Factors Affecting Wage and Salary Occupational Demand Growth, 2020-2030

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After completing a set of employment projections, the Office of Employment and Unemployment Statistics (OEUS) applies a factor analysis technique to projected changes in industry and occupational employment demand.[1] This document details the occupational factor analysis but the industry analysis follows an analogous methodology.

Between 2020 and 2030, wage and salary employment is projected to increase by about 8.3 percent in the BLS projections. At the detailed occupational level, changes in employment demand range from a 77.1-percent increase for wind turbine service technicians, SOC 49-9081, and 70.8-percent increase for motion picture projectionists, SOC 39-3021, to a 36.4-percent decrease for word processors and typists, SOC 43-9022, and 35.0-percent decrease for parking enforcement workers, SOC 33-3041.

To assist the user of the projections in evaluating and understanding the sources of growth or decline in individual occupations, an analysis of the factors embedded in the projection process has been carried out and presented in the tables offered here. It should be noted that all production data referred to in the tables are based on 2012 chain weighted dollars.

The derivation of detailed occupational demand can be expressed with the following equation:

$$\mathbf{O = C * B * T * E * S}$$

The dependent variable ***O*** is a vector of occupations. OEUS identifies 1048 occupations, including summary categories, in the projections analysis.

C is a vector containing the percent distribution of total final demand by its categories, such as consumption, investment, foreign trade, or government. The BLS identifies 11 major final demand product categories in the projections analysis. This factor is identified in the tables as *final demand category levels*.

In addition, the ***C*** vector embodies the change in the grand total for all of final demand in the economy. In past analyses, the grand total for all of final demand was identified as a separate factor for either gross domestic product (GDP) or previously gross national product (GNP). However, GDP is no longer identified as a separate factor because of the difficulties introduced by the chain-weighted method of deflation now used to aggregate final demand components up to GDP.

B is a matrix of percent distributions showing the commodity content of each of the 11 demand product categories identified in ***C*** above. The BLS identifies 205 commodity categories. This factor is identified in the tables as *final demand commodity distribution*.

T is an input-output total requirements matrix, which translates a measure of final demand into each industry's total output necessary to produce that final demand. This factor is identified in the tables as *input-output coefficients*, and represents changes in production technologies.

E is a vector of industry-specific *employment-output relationships* measured by employment/output ratios. Performing a cell-by-cell multiplication of this vector by a corresponding industry output vector yields an estimate of employment required to produce that output.

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[1] See "Factors Affecting Occupational Demand Growth" Between 1990 and 2005 in *Outlook 1990-2005 U.S Department of Labor, Bureau of Labor Statistics, BLS Bulletin 2402*, May 1992, pages 134-144.

See also, for example, Kutscher, R.E. "Structural Change in the USA, Past and Prospective: Its Implication for Skill and Educational Requirements," *Economic Systems Research*, Vol. 1, No. 3, 1989.

For more detailed discussions of the methods and limitations of factor analysis, see Feldman, J.F., McClain, D., and Palmer, K. "*Sources of Structural Change in the United States*, 1963-78: An Input-Output Perspective," *The Review of Economics and Statistics*, Vol. 69, No. 3, August 1987 and see Fujimagari, D. "The Sources of Changes in Canadian Industry Output," *Economic Systems Research*, Vol. 1, No. 2, 1989.

S is a matrix of *occupational staffing patterns* by industry. For each of the detailed industries, this matrix contains a percent distribution of the various occupations employed in that industry to create its output.

To illustrate how these results should be interpreted, consider the first *detailed occupation* shown in the table, *chief executives, SOC 11-1011.* Between 2020 and 2030, the employment in this occupation is projected to decrease by 6.7 percent. However, if only the *final demand category levels* changed, while all other factors in the equation above were kept at their 2020 values, the resulting demand for employees in this occupation would have increased 29.2 percent. This percent change is shown in the *final demand category levels* column for c*hief executives*.

In a like manner, if the commodity makeup of the final demand categories changed while all the other factors remained the same, demand for this occupation would be unchanged (0.0 percent) as shown in the *final demand commodity distribution* column.

Allowing the production technology—the mix of goods and services required in the economy to produce a given final demand—to move to the projected 2030 levels while holding all other factors constant, leads to decrease of 3.5 percent in projected demand for this occupation. This percent change is shown in the *input-output coefficients* column for this occupation.

Decreases in employment-output ratios over the 2020-2030 period would lead to a decline of 12.4 percent in demand for this occupation if all other factors remained unchanged as represented in the *employment output relationships* column.

Changes in staffing patterns, that is, in the mix of the types of occupations used by various industries, accounts for a 13.7 percent decrease in the demand for this occupation as shown in the *occupational staffing patterns* column.

Finally, the interaction of all the factors accounts for a 6.2 percent decline in demand for this occupation. The interaction effect presents a crude measure of the extent of nonlinearities in the employment relationships discussed above.

The individual percent changes may not add to the overall projected percent change between 2020 and 2030 because of rounding and chain weighting of final demand and outputs used in the analysis. However, the details give the user the feel for what proportion of projected change in a given occupation can be attributed to each component of the analysis. It shows which factors are most important and which are least important in determining the ultimate level of an occupation in the projected period.