SHORT-RUN AND LONG-RUN EFFECTS OF TAX AMNESTIES ON TAX REVENUES: EVIDENCES FROM U.S. STATES*

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INTRODUCTION

TAX AMNESTIES ARE INCREASINGLY USED BY ALL types of government as part of their fiscal program all over the world. Some countries have resorted to amnesties on a repeated basis. For example, Argentina, France, India, Ireland, Italy, and Russia have offered tax amnesties a number of times and sometimes the repetition of amnesty took place at an interval as short as every two years. In the United States, although the issue surfaced on several occasions, no tax amnesty has been enacted to date at the federal level; however, 41 states and many local governments (i.e., New York City and Washington D.C.) have enacted tax amnesties several times.

Proponents argue that tax amnesties raise revenues both in the short-run and long-run, by bringing former non-filers back into the tax system. Opponents, on the other hand, contend that amnesties produce little short-run revenue and weaken incentives for long-run tax compliance. Except Alm and Beck (1993) and Luitel and Sobel (2007), however, no studies have investigated whether revenues are generated for state coffers during or after an amnesty. Alm and Beck (1993) analyze the effect of an amnesty on personal income tax revenue for the 1985 Colorado amnesty. The main shortcoming of this study is that the authors assume personal income tax as a proxy for total tax revenue arguing that amnesty collection from personal income tax was the largest source in Colorado, which accounted for over 90 percent of the amnesty collection. It is, however, possible that amnesty collection from personal income tax may not be as high in other states. For example, according to Luitel and Tosun (2005), in West Virginia's 1986 tax amnesty, personal income tax played a significantly smaller role, accounting for only slightly over 10 percent share in total amnesty collection. Moreover, of the 76 amnesties offered during the period of 1982-2004, 72 included all major state taxes, and only 4 were for a specific tax (e.g., income tax, sales tax, and use taxes, etc.). Furthermore, we have examples of many states with no personal income tax but have offered tax amnesties.[1] Therefore, an analysis of a broader measure of tax represented by total tax revenue is justifiable.

The role of research based on experimental studies in public economics has dramatically increased over the years, so has been the interest in such experimental research in tax amnesties. Surprisingly, however, natural experiment has received little attention in the tax amnesty literature. Given their increasing popularity in recent years, state tax amnesties merit alternative investigations. Thus, the objective of this paper is to bring about new evidences on revenue effects of tax amnesties based on the U.S. states' natural experiments, and to provide support to Luitel and Sobel's (2007) findings by showing that there is no endogeneity problem in the data. More importantly, the results of the endogeneity test in this paper also serve to provide a basis for future research on causes of repetition of state tax amnesties.

U.S. STATE TAX AMNESTY EXPERIENCE

Like many countries, tax amnesties have become increasingly popular among the U.S. states in recent years. Table 1 shows a detailed listing of the U.S. state tax amnesties between 1982 and 2004. The duration of tax amnesties varies widely across states. During the 1982-2004 period, the shortest amnesty was conducted by Kentucky (lasting 15 days in 1988), followed by Texas (20 days in 2004 and 29 days in 1984). The longest amnesty periods were offered by Oklahoma (183 days in 1984), Arkansas (183 days in 2004), and Florida (181 days in 1988 and 180 days in 1987). Of the 76 amnesties during 1982 to 2004, 4 amnesties lasted one month or less, 26 amnesties lasted for more than one month but less than two months, 36 amnesties lasted more than two months but less than three months, 5 amnesties lasted more than three months but less than four months, and 5 amnesties lasted more than four months.

*This paper is an alternative exposition and complements Luitel and Sobel (2007). I thank James Alm for his encouragement to continue work on the endogeneity issue in the paper.

Table 1 also shows that tax amnesties averaged only 0.69 percent and never exceeded more than three percent of state general revenue. Looking at the actual figures, 14 state tax amnesties were reported to bring in short-run revenues greater than or equal to $100 million since 1982. Among those, the three largest revenue yields were in New York (2002-2003, $582.7 million), Illinois (2003, $532 million), and in New York (1985-86, $401 million). On the other hand, 10 state tax amnesties generated $1 million or less, with the three smallest revenue yields being North Dakota (1983, $0.2 million), Idaho (1983, $0.3 million) and Louisiana (1987, $0.3 million). While, such sharp difference in revenue yields is partially due to population and economic size of these states, there seems to be a large variation in short-term revenue yields across states.

When we look at per capita figures, New Jersey (1996, $47.75), Illinois (2003, 39.68), and Louisiana (2001, 37.85) have the three largest short-run tax amnesty revenue yields. On the other hand, per capita collections were less than $1 in 13 states with the three smallest per capita revenue yields in Missouri (1983, $0.28), Louisiana (1987, $0.09) and Texas (1984, $0.05). Similarly, when amnesty collections are controlled for state personal income, considerably different ranking of states is obtained. The top three tax amnesties in terms of revenue yields per $100,000 state personal income are Kentucky (1988, $200.34), Louisiana (2001, $156.78), and New Jersey (2002, $144.57).

THEORETICAL FRAMEWORK

Tax revenue (y_t) is a function of tax base (B) and tax rate (t). This simple functional relationship can be expressed as:

(1) $y_t = f(B, t)$.

Because my goal is to capture the impact of an amnesty (A) on tax revenue, the relationship can be modified as follows:

(2) $y_t = f(B, t, A)$.

An increase (decrease) in tax base increases (decreases) tax revenue; therefore, tax base has a positive effect on tax revenue. The effect of tax rate on tax revenue is ambiguous due to income and substitution effect. As tax rate increases, so does the gain from evasion on the margin, therefore, tax evasion increases implying that tax revenue decreases—the substitution effect. On the other hand, tax evasion is a risky affair and, if caught, tax authorities not only confiscate the amount of taxes evaded but also impose additional penalties as a deterrent of breaching the tax rule, which makes taxpayers feel poorer than in the situation without tax evasion and lower tax rate. In the special case of decreasing absolute risk aversion, this tends to reduce evasion implying that tax revenue increases—the income effect. Therefore, the net effect of an increase in tax rate on tax revenue is ambiguous. Furthermore, there is also a Laffer curve argument—if existing tax rate is already high, a further increase in the tax rate decreases tax revenue (i.e., the substitution effect dominates); however, if existing tax rate is low, then an increase in the tax rate results in an increase in tax revenue (i.e., the income effect dominates). Therefore, it is not possible to determine the impact of a change in tax rate on tax revenue.

The key variables of interest—the amnesty variables—capture the impact of offering a tax amnesty on real tax revenue, in both the short run and long run. To do this I include two variables separately for each amnesty offered. The first captures the short-run effect, and is simply a dummy variable equal to one only during the period for which the amnesty is active (which can be one or more quarters). More generally, it can be defined as below: Let A_{it} denote the amnesty status of state i in period t. Then,

(3) $SA_{it} =$

0 if state i does not have an amnesty in period t
1 if state i enacts an amnesty in period t.

This variable captures any upward spike in the revenue collections during the period the amnesty is offered. This would be the revenue generated from the collection of back taxes during the amnesty. The second, to capture the long-run effect, is a dummy variable equal to zero prior to the offering of the tax amnesty and one for every period after the amnesty is offered, forever. More generally, it can be defined as below:

(4) $LA_{it} =$

0 prior to state i enacts an amnesty in period t
1 during and after state i enacts an amnesty in period t.

Table 1
State Tax Amnesty Periods and Ranking of Amnesty Collections (1982-2004)

Name of State	Amnesty Period Begin	End	Days	Amnesty Collection 2000 $ a (000)	Rank	Amnesty Collection Per Capita	Rank	Amnesty Collection per 100,000 State Income	Rank	Percent of State General Revenue	Rank
ALABAMA	1/20/1984	4/1/1984	72	$4,730	55	$7.50	54	$7.50	54	0.05%	62
ARIZONA											
First amnesty	11/22/1982	1/20/1983	59	$9,201	50	$17.31	45	$17.31	45	0.15%	53
Second amnesty	1/1/2002	2/28/2002	58	N/A							
Third amnesty	9/1/2003	10/31/2003	60	$68,869	20	$48.57	23	$48.57	23	0.41%	37
ARKANSAS											
First amnesty	9/1/1987	11/30/1987	90	$2,323	56	$6.01	56	$6.01	56	0.09%	57
Second amnesty	7/1/2004	12/31/2004	183	N/A							
CALIFORNIA	12/10/1984	3/15/1985	95	$282,582	5	$43.94	27	$43.94	27	0.68%	26
COLORADO											
First amnesty	9/16/1985	11/15/1985	60	$9,180	51	$12.92	48	$12.92	48	0.28%	42
Second amnesty	6/1/2003	6/30/2003	29	$17,359	43	$11.72	50	$11.72	50	0.28%	43
CONNECTICUT											
First amnesty	9/1/1990	11/30/1990	90	$66,184	21	$61.89	21	$61.89	21	1.03%	19
Second amnesty	9/1/1995	11/30/1995	90	$50,159	25	$44.77	26	$44.77	26	0.62%	29
Third amnesty	9/1/2002	12/2/2002	92	$104,716	14	$73.72	18	$73.72	18	1.21%	15
FLORIDA											
First amnesty	1/1/1987	6/30/1987	180	$17,761	42	$6.67	55	$6.67	55	0.13%	56
Second amnesty	1/1/1988	6/30/1988	181	$11,097	48	$3.93	58	$3.93	58	0.07%	58
Third amnesty	7/1/2003	10/31/2003	122	$75,473	18	$15.68	46	$15.68	46	0.30%	51
GEORGIA	10/1/1992	12/5/1992	65	$59,386	23	$39.45	31	$39.45	31	0.71%	25
IDAHO	5/20/1983	8/30/1983	102	$460	66	$2.96	60	$2.96	60	0.05%	63
ILLINOIS											
First amnesty	10/1/1984	11/30/1984	60	$237,232	9	$94.56	11	$94.56	11	1.84%	6
Second amnesty	10/1/2003	11/17/2003	47	$501,895	3	$126.62	5	$126.62	5	2.40%	4
IOWA	9/2/1986	10/31/1986	59	$49,263	26	$89.11	13	$89.11	13	1.43%	10
KANSAS											
First amnesty	7/1/1984	9/30/1984	91	$887	63	$1.80	64	$1.80	64	0.03%	65
Second amnesty	10/1/2003	11/30/2003	60	$50,661	24	$66.74	19	$66.74	19	1.07%	18
KENTUCKY											
First amnesty	9/15/1988	9/30/1988	15	$132,111	12	$35.90	4	$200.34	1	2.73%	1
Second amnesty	8/1/2002	9/30/2002	60	$96,069	15	$23.49	13	$96.10	10	1.25%	14
LOUISIANA											
First amnesty	10/1/1985	12/31/1985	91	$1,721	57	$0.39	63	$2.25	63	0.03%	66
Second amnesty	10/1/1987	12/15/1987	75	$410	67	$0.09	67	$0.57	67	0.01%	69
Third amnesty	10/1/1998	12/31/1998	91	$1,348	60	$0.31	65	$1.34	66	0.02%	68
Fourth amnesty	9/1/2001	10/30/2001	59	$169,044	10	$37.85	3	$156.78	2	2.41%	3
MAINE											
First amnesty	11/1/1990	12/31/1990	60	$35,544	34	$28.87	9	$135.50	4	0.31%	40
Second amnesty	9/1/2003	11/30/2003	90	$35,472	35	$27.09	11	$99.52	9	0.24%	46

MARYLAND											
First amnesty	9/1/1987	11/2/1987	62	$47,270	28	$10.35	30	$39.45	30	0.66%	27
Second amnesty	9/1/2001	10/31/2001	60	$38,282	33	$7.12	39	$20.50	42	0.36%	38
MASSACHUSETTS											
First amnesty	10/17/1983	1/17/1984	92	$127,854	13	$21.89	14	$94.19	12	1.48%	9
Second amnesty	10/1/2002	11/30/2002	60	$92,323	17	$14.40	23	$38.46	32	0.65%	28
Third amnesty	1/1/2003	2/28/2003	58	N/A							
MICHIGAN											
First amnesty	5/12/1986	6/30/1986	49	$154,106	11	$16.88	19	$77.08	17	1.18%	16
Second amnesty	5/15/2002	6/30/2002	46	$30,454	37	$3.03	51	$10.50	52	0.14%	55
MINNESOTA	8/1/1984	10/31/1984	91	$17,885	41	$4.30	44	$20.28	43	0.24%	47
MISSISSIPPI											
First amnesty	9/1/1986	11/30/1986	90	$1,404	58	$0.54	60	$3.78	59	0.05%	61
Second amnesty	9/1/2004	12/31/2004	121	N/A							
MISSOURI											
First amnesty	9/1/1983	10/31/1983	60	$1,380	59	$0.28	66	$1.54	65	0.03%	64
Second amnesty	8/1/2002	10/31/2002	91	$73,397	19	$12.92	25	$47.46	24	0.88%	21
Third amnesty	8/1/2003	10/31/2003	91	$18,868	40	$3.30	47	$12.05	49	0.23%	48
NEBRASKA	8/1/2004	10/31/2004	91	N/A							
NEVADA	2/1/2002	6/30/2002	149	$7,013	53	$3.23	48	$10.97	51	0.19%	51
NEW HAMPSHIRE											
First amnesty	12/1/1997	2/17/1998	78	$13,994	45	$11.80	28	$38.41	33	1.34%	12
Second amnesty	12/1/2001	2/15/2002	76	$12,969	47	$10.30	31	$31.06	38	0.71%	24
NEW JERSEY											
First amnesty	9/10/1987	12/8/1987	89	$254,796	8	$33.22	5	$120.76	7	1.96%	5
Second amnesty	3/15/1996	6/1/1996	78	$382,514	4	$47.76	1	$144.57	3	2.50%	2
Third amnesty	4/15/2002	6/10/2002	56	$266,016	6	$31.01	7	$81.96	15	1.51%	8
NEW MEXICO											
First amnesty	8/15/1985	11/13/1985	90	$19,508	39	$13.56	24	$78.27	16	0.94%	20
Second amnesty	8/16/1999	11/12/1999	88	$45,980	30	$26.43	12	$118.28	8	1.30%	13
NEW YORK											
First amnesty	11/1/1985	1/31/1986	91	$563,230	1	$31.58	6	$125.32	6	1.76%	7
Second amnesty	11/1/1996	1/31/1997	91	$265,581	7	$14.64	22	$45.49	25	0.73%	23
Third amnesty	11/18/2002	1/31/2003	74	$549,726	2	$28.61	10	$83.66	14	1.38%	11
NORTH CAROLINA	9/1/1989	12/1/1989	91	$47,863	27	$7.29	38	$34.72	35	0.51%	34
NORTH DAKOTA											
First amnesty	9/1/1983	11/30/1983	90	$307	68	$0.45	62	$2.59	62	0.03%	67
Second amnesty	10/1/2003	1/31/2004	122	$6,392	54	$10.08	32	$38.17	34	0.56%	31
OHIO	10/15/2001	1/15/2002	92	$46,594	29	$4.08	45	$14.61	47	0.22%	49
OKLAHOMA											
First amnesty	7/1/1984	12/31/1984	183	$20,545	38	$6.25	41	$33.23	36	0.52%	33
Second amnesty	8/15/2002	11/15/2002	92	N/A							
PENNSYLVANIA	10/13/1995	1/10/1996	89	N/A							
RHODE ISLAND											
First amnesty	10/15/1986	1/12/1987	89	$956	62	$0.97	57	$4.29	57	0.07%	59
Second amnesty	4/15/1996	6/28/1996	74	$8,417	52	$8.52	34	$32.10	37	0.51%	35

Table 1 (continued)

State Tax Amnesty Periods and Ranking of Amnesty Collections (1982-2004)

Name of State	*Amnesty Period* *Begin*	*End*	*Days*	*Amnesty Collection 2000 $* [a] *(000)*	*Rank*	*Amnesty Collection Per Capita*	*Rank*	*Amnesty Collection per 100,000 State Income*	Rank	*Percent of State General Revenue*	*Rank*
SOUTH CAROLINA											
First amnesty	9/1/1985	11/30/1985	90	$10,184	49	$3.08	50	$18.43	44	0.26%	45
Second amnesty	10/15/2002	12/2/2002	48	$63,598	22	$15.49	20	$63.32	20	1.09%	17
SOUTH DAKOTA	4/1/1999	5/15/1999	44	$511	65	$0.70	59	$2.72	61	0.06%	60
TEXAS											
First amnesty	2/1/1984	2/29/1984	28	$739	64	$0.05	68	$0.23	68	0.01%	70
Second amnesty	3/11/2004	3/31/2004	20	N/A				$0.00			
VERMONT	5/15/1990	6/25/1990	41	$1,226	61	$2.17	53	$9.90	53	0.15%	54
VIRGINIA											
First amnesty	2/1/1990	3/31/1990	58	$39,466	31	$6.35	40	$25.33	40	0.49%	36
Second amnesty	9/2/2003	11/3/2003	62	$92,737	16	$12.59	26	$39.55	29	0.76%	22
WEST VIRGINIA											
First amnesty	10/1/1986	12/31/1986	91	$14,689[b]	44	$7.80	36	$48.81	22	0.57%	30
Second amnesty	9/1/2004	10/31/2004	60	$13,465[b]	46	$7.42	37	$30.95	39	0.32%	39
WISCONSIN											
First amnesty	9/15/1985	11/22/1985	68	$39,160	32	$8.25	35	$41.55	28	0.54%	32
Second amnesty	6/15/1998	8/14/1998	60	$32,030	36	$6.13	42	$22.28	41	0.28%	44
AVERAGE			**80**	**$81,097**		**$20.36**		**$46.02**		**0.69%**	

Source: FTA (2005).

Notes: [a] Total and per capita tax amnesty collections in the table are reported in constant 2000 (dollars).

[b] These figures are based on correspondence with the West Virginia Tax Department.

This variable captures any permanent shift in the mean of the series that begins with the date the amnesty is offered. This potentially includes two effects, the first being the evaders who now come back into the tax system, permanently increasing revenue, and the second being an increase in tax evasion as other taxpayers see the offering of the amnesty as a sign of a low cost of switching to tax evasion. Note, however, that the true first period effect is the combined effect of both the short- and long-run coefficients.

EMPIRICAL ANALYSIS AND RESULTS

The above theoretical framework provides a basis for the following empirical specification:

$$\textbf{(5)} \quad y_{it} = \beta_0 + \beta_{1j}A_j + \beta_{2j}x_{jit} + \beta_{3j}z_{jit} + f_i + \phi_t + \varepsilon_t,$$

where y_{it} denotes tax revenue for state i in period t, A_j denotes short-run and long-run effects of amnesty, x_{jit} denotes explanatory variables of tax revenue such as personal income and tax rates. z_{jit} denotes other control variables such as population and unemployment rate. The unobservable state specific, time-invariant effects is represented by f_i and ϕ_t represents unobservable time specific effects. Finally, ε_t represents white noise (i.e., time-variant unsystematic effects and is i.i.d). Thus, I use state dummies and time dummies to control for these state-specific and time-specific effects.[2]

I use two measures of tax revenue: total tax revenue and per capita total tax revenue. When per capita total state tax revenue is the dependent variable, relevant explanatory variables are also used in per capita terms and population is dropped from the regression. All variables except dummies are entered in logarithmic form. I obtain a panel of quarterly tax data for all 50 states over the 1980-2004 periods. Descriptions of the variables, data sources, and summary statistics are presented in Table 2.

I start with simple OLS. Next, I proceed to run regression diagnostics to check for multi-collinearity and heteroskedasticity in the models. No such problems are detected. Because endogeneity is a major concern of a study like this, I devote the next section discussing this issue in detail. Because my technique involves many different dummy variables, I perform a sensitivity analysis by running specifications on important subsets of the data. In particular, I estimate the model on subsets of the data based on the number of amnesties offered by the state. I estimate the regression only among states with zero or one amnesty, then reestimate it expanding the sample to states with two amnesties, then again to states with three amnesties. Although not reported here, I run regressions from GLS and maximum likelihood estimation methods for comparison purposes. Finally, because my data set is panel data, I run random-effects and fixed-effects models. The Hausman test statistics (not reported here) allows me to use random-effects model but as there is no significant gain using the random-effects model, I use the fixed-effects model. The results from the fixed-effects model are reported in Table 3.

Comparing columns (1) vs (4), (2) vs (5) and (3) vs (6), it makes little difference whether I use total tax revenue or total tax revenue per capita as dependent variable—the coefficient estimates of amnesty variables are almost identical. This is true across all regression specifications (i.e., OLS, GLS, fixed-effects, random-effects, and maximum likelihood estimation models). Next, comparing the first three columns in Table 3, again the results are robust to whether I include or exclude states that have offered multiple amnesties. I tend to prefer what I consider the most appropriate "full" model, which appears in column (3) of Table 3. The estimates from that model are the ones I discuss briefly.[3]

The significant, positive short-run coefficient estimate for amnesty 1 can be interpreted to suggest that the average impact of offering the first amnesty in a state is between a 4 and 5 percent increase in real tax revenue during the period of the amnesty due to the increased collections of previous evaders. The significant, negative long-run coefficient estimate for amnesty 1 can be interpreted to suggest that the long-run impact of offering this first tax amnesty is significantly negative on revenue, resulting in about a 2 to 3 percent ongoing loss each period after the amnesty due to reduced compliance. As a matter of fact, the true first period impact of the amnesty would be the short-run inflow of short-run revenue and also the long-run revenue loss combined. After the first period, only the long-run impact remains. The second amnesty does not produce as much short-run revenue (in fact, the results are insignificantly different from zero), but does produce a significant and negative long-run

Table 2

Variable Description, Data Sources and Summary Statistics

(All data are quarterly, and at the state level)

Variable Name (source)	*Description*	*No. of Observations*	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*
Total Tax Revenue[1]	Total real tax revenue	4938	2.04e+09	2.58e+09	7.93e+07	2.84e+10
Total Tax Revenue Per Capita[1]	Total real tax revenue per capita	4938	396.644	170.849	84	3729
Amnesty[2]	Equals 1 during period of amnesty, 0 before or after					
Short-run Effect of Amnesty 1[2]	Equals 1 during period of first amnesty, 0 before or after	5000	0.0134	0.115	0	1
Short-run Effect of Amnesty 2[2]	Equals 1 during period of second amnesty, 0 before or after	5000	0.010	0.100	0	1
Short-run Effect of Amnesty 3[2]	Equals 1 during period of third amnesty, 0 before or after	5000	0.003	0.051	0	1
Long-run Effect of Amnesty 1[2]	Equals 1 during and after period of first amnesty, 0 before	5000	0.530	0.499	0	1
Long-run Effect of Amnesty 2[2]	Equals 1 during and after period of second amnesty, 0 before	5000	0.094	0.292	0	1
Long-run Effect of Amnesty 3[2]	Equals 1 during and after period of third amnesty, 0 before	5000	0.016	0.126	0	1
Average of the Personal Income Tax Rate[3]	Average personal income tax rate	4056	0.059	0.046	0.015	0.280
Average of the Corporate Income Tax Rate[3]	Average corporate income tax rate	4500	0.068	0.019	0.018	0.127
Average of the Sales Tax Rate[3]	Sales tax rate in the state	4500	0.048	0.011	0.02	0.08
Personal Income[4]	Real personal income of residents	5000	1.27e+11	1.55e+11	8.06e+09	1.18e+12
Personal Income Per Capita[4]	Real personal income per capita of residents	5000	23522.85	5046.307	12620	42527
Population[5]	State population	5000	5125928	5571192	401851	3.59e+07
Unemployment rate[6]	State unemployment rate	5000	0.059	0.020	0.021	0.181

[1]U.S. Census Bureau (various years).

[2]FTA (2005).

[3]Commerce Clearing House, Inc. (1980-2003).

[4]U.S. Department of Commerce.

[5]U.S. Census Bureau.

[6]U.S. Department of Labor.

Table 3

Fixed Effects Regression Results

	Dependent Variables					
	Log of Total Tax Revenue			*Log of Per Capita Total Tax Revenue*		
Variables	*States with one amnesty (1)*	*States with one and two amnesties (2)*	*States with one, two, and three amnesties (3)*	*States with one amnesty (4)*	*States with one and two amnesties (5)*	*States with one, two, and three amnesties (6)*
Short-run effect of Amnesty1	0.064* (2.17)	0.059** (3.36)	0.048** (3.05)	0.064* (2.18)	0.059** (3.34)	0.047** (3.03)
Short-run effect of Amnesty2		-0.009 (0.37)	0.016 (0.88)		-0.009 (0.38)	0.017 (0.95)
Short-run effect of Amnesty3			0.025 (0.58)			0.020 (0.51)
Long-run effect of Amnesty1	-0.041** (3.17)	-0.035** (4.12)	-0.029** (3.73)	-0.039** (3.04)	-0.036** (4.26)	-0.030** (3.76)
Long-run effect of Amnesty2		-0.024* (2.03)	-0.047** (5.03)		-0.026* (2.19)	-0.049** (5.24)
Long-run effect of Amnesty3			-0.008 (0.47)			-0.011 (0.66)
Log of Personal Income	0.812** (7.15)	0.980** (13.97)	1.011** (16.54)			
Log of Per Capita Personal Income				0.778** (7.20)	1.004** (14.54)	1.022** (16.74)
Log of Population	0.117 (0.77)	0.114 (1.25)	0.020 (0.28)			
Log of Personal Income Tax Rate	0.009 (0.62)	-.020 (1.72)	-0.002 (0.18)	0.007 (0.49)	-0.020 (1.68)	-0.001 (0.09)
Log of Corporate Income Tax Rate	0.131** (2.82)	0.021 (0.85)	0.039 (1.80)	0.139** (3.06)	0.009 (0.39)	0.040 (1.83)
Log of Sales Tax Rate	0.201** (5.00)	0.162** (7.30)	0.161** (7.75)	0.197** (4.93)	0.157** (7.13)	0.159** (7.70)
Log of unemployment rate	-0.030 (1.32)	-0.066** (4.59)	-0.068** (5.55)	-0.036 (1.66)	-0.058** (4.21)	-0.066** (5.45)
Constant	-0.201 (0.15)	-4.973** (5.60)	-4.278** (5.27)	-0.920 (0.82)	-3.830** (5.62)	-3.903** (6.49)
R^2	0.966	0.967	0.969	0.615	0.551	0.588
No of Observations	1294	3073	3666	1294	3073	3666

Notes: Figures in parenthesis are absolute t-statistics, **indicates 1 percent significance level, *indicates 5 percent significance level.

effect that is greater than the negative long-run effect for the first amnesty. Finally, when a state offers a third amnesty, again there is no significant short-run revenue produced. Though negative, the estimates for the long-run impact of the third amnesty appear insignificant. This may be due to the small number of states for which third amnesty data is available and in the regression.

Based on these results, it can be concluded that on average, first-time tax amnesties do tend to produce a significant 4 to 5 percent increase in revenue during the period the amnesty is being offered. They, however, also tend to discourage compliance to the magnitude of 3 percent per period, from then on. Repeated broad-based amnesties fail to produce even additional short-run revenue, while creating significant long-run revenue losses due to reduced compliance that grow as additional amnesties are offered. These results sharply contrast with Alm and Beck's (1993, p. 58) findings that "a typical amnesty seems unlikely to generate large one-time revenues, but it also seems unlikely to have negative effects on long run compliance."

ENDOGENEITY ISSUE

Although the objective of this paper is to examine whether amnesties raise revenues for the states, it is natural to argue at this stage that tax system changes are endogenous, and so is the choice to have an amnesty by states. In the presence of endogeneity, the regressors, specifically the amnesty variables, will be contemporaneously correlated with the error term. In other words, the covariance between A_{it} and ε_{it} will not be zero, that is, $Cov(A_{it}, \varepsilon_t) \neq 0$. If this is the case, then, the coefficient estimates so obtained will be biased because these estimates do not accurately reflect variations in total tax revenue arising solely from amnesties. Therefore, I now turn to testing for endogeneity of having an amnesty by states. Here my objective is to show econometrically that the relationship between taxes and amnesties is weakly exogenous. For this I perform several specifications of the Hausman test—the widely used econometric tool of testing for exogeneity of variables. However, before I explain the test procedure that I followed, it is important to note two practical difficulties that I encountered to conduct this test.

First, a Hausman test involves running regressions using an OLS model and an IV model and comparing the full vector of coefficient estimates. Because amnesty is a dichotomous variable, as defined in the third section, I cannot run an OLS regression with amnesty as a dependent variable since the error term for the dependent dichotomous variable in OLS is no longer normally distributed; rather, it follows a Bernoulli distribution that results in violation of the homoskedastic assumption.[4] Second, finding a valid instrument is challenging. Although this is a general problem of all studies involving a Hausman test, it is a special challenge for this particular study—I use six amnesty-related variables and finding six valid instruments is not pragmatic because all the variables that explain total tax revenue can also be argued to explain amnesty. Note that in the first part of the analysis, apart from six amnesty variables, I use only six other variables to explain total tax revenue. As such, a Hausman test involving instrumental variable technique is not appropriate. Thus, I follow the second variant of the test, which is computationally appealing.[5]

The second variant of the Hausman test—the variable addition approach or also known as omitted variables (OV)—is carried out in two stages. In the first stage, I obtain the estimated OLS residuals from equation (5). In the second stage, I estimate the following equation:

$$\textbf{(6)} \quad \text{Prob}(Amnesty = 1) = \delta_0 + \delta_{1j} x_{jit} + \delta_2 v_{it} + \varepsilon_t,$$

where x_{jit} denotes j explanatory variables of amnesty for state i in period t. Here, the explanatory variables of amnesty include total tax, personal income, tax rates, population, and unemployment rate.[6] The estimated OLS residual from equation (5) is V_{it} and, finally, ε_t is the error term. The idea is to test $\delta_2 = 0$, with an F test. $Cov(A_{it}, \varepsilon_t) \neq 0$ implies that δ_2 must be able to explain amnesty adoption by states. On the other hand, $\delta_2 = 0$ violates the condition of $Cov(A_{it}, \varepsilon_t) \neq 0$ by contradiction. Therefore, I can rule out the possibility of an endogeneity problem, if this coefficient, δ_2, turns out to be insignificant from zero. I conduct this test for all amnesties combined, and for the first amnesty, second amnesty, and third amnesty separately. The results are discussed below:

For the full model, I estimate equation (6) using logit, probit, and maximum likelihood estimation methods. The results are reported in Table 4. The results are qualitatively similar whether I use the log of total tax revenue or log of per capita total tax revenue. The coefficients of the residual terms

Table 4
Hausman Test Results
(Amnesty as Dependent Variable)

Variables	*Logit Model (1)*	*Probit Model (2)*	*Maximum Likelihood (3)*	*Logit Model (4)*	*Probit Model (5)*	*Maximum Likelihood (6)*
Log of total tax revenue	-0.689	-0.308	-0.022			
	(1.04)	(1.04)	(1.18)			
Log of Per Capita Total Tax Revenue				-0.511	-0.222	-0.014
				(0.75)	(0.75)	(0.77)
Log of personal income	3.812**	1.654**	0.112**			
	(4.34)	(4.25)	(4.38)			
Log of Per Capita Personal Income				2.678**	1.170**	0.076**
				(3.54)	(3.54)	(3.64)
Log of Personal Income Tax Rate	-0.234	-0.077	-0.006	0.106	0.057	0.003
	(0.88)	(0.68)	(0.82)	(0.48)	(0.60)	(0.58)
Log of Corporate Income Tax Rate	0.147	0.069	0.003	0.006	0.004	-0.001
	(0.40)	(0.45)	(0.36)	(0.02)	(0.03)	(0.07)
Log of Sales Tax Rate	-0.566	-0.239	-0.016	-0.456	-0.191	-0.013
	(1.11)	(1.10)	(1.17)	(0.90)	(0.89)	(0.91)
Log of population	-3.522**	-1.511**	-.101**			
	(4.22)	(4.14)	(4.31)			
Log of unemployment rate	1.838**	0.799**	0.050**	1.357**	0.603**	0.037**
	(4.28)	(4.31)	(4.46)	(3.65)	(3.71)	(3.76)
OLS Residual for total tax	0.657	0.280	0.022			
	(0.56)	(0.55)	(0.69)			
OLS Residual for per capita total tax				0.500	0.222	0.013
				(0.42)	(0.44)	(0.45)
Constant	-28.511**	-12.696**	-0.710**	-24.638	-11.036**	-0.582**
	(4.64)	(4.65)	(3.94)	(4.07)	(4.17)	(3.37)
LR χ^2 value	χ^2 (8) = 26.16	χ^2 (8) = 26.43	χ^2 (8) = 27.28	χ^2 (7) = 20.62	χ^2 (7) = 21.13	χ^2 (7) = 21.40
Probability	0.001	0.0009	0.0006	0.004	0.004	0.003
Log likelihood	-449.280	-449.146	1446.673	-452.050	-451.798	1443.733
No of observations	3666	3666	3666	3666	3666	3666

Notes: Figures in parenthesis are absolute z-statistics, **indicates 1 percent significance level, *indicates 5 percent significance level.

in all cases are positive but not significantly different from zero.[7]

The Hausman test is sensitive to several types of misspecification. Therefore, it is yet to be seen if these results are robust. Because some states have offered amnesties repeatedly, I estimate the model including the OLS residuals on subsets of data based on the number of amnesties by the states—an exercise similar to the one that I did in the previous section. More specifically, I estimate the regression including the residuals only among states with zero or one amnesty, then reestimate it expanding the sample to states with two amnesties, and then again to states with three amnesties. The coefficients of the residual terms in all cases remain positive but not significant from zero. For the final robustness check of the results, I continue the exercise for the first amnesty, second amnesty and third amnesty separately. The coefficients of the residual terms remain always insignificant from zero. These results clearly indicate that the suspicion that regressors are contemporaneously correlated with the error term in equation (5) is not supported.

Despite a legitimate concern, several specifications of the Hausman test carried out here do not lend support to an endogeneity problem in the data. I believe the following two reasons may have partially contributed to such results: First, my data is a panel of quarterly tax data (**NOT** aggregated yearly data) from all U.S. states. One of the main attributes of panel data is that it is better able to deal with omitted variables of the states being analyzed. Second, I assumed that states were responding to the recession by enacting amnesties when their total taxes were failing. This assumption stems from the fact that the frequency of state tax amnesty rose during and after the most recent recession (21 amnesties were offered in 2002 and 2003 combined). However, for the amnesties in the 1980s and 1990s, Dubin, Graetz, and Wilde (1992) and Borgne (2006) find that states with high tax levels were more likely to enact an amnesty. Therefore, it is possible that approximately half of the amnesties were run when the tax level was high and the other half were run when the tax level was low. Consequently, the positive effect of a high tax level was offset by the negative effect of a low tax level, which may cause the Hausman test statistics to be insignificant. Note that if the assumptions of OLS are not violated, then the parameter estimates obtained from the OLS (in my case fixed effects model) are BLUE.

SUMMARY AND CONCLUSION

In this paper I analyze the revenue effects of tax amnesties that many U.S. states offered during 1982-2004. I find that overall, when a state offers an amnesty for the first time, it produces revenue during the amnesty period but then harms revenue in the long run. Repeated broad-based amnesties fail to produce even additional short-run revenue, while creating significant long-run revenue losses due to reduced compliance that grows as additional amnesties are offered. Even the first offering, which brings revenues in the short run, is not clearly a revenue enhancement once the long-run compliance effects are considered.

Because tax amnesties have become increasingly popular in recent years, it is important to revisit why states run amnesties. Past research that investigated amnesties in the 1980s and 1990s found that states with high tax levels were more likely to initiate a tax amnesty (Dubin, Graetz, and Wilde, 1992; and Borgne, 2006). However, it is possible that over the years this cause may have gradually dissipated because the frequency of tax amnesty rose during and after the most recent recession; and, in many of these cases, the amnesty was repeated for a second, third or even fourth time. Therefore, future research should be directed toward the event history analysis of amnesty adoption by states, especially the repetition of amnesty, which will provide better insight into the understanding of state government finances.

Notes

1 For example, Florida (1997, 1988, 2003), Nevada (2002), New Hampshire (1997, 2001), South Dakota (1999), Texas (1984, 2004).

2 Because my data set is quarterly, as a matter of fact, I include quarter dummies (quarter 1, quarter 2, quarter 3, quarter 4, quarter 5, quarter 6, …, quarter N=100).

3 For detailed discussion of the results, please see Luitel and Sobel (2007) pp. 25-37.

4 See Gujarati (2003, pp. 582-585).

5 I follow this test procedure as described in Kennedy (2003, pp. 172-173).

6 I limit the exercise to use only those variables that I use in the first part of the analysis.

7 Here my objective is to show no endogeneity problem in my data set. Therefore, I omit interpretation of the coefficients of other variables.

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