



STATE OF ARIZONA
OFFICE OF THE
AUDITOR GENERAL

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January 27, 2004

The Honorable John Huppenthal, Chair
Joint Legislative Audit Committee

The Honorable Robert Blendu, Vice-Chair
Joint Legislative Audit Committee

RE: The Department of Economic Security's population estimates process

Dear Representative Huppenthal and Senator Blendu:

In conjunction with the Sunset review of the Department of Economic Security and in response to a question from the Legislature, my Office has reviewed the Department of Economic Security's process for estimating populations. In 2006, pursuant to Laws 2003, Ch. 119, §5, the Joint Legislative Budget Committee is required to prepare a report comparing the Department's estimates to census data.

Summary

Arizona Revised Statutes §41-1954 requires the Department of Economic Security (Department) to prepare annual population estimates of Arizona counties, cities, and towns. Under Laws 2003, Ch. 119, for fiscal years 2007 through 2011, local governments may use these estimates instead of United States census data to determine their share of state-wide revenues, such as motor vehicle license taxes, and to determine local government expenditure limits, which cap spending for each county, city, and town. Alternatively, communities may continue to rely on decennial United States Census figures, or obtain a special mid-decennial census or census survey. Because the decennial census in later years may underestimate the population of growing areas, and special censuses and surveys can be expensive, most local governments elect to rely on the Department's figures. The United States Census Bureau also prepares annual census estimates; for Arizona the estimates date is July 1. However, the State does not use these estimates because the Census Bureau does not complete the city and town estimates until approximately 1 year after the July 1 estimates date.

The Department does not prepare its estimates independently, nor does it provide adequate quality assurance over the data or methods used in developing them. As a result, the Auditor General recommends that the Department develop a process to

adequately ensure the quality of the estimates produced for revenue-sharing and expenditure limit determination. In addition, the Department should employ or contract with a professional demographer with a Ph.D. in demography to ensure that it has the technical expertise necessary to prepare population estimates based on sound methodology.

Estimates May Determine Revenue-Sharing and Expenditure Limits

Arizona uses population estimates for a variety of purposes, including setting expenditure limits and distributing a share of certain state tax revenues to each county, city, and town. Arizona's Constitution, Article IX §20, allows local governments to spend only an amount equal to 1979-80 expenditures, adjusted for cost-of-living increases and population changes. The Economic Estimates Commission establishes expenditure limits using the DES population estimates.

Estimates are also used to allocate revenue sharing to local governments. There are three main categories of revenue sharing. First, counties, cities, and towns receive transaction privilege taxes, which consist of many tax classifications, and mining and timbering severance taxes. These taxes accounted for more than \$512 million distributed to the counties and \$316 million distributed to cities and towns in fiscal year 2003. Second, incorporated cities and towns receive a share of net individual and corporate income taxes, called urban revenue sharing. According to a JLBC budget analysis, urban revenue sharing totaled approximately \$430 million state-wide in fiscal year 2003 and approximately \$365 million in fiscal year 2004. Finally, a portion of vehicle license taxes is distributed to counties, cities, and towns based on population. According to Arizona Department of Transportation figures, vehicle license tax distributions to counties, cities, and towns totaled approximately \$344.8 million in fiscal year 2003.

While Maricopa County and its cities and towns received more than 64 percent of total transaction privilege and severance taxes returned to counties in fiscal year 2003, every Arizona county, city, town, and unincorporated area benefits from revenue sharing. For fiscal year 2003, for example, Payson received more than \$1 million, and Yavapai County, one of the fastest-growing counties in the State, received more than \$17 million from transaction privilege and severance taxes. In fiscal year 2003, urban revenue sharing ranged from the \$140.6 million Phoenix received to Jerome's \$35,000. The percentage of a total local budget that revenue-sharing monies account for varies by government entity, but revenue-sharing monies comprised approximately 20 percent of Maricopa County's revenues, for example, and 8 percent of a smaller town's (such as Cottonwood) budget.

Department and Advisory Committee Use Two Population Estimate Methods

The Department's Population Statistics Unit, in the Research Administration of the Division of Employee Services and Support, is responsible for preparing Arizona's state, county, city, and town population estimates. The unit consists of five positions, including a demographer who is responsible for generating population estimates. The Department's estimates are subject to review and advisory recommendations by the Population Technical Advisory Committee (POPTAC) before they are submitted to the Department's Director for final approval. The standards for developing the population estimates are also subject to POPTAC's review. Created by executive order in 1977, POPTAC includes representatives from all three state universities, as well as members from seven state agencies and ten local government organizations. According to one DES official, in practice, POPTAC functions more as a governing board than an advisory board. It directs the Department's population estimates activities, and some members even prepare some of its estimates.

According to the unit's estimates demographer, the Department follows a procedure that uses two methods to prepare annual population estimates. One method, called the Housing Unit Method (HUM), uses census information on occupancy rates and persons per household in conjunction with data on new construction. The Department uses the HUM every year for estimating city and town populations. For state and county population estimates, the Department uses the HUM in the census year and the following year.

The second method, called the Composite Method, relies on births, deaths, school and Medicare enrollments, and driver's license data. The Department completes estimates for the State and counties using this method in the second through ninth years following the census. The Department then calculates a weighted average of the two methods to determine its state and county estimates. Using an average of two methods is intended to reduce the number of extreme errors and to balance undercounts and overcounts. State and county estimates are also used as controls on other estimates so that revenue sharing cannot exceed 100 percent. In addition, the Department's state and county estimates give greater weight to the composite method over time because the HUM uses census information that becomes more and more outdated each year until the next census. However, because some of the data needed for the composite method is available only at the county level and higher, the Department cannot use a weighted average for city and town populations.

POPTAC Voting Members

- Department of Commerce
- Department of Economic Security
- Department of Education
- Department of Health Services
- Department of Revenue
- Department of Transportation
- Department of Water Resources
- Arizona State University
- Northern Arizona University
- University of Arizona
- 6 Regional Councils of Governments
- County Supervisors Association
- League of Arizona Cities and Towns
- Inter-tribal Council of Arizona
- Navajo Tribe

Department Lacks Independent Process To Develop and Ensure Reliability of Estimates

Despite the importance of population estimates, the Department does not currently produce these estimates independently, nor does it have an adequate quality assurance process over its data, methods, and results. Specifically:

- **Department does not develop independent population estimates**—Although the Constitution and statutes make the Department responsible for population estimates, the Department relies on POPTAC and its constituent membership to verify the data it uses, decide on its methods, and in some cases produce population estimates. However, because POPTAC’s membership has vested interests in these estimates, it lacks independence. An Attorney General Opinion in 1987 determined that the Department’s population estimates are not subject to POPTAC approval. Additionally, a 1995 executive order specifically stated POPTAC’s advisory role. However, POPTAC continues to direct the Department’s activities. POPTAC may abide by its own standards for calculating population estimates or vote to deviate from them. For example, in 2002, the Department proposed using a more sophisticated method to determine the relative weights of the Composite Method components, but did not do so on the advice of POPTAC. Because the Department waited for POPTAC’s advice before collecting the Composite Method data, it could use only the HUM instead of the weighted average for both methods, contrary to POPTAC’s population methodology standards.

Further, as allowed by Executive Order 95-2, POPTAC has recommended that the Department’s Director adopt estimates provided by regional councils of governments as the State’s official population estimates. However, those local population estimates do not always contain sufficient detail to fully assess their reliability.

- **Department cannot demonstrate appropriateness of its process**—Despite its reliance on POPTAC and its members for data, methods, and even estimates, the Department should be able to show how the estimates it presents are generated. However, except for a two-page overview of the Housing Unit and Composite methods, the Department lacks policies or guidelines detailing its methodologies and procedures for obtaining estimates data. The two-page outline does not contain sufficient detail to meet a scientific standard for replication. Additionally, a 1990 University of Arizona Division of Economic and Business Research report recommended several methodology revisions based on best practices, but there is no evidence that these recommendations were implemented.¹ Interviews with POPTAC members and department staff suggest the Department has made changes, modifications, alterations, and other

¹ Alberta H. Charney, Ph.D. and Arthur L. Silvers, Ph.D. *Population Estimation/Projection: Analysis and Recommendations, A Final Report Submitted to the Arizona Department of Economic Security*. April 1990.

decisions affecting its methodology, including some recommended in the 1990 report. However, these changes were not documented, and the Department cannot show whether its methods are grounded in the research literature as best practice or adequately tested for their effect.

- **Department lacks adequate procedures to ensure estimates quality—** Regardless of who prepares the estimates or the methods for preparing them, the data used in the estimates and the estimates themselves should be tested for reliability. The Department currently lacks systematic policies, procedures, and guidelines to ensure estimates quality. POPTAC standards state that the Department should use reliable data, and defines “reliable” as data that has been analyzed for accuracy and consistency. However, the Department has not demonstrated that it systematically reviews the data it uses for accuracy or tests its results for reliability. The Department’s methods rely on data provided by state or local governments, such as information on housing permits issued, but the Department has no formal review process, procedures, or guidelines for assessing the quality of this data. Nationally, demographic experts have found that local data varies in quality. Smaller municipalities, rural areas, counties that include Native American reservations, and areas experiencing rapid growth, substantial international migration, or seasonal populations experience greater difficulty in collecting reliable data. The Department mails its data to local governments for confirmation after data entry, but this procedure verifies only that department staff accurately entered the data into its own spreadsheets.

In addition, the Department does not have any formal review procedures or guidelines to assess the reliability of its estimates. It cannot demonstrate reliability either quantitatively through analytic test work assessing the various methodologies’ error rates or qualitatively by documenting any discussion and interaction with POPTAC members. Department staff say they compare their estimates with the results of the decennial census. However, they do not use scientific methods to analyze errors, use the comparison to improve their methods, or track the results over time.

Other states, such as California and Florida, use analytic techniques such as regression on their data as part of testing the quality of their population estimates. In addition, they provide extensive and detailed descriptions of their methods. A common procedure is to publish the exact formula with specific weights used in calculating the population estimate. This documentation serves as an accurate description of how the estimates were derived because the estimates are produced independently of the affected communities.

Another common procedure is to compare the state’s estimates with data from the decennial census to benchmark performance and then track estimates against annual census estimates through the decade. The U.S. Census Bureau prepares annual estimates each year for the previous year. Using measures called MAPE (mean average percent error), MALPE (mean algebraic percent error), and other

measures standard in the demographic literature, states can determine quantitatively their deviation from census estimates. Many state demographic offices publish their MAPE and MALPE analyses.

Options Exist for Improving Process

The Department and the Legislature may wish to each consider an option for ensuring that state population estimates are independently prepared based on sound methodology. Because Arizona's Constitution names the Department of Economic Security as the agency responsible for population estimates, the Legislature cannot transfer responsibility to a different agency. However, the Department can add more technical expertise to the process, and the Legislature could restrict interested parties' influence on the estimates.

- **Department should employ or contract with a professional demographer**—In contrast to Arizona, most states do not have an advisory committee but instead have—or contract with—a professional demographer with a Ph.D. in demography to provide technical expertise. For example, California employs professional demographers in its Department of Finance, and Florida contracts work to an academic researcher at the University of Florida. Arizona relies on its advisory committee to provide technical expertise. However, the expertise required extends beyond what a voluntary member can be expected to contribute in the way of time, written reviews, test work analysis, and recommendations. In addition, the committee is evenly divided between local and state representation, so its decisions may reflect members' interests instead of technical considerations. The Department should use a professional demographer in Arizona for technical expertise, rather than an advisory committee. Doing so could help ensure that the Department takes responsibility for population estimates as required by statute, instead of allowing the committee to control the process.
- **Advisory committee's role could be defined in legislation**—The executive order creating POPTAC in 1977 and subsequent orders in 1988 and 1995 lack detail regarding what the committee can and cannot do. Despite the 1995 executive order describing POPTAC's role as advisory only, the Department continues to yield wide discretion to committee members on data, methods, and final estimates. In addition to spelling out the committee's role, new legislation could require rotating committee members and replacing members who are absent from a specified number of meetings. Some current members no longer participate actively. For example, one university member, important to the committee as a technical advisor and as a representative of the state-wide perspective, has been unable to attend most meetings in recent years.

Obtaining Better Data Expensive, but New Federal Program May Help

Data is the central component of a quality population estimate. Local governments can choose to pay for a mid-decennial census, which entails a count of residents similar to the decennial census, or a census survey, which collects information from a sample of households, to generate the data used to produce their population estimates. Both options are expensive. Tucson, for example, spent more than \$1 million on a census survey in 1995. According to a MAG official, Maricopa County's 1995 special census cost approximately \$9 million. According to one department official, Arizona communities may be reluctant to obtain a 2005 mid-decade census or survey, perhaps because they are not sure whether the revenues resulting from new figures showing population growth would offset the cost of the census or survey. However, in December 2003, MAG members voted to expend approximately \$3.35 million, in addition to \$4.15 million from the Federal Highway Administration, for a mid-decade census survey and group quarters census in Maricopa County.¹ According to a MAG official, communities supported the survey because they believed not doing so could result in financial loss to them. Further, the Federal Highway Administration will help defray the cost to the communities because the survey will improve its traffic projections and enable it to better justify its highway projects.

Despite the cost, a mid-decade census is one of the most reliable ways to measure population estimates and ensure the equitable distribution of state tax revenues. In order to ensure the most accurate distribution of shared revenues, the Legislature could consider developing a fund to pay for a state-wide, mid-decade census, and requiring counties, cities, and towns to contribute to the fund in proportion to their share of the revenues. However, the Legislature would have to weigh the benefits of the census against the significant cost, estimated at more than \$30 million, which represents more than 2 percent of the total fiscal year 2003 shared revenues.

A new federal program may eventually resolve the problem of obtaining sound population estimates if it is funded by Congress. The United States Census Bureau indicates that it is scheduled to implement the American Community Survey for annual population estimates starting in 2004. This survey, based on a decennial census form, would survey 3 million households in every U.S. county each year and would address many of the data problems facing most states, including Arizona. The Department could then focus on supplementing survey information germane to Arizona, such as the Native American population, seasonal residents, and immigrants, through additional questions or sampling in conjunction with the survey.

¹ Group quarters are institutional facilities such as correctional facilities, nursing homes, and mental health hospitals and non-institutional facilities such as college dormitories, military barracks, group homes, missions, and shelters.

Recommendations

1. To better clarify that the role of the Population Technical Advisory Committee (POPTAC) is advisory only, the Legislature should consider establishing it in statute, including defining the committee's advisory role and specifying terms of service for committee members. The Governor could then rescind Executive Order 95-2, which created the existing POPTAC.
2. The Department of Economic Security should employ or contract with a professional demographer with a Ph.D. in demography to ensure that it has the technical expertise necessary to prepare population estimates based on sound methodology.
3. To comply with statutory and constitutional provisions, the Department of Economic Security should prepare population estimates developed through formal methodology and by following appropriate policies and procedures. Specifically, the Department's Research Administration should:
 - a. Establish the scientific basis for future changes to its methodology, including changes recommended by its advisory committee, and document the basis for such changes in its policies and procedures;
 - b. Develop formal policies and procedures establishing the methods used in preparing annual population estimates. If the estimates are prepared by local associations of governments and adopted by the Department, the Department should verify that the methods used to prepare the estimates were appropriate.
 - c. Develop formal policies and procedures establishing the reliability of data used in annual population estimates. If the estimates are prepared by local associations of government and adopted by the Department, the Department should verify the reliability of the data used to prepare the estimates.
 - d. Annually review its population estimates to assess their reliability.

We have reviewed the results of this work with the Department of Economic Security and, as indicated in the attached response, the Department plans to implement all of the recommendations directed at it. If you have additional questions, please do not hesitate to contact me or Shan Hays, Manager, at (602) 553-0333.

Sincerely,

Debbie Davenport
Auditor General

cc: The Honorable Dean Martin
Mr. David A. Berns, Director
Arizona Department of Economic Security

Agency Response



ARIZONA DEPARTMENT OF ECONOMIC SECURITY

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DEC 29 2003

Debra K. Davenport, Auditor General
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Dear Ms. Davenport:

We appreciate the opportunity to comment on the review by your office of the Department of Economic Security's process for estimating population. We generally agree with the audit recommendations and have provided our response to each recommendation.

Recommendation 1: To better clarify that the role of the Population Technical Advisory Committee (POPTAC) is advisory only, the Legislature should consider establishing it in statute, including defining the committee's advisory role and specifying terms of service for committee members. The Governor could then rescind Executive Order 95-2, which created the existing POPTAC.

Response: The finding of the Auditor General is agreed to and a different method of dealing with the finding will be implemented. The Department of Economic Security would welcome clarification of the role of the Population Technical Advisory Committee (POPTAC) and believes this could be accomplished either by executive order or legislation. The Department will not be requesting legislation at this time. The Department works closely with POPTAC in a variety of ways. The participation of Regional Councils of Government has been invaluable in the collection and review of local data used in population estimates. The Department also provides estimates for POPTAC's review and recommendation that are based on sound technical considerations.

Recommendation 2: The Department of Economic Security should employ or contract with a professional demographer with a Ph.D. in demography to ensure that it has the technical expertise necessary to prepare population estimates based on sound methodology.

Response: The finding of the Auditor General is agreed to and the audit recommendation will be implemented. The Department will investigate the opportunity to contract with a professional demographer in the review and analysis of the data and methods used in its population estimates. The Department will prepare and issue a request for proposals to procure the services of a demographer. Award of the contract will be dependent upon its bid cost and available funds. The Department is a member of the Federal-State Cooperative Program for Population Estimates

and will seek guidance from other members on best practices in the development and implementation of sound methodology.

Recommendation 3: To comply with statutory and constitutional provisions, the Department of Economic Security should prepare population estimates developed through formal methodology and by following appropriate policies and procedures. Specifically, the Department's Research Administration should:

- a. *Establish the scientific basis for future changes to its methodology, including changes recommended by its advisory committee, and document the basis for such changes in its policies and procedures.*
- b. *Develop formal policies and procedures establishing the methods used in preparing annual population estimates. If the estimates are prepared by local associations of governments and adopted by the Department, the Department should verify that the methods used to prepare the estimates were appropriate.*
- c. *Develop formal policies and procedures establishing the reliability of data used in annual population estimates. If the estimates are prepared by local associations of government and adopted by the Department, the Department should verify the reliability of the data used to prepare the estimates.*
- d. *Annually review its population estimates to assess their reliability.*

Response: The finding of the Auditor General is agreed to and the audit recommendation will be implemented. The Department has never received any funding from the Legislature to carry out its statutory responsibilities for preparing population estimates and undertakes this activity with available resources. The Department will implement the changes described below:

Item a: The Department has initiated plans to formalize procedures for the review and analysis of suggested changes to methodology. These procedures will include a detailed review and categorization of proposed changes as to soundness, applicability and feasibility. The rationale for implementation of any such changes will be explicitly stated and included in the documentation.

Item b: Department staff compares its estimates with data from the decennial census to benchmark performance. Department staff currently uses analytic techniques such as regression analysis to evaluate the performance of methods. The Department can provide the formula, weights and data inputs used in its estimates and will also obtain this information for estimates prepared by regional councils of government in order to verify that methods used were appropriate. The Department will include this information in its formal policies and procedures. The Department is a member of the Federal-State Cooperative Program for Population Estimates and will seek guidance from other members on improvements to the

analysis and documentation of methods prepared by the Department and by regional councils of government.

Item c: Department staff currently uses analytic techniques such as regression analysis to evaluate the reliability of data series selected for use in the estimates. Department staff collects input data and reviews it for consistency. Staff contacts the local sources of the data to validate the accuracy of data that appear to be inconsistent with past trends or other corroborating information. The Department will initiate the development of formal policies and procedures to assess the reliability of data by documenting its current procedures and investigating options to conduct additional review and verification of data.

Item d: Department staff currently performs annual reviews of the reliability of its estimates and compares its results to the Census Bureau estimates. The Department will improve this process by developing formal policies, documenting its current procedures and investigating options to conduct additional review.

Your comments have provided us with valuable insight. We look forward to implementing the recommendations from your review that will improve Arizona's population estimates. The Department also agrees that data is the central component of a quality population estimate. By far the most significant improvement to the accuracy of population estimates would be the acquisition of current data that can only be gathered from a special census or survey. Although expensive, a mid-decade census is indeed the most reliable way to improve the accuracy of population estimates and ensure the equitable distribution of state tax revenues.

Sincerely,

David A. Berns