University of Massachusetts Amherst

ScholarWorks@UMass Amherst

Center for Economic Development Technical Reports

Center for Economic Development

2009

Summary Report: Population Estimates in Massachusetts: A Report to the Secretary of the Commonwealth

Henry C. Renski
University of Massachusetts - Amherst, hrenski@larp.umass.edu

Susan Strate
Donahue Institute, sstrate@donahue.umassp.edu

Ludgarda Simmonds

Follow this and additional works at: https://scholarworks.umass.edu/ced_techrpts

Part of the Growth and Development Commons, Urban, Community and Regional Planning Commons, and the Urban Studies and Planning Commons

UMASS DONAHUE INSTITUTE

UMass Donahue Institute Population Estimates Program

Summary Report:
Population Estimates in Massachusetts, 2009

A Report to the Secretary of the Commonwealth

September 2010

Report Contributors
Henry Renski, PhD, Principle Investigator
Susan Strate, Program Manager
Ludgarda Simmonds, Research Analyst

Contents

Introduction and Summary

This report summarizes the 2009 estimates results from the UMass Donahue Institute's Population Estimates Program (UMDI-PEP). These population estimates are developed in tandem with the Donahue Institute's data collection efforts, namely our group quarters and housing unit surveys.

There are several reasons why it is necessary for the Commonwealth of Massachusetts to develop its own population estimates. First, county and sub-county population estimates are a key resource for state and local governments, non-profits, and the private sector which use these estimates to prepare reports, grant applications, business plans, and state and federal compliance documents. At present, public agencies in Massachusetts develop their own estimates on a purely ad-hoc basis or rely upon somewhat questionable estimates from the U.S. Census Bureau that have not been vetted by experts that understand the local demography of the Commonwealth. Secondly, the process of generating population estimates helps UMDI evaluate the quality of the information collected through our surveys. Our population estimates provide an early look at how the new survey data will affect official Census estimates and help us prioritize communities that are the best candidates for challenging official Census estimates. Lacking such checks, the Census Bureau has been prone to undercount the Massachusetts population. In 2008 alone, Donahue Institute supported challenges added population that could translate into between \$3.2 and \$33.09 million of federal resources.[1] Lastly, developing our own estimates helps to identify the forces driving population change, whether through changes in migration, births, or deaths. Armed with this knowledge, state and local policymakers can address the policy challenges posed by demographic change in a more informed and proactive manner.

We estimate the 2009 population of the Commonwealth of Massachusetts at 6.64 million persons—a 4.4% increase from the last decennial census in 2000. This is 51,873 more persons than estimated by the U.S. Census Bureau for 2009. Much of this gain is a direct consequence of UMDI-PEP's group quarters (GQ) and housing unit review (HUR) efforts. For the Group Quarters Review project, UMDI-PEP collects and submits to the U.S. Census Bureau updated resident counts for GQ facilities. For HUR, the program collects and reviews building permits, mobile home placements and housing unit loss data for each town and city in Massachusetts to estimate the housing stock in the state and counties. The Bureau does not collect housing unit loss data directly from the towns (as it does with the building permits); instead it calculates a loss-by-age-of-structure rate for the U.S. as a whole and then applies this rate to all regions. New England's housing stock is much older than the national average, so this national rate does not correctly reflect the situation in the region. In 2009, we found that the Census Bureau had overestimated the demolitions and therefore underestimated the number of housing units and population for some towns and cities in Massachusetts. Also, some municipalities in the state have actually increased their housing stock due to "adaptive reuse" of older buildings, which was also a component that the Census Bureau routinely missed.

The Census Bureau's official population estimates for 2009 incorporate data collected by the Donahue Institute on housing units, and may lead to revisions in their official estimates for past years.

---

[1] Range based on results from five different independent analyses: U.S. Conference of Mayors Survey 1999 and Survey of Projected Value 2002-2012, Government Accountability Office Study 1998, PriceWaterhouse Coopers Study 2000, and Brookings Institute Study 2009.

Methods and Data

This section briefly discusses the methods and primary data sources used to develop UMDI's 2009 population estimates.

For our 2009 estimates, we largely follow the procedures adopted by the U.S. Census Bureau, but with a few important differences. Whenever suitable we use our own data sources and develop our own models for measuring population change in lieu of pure reliance on the data and procedures provided by the Census Bureau.

We estimate county and municipal populations separately using two different types of demographic models and independent data sources. We estimate population at the county level using a component of change method (i.e. the component model). This approach estimates changes in the total population based upon an analysis of changes due to natural increase (births minus deaths), net domestic migration, net international migration, municipal-level housing unit challenges, and changes in the group quarters population. Each of these population components is estimated separately, although some components depend upon estimates of another component.

To estimate the municipal population, we follow a different process called the "housing unit method." This method is used because much of the data on the individual components of change is not available at a municipal level. The housing unit method looks at changes in the housing stock to estimate population change. We reconcile the two approaches by adjusting the municipal estimates to sum to the county populations. The state population is the sum total of the individual counties.

As in the previous year, for this year estimates we added a component to both models to account for increases in population that are the result of housing unit challenges. Population adjustments based on housing unit challenges are not adequately captured by other data sources on the components of change, and therefore must be added separately. Last year's challenges resulted in an increase of 22,150 people to the official estimates for 2008.

County Population Estimates – The Components of Change Method

A change in any area's population is due to one of six components of change: births, deaths, in-migration, and out-migration[2], housing unit challenges, and group quarters. We develop estimates for each of these components and then add their net sum to the previous year's household population to estimate the current year's population.

We estimate the group quarters population separately, in order to improve the accuracy of the model. The group quarters population includes students living in dormitories, correctional facilities inmates, residents of convents and monasteries, nursing homes, or other types of collective living facilities. While still subject to the same basic forces of demographic change, the behavior of the group quarters population is typically quite different from that of the household population and is not well represented by the data sources used to estimate household population change. For example, college students in dorms are usually between 17 and 22 years old and have lower death rates than the

---

[2] In- and out-migration includes the movements of people both within the United States and abroad.

UMass Donahue Institute
Economic and Public Policy Research

general population. They also have a tendency to immigrate en masse when starting college and then emigrate once finished. Household populations tend to have more stable migration patterns.

We pull together data on each component of change from a combination of sources. The Census Bureau provides its preliminary estimates of domestic and international migration, births, deaths and group quarters populations to UMDI through the Federal State Cooperative Population Estimates program (FSCPE). The Census Bureau uses this data to develop its annual population estimates. But because our goal is to develop independent estimates, and because past Census estimates are believed to underestimate population in the Commonwealth, UMDI collects its own data on the sources of population change, whenever feasible. Data on births and deaths comes directly from the Massachusetts Vital Statistics records provided by the Department of Public Health. Data on the migration of household populations below 65 years old is estimated from the Internal Revenue Service (IRS) data on changes in tax filings and exemptions. The data for migration of households 65 and older is estimated based on changes in Medicare enrollments, instead of IRS data, because many retirees are not obligated to file taxes. We estimate changes in the group quarters population directly from UMDI's Group Quarters survey. Lacking a better source for international migration, we use the Census Bureau's estimates to calculate the changes in this component.

Municipal Population Estimates – The Housing Unit Method

The housing unit method estimates changes in municipal populations based upon changes in the housing stock. This approach starts with estimates of the existing stock of residential housing units as reported in the 2000 Census. From this number we add new residential constructions and subtract demolitions in each subsequent year. We multiply the number of housing units by average vacancy rates and occupancy rates (i.e. persons per household) to estimate the total resident household population for each municipality. Municipal estimates are constrained to sum to the county-level household population, as estimated through the component method. The final step combines estimates of the residential household population to UMDI's estimates of the group quarters population to produce the total population for each town and city in the Commonwealth.

In our first year (2007), most of the data used to estimate populations using the housing unit method came from the U.S. Census Bureau. Initial estimates of the municipal housing stock, vacancy rates, and estimates of the number of persons per household all came from the 2000 Decennial Census of Housing. Annual estimates of number of newly built housing use municipal building permit data collected through the Census Bureau's annual Census of Construction. Housing unit loss was based on a national loss-by-age-of-structure rate derived by the Census Bureau from the American Housing Survey national sample, and on the type and age of housing units in Census 2000. The rate was higher for older housing that for newer housing. In other words, the Census Bureau assumes that municipalities with older housing stock experience more demolitions with the age of the housing units. Estimates of mobile home placements were based upon the number of annual mobile home shipments by state, and were also provided by the Census Bureau.

In 2008 and 2009, we surveyed municipalities on building permits, demolition activities, and mobile homes placement for the 2000-2009 time series. The three surveys conducted in this period of time resulted in an overall response rate of 74.6% (262 municipalities out of 351). Our findings showed that the Housing Unit Loss component for the respondent communities was significantly lower than what the Bureau's sampling method had indicated for their areas. Corrections to this data over the 2000-2008 time series reduced the total number of units lost by over 10,000 among respondents. We submitted our findings to the U.S. Census Bureau and used them to produce the 2008 and 2009 year estimates for the towns and cities in the state.

UMass Donahue Institute
Economic and Public Policy Research

Annual Population Estimates, 2000 to 2009

In its third program year, UMDI has produced population estimates for the period from 2000 to 2009 for all Massachusetts counties and municipalities using the components of change and housing unit methods. We also provide a preliminary estimate for 2010 based upon a simple linear extrapolation of past components of change or housing units.[3]

Statewide Population Estimates

We estimate the 2009 population of the Commonwealth of Massachusetts at roughly 6.64 million persons (Table 1). Our 2009 estimates are 51,873 persons higher than estimates produced by the Census Bureau during this same period. According to Donahue Institute estimates, the state's population grew by 4.4% between 2000 and 2009, compared to 3.62% according to Census estimates.

Table 1
Population Estimates for the Commonwealth of Massachusetts, 2000 to 2009.

| Year	Census Bureau (Vintage 2009)			Donahue Institute		
	Total	Household	Group Quarters	Total	Household	Group Quarters
2000	6,363,015	6,141,346	221,669	6,363,015	6,141,799	221,216
2001	6,411,730	6,191,067	220,663	6,443,720	6,192,554	251,166
2002	6,440,978	6,215,137	225,841	6,474,657	6,220,972	253,685
2003	6,451,637	6,222,315	229,322	6,492,027	6,234,765	257,262
2004	6,451,279	6,218,246	233,033	6,494,394	6,231,770	262,624
2005	6,453,031	6,215,901	237,130	6,496,961	6,230,590	266,371
2006	6,466,399	6,224,546	241,853	6,513,034	6,241,140	271,894
2007	6,499,275	6,253,535	245,740	6,540,577	6,264,852	275,725
2008	6,543,595	6,295,971	247,624	6,587,770	6,310,468	277,302
2009	6,593,587	6,346,038	247,549	6,645,460	6,365,802	279,658
2010*				6,701,643	6,421,985	279,658

Based on a linear extrapolation of components of change at the county level

UMDI's population estimates are consistently higher than those reported by the Census Bureau (Figure 1). Both sets of estimates use the 2000 Census as a baseline. However, UMDI's estimates begin to noticeably diverge from Census estimates after 2001, and although population growth slowed from 2003 to 2005, unlike the Census estimates, UMDI found no year where the state's population declined. Both sets of estimates show steady growth from 2005 onward.

---

[3]Rather than a linear continuation of past trends, we assume that the group quarters population remains constant from 2009 to 2010. This is because the size of the group quarters population is a direct function of the availability of group quarters facilities, which tend to be fairly stable from year to year.

UMass Donahue Institute
Economic and Public Policy Research

Figure 1
Population Growth in the Commonwealth of Massachusetts, Donahue Institute vs. Census Estimates.
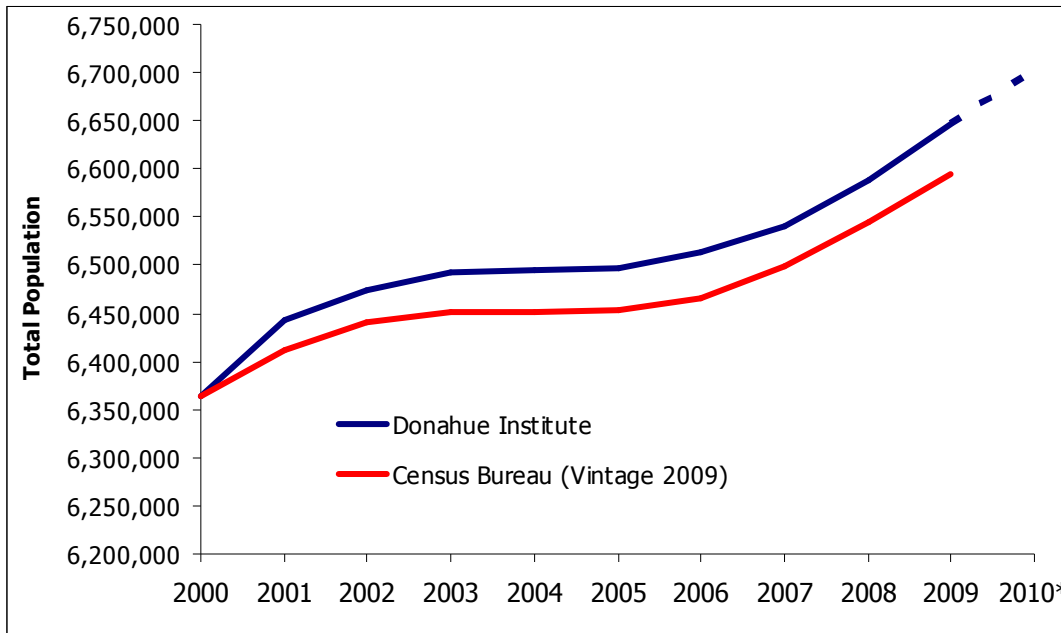
Most of this increase is the direct consequence of UMDI's Group Quarters and Housing Unit Review surveys. The Census Bureau does not conduct its own annual survey of the group quarters population or housing unit loss but permits the states to collect their own data. The Census Bureau uses the state's data if it follows acceptable data collection protocols. In 2007, the Bureau incorporated UMDI group quarters data into their estimates and since 2008 the Institute has been supporting the revision of the housing unit data. According to Donahue Institute estimates, from 2000 to 2009, the group quarters population grew by 26.42% and the household population grew by 3.65%.

Table 2
County Population Estimates, 2009.

	Census Bureau (Vintage 2009)	Donahue Institute	Difference from Census
Barnstable County	221,151	223,584	2,433
Berkshire County	129,288	130,503	1,215
Bristol County	547,433	553,278	5,845
Dukes County	15,974	16,202	228
Essex County	742,582	750,067	7,485
Franklin County	71,778	72,143	365
Hampden County	471,081	478,254	7,173
Hampshire County	156,044	159,658	3,614
Middlesex County	1,505,006	1,516,949	11,943
Nantucket County	11,322	11,445	123
Norfolk County	666,303	673,546	7,243
Plymouth County	498,344	500,892	2,548
Suffolk County	753,580	752,984	-596
Worcester County	803,701	805,955	2,254

County Population Estimates

Table 2 shows our current year (2009) population estimates by county. A full listing of our county population estimates from 2000 to 2010 is provided in Appendix A.

Most counties gained population from 2000 to 2009, with slightly higher growth rates estimated by UMDI compared to the Census Bureau (Figure 2). Nantucket County had the fastest growth rate under both Donahue Institute and Census methods, primarily due to its small size. After Nantucket, the counties of Suffolk, Dukes, and Worcester experienced the fastest growth. Berkshire was the only

UMass Donahue Institute
Economic and Public Policy Research

county to lose population in both the UMDI and the Census Bureau estimates. Barnstable lost population according to the Census Bureau but held steady according to UMDI. According to Donahue Institute estimates, Berkshire County lost 4,284 persons since 2000, a negative population growth rate of 3.2%, while Barnstable increased its population by 339 persons in the same period.

Figure 3 shows the differences between UMDI and the Census Bureau official 2009 county population estimates. All counties except Suffolk gained population in UMDI's estimates. Middlesex and Norfolk counties received the largest gains of 11,943 and 7,243 respectively. The smallest changes were for Dukes and Nantucket counties, which gained 228 and 123 persons, respectively.

We should expect large counties, like Middlesex, to gain more people than small counties, such as Nantucket. Percentage change measures allow for direct comparisons of growth among counties of different sizes (Figure 4). The largest relative gains were for Hampshire, Hampden and Dukes Counties. Franklin and Plymouth Counties, with 0.51% change, is among the counties with small gains. The smallest relative gain was for Worcester with 0.28%.

Figure 2
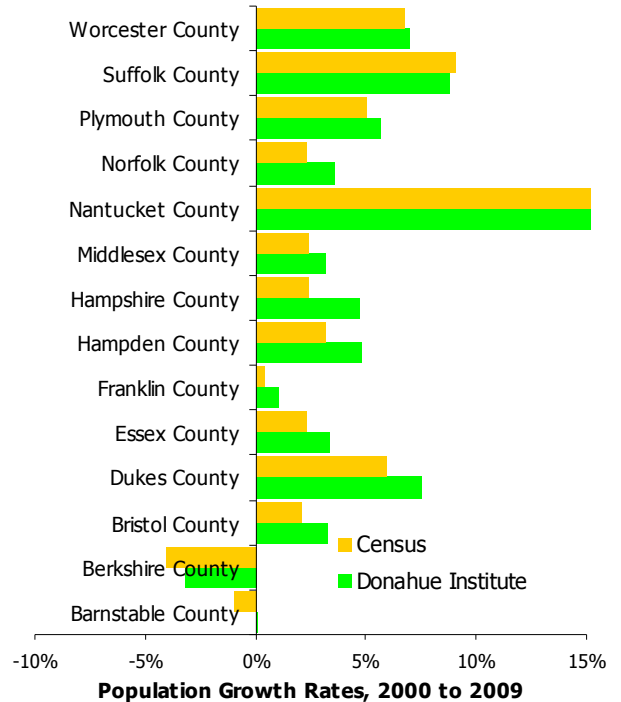Population Growth by County, 2000 to 2009.

Population Growth Rates, 2000 to 2009

Figure 3
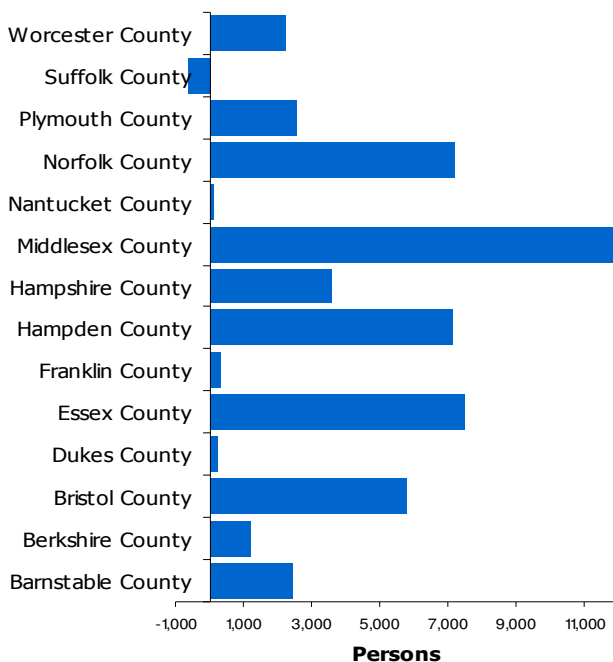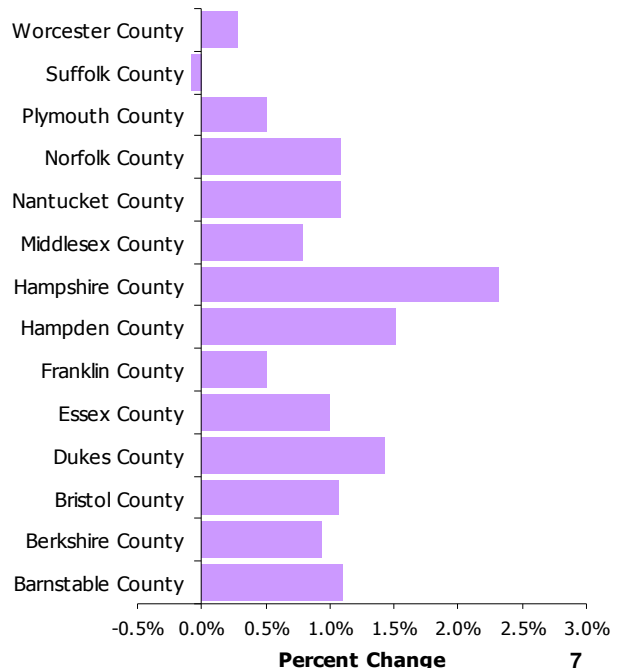Difference between Donahue Institute and Census Bureau population estimates, 2009.

Persons

Figure 4
Percentage difference between Donahue Institute and Census Bureau County estimates, 2009.

Percent Change

UMass Donahue Institute
Economic and Public Policy Research

Municipal Population Estimates

UMDI also produced population estimates for each of Massachusetts's 351 cities and towns for the years from 2000 to 2009. As explained previously, the method we use distributes county-level estimates to individual municipalities based upon estimated changes in their housing stock. In other words, towns that add more housing units gain a greater share of the county's population growth relative to other towns in the same county. The full listing of our municipal population estimates from 2000 to 2010 are provided in Appendix B, sorted first by county then by alphabetical order.

Most municipalities experienced slight to moderate population growth between 2000 and 2009 (Figure 5).

Figure 5
Frequency histogram
Municipal population growth, 2000 to 2009.

Of the 351 municipalities in the state, just under half (48.1%) had growth rates between 0 and 6 %. Only 52 municipalities (15%) lost population during this period, most by less than 2%. Most municipalities gained population according to the UMDI estimates compared to the official Census estimates, but typically by only a small amount (Figure 6). Eighty-two percent of municipalities were underestimated by the Census Bureau in 2009, but the majority of these (51.7%) by fewer than 100 people. Sixty-three communities (18%) had more people under the Census Bureau estimates, but there were only 32 communities where the Census Bureau estimates exceeded Donahue Institute estimates by more than 100 persons.

Figure 6
Frequency histogram of differences between Donahue Institute and Census estimates in 2009.

UMass Donahue Institute
Economic and Public Policy Research
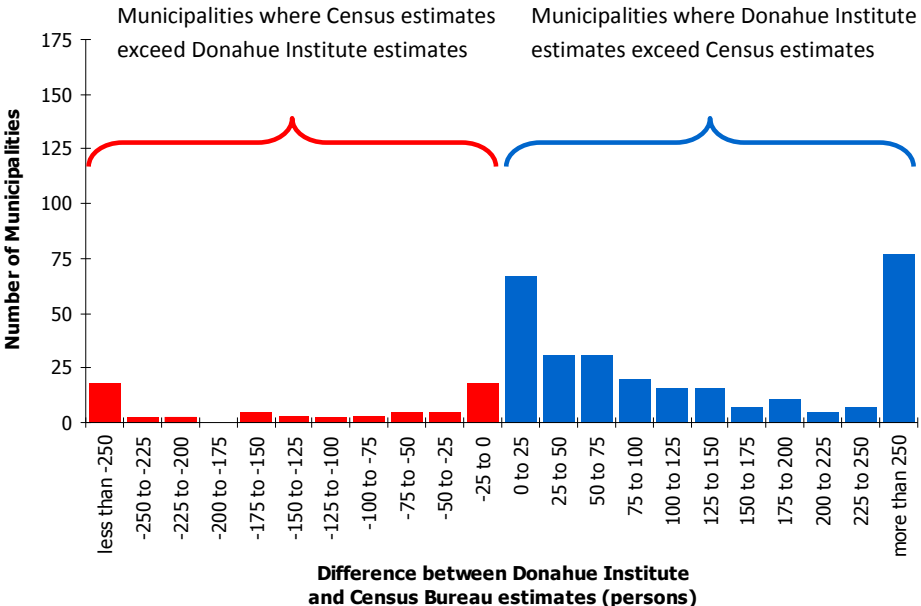
Conclusions and Next Steps

This report describes the results of UMDI's 2009 population estimates for the Commonwealth of Massachusetts, its counties, and municipalities. These estimates were derived independently of similar estimates produced by the U.S. Census Bureau under their Estimates Branch program. Our estimates may be considered more accurate than U.S. Census estimates for the following reasons. The vital statistics, group quarters, and housing unit review data is more current than those used by the Census Bureau for their vintage 2009 estimates. Also, our estimates do not presume a "rake" factor which is used by U.S. Census to ensure that all areas in the U.S. sum to the national total. However, because the Census Bureau uses Donahue Institute inputs in producing its next year vintage estimates, we should expect the two sets of estimates to continue to converge.

Nevertheless, there is always room for improvement. As UMDI's population estimate program moves into its fourth year we will continue to refine and improve our existing data, models, and estimation methods. Following the release of municipal and county estimates from the upcoming decennial census, we will look for opportunities to test the accuracy of our population estimates models against the official census counts, and refine our methods as necessary to ensure accurate counts in the years ahead.

As part of our on-going efforts to continually evaluate and improve our population estimation methods and data sources, the UMDI submitted a proposal to the US Census Bureau aimed at addressing our concerns regarding the accuracy of domestic migration rates in county population estimates. The proposal titled *"Using Interregional Gross Migration Rates in a County Component Model of Population Change"* was recently awarded a small research grant from the US Census Bureau to develop alternate migration estimates and to test their accuracy against the benchmarks set by the 2010 Census. More specifically, the proposal will explore a method, conceived by Andrew Isserman, which calculates separate rates for in- and out-migration rather than a net rate approach.[4] This method may yield more accurate migration and population estimates for the Commonwealth.

---

[4] Isserman, Andrew. (1993). The Right People, The Right Rates. Journal of the American Planning Association. Vol.59, Issue 1. p45.

Appendices: Population Estimates from 2000 to 2010 at County and Municipal Level

UMass Donahue Institute
Economic and Public Policy Research