

## **Tax Flights**

Koleman Strumpf

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### **Lincoln Institute of Land Policy Working Paper**

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## **Abstract**

Tax evasion is difficult to measure, since evaders try to avoid detection and counter-factual behavior is hard to establish. This paper considers evasion in an environment where these two issues can be overcome. Aircraft are taxed as personal property in some American states. Taxes are owed if the plane is hangared in the state on one specific date. Strategic plane owners may try to evade the tax by flying to a non-taxing jurisdiction just before this date and returning shortly thereafter. I assess such tax flights using a database of about twenty million trips covering all general aviation flights in the United States during the period 2004 to 2009. For each flight I know the time, location of the arrival and departure airport, the address of the owner, and the type of plane. I match this to a database of local tax rates and valuation of planes to measure the potential tax bills. To establish the counter-factual flying behavior, I exploit variation in tax policy (at both the state and local level), exemptions for certain classes of planes, type of plane, tax valuation method, and tax date. Preliminary results indicate the presence of tax flights.

## About the Author

**Koleman Strumpf** is the Koch Professor of Economics at the University of Kansas School of Business. His research interests are in applied microeconomics, particularly public economics and industrial organization.

Correspondence should be sent to:  
1300 Sunnyside Avenue  
Lawrence, KS 66045  
cigar@ku.edu

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# 1 Introduction

A central issue in public economics is the extent to which individuals or firms evade taxes. It is typically difficult to quantify such evasion, since it is hard to observe (evaders hide their actions) or establish the counter-factual (what behavior would have been like in the absence of taxes). This paper considers an application, the property taxation of general aviation aircraft, in which these issues might be overcome. These taxes are levied in some states and are based on the plane's location on a specific date referred to as the assessment date.

Strategic plane owners might try to evade the property tax by flying their plane to a non-taxing jurisdiction just before the assessment date and return shortly thereafter.<sup>1</sup> Such *tax flights* could plausibly work since planes are mobile and tax authorities rarely have a complete database of all planes in their jurisdiction (in contrast to other property such as homes or autos).

Precisely measuring tax evasion is possible in this environment. The researcher can observe the underlying behavior because the Federal Aviation Administration (FAA) tracks and caches general aviation flights. The counter-factual of how many flights there would be around the assessment date in the absence of taxes can be established using variation in tax policy (at both the state and local level), in exemptions for certain classes of planes, in type of plane, in tax valuation method, and in the assessment date. Netting out the counter-factual behavior from actual flights around the assessment date gives a measure of tax flights.

In this paper I use a database of about twenty million trips covering all general aviation flights in the United States during the period 2004 to 2009. For each flight I know the time, location of the arrival and departure airport, the address of the owner, and the type of plane. I match this to a database of local tax rates and valuation of planes to measure the potential tax bills. Preliminary results indicate the presence of tax flights.

I build on the large literature which empirically measures tax evasion (see the summary in Slemrod and Yitzhaki, 2002). Because of unique aspects of the problem I study and the very rich data set I have, I am able to consider additional issues beyond the focus of previous work. In particular I build on two important recent

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<sup>1</sup>Senator Claire McCaskill appears to have used such a strategy to evade \$300,000 in property taxes over four years on a plane she co-owns (Wong and Bresnahan, 2011).

papers, Fisman and Wei (2004) and Kleven, et al (2011). Fisman and Wei (2004) measure tariff evasion in the Hong Kong-to-China trade by comparing export and import statistics. They find exports exceed imports for goods facing high tariffs, with some of the missing exports reappearing as imports of lower tariff goods. I use a similar identification strategy in my approach, and in addition I can observe actual evasion at the decision-maker level and can use completely non-taxed planes to help establish the counter-factual. Kleven, et al (2011) measure evasion at the taxpayer-level using a random audit in Denmark. I also analyze individual taxpayers, with the addition that the potential savings from evasion is typically larger and there are business as well as individual decision-makers.

## 2 Background

### 2.1 Institutional Framework

Figure 1 maps state tax policies.<sup>2</sup> Eighteen states allow local governments to levy some form of personal property tax on general aviation aircraft. While most taxing states are in the south or west, there are non-taxing states in all regions (in 2010 forty percent of general aviation traffic involved taxing states). Among taxing states, twelve tax all aircraft, five tax just business-owned aircraft, and one taxes just personal-owned aircraft. The taxing states assess planes on a single date, which is 1 January in sixteen cases and other dates in two others. In seventeen of the states there is a uniform method of determining assessed values (a fraction of current retail or wholesale price, a depreciation schedule based on purchase price, and other permutations) and one state allows each county to pick their own method. Several states also have a variety of exemptions for particular planes (such as planes older than a certain age or planes used in agriculture). States also have a variety of tax situs, with some taxing planes where they are located and others based on where the owner is located.

The property tax system is locally administered. While the state sets the basic rules as described in the last paragraph, counties are in charge of collecting the tax. Most tax officials appear to devote little time or expertise to aircrafts.<sup>3</sup> A reason for

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<sup>2</sup>The Data Appendix contains a list of sources used to generate the stylized facts in this section.

<sup>3</sup>A graphic example of this may be found in Kath (2011).

this is few counties have specialists in aircraft taxes, and the division which typically administers it is primarily focused on real property such as homes. Still, some counties have requested a list of planes hangared at local airports on the assessment date. And unlike with autos, there is no state registry of all planes (the FAA keeps a registry which it updates semi-monthly).

The mechanics of aircraft property taxes typically parallel those on other property. The tax owed on a particular plane is the product of its assessed value and the overall set of rates. The assessed value is based on the state system of valuation applied to the specific assessment date. The rate is the sum of all those from taxing jurisdictions, which may include the state, county, municipality, school district, and special districts. These rates are typically adjusted each year. A key difference from other forms of property taxation is that no bill is typically sent out, but rather owners are responsible for submitting forms along with payments.

A final issue is to describe general aviation (GA) aircraft. This includes almost all civil aviation besides airlines. It includes both commercial and non-commercial aircraft, and it includes a wide range of plane types including reciprocating (piston) engines, turboprops, light jets, and experimentals. There are 8k GA airports in the US, and 350k GA aircraft registered with the FAA (about a third of these planes are inactive).

## **2.2 Identification**

The key question is how much flight activity, presumably wasteful, does this tax system induce. The extent of tax evasion can be measured from several sources of variation:

- (i) taxing versus non-taxing jurisdictions: one can compare flights in states which allow local governments to levy property taxes with those in non-taxing states;
- (ii) tax rates and assessment methods: in states which allow taxes, local governments vary in both the rates they apply and their methods of setting assessed values;
- (iii) plane types: some planes are more valuable than others, and as such face different potential tax burdens if they do not evade;

- (iv) special exemptions: some states only allow taxation of certain kinds of planes, such as business-owned, non-business owned, or those less than a certain age;
- (v) a natural experiment (West Virginia effectively made business planes exempt in 2009 while previously all planes were taxed).

The main specification to be estimated is,

$$\begin{aligned}
 Flights_{igt} = & \beta_1 TaxBill_{igt} \times TaxTime_{gt} + \beta_2 TaxTime_{gt} + \beta_3 TaxBill_{igt} \quad (1) \\
 & + X_{igt}\gamma + \mu_i + \mu_g + \mu_t + \epsilon_{igt}
 \end{aligned}$$

where  $i$  = plane,  $g$  = geographic location (state or local government),  $t$  = date,  $Flights$  = a measure of flight activity,  $TaxBill$  = plane  $i$  value in  $g$  times the tax rate in  $g$ ,  $TaxTime$  = an indicator for assessment time,  $X$  = controls such as weather, and  $\mu$  = fixed effects. The key parameter is  $\beta_1$ , which measures how much flight activity goes up when property tax increase.

The specification can be thought of as either a regression discontinuity or difference-in-difference design. From either perspective, we can think of comparing planes located near the border of a taxing and non-taxing state, comparing planes which are subject to the tax with those that are exempt, or comparing a taxed plane's flights just before/after the assessment date to further off periods. In the case of the West Virginia law change, we can compare business plane flights in the state after the exemption to previous years, compare business plane flights to personal plane flights before and after the exemption, and compare these to comparable differences in other states. The key in all these cases is that there is distinct treatment group (non-exempt planes in a taxing state during the tax period) and control group (otherwise). In addition, there are continuous treatment variables, such as the tax rate (which changes over both jurisdictions and over time within a jurisdiction) or taxable value of the plane (which varies across plane type, over time within a jurisdiction, and between jurisdictions due to differences in assessment systems).

A final issue is concerns about endogeneity. It may be that unobserved factors of flight activity ( $\epsilon$  in the specification) are correlated with the tax bill. For example, plane value might influence flights. But fixed effects largely account for this possibility. Another possibility is that governments take into account tax flights when they set

tax rates (we only have to be concerned about tax rate *changes* due to the fixed effects). But we have already seen that governments do closely monitor airplanes so this is unlikely. In addition, this would be hard to implement since the same property tax rate is used for other forms of personal and sometimes real property and the overlapping taxing jurisdictions would have to coordinate their rates. It is possible to directly account for endogenous tax rates. First, I can refine the *TaxBill* term in the specification to just be an indicator of whether this is a taxing state so the variation in rates is eliminated. Second, I can instrument for the tax rates using characteristics of the property tax system (the timing of reassessment or exemptions up to certain property values) which are primarily set based on real property.

## 3 Data

### 3.1 Sources

There are several data sets which have to be integrated for the analysis. The first step is to assemble a database of annual aircraft tax rates. Planes are taxed as tangible personal property, and the rate is typically the general personal rate. An overlapping set of jurisdictions may levy such taxes, including the state, county, municipality (city, borough, township and other sub-county political sub-divisions), and school districts (unified, secondary and elementary).<sup>4</sup>The database draws from the Lincoln Institute's *Significant Features of Property Tax* (2010), which lists rates at the county and sometimes sub-county level. A variety of state-specific sources is then used to fill in the remaining rates (see Data Appendix). Figure 2 shows an example of the rates for a single state in a single year.

The second step is to determine the taxable values of each plane. This is based on *Aircraft Bluebook Historical Value Reference* (2010) and is discussed in the next sub-section.

The third step is to associate with each plane the set of taxing jurisdictions, and thus the tax rate. Initially various addresses have to be geolocated (determine their longitude and latitude). As described in the last section, some states tax planes based

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<sup>4</sup>In many states single purpose special districts can also levy taxes, but it is not possible to geographically locate all such district and to match them to addresses as described later in this section. I therefore calculate the average rate for each category of special district (safety, fire, sanitation, water, etc) in each county, and then add the sum of these averages to the county rate.

on their location and others base it on the owner's location. Plane locations are based on the airport coordinates in the FAA's *Form 5010: Airport Master Record* (2010) file. The owners' addresses are listed in the FAA's *Aircraft Registry* (various years).<sup>5</sup> Through special arrangement with the FAA, I have copies of this file for each month over the period March 2004 to July 2009. Each file is geocoded using the a three step process and then the coordinates are matched to taxing jurisdictions using the ArcGIS software package and the Census' *TIGER/Line Shapefile* (various years). An example of the output is mapped in Figure 3. The next sub-section discusses this address geocoding procedure in more detail and also its current status.

The final step is to generate a database of plane flights. A log of all general aviation flights in the US for the period January 2004 through July 2009 come from FlightView Inc. These data are generated in the course of normal flight activity when a pilot registers his flight plan with the FAA. The FAA sends a live feed of the flight information to authorized vendors under the Aircraft Situation Display to Industry (ASDI) program. Vendors, such as FlightView, translate the feed into a usable format and remove anomalies (FAA, 2009 provides background on the ASDI program).<sup>6</sup> The final data include the date, the tail number, the aircraft type, the arrival/departure time and airport, and distance between these airports. There are 220k unique planes and 24m flights.

## 3.2 Complications

Some of the data is not yet available in a form amenable to empirical analysis. The three issues listed below will be completed in the next revision of the paper.

Table 1 highlights some of the issues with the local tax rate data. There are several thousand tax units in Texas, Nebraska, Kansas, while there are unusual circumstances

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<sup>5</sup>All plane owners must register their planes with FAA once every three years. These registrations are the basis for the *Aircraft Registry*. Note that the database includes many inactive planes, since the FAA continues to include planes which have not re-registered in their database.

<sup>6</sup>There are two sets of flights which are omitted from this feed. First, a plane owner can select to block his plane from either the general FAA feed or from a specific ASDI vendor database (the procedure is discussed in NBAA, 2010). Second, flight logs are only required under instrument flight rules (IFR) while a pilot can instead fly under visual flight rules (VFR) when weather conditions are favorable and the plane does not fly into certain restricted airspaces. A concern is that pilots may strategically utilize one of these options as a method to evade property taxes. There are reasons to doubt thee possibilities. First, the blocked list is rather small and is largely composed of public figure-owned planes (Grabell and Jones, 2010). Second, the proportion of VFR flights actually decreases in the period just before and after an assessment date in taxing states.

in Nebraska, Virginia and Louisiana. California does not have a centralized database of tax rates (according to its Board of Equalization), so county averages will be used.<sup>7</sup>

A second issue is to determine the taxable value for each airplane. Each plane will be matched to the *Aircraft Bluebook Historical Value Reference* (various years) using its manufacturer, model and manufacturing year. The main difficulties here are accounting for the various assessment systems used in different states (based on retail value, on wholesale value, on depreciation schedules, or some other system), the prevalence of kit and experimental planes, and adjusting for modifications in each aircraft.

The final issue is geocoding addresses. Figure 4 is the flow chart of the process. In the first step the FAA's *Aircraft Registry* address files, which contain over three hundred thousand records, must be converted from pdf to text format. The next step in the second row shows how coordinates for each address are obtained. The full street addresses are matched to a year-specific database in the ArcGIS package, then the zip codes from unmatched addresses are compared to nine-digit zip databases from Maponics and the USPS. The last step, shown in the remaining rows, is to locate the relevant taxing units (state, county, municipality, unified/secondary/elementary school district and additional units in certain states) for each of the matched addresses. Each type of unit must be matched separately using an ArcGIS join to the Census' *TIGER/Line Shapefile* (various years). Roughly 85% of the addresses can be geolocated in this fashion. This process takes roughly a week of processing time for each set of data, and this is not yet complete since there are about sixty sets of addresses (corresponding to each monthly FAA registries).

## 4 Preliminary Results

### 4.1 Johnson County

This section considers the case of one county in detail. The data are compatible with several implications of airplane tax evasion. Still the results here are largely a motivation, since they do not test for the specific tax flight mechanism (the observed

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<sup>7</sup>Proposition 13 limits property tax rates in California to one percent, except when a supermajority of voters approve additional levies for school bonds or facilities. In practice this means there is therefore only small differences in tax rates in the state, and so using county averages omits relatively little variation.

patterns could also result from other means of tax evasion such as owners not reporting their planes even in the absence of evasive flying).

If there is property tax evasion, the number of planes on the tax roll should be far smaller than the number of planes in the area. To examine this in more detail I obtained the tax roll for 2000 to 2008 for Johnson County, KS, an affluent Kansas City suburb with multiple general aviation airports. Table 2 compares the annual number of planes on the county tax roll to the number of plane owners in the county according to the *FAA Registry*. Consistent with the tax evasion story, there are a third fewer planes on the tax roll than on the registry. A caveat is that the registry may overstate the number of planes in the county if owners choose to base their planes in another county (recall that the principle hangar for each plane is not publicly available). But this is not likely to be empirically important (the county is large and airports in adjacent counties are relatively small), and also owners from other counties base their planes there.

The top part of Table 3 shows that half of the planes which were on the tax roll in 2004 remained on the roll in 2008 (almost all of these planes were also on the roll for each of the intervening years). Given the high degree of mobility of plane owners—the bottom part of the table shows less than half remain on the registry during this period—this is consistent with a world in which each owner always pays or never pays.

Planes which are on the roll pay little tax. The top part of Figure 5 shows that over four-fifths of the planes are exempt (business-owned and old planes pay no tax, but still must fill out paper work to be listed on the tax roll). The bottom part shows that even planes paying taxes the median bill is only about \$500, though the average is bigger. This is also consistent with tax evasion, since the relative benefit of avoiding taxes is greater for more valuable planes which would owe the most taxes.

## 4.2 State-level Graphs

Tax flights should lead to different flight patterns at the state-level. There should be an increase in out-of-state traffic just before the assessment date, and an increase in into-the-state traffic just after the date. These effects may be relatively modest since much of the variation in tax rates and plane valuation are lost at the state-level.

Figures 6-10 shows that flight patterns are consistent with tax flights. Figure 6 shows the weekly into-the-state and out-of-the-state traffic for states with an aircraft

property tax. While these two values are almost exactly identical in most weeks, in the week before the assessment outbound flights exceed inbounds and the reverse holds just after the assessment period.<sup>8</sup> This pattern is repeated in each year between 2005 and 2008. The remaining figures show the same comparison for individual states in a single year. The same wedge in the neighborhood of the assessment date is evident.

While this is suggestive of tax flights, at least two steps are needed to draw a conclusion. First, I must show that the same pattern also holds in non-taxing states. Second, I have to show that it is the same planes which are making the outbound and then inbound flight (it is possible that the outbound planes stay out of the state and a separate set of planes fly in to replace them). This will be included in the next revision of the paper.

### 4.3 Preliminary Estimates

Table 4 shows how the sample of flights is constructed. Starting with the full list of 24m flights, about 6m are eliminated due to issues with matching to airports or aircraft types. The resulting set of 18m flights will be referred to as the aggressive sample. Another 7m flights are removed if there are consistency issues with the flight history, such as a departure airport not matching the most recent arrival airport. This sample of 11m flights will be referred to as the conservative sample.

In these initial results the unit of analysis is a flight, and I will test the main implication from Section 2.2: whether there are disproportionate number of out-of-state flights right before or after an assessment period. The dependent variable is an indicator *OutOfState*, which is one if departure state is different than the arrival state, and the key explanatory variables are the indicators *PreTaxTime/PostTaxTime*, that this is the week before/after an assessment date in the state where the plane is currently located. I include interactions with these variables and *EngineType* (this is a discrete, ordered variable and takes on values from 0 to 9, with lower values indicating less sophisticated planes – those using reciprocating engines– and the highest values indicating more sophisticated planes – jets or 4-cycle engines). I report results only for the conservative sample, though the estimates for the aggressive sample are qualitatively similar.

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<sup>8</sup>The figure assumes the assessment date is in week 1, which it is for 16 of the 18 taxing states. The data for the two other states (Alabama and West Virginia) is shifted so that their assessment date lines up with this week.

Table 5 shows the impact in the week before assessment date. The direct effect of the assessment date is negative (first row), indicating fewer out of state flights. But this ignores the interaction effects with engine type. These terms are all positive and increasing (bottom of the table), with the total effect statistically insignificant for less sophisticated planes (those with small valued engine types). For the more sophisticated planes, the effect is positive and economically and statistically significant. This is exactly what the tax flights theory suggests, since the more sophisticated planes have a higher assessed value and so the benefit of avoiding the property tax is greater.<sup>9</sup>

Table 6 shows the analogous estimates for the week after the assessment date. The same pattern emerges. This period has little impact on less sophisticated/lower valued planes, while it does have an economically and statistically significant impact on the more sophisticated/higher valued planes which have the most to gain from tax avoidance.

## 5 Conclusion

The preliminary evidence in this paper suggests that tax flights are a real and economically meaningful phenomenon. In the next revision of this work I hope to provide more specific evidence. In particular I will be making the following additions:

- **more formal estimates of the magnitude of tax flights:** after completing the assembly of the remaining data (local tax rates, approximating each airplane's assessed value, and geocoding the airplane locations), it will be possible to estimate the specifications listed in the text. In particular this will allow me to estimate the increased likelihood of flights during the period just before and after the assessment date for a variety of different cases: taxed versus untaxed planes; high valuation versus low valuation planes; personal-owned taxed planes versus business-owned taxed planes.
- **weather (additional variation in flight patterns):** bad weather such as icy precipitation can force pilots to scrap planned trips, an important possibility

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<sup>9</sup>The largest engine type interactions are missing or slightly smaller than the middle categories. This is because there are very few examples of such planes in the data, e.g. those with ramjet engines.

around the most common assessment date of 1 January. While these conditions can typically be avoided using weather forecasts, sometimes fronts arrive more quickly or slowly than anticipated. I am in the process of assembling a database of actual weather as well as forecasts (three and seven days ahead) from NOAA at the airport-level.

- **validation (additional evidence of tax flights):** the algorithm identifies particular planes which seem to be engaging in tax-related travel. A check on this would be to see if these planes are in fact not paying taxes. I am in the process of obtaining the aircraft tax rolls for counties in the Kansas City-area (there are over a thousand planes in the FAA registry in these counties). For each year I will calculate the proportion of planes making tax flights which are absent from the tax rolls.

These revisions should provide a more precise measure of tax flights. Still there are other strategies which might be used to evade property taxes on airplanes. Owners might strategically hangar their planes in a non-taxing state, an attractive option for those who live near state borders (for example, owners in St. Louis may base planes in Illinois). Another possibility is that owners could put their airplane on the blocked list, which would prevent third parties including tax officials from monitoring their flight patterns. While this list has been private, the FAA is considering make the list private (and at least subsets have been released under Freedom of Information Act requests). Exploring these and other tax evasion strategies are interesting topics for future work.

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## Appendix: Data Sources

### A. State Property Tax Treatment of General Aviation Aircraft

#### 1. National files

- CCH (2009), *2009 US Master Property Tax Tax Guide*, Wolter Kluwer Business. The 2000-2008 editions were also used to determine tax rule changes.
- Conklin & de Decker (2009), *State Tax Guide for General Aviation*. Compact Disc, <https://www.conklindd.com>. The 2003-2008 editions and personal correspondence with Nel Stubbs (Conklin & de Decker VP/Co-Owner) were also used to determine tax rule changes.
- Phil Crowther (2009), *Property Tax: Aircraft and Property Tax Estimates*, personal communication.
- Phil Crowther (undated), *State Taxes of Aviation*, <http://www.nbaa.org/member/admin/taxes/state/StateTaxes.pdf>
- Raymond Speciale (2003), *Aircraft Ownership: A Legal and Tax Guide*, McGraw-Hill.
- National Business Aviation Industry (2010), *NBAA State Aviation Tax Report*, <http://www.nbaa.org/admin/taxes/state/report.php>

#### 2. State Files

- Alabama: *Alabama Department of Revenue: Property Tax FAQ*, <http://www.revenue.alabama.gov/advalorem/faqs.html#pp>; *Alabama Rules and Regulation, 810-4-1-.09, Valuation of aircraft*, <http://www.ador.state.al.us/rules/810-4-1-.09.pdf>
- Alaska: *Property Tax in Alaska: Alaska Taxation and Assessment*, <http://www.commerce.state.ak.us/dca/LOGON/tax/tax-prop.htm>
- Arkansas: Tom Atchley (Excise Tax Administrator)
- California: California State Board of Equalization, *Assessor's Handbook Section 577: Assessment of General Aircraft* (2003), <http://www.boe.ca.gov/>

proptaxes/pdf/ah577final2003.pdf. Note that Proposition 13 did not influence the assessment of personal property tax, which continues to be reassessed annually (see California State Board of Equalization, *California Property Tax: An Overview* (Publication 29, August 2009), <http://boe.ca.gov/proptaxes/pdf/pub29.pdf> and Michael Coleman, *California Local Government Finance Almanac* (2009), <http://www.californiacityfinance.com/#PROPTAX>).

- Georgia: *Property Tax Guide For The Georgia Taxpayer*, <https://etax.dor.ga.gov/PTD/adm/taxguide/gen/assessment.aspx> and *County Ad Valorem Tax Facts*, <https://etax.dor.ga.gov/PTD/county/index.aspx>.
- Kansas: *Kansas Personal Property Summary*, <http://www.ksrevenue.org/pdf/ppsumm.pdf>; *Personal Property Valuation Guide*, <http://www.ksrevenue.org/pdf/PPVG.pdf>; *Kansas Statutes*, <http://www.kslegislature.org/li/statute/>.
- Kentucky: Bill Lawson (Property Tax Division of Kentucky Department of Revenue); various Kentucky tax officials; *Personal Property Tax Forms and Instructions*, <http://revenue.ky.gov/NR/rdonlyres/4BC33A9F-F091-414A-A715-37F3C224482D/0/62A5001109revised21110.pdf>
- Louisiana: *Louisiana Property Tax Basics*, <http://www.lafayetteassessor.com/TopicsPDFs/Louisiana%20Property%20Tax%20Basics%20booklet%203.pdf>; *Louisiana Tax Commission Manual*, [http://www.latax.state.la.us/Menu\\_RulesRegulations/RulesRegulations.aspx](http://www.latax.state.la.us/Menu_RulesRegulations/RulesRegulations.aspx); Paulette Jackson (Louisiana Legislative Auditor's Office)
- Missouri: *Missouri Revised Statutes: Chapter 155 Taxation of Aircraft and Chapter 137 Assessment and Levy of Property Taxes*, <http://www.moga.mo.gov/STATUTES/STATUTES.HTM>
- Nebraska: Elaine Thompson (Tax Specialist Senior, Property Assessment Division, Department of Revenue); Laz Flores (Tax Analyst/Education Coordinator, Property Assessment Division, Department of Revenue); *Property Assessment Division Annual Reports*, [http://www.revenue.ne.gov/PAD/research/annual\\_reports.html](http://www.revenue.ne.gov/PAD/research/annual_reports.html)
- Nevada: *Aircraft Assessment*, <http://www.carson.org/index.aspx?page=1359>; Dave Dawley (Assessor for Carson City)

- North Carolina: *2007 Personal Property Appraisal and Assessment Manual*, [http://www.dornc.com/publications/appraisal\\_assessment.html](http://www.dornc.com/publications/appraisal_assessment.html); *Personal Property Audit Seminar Manual*, [http://www.dornc.com/publications/audit\\_manual.pdf](http://www.dornc.com/publications/audit_manual.pdf); *Cost and Depreciation Schedule*, <http://www.dornc.com/publications/property.html>; Gregg Martin (Property Tax Division of NC Department of Revenue)
- South Carolina: *Homeowner's Guide to Property Taxes in South Carolina*, <http://www.sctax.org/publications/propguid99.html>; Sharon West (Auditor, Spartanburg County)
- Tennessee: *Tennessee Codes Annotated: Title 67 Taxes And Licenses*, <http://www.lexisnexis.com/hottopics/tncode/>; Shannon Tucker (Associate Assessment Analyst, Comptroller of the Treasury, Office of State Assessed Properties)
- Texas: *A Handbook of Texas Property Tax Rules*, <http://www.window.state.tx.us/taxinfo/proptax/proptaxrules.pdf>; *Property Tax Calendar*, <http://www.window.state.tx.us/taxinfo/proptax/taxcalendar/2009calendar.pdf>; *Texas Property Tax Code and Texas Property Tax Laws*, <http://www.window.state.tx.us/taxinfo/proptax/archives.html>
- Virginia: Deborah Midgett (Chief Deputy, Accomack County Commissioner of the Revenue); Steve Kulp (Cooper Center); *Code of Virginia: Title 58.1 - TAXATION. Chapter 35 - Tangible Personal Property, Machinery and Tools and Merchants' Capital*, <http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+T0C58010000035000000000000>
- West Virginia: *Property Taxes*, [http://www.state.wv.us/taxrev/97taxlaws/97tl\\_property.pdf](http://www.state.wv.us/taxrev/97taxlaws/97tl_property.pdf); *West Virginia Tax Laws*, <http://www.state.wv.us/taxrev/publications/taxLawReport.pdf>; *Guide for County Assessors: State of West Virginia*, <http://www.state.wv.us/taxrev/ptdweb/misc/Assessor%20Guide%202007%20.pdf>; *Guidebook to WV Tax (Chapter 6: Property Tax)*, <http://www.jimsturgeon.com/WVTaxGuide/Ch6WVTG2011Final.pdf>; *West Virginia Code: Chapter 11. Taxation*, <http://www.legis.state.wv.us/WVCODE/Code.cfm?chap=11&art=1>.

- Wyoming: David Chapman (Manager of Technical Services Group, Wyoming Department of Revenue Property Tax Division); Joyln Stotts (Appraiser, Wyoming Department of Revenue Property Tax Division); Jeness Saxton (Deputy Assessor, Sublette County Assessor Office); *Tax Information*, [http://www.dot.state.wy.us/wydot/aeronautics/information/frequent\\_questions](http://www.dot.state.wy.us/wydot/aeronautics/information/frequent_questions)

## B. Property Tax Rates

### 1. *National files*

- Partial list of local tax rates: Lincoln Institute (2010). *Significant Features of Property Tax*. George Washington Institute of Public Policy. [http://www.lincolninst.edu/subcenters/significant-features-property-tax/Report\\_TaxRates.aspx](http://www.lincolninst.edu/subcenters/significant-features-property-tax/Report_TaxRates.aspx)
- State average property tax rates on general aviation aircraft: Personal communication from Phil Crowther (2009), Property Tax Estimates.
- Median county property tax rates for 2005-2009: These are 5-year estimates based on data collected between January 2005 and December 2009 (annual values for this period are only available for counties with populations of at least 65,000). The rates are based on variables B25102 (Mortgage Status by Median Real Estate Taxes Paid), B25119 (Median Household Income by Tenure), B25077 (Median Value for Owner-Occupied Housing Unit) in the US Census' *American Community Survey*, [http://factfinder.census.gov/jsp/saff/SAFFInfo.jsp?\\_content=acs\\_guidance\\_2009.html](http://factfinder.census.gov/jsp/saff/SAFFInfo.jsp?_content=acs_guidance_2009.html)

### 2. *State Files*

- Alabama: Alabama Department of Revenue, *County Millage Rates* (various years), <http://www.ador.state.al.us/advalorem/index.html>
- Alaska: Alaska Office of the State Assessor, *Alaska Taxable* (various years), [http://www.dced.state.ak.us/dca/osa/osa\\_home.htm](http://www.dced.state.ak.us/dca/osa/osa_home.htm)

- Arkansas: Arkansas Assessment Coordination Department, *Millage Report* (various years), [http://www.arkansas.gov/acd/statewide\\_values\\_rates.html](http://www.arkansas.gov/acd/statewide_values_rates.html). Taxing Units Value, Rate & Tax (2002-2006), [http://web.archive.org/web/20080906112157/http://www.arkansas.gov/acd/statewide\\_values\\_rates.html](http://web.archive.org/web/20080906112157/http://www.arkansas.gov/acd/statewide_values_rates.html). *1995-2005 Millage Rates*, <http://www.arkansas.gov/acd/publications.html>
- California: California allows sub-county governments to set property tax rates, rates vary over the tens of thousands of tax rate areas (TRAs), but as of 2010 there is no centralized collection of these data nor are all parcels digitally mapped (this was confirmed with Ralph Davis, Research Manager at California's Board of Equalization and with Michael Coleman, Fiscal Policy Advisor, League of California Cities). Instead average rates for each county are used. This is not an unreasonable assumption given the Proposition 13 tax limit, which generally limits total rates to one percent (for example additional taxes can be levied to pay for bonds, so long as a super-majority of local residents approve; see <http://www.boe.ca.gov/proptaxes/faqs/generalinfo.htm#2>). County average rates come from California State Board of Equalization, *Annual Reports* (various years), <http://www.boe.ca.gov/annual/annualrpts.htm>
- Georgia: Georgia Department of Revenue: The Local Government Services Division, *Georgia County Ad Valorem Tax Digest: Millage Rates* (various years), <https://etax.dor.ga.gov/ptd/cds/csheets/millrate.aspx>
- Kansas: League of Kansas Municipalities, *Kansas Tax Rate Book*, (various years), Insert in *Kansas Government Journal* and personal communication (Excel file); *Kansas Township Levies* (2011), personal communication from Peggy Huard (Appraiser II, Abstract Section Division of Property Valuation, Kansas Department of Revenue)
- Kentucky: Department of Revenue: Office of Property Valuation, *Commonwealth of Kentucky Property Tax Rates* (various years), <http://revenue.ky.gov/newsroom/publications.htm>. Tax rates on general aviation were based on conversations with Bill Lawson (Property Tax Division of Kentucky Department of Revenue) and various Kentucky tax officials.

- Louisiana: Office of the Legislative Auditor, *Parish Pension Report* (various years), <http://app1.lla.state.la.us/reassessment.nsf/fmpprr>; Office of the Legislative Auditor, *Maximum Millage Report* (various years), <http://app1.lla.state.la.us/reassessment.nsf/fmMRR>; Louisiana Tax Commission, *Annual/Biennial Report* (various years), [http://www.latax.state.la.us/Menu\\_AnnualReports/AnnualReports.aspx](http://www.latax.state.la.us/Menu_AnnualReports/AnnualReports.aspx) and hard copies. Interpreting the rates in these documents was based on conversations with Paulette Jackson (Louisiana Legislative Auditor’s Office) and Terry Calendar (Louisiana Tax Commission).
- Missouri: Office of the State Auditor, *Review of Property Tax Rates* (various years), <http://www.auditor.mo.gov/auditreports/propertytaxrates.htm>
- Nebraska: *Nebraska Reference List of Taxing Entities, by county, for years 2001 to 2009 (Excel file)*, personal communication from Elaine Thompson (Tax Specialist Senior, Property Assessment Division, Department of Revenue); *Nebraska Average Tax Rates, value & taxes, by county, for years 1993 to 2009 (Excel file)*, personal communication from Elaine Thompson; Property Assessment Division, *Annual Reports* (various years), [http://www.revenue.ne.gov/PAD/research/annual\\_reports.html](http://www.revenue.ne.gov/PAD/research/annual_reports.html).
- Nevada: Nevada Department of Taxation, *Property Tax Rates for Nevada Local Governments (“Nevada Redbook”) (Excel file)* (various years), personal communication from Tom Gransbery (Division of Assessment Standards).
- North Carolina: North Carolina Department of Revenue, *County and Municipal Property Tax Rates and Year of Most Recent Revaluation* (various years), <http://www.dornc.com/publications/propertyrates.html>.
- South Carolina: South Carolina Association of Counties, *Property Tax Rates By County in South Carolina* (various years), <http://sccommerce.com/data-resources>.
- Tennessee: Tennessee Comptroller of the Treasury: Division of Property Assessments, *Tennessee Property Tax Rates* (various years), <http://www.comptroller1.state.tn.us/PAnew/>.
- Texas: Texas Comptroller of Public Accounts, *County and ISD Tax Rates by County* (various years), <http://www.window.state.tx.us/taxinfo/proptax/>;

Texas Comptroller of Public Accounts, *Annual Property Tax Report* (various years), <http://www.window.state.tx.us/taxinfo/proptax/archives.html>; Texas Comptroller of Public Accounts, *Property Tax Rates by County (Excel file)* (various years), <http://www.window.state.tx.us/taxinfo/proptax/archives.html>; *Rates and Levies* (various years), personal communication from Dawn Albright (Open Records Coordinator, Property Tax Assistance Division, Texas Comptroller of Public Accounts).

- Virginia: Weldon Cooper Center for Economic and Policy Studies, *Virginia Local Tax Rates* (various years), <http://www.coopercenter.org/econ/taxrates>; personal communication from Steve Kulp (Cooper Center).
- West Virginia: Local Government Services Division of the West Virginia State Auditor's Office, *Rates of Levy: State, County, School and Municipal* (various years), <http://www.wvsao.gov/localgovernment/Reports.aspx> and personal communication from Joyce Ferrebee (West Virginia State Auditor's Office).
- Wyoming: Wyoming Department of Revenue, *Property Tax Mill Levy by Tax District* (various years), <http://revenue.state.wy.us/PortalVBVS/DesktopDefault.aspx?tabindex=2&tabid=10>; Wyoming CAMA, *Wyoming Tax District Information: Map & GIS Data* (various years), [http://cama.wyoming.gov/DISTRICTS/MAPS\\_ONLINEDOCUMENTS/ShowMAPS\\_ONLINEDOCUMENTSTable.aspx](http://cama.wyoming.gov/DISTRICTS/MAPS_ONLINEDOCUMENTS/ShowMAPS_ONLINEDOCUMENTSTable.aspx); Ad Valorem Tax Division of the Wyoming Department of Revenue, *Tax District Booklet* (various years), personal communication from David Chapman (Manager of Technical Services Group, Wyoming Department of Revenue Property Tax Division).

## C. Aircraft Valuation

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Aircraft Bluebook Price Digest (2009), *Aircraft Bluebook Online* and *Historical Value Reference*, <http://www.aircraftbluebook.com>

## D. Kansas City Metropolitan Tax Rolls

- Ryan Kath (2011), Various Missouri county tax rolls used for “Investigation finds dozens of plane owners not paying taxes, costing local governments big bucks”, personal communication.
- Douglas County, KS: Karla Grosdidier (2011), Personal Property Appraiser Douglas County Appraisers Office, personal communication.
- Johnson County, KS: Cynthia Dunham (2009), Assistant County Counselor Johnson County Legal Department, personal communication.
- Wyandotte County, KS: Wyandotte Treasurer office (2009), personal communication.
- Cass County, MO: Tammy (2011), Cass County Collector office, personal communication.
- Clay County, MO: scrapes from Clay County Collector website (2011), <http://collector.claycogov.com>
- Jackson County, MO: Dan Ferguson (2011), Public Information Officer, personal communication.
- Platte County, MO: Mary Simpson (2011), Platte County Assessor’s Office, personal communication.

**Table 1: Difficulties with Tax Rate Data**

State	Number Taxing Units*	Issues
Texas	2798	
Nebraska	2420-3033	number/names vary over time (government consolidation)
Kansas	2566	
Virginia	505	assessment system varies by county
Louisiana	532	rate variation within school district
California	tens of thousands	No central database of TRA (tax rate area) rates

\*Number taxing units excludes special districts (which cannot be geocode)

**Table 2: Missing Planes in Johnson County, KS**

Year	Tax Roll Planes	FAA Registry Planes*
2008	399	656
2005	445	679
2004	418	629
2002	416	NA
2001	397	NA
2000	411	NA

\*FAA Registries only available back to 2004; Registry totals based on owners who resides in the county

**Table 3: Transition Matrices in Johnson County, KS**

**a. Tax Rolls**

		2008	
		Not on tax roll	On tax roll
2004	Not on tax roll		120
	On tax roll	139	282

**b. FAA Registries\***

		2008	
		Not in registry	In registry
2004	Not in registry		236
	In registry	210	370

\*Omits planes in which ownership or plane model changes (N=74)

**Table 4: Constructing Flight Sample**

Description	Sample Size (Number of flights)
<b>Initial Sample</b>	<b>24,581,002</b>
LESS: Airports listed as “?” or “ZZZZ”	(367,188)
LESS: Unmatched airport codes	(365,335)
LESS: Unmatched aircraft info	(5,827,566)*
<b>“Aggressive” sample</b>	<b>18,093,626</b>
LESS: Problem Data (bad time, bad distance, or discontinuity)	(7,391,084)
<b>“Conservative” sample</b>	<b>10,702,542</b>

\*72,713 overlap with omitted observations above

Table 5: Out-of-State Flights (conservative sample)

logit OutOfState PreTaxTime PreTaxTime#EngineType if  
 UnmatchedApt==0 & MissingAircraftInfo==0 & Problem==0

note: 0.PreTaxTime#9.EngineType != 0 predicts failure perfectly  
 0.PreTaxTime#9.EngineType dropped and 1 obs not used

note: 1.PreTaxTime#6.EngineType identifies no observations in the sample  
 note: 1.PreTaxTime#8.EngineType omitted because of collinearity  
 note: 1.PreTaxTime#9.EngineType identifies no observations in the sample

Iteration 0: log likelihood = -8563879.8  
 Iteration 1: log likelihood = -8224200.9  
 Iteration 2: log likelihood = -8220764  
 Iteration 3: log likelihood = -8220762.4  
 Iteration 4: log likelihood = -8220762.4

Logistic regression	Number of obs	=	13324576
	LR chi2(16)	=	686234.82
	Prob > chi2	=	0.0000
	Pseudo R2	=	0.0401

Log likelihood = -8220762.4

OutOfState	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
PreTaxTime	-.5424939	.0761013	-7.13	0.000	-.6916498 - .393338
PreTaxTime# EngineType					
0 1	-.2490996	.0255513	-9.75	0.000	-.2991792 - .19902
0 2	.0885571	.0255693	3.46	0.001	.0384422 .138672
0 3	.1306075	.0276055	4.73	0.000	.0765018 .1847133
0 4	.7860724	.0258716	30.38	0.000	.735365 .8367797
0 5	.851367	.0255638	33.30	0.000	.8012629 .9014712
0 6	.2097205	1.225011	0.17	0.864	-2.191257 2.610698
0 7	.0232863	.0280819	0.83	0.407	-.0317533 .0783259
0 8	-.8448231	.0261502	-32.31	0.000	-.8960765 -.7935696
0 9	(empty)				
1 0	.7930364	.3584307	2.21	0.027	.090525 1.495548
1 1	.4314563	.0724432	5.96	0.000	.2894703 .5734424
1 2	.6394864	.0735222	8.70	0.000	.4953856 .7835873
1 3	1.298758	.185595	7.00	0.000	.9349987 1.662518
1 4	1.340698	.0883857	15.17	0.000	1.167465 1.513931
1 5	1.24595	.0733751	16.98	0.000	1.102137 1.389763
1 6	(empty)				
1 7	.8995391	.1669179	5.39	0.000	.572386 1.226692
1 8	(omitted)				
1 9	(empty)				
_cons	.4834266	.0255371	18.93	0.000	.4333748 .5334785



Figure 1: State Tax Policies

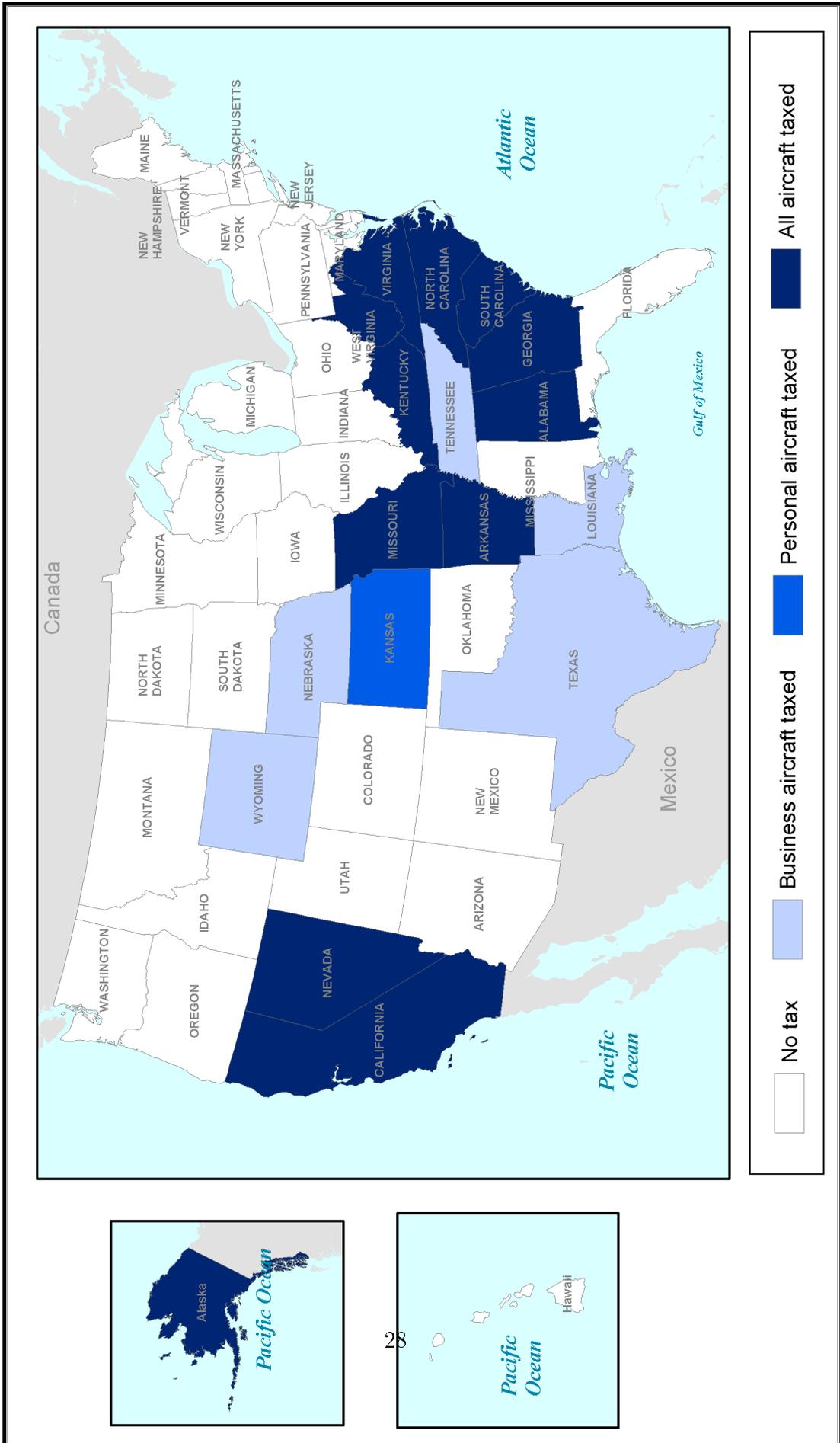


Figure 2: Texas: Tax Units and 2009 Property Tax Rates

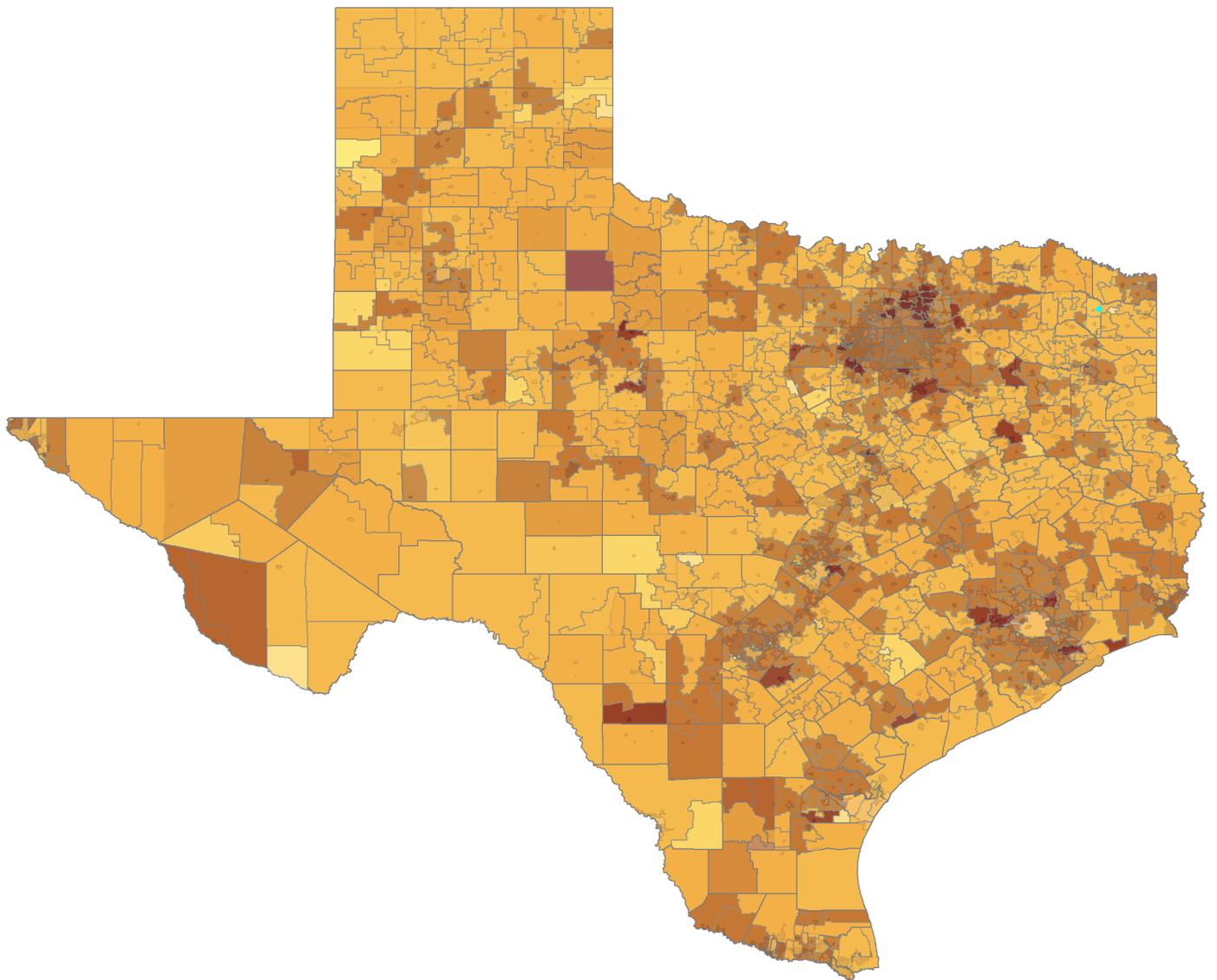


Figure 3: Texas: Geocoded Airports

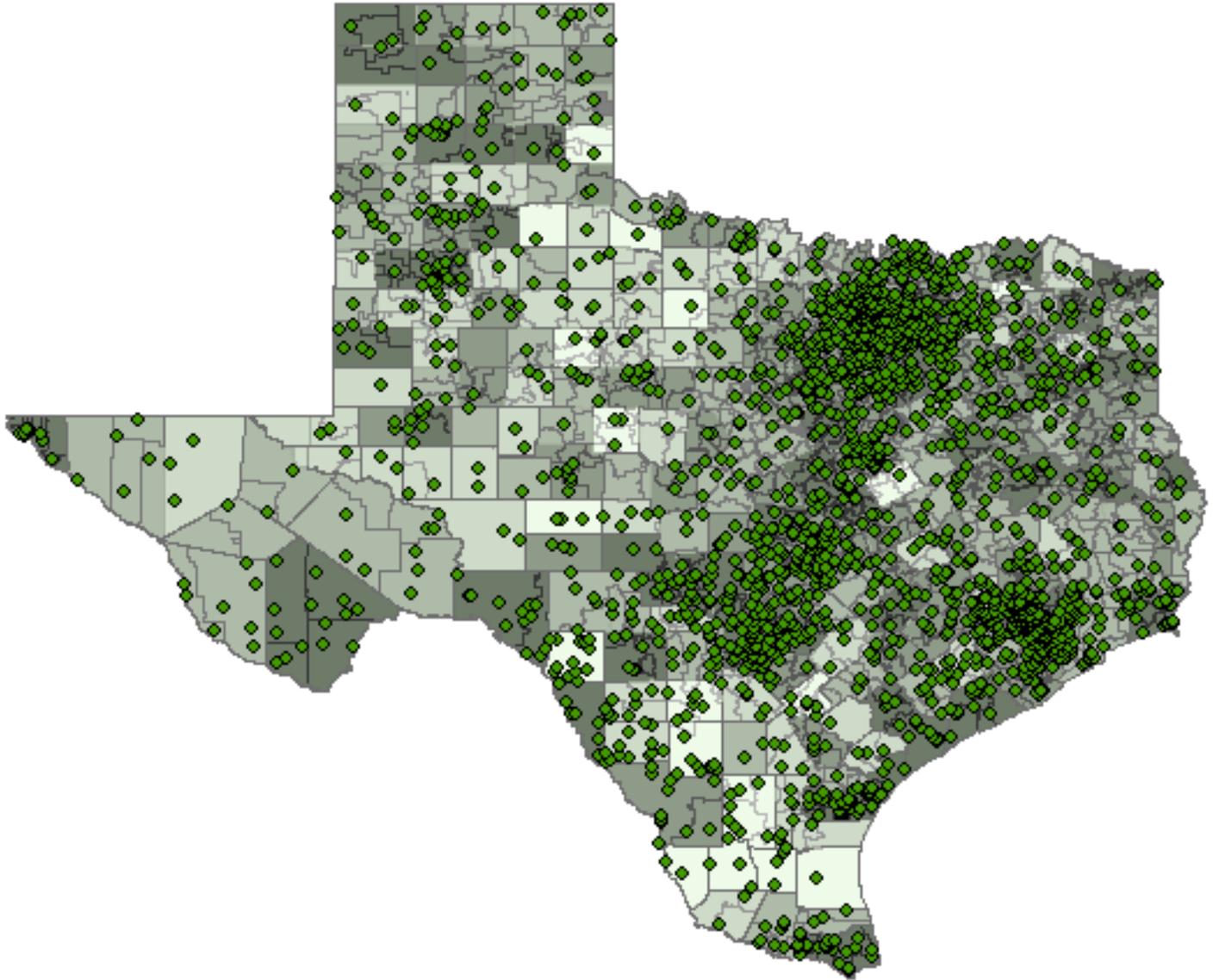


Figure 4: Geocoding Flow Chart

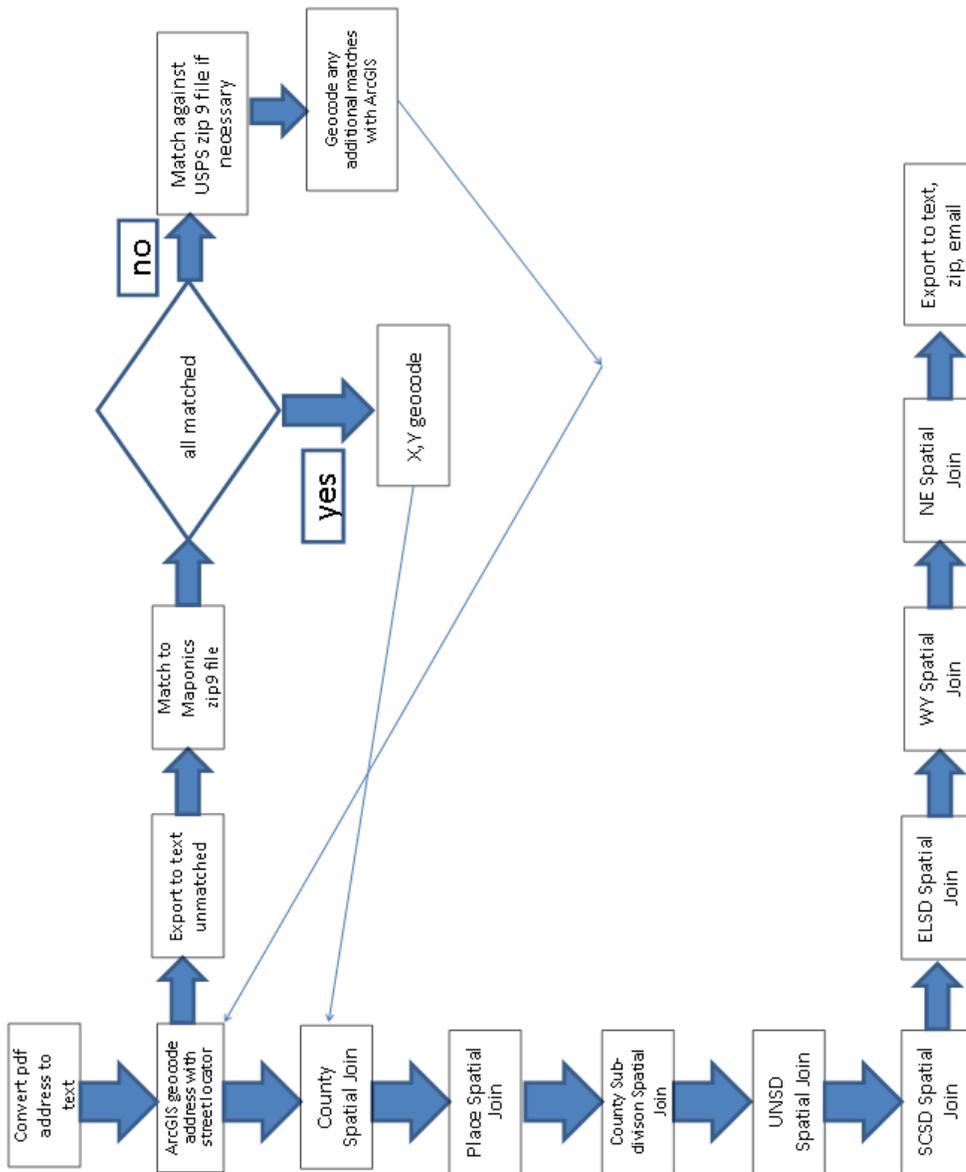
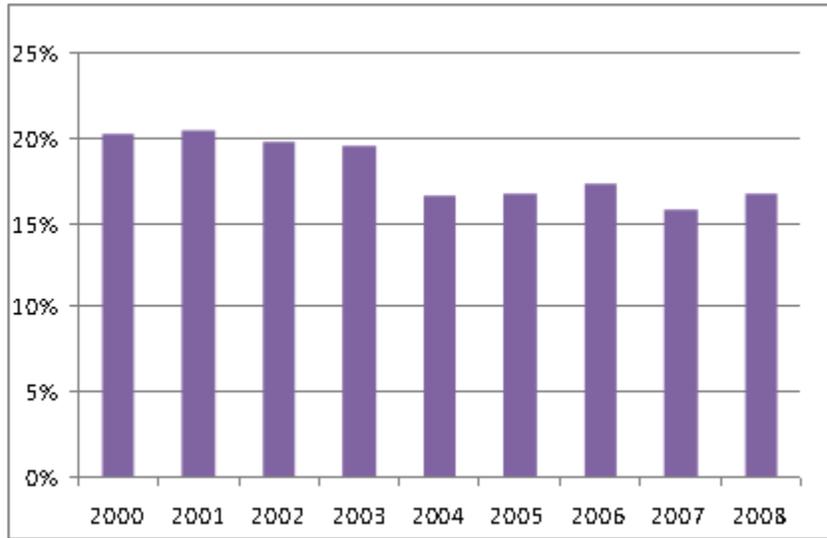


Figure 5: Johnson County Tax Roll

a. Percent non-exempt (paying any tax)



b. Tax bill (conditional on non-exempt)

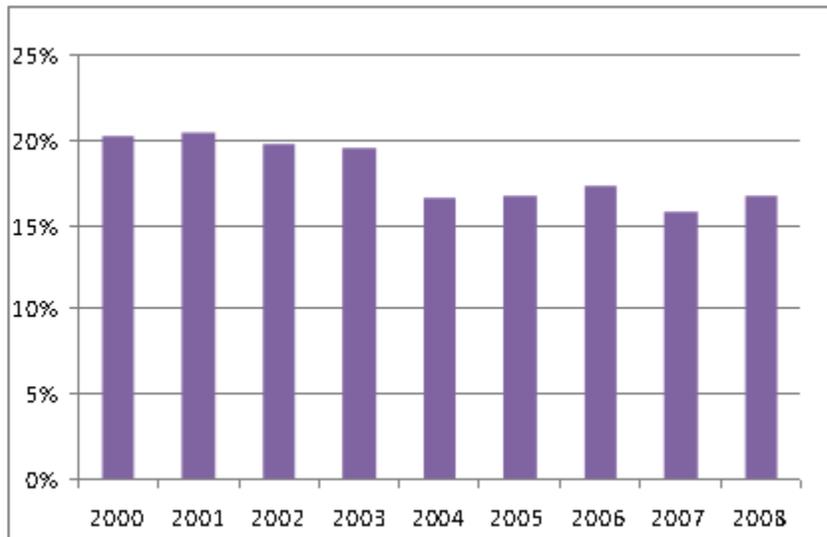


Figure 6: Taxing States - Flights In Neighborhood of Assessment Date

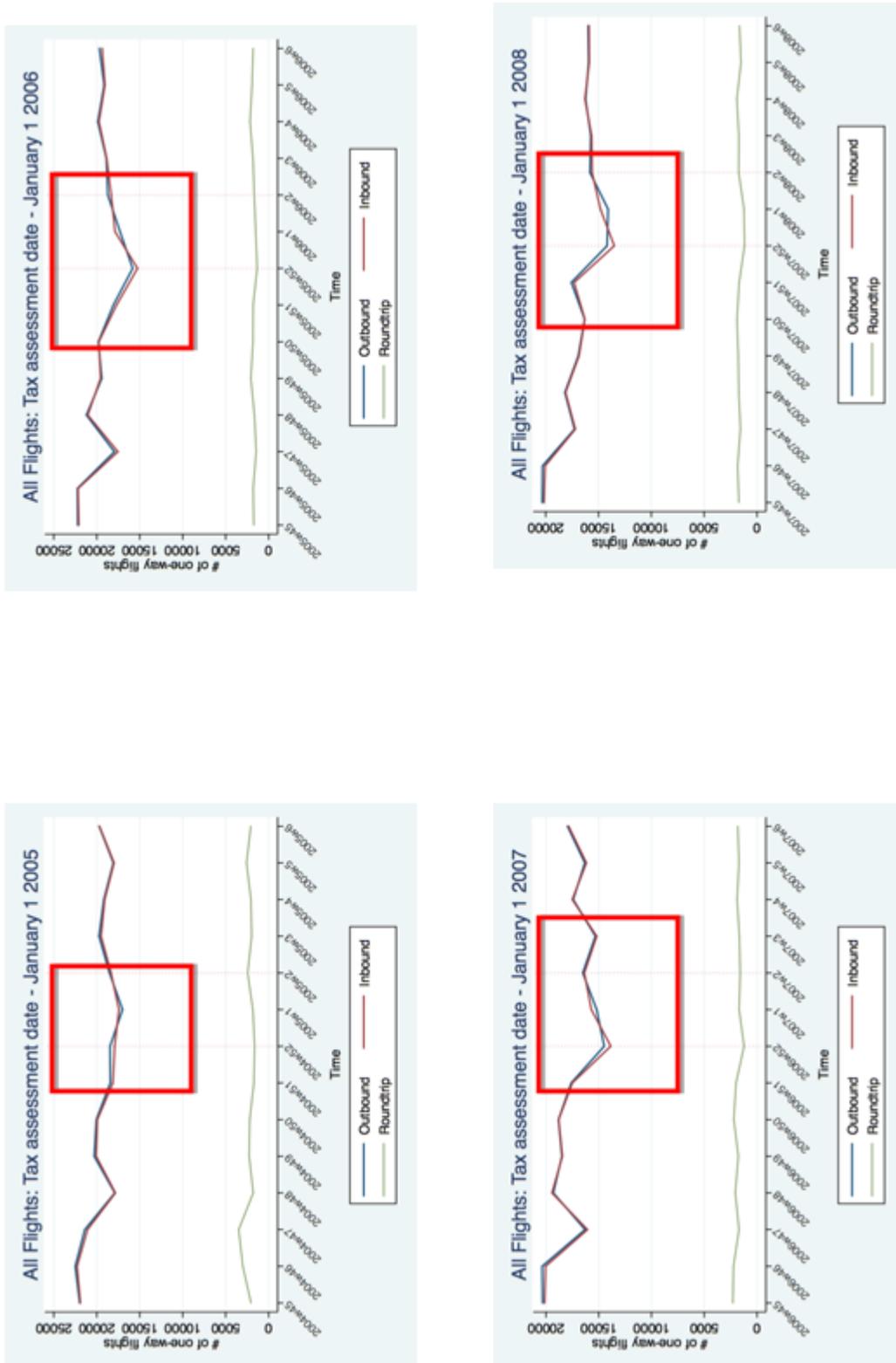


Figure 7: Kansas - Flights In Neighborhood of Assessment Date

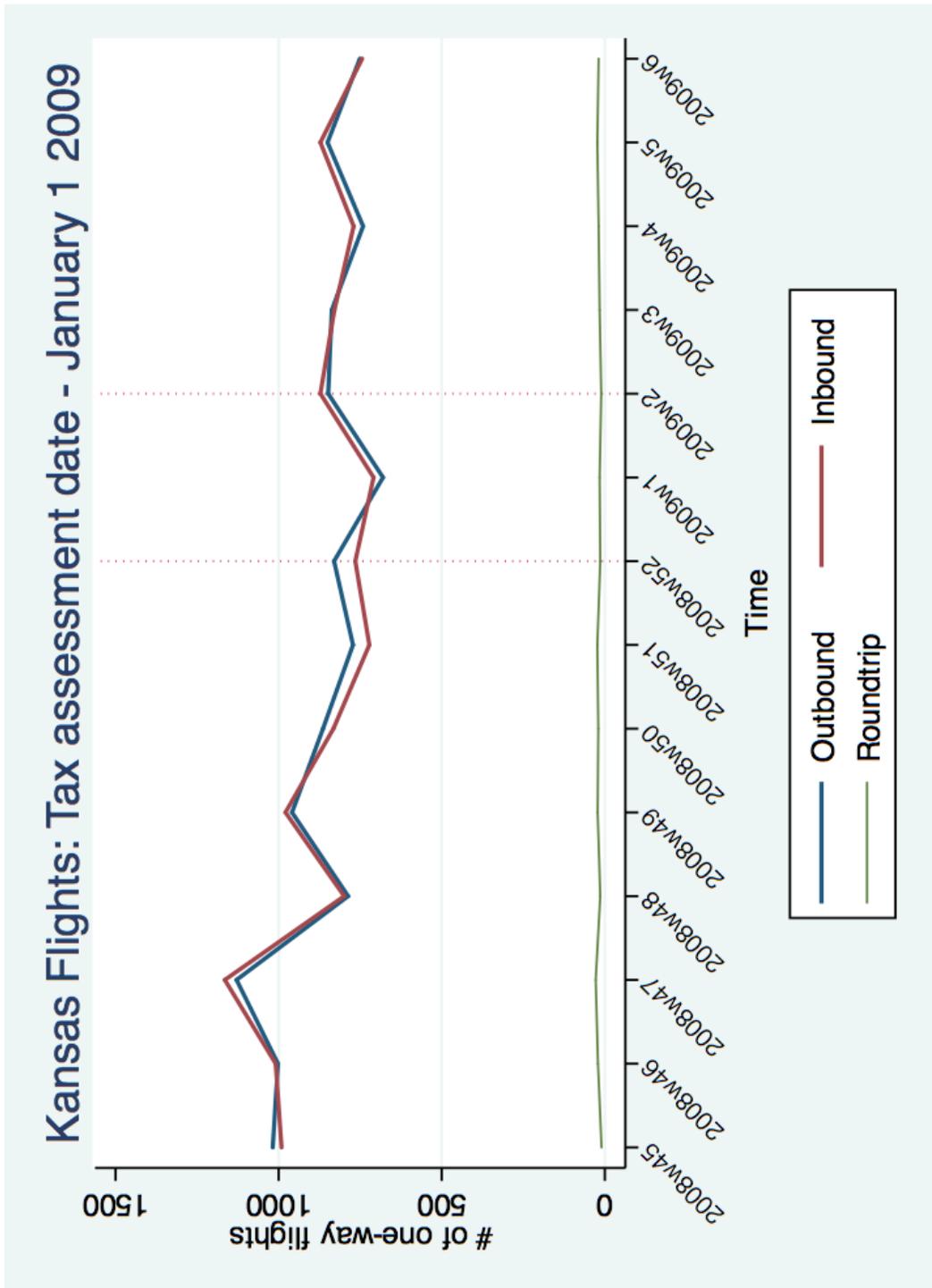


Figure 8: Kentucky - Flights In Neighborhood of Assessment Date

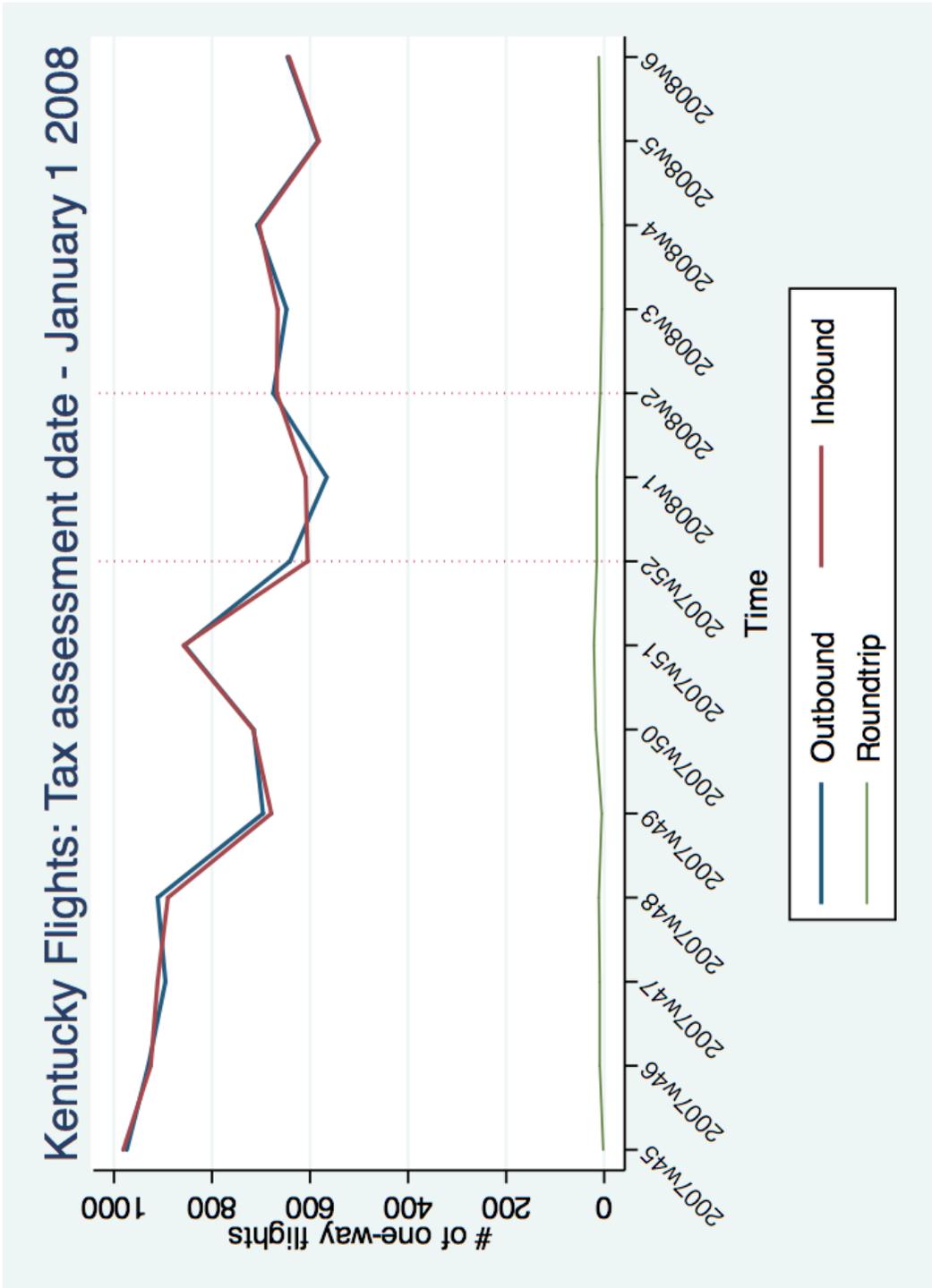


Figure 9: Texas - Flights In Neighborhood of Assessment Date

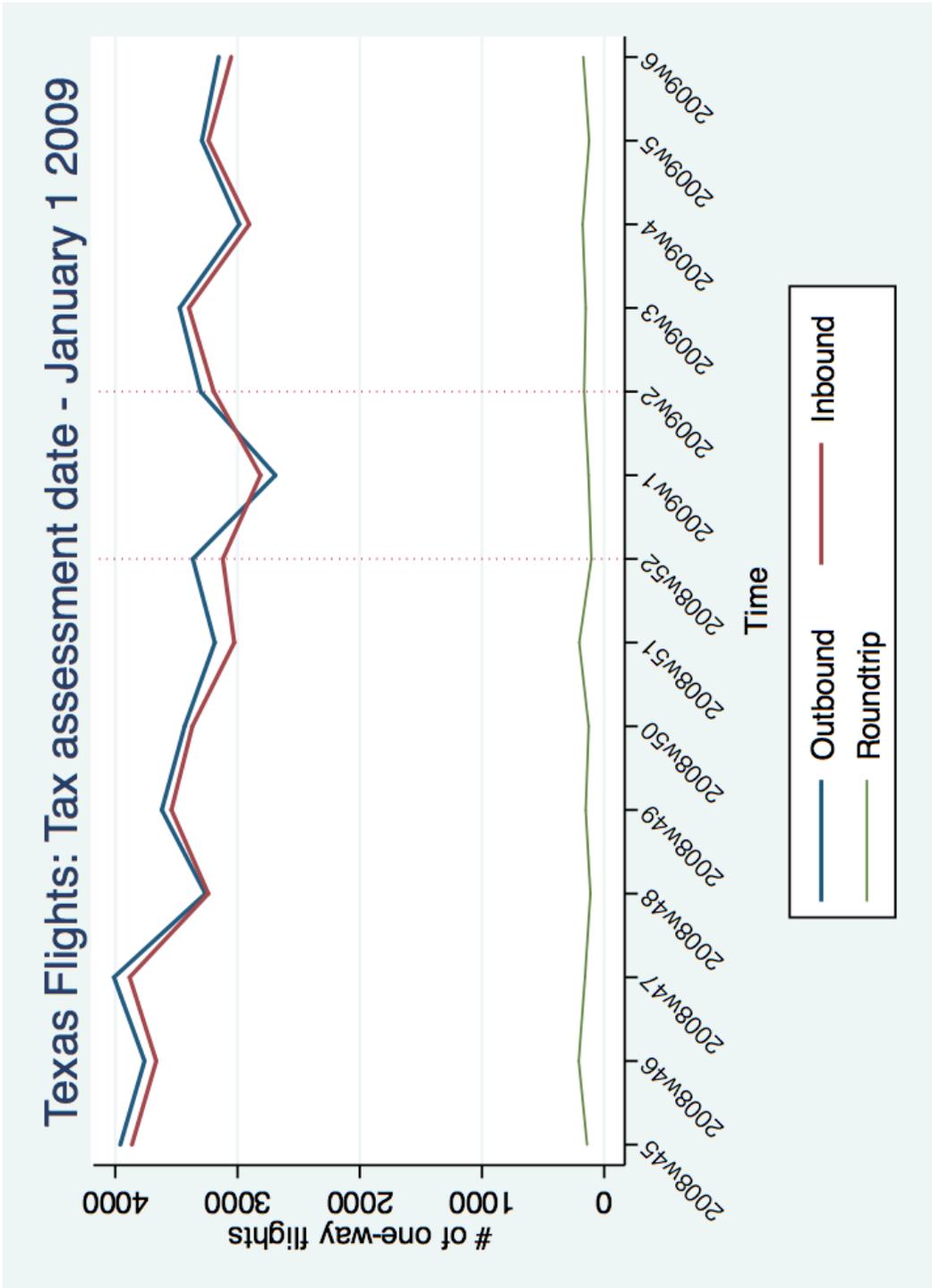


Figure 10: California - Flights In Neighborhood of Assessment Date

