The Effect of Personal Property Tax Repeal on Pennsylvania’s Real Estate Tax Growth and Stability

Abstract - A key question in tax repeal decisions facing state and local governments concerns how potential revenue loss will affect other taxes. Repeal of the personal property tax has been optional for Pennsylvania counties since 1978. This paper investigates the growth and stability of the real estate tax during this era in 66 counties. Its main contribution is that it provides a natural experiment for testing whether the loss of a significant revenue component affected the adequacy of another tax. The estimation results suggest that tax repeal resulted in higher growth and greater variability of real estate taxes. Further, most counties had significant real estate tax growth over the long-run. However, few were cyclically responsive to short-run changes in income.

INTRODUCTION

Repeal of unpopular state and local taxes recently has been proposed or enacted in several states. On the one hand, repeal is politically desirable especially when large budget surpluses make taxpayer relief feasible. On the other hand, a tight budget often requires unfavorable choices. One possibility is to replace the lost revenue with other local revenue sources. Another possibility is to reduce the level of local services. Further, repeal may cause concern about the government’s credit rating if its projected revenues are insufficient to cover projected expenditures. Specific taxes that have faced repeal in several states include various types of automobile taxes and beverage and snack food taxes. Arizona has considered eliminating the corporate and personal income tax (2000) and Arkansas proposed a constitutional amendment to repeal the property tax (1998). The repeal of

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1 In the last few years, several states have proposed or enacted legislation to repeal automobile taxes. In 2001, the scheduled elimination of a local personal property tax on automobiles generated considerable controversy in the Virginia legislature because of a tight budget caused by the slumping economy. Texas and Washington proposed to eliminate a local tax on leased vehicles and an excise tax on vehicles, respectively. Indiana repealed a personal property tax on automobiles and replaced it with an excise tax several years ago. Jacobson and Brownell (2000, Table 2, p. 856) report various tax repeal initiatives for soft drink and snack food taxes in several states. Most of these initiatives occurred between 1995 and 2000.
the intangible personal property tax also has been debated in Florida. Even the repeal of the federal estate tax could mean significant revenue loss in many states because they will lose the credit allowed for the federal estate tax against state estate taxes.

In most cases where tax repeal is being considered, the main concern has been with how the loss of revenue will impact the adequacy of other tax revenues. The local government budget process often proceeds on the assumption that projected expenditures are determined before revenues. This is consistent with the analytical framework provided by several studies of tax composition. Conceptually, vote-maximizing politicians are assumed to be responsive to utility-maximizing voters who are well informed in communicating their preferences. In this process, the property tax often has the role of balancing the residual between expenditures and all other revenues (Netzer, 1966, pp. 170–1). Therefore, one would expect that the repeal of a tax would place a greater burden on the real estate tax.

The Pennsylvania intangible personal property tax offers a unique opportunity to test how the repeal of one tax affects the growth and stability of another tax and its tax base. It is expected that repeal would change the pattern of real estate tax growth because all Pennsylvania counties are highly dependent upon it. Repeal of the personal property tax was optional for much of the period of this study. Thus, some counties levied the tax while others repealed it. Tax repeal in most states usually is not optional and consequently does not allow for analyzing these different treatment effects. This type of natural experiment assumes that repealing and retaining counties would grow at the same rate if it were not for tax repeal. Thus, one hypothesis is that repeal results in higher growth of the real estate tax because these counties inevitably become more dependent upon it. Another possibility is repealing counties might respond to the loss of revenue by cutting expenditures. In that event, real estate tax growth may not be different between repealing and retaining counties. One complication is that factors influencing real estate tax base growth may not have been the same in repealing and retaining counties. This is the well-known problem of sample selectivity bias often encountered when dealing with subsamples. For instance, counties may have repealed the tax because they expected higher growth of taxable real property in the future. Unobservable characteristics influencing the repeal decision may have been related to variables causing higher real estate tax base growth. Consequently, estimating tax base growth when selectivity bias is significant could lead to incorrect inferences about the differential growth rate caused by repeal.

The Pennsylvania personal property tax had a separate tax structure from the real estate tax and mainly was levied by county governments. A law was enacted in 1913 that required the tax be levied in all Pennsylvania counties at the statutory rate of four mills. The law was changed in 1978 giving Pennsylvania counties the option to repeal the tax. Twenty-seven counties repealed the tax between 1978 and 1992. Tax liability was based on the value of intangible assets owned by county residents. The tax applied to mortgages, other interest-bearing obligations and shares of stock. Tangible personal property was not taxed. Certain types of intangible property also were exempt. The most controversial exemption has been

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2 See Blackley and DeBoer (1987) and Sjoquist (1981) for examples of this approach. An alternative hypothesis is the revenue maximizing politician where revenues may drive expenditures. See Niskanen (1971) for a review of this approach.

3 For a good discussion of a tax–based natural experiment, see Goolsbee (1999), especially pp. 7–10.

4 For a good, comprehensive survey of sample selectivity bias, see Vella (1998).
the stock of businesses incorporated or authorized to do business in Pennsylvania. If a corporation was subject to the Pennsylvania capital stock or franchise tax, its shares, bonds, and other intangible properties were exempt from the personal property tax. This exemption led to several constitutional challenges questioning the legality of the exemption.

In 1994, the U.S. Supreme Court ruled that a similar tax in North Carolina was unconstitutional. Several pending lawsuits also threatened its legality in Pennsylvania. If the tax was declared unconstitutional, county governments could have been responsible for refunding up to two years of previously paid personal property taxes. Consequently, all counties repealed or stopped levying the tax by the end of 1998. In June 2000, the state Supreme Court held that while the tax itself is constitutional, the exemption is not. Thus, it is possible that some counties may reinstate the tax in the future if that decision stands.

This study focuses on whether counties that repealed the personal property tax experienced a different pattern of real estate tax growth and stability from counties that retained it. Growth and stability are concerns in government finance because they measure adequacy, one of several criteria used to evaluate the desirability of a tax. Groves and Kahn (1952) defined revenue adequacy in terms of the ability to generate steady and growing receipts to meet the demand for public services over time. Groves and Kahn’s study stimulated many empirical studies of adequacy. Growth generally was estimated by a tax’s income elasticity or its trend rate of growth. Stability also was measured by a tax’s income elasticity coefficient or the average deviation around the trend rate of growth. In this context, these estimates are measures of long–run growth and stability. Short–run growth and stability, on the other hand, are measured by the responsiveness of a tax to short–run changes in income.

The current study uses the methodology of previous revenue adequacy studies to test whether repealing counties had higher rates of real estate tax growth. Various measures of growth and stability are estimated for each of Pennsylvania’s 66 counties over the 1970–1992 period. This was a good period to test whether revenue

5 In 1997, 22 counties dropped the personal property tax leaving only Clarion County and the City of Philadelphia levying the tax. These two jurisdictions dropped the personal property tax in 1998. See Taxation Manual, Commonwealth of Pennsylvania, Department of Community and Economic Development (1999, p. 35) for further details.

6 The constitutionality of the personal property tax was challenged by billionaire Walter Annenberg of Montgomery County. Although the state Supreme Court rejected the Annenberg challenge that the tax was unconstitutional, it directed counties to give meaningful retroactive relief that would leave taxpayers in the same position that would have existed if the unconstitutional exemption did not exist. This relief could be provided in the form of refunds, retroactive tax collection or a combination of the two. See Dean and Gendron (2000, pp. 5 and 52), for further details.

7 Few studies have examined the effect of the personal property tax on other taxes. Mikesell (1992) offers cross–sectional evidence that suggests a smaller personal property tax share increases real estate tax receipts per dollar of personal income. However, Mikesell uses aggregate state data and mostly was concerned with tangible personal property.


9 Groves and Kahn (1952) used income elasticities to measure both growth and stability. Accordingly, high income elasticity implies more variability and less stability of revenue. However, Williams et al. (1973) argued that stability should be measured by deviation from a time growth path rather than by the size of the income elasticity coefficient. Income elasticity gives a less precise measure of stability because fluctuation in revenue does not result from income change alone. Sobel and Holcombe (1996) also offer evidence that casts doubt on the assumed tradeoff between growth and stability. In several cases, they found the slowest growing tax bases showed the greatest cyclical instability.
adequacy differed. The decision to levy the tax was not subject to the constitutional challenges it faced after 1992.

In the next section, a statistical analysis of Pennsylvania county government revenue structures is offered. This includes testing for evidence of sample selectivity bias. It is followed by a discussion of the statistical techniques used to estimate the real estate adequacy of repealing and retaining counties. Next, data sources for the time series analysis are discussed. Empirical results then are presented and analyzed. Finally, the findings are summarized and inferences are given.

ANALYSIS OF REVENUE STRUCTURE AND COMPOSITION

Growth and Composition over the 1970–1992 Period

Pennsylvania counties received little tax revenue from sources other than the real estate tax and the personal property tax. In 1992, real estate taxes comprised 80 percent or more of total own source revenue in all 66 Pennsylvania counties. Until recently, the personal property tax was the only other significant tax source. Aggregate personal property tax receipts for the 66 Pennsylvania counties were about $18 million in 1970 and $68.1 million in 1992 while aggregate real estate tax receipts were $217.6 million in 1970 and $1,192.6 million in 1992. In 1970, the personal property tax was levied in all 66 counties and ranged from 0.9 percent to 28.4 percent of total tax revenue and from 0.8 percent to 20.9 percent of own source revenues. In 1992, the maximum personal property tax share was 19.4 percent of total tax revenue and 15.1 percent of own source revenue. Other Pennsylvania county tax revenues include a per capita tax in 35 counties and an occupation tax in two counties. However, Pennsylvania counties also receive a significant amount of own source revenue from various nontax components including departmental revenues, investment income, licenses, fines, and miscellaneous revenue.

Repealing counties might experience different growth rates because the structure of their real estate taxes may be different. We compiled annual median values for the following three real estate variables: market value per capita (MVC), adjusted real estate mill rate (r) and the real estate tax’s percentage share of own source revenue (RES). Market value per capita is expressed in constant dollars based on the Consumer Price Index for urban consumers. These statistics are broken down into two separate samples based on whether a county had repealed the personal property tax by 1992. Table 1 gives levels of median values in selected years (first three rows) and cumulative percentage changes during certain periods (last three rows). It shows that the median repealing county had a higher market value, a lower real estate mill rate and a higher real estate tax share in most of these years. Both repealing and retaining counties had increased market values, declining tax rates and reduced real estate tax shares between 1970 and 1992. However, the median repealing county had a larger percentage increase in its market value and a larger percentage decrease in its mill rate. The median retaining county also had a larger decrease in its real estate tax share although both types of counties had almost the same percentage decline in real estate tax shares between 1970 and 1978. Real estate tax share increased in the median repealing

10 Allegheny, Bucks, Delaware, and Montgomery counties also were authorized to levy a tax on hotel room rentals. However, Allegheny County only showed receipts from this tax in 1992. See Pennsylvania Department of Community and Economic Development, Taxation Manual, Sixth Edition (1993, pp. 19 and 48).

11 The adjusted mill rate (r) is the dollar amount of the tax per thousand dollars of market value.
county over the 1978–1992 period while it declined slightly in the median retaining county.12

A regression model is used to test whether counties that repealed the personal property tax were more dependent on the real estate tax. A county’s real estate tax percentage share (RES) was assumed to depend upon a dummy repeal variable and several other variables that represent fiscal, economic, and taste differences. Ordinary least squares were used to estimate the effect of these variables using 1992 data. Explanatory variables include market value per capita (MVC), the adjusted mill rate (r), the average annual growth rate of own source revenue (OSG) and the standard error of the growth rate of own source revenue (OSRES), the percentage of the population under the age of 18 (U18), and the county unemployment rate (UNEMP).13 PERS is a dummy variable that equals one if the county levied the personal property tax in 1992 and zero if it did not. The effect of levying the personal property tax (PERS) on real estate tax share (RES) is the primary interest of this empirical estimation. It is expected that it will reduce dependence on the real estate tax. A county will be less dependent on real estate taxes if alternate revenue sources are available. The other variables are hypothesized to have positive coefficients except OSG.

Regression results with t–statistics in parentheses were as follows:

\[
RES = 2.98 - 4.67 \text{PERS} + 0.67 \times 10^{-3} \text{MVC} \\
\text{r} = \begin{cases} 
(1.71) \\
(5.86) 
\end{cases} \\
+ 2.30 \text{r} - 418.6 \text{OSG} - 36.41 \text{OSRES} \\
\text{r} = \begin{cases} 
(2.18) \\
(-4.66) 
\end{cases} \\
+ 1.30 \text{U18} + 1.83 \text{UNEMP} \\
\text{r} = \begin{cases} 
(1.64) \\
(2.42) 
\end{cases} \\
\text{R}^2 = .464
\]

The results show that counties levying the tax had a lower tax share than those that repealed it. They predict retaining

12 The real estate tax’s share of own source was largely replaced by departmental revenue and miscellaneous revenue. See Stine (1998, p. 356) for a detailed statistical analysis that shows these compositional changes between 1970 and 1992.

13 Other explanatory variables were attempted, but none were statistically significant at standard levels. These included poverty rate, percentage of population more than 65 years of age, income per capita, expenditures per capita, and population size. They were dropped because their inclusion did not substantially affect the estimates for the tax repeal variables and several were correlated with the included variables.
counties had a real estate tax share that was lower by 4.7 percentage points in 1992. All the other variables except the stability variable (OSRES) were statistically significant at the 5 percent level. All had the expected signs except OSRES. Another version of the same equation was estimated in which the number of years since the personal property tax was repealed (YEARS) was used in place of the personal property tax variable (PERS). It was found that the real estate tax share increased about 0.5 percentage points for each year the tax was repealed. This shows that the length of time the tax was repealed also made a difference in explaining real estate tax dependence.

A question related to the tax rate changes given in Table 1 is whether repealing counties increased their real estate tax mill rates before the year of repeal. These counties might have chosen to increase tax rates because they anticipated losing revenue. However, few repealing counties raised their tax rate in the year before or during repeal. On the one hand, the mill rate was increased by only five of the 27 repealing counties in the year before repeal and by only seven counties in the year of repeal. On the other hand, 12 counties increased their mill rate in the year after repeal. This suggests that tax rate adjustment to repeal had a stronger lag effect than lead effect. An attempt is made later to estimate the separate temporary and permanent effects of repeal on revenue and tax base growth.

**Testing for Sample Selection Bias**

The summary statistics in Table 1 suggest that the level and growth of per capita market values were higher in repealing counties. This would lead one to expect higher trend rates of growth and higher income elasticities in a time series analysis of revenue adequacy. However, the decision to repeal the personal property tax may have been influenced by unobservable variables correlated with higher market value growth. These unobservable variables, if significant, would increase the probability of repeal. In that event, estimation of market value growth would be overstated because of sample selection bias. For instance, higher growth of the tax base may have been due to greater expansion of local economic development or higher population growth. If these variables also were higher in repealing counties, they are likely to make them more optimistic about the ability of the real estate tax to finance local expenditures without personal property tax revenue. It is the separate influence of unobservable characteristics like the level of optimism that may lead to sample selection bias. Consequently, one might falsely conclude that higher market value growth was due to repeal when it was not.

To test for sample selectivity bias, we follow the two–step approach used by Man and Rosentraub (1998) to estimate the effect that adoption of tax increment financing programs had on property value growth. In the current study, this involves estimating two separate equations for 66 Pennsylvania counties. The first equation estimates the determinants of repeal using maximum likelihood probit and the second equation estimates market value growth using ordinary least squares. The inverse Mills ratio is estimated in the probit equation and included as a regressor in the market value growth equation. It can be interpreted as the error from the probit equation explaining selection (Vella, 1998, p. 134). The t–test for the inverse Mills ratio in the growth equation represents a test of sample se-

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14 PERS and YEARS are not included in the same regression equation because they were highly correlated. Their correlation coefficient was –0.83. The estimates for the other explanatory variables are similar to those given above. Therefore, the results are not reported.
lectivity bias. If the inverse Mills ratio is statistically significant, this suggests that selectivity bias contributed to market value growth. The growth of the real estate tax base is based on its increase in value between 1970 and 1992. This compares a year before (1970) with a year after (1992) personal property tax repeal became optional. This two-stage approach is based on the conceptual analysis of Heckman and Hotz (1989) who suggested that, in the presence of possible sample selection bias, first-difference estimators comparing preprogram and postprogram differences yield consistent estimates of program effects (Man and Rosentraub, 1998, p. 530). The sample selection equation regresses the first difference of the natural logarithms of the market values between 1970 and 1992 against the inverse Mills ratio and a vector of first differenced explanatory variables affecting growth. The explanatory growth variables include income, population, adjusted real estate mill rate, and the assessed value of the personal property tax base. The estimated coefficients from the growth equation are the respective elasticities. The growth equation also includes the same dichotomous repeal variable (REPEAL) used in the probit equation. Its estimated coefficient tests whether personal property tax repeal influenced cumulative growth after controlling for sample selectivity bias and other economic and fiscal variables. We reject the hypothesis that repeal had no influence if its estimated coefficient is statistically significant. The two-stage estimation procedure involves heteroscedastic errors so that the usual t-tests are biased. (Pindyck and Rubinfeld, 1998, p. 327). Consequently, ordinary least squares estimation of the growth equation is corrected to yield heteroscedastic-consistent standard errors. All variables expressed in dollars were adjusted by the CPI for inflation. All the explanatory variables except the real estate mill rate are expected to have a positive influence on market value growth.

The ordinary least squares results for the sample selectivity growth equation are given in Table 2. The results from the sample selectivity growth equation show that both REPEAL and the inverse Mills ratio were not statistically significant. Thus, the evidence does not suggest that self-selection bias influenced market value growth between 1970 and 1992. Rather, market value growth over this period was positively influenced by the growth in income, population and assessed value of personal property while it was negatively influenced by the property tax rate. These results are consistent with theoretical predictions.

STATISTICAL METHODOLOGY

Time series regressions are used to compare the growth and stability of the real estate tax and market value in repealing and retaining counties. Long-run growth rates are estimated by the trend rates of

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15 The assessed value of personal property is a proxy for intangible wealth. For the 27 counties that repealed the personal property tax, assessed value was not available in 1992 and had to be projected. The 1992 assessed value was calculated by weighting the assessed value in the year of repeal by a ratio based on the Standard & Poor's common stock price index. This ratio was the Standard & Poor's price in 1992 over its price in the year of repeal.

16 The probit estimates are not reported here. The probit equation for predicting the probability of repeal regresses a dichotomous dependent variable (REPEAL) against several explanatory variables. The observed value of REPEAL is one if the tax was repealed by 1992 and zero if it was not repealed. The explanatory variables include the following: market value per capita, tax price of repeal, index of revenue diversification, industrial and commercial share of the assessed real estate value, percentage of total revenue received from federal and state aid and other measures of economic and taste differences. While most of these variables were found to be statistically significant at the 5 percent level, market value per capita was not significant at any accepted level (t-statistic = 0.58).
growth and income elasticities over time. Growth trend analysis attempts to explain the movement in a series rather than the factors underlying its change. However, the estimating equations also include a variable for the adjusted real estate mill rate. The mill rate is included because local public officials have the discretion to change it annually. This is unlike other taxes that require legislative initiative in order to change their tax rates. Long-run income elasticity estimates the average annual response of the real estate tax or its tax base to local income growth over the business cycle. If the income coefficient is greater than one, it suggests that the tax or its tax base grew faster than income over the business cycle. If it is less than one, it suggests real estate variables grew more slowly than income. Each estimate provides different information about long-run adequacy. A county’s revenue or tax base may show a different pattern of growth with respect to time than it does to income. For instance, one county’s real estate tax may have had a higher trend rate of growth than another county. However, this does not necessarily imply that the high growth county is more responsive to income than the low growth county. The low trend growth may be explained by low income growth even though taxes were highly responsive to income.

Estimating long-run trend growth and income elasticity of the real estate tax or market value require four separate equations in each county. The specific estimating equations used in each county are as follows:

\[\ln T_t = \ln a_0 + a_1 \ln r_t + a_2 t\]
\[\ln T_t = \ln b_0 + b_1 \ln r_t + b_2 \ln Y_t\]
\[\ln MV_t = \ln a_0 + a_1 \ln r_t + a_2 t\]
\[\ln MV_t = \ln b_0 + b_1 \ln r_t + b_2 \ln Y_t\]

where \(T_t\) is the dollar amount of the real estate tax, \(MV_t\) is the market value of taxable real estate, \(r_t\) is the adjusted real es-

### TABLE 2
REGRESSION RESULTS–SAMPLE SELECTIVITY EQUATION GROWTH OF PER CAPITA MARKET VALUE BETWEEN 1970 AND 1992

<table>
<thead>
<tr>
<th>Dependent Variable: DMVC</th>
<th>Coefficient</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.169</td>
<td>1.95</td>
</tr>
<tr>
<td>REPEAL</td>
<td>0.008</td>
<td>0.09</td>
</tr>
<tr>
<td>Dr</td>
<td>-0.420</td>
<td>-7.08*</td>
</tr>
<tr>
<td>DYC</td>
<td>0.965</td>
<td>4.96*</td>
</tr>
<tr>
<td>DPOP</td>
<td>0.663</td>
<td>4.77*</td>
</tr>
<tr>
<td>DAVP</td>
<td>0.078</td>
<td>3.54*</td>
</tr>
<tr>
<td>RMILL</td>
<td>0.022</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Adjusted \(R^2 = 0.571\)

* Statistically significant at the 1 percent level.

**Variable Definitions:**

DMVC = The difference between the natural logarithm of per capita market value in 1992 and 1970.

REPEAL = 1 if the personal property tax was repealed in 1992; 0 otherwise.

Dr = The difference between the natural logarithm of the adjusted real estate mill rate in 1992 and 1970.

DYC = The difference between the natural logarithm of per capita income in 1992 and 1970;

DPOP = The difference between the natural logarithm of population in 1990 and 1970.

DAVP = The difference between the natural logarithm of the per capita assessed value of personal property in 1992 and 1970.

RMILL = The fitted value of the inverse Mills ratio from the first-stage Probit equation estimating the probability of repeal in 1992.
tate mill rate, \( t \) is an annual time variable \((t = 1, 2, 3, \ldots, 23)\) and \( Y \) is aggregate personal income. The trend rates of growth of the real estate tax and market value are based on the coefficient \( a_2 \) in [1] and [3]. Income elasticities for these variables are estimated by the coefficient \( b_2 \) in [2] and [4]. The coefficients \( a_1 \) and \( b_1 \) give the estimated tax rate elasticities. Tax rate elasticity is expected to be positive for the real estate tax and negative for market value. An increase in the real estate tax rate is likely to increase real estate tax receipts. On the other hand, a reduction in the real estate tax rate is expected to increase the capitalized value of the local real estate tax base.

The standard errors of the estimate from [1] and [3] are measures of tax stability over the long–run. They show the amount by which actual growth deviates from predicted growth. If \( s \) is high, it implies large fluctuations while a low \( s \) implies steady, predictable growth around the variable's growth path. Holcombe and Sobel (1997, p. 88) argue that this measure does not capture cyclical variability even if revenue variables are trend stationary because deviations from the trend include fluctuations not related to changes in income. They argue that annual change in income is a more appropriate measure of cyclical variability. Fiscal problems tend to occur because of recession–related reductions in revenue growth rather than simply because of fluctuations around the long–run trend.

Short–run income elasticity estimates are obtained by first differencing the variables in equations [2] and [4]. These two equations are expressed as follows:

\[
\Delta (\ln T_t) = \ln c_0 + c_1 \Delta (\ln r_t) + c_2 \Delta (\ln Y_t)
\]

\[
\Delta (\ln MV_t) = \ln f_0 + f_1 \Delta (\ln r_t) + f_2 \Delta (\ln Y_t)
\]

where \( c_2 \) and \( f_2 \) are the short–run income elasticity coefficients and \( c_1 \) and \( f_1 \) are the tax rate elasticity coefficients. These coefficients give the percentage change that occurs in the real estate tax or its tax base for a 1 percent change in income or the tax rate.

**DATA**

Revenue and tax base data were obtained from *Local Government Financial Statistics*, an annual publication from the Commonwealth of Pennsylvania’s Department of Community Affairs (now called Department of Community and Economic Development). This publication compiles statistics from the annual financial reports of county governments and other local governments. It includes all sources of local revenue and intergovernmental revenue. Detailed statistics on the real estate tax base and mill rates are provided. The tax base used for tax purposes is based on assessed value of taxable real estate. Market value of real estate is based on the prices at which all taxable property would sell in bona fide transactions. Assessed value usually is less than market value. The assessment laws provide for the establishment of a predetermined ratio of assessed to market value, not to exceed 100 percent. Assessed value of taxable property is computed from a proportionate share of actual value as determined by county assessors. Actual value may be current year market value or some base year market value. The base year usually is the year of the most recent countywide reappraisal. The predetermined ratio varied between 3 and 84 percent in Pennsylvania counties in 1992. All properties within the same county must be assessed at the same ratio. The predetermined ratio is used to convert assessed value to market value (Department of Community Affairs, 1993, p. 7). The stated mill rate is based on the assessed value of real estate. The stated mill rate is converted to the adjusted mill rate by multiplying the county’s stated rate by its predetermined ratio.
The statistical analysis in this paper investigates the revenue growth of 66 Pennsylvania counties over the 1970–1992 period. Philadelphia is the only county excluded because it is consolidated with the City of Philadelphia and does not function separately as a county government. The counties that repealed the personal property tax by 1992 are reported in the Taxation Manual (Department of Community Affairs, 1993, p. 27). The effective year of repeal was the first year that no personal property tax receipts were reported in the annual editions of the Local Government Financial Statistics. Data on population, aggregate personal income and other demographic variables were taken from various editions of the Pennsylvania Abstract (Pennsylvania State Data Center) and the Survey of Current Business (U.S. Department of Commerce, Bureau of Economic Analysis). All dollar value variables in the time series analysis are deflated by the Consumer Price Index. Table 3 gives aggregate summary statistics on the variables used in the time series equations [1] through [6] over the 1970–1992 period. Separate statistics are reported for all 66 Pennsylvania counties, the 27 repealing counties and the 39 retaining counties. The statistics for the variables in equations [1] through [4] are based on the logarithms of the aggregate values for $T$, $MV$, and $Y$. These tended to be higher for retaining counties because many of the larger counties levied the personal property tax in 1992. However, these variables showed higher average growth in repealing counties based on their first differences in equations [5] and [6].

**EMPIRICAL RESULTS**

The first part of this analysis of revenue adequacy uses a linear regression model to estimate the growth and stability of the real estate tax and its tax base. These estimates are given by the parameters in Equations [1] through [6]. The Beach–MacKinnon (1978) maximum likelihood procedure is used to correct for serial correlation. This approach has the advantage of retaining the first year’s observation.

One of the main purposes of this analysis is to test whether the loss of an important local tax affected the growth and stability of another tax. Summary statistics from Table 1 suggest that real estate

<table>
<thead>
<tr>
<th>TABLE 3</th>
<th>SUMMARY STATISTICS VARIABLES IN TIME SERIES ESTIMATING EQUATIONS [1]–[6]* 1970–1992</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>66 Counties</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>$\ln T$</td>
<td>8.194</td>
</tr>
<tr>
<td>$\ln MV$</td>
<td>13.794</td>
</tr>
<tr>
<td>$\ln r$</td>
<td>1.320</td>
</tr>
<tr>
<td>$\ln Y$</td>
<td>13.670</td>
</tr>
<tr>
<td>Observations**</td>
<td>1518</td>
</tr>
<tr>
<td>$\Delta(\ln T)$</td>
<td>0.0217</td>
</tr>
<tr>
<td>$\Delta(\ln MV)$</td>
<td>0.0390</td>
</tr>
<tr>
<td>$\Delta(\ln r)$</td>
<td>-0.0172</td>
</tr>
<tr>
<td>$\Delta(\ln Y)$</td>
<td>0.0207</td>
</tr>
<tr>
<td>Observations**</td>
<td>1452</td>
</tr>
</tbody>
</table>

*The variables $T$, $MV$, and $Y$ are measured in thousands of dollars and $r$ is the dollars of real estate taxes per thousand dollars of market value.

**The number of observations for Equations [1]–[4] are based on the 23 years (1970–1992) for each of the counties. The number of observations in Equations [5]–[6] are based on 22 years (1971–1992) for each of the counties because the first year was dropped.
taxes may have had significantly different growth rates in counties that repealed the personal property tax from those that retained it. First, the level and growth of the tax base per capita were higher in repealing counties over the 1970–1992 period. Second, reliance on the real estate tax was higher in repealing counties. While most counties were less reliant on the real estate tax in 1992 than they were in 1970, most of this reduction occurred between 1970 and 1978. Repealing counties actually became more reliant on the real estate tax after the personal property tax became optional in 1978. The cross-sectional regression results in the first section of this paper also suggest that the real estate tax share was lower in counties levying the personal property tax in 1992.

Table 4 gives the median values for each of the regression estimates from Equations [1] through [6].17 These median values are taken from estimates for all 66 counties and for separate subsamples of retaining and repealing counties. Estimates from Equations [1] and [3] show that trend rates of growth for the real estate tax and market value are higher in repealing counties. Real estate tax revenues showed an average annual growth of 3.3 percent in the median repealing county and 2.1 percent in the median retaining county. Average growth of market value was estimated to be 4.1 percent and 2.8 percent for the median repealing and retaining counties respectively. The results also show that a higher percentage of repealing counties had significant tax growth over the 1970–1992 period. It was found that growth

<table>
<thead>
<tr>
<th>TABLE 4</th>
<th>REGRESSION RESULTS</th>
<th>MEDIAN GROWTH RATES AND INCOME ELASTICITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Retained</td>
</tr>
<tr>
<td><strong>REAL ESTATE TAX:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth Rate (percent)</td>
<td>2.69</td>
<td>2.12</td>
</tr>
<tr>
<td>Tax Rate Elasticity</td>
<td>0.472</td>
<td>0.470</td>
</tr>
<tr>
<td>Standard Error</td>
<td>0.079</td>
<td>0.073</td>
</tr>
<tr>
<td><strong>MARKET VALUE:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth Rate (percent)</td>
<td>3.15</td>
<td>2.84</td>
</tr>
<tr>
<td>Tax Rate Elasticity</td>
<td>-0.291</td>
<td>-0.298</td>
</tr>
<tr>
<td>Standard Error</td>
<td>0.078</td>
<td>0.076</td>
</tr>
<tr>
<td><strong>REAL ESTATE TAX:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income Elasticity</td>
<td>1.018</td>
<td>0.740</td>
</tr>
<tr>
<td>Tax Rate Elasticity</td>
<td>0.390</td>
<td>0.422</td>
</tr>
<tr>
<td><strong>MARKET VALUE:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income Elasticity</td>
<td>1.057</td>
<td>1.035</td>
</tr>
<tr>
<td>Tax Rate Elasticity</td>
<td>-0.325</td>
<td>-0.301</td>
</tr>
<tr>
<td><strong>REAL ESTATE TAX:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income Elasticity</td>
<td>0.347</td>
<td>0.437</td>
</tr>
<tr>
<td>Tax Rate Elasticity</td>
<td>0.498</td>
<td>0.502</td>
</tr>
<tr>
<td><strong>MARKET VALUE:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income Elasticity</td>
<td>0.343</td>
<td>0.494</td>
</tr>
<tr>
<td>Tax Rate Elasticity</td>
<td>-0.306</td>
<td>-0.272</td>
</tr>
</tbody>
</table>

17 The estimated elasticities are assumed to be zero if they are not statistically significant at the 10 percent level. The higher 10 percent significance level is used because it gives more non-zero coefficients. Most time coefficients also were statistically significant at the lower 5 percent level.
rates were significant in 24 of the 27 repealing counties and in 30 of the 39 retaining counties. Only one of the 30 counties showed a significant negative coefficient and its rate of decline was less than 1 percent. For the market value of the real estate tax base, significant growth was found in all 27 repealing counties and in 34 retaining counties. Real estate tax growth rates ranged from \(-1.7\) percent to 4.9 percent in retaining counties and from 0.5 percent to 9.4 percent in repealing counties. Similarly, market value growth rates ranged from 0.1 percent to 5.3 percent in retaining counties and from 0.3 percent to 9.1 percent in repealing counties. Median standard errors, however, are higher for the real estate tax and market value in repealing counties. This suggests that there was more variation around the long–run trend growth in repealing counties.

Long–run income elasticities also were found to be higher in repealing counties. Real estate taxes were considerably more income elastic while market values were slightly more income elastic. The median repealing county had an income elasticity of 1.05 for the real estate tax and 1.08 for its market value. The median retaining county had an income elasticity of 0.74 for the real estate tax and 1.04 for its market value. The income elasticity coefficients were statistically different from zero in all but ten retaining counties and five repealing counties. It also was found that 17 of the 39 retaining counties had income elastic real estate taxes while 16 of the 27 repealing counties had income elastic real estate taxes. Market value was income elastic in 20 repealing counties and 15 retaining counties. Median income elasticity was approximately unitary for real estate variables in the 66–county sample. No counties showed a significant negative income elasticity coefficient over this period. The coefficients had the predicted signs for the tax rate variables in most counties. Table 4 shows very small differences in tax rate elasticities among the three sample groups in Equations [1] and [3]. However, the estimates from Equations [2] and [4] show that the median tax rate elasticity for repealing counties was higher for market value and slightly lower for real estate taxes. This would predict that a given percentage decrease in the tax rate should increase market value by a higher percentage and decrease real estate taxes by a smaller percentage in repealing counties than in retaining counties. Finally, Equations [5] and [6] show that the real estate tax variables had a higher short–run variability in retaining counties. However, most of the income elasticities were not statistically significant.

The second stage of this analysis tests whether the growth and stability results in Table 4 are significantly different for counties that repealed the personal property tax. A weighted least squares procedure was used to test for these differences. The average annual growth rate in each county was regressed against a single dummy variable, REPEAL, where REPEAL = 1 if a county repealed the personal property tax during the 1970–1992 period and REPEAL = 0 if it did not. The regression was weighted by the standard errors of the estimated growth coefficients. If the estimated coefficient of the dummy variable has a positive sign, it suggests that growth or cyclical variability was significantly higher in the repealing county. These results are reported in Table 5. They show that repealing counties had significantly higher trend rates of growth and long–run income elasticities for both revenue variables. However, short–run income elasticity was not found to be statistically significant for either the real estate tax or market value. This suggests that the short–run tax response to changes in income does not depend upon whether the county repealed the personal property tax. Thus, these results support the estimates in Table 4. Repealing counties had higher long–run growth of the real estate tax and market value while their response to
short–run changes in income was not different.

The estimates in Table 4 are based on the assumption that repealing and retaining counties had different growth paths over the entire 1970–1992 period. Another possibility is to test if the same real estate variables grew at different rates in years before and after the tax was repealed. Thus, revenue growth is treated the same for all counties in years in which the personal property tax was levied. Pooled time series and cross sectional regressions were run over the entire 1970–1992 period for all 66 counties to obtain growth rates for real estate taxes and market value. Maximum likelihood estimates were used to correct for serially correlated error terms. The estimating equations were the same as Equations [1] and [3] except that a set of dummy variables is included to test the permanent and temporary effects of repeal on growth. The permanent effect is measured by a differential growth rate coefficient for all years in which the personal property tax was not levied. Then, the same county could have a different growth rate in years before and after the tax was repealed. This allows one to estimate a differential growth rate for years in which the personal property tax was repealed. The rationale for this variable is that a permanent change in taxes takes place in order to make up for the permanent loss of personal property taxes. The temporary effects are measured by single year dummy variables for each of the two years before repeal. Public officials are assumed to be influenced by potential repeal two years before its actual occurrence. Consequently, they try to generate additional revenue to compensate for anticipated future losses. The estimating equations take the following form:

\[ \ln T_{it} = \ln b_0 + b_1 \ln r_{it} + b_2 t_i + b_3 d_{it} t_i + b_4 D1_{it} + b_5 D2_{it} \]

\[ \ln MV_{it} = \ln b_0 + b_1 \ln r_{it} + b_2 t_i + b_3 d_{it} t_i + b_4 D1_{it} + b_5 D2_{it} \]

where all variables have the same definitions as before except that their respective values in the sample are for county \( i \) in year \( t \). The permanent dummy variable \( d_{it} \) equals one if county \( i \) was not levying the personal property tax in year \( t \). Otherwise, \( d_{it} \) equals zero if county \( i \) levied the tax in year \( t \). \( D1_{it} \) equals one if the observation was in the year before the repeal year and \( D2_{it} \) equals one if the observation was two years before the repeal year.\(^\text{18}\) In all other years, these two variables equal zero.

\( \text{Table 5} \)

WEIGHTED LEAST SQUARES RESULTS GROWTH RATES OF 66 COUNTIES REGRESSED ON REPEAL DUMMY VARIABLE

<table>
<thead>
<tr>
<th>EQUATION NO.</th>
<th>DEPENDENT VARIABLE</th>
<th>ESTIMATED DUMMY COEFFICIENT</th>
<th>t–STATISTIC</th>
<th>ADJUSTED R(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Long–run trend rate of growth</td>
<td>0.021</td>
<td>5.26**</td>
<td>.091</td>
</tr>
<tr>
<td>(2)</td>
<td>Long–run income elasticity</td>
<td>1.108</td>
<td>7.24**</td>
<td>.171</td>
</tr>
<tr>
<td>(5)</td>
<td>Short–run income elasticity</td>
<td>0.134</td>
<td>0.94</td>
<td>.046</td>
</tr>
<tr>
<td>(3)</td>
<td>Long–run trend rate of growth</td>
<td>0.016</td>
<td>4.22**</td>
<td>.030</td>
</tr>
<tr>
<td>(4)</td>
<td>Long–run income elasticity</td>
<td>0.059</td>
<td>2.15*</td>
<td>.014</td>
</tr>
<tr>
<td>(6)</td>
<td>Short–run income elasticity</td>
<td>0.076</td>
<td>0.65</td>
<td>.077</td>
</tr>
</tbody>
</table>

*Statistically significant at 5 percent level.

**Statistically significant at 1 percent level.

\( \text{18} \) These temporary dummy variables require information on the repeal decisions in 1993 and 1994. If a county repealed the personal property tax in 1993, \( D1 \) would equal one in 1992 and \( D2 \) would equal one in 1991. If a
The estimates for Equations [1a] and [3a] are given in Table 6. Average annual growth rates were higher in years the tax was repealed. The real estate tax grew at an annual rate of 2.2 percent in the years the personal property tax was levied and 3.0 percent in years that the personal property tax was repealed. The corresponding estimates for market value were 3.2 percent and 3.6 percent. This is consistent with the results in Table 4 showing that repeal contributed to higher long–run growth rates. The short–term dummy variables show that real estate taxes were about 11.9 percent higher a year before repeal and about 5.1 percent higher two years before repeal. Market value was about 5.0 percent higher the year before repeal while it was not significantly different two years before the repeal year.

CONCLUSIONS

This paper addresses two important empirical issues largely ignored by previous revenue adequacy studies. The first is estimating the growth rates of the real estate tax and its tax base. The results show significant growth of these variables for most Pennsylvania counties over the long–run while few counties were responsive to short–run changes in income. The more significant issue concerns the effect of repealing the personal property tax on the growth and stability of the real estate tax. These results suggest that repeal of the personal property tax contributed to higher real estate tax and market value growth while leading to more variation around their long–run growth paths. Repealing counties consistently showed higher growth rates across several alternative regression specifications. This was found even after controlling for differences in adjusted real estate mill rates. Further, pooled regression results also showed that repealing counties had higher growth when differential growth was distinguished by year rather than by county. Finally, the failure to find sample selectivity bias between market value growth and repeal further supports the evidence that shows repeal is associated with higher growth.

One implication of the empirical results is that the permanent loss of a secondary tax can lead to higher discretionary growth of a major tax. This would suggest that at least not all of the response to

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<table>
<thead>
<tr>
<th>Table 6</th>
<th>POOLED REGRESSION ESTIMATES</th>
<th>66 PENNSYLVANIA COUNTIES</th>
<th>1970–1992</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Real Estate Tax Equation [1a]</td>
<td>Market Value Equation [3a]</td>
<td></td>
</tr>
<tr>
<td>Coefficient</td>
<td>t–statistic</td>
<td>Coefficient</td>
<td>t–statistic</td>
</tr>
<tr>
<td>Constant</td>
<td>11.137</td>
<td>96.48</td>
<td>17.092</td>
</tr>
<tr>
<td>t</td>
<td>.022</td>
<td>12.89**</td>
<td>.032</td>
</tr>
<tr>
<td>dt</td>
<td>.008</td>
<td>4.16**</td>
<td>.004</td>
</tr>
<tr>
<td>D1</td>
<td>.119</td>
<td>4.67**</td>
<td>.050</td>
</tr>
<tr>
<td>D2</td>
<td>.051</td>
<td>2.58**</td>
<td>.007</td>
</tr>
<tr>
<td>ln r</td>
<td>.312</td>
<td>18.18**</td>
<td>−.286</td>
</tr>
</tbody>
</table>

**Statistically significant at the 1 percent level.
*Statistically significant at the 5 percent level.
repeal was to reduce government spending. The higher growth of the real estate tax and its tax base in repealing counties is impressive. This growth occurred while tax rates decreased. A personal property tax on intangible assets has many undesirable features. In Pennsylvania, the personal property tax has been poorly administered and enforced. It has discriminated unfairly against certain types of stock ownership. Local taxpayers view it as both inequitable and a nuisance. Further, estimates of personal property tax growth show it is a less adequate revenue source. Few retaining counties experienced significant growth and its growth path showed greater variation than the real estate tax.20

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Dean, J. Gary, and Jean E. Gendron. “If You Thought You Understood Local Taxes.....Think Again.” *Pennsylvania CPA Journal* 71 No. 3 (Fall, 2000): 5 and 52.


20 Equation [1] was used to estimate the average annual growth of the personal property tax. Personal property tax receipts were regressed against time in each of the 39 retaining counties. No tax rate variable was included because the personal property tax rate was constant at four mills throughout the period. It was found that only eight of the 39 counties showed significant positive annual growth. Average annual growth ranged from .016 to .062. However, most of these counties (six) had average annual growth rates between .026 and .034. Moreover, five counties had significantly declining receipts and no significant change was found in 26 counties.


