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A New Approach to Industry and Occupation Recoding in the CPS

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A New Approach to Industry and Occupation Recoding in the CPS

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Abstract

This paper presents a new approach to recoding industry and occupation in the Current Population Survey (CPS) from 1976 to 2019. This recode uses the three- and four-digit Census codes present in the CPS to create consistent aggregate categories that closely align with the detailed and major industry and occupation categories used in the 2019 CPS. This approach yields more consistent aggregate categories than previous recoding schemes. This approach can also successfully be applied to recoding industry and occupation in all panels of the Survey of Income and Program Participation (SIPP).

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I. Introduction

Economists, labor economists specifically, are interested in jobs. What sort of companies are hiring workers? What are these workers doing? Are these trends changing over time? According to the Bureau of Labor Statistics' Current Population Survey, 156 million people were employed in the United States in December 2018. With such a large population, it is infeasible to examine each job separately. Industry and occupation classification schemes sort all jobs into a finite number of categories. Industry variables indicate the sector of the employer, such as logging or legal services, while occupation variables indicate the type of work the employee does, such as web developer or librarian. Over time, some types of jobs disappear while others appear, and industry and occupation classification schemes must adapt to these changes. To keep up with the changing nature of the labor market, the Census Bureau issues a new version of their industry and occupation classification schemes approximately every ten years, though sometimes more frequently.[2] These schemes are then adopted by microdata sets such as the Current Population Survey (CPS) and the Survey of Income and Program Participation (SIPP). After a change in classification scheme, current data are no longer directly comparable with previous data. Industry and occupation codes appear or disappear while others might change scope. Researchers studying industries or occupations over time must find a way to reconcile the different classification schemes.

This paper provides a new industry and occupation coding scheme for the CPS to address the limitations of currently available recodes. To achieve this goal, it recodes the Census codes used in the CPS from 1976 to present to aggregate categories based on the most recent Census classification schemes thus providing a current recode and a recode based on aggregate categories.

[2] Since 1976, the Census has used seven industry classification schemes (1970, 1980, 1990, 2000, 2002, 2007, and 2012) and six occupation classification schemes (1970, 1980, 1990, 2000, 2002, and 2010).

Specifically, this coding scheme is based on the detailed and major industries and occupations in the 2019 CPS which are in turn groupings of the 2012 Census industry codes and the 2010 Census occupation codes. While this recode uses aggregate categories specific to the CPS, the underlying Census codes give it wider relevance. The recode has been successfully applied to the SIPP. While not studied in this paper, the recode is also applicable to the Panel Study of Income Dynamics and other datasets that use the Census classification schemes.

The remainder of this paper describes the creation of this recode and its applications. Section II details the creation of the recode for the CPS. Section A gives an overview of the process while Section B explains exceptions that were made for the sake of consistency. Section III discusses the consistency of the recoded data and remaining problems, and Section IV illustrates how the recode can be applied to the SIPP.

II. Creation of the Recode

The general idea for this coding scheme is to categorize CPS data from 1976 onwards into the major and detailed industry and occupation groups in the 2019 CPS. However, because of the nature of the Census codes, some modifications had to be made to maintain consistent categories over time. Section A covers the general strategy used to create the recode while Section B summarizes deviations from the detailed and major industry and occupation categories in the 2019 CPS.

A. General Strategy

To create my recode, first I need to take stock of the variables I have. Then I need to decide on my preferred variable values. Finally, I need to find a way to assign each of my original variable values to a value in my new variable.

1. Census codes and aggregate categories in the CPS

The first step to creating a successful recode is to understand the data I do have. My dataset of interest is the CPS. The CPS is a monthly address-based labor force survey of U.S. households. Currently, approximately 150,000 people are interviewed each month on a range of topics including geographic area, demographic characteristics, and labor force status. The survey is administered by the Census on behalf of the Bureau of Labor Statistics and is publicly available starting in 1976. The publicly available CPS has had three main iterations: 1976–1988, 1989–1993, and 1994 onwards. In 1989 and 1994, the survey was entirely redesigned. The content of the survey changed, even basic questions were reworded, and, in the microdata, all variable names changed. I was unable to address survey changes in the recode (see Section III for a more detailed discussion). However, I do match variables through these name changes.

Throughout our 1976 to 2019 sample, the CPS has featured variables with the Census industry and occupation categories (see Tables C-1 and C-2 in Appendix C). Most recently the CPS has used the 2012 Census industry codes and 2010 Census occupation codes. Since 2003, the CPS has also used the 2002 and 2007 Census industry classification schemes (2003 to 2008 and 2009 to 2013 respectively) and the 2002 Census occupation classification scheme (2003 to 2010). These classification schemes are very similar to the current codes. However, between 1992 and 2002, the CPS used the 1990 Census industry and occupation classification schemes. The 1990 classification

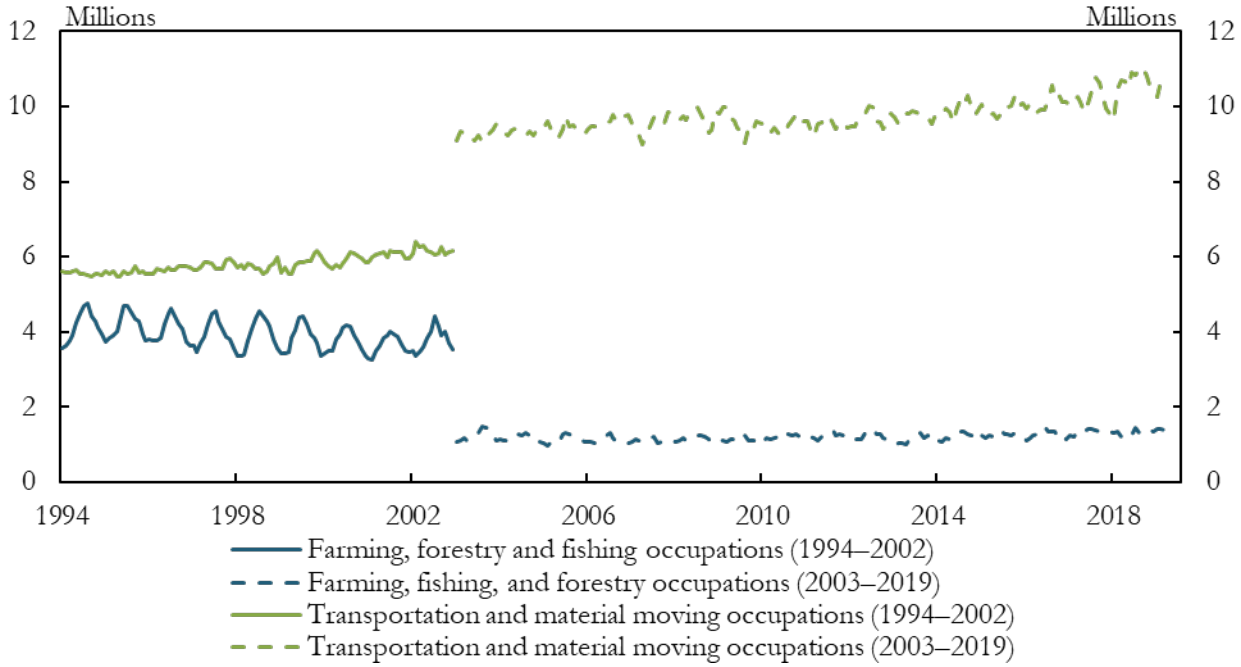
schemes are organized very differently from the later schemes. They also lack codes for many of the computer and technology jobs present today. From 1983–1991, the CPS used the 1980 classification schemes which are very similar to the 1990 schemes. Finally, from 1976–1983, the CPS used the 1970 classification schemes. The 1970 schemes differ greatly in organization and scope from all later classification schemes. For example, the 1970 Census codes feature no computer or internet based industries or occupations. Additionally, the 1970 codes include now obsolete jobs such as elevator operator and bootblack that were added to not elsewhere classified categories in later classification systems.

Currently, the CPS features four aggregate category variables for major industry (prmjind1), detailed industry (prdtind1), major occupation (prmjocc1), and detailed occupation (prdtocc1). The detailed industry and occupation categories are all subsets of the major categories (see Tables C-3 and C-4 in Appendix C). For instance, every job that is classified as detailed industry 22, 'Retail trade,' is also classified as major industry 5, 'Wholesale and retail trade.' The Census codes themselves are subsets of these aggregate categories. Every job with a certain Census code also has the same major and detailed classification. For instance, jobs classified as 2012 industry Census code 3680, 'Ship and boat building,' are always classified as detailed industry 10, 'Transportation equipment manufacturing,' and major industry 4, 'Manufacturing.'

The CPS has featured variables for aggregate categories since 1976 though of varying scope and specificity. The most recent change to the aggregate category variables occurred in 2003 when the CPS switched from the 1990 to 2002 Census codes. The names of the categories look deceptively similar before and after the 2003 change. The current major occupation category 'Farming, fishing, and forestry occupations' seems to have a match in pre-2003 major occupation 'Farming, forestry and fishing occupations.' Both systems feature a major occupation

'Transportation and material moving occupations.' However, despite the very similar names, these variables classify jobs quite differently. Figure 1 displays the time series of these four major occupation categories 1994 to present. The older aggregate categories classify many more jobs as Farming, fishing, and forestry occupations and many fewer jobs as Transportation and material moving occupations. Farther back in time, the aggregate categories resemble our current categories even less. The major occupation variable used in 1976 features such vague categories as 'Operatives except transport' and 'Nonfarm laborers.'

Figure 1: Time-series of farming and transportation major occupations in the CPS 1994 to 2019



Note: These time series were weighted using pwsswgt.
Sources: CPS and author's calculations.

2. A backward compatible aggregate category recode

When creating this recode, I endeavored to address the needs not met by previous efforts. The Integrated Public Use Microdata Series (IPUMS) already hosts three recodes for the Census

industry and occupation classification schemes used in the CPS and the SIPP. The first recode codes all Census industry and occupation categories from 1850 to present to the categories in the 1950 Census classification scheme. IPUMS determined where each industry or occupation fell in the 1950 classification system by use of Census crosswalks (IPUMS USA 2018). The Bureau of Labor Statistics created a similar recode centered at 1990 that is used by IPUMS (Meyer and Osborne 2005). In late 2015, IPUMS released a new occupation recode centered at 2010. They have yet to release an equivalent industry variable.

These recodes are incredibly valuable, but they do have some limitations. First, the classification schemes are not current. IPUMS's industry and occupation recodes based in 1950, while useful when working with decennial Census data that stretch back into the 19th century, are less applicable to more recent datasets such as the CPS and the SIPP. Publicly available CPS data start in 1976 while the SIPP starts in 1984. Coding these data back to 1950 imposes a classification scheme irrelevant to all time periods in the sample. IPUMS's 1990 based recodes do not have this problem, their base year falls within the datasets' sample periods. While not the most current schemes, the 1990 classification codes are fairly similar in scope to the current classification systems (2012 Census industry codes and 2010 Census occupation codes) though their organization is quite different. The IPUMS's 1990 based recode has the advantage, for the 1976 onwards sample, of only recoding data across one major change to Census codes.[3] However, by using the most recent codes, industry and occupation results can be compared to recent research, and researchers can extend such research without substantially affecting the results. IPUMS's 2010 based occupation recode does offer a current recode. However, the lack of a current industry recode limits its use for researchers

[3] Major changes only occurred between the 1970 and 1980 codes and the 1990 and 2000 codes. Pre-1990 data are coded forward through at most the 1970 to 1980 change while post-1990 data are coded backwards through the 1990 to 2000 change.

interested in both industry and occupation. Classification systems of similar vintage are needed to ensure that the industries and occupations are relevant to the same labor market.

A second limitation stems from IPUMS's decision to recode to as many of the 1950 and 1990 Census codes as possible. As stated on their website, "Even the most consistent occupational groupings are often too general and heterogeneous for some purposes, as well as unsuitable for many statistical techniques" (IPUMS USA 2018). Such detailed data are quite valuable. However, often researchers want aggregate categories. The Census classification schemes include hundreds of industries and hundreds of occupations that can prove unwieldy for analysis. As was discussed above, the CPS has a set of detailed industry and occupation categories that are made up of the original Census codes. These, in turn, combine to make up a set of major industry and occupation categories. While a researcher could just group the codes present in the IPUMS variables, this does not result in as consistent of detailed and major industries and occupations as a recode focused on the aggregate level. For IPUMS, the goal is consistent Census codes rather than consistent aggregate categories. Despite using the same Census crosswalks, these different goals can result in different mappings.

In light of the limitations of these recodes, I have three main goals. First, I want my recode to be benchmarked to the present and to be backward compatible. In other words, I want the values of my resultant variables to be those of current classification schemes, not those used back in the 1970s or 1980s. However, I want to take the industry and occupation codes used in the 1970s and 1980s and translate them to fit within this current classification.

Second, I want my resultant variables to be aggregate categories. I do not want to end up with hundreds of Census codes, but at most 50 sectors that encompass the entire economy. IPUMS and the BLS have already created Census code level recodes to fit the needs of researchers doing

analysis at the Census code level. This recode is aimed at the many research projects using broader industry and occupation categories for analysis. Specifically, I use the aggregate categories used in the 2019 CPS: variables prmjind1 and prmjocc1 for major industry and occupation and variables prdtind1 and prdtocc1 for detailed industry and occupation. These categories are already used in research featuring CPS data and are similar to categories used by many other datasets such as the major industry NAICS codes used by the Establishment Survey. Therefore, the categories are comparable to aggregate industry and occupation categories used in current research.

Third, and most importantly, I want the resultant categories to be consistent over time. If a job is assigned to a category in 2019, I want to make sure that that job would be assigned to the same category in 1976. My third objective is not always compatible with the previous two objectives. I chose to prioritize objective three, consistent categories, over the other two objectives. How this affected the creation of the recode is discussed in Section II.B, Deviations from the General Strategy.

3. Creation of the recode

To create my recode, I need to take earlier industry and occupation variables in the CPS and align them with the major and detailed industry and occupation categories in the 2019 CPS. Given that my goal is to end up with aggregate categories, it is tempting to try to match up the aggregate categories present throughout our CPS sample. However, as seen in Section I.A.2, these broad aggregate categories change over time and do not provide the consistency I need. Instead, I must rely on the much greater precision of the Census codes. By virtue of their number, the Census codes allow for small adjustments to be made. Instead of matching up all of 'Farming, forestry and fishing' with my 'Farming, fishing, and forestry' category, I can classify much smaller subsets of jobs. I can

choose to separate 'Veterinary services' from the rest of 'Farming, forestry and fishing' and place it in 'Professional and business services' creating a more consistent recode.

But how would I know that 'Veterinary services' makes more sense in 'Professional and business services' than in 'Farming, fishing, and forestry'? The Census Bureau publishes incredibly detailed crosswalks. Census's 2013 "1990-2012 Census Industry Codes with Crosswalk" provides information on all changes and modifications made to the Census industry codes from the 2000 codes to the 2012 codes while Census's 2011 "2010 Census Occupation Codes with Crosswalk" provides similar information for the Census occupation codes from 2000 to 2010. Here the changes are minor and information can be simply conveyed (i.e. this code is added, this code disappears). As discussed earlier, major changes occurred between the 1990 and 2000 Census industry and occupation codes. Consequently, the crosswalk is much more complicated.

To create the 1990 to 2000 Census crosswalk (Scopp 2003), the Census Bureau took a sample of 146,686 persons in the experienced civilian labor force from the 1990 Census and double-coded them in the 1990 and 2000 classification schemes. As part of the 1990 Census, these civilians had provided descriptions of their jobs and employers which had allowed Census workers to assign their jobs 1990 Census codes for both industry and occupation. Census workers then coded these individuals' jobs in the 2000 classification system based on these descriptions. Therefore, each job was assigned a 1990 and a 2000 Census industry code and a 1990 and a 2000 Census occupation code. The Census Bureau also recoded the 1990 industries and occupations based on their descriptions and titles in its *Alphabetical and Classified Indexes of Industries and Occupations*. Using this crosswalk of expected recodes, they reviewed suspect code combinations. They corrected coding errors and removed responses with vague descriptions that resulted in inconsistent coding. After correcting or removing over 5,300 observations, they created crosswalk tables. These tables report

what percentage of workers in any 1990 category were also classified in each 2000 category. Figure 2 shows a snippet of the crosswalk table. Figure 2 shows that 73% of jobs classified as Census industry code 451, 'Gas and steam supply systems,' in the 1990 system were also classified as code 058, 'Natural gas distribution,' in the 2000 system. There is similar information for every 1990 code.

Figure 2: Census crosswalk mapping for 1990 Census industry code 451

1990 code		2000 code		Percent of 1990 Category	Experienced Civilian Labor Force in 2000
451	Gas and steam supply systems	058	Natural gas distribution	73.096	128,411
		059	Electric and gas and other combinations	1.015	1,783
		067	Water, steam, air-conditioning, and irrigation systems	1.523	2,675
		627	Pipeline transportation	24.365	42,804

Source: Scopp (2003).

To create the crosswalks between the 1990 and 1980 codes (Census 1994) and the 1980 and 1970 codes (Census 1989), Census once more double-coded samples of the relevant censuses. For the 1980 to 1990 crosswalk, the Census Bureau double-coded a sample of 132,744 persons in the 1980 Census while, for the 1970 to 1980 crosswalk, Census double-coded a sample of 127,125 persons in the 1970 Census. Census did not recode the industries and occupations a second time based on descriptions as they did with the 1990 to 2000 crosswalk. Based on the double-coded data, they created tables similar to those in the 1990 to 2000 crosswalk which report what percentage of workers in any 1980 (or 1970) category were in each 1990 (or 1980) category.

To map all time periods to the 2019 CPS aggregate categories, I worked backward through time. First, I studied the most recent crosswalks (Census 2013, Census 2011) to understand changes to the Census codes since 2003, a period during which the aggregate categories did not change. Almost all changes occur within the CPS detailed and major industry and occupation category code

ranges shown in Tables C-3 and C-4 in Appendix C and so required no adjustments. There was one change needed. 'Transportation attendants' is in detailed occupation 22, 'Transportation and material moving occupations,' in the 2010 classification scheme, but in detailed occupation 15, 'Personal care and service occupations,' in the 2002 classification scheme. In the recode, I classified it as detailed occupation 22 throughout to stay consistent with the 2019 CPS aggregate categories.

Then I continued back in time to the pre-2003 codes. The CPS jumped straight from the 1990 Census codes to the 2002 Census codes in 2003. While the CPS skipped the 2000 Census codes, the Census crosswalks did not. Therefore, it was important to examine Census's crosswalks published in 2013 and 2011 to understand the changes made between the 2000 and 2002 Census codes. Once more, most changes were minor. The biggest change was that in the 2002 system onwards, all codes are four digits, while, in the 2000 system, they were only three digits. In general, the four-digit 2002 codes were created by adding a '0' to the end of the 2000 codes.

Then I used the 1990 to 2000 Census crosswalk to see to which industries or occupations each 1990 code mapped. I assigned each 1990 Census code to the detailed industry or occupation code to which the greatest percentage of jobs mapped. For instance, consider the crosswalk excerpt presented in Figure 2. Codes 058, 059, and 067 are in 2019 CPS detailed industry 24, 'Utilities,' while code 627 is in 2019 CPS detailed industry 23, 'Transportation and warehousing.'[4] Therefore, 76% of jobs classified as 1990 code 451 are also classified as detailed industry 24 while only 24% are classified as detailed industry 23. Therefore, I classified 1990 Census code 451 as 2019 CPS detailed industry 24, 'Utilities.' Since 'Utilities' is part of 2019 CPS major industry 6, 'Transportation and utilities,' this is the major industry of 451. It is important to note that each 1990 Census code often

[4] To check the detailed industry of these codes, add a zero to the end (067 becomes 670) and use Table C-3 in Appendix C.

maps to many 2000 Census codes in different detailed industries or occupations. Since there are sometimes more than two detailed categories in contention, the winner does not always have a percentage greater than 50%. This is, however, a rare occurrence.

Once all 1990 codes were assigned a 2019 CPS detailed and major industry and occupation, I continued working backward. I looked at the changes from 1980 to 1990. The two coding systems are very similar so, in general, I could use the same recode. However, I had to make some adjustments. The numbers changed for some codes, some codes disappeared while others appeared, and some codes even split in two. Then I used the same process from 1990 to 2000 to assign the 1970 codes to 2019 CPS detailed and major industries and occupations based on the classification of the 1980 codes.

B. Deviations from the General Strategy

The strategy outlined above did not result in a truly consistent mapping of detailed and major industries and occupations. There were many discontinuities in categories when they converted to newer classification schemes; the time series would suddenly jump significantly higher or lower in a single month and stay at this new level. Therefore, I occasionally deviated from the general strategy to ensure more consistent categories across time. I made two types of changes: I combined 2019 CPS detailed industries and occupations, and I reclassified Census code industries and occupations as different detailed industries and occupations to improve consistency. Please see Appendix A for a complete list of deviations. Tables C-5 and C-6 in Appendix C feature the final

mapping between the revised CPS major and detailed industries and occupations and the Census codes.[5]

The first reason to combine categories was that some 2019 CPS detailed industries and occupations were so closely connected they could not be effectively disentangled. This entanglement was normally caused by one Census industry or occupation code. For instance, I combined detailed industries 8, 'Computer and electronic product manufacturing,' and 9, 'Electrical equipment, appliance manufacturing,' because 1990 code 342, 'Electrical machinery, equipment, & supplies,' while mostly mapping to detailed industry 9 (54%), had a significant number of workers mapping to detailed industry 8 (41%). While for many codes this would not cause a problem, 1990 Census code 342 is quite large. In December 2002, the last month the 1990 Census codes were used in the CPS, a weighted total of 1.3 million people had jobs assigned to 342 according to the CPS microdata. By comparison, in January 2003, the first month the 2019 detailed industry codes were used in the CPS, 2019 CPS detailed industry 8 had a weighted total of 1.8 million and 2019 CPS detailed industry 9 had a weighted total of 0.6 million.[6] By blindly assigning 342 to 2019 CPS detailed industry 9, I would cause the time series to more than halve from December 2002 to January 2003. The only way to avoid large discontinuities in these series is to combine them into a single detailed industry. Similarly, I combined 2019 CPS detailed occupations 3, 'Computer and mathematical science occupations,' and 4, 'Architecture and engineering occupations,' because 1990 code 055, 'Electrical and electronic engineers,' while mostly mapping to 2019 CPS detailed occupation 3, had a significant

[5] I am using 'revised' to refer to the detailed occupations and industries used in the final recode and using '2019 CPS' to refer to the detailed occupations and industries used in the 2019 CPS. As discussed above, some categories were combined. Therefore, some categories and much of the numbering differ.
[6] The detailed industry categories in the CPS did not change from January 2003 to present. Therefore, the categories introduced in January 2003 are the same as those we have been calling the 2019 CPS detailed industries.

number of workers mapping to 2019 CPS detailed occupation 4 creating a significant jump in the series.

The second reason I combined categories was that no 1990 Census codes mapped to 2019 CPS detailed industry 28, 'Internet publishing and broadcasting.' Based on its title, the detailed industry seemed likely to be an offshoot of 2019 CPS detailed industry 25, 'Publishing industries (except internet)' or 2019 CPS detailed industry 27, 'Broadcasting (except internet).' I decided to combine it with 2019 CPS detailed industry 27 because their Census code components share the same first three digits, and their combination resulted in a consistent series through the 2003 classification change.

Many times I could fix jumps in detailed industries and occupations simply by reclassifying a Census code. For instance, consider 2002/2007/2012 Census code 8990, 'Nail salons and other personal care services,' originally part of revised detailed industry 44, 'Personal services.' Census code 8990 maps mostly back to 1990 Census code 791, 'Miscellaneous personal services.' However, code 791 maps forward primarily to 2002 Census codes in revised detailed industry 34, 'Professional services.' Therefore, for a more consistent mapping, I reclassified 2002/2007/2012 Census code 8990 as detailed industry 34. Often reclassifying one variable led to reclassifying others. For example, reclassifying 2002/2007/2012 code 2880, 'Machine shops; turned product; screw nut and bolt manufacturing,' as revised detailed industry 7, 'Machinery manufacturing,' necessitated reclassifying 1970 code 159 and 1980/1990 code 290, 'Screw machine products,' as revised detailed industry 7 since they mapped only to 2880.

While helping to maintain consistency, these changes do affect the composition of the detailed and major industries and occupations. Sometimes reclassifying even one code changed the nature of the category itself. For instance, removing 2002/2007/2012 code 1990, 'Printing and

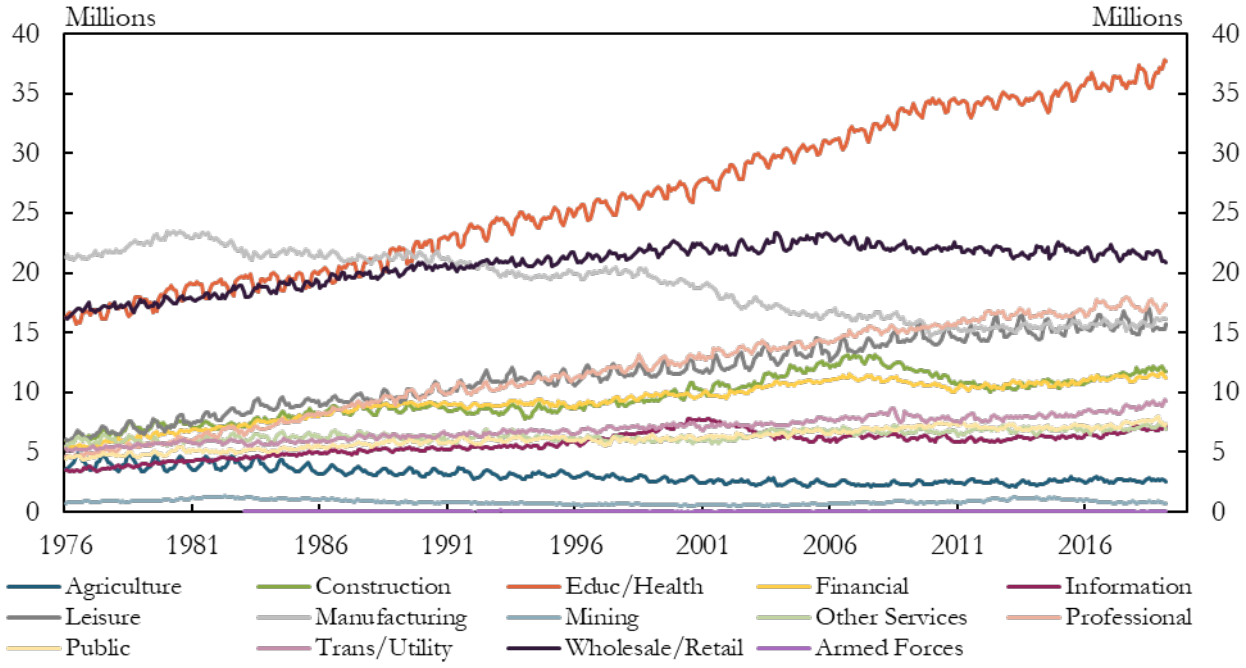
related support activities,' and its previous equivalents from 2019 CPS detailed industry 17, 'Paper and printing,' completely removed the 'printing' aspect. Therefore, I renamed the category 'Paper manufacturing.' For similar reasons, I changed the names of several other categories. While the new revised categories do not exactly match those used in the 2019 CPS, adherence to the 2019 categories is still one of the three main goals of this recode. Therefore, I made changes sparingly. I did not go through every current code and backtrack it through time like I did in the nail salons example. Instead, I looked at the output created by the general strategy recode and tried to address visible discontinuities in the time series.

For research projects that require exact adherence to the 2019 categories, the changes I made in the Appendix A section 'Changes to the Categorization of Individual Census Codes' that affect 2002 Census codes should be implemented in reverse. It is important to note, that undoing these modifications does not make the entire time series in accordance with the 2019 CPS categories. It reverts the time series 2003 on. The reason these deviations are necessary is that, given the nature of the 1970, 1980, and 1990 Census classification schemes, it is sometimes impossible to fit these codes into the 2019 CPS categories. Instead, in these special circumstances, I must make the 2019 CPS categories adapt to the earlier definitions if I want consistent definitions throughout. This means that, after undoing the deviations, pre-2003 data will continue to follow their own definitions which are different from the 2019 CPS categories. Undoing these deviations will also not allow disentangling of the combined detailed categories.

III. Results and Remaining Problems

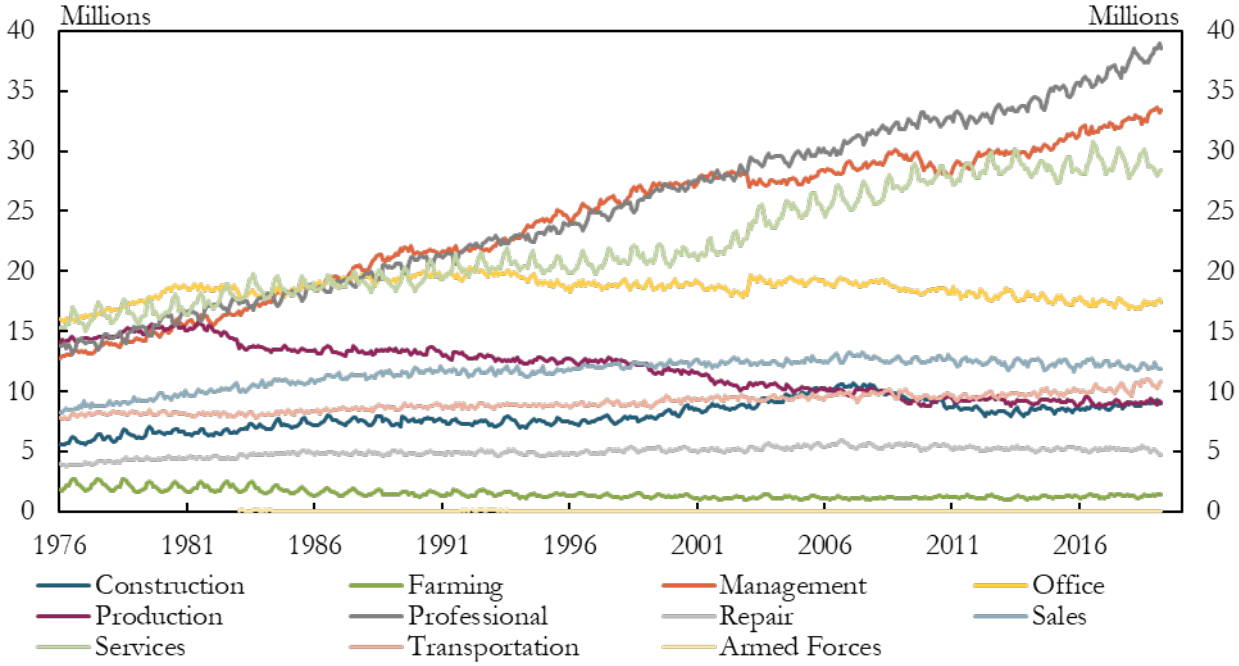
The strategy outlined above results in a consistent mapping of CPS occupations and industries from 1976 to 2019. None of these revised major or detailed industries or occupations have large discontinuities at dates when the classification systems changed (see Figures 3 and 4). However, some small misalignments still exist. Please see Appendix B for a list of the remaining discontinuities and explanations of why they could not be removed. In spite of these small misalignments, this recode delivers more consistent results than aggregated versions of the IPUMS recodes.

Figure 3: Time-series of recoded major industries in the CPS 1976 to 2019



Notes: These time series were weighted using v076 (1976–1988), v2fnlwgt (1989–1993), and pwsswgt (1994–2019). Variable names refer to those used in the CADRE CPS Data Application.
Sources: CPS and author's calculations.

Figure 4: Time-series of recoded major occupations in the CPS 1976 to 2019

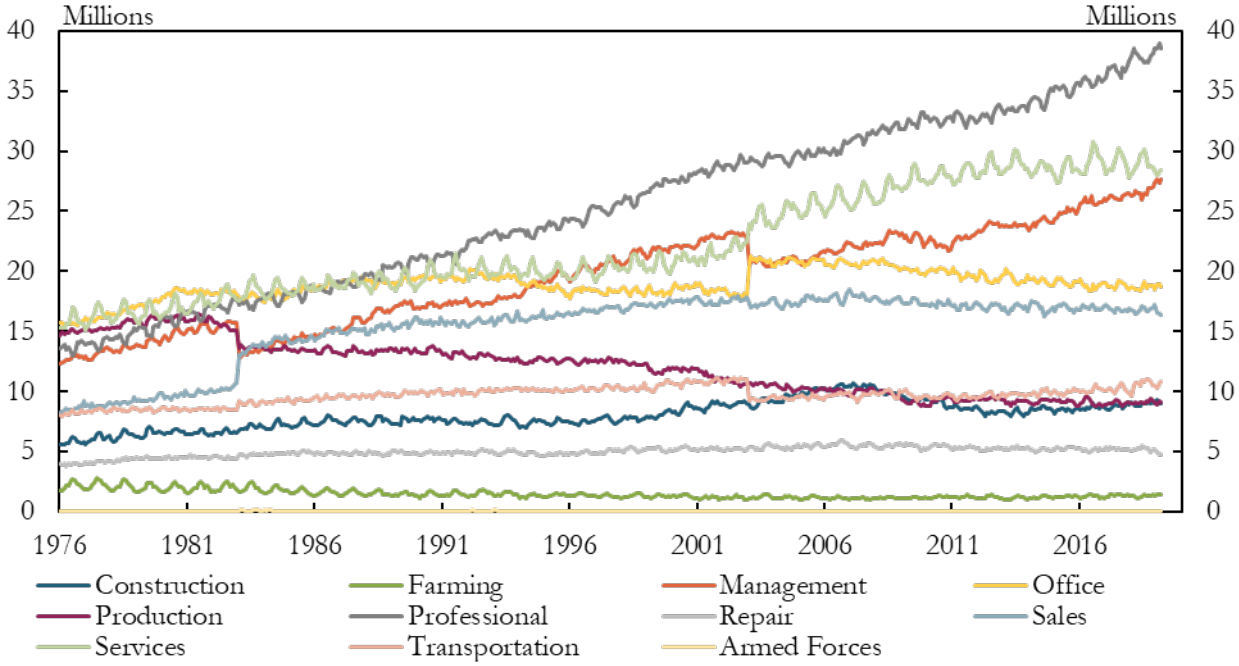


Notes: These time series were weighted using v076 (1976–1988), v2fnlwgt (1989–1993), and pwsswgt (1994–2019). Variable names refer to those used in the CADRE CPS Data Application.
Sources: CPS and author's calculations.

For comparison, I downloaded CPS data from IPUMS with occupation recoded by their 2010 based recode and aggregated these data to the detailed occupations suggested in the variable description (IPUMS CPS 2018). These categories were easily discernible subsets of the 2019 CPS detailed occupations. I combined these IPUMS categories first to the 2019 CPS detailed occupations and then further combined 2019 CPS detailed occupations 3 and 4 so that the categories would more closely resemble our revised categories. However, I made no changes at the Census code level. Figure 5 shows the IPUMS equivalent of Figure 4. Figure 5 shows greater misalignments in major occupations 1 ('Management, business, and financial occupations'), 4 ('Sales and related occupations'), 5 ('Office and administrative support occupations'), 9 ('Production occupations'), and 10 ('Transportation and material moving occupations'). At the detailed occupation level, in addition to proving more consistent for the components of the aforementioned major occupations, the

revised final recode presented here also provides better consistency for detailed occupation 4, 'Life, physical, and social science occupations,' and detailed occupation 14, 'Personal care and service occupations.'

Figure 5: Time-series of IPUMS 2010 based occupation recode aggregated to major occupations 1976 to 2019



Notes: These time series were weighted using WTFINL. IPUMS data come out with a lag to basic CPS data.
Sources: IPUMS CPS and author's calculations.

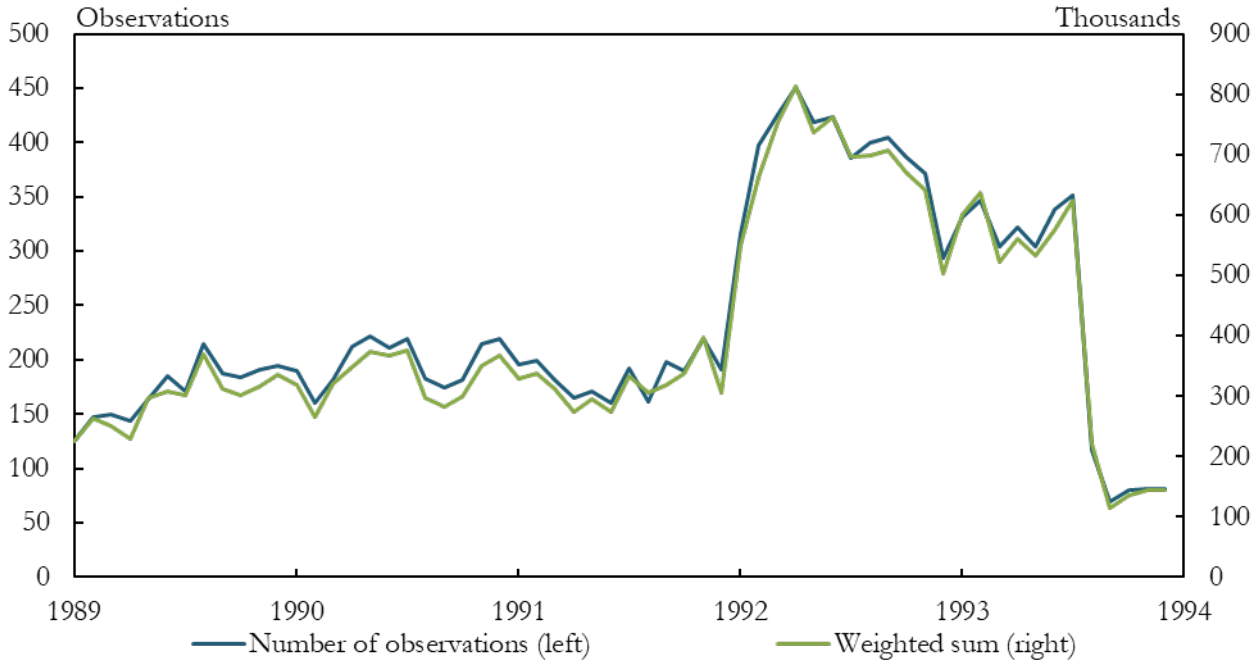
While this recode provides better consistency than the aggregated version of the IPUMS 2010 based occupation recode, it faces three remaining problems. First, I was unable to accurately recode 1970 Census code 215, 'Inspectors except construction, public administration,' 1980 Census code 36, 'Inspectors and compliance officers, except construction,' and 1990 Census code 36, 'Inspectors and compliance officers, except construction.' These codes map to a variety of inspectors in the 2002/2010 Census codes from bank examiners to animal control workers and so to a variety of detailed and major occupations. There was no clear winner: revised detailed occupation 2, 'Business and financial operations occupations,' was the highest at 31% followed by revised

detailed occupation 17, 'Farming, fishing, and forestry occupations,' at 25%, revised detailed occupations 9, 'Healthcare practitioner and technical occupations,' and 11, 'Protective service occupations,' at 13%, and revised detailed occupation 18, 'Construction and extraction occupations,' at 10%. The last 8% maps to revised detailed occupations 20 ('Production occupations'), 21 ('Transportation and material moving occupations'), 3 ('Computer, mathematical science, architecture, and engineering occupations'), and 5 ('Community and social service occupations'). Revised detailed occupation 2 has by far the lowest mapping percentage for a 'winner.' Additionally, the variety of occupations to which the codes map gives greater scope for an improper recode diluting results; animal control workers are unlikely to exhibit the same characteristics as the other members of revised detailed occupation 2, 'Business and financial operations occupations.' Therefore, I decided to exclude these codes from this recode. As a fairly small occupation making up 0.2% of the total workforce at its height, its exclusion makes little impact on any of these detailed or major occupations. Users are encouraged to make their own decisions based on individual use cases.

Second, there is a problem with the data for 1990 Census code 235, 'Technicians, n.e.c.' From January 1992 to July 1993, the number of workers in code 235 are elevated to approximately twice their normal level (see Figure 6). This surge in technicians results in a similar surge in revised detailed occupation 4, 'Life, physical, and social science occupations.' This is an anomaly in the raw data rather than in the recode so this problem will not affect applications of this recode to other datasets.[7]

[7] This spike in technicians can also be seen in the IPUMS data.

Figure 6: Time-series of 1990 code 235, 'Technicians, n.e.c.'



Notes: The weighted sum time series was weighted using v2fnlwgt. Variable names refer to those used in the CADRE CPS Data Application.
Sources: CPS and author's calculations.

Third, pre-1994 the CPS industry and occupation Census data contain non-existent values (see Tables C-7 and C-8 in Appendix C). From October 1961 through December 1993, CPS data were input using bubble sheets and pencils. This process allowed industry and occupation coders to input incorrect values. This problem is particularly apparent in the data from 1989 to 1993 which are only available in an unedited digit by digit form. I made no attempt to classify these values so they have industry or occupation of 'NA' after recoding. The distribution of these workers among different industries and occupations is unknown, so I do not know if failing to classify these workers leads to systematic undercounting of employment or unemployment in certain industries or occupations. In 1994, the CPS converted to computerized interviewing. This process does not allow for any non-existent values.

In 1994, the CPS also changed how they interviewed survey participants about their industry and occupation. Previously, respondents were asked every month to describe their job, and, based on this description, specialized industry and occupation coders would assign them an industry code and an occupation code. Because of slight changes in their description, respondents could be assigned new industry and occupation values even though they did not change jobs. In the new system, respondents are asked for their industry and occupation in month-in-sample one. In months two, three, and four, they are asked if they work for the same employer as last month and, if so, if they have the same job duties. If they have a new employer or new duties, they are then asked the industry and occupation questions, otherwise, their previous industry and occupation information are carried forward. Because of an eight-month gap between month-in-sample four and five, respondents are always asked the industry and occupation questions in month-in-sample five. However, in months six, seven, and eight, they are once more asked if they work for the same employer and have the same duties, and their information can be carried forward. This new system provides much more accurate data on when respondents change jobs. There is no way to apply this standard to previous data. Therefore, pre-1994 data could display a deceptively elevated job-to-job transition rate.[8]

[8] Please see Census (2006) for more information on CPS interviewing and data collection.

IV. Applications to the SIPP

While this recode is based on the detailed and major industry and occupation categories used in the 2019 CPS, it can be applied to any dataset that uses the Census industry or occupation classification schemes. One such dataset is the Survey of Income and Program Participation (SIPP). The SIPP has used Census classification schemes as its main industry and occupation variables since it was officially launched in 1983 (see Tables C-9 and C-10 in Appendix C).[9] However, due to the smaller sample size of the SIPP, many Census industries and occupations are not represented (see Tables C-11 and C-12 in Appendix C).[10] These missing values make mapping Census codes across time less feasible and make aggregate categories a more appealing choice. As the SIPP does not have its own major and detailed industry and occupation categories, the CPS categories provide a good option. Since the two datasets use the same Census codes, the CPS recodes are easily adapted to the SIPP data. The SIPP has a panel structure with overlapping and non-overlapping panels. This structure does not lend itself to the time series charts I can pull from the CPS making it more difficult to check category consistency over time. Figures 7 and 8 show the revised major industry and occupation levels through the 1996, 2001, 2004, and 2008 panels. Despite the gaps, the categories seem fairly consistent across panels and classification changes.

[9] In the SIPP, I provide recodes for industry and occupation variables for first and second jobs. While the current CPS features industry and occupation variables for second jobs, the CPS did not feature such variables pre-1994 limiting the usefulness of a recode. However, you can use the same recodes for the second jobs in the CPS as are presented here for the first jobs.

[10] Note that while almost all omissions appear to be due to small sample size, the 1996 and 2001 panels do not list 1990 Census codes 3 ('Legislators'), 16 ('Postmasters and mail superintendents'), and 179 ('Judges') as possible occupations in their codebooks. Code 179 seems to have been combined with code 178, 'Lawyers,' to form code 178, 'Lawyers and judges.' However, it is unclear where members of 1990 Census codes 3 and 16 are classified. All three occupations are present in earlier panels of the SIPP.

Figure 7: Time-series of recoded major industries in the SIPP 1996 to 2013

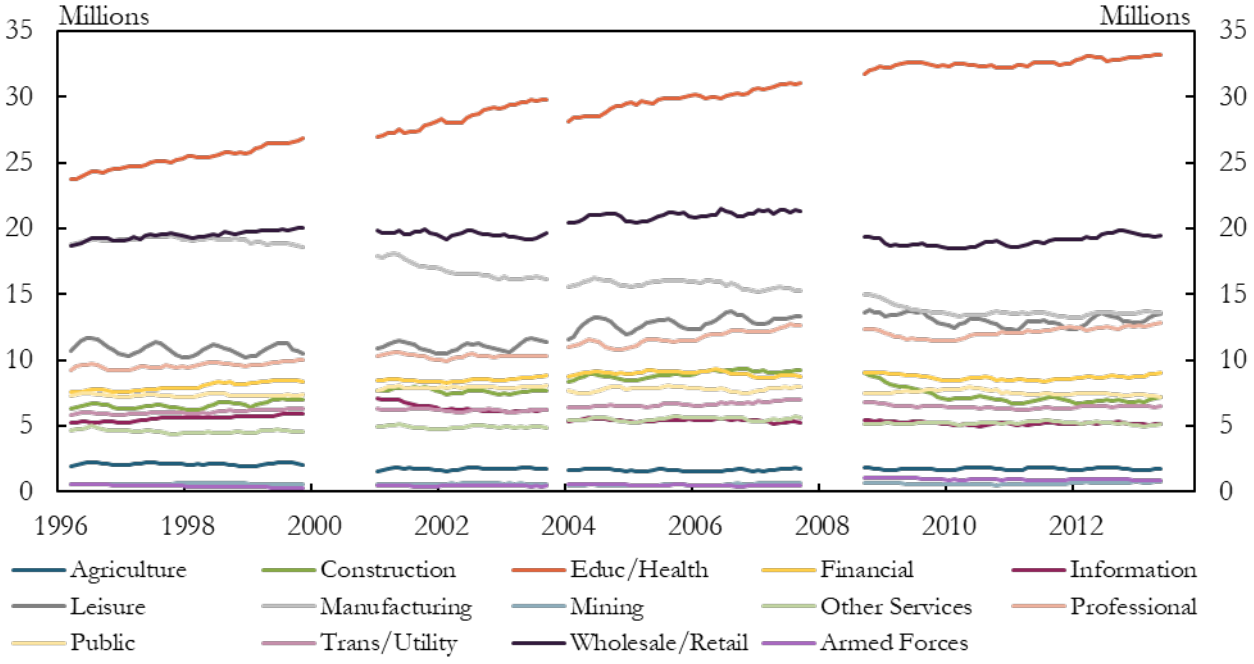
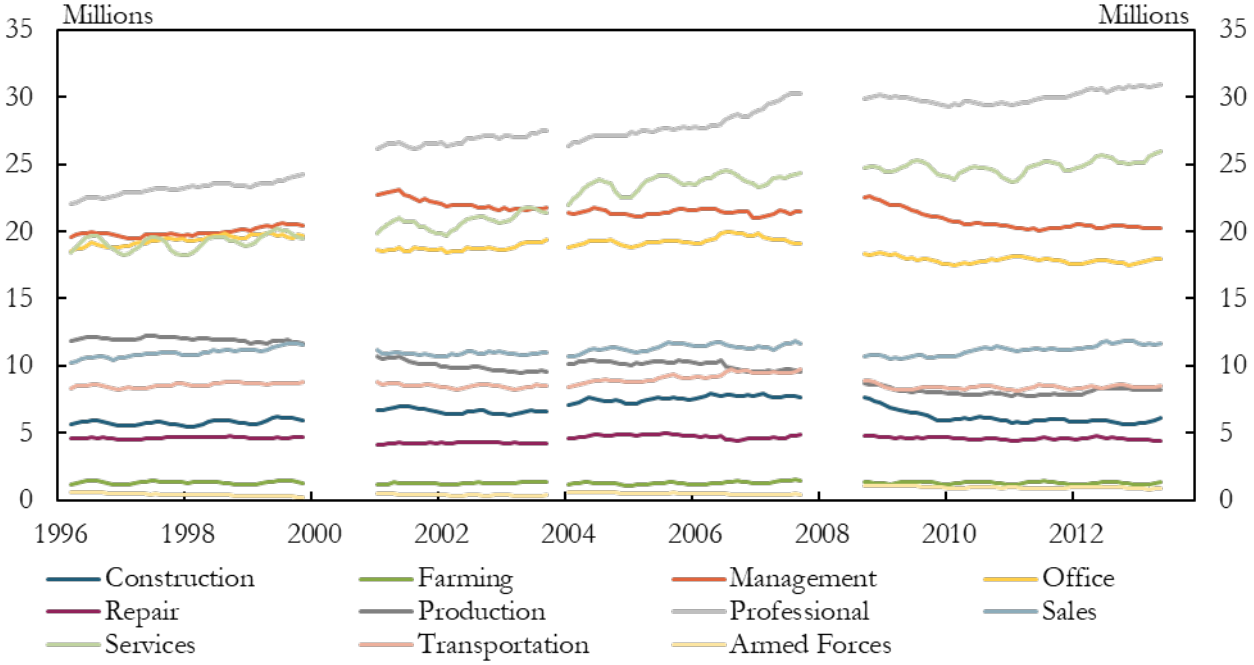


Figure 8: Time-series of recoded major occupations in the SIPP 1996 to 2013



Notes for Figures 7 and 8: These time series were weighted using wpfinwgt. Due to the structure of the SIPP, not all participants are interviewed in the first and last few months of each panel. For these figures, I chose to include only months where the full sample was interviewed.
Sources for Figures 7 and 8: SIPP and author's calculations.

V. Conclusion

The recode presented here aims to provide consistent aggregate industry and occupation categories for data using Census classification systems from 1970 to present. When applied to CPS data, there are some remaining problems. However, in general, the recode appears to provide consistent series for the CPS (1976 to present) and the SIPP (1984 through 2008 panels).

Creating industry and occupation recodes is not a new idea. The BLS and IPUMS have published well-constructed and useful recodes. That does not mean there is no need for another. The recode presented here classifies industries and occupations into aggregate categories, specifically, a slight variation on the aggregate categories used by the 2019 CPS. By coding directly to aggregate categories, this recode provides more consistency in such categories than grouped IPUMS codes. Additionally, the aggregate categories used here are based on the most recent classification systems: the 2012 Census industry codes and the 2010 Census occupation codes. Previously, a recode based on the 2012 industry classification scheme had not been available.

This recode can be applied to other datasets that use the Census codes for industry and occupation such as the Panel Study of Income Dynamics. When applying this recode to a new dataset, there are some things to keep in mind. Different datasets often use slightly modified versions of the Census codes. For example, in two panels, the SIPP combined the codes for lawyers and judges. It is important to check the dataset's list of codes against the CPS list to make sure no modifications are needed. Another valuable step is to make sure there are no impossible codes. I ran into many of those in the unedited industry and occupation variables in the CPS. Additionally, if encountering unexpected discontinuities in the time series when applying the recode to the dataset, this may be due to problems in the target dataset. Remember the example of the 'Technicians, n.e.c.'

category in the 1992 CPS. In spite of the challenges presented by each dataset, this recode should provide an easy to implement and effective way to classify industry and occupation over time.

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Appendix A: Deviations from General Strategy

Changes to the Categories Used

Industries

Detailed industries "8 Computer and electronic product manufacturing" and "9 Electrical equipment, appliance manufacturing" combined: 1990 code "342 Electrical machinery, equipment, & supplies" maps to both detailed industries. When combined, these detailed industries form a consistent series across time.

Detailed industries "27 Broadcasting (except internet)" and "28 Internet publishing and broadcasting" combined: No 1990 Census codes mapped to detailed industry "28 Internet publishing and broadcasting." Based on its title, the detailed industry seemed likely to be an offshoot of "25 Publishing industries (except internet)" or "27 Broadcasting (except internet)." I decided to combine it with 27 because they shared the same first three digits of their Census codes, and their combination resulted in a consistent series through the 2003 classification change.

Detailed industries "36 Professional and technical services," "37 Management of companies and enterprises," and "38 Administrative and support services" combined: Detailed industry 37 is made up of a single 2002/2007/2012 code, "7570 Management of companies and enterprises." This code maps back only onto 1990 code "892 Management and public relations." However, 1990 code 892 primarily maps forward into detailed industry 36 necessitating the combination of detailed industries 36 and 37. 1990 code "741 Business services, n.e.c." is quite large and maps half into detailed industry 36 and half into detailed industry 38 necessitating their combination.

Occupations

Detailed occupations "3 Computer and mathematical science occupations" and "4 Architecture and engineering occupations" combined: 1990 code "055 Electrical and electronic engineers," while mostly mapping to detailed occupation 3, had a significant number of workers mapping to detailed occupation 4 creating a significant jump. When combined, these detailed occupations form a consistent series across time.

Changes to the Categorization of Individual Census Codes[11]

Industries

1970 code "159 Screw machine products," 1980 code "290 Screw machine products," 1990 code "290 Screw machine products," and 2002/2007/2012 code "2880 Machine shops; turned product; screw nut and bolt manufacturing" moved from "6 Primary metals and fabricated metal products" to "7 Machinery manufacturing": 2002/2007/2012 code 2880

[11] Note that all detailed industries and occupations named are those used in the final recode. These differ from those used in the 2019 CPS.

maps almost entirely back into 1990 code "331 Machinery, except electrical, n.e.c." which maps forward primarily to 2002 codes in detailed industry "7 Machinery manufacturing." Therefore, to maintain consistency, it makes sense to move 2002/2007/2012 code 2880 to detailed industry 7. However, 1970 code 159, 1980 code 290, and 1990 code 290 all map exclusively to 2002/2007/2012 code 2880 and so should be moved as well.

1970 code "339 Printing, publishing, and allied industries, except newspapers," 1980 code "172 Printing, publishing, except newspapers," 1990 code "172 Printing, publishing, except newspapers," and 2002/2007/2012 code "1990 Printing and related support activities" moved from "16 Paper manufacturing" to "24 Publishing industries": 1970 code 339, 1980 code 172, and 1990 code 172 contain all of detailed industry 24 except for newspaper publishing. However, they map primarily to 2002/2007/2012 code 1990. Therefore, to maintain a detailed industry 24, it makes sense to move 1970 code 339, 1980 code 172, 1990 code 172, and 2002/2007/2012 code 1990 to detailed industry 24.

2002/2007/2012 code "6780 Other information services" moved from "29 Other information services" to "34 Professional services": 2002/2007/2012 code 6780 maps back onto 1990 codes "740 Detective and protective services" and "741 Business services, n.e.c." which map forward primarily to 2002 codes in detailed industry "34 Professional services." Therefore, to maintain consistency, it makes sense to move 2002/2007/2012 code 6780 to detailed industry 34.

1970 code "739 Computer programming services," 1980 code "740 Computer and data processing services," 1990 code "732 Computer and data processing services," and 2002/2007/2012 code "7380 Computer systems design and related services" moved from "34 Professional services" to "28 Data processing services": Detailed industry 28 maps back almost entirely to 1990 code 732. Therefore, to maintain a detailed industry 28, it is necessary to move 1990 code 732 to detailed industry 28. 1970 code 739 and 1980 code 740 map forward entirely to 1990 code 732, and 2002/2007/2012 code 7380 maps back almost entirely to 1990 code 732 and so should be moved as well.

1970 code "778 Lodging places, except hotels and motels," 1980 codes "770 Lodging places, except hotels and motels" and "862 Child day care services," 1990 codes "862 Child day care services" and "863 Family child care homes," and 2002/2007/2012 code "8470 Child day care services" moved from "39 Social assistance" to "36 Educational services": 1980 code 862 maps back entirely into 1970 code "857 Elementary and secondary schools" which maps forward primarily to 1980 codes in detailed industry "36 Educational services." Therefore, to maintain consistency, it makes sense to move 1980 code 862 to detailed industry 36. However, 1990 code 862 and 2002/2007/2012 code 8470 both map back primarily to 1980 code 862 and so should be moved to detailed industry 36. Unfortunately, 1970 code 778, 1980 code 770, and 1990 code 863 all map forward primarily to 2002/2007/2012 code 8470 and so should be moved as well.

1970 code "749 Automotive services, except repair," 1980 code "750 Automotive services, except repair," 1990 code "750 Automobile parking and carwashes," and 2002/2007/2012 code "8780 Car washes" moved from "43 Repair and maintenance" to "33 Rental and leasing services": Detailed industry "33 Rental and leasing services" maps back entirely to 1980 code 750. Therefore, to maintain a detailed industry 33, it is necessary to move 1980 code 750 to

detailed industry 33. 1970 code 749 maps forward primarily to 1980 code 750, and 1990 code 750 and 2002/2007/2012 code 8780 map back entirely to 1980 code 750 and so should be moved as well.

2002/2007/2012 code "8990 Nail salons and other personal care services" moved from "44 Personal services" to "34 Professional services": 2002/2007/2012 code 8990 maps back primarily to 1990 code "791 Miscellaneous personal services." However, 1990 code 791 maps forward primarily to 2002 codes in revised detailed industry "34 Professional services." Therefore, to maintain consistency, it makes sense to move 2002/2007/2012 code 8990 to detailed industry 34.

1980 code "781 Funeral service and crematories," 1990 code "781 Funeral service and crematories," and 2002/2007/2012 code "9080 Funeral homes, cemeteries and crematories" moved from "44 Personal services" to "32 Real estate": 2002/2007/2012 code 9080 maps back 52% to detailed industry 44 and 48% to detailed industry 32. However, 2002/2007/2012 code 9080 maps back to many codes in detailed industry 32 but only to 1980 code 781 and 1990 code 781 in detailed industry 44. Therefore, to maintain consistency, I moved all three industry codes to detailed industry 32.

1970 code "375 Statistical clerks," 1980 code "386 Statistical clerks," and 1990 code "386 Statistical clerks" moved from "9 Healthcare practitioner and technical occupations" to "16 Office and administrative support occupations": 1990 code 386 maps forward 55% to detailed occupation 9 and 45% to detailed occupation 16. 1970 code 375 maps mainly to 1980/1990 code 386 but also to occupations in detailed occupation 16. Therefore, 1970 code 375 makes more sense in detailed occupation 16. To maintain consistency, I also move 1980 code 386 and 1990 code 386.

Occupations

1980 code "243 Supervisors and proprietors, sales occupations," 1990 code "243 Supervisors and proprietors, sales occupations," and 2002/2010 codes "4700 First-line supervisors/managers of retail sales workers" and "4710 First-line supervisors/managers of non-retail sales workers" moved from "15 Sales and related occupations" to "1 Management occupations": 1980 code 243 maps back almost entirely to 1970 code "245 Managers and administrators, n.e.c." 1970 code 245 is a major component of detailed occupation 1 and so cannot be moved. Therefore, to maintain consistency, it makes sense to move 1980 code 243 to detailed occupation 1. 1980 code 243 maps forward to 1990 code 243, 2002/2010 code 4700, and 2002/2010 code 4710 and so they should be moved as well.

1970 code "312 Clerical supervisors, n.e.c.," 1980 codes "303 Supervisors, general office," "304 Supervisors, computer equipment operators," "305 Supervisors, financial records processing," "306 Chief communications operators," and "307 Supervisors; distribution scheduling, and adjusting clerks," 1990 codes "303 Supervisors, general office," "304 Supervisors, computer equipment operators," "305 Supervisors, financial records processing," "306 Chief communications operators," and "307 Supervisors; distribution scheduling, and adjusting clerks," 2002/2010 code "5000 First-line supervisors/managers of office and administrative support workers" moved from "16 Office and administrative

support occupations" to "1 Management occupations": 2002/2010 code 5000 maps back 49% to detailed occupation 16 and 41% to detailed occupation 1. 2002/2010 code 5000 is quite a large occupation so without some adjustment detailed occupation 16 jumps up in 2003 and detailed occupation 1 jumps down. It maps back to large general occupations in detailed occupation 1 that are hard to disentangle from other occupations in detailed occupation 1. However, 2002/2010 code 5000 maps back to occupations that primarily map forward to it in detailed occupation 16. Therefore, to maintain consistency, I moved 2002/2010 code 5000 and these codes (1970 code 312, 1980 codes 303–307, and 1990 codes 303–307) to detailed occupation 1.

Appendix B: Remaining Discontinuities in Major and Detailed Industries and Occupations in the CPS Sample[12]

Industries

Detailed industry "20 Wholesale trade" jumps down in 2003: There is no one clear reason for this jump. Instead, it results from various imperfect matches between the 1990 and 2002 codes.

Detailed industry "25 Motion picture and sound recording industries" jumps down in 2003 and detailed industry "40 Arts, entertainment, and recreation" jumps up in 2003: 1990 code "800 Theaters and motion pictures" constitutes all of detailed industry 25 from 1992 through 2002. 1990 code 800 maps forward 66% to detailed industry 25 but 33% to detailed industry 40. Therefore, detailed industry 25 is 33% smaller starting in 2003 and detailed industry 40 jumps up.

Detailed industry "26 Broadcasting" jumps up in 1992: There is no one clear reason for this jump. Instead, it results from various imperfect matches between the 1980 and 1990 codes.

Detailed industry "33 Rental and leasing services" jumps up in 2003: 2002 codes "7180 Other consumer goods rental" and "7190 Commercial, industrial, and other intangible assets rental and leasing" are part of detailed industry 33. However, they map back to a variety of detailed industries none of which are detailed industry 33. Given the range of detailed industries to which they map, there did not seem to be a good place to move them.

Detailed industry "39 Social assistance" jumps down in 2003: 1990 code "871 Social services, n.e.c." maps only 57% to detailed industry 39. Since 871 makes up 86% of detailed industry 39, the loss of the other 43% in 2003 results in a jump down.

Detailed industry "40 Arts, entertainment, and recreation" jumps up in 1983: 1980 code "892 Miscellaneous professional and related services" maps forward into detailed industry 40. However, it maps back entirely into detailed industry "34 Professional services." Since detailed industry 40 is a much smaller industry, this results in a jump for it without really affecting detailed industry 34.

Detailed industry "40 Arts, entertainment, and recreation" jumps up in 1992: 1990 code "810 Miscellaneous entertainment and recreation services" maps forward to detailed industry 40 but maps back partially to detailed industry "34 Professional services" and detailed industry "47 Public administration." Since detailed industry 40 is a much smaller industry, this results in a jump for it without really affecting detailed industry 34 and detailed industry 47.

Detailed industry "44 Personal services" jumps up in 2003: 2002 code "9090 Other personal services" is part of detailed industry 44. However, it maps back to a variety of detailed industries none of which are detailed industry 44. Given the range of detailed industries to which it maps, there did not seem to be a good place to move it.

[12] Note that all detailed industries and occupations named are those used in the final recode. These differ from those used in the 2019 CPS.

Occupations

Detailed occupation "2 Business and financial operations occupations" jumps up in 1983: Pre-1983, some occupations that primarily mapped to detailed occupation "1 Management occupations" also mapped to occupations in detailed occupation 2.

Detailed occupation "6 Legal occupations" jumps up in 1983: Pre-1983, some occupations that primarily mapped to detailed occupation "16 Office and administrative support occupations" also mapped to 1980 code "234 Legal assistants."

Detailed occupation "16 Office and administrative support occupations" / major occupation "5 Office and administrative support occupations" jumps up in 2003 and detailed occupation "1 Management occupations" / major occupation "1 Management, business, and financial occupations" jumps down in 2003: These two categories have many interwoven jobs. Consider 2002/2010 code "5700 Secretaries and administrative assistants." 2002/2010 code 5700 maps back only 8% to detailed occupation 1 versus 92% to detailed occupation 16. However, it is such a large occupation that 8% is 350,000 people in the 1990 Census contributing to the jump in the two detailed occupations.

Appendix C: Accompanying Tables

Table C-1: CPS Census industry variables 1976 to 2019

Date	Variable Name	Description	Census classification scheme
1976–1982	v059	Item 23B – Industry	1970
1983–1988	v296	Industry (1980 Edited)	1980
1989–1991	v1indd1 (digit 1), v1indd2 (digit 2), v1indd3 (digit 3)	Item 23B – Industry	1980
1992–1993	v1indd1 (digit 1), v1indd2 (digit 2), v1indd3 (digit 3)	Item 23B – Industry	1990
1994–2002	peio1icd	Industry code for primary job	1990
2003–2008	peio1icd	Industry code for primary job	2002
2009–2013	peio1icd	Industry code for primary job	2007
2014–2019	peio1icd	Industry code for primary job	2012

Note: Variable names refer to those used in the CADRE CPS Data Application.

Table C-2: CPS Census occupation variables 1976 to 2019

Date	Variable Name	Description	Census classification scheme
1976–1982	v060	Item 23C – Occupation	1970
1983–1988	v297	Occupation (1980 Edited)	1980
1989–1991	v1occd1 (digit 1), v1occd2 (digit 2), v1occd3 (digit 3)	Item 23C – Occupation	1980
1992–1993	v1occd1 (digit 1), v1occd2 (digit 2), v1occd3 (digit 3)	Item 23C – Occupation	1990
1994–2002	peio1ocd	Occupation code for primary job	1990
2003–2010	peio1ocd	Occupation code for primary job	2002
2011–2019	peio1ocd	Occupation code for primary job	2010

Note: Variable names refer to those used in the CADRE CPS Data Application.

Table C-3: 2019 CPS mapping between prmjind1, prdtind1, and peio1icd

prmjind1	prdtind1	peio1icd
1 Agriculture, forestry, fishing, and hunting	1 Agriculture	170-180, 290
	2 Forestry, logging, fishing, hunting, and trapping	190-280
2 Mining	3 Mining	370-490
3 Construction	4 Construction	770
4 Manufacturing	5 Nonmetallic mineral product manufacturing	2470-2590
	6 Primary metals and fabricated metal products	2670-2990
	7 Machinery manufacturing	3070-3290
	8 Computer and electronic product manufacturing	3365-3390
	9 Electrical equipment, appliance manufacturing	3470-3490
	10 Transportation equipment manufacturing	3570-3690
	11 Wood products	3770-3875
	12 Furniture and fixtures manufacturing	3895
	13 Miscellaneous and not specified manufacturing	3960-3990
	14 Food manufacturing	1070-1290
	15 Beverage and tobacco products	1370-1390
	16 Textile, apparel, and leather manufacturing	1470-1790
	17 Paper and printing	1870-1990
	18 Petroleum and coal products manufacturing	2070-2090
	19 Chemical manufacturing	2170-2290
	20 Plastics and rubber products	2370-2390
5 Wholesale and retail trade	21 Wholesale trade	4070-4590
	22 Retail trade	4670-5790
6 Transportation and utilities	23 Transportation and warehousing	6070-6390
	24 Utilities	570-690
7 Information	25 Publishing industries (except internet)	6470-6490
	26 Motion picture and sound recording industries	6570-6590
	27 Broadcasting (except internet)	6670
	28 Internet publishing and broadcasting	6672
	29 Telecommunications	6680-6690
	30 Internet service providers and data processing services	6695
	31 Other information services	6770-6780
8 Financial activities	32 Finance	6870-6970
	33 Insurance	6990
	34 Real estate	7070
	35 Rental and leasing services	7080-7190
9 Professional and business services	36 Professional and technical services	7270-7490
	37 Management of companies and enterprises	7570
	38 Administrative and support services	7580-7780
	39 Waste management and remediation services	7790
10 Educational and health services	40 Educational services	7860-7890
	41 Hospitals	8190
	42 Health care services, except hospitals	7970-8180, 8270-8290
	43 Social assistance	8370-8470
11 Leisure and hospitality	44 Arts, entertainment, and recreation	8560-8590
	45 Accommodation	8660-8670

	46 Food services and drinking places	8680-8690
12 Other services	47 Repair and maintenance	8770-8890
	48 Personal and laundry services	8970-9090
	49 Membership associations and organizations	9160-9190
	50 Private households	9290
13 Public administration	51 Public administration	9370-9590
14 Armed forces	52 Armed forces	9890

Table C-4: 2019 CPS mapping between prmjocc1, prdtocc1, and peio1ocd

prmjocc1	prdtocc1	peio1ocd
1 Management, business, and financial occupations	1 Management occupations	10-430
	2 Business and financial operations occupations	500-950
2 Professional and related occupations	3 Computer and mathematical science occupations	1005-1240
	4 Architecture and engineering occupations	1300-1560
	5 Life, physical, and social science occupations	1600-1965
	6 Community and social service occupations	2000-2060
	7 Legal occupations	2100-2160
	8 Education, training, and library occupations	2200-2550
	9 Arts, design, entertainment, sports, and media occupations	2600-2960
	10 Healthcare practitioner and technical occupations	3000-3540
3 Service occupations	11 Healthcare support occupations	3600-3655
	12 Protective service occupations	3700-3955
	13 Food preparation and serving related occupations	4000-4160
	14 Building and grounds cleaning and maintenance occupations	4200-4250
	15 Personal care and service occupations	4300-4650
4 Sales and related occupations	16 Sales and related occupations	4700-4965
5 Office and administrative support occupations	17 Office and administrative support occupations	5000-5940
6 Farming, fishing, and forestry occupations	18 Farming, fishing, and forestry occupations	6005-6130
7 Construction and extraction occupations	19 Construction and extraction occupations	6200-6940
8 Installation, maintenance, and repair occupations	20 Installation, maintenance, and repair occupations	7000-7630
9 Production occupations	21 Production occupations	7700-8965
10 Transportation and material moving occupations	22 Transportation and material moving occupations	9000-9750
11 Armed Forces	23 Armed Forces	9840

Table C-5: Mapping between revised CPS major and detailed industries and Census codes

Major industries	Detailed industries	1970 codes	1980 codes	1990 codes	2002 codes	2007 codes	2012 codes
1 Agriculture, forestry, fishing, and hunting	1 Agriculture	17, 18	10-20	10, 11, 30	170, 180, 290	170, 180, 290	170, 180, 290
	2 Forestry, logging, fishing, hunting, and trapping	27, 28, 107	30, 31, 230	31, 32, 230	190-280	190-280	190-280
2 Mining	3 Mining	47-57	40-50	40-50	370-490	370-490	370-490
3 Construction	4 Construction	67-77	60	60	770	770	770
4 Manufacturing	5 Nonmetallic mineral product manufacturing	119-138	250-262	250-262	2470-2590	2470-2590	2470-2590
	6 Primary metals and fabricated metal products manufacturing	139-158, 167-169, 258	270-282, 291-301	270-282, 291-301	2670-2870, 2890-2990	2670-2870, 2890-2990	2670-2870, 2890-2990
	7 Machinery manufacturing	159, 177-188, 197, 198, 248	290, 310-321, 331, 332, 380	290, 310-321, 331, 332, 380	2880, 3070-3290	2880, 3070-3290	2880, 3070-3290
	8 Electrical product manufacturing	189, 199-209, 239, 249	322, 340-350, 371, 381	322, 340-350, 371, 381	3360-3490	3360-3490	3365-3490
	9 Transportation equipment manufacturing	219-238	351-370	351-370	3570-3690	3570-3690	3570-3690
	10 Wood products manufacturing	108, 109	231-241	231-241	3770-3870	3770-3870	3770-3875
	11 Furniture and fixtures manufacturing	118	242	242	3890	3890	3895
	12 Miscellaneous and not specified manufacturing	247, 257, 259, 398	372, 382, 390-392	372, 390-392	3960-3990	3960-3990	3960-3990
	13 Food manufacturing	268-288, 297, 298, 637	100-112, 121, 122, 610	100-112, 121, 122, 610	1070-1290	1070-1290	1070-1290
	14 Beverage and tobacco products manufacturing	289, 299	120, 130	120, 130	1370, 1390	1370, 1390	1370, 1390
	15 Textile, apparel, and leather manufacturing	307-327, 388-397	132-152, 220-222	132-152, 220-222	1470-1790	1470-1790	1470-1790
	16 Paper manufacturing	328-337	160-162	160-162	1870-1890	1870-1890	1870-1890
	17 Petroleum and coal products manufacturing	377, 378	200, 201	200, 201	2070, 2090	2070, 2090	2070, 2090
	18 Chemical manufacturing	347-369	180-192	180-192	2170-2290	2170-2290	2170-2290
	19 Plastics and rubber products manufacturing	379, 387	210-212	210-212	2370-2390	2370-2390	2370-2390
5 Wholesale and retail trade	20 Wholesale trade	507-588, 679	500-571	500-571	4070-4590	4070-4590	4070-4590
	21 Retail trade	607-629, 638-668, 677, 678, 687-698	580-602, 611-640, 642-691	580-602, 611-640, 642-691	4670-5790	4670-5790	4670-5790

Major industries	Detailed industries	1970 codes	1980 codes	1990 codes	2002 codes	2007 codes	2012 codes
6 Transportation and utilities	22 Transportation and warehousing	407-428, 907	400-422	400-422	6070-6390	6070-6390	6070-6390
	23 Utilities	467-477, 479	460-470, 472	450-470, 472	570-690	570-690	570-690
7 Information	24 Publishing industries	338, 339	171, 172	171, 172	1990, 6470-6490	1990, 6470-6490	1990, 6470-6490
	25 Motion picture and sound recording industries	807	800	800	6570, 6590	6570, 6590	6570, 6590
	26 Broadcasting	447	440	440	6670, 6675	6670, 6672	6670, 6672
	27 Telecommunications	448, 449	441, 442	441, 442	6680, 6690	6680, 6690	6680, 6690
	28 Data processing services	739	740	732	6692, 6695, 7380	6695, 7380	6695, 7380
	29 Other information services	859	852	852	6770	6770	6770
8 Financial activities	30 Finance	707-709	700-710	700-710	6870-6970	6870-6970	6870-6970
	31 Insurance	717	711	711	6990	6990	6990
	32 Real estate	718	712, 781	712, 781	7070, 9080	7070, 9080	7070, 9080
	33 Rental and leasing services	749	750	742, 750, 801	7080-7190, 8780	7080-7190, 8780	7080-7190, 8780
9 Professional and business services	34 Professional services	19, 429, 727-738, 747, 748, 798, 849, 888-897	21, 432, 721-732, 741, 742, 791, 841, 882-891	12, 20, 432, 721-731, 740, 741, 791, 841, 882-892	6780, 7270-7370, 7390-7780, 8990	6780, 7270-7370, 7390-7780, 8990	6780, 7270-7370, 7390-7780, 8990
	35 Sanitary services	478	471	471	7790	7790	7790
10 Educational and health services	36 Educational services	778, 857, 858, 867, 868	770, 842-851, 860, 862	842-851, 860, 862, 863	7860-7890, 8470	7860-7890, 8470	7860-7890, 8470
	37 Hospitals	838	831	831	8190	8190	8190
	38 Health care services, except hospitals	828-837, 839-848, 879	812-830, 832, 840, 870	812-830, 832-840, 870	7970-8180, 8270, 8290	7970-8180, 8270, 8290	7970-8180, 8270, 8290
	39 Social assistance	878	861, 871	861, 871	8370-8390	8370-8390	8370-8390
11 Leisure and hospitality	40 Arts, entertainment, and recreation	808, 809, 869	801, 802, 872, 892	802, 810, 872, 893	8560-8590	8560-8590	8560-8590
	41 Accommodation	777	762	762, 770	8660, 8670	8660, 8670	8660, 8670
	42 Food services and drinking places	669	641	641	8680, 8690	8680, 8690	8680, 8690
12 Other services	43 Repair and maintenance	757-759, 789, 797	751-760, 782, 790	751-760, 782, 790	8770, 8790-8890	8770, 8790-8890	8770, 8790-8890
	44 Personal services	779-788	771-780	771-780	8970, 8980, 9070, 9090	8970, 8980, 9070, 9090	8970, 8980, 9070, 9090
	45 Membership associations and organizations	877, 887	880, 881	873-881	9160-9190	9160-9190	9160-9190
	46 Private households	769	761	761	9290	9290	9290
13 Public administration	47 Public administration	917-937	900-932	900-932	9370-9590	9370-9590	9370-9590
14 Armed forces	48 Armed forces	-	991	991	9890	9890	9890

Table C-6: Mapping between revised CPS major and detailed occupations and Census codes

Major occupations	Detailed occupations	1970 codes	1980 codes	1990 codes	2002 codes	2010 codes
1 Management, business, and financial occupations	1 Management occupations	195-202, 210-212, 216, 220, 222-224, 230-245, 312, 801, 802	3-5, 7-19, 243, 303-307, 473, 475, 476	3-5, 7-22, 243, 303-307, 473, 475, 476	10-430, 4700, 4710, 5000	10-430, 4700, 4710, 5000
	2 Business and financial operations occupations	1, 56, 203, 205, 225, 326	23-34, 37, 375	23-34, 37, 375	500-950	500-950
2 Professional and related occupations	3 Computer, mathematical science, architecture, and engineering occupations	2-21, 23, 34-36, 55, 152-155, 161, 162, 605	43-68, 213-218, 229, 866	43-68, 213-218, 229, 867	1000-1560	1005-1560
	4 Life, physical, and social science occupations	25, 42-54, 91-96, 150, 151, 156, 165, 173	69-83, 166-173, 223-225, 235	69-83, 166-173, 223-225, 235	1600-1960	1600-1965
	5 Community and social service occupations	86, 90, 100, 174, 954	163, 174, 176, 177, 467	163, 174, 176, 177, 465	2000-2060	2000-2060
	6 Legal occupations	30, 31, 376	178, 179, 234, 314	178, 179, 234, 314	2100-2150	2100-2160
	7 Education, training, and library occupations	24, 26, 32, 33, 102-145, 382	113-159, 164, 165, 387	113-159, 164, 165, 387	2200-2550	2200-2550
	8 Arts, design, entertainment, sports, and media occupations	171, 175-194, 425	183-199, 228	183-199, 228	2600-2960	2600-2960
	9 Healthcare practitioner and technical occupations	61-83, 85, 506, 923, 926	84-106, 203-208, 677	84-106, 203-208, 677	3000-3540	3000-3540
3 Service occupations	10 Healthcare support occupations	84, 921, 922, 924, 925	445-447	445-447	3600-3650	3600-3655
	11 Protective service occupations	960-965	6, 413-427	6, 413-427	3700-3950	3700-3955
	12 Food preparation and serving related occupations	910-916, 981	404, 433-444	404, 433-444	4000-4160	4000-4160
	13 Building and grounds cleaning and maintenance occupations	755, 901-903, 982, 984	405, 407, 448-453, 455, 474, 485, 486	405, 407, 448-453, 455, 474, 485, 486	4200-4250	4200-4250
	14 Personal care and service occupations	101, 505, 740, 932-942, 944-953, 980	175, 406, 456-464, 466, 468, 469, 487, 773	175, 406, 456-462, 464, 466-469, 487, 773	4300-4540, 4600-4650	4300-4650
4 Sales and related occupations	15 Sales and related occupations	22, 260-285, 310, 314, 363	253-285	253-285	4720-4960	4720-4965

Major occupations	Detailed occupations	1970 codes	1980 codes	1990 codes	2002 codes	2010 codes
5 Office and administrative support occupations	16 Office and administrative support occupations	301-305, 311, 313, 315-325, 330-362, 364-375, 381, 383-395, 762	308-313, 315-374, 376-386, 389, 877	308-313, 315-374, 376-386, 389, 877	5010-5930	5010-5940
6 Farming, fishing, and forestry occupations	17 Farming, fishing, and forestry occupations	752, 761, 821-824	477-484, 488-499	477-484, 488-499	6000-6130	6005-6130
7 Construction and extraction occupations	18 Construction and extraction occupations	213, 404, 410-412, 415-421, 430, 431, 436, 440, 445, 510-512, 520-523, 534-536, 550, 560, 601, 603, 614, 615, 640, 750, 751	35, 543, 553-576, 579-617, 643, 653, 654, 844, 855, 865, 867, 869	35, 543, 553-576, 579-617, 643, 653, 654, 844, 855, 866, 868, 869	6200-6940	6200-6940
8 Installation, maintenance, and repair occupations	19 Installation, maintenance, and repair occupations	403, 433, 453, 470-495, 502, 516, 552, 554, 642	503-539, 544-549, 577, 864	503-539, 544-549, 577, 865	7000-7620	7000-7630
9 Production occupations	20 Production occupations	172, 401, 402, 405, 413, 422, 423, 426, 434, 435, 441-444, 446-452, 454, 461, 462, 501, 503, 504, 514, 515, 525-533, 540-546, 551, 561-575, 602, 604, 610-613, 620-622, 624-633, 635, 636, 641, 644-660, 662-695, 983	233, 403, 633-639, 644-649, 655-676, 678-769, 774-799, 873	233, 403, 628-639, 644-649, 655-676, 678-769, 774-799, 874	7700-8960	7700-8965
10 Transportation and material moving occupations	21 Transportation and material moving occupations	163, 164, 170, 221, 226, 424, 455, 456, 623, 634, 643, 661, 701-715, 753, 754, 760, 763-785, 931, 943	226, 227, 454, 465, 803-843, 845-853, 856-863, 875, 876, 878-889	226, 227, 454, 463, 803-843, 845-853, 856-864, 875, 876, 878-889	4550, 9000-9750	9000-9750
11 Armed Forces	22 Armed Forces	580	905	905	9840	9840

Table C-7: Missing and extra Census industry values in the CPS by time period

Time Period	Industry	
	Missing	Extra
1976–1982	–	129, 497, 719
1983–1988	–	–
1989–1991	–	0, 12, 22, 32, 51, 52, 61, 62, 70, 71, 72, 80, 90, 91, 92, 131, 170, 202, 240, 260, 302, 330, 430, 431, 450, 451, 452, 480, 481, 482, 490, 491, 492, 520, 570, 572, 680, 690, 692, 720, 792, 810, 811, 902, 911, 912, 920, 940, 941, 942, 950, 951, 952, 960, 961, 962, 970, 971, 972, 980, 981, 982, 990
1992–1993	–	0, 21, 22, 43, 52, 70, 71, 72, 80, 90, 103, 131, 143, 153, 202, 213, 223, 240, 243, 260, 263, 302, 313, 323, 333, 343, 353, 373, 382, 383, 393, 413, 423, 431, 460, 461, 462, 463, 480, 481, 491, 520, 523, 533, 553, 563, 572, 613, 643, 653, 680, 683, 690, 692, 713, 720, 723, 730, 733, 763, 783, 792, 811, 813, 823, 833, 843, 853, 883, 902, 903, 911, 912, 920, 923, 933, 940, 941, 942, 950, 951, 952, 960, 961, 962, 970, 971, 972, 973, 980, 990
1994–2002	–	–
2003–2010	–	–

Notes: The CPS does not use the allocation codes used by the Census with their 1970 classification scheme. Additionally, the 1980 and 1990 codes "290 Screw machine products" and "291 Metal forging and stampings" are often left off of Census code lists, but are, in fact, valid CPS industries.

Table C-8: Missing and extra Census occupation values in the CPS by time period

Time Period	Occupation	
	Missing	Extra
1976–1982	–	294, 346, 393, 659, 684, 875
1983–1988	–	–
1989–1991	–	39, 93, 94, 107, 109, 196, 209, 219, 236, 237, 238, 239, 244, 245, 246, 247, 248, 249, 273, 279, 286, 287, 288, 289, 294, 296, 297, 299, 333, 334, 358, 367, 388, 393, 395, 396, 397, 398, 408, 409, 419, 428, 429, 478, 493, 504, 524, 537, 545, 546, 548, 559, 568, 574, 578, 586, 603, 605, 606, 607, 609, 618, 619, 623, 627, 628, 629, 638, 648, 663, 685, 697, 767, 775, 788, 807, 817, 818, 819, 835, 837, 838, 846, 854, 858, 868, 874, 879, 884, 886, 893, 896, 899, 903, 904, 906, 949, 957, 977, 987, 988, 995, 997, 998, 999
1992–1993	–	2, 11, 12, 31, 32, 38, 39, 41, 42, 62, 91, 92, 93, 94, 102, 108, 111, 121, 122, 151, 162, 172, 182, 192, 196, 201, 202, 209, 212, 219, 221, 222, 231, 232, 236, 237, 238, 241, 242, 244, 245, 246, 247, 248, 249, 251, 252, 261, 271, 272, 273, 279, 281, 282, 286, 287, 289, 291, 296, 301, 302, 311, 312, 321, 324, 331, 332, 333, 334, 342, 349, 352, 362, 367, 369, 372, 388, 391, 394, 396, 401, 402, 408, 409, 412, 421, 422, 428, 429, 431, 432, 437, 441, 442, 451, 452, 478, 491, 502, 504, 513, 528, 531, 532, 537, 545, 548, 552, 559, 561, 562, 574, 586, 591, 601, 602, 604, 606, 607, 618, 623, 624, 625, 626, 627, 629, 633, 638, 641, 642, 652, 663, 671, 673, 682, 685, 697, 701, 718, 722, 731, 741, 742, 751, 761, 762, 771, 776, 778, 781, 782, 788, 791, 792, 794, 801, 802, 805, 807, 812, 816, 817, 831, 832, 841, 842, 846, 854, 861, 862, 863, 873, 879, 882, 886, 891, 893, 894, 896, 899, 921, 922, 931, 966, 976, 977, 995, 997, 998
1994–2002	–	–
2003–2010	–	–

Notes: The CPS does not use the allocation codes used by the Census with their 1970 classification scheme. Additionally, the 1970 codes "383 Telegraph messengers," "572 Unspecified apprentices," and "575 Craftsmen and kindred workers n.e.c." are often left off of Census code lists, but are, in fact, valid CPS occupations.

Table C-9: SIPP Census industry variables 1984 to 2008

Panel	Variable Name	Description	Census classification scheme
1984, 1985, 1986, 1987, 1988, 1989	ws1_ind, ws2_ind	Edited and imputed 3-digit industry code	1980
1990	ws1ind, ws2ind	Industry 1st/2nd Job	1980
1991	ws1ind, ws2ind	Edited and imputed 3 digit industry code	1980
1992, 1993	ws1ind, ws2ind	Edited and imputed 3 digit industry code	1990
1996, 2001	ejbind1, ejbind2	Industry code	1990
2004, 2008	ejbind1, ejbind2	Industry code	2002

Table C-10: SIPP Census occupation variables 1984 to 2008

Panel	Variable Name	Description	Census classification scheme
1984, 1985, 1986, 1987, 1988, 1989	ws1_occ, ws2_occ	Edited and imputed 3-digit occupation code	1980
1990	ws1occ, ws2occ	Occ. 1st/2nd Job	1980
1991	ws1occ, ws2occ	Edited and imputed 3 digit occupation code	1980
1992, 1993	ws1occ, ws2occ	Edited and imputed 3 digit occupation code	1990
1996, 2001	tjbocc1, tjbocc2	Occupation(al) classification code	1990
2004, 2008	tjbocc1, tjbocc2	Occupation(al) classification code	2002

Table C-11: Missing and extra Census industry values in the SIPP by panel

Panel	First job		Second job	
	Missing	Extra	Missing	Extra
1984	122, 301, 382	–	122, 201, 301, 332, 350, 361, 382, 392, 422, 472, 522, 790	–
1985	382, 522	–	122, 150, 190, 201, 210, 271, 301, 332, 350, 381, 382, 461, 462, 472, 522, 571, 790	–
1986	122, 220, 301, 332, 350, 382, 472, 522	–	30, 40, 122, 220, 261, 301, 332, 350, 361, 380, 382, 392, 422, 472, 522	–
1987	122, 301, 332, 382, 522, 790	–	122, 140, 150, 190, 191, 201, 252, 301, 310, 332, 350, 361, 381, 382, 422, 461, 462, 472, 522, 780, 790, 830	–
1988	122, 220, 301, 382, 522	–	41, 122, 130, 140, 150, 201, 210, 220, 222, 252, 290, 301, 332, 350, 361, 380, 381, 382, 462, 522, 571, 782, 790	–
1989	122, 220, 301, 350, 382, 522, 790, 830	–	30, 31, 40, 41, 50, 110, 111, 112, 120, 122, 130, 140, 141, 150, 152, 180, 190, 191, 201, 210, 220, 222, 232, 251, 252, 261, 270, 271, 272, 281, 291, 292, 301, 310, 311, 320, 332, 341, 350, 361, 380, 382, 400, 411, 420, 442, 461, 462, 472, 501, 510, 511, 521, 522, 531, 540, 552, 560, 561, 571, 600, 602, 611, 622, 662, 672, 780, 782, 790, 822, 830, 921	–
1990	122, 301, 332, 382, 522	–	122, 140, 220, 222, 301, 332, 350, 382, 392, 422, 472, 522, 790	–
1991	301, 332, 382, 782, 790	–	41, 122, 140, 141, 190, 201, 210, 220, 222, 252, 290, 301, 310, 332, 350, 382, 422, 462, 472, 522, 571, 782, 790	–
1992	–	–	150, 201, 210, 220, 252, 261, 301, 332, 422, 780, 782, 790	–
1993	332	–	182, 200, 220, 290, 301, 332, 350, 422, 472, 782, 790	–
1996	–	–	332, 472	–
2001	790	–	201, 220, 252, 301, 332, 350, 361, 381, 472, 782, 790	–
2004	–	–	480, 3290, 8890	–
2008	–	–	1390, 2480, 2990, 3290, 8890	–

Note: The 1980 and 1990 codes "290 Screw machine products" and "291 Metal forging and stampings" are often left off of Census code lists, but are, in fact, valid SIPP industries.

Table C-12: Missing and extra Census occupation values in the SIPP by panel

Panel	First job		Second job	
	Missing	Extra	Missing	Extra
1984	88, 146, 284, 369, 499, 834	–	28, 46, 54, 63, 66, 68, 74, 76, 87, 88, 89, 123, 125, 136, 146, 149, 165, 168, 214, 284, 285, 305, 306, 309, 325, 349, 369, 403, 413, 465, 474, 476, 494, 497, 499, 506, 515, 526, 539, 553, 555, 556, 587, 594, 635, 645, 654, 655, 656, 659, 673, 674, 703, 707, 713, 715, 724, 726, 743, 755, 763, 764, 814, 823, 825, 826, 833, 834, 843, 863, 867	–
1985	88, 146, 148, 168, 369, 497, 499, 506, 635, 659, 845	–	17, 28, 45, 46, 47, 49, 58, 66, 67, 68, 76, 77, 86, 88, 89, 113, 115, 117, 124, 125, 134, 136, 139, 146, 149, 168, 173, 179, 214, 233, 258, 284, 285, 305, 306, 309, 325, 326, 349, 353, 369, 374, 403, 413, 454, 474, 476, 483, 489, 494, 497, 499, 506, 515, 526, 536, 539, 543, 553, 554, 556, 557, 564, 598, 636, 644, 645, 649, 654, 655, 656, 659, 667, 669, 673, 693, 694, 695, 704, 705, 707, 713, 714, 717, 724, 726, 728, 735, 757, 763, 764, 766, 773, 793, 794, 798, 814, 823, 826, 828, 833, 834, 843, 845, 849, 867	–

1986	54, 68, 87, 99, 115, 117, 124, 146, 149, 168, 215, 306, 325, 369, 403, 454, 474, 483, 489, 494, 506, 553, 556, 639, 645, 654, 659, 673, 714, 765, 794, 826, 834, 845	–	17, 18, 28, 44, 45, 46, 47, 48, 49, 54, 58, 63, 66, 68, 69, 75, 76, 77, 79, 85, 87, 88, 89, 114, 115, 116, 117, 123, 124, 126, 133, 136, 146, 149, 165, 168, 173, 214, 215, 225, 228, 233, 284, 304, 305, 306, 309, 325, 326, 328, 349, 369, 377, 403, 414, 425, 454, 456, 474, 476, 483, 489, 494, 495, 499, 506, 517, 535, 536, 554, 556, 565, 583, 598, 615, 616, 635, 639, 645, 646, 647, 649, 654, 655, 656, 658, 659, 673, 674, 675, 678, 679, 684, 693, 694, 695, 696, 703, 705, 713, 714, 724, 725, 726, 728, 729, 739, 743, 757, 758, 763, 764, 784, 789, 794, 798, 803, 814, 823, 824, 825, 826, 833, 834, 843, 845, 867, 876	–
1987	46, 88, 116, 126, 136, 146, 148, 149, 284, 403, 413, 454, 474, 483, 499, 515, 556, 635, 639, 645, 655, 659, 673, 674, 714, 794, 798, 833, 834, 845	–	6, 8, 9, 17, 18, 44, 45, 46, 47, 49, 54, 66, 67, 76, 77, 79, 88, 89, 113, 117, 118, 119, 123, 126, 136, 139, 145, 146, 147, 148, 149, 165, 168, 169, 173, 214, 215, 227, 233, 284, 304, 306, 314, 325, 326, 347, 349, 369, 374, 403, 413, 415, 454, 457, 474, 475, 476, 483, 489, 494, 497, 499, 506, 515, 526, 527, 533, 536, 539, 543, 553, 556, 557, 594, 598, 613, 616, 635, 636, 639, 644, 645, 646, 654, 655, 656, 659, 673, 674, 676, 678, 693, 695, 703, 705, 708, 713, 714, 724, 725, 729, 743, 753, 758, 763, 765, 773, 789, 798, 824, 825, 826, 833, 834, 843, 845, 855, 863, 867, 875	–
1988	63, 66, 113, 115, 117, 136, 146, 149, 153, 168, 193, 284, 285, 369, 474, 483, 494, 499, 506, 635, 645, 655, 656, 659, 674, 714, 743, 814, 834	–	4, 17, 28, 34, 35, 45, 46, 47, 49, 58, 66, 67, 69, 74, 75, 78, 83, 85, 87, 88, 89, 114, 116, 117, 123, 124, 126, 134, 136, 144, 146, 149, 153, 168, 169, 173, 193, 205, 214, 215, 226, 233, 258, 284, 285, 304, 306, 307, 314, 325, 326, 345, 346, 347, 349, 369, 404, 405, 454, 465, 473, 474, 476, 483, 494, 499, 506, 529, 536, 539, 555, 556, 557, 564, 589, 598, 613, 616, 635, 636, 639, 644, 645, 649, 655, 656, 658, 659, 669, 674, 675, 678, 684, 693, 694, 695, 699, 703, 707, 713, 714, 717, 724, 725, 726, 728, 729, 738, 743, 757, 763, 764, 773, 787, 794, 798, 823, 825, 826, 833, 834, 843, 845, 849, 867, 875, 876	–
1989	54, 58, 68, 88, 89, 113, 117, 126, 138, 146, 147, 149, 153, 168, 233, 306, 309, 353, 369, 403, 404, 464, 474, 476, 483, 494, 498, 499, 506, 519, 556, 564, 635, 639, 645, 646, 655, 656, 659, 674, 693, 713, 728, 729, 743, 763, 794, 814, 834, 864, 866, 867	–	3, 6, 9, 15, 17, 18, 24, 26, 27, 33, 34, 36, 43, 45, 46, 47, 48, 49, 53, 54, 58, 63, 66, 67, 68, 69, 75, 76, 77, 78, 79, 83, 85, 86, 87, 88, 104, 106, 113, 114, 115, 116, 117, 118, 123, 125, 126, 127, 133, 136, 138, 139, 144, 145, 146, 147, 148, 149, 153, 166, 167, 168, 169, 179, 183, 187, 188, 193, 214, 215, 218, 224, 225, 227, 228, 233, 256, 258, 269, 283, 284, 285, 304, 305, 306, 307, 309, 314, 325, 326, 327, 328, 343, 344, 345, 346, 347, 349, 353, 363, 366, 369, 373, 374, 384, 386, 403, 404, 405, 413, 414, 415, 416, 425, 448, 454, 455, 457, 463, 473, 474, 476, 477, 483, 484, 485, 488, 489, 494, 495, 497, 498, 499, 506, 507, 515, 516, 517, 523, 525, 526, 529, 535, 536, 538, 539, 543, 553, 556, 557, 564, 565, 566, 569, 576, 577, 583, 584, 587, 594, 596, 598, 613, 615, 616, 634, 635, 636, 643, 644, 645, 646, 649, 654, 655, 656, 657, 659, 666, 667, 668, 669, 673, 674, 675, 676, 677, 678, 679, 687, 689, 694, 695, 696, 699, 703, 704, 705, 706, 707, 708, 709, 713, 714, 715, 717, 723, 724, 725, 726, 728, 729, 733, 734, 735, 736, 737, 738, 739, 743, 749, 753, 755, 756, 757, 758, 763, 764, 765, 766, 768, 784, 786, 787, 789, 793, 794, 798, 799, 803, 814, 823, 824, 825, 826, 828, 829, 833, 834, 843, 845, 848, 849, 853, 855, 859, 863, 864, 866, 867, 873, 875, 876	–
1990	46, 146, 148, 214, 369, 474, 483, 497, 506, 645, 655, 659, 728, 845	–	17, 28, 45, 46, 54, 58, 63, 68, 74, 87, 88, 89, 113, 115, 116, 117, 125, 136, 146, 147, 148, 149, 168, 214, 215, 258, 285, 304, 306, 309, 346, 369, 403, 404, 454, 474, 476, 483, 497, 499, 506, 517, 536, 553, 555, 584, 596, 613, 615, 636, 639, 644, 645, 654, 655, 656, 659, 669, 673, 674, 675, 676, 693, 703, 713, 714, 723, 724, 728, 729, 745, 753, 763, 764, 765, 773, 787, 798, 814, 824, 825, 826, 833, 834, 843, 845, 848	–

1991	54, 117, 124, 126, 139, 146, 148, 149, 168, 284, 309, 369, 403, 476, 483, 489, 499, 506, 615, 639, 645, 655, 659, 673, 676, 794, 845	–	4, 28, 45, 46, 47, 49, 54, 58, 63, 66, 74, 76, 77, 79, 83, 87, 88, 89, 116, 117, 123, 124, 126, 133, 136, 144, 145, 146, 148, 149, 168, 169, 179, 214, 215, 233, 258, 284, 306, 307, 309, 314, 325, 326, 328, 346, 349, 353, 366, 368, 369, 403, 404, 405, 416, 454, 474, 475, 476, 483, 494, 497, 498, 499, 506, 515, 535, 536, 539, 543, 553, 554, 555, 556, 557, 583, 589, 594, 613, 615, 616, 617, 635, 636, 639, 644, 645, 647, 649, 654, 655, 656, 659, 669, 673, 674, 675, 676, 679, 689, 693, 699, 703, 705, 706, 707, 713, 714, 717, 724, 725, 729, 733, 735, 743, 745, 755, 763, 786, 787, 794, 798, 814, 823, 824, 826, 833, 834, 843, 845, 848, 863, 866, 875, 876	–
1992	68, 88, 136, 149, 168, 233, 284, 325, 474, 476, 497, 499, 655, 659	–	16, 28, 34, 45, 46, 47, 49, 54, 63, 66, 68, 74, 75, 88, 116, 117, 126, 136, 139, 146, 148, 149, 173, 214, 227, 284, 304, 306, 325, 326, 346, 353, 403, 404, 405, 454, 457, 474, 476, 483, 489, 494, 497, 499, 506, 515, 535, 536, 539, 553, 564, 583, 594, 598, 615, 616, 639, 644, 645, 654, 655, 659, 669, 693, 695, 699, 703, 704, 705, 707, 714, 717, 724, 726, 728, 729, 758, 763, 764, 793, 798, 814, 823, 826, 829, 833, 834, 843, 845, 868, 876	–
1993	113, 117, 146, 149, 284, 403, 474, 483, 659, 676, 714, 845	–	9, 34, 45, 54, 58, 68, 79, 88, 89, 113, 117, 119, 123, 124, 125, 126, 136, 144, 146, 149, 153, 168, 169, 179, 214, 215, 226, 227, 233, 284, 304, 306, 325, 326, 374, 403, 404, 416, 454, 474, 476, 483, 489, 494, 499, 517, 519, 527, 553, 556, 569, 583, 594, 616, 617, 635, 639, 646, 656, 659, 669, 674, 676, 693, 703, 705, 707, 715, 726, 729, 745, 763, 784, 786, 789, 793, 814, 826, 833, 834, 843, 845, 848, 864, 868, 876	–
1996	3, 16, 179, 655	–	3, 16, 46, 49, 58, 89, 116, 117, 136, 168, 179, 214, 227, 284, 306, 403, 474, 476, 489, 536, 553, 635, 645, 649, 655, 656, 659, 674, 707, 713, 787, 798, 814, 826, 833, 834, 843, 845, 868	–
2001	3, 16, 68, 88, 146, 149, 179, 403, 454, 639, 656, 659, 826, 845	–	3, 16, 45, 46, 54, 58, 68, 79, 88, 117, 124, 126, 133, 146, 148, 149, 168, 179, 214, 227, 304, 306, 325, 326, 403, 404, 454, 476, 483, 489, 497, 515, 519, 564, 569, 583, 598, 635, 639, 644, 645, 646, 649, 654, 655, 656, 659, 669, 674, 693, 708, 726, 729, 743, 745, 749, 763, 764, 793, 825, 826, 833, 834, 845, 876	–
2004	1240, 2960, 3120	–	1210, 1240, 1330, 1340, 1440, 1500, 1510, 1830, 2960, 3120, 3840, 3860, 3900, 4160, 5030, 5210, 5830, 6020, 6110, 6430, 6910, 7050, 7520, 7600, 7920, 7930, 8150, 8360, 8410, 8420, 8430, 8520, 8840, 8900, 9230, 9260, 9330, 9340, 9500, 9560, 9730	–
2008	3860, 7520, 8430, 8520	–	900, 1200, 1210, 1330, 1500, 1510, 1710, 1830, 2960, 3000, 3120, 3260, 3830, 3860, 4300, 5030, 5830, 6020, 6110, 6310, 6430, 6740, 6750, 7050, 7520, 7600, 7710, 7740, 7920, 8020, 8060, 8120, 8150, 8160, 8210, 8330, 8340, 8360, 8430, 8440, 8450, 8520, 8630, 8840, 8910, 8940, 9230, 9260, 9340, 9560, 9730	–