Why Can’t They Just Look It Up? Utilizing Restricted Administrative Data to Overcome the Limitations of Surveys in Demography

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Disaster-related migration is hard to measure. Research “often rel(ies) either on census or survey data” (Berlemann and Steinhardt 2017). Censuses only occur rarely, and the intervals are often too large to differentiate between migration from disasters from migration for other reasons. Administrative records capture demographic shifts due to disasters, including deaths, migration, and staying. This project uses administrative data to further our knowledge of disaster-related migration. Beyond migration, this approach can improve demographic estimates, like life expectancy or fertility, particularly for populations underrepresented in traditional surveys

Surveys and other probability-based data sources are often used to generate inferences for a population. However, there are drawbacks to this approach and some of them are growing more consequential. As described by leading economists, “the research frontier moves to use administrative data” (Card et al. 2010:1) for a couple of reasons. First is the cost of sampling and gathering data, which is already paid for in administrative data. Second (and one of the reasons that primary data collection has gotten so expensive recently) are the continually declining response rates in recent years. Non-respondents may be systematically different than those who respond, for example in surveys utilizing phone number sampling frames, there is often a dearth of young and/or poor people, which bias population estimates (Ambel, McGee, and Tsegay 2021).

One of the recent trends in data science is the demand for now-casting, or the ability to assemble data and generate data insights quickly. This is not possible with survey data, which can only describe the present after months of preparation and procedure. Then survey data rapidly loses its value for describing current conditions and needs another costly re-survey. An additional benefit of an administrative records approach is the reduction in measurement error. Only obtaining records removes some of the biases from self-report. Additionally, surveys can leverage administrative records by only having the respondent answer questions not available in the records.

This study demonstrates how administrative data can enhance demographic analysis by creating a comprehensive migration frame that does not rely on traditional surveys. I have already contributed as a part of a team to (1) create a dataset using unique identifiers for people maintained by the U.S. Census Bureau called Primary Identification Keys (PIKs) and identifiers for addresses called Master Address Filer Identifiers (MAFIDs). (2) I will argue for the frame’s validity by illustrating correct PIKs coverage, using the American Community Survey and the 2020 Decennial Census as separate comparators. (3) I will observe the comparability of this new dataset — a demographic frame— made of administrative records, to the ACS and decennial census in 2020 by examining the coverage error for each geography in these datasets. Having shown the ability to make estimates with the demographic frame, I will create a similar, but entirely self-directed approach to identify movers and then (4) estimate measures of migration, such as an in/out migration matrix and overall migration efficiency, with these three data sources and discuss coverage differences across different geographies. While data is available at various geographic granularities, disclosure review will determine the geographic level statistics are presented in. Finally, I will (5) use these datasets to compare the migration related to hurricane Ian.

Disaster migration theories have primarily analyzed individual-level decisions based on push/pull factors (Lee 1966) mitigating risk (Stark and Taylor 1991) and responses to social networks (Massey 2015). This method allows theory to abstract to new aggregations, such as geography or housemates, and observe processes unseen by other methods. For example, methods that cannot differentiate between deaths, survey attrition, and migration.

Getting access to data will be the hardest part for other researchers. I have access because I have been working on the Census Bureau prototype administrative data frame – the Demographic Frame— for several years now. While the Demographic Frame is an important data source that utilizes administrative data to circumvent the drawbacks of surveys, its value is primarily in obtaining stocks, not flows of people in particular geographies. An Business Rules Approach to Person/Place Matching (BRAPPM) is built from the knowledge generated from this team, but (1) is being assembled from the ground up. The demographic frame utilizes a modeling strategy to match some PIKs with MAFIDs, while (2) this system uses no modeling at all, only programmatic logic. The goal of the demographic frame is to provide a frame for the whole country that researchers can use easily, combining records across several years for a fixed reference date. (3) This project creates a person/place data frame that researchers can assemble and modify the logic to tailor the assumptions they make. This is more labor intensive but allows researchers greater freedom to design studies. Freedom to choose their own reference dates and source to identify movers.

Current work on disasters often utilize a single unrepresentative data source, like twitter users (Zou et al. 2019), or hospital records (Craig et al. 2013, 2018). Current work on migration often use a single administrative dataset like the Internal Revenue Service records or the American Community Survey (Molloy, Smith, and Wozniak 2011). This project will supplement existing methods by describing the context of a time or place by leveraging available administrative data from hundreds of sources. These administrative datasets need to be combined to make a data frame to answer these needs. I will make this data frame, compare it to other methods, and then use hurricane Ian to apply it to disaster migration. This study advances demographic methodology and disaster migration theory by introducing a replicable framework for estimating migration trends. By enabling the systematic study of small and vulnerable populations, this approach enhances both theoretical insights and policy responses to disasters. It also contributes to the efforts of the U.S. Census Bureau’s Demographic Frame and illustrates new applications to its innovative approach.

BACKGROUND

While many disciplines have been theorizing about migration for a long time, U.S. sociology begins in the 1940’s (Bijak 2006) with Stouffer’s (1940) intervening opportunities. He posits that migration to a place will increase as the number of opportunities (especially jobs) available at a place increases. The likelihood of migration will decrease relative to the number of places and the number of opportunities available at closer places. This first sociological step identifies the importance of opportunities, as well as establishes a preference for less distance.

Lee (1966) builds upon the idea of intervening opportunities by adding push factors, or the factors that could push a person out of an origin. This literature then further divides push factors into hard and soft push factors. High interest rates, poor schools, etc. are soft push factors compared to hard push factors: war, natural disasters, or humanitarian crises. Disasters are hard push factors. Most of the literature on disaster migration acknowledges the primacy of push factors in life threatening situations, but recent work has identified trends in internal migration related to decline in precipitation or changes in temperature (Berlemann and Steinhardt 2017).

Taylor (1984) notes that migrant social networks seem to be very important pull factors. Ties in a destination diminish the cost of moving by allowing migrants access to social support, information about a place, and the capacity for more preparation by ties already at the potential destination.

Trans-national spaces (Bilecen, Gamper, and Lubbers 2018; Faist 2015; Roth 2009)builds upon this to conceptualize a meso-level space where migrants negotiate their identities between places. Trans-national spaces are the social capital networks and institutions that bridge places together and help in-group members through the transition wholistically. These are places facilitating integration, while establishing a separate identity from either origin or destination identities.

Interdisciplinary theories with sociology exist as well. Institutional theory (Massey et al. 1993) compliments the network-based insights of Taylor’s observation on migrant social networks by examining the connections that migrants have with institutions, like NGOs, corporate recruiters, counselors, and even irregular institutions like human smuggling or trafficking. The emphasis on institutions dovetails into institutional theory of economics well, creating a de facto hybrid, cross-disciplinary theory.

Relatedly, Cumulative Causation is a theory put forward by Massey (Fussell and Massey 2004; Massey 1990).It asserts that migration is an evolutionary process that changes the origin and destination. The people involved undergo a transformation from migration too, returning with more human and social capital (not to mention the other benefits like income). Migration will redistribute the land and other capital in a sending place as well, and these incentives can instigate a migrant culture, where migration is romanticized for its capacity for capital gain, and the costs of migrating can be reduced with a strong migration stream (as pointed out by Taylor’s migrant networks or the trans-national spaces literature) and institutions at the sending and receiving points of the stream. These externalities to migration can reinforce the migration process such that migration takes on a macro-level stream as opposed to many individual actors making many unique individual decisions. Evaluations of this theory have found cumulative causation has a lot of explanatory power for rural and smaller communities, but less predictive power for urban or larger communities. In other words, the migration processes may depend on who and where a migrant is going (Fussell and Massey 2004).

Economic theories of migration also exist and have been influential in sociological theories, resulting in some of the hybrid theories discussed above.

Migration in the neo-classical tradition is a disequilibrium phenomenon where capitalistic economies with a surplus of labor will give workers to economies with a surplus of capital. Capital movements and labor movements go in both directions and migration of these factors will cease once equilibrium is reached.

The micro economic version of this is that individuals are motivated to increase their lifetime earnings. Because of this motivation, workers should permanently move to wherever seems to have the best return to lifetime earnings, with a penalty imposed per distance of the opportunity.

Neoclassical economics does not describe return migration, nor the tendency of humans to organize their economic outputs in collective households (neoclassical economics assumes individuals are all motivated by their own lifetime earnings). There are also migration flows without wage differentials that are unexplained by neoclassical economics.

The new economic theory of migration is a micro economic theory revolving around households as the unit of analysis. These households are incentivized to mitigate risk, not maximize their earnings. When the source of risk in the sending context is addressed or the life cycle of the household has rendered a previous untenable risk tenable, this theory expects the return migration of the household, which is a great expansion on neoclassical economics described above.

Dual labor market theory describes the incentives for migration at a destination. The labor market is divided into two labor markets. There is a capital-intensive market and demand in this market is stable (not stationary). Workers in this market are usually skilled, and disruptions in this market are rarer than in the other market. There is also a labor-intensive market, which handles a lot of variant demand. This labor market is full of low-skill workers whose jobs are unstable. No one really wants to be in the labor-intensive market, but firms span both markets and need people in the labor-intensive market. There are two strategies firms can enact to incentivize workers to work in the labor-intensive market.

First, they can increase compensation for labor-intensive workers. This strategy can result in wages increasing all through the hierarchy as workers observe a group is getting wage increases and apply pressure for their own wage increases. The second option is more popular: Obtaining workers from another place to work for low wages. This saves money for the firm. Because there are no other options to obtain labor, companies lobby the government for more migrants and for fewer obligations for their foreign workforces.

There is also world systems theory, which is hybridized with economic ideas. World systems theory is about the processes affecting the sending of migrants. As capitalism/modernity progresses, markets transition from an agrarian or industrial economy to a service economy. These advances take place in the world “core” or the developed countries usually in the global North, and “periphery” and “semi-periphery” regions. A flow of goods and capital from core to periphery regions is counter balanced by a reverse flow of labor to periphery countries. In core regions, manufacturing jobs become less and less desirable and demand for these jobs increases, creating an opportunity for migration. In periphery regions, the increased production from technological advancements or capital investments results in less demand for workers. These workers are uprooted by these circumstances and incentivized into low paying, labor intensive positions in the core. There are many links from core countries to periphery countries beyond economics, the cultural, historical, linguistic, etc. factors are important too, which separates this from purely economic theories.

As noted by Massey et al. (1993: 448), in the world systems approach “international migration ultimately has little to do with wage rates or employment differentials between countries; it follows from the dynamics of market creation and the structure of global economy”. Special attention is paid to the asymmetric relationship between colonies and colonizer historical relationships, former colonizers being seen as having an advantage in trade. This is controversial, because free trade is seen as reducing income and employment disparities, and thus also migration. This theory is not elucidated mathematically and so is difficult to use in predicting future migration.

Disaster based migration typically situates itself under other migration theories. Typical migration theory processes are applied with careful consideration to the context of the disaster, often framed and treated as a push factor. WORK HERE NEXT!

***Some stuff on disaster migration studies and broad findings here***

*Operationalization of Migrants*

*“Migration scholars of today generally have to make two decisions to define migrants: 1) they choose geographic units to define potential origin and destination locations; and 2) they define the time period in which individuals move between origin and destinations.” (Molloy, Smith, and Wozniak 2011:175)*

Researchers have tended to choose potential origin and destination locations based on the availability of data and the theoretical orientations held. For U.S. based migration, many researchers use economic regions often called metropolitan statistical areas or core-based statistical areas, to analyze the economic processes put forward by dual segmented labor market theory, neoclassical economics, the new economics of migration, or through the lens of push and pull factors. These areas are built using counties or county equivalents by the U.S. Office of Management and Budget (United States Census Bureau 2025a). For research that takes place in a federal data center, researchers have access to microdata, like I do, but are limited in their analyses by a disclosure review board, like I am. Most of the work that is published using micro data is aggregated up to a larger geography, usually a county or state. Many researchers have created matrixes of migration from these aggregations (Curtis, Fussell, and DeWaard 2015; Hauer, Holloway, and Oda 2020; Johnson, Bland, and Coleman 2008).

In U.S. disaster migration work, it is common to analyze counties where Federal Emergency Management Agency issues an emergency declaration (Curtis et al. 2015; Johnson et al. 2008). These counties are sometimes analyzed against counties without an emergency declaration. Recent work has begun to consider the entire matrix of migration relationships: the ties each county has with each other county in send and receiving migrants (Curtis et al. 2015; Hauer et al. 2020).

^OTHER RESEARFHERS ^

Researchers studying migration related to disasters have utilized a couple of different approaches to identify time periods for migration.

*Data Sources Used for Disaster Research*

*Surveys.* The American Community Survey and the Decennial Census are like phone surveys in that all generate random samples from a sampling frame. The ACS and Decennial Census sample addresses to get their random samples. This address-focused approach is a major advantage over other sampling frames, like phone numbers. However, there are some drawbacks to an address-based sampling frame. Addresses are not people, but for many studies, people are the unit of analysis. Any correlations between sampling frame and unit of analysis can bias estimates. For example, the tendency for young and poor people to not have landlines has been a bias in several studies across the world (Ambel et al. 2021). Similarly, though to a lesser extent, sampling frames based on addresses will overrepresent richer people with many houses, and underrepresent those without addresses, those who move out of the country, or those who only fill out addresses on public forms with a P.O. box.

The American Community Survey is the successor of the Decennial long form. The long form had many questions, but pertinently asked “Where did you live five years ago?” (United States Census Bureau 2025b), which yielded five-year migration estimates at every decennial census. Without the long form, 10-year migration estimates are possible using the short form alone. Prior to 2010, 1 in 6 American households filled out the decennial long form. The long form is replaced by the American Community Survey in 2010 and in 2011 3.57 million addresses (households) are sampled each year to create the American Community Survey estimates (United States Census Bureau 2025b, see chapter 4). Like the long form, the ACS has many questions but pertinently asks “Did this person live in this house or apartment 1 year ago?” and “Where did this person live 1 year ago?” yielding one-year migration estimates for large areas with many households sampled. For small areas, ACS responses are aggregated into one-year estimates from a period of five years. For example, while one year migration rates for small counties can be estimated by combing five years of responses together, the question and subsequent estimates are still for one year.

There are some serious drawbacks to using ACS data for disaster migration. The ACS data must be combined to get good sample sizes for many smaller counties and so county migration estimates are only available for non-overlapping five-year spans, e.g. 2010-2014, 2015-2019, etc.)

The Decennial Census is a valiant effort of enumeration of all residents in the United States. In this sense, the Decennial Census covers the same population or universe as the ACS, but instead of surveying a sample of residents, enumerates all it can contact. Decennial enumeration is required by the U.S. constitution, and so sample based methods are legally prohibited. Residents sometimes fill out the Census dishonestly, incorrectly, or fail to comply. These are filtered out or imputed and published in the Census Edited File (CEF). While the Census Unedited File exists, is available, and is used for the official population counts, the CEF edits and imputes person characteristics like addresses, race, age, and sex (Devine, Jonathan, and Ryan 2021).

Despite the thousands of man-hours invested by enumerators, respondents, software, and internal analysts, the Decennial Census has major drawbacks in measuring migration. The largest drawback being its decennial nature, migration is not available for events, and many people will have moved more than once in a decade, which prevents researchers from getting an accurate picture of migration rates. Other concerns include struggles to accurately count the homeless, those off the grid, or sensitive populations like Native Americans on the reservations. Similar to the aims of this project, the 2020 Decennial Census used administrative records: IRS, Medicare/Medicaid, Household Composition File, and the Indian Health Service Patient Database to fill in the gaps (Mulry and Tello-Trillo 2023).

*Administrative records.* The alignment between sampling frame and dependent variable is also important to consider. Phone surveys that do not take into account person information tend to bias studies related to phone owning, like age, health, or income (Ambel et al. 2021; Call et al. 2011; Gourlay et al. 2021). In migration research, both the people selected and the types of people who can move, wealthier, educated, and younger (Feliciano and Lanuza 2017; Stark and Taylor 1991), ideally need to be aligned to prevent bias.

The Internal Revenue Service (IRS) is an administrative record frequently used in migration research (the other ubiquitous sources are the American Community Survey and the Decennial Census) (Hauer and Byars 2019). About 86% of the United States is represented in the county-to-county estimates published by the IRS (Molloy et al. 2011), about 116 million households. While the IRS data is released more frequently and has a much larger sample than the ACS, the IRS only examines households with income and lacks characteristics of the individual/household such as race, ethnicity, age, sex, educational attainment, and more.

With access to IRS, ACS, and Census data, many of the drawbacks of a particular data source can be ameliorated. Using common identifiers for people and places, characteristics that appear in one dataset, like person-level characteristics in the Decennial Census or ACS, can be merged into more frequent or larger sample datasets like the IRS information, which lacks these characteristics. Additionally, we can leverage the information available in many more administrative records to increase coverage, for example including Bureau of Prison data to include the incarcerated population or Medicare data for the elderly. Administrative data can also resolve measurement errors from a single data source, because one-off mistakes will be ignored in favor of consensus of multiple sources.

The first and biggest issue with using administrative records is matching respondents across different records (Harron et al. 2017). People changing their characteristics, like names, can make it difficult to match records collected for different purposes. Thankfully, the U.S. Census Bureau has a whole division working on the matching problem and for modern records, largely overcoming it. PIKs cover about 2.5% fewer people than reported in the 2020 Decennial Census and about 1.8% fewer people than in the official 2020 population estimates (Ortman and Knapp 2023). The false match rate was around .005% (Layne, Wagner, and Rothhaas 2014).

The next most important variable for examining migration are the locations. The Census Bureau also has a solution for researchers here: the Master Address File has IDentification keys (MAFIDs) for addresses. The Master Address File is a record of all known addresses with people living in them, including group quarters, and is regularly updated. The American Community Survey avoids respondent-given addresses by using the Master Address File as their sampling frame. Administrative-data-based efforts rely on matching work to match respondent supplied addresses to Master Address File addresses. Fortunately, this work has been central to Geography division of the Census Bureau for many years. Many administrative data sources, like the United States Postal Service, also have their own MAFID matching processes.

Having identifiers for addresses or people is not enough. Migration research requires datasets with these identifiers on them to be combined to make a person/place table that also records the time the record is seen. Then a time series for a person can be built from the various records showing a person’s moves through time. Key administrative datasets include: the Internal Revenue Service’s 1040 and 1099 data, Veterans Service Group of Illinois’ consumer referential database, the Social Security Office’s records, the National Change of Address Files, American Community Survey data, Decennial Census data, etc. Note that some of these datasets are from third parties, like the consumer referential data.

*Migration Related to Hurricanes*

METHOD

I propose using the datasets available in a Federal Statistics Research Data Center, including the 2020 Decennial Census Edited File (CEF), The American Community Survey micro data (ACS), The Demographic Frame extracts, and all other datasets included in the Demographic Frame Team’s (demoframe) Person Place Table. The Person Place Table includes information from nearly a thousand sources including the U.S. Census Bureau’s version of the Social Security Administration’s Numerical Identification System, data from the Bureau of Prisons, the U.S. Postal Service’s National Change of Address File, and state aid program datasets including the Supplemental Nutrition Assistance Program.

These datasets all identify people using PIKs, and addresses through MAFIDs. The dates of the datasets, or the dates on the records themselves, can be used to identify when a particular person is at a particular address. There are two modeling approaches used here that utilize the Person Place Table as the main input: the demographic frame extracts, which make predictions through machine learning and statistical models for a given extract year, and the business rules approach to person place assignment, which uses flexible logic for the assignment of person\place pairs.

The demoframe extract uses four different models to identify best PIK/MAFID pairs for a given year: an elastic net, random forest, logit, and boosted tree model. It is trained on the ACS data as a truth set and then uses the sources in the Person Place Table to create PIK/MAFID pairs. Other features used for training include the sourceid, or the characteristics of a particular source, and the date a source was considered valid. Each model seems to have different strengths and weaknesses and there are different versions of the demoframe extracts with various reference dates and coverages.

In the context of a business rules approach to person/place matching

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