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Dissemination**Applications and Impact of European Census Microdata****Note by IPUMS, University of Minnesota****Summary*

IPUMS International partners with National Statistical Offices to preserve and harmonize census data from around the world and disseminate microdata for use by the research community. In 2019, 382 anonymized microdata samples from 99 countries are available for scholarly and policy research through the IPUMS International online data dissemination system. These data are used widely across academic disciplines to study large-scale trends such as urbanization, household structure, economic development, migration, aging, educational expansion, and disability. International research organizations and United Nations divisions and agencies use harmonized census microdata to track progress towards the Sustainable Development Goals and inform policy development and evaluation. This paper describes the scale of use of census microdata available from IPUMS, provides examples of applications from academia and civil society, and reflects on the impact of IPUMS harmonization and dissemination efforts.

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I. Introduction

1. Since 1999, IPUMS International has collaborated with over 100 national statistical offices (NSOs) to facilitate the use of census microdata in scholarly and policy research. Microdata are essential for the study of complex population processes, enabling custom tabulation, multivariate analysis, and multidimensional disaggregation of population-level statistics. IPUMS harmonization and dissemination efforts simplify access and analysis of the world's census microdata.
2. During 20 years of IPUMS, thousands of students and researchers across the globe have made use of these data in innovative investigations. Many of these studies address the most pressing population issues facing the UNECE region such as migration, aging, low fertility, and labour supply. As the project enters a new grant period, IPUMS reflects on its impact in the UNECE region and around the world and renews its commitment to providing high-quality population microdata to responsible researchers.

II. IPUMS complements NSO dissemination activities

3. IPUMS International disseminates high-precision census microdata samples from around the world. IPUMS offers a means of disseminating microdata which complements the dissemination activities of National Statistical Offices. NSOs disseminate official statistics and official statistical products to a large number of publics—citizens, officials, the media, analysts, etc. IPUMS-International disseminates microdata on a restricted access basis to researchers who require detailed data on individuals and households to measure and analyze complex relationships, often making comparisons over time and between nations. Per agreements with National Statistical Offices, only vetted applicants with verifiable bona fides and a credible research project are approved to access the international microdata samples.
4. As of 2019, 382 anonymized microdata samples from 99 countries are available to researchers and students free of charge through the IPUMS online data dissemination system. Truly global in its coverage, the series includes more than 50 samples each from Africa, Asia, Europe, and the Americas. The data series includes contemporary data from 1960 to 2015;¹ the project continues to add data from the 2020 census round as microdata samples become available. Most participating national statistical agencies have entrusted the country's full series of extant census microdata to the project, facilitating intra-national as well as international trend analysis. Eighty-eight (88) census samples from 22 UNECE Member States are available from IPUMS (Table 1).
5. Samples distributed by IPUMS are systematically drawn from the total enumerated population by IPUMS or by the statistical office of the country of origin according to a variety of sample designs. Where possible, IPUMS provides 10 percent samples of census data by selecting every 10th household after a random start. Nearly all samples available from IPUMS are cluster samples: they are samples of households rather than individuals.
6. The principal advantage of IPUMS is its reconciliation of census-specific variable codes to produce datasets that integrate records across time and space. The basic goal of variable harmonization is to make data suitable for comparative analysis by applying comparable codes for each variable across all samples in the database. Microdata are integrated so that identical concepts have identical codes. Over 1000 harmonized variables are included in the IPUMS International database.

¹ IPUMS International also disseminates historical census data from the 18th, 19th, and early 20th centuries for Canada, United States, United Kingdom, Germany, Norway, Sweden, Iceland, and Denmark.

Table 1
UNECE-region contemporary census samples available from IPUMS International

<i>Country</i>	<i>2010s</i>	<i>2000s</i>	<i>1990s</i>	<i>1980s</i>	<i>1970s</i>	<i>1960s</i>
Austria	2011	2001	1991	1981	1971	
Belarus	2009	1999				
Canada	2011	2001	1991	1981	1971	
France	2011	2006	1999; 1990	1987; 1982	1975	1968; 1962
Germany				1987; 1981*	1971*; 1970	
Greece	2011	2001	1991	1981	1971	
Hungary	2011	2001	1990	1980	1970	
Ireland	2011	2006; 2002	1996; 1991	1986; 1981	1979; 1971	
Israel			1995	1983	1972	
Italy	2011	2001				
Kyrgyz Republic		2009	1999			
Netherlands	2011	2001			1971	1960
Poland	2011	2002		1988	1978	
Portugal	2011	2001	1991	1981		
Romania	2011	2002	1992		1977	
Russia	2010	2002				
Slovenia		2002				
Spain	2011	2001	1991	1981		
Switzerland		2000	1990	1980	1970	
Ukraine		2001				
United Kingdom		2001	1991			
United States	2015; 2010	2000; 2005	1990	1980	1970	1960

* *German Democratic Republic*

7. The IPUMS online data access system allows researchers to create customized, pooled data extracts that contain only the census samples, variables and cases they require. The IPUMS data extract engine generates a pooled dataset containing the requested microdata and the corresponding set of DDI (Document Data Initiative) compatible metadata, including a codebook suitable for constructing a system data file in SPSS, SAS, Stata or R. The data access system is fully integrated with the variable and sample documentation in a user-friendly online interface, so researchers can make informed decisions as they define their datasets.

8. IPUMS International is possible through direct partnerships with country NSOs. IPUMS also partners with the Demographic and Health Surveys (DHS) Program to harmonize and deliver pooled, customized DHS microdata files. Likewise, IPUMS, the University of Maryland, and University College London have collaborated to harmonize and disseminate time diary data from Austria, Bulgaria, Canada, Finland, Hungary, Israel, Italy, Netherlands, Spain, South Africa, the United Kingdom, and the United States. For more information on these projects, visit ipums.org.

III. IPUMS data users

9. IPUMS International first released harmonized data in 2002 and 2004. Since then, more than 20,000 students and researchers have registered to use data from IPUMS International. Since 2013, approximately 2000 new users have registered with the project each year. IPUMS International users reside in 170 countries and represent a variety of disciplines including economics, demography, sociology, statistics, geography, public policy, public health, political science, and government.

10. More than half of all IPUMS International users are students. A majority of users are graduate students using the data in masters or doctoral research. Several hundred undergraduate students have also registered to use the data in coursework. Researchers from the World Bank and from several United Nations divisions and agencies such as the World Health Organization (WHO), the International Labour Organization (ILO), the International Organization for Migration (IOM) and the United Nations Population Division have used the data extensively. There are nearly two hundred IPUMS users at the World Bank, and more than 100 IPUMS users across the various agencies of the United Nations.

Table 2
UNECE-region-data users by discipline*

<i>Discipline</i>	<i>No. users</i>
Economics	2 680
Demography	705
Sociology	454
Statistics	230
Public Policy	180
Geography	106
History	63
Public Health	58
Political Science	56
Computer Science	29
Other	229

* User data from period 2003 to 2018

Table 3
UNECE-region-data users by discipline*

<i>Status</i>	<i>No. users</i>
Student	2 574
Academic faculty or staff	1 625
Government / public policy	156
Other	435

11. Nearly 5,000 IPUMS users have downloaded a census sample from a UNECE member state. In 2018, 775 unique IPUMS users downloaded UNECE-region data. More than half of data users accessing UNECE-region data are based at research institutions in the United States, United Kingdom, Canada, France, and Spain. Likewise, roughly half of UNECE-region data users are economists or students of economics (Tables 2 and 3). Another quarter are in demography or sociology. UNECE-region-data users are based at some of the world's most reputable research universities and organizations such as Harvard University, the World Bank, and the University of Oxford (Table 4).

Table 4
Top 20 Institutions of UNECE-region-data users*

<i>Institution</i>	<i>No. users</i>
University of California-Davis	89
Harvard University	85
Centre d'Estudis Demogràfics, Universitat Autònoma de Barcelona	68
University of Chicago	62
World Bank	59
United Nations (all divisions / agencies)	53
University of California-Berkeley	53
New York University	51
Universidad Carlos III de Madrid	51
Columbia University	48
Princeton University	47
University of Michigan	42
National University of Singapore	40
El Colegio de Mexico, A.C.	38
London School of Economics	38
University of Toronto	35
University College London	35
Stanford University	33
Brown University	32
University of Oxford	32

* *Excludes IPUMS staff / University of Minnesota*

IV. Applications

12. In 2018, 2,500 unique data users downloaded 13,000 customized datasets using the IPUMS International online data extract system. This number has increased steadily each year from 600 extracts in 2005. Each IPUMS user builds a customized dataset by selecting only the samples and variables required for his or her research. More than half of the datasets downloaded from IPUMS International include multiple samples, suggesting that people are using the resource for comparative research. About 40 percent of all data extracts contain several samples from a single country, and many extracts contain just a single sample. This suggests that IPUMS features such as family relationship variables and documentation are valued by users who are interested in only a single country as well as those using the data in comparative research. Likewise, many researchers who have access to their country's census microdata through the National Statistical Office still download their country data from IPUMS. In 2016, for example, more than 200 researchers each in Canada and France accessed own-country data through IPUMS despite the availability of public use files.

13. Of the 13,000 datasets downloaded from IPUMS in 2018, 10,000 included at least one census sample from a UNECE member state. The most commonly downloaded UNECE-region countries are the United States, France, Canada, Spain, and Austria. Each of the 86 UNECE-region census samples represented in the database in 2018 was included in at least 100 unique data extracts during that year. Nonetheless, use varies greatly by sample. The temporal coverage, the number of years since the country joined the project, and the quality of the data and metadata all influence the demand for a country's data. Samples from more recent censuses are downloaded more frequently than samples from historical censuses. In 2018, samples from the 2010-round censuses of the United States, Canada, Spain, France, Ireland, Portugal, Romania, Greece, and Austria were downloaded more than 400 times each.

14. Census data are used to study many aspects of population dynamics, population characteristics, and economic development. Among the thirteen broad classifications offered by the IPUMS online bibliography, six account for the majority of citations: labour force and occupational structure; migration and immigration; family and marriage; education; methodology and data collection; and fertility and mortality (Table 5). Most IPUMS users utilize the data in advanced-degree theses and dissertations or academic journal articles. IPUMS-based research has been published in the leading English-language demography, sociology, and economic journals.

Table 5
IPUMS International citations by research area*

<i>Research area</i>	<i>No. citations</i>
Labour force and occupational structure	480
Migration and immigration	460
Methodology and data collection	391
Family and marriage	331
Education	316
Fertility and mortality	239
Gender	202
Race and ethnicity	185
Health	175
Poverty	136
Housing and segregation	116
Aging and retirement	86
Other	125

* *Multiple classifications per citation allowed; 2298 total citations as of May 2019*

15. Researchers make use of the flexibility of harmonized microdata to study associations between phenomena, change over time, and regional and global patterns. Many of these scholarly articles address the most pressing population issues facing the UNECE region, including aging, migration, low fertility, labour supply, and urban development with direct implications for public policy and planning. Large and nationally representative datasets make it possible to study small subpopulations and subnational regions of countries. A selection of publications from the last several years illustrate the application and value of IPUMS data for comparative work across academic disciplines and policy areas. A summary of several recent, topical IPUMS-based publications follows. See the bibliography attached to this paper for additional relevant publications.

A. Ageing

16. The large sample sizes available from IPUMS permit the analysis of small population subgroups, including narrowly-defined age groups. For this reason, census microdata are a primary source for studies of the elderly population. Recent scholarly articles shed light on living arrangements of older people in the UNECE region, providing important evidence for aging-related public policy.

17. A paper recently published in *Population and Development Review* (Reher and Requena 2018) examines living alone later in life in several countries, using census microdata available from IPUMS for 30 countries to explore the individual-level determinants of single living among the elderly in different societies. The authors control for individual characteristics such as sex, marital status, and education level and find that the probability of living alone among the population age 65 and older is higher in more highly developed countries than in mid- and less-developed countries. The authors attribute differences in the residential choices of the elderly among developed countries to the varying role of family and differences in access to in-home and institutional care for older people. As the relative

size of the elderly population increases worldwide, Reher and Requena's findings could inform budgetary and policy decisions surrounding elderly care.

18. Glaser and co-authors (2018) also examine living arrangements among the elderly in a recent paper in the *European Journal of Ageing* that looks at intergenerational co-residence. The authors use microdata from IPUMS for Austria, France, Greece, Portugal, Romania, and the United States (as well as ONS-accessed data for England and Wales) to examine the individual and household characteristics associated with intergenerational (grandparent-grandchild) households. In all countries studied, living with a grandchild is associated with socioeconomic disadvantage and the association is stronger in the current decade than it was in previous years. The authors suggest that resident grandparents are becoming providers rather than recipients of support and point to the Great Recession, welfare and child-protection policy changes, and the opioid epidemic (in the United States) as contributory factors.

B. Migration and Immigrant Integration

19. Census data are widely used to measure migrant stocks and flows, but individual-level census microdata allow researchers and policy-makers to investigate the demographic and socioeconomic characteristics of migrants, compare migrants to non-migrants, on a range of metrics, and to disaggregate population-level trends by migratory status. For small countries or countries with small migrant populations, census microdata are the only scientifically robust source of information on this population group.

20. Francesco D'Amuri and Giovanni Peri (2014) examine the impact of immigration on native jobs before and during the Great Recession using census data from IPUMS, Labour Force Survey (EU-LFS) and European Union Statistics on Income and Living Conditions (EU-SILC) data. The authors rely on census data for Austria, France, Greece, Italy, Portugal, Spain and the United Kingdom to produce estimates of immigrants for each country by region of origin, education level, and age group—an example of multidimensional disaggregation that requires large sample sizes. Results from the study provide evidence for an association between immigration and the movement of natives into more "complex" jobs with higher wages before and during the Great Recession. The results have direct implications for the occupational structure in several European countries that have recently received an influx of migrants.

21. A 2019 paper by Alesina, Murard, and Rapoport provides an example of using census microdata to study sub-national trends. The authors use census microdata from IPUMS for several European countries to calculate migrant stock by educational attainment and country of origin at the sub-national regional level (NUTS1 or NUTS2). By combining census and European Social Survey (ESS) data, the authors examine the relationship between regional migrant stocks and attitudes towards redistributive policies (i.e. welfare) within national welfare policy regimes. Results indicate a positive correlation between migrant stock and attitudes against redistribution among European-born voters and that this relationship is stronger when immigrants originate from Middle-Eastern countries, are less skilled than natives, and experience more residential segregation.

C. Fertility and childlessness

22. In recent years, scholars have used census microdata to examine declining fertility and childlessness in Europe and in other regions of the world. Though recent censuses in developed countries rarely include questions on fertility (i.e. children ever born), the household samples distributed by IPUMS allow researchers to study family size and household structure. IPUMS-created family interrelationship variables identify each household member's co-resident mother, father, and spouse, greatly facilitating the use of information about household structure implicit in the census data samples. Additional constructed variables describe household composition, such as the individual's number of own children in the household and age of youngest own child.

23. Barakat and Durham (2013) use data from IPUMS to disentangle the relationship between education, social status (occupation and industry), and fertility in six Central and Eastern European countries. Individual-level data are essential to estimate the association between fertility and female education and work. The authors explicitly state "Census samples from IPUMS are sufficiently large to contain sizeable numbers of unusual combinations, e.g., university graduates in low-status jobs or primary school dropouts in professional categories" (Barakat and Durham 2013, p.1213). The analysis suggests that education is strongly associated with fertility outcomes when controlling for occupation and industry and that fertility outcomes are variable within occupation and industry groups. A better understanding of the relationship between fertility, education and social status contributes to more accurate population projections with implications for many aspects of policy and planning.

24. In a 2016 paper in *Frontiers in Sociology*, Huber and Fieder use data from IPUMS for 41 countries to study the relationship between educational homogamy (similar levels of education among spouses) and childlessness. The authors make use of the IPUMS family interrelationship variables and a feature of the data extract system that allows data users to include in their datasets variables that describe other household members (in this case, spouse's education). The authors find that in both developed and developing countries women in homogamous marriages are less likely to be childless than women in marriages with "mismatched" educational levels.

D. Census microdata for monitoring the Sustainable Development Goals (SDGs)

25. In addition to academic research, IPUMS International data can be used to produce reliable customized national and sub-national statistics for use in policy formation and evaluation (Ruggles et al. 2006). IPUMS International data have been used to track progress towards the SDGs and other measures of economic development. Microdata are flexible enough to fulfil the disaggregation requirements of SDG monitoring in the service of leaving no one behind. Census data, in particular, provides broad enough coverage and even a sample from a census provides sufficient case counts to enable disaggregation of measurements across age, sex, geographic regions, migration status, disability status, and so on. Several recent reports published by United Nations agencies highlight the role of census microdata in SDG monitoring and SDG-adjacent research.

26. A 2018 report by the International Organization for Migration (IOM) titled *A pilot study on disaggregating SDG indicators by migratory status* illustrates the potential of using census data to disaggregate national data by migratory status. The authors present a number of SDG and SDG-related indicators disaggregated by migrant status and other individual characteristics where relevant for dozens of countries across all world regions. Data from IPUMS International were also used to calculate indicators and statistics disseminated in the IOM's Migration Data Portal.

27. In the context of SDG 3c, which aims to "substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States," the World Health Organization (WHO) used data from IPUMS International to measure the stock and density of the health workforce. These estimates are publicly available through WHO's Global Health Observatory Data Repository. WHO also uses data from IPUMS International to assess gender equity in the health workforce in its 2019 report *Gender equity in the health workforce: Analysis of 104 countries*.

28. Both the Statistics Division of the United Nations Department of Economic and Social Affairs (DESA) and UN Women have used data from IPUMS International to track gender equality in sustainable development. The UN DESA report *The World's Women 2015* uses IPUMS extensively to disaggregate by age and sex several population statistics such as the proportion of older persons living alone, the percentage of internal migrants, and the proportion of widowed persons. Likewise, UN Women's *Turning Promises into Action: Gender Equality in the 2030 Agenda for Sustainable Development* uses IPUMS data to

disaggregate indicator 8.6.1—proportion of population aged 15–24 not in education or employment (NEET)—by sex and disability status for 32 countries.

29. Data available from IPUMS International can be used to calculate 28 SDG indicators as officially operationalized. For dozens of additional targets that rely on “big data” and other non-traditional data sources that are not nationally representative, census data will be required to produce population-level estimates. Likewise, census data will be required for the disaggregation of indicators derived from data sources that lack the sample sizes or stratifying variables necessary to support disaggregated estimates (Jeffers et al. 2017). That United Nations division and agencies are accessing international census data through IPUMS International for use in SDG-related activities speaks to the advantages IPUMS offers for comparative policy research and the importance of effective data dissemination.

V. Conclusion

30. IPUMS data are opening new opportunities for comparative analysis and greatly simplifying the study of large-scale trends and processes of change. IPUMS International has stimulated creative research on economic development, population growth and movement, fertility, mortality, household composition, union formation, as well as the economic and social correlates of demographic behaviour and the causes and consequences of demographic change. IPUMS data have also been used by several UN agencies and divisions to support SDG monitoring.

31. IPUMS data are highly valued by the research community. A 2019 IPUMS survey of data users reveals high satisfaction among IPUMS International users. Seventy-five percent of survey respondents were “extremely” satisfied with their overall experience with IPUMS. Several users commented on the benefits of IPUMS for research and its role in innovation in the social sciences. One survey respondent offered the following: “[IPUMS] is a really remarkable and truly unique data resource. It allows us to ask and answer questions that we never could before.” Another echoed this sentiment, commenting “[IPUMS] enables me to do things I could only dream about before.”

32. In 2019, IPUMS International received grants from the National Science Foundation and the National Institutes of Health (NIH) National Institute on Aging that will support for the project for the next five years. During this grant period, IPUMS International will pursue a number of new initiatives including the integration of international labour force surveys and the development of access to restricted microdata through dedicated research data centres.

33. In addition to these new initiatives, IPUMS remains committed to its core mission of preserving the world’s census data and providing harmonized microdata to the research community. In response to a survey question on suggested improvements to IPUMS International, dozens of respondents indicated their desire for broader geographic coverage and more timely incorporation of data from recent censuses. IPUMS asks for the ongoing support of its NSO partners as it works to ensure it remains relevant and continues to serve the needs of the research community.

34. National Statistical Offices not presently associated with IPUMS International are invited to contact the Project Director, Dr. Lara Cleveland at cleveland@umn.edu.

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