

WOODS & POOLE METHODOLOGY _____ APPENDIX **B**

A primary resource for the employment and population forecasts used in the Growth Management Plan is the data provided by Woods & Poole Economics, Inc. This Appendix presents background information on the methodology used by Woods & Poole in preparing their forecasts in general.

The following has been excerpted from the *1999 Data Pamphlet: Columbia County, Georgia*, prepared by Woods & Poole Economics, Inc., Washington, D.C.:

■ Introduction

The Woods & Poole Economics, Inc. database contains more than 550 economic and demographic variables for every county in the United States for every year from 1970 to 2020. 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 2020. In total, there are over 91 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 1999 regional projections and is described in the "Overview of the 1999 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 2020 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 172 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 4 following this chapter); in the 1999 Woods & Poole model, EA definitions released by the BEA in May 1998 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 na-

tional 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.

■ 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 immigration 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 2020 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, 1998-2020, are based on Bureau of the Census population estimates. Woods & Poole adjusts these estimates to reflect current year population estimates. 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.

■ Population and Households

Population is defined as 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.

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.

■ 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, 1969-1996, 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 are by one-digit SIC industry. The one-digit industries are defined in the 1987 Standard Industrial Classification Manual. Over the years, the definitions of certain sectors have changed as new industries have emerged or vanished, entailing some reclassification. However, at the broad industry group level used by Woods & Poole, there have been no changes since 1969, so the sector data are consistent from year to year.

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 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 min-

erals (such as kaolin, 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, includ-

ing 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.

■ 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 a synonym for “projection” and refers to Woods & Poole estimated data for any year from 1997 to 2020 (1998 to 2020 for population); in Woods & Poole publications “forecasts” and “projections” both mean estimates of future data (1997 to 2020, or 1998 to 2020 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 men of “Other” races aged 85 and over, 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.