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# An Examination of the Relation between State Fiscal Health and Amnesty Enactment

**Hari S. Luitel and Mehmet Serkan Tosun**

**Department of Economics /030**
**University of Nevada, Reno**
**Reno, NV 89557-0207**
**(775) 784-6850 | Fax (775) 784-4728**
**email:** tosun@unr.edu

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Hari S. Luitel
*Algoma University*
*Sault Ste. Marie*
*Ontario, P6A 2G4*
*hari.luitel@algomau.ca*

Mehmet Serkan Tosun
*Department of Economics*
*University of Nevada, Reno*
*Reno, NV 89557*
*tosun@unr.edu*

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## An Examination of the Relation between State Fiscal Health and Amnesty Enactment

### 1. Introduction

All state governments in the United States rely on various taxes as a major source of their general fund revenues. Ensuring that citizens comply with their tax codes requires states to spend funds to deter noncompliance, detect its magnitude, and prosecute tax evaders. However, from an economic point of view, these government expenditures are inefficient in that they represent a real resource cost, while any additional revenues generated are simply a transfer of resources from the private to the public sector (Alm 2005). Therefore, states may at times decide to offer tax amnesties to their citizens. Tax amnesties are government programs that usually grant immunity from legal prosecution and reduced financial penalties to tax evaders who voluntarily pay outstanding tax liabilities and interest, typically within a short period of time.

Tax amnesties are sometimes seen as a "costless tax," because participation in an amnesty is voluntary. When a state offers an amnesty, evaders who wish to rejoin the tax system, can do so without facing fines and possible public embarrassment they might face if their evasion gets revealed without the amnesty. This represents a *ceteris paribus* Pareto improvement because these individuals gain, and revenue increases, while no one else loses. States raise additional tax revenues, which they can use to provide more public goods or to payoff public debt than they would have, without the tax amnesty. States can also use the additional revenues that amnesties generate to alleviate their fiscal stress.

However, amnesties are clearly not universal. Some question the abilities of tax amnesties to produce additional revenues. Experiences also indicate that amnesty revenues are overstated or exaggerated that would (or could) have been raised by normal enforcement procedures. Although amnesty revenues may help alleviate fiscal stress, critics see them as

inconsistent with the principles of "good" governance. Tax amnesties provide incentives for otherwise honest taxpayers to start evading taxes in anticipation of future amnesty offerings, thereby weakening tax compliance and fostering a perception of inefficiency in the tax system. Thus, amnesties may not be truly "costless" without any economic and/or fiscal repercussion for the states.

Although the federal tax code has allowed some variation of permanent tax amnesty since 1919 (Andreoni 1991), state tax amnesties are of fairly recent origin. Arizona introduced its first tax amnesty in 1982.[1] Since then, 41 states and the District of Columbia have enacted tax amnesties in three waves: the early to mid- 1980s, the late-1990s, and during the first half of this decade. Table 1 presents the frequency with which states have offered tax amnesties between 1982 and 2005. Using the same period, Figure 1 illustrates the number of amnesties offered each year. Notice that the frequency of tax amnesties rose during and after the 2001 recession. In fact, between 2001 and 2005 alone, states offered twenty-eight amnesties with 24 repeated for a second, third, or even fourth time. These broad-based amnesties include all major state taxes but some exclude property tax, motor fuel tax, or other taxes.

[Table 1, about here]

[Figure 1, about here]

While tax amnesty literature is vast, analysis of the factors behind amnesty adoptions is quite limited.[2] In fact, except Dubin, Graetz, and Wilde (1992) who analyze the first wave of amnesties during the 1980s, none have explored why states enact or repeat an amnesty.

[1] Federation of Tax Administrators (FTA), *http://www.taxadmin.org/fta/rate/amnesty1.html*.

[2] For taxpayer response to amnesties, see Joulfaian (1988), Fisher, Goddeeris, and Young (1989), Alm and Beck (1991), Malik and Schwab (1991), and Christian, Gupta and Young (2002). For revenue effect of an amnesty, see Alm and Beck (1990, 1993), Andreoni (1991), Luitel (2007), and Luitel and Sobel (2007).

Assuming a normal distribution of hazards, Dubin, Graetz, and Wilde (DGW hereafter) conclude that states are likely to run amnesties in response to revenue yield motive. However, given the increased frequency with which states enacted amnesties during and after the 2001 recession, we investigate if there is a possible shift from the revenue yield motive to the fiscal stress motive or if the normal distribution of hazards assumption plays a role in this paradox such that the fiscal stress motive is and has always been the primary factor underlying these amnesties. Analysis of state tax amnesties is important for it provides insight into the behavior of a fiscally constrained state government that faces a trade-off between immediate benefits and future hidden losses.

We apply several methods of event history analysis to examine the initial (first) and the repeated tax amnesties separately, using a panel of annual data from all 50 states for the period 1982-2005. We include various measures of state fiscal health, as well as political and demographic control variables. We find that the assumption regarding the distribution of hazards plays a critical role in distinguishing between the revenue yield and the fiscal stress hypotheses; particularly, the normal distribution of hazards assumption along with the multicollinearity problem led prior research to an erroneous conclusion. As such, our results contrast sharply with prior research. We find that the fiscal stress motive, not the revenue yield motive, is indeed the most significant contributing factor that led the states to enact amnesties. Our results are robust to a separate analysis of the initial and the repeated tax amnesties that states enacted between 1982 and 2005.

The paper is organized as follows: Section 2 presents a brief summary of U.S. state tax amnesty experience, as well as our research hypotheses. Section 3 and Section 4 discuss our study's data and estimation methods. Section 5 reports our results and Section 6 concludes.

## 2. U.S. State Tax Amnesty Experience

Like many countries, tax amnesties have become increasingly popular among the U.S. states in recent years.[3] Table 2, which summarizes the main features of state tax amnesties, reveals that a majority of state amnesties (66 out of 79) were approved through legislative authorization. Similarly, forty-two amnesties allowed delinquent tax payers identified by the tax authorities (accounts receivable) to participate in the program. While twenty-eight amnesties permitted taxes to be paid in installments, thirty-one amnesties did not provide such arrangements.

[Table 2, about here]

Accordingly, Table 3 shows a detailed listing of the state tax amnesties between 1982 and 2005. Tax amnesty length varies widely among states. During the 1982 – 2005 period, Kentucky conducted the shortest amnesty lasting 15 days in 1988, while Oklahoma in 1983 and Arkansas in 1984 offered the longest amnesty lasting 183 days. Similarly, the table also presents the official tax collection data in 2005 constant dollars reported by each state and reveals a large variation in short-term revenue yield among states. While nineteen state tax amnesties were reported to bring in short-run revenues greater than or equal to $100 million, five states generated $1 million or less. On the one hand, such sharp differences in revenue yields may reflect differences in the population and economic size of these states; on the other, though not unimportant, these amnesty collections are small relative to state total tax collections. For example, Table 3 also reveals that between 1982 and 2005 amnesties generated an average of only 0.75 percent, and never account for more than three percent of state total tax collections. More importantly, however, as Luitel (2007) and Luitel and Sobel (2007) show, these short-run

[3] An alternative to a formal state tax amnesty program is a voluntary disclosure agreement (VDA) which allows taxpayers to file taxes owed from previous years within a binding agreement.

revenue gains come only at the expense of long-run future losses accompanying the amnesty. Thus, our objective in this paper is to examine what motivates states to tap these short-run revenue gains on a repeated basis, highlighting the direction of the state government finances in recent years.

[Table 3, about here]

DGW examine the two hypotheses for amnesty adoption by states: revenue yield and fiscal stress. The revenue yield hypothesis suggests that states with high income are more likely to adopt an amnesty because amnesties in such states should generate more revenues. Alternately, the fiscal stress hypothesis argues that states in need of revenues are more likely to adopt an amnesty. For example, when incomes fall during recessions, especially when raising revenues from conventional sources of taxation becomes increasingly difficult, states may be more inclined to introduce new revenue sources. Based on the analysis of a normal distribution of hazards assumption, DGW support the revenue yield hypothesis for initial amnesties enacted during the 1980s. As noted in Section 1, the frequency of repeated amnesties rose in the first half of this decade during and after the 2001 recession (see figure 1). Since most states have balanced budget requirements (GAO 1993), the 2001 recession resulted in many states developing new methods of increasing revenues (NASBO 2004). We explore if fiscal pressure plays any role in the introduction of tax amnesties, with emphasis on repeated amnesties, which have remained largely uninvestigated.

## 3. Factors in Amnesty Enactment

DGW use the normal distribution of hazards assumption to test the revenue yield vs. the fiscal stress hypotheses. In order to provide evidence that use of the normal distribution of hazards assumption is wrong, we use the key variables that DGW use in their analysis: (1)

personal income; (2) tax revenue; and (3) the unemployment rate. However, there are similarities and differences between our use of these variables and DGW's. We discuss them below.

First, like DGW, we use per capita personal income as a measure of a state's fiscal health. The revenue yield hypothesis implies a positive relation between personal income and the probability of a state tax amnesty, while the fiscal stress hypothesis suggests a negative relation. Given our argument that the increased number of amnesties enacted during and after the 2001 recession reflect the fiscal stress hypothesis, we predict a negative relation between these two variables. DGW predict a positive relation between these two variables.

Unlike DGW who use state income tax, we use state total tax revenue as a second measure of fiscal health.[4] Using income tax as a measure of fiscal health ignores states without income taxes. Because nontrivial numbers of states with or without income taxes have enacted amnesties (see Table 1), we argue that when the total tax revenues decline, especially during recessions, states are more determined to close existing loopholes in their tax systems and to expand their tax bases. Consequently, states would be more likely to enact amnesties during periods of fiscal crises when state tax revenues fall. We again predict a negative relation between per capita total tax revenue and the probability that a state introduces an amnesty, consistent with the fiscal stress hypothesis. DGW predict a positive relation between taxes and state amnesty enactments. (For a discussion of causality between taxes and amnesty, see *Normal distribution of hazards* under section *4.1 Parametric Approach.*)

Our final measure of a state's fiscal health indicator is the unemployment rate. During a recession, the unemployment rate rises as production falls, possibly increasing the noncompliance problem as well. If the revenue yield hypothesis holds, then states might not enact an amnesty when the unemployment rate is high since the amnesty would produce less

[4] In fact, DGW use the percentage change specification of state income tax.

revenue. DGW also acknowledge this fact by noting that "states with higher unemployment rates may have unsound economies, and thus an amnesty in such a state would produce less revenue" (pp. 1063). However, because states with fiscal stress are particularly prone to finding new revenue sources (NASBO 2004), we predict a positive relation between the unemployment rate and the probability of a tax amnesty enactment. DGW also predict a positive relationship between the unemployment rate and state tax amnesty enactment but for an entirely different reason. Instead of relating unemployment rate to fiscal stress, they relate it to revenue yield by arguing that the presence of per capita income in their model mitigates the effect of unsound economies and that states with high unemployment rates would have greater potential revenue yield from both higher number of non-filers and a larger underground economy.

As we noted in section 2, a majority of state amnesties (66 out of 79) were approved through legislative authorization. We, therefore, include several state related political variables. At the policy formulation level, an amnesty bill should face less political opposition if the same political party controls both the executive (the governor) and the legislative branches (the house and/or the senate) of government. Hence, a state may be more likely to enact an amnesty if its governor and its legislative branches are controlled by a single party. We use two separate dummy variables, Democrat and Republican, to examine whether a state is more likely to enact an amnesty if its governor and its legislative branches are controlled by either the Democrats or Republicans. Since these two political parties typically hold opposing views regarding taxes and other social issues, using two dummy variables allows us to also examine which political party is more likely to support or oppose an amnesty bill. If the Democrats control both branches of government (i.e. the Governor and the Legislature), Democrat takes the value of 1 and 0

otherwise. Similarly, if the Republicans control the government, Republican takes the value of 1 and 0 otherwise.[5]

Another political variable is the election year dummy, which takes the value of 1 if a gubernatorial election is held in a particular year and 0 otherwise. Torgler, Schaltegger, and Schaffner (2003) and Torgler and Schaltegger (2005) find that tax compliance rises if a possible tax amnesty is subjected to a popular vote, regardless of whether the amnesty is passed or rejected. If elected officials face less opposition enacting amnesties introduced during an election year, an election year dummy will have a positive effect on the probability of tax amnesty enactment. However, if amnesties are seen as a departure from "good governance," candidates may not wish to introduce them during an election year, which implies a negative relation between election year dummy and amnesty. Thus, the predicted relationship between election year dummy and the probability of amnesty is ambiguous.

Additionally, we use state population over the age of 65 as a demographic control variable. The elderly population is generally politically active and tends to oppose tax increases or certain expenditures backed by taxes such as the property tax. Therefore, this age group may support tax amnesties that could be seen as substitutes for tax increases. The higher the share of this population group, the more likely a state will be to introduce an amnesty.

In some specification, we use the personal income tax rate, the corporate income tax rate, and the sales tax rate to control for state tax system changes. The potential relationship between tax rates and amnesty enactments depends on three possibilities: (i) increasing tax rates removes states from the risk of enacting an amnesty; (ii) increasing tax rates raises or lowers (but not to zero) the risk of enacting an amnesty; and (iii) increasing tax rates does not affect the risk of

[5] Note that almost all states have split control in one year or the other in our study period. Therefore, Democrat and Republican do not sum to one and including both of these variables in a regression model does not necessarily lead to a dummy variable trap.

enacting an amnesty. Thus, *a priori,* we cannot predict the relation between the tax rates and the probability of an amnesty enactment.

We obtain a panel of annual data for all 50 United States for the period from 1982 (the year Arizona enacted its first amnesty) to 2005 (the most recent available year).[6] We use the natural logarithmic form for all variables except the dummy variables. Table 4 provides a detailed description of our variables, summary statistics and data sources. Table 5 presents a correlation matrix for our regression variables, which reports that the fiscal health indicators are highly correlated.

## 4. Estimation Methods

We apply various methods of event history to model the effects of these variables on the amnesty adoption decision by states. Amnesty is a dichotomous variable, which takes the value of zero and one as defined below. Let $A_{it}$ denote the amnesty status of state $i$ in period $t$. Then,

$$A_{it} = \begin{cases} 0 \ldots \text{if state i does not enact an amnesty in period t} \\ 1 \ldots \text{if state i enacts an amnesty in period t} \end{cases} \quad (1)$$

We define the *risk set* as those states that have not yet enacted an amnesty and are therefore at risk of introducing one at each point in time. We also define the hazard (transition) rate, $h(t)$, as the probability that an event -- amnesty -- will occur at a particular time in a particular state, given that the state is at risk at that time. More formally, the hazard rate for amnesty at time $t$ is defined as:

$$h(t) = \frac{f(t)}{S(t)} \quad (2)$$

[6] According to DGW, Illinois had its first amnesty from 12/28/1981 to 01/08/1982 but it is not reported in the FTA list. The 1981 Illinois amnesty started four days prior to the end of the year and extended until the first week of 1982, therefore, 1982 would still be a reasonable starting point.

where $f(t)$ is the probability of amnesty adoption by states during the interval from $t$ to $t + \Delta t$ and $S(t)$ is the survival function or the probability of not having adopted an amnesty prior to $t$. Although the hazard rate is unobserved, it controls both the occurrence and the timing of an amnesty; thus, it is the fundamental dependent variable. We model this hazard rate as a function of time and other covariates.

We allow both the revenue yield and the fiscal stress motives to co-exist as the hazard function is likely to change along with a state's economic condition. For example, if the fiscal stress hypothesis holds, then the hazard function may increase during recessions and decrease during economic expansions. In contrast, if the revenue yield hypothesis holds, the function may decrease during recessions and increase during economic expansions. An intermediate case is also possible where some states enact amnesties in response to fiscal pressure concerns, while others enact them in response to revenue yield concerns. Co-existence of both motives requires a separate analysis for each amnesty. Thus, we model a state's first (initial) amnesty separately and all amnesties combined (including repeated amnesties).[7]

### 4.1 Parametric Approach

We use various parametric approaches of event history analysis to model the hazard function based on the following assumptions while investigating the validity of each assumption: (i) normal distribution of hazards; (ii) constant distribution of hazards; and, (iii) increasing or decreasing distribution of hazards.

***Normal distribution of hazards:*** Is a normal distribution of hazards a reasonable assumption to analyze the increased frequency of amnesties enacted during and after 2001 recession? Or, is it

[7] For the analysis of the first amnesty, once a state introduces an amnesty, it is no longer at risk and we drop its subsequent observations from the data set; however, for the analysis of repeated amnesties, all states are at risk at each point in time; therefore, we drop no observation from the data set.

valid only for amnesties in the 1980s? We investigate these questions using data for the period 1982-2005 and for the period 1980-1988 for which we replicate the DGW results.[8]

To estimate the parameters, DGW use a two-stage instrumental variable (2SIV) technique making an argument that the duration model is potentially endogenous to the IRS audit rate. We do not have IRS audit rate data.[9] Surprisingly, DGW do not discuss the multicollinearity problem, which we discover as reported in Table 5. Nevertheless, the potential endogeneity (causality) between taxes and amnesty needs a special attention, which we address next.

In general equilibrium framework, all economic variables affect all other variables, implying that all variables are endogenous (causal). We do not take this route; rather, we utilize the properties of temporal aggregation in this research. Note that the data generating processes for two different series (personal income tax vs. total tax) are different; even for a single series, time series properties of monthly, quarterly, and annual series can have very different characteristics due to temporal aggregation (Rossana and Seater, 1995, Marcellino, 1999). Specifically, the causality property is not invariant to temporal aggregation (Granger, 1990, Marcellino, 1999). When we examine the bidirectional causality between taxes and amnesty using bivariate empirical causality models, we indeed find that taxes and amnesty are weakly exogenous. Simply put, using bivariate models, in no case do we find bidirectional causality between current period taxes and amnesty.[10] It is important to note that the economic agents who announce an amnesty and who participate in the amnesty program are different. Moreover, since

[8] We count the 1981 Illinois amnesty as an event and include it in the analysis only when we replicate the DGW results for the sample period 1980-1988.

[9] We contacted the research division of the IRS to obtain the audit rate data but did not receive any response to our inquiry.

[10] We also checked if taxes and amnesty are correlated. We find that the correlation coefficient between taxes and amnesty is 0.017, which is not significantly different from zero.

a majority of state amnesty programs are approved by legislative authorization as noted in section 2, there is generally a significant lag in the announcement and participation in the amnesty program. Thus, we are convinced that these two facts may play a role in the temporal aggregation. We will point out temporal aggregation's implication in the concluding section.

Note that when two variables are weakly exogenous, statistical testing is permitted (Gujarati, 2003, Kennedy, 2003). Thus, we proceed to test for the normal distribution of hazards assumption using the maximum likelihood estimation (MLE) method, appropriate for both small and large samples. As an estimation method for censored data, MLE combines the censored and uncensored observations and produces estimates that are asymptotically unbiased, normally distributed, and efficient (Allison, 1984).

Untabulated results reveal that the coefficient estimates of the variables of interest using MLE are insignificant either individually or jointly for the full sample period.[11] Therefore, the normal distribution of hazard is not a valid assumption to analyze amnesty adoption by states for the full sample period. Evidently, this will be clear as we discuss DGW's results below.

[Table 6, about here]

Table 6, column 1 shows the regression results from MLE following DGW's methods. Specifically, we use percentage change in total tax revenue and include the 1981 Illinois amnesty, while we exclude Alaska, Connecticut, Florida, Nevada, New Hampshire, South Dakota, Tennessee, Texas, Washington, and Wyoming. We find that per capita income and unemployment rate are positive and significant at the five percent level, while the percentage change in total tax revenue is positive but insignificant. DGW find that taxes and unemployment rate are positive and significant, while per capita income is positive but insignificant. These

[11] These results as well as all results not reported in the ensuing discussion are available from the authors upon request.

differences are due to multicollinearity problem in the data. Apart from these differences, the results presented above qualitatively parallel DGW's results reported in Model 2 of Table IV in their paper (pp. 1068), which they use to interpret their results. Undoubtedly, these results are sensitive to the states included in the sample. Column 2 of Table 6, which reports results from the regression model including all 50 states, reveals that all variables remain positive but they are not individually or jointly significant. Thus, we conclude that the normal distribution of hazards is an invalid assumption to analyze the amnesty adoption process by states for any sample period.

***Constant distribution of hazards:*** If we assume constant distribution of hazards, then amnesties (events) occur randomly independent of time. This assumption implies that states were equally likely to enact an amnesty in 1982 as they were in 2002. Since survival times follow an exponential distribution in this assumption, we use an exponential regression model as a first approximation for comparison purposes. This model is attractive from a mathematical and computational point of view and takes the following form:

$$h(t) = e^{(\alpha+\beta_k x_k)} \tag{3}$$

or,

$$\ln h(t) = \alpha + \beta_k x_k \tag{4}$$

In order to determine the exponential model's goodness of fit, we conduct an analysis of pseudo residuals or generalized residuals as suggested by Cox and Snell (1968). If the model fits the data, these residuals will follow a standard exponential distribution. We obtain the generalized Cox-Snell residuals from each model, calculate an empirical estimate of the cumulative hazard function, and plot it against the Cox-Snell residuals. We find that the model is a poor fit for both the first amnesty and repeated amnesties suggesting that the assumption of

constant hazards is incorrect. Since many amnesties cluster around different points in time, we find no support for the assumption of constant distribution of hazards.

***Increasing or decreasing distribution of hazards.*** If we assume that the hazards change (i.e. increase or decrease) with time, then using the Gompertz model or the Weibull model is appropriate. These two models differ slightly in the way time enters into them. The Gompertz model allows the log of hazards to change linearly with time and takes the following form:

$$\ln h(t) = \alpha + \beta_k x_k + ct \,, \tag{5}$$

where c is a constant which may be either positive or negative (Allison, 1984). The Weibull model assumes that the log of hazards changes linearly with the log of time and takes the following form:

$$\ln h(t) = \alpha + \beta_k x_k + c \ln t \,, \tag{6}$$

where c is constrained to be greater than -1 (Allison, 1984). In these two models, the transition rate either increases or decreases monotonically with time until an amnesty takes place, but the rate does not change direction.

We repeat the analysis of pseudo residuals to assess the goodness of fit of both models. As in the exponential model, we obtain the generalized Cox-Snell residuals, calculate an empirical estimate of the cumulative hazard function, and then plot the cumulative hazard against the Cox-Snell residuals. We find that these models also do not fit the data very well, either for the first amnesty or repeated amnesties.

While the hazard is constant in the exponential model, it may increase or decrease with time, but may not change direction in both the Gompertz and the Weibull models. Thus, a major shortcoming of all three models is that the researcher must assume a constant, increasing, or decreasing relation between the hazard rate and time, and we have little information on which to

base such a choice. More importantly, if the hazard function is truly non-monotonic due to co-existence of revenue yield or fiscal stress motives, then none of the above models is appropriate. These shortcomings are overcome in the Cox regression model, which we describe next.

### 4.2 Semi-parametric Approach

We use Cox's regression model since it does not require any assumption of the relation between time and the hazard rate. The Cox model is the most general form of the regression models, and takes the following form:

$$h(t,x) = h_0(t) * e^{(\beta_k * x_k)}, \tag{7}$$

where $h(t, x)$ denotes the hazard rate, given the values of the $k$ covariates and the survival time ($t$). The term $h_0(t)$ denotes the *baseline hazard*, that is, the hazard for the each state when the values of all covariates are equal to zero. Note that in this model, the hazard rate is a product of two terms, first being the baseline hazard rate, $h_0(t)$, and a second term specifying the possible influences of the covariates on the transition rate. If we divide both sides of equation (7) by $h_0(t)$ and then take the natural logarithm of both sides, the model is then transformed into a linear form:

$$\ln\left[\{h(t,x)\}/h_0(t)\right] = \beta_k * x_k \tag{8}$$

Because this function does not have to be specified, the Cox model is also called partially parametric or semi-parametric, and is often referred to as the "proportional hazards model." Above all, the Cox model is so general and nonrestrictive that it is often considered a satisfactory approximation, even when the proportional hazards assumption is violated (Allison, 1984).

Because our fiscal health indicators are highly correlated as reported in Table 5, we perform a principle components analysis (PCA) due to concerns about multicollinearity. PCA uses a linear combination of these highly correlated variables and creates a composite index that

captures as much of the variation in these variables as possible. The main shortcoming of this approach is that the composite index is difficult to justify because it combines correlated variables, measured in different units, which move in the opposite direction. For example, income and tax revenues, measured in dollars, are negatively associated with the amnesty, while unemployment rate, measured in percentage point, is positively associated with the amnesty. Even so, when we perform this analysis, we find that the main principle component explains more than 65 percent of the variation in these variables. Technically, we find that among the three fiscal health indicators, only one principle component has an eigenvalue greater than one. Therefore, we include only one fiscal health indicator in each regression model, but report results for all fiscal health indicators.

## 5. Empirical Results

We report the results in two sets of regression tables. Table 7A, Table 7B, and Table 7C present results for the adoption of the initial tax amnesties, while Table 8A, Table 8B, and Table 8C present results for the repeated tax amnesties, where each table differs by the main fiscal health indicator included in the regression. In each table, Model (1) shows results for the regressions using all 50 states, while Model (2) shows results only for those states with income and sales taxes. In each model, column (1) shows the size of the coefficients, column (2) shows the hazard ratio, and column (3) shows the *z*-statistics. Notice the relation between column (1) and column (2). The coefficients in column (1) can be obtained by taking the logarithm of the respective coefficients in column (2). Alternatively, the coefficients in column (2) can also be obtained by exponentiating the respective coefficients in column (1). For dichotomous variables, it is common to just report the hazard ratio (column 2). The numbers in column (2) indicate how the hazard ratio would change if the appropriate variable were to change in size by one unit.

According to Teachman and Hayward (1993), the exact interpretation for a dichotomous dummy variable is $100[\exp(\beta_k*1) - \exp(\beta_k*0)]/\exp(\beta_k*0)$, while for a continuous variable is $100\{\exp[\beta_k*(x + 1)] - \exp(\beta_k*x)\}/\exp(\beta_k*x)$. Therefore, a hazard ratio greater (less) than 1 indicates that an increase (decrease) in the explanatory variable increases the probability of an amnesty occurring. However, when the explanatory variables are used in the logarithmic form, the interpretation of the hazard ratio becomes difficult. This difficulty is overcome by taking the logarithm of the hazard ratio -- the coefficient so obtained is then converted into a measure of elasticity. Since we use dummy variables as well as variables in the logarithmic form, we report both the hazard ratio and $\beta$ coefficients.

To give an example of what the numbers in the tables mean, using Model (1) column (1) results in Table 8A, a one percent increase in per capita income lowers the hazard rate by 4.189 percent. This effect may be easier to understand in relation to average per capita personal income. In our sample, average per capita real personal income is $27,353 in 2005 constant dollars. Our results imply that a one percent increase in average per capita personal income (from $27,353 to $27,626) lowers the hazard rate by 4.189 percent. Similarly, using Model (1) column (1) results in Table 8C, if a state experiences a one percent increase in unemployment rate, that state's hazard rate increases by approximately 2.089 percent relative to a state without a change in unemployment rate. Other coefficients have a similar interpretation.

[Table 7A, 7B, 7C, 8A, 8B, and 8C about here]

Consider the fiscal health indicators. The results reveal that, as expected, fiscal health indicators are consistently significant in the expected direction. In each of the regressions reported in the tables, the coefficients on each of the fiscal health indicators are negative, except in the regressions using the unemployment rate where the coefficient is positive. This indicates

that a state's fiscal health (stress) is a significant negative (positive) contributing factor to tax amnesty adoption. Particularly, decreases in per capita personal income, or per capita total tax revenue, are associated with a greater likelihood of tax amnesty adoption. In the case of unemployment, an increase in state unemployment rate is associated with a greater likelihood of tax amnesty adoption. These results are generally similar between the initial and the repeated amnesties.

Except fiscal health indicators, our results do not provide any strong evidence about the effects of political, demographic, and tax rates control variables on amnesty enactment as these variables are not statistically significant in all models. This fact explains why states heavily discount future hidden losses in favor of the short-run revenue gains from the amnesty. Nonetheless, below we discuss the outstanding pattern of results of other variables.

With regard to political factors, the coefficient on the variable Republican is always negative. This might indicate that Republican control of state government decreases the probability of amnesty adoption, which is consistent with Republicans, typically conservatives, opposing liberal initiatives. The coefficient on Election is not significant in any of the models, consistent with the opposing arguments about the relation between an election and amnesty enactment. Interestingly, the coefficient on Election switches sign from negative in the initial amnesties to positive in the repeated amnesties.

The demographic control variable, population 65 years and older typically has a positive coefficient, except when unemployment rate is the main fiscal health indicator in the subset of data that includes tax rate variables in Table 8C. When the estimate is positive, it is statistically significant in some of the regressions. This might be an indication that elderly, who are often a

politically active group, support initiatives like tax amnesties that raise state revenues without new taxes or increased rates for current taxes.

Finally, we report the results including the tax rate variables in Model (2) of each table. Including or excluding the tax rate variables has virtually no qualitative impact on the estimated fiscal health indicators. The coefficient on the personal income tax rate is always positive, but it is not significant when the unemployment rate is the main fiscal health indicator. In contrast, the coefficient on the sales tax rate is always negative, and it is significant when the unemployment rate is the main fiscal health indicator. Though positive, the coefficient on the corporate income tax rate is not significant in any of the models. While it may be possible that in higher rate states, as opposed to increasing the rate, the positive coefficients on personal income tax rate and corporate income tax rate would be consistent with the states having more potential revenue from an amnesty enactment, and thus supporting the revenue yield hypothesis. Historically, however, states increase tax rates in recession. For example, in the 1991-92 and 2001 recessions, 44 and 30 states respectively raised their tax rates (Johnson, Nicholas and Pennington, 2009). Given the conflicting patterns of results between the income tax rate and the sales tax rate, we cannot predict a clear relation between tax rates and amnesty. This requires an elaborate analysis of multiple events, which we intend to pursue in future research.

### 5.1 Extensions and Robustness Checks

We consider a number of issues to examine the robustness and sensitivity of our results. First, we used alternative measures of fiscal health since multicollinearity prevents us from including all fiscal health indicators in each model. We find that our main finding does not change even when we use gross state product (GSP) or federal government transfers to state government. We also tried outstanding debt as another possible fiscal health indicator but we did

not find this variable a consistently significant determinant of amnesty adoption. We are not surprised to see this result, however, for three reasons: First the link between debt and amnesty adoption could be rather complex since many states accumulate debt to finance capital projects during times of fiscal health. This means the relationship between debt and fiscal stress is not necessarily positive. Second, state balanced budget requirements impose restrictions on state borrowing which could lead to significant discrepancy between state borrowing and debt and state fiscal stress.[12] Finally, other studies in related literatures such as state lottery adoption also did not find a significant relationship between long term debt and lottery adoption by states (Alm, McKee and Skidmore, 1993).[13]

Next, we tested if neighborhood effect explains the amnesty adoption decision by states. For this, we use various measures including a simple dummy variable indicating whether a neighboring state has an amnesty, the actual number of neighboring states adopting an amnesty, and the total number of states offering an amnesty. We find no evidence that the neighborhood effect relates to amnesty adoption decision by states. While we already consider several sources of heterogeneity across states in our regressions, we also investigate if other potentially important factors or state characteristics could change our results. These could be state tax characteristics other than tax rates, voting rules or state physical characteristics such as climate, land area, topography, etc. For this we run regressions with state fixed effects. Our main finding on the fiscal stress hypothesis was robust to the inclusion of state fixed effects in our regression models.

[12] Using a fiscal deficit variable is similarly problematic since many states impose strict anti-deficit rules within their balanced budget requirements. See Poterba (1995) for a good overview of state balanced budget requirements.

[13] Alm, McKee, and Skidmore (1993) find a significant relation between a state's short-term debt and state lotteries, but they do not find such a clear relation between a state's long-term debt and state lotteries. In our case, we were not able to obtain a breakdown of short-term and long-term debt for our complete data set.

## 6. Summary and Conclusion

The frequency of tax amnesties increased substantially in the early 2000s with several states offering repeated amnesties. In this paper, we examine if the revenue yield motive or the fiscal stress motive primarily drives states to enact amnesties. We apply several methods of event history analyses to investigate the validity of various assumptions regarding the distribution of hazards that could possibly play a role in tax amnesty enactments. Using a Cox regression model, which does not require any assumption about the distribution of hazards, we find a negative relation between a state's fiscal health and amnesty enactment. Our results suggest that fiscal pressures, especially declines in per capita income and per capita total tax revenue, and increases in the unemployment rate, play an important role in the amnesty adoption decision. These results are robust to a separate analysis of the initial amnesties and the repeated amnesties that states enacted between 1982 and 2005.

Our findings contrast with past research that investigated amnesties in the 1980s and found no evidence that states enacted tax amnesties due to fiscal pressure (Dubin, Graetz and Wilde, 1992). We find that the fiscal stress motive, not the revenue yield motive, was the major factor explaining the increased frequency of amnesty enactment during and after the 2001 recession. Even the initial amnesties in the 1980s do not support the revenue yield motive once we relax the assumption of normal distribution of hazards and control for multicollinearity in the fiscal health variables. A recent Wall Street Journal article by Arden Dale noted that 12 states had tax amnesty programs in 2009 and 10 to 15 more are expected in 2010. It is noteworthy that

these recent amnesties follow closely the financial crisis and the economic recession that started in 2008. They are indeed consistent with the fiscal stress hypothesis and our empirical results.[14]

An important role temporal aggregation plays in our research implies that state legislatures at the policy formulation level may be less concerned with day to day, or monthly or even quarterly fluctuations in tax revenue collections. It may well be that when annual total tax revenue collections decline due to persistent decline in income or steady increase in unemployment, states enact amnesties. At the same time, it is ironic that these tax amnesties can also be interpreted in light of a time inconsistency problem. While each amnesty is announced to be unique, the unprecedented numbers of tax amnesties send a wrong signal to tax-payers. In fact, these repeated amnesties have unintended, long-run consequences that their architects didn't anticipate (Luitel, and Sobel, 2007, Luitel, 2007).

We have identified several areas that need further investigation, which we leave for future research. First, since our objective in present paper was to examine why states enact or repeat an amnesty in the first place, we did not model specific tax amnesty characteristics. As noted in Section 2, there are several differences amongst state amnesties in terms of whether accounts receivable are included, whether installment arrangements are permitted, and whether interest and penalties are waived. One way to explore these differences in the features of amnesty is to model them as sequential events. For example, states first decide to offer an amnesty; then, independent of that decision, they decide whether to include accounts receivable, whether to permit installment arrangements, and whether to waive interest and penalties etc. For this, a multinomial logit analysis would be appropriate. Second, in this paper, we modeled state tax amnesty programs as a single type of event. Again, as indicated in Section 2, voluntary

[14] The article entitled "More States Jump on Tax-Amnesty Bandwagon," appeared on the online version of the Wall Street Journal on November 19, 2009. It can be accessed at http://online.wsj.com/article/SB10001424052748704204304574544051138231422.html

disclosure agreements (VDAs) can be seen as an alternative to a more general state tax amnesty program. As VDAs gain momentum in the future, a comparative analysis of these arrangements to the enactment of tax amnesty programs becomes desirable. Finally, the choice between increasing tax rates and enacting an amnesty needs further analysis. In addition to VDAs, state tax rate increases and tax amnesty programs can be seen as competing risks or multiple events, and the choice among them should be modeled as such.

**References**


Allison, Paul D. *Event History Analysis: Regression for Longitudinal Event Data,* Quantitative Applications in the Social Sciences, Number 07-046, Newbury Park, CA: Sage Publications Inc., 1984.

Alm, James, and William Beck. 1990. "Tax Amnesties and Tax Revenues." *Public Finance Quarterly,* 18 (4): 433-53.

Alm, James, and William Beck. 1991. "Wiping the Slate Clean: Individual Response to State Tax Amnesties." *Southern Economic Journal,* 57 (4): 1043-53.

Alm, James, and William Beck. 1993. "Tax Amnesties and Compliance in the Long Run: A Time Series Analysis." *National Tax Journal,* 46 (1): 53-60.

Alm, James, Michael McKee, and Mark Skidmore.1993. "Fiscal Pressure, Tax Competition, and the Introduction of State Lotteries." *National Tax Journal* 46 (4): 463-76.

Alm, James. 2005. "Tax Evasion." In *The Encyclopedia of Taxation and Tax Policy*, ed. Joseph J. Cordes, Robert D. Ebel and Jane G. Gravelle, 401- 404, Washington D.D.: The Urban Institute Press.

Andreoni, James. 1991. "The Desirability of a Permanent Tax Amnesty." *Journal of Public Economics,* 45 (2): 143-59.

Christian, Charles W., Sanjay Gupta, and James C. Young. 2002. "Evidence on Subsequent Filing from the State of Michigan's Income Tax Amnesty." *National Tax Journal,* 55 (4): 703-21.

Commerce Clearing House, Inc., *State Tax Handbook,* 1980 – 2003.

Cox, D. R. and E. J. Snell. 1968. "A General Definition of Residuals." *Journal of the Royal Statistical Society, Series B (Methodological),* 30(2): 248-275.

Dale, Arden . 2009. “More States Jump on Tax-Amnesty Bandwagon.” *Wall Street Journal,* November 19, 2009.

Dubin, Jeffrey A., Michael J. Graetz, and Louis L. Wilde. 1992. “State Income Tax Amnesties: Causes.” *Quarterly Journal of Economics,* 107 (3): 1057-70.

Federation of Tax Administrators. *http://www.taxadmin.org/fta/rate/amnesty1.html*

Fisher, Ronald C., John H. Goddeeris, and James C. Young. 1989. “Participation in Tax Amnesties: The Individual Income Tax.” *National Tax Journal,* 42 (1): 15-27.

GAO. 1993. Balanced Budget Requirements: State Experiences and Implications for the Federal Government, United States General Accounting Office, Washington, D.C.

Granger, Clive W. J. 1990. “Aggregation of Time-Series Variables: A Survey,” in *Disaggregation in Econometric Modelling*, eds. T. Barker and M. H. Pesaran, London: Routledge, pp. 17-34.

Gujarati, Damodar N. 2003. *Basic Econometrics.* New York: McGraw-Hill/Irwin.

Johnson, Nicholas, Andrew C. Nicholas, and Steven Pennington. 2009. “Tax Measures Help Balance State Budgets: A Common Reasonable Response to Shortfalls.” Center on Budget and Policy Priorities, Washington, D.C.

Joulfaian, D.1988. “Participation in Tax Amnesties: Evidence from a State,” in *Proceedings of the Eighty-first Annual Conference on Taxation* (Washington D.C.: National Tax Association, 1988), 128-132.

Kennedy, Peter. 2003. *A Guide to Econometrics.* Cambridge, MA: MIT Press.

Luitel, Hari S. 2007. “Short-run and Long-run Effects of Tax Amnesties on Tax Revenues: Evidences from US States,” in *Proceedings of the Hundredth Annual Conference on Taxation* (Washington, DC: National Tax Association, 2007), 402-413.

Luitel, Hari S., and Russell S. Sobel. 2007. "The Revenue Impact of Repeated Tax Amnesties." *Public Budgeting and Finance* 27 (3): 19-38.

Malik, Arun S., and Robert M. Schwab. 1991. "The Economics of Tax Amnesties." *Journal of Public Economics,* 46 (1): 29-49.

Marcellino, Massimiliano. 1999. "Some Consequences of Temporal Aggregation in Empirical Analysis." *Journal of Business and Economic Statistics,* 17 (1): 129-136.

National Association of State Budget Officers (NASBO). 2004. "Budget Shortfalls: Strategies for Closing Spending and Revenue Gaps," 4th Edition, Washington D.C.

National Governors Association. http://www.nga.org/

Poterba, James M. 1995. "Balanced Budget Rules and Fiscal Policy: Evidence from the States." *National Tax Journal* 48(3): 329-336.

Rossana, Robert J, and John J. Seater. 1995. "Temporal Aggregation and Economic Time Series." *Journal of Business and Economic Statistics* 13(4): 441-451.

Teachman, Jay D., and Mark D. Hayward. 1993. "Interpreting Hazard Rate Models." *Sociological Methods & Research* 21(3): 340-371.

Torgler, Benno, and Christoph A. Schaltegger. 2005. "Tax Amnesties and Political Participation." *Public Finance Review* 33(3): 403-431.

Torgler, Benno, Christoph A. Schaltegger, and Markus Schaffner. 2003. "Is Forgiveness Divine? A Cross-Culture Comparison of Tax Amnesties." *Schweizerische Zeitschrift für Volkswirtschaft und Statistik,* 139 (3): 375-396.

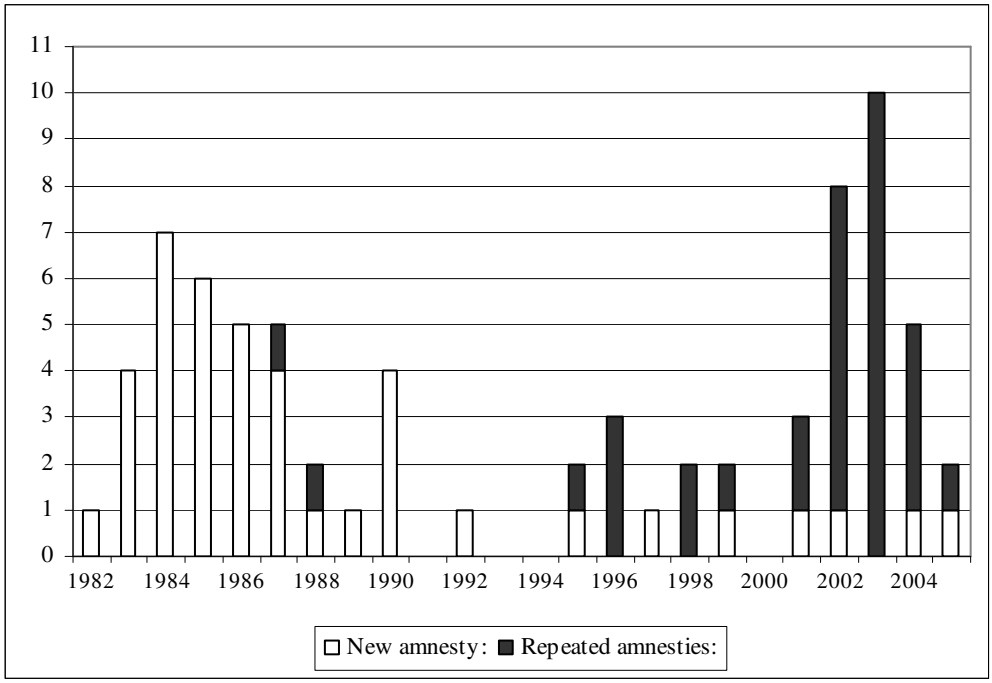
United States Census Bureau, *Population Estimates*, Washington, D.C.

United States Census Bureau, *State Government Finances*, Washington, D.C.

United States Department of Commerce, Bureau of Economic Analysis, *State and Local Personal Income,* Washington, D. C.

United States Department of Labor, Bureau of Labor Statistics, *Demographics,* Washington, D.C.

**Figure 1: New Amnesty vs. Repeated Amnesties (as of December 2005)**




Source: Federation of Tax Administrators, *http://www.taxadmin.org/fta/rate/amnesty1.html*.

## Table 1: Tax Amnesties Offered by the States (as of December 2005)

| Number of Amnesties Offered | Number of States | States |
|---|---|---|
| None | 9 | Alaska[a,c], Delaware[c], Hawaii, Montana[c], Oregon[c], Tennessee[a], Utah, Washington[a,b], Wyoming[a,b] |
| One | 13 | Alabama, Georgia, Idaho, Indiana, Iowa, Minnesota, Nebraska, Nevada[a,b], North Carolina, Ohio, Pennsylvania, South Dakota[a,b], Vermont |
| Two | 20 | Arkansas, California, Colorado, Illinois, Kansas, Kentucky, Maine, Maryland, Michigan, Mississippi, New Hampshire[a,c], New Mexico, North Dakota, Oklahoma, Rhode Island, South Carolina, Texas[a,b], Virginia, West Virginia, Wisconsin |
| Three | 6 | Arizona, Connecticut[d], Florida[a], Massachusetts, Missouri, New Jersey |
| Four | 2 | Louisiana, New York |

**Notes:** a: no personal income tax
b: no corporate income tax
c: no general sales tax
d: Connecticut introduced personal income tax only in 1991.

**Source:** Federation of Tax Administrators, *http://www.taxadmin.org/fta/rate/amnesty1.html*. Web access date: 01/27/2010.

*Table 2* - **Characteristics of State Tax Amnesties (1982 – 2005)**

| | Number of Amnesties with Legislative Authorization | Number of Amnesties that Included Accounts Receivable[a] | Number of Amnesties that Permitted Installment Arrangements |
|---|---|---|---|
| Yes | 66 | 42 | 28 |
| No | 7 | 25 | 31 |
| No information[b] | 6 | 13 | 20 |

**Source:** FTA, July 2007. http://www.taxadmin.org/fta/rate/amnesty1.html. Web access date: 01/27/2010.

**Notes:** [a] The 1984-85 California amnesty allowed known delinquents of individual income taxes to participate in the amnesty but it didn't allow known delinquents of sales taxes to participate in the amnesty. Therefore, it is counted twice in this category.

[b] Information on amnesty characteristics was not available from the FTA.

## *Table 3* - State Tax Amnesty Periods and Ranking of Amnesty Collections (1982 – 2005)

| | *Amnesty Period* | | *Amnesty Collection 2005 $* | | *Percent of State Total tax* | |
|---|---|---|---|---|---|---|
| *Name of State* | *Begin* | *End* | *(000)* | *Rank* | *Revenue* | *Rank* |
| ALABAMA | 1/20/1984 | 4/1/1984 | $5,354 | 59 | 0.12% | 58 |
| ARIZONA | | | | | | |
| First amnesty | 11/22/1982 | 1/20/1983 | $10,416 | 52 | 0.29% | 44 |
| Second amnesty | 1/1/2002 | 2/28/2002 | N/A | | N/A | |
| Third amnesty | 9/1/2003 | 10/31/2003 | $77,577 | 22 | 0.84% | 26 |
| ARKANSAS | | | | | | |
| First amnesty | 9/1/1987 | 11/30/1987 | $2,625 | 60 | 0.09% | 59 |
| Second amnesty | 7/1/2004 | 12/31/2004 | N/A | | N/A | |
| CALIFORNIA | | | | | | |
| First amnesty | 12/10/1984 | 3/15/1985 | $319,932 | 6 | 0.68% | 31 |
| Second amnesty | 2/1/2005 | 3/31/2005 | N/A | | N/A | |
| COLORADO | | | | | | |
| First amnesty | 9/16/1985 | 11/15/1985 | $10,394 | 53 | 0.28% | 45 |
| Second amnesty | 6/1/2003 | 6/30/2003 | $19,554 | 45 | 0.28% | 47 |
| CONNECTICUT | | | | | | |
| First amnesty | 9/1/1990 | 11/30/1990 | $74,792 | 23 | 1.03% | 22 |
| Second amnesty | 9/1/1995 | 11/30/1995 | $56,662 | 27 | 0.62% | 34 |
| Third amnesty | 9/1/2002 | 12/2/2002 | $118,328 | 16 | 1.21% | 18 |
| FLORIDA | | | | | | |
| First amnesty | 1/1/1987 | 6/30/1987 | $20,073 | 44 | 0.13% | 57 |
| Second amnesty | 1/1/1988 | 6/30/1988 | $12,540 | 48 | 0.07% | 60 |
| Third amnesty | 7/1/2003 | 10/31/2003 | $85,016 | 20 | 0.30% | 43 |
| GEORGIA | 10/1/1992 | 12/5/1992 | $67,031 | 25 | 0.71% | 30 |
| IDAHO | 5/20/1983 | 8/30/1983 | $521 | 70 | 0.05% | 65 |
| ILLINOIS | | | | | | |
| First amnesty | 10/1/1984 | 11/30/1984 | $268,545 | 10 | 1.84% | 8 |
| Second amnesty | 10/1/2003 | 11/17/2003 | $565,356 | 3 | 2.40% | 4 |
| INDIANA | 9/15/2005 | 11/15/2005 | $255,000 | 11 | 1.98% | 5 |
| IOWA | 9/2/1986 | 10/31/1986 | $55,769 | 28 | 1.43% | 12 |
| KANSAS | | | | | | |
| First amnesty | 7/1/1984 | 9/30/1984 | $1,004 | 67 | 0.03% | 68 |
| Second amnesty | 10/1/2003 | 11/30/2003 | $57,067 | 26 | 1.07% | 21 |

***Table 3*** **Cont'd**

| *Name of State* | *Amnesty Period* *Begin* | *End* | *Amnesty Collection 2005 $ (000)* | *Rank* | *Percent of State Total tax Revenue* | *Rank* |
|---|---|---|---|---|---|---|
| KENTUCKY | | | | | | |
| First amnesty | 9/15/1988 | 9/30/1988 | $149,280 | 14 | 2.73% | 1 |
| Second amnesty | 8/1/2002 | 9/30/2002 | $108,557 | 17 | 1.25% | 17 |
| LOUISIANA | | | | | | |
| First amnesty | 10/1/1985 | 12/31/1985 | $1,949 | 61 | 0.03% | 69 |
| Second amnesty | 10/1/1987 | 12/15/1987 | $463 | 71 | 0.01% | 71 |
| Third amnesty | 10/1/1998 | 12/31/1998 | $1,520 | 64 | 0.02% | 70 |
| Fourth amnesty | 9/1/2001 | 10/30/2001 | $212,797 | 12 | 2.68% | 2 |
| MAINE | | | | | | |
| First amnesty | 11/1/1990 | 12/31/1990 | $40,166 | 36 | 1.86% | 7 |
| Second amnesty | 9/1/2003 | 11/30/2003 | $39,957 | 37 | 1.39% | 13 |
| MARYLAND | | | | | | |
| First amnesty | 9/1/1987 | 11/2/1987 | $53,425 | 30 | 0.66% | 32 |
| Second amnesty | 9/1/2001 | 10/31/2001 | $43,243 | 35 | 0.36% | 42 |
| MASSACHUSETTS | | | | | | |
| First amnesty | 10/17/1983 | 1/17/1984 | $144,730 | 15 | 1.48% | 11 |
| Second amnesty | 10/1/2002 | 11/30/2002 | $104,324 | 19 | 0.65% | 33 |
| Third amnesty | 1/1/2003 | 2/28/2003 | $11,902 | 49 | 0.07% | 61 |
| MICHIGAN | | | | | | |
| First amnesty | 5/12/1986 | 6/30/1986 | $174,457 | 13 | 1.18% | 19 |
| Second amnesty | 5/15/2002 | 6/30/2002 | N/A | | N/A | |
| MINNESOTA | 8/1/1984 | 10/31/1984 | $20,245 | 43 | 0.24% | 51 |
| MISSISSIPPI | | | | | | |
| First amnesty | 9/1/1986 | 11/30/1986 | $1,589 | 62 | 0.05% | 64 |
| Second amnesty | 9/1/2004 | 12/31/2004 | $8,164 | 55 | 0.15% | 55 |
| MISSOURI | | | | | | |
| First amnesty | 9/1/1983 | 10/31/1983 | $1,562 | 63 | 0.03% | 67 |
| Second amnesty | 8/1/2002 | 10/31/2002 | $82,938 | 21 | 0.88% | 24 |
| Third amnesty | 8/1/2003 | 10/31/2003 | $21,254 | 42 | 0.23% | 52 |
| NEBRASKA | 8/1/2004 | 10/31/2004 | $7,750 | 57 | 0.21% | 53 |
| NEVADA | 2/1/2002 | 6/30/2002 | $7,925 | 56 | 0.19% | 54 |
| NEW HAMPSHIRE | | | | | | |
| First amnesty | 12/1/1997 | 2/17/1998 | $15,787 | 46 | 1.34% | 15 |
| Second amnesty | 12/1/2001 | 2/15/2002 | $14,655 | 47 | 0.71% | 29 |

***Table 3*** **Cont'd**

| *Name of State* | *Amnesty Period* *Begin* | *End* | *Amnesty Collection 2005 $ (000)* | *Rank* | *Percent of State Total tax Revenue* | *Rank* |
|---|---|---|---|---|---|---|
| NEW JERSEY | | | | | | |
| First amnesty | 9/10/1987 | 12/8/1987 | $287,968 | 9 | 1.97% | 6 |
| Second amnesty | 3/15/1996 | 6/1/1996 | $432,069 | 4 | 2.50% | 3 |
| Third amnesty | 4/15/2002 | 6/10/2002 | $300,595 | 7 | 1.51% | 10 |
| NEW MEXICO | | | | | | |
| First amnesty | 8/15/1985 | 11/13/1985 | $22,087 | 41 | 0.95% | 23 |
| Second amnesty | 8/16/1999 | 11/12/1999 | $51,862 | 32 | 1.30% | 16 |
| NEW YORK | | | | | | |
| First amnesty | 11/1/1985 | 1/31/1986 | $637,612 | 1 | 1.76% | 9 |
| Second amnesty | 11/1/1996 | 1/31/1997 | $299,683 | 8 | 0.73% | 28 |
| Third amnesty | 11/18/2002 | 1/31/2003 | $619,235 | 2 | 1.38% | 14 |
| Fourth amnesty | 10/1/2005 | 3/1/2006 | $337,990 | 5 | 0.61% | 35 |
| NORTH CAROLINA | 9/1/1989 | 12/1/1989 | $54,087 | 29 | 0.51% | 39 |
| NORTH DAKOTA | | | | | | |
| First amnesty | 9/1/1983 | 11/30/1983 | $347 | 72 | 0.04% | 66 |
| Second amnesty | 10/1/2003 | 1/31/2004 | $7,130 | 58 | 0.56% | 36 |
| OHIO | 10/15/2001 | 1/15/2002 | $52,650 | 31 | 0.24% | 50 |
| OKLAHOMA | | | | | | |
| First amnesty | 7/1/1984 | 12/31/1984 | $23,257 | 40 | 0.52% | 38 |
| Second amnesty | 8/15/2002 | 11/15/2002 | N/A | | N/A | |
| PENNSYLVANIA | 10/13/1995 | 1/10/1996 | N/A | | N/A | |
| RHODE ISLAND | | | | | | |
| First amnesty | 10/15/1986 | 1/12/1987 | $1,081 | 66 | 0.07% | 62 |
| Second amnesty | 4/15/1996 | 6/28/1996 | $9,508 | 54 | 0.51% | 40 |
| SOUTH CAROLINA | | | | | | |
| First amnesty | 9/1/1985 | 11/30/1985 | $11,531 | 50 | 0.26% | 49 |
| Second amnesty | 10/15/2002 | 12/2/2002 | $71,865 | 24 | 1.09% | 20 |
| SOUTH DAKOTA | 4/1/1999 | 5/15/1999 | $576 | 69 | 0.06% | 63 |
| TEXAS | | | | | | |
| First amnesty | 2/1/1984 | 2/29/1984 | $837 | 68 | 0.01% | 72 |
| Second amnesty | 3/11/2004 | 3/31/2004 | N/A | | N/A | |
| VERMONT | 5/15/1990 | 6/25/1990 | $1,385 | 65 | 0.15% | 56 |
| VIRGINIA | | | | | | |
| First amnesty | 2/1/1990 | 3/31/1990 | $44,598 | 33 | 0.49% | 41 |
| Second amnesty | 9/2/2003 | 11/3/2003 | $104,463 | 18 | 0.76% | 27 |

***Table 3* Cont'd**

| *Name of State* | *Amnesty Period* *Begin* | *End* | *Amnesty Collection 2005 $ (000)* | *Rank* | *Percent of State Total tax Revenue* | *Rank* |
|---|---|---|---|---|---|---|
| WEST VIRGINIA | | | | | | |
| First amnesty | 10/1/1986 | 12/31/1986 | $25,263 | 39 | 0.86% | 25 |
| Second amnesty | 9/1/2004 | 10/31/2004 | $10,747 | 51 | 0.28% | 46 |
| WISCONSIN | | | | | | |
| First amnesty | 9/15/1985 | 11/22/1985 | $44,336 | 34 | 0.54% | 37 |
| Second amnesty | 6/15/1998 | 8/14/1998 | $36,136 | 38 | 0.28% | 48 |
| **AVERAGE** | | | **$93,714** | | **0.75%** | |

**Source:** FTA, July 2007. http://www.taxadmin.org/fta/rate/amnesty1.html. Web access date: 01/27/2010.

## *Table 4* – Variable Description (Source) and Summary Statistics

| Variable Name | Description (source) | No of Observation | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Initial amnesty | Initial amnesty equals 1 during the year of amnesty, 0 before (1) | 517 | .079 | .270 | 0 | 1 |
| Repeated amnesty | Repeated amnesty equals 1 during the year of amnesty, 0 before or after (1) | 1200 | .075 | .263 | 0 | 1 |
| Per capita personal income | Log of per capita personal income (2) | 1200 | 10.073 | .206 | 9.482 | 10.646 |
| Per capita total tax revenue | Log of per capita total tax revenue (3) | 1200 | 7.043 | .558 | 5.375 | 8.309 |
| Unemployment rate | Log of unemployment rate (4) | 1200 | -2.904 | .333 | -3.772 | -1.748 |
| Population 65 years and over | Log of population 65 years and over (5) | 1200 | 12.873 | 1.062 | 9.497 | 15.168 |
| Democrat | Equal to 1 if Democrats control the state and 0 otherwise (6) | 1200 | .242 | .428 | 0 | 1 |
| Republican | Equal to 1 if Republicans control the state and 0 otherwise (6) | 1200 | .170 | .375 | 0 | 1 |
| Election | Equal to 1 if gubernatorial election is held and 0 otherwise (6) | 1200 | .261 | .439 | 0 | 1 |
| Average of the personal income tax rate | Log of average of the personal income tax rate (7) | 975 | -2.980 | .459 | -4.199 | -1.272 |
| Average of the corporate income tax rate | Log of average of the corporate income tax rate (7) | 1080 | -2.725 | .301 | -4.017 | -2.067 |
| Average of the sales tax rate | Log of average of the sales tax rate (7) | 1080 | -3.031 | .225 | -3.912 | -2.525 |

1. Federation of Tax Administrators, http://www.taxadmin.org/fta/rate/amnesty1.html
2. U.S. Department of Commerce, Bureau of Economic Analysis, *State and Local Area Personal Income,* Washington, D. C.
3. U.S. Census Bureau, *State Government Finances,* Washington, D.C.
4. U.S. Department of Labor, Bureau of Labor Statistics, *Demographics,* Washington, D.C.
5. U.S. Census Bureau, *Population Estimates,* Washington, D.C.
6. National Governors Association; Official Election Websites at state level.
7. Commerce Clearing House, Inc., *State Tax Handbook,* 1980 – 2003.

## *Table 5* – Matrix of Correlation Coefficient

| | Log of per capita personal income | Log of per capita total tax revenue | Log of unemployment rate | Log of population 65 years and over | Democrat | Republican | Election | Log of average of the personal income tax rate | Log of average of the corporate income tax rate | Log of the sales tax rate |
|---|---|---|---|---|---|---|---|---|---|---|
| Log of per capita personal income | 1 | | | | | | | | | |
| Log of per capita total tax revenue | 0.777 | 1 | | | | | | | | |
| Log of unemployment rate | -0.545 | -0.508 | 1 | | | | | | | |
| Log of population 65 years and over | 0.376 | 0.103 | 0.153 | 1 | | | | | | |
| Democrat | -0.233 | -0.103 | 0.217 | -0.085 | 1 | | | | | |
| Republican | 0.078 | 0.029 | -0.152 | -0.053 | -0.254 | 1 | | | | |
| Election | -0.055 | -0.055 | 0.041 | -0.035 | 0.032 | -0.012 | 1 | | | |
| Log of average of the personal income tax rate | -0.007 | 0.149 | -0.143 | -0.489 | -0.065 | -0.033 | 0.061 | 1 | | |
| Log of average of the corporate income tax rate | 0.315 | 0.299 | -0.146 | 0.144 | -0.098 | -0.049 | -0.0009 | 0.181 | 1 | |
| Log of average of the sales tax rate | 0.272 | 0.437 | -0.057 | 0.078 | -0.107 | 0.078 | -0.044 | 0.051 | 0.310 | 1 |

## *Table 6* –Maximum Likelihood Estimation Results for Fiscal Health Indicators (Using our variable definitions predicting DGW Results during 1980 to 1988 period)

| Variables | Model (1)[a] | Model (2)[b] |
|---|---|---|
| Per capita personal income | .2897*<br>(2.49) | .1370<br>(1.56) |
| Percentage in Per capita total tax revenue | .4356<br>(1.74) | .1986<br>(1.26) |
| Unemployment rate | .1360*<br>(2.44) | .0673<br>(1.57) |
| Constant | −2.415*<br>(2.24) | −1.099<br>(1.33) |
| LR $\chi^2$ value | $\chi^2$ (3) = 10.72 | $\chi^2$ (3) = 5.02 |
| Probability | 0.013 | 0.170 |
| Log likelihood | −58.023 | −48.964 |
| No of observations | 360 | 450 |

**Notes:** Figures in parenthesis are absolute z-statistics, *indicates 5 percent significance level.

a. Model (1) excludes Alaska, Connecticut, Florida, Nevada, New Hampshire, South Dakota, Tennessee, Texas, Washington and Wyoming.

b. Model (2) includes all 50 states.

## *Table 7A* –Cox Model Regression Results for Initial Amnesties (1982 – 2005) (Log of Per Capita Personal Income as the Main Fiscal Health Indicator)

| Variables | Model (1)[a] | | | Model (2)[b] | | |
|---|---|---|---|---|---|---|
| | $\beta$ | Exp($\beta$) | $z$-statistics | $\beta$ | Exp($\beta$) | $z$-statistics |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Log of per capita personal income | −6.649 | 0.0012 | −5.55** | −7.144 | .0007 | −4.64** |
| Log of population 65 years and over | 0.640 | 1.897 | 3.28** | 0.812 | 2.253 | 2.53* |
| Election | −0.233 | 0.791 | −0.59 | −0.539 | 0.583 | −1.17 |
| Democrat | −0.038 | 0.962 | −0.10 | 0.197 | 1.217 | 0.42 |
| Republican | −1.034 | 0.355 | −1.84 | −1.240 | 0.289 | −1.77 |
| Log of average of the personal income tax rate | – | – | – | 1.131 | 3.100 | 2.24* |
| Log of average of the corporate income tax rate | – | – | – | 0.767 | 2.153 | 0.83 |
| Log of average of the sales tax rate | – | – | – | −1.413 | 0.243 | −1.70 |
| LR $\chi^2$ value | $\chi^2$ (5) = 56.56 | | | $\chi^2$ (8) = 44.63 | | |
| Probability | 0.000 | | | 0.000 | | |
| Log likelihood | −197.743 | | | −144.215 | | |
| No of observations | 517 | | | 276 | | |

**Notes:** **indicates 1 percent significance level, *indicates 5 percent significance level.

a. Model 1 includes all 50 states.

b. Model 2 excludes states without personal income tax, corporate income tax, general sales tax, and Connecticut.

## *Table 7B* –Cox Model Regression Results for Initial Amnesties (1982 – 2005) (Log of Per Capita Total Tax Revenue as the Main Fiscal Health Indicator)

| Variables | Model (1)[a] | | | Model (2)[b] | | |
|---|---|---|---|---|---|---|
| | $\beta$ | Exp($\beta$) | $z$-statistics | $\beta$ | Exp($\beta$) | $z$-statistics |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Log of per capita total tax revenue | −2.891 | 0.055 | −4.17** | −3.747 | 0.0235 | −3.50** |
| Log of population 65 years and over | 0.358 | 1.431 | 1.89 | 0.459 | 1.583 | 1.46 |
| Election | −0.278 | 0.756 | −0.70 | −0.599 | 0.5491 | −1.30 |
| Democrat | 0.415 | 1.515 | 1.18 | 0.533 | 1.704 | 1.19 |
| Republican | −1.241 | 0.288 | −2.09* | −1.315 | 0.2683 | −1.83 |
| Log of average of the personal income tax rate | – | – | – | 1.004 | 2.729 | 2.21* |
| Log of average of the corporate income tax rate | – | – | – | 0.075 | 1.078 | 0.08 |
| Log of average of the sales tax rate | – | – | – | −0.627 | 0.5339 | −0.69 |
| LR $\chi^2$ value | $\chi^2$ (5) = 39.93 | | | $\chi^2$ (8) = 35.56 | | |
| Probability | 0.000 | | | 0.000 | | |
| Log likelihood | −206.062 | | | −148.748 | | |
| No of observations | 517 | | | 276 | | |

**Notes:** **indicates 1 percent significance level, *indicates 5 percent significance level.

a. Model 1 includes all 50 states.

b. Model 2 excludes states without personal income tax, corporate income tax, general sales tax, and Connecticut.

## *Table 7C* –Cox Model Regression Results for Initial Amnesties (1982 – 2005) (Log of Unemployment Rate as the Main Fiscal Health Indicator)

| Variables | Model (1)[a] | | | Model (2)[b] | | |
|---|---|---|---|---|---|---|
| | $\beta$ | Exp($\beta$) | $z$-statistics | $\beta$ | Exp($\beta$) | $z$-statistics |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Log of unemployment rate | 2.148 | 8.567 | 3.75** | 3.642 | 38.169 | 5.98** |
| Log of population 65 years and over | 0.440 | 1.552 | 2.73** | 0.1284 | 1.137 | 0.45 |
| Election | −0.223 | 0.799 | −0.56 | −0.4531 | 0.6356 | −0.98 |
| Democrat | 0.464 | 1.591 | 1.35 | −0.2728 | 0.7612 | −0.61 |
| Republican | −0.446 | 0.639 | −0.80 | −0.8748 | 0.4169 | −1.23 |
| Log of average of the personal income tax rate | – | – | – | 0.7167 | 2.047 | 1.41 |
| Log of average of the corporate income tax rate | – | – | – | 0.9391 | 2.557 | 1.34 |
| Log of average of the sales tax rate | – | – | – | −3.285 | 0.0374 | −3.21** |
| LR $\chi^2$ value | $\chi^2$ (5) = 35.56 | | | $\chi^2$ (8) = 54.54 | | |
| Probability | 0.000 | | | 0.000 | | |
| Log likelihood | −208.243 | | | −139.258 | | |
| No of observations | 517 | | | 276 | | |

**Notes:** **indicates 1 percent significance level, *indicates 5 percent significance level.

a. Model 1 includes all 50 states.

b. Model 2 excludes states without personal income tax, corporate income tax, general sales tax, and Connecticut.

## *Table 8A* –Cox Model Regression Results for Repeated Amnesties (1982 – 2005) (Log of Per Capita Personal Income as the Main Fiscal Health Indicator)

| Variables | Model (1)[a] | | | Model (2)[b] | | |
|---|---|---|---|---|---|---|
| | $\beta$ | Exp($\beta$) | $z$-statistics | $\beta$ | Exp($\beta$) | $z$-statistics |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Log of per capita personal income | −4.189 | 0.0151 | −5.40** | −6.476 | .0015 | −6.19** |
| Log of population 65 years and over | 0.4687 | 1.597 | 3.62** | 0.839 | 2.314 | 4.48** |
| Election | 0.2195 | 1.245 | 0.90 | 0.0504 | 1.051 | 0.18 |
| Democrat | −0.2835 | 0.7530 | −1.03 | −0.3116 | .7322 | −1.05 |
| Republican | −0.5132 | 0.5985 | −1.66 | −0.1563 | .8552 | −0.44 |
| Log of average of the personal income tax rate | – | – | – | 1.062 | 2.892 | 3.18** |
| Log of average of the corporate income tax rate | – | – | – | .7862 | 2.195 | 1.60 |
| Log of average of the sales tax rate | – | – | – | −1.932 | .1448 | −3.21** |
| LR $\chi^2$ value | $\chi^2$ (5) = 41.91 | | | $\chi^2$ (8) = 61.35 | | |
| Probability | 0.000 | | | 0.000 | | |
| Log likelihood | −523.241 | | | −407.990 | | |
| No of observations | 1200 | | | 888 | | |

**Notes:** **indicates 1 percent significance level, *indicates 5 percent significance level.

a. Model 1 includes all 50 states.

b. Model 2 excludes states without personal income tax, corporate income tax, general sales tax, and Connecticut.

## *Table 8B* –Cox Model Regression Results for Repeated Amnesties (1982 – 2005) (Log of Per Capita Total Tax Revenue as the Main Fiscal Health Indicator)

| Variables | Model (1)[a] | | | Model (2)[b] | | |
|---|---|---|---|---|---|---|
| | $\beta$ | Exp($\beta$) | $z$-statistics | $\beta$ | Exp($\beta$) | $z$-statistics |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Log of per capita total tax revenue | −3.153 | .0427 | −6.18** | −5.159 | .0057 | −6.05** |
| Log of population 65 years and over | 0.2560 | 1.291 | 2.16* | .5614 | 1.753 | 2.94** |
| Election | 0.1859 | 1.204 | 0.76 | .0461 | 1.047 | 0.17 |
| Democrat | −0.0164 | .9836 | −0.06 | .1146 | 1.121 | 0.40 |
| Republican | −0.9149 | .4005 | −2.87** | −.3862 | .6796 | −1.09 |
| Log of average of the personal income tax rate | − | − | − | 1.030 | 2.801 | 3.48** |
| Log of average of the corporate income tax rate | − | − | − | .7978 | 2.220 | 1.44 |
| Log of average of the sales tax rate | − | − | − | −.3577 | .6992 | −0.57 |
| LR $\chi^2$ value | $\chi^2$ (5) = 49.00 | | | $\chi^2$ (8) = 57.75 | | |
| Probability | 0.000 | | | 0.000 | | |
| Log likelihood | −519.694 | | | −409.788 | | |
| No of observations | 1200 | | | 888 | | |

**Notes:** **indicates 1 percent significance level, *indicates 5 percent significance level.

a. Model 1 includes all 50 states.

b. Model 2 excludes states without personal income tax, corporate income tax, general sales tax, and Connecticut.

## *Table 8C* –Cox Model Regression Results for Repeated Amnesties (1982 – 2005) (Log of Unemployment Rate as the Main Fiscal Health Indicator)

| Variables | Model (1)[a] | | | Model (2)[b] | | |
|---|---|---|---|---|---|---|
| | $\beta$ | Exp($\beta$) | $z$-statistics | $\beta$ | Exp($\beta$) | $z$-statistics |
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Log of unemployment rate | 2.089 | 8.079 | 4.68** | 3.350 | 28.525 | 6.79** |
| Log of population 65 years and over | 0.1433 | 1.154 | 1.38 | −0.0344 | .9661 | −0.23 |
| Election | 0.2350 | 1.264 | 0.96 | 0.1068 | 1.112 | 0.39 |
| Democrat | −0.0962 | 0.9082 | −0.36 | −0.3563 | .7002 | −1.19 |
| Republican | −0.3837 | 0.6812 | −1.24 | −0.3276 | .7206 | −0.91 |
| Log of average of the personal income tax rate | – | – | – | 0.3857 | 1.470 | 1.24 |
| Log of average of the corporate income tax rate | – | – | – | 0.8111 | 2.250 | 1.79 |
| Log of average of the sales tax rate | – | – | – | −2.419 | .0889 | −4.25** |
| LR $\chi^2$ value | $\chi^2$ (5) = 31.27 | | | $\chi^2$ (8) = 60.77 | | |
| Probability | 0.000 | | | 0.000 | | |
| Log likelihood | −528.563 | | | −408.279 | | |
| No of observations | 1200 | | | 888 | | |

**Notes:** **indicates 1 percent significance level, *indicates 5 percent significance level.

a. Model 1 includes all 50 states.

b. Model 2 excludes states without personal income tax, corporate income tax, general sales tax, and Connecticut.