# Washoe County Consensus Forecast 2008 - 2030

Adopted by the Truckee Meadows Regional Planning Commission
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# Acknowledgments

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# Introduction

The consensus forecast for Washoe County uses a number of leading forecasts, which has several advantages over using a single source for forecasting population. The consensus approach minimizes the risk of large forecast errors and consensus forecasts consistently outperform individual forecasts across a range of variables. The consensus approach is discussed in further detail in the article titled "Consensus Forecasts in Planning", found in Appendix A.

Five reputable sources of long-term forecasts for Washoe County were used: Global Insight, a national forecasting firm in Massachusetts that prepares national, state and county forecasts; NPA Data Services, Inc., a national forecasting firm in Arlington, VA that forecasts for every county in the United States as well as state and national forecasts; Truckee Meadows Water Authority's *Population and Employment Econometric Model*; Woods and Poole, a national forecasting firm in Washington, DC that forecasts for every county in the United States, as well as state and national forecasts; and the 2006 State Demographer's Forecast.

The *Washoe County Consensus Forecast 2008-2030*, uses these sources and outlines the projected population, employment and income for Washoe County through the year 2030. The forecasts in this document are for all of Washoe County (Reno MSA) including both the cities of Reno and Sparks and the unincorporated areas of Washoe County, including Incline Village. A summary of the consensus forecast for Washoe County is shown in Table 1.

**Table 1**
**Washoe County Consensus Forecast Summary**

| Year | Total Population | Total Establishment Based Employment | Total Personal Income $ ('000) | Per Capita Income |
|---|---|---|---|---|
| 2008 | 419,037 | 291,360 | $17,803,397 | $43,041 |
| 2010 | 437,439 | 304,640 | $19,322,433 | $44,832 |
| 2015 | 483,803 | 338,685 | $23,673,633 | $49,823 |
| 2020 | 528,654 | 373,960 | $28,733,037 | $55,217 |
| 2025 | 573,332 | 410,670 | $34,688,380 | $61,058 |
| 2030 | 620,323 | 449,883 | $42,010,473 | $67,975 |

The forecasts prepared by Global Insight, NPA Data Services, Inc., Truckee Meadows Water Authority, Woods and Poole, and the 2006 State Demographer's Forecast were compared for consistency and then averaged to arrive at a consensus number. When comparable numbers were not available from each of the five sources, only the numbers that were comparable were averaged. When less than five sources were used it is noted in the text.

**Table 2**
**Nevada State Demographer's 2006 Forecast**

*Note – The latest version (2007) of the Nevada State Demographer's Forecast is not available at time of printing. The number of new persons added for each year from 2006 to 2026 was averaged (9,001) and applied to this existing forecast in order to extend the population figures to 2030.

**The 2006 Nevada State Demographer's**
**Forecast of Washoe County Population (2006 – *2030)**

| Year | Population |
|---|---|
| 2006 | 406,223 |
| 2007 | 415,775 |
| 2008 | 425,554 |
| 2009 | 435,535 |
| 2010 | 445,660 |
| 2011 | 455,878 |
| 2012 | 466,152 |
| 2013 | 476,300 |
| 2014 | 486,292 |
| 2015 | 496,074 |
| 2016 | 505,614 |
| 2017 | 514,856 |
| 2018 | 523,837 |
| 2019 | 532,567 |
| 2020 | 541,002 |
| 2021 | 549,150 |
| 2022 | 557,050 |
| 2023 | 564,695 |
| 2024 | 572,112 |
| 2025 | 579,299 |
| 2026 | 586,248 |
| ***2027** | **595,249** |
| ***2028** | **604,250** |
| ***2029** | **613,251** |
| ***2030** | **622,252** |

Source: Washoe County and Nevada State Demographer.

Cooperatively, Washoe County and the Nevada State Demographer prepare annual population estimates for July 1 of each year.

# Population

Total population in Washoe County is projected to grow from 419,037 in 2008 to 620,323 in 2030. This represents an average annual growth rate of 1.48 percent. The highest forecasted population for 2030 was 665,150 from NPA Data Services, Inc., and the lowest forecasted population was 539,220 from Woods and Poole. The 2008 and 2030 forecasted population by each source is shown in Table 2.

**Table 2**
**Population by Forecast Source**

| Forecast Source | 2008 Population | 2030 Population |
|---|---|---|
| Global Insight | 414,900 | 649,710 |
| NPA Data Services, Inc. | 417,440 | 665,150 |
| Truckee Meadows Water Authority (TMWA) | 428,780 | 625,285 |
| Woods and Poole | 408,510 | 539,220 |
| 2006 State Demographer's Forecast | 425,554 | 622,252 |
| **Consensus Forecast (Five Sources)** | **419,037** | **620,323** |

Source: Washoe County, Global Insight, NPA, Woods and Poole, TMWA, and 2006 State Demographer's Forecast.

Most recent vital statistics from the Center for Health Data and Research Nevada State Health Division data show that the natural increase in population (ie., births minus deaths) results in a "natural" growth rate of .71 percent per year (in Washoe County, approximately 14.7 births per 1000 population and 7.6 deaths per 1000 population). When compared to the forecast for total population, which is projected to grow at an average annual rate of 1.48 percent through 2030, the remaining component of the growth rate that results from other factors (net in-migration) is .77 percent.*

** These statistics vary by year and time period. For example, the average rates of migration per year for Washoe County for the period of 2000-2005 were: net international migration 5 persons/1000 (0.5 percent) and net internal migration was 14.8 persons/1000 (1.48 percent). Births and deaths also vary over time.*

The consensus population forecast for each year is shown in Table 3.

**Table 3**
**Washoe County Population, 2008 – 2030**

| Year | Population |
|---|---|
| 2008 | 419,037 |
| 2009 | 428,195 |
| 2010 | 437,439 |
| 2011 | 446,883 |
| 2012 | 456,215 |
| 2013 | 465,550 |
| 2014 | 474,670 |
| 2015 | 483,803 |
| 2016 | 492,789 |
| 2017 | 501,795 |
| 2018 | 510,722 |
| 2019 | 519,742 |
| 2020 | 528,654 |
| 2021 | 537,639 |
| 2022 | 546,515 |
| 2023 | 555,480 |
| 2024 | 564,348 |
| 2025 | 573,332 |
| 2026 | 582,242 |
| 2027 | 591,692 |
| 2028 | 601,181 |
| 2029 | 610,725 |
| 2030 | 620,323 |

Source: Washoe County, NPA, Global Insight, Woods and Poole, TMWA, and 2006 State Demographer's Forecast.

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The age distribution of the population is expected to shift over the next two decades. Changes of note include the continued aging of the baby boomer population, a decrease in the working group (ages 20-64) and a marked increase in the retired group (ages 65 and older). Population by cohort data is available from Global Insight, NPA Data Services, Inc. and Woods and Poole, however, this data is not available from TMWA or the 2006 State Demographer's Forecast. Population by 5-year Age Cohort for 2008 - 2030 is shown in Table 5 on page 6.

**Table 4**
**Population and Percent Composition of Total Population by Generalized Age Groups**

| Generalized Age Group | 2008 | | 2030 | |
|---|---|---|---|---|
| | Population | Percent of Total | Population | Percent of Total |
| Preschool (Ages 0-4) | 29,243 | 7% | 43,483 | 7% |
| School (Ages 5-19) | 83,911 | 20% | 123,483 | 20% |
| Working (Ages 20-64) | 251,731 | 61% | 344,293 | 56% |
| Retired (Ages 65 and older) | 48,753 | 12% | 106,767 | 17% |
| Totals* | 413,638 | 100% | 618,026 | 100% |

Source: Washoe County, Global Insight, NPA and Woods and Poole.

*Note: *Population by cohort is not available from Truckee Meadows Water Authority or 2006 State Demographer's Forecast*

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**Table 5**
**Consensus Population Forecast by 5-year Age Cohort, 2008 – 2030**

| Age | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-4 | 29,243 | 29,940 | 30,493 | 31,130 | 31,783 | 32,440 | 33,087 | 33,743 | 34,380 | 35,020 | 35,637 |
| 5-9 | 27,427 | 27,950 | 28,637 | 29,257 | 29,893 | 30,543 | 31,247 | 31,817 | 32,453 | 33,133 | 33,807 |
| 10-14 | 27,437 | 27,760 | 28,070 | 28,390 | 28,787 | 29,277 | 29,890 | 30,397 | 32,257 | 31,643 | 32,300 |
| 15-19 | 29,047 | 29,453 | 29,780 | 30,213 | 30,570 | 30,887 | 31,280 | 31,643 | 31,973 | 32,643 | 32,913 |
| 20-24 | 29,347 | 30,203 | 31,107 | 31,923 | 32,690 | 33,337 | 33,777 | 34,160 | 34,640 | 35,057 | 35,390 |
| 25-29 | 28,673 | 29,310 | 30,080 | 30,620 | 31,237 | 31,810 | 32,500 | 33,280 | 33,967 | 34,653 | 35,200 |
| 30-34 | 27,580 | 28,097 | 28,430 | 29,050 | 29,550 | 30,157 | 30,780 | 31,537 | 32,033 | 32,637 | 33,203 |
| 35-39 | 29,060 | 29,193 | 29,443 | 29,760 | 30,170 | 30,753 | 31,227 | 31,537 | 32,673 | 32,673 | 33,307 |
| 40-44 | 28,977 | 29,040 | 29,323 | 29,637 | 29,930 | 30,113 | 30,227 | 30,467 | 30,750 | 31,140 | 31,683 |
| 45-49 | 31,087 | 31,340 | 31,367 | 31,367 | 31,423 | 31,503 | 31,760 | 32,240 | 32,733 | 33,223 | 33,607 |
| 50-54 | 29,837 | 30,267 | 30,773 | 31,170 | 31,507 | 31,793 | 32,093 | 32,193 | 32,250 | 32,380 | 32,530 |
| 55-59 | 25,993 | 26,623 | 27,150 | 27,680 | 28,193 | 28,640 | 28,913 | 29,273 | 29,557 | 29,793 | 29,990 |
| 60-64 | 21,177 | 22,110 | 23,047 | 23,813 | 24,323 | 24,830 | 25,453 | 25,967 | 26,463 | 26,953 | 27,387 |
| 65-69 | 16,137 | 16,973 | 17,790 | 18,643 | 19,570 | 20,447 | 21,203 | 22,013 | 22,670 | 23,087 | 23,520 |
| 70-74 | 11,883 | 12,370 | 12,890 | 13,440 | 14,087 | 14,733 | 15,047 | 16,020 | 16,693 | 17,363 | 18,167 |
| 75+ | 20,733 | 21,627 | 22,613 | 23,673 | 24,817 | 26,040 | 27,337 | 28,863 | 30,100 | 31,680 | 33,290 |
| **Total** | **413,638** | **422,256** | **430,993** | **439,766** | **448,530** | **457,303** | **465,821** | **475,150** | **485,592** | **493,078** | **501,931** |

| Age | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-4 | 36,290 | 36,923 | 37,557 | 38,190 | 38,837 | 39,483 | 40,157 | 40,820 | 41,490 | 42,133 | 42,817 | 43,483 |
| 5-9 | 34,487 | 35,157 | 35,833 | 36,487 | 37,140 | 37,770 | 38,420 | 39,053 | 39,710 | 40,330 | 40,950 | 41,583 |
| 10-14 | 33,033 | 33,613 | 34,280 | 34,980 | 35,700 | 36,407 | 37,120 | 37,820 | 38,513 | 39,157 | 39,793 | 40,423 |
| 15-19 | 33,410 | 34,127 | 34,813 | 35,523 | 36,263 | 37,077 | 37,727 | 38,463 | 39,240 | 39,990 | 40,737 | 41,477 |
| 20-24 | 35,850 | 36,227 | 36,593 | 37,030 | 37,610 | 38,140 | 38,967 | 39,753 | 40,580 | 41,393 | 42,287 | 42,970 |
| 25-29 | 35,540 | 35,777 | 36,130 | 36,397 | 36,580 | 36,877 | 37,083 | 37,277 | 37,500 | 38,007 | 38,467 | 39,260 |
| 30-34 | 33,927 | 34,710 | 35,430 | 36,127 | 36,683 | 36,993 | 37,230 | 37,557 | 37,793 | 38,073 | 38,470 | 38,750 |
| 35-39 | 33,973 | 34,767 | 35,320 | 35,973 | 36,627 | 37,430 | 38,327 | 39,137 | 39,923 | 40,673 | 41,167 | 41,603 |
| 40-44 | 32,127 | 32,377 | 32,957 | 33,423 | 34,027 | 34,643 | 35,407 | 35,917 | 36,530 | 37,250 | 38,123 | 39,090 |
| 45-49 | 33,957 | 34,413 | 34,950 | 35,570 | 36,357 | 37,037 | 37,550 | 38,380 | 39,150 | 39,877 | 40,637 | 41,530 |
| 50-54 | 32,860 | 33,377 | 33,923 | 34,443 | 34,880 | 35,257 | 35,770 | 36,330 | 37,007 | 37,650 | 38,187 | 38,537 |
| 55-59 | 30,230 | 30,253 | 30,263 | 30,317 | 30,403 | 30,643 | 31,063 | 31,490 | 31,903 | 32,173 | 32,393 | 32,723 |
| 60-64 | 27,657 | 27,993 | 28,287 | 28,527 | 28,737 | 28,980 | 29,033 | 29,067 | 29,153 | 29,227 | 29,447 | 29,830 |
| 65-69 | 24,083 | 24,527 | 24,960 | 25,397 | 25,787 | 26,017 | 26,317 | 26,563 | 26,763 | 26,937 | 27,167 | 27,187 |
| 70-74 | 18,803 | 19,460 | 20,013 | 20,340 | 20,720 | 21,187 | 21,583 | 21,940 | 22,327 | 22,667 | 22,863 | 23,137 |
| 75+ | 34,947 | 36,667 | 38,447 | 40,400 | 42,393 | 44,353 | 46,370 | 48,343 | 50,270 | 52,313 | 54,397 | 56,443 |
| **Total** | **511,174** | **520,368** | **529,756** | **539,124** | **548,744** | **558,294** | **568,124** | **577,910** | **587,852** | **597,850** | **607,902** | **618,026** |

Source: Washoe County, NPA, Global Insight and Woods and Poole.

*Note: Population by cohort is not available from Truckee Meadows Water Authority or 2006 State Demographer's Forecast, therefore the total population number is slightly lower than the Washoe County Consensus Forecast figures.*

# Employment

Employment for all of Washoe County is projected to grow from 291,360 in 2008 to 449,883 in 2030. This represents an average annual growth rate of 1.6 percent. The 2008 and 2030 forecasted employment and percent of total employment by industry group is shown below in Table 6. To allow for consistency within employment sectors, only employment data from NPA Data Services and Woods and Poole forecasts was used.

**Table 6**
**Employment and Percent Composition of Total**
**Establishment Based Employment by Industry Group**

| Employment by Industry Group | 2008 | | 2030 | |
|---|---|---|---|---|
| | Jobs | Percent of Total | Jobs | Percent of Total |
| Natural Resources | 2,833 | 1% | 5,007 | 1% |
| Construction | 26,458 | 9% | 38,558 | 9% |
| Manufacturing | 16,656 | 6% | 26,553 | 6% |
| Transportation, Communication and Public Utilities | 15,748 | 5% | 23,204 | 5% |
| Wholesale Trade | 14,377 | 5% | 25,568 | 6% |
| Retail Trade | 37,904 | 13% | 60,567 | 13% |
| Finance, Insurance, & Real Estate | 30,993 | 11% | 49,586 | 11% |
| Services | 116,930 | 40% | 179,688 | 40% |
| Government | 29,391 | 10% | 41,055 | 9% |
| **Totals** | **291,360** | **100%** | **449,883** | **100%** |

Source: Washoe County, NPA and Woods and Poole.

*Note: The employment data include wage and salary workers, proprietors, private household employees, and miscellaneous workers of full and part-time jobs. Because part-time workers are included, a person holding two part-time jobs would be counted twice. Jobs are counted by place of work and not place of residence of the worker. Therefore, a job in the Reno Metropolitan Area is counted in Washoe County, regardless of where the worker resides. Due to rounding, the "Percent of Total" may not add up to 100%.*

Industry sectors remain remarkably stable from 2008 to 2030. An increase is seen in Wholesale Trade, up from 5% to 6%, while the Government sector suffers a slight decline, from 10% to 9%. The industries that represent the largest percentage of total employment in 2030 are Services, Finance, Insurance and Real Estate (FIRE) and Retail Trade. The largest numeric increase is in the Services sector, up 62,758 jobs, followed by Retail Trade, with an increase of 22,633 jobs.

The industries that represent the smallest percentage of total employment in 2030 are Natural Resources, Manufacturing, Wholesale Trade and Transportation, Communication and Public Utilities. The smallest numeric increase is seen in the Natural Resources category (comprised of Mining, Agricultural Services, Other and Farm Based employment sectors) with an increase of just 2,174 jobs. Transportation, Communication and Public Utilities has the second smallest numeric increase over time, at 7,456 jobs.

The consensus employment forecast by year is listed below.

**Table 7**
**Washoe County Establishment Based Employment 2008 – 2030**

| Year | Employment |
|---|---|
| 2008 | 291,360 |
| 2009 | 298,100 |
| 2010 | 304,640 |
| 2011 | 311,455 |
| 2012 | 318,360 |
| 2013 | 325,030 |
| 2014 | 331,975 |
| 2015 | 338,685 |
| 2016 | 345,695 |
| 2017 | 352,720 |
| 2018 | 359,780 |
| 2019 | 366,860 |
| 2020 | 373,960 |
| 2021 | 381,090 |
| 2022 | 388,580 |
| 2023 | 395,785 |
| 2024 | 403,370 |
| 2025 | 410,670 |
| 2026 | 418,360 |
| 2027 | 426,120 |
| 2028 | 433,960 |
| 2029 | 441,880 |
| 2030 | 449,883 |

Source: Washoe County, NPA and Woods and Poole.

*Note: Total establishment based employment is based on NPA Data Services, Inc. and Woods and Poole forecasts. The Truckee Meadows Water Authority forecast does not provide data regarding employment.*

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# Income

Total personal income is expected to grow from $17,803,397 in 2008 to $42,010,473 in 2030. This represents the total personal income received by persons from wages and salaries, other labor income, and transfer payments less personal contributions for social insurance as adjusted for place of residence. All personal income data are presented in 2004 dollars. This is used to measure the "real" change in earnings and income when inflation is taken into account. The consensus forecast for total personal income for each year is shown in Table 8.

**Table 8**
**Washoe County Total Personal Income, 2008 –2030**

| Year | Total Personal Income $ ('000) |
|---|---|
| 2008 | 17,803,397 |
| 2009 | 18,550,337 |
| 2010 | 19,322,433 |
| 2011 | 20,147,713 |
| 2012 | 21,002,110 |
| 2013 | 21,852,070 |
| 2014 | 22,757,853 |
| 2015 | 23,673,633 |
| 2016 | 24,635,127 |
| 2017 | 25,626,317 |
| 2018 | 26,646,637 |
| 2019 | 27,675,017 |
| 2020 | 28,733,037 |
| 2021 | 29,840,343 |
| 2022 | 30,987,837 |
| 2023 | 32,169,760 |
| 2024 | 33,402,743 |
| 2025 | 34,688,380 |
| 2026 | 36,023,317 |
| 2027 | 37,477,263 |
| 2028 | 38,948,053 |
| 2029 | 40,472,320 |
| 2030 | 42,010,473 |

Source: Washoe County, NPA, Global Insight and Woods and Poole.

*Note: Total personal income is based on Global Insight, NPA Data Services, Inc. and Woods and Poole forecasts. The Truckee Meadows Water Authority forecast or 2006 State Demographer's Forecast does not provide data regarding income.*

The consensus forecast for per capita personal income for each year is listed below:

**Table 9**
**Washoe County Per Capita Personal Income, 2008 –2030**

| Year | Per Capita Personal Income |
|---|---|
| 2008 | 43,041 |
| 2009 | 43,931 |
| 2010 | 44,832 |
| 2011 | 45,815 |
| 2012 | 46,824 |
| 2013 | 47,785 |
| 2014 | 48,855 |
| 2015 | 49,823 |
| 2016 | 50,732 |
| 2017 | 51,972 |
| 2018 | 53,088 |
| 2019 | 54,140 |
| 2020 | 55,217 |
| 2021 | 56,328 |
| 2022 | 57,478 |
| 2023 | 58,624 |
| 2024 | 59,830 |
| 2025 | 61,058 |
| 2026 | 62,334 |
| 2027 | 63,753 |
| 2028 | 65,147 |
| 2029 | 66,577 |
| 2030 | 67,975 |

Source: Washoe County, Global Insight, NPA and Woods and Poole.

*Note: Total per capita personal income is based on Global Insight, NPA Data Services, Inc. and Woods and Poole forecasts. The Truckee Meadows Water Authority forecast and 2006 State Demographer's Forecast does not provide data regarding income.*

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# Jurisdictional Splits

Reno, Sparks and Washoe County use the Governor's certified population estimates of 2007 as a starting point for determining jurisdictional forecasts for the year 2030.

**Table 10**
**2007 Governor's Certified Population Estimates**

| | |
|---|---|
| Washoe County Total 2007 | 418,061 |
| Reno City Total 2007 | 220,613 |
| Sparks City Total 2007 | 89,449 |
| Unincorporated Washoe County Total 2007 | 107,999 |

In 2007, each jurisdiction contained the following percent of total population:

**Table 11**
**2007 Jurisdictional Percent of Total Population**

| | |
|---|---|
| Reno Percent of Total | 52.77% |
| Sparks Percent of Total | 21.40% |
| Unincorporated Washoe County Percent of Total | 25.83% |

An analysis of historic census and estimated population figures since 1980 shows these jurisdictional percentages have remained relatively stable over time, with minor deflections both upward and downward for each jurisdiction.

In this 2008 Consensus Forecast, there was a desire to reflect a potential impact of the 2007 Truckee Meadows Regional Plan on jurisdictional shares of population through the year 2030. The influence of plan policies on growth and development patterns, and the possible impacts on future settlement patterns are the subject of significant debate and reflect a different approach to forecasting in a multi-jurisdictional environment than forecasts based on a mere reflection and continuation of historic trends. While all forecasts reflect inherent uncertainties, especially forecasts associated with regional plan policies can provide a useful guide, over time, as to the effectiveness of such growth policies.

The year 2030 Washoe County Consensus Forecast of 620,343 persons exceeds the 2007 Governor's certified estimate of 418,061 by a growth increment of 202,262 persons.

Reno, Sparks and Washoe County have agreed to allocate the growth increment of 202,262 persons in the following manner:

**Table 12**
**Growth Increment Allocation**

| | |
|---|---|
| 25% of Growth Increment (50,566 persons) at Year 2030 | Allocate to Centers, TOD Corridors, Emerging Employment Centers in Reno and Sparks |
| 75% of Growth Increment (151,696 persons) at Year 2030 | Allocate based on adjusted jurisdictional shares of population of 50% City of Reno, 24% City of Sparks and 26% Unincorporated Washoe County. |

The approach that allocates 25% of the growth increment to Centers, TOD Corridors and Emerging Employment Centers recognizes that the 2007 Regional Plan policies have increasing impact over time. Thus, the growth increment attributed to these policies increases from 2008 to 2030 in a linear

fashion. Interpolation of jurisdictional population forecasts from 2008 to 2030 is the responsibility of each jurisdiction and is addressed in local population master plan elements, if desired. This consensus forecast establishes only the beginning (2007 certified estimates) and end points (allocated 2030 consensus forecast by jurisdiction) of that forecast series for each jurisdiction through the year 2030.

Analysis of the 25% population increment (50,566 persons) allocated to each jurisdiction's Centers, TOD Corridors and Emerging Employment Centers (EEC's) yielded the following assumptions based on corridor, center and emerging employment center land areas and density assumptions:

- 21.3% of the allocated increment will be allocated to the City of Reno (43,082 persons);
- 3.7% of the allocated increment will be allocated to the City of Sparks (7,484 persons).

The City of Sparks has major emerging employment centers in its jurisdiction, and it is recognized that these EEC's are located in or near to Sparks' traditional growth areas. The Spark's EEC's, are extremely important to jobs-housing balance and trip reduction policies.

In the near future, other 2007 Regional Plan policies relating to Secondary Transit Corridors and Infill Opportunity Areas may be analyzed for their impact on population shares in the Consensus Forecast.

Allocation of the remaining (non-centers, corridors and EEC) growth increment (75% or 151,596 persons) to the jurisdictions is based upon a minor modification of the historic jurisdictional distribution of population, as follows:

**Table 13**
**2030 Jurisdictional Distribution of Population (of remaining growth increment)**

| | | |
|---|---|---|
| City of Reno Year 2030 Allocation | 50% | 75,848 persons |
| City of Sparks Year 2030 Allocation | 24% | 36,407 persons |
| Unincorporated Washoe County Year 2030 Allocation | 26% | 39,441 persons |

**Table 14**
**Year 2030 Total Jurisdiction Forecasts**

| Jurisdiction | 2007 Certified Estimates | Centers, Corridors and EEC Increment | Remaining Increment | 2030 Jurisdiction Forecast |
|---|---|---|---|---|
| Reno | 220,613 | 43,082 | 75,848 | 339,543 |
| Sparks | 89,449 | 7,484 | 36,407 | 133,340 |
| Unincorporated Washoe County | 107,999 | | 39,441 | 147,440 |
| Total County | 418,061 | 50,566 | 151,696 | 620,323 |

# Appendix A

## Consensus Forecasts in Planning

By Michael R. Sykes*

*Externally produced macroeconomic forecasts are frequently used as an input to the planning process, often to provide the broad framework within which more specific questions can be addressed. However, the quality of the output is partially dependent on the quality of the macroeconomic inputs chosen. A consensus forecast aggregates the views of a number of leading macroeconomic forecasters who use different approaches and attach different weights to the importance of the various factors that impact the economy. Research suggests that few, if any, individual forecasters consistently outperform the consensus across a range of variables, although some forecasters may perform well for some individual series. Studies also suggest that the use of a consensus minimizes the risk of large forecast errors, which has obvious benefits for firms operating in sectors of the economy particularly sensitive to swings in overall economic activity. The consensus approach allows the user to examine the range or distribution of forecasts, and also permits comparison of individual forecasts, whether produced by external advisers or internal analysts, with the mainstream view.*

MACROECONOMISTS generally summarize the economic outlook by producing projections for a handful of very broad aggregate indicators. On their own, these projections represent only a general template for planners looking at the outlook for a (comparatively) narrowly defined sector of the economy. But as most corporate and strategic planners know, in many industries macro forecasts are regularly used as inputs to the planning process, often to establish a starting point or a broad framework of assumptions within which the more specific problems under consideration can be examined.

For many businesses, product demand in a given market that is sensitive to the strength of economic activity may be well correlated with the behaviour of one or more broad macroeconomic indicators. For example, demand for semiconductor chips in many markets has historically been relatively well correlated with growth in overall industrial production, which is therefore often considered by sector analysts as the best indicator to use in predicting future chip demand. One major industrial company also focuses on expected industrial production growth in various (mainly European) markets, as an indicator of future demand for ball bearings and other products widely used in the industrial production processes.

Obviously, obtaining a reliable set of forecasts for a macroeconomic variable in various countries or markets is far from being the whole story: the relationship between industrial production and demand for computer chips may vary quite widely across markets, depending, for example, on the level of technology employed. Information or knowledge that is more specific to the industry, or to the past experience of the individual firm, also will be necessary. Thus, extrapolating historical relationships between demand for a product and a macroeconomic indicator is a widely used approach but is dependent upon the quality of both the interpretation of events and the macro benchmark forecasts used.

### THE ECONOMIC CYCLE

In the short term, predictions of the timing of turning points in the economic cycle also can be invaluable in reaching decisions on production, inventory and manning levels, marketing strategies

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and pricing. In the trough of an economic cycle, weak demand is likely to mean that producers are facing strong competition for the few available orders, are running plant at well below full capacity and have cut inventory and manning levels. In spite of the rising unit labour costs that usually accompany a downturn in output, producers may be under considerable pressure either to cut prices or to offer significant discounts, and profit margins are inevitably squeezed. The question of whether to cut employment further in order to reduce costs, or possibly to close or scrap plant, will depend to a considerable extent on when and from what level the economy is expected to begin recovering. Producers will not wish to find themselves having cut capacity and employment as the economy is about to turn up, and also will wish to be well positioned from a marketing standpoint as demand begins to revive.

The economic cycle in different industrial sectors is frequently out of phase with that of the economy overall, however. In many countries, for example, construction sector activity turns down ahead of demand in the economy as a whole and often leads the revival. Producers of construction-related materials and equipment therefore also will feel the effects of a downturn and the subsequent revival relatively early. On the other hand, business investment often responds more slowly to a recovery in overall output, as producers first take up the excess capacity resulting from recession before investing in new plant. But even so, in examining either the short-term influence of economic cycles or the longer-term outlook, once a general relationship between demand for a particular product and a broad indicator of total output (such as gross domestic product [GDP] or industrial production) has been established, macroeconomic forecasts adjusted for leads or lags can be used to "drive" a more specific model of demand for the individual sector or product.

## CROSS COUNTRY COMPARISONS

Over a longer time horizon, the expected *relative* performance of various economic indicators in different countries can be a useful guide in reaching decisions about the location of production units, distribution networks and marketing investment. Equally, expected developments in relative wage costs and inflation rates may have a significant bearing on investment or other location decisions. One of the problems here is likely to lie in finding forecasts for all the individual countries under consideration that have been produced on as simultaneous and consistent a basis as possible.

## CHANGING EXPECTATIONS

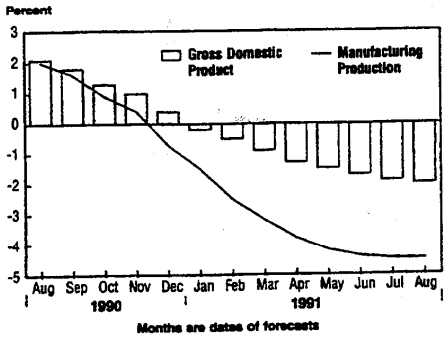
Expectations regarding future trends in output, inflation or other macro variables can change quite rapidly over time, suggesting that forecasts for demand growth in different countries made even a few months apart might provide misleading comparisons. The outbreak of the Gulf crisis in August 1990, for example, marked the beginning of a nine-month period during which 1991 growth forecasts for most economies were revised sharply and continuously downwards. In the United Kingdom, where the gathering gloom was compounded by the realization that tight monetary policy was finally beginning to bite, the deterioration in the consensus outlook for GDP growth and Manufacturing Production was particularly severe (see Figure 1).

Such rapid shifts in expectations can obviously pose problems for companies where the planning cycle involves relatively infrequent reviews of the forecasts underlying the plan. A company conducting an annual forecast review for the United States in August 1990, for example, would, by the beginning of 1991, have found itself with a plan based on assumed GNP growth for 1991 of 2 percent. In the meantime, however, the average independent growth forecast had deteriorated to the point where the economy was expected to contract by around 0.3 percent. Changes in expectations of this magnitude, and wars in the Gulf, are thankfully relatively rare occurrences, but even under more normal circumstances, expectations can shift quite rapidly over a few months. Since the beginning of 1992, for example, consensus forecasts for growth in Japanese industrial production have declined

**Figure I**

**Consensus Forecasts for U.K. Growth**

**1991**



from an average of +1.3 percent to the −3.0 percent now being predicted (early June 1992). Such developments highlight the need for a reliable stream of regularly updated forecasts and the close monitoring of shifts in expectations. In such circumstances a flexible approach to reviewing established plans outside the normal six months or one year cycle and a willingness on the part of business economists to raise the red flag are clearly important. It should at least be possible to draw the attention of others involved in later stages of the planning process to such developments, even if a full scale review is impractical. In view of the difficulties that may be involved in disrupting the planning process in this way, however, it is important that the forecasts used to trigger such changes derive from a consistent and credible source. The choice of this source is therefore an important decision.

### THE FORECAST SOURCE

The choice of forecast source is complicated by the large number and wide diversity of economic forecasting operations. These may be large international consultancy-type firms specializing in economic forecasting and analysis, government or semigovernment institutions such as the OECD, university research units, divisions of major banks or securities firms, or the in-house economic units of large industrial companies. Our company surveys over 180 economic forecasters based in the G-7 countries and Australia every month (of which about 25 are in the United States), and this is by no means an exhaustive list of the available sources. Blue Chip Economic Indicators covers about 50 U.S. forecasters in its principal American panel.

Comparing forecasters' track records is made more complicated by the fact that forecast errors vary in type and can have different consequences for the forecast user. For example, forecasters may correctly predict the direction of change in a series, but get the magnitude wrong (under or overpredicting investment growth, for example). This kind of forecasting error is, however, probably less damaging to the forecast user than a prediction that gets the direction of change wrong (forecasting a rise when the series in fact falls). From the users' point of view, a forecaster who accurately predicts trends but fails to spot turning points may well deserve a lower rating than another who correctly predicts turning points but has a poorer track record at other times. More generally, a good track record does not guarantee consistent success. The fact that a forecaster performed well in predicting economic developments for one or two years does not mean that he or she will continue to do so. Indeed, some of the more recent evidence from studies of forecasting accuracy (reviewed below) indicates that past success is no guarantee of future accuracy. The problem is compounded when forecasts for a range of different variables are considered. One forecaster may have a better track record on production growth, but a poor record on inflation. These results might be combined or weighted in some way, but how is a percentage error in forecasting inflation to be rated vis-a-vis an absolute error in volume terms in a forecast for housing starts, for example? The relative importance of the different variables will vary from user to user.

### THE CONSENSUS APPROACH

All of this suggests that successfully differentiating among the large number of different forecasts available is a complex and challenging task. One possible solution to this problem of "picking winners" is to use aggregated or consensus forecasts, combining the predictions of a number of different forecasters into a single, mean forecast. The idea of using consensus projections is fairly well established in a number of countries, notably in the United States, where surveys of forecasters have been running for some time. Aside from reducing some of the problems of choice and weighting discussed above, the use of a consensus projection also appeals to many users because it does not rest on one particular view of the way an economy functions, but attempts to capture the information implicit in a range of forecasts. The results of these surveys have also attracted a good deal of academic interest and analysis, and several studies of the merits of consensus forecasting as an approach have been conducted.

Much of this work has concentrated on forecasts produced by various time series methods of extrapolation for individual series, although there have also been other studies comparing econometric and/or judgmental forecasts with the consensus. Most of these studies are based on data for the United States, where a long run of consistent back data is available from the surveys published in Blue Chip Economic Indicators over the past fourteen years.

As regards the accuracy of the consensus, the verdict of most of the academic work in this area has generally been favourable. In his study covering forecasts for seven variables made by twenty-two forecasters over nine years (1978 through 1986) Stephen McNees[1] concluded that "only four of the twenty-two individual forecasters were more accurate than the consensus in more than half their forecasts." For all seven variables weighted equally,

[1]See footnote at end of text.

the consensus forecasts ranked 6 (out of 23, including the consensus) on the basis of the RMSE (root mean squared error) criterion.

In addition, McNees noted that:

> "For any particular variable, the Blue Chip consensus was more accurate than most individual forecasters but less accurate than a minority of varying size depending on the predicted variable . . . Every forecaster, [ except one], was more accurate than the consensus for at least one variable but none of the forecasters outperformed the consensus for all seven variables."[2]

Another study[3] comparing seventy-nine individual forecasts of six macroeconomic variables with the group mean found that, on average, the consensus was more accurate than around three-quarters of the individual forecasts, although again this proportion varied depending on the variable considered. On the basis of this evidence, which is broadly consistent with our own experience, it seems reasonable to assume that for some variables some of the individual forecasts making up the consensus will prove to be more accurate than the group mean when the results become known. However, the problem for a user of external forecasts remains how to determine *in advance* which individual forecasters will be more accurate. This would be a relatively simple task if some forecasters were clearly superior to the others and consistently achieved better results.

In fact, the evidence on this question is rather mixed. Victor Zarnowitz[4] examined forecasts submitted to the survey conducted by the American Statistical Association (ASA) and the National Bureau of Economic Research (NBER) from 1968 to 1979, and concluded (by comparing rank correlations of relative RMSEs across variables and forecast horizons) that "a small number of the more regular participants in the ASA-NBER surveys did perform better in most respects than the composite forecasts from the same surveys."

On the other hand a later analysis conducted by Roy Batchelor of the City University Business School[5] in London concluded that there were "no significant differences in the accuracy rankings of individual forecasters." This conclusion supports the argument that, without the benefit of hindsight, it is extremely difficult to pick out an individual forecaster who is likely to outperform the consensus across a range of variables and time horizons. As noted above, however, for certain variables considered in isolation the evidence does suggest that selected forecasters can perform consistently well.

**THE MARKET FOR FORECASTS**

There are a number of problems involved with the use of consensus forecasts. One is the choice of which forecasters to include in the consensus. However, given the competitive nature of the forecasting business (large numbers of suppliers, fairly standardized products, very low or nonexistent barriers to entry, etc.) inaccurate forecasters, or those lacking professional credentials, might be expected to be driven out of business, leaving a group of forecasters producing work of a similar quality. This is supported by the Batchelor study, which finds no evidence of significant differences in forecasters' track records. In a separate study,[6] Batchelor also finds that, perhaps because of this high level of competition in the forecasting business, some forecasters may attempt to differentiate their work by deliberately adopting a stance that is either pessimistic or optimistic in relation to their peers. Far from moving towards the consensus, some forecasters display "variety seeking" behaviour and attempt to distance themselves from the middle ground to some extent. Those that are determinedly optimistic year after year will almost certainly, at some stage, be proved correct when the outcome is better than the consensus predicted. Intuitively, this also ties in with the results showing that few forecasters beat the consensus consistently; neither the optimists nor the pessimists can always be right. This kind of behaviour probably reflects the fact that forecasts, like other types of information, are themselves a marketable commodity. From some perspectives, the middle ground may appear less valuable or interesting and thus more difficult to sell commercially. Thus accuracy may not always be the only consideration for the forecast producer, given that he is operating in a competitive market.

This leads to another caveat regarding the interpretation of consensus projections. The range or spread of different forecasts, which is often measured by the standard deviation of the sample, is frequently used as a measure of the "risk" or uncertainty attached to a consensus forecast. Clustering around the mean might, however, produce a range of forecasts that considerably understates the wide dispersion of likely outcomes, with the result that the deviation in the sample is considerably lower than the "risk" inherent in the forecast. This is reflected in the fact that the actual outcome for a particular variable is frequently outside the range of forecasts. In our experience, we have noted that the dispersion of forecasts may also vary widely from country to country. For example, the forecasts for the French economy produced (on a monthly basis) by a group of around sixteen French-based fore-

casters over the past two years have typically been much more closely grouped around the mean than those produced by a similar group of United States forecasters looking at the American economy. This may reflect structural differences between the two economies (the French economy may be more predictable, for example) or it may reflect more widespread attempts at product differentiation in the U.S. forecasting industry. So caution should be exercised when using forecast ranges to assess the uncertainty attached to the consensus. As always with a table of comparative forecasts, moreover, the astute analyst will endeavour to look past the numbers at the reasoning that lies behind them.

**FOOTNOTES**

[1]Stephen McNees, "The Tyranny of the Majority," New England Economic Review, Federal Reserve Bank of Boston, Nov/Dec 1987.

[2]Ibid.

[3]Victor Zarnowitz, "The Accuracy of Individual and Group Forecasts from Business Outlook Surveys," Journal of Forecasting, Vol 3 (Jan-March 1984).

[4]Ibid, pp. 23-24.

[5]Roy A. Batchelor, "All Forecasters Are Equal," Journal of Business and Economic Statistics, 1990.

[6]Roy Batchelor and Pami Dua "Conservatism and Consensus-Seeking Among Economic Forecasters," Paper presented to the Ninth International Symposium on Forecasting, Vancouver, June 1989.

# Appendix B

**Global Insight**
**Population Forecasting Methodology for Washoe County, Nevada**

For the Washoe County project Global Insight provides an estimate of population for the Reno MSA, broken down into 5-year cohorts.

We first pull the Reno population forecast, which is done on a ten-year cohort basis (as described below). We then break the cohorts into 5-year blocks for the project.

For population history, we use county data maintained by the Census Bureau.

Long-term metro area trends in population generally follow state population trends, which are in turn, dependent on a range of factors, including demographic trends, labor market conditions, employment opportunities, tax burdens, home prices, and climate. We assume that taxes and climate are relatively consistent among metropolitan areas in a given state. Employment opportunities, and to a lesser degree, home prices, are the greatest drivers for population growth at the metro level. The growth in the area's share of total state employment is the primary determinant. We generally assume that a metro area population grows at the same rate as an eight-quarter moving average of its share of employment in a state, adjusted for movements in state population; note that this lag time can vary. This growth is then modified by an elasticity, relating historical metro area population growth to the state in a manner similar to that used in the employment block.

**Global Insight's State and MSA Models**

## 1.0 Overview

The U.S. Regional Economic Service of Global Insight develops economic forecasts for nine census divisions, 50 states and the District of Columbia, 319 primary metropolitan statistical areas (PMSAs), and 3,110 counties of the United States. Quarterly-frequency forecasts are produced four times a year for states and 114 major metropolitan areas using behavioral econometric models. Annual-frequency forecasts are prepared twice a year for the 205 smaller metro areas and counties using simulation-rule models. The spring and fall forecasts for the states, all 319 PMSAs and the counties are 25-year forecasts, while the summer and winter forecasts for the states and the 114 largest MSAs are 5-year forecasts.

Global Insight's state models are dynamic econometric models of competition and growth. Structural details of inter-industry purchasing relationships are integrated into the manufacturing sector of each model. Decisions of businesses to locate or expand in a state are driven by the competitive environment, represented by tax rates, the costs of labor and energy, and climate. Wage rates by industry, components of personal income, housing market activity, population, labor force, and unemployment rates are predicted within the models for each state. This dynamic system captures the interactions between production, employment, incomes, industry costs, population, labor supply, and housing markets.

Global Insight's state econometric models are linked to our newly revised Quarterly Model of the U.S. Economy, incorporating national demands for goods and services as drivers of economic activity

within a state. The influence of the national economy is shaped by state-specific conditions of industry mix; relative cost structures, demographics, and income/expenditure patterns. A state's evolving competitive strengths and weaknesses determine its success in capturing a share of the national market by industry sector.

## 2.0 Theoretical Foundation

The Global Insight approach to state and metropolitan area models represents a significant departure from most previous multi-regional modeling and forecasting efforts. Most other regional models are constructed as proportions of the United States. In the Global Insight system, however, each area is modeled individually and then linked into a national system. Thus, our models do not forecast regional growth as simple proportions of U.S. totals, but focus on internal growth dynamics and differential business cycle response. This approach is referred to as "top-down bottom-up." It contrasts sharply with pure share (top-down) models, and models that are not linked to a national macroeconomic model (bottom-up), and contain the best of both approaches.

Our basic objective is to project how state economic activity varies, given an economic environment as laid out by Global Insight's US Macroeconomic and US Industry forecasts. In order to do this, we must be able to explain the two key phenomena:

- Why states react differently from one another over the business cycle;
- Why states grow or decline relative to each other over the longer run.

Another general characteristic of Global Insight's state models are that they are policy sensitive. There are a number of reasons for this sensitivity, including the following:

- Each state is modeled individually, with different model structures specified according to the characteristics of the state
- National policy is explicitly captured,
- The comparative advantage of one state over another is explicitly modeled using relative cost variables.

The three major components or blocks of Global Insight's state econometric models are discussed below; the key income sector is then described, followed by the housing and consumptions sectors. Most of the discussion that follows explicitly refers to our State models, but a similar structure also exists in the metropolitan area models.

## 3.0 The Export Module

The major linkages among the models occur in the economic base or export sectors. These we identify as primarily agriculture, mining, the federal government, and most manufacturing industries. Global Insight's state modeling approach is an extension of the export base (or economic base) theory, whereby a state's economic growth is enhanced by the sale of its goods and services to markets outside the region. By exporting, industries generate new jobs and income that, in turn, promotes the expansion of businesses that serve the local market, such as retail trade, utilities, services, and construction. As described in the accelerator/multiplier theory, business investment increases as the capital stock adjusts to changes in product demand. New job opportunities attract an in-migration of population, increasing demand for housing.

The ability of an economy to sustain higher growth is, however, constrained by competitive forces captured in Global Insight's state economic models. The entry of new workers into the labor force lags behind gains in employment, causing labor markets to tighten and putting upward pressure on wage rates. Higher operating costs for businesses and higher living costs for residents make the region less attractive, dampening economic growth.

This dynamic process represents a departure from the simple export base theory. The multiplier response to an initial stimulus or policy change is not constant, but rises initially with higher consumption and investment and then moderates as resource constraints and cost pressures impede further growth. Moreover, the response to an economic stimulus will vary across industries and states, depending on their technologies, cost structures, and inter-industry purchasing relationships. Part of the income created by export sales will be spent on goods and services outside the state, diminishing the export multiplier. In the development of the state manufacturing employment equations, Global Insight has incorporated a number of innovations to enhance the explanatory richness of the equations.

- The equations capture inter-industry, interregional, and dynamic linkages by integrating input-output, spatial theory, and econometric concepts.
- The employment equations are estimated using quarterly employment data beginning in 1972. These data cover all two-digit manufacturing sectors across all states, and were derived by Global Insight using data from the Bureau of Labor Statistics (ES-202 and 790 survey data), the Bureau of Economic Analysis, and the Census Bureau. With quarterly data, the equations are able to capture the timing and amplitude of turning points in the business cycle. In addition, at the two-digit level, employment data are the most reliable, accurate, and timely measure of state industrial activity.
- Employment levels are estimated using national and state-specific explanatory variables. Through direct linkages to the national economy we ensure consistency with the Global Insight national forecasts, and we capitalize on the depth of the macroeconomic model and its detailed industrial production sector.

The manufacturing employment equation for each two-digit industry in a given state uses the following independent variables: 1) employment by industry, national; 2) industry mix relative to U.S.; 3) relative inter-industry demand; 4) costs of doing business, relative to U.S.; 5) labor productivity; and 6) final demand factor. The first two terms are the key linkages to U.S. economic activity, and may enter the equation in two ways. First, is the case where U.S. employment by two-digit industry is modified by that industry's mix in the state relative to that in the nation. The second can be interpreted as state-weighted industrial production, modified by national productivity trends in each industry.

Industry mix effects are captured in the "weighted industrial production index," or WJIP, a concept common to all previous versions of the DRI-WEFA regional models. The difference in the current version is in the use of the index of separate two-digit industry equations rather than for total manufacturing alone. The WJIP is simply a re-weighting of the U.S. indexes of industrial production at the three-digit level, according to the relative importance of industries within the state's two-digit sectors (using employment as weights in most applications).

Localized demand may also be an important determinant of manufacturing activity. Construction activity, a major source of regional final demand, has already been included in the creation of the intermediate demand variable, but local housing markets are often explicitly included in the equation. The impact of the other final demand categories enters the employment equations through three-digit SIC state employment weighted industrial production indices.

The third term in the manufacturing employment equation is a measure of demand for an industry's products by other industries. An inter-industry, interregional demand term is constructed for every two-digit SIC industry in each state. As computed, the importance to each industry of each geographic market varies according to:

- Input-output relationships that quantify demand from 70 key industrial buyers by sector and from selected end-user sectors
- The geographic location of potential markets, measured with employment data
- Transportation costs, measured by distance or known trade patterns between states
- Strength of industrial demand, measured by the expected growth of manufacturing activity by sector in every state.

The third set of independent variables to enter the employment equations is the relative costs of doing business in each state. Any explanation of regional growth must take into account that there are few barriers to the flow of economic activity across borders. States actively and openly compete for new and expanding businesses that determine economic growth. Since most industrial firms charge the same price for their products, regardless of their place of origin, differences in profitability are tied directly to differences in relative costs. The major factors affecting relative costs are natural resource costs, unit labor costs, unit capital costs, transportation and distribution costs, energy costs (e.g., natural gas and electric power) and unit taxes, all of which are considered in the export block of our state models.

## 4.0 The Local Module

Most of a state's economy, in terms of percent shares of employment, income, and value added (e.g., gross state product) is captured in the non-manufacturing sector. The classic examples are construction, wholesale, and retail trade, services, local government, utilities, and the like. These are nearly always support services, providing the necessary infrastructure for the base (export) sectors and the local population. The income generated by the export sectors circulates and multiplies through the local economy and generates the greater part of regional employment. These interactions and simultaneities can only be captured in an independent model. Some non-manufacturing sectors, although usually driven by local requirements, can also serve national markets. The best examples are the insurance industry in Connecticut, the banking interests in New York and Chicago and tourism in Hawaii. These exceptions are export sectors in selected states. Where they are export-oriented, these non-manufacturing sectors are driven by national variables.

## 4.1 General Structure of Local Module

The Global Insight state econometric models forecast nine categories of locally-oriented non-manufacturing: 1) Construction; 2) Retail Trade; 3) Wholesale Trade; 4) Transportation, Communications and Public Utilities (TCPU); 5) Finance, Insurance and Real Estate (FIRE); 6) Health Services; 7) Business Services; 8) Other Services; and 9) State and Local Government. Each of these sectors contains a diversified group of sub-industries that vary considerably from state to state. All of these require special analysis and monitoring by our regional analysts; just as in manufacturing, an understanding of underlying structure is critical to making reasonable forecasts. Finally, the generalized structure of the non-manufacturing equations contains four key factors: 1)

measures of activity; 2) a cost term; 3) national conditions of importance to a particular sector, and 4) a measure of the stage of the business cycle.

## 4.2 Measuring Local Activity in Non-Manufacturing Sectors

One of the most crucial objectives in developing a model of the localized economy is to find a suitable measure of the activities driving a particular sector. Real personal income is the most frequently used variable, either alone or in combination with others. It is the best measure of aggregate economic activity at the state level, capturing wages, transfer payments, and non-wage income. Population is another key measure of sector activity. In the DRI-WEFA regional models, population and real income often enter in the same equation, measuring different aspects of the need for services or other non-manufacturing sectors. In summary, non-manufacturing employment and income are so closely intertwined that any model, which does not treat them simultaneously, cannot capture the local economy's short-term behavior. Population is also intertwined with income and employment, but on a longer time scale. The Demographic Forecasting Module will be discussed below.

## 4.3 Costs

When real wages are high and/or rising rapidly, then the tendency of business, government, and other organizations is to hold employment down as much as possible. The reverse holds true when real wages are low or falling rapidly. In the manufacturing sector, wage costs were shown to be one of the principle determinants of business location decisions. In the non-manufacturing support sectors, this is reflected in the level rather than the location of employment. Thus, employment is inversely proportional to real wage costs. Real wages enter many of the non-manufacturing employment equations. For forecast purposes, this wage rate is related to the appropriate national variable and the growth rate of the sector itself.

## 4.4 National Conditions

The national economy is reflected in three areas in the non-manufacturing sectors. First, certain macroeconomic conditions affect local activity significantly, even non-manufacturing. The best example of this is credit availability. Tight credit conditions with high interest rates have an adverse impact on local construction activity, sales of autos, and other durable and the like. The second class of national variables are those that reflect nationwide trends. An example of this is the trend towards an increasingly larger services sector. Capturing this secular trend is sometimes difficult when one uses only local variables in the non-manufacturing equations. The third application of national variables is to the export-oriented non-manufacturing sectors, such as the insurance and banking industries in certain states. In states where tourism is a significant factor in generating services employment, such as Hawaii, more national variables enter the non-manufacturing equations.

## 4.5 Stage of the Business Cycle

A cyclical variable, which measures the stage of the national business cycle, is usually included with each non-manufacturing sector. The purpose of this variable, which is the employment rate or capacity utilization, is to the capture the hiring/firing cycle. As the local economy slides into a

recession, employers are reluctant to lay off workers until necessary. It is costly to dismiss and then re-hire employees, and it is usually difficult to tell whether a recession is really coming in the early stages of a downturn. Conversely, as the economy pulls out of a recession, employers are reluctant to hire new employees until the recovery is clearly underway. Thus, there is a clear lag between the behavior of the activity variables, such as income or export sector employment, and the behavior of employment in the non-manufacturing sectors. Many sectors have a cyclical variable in the specification to capture this lagged effect.

The complex structures and feedback loops contained in the state export sectors, local economy sectors, and demographic formulations are designed to meet three key objectives. The first is to capture the complex interactions between the various sectors, allowing the most sophisticated policy analysis possible. The second is to provide consistent forecasts of output and employment by sector, which are key statistics for many business and government applications. The third is to produce accurate forecasts of personal income because of its important to the whole state economy.

# 5.0 The Demographic Module

## 5.1 Population

The purpose of the Global Insight state population model is to capture the dynamic relationship between population growth and the economy while capturing demographic factors through "cohort-component" techniques. Population change at the state level is made up of births, death, and net migration. During the 1990s, natural increase accounted for a majority of population growth nationwide, but in a number of fast-growing states in the South and West, net migration accounted for over half of the gain, making interstate mobility an important determinant of state population growth. Global Insight's econometric analysis of net migration based upon economic determinants differentiates its forecasts from the Census Bureau's trended state projections.

The demographic factors in population change are built into the model through the use of "cohort-component" techniques. This method projects a given population by applying age and sex-specific rates of fertility, mortality, and migration. Birth, death, and foreign immigration rates are based upon Census Bureau projections, adjusted for interstate differences. Because considerable age and sex detail is maintained over the projection period, the model reflects the sensitivity of population change to variations in age structure and permits analyses of the relative roles of natural increase and migration. The use of age-specific rates allows the distinction to be made between, for example, population growth due to increased birth or survival rates and that due to a change in the age structure, even though the rates at each age may remain constant.

## 5.2 Births and Deaths

One of the most significant demographic developments over the past two decades has been the dramatic drop in the national birth rate. Although U.S. fertility patterns have been characterized by long, regular cycles, there are indications that the most recent downturn reflects structural as well as temporal changes that are likely to reduce the amplitude of future cycles. In order to forecast state births, crude birth rates are calculated based upon these detailed fertility rates. The rates are updated periodically as new state fertility information becomes available.

The differences between the states in life expectancy at birth and in the age-sex structure of survival rates are marked enough to advise against the use of a single set of national survival rates as is generally done. The mortality component of the Global Insight state population model takes account

of these differences by applying age and sex-specific adjustment factors for each of the states as they relate to the national survival rates projected by the Census Bureau. These adjustment factors were calculated as the ratio of state to national birth rates in 2000 and 2001 as reported by the National Center for Health Statistics (NCHS).

### 5.3 Net Migration

In our demographic sector, net migration is driven by economic conditions. The principal assumption is that people follow jobs and higher incomes rather than vice-versa. This does not mean that non-pecuniary determinants of migration do not exist. However, these are either fixed (climate and landscape) or vary only slowly (urbanization) or are special in nature (the ability to sell homes and retire to Sunbelt areas). The important thing is to provide the correct direction of causality. Demographic factors are most important on the consumption side of the regional economy. They are a significant factor in housing, retail sales, autos, etc., and the relationships are captured in the models. Population is also an important long-term determinant of the size of such sectors as state and local government.

Interstate migration is related to regional disparities in economic activity so that, for example, states with rapidly growing employment can be expected to attract a new inflow of migrants. To reflect this view of migration, the annual net migration rate for each of the states has been modeled as a function of relative economic performance such as relative employment or unemployment rates, real per capita income, wages rates, housing costs and housing market activity, and lagged population growth. All explanatory variables are lagged to reflect the decision period for making a move. Relative employment or unemployment rates measure job opportunities, while relative real per capita income measures differences in the standard of living across states. Housing market activity, as measured by starts and sales, is used as a friction term. When houses are difficult to sell, people are less likely to move. Conversely, in a boom period, the ease of selling one's house encourages a move.

## 6.0 Income

Personal income is most the frequently updated and the best overall measure of activity within a state, capturing labor income, property income and transfer payments. Good employment forecasts are critical to a good forecast of personal income since wages and other labor income constitute over 70 percent of income. In addition, there are multiple feedbacks between various employment sectors, cost variables, income, and population.

Compared with most factors of production, there is mobility in the labor market. Consequently, we expect the real wage to be similar across the United States, and nominal wages should increase with the local price level. From the demand side, we expect real wages to vary directly with labor productivity and with state manufacturing output relative to the United States. Finally, in the short-term, the unemployment ratio to population will affect the average wage rate. In order to model manufacturing wages, we explicitly account for the industry mix in the state, as well as the differences in wages per employee between industries as experienced by the state. To accomplish this, a variable called "generated wages" was calculated. The generated wage bill used in the manufacturing wage bill relationship is the sum of locally weighted national hourly earnings at the two-digit SIC level. For the non-manufacturing sector, there are stochastic relationships for components of the total wage bill in each state model. The endogenous components of the wage bill are TCPU, Trade, FIRE, Services, Construction and Mining, State and Local Government, and Manufacturing. The Federal Government is exogenous

## 7.0 Residential Construction

Housing starts is one of the most complex regional variables to forecast. There are two reasons for this -- a lack of data and the nature of the industry. The data problems are legend and probably familiar to many readers. No state-by-state figures on housing starts are available, but rather only permit data. These permit data usually cover only a portion of each state, i.e., "permit issuing places." Thus, historical data on housing starts by state must be estimated from limited coverage permit data. This is an inexact process that can only be verified in Census years (1990 and 2000). The second problem is that housing starts are extremely volatile, responding rapidly to interest rates, credit availability, changes in vacancy rates, strikes, usury ceilings, weather, and other factors. Forecasting housing is analogous to forecasting the change in employment rather than the level of employment. Thus, we are forecasting a volatile series for which historical data must be estimated; our approach for dealing with these problems is summarized below.

Housing starts in permit-issuing areas are calculated by applying monthly, Census Bureau conversion rates by region to county permit data. These rates reflect the lag between the issuance of a permit and the actual housing start. Each ratio represents the proportion of permits issued in month t-i that were started in month t, where i ranges from one to 20 months prior to permit issuance. Starts-to-permits ratios for each of the four Census Regions (Northeast, North Central, West, and South) and by housing type (single-family metro, single-family nonmetro, and five or more units) are assigned to counties according to membership in a particular region. A single set of monthly rates representing a U.S. average is applied to buildings with two or four units. The application of these ratios to permit yields an initial estimate of starts. These estimates are then made consistent with published Census Bureau series on starts in permit areas by Census region.

## 8.0 Consumption and Finance

Up to this point, we have covered the parts of the model that capture the fundamental elements of the state economy: production, employment, population, and income formation. Consumption and finance do not play a central role in the Global Insight regional model for two reasons:

- Regional economies are open economies. Thus, local production is not driven by local consumption, and local capital formation is not dependent upon local financial markets.
- Regional consumption and financial data are severely limited.

Thus, the consumption and finance sectors are essentially satellite models which are driven by the economic and demographic variables described earlier, but which have few direct feedback links to the core model. A good example is retail sales. Above, we described how employment in wholesale and retail trade was related to disposable income and population, among other factors. A fair question is why retail sales have not been used in place of income as a "demand" variable. The answer is that state-level retail sales data were available for only 19 states, and the collection of this data stopped in 1996. Fortunately, in the case of the wholesale/retail employment sector, disposable personal income and retail sales are closely correlated, and little forecasting accuracy is lost by using income as an explanatory variable. We also make full use of the insights provided by the Global Insight's Consumer Service at the national level.

## 9.0 Model Structure and Forecasting Sequence

As described above, the U.S. macroeconomic forecasts and the forecasts of related services such as international, energy, agriculture and the consumer sector serve as the basic drivers for the Regional

Core forecast. These forecasts, in turn, provide the foundation for the other regional forecasting services such as Real Estate. Together, the inter-relationships provide a dynamically consistent modeling system that preserves the basic assumptions underlying each forecast. The key linkages within the Regional Core forecasting block can be traced in a straightforward manner. The basic starting point is the Export sector with 23 industries. Local employment is not usually directly affected by the export sector (except in special cases such as agriculture's effect on wholesale trade in some states), but rather is connected via current and lagged personal income.

After wages are determined for each industry group, the model calculates categories of personal income that depend upon wages or simultaneously upon income. A "residence adjustment" to income is made to account for workers who work in one state but live in another. At this point the federal income tax liabilities are calculated using effective rates of tax that vary from state to state; the rates vary primarily because of differences in per capita income and the progressive nature of the federal tax system. State and local personal taxes and fees are calculated in a similar manner. After-tax or disposable income is the result of the calculation, and is the primary explanatory factor in the non-manufacturing (local) employment equations. This closes the major simultaneous block in the state model.

Also simultaneous with employment determination is the demographic/housing block. Net migration in each state is usually determined by job growth or unemployment rates relative to the nation or to other states. State population growth by age group is then determined by adding net migration and net births to last period's population. Household formation, a key determinant of housing demand, is calculated by applying age-specific "headship rates" to population. Single family and multi-family housing starts that are forecast as a function of household formation, the stock of housing units, housing prices, income, credit conditions, and national housing trends, then are important determinants of construction employment.

The number of unemployed relative to working-age population in each state (the unemployment ratio) is explained by local employment and population growth and national unemployment patterns. This unemployment ratio, which is much more stable than published state unemployment rates, is used as an explanatory variable in many of the model's wage equations.

## 10.0 Conversion from SIC to NAICs

At the time this description was updated in October 2003, Global Insight was in the process of converting all our state and MSA economic models from an SIC basis to a NAICS basis. This process required the re-estimation of equations where personal income and employment variables are either the dependent variables, or are used as independent variables. The employment coverage was expanded to include all the NAICS "super sectors", and some important sub-sectors such as wholesale and retail trade. The number of sectors for which the wage and salary component of personal income is forecast was similarly expanded. Starting in March 2003 when the BLS 790 employment data was released in NAICs format for the first time, we prepared employment forecasts in both a NAICS and an SIC basis for our Spring and Summer 2003 forecasts. The NAICS personal income data for states that was released in the summer of 2003 contained history back only to 2001q1; in order to create the income time series needed to re-estimate our models, we created a NAICs personal income series back to 1990q1. A number of clients have requested this series since NAICs personal income data back this far is not available from the Bureau of Economic Analysis. The employment and personal income variables in our state and metro models have been forecast on a NAICS basis since the Fall 2003 forecast. The only variable that has not been converted to NAICS

is gross state product (GSP); BEA plans to release GSP data in NAICS for the first time in the Fall of 2004.

# Appendix C

Technical Description of the Woods & Poole Economics, Inc.
2007 Regional Projections and Database



Note: this file does not have the highlighting, emphasized text, tables, graphs, and charts included in the printed chapter. Therefore some of the text included in this file may be out of context. It is important to refer to the printed chapter that is was enclosed with this CD-ROM, or pdf file on this CD-ROM, for a more complete description of the data sources, data definitions and projection methods.

## Introduction

The Woods & Poole Economics, Inc. database contains more than 900 economic and demographic variables for every county in the United States for every year from 1970 to 2030. This comprehensive database includes detailed population data by age, sex, and race; employment and earnings by major industry; personal income by source of income; retail sales by kind of business; and data on the number of households, their size, and their income. All of these variables are projected for each year through 2030. In total, there are over 180 million statistics in the regional database. The regional model that produces the projection component of this database was developed by Woods & Poole. The regional projection methods are revised somewhat year to year to reflect new computational techniques and new sources of regional economic and demographic information. Each year, a new projection is produced based on an updated historical database and revised assumptions.

The fact that the proprietary Woods & Poole economic and demographic projections rely on a very detailed database, makes them one of the most comprehensive county-level projections available. A description of some characteristics of the database and projection model is contained in this chapter.

## Overview of the Projection Methods

The strength of Woods & Poole's economic and demographic projections stems from the comprehensive historical county database and the integrated nature of the projection model. The projection for each county in the United States is done simultaneously so that changes in one county will affect growth or decline in other counties. For example, growth in employment and population in Houston will affect growth in other metropolitan areas, such as Cleveland. This reflects the flow of economic activity around the country as new industries emerge or relocate in growing areas and as people migrate, in part because of job opportunities. The county projections are developed within the framework of the United States projection made by Woods &

Poole. The U.S. projection is the control total for the 2007 regional projections and is described in the "Overview of the 2007 Projections" chapter included in Woods & Poole publications.

The regional projection technique used by Woods & Poole - linking the counties together to capture regional flows and constraining the results to a previously determined United States total - avoids a common pitfall in regional projections. Regional projections are sometimes made for a city or county without regard for potential growth in surrounding areas or other areas in the country. Such projections may be simple extrapolations of recent historical trends and, as a result, may be too optimistic or pessimistic. If these county projections were added together, the total might differ considerably from any conceivable national forecast scenario; this is the result of each regional projection being generated independently without interactive procedures and without being integrated into a consistent national projection.

The methods used by Woods & Poole to generate the county projections proceed in four stages. First, forecasts to 2030 of total United States personal income, earnings by industry, employment by industry, population, inflation, and other variables are made. Second, the country is divided into 179 Economic Areas (EAs) as defined by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). The EAs are aggregates of contiguous counties that attempt to measure cohesive economic regions in the United States (a list of all EAs and their component counties can be found in Appendix 6 following this chapter); in the 2007 Woods & Poole model, EA definitions released by the BEA in May 2007 are used. For each EA, a projection is made for employment, using an "export-base" approach; in some cases, the employment projections are adjusted to reflect the results of individual EA models or exogenous information about the EA economy. The employment projection for each EA is then used to estimate earnings in each EA. The employment and earnings projections then become the principal explanatory variables used to estimate population and number of households in each EA.

The third stage is to project population by age, sex, and race for each EA on the basis of net migration rates projected from employment opportunities. For stages two and three, the U.S. projection is the control total for the EA projections. The fourth stage replicates stages two and three except that it is performed at the county level, using the EAs as the control total for the county projections.

## The "Export-Base" Approach

The specific economic projection technique used by Woods & Poole to generate the employment, earnings, and income estimates for each county in the United States generally follow a standard economic "export-base" approach. This relatively simple approach to regional employment projections is one that has been used by a number of researchers (see [5] and [9]). Although this approach has been criticized by several empirical studies (e.g., [8]), given the availability of regional data it remains one of the most feasible methodologies.

Certain industrial sectors at the regional level are considered

"basic." This means that these sectors produce output that is not consumed locally but is "exported" out of the region for national or international consumption. This assumption allows these sectors to be linked closely to the national economy, and hence follow national trends in productivity and output growth. Normally, the "basic" sectors are mining, agriculture, manufacturing, and the Federal government. In contrast, "non-basic" sectors are those such as retail trade, transportation, communication, and construction, the output of which is usually consumed locally. The growth of the "non-basic" sectors depends largely on the growth of the "basic" sectors that form the basis of the region's economy.

Intuitively, this approach has great appeal and there are numerous examples that seem to support the "export-base" theory. Automobile production in Detroit, for instance, is obviously much more sensitive to national and international price and demand for transportation equipment than to local demand. In Texas, oil and natural gas exploration and production are tied closely to the worldwide demand and supply of petroleum resources and not tied primarily to energy consumption in Texas.

Although the theory is appealing, some shortcomings do exist in the "export-base" approach. For example, some "basic" commodities produced locally are consumed locally. Producers of durable equipment used in other manufacturing processes are often affected not by the national demand for their product but by the regional demand. Machine tool makers that supply the local automobile industry in Detroit will prosper to the extent Detroit's automobile producers prosper. In Houston, the strength of the local oil industry will affect the demand and production of equipment for oil and natural gas production and exploration. In both of these instances, some durable manufacturing industries exist to serve local, not national, markets.

However, despite the shortcomings, the availability of relatively clean data for sub-national geographic areas makes the "export-base" approach very useful. The analytical framework for projections using the "export-base" approach entails estimating either demand equations or calculating historical growth rate differentials for output by sector. The principal explanatory variable, or the comparative data series for growth rate differentials, is the national demand for the output of that sector. Employment-by-sector data are often used as a surrogate variable since county output-by-sector data are not available; employment-by-sector data is used by Woods & Poole. Earnings projections are then obtained by using earnings-per-employee data either estimated as part of the model or imposed exogenously on the system. The complementary relationship could also be estimated, i.e., using an earnings forecast to derive employment based on earnings-per-employee data; this procedure has been used previously in some Woods & Poole regional models.

A modification of the "export-base" approach is used by Woods & Poole to account for regional variants to normal "basic"/"non-basic" industry definitions. Some "non-basic" sectors can be more appropriately modeled as "basic" sectors in certain regional economies. The finance sector or wholesale trade sector in New York City, for example, and the service sector in Las Vegas, are cases in which traditionally "non-basic" sectors are really "basic." New York is a worldwide

financial and trade center and thus "exports" these services outside of the region; Las Vegas, as a vacation and entertainment center, similarly "exports" the output of its service sector to other parts of the country. Activity in these sectors, in these specific geographic areas, is therefore linked more closely to the performance of these same sectors in the surrounding regions and the nation as a whole than to the other "basic" industries in the region.

A list of Economic Areas that have traditionally "non-basic" sectors modeled as "basic" sectors is presented in Table 1. Areas with "non-basic" sectors modeled as "basic" are those areas with a proportion of "non-basic" sector employment relative to total employment greater than 1.5 standard deviations above the national mean for a specific sector. With the exception of two sectors that are always considered "non-basic," construction and state and local government, all "non-basic" sectors are evaluated for each EA using this method (see [5]).

Table 1. Economic Area "Non-Basic" Sectors Considered as "Basic" in the 2007 Woods & Poole Regional Model

Transportation
- Anchorage, AK
- Atlanta-Sandy Springs-Gainesville, GA-AL
- Bismarck, ND
- Casper, WY
- Duluth, MN-WI
- Farmington, NM
- Joplin, MO
- Kansas City-Overland Park-Kansas City, MO-KS
- Memphis, TN-MS-AR
- New Orleans-Metairie-Bogalusa, LA
- Omaha-Council Bluffs-Fremont, NE-IA
- Scotts Bluff, NE

Wholesale Trade
- Atlanta-Sandy Springs-Gainesville, GA-AL
- Charlotte-Gastonia-Salisbury, NC-SC
- Chicago-Naperville-Michigan City, IL-IN-WI
- Dallas-Fort Worth, TX
- Fargo-Wahpeton, ND-MN
- Houston-Baytown-Huntsville, TX
- Idaho Falls-Blackfoot, ID
- Kansas City-Overland Park-Kansas City, MO-KS
- Memphis, TN-MS-AR
- Miami-Fort Lauderdale-Miami Beach, FL
- New Orleans-Metairie-Bogalusa, LA
- New York-Newark-Bridgeport, NY-NJ-CT-PA
- Omaha-Council Bluffs-Fremont, NE-IA
- Wenatchee, WA

Retail Trade
- Alpena, MI
- Dover, DE
- Eugene-Springfield, OR
- Farmington, NM

Flagstaff, AZ
Marinette, WI-MI
Mcallen-Edinburg-Pharr, TX
Missoula, MT
Myrtle Beach-Conway-Georgetown, SC
Orlando-The Villages, FL
Panama City-Lynn Haven, FL
Pueblo, CO
Sarasota-Bradenton-Venice, FL
Tampa-St. Petersburg-Clearwater, FL
Traverse City, MI

Finance, Insurance & Real Estate
Austin-Round Rock, TX
Chicago-Naperville-Michigan City, IL-IN-WI
Dallas-Fort Worth, TX
Denver-Aurora-Boulder, CO
Des Moines-Newton-Pella, IA
Hartford-West Hartford-Willimantic, CT
Honolulu, HI
Jacksonville, FL
Los Angeles-Long Beach-Riverside, CA
Miami-Fort Lauderdale-Miami Beach, FL
New York-Newark-Bridgeport, NY-NJ-CT-PA
Phoenix-Mesa-Scottsdale, AZ
Richmond, VA
San Jose-San Francisco-Oakland, CA
Sarasota-Bradenton-Venice, FL
Tampa-St. Petersburg-Clearwater, FL

Services
Albuquerque, NM
Boston-Worcester-Manchester, MA-NH
Flagstaff, AZ
Las Vegas-Paradise-Pahrump, NV
Los Angeles-Long Beach-Riverside, CA
Miami-Fort Lauderdale-Miami Beach, FL
New York-Newark-Bridgeport, NY-NJ-CT-PA
Orlando-The Villages, FL
Philadelphia-Camden-Vineland, PA-NJ-DE-MD
Reno-Sparks, NV
San Jose-San Francisco-Oakland, CA
Santa Fe-Espanola, NM
Sarasota-Bradenton-Venice, FL
Tampa-St. Petersburg-Clearwater, FL
Washington-Baltimore-Northern Virginia, DC-MD-VA-WV

Federal Civilian
Anchorage, AK
Charleston-North Charleston, SC
El Paso, TX
Flagstaff, AZ
Gulfport-Biloxi-Pascagoula, MS
Honolulu, HI
Huntsville-Decatur, AL
Macon-Warner Robins-Fort Valley, GA
Pensacola-Ferry Pass-Brent, FL

San Antonio, TX
Texarkana, TX-Texarkana, AR
Virginia Beach-Norfolk-Newport News, VA-NC
Washington-Baltimore-Northern Virginia, DC-MD-VA-WV

In addition to following an "export-base" approach, Woods & Poole uses exogenous information about EA economies as well as some individual EA models to make projections. Although almost all EAs are not modeled individually, since most are assumed to fit a normative structure, certain EAs that have interesting features can be modeled separately. Areas that have had rapid growth (such as Houston) or severe economic recessions as in some heavy-industry EAs (such as Cleveland) lend themselves to individual models. These regional economies, at least in part, can be modeled separately. This is a simple "bottom-up" approach that can take into account the idiosyncrasies of individual areas (see [2], [3], [7]).

An example of the "bottom-up" approach is shown with the equations for Cleveland, Houston, Sioux City IA, and Seattle, presented in Table 2. The Cleveland-Akron-Elyria OH-PA Economic Area is defined as Ashland, Ashtabula, Carroll, Columbiana, Crawford, Cuyahoga, Erie, Geauga, Harrison, Holmes, Huron, Lake, Lorain, Mahoning, Medina, Portage, Richland, Stark, Summit, Trumbull, Tuscarawas, and Wayne counties in Ohio; and Mercer county in Pennsylvania. The Houston-Baytown-Huntsville TX Economic Area is defined as Angelina, Austin, Brazoria, Brazos, Burleson, Calhoun, Chambers, Colorado, DeWitt, Fayette, Fort Bend, Galveston, Goliad, Grimes, Harris, Houston, Jackson, Lavaca, Leon, Liberty, Madison, Matagorda, Montgomery, Nacogdoches, Polk, Robertson, Sabine, San Augustine, San Jacinto, Shelby, Trinity, Victoria, Walker, Waller, Washington, and Wharton counties. The Sioux City IA-NE-SD Economic Area is defined as Monona, O'Brien, Osceloa, Plymouth, Sioux, and Woodbury counties in Iowa; Antelope, Boyd, Cedar, Dakota, Dixon, Holt, Knox, Madison, Pierce, Stanton, Thurston, Wayne, and Wheeler counties in Nebraska; and Bon Homme, Clay, Union and Yankton counties in South Dakota. The Seattle-Tacoma-Olympia WA Economic Area is defined as Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Kittitas, Lewis, Mason, Pacific, Pierce, San Juan, Skagit, Snohomish, Thurston, and Whatcom counties.

The following discussion of these equations illustrates some of the logic and assumptions that go into the Woods & Poole model. The historical data used in the model equations is defined and explained in a later section of this chapter. Figure 1 illustrates graphically the degree of fit for several of the equations.

In equation (1) Cleveland manufacturing employment is a function of total U.S. manufacturing employment, the wages of Cleveland manufacturing workers relative to manufacturing workers for the U.S. as a whole, and a lagged dependent variable. All the coefficients are significant at a 95% confidence level, and together clearly explain historical manufacturing in Cleveland. It is interesting to note that the coefficient for relative wages is significant and negative. The ratio of earnings per manufacturing worker in Cleveland to U.S. earnings per manufacturing worker (this is the definition of relative wages) historically has always been greater than one, with a mean of

1.12 for the period 1969 to 2003. Relatively high wages explain, in part, the decline in manufacturing employment in areas such as Cleveland. Faced with relatively high wages, manufacturers have an incentive to increase the productivity of existing plants and save labor, move plants to other areas where wages are lower, or close plants permanently because of competition from other facilities able to produce the same goods more efficiently.

Equation (2) explains Houston manufacturing employment as a function of total U.S. mining earnings times a dummy variable for the years 1971 to 1985, U.S. manufacturing earnings, and a lagged dependent variable. U.S. mining earnings measures the expansion of domestic mining activity as oil and natural gas prices increased during the 1970s. Historically the largest manufacturing sectors in the Houston Economic Area were the production of equipment used in the exploration and extraction of petroleum resources and the production of refined fuels and chemicals from oil; both of these manufacturing sectors were dependent on the output of the mining sector for the U.S. as a whole. As the price of oil increased during the 1970s, demand for new extraction and exploration increased. Similarly, as prices fell in the 1980s, demand for new exploration waned. Both of these phenomena have affected Houston's manufacturing employment base.

Equation (3) measures Houston mining employment as a function of U.S. mining earnings and the dependent variable lagged one year. Mining employment in Houston, another "basic" sector, depends on total demand for domestic mining output. As the price of oil rises, marginal U.S. reserves, which are relatively more expensive to produce or refine, become competitive, and Houston (and U.S.) production increases. In addition, increased mining revenues allow more capital to be used in the production of oil when prices are high. When prices are low, Houston (and U.S.) production declines and imports generally rise.

In equation (4) Sioux City IA farm employment is a function of U.S. farm employment, the dependent variable lagged one year, and an intercept term. Farming, the largest "basic" sector in Sioux City, has experienced significant employment declines in recent years. Sioux City farm employment is related to U.S. farm employment in this equation because the reasons for job losses in Sioux City are related to nationwide changes in agriculture. In every decade this century, farm employment in the U.S. has declined as farm productivity has increased. The experience of Sioux City is like that of most other farming areas: employment has declined as output has remained steady or increased. The national projections of agricultural productivity growth are important to expected farm employment in Sioux City.

Equation (5) explains Sioux "non-basic" employment as a function of Sioux City "basic" employment, the dependent variable lagged one year, and an intercept term. This equation illustrates the relationship between "basic" employment losses and subsequent "non-basic" employment losses. As the population declined in Sioux City, so did "non-basic" employment.

In equation (6) Seattle manufacturing employment is a function of an intercept term, the U.S. unemployment rate, a dummy variable for 1970 to 1972, and a lagged dependent variable. The largest manufacturing sectors in Seattle - aircraft, lumber, and wood products - are

sensitive to U.S. business cycles. U.S. business cycles are measured by the civilian unemployment rate, which has a negative coefficient in equation (6). The negative coefficient of the dummy variable for 1970 to 1972 adjusts the specification of the equation for the severe regional recession during that time.

Equation (7) explains Seattle "non-basic" employment as a function of an intercept term, Seattle population, a dummy variable for the 1970-72 regional recession, and the U.S. unemployment rate. The unemployment rate measures the sensitivity of Seattle employment to U.S. business cycles. "Non-basic" employment is also a function of the population of the region; as the population of Seattle has grown, the demand for "non-basic" sector employment has also increased. It is interesting that population is contemporaneous with the dependent variable, "non-basic" employment, in equation (7) but lagged in equation (5). In rapidly growing areas, such as Seattle, population increases have an immediate effect on employment growth in "non-basic" industries. In some very rapidly growing areas of Texas in the late 1970s, population growth actually preceded "non-basic" employment growth. This is analogous to "boom towns" of the Old West as the economy catches up to the demand created by the new population growth and new businesses locate in the fast-growing area. However, in areas losing population, "non-basic" employment does not decline in step with population losses. Many "non-basic" businesses in a declining area will hang on as long as possible in anticipation of an upturn in the region's economy. This reflects the local nature of most "non-basic" businesses and the desire of firms to protect their capital investment in a specific site.

## The Demographic Model

The demographic portion of the regional model follows a traditional cohort-component analysis based on calculated fertility and mortality in each county or EA. The "demand" for total population is estimated from the economic model: if the demand for labor is forecast to rise for a particular county or EA, then either the labor force participation rate will rise or population in-migration will be positive. The inverse is true for counties and EAs with projected declines in employment. Therefore, future EA and county migration patterns for population by age, sex, and race are based on employment opportunities. Individuals and families are assumed to migrate, at least in part, in response to employment opportunities (see [1], [4], and [6]) with two exceptions: for population aged 65 and over and for college or military-aged population, migration patterns over the forecast period are based on historical net migration and not economic conditions. The integration of economic and demographic regional analysis is a significant strength of the Woods & Poole approach.

The age, sex, and race distribution of the population is projected by aging the population by single year of age by sex and by race for each year through 2030 based on county or EA specific mortality, fertility, and migration rates estimated from historical data. In the Woods & Poole model, projected net mortality and migration are estimated based on the historical net change in population by age, race, and sex for a particular county or EA. Similarly, projected net births and migration of age zero population by race are estimated based on the historical

change in age zero population by race per female population age 15 to 44 by race for a particular county or EA.

The United States population by age, sex, and race projections, 2007-2030, are based on Bureau of the Census population estimates for 2000 through 2006. Woods & Poole forecasts these U.S. estimates with a cohort-component model based on the year to year change in U.S. population by single year of age, race, and sex. Forecast fertility, mortality, and international migration are estimated from the Census population estimates and are applied exogenously to the Woods & Poole U.S. projections. Woods & Poole produces only a "middle" U.S. population forecast - this forecast is similar to the Census "middle" forecast scenario for the U.S. population. The U.S. population by age, sex, and race forecast is the control total for the EA projections. Each EA projection serves as the control totals for the county projections.

## The Accuracy of the Projections

Unlike other sciences, economics and demographics cannot rely on experimentation to test theories and verify hypotheses. Rather, historical data are analyzed and theories are developed that explain the historical data. The resulting models are then used to make a projection. Woods & Poole projections, like all economic and demographic projections, utilizes this approach: analyzing historical data to make estimates of future data. There are, of course, inherent limitations to projections, and the Woods & Poole projections should never be interpreted as an infallible prediction of the future; future data may differ significantly from Woods & Poole projections and Woods & Poole does not guarantee the accuracy of the projections. In all Woods & Poole publications, the word "forecast" is used as a synonym for "projection" and refers to Woods & Poole estimated data for any year from 2006 to 2030 (2007 to 2030 for population); in Woods & Poole publications "projections", or "forecasts", both mean estimates of future data (2006 to 2030, or 2007 to 2030 for population).

One key limitation to all projections, and Woods & Poole projections in particular, is that the future is never known with any certainty. The model on which the projections are based may not accurately reflect future events. In addition, there is always the possibility of an unanticipated shock to the economy, or of some other event that was not foreseen based on an analysis of historical data. For instance, a local government may enact a new industrial policy that has an unexpected, beneficial effect on employment growth. Or an abrupt economic change, although anticipated, may occur with much greater intensity or in a shorter time period than expected. For example, the projection may assume an increase in the price of a commodity, such as oil, over a five-year period, but an embargo may raise the price to that level in only one year. In addition, the projections may not be accurate because historical data is revised; or because the projection model does not accurately reflect demographic or economic phenomena; or because the projections contain errors; or because the smooth growth path of the long-term projections inaccurately reflects important variance in economic or demographic growth for particular regions; or because assumptions about national or regional growth, upon which the projections are based, turn out to be incorrect. There

are many other types of economic and demographic events that could create outcomes far different from Woods & Poole's projections.

Another limitation results from doing forecasts for small geographic areas for small data series. Statistically, models are more reliable the larger the area and/or the series being studied. Small area forecasts, such as county population for White men age 84, are subject to more error because of the small sample size. This error can be reduced, although never eliminated, by constraining the small area forecasts to the forecast totals for a larger area or series; this is the method used by Woods & Poole.

One way to evaluate the effectiveness of a projection method is to compare previous projections to current data; although such a comparison does not indicate the potential accuracy of current or future projections, it can be useful to measure the magnitude of error of previous projections. Table 3 illustrates how well Woods & Poole regional models projected employment, population, and personal income over a 1-year to 10-year forecast horizon for various geographies.

One statistic used to evaluate the projections is the Average Absolute Percent Error (AAPE), which is the average of the absolute values of the percent difference from the projected data to the actual data. The lower the AAPE, the more accurate the projection (e.g., Woods & Poole's 3-year population projections have been accurate within +/-1.8% for states and +/-3.2% for counties). All Woods & Poole projections are evaluated for each projection horizon; thus, the AAPE for 1-year projections is calculated based on all Woods & Poole one-year projections (there have been twenty 1-year projections and eleven 10-year projections). Changes to historical data are not adjusted when calculating the AAPEs. Thus, if a projection was made using historical data that were subsequently revised, the AAPE is calculated based on the revised data, probably inflating the AAPE, particularly for short-term projections. For example, projections of 1993 employment done in 1984 were made using a different definition of employment; in the 1984 forecast, U.S. total employment in 1980 was estimated to be 106.4 million jobs. However, since then, the definition of employment has been revised several times by the Department of Commerce and now U.S. total employment in 1980 is estimated to be 114.2 million jobs; therefore, the AAPEs are calculated based on revised data so they incorporate not only forecast error but definitional changes as well, probably inflating the AAPEs.

The longer the forecast horizon, the larger the AAPE. Thus for all Metropolitan Statistical Areas (MSAs), 1-year population projections have been accurate within +/-1.2% compared to +/-6.3% for the 10-year projection. In addition, population projections, the most stable series and the data least subject to historical revision, have the lowest AAPEs.

Personal income has the highest AAPE for all geographies because, in addition to projecting the level of personal income, there is an implicit price inflation forecast built into the income projections. In the early 1980s after a period of rapid inflation, the Woods & Poole personal income projections had relatively high AAPEs (the 10-year personal income forecast had an AAPE of +/-17.1% for counties). As inflation mitigated in the 1980s, the AAPEs for personal income dropped

sharply; the 5-year AAPE dropped to +/-10.0% for counties.

Generally, the smaller the geography, the larger the AAPEs for all variables. For all counties, the AAPE for 8-year population projections was +/-7.5%. However, for counties with population under 50,000 in 2000, the 8-year projection AAPE was +/-8.1%. Similarly, for larger geographies, the AAPEs are usually lower. The AAPE for counties with 2000 population between 50,000 and 100,000 was +/-6.4%; for counties with population over 100,000 the AAPE was +/-6.1%. AAPEs for smaller variables tend to be higher than AAPEs for larger variables. Thus, the AAPE for retail trade employment would probably be higher than the AAPE for total employment, holding geographic area size and forecast horizon constant.

The accuracy of Woods & Poole's projections has been comparable to the accuracy of other regional forecasting programs. Figure 2 compares Woods & Poole's projections to Department of Commerce Bureau of Economic Analysis (BEA) and Census Bureau projections over comparable forecast horizons. The Woods & Poole 8-year forecast AAPEs for states for the year 1990 for employment and personal income were slightly below the BEA AAPEs, and slightly above the BEA for population. Similarly, the Woods & Poole 1-year to 3-year population projections AAPE for states were slightly below the Census AAPEs while the 4-year and 5-year Woods & Poole state population projection AAPEs were slightly above Census AAPEs.

Other statistics are sometimes used to evaluate forecasts. The AAPE is most commonly used as a measure of accuracy for projections when the units being compared are of different sizes (e.g., county population, the base of which can range from 100 for Loving, TX to 8 million for Los Angeles, CA). It has the advantage of being able to compare units of different sizes equally. In some models, the Root Mean Squared Error (RMSE) is used to measure accuracy. The RMSE has the disadvantage of giving modest errors for large units a greater weight than modest errors for small units (i.e., an error of 10,000 on a base of 2 million is given greater weight than an error of 1,000 on a base of 20,000, just the opposite of the AAPE).

Another useful statistic in evaluating forecasts is the simple average of all the percent errors: the Average Percent Error (APE). This measures the bias of the forecast. In Woods & Poole projections, employment for counties have always had a downward bias (the APE has been negative). The APE for all 5-year Woods & Poole county employment projections is -2.0% with a standard deviation of 12.2% (see Table 3). In contrast, the county population projections have always had an upward bias (the APE has been positive). The APE for all 5-year Woods & Poole county population projections is +0.2% with a standard deviation of 7.3%.

## Historical Data

Much of the historical economic data in the Woods & Poole regional databases are obtained from the Bureau of Economic Analysis (BEA) of the Department of Commerce. The historical data from the BEA include county-level data for each year 1969 through 2005 for employment by one-digit Standard Industrial Classification (SIC) code, earnings by

one-digit SIC code, and personal income by source of income. Other sources of data include the 1970, 1980, 1990, and 2000 Censuses and post-Censal reports for population and household data, and the quinquennial Census of Retail Trade for retail sales data. Woods & Poole generally accepts the government data as given unless indicated otherwise in this chapter. The discussion which follows, of the historical data used by Woods & Poole, is not intended to be a complete explanation of the historical data; the user should consult the government sources of the historical data for a complete explanation. Some of the sources of government data used by Woods & Poole have technical explanations of how the historical data is collected, how the data can be used, and limitations to the data; the documentation may contain important information on the applicability of the data for particular applications and should be reviewed by users of the historical data; the documentation can be obtained from the U.S. Dept. of Commerce, the Government Printing Office or many public libraries. All data for the years 2006-2030 (2007-2030 for population) are projected by Woods & Poole.

Historical data are subject to revision from time to time. Historical employment and income data from the Bureau of Economic Analysis are revised on a regular basis. For example, historical data released by the Bureau of Economic Analysis in 1984 showed total employment for the United States in 1980 to be 106.4 million jobs; the current estimate of 1980 U.S. total employment is 114.2 million jobs. When using the historical data, it is important to use the current revision and not combine this data with previous versions since there may be definitional changes in the data.

## Gross Regional Product

Gross Regional Product (GRP) is historical for the United States total, regions, and states for the years 1969-2006 from the Bureau of Economic Analysis. All county, and metropolitan area, historical GRP data, 1969-2006, is estimated by Woods & Poole by allocating state GRP in a particular year to counties within the state based on the proportion of total state earnings of employees originating in a particular county. County GRP estimates are constrained to state totals for the years 1969-2006. All GRP data is establishment based.

## Employment

The employment data in the Woods & Poole database are a complete measure of the number of full- and part-time jobs by place of work. Historical data, 1969-2005, are from the U.S. Department of Commerce, Bureau of Economic Analysis. The employment data include wage and salary workers, proprietors, private household employees, and miscellaneous workers. Wage and salary employment data are based on an establishment survey in which employers are asked the number of full- and part-time workers at a given establishment. Because part-time workers are included, a person holding two part-time jobs would be counted twice. Also, since the wage and salary employment data are based on an establishment survey, jobs are counted by place of work and not place of residence of the worker; thus, a job in the New York Metropolitan Area is counted in the New York Metropolitan Area

regardless of where the worker lives.

Data on proprietors include farm and non-farm proprietors by sector. Proprietors include not only those people who devote the majority of their time to their proprietorship, but people who devote any time at all to a proprietorship. Thus, a person who has a full-time wage and salary job and on nights and weekends runs a small business legally defined as a proprietorship would be counted twice. The employment data therefore include full- and part-time proprietors.

Private household employment data include persons employed by a household on the premises, such as full-time baby-sitters, housekeepers, gardeners, and butlers. Miscellaneous employment data include judges and all elected officials, persons working only on commission in sectors such as real estate and insurance, students employed by the colleges or universities in which they are enrolled, and unincorporated subcontractors in sectors such as construction.

The employment data used by Woods & Poole comprise the most complete definition of the number of jobs by county. Woods & Poole data may be higher than that from other sources because they measure more kinds of employment.

There are three other commonly used government sources for employment data: the Bureau of Labor Statistics (BLS), the Bureau of the Census, and the National Income and Product Accounts (NIPA). These sources of employment data differ from the data used by Woods & Poole. The BLS establishment data are generally much lower than the Woods & Poole data because agricultural workers, the military, proprietors, households, and miscellaneous employment are not included; the exclusion of proprietors from the BLS data is the most significant difference. Data from the Census (and some survey data from the BLS) are based on employment by place of residence and differ fundamentally in concept from the Woods & Poole employment data by place of work; Census employment data are generally lower than Woods & Poole data, but not always. Since Census data are based on a household survey, persons holding two jobs would be counted only once, and, therefore, the data would be lower than Woods & Poole. However, Census survey data for counties that have a large number of commuters and relatively few jobs within the county could yield employment data higher than Woods & Poole. Employment data in the National Income and Product Accounts are close to Woods & Poole data, except that part-time proprietors and certain miscellaneous employees are excluded; therefore, these data are usually lower.

## Employment by Sector

The employment data is by one-digit SIC industry. The one-digit industries are defined in the 1987 Standard Industrial Classification Manual. The employment data in the Woods & Poole 2007 database is not based on the 1997 North American Industry Classification System (NAICS) definitions. For the years 2001-2005 only the BEA provided employment industry data by NAICS rather than by SIC; Woods & Poole has estimated the SIC industry data for 2001-2005 from the BEA NAICS 2001-2005 employment industry data and the SIC employment industry data for the years 1969-2000.

As a rule, employment is classified in a given industry depending on the primary activity of the establishment. For example, employees of a large oil company are classified in many different sectors depending on the specific establishment in which they worked, even though the company as a whole would be considered a mining company: employees at a refinery are in manufacturing; employees at the company headquarters are in services; pipeline operators are in transportation; and oil field workers are in mining. If a given establishment is engaged in activities in different sectors, all employees are classified according to the primary activity of the establishment regardless of their actual occupations; thus, a secretary for a trucking company is a transportation worker and an accountant at a small plumbing company is a construction worker. The main exception to this rule is the classification of government workers in the Woods & Poole database: all government employees are classified in Federal civilian, Federal military, or state and local government employment, regardless of the usual classification of the establishment in which they work. Definitions for each sector, based on SIC industries, in the Woods & Poole database are as follows:

Farming includes all establishments such as farms, orchards, greenhouses, and nurseries primarily engaged in the production of crops, plants, vines, trees (excluding forestry operations), and specialties such as sod, bulbs, and flower seed. It also includes all establishments such as ranches, dairies, feedlots, egg production facilities, and poultry hatcheries primarily engaged in the keeping, grazing, or feeding of cattle, hogs, sheep, goats, poultry of all kinds, and special animals such as horses, bees, pets, and fish in captivity.

Agricultural services, forestry, fisheries, and other includes establishments primarily engaged in performing soil preparation, crop services, veterinary services, farm labor and management, and horticultural services. Forestry includes establishments engaged in the operation of timber tracts, tree farms, forest nurseries, and related activities such as reforestation. Fisheries include commercial fishing (including shellfish) and commercial hunting and trapping. Other includes the jobs of U.S. residents working for international organizations, foreign embassies, and consulates in the U.S.

Mining includes establishments primarily engaged in the extraction, exploration, and development of coal, oil, natural gas, metallic minerals (such as iron and copper), and nonmetallic minerals (such as stone and sand). Mining does not include refining, crushing, or otherwise preparing mining products; this activity is classified as manufacturing.

Construction includes establishments engaged in building new structures and roads, alterations, additions, reconstruction, installations, and repairs. It includes general contractors engaged in building residential and nonresidential structures; contractors engaged in heavy construction, such as bridges, roads, tunnels, and pipelines; and special trade contracting, such as plumbing, electrical work, masonry, and carpentry. Employment is counted at the fixed place of business where establishment-type records are maintained and not at the job site. Establishments engaged in managing construction projects are

classified under services. Establishments engaged in the selling and installation of construction materials are generally classified under trade, except for materials such as installed elevators and sprinkler systems. The installation of prefabricated building materials is included in construction.

Manufacturing includes establishments engaged in the mechanical or chemical transformation of materials or substances into new products. Included in manufacturing are establishments engaged in assembling component parts not associated with structures and those engaged in blending materials, such as lubricating oils or liquor. Broadly defined, manufacturing industries include the following: food processing, such as canning, baking, meat processing, and beverages; tobacco products; textile mill products, such as fabric, carpets and rugs; apparel; wood products, including logging, sawmills, prefabricated homes, and mobile homes; furniture; paper; printing and publishing; chemicals, such as plastics, paints, and drugs; petroleum refining; rubber and plastics; leather products; stone, clay, and glass; primary metals, such as steel, copper, aluminum, and including finished products such as wire, beams, and pipe; fabricated metals, such as cans, sheet metal, cutlery, and ordnance; industrial machinery, including computers, office equipment, and engines; electronics and electrical equipment; transportation equipment, such as cars, trucks, ships, and airplanes; instruments; and miscellaneous industries, such as jewelry, musical instruments, and toys.

Transportation, communications, and public utilities includes establishments providing, to the general public or to other business enterprises, passenger and freight transportation, communications services, electricity, gas, steam, water, or sanitation services, and the Postal Service. Transportation includes railroads, highway passenger transportation, trucking and warehousing, shipping, air transportation, pipelines, and transportation services such as travel agencies and tours. Communications includes point-to-point telephone and telegraph services, radio, television, and cable broadcasting. Sanitary services includes water supply and trash removal.

Wholesale trade includes establishments primarily engaged in selling merchandise to retailers; or to industrial, commercial, institutional, farm, construction contractors; or to professional business users; or to other wholesalers or brokers. The merchandise sold by wholesalers includes all goods used by institutions, such as schools and hospitals, as well as virtually all goods sold at the retail level. The three main types of wholesalers are merchant wholesalers who purchase goods from manufacturers or other wholesalers and sell them; sales branches of manufacturing, mining, or farm companies engaged in marketing the products of the company to retail establishments; and agents, merchandise or commodity brokers, and commission merchants.

Retail trade includes establishments engaged in selling merchandise for personal or household consumption and rendering services incidental to the sale of goods. Buying goods for resale to the consumer is a characteristic of retail trade establishments that distinguishes them from agricultural and extractive industries: farmers who sell only their own produce at or from the point of production are not classified as retailers. Retail establishments include hardware stores, garden supply stores, and mobile home dealers; department stores; food

stores, including supermarkets, convenience stores, butchers, bakeries, and fruit stands; automobile dealers; gasoline service stations; apparel and accessory stores; furniture and home furnishing stores, including electronics and home appliances; eating and drinking places, including restaurants, bars, and take-out stands; and miscellaneous establishments, including drug stores, liquor stores, thrift shops, bookstores, florists, mail-order houses, and pet stores.

Finance, insurance, and real estate includes the following establishments: depository institutions, such as commercial banks, savings and loans, and foreign banks; credit institutions; holding companies not engaged in operation; investment companies; brokers and dealers in securities and commodity contracts; security and commodity exchanges; carriers of all types of insurance; insurance agents and insurance brokers; real estate operators including operators of nonresidential facilities, apartments, other residential properties, mobile home parks, and railroad properties; real estate agents and managers; title offices; and developers not engaged in construction.

Services includes establishments primarily engaged in providing services for individuals, businesses, governments, and other organizations. Service industries include the following: hotels and other lodging places; personal services, such as laundries, dry cleaners, barber shops, shoe repair, and funeral homes; business services, such as advertising, employment agencies, office equipment repair, computer and data processing, credit reporting and collecting; automobile repair and automobile services, including car washes and car rental; motion pictures, including video rentals; entertainment, including theaters, casinos, amusement parks, and professional sports; health services, such as hospitals, clinics, nursing homes, and dentists; legal services; education services, such as private elementary and secondary schools, colleges, junior colleges, universities, and vocational schools; social services provided in privately owned establishments; private museums and zoos; membership organizations, including churches, labor unions, professional membership organizations, and political organizations; professional services, such as engineering, architecture, accounting, research services, and public relations; and private household employment, such as full-time baby-sitters, housekeepers, and butlers employed by a household on the premises.

Federal civilian includes all Federal government workers regardless of their establishment classification. Federal civilian employment includes executive offices and legislative bodies; courts; public order and safety; correctional institutions; taxation; administration and delivery of human resource programs, such as health, education, and public assistance services; housing and urban development programs; environmental programs; regulators, including air traffic controllers and public service commissions; and other Federal government agencies.

Federal military includes Air Force, Army, Marine Corps, National Guard, and Navy. In the Woods & Poole database, only personnel stationed in Alaska, Hawaii, and the continental U.S. are counted in employment and earnings. Civilians working on a military base are classified in the sector appropriate to their occupation.

State and local government is defined the same as Federal civilian except that the activities are run by state and local governments. At the local level, this includes all public schools as well as police and fire departments; at the state level, it includes all public junior colleges, colleges, and universities.

## Earnings

Earnings of employees is the sum of wages and salaries, other labor income, and proprietors' income. Earnings also includes personal contributions for social insurance, but does not include residence adjustment; each of these components is defined in the discussion of total personal income that follows. As with employment, the historical earnings data (1969-2005) are from the U.S. Department of Commerce, Bureau of Economic Analysis. Also, like employment, earnings data are by place of work, so that earnings of an employee who works in one county but resides in another are counted in the county where the job is.

The one-digit SIC sectors for earnings are defined the same as for employment in the preceding section. The earnings data is by one-digit SIC industry and the one-digit industries are defined in the 1987 Standard Industrial Classification Manual. As with employment, the earnings data in the Woods & Poole 2007 database is not based on the 1997 North American Industry Classification System (NAICS) definitions. For the years 2001-2005 only the BEA provided earnings industry data by NAICS rather than by SIC; Woods & Poole has estimated the SIC industry data for 2001-2005 from the BEA NAICS 2001-2005 earnings industry data and the SIC earnings industry data for the years 1969-2000.

Earnings relates to workers' compensation and is not a measure of company earnings or profits. Earnings-by-sector data are sometimes used as a surrogate variable for output by sector at the regional level where output data are not generally available.

## Personal Income

The historical data (1969-2005) for total personal income are from the U.S. Department of Commerce, Bureau of Economic Analysis. Total personal income is the income received by persons from all sources, that is, from participation in production, from both government and business transfer payments, and from government interest, which is treated like a transfer payment. Persons consist of individuals, nonprofit institutions serving individuals, private uninsured welfare funds, and private trust funds. Personal income is the sum of wages and salaries, other labor income, proprietors' income, rental income of persons, dividend income, personal interest income, and transfer payments less personal contributions for social insurance. Definitions for the sources of personal income follow:

Wages and salaries consists of monetary remuneration of employees, including compensation of corporate officers; commissions, tips, and bonuses; and receipts-in-kind that represent income to the recipients.

Other labor income consists primarily of employer contributions to private pension and private welfare funds, including privately administered workers' compensation funds.

Proprietors' income includes inventory valuation and capital consumption adjustments and is defined as the income, including income-in-kind, of proprietorships and partnerships, and of tax-exempt cooperatives. Inventory valuation adjustment is the difference between the cost of inventory withdrawals as valued in determining profits before tax, and the cost of withdrawals valued at current replacement costs. Capital consumption adjustment is depreciation and damage to a proprietor's fixed capital less the value of the current services of the fixed capital assets owned by and used by the proprietor.

Dividend income is the dividend income of persons from all sources. Rental income of persons is the income of persons from the rental of real property, except the income of persons primarily engaged in the real estate business; the imputed net rental income of owner-occupants of nonfarm dwellings; and the royalties received by persons from patents, copyrights, and rights to natural resources. Rental income also includes a capital consumption adjustment as defined under proprietors' income. Personal interest income is the interest income of persons from all sources.

Transfer payments to persons are the income of payments to persons, generally in monetary form, for which they do not render services. It consists of business transfers such as liability payments for personal injury, corporate gifts to nonprofit institutions, and defaults by consumers on debts owed to business. Primarily, however, transfers consist of payments by the government to persons under many different programs. These programs include Social Security, Medicaid, unemployment insurance, workers' compensation, food stamps, veterans' benefits, and direct aid.

Personal contributions for social insurance include payments by employees, the self-employed, and other individuals who participate in the following programs: Social Security, supplementary medical insurance, unemployment insurance, railroad retirement insurance, government retirement, veterans life insurance, and temporary disability insurance. Personal contributions for social insurance are thus deducted in tabulating total personal income.

Residence adjustment is the net amount of personal income of persons residing in a specific geographic area but receiving the income outside that geographic area. For example, a person who earns income in one county but lives in a different county would have that income counted under residence adjustment; the county in which the person lives would have a positive residence adjustment and the county in which the person works would have a negative adjustment. Residence adjustment adjusts the earned component of personal income, which is establishment-based by place of work, to population, which is by place of residence. When total personal income is adjusted this way, personal income per capita can be calculated. Residence adjustment is a net number for a given county; if it is negative, it means that there is net commuting into the county; if it is positive, it means that there is net commuting out of the county.

As with employment, the definition of total personal income used by Woods & Poole is the most comprehensive one available. Another commonly used measure of income is money income of persons. Money income is the concept used by the Bureau of the Census and is widely used in other sources. When Woods & Poole's income data are higher than data from another source, once inflation adjustments are taken into account, it is probably because the other source uses money income base data. Total personal income includes all of money income plus the exclusions to money income. Money income excludes payments-in-kind such as food stamps, agricultural payments-in-kind, and the value of in-kind medical payments; the imputed rental value of owner-occupied housing; the imputed value of certain interest payments such as the value to consumers of free non-interest bearing checking accounts; all other labor income; capital consumption adjustments for proprietors; inventory valuation adjustments, although sometimes this is negative; and lump-sum payments such as liability judgments and consumer defaults on debts to businesses. For the U.S. as a whole, money income is about 25% less than total personal income; at the regional level, the difference varies depending on the specific composition of total personal income.

Another commonly used measure of income is disposable income, which is defined as total personal income less personal tax and non-tax payments. Disposable income is the income available to persons for spending or saving. Tax payments are payments, net of refunds, made by persons to the government; it includes taxes such as income, estate and gift, and personal property taxes, but it excludes personal contributions to social insurance. Non-tax payments include tuition and fees paid to schools and hospitals operated mainly by the government, donations to such institutions, passport fees, and fines and penalties.

## Retail Sales

Data for retail sales by kind of business are from the 1972, 1977, 1982, 1987, 1992, and 1997 Census of Retail Trade (U.S. Department of Commerce, Bureau of the Census). Retail sales data for 1997 has been changed by Woods & Poole from NAICS classifications to estimated SIC kind of business classifications to be consistent with previous Census of Retail Trade data. The intervening historical data for the years 1969-71, 1973-76, 1978-81, 1983-86, 1988-91, and 1993-96 are also estimated by Woods & Poole. These estimates are made by interpolating retail sales by kind of business per capita for the intervening years (e.g., 1973-76). These proportions are then multiplied by population for the intervening years to estimate retail sales by kind of business. The estimates are then constrained to U.S. retail sales by kind of business for the intervening years. U.S. retail sales data for 1969-1997 are from the Bureau of Economic Analysis but are revised by Woods & Poole to be consistent with the sum of the county retail sales data for the Census years. Therefore, retail sales data for the U.S. are the sum of county retail sales as published in the Census of Retail Trade and differ from the U.S. data published monthly by the Department of Commerce.

Some county data from the Census of Retail Trade are withheld because of Federal information disclosure policies. All withheld data have

been estimated by Woods & Poole; the techniques used to make these estimates are described below in the section titled "Estimation of Missing Historical Data."

Retail sales are counted, as are employment and earnings, on an establishment basis. Mail-order sales are counted at the point from which the merchandise is sent and not at the point at which it is received. Retail sales are classified by kind of business according to the principal lines of commodities sold (e.g., groceries or hardware) or the usual trade designation (e.g., drug store or cigar store). In some cases, an establishment sells goods in several different business groups, such as a convenience store with gasoline pumps. In these cases, all the establishment's sales are classified in the business group that is the primary activity of the establishment; therefore, the retail sales data by kind of business does not reflect retail sales by merchandise line. The specific kinds of business, on an SIC basis, are described as follows:

Building materials and hardware includes retail establishments primarily engaged in selling lumber and other building materials; paint, glass, and wallpaper; hardware; nursery stock; lawn and garden supplies; and mobile homes. It includes lumber and other building materials dealers, and paint, glass, and wallpaper stores selling to the general public, even if sales to contractors account for a larger proportion of total sales.

General merchandise stores includes department stores, general discount stores, variety stores, and miscellaneous general merchandise stores. These stores all sell a number of lines of merchandise, such as dry goods, apparel and accessories, furniture and home furnishings, small wares, hardware, and food in one establishment.

Food stores includes establishments primarily engaged in selling for home preparation and consumption. Food stores include grocery stores, including supermarkets and convenience stores; meat and fish markets; fruit and vegetable markets; candy, nut, and confectionery stores; dairy product stores; retail bakers; and miscellaneous stores such as health food stores and coffee and tea stores.

Automobile dealers includes establishments selling new and used cars, and trucks, boats, recreational vehicles, utility trailers, aircraft, snowmobiles, motorcycles, and mopeds. It also includes dealers selling new automobile parts and accessories as well as automobile repair shops maintained by establishments engaged in the sale of new automobiles.

Gasoline service stations includes establishments primarily selling gasoline and automotive lubricants. These establishments frequently sell other merchandise, such as tires, batteries, accessories, and other automobile parts, or perform minor repair work. Establishments called garages but deriving more than half of their receipts from the sale of gasoline and automotive lubricants are included. Gasoline stations combined with other activities such as convenience stores or car washes are classified by their primary activity as determined by sales.

Apparel and accessories includes retail stores primarily engaged in selling clothing of all kinds and related articles for personal wear

and adornment. These establishments include men's, boys', women's, and girls' clothing stores; shoe stores; specialty stores, such as lingerie and handbags; and miscellaneous stores, such as uniforms, sports apparel, and custom tailors. Establishments that meet the diversity criterion for department stores are not included.

Furniture and home furnishings stores includes establishments primarily selling furniture; floor coverings; draperies; glass and china; household appliances, such as stoves, refrigerators, and other household gas and electric appliances; radios, televisions, and electronics; computers and software; records, tapes, and compact discs; and musical instruments.

Eating and drinking places includes establishments selling prepared food and drinks for consumption on the premises; it also includes lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption. These establishments include restaurants and lunchrooms; social caterers; cafeterias; refreshment places, such as take-out hamburger and chicken stands; contract feeding, such as institutional food service; ice cream and frozen yogurt stands; and drinking places, such as bars and lounges.

Drug stores are establishments engaged in the retail sale of prescription drugs. They may carry a number of related lines, such as cosmetics, toiletries, tobacco, and novelty merchandise and may operate a soda fountain or lunch counter. These stores are classified on the basis of their usual trade designation rather than on the stricter interpretation of commodities handled. Also included are proprietary stores that are establishments generally selling the same merchandise as drug stores, except that prescriptions are not filled and sold.

Miscellaneous retail sales includes liquor stores, thrift stores, sporting goods stores, bookstores, stationery stores, jewelry stores, toy stores, camera stores, gift shops, luggage stores, fabric stores, catalog and mail-order houses, florists, tobacco stands, newsstands, and fuel oil dealers.

## Constant and Current Dollars

All earnings, personal income, and retail sales data in the Woods & Poole database are presented in 2004 dollars. These are called "constant" dollars and are used to measure the "real" change in earnings and income when inflation is taken into account. For example, it would be incorrect to assume that Americans were more than twice as wealthy in 1980 as in 1970 even though income per capita increased from $4,081 to $10,114; during those ten years the general price level increased more than 97%, and $10,114 in 1980 could not buy as much as $10,114 could in 1970. When adjusted for the rate of inflation by making income per capita "constant" in 2004 dollars, the increase from 1970 to 1980 was only 26% ($16,722 to $21,048).

In the Woods & Poole database, the personal consumption expenditure deflator is used to convert current dollars into constant dollars; the chain-type deflator, revised by the BEA in 2000, is used by Woods & Poole. The personal consumption expenditure deflator for each year from 1969 to 2030 is listed in Table 4. To convert current dollar data

to 2004 dollars, divide the current dollars by the deflator for the appropriate year in Table 4 divided by 100. To convert constant 2004 dollar data into current dollars, multiply the constant dollars by the deflator for the appropriate year in Table 4 divided by 100. The same deflator is used for the U.S. and all counties in the Woods & Poole database; hence, the rate of inflation (the percent difference year to year in the deflator) is assumed to be constant for all parts of the country.

Table 4. Personal Consumption Expenditure Deflator
(2004 = 100)

| | |
|---|---|
| 1969 | 23.30 |
| 1970 | 24.40 |
| 1971 | 25.44 |
| 1972 | 26.32 |
| 1973 | 27.76 |
| 1974 | 30.63 |
| 1975 | 33.18 |
| 1976 | 35.02 |
| 1977 | 37.29 |
| 1978 | 39.91 |
| 1979 | 43.42 |
| 1980 | 48.05 |
| 1981 | 52.34 |
| 1982 | 55.23 |
| 1983 | 57.61 |
| 1984 | 59.79 |
| 1985 | 61.76 |
| 1986 | 63.27 |
| 1987 | 65.47 |
| 1988 | 68.06 |
| 1989 | 71.03 |
| 1990 | 74.28 |
| 1991 | 76.97 |
| 1992 | 79.19 |
| 1993 | 81.02 |
| 1994 | 82.73 |
| 1995 | 84.50 |
| 1996 | 86.32 |
| 1997 | 87.77 |
| 1998 | 88.56 |
| 1999 | 90.04 |
| 2000 | 92.27 |
| 2001 | 94.21 |
| 2002 | 95.54 |
| 2003 | 97.44 |
| 2004 | 100.00 |
| 2005 | 102.88 |

| | |
|---|---|
| 2006 | 105.71 |
| 2007 | 108.69 |
| 2008 | 111.78 |
| 2009 | 115.00 |
| 2010 | 118.35 |
| 2011 | 121.85 |
| 2012 | 125.52 |
| 2013 | 129.36 |
| 2014 | 133.38 |
| 2015 | 137.60 |
| 2016 | 142.02 |
| 2017 | 146.65 |
| 2018 | 151.50 |
| 2019 | 156.59 |
| 2020 | 161.93 |
| 2021 | 167.53 |
| 2022 | 173.41 |
| 2023 | 179.59 |
| 2024 | 186.07 |
| 2025 | 192.88 |
| 2026 | 199.94 |
| 2027 | 207.26 |
| 2028 | 214.84 |
| 2029 | 222.71 |
| 2030 | 230.86 |

Note: Chain-type deflator; historical data, 1969-2006, from U.S. Dept. of Commerce; projected data, 2007-2030, from Woods & Poole Economics, Inc.

Population

The historical population data for the years 1969 to 2006 is from the U.S. Department of Commerce, Bureau of the Census. The historical population data in the 2007 Woods & Poole database includes 2000 Census results. The historical county total population and population by single year of age by race and sex for the years 1991-1999 and 2001-2006 was estimated by Woods & Poole using 1990 and 2000 Census results and Bureau of the Census post-Censal estimates. The historical county population by single year of age by race and sex for the years 1971-1979 and 1981-1989 is estimated by using single year of age data from the 1970, 1980, and 1990 Census of Population for counties, and U.S. annual population by single year of age by race and sex.

Population is defined as July 1 residential population and includes: civilian population; military population except personnel stationed overseas; college residents; institutional populations, such as prison inmates and residents of mental institutions, nursing homes, and hospitals; and estimates of undocumented aliens. Excluded are persons residing in Puerto Rico, U.S. territories and possessions, and U.S.

citizens living abroad.

For the years 1990 to 2030 the population data is broken down by five race/ethnic groups: White not including Hispanic or Latino (i.e. Non-Hispanic), Black Non-Hispanic, Native American or American Indian Non-Hispanic, Asian American and Pacific Islanders Non-Hispanic, and Hispanic or Latino. Population by race as defined by the Census Bureau reflects self-identification by respondents and does not denote any clear-cut scientific definition of biological stock. White population includes people who identify themselves as White and people who do not identify themselves by any race but identify themselves by nationality, such as Canadian, German, Italian, Arab, Lebanese, Near Eastern, or Polish. Black population includes people who identify themselves as Black and people who do not identify themselves by any race but identify themselves by nationality, such as African American, Afro-American, Black Puerto Rican, Jamaican, Nigerian, West Indian, or Haitian. Native American population includes people who identify themselves as Alaska Native or American Indian by Indian tribe or classify themselves as Canadian Indian, French American Indian, Spanish-American Indian, Eskimos, Aleuts, and Alaska Indians. Asian American and Pacific Islander population are people who identify themselves as having origins in any of the original peoples of the Far East, Southeast Asia,or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, Vietnam, Hawaii, Guam, Samoa, or other Pacific Islands.

Hispanic or Latino population are people whose origins are from Spain, the Spanish-speaking countries of Central or South America, the Dominican Republic, and who identify themselves generally as Spanish, Spanish-American, Hispanic, Hispano, Latino, and so on. Hispanic population is not a race group but rather a description of ethnic origin. Although Hispanics are part of the other four race groups they split out separately in the Woods & Poole database so that the four race groups plus Hispanic equals total population.

Hispanic data are historical for 1970, 1980, and 1990-2005 from the decennial censuses, adjusted to July 1, and from Census Bureau intercensal and postcensal population estimates. For counties with Hispanic population greater than 40,000, actual historical data for 1981-1985 from a special Census Bureau report are included. Census Bureau data are also included for the U.S. for 1969-1990, and for states for 1981-1985 and 1990. Hispanic data for all other years are estimated. The Woods & Poole Hispanic population data for 1980 differ significantly from the final 1980 Census for some states, e.g., Alabama and Mississippi; this is because of post-1980 Census Bureau revisions to the 1980 Census that are incorporated in the Woods & Poole data.

For the years 1970 to 1989 the population in the Woods & Poole database is available in three race groups which sum to total population: White, Black, and Other. All three of these race groups include Hispanic population. The Hispanic data for 1970 to 1989 is provided separately. Although the total Hispanic population and the population by age and gender for the years 1970 to 1989 are consistent with the data 1990 to 2030, the population by race data is not.

The Woods & Poole database includes 2000 Census population data,

adjusted to July 1, for total population by single year of age, race and sex. However, the 2000 Census race classifications were adjusted to create a consistent time-series for the years 1990 to 2000. The 2000 Census classification Some Other Race was distributed as follows: of the 15.36 million people classifying themselves as Some Other Race, 14.89 million were Hispanic and were therefore added to Hispanic population; the remaining 468,000 were distributed to the other four race groups proportionally by age and gender. The 2000 Census classifications for Two or More Races were distributed as follows: of the 6.8 million people classifying themselves as Two or More Races, 2.22 million were Hispanic and were added to the Hispanic population; the remaining 4.60 million were distributed to the other four race groups proportionally by age and gender.

The population data in the Woods & Poole database are generally consistent with data from other sources, including the Census Bureau. The most significant difference between the Census Bureau data used by Woods & Poole and the actual 1970, 1980, 1990, and 2000 Census results is that Woods & Poole data are July 1-based and the decennial census data are April 1-based. Decennial census data were adjusted forward from April 1 to July 1 to make them consistent with population data for other years as well as with the employment and income data, which are also July 1-based.

## Households

The data for households are from Census Bureau counts in 1970, 1980, 1990, and 2000 and Census Bureau estimates for 1985. As with population, the household data from the decennial censuses were adjusted from April 1 to July 1. The 1985 Census Bureau estimate was already July 1-based. All other years of county household data (i.e., 1969, 1971-1979, 1981-1984, 1986-1989, and 1991-1999) are estimates. Household data for the U.S. and states, 1969-2000, are based on Census Bureau data.

Household data for total number of households, group quarters population, and average size of households from the 1990 and 2000 Census, adjusted to a July-1 base, are included in the Woods & Poole database.

Households are defined as occupied housing units. A housing unit is a house, an apartment, a group of rooms, or a single room occupied as separate living quarters. The occupants of a housing unit may be a single family, one person living alone, two or more families living together, or any group of related or unrelated persons who share living quarters. All people are part of a household except those who reside in group quarters. Group quarters include living arrangements such as prisons, homes for the aged, rooming houses, college dormitories, and military barracks. The average size of households is defined as total population less group quarters population divided by the number of households. Mean household income is defined as total personal income less estimated income of group quarters population divided by the number of households.

## Households by Income Bracket

The number of households by income bracket is historical only for 1990 and 2000 and is based on Census data for household income in the years 1989 and 1999, respectively. The income brackets are in 2000 dollars and since the brackets themselves are not adjusted over the projection horizon all brackets from 2001 to 2030 are also in 2000 dollars. The 2000 Census income brackets are retained for the projection years; as a result, in the Woods & Poole projections, there is a heaping of households into the higher income brackets because of projected real increases in total personal income. The projection of the number of households by income bracket is made simply by changing the median income for the years 2001 to 2030 in relation to projected mean household income, and retaining the income distribution around the 2000 median. The lack of historical time series data for county households by income bracket means that the projections are based on a single observation point; projections based on extrapolations from a single data point are less reliable that projections based on time-series data.

## Woods & Poole Wealth Index

The Woods & Poole Wealth Index is a measure of relative total personal income per capita weighted by the source of income. The Wealth Index is the weighted average of regional income per capita divided by U.S. income per capita (80% of the index); plus the regional proportion of income from dividends/interest/rent divided by the U.S. proportion (10% of the index); plus the U.S. proportion of income from transfers divided by the regional proportion (10% of the index). Thus, relative income per capita is weighted positively for a relatively high proportion of income from dividends, interest, and rent, and negatively for a relatively high proportion of income from transfer payments. Because the imputed rent of owner-occupied homes is added to rental income of persons in calculating total personal income, some of the appreciated value of owner-occupied homes is included in rental income. Since dividends, interest, and rent income are a good indicator of assets, the Woods & Poole Wealth Index attempts to measure relative wealth.

## Comparative Data

Some Woods & Poole statistical tables and data files contain summary data on unemployment, number of business establishments, and educational attainment. These data are provided for comparison purposes and are not part of the Woods & Poole forecasting model.

Labor force and unemployment data are from the Bureau of Labor Statistics. Data are provided for the civilian labor force, employment, unemployment, and the unemployment rate for 2003, 2004, 2005, and monthly for April 2006 to October 2006. Employment is defined by the Bureau of Labor Statistics and excludes military employment and proprietors. Civilian labor force is defined as people who are either employed or who are unemployed and looking for work; civilian labor force is the sum of the employed and unemployed. The unemployment rate is the number of people unemployed divided by the civilian labor force. The monthly data are not seasonally adjusted.

The labor force, employment, and unemployment data are all by place of residence and not by place of work.

Business establishments by size and industry is from the Bureau of the Census. Data are provided for the total number of business establishments and the number with fewer than fifty employees and the number with fifty or more employees by one-digit NAICS industries. The data are for March 2004 and March 2005 and are not an annual average. The number of business establishments excludes proprietors and government. The industry groups are based on 1997 North American Industry Classification System (NAICS) definitions. The data on the number of business establishments includes establishments by industry that are statewide and not part of any particular county. In the Woods & Poole database, statewide establishments are distributed proportionally to counties within the state based on the number of establishments by industry within a particular county; therefore, Woods & Poole county data may differ from other published data.

Educational attainment data for the years 1970, 1980, 1990, and 2000 are from the Bureau of the Census. The percent of the population age 25 or more not completing high school, completing high school, and completing four or more years of college is reported. The educational attainment data are based on self-reporting by decennial Census respondents and are not matched to actual school enrollment or graduation data.

Land area is from the 2000 Census and is in square miles. The data are for all U.S. counties; the land area for geographic units larger than county (including the U.S. as a whole) is calculated by summing county land area.

## Estimation of Missing Historical Data

A small amount of historical earnings and employment data by sector was withheld by the Department of Commerce because of Federal information disclosure policies. Data are usually withheld in very small sectors in a specific county; the reporting of this data would divulge confidential employment and earnings information about specific companies in that area. In order to make the database consistent, and facilitate the forecasting model, all missing data points were estimated by Woods & Poole. In sum, approximately 4% of all data in the historical database were withheld and had to be estimated.

The algorithms used to estimate the missing data were applied in two stages. First, a "best guess" of the missing data was obtained. For example, in the case of mining employment, missing data for a county were estimated by observing the relationship between that county's mining employment in reported years and statewide mining employment for the same years. This method took into account, when possible, fluctuations in a series because of business cycles during the historical period. When sufficient years in a series were reported to provide statistical reliability (this occurred in approximately 33% of the cases where data were withheld), business cycles were all estimated separately, thus enabling reliable estimates to be made of the missing data points. In other cases, where too many years in a series were withheld, business cycles were not taken into account, but the same

method of observing the relationship between county series, in reported years, to the state series in the same years was used (this occurred in approximately 61% of the cases). In approximately 6% of the cases, the data for a county series, such as mining employment, were withheld for every year, and the relational method would not work. In these cases, the relationship between total economic activity in the county to the state, in a non-cyclical manner, was used to derive "best guess" results.

Once the "best guess" results were estimated, an iterative procedure was used to simultaneously constrain the "best guess" to the county control total, (i.e., total employment in the above example) and the state total for the series (i.e., state mining employment in the above example). This iterative procedure, beginning with the "best guess" solution, produced, for all missing data points, a convergence point that is used as historical data. However, since the data are truly withheld by the government, there is no mathematically tractable solution to the problem of missing data. Estimated withheld data are indicated for employment and earnings of employees in the Woods & Poole database printed tables with an "e" following the estimated data; estimated withheld data for retail sales by kind of business and other data series is not indicated in the Woods & Poole database.

## Average Annual Rate of Growth

In some statistical tables in Woods & Poole publications, data are presented for the average annual rate of growth for a particular variable over a specified time period. The average annual rate of growth is the compounded growth of a variable over time. Thus, a 3.0% average annual rate of growth between 1970 and 1980 for population would mean that, on average, the population increased 3.0% each year between 1970 and 1980.

An average annual rate of growth can be calculated by dividing the data year t+n by data year t and calculating the nth root of the quotient (where n is the number of years between t and t+n). Subtract one and multiply by 100 to convert the growth into percent. A negative average annual rate of growth would mean a decline in the variable over time.

## Rounding of Data

Data for the U.S., states, Metropolitan Statistical Areas (MSAs), Designated Market Areas (DMAs), and other regions are the sum of counties. Due to rounding, the subtotals in Woods & Poole data tables may not exactly equal the components. Special calculations in some data tables (e.g., population growth rates) also may not exactly equal the data because of rounding. Since the U.S. and state data are based on county estimates, they may differ from U.S. and state data available from other sources.

## County Definitions

The county definitions and county-equivalent definitions used in the Woods & Poole database are defined by the BEA. In New England,

counties were created by summing townships and creating county-equivalent areas. Parishes in Louisiana, Boroughs in Alaska, and Independent Cities in Maryland, Missouri, and Nevada are called counties in the Woods & Poole database. In some states, notably Virginia, counties exist with independent cities. In cases where boundaries between counties and independent cities (or counties and other counties) have changed since 1969, new county groups are created to maintain the consistency of the historical data. Table 5 lists all the special county groupings in the Woods & Poole database.

Broomfield County Colorado (FIPS 08014) is a new county created after the 2000 Census from portions of Boulder, Adams, Jefferson and Weld counties; it is not included separately in the 2007 Woods & Poole database.

Federal Information Processing Standards (FIPS) codes are defined by the National Institute of Standards and Technology to give numeric "names" to geographic areas such as states and counties. Each state has a two-digit FIPS code (Alabama is 01 and Wyoming is 56) and counties have five-digit codes with the first two digits being the state code: Autauga AL is 01001 and Weston WY is 56045.

Table 5. Woods & Poole Special County Definitions
(FIPS codes in Parentheses)

Northwest Arctic Borough, AK (02188)
- Kobuk, AK (02140)

Remainder of Alaska, AK (02999)
- Aleutian Islands, AK (02010)
- Aleutian Islands East Borough, AK (02013)
- Aleutian Islands West Census Area, AK (02016)
- Bethel Census Area, AK (02050)
- Denali Borough, AK (02068)
- Dillingham Census Area, AK (02070)
- Haines Borough, AK (02100)
- Kenai Peninsula Borough, AK (02122)
- Lake and Peninsula Borough, AK (02164)
- North Slope Borough, AK (02185)
- Prince of Wales-Outer Ketchikan, AK (02201)
- Sitka Borough, AK (02220)
- Skagway-Yukatat-Angoon, AK (02231)
- Skagway-Hoonah-Angoon Census Area, AK (02232)
- Southeast Fairbanks Census Area, AK (02240)
- Valdez-Cordova Census Area, AK (02261)
- Wrangell-Petersburg Census Area, AK (02280)
- Yakutat Borough, AK (02282)
- Yukon-Koyukuk, AK (02290)

Yuma + La Paz, AZ (04027)
- La Paz, AZ (04012)
- Yuma, AZ (04027)

Miami-Dade, FL (12086)
- Dade, FL (12025)

Maui + Kalawao, HI (15901)
Kalawao, HI (15005)
Maui, HI (15009)

Fremont, ID (16043)
Fremont, ID (16043)
Yellowstone Park, ID

Park, MT (30067)
Park, MT (30067)
Yellowstone Park, MT (30113)

Valencia + Cibola, NM (35061)
Cibola, NM (35006)
Valencia, NM (35061)

Halifax, VA (51083)
Halifax, VA (51083)
South Boston City, VA (51780)

Albemarle + Charlottesville, VA (51901)
Albemarle, VA (51003)
Charlottesville City, VA (51540)

Alleghany + Clifton Forge + Covington, VA (51903)
Alleghany, VA (51005)
Clifton Forge City, VA (51560)
Covington City, VA (51580)

Augusta + Staunton + Waynesboro, VA (51907)
Augusta, VA (51015)
Staunton City, VA (51790)
Waynesboro City, VA (51820)

Bedford + Bedford City, VA (51909)
Bedford, VA (51019)
Bedford City, VA (51515)

Campbell + Lynchburg, VA (51911)
Campbell, VA (51031)
Lynchburg City, VA (51680)

Carroll + Galax, VA (51913)
Carroll, VA (51035)
Galax City, VA (51640)

Dinwiddie + Colonial Heights + Petersburg, VA (51918)
Dinwiddie, VA (51053)
Colonial Heights City, VA (51570)
Petersburg City, VA (51730)

Fairfax + Fairfax City + Falls Church City, VA (51919)
Fairfax, VA (51059)
Fairfax City, VA (51600)
Falls Church City, VA (51610)

Frederick + Winchester, VA (51921)
Frederick, VA (51069)
Winchester City, VA (51840)

Greensville + Emporia, VA (51923)
Greensville, VA (51081)
Emporia City, VA (51595)

Henry + Martinsville, VA (51929)
Henry, VA (51089)
Martinsville City, VA (51690)

James City + Williamsburg, VA (51931)
James City County, VA (51095)
Williamsburg City, VA (51830)

Montgomery + Radford, VA (51933)
Montgomery, VA (51121)
Radford City, VA (51750)

Pittsylvania + Danville, VA (51939)
Pittsylvania, VA (51143)
Danville City, VA (51590)

Prince George + Hopewell, VA (51941)
Prince George, VA (51149)
Hopewell City, VA (51670)

Prince William + Manassas + Manassas Park, VA (51942)
Prince William, VA (51153)
Manassas City, VA (51683)
Manassas Park City, VA (51685)

Roanoke + Salem, VA (51944)
Roanoke, VA (51161)
Salem City, VA (51775)

Rockbridge + Buena Vista + Lexington, VA (51945)
Rockbridge, VA (51163)
Buena Vista City, VA (51530)
Lexington City, VA (51678)

Rockingham + Harrisonburg, VA (51947)
Rockingham, VA (51165)
Harrisonburg City, VA (51660)

Southampton + Franklin, VA (51949)
Southampton, VA (51175)
Franklin City, VA (51620)

Spotsylvania + Fredericksburg, VA (51951)
Spotsylvania, VA (51177)
Fredericksburg City, VA (51630)

Washington + Bristol, VA (51953)
Washington, VA (51191)
Bristol City, VA (51520)

Wise + Norton, VA (51955)
Wise, VA (51195)
Norton City, VA (51720)

York + Poquoson, VA (51958)
York, VA (51199)
Poquoson City, VA (51735)

Shawano (includes Menominee), WI (55901)
Menominee, WI (55078)
Shawano, WI (55115)

Metropolitan Area Definitions

Metropolitan Statistical Areas (MSAs), Combined Metropolitan Statistical Areas (CSAs), Micropolitan Statistical Areas (MICROs), and Metropolitan Divisions ( MDIVs) in the Woods & Poole database are as defined in the December 2005, Office of Management and Budget (OMB) "Revised Definitions of Metropolitan Statistical Areas, New Definitions of Micropolitan Statistical Areas and Combined Statistical Areas, and Guidance on Uses of the Statistical Definitions of These Areas" (OMB BULLETIN NO. 06-01).

All Woods & Poole historical data back to 1969 is revised to reflect the new 2005 OMB Metropolitan Area (MSA, CSA, MICRO, and MDIV) definitions. There are 361 MSAs, 120 CSAs, 577 MICROs, and 29 MDIVs in the 2007 Woods & Poole database. A list of all CSAs, MSAs, MICROs, and MDIVs and their component counties can be found in Appendices 2, 3, 4 and 5, respectively. These Appendices follow this chapter and begin on page 40. Although CSAs can be defined in terms of MSAs and MICROs, in the Woods & Poole database, and in Appendix 2, they are defined in terms of counties.

New England City and Town Areas (NECTAs) and Combined New England City and Town Areas (CNECTAs) are not in the Woods & Poole database because they are defined with geographic units smaller than counties. The 19 MSAs, CSAs, and MICROs in Puerto Rico are also not included in the Woods & Poole database.

MSAs, as defined by the OMB, have at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties. Micropolitan Statistical Areas - a new set of statistical areas - have at least one urban cluster of at least 10,000 but less than 50,000 population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties. The central cities that form the basis on MSAs and MICROs are generally included in their titles, as well as the name of each state into which the MSA or MICRO extends. MSAs and MICROs are defined in terms of whole counties (or equivalent entities), including in the six New England States. If the specified criteria are met, a MSA containing a single core with a population of 2.5 million or more may be subdivided to form smaller groupings of counties referred to as Metropolitan Divisions. MDIVs are not comparable to either MSAs or MICROs and should not be ranked together.

According to the OMB if specified criteria are met, adjacent MSAs and MICROs, in various combinations, may become the components of a new set of areas called Combined Statistical Areas. For instance, a CSA may comprise two or more MSAs, a MSA and a MICRO, two or more MICROs, or multiple MSAs and MICROs. In the Woods & Poole database CSAs are defined in terms of counties. According to the OMB combinations for adjacent areas with an employment interchange of 25 or more are automatic. Combinations for adjacent areas with an employment interchange of at least 15 but less than 25 are based on local opinion as expressed through the Congressional delegations.

## DMAs and Regions

Television Designated Market Areas (DMAs) are defined in the September 2006 U.S. Television Household Estimates published by Nielsen Media Research, Inc. DMAs are geographic definitions of television markets based on measured viewing patterns. DMAs are aggregates of counties, and generally each county is in only one DMA. A list of all DMAs and their component counties can be found in Appendix 7 following this chapter. In the few cases where a county is split into more than one DMA, an estimated proportion of the population, employment, households, and income in the county have been assigned to each DMA. The specific proportions used for split counties are listed parenthetically in Appendix 7.

The eight regions in the Woods & Poole database are aggregates of states and are defined by the Bureau of Economic Analysis. A list of all BEA regions and their component states can be found in Appendix 1 following this chapter. The BEA regions used by Woods & Poole differ from the nine regions defined by the Census Bureau and used in their publications.

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# Appendix D

NPA Data Services, Inc.

DOCUMENTATION FOR REGIONAL
ECONOMIC PROJECTIONS SERIES (REPS)

DEMOGRAPHIC TOTAL POPULATION DATABASE 2007 Update
Released September 28th, 2007

CONTENTS

The Demographic Databases contains estimates of resident population measured in thousands. Estimates of total population by age and sex are contained in this CD.

For each geographic area there is a database of 51 data items, each available annually for the 62 year period 1969 to 2030. The database contains resident population for 17 age classes (total plus 5-year cohorts aged 0-4 through 75+) and 3 sex classifications (total, male and female).

The 2007 Update of the Demographic Database of the Regional Economic Projections Series contains historical U.S. Census Bureau data for the years 1969-2006, estimates by NPA Data Services, Inc. for 2007 and projections for the years 2008-2030 prepared and copyrighted by NPA Data Services, Inc. The current database reflects the following: (1) Earlier Census Bureau reports of county population total and by age, sex and race for July 1, 1969-1999; (2) Intercensal Census Bureau estimates of county total population for the years 1990-99; (3) Census Bureau reports of county population for July 1 2000-2006, and (4) NPA data Services, Inc. estimates and projections of county population by age, sex and race, for July 1, 2007-2030. These projections embody the 2000 Census Bureau projections of future national age specific birthrates and of future age and sex specific survival rates adjusted for regional variations by the NPA Data Services, Inc., international net migration rates reported by the Census Bureau through 2006 and projected by NPA Data Services, Inc. to 2030, and internal U.S. net migration flows based on economic changes projected by the NPA Data Services, Inc. in 2007.

The variable names used in the standardized tables of the NPA Data Services Demographic Database and a brief description of the variables are as follows:

LIST OF VARIABLES IN THE DEMOGRAPHIC DATABASE -- Total Population*

| Variable Line | Code | Variable Description |
|---|---|---|
| 1 | P | Population - All Ages |
| 2 | P0004 | Population - Age 00--4 |
| 3 | P0509 | Population - Age 05-09 |
| 4 | P1014 | Population - Age 10-14 |
| 5 | P1519 | Population - Age 15-19 |
| 6 | P2024 | Population - Age 20-24 |

| | | |
|---|---|---|
| 7 | P2529 | Population - Age 25-29 |
| 8 | P3034 | Population - Age 30-34 |
| 9 | P3539 | Population - Age 35-39 |
| 10 | P4044 | Population - Age 40-44 |
| 11 | P4549 | Population - Age 45-49 |
| 12 | P5054 | Population - Age 50-54 |
| 13 | P5559 | Population - Age 55-59 |
| 14 | P6064 | Population - Age 60-64 |
| 15 | P6569 | Population - Age 65-69 |
| 16 | P7074 | Population - Age 70-74 |
| 17 | P75+ | Population - Age 75+ |
| 18 | PM | Population - Male All Ages |
| 19 | PM0004 | Population - Male Age 00-04 |
| 20 | PM0509 | Population - Male Age 05-09 |
| 21 | PM1014 | Population - Male Age 10-14 |
| 22 | PM1519 | Population - Male Age 15-19 |
| 23 | PM2024 | Population - Male Age 20-24 |
| 24 | PM2529 | Population - Male Age 25-29 |
| 25 | PM3034 | Population - Male Age 30-34 |
| 26 | PM3539 | Population - Male Age 35-39 |
| 27 | PM4044 | Population - Male Age 40-44 |
| 28 | PM4549 | Population - Male Age 45-49 |
| 29 | PM5054 | Population - Male Age 50-54 |
| 30 | PM5559 | Population - Male Age 55-59 |
| 31 | PM6064 | Population - Male Age 60-64 |
| 32 | PM6569 | Population - Male Age 65-69 |
| 33 | PM7074 | Population - Male Age 70-74 |
| 34 | PM75+ | Population - Male Age 75+ |
| 35 | PF | Population - Female All Ages |
| 36 | PF0004 | Population - Female Age 00-04 |
| 37 | PF0509 | Population - Female Age 05-09 |
| 38 | PF1014 | Population - Female Age 10-14 |
| 39 | PF1519 | Population - Female Age 15-19 |
| 40 | PF2024 | Population - Female Age 20-24 |
| 41 | PF2529 | Population - Female Age 25-29 |
| 42 | PF3034 | Population - Female Age 30-34 |
| 43 | PF3539 | Population - Female Age 35-39 |
| 44 | PF4044 | Population - Female Age 40-44 |
| 45 | PF4549 | Population - Female Age 45-49 |
| 46 | PF5054 | Population - Female Age 50-54 |
| 47 | PF5559 | Population - Female Age 55-59 |
| 48 | PF6064 | Population - Female Age 60-64 |
| 49 | PF6569 | Population - Female Age 65-69 |
| 50 | PF7074 | Population - Female Age 70-74 |
| 51 | PF75+ | Population - Female Age 75+ |

* Population in thousands.

Note: (1) The data for the newly organized (2001) Broomfield County, Colorado (FIPS code 08014) are introduced here as of 2002. No data are available for Broomfield county for earlier years; consequently, those data entries are blank. It was created out of parts of Adams County (FIPS code 08001), Boulder County (FIPS code 08013), Jefferson County (FIPS code 08059) and Weld County (FIPS code 08123). The changes in the data for these four counties between 2001 and 2002 include the results of the transfer of parts of the counties to Broomfield County.

(2) Because no meaningful projection could be made within the methods used in projections of certain variables for the counties damaged by hurricane Katrina in 2005, stylized projections of population, employment and income were made for 13 parishes in Louisian and 5 counties in Mississippi to avoid seriously distorted projections at metropolitan and state levels. The Louisiana parishes are : Cameron, Plaquemines, St. Tammany, Orleans, Jefferson, St. Bernard, St. John the Baptist, Calcasieu, St. Charles, St. Helena, Iberville, Ascension and Beauregard. The Mississippi counties are: Hancock, Harrison, Jackson, Pearl River and Stone.

NPA Data Services, Inc.

DOCUMENTATION FOR REGIONAL ECONOMIC PROJECTIONS SERIES (REPS)

ECONOMIC DATABASE CD-ROM – FALL 2007

Released September 15, 2007

CONTENTS:

The Fall 2007 Update of the Economic Database of the Regional Economic Projections Series contains historical data for the years 1969-2006 and projections for the years 2007-2030. This current database reflects the July 1 annual county population data for the years through 2006, including the intercensal reconciliation for July 1, 1990 to July 1, 1999, as reported by the Census Bureau population data from the 2000 Census of Population, Census population estimates for July 1, 2000-2006. The annual county level and the corresponding state level regional employment and income was reported for the years through 2005 by the Regional Economic Information System (REIS) of the Bureau of Economic Analysis. Regional data for 2006 reported by various statistical agencies of the U.S. Government were consolidated by the NPA Data Services, Inc. Projections for the years 2007-2030 were prepared and copyrighted by NPA Data Services. This update is based on data available as of August 2007.

The data items available for each geographic area include population, employment, and income. Population is measured in thousands of persons and employment is measured in thousands of jobs. The income items are measured in millions of 2000 dollars as deflated by the chain-type price index for Personal Consumption Expenditure. Per capita income is in 2000 dollars. The employment detail includes for the years 1969-2000 full and part-time employment estimates of one digit Standard Industrial Classification (SIC) industry employment (wage and salary workers and proprietors) and also farm and nonfarm, wage and salary and proprietor jobs. The income includes earnings; personal contributions to social insurance; a residence adjustment; dividend, interest, and rental income; and transfer payments income. Estimates of earnings for one digit SIC industries are the sum of wages and salaries, other labor income, and the income of proprietors.

For the years 2001-2030 the industry detail of employment and earnings in private nonfarm industries is provided in nine groupings of the major industry categories of the newly

introduced North American Industry Classification System (NAICS), which correspond to the nine private nonfarm industry SIC categories used in the data for 1969-2000. No historical NAICS data were provided by the REIS for the years before 2001. Because the data in these two sets of definitions is not directly comparable, special procedures to bridge the transition between the two sets of data were employed in developing the projections. The variable codes for the industries affected by this change (lines 9-17 and 30-38) were modified by an addition of the number "2" to the abbreviated codes, as is shown in the following two listings. For more discussion of the treatment of the transition to NAICS categories, see the appendix below.

The variable names used in the standard tables of the NPA Data Services Economic Database for the two periods and a brief description of the variables are as follows:

LIST OF ECONOMIC VARIABLES FOR THE YEARS 1969-2000

| Variable Line | Code | Variable Description |
|---|---|---|
| 1 | E | Employment - Total, All Industries |
| 2 | EP | Employment - Proprietors, All Industries |
| 3 | EPF | Employment - Proprietors Farm |
| 4 | EPNF | Employment - Proprietors Nonfarm |
| 5 | EW | Employment - Wage and Salary Workers, All Industries |
| 6 | ETF | Employment - Farm |
| 7 | ETNF | Employment - Nonfarm |
| 8 | ETPNF | Employment - Private Nonfarm (PNF) |
| 9 | ETOTH | Employment - PNF Other (Agricultural Services, Forestry, Fisheries) |
| 10 | ETMIN | Employment - PNF Mining |
| 11 | ETCON | Employment - PNF Construction |
| 12 | ETMFG | Employment - PNF Manufacturing |
| 13 | ETTCPU | Employment - PNF Transportation, Communications, and Public Utilities |
| 14 | ETTRDW | Employment - PNF Trade Wholesale |
| 15 | ETTRDR | Employment - PNF Trade Retail |
| 16 | ETFIRE | Employment - PNF Finance, Insurance and Real Estate |
| 17 | ETSVS | Employment - PNF Services |
| 18 | ETG | Employment - Government |
| 19 | ETGFC | Employment - Government Federal Civilian |
| 20 | ETGFM | Employment - Government Federal Military |
| 21 | ETGSL | Employment - Government State and Local |
| 22 | ETRES | Residual Employment not Allocated to Industries |
| 23 | YWWS | Income - Wage and Salary, All Industries |
| 24 | YWOL | Income - Other Labor Income, All Industries |
| 25 | YP | Income - Proprietors, All Industries |
| 26 | YPF | Income - Proprietors Farm |
| 27 | YPNF | Income - Proprietors Nonfarm |
| 28 | YEF | Income - Earnings Farm |

29 YENF Income - Earnings Nonfarm
30 YEPNF Income - Earnings Private Nonfarm
31 YEOTH Income - Earnings PNF Other (Agricultural services, Forestry, Fisheries)
32 YEMIN Income - Earnings PNF Mining
33 YECON Income - Earnings PNF Construction
34 YEMFG Income - Earnings PNF Manufacturing
35 YETCPU Income - Earnings PNF Transportation, Communication, and Public Utilities
36 YETRDW Income - Earnings PNF Trade Wholesale
37 YETRDR Income - Earnings PNF Trade Retail
38 YEFIRE Income - Earnings PNF Finance, Insurance and Real Estate
39 YESVS Income - Earnings PNF Services
40 YEG Income - Earnings Government
41 YEGFC Income - Earnings Government Federal Civilian
42 YEGFM Income - Earnings Government Federal Military
43 YEGSL Income - Earnings Government State and Local
44 YERES Income - Residual Not Allocated to Industries
45 YELP Income - Earnings Labor and Proprietors Total
46 YSI Income - Social Insurance Contributions
47 YELPW Income - Earnings Labor and Proprietors by Place of Work
48 YRAD Income - Residence Adjustment
49 YELPR Income - Earnings Labor and Proprietors by Place of Residence
50 YDIV Income - Dividends, Interest, and Rent
51 YTRAN Income - Income - Transfers
52 Y Income - Personal Income
53 Y/P Income - Personal Income Per Capita
54 P Population - Total

LIST OF ECONOMIC VARIABLES FOR THE YEARS 2001-2030

Variable
Line Code Variable Description
1 E Employment - Total, All Industries
2 EP Employment - Proprietors, All Industries
3 EPF Employment - Proprietors Farm
4 EPNF Employment - Proprietors Nonfarm
5 EW Employment - Wage and Salary Workers, All Industries
6 ETF Employment - Farm
7 ETNF Employment - Nonfarm
8 ETPNF Employment - Private Nonfarm (PNF)
9 ETOTH2 Employment - PNF Other (Forestry, Fisheries, Other)
10 ETMIN2 Employment - PNF Mining
11 ETCON2 Employment - PNF Construction
12 ETMFG2 Employment - PNF Manufacturing

13 ETTTIU2 Employment - PNF Transportation, Information, and Utilities
14 ETTRDW2 Employment - PNF Trade Wholesale
15 ETTRDR2 Employment - PNF Trade Retail
16 ETFIRE2 Employment - PNF Finance, Insurance and Real Estate
17 ETSVS2 Employment - PNF Services
18 ETG Employment - Government
19 ETGFC Employment - Government Federal Civilian
20 ETGFM Employment - Government Federal Military
21 ETGSL Employment - Government State and Local
22 ETRES Residual Employment not Allocated to Industries
23 YWWS Income - Wage and Salary, All Industries
24 YWOL Income - Other Labor Income, All Industries
25 YP Income - Proprietors, All Industries
26 YPF Income - Proprietors Farm
27 YPNF Income - Proprietors Nonfarm
28 YEF Income - Earnings Farm
29 YENF Income - Earnings Nonfarm
30 YEPNF Income - Earnings Private Nonfarm
31 YEOTH2 Income - Earnings PNF Other (Agricultural services, Forestry, Fisheries)
32 YEMIN2 Income - Earnings PNF Mining
33 YECON2 Income - Earnings PNF Construction
34 YEMFG2 Income - Earnings PNF Manufacturing
35 YETIU2 Income - Earnings PNF Transportation, Information, and Utilities
36 YETRDW2 Income - Earnings PNF Trade Wholesale
37 YETRDR2 Income - Earnings PNF Trade Retail
38 YEFIRE2 Income - Earnings PNF Finance, Insurance and Real Estate
39 YESVS2 Income - Earnings PNF Services
40 YEG Income - Earnings Government
41 YEGFC Income - Earnings Government Federal Civilian
42 YEGFM Income - Earnings Government Federal Military
43 YEGSL Income - Earnings Government State and Local
44 YERES Income - Residual Not Allocated to Industries
45 YELP Income - Earnings Labor and Proprietors Total
46 YSI Income - Social Insurance Contributions
47 YELPW Income - Earnings Labor and Proprietors by Place of Work
48 YRAD Income - Residence Adjustment
49 YELPR Income - Earnings Labor and Proprietors by Place of Residence
50 YDIV Income - Dividends, Interest, and Rent
51 YTRAN Income - Income - Transfers
52 Y Income - Personal Income
53 Y/P Income - Personal Income Per Capita
54 P Population - Total

Employment and Population are in thousands; Earnings and Income in millions of 2000 dollars; Income Per Capita in 2000 dollars.

Note: (1) The data for the newly organized (2001) Broomfield County, Colorado (FIPS code 08014) are introduced here as of 2002. No data are available for Broomfield county for earlier years; consequently, those data entries are blank. It was created out of parts of Adams County (FIPS code 08001), Boulder County (FIPS code 08013), Jefferson County (FIPS code 08059) and Weld County (FIPS code 08123). The changes in the data for these four counties between 2001 and 2002 include the results of the transfer of parts of the counties to Broomfield County.

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APPENDIX

CHANGES IN STATISTICAL DEFINITIONS OF PRIVATE NONFARM INDUSTRIES

The present projections incorporate the new definitions of the private nonfarm industries, based on the North American Industrial Classification System (NAICS). This system replaces the previously used United States Standard Industrial Classification (SIC) definitions of industries in all U.S. government industry statistics. This change affects only the definitions of private nonfarm industries for which employment and earnings data are included in the NPA Data Services, Inc. national and regional databases. The data definitions for farming and for the government sectors did not change. Also, the definitions of the total employment and earnings as well as for personal income and its components remain the same as before at all levels of geography.

The national and regional data for employment and earnings in the private nonfarm industries used in the databases of the NPA Data Services, Inc. National and Regional Economic Projections Series (beginning with data for the year 2001 are now based on the NAICS definitions. No NAICS based historical data have been provided at the regional and county level by the Regional Economic Information System from which our databases are derived. Therefore, the historical data for the years through 2000 continue to be based on the previously used SIC definitions. The partial discontinuity in the data series is bridged here by developing a set of more aggregated NAICS categories, including industry groupings corresponding approximately in content to the earlier SIC definitions on a one-to-one basis. The national level data in Table A (employment) and Table B (income), which are located in the Utilities folder, explains this approach. These data were obtained from U.S. national totals provided by the REIS in both formats for the year 2001.

The tables compare the employment and income data of the nine SIC industry division with the corresponding nine groupings of the nineteen industry divisions defined by NAICS. The major changes are noted on the left under the SIC heading. One major innovation brought by the NAICS definitions was the identification of 8 detailed categories of services as major industries, breaking up the previously single very large service sector. Another major change was the creation of a new major information industry. It brought together the data for the printing and publishing industries, which were previously included in manufacturing, along with the data for software publishing and services, the telecommunication industries, and various communication and computer services. Another large realignment was the transfer of eating and drinking places from retail trade to services. As a result of this change, for example, employment in the retail trade sector was reduced by 32 percent, while the total service sector employment was increased by 20 percent.

It is not possible at this time to change the entire databases for the years before 2001 to NAICS definitions because no historical data for the NAICS industries were provided by the REIS. In order to maintain continuity of projections data with the trends in the historical data we provide an aggregated NAICS categories which are shown in Table A and Table B along with the corresponding previously used SIC categories. We have modified the projection methods to account for the changes made in the content of industry groups by the changes in definitions.

Table A (Excel file "TABLE A.xls") and Table B (Excel file "TABLE B.xls") show the data organized by the new NAICS definitions on the right and by the old SIC definitions on the left. The last column in Table A shows the ratio of employment in the NAICS categories to employment in the corresponding SIC categories. The last column in Table B shows the ratio of income in the NAICS categories to income in the corresponding SIC categories. Some sectors, such as mining, construction, manufacturing, wholesale trade, and finance, insurance and real estate were only moderately changed.

# Appendix E

The Nevada State Demographer's projections are developed using the Regional Economic Models, Incorporated (REMI) model through 2026.

The REMI model is a comprehensive model that encompasses a wide range of demographic and economic activity. It relates a region or set of regions to each other and the nation as whole. It also comes with differing levels of industrial detail. The model is used by the Nevada Commission on Economic Development, the Nevada Department of Administration, and the University of Nevada, Las Vegas. The model used in producing these projections is a 17 region model with a breakdown into 23 industrial sectors. Documentation about the model can be found at http://www.remi.com/support/documents.shtml.

The overall linkages of the REMI model are shown in Figure 1.

The REMI model comes with a baseline forecast, what has come to be referred to as an out of the box projection (see Appendix pages). The user can do things such as update employment for all sectors and by specific sectors through what are called policy variables. For the most part, those kinds of changes were made to the model in producing the projections. One area of concern in looking at the model was the performance of the Population and Labor Supply Block which is illustrated in Figure 2.

Block 3. Population and Labor Supply

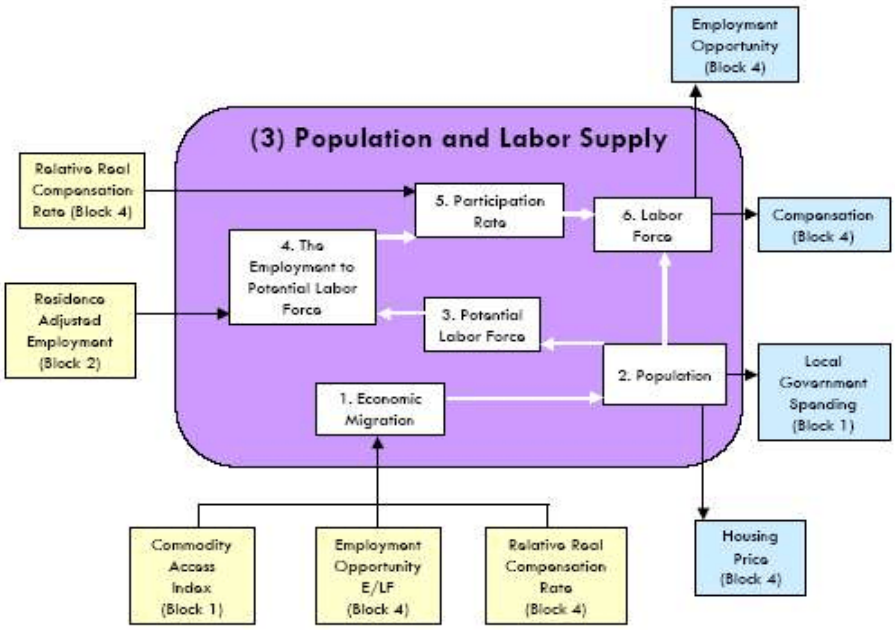


Figure 2: Source: Regional Economic Models, Inc.; REMI Policy Insight 8.0 User Guide; 2006; p.16.

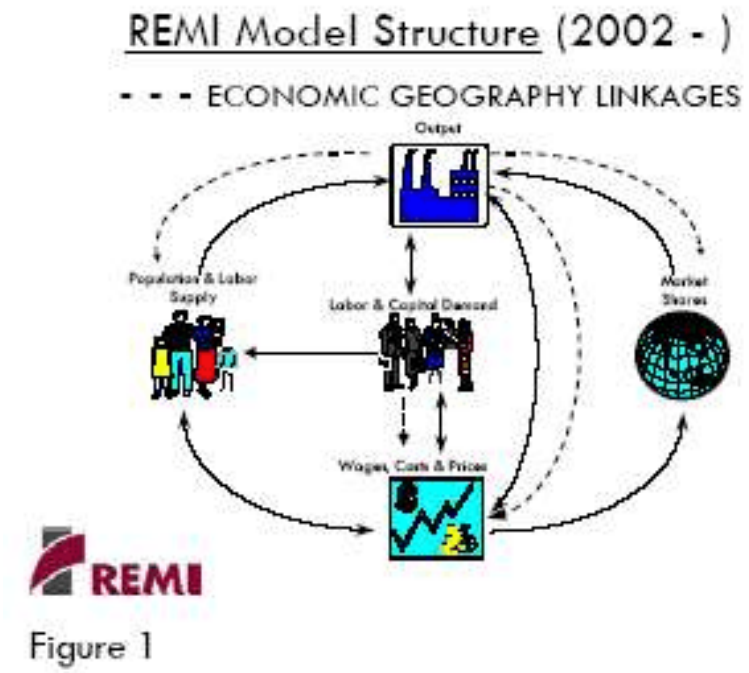


Figure 1 Source: Regional Economic Models, Inc.; REMI Policy Insight 8.0 User Guide; 2006; p.6.

**LIMITATIONS TO THE PROJECTIONS**

REMI has a number of strengths. The model is under constant research and has been available for over 25 years. It has been examined and reviewed through peer-reviewed articles. The User Guide and other information is available to anyone with a computer, that is much of the detail of their methodology is publicly available. One of the major limitations with the model is that there is currently limited historic data from which it is built. This is because of the change from the Standard Industrial Classification (SIC) to the North American Industrial Classification System (NAICS) in 2001. Limited history limits the amount of information that a model can be constructed from for portraying the area that is being modeled. Another limit is that Nevada has a number of small counties as well as areas with limited numbers of employees or employers in various economic sectors. This leads to missing information through data suppression which REMI and this office has to then estimate values to substitute for that missing information.

Also, REMI is built on Federal data including the annual estimates that are done by the Census Bureau. So any projections done within the model have to be re-based off of Nevada's generated estimates.

# Appendix F

**Memorandum**

Date: April 6, 2007

To: John Erwin

From: Hilary Lopez

RE: Truckee Meadows Water Authority Population and Employment Econometric Model

## INTRODUCTION

The 2006 Truckee Meadows Water Authority Population and Employment Econometric Model (TPEM) for Washoe County is a time series model that was developed in partnership with Dr. Klaus Moeltner at the University of Nevada, Reno, to provide a forecast of population and employment through 2030. The purpose of this forecast is to prepare a platform on which to project future water usage within Truckee Meadows Water Authority's (TMWA) service boundary and the immediate region's hydrographic basins. This econometric model is a tool for TMWA in making important resource allocation decisions for the future.

Forecasted population and employment figures are also contributed to the Washoe County Consensus Forecast (Consensus Forecast).

The methodology, model, and results of the TPEM are more fully described below.

## SUMMARY OF RESULTS

*Population*

The 2030 population range forecasted by the TPEM is between 625,285 and 728,202. These figures correspond to a constrained and unconstrained population estimate, respectively, which represent the lower and upper bounds of population growth in a given year. The unconstrained, or upper bound, estimate represents potential population growth based on the assumptions that there are no constraints to the amount of developable land available and/or land is used more intensely than in the past, for example higher density development. The constrained estimate integrates a developable land constraint, built by TMWA, which is based on the assumption that future resources will not be able to sustain the rate of growth experienced in the area in the early 21st Century.

Under both scenarios the population growth rate is projected to decrease steadily between 2006 and 2030 from 2.9% to 2.2% and from 2.9% to 1.4%, for the unconstrained and constrained estimates respectively. The table and chart below shows the TPEM unconstrained and constrained population forecasts through 2030.