Changes in Household Composition and Its Demographic Driving Forces

Leiwen Jiang
National Center for Atmospheric Research

Abstract:

Projections of changes in household composition are crucial for understanding how demographic dynamics affect future social, economic and environmental development pathways, given that household is often the unit of consumption of goods and services and even a unit of production in many traditional societies. However, consistent population and household projections are underdeveloped, mainly due to the complexity of household formation/dissolution processes and data limitations. This study is designed to explore the patterns of household compositional changes, through analyzing the evolution of age- and size-specific headship rates among rural and urban populations of different regions of the world, and over time. Using data from Integrated Public Use Microdata Series (IPUMS International), we compare the headship rates of 55 countries across several decades to over a century, and investigate how headship rates of a country evolve over time, and how headship rates vary across countries. This paper pays particular attention to the relationships between changes in major demographic variables and changes in headship rates. We also study the headship rates of population by different characteristics, such as rural/urban residence, education attainments. Our study reveals a general pattern of evolution of headship rates by age, rural/urban status, and size over time and across countries at different socioeconomic development levels and different stages of demographic transition. A multivariate regression model is constructed to project the changes in headship rates as the consequences of socio-demographic factors, which will be used to inform the development of an improved and extended headship rate household model that project future household numbers and compositions by considering the impacts of demographic dynamics on household formation.

Key Word: household composition, headship rate, demographic factors, projection

Extended Abstract

1. Introduction

Projections of changes in household composition are crucial for understanding how demographic dynamics affect future social, economic and environmental development pathways (MacKeller et al., 1995; Jiang, 1999; Liu et al., 2003), given that household is often the unit of consumption of goods and services and even a unit of production in many traditional societies. Anticipating changes in the number, size, and composition of households is an important element of many issues of social concern including elderly support (Dalaker, 1999), housing policies (Holmberg 1987; King, 1999; Muller et al., 1999; Canada Depository Service Program, 1996; Scottish Executive, 2000), household savings and consumption patterns (Deaton and Paxson, 2000; Tsai et al., 2000; Gokhale et al. 1996), and environmental consequences (O'Neill et al. 2010; Liu et al., 2003; O'Neill et al., 2001; Perz, 2001; MacCracken et al., 1999; Van Diepen 1995; Jiang, 1999; MacKeller et al., 1995; Fuernkranz-Prskawetz, et al. 2001; Carlsson-Kanyama and Linden, 1999).

However, consistent population and household projections are underdeveloped, mainly due to the complexity of household formation/dissolution processes and data limitations (Jiang and O'Neill 2004

and 2007). While there have been a number of micro- (e.g. Hammel et al., 1976; Wachter 1987) and macro-dynamic (e.g. Van Imhof & Keilman 1991; Zeng et al. 1997) household simulation/projection models, the static headship rate method is most widely used for household projections. This is because the existing micro- and macro-dynamic household projection models often have high computational intensity and require extensive inputs which usually are not available from conventional demographic data sources. The headship rate approach is a popular methodological choice because it is easy to apply and its data demands are modest (e.g. US Bureau of the Census, 1996; Muller Canada Depository Service Program, 1996; King, 1999; Scottish Executive, 2000; Statistics New Zealand, 2003; Australian Bureau of Statistics, 2003).

However, a classic headship rate method suffers from two main limitations. First, it produces limited detail in projecting changes in household composition. For instance, it does not project the number of households by size, while a number of studies reveal that changes in household composition by size will affect per capita consumption of energy and other goods and services given the changes in economy of scales (Jiang 1999; Fuernkranz-Prskawetz, et al. 2001; Liu et al., 2003). Moreover, changes in household size among the elderly population are also important to anticipating changes in social service demand. The second limitation of a headship rate model is that it typically assumes constant headship rates, when in fact they are likely change due to changes in age structure and in behavior, which have clear linkage to demographic events, such as fertility, mortality and migration.

Over the past decade, we have been working to develop a method that (1) project changes in number of households, distribution by size and age of the householders; (2) use the conventional demographic data sources and therefore easy to apply; and (3) can clearly identify links between demographic events and changes in household composition (Jiang 1999; Jiang and O'Neill 2004, 2007, and 2009; O'Neill and Jiang 2007). This method is based on extending and improving conventional headship rate model. The current paper takes an important step to understand how age- and size-specific headship rates evolve over time and across rural and urban areas in different countries/regions of the world, and explore any existing regularity in the changes and their possible linkages with major demographic events.

2. Data and Method

The headship rate is derived from the number of household heads by age a, household size s and rural/urban resident r, $H_{(a,s,r,t)}$, over the population of corresponding age and rural/urban residence denoted as $P_{(a,r,t)}$. The basic relation is

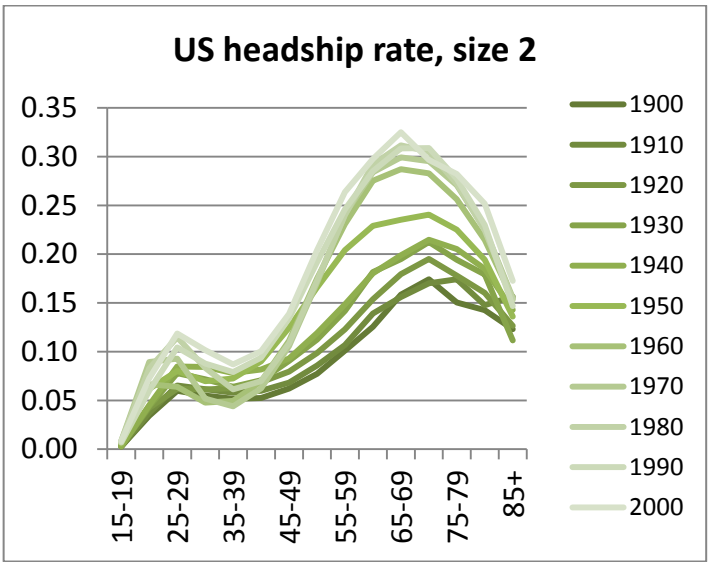
$$h_{(a,s,r,t)} = \frac{H_{(a,s,r,t)}}{P_{(a,r,t)}}$$

In this research, we use all datasets available from Integrated Public Use Microdata Series (IPUMS) and take advantage of the large sample size of the IPUMS data that covers 55 countries from different regions and span multi-decades. The IPUMS-USA includes data from the US decennial censuses of more than a century which was firstly used in our analysis. The harmonized dataset of the IPUMS-International from other 54 countries is compatible with the data from the IPUMS-USA, therefore is preferred in our research. However, as the aim of our research is to calculate the headship rates by rural/urban status and the harmonized dataset for many countries do not include the variable of

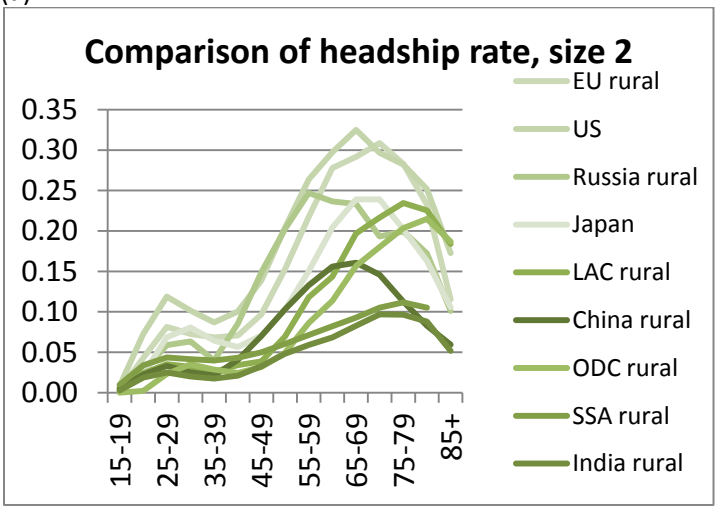
rural/urban status, we have to use the unharmonized data to impute the rural/urban status of the households surveyed.

3. Preliminary Results

Based on our preliminary analysis, we find that the age-size-specific headship rate changed significantly over time in all countries, and assuming constant headship rates for future household projections will underestimate the changes in the number and composition of households. This is particularly true for the developing world which is under considerable social and demographic transition. More importantly, our research reveals that there exists a general pattern of changes in age-size-specific headship rates across different regions of the world and over time, and the changes are closely related to their stages of demographic transition.



(a)

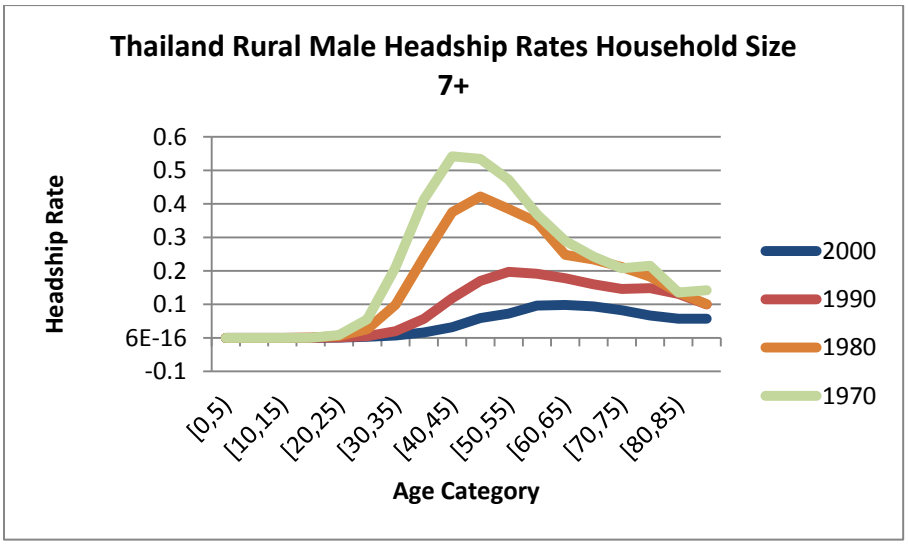


Note: LAC-Latin America, SSA-Sub-Saharan Africa

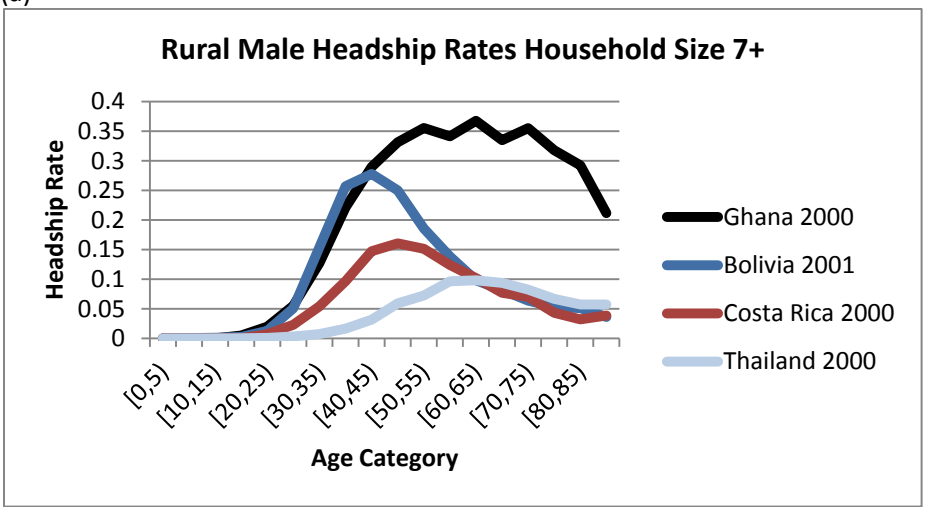
(b)

Figure 1 comparison of headship rate of size 2

As an example, Figure 1 shows that the age-specific headship rates for household size 2 in the US have continuously increased in the past century, and the increase is particularly significantly for old age and young adult groups. And the same pattern of changes exists across regions/countries at different stages of demographic transition. Evolving age-size-specific headship rates reflect the behavioral changes in household formation and dissolution, which can be directly represented by the main comprehensive demographic variables, such as total fertility rate, life expectancy, internal and international migration rate. Figure 2 shows the changes in the age-specific headship rates of large households (size 7+) in rural Thailand over the past three decades (Figure 2a) and the comparison of the headship rates of large households in the rural areas of several developing countries (Figure 2b). In the past three decades, the headship rates of large households (size 7+) in Thailand declined substantially. This change to a great extent is owing to the dramatic fertility decline (TFR declined from 5.99 in 1970, to 3.92 in 1980, 2.30 in 1990, and to 1.77 in 2000). The large difference in headship rates of large households between the listed developing countries in Figure 2b also correspond to the differences in their TFRs (Ghana 5.34, Bolivia 4.80, Costa Rica 2.95, and Thailand 1.77).



(a)



(b)

Figure 2 Changes in headship rates of household size 7+

A care study of the relationship between some comprehensive demographic indicators (TFR, life expectancy, urbanization level) and age-size-specific headship rates will lead to the establishment of a regression model, which can help to project the changes in household composition by age, size and rural/urban residence. More importantly, these indicators are also the parameters in a population projection. Therefore, adopting the same scenarios on the changes in these demographic events will ensure consistent projections in the number and composition of population and households.

References

Canada Depository Service Program, 1996: The Long-Term Housing Outlook: Household Growth, 1991-2016, Research and Development Highlights, Issue 28;

J. Dalaker, 1999: Poverty in the United States: 1998. Table 2. U.S. Census Bureau, Current Population Reports P60-207. Washington, DC: U.S. Government Printing Office.

Y. Zeng, J. Vaupel and Z. Wang, 1997: A multidimensional model for projecting family households – with an illustrative numerical application, Mathematical Population Studies, 15(3), 187–216.

Fuernkranz, A., L. Jiang, et al. (2004). Demographic composition and projecions of car use in Austria. Vienna Yearbook of Population Research 2004: 274-326.

K. Wachter, 1987: Microsimulation of household cycles, in J. Bongaarts, T.K. Burch and K.W. Wachter (eds.), Family Demography – Methods and their Application, Oxford, Clarendon Press, 215–227.

Tsai IJ, Chu CYC, Chung CF, 2000: Demographic transition and household saving in Taiwan, Population and Development Review, 26: 174-193 Suppl. S.

US Bureau of the Census, 1996: Projections of the Number of Households and Families in the United States: 1995-2010, http://www.census.gov/population/methods/p251129.txt.

A. Van Diepen, 1995: Population, land use and housing trends in the Netherlands since 1950, Laxenburg, International Institute for Applied Systems Analysis (IIASA), wp-95-63;

E. Van Imhoff and N. Keilman, 1991: Lipro 2.0: An Application of a Dynamic Demographic Projection Model to Household Structure in The Netherlands, Amsterdam/Lisse and Berwyn PA, Swets & Zeitlinger Inc.

Leiwen Jiang 1999: Population and Sustaianable Development in China – Population and Household Scenarios for Two Regions, Amsterdam: Thelasis.

Jiang, Leiwen and Brian O'Neill, 2007: Impact of demographic trend on US household size and structure, Population and Development Review, 33 (3): 429-656.

O'Neill, Brian, M. Dalton, R. Fuchs, L. Jiang, S. Pachauri, and K. Zigova, 2010: Global demographic trends and future carbon emissions, Proceedings of the National Academy of Sciences of the United States of America, 107(41):17521-17526.

Jiang, Leiwen and B.C. O'Neill (2009). Household projections for rural and urban areas of major regions of the world. IIASA Interim Report IR-09-026. Laxenburg, Austria: IIASA.

Brian O'Neill and Leiwen Jiang, 2007: Project US household changes with a new household model, International Institute for Applied System Dynamics Analysis, Interim Report, IR-07-012, Laxenurg, Austria.

Jiang, L. and B. O'Neill (2004). Towards a new model for probabilistic household forecasts. International Statistical Review 72(1): 51-64.

E. Hammel, D. Hutchinson, K. Wachter, R. Lundy and R. Deuel, 1976: The SOCSIM Demographic-Sociological Microsimulation Program, Berkeley, Institute of International Studies, University of California (Research Series No. 27).

J. Liu, G. Daily, P. Erlich, G. Luck, 2003: Effects of household dynamics on resource consumption and biodiversity, Nature, January 12.

L. MacKellar, W. Lutz, C. Prinz and A. Goujon, 1995: Population, households and CO2 emissions, Population and Development Review, 21(4), 849–865.

B. O'Neill, F.L. MacKellar, and W. Lutz, 2001: Population and Climate Change, Cambridge University Press, Cambridge, UK. 266 pp.

S.G. Perz, 2001: Household demographic factors as life cycle determinants of land use in the Amazon. Population Research and Policy Review 20: 159–186.

Scottish Executive, 2000: 1998-Based Household Projections for Scotland, Scottish Executive Statistical Bulletin Housing Series: HSG/2000/4.

Australian Bureau Statistics, 2003: Year Book Australia 2003, Population, Households and families, http://www.abs.gov.au/Ausstats/abs@.nsf/Lookup/F25B71FD61F5346CAE00053F9B, active date: 1/2/2004.

A. Deaton and C Paxson, 2000: Growth and saving among individuals and households, Review of Economics and Statistics, 82 (2): 212-225.

Jagadeesh Gokhale, Laurence J. Kotlikoff, John Sabelhaus, Barry Bosworth, Robert Haveman, 1996: Understanding the Postwar Decline in U.S. Saving: A Cohort Analysis Brookings Papers on Economic Activity, Vol. 1996, No. 1142., pp. 315-407.

A. Kuijsten and A. Vossen (1988), Introduction, in N. Keilman, A. Kuijsten and A. Vossen (eds.), Modelling Household Formation and Dissolution, Oxford, Clarendon Press, 3–12.

D. King, 1999: Official household projections in England: Methodology, usage and sensitivity tests, paper presented at "Joint ECE-EUROSTAT work session on Demographic Projections, Perugia, Italy, 3-7 May 1999.

C. Muller, Kottai S. Gnanasekaran, and Kenneth Knapp, 1999: Housing and Living Arrangements of the Elderly, An International Comparison Study, New York: International Longevity Center – USA, Ltd. Almanac Phase 4

Statistics New Zealand, 2003: National Family and Household Projections (Base) – 2021, http://www.stats.govt.nz./domino/external/pasfull/pasfull.nsf/, active date: 2/3/2004.

I. Holmberg, 1987: Housheold change and Housing Needs: A forecasting model, in J. Bongaarts, T. Burch, and K. Watchter (eds.): Family Demography - Methods and their Application, Oxford: Clarendon Press.