
	RM < .45	16	2.4	4.7	4.9	6.5
New York	RRTX > 5%	1	0	2.6	2.7	5.4
	RRTX < 0	7	1.1	3.7	3.9	5.4
	RRTX < 0 plus Maximum Subsidiary Tax	7	2.1	4.7	4.9	6.4
Rhode Island	RRTO > 14%	1	.8			5.4
	RRTO < 6.5%	9	2.3	4.8	5.4	8.4
South Dakota	Fund Balance > $11 million	1	.1	3.0	6.0	9.0
	Fund Balance < $5.5 million	16	1.6	4.5	7.5	10.5

a. Source: Tax schedule data taken from Commerce Clearinghouse (1986).

b. Dollars = Level of the Trust Fund; RRTO = Reserve Ratio-Trust Fund as a Proportion of Total Covered Payroll, RRTX = Reserve Ratio-Trust Fund as a Proportion of Taxable Covered Payroll; RM = Reserve Multiple; Other = All Other Systems

In addition to the basic set of statutory rate schedules a state may provide for other UI taxes to finance benefits not assignable to individual employers and/or to build the fund balance when it is low. These additional taxes also will enter into the structure of tax rates that experience rated employers must pay. In New York State, for example, the subsidiary tax that covers ineffectively charged benefits can add up to 1.0 percent to the rate applicable to all employers. Thus with the maximum subsidiary tax, the top range of tax rates is from 2.1 percent to 6.4 percent.

Almost every state applies just a single statutory tax rate schedule within a given calendar year. The fund balance as of a certain date in the previous year, say June 30th, determines which schedule is applicable. Since the model is annual, it must approximate the fund balance at this earlier date. The approximation which is used is the following:

$$TF_{TS} = \left(\frac{m}{12}\right) TF_{-2} + \left(\frac{12-m}{12}\right) TF_{-1} \tag{22}$$

when TF_{TS} = the lagged trust fund balance on the computation date that determines the tax schedule to be used in the current year,

TF_{-2} = the trust fund balances at the end of the second prior year,

TF_{-1} = the trust fund balance at the end of the prior, and

m = the number of months between the date when the trust fund is evaluated and when the new schedule of rates goes into effect.

Typically m will be either 6, 3 or 0 indicating evaluation dates of June 30th, September 30th and December 31st respectively. The procedure implied by equation (22) applies to whatever triggering mechanism is used by the state to identify the appropriate tax schedule, i.e., the reserve ratio or the reserve multiple, as well as the absolute fund balance. The model has a look-up table which uses TF_{TS} to identify the applicable tax schedule and the statutory rates for the current year.

Once the current year's tax rate schedule has been identified a combination of its statutory rates (Ts) is used in an equation (perhaps with other arguments) to predict the average tax rate on taxable wages. For example, a simple characterization of the statutory rates that works well in many reserve ratio states is the following:

(23) $$\bar{T}_s = (T_{MIN} + T_{MAX})/2$$

This variable enters a regression equation to explain $\bar{T}$:

(24) $$\bar{T} = c_4 + c_5\bar{T}_s$$

The parameters c_4 and c_5 are both positive, and c_5 lies in the range between 0 and 1. Although (24) is a very simple equation the simple characterization of $\bar{T}_s$ as shown in (23) explains more than 90 percent of the variation in T in Maine, New York, and Rhode Island over the 1970-1984 period. It worked less well in explaining $\bar{T}$ in Nebraska and South Dakota. In some reserve ratio states a measure of the aggregate trust fund balance may also add significantly to the explanation of $\bar{T}$ in (24). Also, the characterization of T_s can be made more complex to take account of the zero balance rate and/or the lowest negative balance rate if that is appropriate. In South Dakota, for example, the statutory rate increases sharply (by 3 percentage points) when an employer's balance turns negative. Thus the zero balance rate is more important here than in other states where the rate progression is smoother as an employer's balance changes from positive to negative.

Table 9 shows statutory tax rate schedules in five states that use benefit ratios to experience rate their employers. The same four tax schedule triggering mechanisms identified previously in Table 8 are also present in these jurisdictions. Because individual employer account balances are not known in benefit ratio states, the rate structure in each schedule can be described with just two rates; the minimum rate and the maximum rate. As in reserve ratios states, the model uses equation (22) to approximate the level of the fund balance on the date when the tax schedule is to be selected, and then it uses a look-up table to provide the minimum and maximum tax rates from that schedule.

In benefit ratio states the average statutory rate structure ($\bar{T}_s$) is approximated by the simple average of the minimum and maximum rates, i.e., equation (23). It, in turn, is the principal variable to explain the average tax rate on taxable wage, i.e., relation (24). In benefit ratio states it appears that recent benefit payout rates also play a significant role in determining the average tax rate. Thus the tax rate equation may be specified as follows:

(25) $\bar{T} = c_4 + c_5 \bar{T}_s + c_6 BR$

where BR = the benefit payout rate (benefits as a percent of total payroll) for the averaging period (often three years) used to set individual employer tax rates.

The parameter c_6 in (25) is positive and shows the effect of recent benefit payouts on the average tax rate. In general, it appears that equations like (24) and (25) have larger errors in benefit ratio states than in reserve ratio states.

Table 9. Tax Schedules and Tax Schedule Triggers in Five Benefit Ratio States: 1986[a]

STATE	Tax Schedule Trigger (Dollars, RRTO, RRTX RM or Other)[b]	Tax Schedule Number	Statutory Tax Rates: Minimum Tax Rate T_{MIN}	Statutory Tax Rates: Maximum Tax Rate T_{MAX}
Minnesota	Fund Balance > $200 million	1	.1	7.5
	Fund Balance < $80 million	8	1.0	7.5
Oregon	RM > 2.0	1	.9	5.4
	RM < 1.0	8	2.5	5.4
Texas	RRTX > 2%	1	0	6.0
	RRTX < 1%		.1	6.0
	+Deficit Tax Rate (Max = 2 %) + Solvency Tax (.36% in 1986)		.36	8.36
Vermont	RM > 2.5	1	.4	5.4
	RM < 1.0	5	1.3	8.4
Virginia	RRTO > 5%	1	.1	6.2
	RRTO < 3 %		.7	6.2
	+ Maximum Solvency Tax		1.0	7.1

a. Source: Tax schedule data taken from Commerce Clearinghouse (1986)

b. Dollars = Level of the trust fund; RRTO = the reserve ratio based on total wages; RRTX = the reserve ratio based on taxable wages and RM = the reserve multiple.

Interest income to a state's trust fund is the product of the annual interest rate and the average trust fund balance for the year, i.e.,

(26) $Int = r\,(TF + TF_{-1})/2$

when Int = interest income to the trust fund for the year, and

r = the interest rate paid on trust fund balances.

Since there is simultaneity between Int and TF, an approximation to TF is used for purposes of determining interest income for the current year. The approximation is as follows:

(27) $\hat{TF} = TF_{-1} + Tax - Ben$

where Ben = total benefit payments for regular UI.

When fund balances are positive this approximation understates the level of the trust fund in (26) by a small amount, but the understatement has only a tiny effect on estimated interest income for the year.

D. Some Limitations of the ASM

The ASM as described in this chapter is designed for limited applications and not intended to be an all purpose vehicle. Some of its limitations are discussed in the following pages.

The model was designed for use with annual data. For states with immediate funding problems the model does not indicate the subperiod within the year when borrowing will commence. Borrowing within each of the four quarters of any calendar year is treated equivalently.

A further limitation is that the ASM cannot indicate to a state the seriousness of a funding deficiency. As currently structured it does not show the total volume of loans that a state would need in a serious recession or the time pattern of borrowing that would occur. Some debt questions that the model does not address are the following: (i) How long will the state be in debt?, (ii) How much total debt will be incurred?, (iii) Will the debt be fully repaid in the ensuing economic recovery? This is a serious limitation because states are as likely (or more likely) to be concerned with the long term outlook for solvency as whether or not they will have to borrow.

The model ignores the use of the trust to pay extended benefits. The recent changes the EB triggers make it difficult to incorporate this program change since states have had little experience under the revised EB program. It should be noted, however, that EB is now less likely to trigger on than in the past. Also it should be noted that the SBFSM fails to reflect the recent changes in EB.

The accounting identities shown as (2) and (3) do not recognize interest income to the trust fund from cash flow during the year. This will produce a small bias except when the trust fund balance at the beginning of the period is very small relative to the change over the year (Tax-Ben). An adequate correction for this limitation would need to take into account the seasonal nature of tax and benefit cash flows.

All of the previous limitations in the ASM could be addressed if the model were expanded to incorporate more behavioral relations and relationships fitted to quarterly (as opposed to annual) data. They would have the effect of making the ASM resemble more closely the full SBFSM. The changes would make the model much more complicated and move it away from the simplicity and the ease of use of its present structure. Users who wish to work with a more complicated model should think of working directly with the SBFSM.

Another limitation of the ASM should also be discussed. Like all other simulation models the quality of the model's simulations will be heavily dependent on the quality of inputs used to prepare the simulations. States must be able to project the IUR, AWB/AWW and Tax/TP with accuracy to obtain useful results. We suggest that states test the effects of using alternative projections of future IURs to determine what kinds of downturns their UI system can tolerate. If the state has concern about the AWB/AWW and/or Tax/TP projections, simulations with alternative parameters should be conducted.

Other general problems associated with model projections should also be recognized. Parameters should be estimated with data from periods when statutory effects were stable and when the structure state's economy was stable. Also, simulation accuracy will decline as the out years become further removed from the present and when the exogenous variables in the projection period fall outside their historic range. Careful attention to these potential problems by model users is essential.

E. Conclusions

The ASM is a compromise between the very simplistic 1.5 reserve ratio multiple rule of thumb and the very complex SBFSM. While providing much more guidance than the 1.5 multiple rule, it does require more work to implement. On the other hand, it is much simpler than the SBFSM to develop and use, but it lacks much of the SBFSM's power and flexibility.

We would consider the ASM suitable as an interim measure for states to use until the better SBFSM model can be developed. Many observers consider the 1.5 reserve ratio multiple rule to be too crude to be of much use, and the ASM can provide better guidance to them on the adequacy of their UI system.

No simulation model or rule can substitute for a continuing review of the state's economy and financial status. Changes in the economy of the state can alter the relationships modeled in the ASM or SBFSM, and models must be periodically assessed and updated.

Footnotes

1. Michigan and Pennsylvania use both reserve ratios and benefit ratios to set employer tax rates. They have been classified among the nineteen benefit ratio systems in the present discussion. Thus the 32-19 split between stock and flow based tax systems would be changed to a 34-17 split if the two states were reclassified. Note that Puerto Rico and the Virgin Islands are not included in this discussion.

2. Loans during 1972-79 were less than one percent of 1975 covered payrolls in the following nine states: Alabama, Arkansas, Florida, Maryland, Montana, Nevada, New York, Ohio and Oregon.

3. Loans during 1980-85 were less than one percent of 1979 covered payrolls in fourteen states: Alabama, Connecticut, Delaware, Indiana, Maine, Missouri, New Jersey, Rhode Island, South Carolina, Tennessee, Utah, Virginia, Washington and Wyoming.

4. The fourteen were Connecticut, Illinois, Louisiana, Michigan, Minnesota, North Dakota, Ohio, Pennsylvania, Puerto Rico, Texas, Vermont, the Virgin Islands, West Virginia and Wisconsin.

5. These factors are discussed more fully in Chapters 1 and 2 of Vroman (1986a).

6. The most common actuarial standard is the 1.5 reserve ratio multiple. This will be discussed in Part III of this paper. Typically, the states requiring major loans had had inadequate trust fund balances for at least five years prior to their first year of borrowing.

7. See Chapter 3 in Vroman (1986a).

8. Having indexed their taxable wage bases prior to the onset of recession has helped many states to avoid large scale borrowing or to completely avoid borrowing.

9. The counterfactual estimate was made as follows. Total covered payrolls in 1984 were $1369 billion. If thirteen programs needed loans, if each loan equaled one percent of payroll and if the thirteen were chosen at random from the fifty-three programs, loans would be about .25 percent of covered payrolls or $3.4 billion.

10. For this illustration (and throughout the entire paper) reserves are measured at the end of the year in question while payrolls are measured over the entire year. Covered payrolls in 1985 were estimated by increasing the 1984 level of covered payrolls by 6.77 percent (the percentage growth in private wages and salaries as measured in the national income accounts).

11. The second largest two year gain in the reserve ratio was .78 percentage points which took place during the years 1978 and 1979.

12. The reserve ratio rose from 2.80 percent in 1961 to 3.54 percent in 1969 an increase of .74 percentage points.

13. The four highest annual cost experiences in national data during recessions were as follows: 1975 - 2.24 percent, 1958 - 2.05 percent, 1949 - 1.85 percent and 1982 - 1.83 percent.

14. Puerto Rico started to pay UI benefits in 1961 while the Virgin Islands first paid benefits in 1978.

15. The highest cost period in national data was from January to December, 1975.

16. From Table A of Appendix A the reader will observe that just five years accounted for the highest rates of benefit costs in forty-four states. The years and number of states were as follows: 1975 - 17 states; 1982 - 10 states; 1958 - 7 states; 1983 - 6 states and 1949 - 4 states. All five years were recession years.

17. See Burtless (1983), Burtless and Vroman (1984) and Vroman (1985) for statistical analysis of this downtrend in national data for the 1980s. A description of the downtrend in several of the large industrial states is given in Vroman (1986b).

18. The twelve states are Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin. Their high cost years are shown in Table A of the Appendix.

19. A similar statement could be made about the cost experiences of states that depend heavily on energy production and/or mining. They too experienced very high costs during the 1980-84 period.

20. The nine states are Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont. Their high cost years are shown in Table A of the Appendix.

21. Massachusetts provides a vivid illustration of this point. Its high cost experiences were as follows: (i) highest cost ever during 1948-84 - 3.22 percent in 1975; (ii) second highest cost - 2.47 percent in 1949 and (iii) highest cost during 1980-84 - 1.44 percent in 1982.

22. The cost rates and three year periods for each state are identified in Table A of the Appendix.

23. Among the fifty-one jurisdictions only five had outflows in these other two years that averaged as much as 80 percent of the outflow in the highest cost year. These five states and their three year high cost periods were as follows: the District of Columbia in 1975-77, Illinois in 1980-82, North Dakota in 1982-84, South Dakota in 1962-64, and Wisconsin in 1980-82. The two states with unusually high sustained costs in the 1980s were both major borrowers from the U.S. Treasury during these years. See Table A in the Appendix.

24. There are eleven instances in the 1948-84 period. These are the five previously identified in footnote 18 plus Alaska in 1953-55, Colorado in 1961-63, Hawaii in 1975-77, Maine in 1975-77, Maryland in 1958-60 and Montana in 1958-60. In the latter six instances, the three year cost rate was between 2.5 and 2.6 times the highest single year cost rate.

25. In 1986 the types of triggers used by the fifty-two jurisdictions with experience rating (all but Puerto Rico) had the following distribution: absolute dollar amounts-6 states; reserve ratios-21 states; reserve multiples-11 states and "all other" triggering arrangements-14 states. The last category covers a wide variety triggering arrangements that cannot be concisely summarized.

26. In contrast, reserve ratio systems use stock measures to determine both which schedule is in effect (using the overall fund balance) and which rate to apply to the individual employer (using individual employer account balances).

27. The five states are the following: Alabama, Delaware, Illinois, and Oklahoma which use benefit-wage ratios and Alaska which uses payroll declines to experience rate their employers.

28. The federal UI taxes finance the administrative costs of both unemployment insurance and the employment service as well as certain costs of long term UI benefits.

29. Sixteen states fully index the taxable wage base to changes in average (weekly or annual) wages. The seventeenth state with indexation is Washington. Since 1985, its taxable wage base increases by 15 percent per year and it will continue to advance at that pace until the tax base reaches 86 percent of annual average wages. Besides the seventeen jurisdictions with indexation covered by Table 2, indexation is also used in the Virgin Islands.

30. The ten largest states (measured on the bases of total covered payrolls) are California, Florida, Massachusetts, Michigan, New Jersey, New York, Ohio, Pennsylvania and Texas. Only New Jersey is estimated to have a taxable wage proportion above .450 in 1986, and that proportion is only .456.

31. The tax rate schedules appear in Commerce Clearinghouse, Volume VI (1986).

32. One exception to this statement would arise if a state imposed the same tax rate on all employers. This has occurred a few times in the past when states have imposed a single rate on a temporary basis to replinish a depleated trust fund balance. Washington had uniform tax rates from 1960 to 1963 and again from 1972 to 1984.

33. In Alaska, New Jersey and Pennsylvania the estimate of 1986 tax capacity also includes employee taxes.

34. Between 1972 and 1984, Washington had a tax provision that automatically raised the taxable wage base by $600 per year whenever the fund balance was less than 4.5 percent of covered payrolls (and the wage base did not exceed 80 percent of average annual wages). California had a provision that raised the tax base to $7000 when the aggregate trust fund fell below a designated threshhold. In both states these automatic tax base responses were activated during recessions of the 1970s.

35. The states with the three month lag were Alabama, Delaware, Massachusetts, Montana, North Dakota, Rhode Island and Texas. The states with a zero lag between the tax computation date and the date of the new effective tax rates were Florida, Hawaii, Nebraska, New York, Oklahoma, South Dakota, Utah and the Virgin Islands.

36. See footnote 25.

37. The six were Colorado, Kentucky, Minnesota, Missouri, South Dakota, and Tennessee. Additionally, Louisiana and New Hampshire use dollar amounts as one element in determining the applicable tax rate schedule.

38. Michigan's limiter was abolished while Wisconsin's was widened from one to two percentage points per year.

39. The ten states are California, Idaho, Louisiana, Massachusetts, Michigan, New York, Ohio, Pennsylvania, West Virginia and Wisconsin.

40. Phone interviews were conducted with professional staff in Arizona, Illinois, Maryland, Massachusetts, Minnesota, New York, Ohio and Texas.

41. Primary and secondary downturns were distinguished. The start of the latter can follow the end of the former by as little as one year during which the trust fund increased in size. There were a total of 208 primary downturns and 157 secondary downturns.

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Appendix A: High Cost Experiences, 1948 to 1984

Table A displays state data on high cost experiences in individual programs for the 1948-1984 period. For each measure of high cost experience the year (or years) is shown as well as benefit costs measured as a percentage of total covered payrolls. Costs since 1971 include the state share of Federal-State Extended Benefit costs. Cost data from 1958 to 1984 refer to consecutive twelve-month periods (not necessarily calendar years) whereas earlier data refer to costs measured on a calendar year basis.

The highest and second highest twelve-month cost rates for the 1948-1984 period are both shown. The latter may be viewed as more typical of a recessionary experience and less influenced by special or one time factors. The table also shows the highest cost rate for the 1980-84 period which is more descriptive of recent cost experiences. Finally, the highest three year cost rate is shown. These cost rates underline the distributions of cost rates shown in Table 1 of the text.

Table A. Selected Data on Highest Benefit Cost Experiences by State: 1948 to 1984

State	Highest Cost Rate Since 1948		Second Highest Cost Rate Since 1948		Highest Cost Rate Since 1980		Highest Three Year Cost Rate Since 1948		Second Highest / Highest Cost	the 1980s Highest Cost / Highest Cost
	Rate	Year	Rate	Year	Rate	Year	Rate	Years		
U.S. Total	2.24	1975	2.05	1958	1.83	1982	1.69	1975-77	.915	.817
Alabama	2.17	1975	2.06	1949	1.69	1982	1.62	1975-77	.949	.779
Alaska	4.54	1954	4.33	1958	2.13	1984	3.81	1953-55	.954	.469
Arizona	2.48	1975	1.34	1982	1.34	1982	1.59	1974-76	.540	.540
Arkansas	2.69	1975	1.86	1982	1.86	1982	1.75	1975-77	.691	.691
California	3.20	1949	2.34	1975	1.66	1982	2.38	1948-50	.731	.519
Colorado	1.26	1963	1.24	1983	1.24	1983	1.06	1961-63	.984	.984
Connecticut	3.29	1975	3.17	1971	1.02	1983	2.48	1974-76	.964	.310
Delaware	2.70	1975	1.95	1971	1.40	1980	2.07	1975-77	.722	.519
Dist. of Col.	1.84	1975	1.82	1976	1.46	1982	1.77	1975-77	.989	.793
Florida	1.84	1975	1.16	1949	.75	1982	1.31	1975-77	.630	.408
Georgia	2.13	1975	1.57	1958	1.17	1982	1.39	1975-77	.737	.549
Hawaii	2.65	1976	2.22	1975	1.64	1982	2.24	1975-77	.838	.619
Idaho	3.17	1982	2.09	1961	3.17	1982	2.33	1981-83	.659	1.000
Illinois	2.67	1982	2.22	1983	2.67	1982	2.32	1981-83	.831	1.000
Indiana	1.79	1975	1.73	1958	1.55	1982	1.30	1980-82	.966	.866
Iowa	2.62	1982	1.52	1975	2.62	1982	2.04	1981-83	.580	1.000
Kansas	1.97	1982	1.38	1983	1.97	1982	1.45	1981-83	.701	1.000
Kentucky	2.77	1958	2.53	1982	2.53	1982	2.17	1980-82	.913	.913
Louisiana	3.08	1983	2.30	1982	3.08	1983	2.39	1982-84	.747	1.000
Maine	2.84	1958	2.84	1975	1.77	1982	2.37	1975-77	1.000	.623
Maryland	2.19	1958	2.09	1949	1.73	1982	1.85	1958-60	.954	.790
Massachusetts	3.22	1975	3.04	1949	1.44	1982	2.47	1974-76	.944	.447
Michigan	3.69	1958	3.62	1982	3.62	1982	2.92	1980-82	.981	.981
Minnesota	1.96	1982	1.70	1958	1.96	1982	1.61	1980-82	.867	1.000
Mississippi	2.07	1954	1.97	1961	1.82	1982	1.58	1959-61	.952	.879
Missouri	1.98	1975	1.39	1980	1.39	1980	1.38	1975-77	.702	.702
Montana	3.03	1958	2.36	1960	1.92	1982	2.55	1958-60	.779	.634
Nebraska	1.50	1975	1.06	1982	1.06	1982	1.03	1974-76	.707	.707
Nevada	2.75	1958	2.57	1975	2.00	1982	2.09	1974-76	.935	.727
New Hampshire	3.56	1949	2.51	1975	1.01	1982	2.46	1949-51	.705	.284
New Jersey	3.33	1975	2.62	1958	1.94	1982	2.67	1974-76	.787	.583
New Mexico	1.64	1961	1.48	1983	1.48	1983	1.32	1960-62	.902	.902
New York	2.54	1949	2.50	1975	1.23	1980	1.94	1948-50	.984	.484
North Carolina	2.58	1975	1.83	1982	1.83	1982	1.63	1975-77	.709	.709
North Dakota	2.34	1983	1.87	1982	2.34	1983	2.06	1982-84	.799	1.000
Ohio	3.09	1982	2.43	1958	3.09	1982	2.35	1980-82	.786	1.000
Oklahoma	1.36	1983	1.30	1958	1.36	1983	1.10	1960-62	.956	1.000
Oregon	3.21	1982	2.62	1958	3.21	1982	2.53	1981-83	.816	1.000
Pennsylvania	3.37	1982	3.02	1958	3.37	1982	2.75	1981-83	.896	1.000
Rhode Island	5.25	1949	4.37	1975	2.75	1982	3.28	1948-50	.832	.524
South Carolina	2.89	1975	2.07	1982	2.07	1982	1.73	1975-77	.716	.716
South Dakota	1.04	1964	.98	1982	.98	1982	.91	1962-64	.942	.942
Tennessee	2.18	1958	2.12	1954	1.78	1982	1.67	1954-56	.972	.817
Texas	1.01	1983	.97	1958	1.01	1983	.80	1958-60	.960	1.000
Utah	2.02	1982	1.66	1975	2.02	1982	1.60	1981-83	.822	1.000
Vermont	3.18	1975	2.65	1949	2.11	1982	2.46	1974-76	.833	.664
Virginia	1.31	1975	1.17	1949	1.01	1982	.93	1975-77	.893	.771
Washington	4.21	1971	2.92	1970	2.90	1982	2.98	1970-72	.694	.689
West Virginia	4.00	1983	3.21	1982	4.00	1983	3.10	1981-83	.802	1.000
Wisconsin	2.37	1982	2.25	1980	2.37	1982	2.20	1980-82	.949	1.000
Wyoming	3.03	1983	2.23	1962	3.03	1983	2.10	1982-84	.736	1.000

Source: All data were taken from U.S. Department of Labor, Unemployment Insurance Financial Data, ET Handbook 394, (Washington, DC: GPO, 1983) and 1983 and 1984 Handbook updates.

Appendix B: Derivation of the Test for Trust Fund Adequacy

This appendix shows how the test for trust fund adequacy (shown as equations (2) and (3) in Chapter IV) is derived by making use of an accounting identity and some simplifying assumptions. The simplifying assumptions are noted to point out the limitations of this approach and so that the interested reader can consider adding more realistic assumptions.

Begin with an accounting identity that relates the trust fund balance in period i to the balance in period i-1:

(1) $TFB_i = TFB_{i-1}(1+r) + TAX_i - BEN_i$

where TFB_i = the trust fund balance in period i;

r = the interest rate paid on positive trust fund balances;

TAX_i = taxes collected in period i; and

BEN_i = benefits paid in period i.

Because interest on loans is not paid out of the trust fund, equation (1) is valid only in periods where the trust fund balance is positive. The interest rate r is held fixed for computational convenience, but users can test the sensitivity of the simulations to alternative interest rates. The assumption that interest is paid only on the prior period balance is made to simplify the calculations; for a more accurate approximation, $TAX_i - BEN_i$ could be multiplied by $(1+r)^{.5}$ Finally, while the equation can be specified on a quarterly or annual basis, we recommend that the model be used on an annual basis to minimize complexity.

By making repeated substitutions into equation (1), the trust fund balance i years in the future can be expressed as a function of the balance in the initial period, TFB_0, and the taxes collected and benefits paid in all years after the initial period. For example, the balance in year 1 is:

(2) $TFB_1 = TFB_o (1+r) + TAX_1 - BEN_1,$

and the trust fund balance in year 2 is:

(3) $$TFB_2 = TFB_1 (1+r) + TAX_2 - BEN_2$$
$$= TFB_o (1+r)^2 + TAX_1 (1+r) + TAX_2 - BEN_1 (1+r) - BEN_2.$$

By continuing the substitution process, the general formula for the trust fund balance in period 1 can be expressed as:

(4) $$TFB_i = TFB_o (1+r)^i + TAX_t (1+r)^{i-t} - BEN_t (1+r)^{i-t}$$

The initial trust fund balance is adequate through year i if $0 \leq TFB_i$, i.e., if the state does not have to borrow. Thus, a state has an adequate initial trust fund if the following inequality is true:

(5) $$0 \leq TFB_o (1+r)^i + TAX_t (1+r)^{i-t} - BEN_t (1+r)^{i-t}$$

Solving inequality (5) for TFB_o, we find that the initial trust fund balance is adequate to avoid borrowing through period t when:

(6) $$TFB_o \geq BEN_t (1+r)^{-t} - TAX_t (1+r)^{-t}$$

Now define c as the cost rate criterion, the denominator in the reserve ratio multiple (RRM) and TP_o as the total covered payroll in the base period. Dividing both sides of inequality (6) by cTP_o, we obtain:

(7) $$\frac{TFB_o}{cTP_o} > \frac{\sum_t BEN_t (1+r)^{-t}}{cTP_o} - \frac{\sum_t TAX_t (1+r)^{-t}}{cTP_o} \qquad \text{or}$$

$$RRM_o > \frac{\sum_t BEN_t (1+r)^{-t}}{cTP_o} - \frac{\sum_t TAX_t (1+r)^{-t}}{cTP_o} .$$

The left side of the adequacy test is the reserve ratio multiple in the base period. All that remains is to express the expressions on the right side of the inequality in terms of variables that are known or can be readily estimated. If we assume that the total covered payroll (TP) grows at a constant rate g, then the TP in year t can be expressed as:

(8) $TP_t = TP_o (1+g)^t$.

Note that equation (8) is an approximation because it ignores cyclical effects on the size of the total covered payroll. Equation (8) can be solved for TP_o to obtain:

(9) $TP_o = TP_t (1+g)^{-t}$

We can now substitute equivalent terms for TP_o into equation (7) to express the condition for trust fund adequacy as:

$$(10) \quad RRM_o > \sum_t \frac{BEN_t (1+g)^t}{cTP_t (1+r)^t} - \sum_t \frac{TAX_t (1+g)^t}{cTP_t (1+r)^t}$$

The terms in the right summation are all known or assumed except for the TAX_t/TP_t ratio which must be estimated for each state. The terms in the left summation can be further simplified by noting the following relationships:

(11) $BEN_t = UI_t \times AWB_t \times 52$

where:

UI_t = average number of insured unemployed adjusted for the fraction actually drawing benefits in year t

AWB_t = average weekly benefits in year t

(12) $TP_t = EC_t \times AWW_t \times 52$

where:

EC = average number of covered employed workers in year t and

AWW_t = average weekly wage in year t.

Dividing equation (11) by equation (12) we obtain:

$$(13) \quad \frac{BEN_t}{TP_t} = \frac{UI_t \times AWB_t}{EC_t \times AWW_t}$$

$$= IUR_t \frac{AWB_t}{AWW_t}$$

where IUR_t is the insured unemployment rate in year t adjusted to include only claimants who draw benefits. Equation (13) can be substituted into equation (10) to express the trust fund adequacy measure as:

$$(14) \quad RRM_o \geq \sum_t IUR_t \frac{AWB_t \ (1+g)^t}{AWW_t \ (1+r)^t c} - \sum_t \frac{TAX_t \ (1+g)}{TP_t \ (1+r)^t c}$$

which is the adequacy test found in the report. The AWB_t/AWW_t and IUR series must be estimated for each state.

For computational convenience, the inequality can also be expressed in terms of the reserve ratio (RR) rather than the reserve ratio multiple. When the left and right sides of the inequality are multiplied by c, we obtain:

$$(15) \quad RR_o \geq \sum_t IUR_t \frac{AWB_t \ (1+g)^t}{AWW_t \ (1+r)^t} - \sum_t \frac{TAX_t \ (1+g)^t}{TP_t \ (1+r)^t}$$

Appendix C: An Analysis of Selected Equations in the State Benefit Financing Simulation Model

After reviewing the 1977 documentation on the PP and FFP sections of the SBFSM along with the update on selected equation specifications, it seemed that at least six areas in the model could be examined. These six are the procedures in the model to determine; (1) insured unemployment, (2) the average weekly bernefit amount, (3) the ratio of taxable wages to total wages, (4) the EB triggering mechanism, (5) the distribution of taxable wages by rating account percentages (RAPs) and (6) the distribution of benefits by RAPs. In each area it undoubtedly would be useful to do a thorough analysis of how the simulation equations and procedures have been tracking in recent years.

This appendix will focus on the first three areas of the preceding list. For all three there will be an analysis of how the model's equations perform when applied to recent data. In each area actual data from Michigan and New York are used to evaluate the equations. Since the regression analysis of the weekly benefit amount and the ratio of taxable to total wages is conducted with annual data the results give an indication of how two equations of the Annual Simulation Model (ASM) as described in Chapter IV could appear if the model were to be estimated for these two states.

1. Insured Unemployment

The Projection Program (PP) model of the SBFSM takes the annual insured unemployment rate as an exogenous variable and uses four separate equations to derive the quarterly estimates. The unemployment rate that is used is somewhat lower than the traditional insured unemployment rate (IUR). The IUR is the ratio of UI claimants to covered employment whereas QI in the model is the ratio of UI claimants to the insured labor force, i.e., covered employment plus UI claimants. Equation (1.1) gives the specification used to translate annual QI into quarterly QIs.

(1.1) $QI_j = b_{0j} + b_{1j}\, QI_{t-1} + b_{2j}\, QI_t + b_{3j}\, QI_{t+1}$

when j is a quarterly subscript (j=1,2,3,4) and t refers to annual QI.

Tables M1 and N1 show how the equations perform in Michigan and New York for the period 1972 to 1984. The tables show residuals obtained by using the set of quarterly b_j parameters currently used in the two state models. In Michigan the b_j parameters were derived from regressions that covered the years 1970 to 1982. Two error thresholds are identified: 5 percent and 10 percent of the actual QI for the quarter. For the eleven years 1972 to 1982 there are 26 errors of at least five percent and 14 exceed ten percent of the actual QI for the quarter. Third and fourth quarter predictions have the largest errors with 16 and 9 exceeding the two error threshholds respectively.

The projections for 1983 and 1984 in Michigan make large errors. Each of the four projections for 1983 differ the actual QI by at least 10 percent. In 1984 three of four exceed the ten percent threshold. As would be expected the performance of Michigan equations deteriorates in the post-estimation period.

Forecast errors are more serious when they make systematic average errors over individual calendar years. When the errors were averaged for the years 1972 to 1982 only one of the averages (1979) was as large as 5 percent of annual QI. Thus, during the estimation period the within-year errors roughly cancel out. For 1983 and 1984, the average errors were respectively only 3 percent and 2 percent of the actual QIs. The annual averages of the QI forecasts in Michigan are much better than the individual quarterly observations and this holds in the first two post-estimation years as well as during 1972-1982.

For accuracy in model simulations it is essential that the average annual error from the four quarterly QI projections be close to zero. If the average error did depart substantially from zero it would be important to understand why and then develop a procedure for constraining the annual errors to sum to zero. The original 1977 model documentation did include a description of such a constraint procedure. Fortunately, the annual errors in Michigan averaged close to zero even in the post-sample years 1983 and 1984.

Forecast errors in New York appear in Table N1. The underlying estimating equations were fitted to data for the 1972-1983 period. For these twelve years, only ten of the fitted QIs differ from the actual QIs by as much as 5 percent, and just two errors exceed the 10 percent threshhold (1972I and 1982IV). When the four quarterly errors for each year are averaged, not one of the averages is as large as 5 percent of annual QI. The largest average error for one year is a 2.5 percent overprediction for 1974.

The equations also perform reasonably well in 1984, the first year beyond the estimation period. Only one of the errors is as large as 5 percent of the actual QI (1984II). In all respects the procedure for estimating quarterly QIs has better results in New York than in Michigan.

Table M1

Predictions of the Insured Unemployment Rate (QI) in Michigan; 1972 to 1984

Year	Prediction Errors by Quarter[a]			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1972	.08	.34[b]	.30[b]	-.16[b]
1973	.08	.36[b]	-.15[b]	-.83[c]
1974	-.21	-.05	-.52[c]	-.25
1975	1.87[c]	.52	-1.46[c]	-.45[b]
1976	-.29	.20	-.19	.57[b]
1977	.58[c]	.04	-.26[b]	.00
1978	.48[b]	.03	-.12	-.49[c]
1979	-1.14[c]	-.97[c]	.77[c]	.07
1980	-1.32[c]	.28	1.68[c]	-.26
1981	-.46[b]	-.24	-.62[c]	.62[b]
1982	.03	-.62[b]	-.89[c]	2.03[c]
1983	1.69[c]	-.68[c]	-1.22[c]	-.48[c]
1984	-.10	.37[c]	-.36[c]	.43[c]

[a]Predictions based on equation (1.1).

[b]Prediction error exceeds the actual insured unemployment rate by at least 5 percent.

[c]Prediction error exceeds the actual insured unemployment rate by at least 10 percent.

Table N1

Predictions of the Insured Unemployment Rate (QI) in New York; 1972 to 1984

Year	Prediction Errors by Quarter[a]			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1972	.60[c]	.14	-.11	-.35[b]
1973	.03	.17	-.02	-.28[b]
1974	-.25[b]	-.33[b]	.03	.06
1975	.20	.15	-.04	-.18
1976	-.32[b]	-.06	.04	.17
1977	.19	-.06	-.10	-.01
1978	.17	-.12	.11	-.08
1979	.17	-.10	-.05	-.03
1980	-.19	.12	.12	.17
1981	.02	-.04	-.08	.06
1982	-.35[b]	-.05	.12	.48[c]
1983	.34[b]	.30[b]	-.19	-.18
1984	.13	.33[b]	-.10	-.10

[a]Predictions based on equation (1.1).

[b]Prediction error exceeds the actual insured unemployment rate by at least 5 percent.

[c]Prediction error exceeds the actual insured unemployment rate by at least 10 percent.

2. The Average Weekly Benefit Amount

The PP model currently determines the average weekly benefit amount (AWBA) using three control variables; (i) the maximum weekly benefit (MWB), (ii) the average weekly wage (AWW) and (iii) the rate of insured unemployment (IUR). Model documentation shows that two equations are used, and they are reproduced below as (2.1) and (2.2).

(2.1) $AWBA = c_1 + c_2 (MWB \cdot AWW) + c_3\ IUR$

(2.2) $AWBA = c_1 + c_2\ MWB + c_3\ AWW + c_4\ IUR$

The coefficients on MWB and AWW are expected to be positive while IUR is included as a cyclical control and its coefficient is also expected to be positive.

Equations 1 and 2 in Tables M2 and N2 show how these specifications fit when applied to annual time series data for Michigan and New York for the years 1970 to 1984. The $\bar{R}^2$s are high and both MWB and AWW have positive and highly significant coefficients. The rate of insured unemployment also enters with a positive coefficient in each state and its t ratio ranges from 1.96 to 2.87 across the four equations. When the equations in Tables M2 and N2 are compared it is clear that the standard errors of estimate are uniformly larger in Michigan than in New York. The errors range from \$4.18 to \$5.34 in Michigan and from \$.91 to \$2.56 in New York.

In modeling the cyclical component of specifications like (2.1) and (2.2) one can propose at least three variables to control for cyclical effects. These are: the insured unemployment rate (IUR), the total unemployment rate (TUR) and percent changes in covered employment (PCE). In a recession the IUR and TUR will rise while PCE will decline and even be negative if the recession is sufficiently severe. Thus, expected signs of the regression coefficients are positive for the IUR and TUR but negative for PCE. A priori, there is no way of knowing which of the three performs best as a cyclical control. An examination of equations 2, 3 and 4 in Tables M2 and N2 shows that all three have coefficients with expected algebraic signs. In Michigan, the TUR has the highest t ratio while in New York PCE is most significant. As determinants of average weekly benefits the three cyclical controls have roughly comparable explanatory power in the equations of Tables M2 and N2.

An alternative approach for determining the average weekly benefit amount that incorporates more detail on state benefit statutes and more behavioral responses is given below. It adds to the previous specifications known information on the statutory replacement rate and allows for effects of inflation as well as unemployment in determining weekly benefits.

The starting print for this investigation is equation (2.3).

$$(2.3) \quad AWBA = \left(\frac{ARR}{SRR}\right) \cdot SRR \cdot AWW$$

where AWBA and AWW are defined as before,

SRR = the statutory replacement rate and

ARR = the average actual replacement rate, i.e., AWBA ÷ AWW

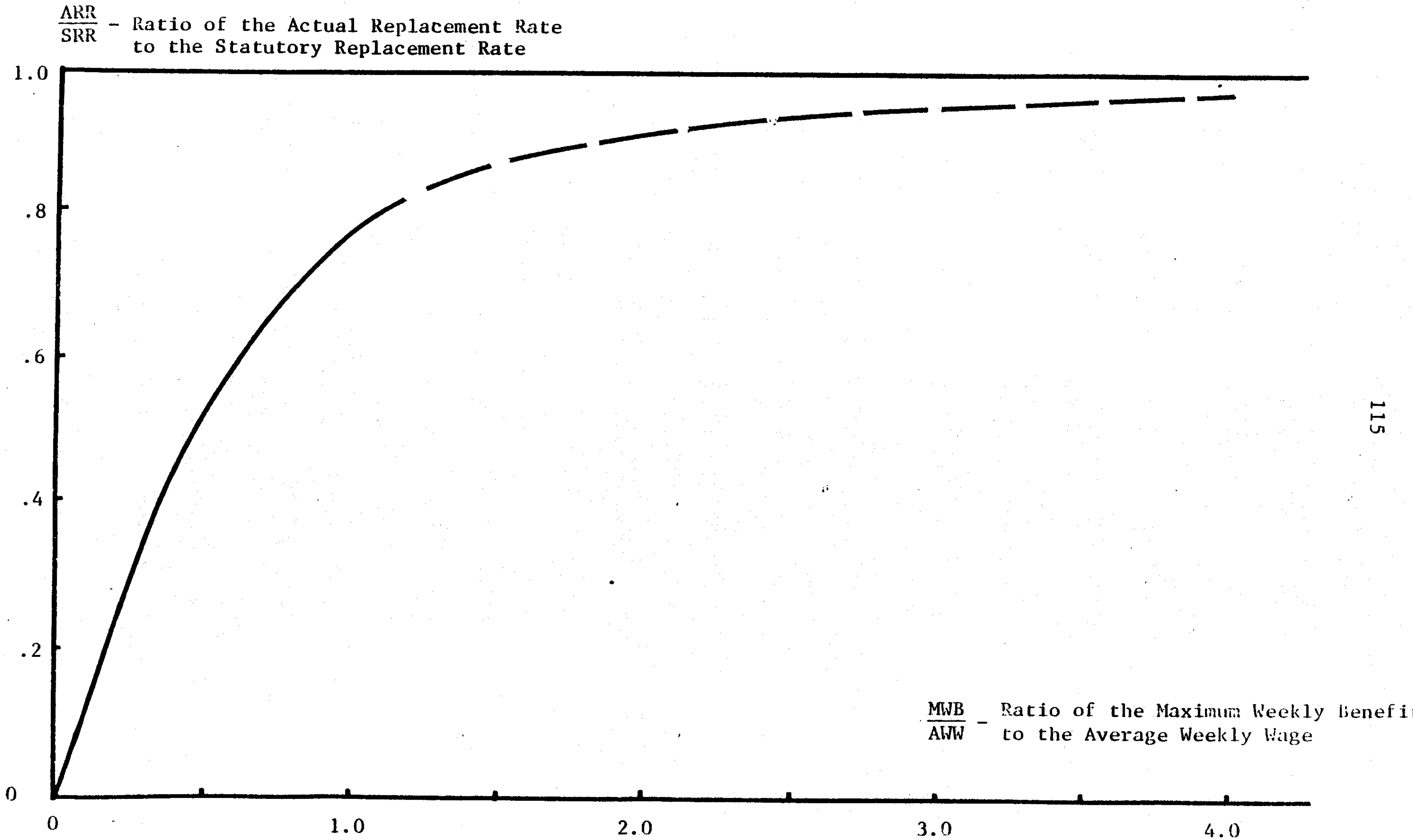
The statutory replacement rate may be based on high quarter wages, average weekly wages or some other measure of earnings from the base period. Thus, states that pay one twenty-sixth of high quarter base period wages or half of average weekly wages in the base period both have statutory replacement rates of .50 or 50 percent. In equation (2.3) two of the right hand variables, SRR and AWW, are known and can be taken as predetermined variables. The determination of the AWBA then reduces to developing an equation that explains movements in the (ARR/SRR) ratio.

Figure 1 is a graph that shows one key element in determining the (ARR/SRR) ratio, namely the level of the maximum weekly benefit amount relative to the average wage (MWB/AWW). As the latter ratio rises, the (ARR/SRR) ratio also rises. Eventually, this relation has decreased curvature because the upper limit to (ARR/SRR) is 1.0. If the maximum weekly benefit were to be eliminated then the (MWB/AWW) ratio would be infinite and (ARR/SRR) would equal 1.0. In fact, the (MWB/AWW) ratio typically falls in the range between .3 and .8. Therefore, the relationship for (MWB/AWW) points that exceed 1.0 appears as a dashed line in Figure 1. Over the lower range, i.e., (MWB/AWW) <1.0, the relation between (ARR/SRR) and (MWB/AWW) may be approximately linear.

Two other influences on the (ARR/SRR) ratio can also be identified; inflation and the business cycle. Weekly benefits are based on earnings of a base period that is centered some 6 to 12 months prior to the time when the claimant's weekly benefit amount is determined. This lag means that the (ARR/SRR) ratio will tend to fall when inflation increases. The (ARR/SRR) ratio also can have a cyclical component as the mix of applicants changes during the different phases of the business cycle. Typically, a recession causes the proportion of high wage applicants (many from manufacturing industries) to increase and this raises the AWBA and the (ARR/SRR) ratio. In modeling this cyclical component one can consider the three possible cyclical controls noted earlier; the IUR, the TUR and PCE. Again, it is an empirical question as to which of the three performs best.

Tables M3 and N3 display several regressions that explain variation in the (ARR/SRR) ratio. In all equations the (MWB/AWW) ratio has a positive and

Figure 1. The Ratio of the Actual to the Statutory Replacement Rate as a Function of the Ratio of the Maximum Weekly Benefit to the Average Weekly Wage



highly significant coefficient and it performs consistently as the most important explanatory variable, i.e., its t ratio is consistently the largest. In the simple regressions (equation 1 in both tables) its t ratio is 8.29 in Michigan and 7.25 in New York. The effects of inflation are approximated with the percent change in average weekly wages. Its coefficient has the expected negative sign in the six equations where it enters, and its t ratio ranges from 1.94 to 2.72.

None of the three cyclical control variables performs consistently strongly in the two states. Employment changes have a negative and significant effect in New York but no discernable effect in Michigan. The IUR variable is insignificant (t ratios smaller than 1.0) in both states. The TUR variable has the expected positive effect in Michigan, but its t ratio is only 1.21 while its coefficient is negative in New York with a t ratio of 1.93. The equations with the smallest standard errors use the TUR as the cyclical control in Michigan and PCE in New York. Tests for a nonlinear effect of (MWB/AWW) using a second degree polynomial did not show evidence of a significant nonlinearity in either state.

How useful is the approach suggested by equation (2.3) in comparison to equations (2.1) and (2.2)? One way to make comparisons is to note the size of prediction errors over the 1970-1984 period. Since equation (2.2) fits better than (2.1) in both Table M2 and Table N2, the standard errors of this specification are the most relevant basis for such comparisons. Predictions from equation (2.3) were made using the triple product on its right hand side when equation 3 of Table M3 and equation 4 of Table N3 provided predicted values of the (ARR/SRR) ratio. The standard error from using the triple product approach was \$3.81 in Michigan and \$1.98 in New York. These are somewhat smaller than the standard error of the comparison equation in Michigan ($4.46) but somewhat larger than the error of the comparison equation in New York ($.95). The relative rankings in the two states are the same when prediction errors for the final three years (1982-1984) are compared. The errors in Michigan were as follows; Equation (2.2) - $10.16, $1.84 and $-5.51 and equation (2.3) - $7.72, $.88 and $1.39. In New York the two sets of prediction errors were; equation (2.2) - $.70, $-1.06 and $.83 and equation (2.3) $.05, $-3.86 and $2.26.

An advantage of the alternative approach for determining the AWBA, i.e., equation (2.3), is that it allows more statutory and economic factors to be included in the model. It adds to the three included variables (the maximum weekly benefit amount, the average weekly wage and the cyclical control (the IUR in equation 2.2)), the possible effects of the statutory replacement rate, and the rate of wage inflation. All of these latter variables can be treated as exogenous in the determination of the AWBA. A drawback in using equation (2.3) is that it is a slightly more complicated procedure, i.e., requiring predictions of the (ARR/SRR) ratio prior to making predictions of AWBA. Since the variables that explain the (ARR/SRR) ratio are predetermined in the PP model, following this procedure would not entail the need for any simultaneous equations solution routines.

Table M2

Regressions Explaining the Average Weekly Benefit Amount (AWBA) in Michigan, 1970 to 1984

Ind. Variables[a]	Equations, Coefficients and t Ratios								
	1	2	3	4	5	6	7	8	9
Constant	34.535 (7.22)	-3.955 (.68)	-4.405 (.82)	3.343 (.67)					
MWB·AWW	.00137 (23.43)								
MWB		.508 (6.41)	.397 (4.88)	.505 (6.51)					
AWW		.118 (2.55)	.138 (3.21)	.122 (2.70)					
IUR	2.230 (2.87)	1.466 (2.23)							
TUR			1.613 (2.69)						
PCE				-.532 (2.36)					
Summary Statistics									
$\bar{R}^2$	.976	.983	.985	.984					
Std. Error	5.34	4.46	4.18	4.38					
D.W.									

[a]All variables defined in the text.

Table N2

Regressions Explaining the Average Weekly Benefit Amount (AWBA) in New York, 1970 to 1984

Ind. Variables[a]	Equations, Coefficients and t Ratios 1	2	3	4	5	6	7	8	9
Constant	38.779 (9.45)	8.429 (4.58)	10.362 (6.77)	10.070 (9.10)					
MWB·AWW	.00118 (26.19)								
MWB		.404 (14.56)	.407 (13.27)	.436 (14.76)					
AWW		.103 (9.74)	.097 (8.37)	.092 (8.99)					
IUR	1.534 (2.00)	.547 (1.96)							
TUR			.204 (1.03)						
PCE				-.309 (2.27)					
Summary Statistics									
$\bar{R}^2$	.984	.998	.997	.998					
Std. Error	2.56	.95	1.05	.91					
D.W.	.46								

[a]All variables defined in the text.

Table M3

Regressions Explaining the Ratio of the Actual Replacement Rate to the Statutory Replacement Rate in Michigan, 1970 to 1984

Ind. Variables[a]	Equations, Coefficients and t Ratios								
	1	2	3	4	5	6	7	8	9
Constant	.114 (1.97)	.210 (3.22)	.232 (3.84)	.203 (3.17)					
MWB/AWW	1.173 (8.29)	1.074 (8.54)	.937 (5.70)	1.087 (8.67)					
PCAWW		-.00909 (2.61)	-.00876 (2.68)	-.00810 (2.09)					
IUR		.00076 (.20)							
TUR			.00376 (1.21)						
PCE				-.00088 (.58)					

Summary Statistics

	1	2	3	4
$\bar{R}^2$	.829	.877	.891	.880
Std. Error	.031	.026	.025	.026
D.W.	1.26	1.76	1.53	1.71

[a]All variables defined in the text.

Table N3

Regressions Explaining the Ratio of the Actual Replacement Rate to the Statutory Replacement Rate in New York, 1970 to 1984

Ind. Variables[a]	Equations, Coefficients and t Ratios								
	1	2	3	4	5	6	7	8	9
Constant	.132 (2.16)	.212 (3.02)	.261 (3.92)	.220 (3.88)					
MWB/AWW	1.069 (7.25)	.957 (6.35)	.947 (7.42)	.979 (8.41)					
PCAWW		-.00647 (1.94)	-.00613 (2.09)	-00738 (2.72)					
IUR		.00248 (.55)							
TUR			-.00486 (1.93)						
PCE				-.00394 (2.52)					
Summary Statistics									
$\bar{R}^2$	.786	.816	.859	.880					
Std. Error	.0176	.0163	.0143	.0132					
D.W.	.45	.83	1.35	1.42					

[a]All variables defined in the text.

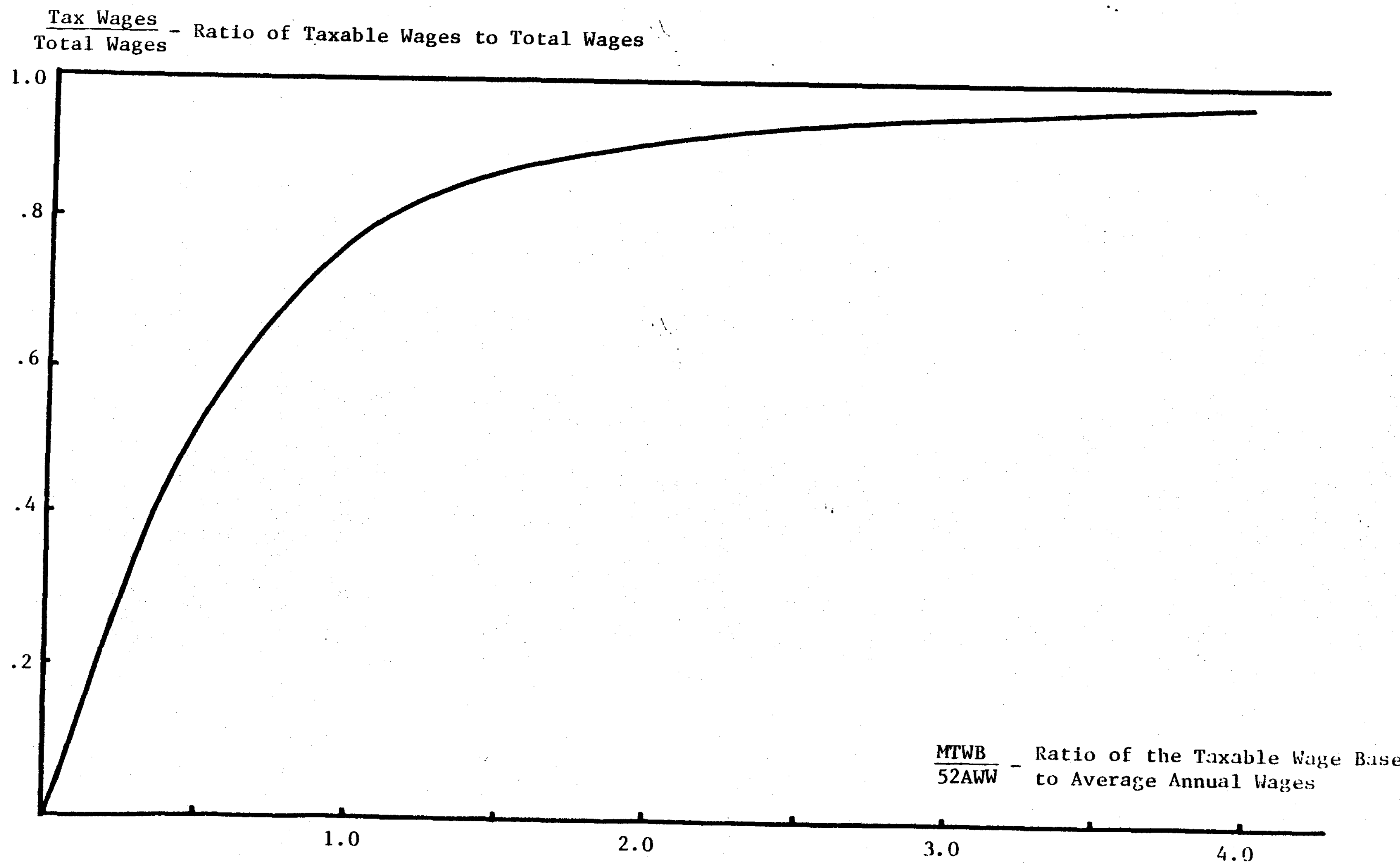
3. The Ratio of Taxable Wages to Total Wages

The PP model explains time series variation in the ratio of taxable wages to total wages using three variables; the ratio of the taxable wage base to average annual wages (MTWB/52AWW), the taxable wage base (MTWB) and the insured unemployment rate (IUR). The latter variable is included as a cyclical control while the former two variables are included to control for the location of the tax base relative to the distribution of annual wages in the state. Figure 2 is a graphical representation of the relationship between (MTWB/52AWW) and the taxable wage proportion. There is a positive association between the two but as the (MTWB/52AWW) ratio rises, the slope becomes flatter and approaches zero as the taxable wage proportion approaches unity. Documentation of the PP model depicts both a semi log as well as a linear specification for determining the taxable wage proportion. Our attention will be confined to the linear functional form.

Equation 1 in Tables M4 and N4 show the results of fitting the linear specification to annual data for the 1970-1984 time period. Two of the three explanatory variables are significant in Michigan while all three are significant in New York. In both states about 99 percent of the time series variation in the taxable wage proportion is explained by the regressions.

The single unusual finding in these regressions is that the taxable wage base variable has a negative coefficient in both states. A priori one would have expected this coefficient to be positive, i.e., the taxable wage proportion rises as the taxable wage base increases. Note, however, that the taxable wage base is present in two explanatory variables. When the total derivative of its effect on the taxable wage proportion was evaluated (at the mean of MTWB and AWW), it was found to be positive in both states.

Figure 2. The Ratio of Taxable to Total Wages



Nevertheless the negative sign on MTWB in these regressions is troubling and we will return to this shortly.

Equations 2 and 3 in Tables M4 and N4 explore the effects of using alternative controls for the effects of the business cycle. In Michigan the percent change in covered employment (PCE) is more significant than the other cyclical controls, while in New York the IUR and TUR both perform better than PCE. The MTWB variable consistently has a negative coefficient in all three specifications, i.e., equations 1, 2 and 3 in both tables.

The negative coefficients on MWTB are puzzling and could arise from spurious correlation between MTWB with some omitted variable. When MTWB entered the equations alone, i.e., (MTWB/52AWW) was omitted, it had a positive regression coefficient but the basic fit of the equation was much worse then for the equations shown in Tables M4 and N4. When MTWB entered in conjunction with (MTWB/52AWW) it consistently had negative and highly significant coefficients as shown in equations (1), (2) and (3) of these tables.

One test for a correlation between MTWB and an omitted variable was to add a time trend variable (T) to the equations. In Michigan the trend enters with a negative coefficient and causes the sign on MTWB to change from negative to positive but it is insignificantly different from zero. The effect of adding the trend is even stronger in New York where the trend coefficient is significantly negative while MTWB now enters with a positive and significant effect (equations 4, 5 and 6 in Table N4). A tentative inference from this analysis may be that the taxable wage proportion was trending downward during 1970-84 (perhaps indicating a greater degree of earnings inequality, or an impact from inflation or some other factor), and that the MTWB variable was originally capturing this trend effect. After an explicit time trend was added to the regressions, the MTWB variable more correctly captures the effect of tax base changes on the taxable wage proportion.

The cyclical control variables have much weaker effects in Michigan compared to New York. A priori one would expect negative coefficients for the IUR and TUR but a positive coefficient for PCE. This expectation is realized in New York and both the IUR and the TUR have highly significant coefficients. Neither of the two are significant in Michigan while the PCE coefficient is negative and only marginally significant.

Because the taxable wage proportion cannot exceed 1.0 the marginal effect of changes in the (MTWB/52AWW) ratio is not a constant. Figure 2 depicts this nonlinearity where the marginal effect of (MTWB/52AWW) diminishes as the ratio gets larger. Attempts to find a nonlinear effect of (MTWB/52AWW) using a second degree polynomial specification did not yield significant findings in either state. The linear and second degree terms were highly collinear. The most likely reason for this null result is the restricted range of variation of (MTWB/52AWW) during the 1970-1984 period. In Michigan the variable only ranged from .305 to .426 while in New York it ranged from .318 to .450. Although it is clear that the relationship should reveal a major nonlinearity the restricted range of variation in (MTWB/52AWW) prevents this nonlinearity from being apparent.

Overall, the equations in Tables M4 and N4 have very good fits. Note, however, that the smallest standard error in New York (equations 4 and 5) is about half the size of the smallest standard error in Michigan (equation 6). Variation in the taxable wage proportion is explained very well in both states, but somewhat better in New York than in Michigan.

Table M4

Regressions Explaining the Ratio of Taxable Wages to Total Wages in Michigan, 1970 to 1984

Ind. Variables[a]	Equations, Coefficients and t Ratios								
	1	2	3	4	5	6	7	8	9
Constant	.104 (4.85)	.114 (6.17)	.083 (5.65)	.164 (5.28)	.174 (5.49)	.138 (4.42)			
MTWB/52AWW	.870 (20.52)	.850 (20.57)	.918 (27.08)	.600 (4.99)	.595 (4.87)	.697 (5.90)			
MTWB/1000	-.00719 (9.32)	-.00689 (7.68)	-.00658 (9.89)	.01011 (1.37)	.00863 (1.20)	.00588 (.91)			
IUR	.0008 (.10)			.00048 (.69)					
TUR		-.00035 (.61)			-.00024 (.49)				
PCE			-.00051 (2.22)			-.00040 (1.84)			
T				-00651 (2.35)	-.00592 (2.17)	-.00478 (1.94)			

Summary Statistics

$\bar{R}^2$	.987	.988	.991	.991	.991	.993
Std. Error	.0039	.0038	.0032	.0033	.0033	.0029
D.W.		.97		1.74	1.89	1.58

[a]All variables defined in the text.

Table N4

Regressions Explaining the Ratio of Taxable Wages to Total Wages in New York, 1970 to 1984

Ind. Variables[a]	Equations, Coefficients and t Ratios								
	1	2	3	4	5	6	7	8	9
Constant	.152 (12.74)	.154 (17.79)	.123 (7.22)	.158 (29.24)	.156 (30.88)	.153 (18.65)			
MTWB/52AWW	.833 (38.01)	.805 (46.54)	.840 (22.89)	.680 (27.49)	.694 (27.28)	.622 (18.50)			
MTWB/1000	-.00964 (11.80)	-.00683 (12.71)	-.00819 (5.64)	.00732 (2.88)	.00578 (2.16)	.01363 (4.46)			
IUR	-.00455 (4.28)			-.00241 (4.22)					
TUR		-.00323 (6.50)			-.00183 (4.44)				
PCE			.00036 (.42)			.00052 (1.45)			
T				-.00523 (6.73)	-.00423 (4.75)	-.00714 (7.29)			
Summary Statistics									
$\bar{R}^2$	.992	.996	.979	.998	.998	.996			
Std. Error	.0034	.0026	.0056	.0015	.0015	.0023			
D.W.		1.90		2.18	2.24	1.77			

[a]All variables defined i the text.

4. Conclusions

This review of the simulation model has been confined to just three areas: the predictions of quarterly insured unemployment rates (with known annual insured unemployment rates), the average weekly benefit amount (AWBA) and the taxable wage proportion. The equations as currently specified in the model perform reasonably well. An alternative approach for determining the AWBA was examined, and for both the AWBA and the taxable wage proportion alternative equation specifications were tested using annual data from Michigan and New York. Although the empirical results were suggestive, nothing in these results seemed to demonstrate conclusively that the present equation specifications and parameter values in the PP component of the SBFM would cause the model to make large and systematic errors. Before altering the model for either state, one would want to carefully weigh possible gains in simulation accuracy against the costs of revising the present equations. Based on the analysis of this memo it is arguable that the gains from making changes would not clearly outweigh the costs.

One consistent finding was that the equations examined here performed better in New York than in Michigan. The contrasts by state were most obvious in comparisons of average (or standard) errors. In all four pairs of tables the New York errors were consistently smaller than the Michigan errors but the differences were largest in the first two pairs of tables, i.e., M1-N1 and M2-N2.

The analysis of the AWBA and the taxable wage proportion also compared the relative performance of three cyclical control variables; the IUR, the TUR and percentage changes in covered employment (PCE). None of the three performed consistently better than the other two. In each of the six tables where the three could be compared (M2, N2, M3, N3, M4 and N4) either the TUR or PCE entered the regressions with a higher t ratio than the IUR. It may be that each state that uses the simulation model should experiment with all three as control variables and then choose the best one.

Finally, a comment should be made about the approach for determining the AWBA based on equation (2.3). In the 1980s Michigan changed its statutory replacement rate twice (effective in March 1981 and January 1983) as did New York (lowering the replacement rate for low wage workers to 53 percent in September 1983 and moving to a flat 50 percent replacement rate for all workers in July 1984). The approach based on equation (2.3) can potentially capture the effects of such changes on the AWBA whereas the model's current equations do not control for changes in the statutory replacement rate (or changes in the inflation rate). Because it can consider the effects of more variables that influence the AWBA, the approach based on equation (2.3) (as opposed to equation (2.1) or (2.2)) should be considered for inclusion in the model. The potential advantage of using the approach of equation (2.3) would be greatest in a situation where a state made a large change in its statutory replacement rate.

Appendix D: Developing a Computer Program to Implement the ASM

This Appendix illustrates how states can develop a computer program to implement the Annual Simulation Model. We have developed a sample model for one state, and the same techniques may be used to develop models in most other states. As noted in Chapter IV, for useful models to be estimated, the ratio of average weekly benefits to average weekly wages and the ratio of taxes collected to total payroll must be estimated. In many states these relationships can be estimated straightforwardly, but a stable relationship may not exist in some states. For example, the tax schedule in Nebraska is set by the Commissioner each year, so it is not possible to model the tax structure in that state.

In the remainder of this Appendix we first indicate how the benefit/wage and tax/payroll relationships for the state were determined. We then describe the other parameters needed to estimate the model. Finally, we present a program written in Fortran for this state and indicate how it can be used and how it could be improved.

The state selected indexes average weekly benefits to average weekly wages. If the average weekly wage in the state increases by 5 percent, then the maximum benefit in the state increases by 5 percent. In such a state it is usually reasonable to assume that the average weekly benefit will increase by the same percentage and that the ratio of the average weekly benefit to the average weekly wage will remain constant over time. This assumption is consistent with the output from the State Benefit Financing Simulation Model for the state. Chapter IV of the text provides methods of estimating how the ratio will vary over time when the maximum benefit is not indexed.

The Tax Equations

There are five tax equations in the ASM for the selected state. Two are definitional identities, two are regression equations and one is a synthetic equation that approximates the way different statutory tax schedules are activated by changes in the state's trust fund balance. Combined, they determine the size of annual tax receipts measured as a percent of total covered payrolls, i.e. equation (2) of Chapter IV.

The taxable wage proportion (TxP/TP) is determined by parameters of a regression equation fitted to data for the years 1970 to 1984.

$$(TxP/TP) = \underset{(76.9)}{1.401}\,(TM/52AWW) - \underset{(22.3)}{.670}\,(TM/52AWW)^2 - \underset{(11.7)}{.00257}T70$$

$$\bar{R}^2 = .995$$

where TM and AWW are defined as in Chapter IV and T70 is a linear trend that equals 1 in 1970, 2 in 1971, etc.

Beneath each coefficient is a t ratio. Given the size of the t ratios, all three explanatory variables are highly significant. The equation indicates that the taxable wage proportion increases as the (TM/52AWW) ratio rises but the rate of increase decreases as (TM/52AWW) rises to higher levels. The time trend indicates that the taxable wage proportion was trending downward over the 1970-84 period even after controlling for the effects of the (TM/52AWW) ratio. From the level of the $\bar{R}^2$ (=.995), it is clear that the equation explains nearly all of the variation in the taxable wage proportion.

The state uses a reserve multiple (RM) to determine which of its various tax rate schedules is to be in effect for each calendar year. The reserve multiple is evaluated on June 30th in setting the next year's tax schedule. Following equation (22) of Chapter IV, the approximation for the reserve multiple as of June 30th (RM_{TS}) is:

$$RM_{TS} = (6/12)\,RM_{-2} + (6/12)\,RM_{-1}$$

Once the reserve multiple has been calculated the next step is to decide what approximation to use as a summary measure of statutory tax rates from each tax schedule. In this particular state we have used the simple average of the minimum and the maximum tax rate from each tax schedule, i.e., $\bar{T}_s = (T_{MIN} + T_{MAX})/2$.

To approximate the behavior of $\bar{T}s$ following step function equation is used:

$$\bar{T}_s = \begin{cases} \text{(i)} & 2.95 \text{ if } RM_{TS} > 2.5 \\ \text{(ii)} & 2.95 + .357\,(2.5 - RM_{TS}) \text{ if } 2.5 \geq RM_{TS} \geq 1.5 \\ \text{(iii)} & 3.35 + .714\,(1.5 - RM_{TS}) \text{ if } 1.5 > RM_{TS} \geq .45 \\ \text{(iv)} & 4.45 \text{ if } RM_{TS} < .45 \end{cases}$$

This approximation was developed after examining the progression of rates associated with the individual statutory tax schedules. The approximation provides a simple way to characterize the average statutory tax rate (as defined in the previous paragraph) for all possible values of the state's reserve ratio multiple.

The average statutory tax rate has a powerful effect on the average tax rate that employers actually pay ($\bar{T}$). A regression equation that estimates this relationship is the following:

$$\bar{T} = \underset{(.1)}{-.019} + \underset{(20.9)}{.847\bar{T}_s} - \underset{(6.5)}{.640\ D85} \qquad \bar{R}^2 = .965$$

The equation was fitted for the period 1970 to 1986 with estimated values for $\bar{T}$ (as estimated by the state) used in 1985 and 1986. The variable D85 is a dummy variable that equals 1 in 1985 and 1986 and zero in earlier years. It controls for both the use of estimated tax rates in 1985-86 and the introduction of a new set of tax schedules in 1985. After actual tax rate data for 1985 and 1986 become available it would be prudent to reestimate this equation. The t ratios show that both explanatory variables are highly significant. Overall, the equation explains more than 96 percent of the variation in the average employer tax rate.

The preceding equations from the ASM provide the information needed to simulate tax payments.

Data Required to Implement the ASM

The ASM for the selected state has been developed under the assumption that the benefit and tax equations would not be changed frequently. Consequently, these equations are imbedded in the model. If a state wished to simulate the impact of alternative tax or benefit relationships, the relationships could be specified as input to the model.

Equations (2) and (3) of Chapter IV list the basic variables that will be required in all models. However, the estimation of the tax and benefit relationships may require additional data. In the state selected for modeling, several additional variables are required.

The additional data required may be classified as initial conditions and economic assumptions. In the selected state, the tax rate depends on lagged reserve multiples. Thus it is necessary to include the reserve multiples in the base year and the prior year. Furthermore, since the computations require calculating the trust fund level for each year of the simulation, it is also necessary to enter the initial trust fund level, the initial total payroll, the cost rate criterion (the denominator in the reserve multiple), the average weekly wage in the base year, and maximum taxable wages per worker.

Chapter IV noted that the most important economic data are the insured unemployment rates assumed over the simulation period. As currently written, up to 10 years of IURs may be included in the simulation. Because the results of the simulation are likely to be highly sensitive to the IURs assumed, we recommend that states conduct several simulation runs, varying the assumed IURs each time. Other required economic assumptions include the interest rate paid on positive trust fund balances, the annual growth rate of total payroll, and the annual growth rate of average weekly wages. While these parameters can also be varied, they are not as likely as the IUR series to have a major influence on solvency.

The Sample Fortran Model

Exhibit D-1 provides the Fortran code for the ASM developed for the selected state. The program was written in Microsoft Fortran for use on an IBM personal computer. With minor adaptations, the program can be run on a mainframe computer or another personal computer. The program is written to function interactively with the user. When the user executes the program by typing "uisim" on the keyboard, prompts for all required data appear on the screen. The user then enters the requested data, and the next prompt appears. When all data have been entered, a summary of the input appears along with the results of the simulation. In addition, all the prompts, the responses by the user, the simulation output are stored in a file on the hard disk labeled "uiout." Exhibit D-2 contains the output from a session as stored in the file uiout. Two simulations are displayed in Exhibit D-2.

The Fortran program consists of three sections. The first section prompts the user for the required input and stores the data in appropriate memory locations. The length of this section is due to the effort to make the program easy to use and to store the input in an accessible form.

The second section of the program performs all the required calculations. The equations used are all explained earlier in this appendix or in Chapter IV of the text. The final section of the program writes the output for the simulation on the screen and in the file output. At the end of the program a list of variable definitions is provided.

The program provided here can serve as a useful starting point for other states wishing to implement an ASM. Obviously, the specific tax and benefit equations would have to be modified to reflect each state's specific laws. This may require adding or deleting variables in the model. In addition, several other improvements can be made. First, edit checks can be imbedded in the model to rule out obviously incorrect data values. For example, warning messages can be printed if an IUR is entered that falls outside the normal range. Warning messages could also appear if the growth rate in weekly wages exceeds the growth rate of total payroll (unless the state is experiencing a decline in the size of its labor force) or if the IUR is high enough to trigger the extended benefits program.

More ambitious changes to the model can also be made. For example, the model could be extended to simulate periods of borrowing by switching the interest rate to zero when the trust fund balance is negative. An obvious, but difficult, extension of the model would be to incorporate the Federal-State Extended Benefits (EB) program.

Exhibit D-1. The Fortran Code for the ASM

```
C       THIS PROGRAM RUNS THE UNEMPLOYMENT INSURANCE ANNUAL SIMULATION MODEL
C       THE PROGRAM IS SET UP FOR AN IBM PC AND IS WRITTEN IN FORTRAN
C       THE TAX EQUATIONS ARE CONTAINED IN THE PROGRAM
C       THE PROGRAM WAS PREPARED FOR USE IN A SPECIFIC STATE.  OTHER STATES
C       SHOULD NOTE THE GENERAL FORMAT OF THE MODEL BUT SHOULD TAILOR THE
C       MODEL TO THE TAX AND BENEFIT SPECIFICATIONS OF THEIR OWN LAWS
C       THE PROGRAM WAS PREPARED UNDER A CONTRACT ISSUED BY THE U.S.
C       DEPARTMENT OF LABOR TO ICF INCORPORATED AND IS IN THE PUBLIC
C       DOMAIN.  THE PROGRAM WAS WRITTEN BY BURT S. BARNOW OF ICF, AND THE TAX
C       EQUATIONS WERE ESTIMATED BY WAYNE VROMAN OF THE URBAN INSTITUTE.
C
C
C
C       THIS SECTION READS THE INPUT DATA FROM THE KEYBOARD
C       ALL VARIABLES ARE DEFINED AT THE END OF THE PROGRAM
        REAL*8 IUR(10),AWW(10),TP(10),BEN(10),RMTS(10),TBARS(10),
     *  TBAR(10),TXPRTP(10),TFB(10),TAXES(10),YEAR(10),AWB(10),RM(10),
     1  TXRATE(10),TP0,TFB0
        OPEN(10,FILE='UIOUT.')
        WRITE(*,300)
        WRITE(10,300)
300     FORMAT(' YOU HAVE ACCESSED THE UNEMPLOYMENT INSURANCE',
     1  ' ANNUAL SIMULATION MODEL',/,
     2  ' MAKE SURE SURE YOU INCLUDE DECIMAL POINTS FOR ALL ENTRIES',/,
     3  ' EXCEPT FOR THE NUMBER OF YEARS TO BE SIMULATED')
        WRITE(*,1)
        WRITE(10,1)
1       FORMAT(' TYPE IN THE INTEREST RATE PAID ON YOUR TRUST FUND',/,
     *  ' WRITE IT AS A PERCENT;E.G., 4 PERCENT IS 4.00')
        READ (*,2)R
        WRITE(10,2)R
2       FORMAT(F10.4)
        WRITE(*,3)
        WRITE(10,3)
3       FORMAT(' TYPE IN THE ANNUAL GROWTH RATE OF TOTAL'
     *  ,' PAYROLL',/,' WRITE IT AS A PERCENT')
        READ(*,2) G
        WRITE(10,2)G
        WRITE(*,4)
        WRITE(10,4)
4       FORMAT(' TYPE IN THE RESERVE MULTIPLE IN THE BASE YEAR')
        READ(*,2)RM0
        WRITE(10,2)RM0
        WRITE(*,5)
        WRITE(10,5)
5       FORMAT(' TYPE IN THE RESERVE MULTIPLE IN THE YEAR PRIOR'
     *  ,' TO THE BASE YEAR')
        READ(*,2)RMP
        WRITE(10,2)RMP
        WRITE(*,6)
        WRITE(10,6)
```

```
6       FORMAT(' TYPE IN THE NUMBER OF YEARS TO BE SIMULATED',/,
     *  ' THERE IS A MAXIMUM OF 10 YEARS.DO NOT INCLUDE DECIMAL PT.')
        READ(*,7)NUMB
        WRITE(10,7)NUMB
7       FORMAT(I2)
        WRITE(*,19)
        WRITE(10,19)
19      FORMAT(' TYPE IN THE PERCENTAGE OF UI CLAIMANTS THAT ARE',
     1  ' UI RECIPIENTS',/,' ENTER AS A PERCENT')
        READ(*,2)PCTCL
        WRITE(10,2)PCTCL
        DO 8 I=1,NUMB
        WRITE(*,9)I
        WRITE(10,9)I
9       FORMAT(' TYPE IUR FOR YEAR ',I2)
        READ(*,2)IUR(I)
        WRITE(10,2)IUR(I)
8       CONTINUE
        WRITE(*,10)
        WRITE(10,10)
10      FORMAT(' TYPE IN THE RATIO OF AVERAGE WEEKLY BENEFITS TO'
     *  ,/,' AVERAGE WEEKLY WAGES')
        READ(*,2) BENRWA
        WRITE(10,2)BENRWA
        WRITE(*,11)
        WRITE(10,11)
11      FORMAT(' TYPE IN THE COST RATE CRITERION',/,
     *  ' IT IS THE DENOMINATOR IN THE RESERVE MULTIPLE')
        READ(*,2)C
        WRITE(10,2)C
        WRITE(*,12)
        WRITE(10,12)
12      FORMAT(' TYPE IN THE MAXIMUM TAXABLE WAGE LEVEL',/,
     *   ' PROGRAM ASSUMES IT IS FIXED IN SIMULATION PERIOD')
        READ(*,2)TXMAX
        WRITE(10,2)TXMAX
        WRITE(*,13)
        WRITE(10,13)
13      FORMAT(' TYPE IN AVERAGE WEEKLY WAGE IN BASE YEAR')
        READ(*,2)AWWO
        WRITE(10,2)AWWO
        WRITE(*,14)
        WRITE(10,14)
14      FORMAT(' TYPE IN GROWTH RATE OF AVERAGE WEEKLY WAGES',/,
     *  ' MAKE IT A PERCENT')
        READ(*,2)W
        WRITE(10,2)W
        WRITE(*,15)
        WRITE(10,15)
15      FORMAT(' TYPE IN THE INITIAL TRUST FUND BALANCE')
        READ(*,16)TFBO
        WRITE(10,16)TFBO
16      FORMAT(F12.0)
```

```
      WRITE(*,17)
      WRITE(10,17)
17    FORMAT(' TYPE IN TOTAL PAYROLL IN BASE YEAR')
      READ(*,16)TP0
      WRITE(10,16)TP0
      WRITE(*,18)
      WRITE(10,18)
18    FORMAT(' TYPE IN THE BASE YEAR:  E.G., 1986=1986.0')
      READ(*,16)BASEYR
      WRITE(10,16)BASEYR
C     THIS COMPLETES THE DATA INPUT SECTION
C
C
C
C     THIS SECTION PERFORMS THE COMPUTATIONS
C     SEE TEXT FOR DERIVATION OF TAX EQUATIONS
      AWW(1)=AWW0*(1+W/100.0)
      AWB(1)=AWW(1)*BENRWA
      TP(1)=TP0*(1+G/100.0)
      BEN(1)=IUR(1)*PCTCL*BENRWA*TP(1)/100.0/100.0
      RMTS(1)=(RM0 + RMP)/2.0
      IF(RMTS(1) .GT. 2.5)TBARS(1)=2.95
      IF(RMTS(1) .LE. 2.5 .AND. RMTS(1) .GE. 1.5)TBARS(1)=2.95+
     * .3571*(2.50 - RMTS(1))
      IF(RMTS(1) .LT. 1.5 .AND. RMTS(1) .GE. 0.45)
     * TBARS(1)=3.35 + .7142*(1.50 - RMTS(1))
      IF(RMTS(1) .LT. 0.45)TBARS(1)=4.45
      TBAR(1)= -.01907 + .8475*TBARS(1) - .6404
      TXPRTP(1)=1.40124*TXMAX/(52.*AWW(1)) -
     *  .67008*TXMAX**2/(52.*AWW(1))/(52.*AWW(1))
     * -.0025656*(BASEYR+1.0-1969.0)
      TAXES(1)=TXPRTP(1)*TP(1)*TBAR(1)/100.0
      TFB(1)=TFB0*(1+R/100.0) + TAXES(1) - BEN(1)
      RM(1)=TFB(1)/TP(1)/C
      TXRATE(1)=TAXES(1)/TP(1)
      DO 100 I=2,NUMB
      AWW(I)=AWW(I-1)*(1+W/100.0)
      AWB(I)=AWW(I)*BENRWA
      TP(I)=TP(I-1)*(1+G/100.0)
      BEN(I)=IUR(I)*PCTCL*BENRWA*TP(I)/100.0/100.0
      IF(I .EQ. 2)RMTS(I)=(RM0 + TFB(I-1)/TP(I-1)/C)/2.0
      IF(I .GT. 2)RMTS(I)=(TFB(I-2)/TP(I-2)/C +
     * TFB(I-1)/TP(I-1)/C)/2.0
      IF(RMTS(I) .GT. 2.5)TBARS(I)=2.95
      IF(RMTS(I) .LE. 2.5 .AND. RMTS(I) .GE. 1.5)TBARS(I)=
     * 2.95 + .3571*(2.5 - RMTS(I))
      IF(RMTS(I) .LT. 1.5 .AND. RMTS(I) .GE. 0.45)
     * TBARS(I)=3.35 + .7142*(1.50 - RMTS(I))
      IF(RMTS(I) .LT. 0.45)TBARS(I)=4.45
      TBAR(I)= -.01907 + .8475*TBARS(I) -.6404
      TXPRTP(I)=1.40124*TXMAX/(52.*AWW(I))
     *  - .67008*TXMAX*TXMAX/(52.*AWW(I))/(52.*AWW(I))
     * -.0025656*(BASEYR + I - 1969.0)
```

```
      TAXES(I)=TXPRTP(I)*TP(I)*TBAR(I)/100.0
      TXRATE(I)=TAXES(I)/TP(I)
      TFB(I)=TFB(I-1)*(1+R/100.0) + TAXES(I) - BEN(I)
      RM(I)=TFB(I)/TP(I)/C
100   CONTINUE
C     END OF COMPUTATION SECTION
C
C
C     THIS SECTION PRINTS PRETTY TABLES
C     THIS PROGRAM WRITES TO THE SCREEN AND TO THE FILE UIOUT
      WRITE(*,200)
      WRITE(10,200)
200   FORMAT(' ANNUAL SIMULATION MODEL OUTPUT',//,' ASSUMPTIONS')
      WRITE(*,201) R,G,W,AWW0,PCTCL,RM0,RMP,NUMB,BENRWA,C,TXMAX,TFB0,TP0
      WRITE(10,201)R,G,W,AWW0,PCTCL,RM0,RMP,NUMB,BENRWA,C,TXMAX,TFB0,TP0
201   FORMAT(' INTEREST RATE PAID ON TRUST FUND= ',F6.2,'%',/,
     * ' GROWTH RATE OF TOTAL PAYROLL= ',F6.2,'%',/,
     2 ' GROWTH RATE OF AVERAGE WEEKLY WAGE= ',F6.2,'%',/,
     2 ' AVERAGE WEEKLY WAGE IN BASE YEAR= $',F4.0,/,
     3 ' PERCENT OF CLAIMANTS WHO ARE RECIPIENTS= ',F5.2,'%',/,
     3 ' RESERVE MULTIPLE IN BASE YEAR= ',F6.2,/,
     4 ' RESERVE MULTIPLE IN YEAR BEFORE BASE YEAR= ',F6.2,/,
     5 ' NUMBER OF YEARS SIMULATED= ',I2,/,
     6 ' RATIO OF AVE. WEEKLY BENEFITS TO AVE. WEEKLY WAGE= ',F5.3,/,
     7 ' COST RATE CRITERION= ',F6.4,/,
     8 ' MAXIMUM TAXABLE WAGES= $',F7.0,/,
     9 ' INITIAL TRUST FUND BALANCE= $',F12.0,/,
     1 ' INITIAL TOTAL PAYROLL= $',F12.0,/)
      IBROKE=0
      DO 202 I=1,NUMB
      IF(TFB(I) .LT. 0.0)IBROKE=I
      IF(TFB(I) .LT. 0.0)GO TO 203
202   CONTINUE
203   CONTINUE
      IF(IBROKE .EQ. 0)WRITE(*,204)
      IF(IBROKE .EQ. 0)WRITE(10,204)
      IF(IBROKE .GT. 0)WRITE(*,205)IBROKE
      IF(IBROKE .GT. 0)WRITE(10,205)IBROKE
204   FORMAT(' STATE DOES NOT BORROW IN PERIOD SIMULATED')
205   FORMAT(' STATE BORROWS IN YEAR ',I2,' OF SIMULATION',/,
     1 ' SIMULATION IS TERMINATED IN THAT YEAR')
      YEAR(1)=BASEYR +1.0
      DO 206 I=2,NUMB
206   YEAR(I)=YEAR(I-1) + 1.0
      WRITE(*,207)
      WRITE(10,207)
207   FORMAT(' YEAR',5X,'IUR',4X,'AWW',5X,'AWB',3X,'TAX/TP',
     1 7X,'BEN'12X,'TAX',7X,'TF BALANCE')
      IF(IBROKE .EQ. 0)IBROKE=NUMB
      DO 208 I=1,IBROKE
      WRITE(*,209) YEAR(I),IUR(I),AWW(I),AWB(I),TXRATE(I),
     1 BEN(I),TAXES(I),TFB(I)
      WRITE(10,209)YEAR(I),IUR(I),AWW(I),AWB(I),TXRATE(I),
```

```
     1  BEN(I),TAXES(I),TFB(I),
209     FORMAT(1X,F5.0,4X,F4.2,3X,F4.0,3X,F4.0,3X,F6.4,2X,F12.0,
     1  2X,F12.0,2X,F12.0)
208     CONTINUE
        WRITE(*,210)
        WRITE(10,210)
210     FORMAT(/,/,/,' YEAR',5X,'IUR',5X,'RES MUL',4X,'TBARS',3X,
     1  'TBAR',6X,'TXPRTP',5X,'TOT. PAYROLL')
        DO 211 I=1,IBROKE
        WRITE(*,212) YEAR(I),IUR(I),RM(I),TBARS(I),TBAR(I),
     1  TXPRTP(I),TP(I)
        WRITE(10,212)YEAR(I),IUR(I),RM(I),TBARS(I),TBAR(I),
     1  TXPRTP(I),TP(I)
212     FORMAT(1X,F5.0,4X,F4.2,5X,F4.2,6X,F5.3,3X,F5.3,4X,
     1  F5.3,3X,F16.0)
211     CONTINUE
        STOP
        END
C
C
C
C
C  LIST OF VARIABLES AND THEIR DEFINITIONS
C  R          INTEREST RATE PAID ON POSITIVE TRUST FUND BALANCES
C  G          GROWTH RATE OF TOTAL PAYROLL
C  RM0        RESERVE MULTIPLE IN BASE YEAR
C  RMP        RESERVE MULTIPLE IN YEAR PRIOR TO BASE YEAR
C  NUMB       NUMBER OF YEARS TO BE SIMULATED
C  PCTCL      PERCENT OF CLAIMANTS THAT ARE RECIPIENTS
C  IUR(I      INSURED UNEMPLOYMENT RATE IN YEAR I
C  BENRWA     RATIO OF AVE. WEEKLY BENEFITS TO AVE. WEEKLY WAGE
C  C          COST RATE CRITERION
C  TXMAX      MAXIMUM TAXABLE WAGE
C  AWW0       AVERAGE WEEKLY WAGE IN BASE YEAR
C  TP0        TOTAL PAYROLL IN BASE YEAR
C  W          GROWTH RATE OF AVERAGE WEEKLY WAGES
C  TFB0       TRUST FUND BALANCE IN BASE PERIOD
C  BASEYR     BASE YEAR
C  AWW(I)     AVERAGE WEEKLY WAGE IN YEAR I
C  AWB(I)     AVERAGE WEEKLY BENEFIT IN YEAR I
C  TP(I)      TOTAL PAYROLL IN YEAR I
C  BEN(I)     TOTAL BENEFITS PAID IN YEAR I
C  RMTS(I)    AVERAGE OF RESERVE MULTIPLE IN YEARS I-1 AND I-2
C  TBARS(I)   AVE. STATUTORY  TAX RATE IN YEAR I
C  TBAR(I)    AVE. TAX RATE ON TAXABLE INCOME IN YEAR I
C  TXPRTP(I)  RATIO OF TAXABLE TO TOTAL PAYROLL IN YEAR I
C  TAXES(I)   TOTAL TAXES COLLECTED IN YEAR I
C  TFB(I)     TRUST FUND BALANCE IN YEAR I
C  RM(I)      RESERVE MULTIPLE IN YEAR I
C  TXRATE(I)  AVE. TAX RATE ON TOTAL PAYROLL IN YEAR I
C  IBROKE     YEAR OF SIMULATION WHEN STATE BORROWS
```

Exhibit D-2. Simulated Output from the ASM

```
YOU HAVE ACCESSED THE UNEMPLOYMENT INSURANCE ANNUAL SIMULATION MODEL
MAKE SURE SURE YOU INCLUDE DECIMAL POINTS FOR ALL ENTRIES
EXCEPT FOR THE NUMBER OF YEARS TO BE SIMULATED
TYPE IN THE INTEREST RATE PAID ON YOUR TRUST FUND
WRITE IT AS A PERCENT;E.G., 4 PERCENT IS 4.00
   7.0000
TYPE IN THE ANNUAL GROWTH RATE OF TOTAL PAYROLL
WRITE IT AS A PERCENT
  11.0000
TYPE IN THE RESERVE MULTIPLE IN THE BASE YEAR
    .6500
TYPE IN THE RESERVE MULTIPLE IN THE YEAR PRIOR TO THE BASE YEAR
    .6870
TYPE IN THE NUMBER OF YEARS TO BE SIMULATED
THERE IS A MAXIMUM OF 10 YEARS.DO NOT INCLUDE DECIMAL PT.
8
TYPE IN THE PERCENTAGE OF UI CLAIMANTS THAT ARE UI RECIPIENTS
ENTER AS A PERCENT
  80.0000
TYPE IUR FOR YEAR  1
   3.6000
TYPE IUR FOR YEAR  2
   3.5300
TYPE IUR FOR YEAR  3
   3.5300
TYPE IUR FOR YEAR  4
   4.2100
TYPE IUR FOR YEAR  5
   4.7000
TYPE IUR FOR YEAR  6
   4.5400
TYPE IUR FOR YEAR  7
   3.6000
TYPE IUR FOR YEAR  8
   3.5300
TYPE IN THE RATIO OF AVERAGE WEEKLY BENEFITS TO
AVERAGE WEEKLY WAGES
    .3630
TYPE IN THE COST RATE CRITERION
IT IS THE DENOMINATOR IN THE RESERVE MULTIPLE
    .0284
TYPE IN THE MAXIMUM TAXABLE WAGE LEVEL
PROGRAM ASSUMES IT IS FIXED IN SIMULATION PERIOD
7000.0000
TYPE IN AVERAGE WEEKLY WAGE IN BASE YEAR
 343.9100
TYPE IN GROWTH RATE OF AVERAGE WEEKLY WAGES
MAKE IT A PERCENT
   7.0000
TYPE IN THE INITIAL TRUST FUND BALANCE
 103356377.
TYPE IN TOTAL PAYROLL IN BASE YEAR
6127460000.
TYPE IN THE BASE YEAR:  E.G., 1986=1986.0
      1987.
```

ANNUAL SIMULATION MODEL OUTPUT

ASSUMPTIONS
INTEREST RATE PAID ON TRUST FUND= 7.00%
GROWTH RATE OF TOTAL PAYROLL= 11.00%
GROWTH RATE OF AVERAGE WEEKLY WAGE= 7.00%
AVERAGE WEEKLY WAGE IN BASE YEAR= $344.
PERCENT OF CLAIMANTS WHO ARE RECIPIENTS= 80.00%
RESERVE MULTIPLE IN BASE YEAR= .65
RESERVE MULTIPLE IN YEAR BEFORE BASE YEAR= .69
NUMBER OF YEARS SIMULATED= 8
RATIO OF AVE. WEEKLY BENEFITS TO AVE. WEEKLY WAGE= .363
COST RATE CRITERION= .0284
MAXIMUM TAXABLE WAGES= $ 7000.
INITIAL TRUST FUND BALANCE= $ 103356377.
INITIAL TOTAL PAYROLL= $ 6127460000.

STATE BORROWS IN YEAR 6 OF SIMULATION
SIMULATION IS TERMINATED IN THAT YEAR

YEAR	IUR	AWW	AWB	TAX/TP	BEN	TAX	TF BALANCE
1988.	3.60	368.	134.	.0100	71105400.	68280688.	107766611.
1989.	3.53	394.	143.	.0095	77392302.	71808808.	109726780.
1990.	3.53	421.	153.	.0090	85905456.	75375608.	106877807.
1991.	4.21	451.	164.	.0085	113723735.	78628947.	79264466.
1992.	4.70	482.	175.	.0087	140925588.	89921661.	33809052.
1993.	4.54	516.	187.	.0080	151102214.	92129433.	-22797096.

YEAR	IUR	RES MUL	TBARS	TBAR	TXPRTP	TOT. PAYROLL
1988.	3.60	.56	3.944	2.683	.374	6801480600.
1989.	3.53	.51	3.990	2.722	.349	7549643466.
1990.	3.53	.45	4.039	2.764	.325	8380104247.
1991.	4.21	.30	4.078	2.797	.302	9301915714.
1992.	4.70	.12	4.450	3.112	.280	10325126443.
1993.	4.54	-.07	4.450	3.112	.258	11460890352.

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