Employment outlook: 2006–16

An overview of BLS projections to 2016

The U.S. economy is projected to grow at a moderate pace over the next 10 years; productivity growth is expected to slow, but still grow at a rate faster than the 1970s and 1980s; and the labor force will grow older as baby boomers move into the 55-and-older age group

James C. Franklin

The BLS projections of the U.S. economy to 2016 present an economy with steady but slowing growth. Growth in the population, and therefore the labor force, is expected to slow. As the baby boomers age, so too does the population, but also, the boomers begin their transition into retirement. Productivity growth is expected to maintain a pace slower than the late 1990s and early 2000s but one faster than the period from the 1970s to the early 1990s. Together, these trends combine to produce an expectation of gross domestic product (GDP) growth of 2.8 percent per year, slower than the 1996–2006 annual growth of 3.1 percent.

On a biennial basis, BLS prepares a set of 10-year projections of industry and occupational employment. The current projections to 2016 are the 20th in the series.[1] In this issue, four articles examine, in detail, the main aspects of these projections: the aggregate economy; the labor force; industry output and employment; and occupational employment and job openings.[2] The U.S. economic trends projected over the 2006–16 decade arise from methods that include both analytical judgment and econometric models, and rest on assumptions that are explicit and implicit to the projections methods.

These projections provide information for individuals seeking career guidance and for organizations and individuals that offer career guidance resources. In addition, policymakers, community planners, and educational authorities who need information for long-term policy planning purposes make use of the BLS employment projections. BLS projections also are used by States in preparing State and local area projections.

These new projections supersede the 2004–14 projections published in November 2005, and they form the basis of updated Internet and print editions of the *Occupational Outlook Handbook, Career Guide to Industries, and Occupational Projections and Training Data.* The remainder of this article presents a summary of the results of each projections component, a brief methods statement, and some discussion of risks and issues related to the projections.

Summary of articles

Aggregate economy. In the first article, Betty Su focuses on the aggregate economic outlook for the coming decade (pages 13–32). Gross domestic product (GDP), which measures the sales of domestically produced goods and services to final users, is projected to grow at an annual average rate of 2.8 percent over the 2006–16 period. (See table 1.) This is slower than either of the preceding two decades. Historically, in nominal terms, consumer spending accounts for about two-thirds of GDP. Over the projections period, consumer spending is expected to maintain

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Table 1. Summary of results of BLS aggregate economic projections, 1986, 1996, 2006, and projected 2016

Real gross domestic product (GDP) and components (Billions of chained 2000 dollars)	1986	1996	2006	2016	Average annual rate of change		
					1986–96	1996–2006	2006–16
Gross domestic product	$6,263.6	$8,328.9	$11,319.4	$14,875.2	2.9	3.1	2.8
Personal consumption expenditures	4,228.9	5,619.4	8,044.1	10,718.3	2.9	3.7	2.9
Gross private domestic investment	843.9	1,234.3	1,919.5	2,609.5	3.9	4.5	3.1
Exports	353.7	843.4	1,304.1	2,229.7	9.1	4.5	5.5
Imports	510.0	923.0	1,928.6	2,912.0	6.1	7.6	4.2
Federal defense consumption expenditures and gross investment	462.4	383.8	491.5	542.3	–1.8	2.5	1.0
Federal nondefense consumption expenditures and gross investment	160.1	189.6	250.7	253.1	1.7	2.8	.1
State and local consumption expenditures and gross investment	766.4	990.5	1,239.0	1,489.0	2.6	2.3	1.9
Nominal GDP and percent distribution (billions of dollars)"	**1986**	**1996**	**2006**	**2016**	**Percent distribution**		
					1986	**1996**	**2006**	**2016**
Gross domestic product	$4,462.8	7,816.9	13,194.7	22,642.3	100.0	100.0	100.0	100.0
Personal consumption expenditures	2,899.8	5,256.8	9,224.5	15,881.1	65.0	67.2	69.9	70.1
Gross private domestic investment	746.5	1,240.3	2,209.1	3,769.1	16.7	15.9	16.7	16.6
Exports	320.5	868.5	1,467.6	3,162.4	7.2	11.1	11.1	14.0
Imports	453.3	964.8	2,229.6	4,194.3	10.2	12.3	16.9	18.5
Federal defense consumption expenditures and gross investment	330.9	354.6	624.3	913.0	7.4	4.5	4.7	4.0
Federal nondefense consumption expenditures and gross investment	107.8	172.8	308.2	437.2	2.4	2.2	2.3	1.9
State and local consumption expenditures and gross investment	510.7	888.6	1,590.5	2,673.9	11.4	11.4	12.1	11.8
Labor supply and productivity	**1986**	**1996**	**2006**	**2016**	**Average annual rate of change**		
					1986–96	**1996–2006**	**2006–16**
Total population (millions)	240.4	269.8	300.5	327.0	1.2	1.1	0.9
Civilian population aged 16 and older	180.6	200.6	228.8	250.6	1.1	1.3	.9
Civilian labor force	117.8	133.9	151.4	164.2	1.3	1.2	.8
Civilian household employment	109.6	126.7	144.4	155.9	1.5	1.3	.8
Nonfarm payroll employment	99.5	119.7	136.2	151.1	1.9	1.3	1.0
Unemployment rate (percent)	7.0	5.4	4.6	5.0	–2.6	–1.5	.8
Private nonfarm business output per hour (chained 2000 dollars)	30.4	35.3	45.6	56.9	1.5	2.6	2.2

[1] Imports are subtracted from GDP compnents because they are produced outside of the United States.

SOURCE: Historical data, Bureau of Economic Analysis; projected data, Bureau of Labor Statistics.

its 2006 share of about 70 percent. In real terms, consumer spending has a projected growth rate of 2.9 percent per year from 2006 through 2016. For private investment, the projected real annual growth rate is 3.1 percent. Over the projections period, a deficit foreign trade position will persist. Growth of exports in real terms is expected to average 5.5 percent on an annual basis, while real imports are expected to grow at a 4.2-percent annual rate. This reflects an increase in the growth rate of exports and a decrease in the growth rate of imports over the previous decade. Real federal spending on defense is projected to grow at a rate of 1.0 percent through the decade, while nondefense spending is expected to remain nearly flat. State and local government expenditures are projected to grow in real terms at an annual average rate of 1.9 percent.

The macroeconomic projections are developed under certain assumptions and expectations. The unemployment rate is assumed to be 5.0 percent in 2016. Nonfarm business labor productivity is assumed to grow at an annual rate of 2.2 percent. This is slower than the 2.6-percent rate for 1996–2006, but faster than the 1.5-percent annual growth rate for 1986–96. The world economy is expected to be moderately strong along with a continuing and steady depreciation of the dollar against our major trading partners. Inflation, as measured by the GDP

price index, is assumed to be 2.7 percent per year over the projection period.[3]

In summary, moderately strong economic growth is expected, with productivity growth slightly faster than the long run trend.

Labor force. Mitra Toossi, the author of the second article in the series, presents the projected growth of the labor force by age, sex, race, and ethnicity (pages 33–52). The essential story of the labor force has three aspects. First, population growth is expected to slow over the coming decade, and consequently, labor force growth will also slow. Second, over the next 10 years, the labor force component of older individuals is expected to grow at a rate more than 5 times faster than the growth of the labor force overall. This reflects the movement of baby boomers into this older cohort and expected increases in labor force participation among older workers. Finally, the historical trend of increasing racial and ethnic diversity of the labor force is expected to continue.

The civilian labor force is projected to grow at an annual rate of 0.8 percent (See table 2.), slightly slower than the population growth rate of 0.9 percent annually.[4] Growth in the labor force is a consequence of changes in both the population and labor force participation rates. The overall participation rate is projected to decline slightly from 66.2 percent in 2006 to 65.5 percent in 2016. (See table 3.) The slower growth in the labor force relative to the population growth is a reflection of the declining overall participation rate. This, in turn, is being driven by the aging baby-boom cohort as they enter the 55-and-older age group with a significantly lower participation rate than the 25- to 54-year-old age group.

The progression of the baby boomers through their career paths over the last 40 years has had a significant impact on the growth characteristics of the labor force. Over the next 10 years, the "boomers'" decisions about work and retirement also will have significant impacts on the character of the labor force. An examination of the projected labor force participation rates by age shows a significant variation across the three main age groups. The 16- to 24-year-olds have a decreasing participation rate from 60.6 percent in 2006 to 57.1 percent in 2016; individuals in their prime work years of ages 24 to 54 have a slightly increasing participation rate of 82.9 percent to 83.6 percent; and the 55-and-older age group have the greatest increase in their participation rate, from 38.0 percent to 42.8 percent. For the 55-and-older age group, the participation rate change, along with increased numbers of individuals in their group, translates into an annual projected growth rate of 3.9 percent for the number of those 55 and older in the labor force, as shown in table 2. This growth rate is nearly 5 times the overall labor force annual growth rate of 0.8 percent.

The increase in the participation of those 55 and older is a continuation of the increase over the 1996–2006 decade from 30.3 percent to 38.0 percent. During this decade, the oldest of the baby boomers joined the 55-and-older component of the population. By contrast, the participation rate of the 55 and older group remained relatively flat between 1986 and 1996 at 30.1 percent and 30.3 percent respectively. The baby boomers in 1996 were aged 32 to 50, but by 2006 were aged 42 to 60. The first of the baby boomers entered into the 55-and-older age group in 2001. Many factors influence an individual's decision to remain in the work force or to retire. Health and the ability to work are very important. In general, people are living longer and healthier, allowing them to extend their working years. Government policies and legislation, and private sector business policies that affect retirement benefits also influence retirement decisions. The general trend towards defined contribution retirement plans rather than defined benefit plans encourages individuals to work longer. So too, the gradual increases in the age of eligibility for full Social Security payments that began in 2000 encourage individuals to work longer. These factors together underlie the trend towards increased participation of the 55-and-older age group.

Immigration plays a significant role in the dynamics of population and labor force growth. The Census Bureau estimate of population change between April 2000 and July 2006 is about 18 million.[5] Of that, about 7.6 million, or 43 percent was supplied by net international migration. Asian immigrants accounted for about 23 percent of the net migration and immigrants of Hispanic origin, about 52 percent. Similarly, Asians and Hispanics have been the fastest growing components of the labor force since 1986, and this is expected to continue into the future. Their respective labor forces have projected growth rates of 2.7 per year during the 2006–16 period.

In summary, the labor force is projected to grow at a pace slightly less than that of the overall population. This reflects an aging workforce as the baby boomers move well into the ages considered traditional for retirement.

Industry employment. The third article (pages 53–85), by Eric Figueroa and Rose Woods, examines the growth of industry output and employment. Projections of employment and output at the aggregate level show the combined macro effects of slower growth in both productivity

Table 2. Civilian labor force by age, sex, race, and Hispanic origin, 1986, 1996, 2006, and projected 2016

(Numbers in thousands)

Age, sex, race, and ethnicity	Level				Change			Percent distribution				Average annual rate of change		
	1986	1996	2006	2016	1986–96	1996–2006	2006–16	1986	1996	2006	2016	1986–96	1996–2006	2006–16
Total, 16 years and older	117,834	133,943	151,428	164,232	16,109	17,485	12,804	100.0	100.0	100.0	100.0	1.3	1.2	0.8
Age, years:														
16 to 24	23,367	21,183	22,394	20,852	–2,184	1,211	–1,542	19.8	15.8	14.8	12.7	–1.0	.6	–.7
25 to 54	79,563	96,786	103,566	106,026	17,223	6,780	2,460	67.5	72.3	68.4	64.6	2.0	.7	.2
55 and older	14,904	15,974	25,468	37,354	1,070	9,494	11,886	12.6	11.9	16.8	22.7	.7	4.8	3.9
Sex:														
Men	65,422	72,087	81,255	87,781	6,665	9,168	6,526	55.5	53.8	53.7	53.4	1.0	1.2	.8
Women	52,413	61,857	70,173	76,450	9,444	8,316	6,277	44.5	46.2	46.3	46.6	1.7	1.3	.9
Race:														
White	101,801	113,108	123,834	130,665	11,307	10,726	6,831	86.4	84.4	81.8	79.6	1.1	.9	.5
Black	12,654	15,134	17,314	20,121	2,480	2,180	2,807	10.7	11.3	11.4	12.3	1.8	1.4	1.5
Asian	3,379	5,701	6,727	8,741	2,322	1,026	2,014	2.9	4.3	4.4	5.3	5.4	1.7	2.7
All other groups[1]	–	–	3,553	4,705	–	–	1,152	–	–	2.3	2.9	–	–	2.8
Ethnicity:														
Hispanic origin	8,076	12,774	20,694	26,889	4,698	7,920	6,195	6.9	9.5	13.7	16.4	4.7	4.9	2.7
Other than Hispanic origin	109,758	121,169	130,734	137,343	11,411	9,565	6,609	93.1	90.5	86.3	83.6	1.0	.8	.5
White non-Hispanic	94,027	100,915	104,629	106,133	6,888	3,714	1,504	79.8	75.3	69.1	64.6	.7	.4	.1
Age of baby boomers	22 to 40	32 to 50	42 to 60	52 to 70										

[1] The "all other groups" category includes (1) those classified as being of multiple racial origin and (2) the race categories of (2a) American Indian and Alaska Native or (2b) Native Hawaiian and Other Pacific Islanders. Dash indicates no data collected for category.

Table 3. Civilian labor force participation rates by age, 1986, 1996, 2006, and projected 2016

(In percent)

Group	Participation rate				Percentage point change			Average annual rate of change		
	1986	1996	2006	2016	1986–96	1996–2006	2006–16	1986–96	1996–2006	2006–16
Total, 16 years and older	65.3	66.8	66.2	65.5	1.5	–0.6	–0.7	0.2	–0.1	–0.1
16 to 24	68.6	65.5	60.6	57.1	–3.1	–4.9	–3.5	–.5	–.8	–.6
16 to 19	54.7	52.3	43.7	37.5	–2.4	–8.6	–6.2	–.4	–1.8	–1.5
20 to 24	78.9	76.8	74.6	71.8	–2.1	–2.2	–2.8	–.3	–.3	–.4
25 to 54	82.0	83.8	82.9	83.6	1.8	–.9	.7	.2	–.1	.1
25 to 34	82.9	84.1	83.0	85.4	1.2	–1.1	2.4	.1	–.1	.3
35 to 44	83.7	84.6	83.8	83.3	.9	–.8	–.5	.1	–.1	–.1
45 to 54	78.0	82.1	81.9	82.1	4.1	–.2	.2	.5	.0	.0
55 and older	30.1	30.3	38.0	42.8	.2	7.7	4.8	.1	2.3	1.2
55 to 64	54.0	57.9	63.7	66.7	3.9	5.8	3.0	.7	1.0	.5
65 to 74	15.2	17.5	23.6	29.5	2.3	6.1	5.9	1.4	3.0	2.3
75 and older	4.0	4.7	6.4	10.5	.7	1.7	4.1	1.6	3.1	5.1

and the labor force. Nonagricultural wage and salary employment[6] is projected to grow by 15 million, an annual growth rate of 1.0 percent, during the projections decade. Projected total industry output is expected to increase[7] on a real basis at an annual rate of 2.9 percent. (See table 4.) This growth in both employment and output is slower than the respective annual growth rates of 1.3 percent and 3.0 percent in the historical 1996–2006 period.

Nearly all the growth in nonagricultural wage and salary employment is projected to occur in the service-providing sectors of the economy. Employment in services is expected to account for 86 percent of all jobs. The projected 2016 level of employment in services is 130.2 million which is attained with an expected 1.3-percent annual growth rate. The two fastest growing service-providing sectors are health care and social assistance, and professional and business services, with growth rates of 2.4 and 2.1 percent respectively. The combined employment growth for these two sectors, 8.1 million, account for more than half the total projected employment increase.

Construction, projected to add about 780,000 jobs, is the only component of the goods-producing sector expected to have a positive employment growth. Manufacturing declined by 3.0 million jobs during 1996–2006 at an annual rate of –1.9 percent. The decline is expected to continue at a slower pace over 2006–16 of –1.1 percent annually, resulting in a 1.5-million job loss. The projected decline in manufacturing employment, and the goods-producing sector overall, is not accompanied by expected real output declines, however. Expected productivity increases during 2006–16 offset the employment declines, resulting in a projected annual growth rate for the output from the goods-producing sector of 2.1 percent, and for manufacturing output of 2.4 percent. Real output for the service-producing sector has a projected annual growth rate of 3.3 percent. With the associated employment growth, productivity gains clearly contribute less to service output growth than goods output growth.

The two sectors within the service-producing sector with the fastest projected employment growth also are expected to have strong real output growth. Health care and social assistance real output growth is projected at 3.6

Table 4. Real output and nonfarm wage and salary employment, by major industry, 2006 and 2016

Industry sector	Output[1]		Average annual rate of change	Employment[2]		Average annual rate of change
	2006	2016		2006	2016	
Total	$20,265.3	$27,093.7	2.9	136,912.2	151,962.3	1.0
Goods-producing, excluding agriculture	5,297.3	6,535.0	2.1	22,504.9	21,772.6	–.3
Mining	242.2	268.6	1.0	618.7	608.5	–.2
Construction	899.1	1,031.1	1.4	7,688.9	8,469.6	1.0
Manufacturing	4,145.8	5,263.6	2.4	14,197.3	12,694.5	–1.1
Service-producing	13,778.0	18,992.2	3.3	114,407.3	130,189.7	1.3
Utilities	323.4	353.5	.9	548.5	517.6	–.6
Wholesale trade	1,041.9	1,702.7	5.0	5,897.7	6,326.2	.7
Retail trade	1,305.3	1,892.1	3.8	15,319.4	16,006.4	.4
Transportation and warehousing	669.9	889.9	2.9	4,465.8	4,962.0	1.1
Information	1,006.2	1,682.8	5.3	3,054.9	3,266.7	.7
Financial activities	2,621.1	3,761.6	3.7	8,363.2	9,570.1	1.4
Professional and business services	2,130.7	2,990.7	3.4	17,551.6	21,643.7	2.1
Educational services	157.1	190.9	2.0	2,918.4	3,527.4	1.9
Health care and social assistance	1,210.9	1,720.2	3.6	14,919.8	18,954.1	2.4
Leisure and hospitality	739.3	909.4	2.1	13,143.4	15,016.7	1.3
Other services	439.1	550.5	2.3	6,234.6	7,077.2	1.3
Federal Government	715.1	760.7	.6	2,728.3	2,625.7	–.4
State and local government	1,435.9	1,748.7	2.0	19,261.7	20,696.1	.7

[1]Output is on a gross duplicated basis in billions of chained 2000 dollars. Total includes agriculture which is excluded from detail.

[2]Employment is in thousands. Includes wage and salary data from the Current Employment Statistics survey, except private households, which is from the Current Populations Survey. Logging workers are excluded.

percent annually, while professional and business services real output is expected to grow at an annual rate of 3.4 percent. The information sector is the fastest growing service-producing sector, with projected real output growth of 5.3 percent annually. The growth for the information sector is driven by expectations of growth for telecommunications, software publishing, and Internet and other related services.

In summary, the long-term historical shift of employment from the goods-producing to the service-producing sector is expected to continue. In part, this is predicated on differences in productivity growth at the sector level, but also, in part, demographics and technological change are driving the shift.

Occupational employment. The final article, by Lynn Shniper and Arlene Dohm, discusses the results of the occupational component of the projections (pages 86–125). The two largest of the major occupational groups[8] in 2006, professional and related occupations, and service occupations, are expected to remain the two largest in 2016. (See table 5.) These two occupational groups are projected as the fastest growing, accounting for about 63 percent of the total projected growth. With the addition of the management, business, and financial occupational group—the only other group expected to exceed the projected average occupational growth—these three occupational groups account for 73 percent of total growth. On the opposite end of the growth spectrum resides the fishing, forestry, and farming occupations and the production occupations. These two occupational groups have projected declines in the number of jobs over the 10-year span 2006–16. The remaining occupational groups are expected to grow, but at a rate less than the average for all occupations.

Within the professional and related occupational group, three major occupational groups account for 3.5 million of the projected jobs growth. Health care practitioners and technical occupations contribute 1.4 million; education, training, and library contribute 1.3 million; and computer and mathematical science contribute 822,000. Within the service occupational group, the major group, healthcare support occupations, is expected to be the fastest growing at nearly 27 percent over the 2006–16 period.

New job growth is not the only source of employment opportunities. People retire, or leave the workforce for several reasons; people also leave their jobs and take work in different occupations. The job opportunities that arise from the need to replace workers are significant: at 35.1 million it is more than double the 15.6 million of new jobs attributed to growth. As the baby boomers age, an increasing share of replacement needs will arise from their retirements.

The occupational article also examines the most significant source of training by occupation. The analysis of the most significant source of training reveals that the occupations historically requiring short-term on-the-job training are expected to be about 30 percent of all new jobs. Jobs that historically require a bachelor's degree as the most significant source of training are expected to account for about 20 percent of all new jobs.

In summary, the occupational projections are similarly impacted by the factors that drive the industry employment projections. The combined influence of the productivity outlook, the aging demographic, and the technolog-

Table 5. Employment by major occupational group, 2006 and projected 2016

(Numbers in thousands)

Occupation	Level		Change	Percent distribution		Percent change
	2006	2016		2006	2016	
Total, all occupations	150,620	166,220	15,600	100.0	100.0	10.4
Management, business, and financial	15,397	16,993	1,596	10.2	10.2	10.4
Professional and related	29,819	34,790	4,970	19.8	20.9	16.7
Service	28,950	33,780	4,830	19.2	20.3	16.7
Sales and related	15,985	17,203	1,218	10.6	10.3	7.6
Office and administrative support	24,344	26,089	1,745	16.2	15.7	7.2
Farming, fishing, and forestry	1,039	1,010	–29	.7	.6	–2.8
Construction and extraction	8,295	9,079	785	5.5	5.5	9.5
Installation, maintenance, and repair	5,883	6,433	550	3.9	3.9	9.3
Production	10,675	10,147	–528	7.1	6.1	–4.9
Transportation and material moving	10,233	10,695	462	6.8	6.4	4.5

ical changes that confront both consumers and businesses are expected to motivate a continued shift towards service-producing activities.

Risks to the projections

Every forecast has associated risks; the BLS projections are no different. At the first level, the underlying assumptions of the projections, whether explicit or implicit within the analytic methods, are a point of risk. At the second level, the analytic results have risk owing to the uncertain nature of the issues addressed. These projections are an attempt to identify the most likely path for employment within the U.S. economy over the coming decade. That attempt requires giving qualitative and quantitative boundaries to several issues facing the economy. These issues include the aging population, globalization and immigration, and other considerations such as the current wars and the reality of terrorism. The section that follows briefly discusses these issues.

General risks. Statistical and econometric models formally project historical relationships. Subjective analysis, as well, relies on understanding history and extrapolating that understanding to conceive the future. Exercises such as the BLS projections typically stipulate a disclaimer for unanticipated events: no new wars, no forthcoming natural disasters or other significant unanticipated events. Such a disclaimer reinforces the point that the methods rely on an extrapolation of history, and that the occurrence of such events could upset the behavior of the various models or upend the basis of analysis. This disclaimer applies to the BLS projections.

Aging population. The aging of the U.S. population and the implications for Social Security and healthcare present challenges for domestic policymakers. Future policy decisions present an associated risk to these projections. BLS assumes that the laws and policies in effect, or legislated to be effective, during the development of the projections are not changed. Therefore, the current laws regarding Social Security and Medicare are assumed throughout the projections. However, it is clear there are long-term fiscal issues regarding both that require political solutions. BLS makes no presumptions about the nature of any future political solutions, nor what the impacts might be upon the projections.

Globalization and immigration. Political and economic concerns revolve around the reality of globalization and immigration. Persistent foreign trade deficits in goods and services, along with increased flows of capital and strong immigration growth have prompted both political and economic debate about appropriate U.S. policy. Again, BLS makes no presumptions during the development of these projections about future laws or policies regarding these issues. The projections do recognize the reality of historical trends, and generally expect the persistence of these trends.

Economic growth requires energy, and crude oil is a fundamental source of energy on a global basis. These projections use the annual energy forecast provided by the Department of Energy to develop the underlying energy assumptions.[9] The cost of imported oil to refiners averaged just shy of $21 a barrel in real terms. When deflated by the GDP price deflator (2000 chain-weighted basis), the cost to refiners ranged from about $13 to $28 a barrel from 1986 through 2002.[10] In 1980, imported oil peaked at a real price of almost $63 a barrel. With the beginning of the Iraq war in 2003, the real cost of imported oil began to climb, but at of the end of 2006, it had not reached the 1980 peak. The real cost of oil can be volatile, and is subject to political as well as market forces. These projections mirror the reference case of the Department of Energy's projections in assuming a fairly optimistic outlook, where the price of oil is expected to retreat somewhat from the high real levels in 2006 and not return to the relatively lower prices of the late 1980s and 1990s.

With regard to offshoring of jobs, BLS has attempted to address the possible impacts on occupational demand in a qualitative sense.[11] These efforts involve a process of "scoring" individual occupations according to susceptibility of being offshored. The scores are derived from the answers regarding specific characteristics of work as they pertain to each occupation. Based on these scores, certain occupations are identified as most susceptible—but not necessarily certain—to be offshored. This analysis lends a structured qualitative understanding to one factor among many that affect occupational demand for a given industry.

The immigration assumptions are embedded in the Census Bureau's population projections. In developing the labor force projections, BLS adjusts the population projections so that they correspond with the most recent historical population data. No other adjustment is made to the population projections. As Mitra Toossi discusses in her article, there is a difference of about 400,000 immigrants per year between the Census Bureau's estimates of the immigrant population and the Census Bureau's pro-

jection of the immigrant population, over the 2000–06 period. This difference, extrapolated through the 2006–16 decade, would add 4 million persons to the projected resident population to yield 329 million instead of 325 million in 2016. The projected labor force, given the projected participation rates, would be nearly 167 million in 2016 as opposed to 164.2 million.

There is much current political debate about immigration. The context of that debate is twofold: economic and defensive security. The economic context ranges from the advantages of immigration for the overall economy, to the risk of job opportunities for U.S. citizens. The security context focuses on the issue of potential terrorist activity within U.S. borders. The political outcomes can have varying impacts upon the projections. Generally, however, immigrants are motivated by economic opportunity and therefore are expected to have higher labor force participation rates than the resident population, on average.

Projections methods

The projections are developed by BLS as a series of analytical processes that incorporate a variety of methods, ranging from econometric and time-series models to explicitly subjective analyses. The process begins with the projection of the labor force, followed by the projection of aggregate economic activity, then industrial production and employment, and finally the translation of industry employment into occupational employment. The methods used are discussed in general terms in the following section. A more detailed discussion is available in the BLS *Handbook of Methods*.[12]

The labor force projections are developed by first extrapolating detailed labor force participation rates and then applying those rates to a set of population projections. The U.S. Census Bureau provides population projections by detailed age, sex, race, and ethnicity groupings.[13] The historical labor participation rates are projected using time-series smoothing and extrapolation techniques.[14] These extrapolated labor force participation rates are then multiplied by the projected population to arrive at the initial estimates of the labor force groupings. The projected participation rates and labor force levels are reviewed for anomalous behavior, such as unexplained changes in the relationships between the various groupings of the labor force. When completed, the total of the projected labor force is supplied, as an exogenous variable, to the next stage of the projections.

The aggregate economic projections are developed using the Macroeconomic Advisers, LLC (MA) quarterly macroeconomic model. MA is a St. Louis, MO, based forecasting group that provides both monthly short-term and quarterly long-term projections of the U.S economy.[15] The MA macroeconomic model (WUMMSIM 2005 version 2.0) comprises 744 variables descriptive of the U.S. economy. Of these, 134 are behavioral equations, 409 are identities. The remaining 201 variables are exogenous and must be supplied to the model in order to calculate a solution for the projections horizon. Among the exogenous variables, only a relatively small number significantly affect the long-term projections of the value of GDP and its demand makeup, as well as the level of employment necessary to produce that GDP. Included in the list of critical assumptions are monetary and fiscal policies, energy, outlook, population growth, and demographic changes. These are supplied to the model which is then solved for the behavioral and identity equations. Further discussion and presentation of the exogenous macro assumptions is found in the article by Betty Su.

The projections are generally prepared with a prior notion of target values for selected variables in the macroeconomic model. These include the inflation rate, the level of the unemployment rate, the labor productivity growth rate, and variables related to international trade. Setting preliminary target values for those key variables defines a context in which the model results are evaluated. The final results for these variables are determined through several iterations of model solution and review. When the aggregate economic projection is final, the components of GDP are then supplied to the industry component of the projections process.

The translation of GDP into detailed industrial production is the next stage in the process of developing the BLS employment projections. This involves two tasks. The first is to allocate the GDP components, supplied by the macroeconomic model, to a detailed list of commodities purchased. The individual GDP components are allocated to a detailed commodity-by-category matrix. This matrix comprises 201 commodity sectors and 194 categories. The methods vary by GDP component and include econometric and statistical techniques, as well as analytic judgment. This redistribution of GDP provides the demand component of an inter-industry model of the U.S. economy.

The second task is to derive industry output, using the final demand allocated to commodity and an inter-industry model of the U.S. economy. This involves projecting an input-output system for the target year that allows the calculation of the industry and commodity output necessary to produce the projected level of GDP.[16] This task

also is accomplished by using a combination of statistical methods and analytic judgments. The industry total output includes both industry sales to final users and to other industries as intermediate inputs. This measure of industry output is also referred to as gross duplicated output, and, at a detailed industry level, is the determinant for the primary factors of production (labor and capital) necessary to produce that given level of output.

Wage and salary employment is solved independently for each industry through a system of equations. The individual industry estimates of employment are controlled back to a total employment level derived from the macroeconomic solution. Total hours are first estimated through an estimated production function for each of the detailed industries. These equations solve for total hours as a function of industry output, sector wage rates, the unemployment rate, and a trend variable standing as a proxy for technological change. A separate set of trend equations estimates average weekly hours for each industry. An identity relating average weekly hours, total hours, and employment yields a count of jobs by industry.[17] Self-employment is estimated as a trend of the historical relationship with wage and salary employment. In the final stage, the industry employment for the 201 industries is extrapolated to more than 300 industries of the North American Industry Classification System (NAICS), for input to the occupational demand component.

The occupational projections also involve two basic tasks. In the first task, the latest historical industry-by-occupation staffing pattern matrix is extrapolated to the projections year. The second task applies the projected industry employment from the labor model to a projected staffing pattern matrix to derive occupational employment. A staffing pattern matrix presents the proportional distribution of detailed occupations within each of the 311 detailed NAICS industries. Analysts make specific judgments as to whether an occupational ratio should remain unchanged, increase, or decrease over the projections horizon. These ratio analyses are conducted relative to all the other ratios within a given industry. Analysts' judgments are based on reviews of available historical data, studies of specific industries and occupations, and ongoing consultations with industry, trade and professional associations. Balancing procedures ensure that the changed ratios sum to unity for each industry. The final step, applying the previously projected industry employment levels, result in estimates of new job growth for more than 700 detailed occupations. Estimates of job growth for the self-employed are carried out in a similar, but separate step.

The projections analysts also form estimates of replacement demand for individuals who temporarily leave the labor force, retire, or move on to other occupations during the projections decade. These estimates are based on data from the Current Population Survey. Replacement demand is expected to be more than double new occupational job growth. By considering replacement demand in conjunction with new job growth, a better understanding is gained for potential job opportunities in many occupations.

The results of each stage of the projections are reviewed both as an independent step, and in the context of cumulative results. The results are examined for consistency and meaningfulness in the context of the modeling framework, research and analysis, and understanding of market dynamics. The review process can have feedback effects on prior steps so that, for example, a result in occupational levels may influence rethinking the determinants of industry outputs and/or employment, or even precipitate revisiting the results at the aggregate level of detail. BLS conducts this detailed review process to provide estimates that are consistent from the aggregate to the most detailed occupations.

As a final review, BLS evaluates previous projections when historical data overtakes the projected years. The Bureau has carried out and published projections evaluations since the 1970 projections.[18] These evaluations are conducted to provide insight on the efficacy of BLS methods, to give BLS guidance on potential improvements of methods, and to provide users with a basis to determine for themselves both weaknesses and strengths in the projections.

THE BLS PROJECTIONS are undertaken to provide guidance primarily to those seeking labor market and career information. These projections present a reasonable and attainable view of the likely path of the U.S. economy, given the caveats associated with the projections methods.

The U.S. economy has been resilient over these last 10 years, and the 2006–16 projections indicate that this is expected to continue, with an expected GDP growth rate of 2.8 percent through 2016. The population is aging and becoming more diverse, as is the labor force, and those trends are expected to continue. The moderate growth of the U.S. economy and the aging of both the workforce and the population combine to present a unique set of opportunities for those seeking employment and unique challenges for policymakers and educators. □

Notes

[1] The 20 projection groups span projections to 1970, published in 1966, to the current projections to 2016. They represent a unified set of aggregate economic, labor force, industry, and occupational demand projections presented as a series of linked outlook estimates. The occupational demand projections predate these unified sets of projections by 17 years with the first publication of the *Occupational Outlook Handbook* in 1949. A series of articles published in the May 1999 issue of the *Monthly Labor Review* takes a comprehensive look at the history of the occupational projections program in BLS. These are available at **www.bls.gov/opub/mlr/1999/05/contents.htm** (visited Nov. 19, 2007).

[2] See in this issue, Betty Su, "The U.S. economy to 2016: slower growth as boomers begin to retire," pp. 13–32; Mitra Toossi, "Labor force projections to 2016: more workers in their golden years," pp. 33–52; Eric Figueroa and Rose Woods, "Industry output and employment projections to 2016," pp. 53–85; and Arlene Dohm and Lynn Shniper, "Occupational employment projections to 2016: less production, more health care jobs," pp. 86–125.

[3] See Su, "The U.S. economy," for additional disscussion of macroeconomic assumptions.

[4] The labor force is defined as the population that is 16 and older at work or actively seeking work. The labor force participation rate is the ratio of the labor force to the population aged 16 and older. The bottom panel of table 1 shows the 0.9-percent increase in the total population.

[5] See Table 5: Cumulative Estimates of the Components of Population Change by Race and Hispanic or Latino Origin for the United States: April 1, 2000 to July 1, 2006 (NC–EST2006–05), Population Division, U.S. Census Bureau, online at **http://www.census.gov/popest/national/asrh/NC-EST2006/NC-EST2006-05.xls** (visited Nov. 19, 2007).

[6] Nonagricultural wage and salary employment includes data from the Current Employment Statistics survey, except private households, which is from the Current Population Survey.

[7] When referencing industry and total industry output, this article uses the gross duplicated output concept. Gross duplicated output includes intermediate as well as final purchases of goods and services. Real output is measured as a 2000 based chain-weighted Fisher index and is used for historical rate of growth comparisons. Real output on an industry basis does not add to their higher level aggregates because of chain weighting. See Charles Steindel, "Chain-weighting: The New Approach to Measuring GDP," Current Issues in Economics and Finance (New York, Federal Reserve Board of New York, December 1995).

[8] The Standard Occupational Classification (SOC) system broadly classifies occupations in one of 23 major groups. This article uses an aggregation of the 23 major groups referred to as the SOC Intermediate Aggregation which is comprised of 11 groups. The groupings, management, business, and financial occupations; professional and related occupations; and service occupations are comprised of selections of the 23 major group levels. Military specific occupations are excluded, and represent a specific grouping under the 23 major groups as well as the intermediate aggregation.

[9] See *Annual Energy Outlook 2007* (U.S. Department of Energy, Energy Information Agency, February 2007), pp 34–35.

[10] See *Annual Energy Review* (U.S. Department of Energy, Energy Information Agency, June 2007), table 5.21, p 171.

[11] For more information about BLS methods of evaluating offshoring risk, see "Accounting for Offshoring in Occupational Projections," Occupational Projections and Training Data, 2006–2007 Edition, Bulletin 2602 (U.S. Department of Labor, February 2006), pp.12–15.

[12] The *BLS Handbook of Methods* is available online as a series of chapters in pdf format. The projections program is described in chapter 13 of the *Handbook* at **http://www.bls.gov/opub/hom/pdf/homch13.pdf** (visited Nov. 19, 2007).

[13] BLS labor force projections are classified by 136 different groups including gender, 17 age groups, and 4 race and ethnic categories. The race categories include white-only, black-only, Asian-only and "all other." The "all other" group includes all those who claim multiracial backgrounds in addition to the race categories of American Indian, Alaska Natives, and Native Hawaiian and other Pacific Islanders. In addition, projections are made of the Hispanic ethnic category and white non-Hispanics.

[14] For detail on the extrapolation techniques applied to the labor force participation rates, see Mitra Toossi, "Labor force projection methodology" (unpublished documentation memorandum, Bureau of Labor Statistics). For updates contact Toossi.Mitra@bls.gov.

[15] Information about Macroeconomic Advisors, LLC, and the products and services they offer, are available online at **http://www.macroadvisers.com** (visited Nov. 19, 2007).

[16] The source data for the input-output model is published by the Bureau of Economic Analysis. More information about the data and methods is available online at **http://www.bea.gov/industry/** (visited Nov. 19, 2007).

[17] For details about the industry employment model, see "A model of detailed industry labor demand" (unpublished documentation memorandum, Bureau of Labor Statistics). For updates contact Woods.Rose.A @bls.gov or Figueroa.Eric@bls.gov.

[18] For the most recent BLS evaluations, see Howard N Fullerton Jr., "Evaluating the BLS labor force projections to 2000," *Monthly Labor Review*, October 2003, pp. 3–12 and Jill Auyer, and Andrew Alpert "Evaluating the BLS 1988–2000 employment projections," *Monthly Labor Review*, October 2003, pp. 13–37.