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# Residential Property Taxation: Is Periodic Reassessment worth it?

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# Residential Property Taxation: Is Periodic Reassessment Worth It?


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**Abstract**

Most of the states that tax residential property determine the tax base through a periodic reassessment (PR) of properties based on sales of comparable properties. Two states replaced the PR approach with assessment based on acquisition value (AV = purchase price) with an annual inflation adjustment. Many others continue to periodically reassess, but have directly or indirectly set low caps on the growth rate of taxable value.

The research tested the null hypothesis that the PR approach yields no more taxable residential value than an AV approach, which costs less to administer and eliminates the threat that rising property values could evict someone from their home.

The econometric analysis of an unbalanced panel from 31 states over the period 1979-2005 yielded mixed results. Consistent with conventional wisdom, terminating PR in favor of an AV approach can have a significant short-run impact. But the short-run finding is not robust. It is driven by the data for Oregon, and disappears or weakens significantly if the Oregon data are adjusted for Oregon's late-90's assessment rollback. Consistent with the presence of long-term offsetting factors, substituting AV for PR has a smaller or zero effect on taxable residential property value in the long-run. The regressions omitting Oregon failed to reject the null hypothesis that assessment based on PR does not yield significantly more taxable value than an AV approach, or approximations of an AV approach through a cap on assessed value growth.



*Keywords*: Periodic reassessment; Acquisition value; Residential property tax

*JEL Classification*: H21, H71



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# 1 Introduction

The typical periodic reassessment (PR) policy for residential property impose costs (lower property values, gentrification, historic preservation, appraisal protest industry), that have not been measured. Many of those effects are still not even widely recognized. For example, the assertion that Texas' residential property tax policy (PR plus high rates) were a home improvement deterrent surprised a state legislator. He said the issue had not come up in the legislature.

Due to some states' rapidly rising residential property values, outrage about sharply rising property tax bills has seen a recent resurgence (Gilliland, 1995; Powell, 2004; Wall Street Journal, 2006, 2007a, 2007b; Waxman, 2005); naturally, more so in the states where a high effective tax rate makes assessed value growth especially significant. That may cause some additional states to base taxable value on acquisition value (AV), and/or limit assessment hikes between property transfers to inflation up to a defined limit like California's (Proposition 13) limit of two percent per year, and the three percent limit in Florida and Oregon. The limits went into effect even though proponents agreed with their critics that assessment growth caps would severely impact property tax revenue growth.

The key property tax reform issues (Jonsson, 2006; Smith, 2004; Wall Street Journal, 2005, 2006, 2007a, 2007b) are tax revenue losses and tax fairness vs. the injustice of higher taxes without increased ability to pay, sometimes to the point of forced sale due to inability to afford the tax hike (Hale, 1985; p 395 and Accordino and Johnson, 2000; p 302). AV and/or low caps on assessment growth might be more common but for little recognition of several costs (discussed below) of the typical periodic reassessment (PR) approach to property valuation for tax purposes, and the untested assumption that without a rate increase, switching to an AV approach would reduce revenues significantly.

The key aim of the research was to test the assumption that AV approaches, including low caps on assessed value growth, yield less taxable residential property value than PR. Since acquisition value-based (AV) approaches and low caps on assessed value growth raise significant horizontal inequity (unequal taxation of equal properties) concerns, we will also discuss fairness trade-offs, and how deferral might be used to capture key advantages of AV, while avoiding the key horizontal inequity disadvantage.

The next section combines a literature review and a comparison of the AV and PR approaches to valuation of residential property. Section 3 describes the empirical model. Section 4 describes the data set and discusses the econometric issues. Section 5 reports the results of the empirical analysis. Section 6 discusses the trade-offs in the property tax reforms suggested by the empirical analysis, including a deferral policy that avoids the horizontal inequity of AV approaches and low caps on assessed value growth. Section 7 contains a summary, and concluding remarks.

## 2 AV-PR Discussion and Comparison

Periodic revision of each property's taxable value is the key feature of the typical property tax regime. Between title transfers, the tax assessor uses data like recent sales of comparable properties and judgment to revise each residential property's assessed value for tax purposes. Both AV and PR regimes revise assessed value when the property undergoes significant structural changes.

The key justifications of PR are automatic revenue growth and horizontal equity. Both are so widely seen as compelling that PR is typically assumed. For example, Coffman's (1989; p 235) thirty-five key questions covering administrative, structural, and procedural alternatives do not include whether to periodically reassess (PR). The rare cases that even note AV as an assessment option (Coffman, 1989; Fischel, 1989; O'Sullivan et al, 1995; Sexton, 2003), dismiss AV as costly (reduced tax revenue) and inequitable. The basis of the latter is that the rate of appreciation could top indexing for inflation, so that recently sold properties could carry a higher tax liability than a long held property of equal value.[1] However, the U.S. (New, 2003; p 4) and California Supreme Courts (Youngman, 1994; p 238) said that an AV approach does not violate the constitutional guarantee of equal protection (fairness). Equal taxation of equal properties is not the only plausible way to define fairness.

PR can, theoretically, prevent significant differences in the tax liabilities of properties of comparable value. But does PR, as practiced in the real world, do so? Brunori (2003), a strong proponent of property taxation as a revenue source, concedes that, discrepancies between the assessed and market value of property abound (p 59). A Utah Foundation study (2000; p 20) noted that, major discrepancies survived over fifty years of significant time and effort to eliminate them. Owens (2000), quoting Joan Youngman and Edwin Mills, noted frequent extreme discrepancies, including 100 percent differences between similar properties.

Significant disparities apparently survive even the cleanest, well-funded, modern approach to PR, and that version of PR is arguably not the norm. Persistent concern about appraisal error (Borland and Lile, 1980; Mehta and Giertz, 1996; Oates, 1999; Strumpf, 1999) and manipulation has a long history (Hale, 1985); certainly significantly pre-dating even Aaron (1975), Oates (1969), Paglin and Fogarty (1972), and Thompson (1968). Appraisal methods have improved significantly (Youngman, 1994; Oates, 2001), but they are still corrupted by politics and stifled by information gaps and limited funding.

Quite significant funding can still leave much unobserved and uncorrected. For example, Texas' Appraisal Districts spent $276 million dollars in 2004, but still they only reassess a typical residential property every 2-3 years, and then without any information about the interior features of a dwelling. In contrast, with an AV approach, the life of the county assessor is comparatively easy (O'Sullivan et al, 1995; p 55), and homeowners no longer have to spend millions protesting[2] the PR-based estimate of their property's value. An intangible cost of PR is the psychic losses associated with two-faced advocacy. Homeowners are under pressure to seek a low assessed value at an appraisal protest hearing, and then argue for a higher price when the property is put on the market. Also, just the surreal nature of someone wishing that their assets were worth less – even temporarily, until time to sell – hints of a significant policy improvement opportunity.

PR raises taxes owed when estimated wealth accrues because of what other people are paying for similar, nearby properties. As Waxman (2005) pointed out, in the years after someone purchases a home, the property tax [bill] is determined by what someone else can afford; something the California Court noted (Youngman, 1994; p 238) as a basis for its declaration that the [AV] system may operate on a fairer basis than a current value [PR] approach. The court specifically noted that acquisition value better corresponded to homeowners' willingness and ability to pay taxes. The U.S. Supreme Court noted the fairness issue of greater predictability of future property tax payments, and because PR can pit gentrifiers against established residents (Hale, 1985; p 399), the court noted a legitimate state interest in neighborhood stability (New, 2003; p 4).

Even the purchase price is not that strongly correlated with the liquid wealth needed to pay taxes. Some people spend more of their income on housing than others. The link between significantly increased property value and greater ability to pay is even more tenuous (Gold, 1981; Guilfoyle, 2003; Youngman, 2005). Many causes of greater property value growth – for example, suddenly increased region/neighborhood popularity – will not benefit many current residents ability to pay higher taxes, and could quite plausibly reduce ability to pay by raising other prices in the area. Certainly, PR causes property value growth to reduce disposable income. The property owner can capitalize on the accrued wealth being taxed only by selling the property and moving to less expensive housing, or temporarily by borrowing against the increased property value. When property value escalation is regional, a sale forced by a higher property tax liability means you have to severely downsize, or leave the area.

So, the point is that there are numerous significant reasons to seriously consider caps on PR-based assessed value growth or termination of PR in favor of an AV-based approach. The likely horizontal equity advantages of PR are over-stated for reasons noted above; more so when real estate turnover and the likely less-than-ideal implementation of PR is taken into account. And contrary to conventional wisdom,[3] even the direction of the tax revenue difference between the acquisition value (AV) and periodic reassessment (PR) approaches is an empirical issue, especially for the long run.

There are four reasons why an AV approach to assessing taxable value, especially when combined with indexing (AV in practice), could yield equal, or even greater levels of residential property value for local governments to tax than even the unlikely flawless implementation of PR. The first three are uncontroversial, though unmeasured, widely ignored reasons why periodic reassessment (PR) depresses property values. 1.) AV makes property ownership more attractive, creating a capitalization effect (Duncombe and Yinger, 2001; p 290 and Rosen, 1992; p 548); 2.) PR makes renovation more costly. The law of demand says that PR reduces renovation (example: Oates, 2001; p 22) with an unknown elasticity well worth measuring. With PR and a three percent effective tax rate, a $100,000 renovation costs the owner $3000 per year in higher property taxes. Since the effect on total renovation cost depends on how close to sale the renovations occur, PR biases renovation spending towards the end of expected ownership tenure.[4] Combined with high effective tax rates, AV creates a strong incentive to buy and refurbish run-down properties. That's especially important for older, sometimes historic neighborhoods. The condition and longevity of the structures in those neighborhoods is a public good; 3.) PR's impact on renovation is largest for the exterior improvements most visible to the tax assessor, and therefore also neighbors. Therefore, PR's impact on renovation spending also has spillover effects. Homes in need of a facelift reduce the taxable value of adjacent properties (Accordino and Johnson, 2000; p 303 and Fischel, 2001; p 52). PR distorts renovation spending towards interior upgrades that yield no beneficial spillover effects, and PR also biases renovation efforts towards undocumented do-it-yourself projects that may not be as value enhancing in the long run as professional work documented by contracts or permits known to the tax assessor; 4.) And finally, PR has much higher administrative costs. Geraci (1977; p 195) notes that, good property tax administration requires substantial government expenditure [and wonders whether] the benefits of good property tax administration justify the costs. A noteworthy related factor is that appraisers sometimes deliberately (Benson and Schwartz, 1997; p 219) under-assess to reduce appraisal board spending on costly protest hearings, which may be an economically rational effort to balance marginal tax revenue foregone against the marginal cost of additional protest hearings.

Figure 1 illustrates the empirical issues. The PR line is smoother than the (W/O PR = pure AV) line. The fairly steady upward slope of the PR line reflects the fact that population growth, income growth, inflation, and some visible renovation will raise a typical property's assessed value between the times it is sold. Because homeowner protests may push assessed values below market value, and because the effect of the tax on renovation spending is smaller the closer the renovation to the planned time of sale, the slope of the PR line rises just before a property is sold. Since the incentive to defer renovations when the sale of the property is not imminent can have long-term consequences for the condition of a property, and last-minute renovations can be less extensive than changes the renovator would enjoy, PR causes some homes to be worth less at the time of sale than they otherwise would be. The higher peaks in the W/O PR line, which are the times the property is sold, reflect those effects and the capitalization of the W/O PR expected property tax savings.

For a given tax rate, pure AV yields more revenue from a residential property, over time, than PR if the solid shaded areas where the W/O PR line is above the PR line exceed the crosshatched shaded areas where the PR line is above the W/O PR line. PR is the more prolific area-wide revenue source when a positive difference exceeds the value of lost renovation spillovers and the higher administrative and compliance costs of PR. The relative sizes of the solid and crosshatched shaded areas will depend on how the early renovation penalty imposed by PR affects property values at sale, by the ability of tax assessors to gauge market value between sales and prevail in protest hearings, and by how frequently the property sells. Without PR, the higher tax levy on a similar newly acquired property is an incentive to move less often (Sexton, 2003; Strumpf, 1999; Wall Street Journal, 2007b). The O'Sullivan et al (1995; p 138) study of California's AV experience found a small lock-in effect. With more frequent property transfers, PR doesn't change the cost of renovation as much, and thus discourages and defers less of it. That would raise the PR line. But with more frequent sales, the W/O PR line catches up to and temporarily surpasses the PR line more often. Figure 1 does not reflect that sales will be more frequent with PR. On that basis, Figure 1 overstates the size of the solid shaded areas relative to the size of the crosshatched areas. But two other simplifications overstate the gains from PR. The PR line is not smooth unless every property is reassessed every year; something not typically funded. Second, W/O PR means pure AV – no assessed value adjustments between property transfers – an extreme version never proposed. The inflation adjustments used by the two AV states (CA and OR) change the flat sections of the W/O PR line to slightly upward sloping. That reduces the cross-hatched area. The next two sections describe the econometric model and the data that address the fiscal differences between AV and PR.

## 3 The Econometric Model

The central fiscal issue is whether PR yields enough additional taxable residential property value to justify its many shortcomings. Therefore, the econometric model tests the null hypothesis that PR does not significantly change the assessed value of residential property for tax purposes. Consistent with the widely held belief that it is a no-brainer that without a rate increase AV will yield less revenue,[5] the alternate hypothesis is that the coefficient of the PR dummy variable will be positive and significant; PR will significantly raise taxable assessed value. PR vs. AV is mostly a state policy choice,[6] so state data are appropriate. To control for wide differences in state population, and for inflation, the assessed value data were adjusted to yield real, assessed, full taxable value of residential property per capita[7] (AVRP).

AVRP will reflect several housing demand and supply factors. Willingness to pay varies with income, ownership costs and benefits, household size, the price of housing complements like appliances and furniture, and tastes regarding housing vs. other goods and services and commercial vs. non-commercial residential housing. The per capita value of residential property will also reflect the scarcity of land and building costs. Unfortunately, annual state data do not exist for all of those factors. For example, there are no annual state data for housing tastes, and cost indices for construction and housing-related goods exist only for the nation. Data for household size are not available annually. Thus, through omission, we assume that those factors do either do not differ significantly across the states in our data set, or they have insignificant effects.

Available proxies for ownership costs include mortgage interest rates, limits on assessed value growth, and effective tax rates. It is well-known that property tax rates are capitalized into the value of property (Ladd and Bradbury, 1988; Rosen, 1992). Population density is a proxy for land scarcity. A May, 1997 change in federal tax law created a new ownership benefit; income tax-free appreciation of owner-occupied housing. The long-time customary proxy for ownership benefit is a variable reflecting the quality of local public services (Oates, 1969). Traditional quality expenditure measures are unsatisfactory, especially per pupil expenditure on public schooling (Oates, 1969). Most studies (see Hanushek, 2003) find no positive correlation between school spending and school effectiveness. Perceived school quality is a well-known, key determinant of property value,[8] so our preferred measure of the quality of local services was student test scores from NAEP (National Assessment of Educational Progress). However, since those data are not available annually, we test the importance of this variable only through a robustness check on the results we derive from our larger set of annual data.

Likewise, data for commercial housing (apartments) rental rates are quite limited. Annual data are available only by region, and for fewer years than we would like to base our key findings on. Therefore, we also test the importance of this variable only through a robustness check on the results we derive from our larger data set. So:

$$AVRP = f(EFFTAX, DENSE, PCI, MORTINT, FEDTAX, PR) \tag{1}$$

$$AVRP = f(EFFTAX, DENSE, PCI, MORTINT, FEDTAX, PR, NAEP) \tag{1A}$$

$$AVRP = F(EFFTAX, DENSE, PCI, MORTINT, FEDTAX, PR, RENT) \tag{1B}$$

where:

$AVRP$ = Real, full, taxable assessed value of residential property per capita (source: Respective state department's of revenue);

$EFFTAX$ = Average effective residential property tax rate (rate × assess ratio) (source: Respective state department's of revenue);

$DENSE$ = Population density (source: Census Current Population Surveys and for land area: www.infoplease.com/ipa/A0108355.html);

$PCI$ = Per capita real income (sources: Bureau of Economic Analysis, Regional Economic Information System, and Bureau of Labor Statistics for the Deflator (CPI));

$MORTINT$ = Average, 30-year fixed rate residential mortgage interest rate (source: http://www.federalreserve.gov/releases/h15/data/Annual/H15_MORTG_NA.txt);

$FEDTAX$ = Dummy for taxing capital gain, equals 1 through 1997, 0 thereafter;

$PR$ = Dummy for periodic reassessment, 1 = Yes, 0 = No (source: Respective state departments of revenue);

$NAEP$ = either 8th grade math or reading scores: nces.ed.gov/nationsreportcard/;

$RENT$ = real, median asking rent. Census Housing Vacancy Survey.

## 4 The Data Set and Econometrics Issues

Thirty-one states published trustworthy AVRP and EFFTAX data; more observations for some states than others for a total of 356 observations. Three states (Mississippi, Missouri, and South Dakota) published only one AVRP and EFFTAX observation. Four states (California, Idaho, Oregon, and Wisconsin) published complete, trustworthy data for the full 1979-2005 period used to incorporate all of the less numerous PR = 0 observations.[9] See the Appendix for details on the other 24 states represented in the data set. Table 1 contains descriptive statistics.

The resulting 'incomplete' and unbalanced panel (Baltagi and Chang, 1994) data set includes several versions of PR = 0 to test differences between actual AV, as practiced in California and Oregon, and near-AV in the form of direct restrictions on assessed value growth (Alaska, Florida, Iowa, Kentucky, Minnesota, Nebraska, New Mexico, Ohio, Oklahoma, South Dakota, Texas, West Virginia, and Michigan[10]), and indirect restrictions (revenue growth, per property levy growth) on assessed value growth (Massachusetts, Missouri, and Washington). Note that given the relatively big magnitudes of $AVRPPC$, $DENSE$, $PCI$ and possible nonstationarity in these variables, we take natural logarithm of these variables.

Based on (1), we use the following one-way error component model

$$\begin{aligned} y_{it} =& \alpha + X_{it}'\beta + u_{it},\ i = 1, \cdots, N;\ t = 1, \cdots, T_i \\ u_{it} =& \mu_i + \nu_{it}, \end{aligned} \tag{2}$$

where $y_{it} = \ln AVRP_{it}$, $X_{it}$ is the vector of regressors consisting of $EFFTAX_{it}$, $\ln DENSE_{it}$, $\ln PCI_{it}$, $MORTINT_{it}$, $FEDTAX_{it}$,and $PR_{it}$, $\mu_{it} \sim IIN(0, \sigma_\mu^2)$ and independent of $\nu_{it} \sim IIN(0, \sigma_\nu^2)$. The standard ordinary least squares (OLS) procedure on (2) yields a consistent estimator. However, it is less efficient compared with the generalized least squares (GLS) estimator. This can be seen more clearly if we rewrite (2) in vector form

$$\begin{aligned} y &= \alpha\iota_n + X\beta + u = Z\delta + u \\ u &= Z_\mu\mu + v, \end{aligned} \tag{3}$$

where $y$ and $Z$ are of dimensions $n \times 1$ and $n \times 7$, respectively, $Z = (\iota_n, X)$, $\delta' = (\alpha, \beta')$, $n = \sum_{i=1}^N T_i$, $Z_\mu = diag(\iota_{T_i})$, and $\iota_{T_i}$ is a vector of ones of dimension $T_i$, $\mu = (\mu_1, \mu_2, \cdots, \mu_N)'$, and $\nu = (\nu_{11}, \cdots, \nu_{1T_1}, \cdots, \nu_{N1}, \cdots, \nu_{NT_N})'$. Then, the error vector has a non-identity covariance matrix

$$\Omega = E(uu') = \sigma_v^2 I_n + \sigma_\mu^2 Z_\mu Z_\mu'. \tag{4}$$

The GLS estimator is given by

$$\hat{\delta} = (Z'\Omega^{-1}Z)^{-1}Z'\Omega^{-1}y. \tag{5}$$

In practice, since $\Omega$ is unknown, we have to use a Feasible Generalized Least Squares (FGLS) model with $\sigma_v^2$ and $\sigma_\mu^2$ in (4) consistently estimated. We follow Baltagi and Chang (1994) to use the Wallace and Hussain (1969), Swamy and Arora (1972), Henderson (1953) and Fuller and Battese (1974), and maximum likelihood, restricted maximum likelihood estimators, denoted WH, SA, HFB, ML, REML, respectively, to estimate the variance components $\sigma_v^2$ and $\sigma_\mu^2$.[11]

# 5 Results

Except with data sets that included Oregon, the empirical analysis failed to reject the null hypothesis that PR does not increase AVRP. Without Oregon among the PR = 0 states, the 'PR' variable is statistically insignificant (t-stat < 1) with either LnAVRP or Annual Percentage Change in AVRP as the dependent variable. That result held for all combinations of the states that had assessment growth limits equal to Oregon's three percent per year limit, or a lower limit, and whether the PR = 1 states were all of the states with higher limits on annual assessment growth than Oregon's three percent, plus the states with no limit on assessment growth, or just the latter. Sensitivity analysis with 'outlier states' (Alabama, Montana, and North Dakota) added, or with Colorado omitted, yielded no substantive impact on the results reported in greater detail below. Regressions were run once with Colorado among the states that did not cap assessed value growth, and once omitted from the data set, because though Colorado did not explicitly limit assessment growth, Colorado's strong taxpayer bill of rights imposes limits that may make it an inappropriate member of the no-cap share of the data set.

A likely contributing cause to the 'Oregon effect' is that Oregon's Measure 50, that terminated PR in favor of an AV-based approach and an assessment growth limit of three percent per year, also rolled 1998 assessments back to 90% of the 1996 level. With inflation at four percent from 1996 to 1998, Measure 50's assessment rollback provision reduced the assessed value of most Oregon residential property[12] fourteen percent below where it would have otherwise been in 1998, and with the assessment growth limit of three percent per year, by a somewhat smaller percentage each successive year thereafter.[13] Since the effect of the Measure 50 assessment rollback mandate is not reasonably attributable to ending PR, the question becomes what should be done to disentangle the PR = 0 and rollback mandate effects. The regressions were re-run once each with the 1998-2005 Oregon AVRP data inflated by fourteen percent, and with the 1998 Oregon AVRP data inflated fourteen percent, the 1999 data inflated thirteen percent, and so on, with the 2005 data inflated seven percent. The flat fourteen percent data adjustment eliminated the Oregon effect, while the other adjustment substantially weakened the Oregon effect, but did not eliminate it.

From those results, we surmise that, in time, the dynamic effects of AV (greater demand for property, increased renovation plus spillovers) will offset the PR updating of AVRP between property transfers. But, since dynamic effects take time to manifest themselves, terminating PR during periods of rapid real estate appreciation (Oregon, mid-1990s) can temporarily reduce the taxable value of residential property. Increased confidence in this interpretation comes from analyzing California-only regressions (not shown). California has had AV since 1979; more time to roll dynamic effects into AVRP. In one of the California-only regressions, PR = 1 for all states except California. In the other, all of the observations with assessed value growth limits, except California, were excluded. In that model, PR = 1 just for states with no cap on assessed value growth. The analysis did not come close to rejecting the null hypothesis. California's AV plus up to two percent per year policy (tighter than Oregon's) did not explain any of the difference between California's AVRP, and the AVRPs of the other states. Combining California and Florida under PR = 0 yielded the same 'PR' result as PR = 0 for just California.

We turn now to a closer examination of several versions of our results. In Table 2, $PR_{CAP} = 0$ for all the states with direct and indirect assessment growth limits, and $PR_{CAP} = 1$ for the states that do not limit assessment growth. Except for $PR_{CAP}$, all of the FGLS explanatory variables are statistically significant (at 1%, 5%, or 10%, denoted by *, **, and ***, respectively). Standard errors appear below the coefficient estimates. We also note the estimated covariance components and the values of Breusch-Pagan lagrangian multiplier (LM) test for and Hausman's specification test, denoted and respectively. For comparison purpose, we include the less efficient OLS estimates too. In contrast to the often drastically different OLS and FGLS estimators, the various FGLS estimators give similar estimates. The LM and Hausman's tests favor the random-effects over the fixed-effects model. As such, the FGLS estimates are more trustworthy and we draw our conclusions based on the FGLS results.

The FGLS regressions reveal a tax rate capitalization effect of approximately twenty-seven percent for a one unit rise in the effective property tax rate. This stands in contrast to the much smaller Ladd and Bradbury (1988, p. 503) effective tax rate capitalization finding. A one percent change in per capita income changes by slightly more than one percent. The population density elasticity is approximately 0.1. A ten percent change in population density changes by one percent. While the WH estimator gives positive effect of the mortgage interest rate on the other four FGLS estimators give the expected negative effect, but with only 10% significance. Finally, the 1997 change in the federal income status of capital gains on owner occupied dwellings increased by approximately 2.5 percent.

Up through the $PR_2$ row, Table 3 shows the results of setting $PR_2 = 0$ for the states with assessment growth limits of two percent or less, and $PR_2 = 1$ for the other states. The $PR_3$ row reveals the effect on the 'PR' coefficient of redefining $PR_3 = 0$ to be states with assessment growth limits of three percent or less, which moves Alaska, Florida, Massachusetts from 1998-2005, Nebraska, and 1998-2005 Oregon from the $PR_2 = 1$ observations to the $PR_3 = 0$ observations. Subsequent analysis (discussion of Table 3, below) reveals that moving the Oregon observations from $PR_2 = 1$ to $PR_3 = 0$ was the reason why $PR_2$'s coefficient is not nearly significant, but $PR_3$'s coefficient is statistically significant. The $PR_{2X}$ and $PR_{3X}$ rows indicate that omitting states with assessment growth limits above two and three percent per year ($PR_{2X} = 1$ and $PR_{3X} = 1$ only for states with no assessment growth limit), respectively, does not affect the interpretation of the $PR_2$ result, but the $PR_3$ coefficient is no longer statistically significant.

Up through the $PR_{CAFLORX}$ row, Table 4 displays the results of $PR_{CAFLORX} = 0$ for the prominent assessment growth cap states, California, 1995-2005 Florida, and 1998-2005 Oregon, and $PR_{CAFLORX} = 1$ for the other states. The $PR_{CAFLX}$ row reveals the effect of omitting 1998-2005 Oregon from the $PR_{CAFLORX}$ regression. The $PR_{OR+14}$ and $PR_{OR+14\text{-}7}$ rows reveal the effect on the PR $_{CAFLORX}$ regression of making the Oregon 'Measure 50' adjustments described above. With the fourteen percent upward adjustment of the 1998-2005 observations, the 'PR' coefficient ($PR_{OR+14}$) is still positive, but it is no longer statistically significant. The graduated adjustment, fourteen percent in 1998 down to seven percent in 2005, leaves the 'PR' coefficients teetering on the brink of statistical (in)significance. So, Oregon's policy shift from PR to AV, and the reduction in the appraisal growth limit from six to three percent may be partly responsible for Oregon's AVRP growth being less than what one would expect from the other explanatory variables. That finding is quite sensitive to the Oregon 'Measure 50' adjustments. In the other 'cap' states, effects of ending or limiting the application of PR are not evident.

Addition of a NAEP 8th Grade reading or math score to the empirical models described above confirmed that property values will reflect perception of relative public service quality (Oates, 1969), but the addition of the NAEP variables did not significantly alter the 'PR' results described above. The math scores were better explanatory variables than reading scores, with property value elasticities ranging from 2.7 to 4.4.

RENT was statistically significant, and adding it to the models significantly increased the size and significance of PCIREAL, MORTINT, and FEDTAX. Since RENT and DENSE should reflect land scarcity, adding RENT to the models weakened the explanatory power of DENSE, which became insignificant in some specifications, though larger and still significant in others. However, adding RENT to the models significantly changed only one of the basic PR results reported in Tables 2-4. The Oregon effects disappeared. PR did not have a significant, positive coefficient in any of the models. Then, the question is why not report and rely on the models with RENT? We chose without RENT. Since the RENT data begin in 1988, including it would entail loss of 1/3 of the data for key states.

## 6 A Third Way: Horizontal Equity without PR through Deferral

Even though equal property value does not mean equal ability to pay taxes, especially in times/places of rapid appreciation, the simple clarion call of equal taxation of equal properties may be politically compelling. Policymakers can answer that call without PR. AV plus deferral of taxation of property value growth (Hale, 1985; p 400 and Rosen, 1992; p 554) above the inflation-based adjustments until a property is sold ensures equal taxation of properties that do actually have the same market value, as opposed to equal PR-based estimates of market value. The deferral also recaptures the short-term tax revenue losses that may result from a shift from PR to an AV-based assessment policy.

Suppose a property purchased in 2001 for \$100,000 ($X_0$) sells for \$150,000 in 2008 ($X_N$); average annual growth of nearly six percent each year for seven years ($N$).

$$X_0(1+r)^N = X_N \tag{6}$$

$$r = (X_N/X_0)^{1/N} - 1 \tag{7}$$

$$r = (150,000/100,000)^{1/7} - 1, \; r \simeq 0.06$$

Suppose the assessment growth rate is capped at four percent ($r_{\max}$). Then, at the time of sale, the seller of the property owes deferred taxes ($DT^*$) on the difference in its value at the rate $r$ , and the AV adjusted by the assessment growth limit ($\leq r_{\max}$) times the tax rate per year ($t_n$) from 2001 to 2008. With a constant tax rate of 3% (each $t_n = 0.03$), and AV adjustment by the full $r_{\max}$ of four percent per year, \$2011 is due at closing:

$$DT^* = X_0 \left[ \sum_{n=1}^{N} ((1+r)^n - (1+r_{\max})^n) t_n \right] = 2011. \tag{8}$$

payable at closing. A less precise, but less complex approach ($DT'$ in (8)) is to base the estimated $DT$ of each year on the product of the average tax rate and the average difference between the market value and assessed value. Assuming linear growth at rate $r$, the average difference between each year's $AVRP$ and market value is $(X_T - X_0(1+r_{\max})^N)/2$.

$$X_0(1+r_{\max})^N = 100,000(1+0.04)7 = 131,593 \tag{9}$$

$$DT' = [(150,000 - 131,593)/2] \times t \times N = 9203 \times 0.03 \times 7 = \$1934.65 \tag{10}$$

We did not include the interest charges that are typical of the deferral programs used for selective property tax relief in twenty-two states (Brunori, 2003; p 66) because it is unclear whether taxes are legitimately owed on property appreciation immediately upon its estimated accrual (O'Sullivan et al, 1995; p 128), or when the gains are realized with the sale of the asset. Income taxation of capital gains occurs when the gains are realized.

So, PR is not a prerequisite for a commitment to pursue horizontal equity defined as equal taxation of properties with equal market value. Deferred taxation of appreciation beyond the level captured in the AV inflation adjustment achieves the equal taxation of comparable properties on the basis of actual market values, and without PR's administrative and compliance costs, and without most of PR's other shortcomings. Recouping taxes on property appreciation in excess of the overall rate of inflation still penalizes renovation, but with a smaller negative impact on property value. Deferral eliminates the renovation-depressing fear that renovation would lead to unaffordable increased taxation. And termination of PR eliminates the bias against exterior renovation and professional work that magnifies property tax base-reducing spillovers.

# 7 Summary and Concluding Remarks

In the name of fairness and revenue maximization, most states periodically adjust the assessed value of residential properties. But to keep rapidly rising assessed values from forcing anyone to sell, some states have capped the annual increase in the assessed value, and two – California and Oregon – no longer reassess property between sales. Their residential property tax base is the acquisition value (AV) plus an annual inflation adjustment not to exceed two and three percent, respectively. The capitalization effect and a widely ignored, but obvious renovation penalty created by periodic reassessment (PR) means that we cannot be confident that PR will generate more revenue for a given tax rate than AV. It's an empirical issue.

This first installment of empirical evidence indicates that PR has no long-term effect on the combined taxable value of the residential property inventory. The short-term effect, if any, appears limited to places with especially rapid real estate appreciation. Deferred collection of taxes on property value increases in excess of general inflation not only recoups potential revenue losses from short-term differences between the effects of PR and AV, it eliminates the remaining horizontal equity justification for the costly PR approach to assessing taxable value. The recommended deferral policy also eliminates the need for the special treatment programs (e.g. appraisal freezes for the elderly) enacted by many states to avoid harmful effects of periodic reassessment.

## Notes

[1]In a Wall Street Journal letter billionaire Warren Buffet (2003), an AV critic, said a recently purchased property, worth half what another property is worth, carries five times the property tax bill.

[2]The existence of an appraisal protest industry is significant evidence of persistent appraisal error.

[3]A prominent limited government activist asked one of the authors (JM), "how can it [PR] not increase property tax revenue."

[4]'They must be planning to sell' is almost a knee-jerk assumption about major renovation efforts.

[5]See note 1.

[6]A few states allow AV as a local option.

[7]All relevant measures of state size (households, single-family dwelling units, population) have drawbacks. Population data are readily available annually, but state. The others are not readily available, annually, by state.

[8]David N. Figlio, Maurice E. Lucas, What's in a grade? school report cards and house prices. *American Economic Review* 94:3 (June, 2004): 591-604.

[9]Began with 1979 data for California; first year after the passage of Proposition 13.

[10]Not included in the analysis because Michigan did not publish tax rate data. Note also that some states with such restrictions did not have trustworthy AVRP or EFFTAX data, and thus are not listed here.

[11]Baltagi and Change (1994) also considered the Wansbeek and Kapteyn (1989) (WK for short), minumum norma and minimum variance quadratic unbiased estimator (MINQUE and MIVQUE) estimators. They showed that the more computationally demanding MINQUE and MIVQUE estimators do not necessarily perform better. We do not include the WK estimator in our study because some preliminary regressions indicate that sometimes it can produce very unreliable estimator of $\sigma_\mu^2$. Note that WH (etc.) stand for the names of its originators and that they differ in how they estimate the variance components $\sigma_\nu^2$ and $\sigma_\mu^2$.

[12]'Most', not all; the exceptions are new construction and properties sold between 1996 and 1998.

[13]Ibid, note 6.

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## Appendix

*Unbalanced Panel: 31 states, 356 observations*

One complete observation each for Mississippi, Missouri, and South Dakota

Two complete observations each for Arkansas and Wyoming

Three complete observations each for Rhode Island and New Mexico

Five complete observations each for Ohio, Utah, and Vermont

Six complete observations each for Georgia, Kentucky, and Tennessee

Nine complete observations each for Illinois, Minnesota, and New Jersey

Eleven complete observations each for Florida and Texas

Twelve complete observations each for Iowa and West Virginia

Thirteen complete observations for Massachusetts

Fourteen complete observations for Nebraska

Sixteen complete observations for Kansas

Nineteen complete observations for Colorado

Twenty complete observations for Oklahoma

Twenty-four complete observations for Maine

Twenty-five complete observations for Washington

Twenty-seven complete observations each for California, Idaho, Oregon, and Wisconsin

Figure 1: Assessed Value

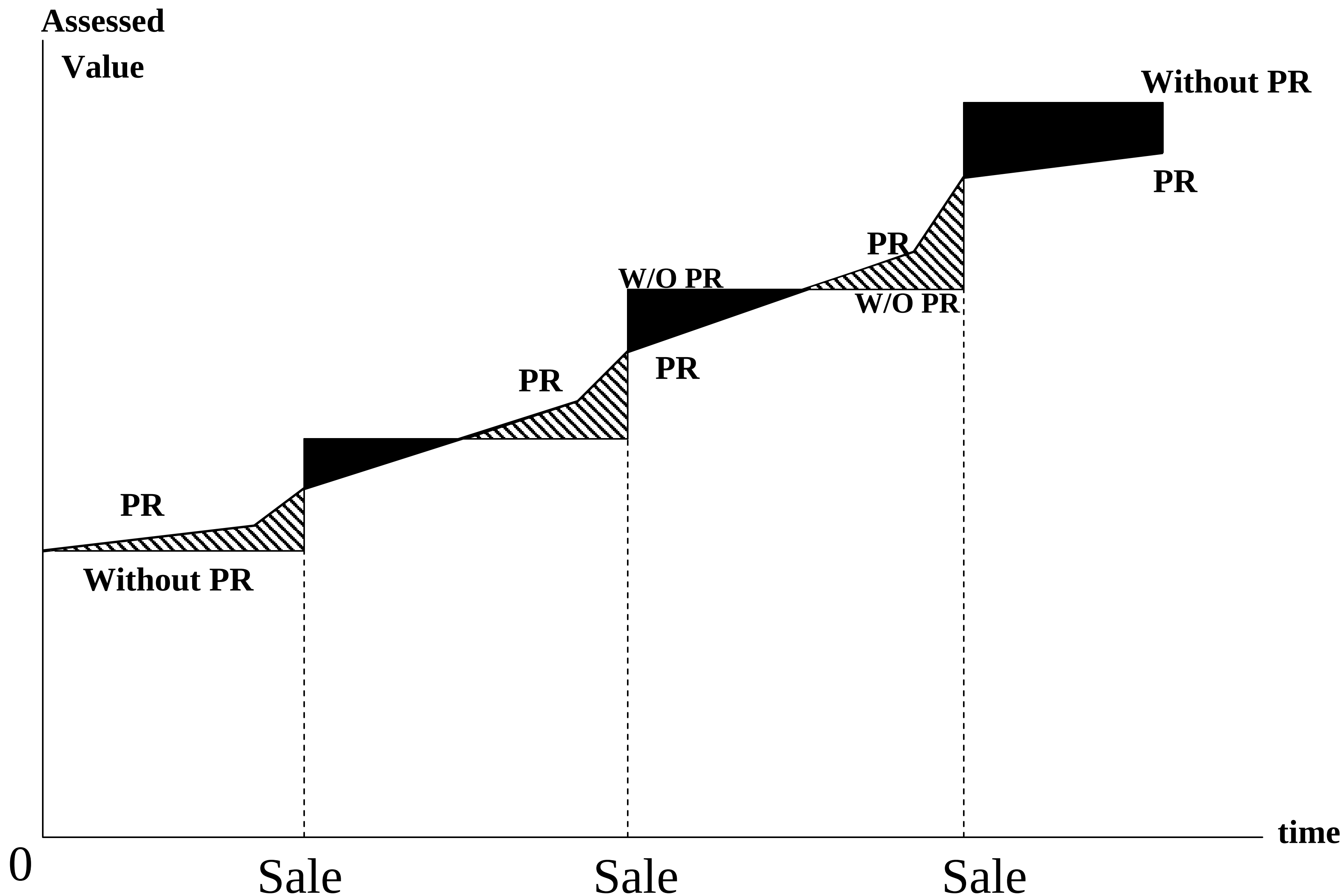

**Table 1: Descriptive Statistics**

| Variable | Mean | SD |
|---|---|---|
| AVRP | 25504.4046 | 14287.7363 |
| lnAVRP | 10.0096 | 0.5222 |
| EFFTAX | 1.5884 | 0.7481 |
| DENSE | 140.1026 | 233.9667 |
| lnDENSE | 4.2194 | 1.1209 |
| PCI | 15242.3032 | 2499.4287 |
| lnPCI | 9.6185 | 0.1632 |
| MORTINT | 8.2731 | 2.5413 |

**Table 2: Limits of any Kind vs. No Limits on Assessment Growth**

| | OLS | WH | SA | HFB | ML | REML |
|---|---|---|---|---|---|---|
| Intercept | -20.7095 | -2.6410 | -0.9086 | -0.3245 | -0.1014 | -0.0674 |
| | 5.8346 | 2.2376 | 1.2245 | 1.2426 | 1.2398 | 1.2505 |
| EFFTAX | -0.1453** | -0.2263*** | -0.2601*** | -0.2721*** | -0.2768*** | -0.2776*** |
| | 0.0725 | 0.0400 | 0.0223 | 0.0228 | 0.0228 | 0.0230 |
| lnDENSE | -0.1121 | 0.0715* | 0.0871** | 0.0925** | 0.0946** | 0.0949** |
| | 0.0743 | 0.0504 | 0.0392 | 0.0490 | 0.0546 | 0.0561 |
| lnPCI | 3.1700*** | 1.3007*** | 1.1246*** | 1.0653*** | 1.0426*** | 1.0392*** |
| | 0.6126 | 0.2307 | 0.1267 | 0.1291 | 0.1291 | 0.1303 |
| MORTINT | 0.0860 | 0.0006 | -0.0039 | -0.0054* | -0.006* | -0.0061* |
| | 0.0181 | 0.0074 | 0.0040 | 0.0040 | 0.0040 | 0.0041 |
| FEDTAX | 0.2391 | -0.0147 | -0.0235* | -0.0261* | -0.0270* | -0.0272* |
| | 0.0775 | 0.0347 | 0.0186 | 0.0187 | 0.0186 | 0.0188 |
| $PR_{cap}$ | 0.2088 | 0.0134 | -0.0294 | -0.0459 | -0.0524 | -0.0535 |
| | 0.1629 | 0.0839 | 0.0489 | 0.0507 | 0.0510 | 0.0515 |
| $\hat{\sigma}_{\nu}^2$ | NA | 0.0301 | 0.0082 | 0.0082 | 0.0081 | 0.0082 |
| $\hat{\sigma}_{\mu}^2$ | NA | 0.1552 | 0.1068 | 0.1827 | 0.1827 | 0.1827 |
| $p_{LM} = 0.0012$ | | $p_H = 0.0713$ | | $n = 357$ | | $N = 31$ |

**Table 3: 2% or 3% Annual Growth Limit on Assessment Growth vs. No Limits on Assessment Growth**

| | OLS | WH | SA | HFB | ML | REML |
|---|---|---|---|---|---|---|
| Intercept | -20.5785 | -2.4914 | -0.9848 | -0.2747 | -0.1165 | -0.0833 |
| | 6.9978 | 2.2678 | 1.2300 | 1.2535 | 1.2487 | 1.2596 |
| EFFTAX | -0.1318* | -0.2295*** | -0.2577*** | -0.2715*** | -0.2746*** | -0.2752*** |
| | 0.0906 | 0.0406 | 0.0223 | 0.0229 | 0.0229 | 0.0231 |
| lnDENSE | -0.1164 | 0.0737* | 0.0865** | 0.0932** | 0.0950** | 0.0954** |
| | 0.0777 | 0.0520 | 0.0383 | 0.0503 | 0.0542 | 0.0557 |
| lnPCI | 3.1572*** | 1.2842*** | 1.1298*** | 1.0566*** | 1.0402*** | 1.0368*** |
| | 0.7288 | 0.2346 | 0.1278 | 0.1309 | 0.1306 | 0.1319 |
| MORTINT | 0.0893 | 0.0002 | -0.0037 | -0.0055* | -0.0059* | -0.0059* |
| | 0.0219 | 0.0075 | 0.0040 | 0.0041 | 0.0041 | 0.0041 |
| FEDTAX | 0.2310 | -0.0143 | -0.0247* | -0.0294* | -0.0304* | -0.0306* |
| | 0.0883 | 0.0347 | 0.0183 | 0.0185 | 0.0183 | 0.0185 |
| $PR_2$ | 0.0797 | 0.0169 | 0.0133 | 0.0119 | 0.0116 | 0.0116 |
| | 0.1597 | 0.0852 | 0.0468 | 0.048 | 0.0478 | 0.0483 |
| $PR_3$ | 0.1060 | 0.0765 | 0.1124 | 0.1286 | 0.1348 | 0.1356 |
| | 0.1696 | 0.0709 | 0.0388 | 0.0398 | 0.0399 | 0.0402 |
| $PR_{2X}$ | 0.1589 | 0.0668 | 0.0206 | 0.0053 | -0.0051 | -0.0062 |
| | 0.1848 | 0.1307 | 0.0744 | 0.0777 | 0.0790 | 0.0802 |
| $PR_{3X}$ | 0.2334 | 0.0347 | 0.0145 | 0.0100 | 0.0055 | 0.0050 |
| | 0.1772 | 0.1160 | 0.0743 | 0.0771 | 0.0790 | 0.0801 |

Note: When we change the PR variable from $PR_2$ to $PR_3$, $PR_{2X}$, $PR_{3X}$, the estimated coefficients for the other variables do not change much and to save space we do not report them here. The *p* values of the LM test and Hausman's test both favor the random-effects model over the fixed-effects model. For $PR_2$ and $PR_3$, $n = 357$, $N = 31$; for $PR_{2X}$, $n = 245$, $N = 22$; for $PR_{3X}$, $n = 292$, $N = 27$.

**Table 4: Focus on California, Florida, and Oregon; Various Combinations and Oregon Data Adjustments**

| | OLS | WH | SA | HFB | ML | REML |
|---|---|---|---|---|---|---|
| Intercept | -13.4604 | 0.8847 | 1.3141 | 1.5593 | 1.8411 | 1.8743 |
| | 8.9207 | 2.0254 | 1.5024 | 1.5134 | 1.5078 | 1.5291 |
| EFFTAX | -0.0906 | -0.3007*** | -0.3112*** | -0.3172*** | -0.3239*** | -0.3247*** |
| | 0.1029 | 0.0375 | 0.0279 | 0.0282 | 0.0281 | 0.0286 |
| lnDENSE | -0.2161 | 0.0947* | 0.1056** | 0.1132** | 0.1248* | 0.1265* |
| | 0.0864 | 0.0697 | 0.0594 | 0.0663 | 0.0769 | 0.0798 |
| lnPCI | 2.5316*** | 0.9431*** | 0.8950*** | 0.8668*** | 0.8331*** | 0.8290*** |
| | 0.9381 | 0.2097 | 0.1555 | 0.1567 | 0.1560 | 0.1582 |
| MORTINT | 0.0484 | -0.0071 | -0.0081** | -0.0087** | -0.0093** | -0.0093** |
| | 0.0249 | 0.0062 | 0.0046 | 0.0047 | 0.0047 | 0.0047 |
| FEDTAX | 0.1353 | -0.0389 | -0.0421** | -0.0439** | -0.0459** | -0.0461** |
| | 0.1101 | 0.0311 | 0.0229 | 0.0230 | 0.0228 | 0.0231 |
| $PR_{CAFLORX}$ | -0.1972 | 0.1254** | 0.1374*** | 0.1442*** | 0.1521*** | 0.1530*** |
| | 0.1717 | 0.0600 | 0.0443 | 0.0445 | 0.0441 | 0.0447 |
| $PR_{CAFLX}$ | -0.1053 | 0.0153 | 0.0235 | 0.0263 | 0.0288 | 0.0296 |
| | 0.1938 | 0.3450 | 0.3080 | 0.3540 | 0.4136 | 0.4489 |
| $PR_{OR+14}$ | -0.2334 | 0.0148 | 0.0247 | 0.0310 | 0.0380 | 0.0388 |
| | 0.1819 | 0.0596 | 0.0446 | 0.0448 | 0.0444 | 0.0450 |
| $PR_{OR+14-7}$ | -0.2247 | 0.0410 | 0.0512 | 0.0576 | 0.0647 | 0.0656 |
| | 0.1792 | 0.0594 | 0.0444 | 0.0446 | 0.0442 | 0.0448 |

Note: When we change the PR variable from $PR_{CAFLORX}$ to $PR_{CAFLX}$, $PR_{OR+14}$, $PR_{OR+14-7}$, the estimated coefficients for the other variables do not change much and to save space we do not report them here. The *p* values of the LM test and Hausman's test both favor the random-effects model over the fixed-effects model. For $PR_{CAFLORX}$, $PR_{OR+14}$, and $PR_{OR+14-7}$, $n = 228$, $N = 19$; for $PR_{CAFLX}$, $n = 201$, $N = 18$.