Exercise 12. The Demographic Equation

Purpose: This exercise will provide a basic introduction to the estimation of population change. Such procedures are used by the Bureau of the Census and the various states to estimate the composition and count of the population between censuses and for estimating what the likely values will be decades in the future. The models developed to do this can be quite complex as demographers try to account for detailed differences in the age, racial composition, birth and death measures, and migration within the overall population. Sometimes additional data sources like drivers license records, phone records, life expectancy tables, and membership in the armed forces are incorporated into the estimation process.

The basic three components of population change are births, deaths, and migration. The *Demographic Equation* expresses the interrelationship of these components.

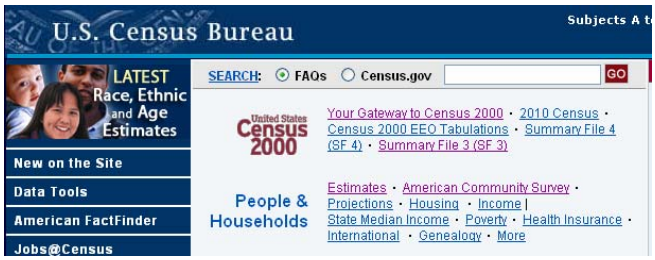
Pop Change = Births - Deaths + In-migrants - Out-migrants

The excess of births over deaths is called *natural increase* and the difference between in-migration and out-migration is called *net migration*.

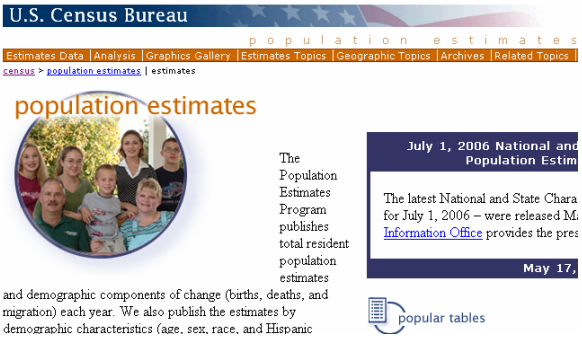
For more discussion on this topic see: Current Population Reports: Population Projections of the United States by Age, Sex, Race, and Hispanic Origin: 1995 to 2050. P25-1130 http://www.census.gov/prod/1/pop/p25-1130.pdf

U. S. Census Population Estimates

1. Go to the Census web site at www.census.gov and select the *Estimates* link from the *People & Households* category in the center of the page.

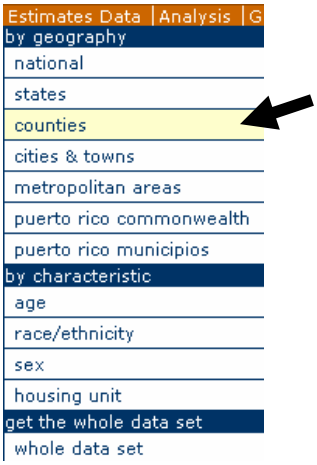


The population estimates web page contains a variety of resources related to the estimation of population in the U.S.

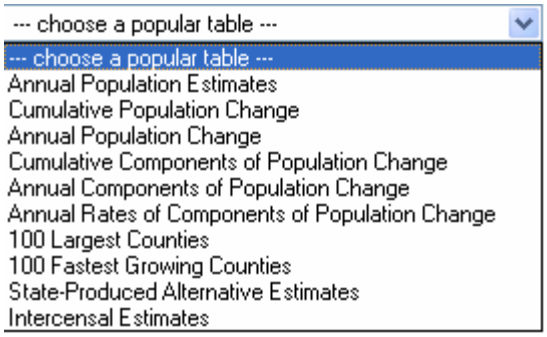


2. Check out the menus at the top of this page to see what is available.

3. Click on the *Estimates Data* menu. Select the *counties* link.



4. On the counties page select the *choose a popular table* window and select the *Annual Components of Population Change* link. Then click *Go.*



5. From the list of states choose *California* in *Excel* format. This will open in an *Excel* table.

Table 5: Estimates of the Components of Population Change for Counties of California: July 1, 2005 to July 1, 2006

Geographic Area	Total Population Change*	Natural Increase			Net Migration		
		Total	Births	Deaths	Total	Net International Migration	Net Internal Migration
California	**303,402**	**325,333**	**561,364**	**236,031**	**-21,389**	**266,295**	**-287,684**
Alameda County	6,361	11,358	20,985	9,627	-4,973	14,421	-19,394
Alpine County	42	1	9	8	41	-	41

6. Select the entire spreadsheet, copy it, open *Excel*, and then paste the sheet into a new spreadsheet within the *Excel* program.

Note the *Total Population Change* includes a residual value so if you add the components of change you will get a slightly different value for the total.

7. In a cell to the right of the last value for California calculate the total population change based on the demographic equation. Simply stated, it would be total natural increase + total net migration.

8. Select all data cells and sort the table by total population change. What five counties have the greatest change?

9. Resort the table by total natural increase. What five counties had the greatest natural increase?

10. Resort the table by net international migration. What five counties had the greatest net international migration?

11. Resort the table by net internal migration. What five counties had the greatest net internal migration?

12. Discuss what population changes seem to be taking place in California counties.

13. Compare change estimates in California to Arizona, Nevada, or Oregon.

14. Using the state totals compare changes in the estimated population for different ethnic groups in California.

Population Estimates from the California Department of Finance

The California Department of Finance provides a range of demographic and economic data about the state. The Department uses different procedures for estimating population and, in some cases, has arrived at different values than the Bureau of the Census. For example, the DOF has estimated a much lower loss of domestic population for California over the last few years. However, their intent is to focus on the state while the Bureau of the Census attempts to apply methods uniformly to all states.

1. Go to the California Department of Finance web page. http://www.dof.ca.gov/

2. On the left panel select the *Demographic, Economic, and Financial Research* link. Browse some of the links on the resulting page to get a feel for what documents are available.

3. Under the *Demographic Research* heading click on the *Reports and Research Papers* link.

4. Scroll down the list of tables to E-6 County Population Estimates and Components of Change — July 1, 2000–2006**. Open the table.**

5. Look over the components for the state of California.

		Population (July 1)	Percent Change*	Numeric Change	Births	Deaths	Natural Increase	Net Migration	Net Foreign Immigration	Net Domestic Migration
California	1999	33,418,578								
	Census 2000	33,873,086								
	Apr-Jun 2000			225,654	129,778	54,032	75,746	149,908	59,110	90,798
	2000	34,098,740	2.04	680,162	525,427	227,915	297,512	382,650	236,440	146,210
	2001	34,784,382	2.01	685,642	529,395	231,737	297,658	387,984	290,812	97,172
	2002	35,392,960	1.75	608,578	526,280	232,941	293,339	315,239	249,680	65,559
	2003	35,990,107	1.69	597,147	537,419	233,295	304,124	293,023	227,434	65,589
	2004	36,522,026	1.48	531,919	539,858	239,325	300,533	231,386	227,310	4,076
	2005	36,981,931	1.26	459,905	547,137	232,448	314,689	145,216	204,844	-59,628
	2006	37,444,385	1.25	462,454	551,855	234,977	316,878	145,576	212,921	-67,345
		Sum*		3,571,299	3,361,722	1,458,755	1,902,967	1,668,332	1,472,111	196,221
		Average*		571,408	537,876	233,401	304,475	266,933	235,538	31,395

The table below shows the figures of population change shown by the Bureau of the Census and the Dept. of Finance. Note the differences in some of the values.

	Population (July 1)	Percent Change*	Numeric Change	Births	Deaths	Natural Increase	Net Migration	Foreign Immigration	Domestic Migration
CA DOF 2006	37,444,385	1.25	462,454	551,855	234,977	316,878	145,576	212,921	-67,345
Census			303,402	561,364	236,031	325,333	-21,389	266,295	-287,684

6. Using the DOF data look up one of California's counties and note which components are adding or subtracting from the population.

7. In what year did your county gain most population? Is this part of a pattern?

8. Have births and deaths changed over the time period?

9. How has international and domestic migration changed?

10. Compare your data to that for the entire state. Are the patterns similar?

11. Use *Excel* to graph the percent change in population for your county.

12. Use *Excel* to graph the change in Net Domestic Migration. Can you offer any explanation for the trends?

13. Return to the DOF list of *Reports and Research Papers*. Scroll down and examine some of the other types of data tables available.