Taxable Property Values: Exploring the Feasibility of a Survey

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Abstract

In 2007, the Committee on National Statistics evaluated Governments Division programs and recommended that the Division "carry out a program of research and testing to explore conceptually sound and cost-effective means of collecting data on taxable property values". The Governments Division of the U.S. Census Bureau initiated a study to determine the feasibility of collecting and producing national statistics on taxable property values. One of the first aspects of the feasibility study was to examine options for data collection that meet statistical standards. We evaluated the availability and quality of data from a third party vendor, direct collection from local jurisdictions, and local jurisdiction websites. To evaluate the quality and availability of data from direct collection and local jurisdiction websites, a sample of local jurisdictions representing small, medium, and large governments from each of the 50 states was selected for both assessment and recorder of deeds offices. The insights provided by the jurisdictions, along with the evaluation of the other data collection methods helped us to understand the complexity of the multiple facets of developing a survey of taxable property values. This paper presents the analysis and summarizes our findings on the feasibility study of data collection methods.

1. Introduction

Property tax is a principal revenue source of local governments in the United States, and acts as a critical means for the self sustainability and autonomy of these governments. According to the Census Bureau's 2008 State and Local Government Finance data, property taxes were the largest revenue source at the local level, amounting to $397.0 billion[1] or 72.3 percent of total local tax collection. In comparison, sales and gross receipts comprised only 16.4 percent and personal income taxes comprised 4.8 percent of local government tax revenue. Additionally, property tax made up 30.8 percent of all tax collected for general purpose governments and 64.2 percent of the total revenue for school districts in 2008. Understanding the property tax base is a key component in understanding local government financing roles and intergovernmental relationships.

Currently, no comprehensive data source exists that summarizes the taxable property in the United States. Similarly, no source can compare the property tax base and assessment quality of property tax values across states. To better understand the capacity of the property tax base, the Governments Division of the Census Bureau completed an investigation of methods for collecting data similar to the data collected by the former Taxable Property Values (TPV) surveys. This research study explores the feasibility of a new incarnation of TPV that could provide some configuration of taxable property products similar to the former Census Bureau surveys.

The primary objective of this feasibility study was to examine options for taxable property value data collection that could meet Census Bureau statistical quality standards within applicable resource limits. To do so, we evaluated the quality and availability of data from third party vendors, data collected directly from jurisdictions, and data obtained from jurisdiction websites. This paper presents the analysis and summarizes findings on the feasibility of producing taxable property value statistics using data from these three sources.

2. Background

Data on taxable property values were originally compiled by the Census Bureau every ten years, starting with the 1850 Census. From 1957 through 1992, these data were compiled every five years by the Taxable Property Value (TPV) survey, as part of the Census of Governments. The TPV survey originally consisted of two parts: No 1,

1 For more information see: http://www.census.gov/govs/estimate/

Assessed Valuations for Local General Property Taxation, and No 2, *Taxable Real Property Assessment/Sales Price Ratios*. Cost, resource, and quality issues eventually led to a scaling down, and then elimination of the TPV survey. The 1982 version was the last comprehensive TPV survey; after 1982, resource constraints limited the amount of data produced by the TPV survey. In 1987, only the assessed valuations data for local general property taxation and use class information were published. By 1992, only statistics on the official values of property were reported. After 1992, the TPV survey was discontinued.

Though Governments Division has not published taxable property products in nearly twenty years, outreach operations and literature reviews have indicated continued interest among data users in these products. In 2007, the National Research Council Committee on National Statistics evaluated the programs in the Governments Division and addressed the elimination of the TPV survey in their findings. Though budget constraints were acknowledged as a major stumbling block, the panel also recommended that the Governments Division explore the possibility of reinstating some form of the TPV survey. Specifically, the recommendation stated:

> In view of the importance of consistent, comparable, objective data on property tax valuation and other features of property taxation by state and local governments, the Governments Division should carry out a program of research and testing to explore conceptually sound and cost effective means of collecting data, which could be in conjunction with, or independent from, the Census of Governments.[2]

Based on this recommendation and the interest among data users, Governments Division initiated a feasibility study on reinstatement of the TPV survey. The feasibility study explored data collection options for resumption of TPV survey activities, which included direct collection from local jurisdictions, data from jurisdiction websites, and data provided by third party vendors. Data collection options were evaluated by availability, resource requirements and data quality, or compliance with Census Bureau's statistical quality standards.

3. Sample Design

Research activities for this feasibility study were organized in phases that were based on data collection options. Thus, phase one was devoted to jurisdiction website research, phase two examined direct collection from jurisdictions, and phase three evaluated third party data options. Phase four of this study included a comparison study that evaluated how closely data from the selected third party vendor matched with data collected directly from local jurisdictions. The methodology, results and analysis for all four phases are discussed in the following sections.

The Governments Division maintains a master list of government organizations in the U.S., which includes all counties, municipalities, and townships for each state. Using this master list, a universe of all assessment and deeds jurisdictions was created for each state.

For the direct collection phase, samples were drawn from both the assessment and deeds jurisdiction universes. The two universes included state information with population as the size variable. Both deeds and assessment samples used an identical design: each universe was stratified by state and then stratified by size into small, medium, and large offices. Initially, states were to be stratified by size using the cumulative square root of the frequency method. However, due to the highly skewed positive characteristics of the sample data, this approach was eventually dropped in favor of a geometric method for stratum boundaries. As explained by Gunning and Horgan (2006), the cumulative square root method is not always appropriate for highly skewed positive data, and a geometric method can serve as an alternative approach for these situations.

Once both universes were stratified by state and size, a simple random sample was drawn, with one observation taken from each stratum. The two stage stratified sample design yielded approximately 300 units in the sample (50 states * 3 size strata * 2 universes). The purpose of this sample design was not to get estimates, but to yield

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representation from all states and jurisdiction sizes to see if there are differences between the vendor and jurisdiction records at any sizes. The sample size for this study was limited due to resource considerations.

The sample design for the jurisdiction website data collection phase was very similar to that used for the direct collection. For website data collection, the assessment and deeds universes were broken into only two sized based strata (small and large) rather than three to decrease burden on analysts. This two-stage stratified sample design yielded approximately 200 units in the sample.

4. Phase One: Website Data Collection

This phase of the feasibility study evaluated the possibility of collecting data for a Taxable Property Values survey directly from government jurisdiction websites. Since the TPV survey was discontinued in 1992, the Internet has emerged as an important new mode of data collection. Local government websites offer much promise to decrease survey costs and respondent burden and also alleviate other constraints associated with the historical TPV survey. Local government website data collection was evaluated by testing a sample of tax assessment and sales jurisdictions for availability and data quality.

4.1 Methodology

The sample design used to evaluate jurisdiction website data collection is described in Section 3. National samples were drawn for both assessment and deeds jurisdictions. For all 50 states and the District of Columbia, a small and a large jurisdiction were selected from both the assessments and deeds universes. Thus, one sample included 101 assessment jurisdictions and the other sample included 101 deeds jurisdictions.

Our objective was to find websites for all 202 local jurisdictions included in the two samples and then determine whether the relevant data for a TPV survey were accessible and usable. All selected jurisdictions were searched to confirm if a general purpose website existed. If a general government website was found, analysts then attempted to identify specific information about the local assessor or deeds office.

For each selected jurisdiction, analysts searched for online property databases with relevant assessment or sales data from related websites (general purpose government websites, assessment office websites, deeds office websites). It was expected that when data were available, it would be in one of two forms: a searchable database or a database with a full listing of assessments or sales data for all properties. For jurisdictions in the assessment sample, the local assessor's website was used to evaluate data accessibility and usability. In the deeds sample, websites for various local departments and offices had to be searched due to inconsistencies with which local organization was responsible for collecting sales data across jurisdictions. For example, in some jurisdictions, the county clerk is responsible for sales data, while in others, a register of deeds would be responsible.

For all selected jurisdictions, analysts searched for the most direct level of government first. Thus, if a sampled jurisdiction was a county government, then the county website was searched first. Similarly, if a sampled jurisdiction was a township or borough, this level of government was searched first. If relevant online data records were unavailable for the lowest level, analysts searched for them at the next highest government level. For example, if a sampled jurisdiction was a township government and online data records were not available at the township website, then the county government website would be searched.

To meet all the requirements for a TPV survey, jurisdiction websites must: (i) offer complete database access, (ii) have sufficient data content, and (iii) provide data in a useable format. Only jurisdiction websites that provide access to assessment/sales data for all properties would be considered "complete database access" websites. To offer sufficient content, a jurisdiction website must include an assessment/sales date, a matching mechanism (i.e., assessor parcel numbers, name/address combinations), designation of use class, and the assessment/sales value with all data records. To meet the usable format requirement, jurisdiction websites must provide complete data that can be downloaded in an Excel spreadsheet or text files.

Note that these requirements for a TPV survey would have to be met both for current year and historical (one year prior) data. Jurisdiction websites would need to provide historical data for a TPV survey because we anticipate publishing TPV data products one year behind current year (real-time) data. Delays of one year or longer are

common for Governments Division surveys, due to differences in fiscal year end dates across jurisdictions. The extra time ensures all state and local jurisdictions have completed data processing and allows for flexibility in meeting data collection objectives.

4.2 Results

The results of the website data collection phase of the feasibility study are given in Table 1.

Table 1. Website Data Collection Results

	Assessments	Sales
Data Available Online:		
Small	34	18
Large	38	22
Total	73*	41*
Data by Parcel Search:		
Small	27	13
Large	31	20
Total	59*	34*
Complete Database Access:		
Small	7	9**
Large	7	8**
Total	14	18***
Complete Database with Sufficient Detail:		
Small	5	3
Large	4	2
Total	9	6*
Data in a Usable Format:		
Small	4	3
Large	1	2
Total	5	5
Complete Database with Sufficient Detail in a Usable Format (both Current and Historical Data):		
Small	0	1
Large	0	1
Total	0	2

*including Washington, D.C.
**Values include date range searchable databases
*** Value includes date range searchable databases and Washington, D.C.

Appropriate jurisdiction websites were found for a total of 99 of the 101 units in the assessments sample and 96 of the 101 units in the sales sample. Online assessment data were available for 73 of 101 sampled jurisdictions, while online sales data were available for only 41 of 101 sampled jurisdictions. For both assessment and sales samples, jurisdictions with online data were nearly equally divided between the small and large size categories.

4.3 Discussion

Of the 73 assessment jurisdictions with online data, 59 had searchable databases; of the 41 sales jurisdictions with online data, 34 had searchable databases. The jurisdiction websites with searchable databases required some form of parcel information, such as a parcel identifier or address, to be entered as the search criteria. Though this type of search capability could be useful for a small number of records, it would not be an option for a renewed TPV survey, because it lacks the required scale that could provide comprehensive data for one request (i.e., assessment data for all parcels in a jurisdiction).

A total of 14 jurisdiction websites in the assessment sample and 18 jurisdictions in the sales sample offered complete database access. Nine assessment jurisdiction websites and six sales jurisdiction websites could provide complete database access with sufficient content. Most often, missing use class designations disqualified sampled jurisdictions from offering sufficient content, both for assessment and sales data. Only five jurisdiction websites in both the assessment and sales samples could provide complete database access to current year data (2011) with sufficient content in a usable format. When historical data were taken into account, only two sales jurisdiction websites could meet all requirements for a TPV survey; none of the jurisdiction websites in the assessments sample could meet all the requirements.

Based on these findings, local government websites would be an unsuitable data collection option for a TPV survey. At best, online data resources may be useful for checking small groups of records or for verification purposes during TPV survey activities.

5. Phase Two: Direct Data Collection from Local Governments

The feasibility study evaluated direct data collection from local jurisdictions as another option for a TPV survey. Though third party vendors offer promise as a comprehensive data source, a TPV survey would also make use of direct data collection in some situations. In particular, direct data collection would be required to obtain sales data from jurisdictions in non-disclosure states, or both assessment and sales data from jurisdictions in rural areas that could not be covered by any other alternatives.

5.1 Methodology

Without established relationships in the sampled jurisdictions, analysts conducted internet research to identify basic contact information (addressee, postal address) prior to the initial data request. Request letters sent to assessment jurisdictions included an explanation of the TPV feasibility study and instructions for submitting data. The request letter asked for calendar year 2009 data including, but not limited to, the following variables: parcel ID number, 2009 gross assessed value of land and improvements, valuation date, property use class, parcel address, and property owner name. Request letters sent to deeds jurisdictions were very similar to those sent to assessment jurisdictions and asked for 2009 data including, but not limited to, the following variables: parcel ID number, 2009 sales amount, sales date, parcel property address, parcel owner (buyer) name, and deed type.

The request letters were mailed out to all sampled jurisdictions on March 4, 2011 and asked for data by April 15, 2011. A telephone help line and a website account were created to assist respondents with any questions or concerns. Additionally, a File Transfer Protocol (FTP) site was developed as the primary option for jurisdictions to provide data, although data were accepted in any format.

5.2 Results

In response to request letters, 13.2 percent of assessment jurisdictions and 26.4 percent of deeds jurisdictions provided data within the requested two week period. Two weeks after the initial request, non-response follow-up activities began. In most cases, follow-up contact with non-responding jurisdictions was conducted with phone calls, but email was more effective in some situations. A lack of established relationships with sampled local governments slowed non-response efforts, as multiple follow-ups were often necessary to identify the person that could provide the requested data. After four weeks of non-response follow-up, 51.7 percent of sampled assessment jurisdictions and 43.0 percent of sampled deeds jurisdictions had provided data. Of the 151 assessment jurisdictions contacted, 123 received non-response attempts, and only 78 provided data. Of the 151 deeds jurisdictions contacted, only 65 supplied data, while 21 declined to participate due to nondisclosure policies.

5.3 Discussion

Non-response was the most frequent cause of missing data for sampled jurisdictions. Non-respondents included jurisdictions that did not reply to multiple follow-up attempts, jurisdictions that agreed to participate but did not send data, and jurisdictions that refused to participate. Most refusals came from sampled jurisdictions in states with non-disclosure policies; five jurisdictions refused that were not in non-disclosure states. Reasons for refusals

ranged from lack of resources, the voluntary nature of the request, and questions about the Census Bureau's authority to collect sales data.

Costs associated with providing jurisdiction data also led to missing data. While planning the feasibility study, we anticipated some jurisdictions would charge a fee for providing data. During the direct data collection, fourteen jurisdictions quoted a cost for purchase of data, ranging from $60 to $3,000. Due to complications with payment processing, no jurisdictions were paid for providing data. Three jurisdictions opted to supply data without payment, while the others declined to do so.

Timeliness was also a cause of missing data. During non-response follow-up activities, a number of jurisdictions were willing to participate, but could not provide data in the requested time period due to limited resources and high activity levels for tax reassessments. In other situations, jurisdictions could only provide current year (2010) data, rather than the 2009 data that was requested.

Two sampled jurisdictions in rural areas could not provide data in electronic format as originally requested, and sent paper copies instead. Though pages of jurisdiction data could be scanned and eventually converted to digital format, the process can be labor intensive and time consuming. With limited time and resources, data from these jurisdictions could not be used in our feasibility study.

6. Phase Three: Third Party Vendor Evaluation

The feasibility study also evaluated third party vendors as potential data suppliers for a TPV survey. Third party vendors could offer a superior alternative to the Governments Division survey data collection efforts due to their process efficiencies and ability to collect, package, and resell information.

Most of the vendors we considered were multi-faceted firms that compiled information on various sectors of industry, including real estate property valuations and transactions. We compared vendor candidates based on the type, cost, geographic coverage, and depth of information available for purchase. Geographic coverage was critical during the selection process; only vendors that could provide data for the majority of U.S. counties were considered. The following variables were required from third party vendors: parcel level, assessment value, market value, sales price (if a parcel was sold within a year from the starting point of the study), parcel land use code, and matching identifiers, such as the Assessor's Parcel Number (APN). Most vendors could supply data for all the required variables, but were usually deficient in geographic coverage, only providing data for highly populated metro areas.

A total of five third party vendors were considered as potential data suppliers for a TPV survey. After a period of analysis, one vendor was chosen as a candidate for further in-depth evaluations. The selected vendor could provide assessment data for 98 percent and sales data for 82 percent of U.S. counties.

6.1 Methodology

In the spring of 2010, the Governments Division made a one-time purchase of 2009 calendar year data from the selected vendor. The 2009 data were provided in DVD format in twelve different deliveries over a ten month period. The delivered DVD's contained two sets of data files: one national database with assessment-related information and a second national database with sales-related information.

6.2 Results

According to vendor documentation, geographic coverage varied by state for both assessment and sales data. A breakdown of the coverage is shown in Table 2.

Table 2. National Coverage of 2009 Assessment and Sales Data Files from Selected Vendor

Percent Coverage by County	Number of States (Assessments)	Number of States (Sales)
100	44*	23*
90.0-99.9	4	6
80.0-89.9	0	6
70.0-79.9	1	3
< 70.0	2	13

*includes Washington DC

Comparing the number of states in each coverage category in Table 2, the vendor's national coverage was clearly higher for assessment versus sales data files. The assessment data files covered all counties in 44 states, but sales data files covered all counties in only 23 states. The selected vendor's assessment files had less than 80 percent coverage in 3 states, while their sales files fell below 80 percent coverage in 16 states. In the three states where vendor assessment files covered less than 80 percent of the counties, the low coverage was attributed to the low population density and rural nature of these states.

6.3 Discussion

The selected vendor provided parcel data for over 147 million U.S. properties, organized at the county level. In some areas where assessments and deeds jurisdictions are organized at the municipal/township level (i.e., New England states), the vendor grouped data from neighboring municipalities and townships into "counties" based on historical boundaries. According to vendor documents, their database was populated using data provided by state and local government offices, where available. In some cases, when the vendor couldn't obtain sales data directly from a jurisdiction, they made estimates based on undisclosed methods. In other situations, when local jurisdiction data were unavailable, the vendor provided no data.

Twelve states are considered non-disclosure states. These states do not publicly report or disclose the sales price for real estate transactions. The sales files for the selected vendor had less than 70 percent coverage (as shown in Table 2) in nine of the twelve non-disclosure states. For the remaining three non-disclosure states, the vendor estimated sales data using undisclosed methods. Because the selected vendor did not release the formulas used to estimate sales data for these states, their methods could not be verified for compliance with Census Bureau statistical quality standards. For that reason, vendor sales data for these three states could not be used in this TPV feasibility study.

The Governments Division chose to purchase all available data from the selected vendor to evaluate its potential as a data source. The results from Table 2 show that the national coverage for vendor assessment files was consistently higher than vendor sales files and vendor assessment data would be more promising for use in a TPV survey. Thus, we chose to focus in-depth research and evaluation on vendor assessment data first, and then evaluate the vendor sales data at a later time.

6.3.1 Edit Testing

In-depth research of the vendor assessment files was initiated by conducting a series of automated edit tests that searched for artifacts in the data. The nine critical assessment variables examined during the edit testing can be organized with three equations:

(i) total value calculated = total land value + total improvement value
(ii) assessed total value = assessed land value + assessed improvement value
(iii) market total value = market land value + market improvement value

Equations (i)-(iii) show the relationship between three total variables that were found in all vendor assessment files: total value calculated (for a parcel), assessed total value (as provided by the local testing/assessment authority), and market total value (a parcel's market value). The automated edit testing checked all vendor assessment files to determine the specification of the data structures and to evaluate the quality of vendor information.

Initial results of the edit testing showed the selected vendor sent 316 duplicate assessment files. In addition, 46 assessment files were found where all parcels reported missing values for all nine variables in equations (i)-(iii) above. The vendor eventually corrected the problem, sending replacements for all 46 files.

The edit testing also identified the number of occurrences in vendor assessment files where the land value and improvement value variables did not sum to the total value variable in equations (i)-(iii). Most of these inconsistencies were caused by local jurisdictions that reported values for the total variables, but did not provide corresponding values for the land and improvement variables. Rounding errors were also responsible for some of these inconsistencies. The remainder of these inconsistencies occurred when total value variables in vendor assessment files did not include exemptions granted by local jurisdictions.

6.3.2 Metadata Analysis of Vendor Assessment Files

Output files generated by edit testing provided the basis for a metadata analysis of the vendor assessment data, to examine the underlying structure within the data. Though Governments Division requested a metadata structure for each state, the selected vendor did not provide this information. The metadata structure was critical to our evaluation, in order to determine what data were available in vendor assessment files and how to use and interpret these data in a TPV survey.

One of the primary objectives during the metadata analysis of vendor assessment files was to address how exemptions and fractional assessments affect the reported assessed values. Exemptions provide tax relief by reducing a property's taxable assessed value; common exemptions include: homestead exemptions, veteran's exemptions, and exemptions for the elderly or disabled. Fractional assessments apply tax rates as a ratio of assessment value to market value (i.e., the assessment ratio), and are typically defined by state or local law. Both exemptions and fractional assessments are common practices in local jurisdictions and effectively reduce a property's assessed value. Exemptions and fractional assessments can also lead to inconsistencies between assessed values reported by the selected vendor and those reported by local jurisdictions, because the vendor may not always be aware of all the different ways jurisdictions can modify property values using these techniques.

The metadata analysis was conducted through a comparison of two variables from equations (i) and (ii) above, found in assessment data files: the total value calculated and the assessed total value. Two assumptions were made at the start of the analysis:

- The total value calculated variable represented the market value of the property.
- The assessed total value variable represented the value which the tax rate was applied, after exemptions or fractional assessments.

If a comparison showed the two values were equivalent, then no exemptions or fractional assessments applied for that property. Conversely, if a comparison showed the two values were unequal, then the difference was attributed to fractional assessments or exemptions.

Assessed data values for individual properties could usually be verified using a parcel search found on many local government websites. This verification process could reveal what assessment data were being captured in vendor data files, and whether any data were missing.

Three main findings were observed from our metadata analysis of vendor assessment files:

- The properties from states that don't use fractional assessments are generally assessed at full market value; this was reflected in vendor assessment files, where the total value calculated variable equaled the assessed total value variable (see equation (i)).
- The properties from states where fractional assessments are defined by law had differences between market values and assessed values in vendor data files, as expected. For properties where the total calculated value was unequal to the assessed total value, the fractional assessments were generally calculated correctly, but assessment data for each state had to be manually inspected for exceptions. Time constraints did not permit exploration of automated methods in place of these manual inspections of vendor files.

- The vendor assessment files did not reflect any of the various types of available exceptions in the total calculated value and assessed total value variables.

The varying results observed for fractional assessments versus exemptions are unsurprising considering the differences between the two methods. Fractional assessments can be applied to all properties where the law is in effect, whether it's a township, municipality, county, or state. But exemptions are inherently more complex than fractional assessments and much narrower in scope, because they can vary in application from one property to another. Resource limitations, along with the complexity of the laws used to define exemptions, can defy efforts to determine the correct combination of exemptions for each property across the U.S.

Our analysis also revealed that a comprehensive, sustained effort would be required to discover the metadata structure in all vendor assessment files and assure they could be used in a TPV survey. Vendor assessment files must be examined separately for each state, because no two states report assessed values in the same way. Though some states report assessment values consistently, there are exceptions, where some counties or townships in these states assess property values differently. In other states, where assessment laws can vary from one local jurisdiction to another, all vendor assessment files would have to be carefully examined to determine the metadata structure.

Due to the local nature of property assessments, making interpretations of data from vendor assessment files can only be accomplished with knowledge of the complex laws and statutes that define the data. Thus, the metadata structure in vendor assessment files would have to be defined for all U.S. counties before they could be a data source in a TPV survey. In addition, the metadata patterns found in the vendor's 2009 assessment files may not stay consistent in the future; similar research would be required to determine how the metadata structure might change in future years and what the implications might be for a TPV survey.

7. Phase Four: Comparison Study

This phase of the feasibility study compared data provided by the selected vendor with data sent by direct collection from local jurisdictions. The comparisons were made for both assessment and sales data files and were carried out on all properties (parcels) within a township or county. Calculating the proportion of matching properties and tracking the differences in the assessed and sales values allowed us to quantify the degree of similarity between vendor and local government data.

Our initial goal was to compare corresponding vendor and local government files for all jurisdictions in the assessments and deeds samples, as described in section 3. This goal was eventually modified due to complications encountered during the comparison work and with the direct data collection from jurisdictions.

The comparison study was conducted using the SAS software package. A number of additional steps beyond receipt of jurisdiction and vendor data at the Census Bureau were required to carry out the comparison study. An outline of the process used by analysts during the comparison work is given below; a complication with any of these steps could result in exclusion of the sampled jurisdiction from the comparison study.

(1) Verify jurisdiction file was in a known, recognizable format.
(2) Locate the vendor file corresponding to the local government file.
(3) Import both vendor and local government files into SAS.
(4) Verify that both vendor and local government files contained the necessary assessments/sales data to carry out a comparison.
(5) Examine the contents of local government data and determine if parcels could be matched with parcels in the corresponding vendor file.
(6) Implement the unit matching strategy in SAS and then compare differences in the assessed values/sales prices between local government and vendor files.

7.1 File Usability

Verifying the usability of both vendor and local jurisdiction files was an important first step in the comparison process. File format issues delayed, and sometimes even prevented, comparisons between vendor and jurisdiction data.

Supplied from a single source, vendor files offered potential advantages of comprehensive coverage and a consistent format (ASCII text) across the entire set of data files. In practice, the vendor files were remarkably consistent, with a very large set of variables appearing in the same columns in nearly all cases.

The usability issues with the sampled jurisdiction data files were far more serious and prevalent. Overall, jurisdiction files for assessments had more issues with unknown formats than those for deeds. These issues usually involved unknown formats of the local government data files, as these files were often transmitted to us with incorrect filename extensions or no filename extensions at all. For a limited set of jurisdiction files, the format could not be determined; some files from this set appeared to be encrypted. Other file usability issues included missing or incomplete data in both jurisdiction and vendor files. For example, on rare occasions, vendor files lacked assessed values for all parcels, which made comparison work impossible for these counties. In addition, with the great diversity of possible formats, jurisdiction files often had missing or incomplete data issues.

A summary of file usability issues encountered by analysts during the comparison study is given in Table 3.

Table 3. File usability summary for the comparison study

Usability Category	**Assessments**	**Deeds**
Govt. files could not be opened (unknown formats)	7	1
Could not locate corresponding vendor file	0	5
Govt. text files had multiline record format	3	1
Could not develop viable parcel matching strategy	11	3
Govt. and vendor files not from same time period	0	1
Successful TPV Comparisons	**37**	**28**
Total Local Govt. Files Examined	**58**	**39**

As shown in Table 3, file usability issues were a liability for the TPV comparison study, preventing over 25 percent of attempted deeds comparisons and over 35 percent of attempted assessment comparisons. Jurisdiction assessment files tended to have more issues with unknown formats and developing viable unit matching strategies. Jurisdiction deeds files tended to have fewer problems with unknown formats and implementing parcel matching, but more problems with locating corresponding vendor files.

The number of attempted comparisons listed in Table 3 is less than the total number of jurisdiction files received, both for assessments and deeds. The difference can be explained by the modification of our analysis goals over the course of the comparison study. Shortly after this phase of the TPV feasibility study was initiated, it became apparent that the comparison work was more resource intensive than expected, and the original goal of analyzing three local governments per state (both for deeds and assessments) could not be met due to time constraints. As a result, the original goal was eventually modified in favor of an analysis based on Census regions, which is discussed in Section 7.4. Once the regional approach was adopted, analysts focused their efforts on performing a number of complete comparisons for all three government size classes (small, medium, large) within a Census region. For each regional size class category, analysts attempted as many comparisons as possible to meet the new objectives: complete three assessments comparisons and two deeds comparisons per category.

Usability problems with the jurisdiction files point to a larger issue that once afflicted the historical TPV survey and cannot be ignored now: a lack of standard data formats. If standard formats were established for taxable property data in jurisdiction files, direct data collection could become a more practical option. Without standard formats, the Governments Division must confront a formidable task: parsing relevant data from the great diversity of jurisdiction files and then forcing that data into a consistent format. Unfortunately, the required workload for this task increases with the number of jurisdictions in a sample. The workload needed to process data from the diverse array of file

formats means it would be very challenging to scale the required resources for a TPV survey to the point it could produce national estimates.

7.2 Parcel Matching Strategies

The most critical task of the comparison process was matching land parcels between vendor and jurisdiction data files. This was usually the most time consuming step, as discrepancies between jurisdiction and vendor data often meant that analysts had to develop customized matching algorithms.

After files were imported into SAS, both jurisdiction and vendor data were examined to determine a parcel matching strategy. The principal matching method was to utilize Assessor's Parcel Number (APN) values, because they could uniquely identify each parcel. However, APN values from jurisdiction files were given in various formats, often requiring analysts to perform string manipulations before parcel matching could be initiated. Developing SAS code that could perform the necessary string manipulations was often time-consuming, but worthwhile, because APNs offered the most reliable parcel matching method.

When APN values were unavailable in jurisdiction files, analysts used alternative methods to perform parcel matching. The first alternate method used account number variables, assuming they were provided in both jurisdiction and vendor files. When APNs and account numbers were both unavailable, analysts explored matching methods based on name/address combinations. This approach was inexact and error-prone, as analysts used exact matching techniques on long string variables such as names and street addresses, where one extraneous space or other character could invalidate a potential match. More sophisticated matching methods using name and address combinations were not explored due to time and resource constraints.

Inherent differences between assessments and sales data affected the methods used to carry out parcel matching. During the comparison work, analysts assumed jurisdiction and vendor data files included all assessments/sales transactions over a one-year period. Assessment records were simple to understand over the course of a year: one assessment value was provided for each parcel in nearly all cases. The situation was far more complicated for deeds files, because one parcel could be bought and sold more than once during a one-year period. Further, sales data in vendor files could show multiple transactions for a parcel in a short time period, as a property could be transferred between investment companies, private trusts, and other entities, which added to the overall complexity. As a result, parcel matching for sales data often included a large number of duplicate matches using SAS MERGE. Steps were taken to minimize the number of duplicates by adding a sales date to the APN value for use as a match key, but complex transactions in vendor files made it impossible to eliminate all duplicates. In contrast, duplicate matches were rarely an issue when doing parcel matches for assessment files.

7.3 Evaluating Matching Performance

Analysts calculated basic performance metrics at the end of the comparison process, including the match rate and percentage of non-zero differences among matching parcels. When performing the matching, one important matter to consider was how to define the matching rate, or total coverage of the matching parcels. To develop a matching rate, we had to decide on the point of reference; that is, whether the calculated ratio would incorporate parcels from the local government files or vendor files. Ultimately, jurisdiction files were chosen as the point of reference for the match rate because the vendor files were designed to be comprehensive and potentially replace jurisdiction files. Thus, we decided to define the match rate as the proportion of parcels in a jurisdiction file that could be matched with parcels in the corresponding vendor file to the total number of parcels in a jurisdiction file:

$$\text{Match Rate} = N_v/N$$

where N_v = Number of jurisdiction parcels found in the vendor file
N = Number of jurisdiction parcels

With this definition of the match rate, we focused our initial efforts on determining the coverage rate of parcels from jurisdiction files. Follow-up efforts will eventually bring additional focus to these coverage issues and the non-matching parcels in vendor files.

Among the matching parcels, differences between assessed values or sales values were calculated. The ratio of non-zero differences to total matching parcels provided a measure of the degree of synchronization between matching parcel values.

Initially, the Wilcoxon Signed Rank Test was selected as a rigorous statistical check on differences between vendor and local government data. The Wilcoxon Signed Rank Test is similar to the Student t-test, but serves as a nonparametric alternative that does not assume differences are normally distributed like the t-test does (Ott, 1993). Because zero differences are not ranked, only the non-zero differences calculated for matching parcels would be included in the Signed Rank Test. Results of this test could then indicate whether there were significant differences between vendor and jurisdiction data.

However, application of the Wilcoxon Signed Rank Test to the comparison study proved to be problematic. We observed that comparisons between jurisdiction and vendor data could show significant differences if the percentage of matching parcels with non-zero differences was as low as 0.5 percent. But comparisons between local government and vendor data rarely showed that level of synchronization among matching parcels. The sensitivity of the Signed Rank Test, along with high levels of discrepancies between assessment and sales values for matching parcels, meant that differences between jurisdiction and vendor data were almost always found to be significant.

Though the selected vendor collected data for all U.S. counties from the states, we received local data directly from local governments. Due to the two sources of data collection, assessed values and sales values could get out of sync for various reasons, including:

- Time periods for assessed or sales values may be different for vendor files versus local government files.

- As discussed in Section 6.3.2, assessed values are often based on local laws, and each jurisdiction can assess properties differently. This practice can lead to discrepancies between jurisdiction data and vendor data for assessed values within a state.

- Assessed values in jurisdiction files often incorporate a number of exemptions, while assessed values in vendor files do not, as discussed in Section 6.3.2. This was the most common source of differences between assessed values in the jurisdiction versus vendor files.

Because of inherent discrepancies between jurisdiction and vendor data, we decided to use the median difference between matching parcels in place of the Wilcoxon Signed Rank Test. The median difference was defined as:

$$\text{Median}(Di) \qquad Di=(Val)gov - (Val)v$$

where

$(Val)gov$ = Assessed or sales value in the jurisdiction file
$(Val)v$ = Assessed or sales value in the vendor file
Di = Difference in parcel's assessed or sales value

Though the median difference was zero in most cases, it provided a useful check and flagged jurisdictions with high levels of discrepancies versus vendor files. Ultimately, we decided to use the median difference, parcel matching rate, and percentage of difference equal to zero (among matching parcels) to evaluate matching performance.

7.4 Results

As discussed in Section 5.3, non-response was a serious issue during the direct data collection from sampled jurisdictions. Further, many of the jurisdiction data files we received had issues that either inhibited or prohibited comparisons with corresponding vendor files. As a result, the original goal of analyzing three units per state was not realized and was eventually set aside in favor of an analysis based on Census regions. Additionally, it was decided that the analysis would focus on national differences by size class.

Results of the comparison study are given in Tables 4 and 5.

Table 4. Comparison Study: Assessments Results

Region		Name of County/Town	Match Rate of Parcel IDs*	Match Rate of Assessed Values**	Overall Match Level
Northeast		Arietta Town, NY	75.3%	99.9%	
	S	Averill, VT	100.0%	99.6%	
		Somerset County, PA	94.7%	0.0%	
	M	Scituate Town, RI	99.4%	99.8%	
		Waterbury, CT	96.8%	94.0%	
		Brockton City, MA	96.3%	96.9%	
	L	Berks County, PA	97.9%	96.0%	
Midwest		Santa Fe Township, IL	70.0%	30.3%	
		Rock County, MN	98.1%	96.8%	
	S	McPherson County, NE	99.0%	60.9%	
		Surrey Township, MI	80.3%	99.9%	
	M	Grafton Township, ND	86.9%	85.3%	
		Linn County, IA	94.4%	80.8%	
		Shawnee County, KS	96.7%	87.2%	
	L	Wauwatosa City, WI	99.3%	100.0%	
South		Kent, DE	99.2%	99.9%	
		Gallatin County, KY	93.5%	60.4%	
	S	Covington City, VA	98.5%	99.7%	
		Calhoun County, AL	80.9%	67.9%	
		Ashe County, NC	94.5%	97.5%	
	M	Van Zandt, TX	99.3%	98.9%	
		Madison County, MS	99.6%	100.0%	
		Rutherford, TN	89.6%	99.8%	
	L	Arlington, VA	97.7%	99.8%	
West		Gila County, AZ	96.9%	47.4%	
		Ouray, CO	99.5%	87.2%	
		Oneida, ID	97.1%	91.0%	
		Storey County, NV	90.1%	52.2%	
		Daggett, UT	99.6%	84.9%	
	S	Hot Springs, WY	99.0%	99.5%	
		Tulare, CA	99.6%	66.0%	
		Nye County, NV	98.9%	96.9%	
	M	Columbia County, OR	98.8%	100.0%	
		Maricopa County, AZ	94.8%	13.2%	
		Washington County, OR	56.7%	99.9%	
		Kitsap County, WA	92.6%	95.9%	
	L	Campbell County, WY	75.8%	100.0%	

High Match **Medium Match** **Low Match**

* Match Rate of Parcel IDs only reflect the number of parcel ids from jurisdiction files that match with the parcel ids from vendor files.

** Match Rate of Assessed Values reflects the percentage of matches based on parcel id where the assessed value from the jurisdiction file and vendor file matched.

Table 5. Comparison Study: Deeds Results

Region		Name of County/Town	Match Rate of Parcel IDs*	Match Rate of Sales Values**	Overall Match Level
Northeast		Barkhamsted, CT	74.1%	69.9%	
	S	Nantucket Census County, MA	73.0%	89.7%	
		Barnstable, MA	61.9%	48.2%	
	M	East Greenwich, RI	58.9%	88.5%	
		New York City, NY	81.2%	82.0%	
	L	South Burlington, VT	42.6%	96.2%	
Midwest		Clayton, IA	64.5%	95.6%	
	S	Taylor, WI	75.6%	53.5%	
		Knox, IL	45.7%	84.1%	
	M	Hancock, IN	71.3%	22.0%	
		Kalamazoo, MI	85.0%	90.5%	
		Lancaster, NE	70.7%	64.6%	
	L	Winnebago, WI	44.2%	55.0%	
South		Hamilton, FL	34.8%	47.2%	
	S	Washington, NC	84.2%	83.2%	
		Indian River, FL	38.6%	65.2%	
		Barrow, GA	79.9%	69.0%	
	M	Montgomery, TN	80.8%	96.5%	
		Augusta-Richmond, GA	76.4%	75.3%	
	L	Mecklenburg, NC	91.1%	83.2%	
West		Greenlee, AZ	62.7%	8.5%	
		Eureka, NV	64.1%	60.0%	
	S	Adams, WA	80.0%	82.4%	
		Crook, OR	15.2%	9.4%	
	M	Skagit, WA	76.8%	29.6%	
		Pima, AZ	95.2%	77.4%	
	L	Pueblo, CO	51.6%	74.5%	

High Match **Medium Match** **Low Match**

* Match Rate of Parcel IDs only reflect the number of parcel ids from the jurisdiction files that match with the parcel ids from vendor files.
* *Match Rate of Assessed Values reflects the percentage of matches based on parcel id where the assessed value from the jurisdiction file and vendor file matched.

Tables 4 and 5 list all the completed comparisons in each regional size class category. As discussed in Section 7.1, our objectives were to complete three assessment comparisons and two deeds comparisons in all regional size class categories. These goals were met in nearly all cases, except the assessment comparisons for small and medium sized governments in the northeast region and the assessment comparisons for medium sized governments in the midwest region. In these three regional size class categories, complications with both jurisdiction and vendor assessment files, and time constraints prevented analysts from meeting the comparison study goals.

As shown in Tables 4 and 5, the match rate of parcel ID's and match rate of assessed values are provided for all townships, cities, or counties where analysts successfully completed a comparison between jurisdiction and vendor files. The rows in each region are divided into three sections, indicating small, medium, and large populations from the original sample design. Three categories were created to designate match levels between jurisdiction and vendor files.

For both assessments and deeds data, a match level was designated as "high" if the median difference between the assessed or sales values for matching parcels in jurisdiction and vendor files was zero and both the parcel ID match rate and the value match rate (assessed or sales) exceeded 80 percent. A match level was designated as "medium" if the median difference between assessed or sales values was zero and one or both match rates was between 60 percent and 80 percent. A match level was set to "low" if there was a non-zero median difference between assessed or sales values and/or one or both match rates that were below 60 percent.

The following observations were made based on these results:

- Of the assessment comparisons completed, the southern region had the best level of synchronization between jurisdiction and vendor data. Though the cooperation from states in the western region yielded more comparisons, the matching levels were not as high as those observed in the southern region.

- The completed assessments also indicated that larger population jurisdictions tended to have higher matching levels than small or medium population jurisdictions, with the exception of the western region.

- For the completed deeds comparisons, the southern region seemed to have the highest level of agreement between jurisdiction and vendor data, though the results are not conclusive.

- The completed deeds comparisons also showed that larger population jurisdictions tended to have higher matching levels than small or medium population jurisdictions.

Due to challenges with non-response, data format usability during the direct data collection from jurisdictions, and time constraints, this analysis was modified to incorporate a regional approach. But the original sample design was based on U.S. states rather than Census regions. For that reason, inference from the results in Tables 4 and 5 should not be drawn beyond these data.

8.0 Conclusions

Jurisdiction websites seemed to offer a promising data collection option for a TPV survey, both in terms of reduced costs and decreased respondent burden. But only two of the sampled sales jurisdictions and none of the sampled assessment jurisdictions had websites that could meet all the requirements for TPV survey activities. Our research indicates that jurisdiction websites could be used for verification purposes, but would not be a suitable data collection option for a TPV survey.

Direct data collection from jurisdictions was also evaluated during this feasibility study. Our results show that some of the same issue with the historical TPV survey, including jurisdiction non-response and unusable data formats, would continue to affect direct data collection if TPV activities were resumed. Though direct data collection is a resource-intensive option with a number of challenges, it's also a necessary one as a backup method when jurisdiction data can't be obtained any other way. Thus, direct data collection could play a limited but essential role in a reconstituted TPV survey.

The results of the feasibility study indicate that third party vendors are the most promising data source for a future TPV survey, but with important qualifications. The selected vendor offers the data required by a TPV survey at a comprehensive level, providing assessment data for 98 percent and sales data for 82 percent of U.S. counties. However, nondisclosure issues are a formidable barrier, restricting sales data in twelve states. Further, the metadata structure must be determined for all vendor files before they could be incorporated into a TPV survey, which would be an on-going and resource intensive task. A TPV survey could potentially use vendor files to supply most of the required data and then collect data directly from jurisdictions that are outside the vendor's coverage areas. More research would be required to discover how vendor files and direct data collection could be combined in a future TPV survey, and whether this sort of design would be practical for the Governments Division.

This feasibility study has yielded a number of important findings, indicating that resumption of a TPV survey would be a highly challenging endeavor for the Governments Division at a time of limited resources. But our research remains unfinished. Future research activities could continue the metadata analysis on the selected vendor's assessment files. Eventually, a new round of edit testing and metadata analysis could be initiated for the vendor's sales files. The findings from these two sets of metadata analyses could reveal if a configuration of vendor files and direct data collection would ultimately result in a practical TPV survey design.

9.0 References

Gunning P., Horgan J.M., "A New Algorithm for the Construction of Stratum Boundaries in Skewed Populations", *Statistics Canada* 30.2 (2006) 159-66.

National Research Council, *State and Local Government Statistics at a Crossroads,* (2007): 68.

Ott R.L., *An Introduction to Statistical Methods and Data Analysis 4th Edition*, Duxbury Press, 1988.