UNITED STATES DEPARTMENT OF COMMERCE
Economics and Statistics Administration
U.S. Census Bureau
Washington, DC 20233-0001

August 23, 2018

2018 AMERICAN COMMUNITY SURVEY RESEARCH AND EVALUATION REPORT
MEMORANDUM SERIES ACS18-RER-06

CENTER FOR ADMINISTRATIVE RECORDS RESEARCH AND APPLICATIONS
MEMORANDUM SERIES # 12-2016

MEMORANDUM FOR	ACS Research and Evaluation Workgroup
From:	Lisa M. Blumerman Chief, Center for Administrative Records Research and Applications (CARRA)
Prepared by:	Michaela Dillon Center for Administrative Records Research and Applications (CARRA)
Subject:	Use of Administrative Records to Replace or Enhance the Mortgage/Home Equity Loan Amount & Payment Questions on the American Community Survey

Attached is the Center for Administrative Records Research and Applications (CARRA) Research and Evaluation report, "Use of Administrative Records to Replace or Enhance the Mortgage/Home Equity Loan Amount & Payment Questions on the American Community Survey." We conducted this evaluation to assess the potential for using commercial vendor data sourced from mortgage transaction records to replace or supplement the mortgage type and payment amount questions on the American Community Survey (ACS).

If you have any questions about this report, please contact Lisa Blumerman at 301-763-8050, Nikolas Pharris-Ciurej at 301-763-8924, or Michaela Dillon at 301-763-3567.

Attachment

cc:

Jennifer Ortman	(ACSO)	Asaph Young Chun	(DSSD)
David Raglin	(ACSO)	Nathan Walters	(SEHSD)
Nikolas Pharris-Ciurej	(CARRA)	Edward Welniak	(SEHSD)
Edward Castro	(DSSD)		

This page intentionally left blank.

Use of Administrative Records to Replace or Enhance the Mortgage/Home Equity Loan Amount & Payment Questions on the American Community Survey

Michaela Dillon

Center for Administrative Records Research and Applications

United States™

Census Bureau

This page intentionally left blank.

TABLE OF CONTENTS

LIST OF TABLES

This page intentionally left blank.

EXECUTIVE SUMMARY

As detailed in the report, "Agility in Action 2.0: A Snapshot of Enhancements to the American Community Survey" (Census Bureau, 2017), the Census Bureau is investigating ways to reduce the difficulty and length of the American Community Survey (ACS) using administrative records to address the burden survey participation places on respondents and improve data quality. Some of the ACS questions we are investigating include primary and secondary mortgage type and the associated monthly mortgage payment for each. This research will inform the determination of whether an identified administrative records source has data of sufficient coverage and quality to allow the removal of the question on the ACS. Alternatively, we may find the administrative record source sufficient only to serve as a supplement to data provided by respondents to fill in missing responses or enhance editing routines. A Census Bureau team will use this report and conduct additional research to make recommendations on whether each question is a good candidate for removal by using the external data source in its place.

This report explores the linkage of residential mortgage transaction data compiled by a third-party commercial vendor to the ACS sample collected in 2014. We assess the presence of comparable mortgage data and the agreement of this vendor data with unedited self-reported responses from the ACS. The analysis includes an evaluation of vendor data *coverage* of the ACS sample via the MAFID-match rate, *availability of valid* (i.e. non-missing) *information* within linked vendor data, and *value agreement* between the vendor data and ACS.

Assessing coverage of the vendor data requires linking the 2014 ACS to the vendor data by the Master Address File Identifier (MAFID). The 2014 ACS is a representative sample of the U.S. population covering 2.3 million households. The vendor data contains mortgage transaction records for over 76.7 million households. Just over half, 51.67 percent, of ACS households can be matched to the vendor data.

Among linked households, the rates at which ACS records match to non-missing information within vendor data vary considerably. The vendor data provides non-missing information on housing unit primary mortgage type and the monthly payment at relatively high rates—77.16 and 66.61 percent, respectively. The vendor data provides non-missing information on the type of secondary mortgage for 13.56 percent of ACS households, which is comparable to the 13.36 percent ACS self-response rate for this question. As for the monthly payment on secondary mortgages, the vendor data provides insufficient information on key contract terms required to calculate this value. Specifically, while items such as length to maturity and principal amount are available for 3.57 percent of the linked sample, the interest rate is missing entirely. Therefore, this question is excluded from the analysis.

The remainder of the analysis focuses on agreement in values between the linked data. The rates of agreement are as follows for each topic: primary mortgage type (55.84 percent), monthly mortgage payment (27.37 percent), and secondary mortgage type (81.44 percent). The agreement rates for primary and secondary mortgage type increase when cases with missing ACS or vendor data information are removed. In this case, vendor data agrees with ACS values 76.48 percent of the time for primary mortgage type and 87.13 percent for secondary mortgage type. The agreement rate for monthly payment on the primary mortgage decreases to 13.16 percent, indicating high agreement among missing values within the linked data for this topic.

There are some limitations that influence the quality of linked data and its suitability for ACS item replacement or imputation. Due to differences in the objectives and methods of collecting the data, the structure of the vendor data requires a significant amount of manipulation and inference in order to conceptually align with the ACS questionnaire. In addition, the prevalence of missing and outdated information within the vendor data is problematic. For example, missing interest rates prevented the calculation of the monthly mortgage payment for second mortgages all together. These factors restrict the usefulness of the vendor data for ACS replacement.

The benefit of any administrative records source is assessed by its provision of non-missing information, agreement with survey values, and conceptual alignment of measured data. The mortgage transaction data used in this report provides high linkage rates to non-missing data for the primary mortgage type and monthly payment topics in the ACS. In the case of secondary mortgage type information, missing values are prevalent, but still predictive of the linked ACS response, particularly for reports of a home equity loan or no secondary financing at all. The vendor data for primary and secondary financing type display frequent agreement with ACS values. Despite the frequency of non-missing information on primary mortgage contract terms, incomplete and/or outdated information inhibits the vendor data from enhancing the primary mortgage monthly payment ACS question due to low agreement with reported survey values. For these reasons, vendor data on primary and secondary mortgage type show potential for item supplementation or imputation purposes.

1. INTRODUCTION

Stemming from concerns about the burden that American Community Survey (ACS) participation places on respondents, the Census Bureau is looking for ways to reduce the difficulty and length of the survey with administrative records. We have identified sources of both federal and commercial data that may potentially alleviate the need to ask certain questions altogether or for a subset of the ACS sample. Work is underway to acquire new sources and assess the quality of the matching and coverage of these sources. Data from other agencies are under review to potentially replace ACS content, including the Internal Revenue Service to provide income information and the Social Security Administration for pension and disability information. The American Community Survey Office (ACSO) is consulting with stakeholders, including Congress, regarding the appropriateness of direct substitution.

Recently, the ACSO contracted with the National Opinion Research Center (NORC) to report on the availability of data sources, as well as the potential issues with those sources, as candidates for replacing/supplementing data currently collected by the ACS. Using this report (Ruggles, 2015) as well as their experience, the Center for Administrative Records Research and Applications (CARRA) identified several topics for further study based on the availability of data and likelihood of successful matching and analysis. These topics include:

- Year built
- Part of Condominium
- Tenure
- Property value
- Real estate taxes
- Have mortgage/mortgage amount
- Second mortgage/HELOC and payment
- Income in the past 12 months
- Residence one year ago
- Number of rooms/bedrooms
- Facilities
- Fuel type
- Acreage
- Self-employment income in the past 12 months
- Sale of agricultural products
- Social security income and Supplemental security income in the past 12 month
- Telephone service

For each topic, CARRA will acquire and match the administrative records to survey data, provide a report or memo describing the quality and coverage of the data source, and compare the administrative record value to ACS self-reported and imputed responses. CARRA will document the linked file and put the research extract in the Data Management System (DMS) for future research.

This research is intended to be a first look at the various topics to document the coverage, quality, and availability of external data sources for potential ACS integration. This research will

enable the ACS to evaluate the potential of the replacement data sources, identify challenges, and provide direction for further research. It is an exploratory investigation of the feasibility of replacing ACS data with administrative records.

Next, the ACSO will create teams for each ACS topic identified as a potential candidate for records usage based on the results from the first phase of research. Each team will include statistical researchers, subject matter experts, and data processors that together can identify and research issues related to records usage.

The teams will make recommendations on which questions are good candidates for removal with the use of external data sources in its place. This recommendation will be based on an assessment of the implications of implementing such a change, considering data quality, availability, alignment of reference periods, break in series, and the limitations of the data source affecting the suitability for use. The team will document and evaluate various options for integrating the records. For instance, for some topics, records may be better suited in assisting with imputation whereas for other topics the records may be used for direct substitution of a survey question (for all or a subset of the ACS respondent pool).

Moreover, the ACSO will gauge reactions to our intention to use external data sources from data users, stakeholders, and the public. The ACSO will review current ACS mail materials to ensure proper transparency, as well as publicly share our vision in public forums such as the ACS Data Users Conference, meetings of the Association of Public Data Users (APDU), the Population Association of America (PAA), the Joint Statistical Meetings (JSM), the American Association of Public Opinion Research (AAPOR), and other public venues.

2. LITERATURE REVIEW

The report, "Review of Administrative Data Sources Relevant to the American Community Survey (Ruggles, 2015)," provided a review of data sources that could be used to replace or improve specific questions on the ACS. Its purpose was to support the work of the ACS Content Review (Chappell and Obenski. 2014) by providing additional input on potential data sources that might be used to strengthen the survey, improve its content, or reduce the burden associated with its collection. While several studies emphasize the coverage of administrative records for persons, there is a subset of the literature focusing on the availability and quality of data suitable for household-level questions and surveys. For example, the 2010 American Community Survey Match Study (Luque and Bhaskar, 2014) assessed the coverage of person and address administrative records data from twenty federal and third party data sources, finding that records provide substantial coverage for persons and addresses in the 2010 ACS (92.1 and 92.7 percent respectively).

A study comparing the 2001 Survey of Consumer Finances household survey data to mortgage services administrative data provided by Loan Performance Corporation found survey respondents are generally accurate with the broad terms of their contract such as the type, current payment, and maturity. However, they are somewhat uncertain or forgetful about the finer details of their mortgage such as the interest rate cap (Bucks and Pence, 2008). Adjustable Rate Mortgage (ARM) borrowers tend to have the most difficulty recalling and/or understanding the terms of their mortgage. Eighteen percent of ARM borrowers versus 9 percent of fixed rate

borrowers reported not knowing the interest rate on their loan. This is a common outcome across several surveys including the American Housing Survey (AHS) and the Survey of Income and Program Participation (SIPP). Also, low income, less educated, older, and minority borrowers tend to report their mortgage terms incorrectly. The authors of this study concluded that confusion stems from the borrowers perceived high cost of accessing and mentally processing financial information about their mortgage and acknowledge differences between the survey data and administrative records could also be the result of differences in sample coverage and treatment of missing data.

Additional research on linking administrative records to household survey data describes the coverage and quality of data provided by local governments. Certain unique patterns in housing data should be considered for the successful integration of third-party sources with survey data. In particular, the match rates vary by structure type and subsequently tenure. For example, linkage of the 2009 AHS to the commercial data from county and municipal property tax records showed 79 percent of single-family housing units and 14.8 percent of multi-unit housing structures were successfully matched (Brummet, 2014). The large difference in match rates between single-family and multi-unit housing structures highlights constraints on the potential for deeds records to provide the required information for significant portions of the nation's households. The low match rate for multi-unit housing structures is most likely due to a misalignment between the objectives of AHS and local government for collecting housing data. For the purposes of taxation, local governments often record data at aggregate levels reflecting the entire structure and/or parcel of land rather than the housing units within. Availability of more detailed information on individual housing units depends on the mandate of state and local laws. Timing is also a documented issue when linking to tax records, which may result in lower than expected agreement rates due to differences in the frequency of taxation across locations, and lags in the data collection process of recent construction for example.

Subsequent work adjusted for the aforementioned issues by focusing on single-family, owner-occupied homes and found 69.1 percent of 2010 ACS households could be linked to a commercial data record with non-missing information (Seeskin, 2016). The distribution of property tax values is similar to those reported in the ACS and display greater variation occurs in the tails of the distribution. Additionally, the linked data has a Pearson correlation of 0.724. While property tax data are not perfect, studies support the use of administrative records for imputation and nonresponse adjustments (Zanutto and Zaslavsky 2002). The use of these data in models of nonresponse can be further improved by relaxing the assumption that missing data are randomly distributed (Manski, 2007).

There is evidence that the quality of the linked data varies systematically along several dimensions. Some groups are less likely to be linked. These groups include minorities, group quarters residents, recent movers, low-income individuals, and the unemployed (Bond et al., 2014). Furthermore, when households within these groups do match, they are more likely to link to missing information. The probability of linking to missing information decreases with educational attainment (Seeskin, 2016).

Other research has identified additional factors unique to housing data that exacerbate differences between respondent and third party data values. For example, the format of the data can limit agreement between the linked data. A survey may solicit responses for property value

within aggregate categories while an exact dollar amount is reported in administrative records. Also, respondents have a tendency to round their estimates of home value to the nearest thousand (Pudney, 2008; Manski and Molinari, 2010).

Timing and economic conditions may bear influence on agreement as survey responses to home value tend to be higher among recent movers and those who purchased their home during an economic boom (Kiel and Zabel, 1999; Benitez-Silva et al., 2008). Generally, recent movers display better agreement with administrative data than non-recent movers do, as they are more aware of home value after a recent purchase. Disagreement between survey response and record data also occurs when local authorities use measures of property value like assessed value that measures and weights housing characteristics differently than the constantly fluctuating housing market value that respondents often pay attention to (Kingkade, 2013).

Lastly, agreement between linked data can vary across survey response modes. One study calculates the percentage difference between ACS and commercial tax data on property values among linked households and finds the interquartile range of these values is lowest for internet and mail respondents (16.6) and highest for CATI respondents (29.1) (Seeskin, 2016).

3. ACS BACKGROUND

The housing section of the 2014 ACS includes questions on the financing and subsequent monthly payments for a housing unit. This section will describe the content of the ACS regarding these topics.

The ACS is conducted via multiple data collection methods including: paper, internet, computer-assisted telephone interview (CATI), and computer-assisted personal interview (CAPI).[1] Descriptions of the paper survey are provided below.

3.1   Mortgage Type and Payment Amount

Question 22 contains two parts relevant to the financing of the housing unit. Part a asks, "Do you or any member of this household have a mortgage, deed of trust, contract to purchase, or similar debt on THIS property?" Note that the term *mortgage* refers to "all types of loans secured by real estate." The respondent is provided with three checkbox responses to choose from. The first reads, "Yes, mortgage, deed of trust, or similar debt." The second reads, "Yes, contract to purchase." The third reads, "No→*SKIP to question 23a*."

The ACS instruction guide provides the following information for housing question 22a, "Mortgages includes all types of loans secured by real estate." (Census Bureau, 2013)

Part b reads, "How much is the regular monthly mortgage payment on THIS property?" Further directions require the

Source: 2014 American Community Survey

---

[1] The ACS program discontinued use of CATI for non-response follow-up operations in October 2017.

respondent to "*include payment only on FIRST mortgage or contract to purchase*." A five-digit space is provided for the respondent to write (in U.S. dollars) their monthly mortgage amount. A checkbox is also provided to indicate, "no regular payment required." If this checkbox is chosen, the respondent should "*SKIP to question 23a.*" The contents of question 23 are discussed in the next section.

The instruction guide provides detailed supplemental information for this question. It directs the respondent to:

> "Enter a monthly amount even if it is unpaid or paid by someone else. If the amount is paid on some other periodic basis, see the instructions for 18a to change it to a monthly amount.
>
> Include payments on first mortgages and contracts to purchase only. Report payments for second or junior mortgages and home equity loans in 23b.
>
> If this is a mobile home, report payments on installment loans but DO NOT include personal property taxes, site rent, registration fees, and license fees on the mobile home and site. Report these fees in item 24."

Instructions for question 18a asks the respondent to multiply his/her daily, weekly, or bi-weekly rental payment by 30, 4, or 2, respectively. Less frequent rental payments, made on a quarterly, semi-annual, or annual basis, should be divided by 3, 6, or 12, respectively.

3.2   Second Mortgage and Payment Amount

Question 23 contains two parts and asks about second mortgages or home equity loans secured by real estate. Part a asks, "Do you or any member of this household have a second mortgage or home equity loan on THIS property?" The respondent is provided with four checkbox responses to choose from. The response options are: "Yes, home equity loan," "Yes, second mortgage," "Yes, second mortgage and home equity loan," "No→*SKIP to D*." The respondent must have a first mortgage in order have a second mortgage. However, he/she may have a home equity loan with or in lieu of any mortgage.

Part b asks, "How much is the regular monthly payment on all second or junior mortgages and all home equity loans on THIS property?" A five-digit space is provided for the respondent to write (in U.S. dollars) the monthly payment amount, whether it is unpaid or paid by someone

Source: 2014 American Community Survey

else. Installments paid in frequencies other than monthly should be translated into monthly values as described in part b of question 22. Additionally, a checkbox is provided to indicate "No regular payment [is] required."

4. RESEARCH QUESTIONS

The research questions are as follows:

1. What is the coverage of the linked administrative records over the ACS sample, and how often does it contain data that can be used to replace or supplement the respondent-provided response (i.e. non-missing information)?
2. To what extent is the administrative records data conceptually aligned with the topical construct measured by the ACS questions?
3. How often do the housing unit data from the administrative records source agree with ACS responses by major subpopulation and housing characteristics?

5. METHODOLOGY

MAFID-match Process and Data Description

Records of mortgage transactions are the administrative record used in this analysis of the ACS mortgage type and monthly payment amount questions. A third party data aggregator compiles these data. The mortgage transactions records are from 2014, the most recent year of data available to the Census Bureau at the time of the analysis. The administrative records are compared to unedited values reported in the 2014 ACS.

Each vendor data record is linked to the ACS response using the Master Address File Identifier (MAFID). The MAFID is a number associated with each record in the Master Address File (MAF). The MAF is a database containing the address, or location description, and geographic information of every building (residential or non-residential) in the United States known to the Census Bureau. The ACS responses include MAFIDs. The vendor data are processed by appending MAFIDs to each address, where possible. The analysis is restricted to households where vendor data are linked to a housing unit in the ACS by MAFID. The analysis shows counts of ACS unswapped and unweighted records.[2]

After linking 2014 ACS data to the 2014 vendor data, research question #1 is addressed by calculating the percentage of 2014 ACS households that can be linked with vendor data records. Furthermore, the linkage rate to both missing and non-missing vendor data information is calculated as a percentage of MAFID-matched ACS households.

Evaluating Agreement

The second goal of this research is to evaluate agreement, both conceptually and empirically, between ACS and vendor data for MAFID-matched observations. For research question #2, in the results section, key vendor data variables are described and compared to the topical ACS

---

[2] The analysis is within this report documents agreement between unedited ACS responses and the vendor data to assess suitability of administrative records for item replacement. Data swapping "is a perturbation method used for statistical disclosure control. The objective of data swapping is to reduce the risk that anyone can identify a respondent and his or her responses to questionnaire items by examining publicly released microdata or tables while preserving the amount of data and its usefulness." (Lavrakas, 2008).

items covered in this report to evaluate conceptual agreement and suitability of the vendor data for ACS supplementation.

Two sets of results are presented to address research question #3. The first set of results are reported via a cross-tabulation of the ACS and vendor data. Topics with clearly defined categorical response values, such as the mortgage type questions, are compared with vendor data based on ACS categories outlined in the questionnaire.[3] For the monthly mortgage payment topics where the responses are in monetary terms, the responses are divided into ten groups approximating decile cutoffs for comparison. Several statistics are calculated from the values presented in the cross-tabulation tables:

- For each topic:
  - The overall agreement rate is the sum of the shaded diagonal values divided by the total number of linked ACS cases in this study, 1,174,788. For replicate tables on single family, owner-occupied homes in the appendix, the denominator is 941,489.
  - The rate at which the vendor data can replace missing ACS values with non-missing information is the sum of missing ACS values linked to non-missing vendor data divided by the total count of missing value ACS observations. Alternatively, subtract the row percentage where ACS and vendor data is missing from 100. These values are found in the bottom row.

- For financing type, specifically:
  - The percent of ACS cases with vendor-confirmed mortgages is the number of linked cases with both reporting an active mortgage divided by total ACS households reporting a mortgage.
  - The percent of ACS cases reporting no mortgage, but found with an active mortgage in the vendor data is calculated by dividing the number of linked cases where the vendor data reports and active mortgage and the ACS reports "None" by the total ACS households reporting "None."

The second set of results show the coverage and agreement rates of the linked data over several householder demographic and geographic categories. The responses across each topic are compared in terms of inequalities, where the MAFID-matched vendor data value is equal or not equal to the ACS response for the mortgage type questions, and less than, equal to, or greater than for the payment amount questions. For payment amount responses, two separate constraints are imposed on the data in order to evaluate agreement. The first is relatively stringent, representing exact value agreement. Since the probability of both datasets reporting the same dollar amount is low, "exact value agreement" means allowing the vendor data value to differ up to one percent from the ACS value. The second constraint is relatively relaxed to account for conceptual differences and to consider the wider effect of uncertainty in the survey response for monthly mortgage payment. Under this constraint, the vendor data value may differ up to five

---

[3]The vendor data documents the following transaction types as corresponding to the presence of a mortgage, deed of trust, or other financing instrument secured by real estate: seller carried loan, conforming, non-conforming, FHA, VA, CNV, SBA, private party, fixed, adjustable, construction loan, equity (closed or revolving), refinance, other subordinate loans, and residential (modeled).

percent from the ACS value and be deemed "equal." Results in these tables are described as follows:

- Percentages describing the agreement rate between vendor data and ACS values are ratios of the count where the vendor value equals the ACS value divided by number of linked records in the referenced demographic or geographic category.
- The rate of missing values across states is calculated by dividing the number of cases where vendor data is missing in each state by the total linked cases in that state.

A secondary analysis of single-family, owner-occupied housing units is included in this report. Previous literature on MAFID linkage between household survey and external data show increased coverage and higher quality responses (i.e. lower nonresponse) for these particular types (Brummet, 2014; Seeskin, 2016). The formal results are presented in the appendix. Generally, linkage rates are comparable between the full sample and single-family, owner-occupied subsample. The subsample links to non-missing information less frequently than the full sample. Consequently, agreement rates slightly improve across various respondent and housing characteristics.

6. LIMITATIONS

Some of the limitations of the vendor data, which may influence the quality of linked data and its suitability for ACS item replacement or imputation, include:

1. Potentially outdated and incomplete mortgage term information.
2. Several mortgages with zero percent interest.
3. No interest information for second mortgage.

A property may have several recorded mortgage transactions in the vendor data. However, the prevalence of missing information on the terms of the mortgage contract frequently prevents one from simply selecting the most recent transaction as the most appropriate for analysis. Therefore, to achieve a one-to-one MAFID match with the ACS, the most recent mortgage transaction with meaningful information is selected (i.e., non-zero mortgage amounts and interest values). For linked vendor records with only partial mortgage information, the most recent transaction record is used.

Due to the high rate of incomplete and/or illogical information on mortgage contract terms, it is impossible to calculate monthly mortgage payments for many observed MAFIDs. The vendor data does not provide the interest rate for second mortgages, preventing the calculation of monthly payments entirely. Therefore, this analysis does not include the monthly payment portion of ACS question 23.

7. RESULTS

7.1 Coverage and Linkage to Valid Information

As shown in Table 1, the 2014 ACS contains over 5 million person-level observations divided among 2.3 million households. The vendor data reports data for the housing unit and includes 76,662,230 unique MAFIDs, which were linked to the 2,273,701 households in the 2014 ACS.

Vendor data contains a match for 1,174,788 ACS households, yielding a MAFID match rate of 51.67 percent.

Table 1: MAFID Match Rate of ACS and Vendor Data

| | ACS | | Vendor data |
	Full sample	Single-family, owner-occupied subsample	
Total Observations (individual persons)	5,325,044		338,283,965
Number of Households	2,273,701	1,320,918	-
Number of Unique MAFIDs	2,273,701	1,320,918	76,662,230
Households with MAFID Match	1,174,788	941,489	-
MAFID-Match Rate	***51.67%***	***71.28%***	***-***

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.

The remaining analysis is conducted on the 1,174,788 ACS households that match to a vendor record by MAFID. Table 2 displays the rate at which the vendor data provides non-missing and missing data for ACS records across the topics of this report.

Table 2: Match Rate for Non-Missing and Missing Vendor Data among MAFID-Matched Observations

ACS topic	Count, ACS records linked to non-missing vendor data	% of ACS records linked to non-missing vendor data	Count, ACS records linked to missing vendor data	% of ACS records linked to missing vendor data
Financing Type	906,473	77.16	268,315	22.84
Mortgage Payment Amount	782,564	66.61	392,224	33.39
Second Mortgage/ HEL	159,314	13.56	1,015,474	86.44
Second Mortgage/ HEL Amount	41,900	3.57	1,132,888	96.43

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.
Note: Rows sum to total MAFID-matched observations. Number of ACS households = 1,174,788. Overall MAFID-match rate=51.67%; calculated in Table 1. HEL=Home Equity Loan.

The highest match rates with non-missing vendor data occur with financing type (77.16 percent) and mortgage payment amount (66.61 percent). The match rates are lower for second mortgage questions. The ACS data links to non-missing vendor data 13.56 and 3.57 percent of the time within the second mortgage type and payment amount topics, respectively.

7.2 Financing Type

7.2.1 Cross-Tabulation of ACS and Vendor Data Financing Type Response

To evaluate conceptual agreement, the vendor data are arranged into analogous categories similar to the ACS. Several detailed types of financing instruments are available within the vendor data that required aggregation into flag variables indicating the presence of a mortgage/deed of trust or contract to purchase for each MAFID. Twenty-eight category codes containing the key words "mortgage," "mtg," and "deed of trust" were flagged to indicate a mortgage or deed of trust. The indicator for contract to purchase did not require any aggregation of vendor data codes. However, none of the MAFIDs in the linked sample used this code. Therefore, the contract to purchase value is not included in the cross-tabulation analysis.

Table 3 shows the frequency of agreement between available vendor data and ACS values. Linked ACS and vendor data have the same value 55.84 percent of the time.[4] The row percentages in Table 3 show the composition of linked ACS records within each ACS response category. If the lack of a MAFID-match to the vendor data is interpreted as a lack of a mortgage, then the vendor data confirms 71.69 percent of the mortgages reported in the ACS and indicates there is an active mortgage for 31.59 percent of ACS households reporting "None."[5] Across response categories, the highest rate of agreement between sources occurs with the mortgage, deed of trust, or debt secured by real estate financing (88.77 percent). According to Table 2, the ACS links to non-missing vendor data 77.16 percent of the time. Subsequently, vendor data can assign a value for 65.47 percent of the ACS cases that are missing values for financing type.[6]

---

[4] This percentage is calculated as the sum of the shaded diagonal values in Table 3 divided by the total number of linked ACS cases in this study, 1,174,788. For replicate tables on single family, owner-occupied homes in the appendix, the denominator is 941,489.
[5] The percent of ACS cases with vendor-confirmed mortgages is the number of cases with agreement divided by total ACS households reporting a mortgage. The percent of ACS cases without a mortgage found in the vendor data is calculated by dividing the number of mortgages in the vendor data by the total ACS households reporting "None."
[6] This percentage is calculated as the sum of missing ACS values linked to non-missing vendor data divided by the total count of missing value ACS observations. Alternatively, subtract the row percentage where ACS and vendor data is missing from 100. These values are found in the bottom row of Table 3.

Table 3: ACS Financing Type by Vendor Data

| ACS Financing Type | Total ACS Count | Linked ACS Count (Row total) | Vendor Financing Type | | | |
| | | | Mortgage | | NA | |
			N	Row % / Col. %	N	Row % / Col. %
Mortgage, deed of trust, or debt secured by real estate	799,748	645,835	573,329	88.77 / 63.25	72,506	11.23 / 27.02
Contract to purchase	14,232	8,642	5,819	67.33 / 0.64	2,823	32.67 / 1.05
None	539,644	280,734	170,471	60.72 / 18.81	110,263	39.28 / 41.09
NA	920,077	239,577	156,854	65.47 / 17.30	82,723	34.53 / 30.83
Column total	2,273,701	1,174,788	906,473		268,315	

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.
Note: Row percentages are proportions of linked ACS cases. Vendor data does not contain analogous information for the "contract to purchase" or "none" ACS responses.

7.2.2 Agreement in Financing Type across Subpopulation and Housing Characteristics

Table 4 shows male householders have a higher agreement rate than female householders (49.95 versus 47.65 percent).[7] Agreement is highest among 45-49 year old householders at 60.48 percent. Asian householders possess the highest rate of agreement at 55.77 percent and American Indian or Alaska Native householders possess the lowest rate at 39.66 percent.[8] Non-Hispanic householders display a slightly higher agreement rate compared to Hispanics in financing type at 48.99 percent. The responses of foreign-born householders agree with vendor data more frequently than those born in the United States (50.6 versus 48.58 percent).

Geographically, vendor data agree with ACS responses from householders in metropolitan areas at a higher rate than non-metropolitan areas (30.66 percent versus 17.46 in micropolitan areas and 12.26 percent in other areas). Across states, agreement rates range from 1.02 percent in South Dakota to 64.17 percent in New Hampshire.[9] When linked records do not agree between ACS and vendor data, the vendor data has a higher rate of missing values for twenty-four

---

[7] Percentages describing the agreement rate between vendor data and ACS values are ratios of the count where vendor=ACS divided by number of linked records in the referenced demographic or geographic category.
[8] Among White householders, the largest race group, the agreement rate is 49.04%.
[9] The frequency of states across the range of agreement rates is a follows: [0-20%) agreement--4 states, [20-40%)--5, [40-60%)--38, [60%+]--3.

states.[10] The District of Columbia has the lowest rate of missing values in linked vendor data (5.69 percent) while South Dakota has the highest (98.52 percent).[11, 12]

Table 4: Coverage and Match Rates for ACS Financing Type by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data

	Linked Count	% of Linked Count	Rate of Agreement		
			vendor = ACS	vendor ≠ ACS	vendor is missing
Sex (of householder)					
Male	589,109	50.15	49.95	28.19	21.85
Female	585,679	49.85	47.65	28.52	23.83
Age (of householder)					
15-19	3,900	0.33	29.21	46.46	24.33
20-24	21,192	1.80	27.33	45.5	27.18
25-29	55,631	4.74	45.36	33.51	21.13
30-34	84,142	7.16	54.56	27.64	17.79
35-39	93,370	7.95	57.91	25.21	16.88
40-44	107,795	9.18	60.18	23.22	16.6
45-49	117,669	10.02	60.48	22.64	16.87
50-54	136,452	11.62	57.84	23.77	18.39
55-59	137,146	11.67	53.78	26.29	19.93
60-64	123,457	10.51	48.28	29.36	22.36
65-69	105,063	8.94	42.21	32.67	25.12
70 and over	188,708	16.06	25.65	34.66	39.69
Race (of householder)					
White alone	982,928	83.67	49.04	27.08	23.88
Black or African American alone	92,515	7.88	43.90	34.54	21.56
American Indian or Alaska Native alone	5,842	0.50	39.66	30.88	29.46
Asian alone	50,121	4.27	55.77	34.36	9.87
Native Hawaiian or Pacific Islander alone	1,054	0.09	44.40	40.23	15.37
Some Other Race alone	23,097	1.97	45.33	41.00	13.67
Two or More Races	19,231	1.64	49.18	31.92	18.90

---

[10] Based on the comparison of the proportion of linked cases for each state where vendor data does not equal ACS values to those where vendor data is missing, states with relatively high rates of missing data include: Alabama, Arkansas, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New York, Oklahoma, Pennsylvania, South Carolina, South Dakota, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming.

[11] These percentages are calculated by dividing the number of cases where vendor data is missing in each state by the total ACS cases in that state.

[12] The vendor data does not report any mortgage information Vermont. Therefore, all results on agreement for this state are zero percent and the rate of missing information is 100 percent.

Table 4: Coverage and Match Rates for ACS Financing Type by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data (continued)

	Linked Count	% of Linked Count	Rate of Agreement		
			vendor = ACS	vendor ≠ ACS	vendor is missing
Ethnicity (of householder)					
Hispanic or Latino (of any race)	107,743	9.17	46.99	37.69	15.33
Not Hispanic or Latino	1,067,045	90.83	48.99	27.42	23.60
Nativity (of householder)					
Native	1,044,280	88.89	48.58	27.26	24.16
Foreign born	130,508	11.11	50.60	37.12	12.29
Tenure					
Owned	1,002,454	85.33	57.16	21.39	21.44
Rented	156,373	13.31	0.14	70.66	29.20
Other	15,961	1.36	0.43	51.34	48.23
Metropolitan Statistical Area					
Metropolitan	998,110	84.96	52.34	30.66	16.99
Micropolitan	104,376	8.88	32.87	17.46	49.67
Other	72,302	6.15	22.92	12.26	64.82
State					
Alabama	12,499	1.06	35.53	18.10	46.37
Alaska	2,132	0.18	63.04	28.71	8.26
Arizona	26,465	2.25	50.97	40.50	8.53
Arkansas	11,471	0.98	29.42	16.64	53.94
California	132,681	11.29	54.75	34.29	10.96
Colorado	23,807	2.03	59.7	29.92	10.38
Connecticut	14,319	1.22	59.38	33.96	6.66
Delaware	3,966	0.34	58.12	30.41	11.47
District of Columbia	2,037	0.17	59.30	35.00	5.69
Florida	74,570	6.35	44.96	40.28	14.77
Georgia	31,323	2.67	50.29	29.02	20.69
Hawaii	4,632	0.39	44.95	29.23	25.82
Idaho	5,192	0.44	55.34	30.07	14.60
Illinois	51,344	4.37	54.02	30.39	15.59
Indiana	25,675	2.19	42.23	18.47	39.30
Iowa	16,314	1.39	47.89	21.88	30.24
Kansas	13,082	1.11	35.16	17.57	47.27
Kentucky	14,261	1.21	35.57	16.35	48.09
Louisiana	9,397	0.80	38.73	17.38	43.90
Maine	4,292	0.37	56.57	21.67	21.76
Maryland	25,278	2.15	63.70	29.24	7.06
Massachusetts	24,911	2.12	58.90	34.62	6.49
Michigan	47,438	4.04	45.97	24.45	29.58

Table 4: Coverage and Match Rates for ACS Financing Type by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data (continued)

	Linked Count	% of Linked Count	Rate of Agreement		
			vendor = ACS	vendor ≠ ACS	vendor is missing
Minnesota	32,086	2.73	43.11	16.90	40.00
Mississippi	5,116	0.44	11.98	5.98	82.04
Missouri	22,696	1.93	46.66	24.62	28.73
Montana	3,926	0.33	46.61	26.13	27.25
Nebraska	9,743	0.83	41.19	19.48	39.33
Nevada	11,366	0.97	46.05	42.68	11.27
New Hampshire	4,868	0.41	64.17	22.49	13.33
New Jersey	31,589	2.69	59.06	32.85	8.09
New Mexico	5,267	0.45	51.21	30.15	18.64
New York	51,844	4.41	44.07	23.24	32.70
North Carolina	36,608	3.12	51.49	27.05	21.47
North Dakota	2,626	0.22	56.93	28.33	14.74
Ohio	53,910	4.59	49.35	32.98	17.67
Oklahoma	19,509	1.66	39.11	25.17	35.72
Oregon	14,962	1.27	54.57	31.51	13.92
Pennsylvania	59,592	5.07	43.09	25.97	30.94
Rhode Island	2,672	0.23	58.61	33.12	8.27
South Carolina	17,400	1.48	42.59	22.84	34.57
South Dakota	1,960	0.17	1.02	0.46	98.52
Tennessee	24,946	2.12	46.78	27.09	26.12
Texas	73,695	6.27	47.34	29.18	23.48
Utah	11,030	0.94	59.69	31.44	8.87
Vermont	2,410	0.21	0.00	0.00	100.00
Virginia	32,287	2.75	53.24	22.95	23.81
Washington	28,473	2.42	58.11	32.50	9.38
West Virginia	3,739	0.32	15.51	6.26	78.23
Wisconsin	31,981	2.72	43.49	18.72	37.78
Wyoming	1,401	0.12	46.82	18.92	34.26

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.

7.3 Mortgage Payment Amount

7.3.1 Cross-Tabulation of ACS and Vendor Data Mortgage Payment Amount Responses

For conceptual alignment with the ACS, the monthly mortgage payment needed to be calculated using several variables within the vendor data describing contract terms. The vendor data provided the mortgage amount, interest rate, length to maturity and its unit of frequency (days, months, years). Length to maturity values were scaled where necessary to reflect monthly periods. These values were input into an embedded mortgage payment calculator within SAS software and yielded the monthly payment value for each MAFID.

Table 5: Decile Ranges for ACS Mortgage Payment Responses

Decile	Lower Limit of Decile	Adjusted Decile Range	Percent of Linked ACS Cases
1	0	[0-300)	3.75
2	303	[300-500)	4.32
3	512	[500-670)	5.47
4	669	[670-800)	5.39
5	802	[800-980)	5.97
6	979	[980-1,160)	5.83
7	1,160	[1,160-1,375)	6.12
8	1,372	[1,375-1,690)	6.18
9	1,687	[1,690-2,200)	6.43
10	2,201	[2,200+]	6.15

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.
Note: The percentages do not sum to 100% as missing values are excluded from the calculation of deciles. Responses are divided into ten groups approximating decile cutoffs for comparison. The adjusted range rounds the decile limits to the nearest value divisible by five. The use of open intervals for the adjusted range indicate the inclusion of values up to, but not including, the upper endpoint.

After calculating the vendor data value for monthly payment, both the ACS and vendor data responses are collapsed into ten groups approximating deciles of ACS values as shown in Table 5. These groups inform on the distribution of non-missing mortgage payment values within the data and are used to evaluate agreement between ACS and vendor data across the distribution of mortgage payment values.

Table 6 shows 27.37 percent of the linked cases have response values in the same decile.[13] Across response categories, the highest rate of agreement occurs with missing values (48.68 percent), followed by payment values greater than or equal to $2,200 (29.15 percent). Table 2 shows the ACS links to non-missing vendor data 66.61 percent of the time. Subsequently, vendor data can assign a value for 51.32 percent of the ACS cases that are missing a value for mortgage payment value.[14]

---

[13] Overall agreement rate is the sum of the shaded diagonal values divided by the total number of linked ACS cases in this study, 1,174,788. For replicate tables on single family, owner-occupied homes in the appendix, the denominator is 941,489.

[14] To find vendor coverage of ACS missing values, subtract the row percentage where ACS and vendor data are missing from 100. These values are found in the bottom row.

Table 6: ACS Mortgage Amount by Vendor Data

ACS Mortgage Adjusted Deciles	Linked ACS Count	Vendor Mortgage Adjusted Deciles										
		1	2	3	4	5	6	7	8	9	10	NA
1	44,023	9,439	3,889	2,058	1,030	1,229	876	661	682	613	947	22,599
		21.44	8.83	4.67	2.34	2.79	1.99	1.50	1.55	1.39	2.15	51.33
2	50,773	18,829	7,226	1,807	722	693	480	291	269	200	370	19,886
		37.08	14.23	3.56	1.42	1.36	0.95	0.57	0.53	0.39	0.73	39.17
3	64,289	19,814	15,676	4,884	1,524	1,202	630	476	393	281	462	18,947
		30.82	24.38	7.60	2.37	1.87	0.98	0.74	0.61	0.44	0.72	29.47
4	63,345	14,118	16,967	9,065	3,112	1,918	1,053	651	565	396	565	14,935
		22.29	26.79	14.31	4.91	3.03	1.66	1.03	0.89	0.63	0.89	23.58
5	70,163	9,069	20,195	11,831	6,331	4,295	1,718	1,042	829	606	772	13,475
		12.93	28.78	16.86	9.02	6.12	2.45	1.49	1.18	0.86	1.10	19.21
6	68,545	5,376	16,794	11,490	7,633	7,364	3,198	1,680	1,277	943	1,104	11,686
		7.84	24.50	16.76	11.14	10.74	4.67	2.45	1.86	1.38	1.61	17.05
7	71,955	4,535	11,740	12,439	8,150	9,674	6,056	3,514	2,065	1,452	1,575	10,755
		6.30	16.32	17.29	11.33	13.44	8.42	4.88	2.87	2.02	2.19	14.95

Table 6: ACS Mortgage Amount by Vendor Data (continued)

ACS Mortgage Adjusted Deciles	Linked ACS Count	Vendor Mortgage Adjusted Deciles										
		1	2	3	4	5	6	7	8	9	10	NA
8	72,582	3,914	5,478	12,027	7,898	9,615	8,167	6,530	4,430	2,496	2,426	9,601
		5.39	7.55	16.57	10.88	13.25	11.25	9.00	6.10	3.44	3.34	13.23
9	75,512	3,702	2,498	5,272	7,528	9,573	9,041	7,758	9,146	6,591	5,605	8,798
		4.90	3.31	6.98	9.97	12.68	11.97	10.27	12.11	8.73	7.42	11.65
10	72,285	2,994	1,634	1,448	1,887	4,567	7,310	4,414	8,093	11,120	21,069	7,749
		4.14	2.26	2.00	2.61	6.32	10.11	6.11	11.20	15.38	29.15	10.72
NA	521,316	67,658	55,292	34,124	19,810	21,528	15,415	11,463	11,880	10,695	19,658	253,793
		12.98	10.61	6.55	3.80	4.13	2.96	2.20	2.28	2.05	3.77	48.68
Column total	1,174,788	159,448	157,389	106,445	65,625	71,658	53,944	38,480	39,629	35,393	54,553	392,224

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.
Note: Values in shaded rows are row percentages associated with above cross-tabulation frequency. Row percentages are proportions of linked ACS cases.

7.3.2 Agreement in Mortgage Payment Amount across Subpopulation and Housing Characteristics

Table 7 presents counts on agreement based on differences in value less than one percent between the ACS and vendor data. The agreement rates for male and female householders are similar. Agreement reaches a maximum of 0.72 percent among households with householders who are 45-49 years old. Across races, households with Asian householders have the highest rate of agreement at 1.03 percent and Native Hawaiian or Pacific Islanders the lowest at 0.19 percent. Households with Non-Hispanic householders agree with vendor data values more frequently than households with Hispanic householders (0.57 versus 0.47 percent). Similarly, households with householders born outside the U.S. agree with vendor data at a higher rate than households with foreign-born householders (0.77 versus 0.53 percent).

Geographically, vendor data agrees with ACS responses in metropolitan areas (0.62 percent). Across states, agreement rates range from 0 percent in South Dakota to 1.61 percent in Virginia. Vendor data tends to be lower than ACS values when cases do not agree between ACS and vendor data for every state. South Dakota has the highest rate of missing values in linked data (99.08 percent).[15] Alaska has the lowest missing data rate at 41.65 percent.

---

[15] The vendor data does not report any mortgage information Vermont. Therefore, all results on agreement for this state are zero percent and the rate of missing information is 100 percent.

Table 7: Coverage and Match Rates for ACS Mortgage Payment by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data —1 percent difference

	Linked Count	% of Linked Count	Rate of Agreement			
			vendor < ACS	vendor = ACS	vendor > ACS	vendor is missing
Sex (of householder)						
Male	589,109	50.15	37.73	0.62	6.79	54.86
Female	585,679	49.85	35.82	0.50	6.22	57.47
Age (of householder)						
15-19	3,900	0.33	13.59	0.10	4.33	81.97
20-24	21,192	1.80	19.25	0.27	4.03	76.45
25-29	55,631	4.74	36.24	0.41	5.69	57.66
30-34	84,142	7.16	44.00	0.54	6.28	49.18
35-39	93,370	7.95	45.76	0.63	6.99	46.62
40-44	107,795	9.18	46.78	0.68	7.23	45.31
45-49	117,669	10.02	46.02	0.72	7.27	46.00
50-54	136,452	11.62	43.42	0.62	6.86	49.10
55-59	137,146	11.67	40.37	0.60	6.50	52.53
60-64	123,457	10.51	35.63	0.58	6.38	57.41
65-69	105,063	8.94	30.53	0.57	6.60	62.29
70 and over	188,708	16.06	17.06	0.36	5.82	76.76
Race (of householder)						
White alone	982,928	83.67	37.07	0.55	6.27	56.1
Black or African American alone	92,515	7.88	33.21	0.40	6.10	60.3
American Indian or Alaska Native alone	5,842	0.50	30.97	0.34	5.89	62.8
Asian alone	50,121	4.27	40.19	1.03	10.50	48.28
Native Hawaiian or Pacific Islander alone	1,054	0.09	32.16	0.19	7.87	59.77
Some Other Race alone	23,097	1.97	32.31	0.47	8.80	58.42
Two or More Races	19,231	1.64	37.32	0.58	7.32	54.78

Table 7: Coverage and Match Rates for ACS Mortgage Payment by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data —1 percent difference (continued)

	Linked Count	% of Linked Count	Rate of Agreement			
			vendor < ACS	vendor = ACS	vendor > ACS	vendor is missing
Ethnicity (of householder)						
Hispanic or Latino (of any race)	107,743	9.17	35.19	0.47	8.33	56.01
Not Hispanic or Latino	1,067,045	90.83	36.93	0.57	6.32	56.17
Nativity (of householder)						
Native	1,044,280	88.89	36.81	0.53	6.12	56.54
Foreign born	130,508	11.11	36.50	0.77	9.63	53.11
Tenure						
Owned	1,002,454	85.33	43.06	0.66	7.54	48.74
Rented	156,373	13.31	0.23	0.00	0.40	99.37
Other	15,961	1.36	0.10	0.00	1.47	98.43
Metropolitan Statistical Area						
Metropolitan	998,110	84.96	39.44	0.62	7.06	52.89
Micropolitan	104,376	8.88	25.26	0.27	3.66	70.81
Other	72,302	6.15	16.61	0.20	3.00	80.19
State						
Alabama	12,499	1.06	29.26	0.26	3.30	67.18
Alaska	2,132	0.18	54.13	0.42	3.80	41.65
Arizona	26,465	2.25	38.04	0.45	10.28	51.23
Arkansas	11,471	0.98	23.76	0.22	4.68	71.34
California	132,681	11.29	35.17	0.97	13.84	50.02
Colorado	23,807	2.03	47.26	0.75	9.55	42.44
Connecticut	14,319	1.22	39.2	0.25	6.36	54.19
Delaware	3,966	0.34	45.59	0.53	5.04	48.84
District of Columbia	2,037	0.17	43.15	0.83	11.63	44.38
Florida	74,570	6.35	33.54	0.49	8.74	57.23
Georgia	31,323	2.67	41.34	0.55	7.49	50.62
Hawaii	4,632	0.39	31.58	0.28	5.40	62.74
Idaho	5,192	0.44	46.21	0.40	5.91	47.48
Illinois	51,344	4.37	41.39	1.48	8.44	48.70
Indiana	25,675	2.19	36.59	0.27	4.01	59.13
Iowa	16,314	1.39	38.28	0.23	4.68	56.82
Kansas	13,082	1.11	29.14	0.21	2.24	68.41
Kentucky	14,261	1.21	26.79	0.25	3.27	69.70
Louisiana	9,397	0.80	27.73	0.23	2.32	69.71
Maine	4,292	0.37	44.94	0.42	4.31	50.33

Table 7: Coverage and Match Rates for ACS Mortgage Payment by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data —1 percent difference (continued)

	Linked Count	% of Linked Count	Rate of Agreement			
			vendor < ACS	vendor = ACS	vendor > ACS	vendor is missing
Maryland	25,278	2.15	48.69	0.67	8.04	42.60
Massachusetts	24,911	2.12	32.26	0.14	1.87	65.73
Michigan	47,438	4.04	33.83	0.36	4.85	60.95
Minnesota	32,086	2.73	35.99	0.42	5.24	58.35
Mississippi	5,116	0.44	10.65	0.06	1.33	87.96
Missouri	22,696	1.93	37.8	0.30	4.56	57.34
Montana	3,926	0.33	36.78	0.28	5.15	57.79
Nebraska	9,743	0.83	34.69	0.22	2.68	62.41
Nevada	11,366	0.97	30.62	0.32	12.49	56.57
New Hampshire	4,868	0.41	48.58	0.39	4.62	46.41
New Jersey	31,589	2.69	42.75	0.52	5.17	51.56
New Mexico	5,267	0.45	41.01	0.66	5.07	53.26
New York	51,844	4.41	30.36	0.69	3.40	65.54
North Carolina	36,608	3.12	42.80	0.44	5.37	51.38
North Dakota	2,626	0.22	47.45	0.34	7.88	44.33
Ohio	53,910	4.59	39.12	0.40	5.64	54.84
Oklahoma	19,509	1.66	32.46	0.26	4.10	63.19
Oregon	14,962	1.27	45.40	0.51	7.47	46.62
Pennsylvania	59,592	5.07	30.62	0.31	2.92	66.16
Rhode Island	2,672	0.23	27.13	0.11	1.68	71.07
South Carolina	17,400	1.48	34.99	0.42	5.06	59.52
South Dakota	1,960	0.17	0.77	0.00	0.15	99.08
Tennessee	24,946	2.12	38.25	0.49	5.41	55.84
Texas	73,695	6.27	40.26	0.38	3.96	55.40
Utah	11,030	0.94	45.51	0.59	7.12	46.78
Vermont	2,410	0.21	0.00	0.00	0.00	100.00
Virginia	32,287	2.75	41.83	1.61	7.06	49.50
Washington	28,473	2.42	47.08	0.65	7.86	44.42
West Virginia	3,739	0.32	10.27	0.16	0.64	88.93
Wisconsin	31,981	2.72	30.91	0.39	3.77	64.94
Wyoming	1,401	0.12	40.69	0.21	3.35	55.75

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.
Note: The vendor data does not report any mortgage information on Vermont. Therefore, all results on agreement for this state are zero percent and the rate of missing information is 100 percent.

Table 8 shows agreement rates improve when agreement is based on a five-percent difference between ACS and vendor data values. Many of the patterns from the one-percent value difference persist. However, under this relaxed criteria, households with American Indian or Alaska Native householders have the lowest agreement rate across races (1.20 percent). Also, households with Hispanic householders display higher agreement than non-Hispanic householders with vendor data at 1.84 percent.

Table 8: Coverage and Match Rates for ACS Mortgage Payment by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data —5 percent difference

	Linked Count	% of Linked Count	Rate of Agreement			
			vendor < ACS	vendor = ACS	vendor > ACS	vendor is missing
Sex (of householder)						
Male	589,109	50.15	37.02	1.88	6.24	54.86
Female	585,679	49.85	35.19	1.63	5.72	57.47
Age (of householder)						
15-19	3,900	0.33	13.23	0.72	4.08	81.97
20-24	21,192	1.80	18.90	0.92	3.72	76.45
25-29	55,631	4.74	35.66	1.45	5.23	57.66
30-34	84,142	7.16	43.21	1.92	5.69	49.18
35-39	93,370	7.95	44.88	2.18	6.32	46.62
40-44	107,795	9.18	45.87	2.30	6.52	45.31
45-49	117,669	10.02	45.14	2.26	6.60	46.00
50-54	136,452	11.62	42.56	2.09	6.24	49.10
55-59	137,146	11.67	39.67	1.87	5.93	52.53
60-64	123,457	10.51	35.02	1.70	5.87	57.41
65-69	105,063	8.94	30.02	1.51	6.18	62.29
70 and over	188,708	16.06	16.79	0.88	5.58	76.76
Race (of householder)						
White alone	982,928	83.67	36.42	1.72	5.76	56.10
Black or African American alone	92,515	7.88	32.58	1.54	5.59	60.30
American Indian or Alaska Native alone	5,842	0.50	30.52	1.20	5.48	62.80
Asian alone	50,121	4.27	39.11	2.91	9.70	48.28
Native Hawaiian or Pacific Islander alone	1,054	0.09	31.02	1.80	7.40	59.77
Some Other Race alone	23,097	1.97	31.55	1.82	8.21	58.42
Two or More Races	19,231	1.64	36.68	1.83	6.71	54.78

Table 8: **Coverage and Match Rates for ACS Mortgage Payment by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data —5 percent difference (continued)**

	Linked Count	% of Linked Count	Rate of Agreement			
			vendor < ACS	vendor = ACS	vendor > ACS	vendor is missing
Ethnicity (of householder)						
Hispanic or Latino (of any race)	107,743	9.17	34.43	1.84	7.71	56.01
Not Hispanic or Latino	1,067,045	90.83	36.28	1.74	5.81	56.17
Nativity (of householder)						
Native	1,044,280	88.89	36.17	1.67	5.62	56.54
Foreign born	130,508	11.11	35.58	2.41	8.90	53.11
Tenure						
Owned	1,002,454	85.33	42.28	2.05	6.92	48.74
Rented	156,373	13.31	0.22	0.01	0.39	99.37
Other	15,961	1.36	0.09	0.01	1.47	98.43
Metropolitan Statistical Area						
Metropolitan	998,110	84.96	38.7	1.93	6.48	52.89
Micropolitan	104,376	8.88	24.96	0.82	3.41	70.81
Other	72,302	6.15	16.38	0.63	2.8	80.19
State						
Alabama	12,499	1.06	28.96	0.84	3.02	67.18
Alaska	2,132	0.18	53.47	1.69	3.19	41.65
Arizona	26,465	2.25	37.06	2.22	9.49	51.23
Arkansas	11,471	0.98	23.35	0.91	4.40	71.34
California	132,681	11.29	33.97	3.19	12.82	50.02
Colorado	23,807	2.03	45.95	3.01	8.59	42.44
Connecticut	14,319	1.22	38.61	1.20	6.01	54.19
Delaware	3,966	0.34	44.93	1.66	4.56	48.84
District of Columbia	2,037	0.17	41.73	3.53	10.36	44.38
Florida	74,570	6.35	32.91	1.61	8.24	57.23
Georgia	31,323	2.67	40.55	1.96	6.87	50.62
Hawaii	4,632	0.39	31.17	1.06	5.03	62.74
Idaho	5,192	0.44	45.4	1.89	5.24	47.48
Illinois	51,344	4.37	40.44	3.15	7.71	48.70
Indiana	25,675	2.19	36.15	1.09	3.63	59.13
Iowa	16,314	1.39	37.81	0.95	4.42	56.82
Kansas	13,082	1.11	28.80	0.80	2.00	68.41
Kentucky	14,261	1.21	26.37	0.94	2.99	69.70
Louisiana	9,397	0.80	27.52	0.57	2.19	69.71

Table 8: **Coverage and Match Rates for ACS Mortgage Payment by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data— 5 percent difference (continued)**

	Linked Count	% of Linked Count	Rate of Agreement			
			vendor < ACS	vendor = ACS	vendor > ACS	vendor is missing
Maine	4,292	0.37	44.29	1.40	3.98	50.33
Maryland	25,278	2.15	47.64	2.48	7.28	42.60
Massachusetts	24,911	2.12	32.07	0.45	1.76	65.73
Michigan	47,438	4.04	33.37	1.21	4.48	60.95
Minnesota	32,086	2.73	35.57	1.17	4.92	58.35
Mississippi	5,116	0.44	10.52	0.27	1.25	87.96
Missouri	22,696	1.93	37.27	1.19	4.20	57.34
Montana	3,926	0.33	36.30	1.17	4.74	57.79
Nebraska	9,743	0.83	34.40	0.77	2.41	62.41
Nevada	11,366	0.97	29.85	1.87	11.71	56.57
New Hampshire	4,868	0.41	48.01	1.31	4.27	46.41
New Jersey	31,589	2.69	42.32	1.29	4.83	51.56
New Mexico	5,267	0.45	40.19	1.97	4.58	53.26
New York	51,844	4.41	29.94	1.45	3.06	65.54
North Carolina	36,608	3.12	42.10	1.65	4.87	51.38
North Dakota	2,626	0.22	46.95	1.41	7.31	44.33
Ohio	53,910	4.59	38.51	1.50	5.15	54.84
Oklahoma	19,509	1.66	32.13	0.85	3.83	63.19
Oregon	14,962	1.27	44.57	1.92	6.88	46.62
Pennsylvania	59,592	5.07	30.31	0.88	2.65	66.16
Rhode Island	2,672	0.23	26.98	0.41	1.53	71.07
South Carolina	17,400	1.48	34.40	1.34	4.73	59.52
South Dakota	1,960	0.17	0.77	0.05	0.10	99.08
Tennessee	24,946	2.12	37.74	1.47	4.94	55.84
Texas	73,695	6.27	39.85	1.17	3.59	55.40
Utah	11,030	0.94	44.39	2.58	6.25	46.78
Vermont	2,410	0.21	0.00	0.00	0.00	100.00
Virginia	32,287	2.75	40.56	3.82	6.12	49.50
Washington	28,473	2.42	46.05	2.41	7.13	44.42
West Virginia	3,739	0.32	10.08	0.45	0.53	88.93
Wisconsin	31,981	2.72	30.48	1.14	3.45	64.94
Wyoming	1,401	0.12	40.04	1.00	3.21	55.75

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.
Note: The vendor data does not report any mortgage information on Vermont. Therefore, all results on agreement for this state are zero percent and the rate of missing information is 100 percent.

7.4 Second Mortgage/Home Equity Loan

7.4.1 Cross-Tabulation of ACS and Vendor Data Second Mortgage/Home Equity Loan Responses

To evaluate conceptual agreement, the vendor data are arranged into analogous categories similar to the ACS. Several detailed types of financing instruments are available within the vendor data that required aggregation into flag variables indicating the presence of a second mortgage or home equity loan for each MAFID. Using the key words "mortgage" or "deed of trust", thirteen category codes on second mortgage deed type were flagged to indicate a second mortgage.[16] Three codes describing type of equity loans were aggregated to create a flag for home equity loans within the vendor data.

Table 9 shows the frequency of agreement between available vendor data and ACS values. Among linked cases, 81.44 percent have the same value in the ACS and the vendor data.[17] The bulk of that agreement occurs when both sources report missing values (89.51 percent) followed by reports of a home equity loan. Table 2 shows the ACS links to non-missing vendor data 13.56 percent of the time. Subsequently, vendor data can assign a value for 10.49 percent of the ACS missing value cases for financing type.[18]

---

[16] A deed of trust is similar to a mortgage with the exception that a third party is included in the transaction in the form of a trustee that holds legal title in real property as security for the loan. Since the loan itself is essentially the same, "deed of trust" is used as a keyword for the search on secondary mortgages. Furthermore, its use maximized the amount of information on secondary financing extracted from the vendor data.

[17] This percentage is calculated as the sum of the shaded diagonal values in Table 9 divided by the total number of linked ACS cases in this study, 1,174,788. For tables with results just for single-family, owner-occupied homes in Table 17 in the appendix, the denominator is 941,489.

[18] This percentage is calculated as the sum of missing ACS values linked to non-missing vendor data divided by the total count of missing value ACS observations. Alternatively, subtract the row percentage where ACS and vendor data are missing from 100. These values are found in the bottom row of Table 9.

Table 9: ACS Second Mortgage/Home Equity Loan (HEL) by Vendor Data

ACS Second Mortgage/ HEL	Total ACS Count	Linked ACS Count	Vendor Second Mortgage/HEL							
			HEL		Second mortgage		HEL and second mortgage		NA	
			N	Row % / Col. %	N	Row % / Col. %	N	Row % / Col. %	N	Row % / Col. %
Home equity loan	153,112	125,739	42,149	33.52 / 35.18	3,069	2.44 / 7.82	43	0.03 / 17.62	80,478	64.00 / 7.93
Second mortgage	32,097	26,253	2,162	8.24 / 1.80	3,627	13.82 / 9.24	10	0.04 / 4.10	20,454	77.91 / 2.01
HEL and second mortgage	6,211	5,009	1,246	24.88 / 1.04	234	4.67 / 0.60	-	- / -	3,529	70.45 / 0.35
NA	2,082,281	1,017,787	74,243	7.29 / 61.97	32,340	3.18 / 82.35	191	0.02 / 78.28	911,013	89.51 / 89.71
Column total	2,273,701	1,174,788	119,800		39,270		244		1,015,474	

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.
Note: Row percentages are proportions of <u>linked</u> ACS cases.

7.4.2 Agreement in Second Mortgage/Home Equity Loan across Subpopulation and Housing Characteristics

Across demographic characteristics, Table 10 shows that households with a male householder have a slightly higher agreement rate in responses than female householders (4.13 versus 3.66 percent).[19] Agreement increases with age and reaches a maximum of 5.80 percent among households with 60-64 year old householders. Across races, White households possess the highest rate of agreement at 4.13 percent and householders of some other race alone the lowest at 1.74 percent. Households with Non-Hispanic householders agree with vendor data more frequently than households with Hispanic householders (4.05 versus 2.43 percent). The responses for households with householders born in the United States (4.00 percent) agree with vendor data more frequently than foreign born at 3.04 percent. Likewise, responses among owners present greater agreement at 83.51 percent compared to renters and other types of occupants.

Geographically, vendor data agrees with ACS responses from households in metropolitan areas at a higher rate (4.18 percent) than those located in non-metropolitan areas. Across states, agreement rates range from 0.15 percent in South Dakota to 8.08 percent in Maine. When linked records do not agree between ACS and vendor data, the vendor data tends to take on a missing value. In every state, the rate of missing data exceeds the rate for linked where values are present but disagree. Hawaii has the lowest rate of missing values in linked vendor data (81.74 percent) while South Dakota has the highest (99.85 percent).[20, 21]

---

[19] The percentages that describe the agreement rate between vendor data and ACS values are ratios of the count where vendor=ACS divided by number of linked cases in the referenced demographic or geographic category.

[20] These percentages are calculated by dividing the number of cases where vendor data is missing in each state by the total linked cases in that state.

[21] The vendor data does not report any mortgage information Vermont. Therefore, all results on agreement for this state are zero percent and the rate of missing information is 100 percent.

Table 10: Coverage and Match Rates for ACS Second Mortgage/Home Equity Loan by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data

	Linked Count	% of Linked Count	Rate of Agreement		
			vendor = ACS	vendor ≠ ACS	vendor is missing
Sex (of householder)					
Male	589,109	50.15	4.13	9.91	85.96
Female	585,679	49.85	3.66	9.42	86.92
Age (of householder)					
15-19	3,900	0.33	0.64	10.13	89.23
20-24	21,192	1.80	0.50	9.89	89.60
25-29	55,631	4.74	0.69	8.98	90.34
30-34	84,142	7.16	1.19	9.33	89.48
35-39	93,370	7.95	2.06	9.27	88.67
40-44	107,795	9.18	2.79	9.30	87.91
45-49	117,669	10.02	3.78	9.22	86.99
50-54	136,452	11.62	4.68	9.30	86.02
55-59	137,146	11.67	5.46	9.45	85.09
60-64	123,457	10.51	5.80	10.21	83.98
65-69	105,063	8.94	5.72	10.55	83.72
70 and over	188,708	16.06	4.14	10.23	85.63
Race (of householder)					
White alone	982,92	83.67	4.13	9.43	86.44
Black or African American alone	92,515	7.88	2.53	9.47	88.00
American Indian or Alaska Native alone	5,842	0.50	2.12	7.94	89.93
Asian alone	50,121	4.27	3.58	12.98	83.44
Native Hawaiian or Pacific Islander alone	1,054	0.09	2.47	11.20	86.34
Some Other Race alone	23,097	1.97	1.74	13.21	85.05
Two or More Races	19,231	1.64	2.62	9.94	87.44

Table 10: Coverage and Match Rates for ACS Second Mortgage/Home Equity Loan by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data (continued)

	Linked Count	% of Linked Count	Rate of Agreement vendor = ACS	vendor ≠ ACS	vendor is missing
Ethnicity (of householder)					
Hispanic or Latino (of any race)	107,743	9.17	2.43	12.49	85.08
Not Hispanic or Latino	1,067,045	90.83	4.05	9.38	86.58
Nativity (of householder)					
Native	1,044,280	88.89	4.00	9.25	86.75
Foreign born	130,508	11.11	3.04	13.00	83.96
Tenure					
Owned	1,002,454	85.33	4.56	9.49	85.95
Rented	156,373	13.31	0.01	10.88	89.12
Other	15,961	1.36	0.07	9.03	90.90
Metropolitan Statistical Area					
Metropolitan	998,110	84.96	4.18	10.49	85.33
Micropolitan	104,376	8.88	2.72	5.58	91.7
Other	72,302	6.15	1.73	4.17	94.09
State					
Alabama	12,499	1.06	3.22	6.41	90.38
Alaska	2,132	0.18	2.02	8.35	89.63
Arizona	26,465	2.25	2.98	11.97	85.04
Arkansas	11,471	0.98	1.20	3.66	95.14
California	132,681	11.29	3.57	13.78	82.65
Colorado	23,807	2.03	3.72	11.83	84.45
Connecticut	14,319	1.22	1.18	4.97	93.85
Delaware	3,966	0.34	5.27	12.83	81.90
District of Columbia	2,037	0.17	4.32	13.60	82.08
Florida	74,570	6.35	3.70	12.21	84.09
Georgia	31,323	2.67	2.98	8.34	88.69
Hawaii	4,632	0.39	6.99	11.27	81.74
Idaho	5,192	0.44	4.03	10.86	85.11
Illinois	51,344	4.37	5.47	12.21	82.32
Indiana	25,675	2.19	3.74	7.10	89.16
Iowa	16,314	1.39	3.85	11.14	85.01
Kansas	13,082	1.11	2.07	4.75	93.17
Kentucky	14,261	1.21	3.19	6.22	90.59
Louisiana	9,397	0.80	2.00	5.77	92.23
Maine	4,292	0.37	8.08	8.99	82.92

Table 10: Coverage and Match Rates for ACS Second Mortgage/Home Equity Loan by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data (continued)

	Linked Count	% of Linked Count	Rate of Agreement		
			vendor = ACS	vendor ≠ ACS	vendor is missing
Maryland	25,278	2.15	5.38	10.90	83.72
Massachusetts	24,911	2.12	2.29	4.05	93.66
Michigan	47,438	4.04	3.72	6.07	90.21
Minnesota	32,086	2.73	3.10	7.09	89.81
Mississippi	5,11	0.44	0.74	1.74	97.52
Missouri	22,696	1.93	3.28	7.88	88.84
Montana	3,926	0.33	2.83	9.09	88.08
Nebraska	9,743	0.83	2.49	6.28	91.22
Nevada	11,366	0.97	1.96	12.07	85.97
New Hampshire	4,868	0.41	7.25	8.11	84.63
New Jersey	31,589	2.69	6.95	10.94	82.11
New Mexico	5,267	0.45	3.08	10.23	86.69
New York	51,844	4.41	5.51	8.57	85.92
North Carolina	36,608	3.12	5.58	9.69	84.72
North Dakota	2,626	0.22	2.89	8.72	88.39
Ohio	53,91	4.59	5.84	11.10	83.06
Oklahoma	19,509	1.66	1.16	5.28	93.55
Oregon	14,962	1.27	4.19	12.70	83.11
Pennsylvania	59,592	5.07	5.75	10.01	84.24
Rhode Island	2,672	0.23	0.75	2.62	96.63
South Carolina	17,400	1.48	3.51	7.63	88.87
South Dakota	1,960	0.17	0.00	0.15	99.85
Tennessee	24,946	2.12	4.14	10.36	85.50
Texas	73,695	6.27	2.37	9.72	87.91
Utah	11,030	0.94	3.79	11.21	85.00
Vermont	2,410	0.21	0.00	0.00	100.00
Virginia	32,287	2.75	3.27	8.42	88.31
Washington	28,473	2.42	3.73	11.33	84.94
West Virginia	3,739	0.32	1.68	2.65	95.67
Wisconsin	31,981	2.72	3.78	6.49	89.73
Wyoming	1,401	0.12	3.00	6.78	90.22

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.
Note: The vendor data does not report any mortgage information on Vermont. Therefore, all results on agreement for this state are zero percent and the rate of missing information is 100 percent.

8. CONCLUSIONS

This report describes the agreement of 2014 vendor data to various housing finance topics collected in the ACS in order to evaluate the coverage and quality of administrative record data

for survey item replacement or supplementation. Four ACS topics of interest are covered in this report: primary mortgage type and monthly payment, and secondary mortgage and/or home equity loan and monthly payment. [22] To address these topics, the vendor data consists of housing unit level administrative data on mortgage transactions. The analysis includes an evaluation of vendor data coverage of the ACS sample via the MAFID-match rate, availability of valid (i.e. non-missing) information within linked vendor data, and value agreement between the vendor data and ACS.

Overall coverage of the vendor data is represented by the MAFID-match rate, which is 51.67 percent of all 2014 ACS households. Among linked cases, linkage to non-missing values in the vendor data is relatively high for the primary financing type (77.16%) and monthly payment for primary mortgage (66.61%) topics. The linkage rate to non-missing values for secondary financing type is a relatively low 13.56 percent. Because this rate is comparable to the 13.36 percent ACS self-response rate among linked cases, it appears the vendor data displays sufficient availability of information on this topic in spite of its low linkage rate to non-missing information. Unfortunately, vendor data on the contract terms for secondary mortgages does not provide enough information to calculate the monthly payment for comparison to ACS data. Only 3.57 percent of linked records have non-missing vendor data on contract terms of secondary mortgages such as loan maturity and principle. There is no vendor data on the interest rate for secondary loans. Missing vendor data is also an issue for one particular state, Vermont. No mortgage information for this state is reported in the vendor data.

The final part of the analysis focuses on agreement between linked values. Overall agreement rates (including ACS missing responses) for each topic are as follows: primary financing type (55.84 percent), monthly mortgage payment (27.37 percent), and second mortgage/home equity loan (81.44 percent). It is worthwhile to note that agreement rates differ among linked cases without missing values. In this case, ACS responses agree with vendor values 76.48 percent of the time for primary financing type, 13.16 percent for monthly payment of primary mortgage, and 87.13 percent for secondary financing type. Removal of missing values augments overall agreement for the financing type questions. This suggests vendor data may be valuable for use in an imputation scheme as valid vendor data values are predictive of the existence of a mortgage, although not necessarily the type. As the mortgage contract terms measure has missing data, it limits the agreement rate for monthly mortgage payment. In fact, the monthly payment of second mortgages could not be calculated because the interest rate on these loans is unavailable.

Data limitations largely stem from missing and outdated information within the vendor data. Conceptual misalignment between the ACS and the vendor data is also a factor, due to differences in data objectives and collection methods. In spite of such limitations, administrative mortgage transaction data display potential for supplementation and imputation purposes. As evidenced by decent agreement in linked values, the vendor data performs well for the ACS financing type topics. Additionally, linkage to non-missing information allows vendor data to supplement missing ACS values. For example, the vendor data confirms active mortgages for 31.59 percent of ACS households reporting "none." In this manner, mortgage transaction data may add value to the ACS.

---

[22] Analysis is also conducted on single-family, owner-occupied subsample. Results reported in the appendix.

9. REFERENCES

Benitez-Silva, H., Eren, S., Heiland, F. & Jimenez-Martin, S. (2008). "How well do individuals predict the selling prices of their homes?", Working Paper, Levy Economics Institute, No. 571.

Bond, B., Brown, J., Luque, A. & O'Hara, A. (2014). "The Nature of the Bias When Studying Only Linkable Person Records: Evidence from the American Community Survey," CARRA Working Paper Series, Working Paper #2014-08. Washington, D.C.: U.S. Census Bureau.

Brummet, Q. O. (2014). Comparison of Survey, Federal, and Commercial Address Quality. CARRA Working Paper #2014-06. Washington, D.C.: U.S. Census Bureau.

Bucks, B. & Pence, K. (2008). "Do Borrowers Know their Mortgage Terms?", *Journal of Urban Economics, 64*, 218-233.

Chappell, G. & Obenski, S. (2014). "Fiscal Year 2014 Content Review Results", American Community Survey Fiscal Year 2014 Content Review. Washington, D.C.: U.S. Census Bureau.

Kiel, K. A. & Zabel, J. E. (1999). "The Accuracy of Owner-Provided House Values: The 1978–1991 American Housing Survey", Real Estate Economics, 27(2), 263–298.

Kingkade, W. W. (2013). "Self-Assessed Housing Values In The American Community Survey: An Exploratory Evaluation Using Linked Real Estate Records", Paper presented at the 2013 Joint Statistical Meetings in Montreal, Canada.

Lavrakas, P. J. (2008). *Encyclopedia of Survey Research Methods*. Thousand Oaks, CA: SAGE Publications, Inc. (1). 180.

Luque, A. & Bhaskar, R. (2014). "2010 American Community Survey Match Study", CARRA Working Paper Series, Working Paper #2014-03. Washington, D.C.: U.S. Census Bureau.

Manski, C. F. (2007). Identification for Prediction and Decision. Harvard University Press.

Manski, C. F. & Molinari, F. (2010). "Rounding Probabilistic Expectations in Surveys", Journal of Business and Economic Statistics, 28(2), 219-231.

Pudney, S. (2008). "Heaping and Leaping: Survey Response Behaviour and the Dynamics of Self-Reported Consumption Expenditure", Institute for Social and Economic Research Working Paper #2008-09. University of Essex, U.K.

Ruggles, P. (2015). "Review of Administrative Data Sources Relevant to the American Community Survey", Prepared for the U.S. Census Bureau, January 31.

Seeskin, Z. H. (2016). Evaluating the Use of Commercial Data to Improve Survey Estimates of Property Taxes. CARRA Working Paper #2016-06. Washington, D.C.: U.S. Census Bureau.

U.S. Census Bureau. (2015). "Agility in Action: A Snapshot of Enhancements to the American Community Survey", https://www.census.gov/content/dam/Census/programs-

surveys/acs/operations-and-administration/2015-16-survey-enhancements/Agility_in_Action_V1.1.pdf.

U.S. Census Bureau. (2017). "Agility in Action: A Snapshot of Enhancements to the American Community Survey", https://www.census.gov/content/dam/Census/programs-surveys/acs/operations-and-administration/2015-16-survey-enhancements/Agility%20in%20Action%20v2.0.pdf.

Zanutto, E. & Zaslavsky, A. (2002). "Using Administrative Records to Impute For Nonresponse", *Survey Nonresponse*. New York: John Wiley and Sons, 403–415.

10. APPENDIX: SUPPLEMENTAL TABLES AND SUBSAMPLE ANALYSIS OF SINGLE-FAMILY, OWNER-OCCUPIED HOUSING UNITS

Table 11: Match Rate for Non-Missing and Missing Vendor Data among MAFID-Matched Observations, Single-Family, Owner-Occupied Subsample

ACS topic	Count, ACS records linked to non-missing vendor data	% of ACS records linked to non-missing vendor data	Count, ACS records linked to missing vendor data	% of ACS records linked to missing vendor data
Financing Type	747,094	79.35	194,395	20.65
Mortgage Payment Amount	648,289	68.86	293,200	31.14
Second Mortgage/ HEL	134,502	14.29	806,987	85.71
Second Mortgage/ HEL Amount	30,747	3.27	910,742	96.73

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.
Note: Rows sum to total MAFID-matched obs. (Number of ACS households) = 941,489

10.1 Financing Type

10.1.1 Cross-Tabulation of ACS and Vendor Data Financing Type Responses

Table 12: Table 12: ACS Financing Type by Vendor Data, Single-Family, Owner-Occupied Subsample

ACS Financing Type	Total ACS Count	Linked ACS Count (Row total)	Vendor Financing Type			
			Mortgage		NA	
			N	Row % / Col. %	N	Row % / Col. %
Mortgage, deed of trust, or debt secured by real estate	737,006	612,944	545,951	89.07 / 73.08	66,993	10.93 / 34.46
Contract to purchase	10,560	7,360	5,127	69.66 / 0.69	2,233	30.34 / 1.15
None	421,402	246,089	152,005	61.77 / 20.35	94,084	38.23 / 48.40
NA	151,950	75,096	44,011	58.61 / 5.89	31,085	41.39 / 15.99
Column total	1,320,918	941,489	747,094		194,395	

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.
Note: Row percentages are proportions of linked ACS cases. Vendor data does not contain analogous information for the "contract to purchase" or "none" ACS responses.

10.1.2 Agreement in Financing Type across Subpopulation and Housing Characteristics

Table 13: Coverage and Match Rates for ACS Financing Type by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data — Single-Family, Owner-Occupied Subsample

	Linked Count	% of Linked Count	Rate of Agreement		
			vendor = ACS	vendor ≠ ACS	vendor is missing
Sex (of householder)					
Male	485,364	51.55	57.92	22.26	19.82
Female	456,125	48.45	58.06	20.41	21.53
Age (of householder)					
15-19	1,953	0.21	55.76	26.06	18.18
20-24	8,856	0.94	61.12	17.85	21.03
25-29	32,784	3.48	72.41	11.39	16.20
30-34	57,724	6.13	75.15	10.77	14.08
35-39	68,645	7.29	75.09	11.19	13.72
40-44	84,336	8.96	73.82	12.50	13.68
45-49	96,424	10.24	71.02	14.88	14.10
50-54	114,705	12.18	66.18	18.09	15.74
55-59	117,403	12.47	60.22	22.27	17.51
60-64	106,619	11.32	53.23	26.45	20.32
65-69	90,863	9.65	46.03	30.68	23.29
70 and over	161,026	17.10	27.80	33.24	38.96
Race (of householder)					
White alone	805,235	85.53	57.12	21.09	21.78
Black or African American alone	63,521	6.75	60.81	21.64	17.55
American Indian or Alaska Native alone	3,985	0.42	55.33	19.47	25.19
Asian alone	39,401	4.18	65.63	26.24	8.13
Native Hawaiian or Pacific Islander alone	649	0.07	67.80	19.26	12.94
Some Other Race alone	15,278	1.62	64.89	24.95	10.16
Two or More Races	13,420	1.43	66.51	18.52	14.97
Ethnicity (of householder)					
Hispanic or Latino (of any race)	74,944	7.96	63.86	24.12	12.02
Not Hispanic or Latino	866,545	92.04	57.48	21.13	21.39
Nativity (of householder)					
Native	843,967	89.64	57.43	20.70	21.87
Foreign born	97,522	10.36	62.85	27.12	10.03
Tenure					
Owned	941,489	100.00	57.99	21.36	20.65

Table 13: Coverage and Match Rates for ACS Financing Type by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data — Single-Family, Owner-Occupied Subsample (continued)

	Linked Count	% of Linked Count	Rate of Agreement		
			vendor = ACS	vendor ≠ ACS	vendor is missing
Metropolitan Statistical Area					
Metropolitan	800,849	85.06	62.12	22.94	14.94
Micropolitan	83,356	8.85	39.33	13.98	46.69
Other	57,284	6.08	27.34	10.15	62.51
State					
Alabama	10,181	1.08	42.67	13.97	43.37
Alaska	1,744	0.19	73.97	19.67	6.36
Arizona	19,770	2.10	65.48	27.41	7.11
Arkansas	8,659	0.92	37.51	12.39	50.10
California	100,123	10.63	68.69	22.26	9.05
Colorado	18,926	2.01	71.07	20.50	8.43
Connecticut	12,171	1.29	65.99	28.63	5.38
Delaware	3,428	0.36	65.61	24.30	10.09
District of Columbia	1,240	0.13	73.63	22.02	4.35
Florida	51,737	5.50	58.57	30.81	10.62
Georgia	24,266	2.58	62.42	20.71	16.87
Hawaii	2,963	0.31	57.31	21.53	21.16
Idaho	4,233	0.45	66.01	22.16	11.84
Illinois	41,421	4.40	61.56	24.16	14.28
Indiana	21,413	2.27	49.93	14.49	35.58
Iowa	14,061	1.49	54.63	17.25	28.13
Kansas	10,801	1.15	42.23	13.52	44.26
Kentucky	11,449	1.22	42.91	13.08	44.00
Louisiana	7,349	0.78	47.65	13.73	38.62
Maine	3,731	0.40	62.40	18.57	19.03
Maryland	21,310	2.26	72.80	21.90	5.30
Massachusetts	20,320	2.16	64.97	29.43	5.61
Michigan	40,364	4.29	53.08	20.01	26.90
Minnesota	28,417	3.02	47.07	14.17	38.76
Mississippi	3,957	0.42	15.19	4.75	80.06
Missouri	18,587	1.97	55.21	18.42	26.38
Montana	3,209	0.34	54.66	20.22	25.12
Nebraska	8,286	0.88	48.13	15.47	36.40
Nevada	7,715	0.82	64.64	26.88	8.48
New Hampshire	4,247	0.45	70.19	18.81	11.00
New Jersey	26,872	2.85	65.45	27.85	6.71
New Mexico	4,148	0.44	62.27	22.54	15.19
New York	42,893	4.56	49.14	19.59	31.27
North Carolina	28,585	3.04	62.86	20.14	17.00

Table 13: Coverage and Match Rates for ACS Financing Type by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data — Single-Family, Owner-Occupied Subsample (continued)

	Linked Count	% of Linked Count	Rate of Agreement		
			vendor = ACS	vendor ≠ ACS	vendor is missing
North Dakota	2,333	0.25	62.24	24.77	12.99
Ohio	44,706	4.75	58.24	26.33	15.43
Oklahoma	14,709	1.56	50.08	17.99	31.93
Oregon	11,527	1.22	67.03	22.30	10.67
Pennsylvania	51,373	5.46	48.91	22.49	28.6
Rhode Island	2,208	0.23	66.58	26.22	7.20
South Carolina	13,584	1.44	52.12	17.87	30.01
South Dakota	1,672	0.18	1.20	0.54	98.27
Tennessee	19,848	2.11	56.27	20.71	23.02
Texas	59,635	6.33	57.08	22.76	20.16
Utah	9,285	0.99	68.71	23.72	7.57
Vermont	1,975	0.21	0.00	0.00	100.00
Virginia	26,211	2.78	62.50	15.88	21.62
Washington	22,329	2.37	69.21	23.35	7.44
West Virginia	3,105	0.33	18.36	4.99	76.65
Wisconsin	27,241	2.89	49.08	14.47	36.46
Wyoming	1,172	0.12	54.86	13.82	31.31

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.

10.2 Mortgage Payment Amount

10.2.1 Cross-Tabulation of ACS and Vendor Data Mortgage Payment Amount Responses

Table 14: ACS Mortgage Amount by Vendor Data, Single-Family, Owner-Occupied Subsample

ACS Mortgage Adjusted Deciles	Linked ACS Count	Vendor Mortgage Adjusted Deciles										
		1	2	3	4	5	6	7	8	9	10	NA
1	38,151	8,323	3,442	1,826	925	1,106	788	593	614	537	830	19,167
		21.82	9.02	4.79	2.42	2.90	2.07	1.55	1.61	1.41	2.18	50.24
2	45,104	16,979	6,519	1,626	633	622	427	262	242	179	340	17,275
		37.64	14.45	3.61	1.40	1.38	0.95	0.58	0.54	0.40	0.75	38.30
3	59,064	18,248	14,568	4,457	1,414	1,106	578	429	372	256	419	17,217
		30.90	24.66	7.55	2.39	1.87	0.98	0.73	0.63	0.43	0.71	29.15
4	59,601	13,350	16,042	8,526	2,924	1,808	977	612	520	361	518	13,963
		22.40	26.92	14.31	4.91	3.03	1.64	1.03	0.87	0.61	0.87	23.43
5	66,933	8,689	19,309	11,299	6,026	4,087	1,618	984	784	565	731	12,841
		12.98	28.85	16.88	9.00	6.11	2.42	1.47	1.17	0.84	1.09	19.18
6	65,838	5,180	16,151	11,116	7,344	7,087	3,025	1,606	1,201	899	1,048	11,181
		7.87	24.53	16.88	11.15	10.76	4.59	2.44	1.82	1.37	1.59	16.98

Table 14: ACS Mortgage Amount by Vendor Data, Single-Family, Owner-Occupied Subsample (continued)

ACS Mortgage Adjusted Deciles	Linked ACS Count	Vendor Mortgage Adjusted Deciles										
		1	2	3	4	5	6	7	8	9	10	NA
7	69,404	4,403	11,379	12,007	7,870	9,354	5,815	3,347	1,959	1,378	1,501	10,391
		6.34	16.40	17.30	11.34	13.48	8.38	4.82	2.82	1.99	2.16	14.97
8	70,179	3,794	5,327	11,660	7,656	9,330	7,927	6,276	4,212	2,368	2,324	9,305
		5.41	7.59	16.61	10.91	13.29	11.30	8.94	6.00	3.37	3.31	13.26
9	72,974	3,586	2,423	5,134	7,306	9,273	8,750	7,499	8,828	6,334	5,374	8,467
		4.91	3.32	7.04	10.01	12.71	11.99	10.28	12.10	8.68	7.36	11.60
10	69,742	2,822	1,580	1,402	1,827	4,421	7,110	4,248	7,812	10,742	20,351	7,427
		4.05	2.27	2.01	2.62	6.34	10.19	6.09	11.20	15.40	29.18	10.65
NA	324,499	41,935	33,626	20,410	11,535	12,686	8,879	6,439	6,715	5,857	10,451	165,966
		12.92	10.36	6.29	3.55	3.91	2.74	1.98	2.07	1.80	3.22	51.15
Column total	941,489	127,309	130,366	89,463	55,460	60,880	45,894	32,295	33,259	29,476	43,887	293,200

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.
Note: Values in shaded rows are row percentages associated with above cross-tabulation frequency. Row percentages are proportions of linked ACS cases.

10.2.2 Agreement in Mortgage Payment Amount across Subpopulation and Housing Characteristics

Table 15: Coverage and Match Rates for ACS Mortgage Payment by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data —1 Percent Difference, Single-Family, Owner-Occupied Subsample

	Linked Count	% of Linked Count	Rate of Agreement			
			vendor < ACS	vendor = ACS	vendor > ACS	vendor is missing
Sex (of householder)						
Male	485,364	51.55	43.87	0.71	7.69	47.73
Female	456,125	48.45	43.75	0.60	7.40	48.25
Age (of householder)						
15-19	1,953	0.21	26.06	0.20	7.83	65.90
20-24	8,856	0.94	43.12	0.55	8.43	47.89
25-29	32,784	3.48	58.13	0.62	8.74	32.52
30-34	57,724	6.13	60.84	0.72	8.38	30.06
35-39	68,645	7.29	59.54	0.80	8.83	30.83
40-44	84,336	8.96	57.53	0.83	8.68	32.96
45-49	96,424	10.24	54.15	0.83	8.39	36.63
50-54	114,705	12.18	49.81	0.71	7.68	41.81
55-59	117,403	12.47	45.26	0.67	7.12	46.96
60-64	106,619	11.32	39.32	0.63	6.96	53.08
65-69	90,863	9.65	33.34	0.62	7.09	58.95
70 and over	161,026	17.10	18.53	0.39	6.20	74.89
Race (of householder)						
White alone	805,235	85.53	43.3	0.64	7.14	48.92
Black or African American alone	63,521	6.75	46.06	0.53	8.16	45.24
American Indian or Alaska Native alone	3,985	0.42	43.21	0.45	7.75	48.58
Asian alone	39,401	4.18	47.37	1.21	12.26	39.16
Native Hawaiian or Pacific Islander alone	649	0.07	49.77	0.31	11.71	38.21
Some Other Race alone	15,278	1.62	46.37	0.67	12.43	40.53
Two or More Races	13,420	1.43	50.66	0.76	9.55	39.03
Ethnicity (of householder)						
Hispanic or Latino (of any race)	74,944	7.96	47.93	0.64	11.09	40.35
Not Hispanic or Latino	866,545	92.04	43.46	0.66	7.25	48.64
Nativity (of householder)						
Native	843,967	89.64	43.62	0.62	7.06	48.70
Foreign born	97,522	10.36	45.45	0.96	11.81	41.78

Table 15: Coverage and Match Rates for ACS Mortgage Payment by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data — 1 Percent Difference, Single-Family, Owner-Occupied Subsample (continued)

	Linked Count	% of Linked Count	Rate of Agreement vendor < ACS	vendor = ACS	vendor > ACS	vendor is missing
Tenure						
Owned	941,489	100	43.81	0.66	7.55	47.98
Metropolitan Statistical Area						
Metropolitan	800,849	85.06	46.92	0.72	8.19	44.17
Micropolitan	83,356	8.85	30.33	0.32	4.27	65.08
Other	57,284	6.08	19.95	0.24	3.42	76.38
State						
Alabama	10,181	1.08	35.10	0.28	3.89	60.72
Alaska	1,744	0.19	63.36	0.52	4.36	31.77
Arizona	19,770	2.10	48.90	0.59	13.28	37.22
Arkansas	8,659	0.92	30.52	0.25	5.52	63.70
California	100,123	10.63	44.24	1.20	17.15	37.41
Colorado	18,926	2.01	56.50	0.87	11.10	31.53
Connecticut	12,171	1.29	43.60	0.27	7.09	49.03
Delaware	3,428	0.36	51.40	0.61	5.63	42.36
District of Columbia	1,240	0.13	53.47	0.65	14.11	31.77
Florida	51,737	5.50	43.95	0.61	10.97	44.46
Georgia	24,266	2.58	51.39	0.68	8.93	39.00
Hawaii	2,963	0.31	39.72	0.40	6.82	53.05
Idaho	4,233	0.45	55.00	0.50	7.02	37.49
Illinois	41,421	4.40	47.06	1.69	9.50	41.75
Indiana	21,413	2.27	43.25	0.32	4.62	51.81
Iowa	14,061	1.49	43.74	0.26	5.27	50.74
Kansas	10,801	1.15	35.01	0.26	2.66	62.08
Kentucky	11,449	1.22	32.13	0.30	3.86	63.71
Louisiana	7,349	0.78	34.58	0.29	2.75	62.39
Maine	3,731	0.40	49.77	0.46	4.53	45.24
Maryland	21,310	2.26	55.67	0.76	9.10	34.46
Massachusetts	20,320	2.16	35.78	0.17	2.01	62.04
Michigan	40,364	4.29	39.10	0.42	5.50	54.98
Minnesota	28,417	3.02	39.45	0.46	5.54	54.55
Mississippi	3,957	0.42	13.60	0.08	1.62	84.71
Missouri	18,587	1.97	44.85	0.34	5.24	49.56
Montana	3,209	0.34	43.41	0.28	5.95	50.36
Nebraska	8,286	0.88	40.55	0.25	3.07	56.13
Nevada	7,715	0.82	42.77	0.43	17.62	39.18
New Hampshire	4,247	0.45	53.19	0.35	5.11	41.35
New Jersey	26,872	2.85	47.29	0.58	5.65	46.48

Table 15: Coverage and Match Rates for ACS Mortgage Payment by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data — 1 Percent Difference, Single-Family, Owner-Occupied Subsample (continued)

	Linked Count	% of Linked Count	Rate of Agreement			
			vendor < ACS	vendor = ACS	vendor > ACS	vendor is missing
New Mexico	4,148	0.44	49.98	0.80	6.05	43.18
New York	42,893	4.56	33.95	0.79	3.53	61.73
North Carolina	28,585	3.04	52.16	0.53	6.46	40.85
North Dakota	2,333	0.25	51.99	0.39	8.4	39.22
Ohio	44,706	4.75	46.18	0.46	6.53	46.83
Oklahoma	14,709	1.56	41.71	0.34	4.96	52.99
Oregon	11,527	1.22	55.73	0.63	9.06	34.58
Pennsylvania	51,373	5.46	34.79	0.35	3.24	61.62
Rhode Island	2,208	0.23	31.25	0.09	1.72	66.94
South Carolina	13,584	1.44	42.93	0.54	5.98	50.54
South Dakota	1,672	0.18	0.90	0.00	0.18	98.92
Tennessee	19,848	2.11	46.22	0.59	6.35	46.84
Texas	59,635	6.33	48.58	0.46	4.63	46.33
Utah	9,285	0.99	52.28	0.68	8.21	38.84
Vermont	1,975	0.21	0.00	0.00	0.00	100.00
Virginia	26,211	2.78	49.19	1.89	8.09	40.83
Washington	22,329	2.37	56.29	0.75	9.16	33.80
West Virginia	3,105	0.33	12.17	0.19	0.68	86.96
Wisconsin	27,241	2.89	34.9	0.45	4.20	60.45
Wyoming	1,172	0.12	47.61	0.26	4.01	48.12

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.

Table 16: Coverage and Match Rates for ACS Mortgage Payment by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data —5 Percent Difference, Single-Family, Owner-Occupied Subsample

	Linked Count	% of Linked Count	Rate of Agreement			
			vendor < ACS	vendor = ACS	vendor > ACS	vendor is missing
Sex (of householder)						
Male	485,364	51.55	43.06	2.15	7.06	47.73
Female	456,125	48.45	42.99	1.96	6.80	48.25
Age (of householder)						
15-19	1,953	0.21	25.35	1.43	7.32	65.90
20-24	8,856	0.94	42.36	1.96	7.79	47.89
25-29	32,784	3.48	57.21	2.24	8.04	32.52
30-34	57,724	6.13	59.77	2.59	7.57	30.06
35-39	68,645	7.29	58.41	2.78	7.98	30.83
40-44	84,336	8.96	56.42	2.81	7.82	32.96
45-49	96,424	10.24	53.13	2.63	7.61	36.63
50-54	114,705	12.18	48.83	2.39	6.97	41.81
55-59	117,403	12.47	44.49	2.06	6.49	46.96
60-64	106,619	11.32	38.66	1.85	6.41	53.08
65-69	90,863	9.65	32.79	1.63	6.63	58.95
70 and over	161,026	17.10	18.23	0.95	5.93	74.89
Race (of householder)						
White alone	805,235	85.53	42.55	1.97	6.56	48.92
Black or African American alone	63,521	6.75	45.19	2.12	7.45	45.24
American Indian or Alaska Native alone	3,985	0.42	42.61	1.63	7.18	48.58
Asian alone	39,401	4.18	46.09	3.44	11.31	39.16
Native Hawaiian or Pacific Islander alone	649	0.07	47.92	2.77	11.09	38.21
Some Other Race alone	15,278	1.62	45.28	2.61	11.58	40.53
Two or More Races	13,420	1.43	49.78	2.43	8.76	39.03
Ethnicity (of householder)						
Hispanic or Latino (of any race)	74,944	7.96	46.89	2.50	10.26	40.35
Not Hispanic or Latino	866,545	92.04	42.69	2.02	6.65	48.64
Nativity (of householder)						
Native	843,967	89.64	42.88	1.95	6.48	48.70
Foreign born	97,522	10.36	44.32	3.00	10.90	41.78
Tenure						
Owned	941,489	100.00	43.03	2.06	6.93	47.98

Table 16: Coverage and Match Rates for ACS Mortgage Payment by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data — 5 Percent Difference, Single-Family, Owner-Occupied Subsample (continued)

	Linked Count	% of Linked Count	Rate of Agreement			
			vendor < ACS	vendor = ACS	vendor > ACS	vendor is missing
Metropolitan Statistical Area						
Metropolitan	800,849	85.06	46.05	2.27	7.51	44.17
Micropolitan	83,356	8.85	29.97	0.98	3.97	65.08
Other	57,284	6.08	19.69	0.73	3.20	76.38
State						
Alabama	10,181	1.08	34.76	0.97	3.55	60.72
Alaska	1,744	0.19	62.56	2.01	3.67	31.77
Arizona	19,770	2.10	47.64	2.89	12.25	37.22
Arkansas	8,659	0.92	30.00	1.10	5.20	63.70
California	100,123	10.63	42.73	3.97	15.88	37.41
Colorado	18,926	2.01	54.99	3.50	9.98	31.53
Connecticut	12,171	1.29	42.94	1.33	6.70	49.03
Delaware	3,428	0.36	50.67	1.90	5.08	42.36
District of Columbia	1,240	0.13	51.85	3.55	12.82	31.77
Florida	51,737	5.50	43.15	2.04	10.34	44.46
Georgia	24,266	2.58	50.42	2.41	8.17	39.00
Hawaii	2,963	0.31	39.15	1.35	6.45	53.05
Idaho	4,233	0.45	54.00	2.32	6.19	37.49
Illinois	41,421	4.40	46.02	3.55	8.69	41.75
Indiana	21,413	2.27	42.75	1.28	4.17	51.81
Iowa	14,061	1.49	43.21	1.06	4.99	50.74
Kansas	10,801	1.15	34.60	0.96	2.36	62.08
Kentucky	11,449	1.22	31.64	1.13	3.53	63.71
Louisiana	7,349	0.78	34.30	0.71	2.60	62.39
Maine	3,731	0.40	49.05	1.50	4.21	45.24
Maryland	21,310	2.26	54.48	2.82	8.24	34.46
Massachusetts	20,320	2.16	35.59	0.48	1.89	62.04
Michigan	40,364	4.29	38.57	1.39	5.06	54.98
Minnesota	28,417	3.02	38.98	1.27	5.20	54.55
Mississippi	3,957	0.42	13.42	0.35	1.52	84.71
Missouri	18,587	1.97	44.22	1.37	4.84	49.56
Montana	3,209	0.34	42.85	1.34	5.45	50.36
Nebraska	8,286	0.88	40.21	0.91	2.75	56.13
Nevada	7,715	0.82	41.70	2.58	16.54	39.18
New Hampshire	4,247	0.45	52.55	1.34	4.76	41.35
New Jersey	26,872	2.85	46.81	1.43	5.27	46.48
New Mexico	4,148	0.44	48.99	2.36	5.47	43.18
New York	42,893	4.56	33.48	1.62	3.17	61.73

Table 16: Coverage and Match Rates for ACS Mortgage Payment by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data — 5 Percent Difference, Single-Family, Owner-Occupied Subsample (continued)

	Linked Count	% of Linked Count	Rate of Agreement			
			vendor < ACS	vendor = ACS	vendor > ACS	vendor is missing
North Carolina	28,585	3.04	51.32	2.00	5.83	40.85
North Dakota	2,333	0.25	51.48	1.54	7.76	39.22
Ohio	44,706	4.75	45.47	1.76	5.95	46.83
Oklahoma	14,709	1.56	41.29	1.09	4.63	52.99
Oregon	11,527	1.22	54.74	2.34	8.34	34.58
Pennsylvania	51,373	5.46	34.44	0.99	2.95	61.62
Rhode Island	2,208	0.23	31.07	0.45	1.54	66.94
South Carolina	13,584	1.44	42.20	1.68	5.58	50.54
South Dakota	1,672	0.18	0.90	0.06	0.12	98.92
Tennessee	19,848	2.11	45.62	1.76	5.78	46.84
Texas	59,635	6.33	48.08	1.40	4.19	46.33
Utah	9,285	0.99	50.99	2.99	7.18	38.84
Vermont	1,975	0.21	0.00	0.00	0.00	100.00
Virginia	26,211	2.78	47.69	4.49	6.99	40.83
Washington	22,329	2.37	55.07	2.84	8.29	33.80
West Virginia	3,105	0.33	11.95	0.55	0.55	86.96
Wisconsin	27,241	2.89	34.43	1.27	3.85	60.45
Wyoming	1,172	0.12	46.84	1.19	3.84	48.12

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.

10.3 Second Mortgage/Home Equity Loan

10.3.1 Cross-Tabulation of ACS and Vendor Data Second Mortgage/Home Equity Loan Responses

Table 17: ACS Second Mortgage/Home Equity Loan by Vendor Data, Single -Family, Owne r-Occupied Subsample

ACS Second Mortgage/ HEL	Total ACS Count	Linked ACS Count	Vendor Second Mortgage/HELOC data								
			HEL		Second mortgage		HEL and second mortgage		NA	
			N	Row % / Col. %	N	Row % / Col. %	N	Row % / Col. %	N	Row % / Col. %
Home equity loan	146,483	121,828	40,957	33.62 / 38.76	2,917	2.39 / 10.18	39	0.03 / 21.91	77,915	63.95 / 9.66
Second mortgage	30,082	25,040	2,077	8.29 / 1.97	3,377	13.49 / 11.78	10	0.04 / 5.62	19,576	78.18 / 2.43
HEL and second mortgage	5,818	4,789	1,198	25.02 / 1.13	221	4.61 / 0.77	-	0.00 / -	3,370	70.37 / 0.42
NA	1,138,535	789,832	61,426	7.78 / 58.14	22,151	2.80 / 77.27	129	0.02 / 72.47	706,126	89.40 / 87.50
Column total	1,320,918	941,489	105,658		28,666		178		806,987	

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.
Note: Row percentages are proportions of linked ACS cases.

10.3.2 Agreement in Second Mortgage/Home Equity Loan across Subpopulation and Housing Characteristics

Table 18: Coverage and Match Rates for ACS Second Mortgage/Home Equity Loan by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data—Single-Family, Owner-Occupied Subsample

	Linked Count	% of Linked Count	Rate of Agreement		
			vendor = ACS	vendor ≠ ACS	vendor is missing
Sex (of householder)					
Male	485,364	51.55	4.87	9.85	85.29
Female	456,125	48.45	4.54	9.29	86.17
Age (of householder)					
15-19	1,953	0.21	1.23	11.52	87.25
20-24	8,856	0.94	1.13	9.36	89.51
25-29	32,784	3.48	1.11	7.94	90.95
30-34	57,724	6.13	1.66	8.37	89.96
35-39	68,645	7.29	2.68	8.73	88.59
40-44	84,336	8.96	3.44	8.86	87.71
45-49	96,424	10.24	4.48	8.92	86.59
50-54	114,705	12.18	5.42	9.18	85.40
55-59	117,403	12.47	6.22	9.54	84.25
60-64	106,619	11.32	6.55	10.35	83.10
65-69	90,863	9.65	6.40	10.82	82.78
70 and over	161,026	17.10	4.66	10.56	84.78
Race (of householder)					
White alone	805,235	85.53	4.89	9.40	85.71
Black or African American alone	63,521	6.75	3.55	9.23	87.22
American Indian or Alaska Native alone	3,985	0.42	3.01	8.13	88.86
Asian alone	39,401	4.18	4.24	12.65	83.10
Native Hawaiian or Pacific Islander alone	649	0.07	3.85	10.94	85.21
Some Other Race alone	15,278	1.62	2.51	12.96	84.53
Two or More Races	13,420	1.43	3.62	9.52	86.86
Ethnicity (of householder)					
Hispanic or Latino (of any race)	74,944	7.96	3.31	12.30	84.39
Not Hispanic or Latino	866,545	92.04	4.83	9.34	85.83

Table 18: Coverage and Match Rates for ACS Second Mortgage/Home Equity Loan by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data—Single-Family, Owner-Occupied Subsample (continued)

	Linked Count	% of Linked Count	Rate of Agreement		
			vendor = ACS	vendor ≠ ACS	vendor is missing
Nativity (of householder)					
Native	843,967	89.64	4.81	9.21	85.97
Foreign born	97,522	10.36	3.82	12.72	83.46
Tenure					
Owned	941,489	100.00	4.71	9.58	85.71
Metropolitan Statistical Area					
Metropolitan	800,849	85.06	5.04	10.33	84.63
Micropolitan	83,356	8.85	3.33	5.84	90.84
Other	57,284	6.08	2.12	4.48	93.41
State					
Alabama	10,181	1.08	3.92	6.71	89.37
Alaska	1,744	0.19	2.47	8.03	89.51
Arizona	19,770	2.10	3.89	11.46	84.64
Arkansas	8,659	0.92	1.56	4.11	94.33
California	100,123	10.63	4.53	13.13	82.34
Colorado	18,926	2.01	4.51	11.71	83.77
Connecticut	12,171	1.29	1.30	4.63	94.07
Delaware	3,428	0.36	5.98	12.43	81.59
District of Columbia	1,240	0.13	5.81	12.58	81.61
Florida	51,737	5.50	4.96	12.18	82.86
Georgia	24,266	2.58	3.75	8.46	87.79
Hawaii	2,963	0.31	9.35	11.78	78.87
Idaho	4,233	0.45	4.89	11.10	84.01
Illinois	41,421	4.40	6.45	12.37	81.19
Indiana	21,413	2.27	4.42	7.47	88.11
Iowa	14,061	1.49	4.41	11.15	84.44
Kansas	10,801	1.15	2.49	4.93	92.57
Kentucky	11,449	1.22	3.94	6.63	89.43
Louisiana	7,349	0.78	2.56	5.95	91.5
Maine	3,731	0.40	8.84	9.22	81.94
Maryland	21,310	2.26	6.28	10.69	83.03
Massachusetts	20,320	2.16	2.61	3.93	93.46
Michigan	40,364	4.29	4.33	6.33	89.34
Minnesota	28,417	3.02	3.43	7.15	89.42
Mississippi	3,957	0.42	0.96	1.87	97.17
Missouri	18,587	1.97	3.93	7.91	88.15
Montana	3,209	0.34	3.46	9.19	87.35
Nebraska	8,286	0.88	2.93	6.38	90.68

Table 18: Coverage and Match Rates for ACS Second Mortgage/Home Equity Loan by Characteristics of the Householder and Geography for Data Linked by MAFID to Vendor Data—Single-Family, Owner-Occupied Subsample (continued)

	Linked Count	% of Linked Count	Rate of Agreement		
			vendor = ACS	vendor ≠ ACS	vendor is missing
Nevada	7,715	0.82	2.73	11.25	86.01
New Hampshire	4,247	0.45	7.94	8.19	83.87
New Jersey	26,872	2.85	7.90	10.77	81.34
New Mexico	4,148	0.44	3.83	10.25	85.92
New York	42,893	4.56	6.36	8.48	85.16
North Carolina	28,585	3.04	6.99	10.26	82.75
North Dakota	2,333	0.25	3.17	9.17	87.66
Ohio	44,706	4.75	6.95	11.13	81.92
Oklahoma	14,709	1.56	1.50	5.53	92.97
Oregon	11,527	1.22	5.20	13.04	81.76
Pennsylvania	51,373	5.46	6.54	9.94	83.52
Rhode Island	2,208	0.23	0.86	2.67	96.47
South Carolina	13,584	1.44	4.42	7.97	87.62
South Dakota	1,672	0.18	0.00	0.18	99.82
Tennessee	19,848	2.11	5.13	10.74	84.13
Texas	59,635	6.33	2.90	10.25	86.86
Utah	9,285	0.99	4.42	11.06	84.52
Vermont	1,975	0.21	0.00	0.00	100.00
Virginia	26,211	2.78	3.87	7.87	88.26
Washington	22,329	2.37	4.57	11.23	84.20
West Virginia	3,105	0.33	2.00	2.71	95.30
Wisconsin	27,241	2.89	4.33	6.52	89.15
Wyoming	1,172	0.12	3.50	7.17	89.33

Source: 2014 American Community Survey (unedited) and administrative record mortgage data.