New York Metropolitan Transportation Council

The Metropolitan Planning Organization

Demographic and Socioeconomic Forecasting

Technical Memorandum
2040 Forecasts Modeling Methodology
County/Subregional Level

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D E M O G R A P H I C A N D
S O C I O E C O N O M I C F O R E C A S T I N G

2040 FORECASTS MODELING METHODOLOGY
COUNTY/SUBREGIONAL LEVEL

By NYMTC

TECHNICAL MEMORANDUM
MODELING METHODOLOGY AT COUNTY/SUBREGIONAL LEVEL

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1. Introduction

Federal Transportation Planning Grant Requirements direct metropolitan planning organizations (MPO) to prepare and adopt long range economic forecasts for their regions to be used in transportation and land use analyses. The New York Metropolitan Transportation Council (NYMTC) is the MPO for New York City, Long Island and the lower Hudson Valley.

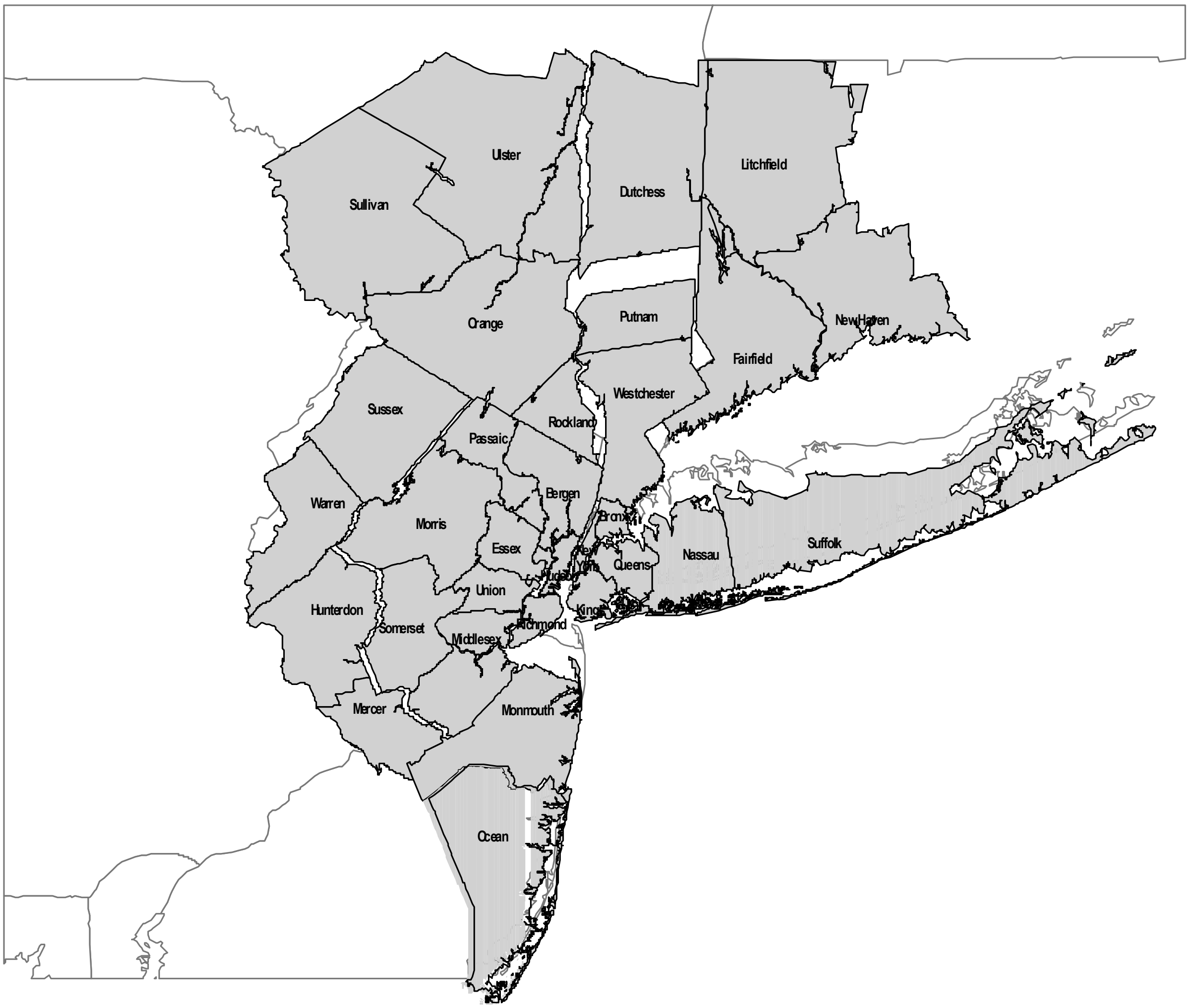
This technical report presents NYMTC's new set of forecasts developed for the New York Metropolitan Region (31 counties) at the subregional and county levels for use in NYMTC's 2015-2040 Regional Transportation Plan and conformity analysis. These socioeconomic forecasts provide necessary data inputs to the New York Best Practice Model (NYBPM), NYMTC's in-house methodology for forecasting changes in future travel patterns that responds to projected changes in socioeconomic conditions and to planned changes in the transportation system in the region. The five subregions are comprised of the following counties:

New York City:	Bronx, Kings, New York, Queens and Richmond;
Long Island:	Nassau and Suffolk;
Lower Hudson Valley:	Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster and Westchester;
Connecticut:	Fairfield, Litchfield and New Haven;
New Jersey:	Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Sussex, Union and Warren.

By the time the 2035 series of forecasts were adopted by PFAC in September 2009 the regional economic situation had changed dramatically. It was the conclusion of NYMTC and the member agencies that a new 2040 series of SED forecasts were required for the upcoming RTP and conformity analysis. Because of the constraints of time, and the logistics of bringing in an outside consultant, the Forecast Working Group (FWG) made a decision to produce the next series of forecasts in house. To produce the new series of forecasts the models of the 2035 forecast series were used, with updated data. During the entire process NYMTC's Forecast Working Group (FWG) provided important insight and valuable feedback which was incorporated into the forecasting process.

This report contains the methodology which was used for the four models (population, employment, labor force and household formation) to produce the 2015-2040 series of forecasts at the subregional and county level. Updated national economic indicators, census data and other resources were used to create new 2010 base year information.

Map 1. Thirty One County New York Metropolitan Region



2. <u>Population Model</u>

The Population Model is based on the cohort-survival technique, a standard population forecasting methodology. In this method, the population is broken into separate age/sex-specific cohorts. A separate projection is made for every cohort for each time interval, based on the cohort's population at the beginning of the interval, its forecasted survival rate during the interval, and any net in- or out-migration over the interval. Population growth due to births for each interval is calculated based on forecasted age-specific fertility rates for the female population. The cohort-survival method provides a reliable measure of population change due to natural cause (i.e., births and deaths) and estimates the effects of net-migration. The Population Model accounts for the net-migration component as a function of historical rates and the future demand of employment for labor force. The model's structure is discussed in detail in Section 2.2 below.

The Population Model generates population forecasts by sex and five-year age cohort through 84 years-of-age, as well as for persons 85 years-of-age and over. A separate model was run for each subregion and for each partner county of the NYMTC territory. Within each subregional model, submodels generate separate outputs for each mutually-exclusive racial/ethnic group (non-Hispanic White, non-Hispanic Black, non-Hispanic Asian/Other, and Hispanic). Each model includes a historical section, covering the years 1970 through 2010, and a forecast section, covering the years 2010 through 2040. All outputs are generated on a five-year interval basis. A separate forecasting routine disaggregates the subregional population forecasts to the county level for the non-partner counties of the NYMTC study area.

The Population Model uses US Census Bureau historical population figures as a basis for all projections, including the interim population estimates by age/sex/race-ethnicity. Forecasted survival and fertility rates will be developed in consultation with Census Bureau demographers, based upon national-level Census Bureau forecasts adjusted for subregional differences. The forecasts of births and deaths are controlled by an adjustment factor that reflects the difference between actual historical births and deaths, on a racial/ethnic-specific basis, from state Department of Health (DOH) sources, and predicted births and deaths based on population and fertility figures from the Census Bureau historical series. Net migration forecasts are based on historical levels forecasted in relation to natural increase, and the constraint imposed by regional employment and labor force forecasts.

2.1 Data Inputs

The Population Model incorporates a number of inputs at each five-year interval:

- Historical population figures by racial/ethnic group, sex and five-year age cohort.
- Population in 2010 by racial/ethnic group, sex and five-year age cohort.
- Historical and forecasted survival rates by racial/ethnic group, sex and five-year age cohort.

- Historical and forecasted fertility rates by racial/ethnic group and five-year age cohort of women in reproductive ages.

- Historical births and deaths, by racial/ethnic group where available.

- Labor force net migration, by racial/ethnic group, sex and age.

This section discusses the various inputs to each model, gives their sources, and where relevant discusses any adjustments to source data.

As discussed above, each subregional and county model incorporates submodels for each racial/ethnic group. Where necessary, source data were disaggregated by racial/ethnic group within the model for incorporation into each racial/ethnic submodel. For the sake of convenience, this disaggregation process is described together with the discussion of each input, below.

2.1.1 Historical Population Data

The Population Model uses 2010 Census as a base for all forecasts. In addition, decennial Census population data for 1970 to 2000 are incorporated as inputs in the historical section where they are used in the calculation of control factors used in births and deaths forecasting. Data for 2000 came from the Census's Modified Race Data Summary File (MRS), while data for 1980 and 1990 came from the Modified Age/Race/Sex (MARS) data set; and data for 1970 came from the Summary Tape File (STF) data set. All Census data are aggregated by sex and five-year age cohort through age 84 with an additional cohort including persons 85 years of age and older. MRS and MARS data are reported by the racial/ethnic groupings used in this study; data for 1970 were adjusted to fit these groupings. All figures are aggregated at the subregional level.

For intercensal years 1975 and 1985, the Census Bureau did not release age-, sex- and race-specific figures; for intercensal year 1995, such data were released but judged to be inaccurate upon enumeration of the 2000 Census. Therefore, for these years, figures were interpolated from the preceding and following decennial Census years.

2.1.2 Census 2010 Population

Age/sex/racial-ethnic population estimates are compiled for the year 2010 from the Census Bureau's count. Table 1 compares the regional summary of all races for 2010 with the population in 2000, used in cohort-survival forecasting models.

Table 1. Age/Sex Structure of All Races Population of the New York Metropolitan Region in 2000 & 2010

Male All Races Population	Estimate		Change	
	2000	2010	Absolute	Percent
Under 5	743,303	749,118	5,815	0.78%
5-9	787,431	739,230	-48,201	-6.12%
10-14	762,732	725,391	-37,341	-4.90%
15 - 19	702,722	771,034	68,312	9.72%
20 - 24	668,270	724,873	56,603	8.47%
25 - 29	734,281	784,253	49,972	6.81%
30 - 34	833,241	757,300	-75,941	-9.11%
35 - 39	898,212	762,664	-135,548	-15.09%
40 - 44	854,088	814,357	-39,731	-4.65%
45 - 49	737,544	864,326	126,782	17.19%
50 - 54	657,204	787,977	130,773	19.90%
55 - 59	500,016	657,085	157,069	31.41%
60 - 64	395,220	535,636	140,416	35.53%
65 - 69	326,859	384,689	57,830	17.69%
70 - 74	292,626	289,301	-3,325	-1.14%
75 - 79	228,316	224,660	-3,656	-1.60%
80 - 84	139,529	164,449	24,920	17.86%
85 & Over	99,156	131,300	32,144	32.42%
Total Male	10,360,750	10,867,641	506,891	4.89%
Female All Races Population	**Estimate**		**Change**	
	2000	**2010**	**Absolute**	**Percent**
Under 5	710,198	723,733	13,535	1.91%
5 - 9	751,424	713,188	-38,236	-5.09%
10-14	727,547	694,068	-33,479	-4.60%
15 - 19	662,064	730,439	68,375	10.33%
20 - 24	670,417	713,315	42,898	6.40%
25 - 29	762,199	776,039	13,840	1.82%
30 - 34	865,113	766,790	-98,323	-11.37%
35 - 39	931,890	789,020	-142,870	-15.33%
40 - 44	893,788	839,533	-54,255	-6.07%
45 - 49	792,316	888,330	96,014	12.12%
50 - 54	731,876	822,128	90,252	12.33%
55 - 59	570,499	706,060	135,561	23.76%
60 - 64	459,249	605,640	146,391	31.88%
65 - 69	403,909	457,271	53,362	13.21%
70 - 74	393,642	358,435	-35,207	-8.94%
75 - 79	347,311	304,411	-42,900	-12.35%
80 - 84	250,124	257,843	7,719	3.09%
85 & Over	250,371	286,405	36,034	14.39%
Total Female	11,173,937	11,432,648	258,711	2.32%
Total Population	**21,534,687**	**22,300,290**	**765,603**	**3.56%**

Source: United States Census Bureau, Interim Population Estimates

Prior to 2000, the Census series provided aggregate county level population by four race categories (White, Black, American Indian and combination of Alaska Native, Asian and Pacific Islander) cross-tabulated by two ethnicity categories (Hispanic, non-Hispanic), yielding eight racial-ethnic population estimates by county. With the 2000 Census, and subsequently with annual estimates, the Bureau provided race and Hispanic origin data by age and sex on a more detailed basis. In addition to five race categories now identified (White, Black, American Indian and Alaska Native, Asian, and combination of Native Hawaiian and Other Pacific Islander), respondents were given the option to mark one or more races as their racial identity, or to indicate “Some other race” if none qualified.[1]

Cross-tabulated by two ethnicity categories, the multiplicity of racial choices resulted in 63 age/sex/race-ethnicity categories that required consolidation to four mutually-exclusive racial/ethnic groups used in forecasting. This was performed by segregating the difference between a non-Hispanic age/sex cohort of a racial category on a solitary basis and in combination with another race, that difference then being normalized by a control across all races for non-Hispanics of two or more racial groups in the age/sex cohort. Hispanics by race alone or two or more races were taken as reported. These procedures were followed for each subregion and NYMTC partner's county in 2000 and 2010.

2.1.3 Survival Rates

For each five-year age group the model requires inputs of race/sex-specific rates. For any given population group, the survival rate is defined as the percentage of persons alive at the beginning of a time interval who survive to the end of that interval. Survival rates are typically presented in life tables, which show the attrition of a hypothetical population cohort (usually of 100,000 persons) on an annual basis given the age-specific survival rates for a given year. While complete life tables show survival rates by single year-of-age, abridged life tables present comparable figures for five-year age groups. The survival rates applied in the model were documented in the Appendix 1.

Census Bureau survival rates have been used as inputs to the population model for both the historical and forecast periods, because they include the required level of racial/ethnic group detail. It should be noted that all figures represent characteristics of the nation as a whole, since sub-national level survival rate data are not published by the required level of age/sex/race detail for the majority of the NYMTC Region.

As part of its ongoing program of population projections, the Bureau regularly prepares updated base-year and forecasted life tables. However, life tables are not prepared for all years. As noted above, for any given forecast cycle, the Bureau prepares a base-year table and one or more forecast year tables; tables for intermediate years must be interpolated. Furthermore, not all vital rates used by the Bureau are published, nor does the Bureau publish compilations of their vital rates estimates for past years. Survival rates used as inputs to the population model are thus subject to the availability of published and unpublished figures.

[1] Those that responded to the latter option were primarily of Hispanic origin.

2.1.4 Deaths Source

Deaths records are maintained by state and local governments, and are assembled for the nation as a whole by the National Center for Health Statistics (NCHS) under the Vital Statistics Cooperative Program (VSCP). Death records are necessary inputs to the Population Model that regionalize the imputed mortality of national survival rates, applied at the county and subregional level, by controlling the Model's racial-ethnic output to the actual level of recorded deaths.

Locally maintained death records vary in quality of racial-ethnic detail, with not all areas providing mutually exclusive data with racial deaths reported on a non-Hispanic basis. Death statistics are also available from the U.S. Bureau of the Census, Interim Population Estimates. This source of state and county level post-censual population provides data on the demographic components of change, including births, deaths and net migration. Table 2 summarizes deaths reported by the Census Interim Population Estimates program for all counties in the New York Metropolitan Region, annually from 2005-2009.

Table 2. Total Deaths for All Races & Ethnicities by County & Subregion in the New York Metropolitan Region, 2005 -2009

Area Name	2005	2006	2007	2008	2009
New York City	**56,692**	**54,163**	**54,199**	**55,743**	**57,999**
Bronx	9,482	9,399	9,325	9,488	9,960
Kings	17,371	16,434	16,334	17,172	17,772
New York	10,909	10,374	10,400	10,490	11,043
Queens	15,338	14,546	14,652	15,038	15,516
Richmond	3,592	3,410	3,488	3,555	3,708
Long Island	**21,918**	**21,562**	**21,738**	**22,083**	**23,097**
Nassau	10,582	10456	10565	10736	11144
Suffolk	11,336	11106	11173	11347	11953
Mid Hudson	**16,515**	**16,106**	**16,600**	**16,605**	**16,856**
Dutchess	2,190	2,157	2,264	2,216	2,279
Orange	2,425	2,416	2,473	2,487	2,544
Putnam	587	581	598	579	585
Rockland	1,912	1,956	1,930	2,045	2,112
Sullivan	699	671	703	680	674
Ulster	1,569	1,438	1,527	1,520	1,553
Westchester	7,133	6,887	7,105	7,078	7,109
New Jersey	**55,428**	**52,952**	**53,300**	**53,513**	**54,372**
Bergen	7,303	6,763	6,890	6,877	7,019
Essex	6,523	6,188	6,083	6,190	6,229
Hudson	4,309	4,116	4,007	3,862	3,993
Hunterdon	829	770	832	809	830
Mercer	2,906	2,872	2,891	2,970	2,877
Middlesex	5,625	5,475	5,347	5,552	5,567
Monmouth	5,199	5,127	5,216	5,238	5,363
Morris	3,454	3,296	3,443	3,402	3,519
Ocean	6,965	6,776	6,854	6,881	7,180
Passaic	3,872	3,597	3,688	3,705	3,719
Somerset	2,117	1,959	2,058	2,106	2,143
Sussex	1050	932	1,045	941	1018
Union	4,384	4,198	4,055	4,059	4,003
Warren	892	883	891	921	912
Connecticut	**16,324**	**15,918**	**15,628**	**15,583**	**15,659**
Fairfield	6,787	6,562	6,432	6,432	6,566
Litchfield	1,701	1,713	1,687	1,602	1,651
New Haven	7,836	7,643	7,509	7,549	7,442
Region	**166,877**	**160,701**	**161,465**	**163,527**	**167,983**

2.1.5 Fertility Rates

The model uses age-specific fertility rates, together with population figures for women of childbearing age, in the forecasting of births by racial/ethnic group. The age-specific fertility rate is the fertility rate for a specified age group, expressed in terms of live births per thousand women in the group. The Population Model uses fertility rate inputs specific to the racial/ethnic groups used in this study, by five-year age cohort for ages 10 through 49. Because of the lack of county and subregional age-specific fertility rates for the required level of racial/ethnic detail, fertility rates have been adopted from national level Census Bureau forecasts. Within the Population Model, births are estimated for each five-year time period as a whole, using rates for the midpoint of that period (e.g., 2003 for the interval 2000 to 2005). For detailed fertility rates by Race-Ethnicity used in the model, please refer to the Appendix 2. The Model output of births is then controlled, or regionalized, by the recorded births of State Departments of Health.

The Census Bureau periodically revises fertility rate estimates as part of its ongoing population projections program. Historical rates were obtained from the P-25 series, Nos. 917, 995, 1018, and 1092.[2] Rates for 1978 were interpolated from the preceding and following periods. Separate rates for Asians were not available and were therefore adjusted from the rates for Whites for all periods from 1970 through 1990. For the period 1990 to 1994, fertility rates are carried over from the national-level figures published in the Census Bureau's report Population Projections of the United States, by Age, Sex, Race, and Hispanic Origin: 1993 to 2050.[3] For the period 1995 to 1999, figures were obtained from an updated version of the report, Population Projections of the United States, by Age, Sex, Race, and Hispanic Origin: 1995 to 2050.[4] Both reports include high-middle- and low-series fertility rates for the racial/ethnic and age groups used in this study; model inputs are based on middle-series figures.

From 2000 onward, fertility rates were derived from Population Projections of the United States by Age, Sex, Race, Hispanic Origin, and Nativity: 1999 to 2100.[5] Rates for 2000 differ in format from previous releases. In previous years, rates were published in tables by mother's five-year age cohort for each forecast; model inputs were adopted from the middle year of each five-year forecast interval. In 2000, rates have been released in electronic format only by mother's single-year-of-age. These figures were converted to five-year figures using the single-year-of-age fertility rates in combination with comparable single-year-of-age projections of the female population, released concurrently by the Bureau. Births have been calculated as the product of female population and the fertility rate for each group. Five-year cohort fertility rates have then been calculated by

2 United States Census Bureau; Population Projects. www.census.gov.

3 US Bureau of the Census, Current Population Report, P25-1104, US Government Printing Office, Washington, DC, 1993, Appendix A.

4 US Bureau of the Census, Current Population Report, P25-1130, US Government Printing Office, Washington, DC, 1996, Appendix A.

5 Internet Release Date: May 2000.

dividing the total number of births for each cohort by the total number of women in the cohort.

2.1.6 Births

Inputs of births to the Population Model's historical section provide a subregional-level control to the national-level fertility behavior reflected in the age-specific fertility rate inputs. Historical data and recent estimates of total births were obtained from US Census Bureau and state Department of Health (DOH) sources.

Under the federal/state cooperative program, the Census Bureau works with states to produce an annual series of birth estimates that are consistent in methodology for the entire nation. Birth data compiled by state Departments of Health are published annually in registration reports and maintained on their web sites.[6] For the fertility rates by Age-Specific Fertility used in the model, please refer to the Appendix 3. State Department of Health birth data are not uniformly available on a racial/ethnic basis, as required in the Population Model. Using Census Bureau births as a control, limited DOH shares of racial-ethnic data were applied to disaggregate total births, supplemented where needed by the model-generated estimates of racial-ethnic births from national fertility rates. Total births by racial/ethnic group were divided between male and female on a 51-49 percent basis. The total births for all races and ethnicities by county and subregion in the New York Metropolitan Region for years 2006 through 2009 are summarized in Table 3.

[6] New York State: www.health.state.ny.us; New Jersey: www.state.nj.us/health/chs/; Connecticut: www.state.ct.us/dph/.

Table 3. Total Births for All Races & Ethnicities by County & Subregion in the New York Metropolitan Region, 2006 -2009

Area Name	2005	2006	2007	2008	2009
New York City	**118,046**	**117,389**	**121,793**	**121,662**	**119,540**
Bronx	22,045	22,040	22,934	22,877	22,765
Kings	39,644	39,550	41,357	41,233	40,300
New York	20,430	20,148	20,590	20,750	20,634
Queens	30,238	29,944	31,047	30,872	29,869
Richmond	5,689	5,707	5,865	5,930	5,972
Long Island	**34,500**	**34,156**	**34,054**	**32,923**	**32,252**
Nassau	15,186	15,252	15,263	14,514	13,976
Suffolk	19,314	18,904	18,791	18,409	18,276
Mid Hudson	**28,815**	**28,715**	**29,136**	**28,681**	**28,675**
Dutchess	3,152	3,114	3,137	3,076	3,146
Orange	5,203	5,357	5,331	5,439	5,565
Putnam	1,103	1,045	1,039	987	978
Rockland	4,648	4,521	4,777	4,669	4,625
Sullivan	880	922	990	916	956
Ulster	1,728	1,831	1,935	1,817	1,861
Westchester	12,101	11,925	11,927	11,777	11,544
New Jersey	**89,143**	**86,625**	**87,978**	**87,254**	**86,759**
Bergen	9,707	9,119	9,204	9,240	9,358
Essex	11,584	11,275	11,704	11,481	11,243
Hudson	8,575	8,083	8,317	8,405	8,433
Hunterdon	1,356	1,231	1,237	1,137	1,209
Mercer	4,436	4,599	4,633	4,775	4,602
Middlesex	10,384	10,242	10,638	10,500	10,384
Monmouth	7,370	7,247	7,110	6,878	7,163
Morris	5,948	5,632	5,543	5,275	5,333
Ocean	7,608	7,609	7,700	7,947	7,913
Passaic	7,675	7,526	7,614	7,621	7,345
Somerset	4,213	3,983	3,959	3,866	3,864
Sussex	1,587	1,587	1,607	1,526	1,572
Union	7,406	7,247	7,474	7,383	7,125
Warren	1,294	1,245	1,238	1,220	1,215
Connecticut	**23,871**	**23,700**	**23,847**	**23,135**	**22,916**
Fairfield	11,816	11,640	11,543	11,096	10,969
Litchfield	1,876	1,864	1,853	1,732	1,812
New Haven	10,179	10,196	10,451	10,307	10,135
Region	**302,539**	**290,585**	**296,808**	**293,655**	**290,142**

2.1.7 Net Migration

For the historical period, net migration is calculated within the model as the residual of the population at the end of the interval and natural increase over the interval. Since 1990, the Census Bureau's Interim Population Estimates have provided an annual estimate of net migration by county, with more recent years disaggregating this estimate by domestic versus foreign net migration.

Table 4 presents the Bureau's estimate by county and subregion for the period 2000-2009. Components of change in the Population Model for the period 2000-2009 reflect the Bureau's migration estimate, broken by mutually exclusive racial-ethnic groups based upon the 2000 and 2009 racial-ethnic population totals.

In the forecast period, net migration is calculated in two components: an initial estimate based upon historical rates of net migration, and an adjustment reflecting labor force demand as computed in the Labor Force Model. The first component of net migration is calculated within the model based on rates of net migration for the previous period. The second component is input from the Labor Force Model and reflects the effect of employment demand on the migration of workers in or out of a given subregion. Foreign versus domestic net migration is not explicitly shown in the forecast period. However, racial-ethnic differences in future net migration suggest the relative importance of foreign versus domestic net migration.

Table 4. Net Domestic & Foreign Migration by County & Subregion in the New York Metropolitan Region, 2000 -2009

Area Name	Foreign Migration	Domestic Migration	Net Migration	Natural Increase	Pop .Change 2000-2009
New York City	**646,676**	**-1,254,305**	**-607,629**	**577,797**	**383,195**
Bronx	89,885	-211,357	-121,472	118,639	64,635
Kings	200,449	-458,969	-258,520	208,953	101,567
New York	111,421	-146,796	-35,375	87,747	91,659
Queens	232,263	-432,750	-200,487	141,436	77,333
Richmond	12,658	-4,433	8,225	21,022	48,001
Long Island	**59,941**	**-156,239**	**-96,298**	**115,729**	**121,986**
Nassau	30,462	-96,294	-65,832	42,366	22,883
Suffolk	29,479	-59,945	-30,466	73,363	99,103
Mid Hudson	**73,126**	**-95,147**	**-22,021**	**113,929**	**104,500**
Dutchess	5,163	1,191	6,354	8,808	12,561
Orange	5,343	13,421	18,764	25,224	40,377
Putnam	1,772	-2,343	-571	4,695	3,186
Rockland	10,270	-28,443	-18,173	23,695	12,718
Sullivan	1063	-464	599	1,692	1,592
Ulster	1,618	632	2,250	2,578	3,609
Westchester	47,897	-79,141	-31,244	47,237	30,457
New Jersey	**368,200**	**-468,050**	**-99,850**	**317,334**	**185,476**
Bergen	51,267	-59,607	-8,340	24,476	9,921
Essex	46,891	-113,928	-67,037	47,519	-22,658
Hudson	68,108	-116,191	-48,083	38,600	-11,498
Hunterdon	2,083	2,014	4,097	4,797	7,481
Mercer	16,754	-14,840	1,914	15,813	14,661
Middlesex	59,078	-59,626	-548	45,630	38,033
Monmouth	14,081	-16690	-2,609	20,440	26,978
Morris	20,205	-22,056	-1,851	23,035	17,180
Ocean	5,006	53,112	58,118	4,394	59,992
Passaic	32,369	-63,369	-31,000	34,750	975
Somerset	16,026	-4,083	11,943	19,425	27,954
Sussex	1,409	396	1,805	5,930	6,500
Union	32,894	-55,260	-22,366	28,870	3,277
Warren	2,029	2,078	4,107	3,655	6,680
Connecticut	**76,750**	**-88,473**	**-11,723**	**72,720**	**45,902**
Fairfield	51,294	-74,049	-22,755	46,291	16,788
Litchfield	1,930	3,604	5,534	2,026	6,100
New Haven	23,526	-18,028	5,498	23,953	23,014
Region	**1,224,693**	**-2,062,214**	**-837,521**	**1,197,059**	**841,059**

Source: United States Census Bureau, Interim Population Estimates

2.2 Methodology

The Population Model is developed based on a subregional level and within subregions by racial/ethnic group, for purposes of forecasting population growth from 2010 to 2040. The models' conceptual organization, as illustrated in Figures 1 and 2, has not changed since the earlier forecast applications. Each subregional model is functionally divided into a historical and a forecast section. In the forecast section, for the 2040 forecasts, base year 2010 population is projected forward based on estimated future patterns of fertility and mortality, as well as recent subregional patterns of net migration. Because the fertility and mortality rates used in this section are based on national rather than subregional patterns, an adjustment for subregional conditions was necessary. This is the primary purpose of the historical section. In the historical section, births and deaths adjustment factors are generated based on the difference between actual reported subregional births and deaths in recent years, and the level of births and deaths that would have resulted if regional fertility and mortality rates had followed national patterns. The adjustment factors are carried forward into future periods to modify the expected number of births and deaths that result from application of forecasted fertility and mortality rates.

The historical section also generates estimates of past net migration rates, which are used in the forecast section in the projection of future levels of net migration. In addition, the forecast section of the model depends, directly and indirectly, on the labor force and employment models, as shown in Figure 3. These relationships can be stated briefly as follows: Employment is forecasted independently of population and labor force. Labor force supply is assumed to respond to employment demand, and net population migration is assumed to be affected by subregional labor force requirements. Thus, forecasted net migration was determined by both past patterns of migration and forecasted employment opportunities.

2.2.1 Overview of the Cohort-Survival Methodology

The Population Model is a modified version of the Cohort-Survival methodology. The latter is a standard population forecasting technique that is used to account for the effects of natural increase, i.e., the sum of births and deaths. In this technique a base year population is projected forward, subject to anticipated levels of fertility and mortality, to produce the estimated population for a future year. This future year population can then be used as the basis for a further round of projections. A projection interval of five years, as used in the Population Model, is typical; however one year, or any other time period, can be used.

In the Population model, the Cohort-Survival-Method extended to account for net migration, which, as discussed above, is in turn assumed to respond to forecasted employment levels.

Each component of change (births, deaths, and net migration) was accounted for separately. While changes in natural increase (i.e., births and deaths) depend on socioeconomic factors that cannot always be foreseen (such as severe economic downturns or lifestyle changes) patterns display some degree of regularity over time and changes are usually gradual. In addition, accurate historical births and deaths are available from federal and state sources, and can be used to control modeling results. Net migration trends are more difficult to forecast reliably because they vary widely over time and are subject to influences that are often volatile in nature (e.g., government policies, political and economic events specific to foreign countries, etc.). In addition, historical net migration data are not as robust as births or deaths data.

In the cohort-survival method, population is divided into a number of separate age groups, or cohorts, and the behavior of each group is accounted for separately in terms of fertility and mortality. Although in principle any age grouping can be used, a five-year cohort is standard; in the Population Model, five-year cohorts used through age 84, with an additional cohort for ages 85 and over. Live births were calculated by applying age-specific fertility rates to the female population cohorts of childbearing age, and then brought into the model at each interval as the youngest age cohort. Deaths were accounted for by applying age/sex-specific survival rates to each cohort and then subtracted from the model during each interval. An initial ("closed") population projection for each age/sex-cohort calculated as the cohort's initial population (including births) minus deaths, based on natural increase alone without the effects of net migration.

In the Population Model net migration is accounted for based on two factors: historical rates of net migration by age/sex/race, and forecasted demand for labor on a racial/ethnic basis. Thus, an initial estimate of net migration by age/sex-cohort calculated as a function of the previous net migration levels expressed as age-specific rates of the "closed" population projection for the prior period. The predicted net in- and/or out-migration by age and sex were supplemented by a labor induced migration component when the demand for labor in the Labor Force Model is not adequately matched by the labor supply from the "closed" population and expected migration.

A final ("open") forecast by age/sex-cohort was made by adding the net migration component(s) to the "closed" projection, as expressed in the equation:

$$P = P' + M + L$$

where, for any given age/sex-cohort, P represents the "open" forecast, P' represents the "closed" projection, M represents net migration (from prior interval rates), and L represents labor induced in or out-migration. The open forecasts are functionally equivalent within the model to census-year population figures or intercensal estimates or interpolations. This method used to produce forecasts, at five-year intervals, for the years 2010 through 2040.

The structures of the historical and forecast sections differ and are therefore discussed in more detail separately, below. All discussions are at the level of the racial/ethnic submodels within each subregional model. These submodels are interdependent where necessary to aggregate historical births and deaths statistics by racial/ethnic group or to disaggregate employment and commutation shares in the Labor Force Model.

2.2.2 Historical Section

As noted previously, Figure 1 on page 73 presents the conceptual organization of the Population Model's historical section. In the historical section of the model, the cohort survival method is applied to historical population, fertility and survival data. Generating estimates, for each interval, of the various components of population change (births, deaths, net migration). By comparing the model's results with actual reported births and deaths statistics, actual-to-estimated adjustment factors were developed which are used to control birth and death estimates generated in the forecast section. The net migration figures generated by the model for the historical period 2000 to 2010 were used as a base for forecasting net migration in subsequent years. In addition, the population model supplies historical labor force population figures to the labor force model. The outputs of the historical section can thus be summarized as follows:

- Births Adjustment Factor (to Population Model forecast section)
- Deaths Adjustment Factor (to Population Model forecast section)
- Net Migration Rate by Age and Sex (to Population Model forecast section)
- Labor Force Population (to Labor Force Model)

In the historical section, each five-year interval is discrete; the results of one period are not carried over to the next. New Census population data (or interim population estimates for non-Census years) is introduced at the beginning of each interval as a base for estimates generated within that period. The sum of historical results is used, however, in the computation of adjustment factors. One birth adjustment factor and one death adjustment factor were generated for each racial/ethnic group; this factor was then applied uniformly across age groups and for all time intervals in the model's section.

Each interval in the historical section follows several steps. First, cohort-specific survival rates applied to each age group, generating an estimated number of deaths within that age group during the interval. Second, the estimated deaths controlled by the actual reported total deaths (for all ages) for the interval, resulting in an age-specific deaths estimate in agreement with historical deaths totals. Births over the five-year interval will also be entered and survived. Third, the adjusted deaths for each age cohort subtracted from the cohort's population at the beginning of the interval, resulting in a "closed" population projection for the end of the interval, which excludes the effect of net migration. Fourth, net migration estimated for each age cohort by comparing this projected "closed" population, based on natural increase alone, with the actual population at the end of the interval from Census data (or interim population estimates). The net migration estimated for each cohort equals to the difference between these two figures, a positive figure if the actual population for the cohort exceeds the "closed" projection, and a negative figure if it is less. This process was then repeated for the subsequent interval using the new Census figures.[7]

2.2.3 Births Adjustment Factors

Birth and death adjustment factors are generated within the historical section for application in the forecast section. The purpose of these factors is to act as a control to the model's births and deaths forecasting methodology by comparing outputs for historical periods with actual reported births and deaths data for the same years. The ratio of actual to estimated births/deaths in past years can then be used to adjust births/deaths estimates generated in the model's forecast section.

The Population Model includes separate sections within each racial/ethnic submodel for the estimation of live births. Births are estimated for each five-year interval as a whole, based on population figures for women of childbearing age (ages 10 through 49) and fertility rates by age for the mid-point of each five-year interval. These population and fertility rate figures are specific to each racial/ethnic group and five-year age cohort. Fertility rates are expressed as the number of live births per thousand women. The number of live births in a given five-year interval is calculated separately for each female age cohort, and these figures were then summed to equal the total number of births for each racial/ethnic group.

Estimated births generated by the model for the period 1990 through 2005 are totaled, as actual reported births for the same period. The Births Adjustment Factor is calculated as the ratio of actual to estimated births. For the historical period, actual births are used in the model. These totals then divided between males and females on a 51-to-49 percent basis and incorporated within the main section of the model.

2.2.4 Deaths Adjustment Factors

Death estimates are generated within the main section of the model as a part of the cohort survival method. A separate deaths estimate was made for each age/sex cohort at every time interval as a function of the cohort's population at the beginning of the interval and its five-year survival rate. These age/sex-specific death figures were then summed within the model to equal the total number of deaths for each racial/ethnic group during each interval.

[7] Because end-of-period Census population figures make it possible to calculate net migration for a given period as a residual of actual final population and estimated natural increase, input from the Labor Force Model is not necessary in the Population Model's historical section. The historical section of the Labor Force Model incorporates Census-based estimates of actual labor force supply, and therefore produces no historical estimates of induced labor force immigration.

In the historical period, estimated deaths are adjusted upward or downward by actual deaths. In the forecast period, death adjustment factors, generated by the same methodology used in the calculation of birth adjustment factors were applied to adjust deaths accordingly.

2.2.5 Forecast Section

Figure 2 on page 74 presents the conceptual organization of the Population Model's forecast section. While the forecast section of the model is largely similar to that of the historical section, described above, there are some differences in the calculation of the various components. Whereas in the historical section birth and death adjustment factors are generated through the comparison of model outputs with reported data, in the forecast section these factors applied as controls. And whereas in the historical section it is possible to calculate net migration for an interval as the residual of the population at the interval's end after natural increase is accounted for over the interval, in the forecast section this is not possible since it is the final population which is to be determined. Net migration for each interval was thus projected based on the level for the previous interval, natural increase, and the effects of employment demand. The births, deaths and net migration components are discussed separately in greater detail below.

For each interval, the effects of births and deaths were accounted for first, with births inputted as the youngest age cohort (less than five years) and each cohort then "survived" forward to produce an initial, "closed," projection which excludes the effects of net migration. The net migration component was then added, producing a final, "open" forecast for the end of the interval. These "open" forecasts are equivalent in the model structure to Census data or interim population estimates, and are used as a basis for forecasting in the next interval. This procedure for any given age cohort and time interval can be expressed in the equation:

$$P = P' + M + L$$

where P represents the "open" population forecast, P' represents the "closed" projection, M represents net migration (from prior interval rates), and L represents labor induced in- or out-migration.

2.2.6 Births and Deaths

Births are calculated in a separate model subsection within each racial/ethnic submodel. An initial births estimate is made using the same methodology as described for the historical section above: births for each age cohort of women of child-bearing age are calculated separately, based on the population for the cohort and its fertility rate; cohort-specific births were then combined to equal the initial total for any given racial/ethnic group. The final total for each group was then calculated as the product of the initial total and the group's births adjustment factor, generated in the model's historical section.

Births are then divided between males and females on a 51-to-49 percent basis and incorporated in the model's main section as the youngest age cohort.

Deaths are accounted for in the model's main section. First, an initial deaths estimate is made for each cohort based on the cohort's population at the start of the interval and the cohort-specific survival rate. For the 5 to 9 year old cohort, for example, this can be expressed in the equation:

$$ {}_{5-9}D'_{t+5} = {}_{0-4}P_t - \left({}_{0-4}P_t \times {}_{0-4}S_t \right) $$

where D' represents the initial deaths estimate, P represents the cohort's initial population, S represents the cohort's five-year survival rate and t represents a given time interval. A final deaths estimate is produced as a function of the initial deaths estimate and the adjustment factor:

$$ {}_{5-9}D_{t+5} = {}_{5-9}D'_{t+5} \times a $$

where a represents the adjustment factor, a constant for each racial/ethnic group for all age cohorts and time intervals.

The number of deaths within a cohort is subtracted from the cohort's initial population to produce a "closed" population projection for the cohort. This can be expressed in the equation:

$$ {}_{5-9}P'_{t+5} = {}_{0-4}P_t - {}_{5-9}D_{t+5} $$

where P' is the "closed" projection, P is the population at the beginning of the interval and D is the number of deaths.

2.2.7 Net Migration

Net migration comprises two components and is calculated in two steps. First, an initial estimate is made of net migration for each age cohort, based on the net migration level for the previous interval and growth in "closed" population between the two intervals, as expressed, for any given cohort, in the equation:

$$ M'_{t+5} = M_t \times \frac{P'_{t+5}}{P'_t} $$

where M' represents the initial net migration estimate for a given cohort, M represents a final Net Migration estimate, P' represents a "closed" population projection, and t represents a given time interval. Second, the initial estimate for each cohort is adjusted based on the match between forecasted labor force supply and demand for the time period. This match is determined in the Labor Force Model. The Labor Force Model produces outputs, at each interval, of race/sex/age-specific net migration levels, to account for the in- or out-migration of workers in search of employment. In the Population Model these figures are added to the initial net migration estimates to produce a final net migration estimate for each age cohort:

$$M_t = M'_t + L_t$$

where L represents the net migration figure input from the Labor Force Model.

The disaggregation of subregional forecasts to county level was based on historical patterns.

3. Employment Model

The purpose of the Employment Model is to generate annual employment forecasts by industry for each of five subregions, and subsequently by private versus public employment in the thirty-one counties of the Region. The Employment Model is based on historical data and national data provided by Global Insight, Inc. (GI), and economic data from the Regional Economic Information System (REIS) of the U.S. Bureau of Economic Analysis (BEA). The model is composed of five (5) sets of equations, comprised of approximately thirty (30) equations each, with one set for every subregion. The county forecasts are disaggregated from the subregional forecasts for New York City, Long Island, the Mid-Hudson, northern New Jersey, and southeastern Connecticut, using historical share relationships. The equations were derived using ordinary least squares (ols) regression analysis, a common statistical process used in econometric modeling. The data required by the model is discussed in further detail in Section 3.1, while the structure of the model and the methodology used to recalibrate it are explained in Section 3.2.

The Employment Model is critical to operation of the New York Best Practices Model (NYBPM) for several reasons. As mentioned previously, the model generates annual county-level employment forecasts that provides a basis for generating work trips in the journey-to-work forecasting process. The output of the Employment Model also impacts the forecasting of future population and labor force in the Region. This relationship is portrayed in the flow chart, Figure 3, Interrelationships of Population, Labor Force, Employment and Journey to Work Models. Employment forecasts enter the Labor Force Model and set the level of demand for workers in each subregion. In turn, the labor force forecasts enter the Population Model and determine the necessary level of net in- or out-migration, in conjunction with the expected labor force participation of the resident population.

It is important to clearly understand the differences between labor force and employment. Labor force data indicate how many residents of a particular area have jobs or are unemployed, but provide no information on where the residents actually work. Employment data, by contrast, supply information on the number of persons working in an area, regardless of where the workers may actually live. Labor force forecasts are driven by employment and labor force participation rates, whereas the employment forecasts are based on a range of economic variables discussed below.

3.1 Model Variables

Because of the range of subregions and industries that are involved, the Employment Model uses a significant number of both dependent and independent variables. Many of the variables are similar, however, and can be grouped together for the purpose of explanation. In further discussions the following convention will be used for variable names:

Index	refers to:
III	Industry mnemonic
SSS	Subregion mnemonic
CCC	County mnemonic

3.1.1 Dependent Variables

The dependent variables in the model are those that are to be forecasted. Each dependent variable has a unique equation associated with it in the model. For all dependent variables there exist at least 16 years of historical data on a quarterly basis which are used to develop the equations (See Section 3.2 for details). The dependent variables in the Employment Model are, in their most disaggregated form:

- Nonfarm payroll employment in:
    - Natural Resources & Mining
    - Construction
    - Manufacturing
    - Trade Transportation & Utilities
        - Wholesale Trade
        - Retail Trade
        - Transportation & Warehousing
        - Utilities
    - Information Services
    - Financial Activities
        - Finance & Insurance
        - Real Estate Rental & Leasing
    - Professional & Business Services
    - Education & Health Services
        - Educational Services
        - Health Care & Social Assistance
    - Leisure & Hospitality
        - Arts, Entertainment & Recreation
    - Other Services
    - Government
        - Federal Government

State Government
Local Government
- Proprietors employment
- Wage rates in:
  Natural Resources & Mining
  Construction
  Manufacturing
  Trade, Transportation & Utilities
    Retail Trade
    Utilities
  Information Services
  Financial Activities
  Professional & Business Services
  Education & Health Services
  Leisure & Hospitality
  Other Services
  Government
    Federal nondefense
    State and Local
- Personal income, including:
  Wages and salaries
  Proprietors 'income
  Other income
- Unemployment rate

The main task of the Employment Model is to forecast future nonfarm and proprietor employment levels for a measure of total employment by subregion to 2040. The other dependent variables are forecasted because they contribute to the employment forecasting process. The forecasts of aggregate wages, personal income, and the unemployment rate are utilized in other modeling processes, including the Labor Force Model (Section 4) and the Household Model (Section 5).

3.1.2 Nonfarm Employment

Nonfarm employment is derived from and consistent with the Series 790 Non-agricultural employment data collected by the various state Departments of Labor (DOLs) in the Region. The historical data used in the model covers the period from 1990 through 2006 on a quarterly basis, and are categorized by industry at the subregional and county levels, and by public and private sector jobs. The data are quarterly average figures calculated from information collected on a monthly basis. The data cover all payroll workers who do not work on farms or are not self-employed. A summary of data trends by five year interval are presented for subregions in Table 5.

Table 5. Total, Nonfarm & Proprietors Employment by Subregion in the New York Metropolitan Region, 1995 to 2010, (in 000s)

Area's Industries	1995	2000	2005	2010
New York City	**3,795.8**	**4,277.3**	**4,360.8**	**4,611.1**
Nonfarm Employment	3,339.3	3,723.1	3,599.4	3,707.9
-Construction and Natural Resources	89.8	120.6	112.9	111.9
-Manufacturing	207.8	176.8	114.3	76.5
-Transportation, Trade and Utilities	532.5	569.6	545.2	557.4
-Information	154.4	187.3	162.9	163.8
-Finance, Insurance, Real Estate and Leasing	467.2	488.8	446.2	428.6
-Professional and Business Services	444.8	586.5	554.1	577.4
-Educational and Health Services	551.6	620.1	678.6	753.7
-Leisure and Hospitality	208.5	256.7	276.8	320.1
-Other Services	122.6	147.4	153.3	160.6
-Government	560.1	569.5	554.9	558.0
Proprietors	456.5	554.2	761.6	903.2
Long Island	**1,316.4**	**1,457.6**	**1,548.0**	**1,544.3**
Nonfarm Employment	1,093.1	1,218.0	1,240.6	1,226.5
-Construction and Natural Resources	42.8	61.0	66.6	60.8
-Manufacturing	101.2	105.5	87.3	73.0
-Transportation, Trade and Utilities	255.2	273.1	271.2	256.2
-Information	26.6	31.8	29.4	25.4
-Finance, Insurance, Real Estate and Leasing	80.4	84.2	81.9	69.8
-Professional and Business Services	128.8	155.6	158.4	152.8
-Educational and Health Services	158.8	178.5	199.5	225.3
-Leisure and Hospitality	77.1	86.0	95.7	100.9
-Other Services	42.7	52.1	52.1	52.9
-Government	179.6	190.2	198.5	208.9
Proprietors	223.3	239.5	307.4	317.8
Mid-Hudson	978.3	1,080.2	1,167.7	1,189.4
Nonfarm Employment	793.7	880.5	911.3	880.7
-Construction and Natural Resources	31.7	45.7	49.9	40.6
-Manufacturing	79.2	74.0	61.1	49.4
-Transportation, Trade and Utilities	163.7	177.9	183.0	171.6
-Information	24.2	28.4	23.6	19.2
-Finance, Insurance, Real Estate and Leasing	45.1	49.3	51.7	45.2
-Professional and Business Services	74.7	88.1	98.5	93.6
-Educational and Health Services	136.1	158.5	167.1	183.5
-Leisure and Hospitality	59.8	64.0	70.9	74.2
-Other Services	29.3	35.1	37.2	37.6
-Government	149.8	159.6	168.3	170.0
Proprietors	184.6	199.7	256.4	308.7

Table 5. Total, Nonfarm & Proprietors Employment by Subregion in the New York Metropolitan Region, 1995 to 2010, (in 000s) (Continue…)

Area's Industries	1995	2000	2005	2010
New Jersey	**3,386.4**	**3,752.6**	**3,894.6**	**3,884.6**
Nonfarm Employment	2,896.2	3,227.6	3,170.3	3,085.7
-Construction and Natural Resources	94.0	130.1	127.2	101.0
-Manufacturing	376.1	337.5	255.6	205.8
-Transportation, Trade and Utilities	654.8	708.3	687.0	650.7
-Information	106.5	102.9	84.7	69.4
-Finance, Insurance, Real Estate and Leasing	195.7	231.0	231.8	213.9
-Professional and Business Services	395.1	508.3	493.0	499.1
-Educational and Health Services	348.7	388.3	436.4	485.2
-Leisure and Hospitality	175.3	200.2	214.8	230.1
-Other Services	100.3	128.2	143.5	129.2
-Government	449.7	492.7	496.3	501.3
Proprietors	490.1	525.0	684.8	798.9
Connecticut	**965.6**	**1,043.3**	**1,099.6**	**1,110.6**
Nonfarm Employment	780.8	842.3	822.3	804.7
-Construction and Natural Resources	25.9	31.3	31.7	26.3
-Manufacturing	127.0	118.0	94.8	81.5
-Transportation, Trade and Utilities	147.4	158.5	155.6	148.3
-Information	23.6	26.1	20.8	17.6
-Finance, Insurance, Real Estate and Leasing	51.7	63.5	64.1	60.1
-Professional and Business Services	118.6	135.3	124.2	111.3
-Educational and Health Services	112.0	124.6	137.8	158.3
-Leisure and Hospitality	55.5	58.3	63.2	64.4
-Other Services	28.6	29.4	30.5	31.6
-Government	90.5	97.1	99.5	105.3
Proprietors	184.8	201.0	255.2	305.9
Regional Total	**10,442.3**	**11,610.9**	**12,070.9**	**12,340.0**
Nonfarm Employment	8,903.1	9,891.5	9,743.9	9,705.5
-Construction and Natural Resources	284.2	388.7	388.3	340.4
-Manufacturing	891.3	811.8	613.1	486.0
-Transportation, Trade and Utilities	1,753.6	1,887.4	1,842.0	1,783.4
-Information	335.3	376.5	321.4	295.3
-Finance, Insurance, Real Estate and Leasing	840.1	916.8	875.7	817.4
-Professional and Business Services	1,162.0	1,473.8	1,428.2	1,433.7
-Educational and Health Services	1,307.2	1,470.0	1,619.4	1,805.2
-Leisure and Hospitality	576.1	665.2	721.4	789.3
-Other Services	323.4	392.2	416.7	411.8
-Government	1,429.7	1,509.1	1,517.6	1,542.7
Proprietors	1,539.2	1,719.4	2,265.5	2,634.5

Source: New York, New Jersey & Connecticut State Departments of Labor and the U.S. Bureau of Economic Analysis

3.1.3 Proprietors Employment

Proprietors 'employment, also called self-employment, is representing proprietors and partners in non-limited partnerships. The historical data are derived from the Regional Economic Information System (REIS) CD-ROM, produced by the U.S. Bureau of Economic Analysis (BEA), and cover the period 1990 to 2010. The data represent annual averages of self employment at the county level summarized to the subregional level.

The variable for U.S. proprietor's employment is named PROPUS in the model, while the variables for subregional proprietors are named PROPSSS, and for county proprietors, PROPCCC.

3.1.4 Wage Rates

Wage rates represent average annual earnings per worker by industry and subregion. The historical data, which cover the period 1990 to 2010, come from the REIS CD-ROM (Table CA05, Personal Income & Industry Earnings). It should be noted that the CD-ROM does not contain wage rate data per se. The wage rates must be computed by dividing the total industry-specific earnings (including proprietor earnings) by the total industry-specific employment. A separate estimate of average wage and salary earnings, distinct from proprietor's income, was produced by dividing the aggregate wage and salary earnings by nonfarm payroll employment. Both total earnings by industry and total employment by industry can be extracted from the CD-ROM. It is also important to realize that the BEA employment figures and the DOL employment figures are not equivalent because of different counting methodologies, definitions of employment and data sources.

In the model, the wage rate variables have names of the form WAGRATESSS.

3.1.5 Personal Income

Aggregate personal income is forecasted because it often appears as an independent variable in the employment equations. In the context of the Employment Model, total personal income is considered the sum of wages and salaries, self-employment income and other income. Other income is composed of unearned income (interest, dividends, rent, etc.) transfer payments, residence adjustments (from commutation), other labor income and a subtraction for personal contributions to social insurance. The county-level historical data come from the REIS CD-ROM (Table CA05, Personal Income & Industry Earnings) and cover the period 1990 to 2010.

The various personal income variables have names in the following formats in the model:

Total Personal Income:	*PISSS*
Wage and Salary Income:	*WAGSSS*
Other Income:	*YOTHSSS*

3.1.6 Unemployment Rate

Countywide unemployment rates are also forecasted because they appear as independent variables in some of the employment forecasts. The historical unemployment rates are derived from annual average labor force statistics of the state Departments of Labor (DOLs) in the Region, collected under the Local Area Unemployment Survey (LAUS) program. The historical data cover the period 1990 to 2010. The unemployment rate variables have names of the form *RUSSS*.

3.1.7 Independent Variables

The Employment Model uses a number of exogenously supplied independent variables. In addition, it is possible for a dependent variable from one equation to act as an independent variable in another. For example, in the equations for forecasting employment, the employment of another industry sector, personal income or the unemployment rate may be used as an independent variable. A subsequent discussion on Employment Equations will present a summary table identifying independent variables in subregional equations.

The historical and forecast data for national-level independent variables supplied by Global Insight, Inc. (GI), as well as the regional inflation rate data are the independent variables. These data cover the period 1990 to 2040 on a quarterly basis. Global Insight, Inc. is a commercial vendor of econometric services, providing economic data and widely accepted forecasts to government and businesses.

3.1.8 Global Insight's U.S. Long Term Trend Forecast, January 2011

GI's trend scenario is the principal long range forecast or baseline scenario. It is regarded as the best unbiased projection of where the U.S. economy is headed, with only a 10 percent chance that the realized path will lay outside this trajectory. Unlike the optimistic or pessimistic scenarios, which GI also forecasts, the baseline assumes that the national economy will grow smoothly along a full employment path, suffering no major mishaps between 2010 and 2040 (as indicated in Table 6). Such disruptions could include excessive increases in demand, oil price shocks, or untoward swings in macroeconomic policy.

GI's trend scenario supplies the national assumptions for the forecasts. The trend scenario is the principal long range forecast or baseline scenario. Unlike the optimistic or pessimistic scenarios, which GI also forecasts, the baseline assumes that the national economy will grow smoothly along a full employment path, suffering no major mishaps between 2010 and 2040.

In late 2007, the U.S. officially entered into a recession, according to National Bureau of Economic Research. This recession was one of the longest downturns since the Great Depression of the 1930's and the most costly in terms of payroll jobs lost and unemployment rate increased.

Table 6. Baseline Assumptions for National Variables in Employment Model: Global Insight, Inc. Long Term Trend Forecast, January 2011

	Forecasted Values						
	2010 (Actual)	2015	2020	2025	2030	2035	2040
Real GDP 2000 $B	$11,595	$13,313	$15,276	$17,555	$19,947	$22,612	$25,639
Personal Income $B	$12,503	$15,629	$20,242	$25,838	$32,612	$40,730	$50,944
Population (mil)	310.8343	326.159	342.0145	358.0572	374.0828	390.086	406.1974
Total Nonfarm (mil)	130.2464	141.3013	149.1379	155.8931	163.3167	169.8768	177.4588
Labor Force (mil)	153.9613	160.4669	166.5032	170.8909	175.9871	182.7824	190.5232
Mortgage Rate	4.9%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%
T-Bill 3 Month	0.1%	4.5%	4.6%	4.6%	4.6%	4.6%	4.6%
Unemployment Rate	9.7%	7.3%	5.3%	5.0%	5.1%	5.2%	5.3%

	Average Annual Growth Rates							
	2005-10	2010-15	2015-20	2020-25	2025-30	2030-35	2035-40	2010-40
Real GDP	1.0%	2.8%	2.8%	2.8%	2.6%	2.5%	2.55%	2.4%
CPI	2.2%	2.0%	2.0%	1.9%	2.0%	1.9%	1.99%	2.0%
Nonfarm Employment								
Total Nonfarm	-0.5%	1.6%	1.1%	0.9%	0.9%	0.8%	0.9%	0.8%
Nat Res & Mining	3.0%	-1.5%	-2.4%	-1.1%	0.0%	0.1%	0.1%	-0.3%
Construction	-5.2%	5.1%	2.7%	1.6%	1.3%	1.4%	1.5%	1.2%
Manufacturing	-3.9%	2.0%	-0.1%	-1.8%	-1.2%	-0.8%	-0.6%	-0.9%
Trade, Trans, Utility	-0.9%	1.6%	0.4%	0.8%	0.5%	0.1%	0.0%	0.4%
Whole Trade	-0.6%	2.3%	1.1%	1.4%	0.4%	-0.2%	-0.2%	0.6%
Retail Trade	-1.1%	0.8%	-0.2%	0.2%	0.5%	0.3%	0.4%	0.1%
Info Services	-2.3%	1.6%	1.0%	0.5%	1.1%	1.5%	2.0%	0.8%
Fin & Insurance	-1.2%	0.4%	-0.6%	0.5%	1.1%	1.2%	1.1%	0.4%
Real Est Retail & Lsg.	-1.9%	1.6%	-0.3%	-0.4%	-0.2%	-0.2%	-0.2%	-0.2%
Prof & Bus Service	-0.3%	3.9%	3.4%	2.5%	2.1%	2.1%	2.2%	2.3%
Ed & Health	2.4%	1.5%	1.7%	1.1%	1.3%	1.0%	0.9%	1.4%
Educational Services	2.1%	-1.4%	-0.9%	0.5%	0.3%	0.2%	0.6%	0.2%
Health & Soc Assist	2.5%	2.0%	2.0%	1.2%	1.4%	1.1%	0.9%	1.6%
Leisure & Hospitality	0.5%	0.2%	-0.2%	0.8%	1.0%	0.8%	0.7%	0.5%
Arts Entert Recreation	0.1%	0.0%	-0.4%	3.2%	2.8%	1.9%	0.7%	1.2%
Other Services	-0.2%	0.2%	-0.5%	0.8%	0.6%	0.2%	0.3%	0.2%
Government	0.6%	0.5%	1.0%	0.6%	0.7%	0.3%	0.5%	0.6%
Federal	1.6%	-1.9%	0.9%	-1.0%	1.0%	-1.0%	1.0%	0.1%
State & Local	0.5%	0.8%	1.0%	0.8%	0.6%	0.5%	0.5%	0.7%
Income and Workers								
Personal Income	3.6%	4.6%	5.3%	5.0%	4.8%	4.5%	4.6%	4.6%
Wages	2.2%	4.4%	4.3%	4.4%	4.5%	4.3%	4.3%	4.1%
Proprietor Income	-0.3%	5.4%	5.7%	5.3%	4.7%	4.5%	4.7%	4.3%
Population	0.9%	1.0%	1.0%	0.9%	0.9%	0.8%	0.8%	0.9%
Labor Force	0.6%	0.8%	0.7%	0.5%	0.6%	0.8%	0.8%	0.7%
Employed	-0.4%	1.4%	1.2%	0.6%	0.6%	0.7%	0.8%	0.7%

Source: Global Insight, Inc., January 2011

Nationwide, the forecast's annualized employment growth rate from 2010 to 2040 is about 0.8 percent, which is slower than the 2007 forecasts from GI of 0.9 percent. From 2007 to 2010, the U.S. lost about 7.3 million jobs, wiping out the amount of jobs gained through 2002-2007. According to GI, the U.S. will add payroll jobs starting from 2011. Employment will expand more rapidly in the near term, by 1.7 percent annually from 2011-2015.

After a significant loss during the recession years, construction is forecasted to grow by 2.3 percent annually from 2010 to 2040, with even more robust growth of 8% annually during the near term from 2013 to 2015. The strongest gainer in employment growth is the professional and business services sector, which consistently expands above 2 percent annually for the entire forecast period from 2010 to 2040. Health care and social assistance expanded during the recession years, and is forecasted to continue the growth at about 1.4 percent annually, faster than the total employment average. The growth of finance and insurance fluctuates until 2025, and grows by about 1 percent annually afterwards. Government expansion also remains positive, with periodic federal losses offset by state and local gains, but overall, government job growth averages less than 0.6 percent annually in the national economy.

Manufacturing employment declines throughout the forecast period, with an annualized rate of about negative 0.9 percent. Though education services expanded in the recession years, this sector is expected to cut jobs during 2012-2020. The annualized growth rate for educational services after 2020 is about 0.38 percent, lagging behind the total employment average growth rate. Job losses are expected in leisure and hospitality and in other services during the 2010-2020 decade. Although real estate rental and leasing employment is expected to grow until 2015, this sector is forecasted to lose job slowly afterwards.

Real economic growth rate is a measure of economic growth from one period to another, adjusted for inflation. Between 2010 and 2040, real economic growth is expected to average just under 2.4 percent per year.

Over the next 30 years, wage rates will expand roughly by 4.1 percent on an average while inflation will advance by 2 percent annually, suggesting a 2.4 percent real growth in earnings. The pick-up in productivity growth reflects in part the expected benefits of new investment in capital goods and technology, encouraged by low interest rates. Both long-term and short-term interest rates will remain below their equilibrium levels by a monetary policy intended to curb inflation. The dollar continues to depreciate against foreign currencies, to slow the growth in current account deficits, while capital inflows contribute to net domestic investment over the forecast period.

Gross Domestic Product (GDP)

Historical and forecasted GDP data have been provided by Global Insight, Inc. in real (constant dollar) terms on an annual basis in chained 2000 dollars. The GDP growth rate variable has been tasted in some employment equations, particularly in national market industries. No equivalent regional variable is available. The national output variable is named GDP.

Consumer Price Index (CPI)

Historical and forecasted annual CPI data have been provided by Global Insight, Inc. for both the nation and the New York-New Jersey Region. The ratio of the regional CPI to the national CPI is often used in both employment and wage rate equations as a measure of the relative cost of doing business in the Region. For some subregions, the local inflation rate -- or annual rate of change in the regional CPI -- better explains employment trends in an industry than the relative CPI. Table 7 shows the baseline assumptions for regional variables in employment model.

Table 7. Baseline Assumptions for Regional Variables in Employment Model: Global Insight, Inc. Regional Forecast, January 2011

Regional Variable	**Average Annual Growth Rates**							
	2005-2010	**2010-2015**	**2015-2020**	**2020-2025**	**2025-2030**	**2030-2035**	**2035-2040**	**2010-2040**
CPI-NY	2.5%	2.0%	2.1%	1.9%	2.1%	2.0%	2.0%	2.0%

Source: Global Insight, Inc., January 2011

The regional CPI variable is called CPINYNJ, while the national variable is named CPIU. The relative cost of doing business is denoted by the variable CPINYNJ/CPIU, and the annual rate of inflation by the variable, CPINYNJ/CPNYNJ\1. Note that neither variable has further indices for other levels of regional geography.

National Employment by Industry

Global Insight, Inc. provided historical and forecasted quarterly employment data by industry for the nation, from 1990 to 2040 on a NAICS (North American Industrial Classification System) basis. National employment is used as a variable in equations of the Employment Model, appearing in many industry-specific employment equations, the wage rate equations and the unemployment rate equations.

Global Insight, Inc. variable names use different industry abbreviations from those adopted for local employment variables. The following table lists the Global Insight national employment variables:

EME:	Total nonfarm employment
EENRM:	Natural resources & mining employment
EECON:	Construction employment
EEMFG:	Manufacturing employment
EETTU:	Transportation, trade & utilities employment

EETTR:	Transportation employment
EETRET:	Retail trade employment
EETWST:	Wholesale trade employment
ET22:	Utilities employment
EEINF:	Information employment
EEF52:	Finance & insurance employment
EEF53:	Real estate rental & leasing employment
EEPBS:	Professional & business services employment
EEE61:	Educational services employment
EEE62:	Health services employment
EELHS:	Leisure & hospitality services employment
EEOTS:	Other services employment
EEGFED:	Federal government employment
EEGSAL:	State & local government employment

Average Hourly Earnings

Global Insight, Inc. provided both historical and forecasted industry-specific data on average earnings of nonfarm employment. These data are the national comparable to subregional-level wage rate data. The ratio between the two may be used as a variable in the employment equations. National earnings data can also be used in the wage rate equations.

The variable names for the national average earnings data are as follows:

AAENRM:	Natural resources & mining earnings
AAECON:	Construction earnings
AAEMFN:	Manufacturing earnings
AAER:	Trade, transportation & utilities earnings
AAETR:	Retail trade earnings
AAET22:	Utilities earnings
AAEINF:	Information earnings
AAEFIR:	Financial activities earnings
AAEPBS:	Professional & business services earnings
AAE6162:	Education & health services earnings
AAELHS:	Leisure & hospitality earnings
AAESER:	Other services earnings
AAEGOV:	Government earnings
AAEGFD:	Federal nondefense government earnings
AAEGSL:	State & local government earnings

Note that only major industry level earnings data are used for financial activities services and selected trade, transportation & utilities sector equations because of national data limitations.

National Personal Income

National equivalents of the personal income dependent variables were provided by Global Insight, Inc. The data include historical and forecasted national values for total personal income, wages and salaries, proprietors' income, and other income. The personal income variables are included in the income equations where needed. The variables appear in the model as follows:

Total Personal Income:	YP
Wage and Salary Income:	WSD
Proprietors' Income:	YPROP
Other Income:	YOTH

Population

Historical population data were provided by the U.S. Bureau of the Census on annual basis for the nation and by county, aggregated to subregion, for the period 1990 to 2010. The national population occasionally included in the model, typically as a denominator for use in measuring national per capita personal income. Forecasted national population data including armed forces overseas were provided by Global Insight, Inc. and are shown in the following table (Table 8), where it is compared with U.S. Bureau of the Census resident population projections. As Table 8 shows, the two series are virtually equivalent, varying only by a fraction of one percentage point in any year.

Table 8. Comparison of Global Insight, Inc. National Population Projection with U.S. Bureau of Census Projection (Middle Series)

National Variable	Comparison of Population Projections Middle Series							
	2005	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Global	297.0	310.8	326.2	342.0	358.1	374.1	390.1	406.2
U.S. Census	295.5	313.2	325.5	341.4	357.5	373.5	389.5	405.7

Source: Global Insight, Inc., (January 2011); United States Census Bureau. Interim Projections by Age, Sex, Race and Hispanic Origin (May 11, 2004)

Subregional population variables are named POPSSS. The national population appears as NP in the equations.

Mortgage Rate

Historical and forecasted mortgage rate data, provided by Global Insight, Inc., may be used in some of the equations projecting construction, finance & insurance, real estate, rental & leasing employment.

In the model, the variable associated with the mortgage rate is named as RMMTGENS.

Treasury Bill Interest Rate

Historical and forecasted 3-month Treasury bill interest rates are occasionally used in equations forecasting employment in the wholesale trade, retail trade, finance & insurance, real estate, rental & leasing industries. When compared to mortgage rates, as in the financial sector equation, the relationship expresses the differential between long term and short term costs of financing.

The 3-month Treasury bill interest rate is represented by the variable RMGBS3NS in the model.

AAA Corporate Bond Rate
Historical and forecasted values of AAA Corporate Bond Rates were provided by Global Insight, Inc. These rates may be used in selected employment equations as a proxy for financing costs of capital investments.

The corporate bond rate is called RMMBCAAANS.

S&P 500 Index of Common Stocks
Historical and forecasted values of the S&P 500 Index of Common Stocks may be used in equations for forecasting employment in finance & insurance. The S&P 500 is a market-value weighted index with each of 500 stocks -- chosen for market size, liquidity and industry group representation -- weighted in the index in proportion to their market value. The S&P 500 is a widely used benchmark of U.S. equity performance and a proxy for activity on the stock exchanges.

The index is represented in the model by the variable JSP500.

National Unemployment Rate
The historical and forecasted data for the national unemployment rate were provided by Global Insight, Inc. The variable may be used in subregional unemployment rate equations.

The national unemployment rate was denoted by the variable RUC in the model.

3.2 Model Structure

3.2.1 General Description

The Employment Model is a standard econometric model consisting of several hundred equations in five subregional industry models and thirty-one county disaggregation models.

Econometric modeling is a statistical technique that develops predictive mathematical models based on patterns and relationships in historical data. Econometric modeling also requires that the modeler make a number of assumptions regarding the underlying structure of the model, particularly in terms of what variables are likely to be required. Because of these assumptions and modeling processes, it should be noted that excessive reliance should not be placed on econometric equations. The regression coefficients developed from historical data cannot precisely and adequately address the interrelationships between dependent and independent variables in future years. To avoid any irregularity and/or unreasonableness in forecasts produced by econometric models, qualitative reviews are necessary.

The econometric model developed for 2035 forecasts has been used for the 2040 forecast series and is comprised of several hundred equations that produce forecasts at the subregional level based on historical data. Each dependent variable of interest (e.g., finance and insurance employment in New York City) has a unique equation associated with it in the model. Once the structure of each equation has been satisfactorily determined based on the relevant historical data, the equations can be used to generate forecasts for all of the dependent variables. The historical data are used to determine the mathematical relationship between the historical independent variables and the historical dependent variable for each equation. By assuming that this relationship will hold true into the future, the equations can be used to forecast future values for the dependent variables based on forecasts of the necessary independent variables. By its very nature, an econometric model cannot predict future conditions that have no basis in past trends, such as the outcome of disruptive natural forces, seismic changes in public policies and regulations, or major revolutions in technology.

A regional model of comparable structure also developed to independently and forecast the long term regional outlook in relation to the nation. The regional model used for the informative purposes, and not as a control on the sum of subregional level forecasts. Once the subregional forecasts are solved, county level disaggregation models developed that share the industry-specific subregional forecast to component counties, based upon historical relationships. County forecasts expressed as the sum of private and public sector nonfarm employment. The county models have separate equations for forecasting proprietors, in order to yield a total employment forecast of nonfarm payroll and self employment.

Each subregional model is a collection of approximately thirty (30) simultaneous[8] equations for predicting the various dependent variables of interest. Most of the subregional models are mathematically independent of one another such that the results of of one have no bearing on the results of the others. The exceptions to this independence involve the employment and income equations for some suburban subregions. For example, in several suburban subregions the employment and income equations have variables for New York City. These relationships demonstrated in a subsequent table.

While some dependence between subregional models may be allowed, it is restricted to dependence in one direction only. For example, as mentioned above, the income and employment equations for some suburban subregions may be affected by employment in New York City. However, the employment equations of New York City will not be affected by income and employment in those same suburban subregions. Without this simplifying restriction the five subregional models would have to be combined into larger models such that all areas dependent on others would be grouped into the same large model. Had interactions been allowed to be complex enough, it is conceivable that all

[8] Most of the equations within each subregional model are actually independent of one another. In some cases, the wage rate and employment equations for particular industries are dependent on one another and therefore truly simultaneous.

subregions would have had to be grouped into a single model. The number of equations would remain roughly constant but they would have had a much higher degree of simultaneity because of the complex interactions between subregions. This would have made the Employment Model much more complex from a computational standpoint.

The process by which independent variables are chosen for the model is called ordinary least squares (OLS) regression analysis. Regression analysis is a standard statistical technique for determining the “best fit” equation for a set of data points. In the case of the econometric model developed for 2035 forecasts, the data points were the historical values of the various dependent variables of interest. The historical data can be thought of as being plotted on a graph with a horizontal time axis and a vertical axis of appropriate units (e.g. employment). Regression analysis determines an equation that most closely approximates the curve defined by the plotted data points. The candidate independent variables for the equation are chosen by the modeler based upon the relationships that are believed to exist in the data. The regression analysis process identifies which of the candidate independent variables are contributing to the ‘goodness of fit” of the equation and which are not. The modeler then adds and removes independent variables, changes their form from current to lagged or from absolute to relative change, and repeats the regression analysis until satisfied with the fit of the equation.

For each equation a set of “rules” is developed concerning the coefficients for each independent variable. The sign of the coefficient indicates whether the independent variable (e.g., national construction employment) is positively or negatively associated with the dependent variable (e.g., subregional employment). For example, in the employment equations it will likely be decided that the term representing national employment in a given industry should have a positive coefficient if it appears in the equation for that subregional industry. The positive coefficient will cause an increase in subregional employment if there is an increase in national employment and a decrease if the national employment decreases. While this may not always be true it does make more intuitive sense than allowing the subregional and national employment to move in opposite directions via a negative coefficient on the national employment. It may also be necessary to require the coefficients on some variables to be less than one (1) to avoid instability problems in the model. Variables in equations that are in natural logarithmic form are not allowed to have negative coefficients in order to avoid problems with inverse logarithms. Independent variables, whose coefficients fail to satisfy the set of “rules” developed for each equation, as described above, are dropped from the model.

The contribution made by each independent variable to the “goodness of fit” is determined by a test of significance. After each regression analysis is performed, a value called the t-statistic is calculated for each independent variable. The t-statistic indicates how statistically significant the variable is in terms of explaining the behavior of the dependent variable. For the Employment Model, the t-statistics must be either greater than +1.0 or less than -1.0, but they should be either greater than 1.6 or less than -1.6.

The fit of the equation can be judged in a number of ways. The most obvious is to overlay a plot of the historical data with a plot of the equivalent data as determined by the equation. By comparing the shapes of the two plots the modeler can get an overall visual impression of the fit and can identify years where the fit may need to be improved.

In addition to examining the graph, the modeler can also look at the coefficient of determination (commonly referred to as "R-squared") that is calculated during the regression analysis. The R-squared value is a quantitative measure of goodness of fit. Its value lies between zero (0) and one (1), with one (1) indicating a perfect fit. For the Employment Model, the R-squared values for each equation should typically be greater than 0.95.

Another evaluation technique that can be used involves examining the "errors" in the fit of the equation. The difference between the actual value of a data point and the corresponding value calculated by the equation is called the residual. The residuals represent variation in the dependent variable that is caused by some unidentified independent variable. For equations in the Employment Model, the residuals should not be allowed to be more than five (5) percent of the corresponding historical value.

Once the "fit" of the equations is satisfactory, the equations can be used for forecasting. Future values for each of the independent variables in the model are entered and the model calculates the desired dependent variables. In some cases, the dependent variable for one equation appears as a dependent variable in another equation, and vice versa. These equations are solved simultaneously and in virtually all cases a unique solution for the two variables can be found.

Occasionally the forecasts produced by a subregional model may be clearly unrealistic, being either too high or too low. Typically, when very large changes, of say greater than 10 percent, occur in an annual forecast at the subregional level, such outcomes can be considered unrealistic. In these cases the modeler must apply expert judgment in review of the model structure and input data, including historical series, to determine what is triggering the effect. Checks will be made for instability in variable relationships, for data outliers (extreme values), and for other factors. Either some theoretically acceptable way must be found to modify the existing equations, such as expression in log-linear mode or the model must be rebuilt. If the problem exists with the employment equations, it is often possible to include a constant adjustment factor that makes the forecast more reasonable.

It should be noted that some equations in the Employment Model made use of special independent variables called "dummies". Dummy variables are used to improve the fit of equations when it is apparent that some unknown variable is having a deleterious effect. In some cases, an unusually large residual may appear in one year and a dummy variable are used to eliminate it. Dummies used for this reason appear in the model as "DUMxx", where xx corresponds to the year with the large residual (e.g. "99" for 1999). These dummy variables are treated like independent variables that have a value of one (1) for the year that corresponds to the variable name and a value of zero (0) for all other years, past and future. This has the effect of making the variable relevant only to that one specific year, when it helps to account for effects in that year that other variables cannot explain.

The TREND variable is a special variable that is also used to improve the fit of some equations. TREND is basically a variable that is incremented by one (1) every period and can be useful when the data display a definite trend over time.

Some of the variables included in the model may be "lagged," i.e. they may represent data for the same variable from a previous year. Variables that represent lagged data are suffixed by "\x", where x indicates the number of lagged time periods. The following section presents a summary table identifying lagged variables among all independent variables in each subregion's equations. An example of a lagged variable can be seen in the equation for forecasting construction employment in New York City to 2030:

CONEMNyCEQ = EXP (<#COEF1:0.390978>+<#coef2:0.954078>*LN (conemnyc\4) + <#coef3:0.120913>*LN (eecon) +<#coef4:1.32657>*LN (tnemnyc\1/tnemnyc\5)- #coef5:0.217743>*LN (rmmtgens\3) +<#coef6:7.33842>*LN (popnyc\1/popnyc\5)- <#coef7:0.0528006>*&&dum92Q4)

The term CONEMNYC\4 is a lagged variable that indicates that the city's construction employment in any given year is based in part on the city's construction employment in four years previously. As the summary table shows, prior years' industry-specific or subregional nonfarm employment is used in most employment equations. The term POPNYC\1/POPNYC\5 uses a lagged expression of population in New York City as the numerator and denominator of a variable that represents the rate of population change. Population growth rates are often used as explanatory variables in employment equations, particularly those that model population-serving activities.

Table 9 presents the regression output for the same construction employment equation, as a means of illustrating the use of evaluation statistics. Referring to the above equation for construction employment in the New York City subregion, it should be noted that a constant term or intercept value (0.390978) is part of the functional form of this regression. Other equations may, or may not, include a constant term, depending upon the modeler's determination of its statistical significance and its reasonableness.

Reading across the columns of Table 9, by the rows listing each independent variable in the equation, the Coefficient estimated by the regression analysis is the estimated value of the unknown percentage of each independent variable in the equation. The Standard Error is the error of the estimated value of the coefficient. The T-Statistic is a measure of the statistical significance of each estimated coefficient that reduces to the value of the coefficient divided by its standard error. Generally speaking, a t-statistic greater than two

(2) in absolute value indicates that the variable in question is statistically significant in explaining changes in the dependent variable at a 95 percent confidence level.

The Other Statistics pertain to overall evaluation of the regression equation. The R-Squared is a measure of how well the equation fits the data. It reduces to the explained sum of squares divided by the total sum of squares. As previously noted, the R-Squared ranges from zero (0) to one (1) where a fit close to one (1) is desired. The R-Bar Squared is the R-Squared corrected for degrees of freedom. Thus, it is a more exacting measure of goodness of fit.

Table 9. Illustrative Evaluation Statistics for New York City Construction Employment Equation

New York City Construction: Dependent Variable – CONEMNYC	Coefficient	Standard Error	T-Statistic	Other Statistics
For Independent Variables				
CONSTANT	0.390978	0.1504	2.599	
CONEMNYC\4	0.954078	0.05409	17.64	
EECON	0.120913	0.06243	1.937	
TNEMNYC\1/TNEMNYC\5	1.32657	0.3318	3.998	
RMMTGENS\3	-0.217743	0.04286	-5.080	
POPNYC\1/POPNYC\5	7.33842	2.726	2.692	
DUM92Q4	-0.0528006	0.02157	-2.448	
For Regression				
R-BAR SQUARED:				0.9795
DURBIN-WATSON:				1.4778
STANDARD ERROR:				0.02028
NORMALIZED:				0.004398

The Durbin-Watson statistic is a measure of first order serial correlation in the residuals. The Durbin-Watson measure ranges from zero (0) to four (4) where a value of two (2) indicates no first order serial correlation. If the regression contains lags of the dependent variable, the Durbin-Watson statistic is an unreliable measure of autocorrelation. Lastly, the Standard Error of the regression is a measure of the standard deviation of the calculated error term in the equation. The Normalized Standard Error is the standard error of the regression divided by the mean of the dependent variable. In general, the lower the standard error of the regression, the better is the equation. When estimating dependent variables with very large or very small values, the normalized standard error is especially useful.

3.2.2 Model Structure

Each of the five subregion models that comprise the Employment Model uses the same basic underlying structure. There are some variations to account for special situations (e.g. suburban subregions whose employment is closely tied to employment in New York City) but, for the most part, the functional format of the equations is similar. For ease in viewing the commonalties and differences in subregional equations, Table 10 is offered as a guide to the array of national, regional, local and other independent variables that may be included in an employment equation.

Table 10. Schematic of Independent Variables Used in Employment Equations, by Form of Expression

National Variables	**Local Variables**			**Other Variables**
	Regional	**Own Subregion**	**Neighboring Subregion**	
• Employment *(level, change)*	• Inflation *(level, change)*	• Employment *(lag, share, change, other industry)*	• Employment *(total, or same industry)*	• Year Dummies
• Wages *(level)*	• Cost of Doing Business *(relative)*	• Wages *(level, lag, relative, real, change)*	• Wages *(lag, relative)*	
• Population *(level)*		• Population *(level, lag, share, change)*		• Trend Dummies
• Financial Rates *(level, relative, change)*		• Income *(share, change, real, lag, percapita)*		
		• Unemployment Rates *(level, lag, relative)*		

In addition to employment forecasts by industry, the subregional models are designed to generate annual forecasts for the following variables: wage rates by industry, personal income and its components, and the unemployment rate. Separate equations disaggregate the subregional industry-specific employment to component counties and forecast the number of proprietors by county, using ordinary least squares (OLS) regression analysis. The functional format for each equation is discussed below.

<u>*3.2.3 Employment Equations*</u>

The basic form of the employment equation is a linear regression relationship that states the level of subregional employment that is a function of one or more independent variables, including national and regional measures of economic activity and competitive advantage, such that

$$III\ \mathrm{EM}\ SSS = f\left(\mathrm{EE}\ i, \frac{\mathrm{WAGERATE}\quad i}{\mathrm{WSD}\quad i}, \frac{\mathrm{CPINYNJ}}{\mathrm{CPIU}}, Other\right)$$

where *III* and *i* refer to the industry, EM is local employment, and *SSS* refers to the subregion. EE is national employment, WAGERATE/WSD is the subregion wage differential vis-à-vis the nation, and CPINYNJ/CPIU is the relative price differential of the Region to the nation. *Other* includes other indicators of national and regional demand including:

Measure	Variable
Previous period's employment:	*IIIEMSSS*\1
Subregion unemployment rate:	RU*SSS*
Personal income:	PI*SSS*
Change in personal income:	(*PISSS* /PI*SSS*\1)
Real per capita income:	(PI*SSS*/CPINYNJ)
Change in population:	(*POPSSS/POPSSS*\1)
Mortgage rate:	RMMTGENS
Treasury bill interest rate:	RMGBS3NS

The ratios involving the wage rates and inflation should have negative coefficients. The unemployment rate, if included, should also have a negative coefficient. The previous period's employment should have a positive coefficient that is less than one (1) to avoid instability in the model. The national employment, along with any income or population measures, should also have a positive coefficient.

The requirements for the coefficients reflect the positive and negative effects that various factors have on employment. The sensitivity of each equation to the input variables is expressed by the value of the coefficients attached to each independent variable. Employment in an industry should be affected positively by both the national demand in the industry sector (represented by national industry employment in the model) and the subregional demand for the industry's products (as represented by a variable such as income). Industry employment is negatively affected by factors such as the relative costs between the subregional and national economies. The wage rate and CPI ratios both represented the relative costs of doing business in the subregion.

The actual variables chosen for each equation depend on whether the associated industry is an export industry (e.g. manufacturing) or a domestic industry (e.g. services). Export industries tend to be more strongly connected to national demand while domestic industries are more affected by local demand. Some variables are also only associated with particular industries. As examples, the mortgage rate appears in equations for construction employment, while the difference between the mortgage rate and the Treasury bill rate appears in some of the financial employment equations.

3.2.4 Wage Rate Equations

The general format for the wage rate equations is:

$$\mathrm{W}AGERATEiSSS = f\left(\mathrm{W}SDi, \frac{\mathrm{CPINYNJ}}{\mathrm{CPIU}}, \frac{III\mathrm{EM}SSS}{\mathrm{EE}III}, \mathrm{WAGERATE}iSSS \setminus 1\right)$$

or, alternatively,

$$\ln\left(\mathrm{W}AGERATEiSSS\right) = f\left(\ln(\mathrm{WSD}i), \ln\left(\frac{\mathrm{CPINYNJ}}{\mathrm{CPIU}}\right), \ln\left(\frac{III\mathrm{EM}SSS}{\mathrm{EE}III}\right), \ln\left(\mathrm{WAGERATE}iSSS \setminus 1\right)\right)$$

where *i* refers to the industry and *SSS* to the subregion.

The model presumes that the wage rate in an industry is positively associated with the national average wage for that industry (WSD*i*), regional prices relative to national prices (CPINYNJ/CPIU), and regional employment relative to national employment (*III*EM*SSS*/EE*III*) and, possibly, the previous period's wage rate (WAGERATE*iSSS*\1). In order to incorporate these assumptions it may be necessary to restrict the coefficients of all variables to positive values. Furthermore, if the lagged wage rate variable is used, it may be necessary to restrict its coefficient to values of less than one (1) to avoid stability problems.

3.2.5 Unemployment Rate Equations

The subregional unemployment rate equations have the following basic form:

$$\mathrm{R}USSS = f\left(\frac{\mathrm{WAGEMP}SSS}{\mathrm{EME}}, \mathrm{RUC}, \mathrm{RU}SSS \setminus 1\right)$$

where i refers to the industry, SSS to the subregion.

The ratio between total nonfarm employment in a subregion and total nonfarm employment in the nation (WAGEMPSSS/EME) has a negative coefficient to reflect the negative effect that an increased local share of national employment would have on the unemployment rate. The coefficients of the other two terms are positive because of the positive association between local and national unemployment rates and the positive effect of the prior period's unemployment rate.

3.2.6 Income Equations

The equations for proprietors' income are as follow:

$$\ln\left(\mathrm{YPROP}CCC\right) = f\left(\ln\left(\mathrm{YPROP}CCC \setminus 1\right), \ln(\mathrm{YENTNFADJ}), \ln\left(\frac{\mathrm{WAGEMP}SSS}{\mathrm{EME}}\right), \ln\left(\mathrm{PROP}CCC\right)\right)$$

where *CCC* refers to the county.

The log-log form of the equation is used to take into account the multiplicative nature of the relationship between the variables involved.

The coefficients for all variables should be positive. Proprietors' income is assumed to be positively related to national proprietors' income (YENTNFADJ), the ratio of subregion to national employment (WAGEMPSSS/EME), the number of proprietors in the county (PROPCCC) and the proprietors' income for the previous period (YPROPCCC\1). Proprietor's income by county was summed to subregional proprietor's income (YPROPSSS).

The equation for other personal income is of the form:

$$\ln\left(\mathrm{YOTH}\,SSS\right) = f\left(\ln\left(\mathrm{YOTH}\,SSS\setminus 1\right), \ln\left(\mathrm{YOTH}\right), \ln\left(\frac{\mathrm{POP}\,SSS}{\mathrm{NP}}\right)\right)$$

where *SSS* refers to the subregion.

Again, the log-log form of the equation is used because of the multiplicative nature of the relationship.

Other personal income is assumed to be positively related to national other personal income (YOTH), the ratio of subregional population to national population (POPSSS/NP) and the other personal income (YOTHSSS\1) of the previous period. Equations for some subregions may also include employment variables from a neighboring subregion if a significant amount of the first subregion's labor force works in the neighboring subregion. This may occur in a number of the suburban subregions whose residents work in New York City.

Total wages and salaries for each subregion were calculated using the following formula:

$$\mathrm{WAG}\,SSS = \sum_{ii} \mathrm{EM}\,SSS \cdot \mathrm{WAGERATE}\quad SSS$$

which is simply multiply the employment by industry times the wage rate by industry and then sum the result to the subregional total.

Total personal income (PI*SSS*) is simply summed the three types of income already discussed or,

$$\mathrm{PI}SSS = \mathrm{WAG}SSS + \mathrm{YPROP}SSS + \mathrm{YOTH}SSS\,.$$

4. Labor Force Model

The term "labor force" refers to workers on a resident basis, that is, residents of an area regardless of whether they are employed or unemployed in that area. By contrast, "employment" refers to jobs by location of workplace, or the number of jobs in a given area regardless of whether the people who hold those jobs also live in that area. Labor force forecasts are driven by expected growth in population, rates of labor force participation, and employment levels, while employment forecasts are based on market-driven factors. These include, at the regional level, relative competitiveness in terms of the ‘cost of doing business,’ productivity advantages, and local market consumption; and, at the national level, demand for output, productivity, interest and exchange rates, and inflation.

As previously noted, in Section 3, employment forecasts are presented in a separate model that drives the entire forecasting process. The labor force forecasts depend heavily on outputs of the Population Model, as adjusted for the demand for labor forecasted by the Employment Model. The Labor Force Model utilizes the US Bureau of Labor Statistics (BLS) Civilian Labor Force (CLF) concept from 2000 onward, while decennial Census Bureau data are the basis of historical resident labor force before 2000.

Within the process of regional transportation modeling, labor force forecasts are useful for two primary reasons. First, the size and distribution of the labor force affect the number and pattern of journey-to-work trips, which account for a large proportion of all travel within the Region, especially during peak hours. Labor force forecasts are thus necessary as a control in the process of journey-to-work forecasting. Second is the effect of labor force demand on population. Unlike at the national level, where employment levels tend to follow population growth, at the regional level employment leads population, with the number of jobs establishing the demand for labor, which in turn affects population and migration. A growing job base can be expected to attract workers to a region, and a declining job base would result in out-migration of local workers seeking employment elsewhere. By matching the expected labor force supply to anticipated levels of employment, it is possible to account for these effects on migration.

In any forecast period, the Labor Force Model thus produces two sets of outputs: first, the initial labor force estimate and, second, the net in- or out-migration level induced by a match between labor force supply and demand for employees. Initial labor force estimates are generated, in any forecast year, based upon expected population from net natural increase and aging of the population, previous period rates of net migration, and forecasted rates of labor force participation. Induced net in- or out-migration is calculated by comparing this resulting labor force supply with the expected levels of employment as forecasted in the Employment Model. The Population Model incorporates the change to initial net migration that results from this matching process, at each five-year interval.

All outputs of the Labor Force Model are generated by sex and age-group for the population 16 years of age and over. A separate model is run for each subregion; within each subregional model, sub-models generate outputs for each racial/ethnic group. Each model includes a historical section, covering the years 1970 through 2010, and a forecast section, covering the years 2015 through 2040. All outputs are generated on a five-year interval basis.

Reflecting these interactions between labor force supply, employment availability, and population, the Labor Force Model was developed in conjunction with other models. It depends on the Population Model for inputs of forecasted population by sex, race/ethnicity and age, and on the Employment Model for inputs of forecasted nonfarm employment and proprietors. The Labor Force Model, in turn, controls the results of the Population Model.

4.1 Data Inputs

The subregional Labor Force Model incorporates a number of independent variables as inputs at each five-year interval:

- Population by racial/ethnic group, sex, and age-group.
- Labor Force Participation Rates by racial/ethnic group, sex, and age group.
- Unemployment Rates by racial/ethnic group.
- Net Commutation.
- Employment levels, combining nonfarm employees and proprietors.
- Work-at-Home Employment.

For the historical section of the model, data from 1970 through 1995 was taken from prior runs of the Labor Force Model, based upon data gathered under Tasks 1.1.1, Population Data Collection And Analysis, 1.1.2, Employment Data Collection And Analysis, and 1.1.3, Labor Force Data Collection And Analysis.[9] For labor force and unemployment levels in 2000 and 2005, data were compiled for Technical Memorandum 1.1.5.8, 2002-2005 County/Subregion Time Series Data for Existing Models[10]. For 2010 labor force and and unemployment, data were compiled from ACS. For the forecast section, some of the necessary inputs were derived from the outputs of other models; others are the official forecasts of government sources. Where necessary, estimates are made for some inputs based on historical data.

Tables 11 to 13 present current estimates of the resident civilian labor force, employed residents, and the unemployed by county and subregion for the period 2006 to 2010. Data were compiled from the Local Area Unemployment Survey (LAUS), a cooperative program of the U.S. Bureau of Labor Statistics and the state Departments of Labor. Table 14 present Aggregate Civilian Labor Force Participation Rates of Racial-Ethnic Population by County & Subregion in the New York Metropolitan Region, 2010. Labor force participation rates by age/sex/race-ethnicity, as well as net commutation and work-at-home employment have been compiled from the 2000 Census of Population and the 2005 American Community Survey (ACS) for the respective areas (see Tables 14, 15 and 16).

[9] Technical Memorandum 1.1.1., Population Data Collection And Analysis, August 31, 2000; Technical Memorandum 1.1.2 Employment Data Collection And Analysis, September 29, 2000; Technical Memorandum 1.1.3, Labor Force Data Collection And Analysis, August 31, 2000

[10] Technical Memorandum 1.1.5.8, 2002-2005 County/Subregion Time Series Data for Existing Models, October 2, 2007

Table 11. Trends in Civilian Labor Force by County & Subregion in the New York Metropolitan Region, 2006 to 2010, (in 000s)

	Civilian Labor Force				
Area Name	**2006**	**2007**	**2008**	**2009**	**2010**
New York City	**3,820**	**3,874**	**3,932**	**4,004**	**4,003**
Bronx	506	514	524	540	543
Kings	1,075	1,091	1,108	1,132	1,133
New York	910	921	933	942	935
Queens	1,093	1,107	1,122	1,142	1,142
Richmond	237	241	245	249	250
Long Island	**1,480**	**1,485**	**1,496**	**1,481**	**1,474**
Nassau	695	696	699	691	688
Suffolk	785	789	798	790	787
Mid Hudson	**1,149**	**1,151**	**1,159**	**1,145**	**1,134**
Dutchess	147	146	146	145	143
Orange	180	180	181	180	179
Putnam	56	56	56	55	54
Rockland	152	154	156	153	152
Sullivan	35	35	36	35	35
Ulster	92	91	90	90	89
Westchester	486	490	494	486	481
New Jersey	**3,506**	**3,508**	**3,546**	**3,561**	**3,541**
Bergen	473	473	478	479	477
Essex	364	363	365	366	363
Hudson	290	291	293	299	298
Hunterdon	72	72	73	73	72
Mercer	196	197	202	204	204
Middlesex	422	422	425	426	423
Monmouth	329	332	335	335	333
Morris	272	273	275	274	270
Ocean	256	257	262	264	263
Passaic	237	237	240	244	243
Somerset	180	180	181	182	181
Sussex	84	84	85	85	85
Union	269	268	272	273	269
Warren	59	58	59	59	59
Connecticut	**1,000**	**1,010**	**1,019**	**1,026**	**1,034**
Fairfield	459	464	468	471	474
Litchfield	104	104	105	105	106
New Haven	437	442	446	450	455
Region	**10,955**	**11,028**	**11,153**	**11,216**	**11,186**

Source: *LAUS* of NY/NJ/CT Departments of Labor

Table 12. Trends in Resident Employed Labor Force by County & Subregion in the New York Metropolitan Region, 2006 to 2010, (in 000s)

	Employed Labor Force				
Area Name	**2006**	**2007**	**2008**	**2009**	**2010**
New York City	**3,630**	**3,684**	**3,719**	**3,633**	**3,625**
Bronx	472	480	486	475	474
Kings	1,017	1,033	1,043	1,020	1,018
New York	871	882	889	863	861
Queens	1,044	1,059	1,068	1,046	1,044
Richmond	226	230	233	229	228
Long Island	**1,422**	**1,428**	**1,424**	**1,374**	**1,365**
Nassau	668	670	666	642	638
Suffolk	754	758	758	731	727
Mid Hudson	**1,103**	**1,106**	**1,102**	**1,059**	**1,048**
Dutchess	141	140	139	133	132
Orange	172	172	171	166	164
Putnam	54	54	53	51	51
Rockland	146	148	148	143	141
Sullivan	33	33	33	32	32
Ulster	88	87	86	83	82
Westchester	467	472	471	451	446
New Jersey	**3,348**	**3,363**	**3,359**	**3,247**	**3,217**
Bergen	455	457	456	441	439
Essex	343	343	341	328	323
Hudson	274	276	275	267	266
Hunterdon	70	70	70	68	67
Mercer	188	189	192	189	188
Middlesex	404	405	404	389	386
Monmouth	316	320	319	307	305
Morris	263	264	264	254	251
Ocean	244	246	246	239	237
Passaic	224	225	224	217	216
Somerset	174	174	174	169	167
Sussex	81	81	81	78	77
Union	255	256	256	247	243
Warren	57	56	56	55	54
Connecticut	**957**	**964**	**963**	**940**	**939**
Fairfield	441	445	444	434	434
Litchfield	99	99	99	97	96
New Haven	416	419	419	410	409
Region	**10,460**	**10,545**	**10,565**	**10,253**	**10,194**

Source: *LAUS* of NY/NJ/CT Departments of Labor

Table 13. Trends in Resident Unemployed Labor Force by County & Subregion in the New York Metropolitan Region, 2006 to 2010, (in 000s)

	Unemployed Labor Force				
Area Name	**2006**	**2007**	**2008**	**2009**	**2010**
New York City	**190.0**	**189.7**	**213.2**	**370.3**	**378.5**
Bronx	33.7	34.2	38.2	64.4	69.4
Kings	57.6	57.7	64.4	111.5	115.4
New York	39.2	38.9	44.2	78.9	74.5
Queens	49.0	48.2	54.4	95.3	97.5
Richmond	10.6	10.7	12.0	20.3	21.6
Long Island	**58.0**	**56.9**	**72.8**	**107.7**	**109.1**
Nassau	26.6	26.0	33.0	48.8	49.1
Suffolk	31.4	30.9	39.8	58.8	60.1
Mid Hudson	**45.9**	**45.8**	**57.8**	**85.8**	**86.1**
Dutchess	5.7	5.8	7.5	11.3	11.3
Orange	7.7	7.8	9.7	14.4	14.8
Putnam	2.0	1.9	2.5	3.8	3.7
Rockland	5.8	6.0	7.4	10.8	10.9
Sullivan	1.8	1.9	2.3	3.1	3.2
Ulster	3.9	4.0	4.9	7.1	7.3
Westchester	18.9	18.4	23.6	35.3	34.9
New Jersey	**157.9**	**144.7**	**187.3**	**313.5**	**323.2**
Bergen	18.3	16.3	21.4	37.3	38.7
Essex	21.2	19.4	24.0	37.8	40.0
Hudson	15.9	14.6	18.6	31.4	32.1
Hunterdon	2.4	2.1	2.8	4.9	5.1
Mercer	8.3	7.6	9.8	15.5	15.9
Middlesex	18.3	16.3	21.3	36.2	36.7
Monmouth	13.5	12.5	16.3	27.9	28.6
Morris	9.0	8.3	11.0	19.4	19.6
Ocean	12.7	11.8	15.6	25.2	26.6
Passaic	13.3	12.7	16.3	26.9	27.3
Somerset	6.2	5.6	7.4	13.2	13.4
Sussex	3.5	3.3	4.3	7.3	7.9
Union	13.0	12.1	15.6	25.4	26.0
Warren	2.4	2.2	3.0	5.2	5.4
Connecticut	**43.4**	**45.6**	**56.9**	**85.9**	**94.4**
Fairfield	17.9	18.7	23.9	36.8	39.4
Litchfield	4.2	4.5	5.5	8.7	9.3
New Haven	21.2	22.4	27.6	40.3	45.7
Region	**495.2**	**482.7**	**587.9**	**963.2**	**991.3**

Source: *LAUS* of NY/NJ/CT Departments of Labor

Table 14. Aggregate Civilian Labor Force Participation Rates of Racial-Ethnic Population by County & Subregion in the New York Metropolitan Region, 2010

Area Name	% of Persons Aged 16+ in Civil Labor Force (2010)			
	White nonHisp	Black	Asian/Other	Hispanic
New York City	**61.06%**	**61.44%**	**63.40%**	**62.38%**
Bronx	52.00%	60.90%	61.70%	59.20%
Kings	60.00%	62.50%	62.70%	59.90%
New York	74.50%	56.30%	66.00%	58.80%
Queens	59.40%	66.40%	65.20%	70.40%
Richmond	59.40%	61.10%	61.40%	63.60%
Long Island	**64.15%**	**67.75%**	**65.55%**	**74.05%**
Nassau	63.00%	69.70%	66.50%	74.70%
Suffolk	65.30%	65.80%	64.60%	73.40%
Mid Hudson	**64.40%**	**59.36%**	**67.14%**	**67.60%**
Dutchess	65.00%	61.20%	66.60%	66.90%
Orange	66.60%	68.80%	67.30%	71.90%
Putnam	67.00%	58.60%	67.00%	65.10%
Rockland	62.10%	69.00%	70.20%	72.40%
Sullivan	61.20%	47.10%	72.00%	62.80%
Ulster	65.80%	45.20%	58.10%	62.30%
Westchester	63.10%	65.60%	68.80%	71.80%
New Jersey	**66.21%**	**64.84%**	**69.95%**	**72.65%**
Bergen	64.50%	71.40%	65.30%	73.40%
Essex	64.70%	65.00%	70.10%	68.20%
Hudson	69.20%	67.10%	70.40%	69.90%
Hunterdon	69.90%	25.20%	74.60%	60.50%
Mercer	64.90%	64.10%	69.00%	73.30%
Middlesex	64.80%	67.40%	69.20%	71.30%
Monmouth	66.80%	66.50%	68.40%	74.80%
Morris	67.80%	67.80%	71.70%	78.90%
Ocean	57.30%	68.60%	71.80%	75.20%
Passaic	65.50%	58.30%	68.00%	65.30%
Somerset	68.10%	72.80%	71.70%	78.00%
Sussex	71.30%	75.70%	66.10%	76.30%
Union	64.40%	67.60%	71.70%	75.10%
Warren	67.80%	70.30%	71.30%	76.90%
Connecticut	**67.33%**	**68.65%**	**70.20%**	**71.10%**
Fairfield	65.60%	68.70%	69.80%	73.70%
Litchfield	69.20%	NA	NA	69.20%
New Haven	67.20%	68.60%	70.60%	70.40%
Region	**64.63%**	**64.41%**	**67.25%**	**69.56%**

Source: 2006-2010 American Community Survey

Table 15. Trends in Work at Home of Resident Labor Force by County & Subregion in the New York Metropolitan Region, 2000 & 2010

Area Name	2000			2010			2000-2010	
	Workers 16+ Total	Workers 16+ Worked at home	Ratio of Workers at home to Total	Workers 16+ Total	Workers 16+ Worked at home	Ratio of Workers at home to Total	Change of Workers Total	Change of Workers at home
New York City	**3,192,070**	**92,151**	0.029	**3,641,405**	**139,770**	0.038	**449,335**	**47,619**
Bronx	415,075	7,756	0.019	518,939	15,350	0.030	103,864	7,594
Kings	901,027	20,663	0.023	1,060,308	40,996	0.039	159,281	20,333
New York	753,114	43,853	0.058	826,997	52,281	0.063	73,883	8,428
Queens	931,709	16,673	0.018	1,031,087	26,367	0.026	99,378	9,694
Richmond	191,145	3,206	0.017	204,074	4,776	0.023	12,929	1,570
Long Island	**1,289,992**	**36,193**	0.028	**1,342,796**	**46,405**	0.035	**52,804**	**10,212**
Nassau	619,586	18,392	0.030	633,950	21,577	0.034	14,364	3,185
Suffolk	670,406	17,801	0.027	708,846	24,828	0.035	38,440	7,027
Mid Hudson	**997,717**	**35,861**	0.036	**1,054,119**	**53,020**	0.050	**56,402**	**17,159**
Dutchess	128,437	4,162	0.032	138,358	6,276	0.045	9,921	2,114
Orange	152,489	4,085	0.027	170,425	9,131	0.054	17,936	5,046
Putnam	48,167	1,584	0.033	47,539	2,184	0.046	-628	600
Rockland	132,302	4,685	0.035	137,728	5,889	0.043	5,426	1,204
Sullivan	29,544	1,090	0.037	33,143	1,952	0.059	3,599	862
Ulster	81,726	3,950	0.048	86,995	6,084	0.070	5,269	2,134
Westchester	425,052	16,305	0.038	439,931	21,504	0.049	14,879	5,199

Table 15. Trends in Work at Home of Resident Labor Force by County & Subregion in the New York Metropolitan Region, 2000 & 2010 (continue...)

Area Name	2000			2010			2000-2010	
	Workers 16+ Total	Workers 16+ Worked at home	Ratio of Workers at home to Total	Workers 16+ Total	Workers 16+ Worked at home	Ratio of Workers at home to Total	Change of Workers Total	Change of Workers at home
New Jersey	**3,073,471**	**86,945**	0.028	**3,266,509**	**116,982**	0.036	**193,038**	**30,037**
Bergen	427,462	13,292	0.031	437,135	17,707	0.041	9,673	4,415
Essex	328,214	9,106	0.028	347,517	10,185	0.029	19,303	1,079
Hudson	264,544	4,644	0.018	313,710	7,349	0.023	49,166	2,705
Hunterdon	62,359	3,665	0.059	63,259	4,541	0.072	900	876
Mercer	163,257	5,161	0.032	171,098	6,899	0.040	7,841	1,738
Middlesex	363,176	7,690	0.021	385,209	12,412	0.032	22,033	4,722
Monmouth	291,938	9,504	0.033	302,960	12,118	0.040	11,022	2,614
Morris	239,839	8,845	0.037	245,176	11,490	0.047	5,337	2,645
Ocean	209,328	5,291	0.025	237,250	8,,946	0.038	27,922	3,655
Passaic	210,378	4,493	0.021	224,150	5,041	0.022	13,772	548
Somerset	151,284	5,438	0.036	159,290	6,602	0.041	8,006	1,164
Sussex	72,728	2,442	0.034	75,848	4,015	0.053	3,120	1,573
Union	238,606	5,692	0.024	250,862	7,117	0.028	12,256	1,425
Warren	50,358	1,682	0.033	53,045	2,560	0.048	2,687	878
Connecticut	**901,221**	**32,219**	0.036	**941,209**	**39,743**	0.042	**39,988**	**7,524**
Fairfield	419,237	18,964	0.045	428,570	21,642	0.050	9,333	2,678
Litchfield	93,934	3,691	0.039	97,499	4,681	0.048	3,565	990
New Haven	388,050	9,564	0.025	415,140	13,420	0.032	27,090	3,856
Region	**9,454,471**	**283,369**	0.030	**10,246,038**	**395,920**	0.039	**791,567**	**112,551**

Source: 2000 Census of Population, American Community Survey

Table 16. Trends in Out Commutation of Resident Labor Force by County & Subregion in the New York Metropolitan Region, 2000 & 2010

Area Name	2000		2010	
	Worked in County of Residence	Worked Outside County of Residence	Worked in County of Residence	Worked Outside County of Residence
New York City	**1,685,614**	**1,506,456**	**1,982,106**	**1,659,299**
Bronx	168,903	246,172	226,315	292,624
Kings	431,559	469,468	533,683	526,625
New York	631,132	121,982	696,081	130,916
Queens	367,823	563,886	430,249	600,838
Richmond	86,197	104,948	95,778	108,296
Long Island	**851,534**	**438,458**	**903,261**	**439,535**
Nassau	359,698	259,888	369,694	264,256
Suffolk	491,836	178,570	533,567	175,279
Mid Hudson	**616,082**	**381,635**	**660,557**	**393,562**
Dutchess	88,963	39,474	93,389	44,969
Orange	99,901	52,588	109,987	60,438
Putnam	13,721	34,446	15,391	32,148
Rockland	72,022	60,280	81,337	56,391
Sullivan	19,922	9,622	23,713	9,430
Ulster	54,373	27,353	58,340	28,655
Westchester	267,180	157,872	278,400	161,531
New Jersey	**1,643,418**	**1,430,053**	**1,738,298**	**1,528,211**
Bergen	246,163	181,299	242,407	194,728
Essex	175,248	152,966	184,635	162,882
Hudson	121,352	143,192	142,396	171,314
Hunterdon	25,761	36,598	27,218	36,041
Mercer	112,449	50,808	116,514	54,584
Middlesex	201,811	161,365	211,324	173,885
Monmouth	175,070	116,868	184,816	118,144
Morris	138,737	101,102	139,604	105,572
Ocean	120,741	88,587	140,570	96,680
Passaic	95,790	114,588	101,354	122,796
Somerset	66,341	84,943	70,677	88,613
Sussex	29,658	43,070	32,824	43,024
Union	113,263	125,343	121,812	129,050
Warren	21,034	29,324	22,147	30,898
Connecticut	**676,977**	**224,244**	**689,753**	**251,456**
Fairfield	335,378	83,859	335,872	92,698
Litchfield	51,501	42,433	51,410	46,089
New Haven	290,098	97,952	302,471	112,669
Region	**5,473,625**	**3,980,846**	**5,973,975**	**4,272,063**

Source: American Community Survey

As mentioned previously, subregional Labor Force Model incorporate submodels for each racial/ethnic group. These sub-models are interdependent where necessary to aggregate racial/ethnic shares of overall employment, commutation, and work-at-home employment to subregional totals. For the sake of clarity, this aggregation process is described, together with the discussion of each input, below.

4.1.1 Population

The Labor Force Model depends on the Population Model for inputs, at each five-year interval, of population by sex and age cohort for all persons 16 years and older, by racial/ethnic group. The eight age cohorts are determined by their differences in labor force participation, as follows:

- Age 16 - 19: Teenage workers.
- Age 20 - 24: Recent high school and college graduates.
- Age 25 - 34: Young labor force.
- Age 35 - 44: Prime labor force.
- Age 45 - 54: Middle labor force.
- Age 55 - 64: Mature labor force.
- Age 65 - 74: Early Retirement Ages.
- Age 75+ Elderly Retirement Ages

4.1.2 Labor Force Participation Rates

The Labor Force Participation Rate is defined as the percentage of all residents of a particular population group who are in the Civilian Labor Force, as expressed in the equation:

$$LFPR = \frac{CLF}{POP}$$

where LFPR equals Labor Force Participation Rate, CLF equals the Civilian Labor Force and POP equals the resident population. Civilian Labor Force includes both employed and and unemployed workers, and excludes military personnel and all other residents who are not in the labor market. Labor Force Participation Rates for the historical section of the model were calculated by age, sex, and racial/ethnic characteristics of the subregional population, based on data from the decennial Census[11]. Rates for the forecast section were benchmarked on national forecasts prepared by the US Bureau of Labor Statistics.

[11] It should be noted that all population figures used in the calculation of Labor Force Participation Rates are based upon the Census Bureau's STF data set, whereas the data described in the section above on population inputs rely on the Bureau's Modified Age, Race, Sex (MARS) data set for 1980 and 1990. The MARS data set incorporates adjustments to the STF data in order to improve allocation by racial/ethnic group and age. However, since the Census's labor force figures rely on unadjusted STF population data, STF data were used in the calculation of Labor Force Participation Rates for the sake of consistency.

The increasing relative -- as well as absolute -- importance of minorities in the Region's labor force is considered likely to encourage greater supply, just as the declining importance of earlier dominant sources of labor has correlated with reductions in their Labor Force Participation Rates. However, the new rates are anticipated to reveal increases in labor force participation among older workers, even as the baby boom generation exits the prime-aged workforce.

4.1.3 Unemployment Rates

Unemployed persons are defined as those who are in the Civilian Labor Force but are not currently working; they are counted based on unemployment claims. Unemployment figures do not include certain groups of persons who are not employed for a variety of reasons and are not considered part of the labor force, such as the disabled or the long-term unemployed who have stopped seeking work. The unemployment rate is defined as the percentage of unemployed persons in the Civilian Labor Force:

$$UNEMP\_RATE = \frac{UNEMP}{CLF}$$

The Labor Force Model requires Unemployment Rate inputs at each interval for each racial/ethnic group as a whole; age- and sex-specific Unemployment Rates are not required.

Historical unemployment inputs have been derived from a combination of US Census and state Department of Labor sources. The decennial Census provides county-level unemployment data by race and ethnicity for the years 1970, 1980, 1990 and 2000, although reporting is incomplete and reflects problems with racial/ethnic categorizations similar to those cited for Labor Force Participation Rates. State DOLs provide unemployment data for intercensal years, but not by racial/ethnic group.

For each Census year, subregional Unemployment Rates were derived by race-ethnicity from county-level data as the number of unemployed persons divided by the size of the CLF:

$$UNEMP\_RATE_s = \frac{\sum UNEMP_c}{\sum CLF_c}$$

where c denotes county-level figures and s denotes subregional-level figures.

Rates for 1975, 1985, 1995 & 2005

As discussed above, the source used for unemployment rates on a racial/ethnic basis is the US decennial Census. Estimates of total and unemployed civilian labor force are available from the state Departments of Labor (DOL) at the county level for all years through 2005, but not by racial/ethnic group. Subregional unemployment rates were calculated from these data using the formula above. These total subregional figures were adjusted by racial/ethnic group on the assumption that the ratio of the group-specific Unemployment Rate to that of the Civilian Labor Force as a whole would be the same as for the preceding Census year. This can be expressed as the formula:

$$UNEMP\_RATE_{ir} = UNEMP\_RATE_{it} \times \frac{UNEMP\_RATE_{cr}}{UNEMP\_RATE_{ct}}$$

where i refers to the intercensal year, c refers to the preceding Census year, r refers to a race-specific Unemployment Rate for the given year, and t refers to the Unemployment Rate for the Civilian Labor Force as a whole.

4.1.4 Unemployment Rates for Forecast Years

Unemployment rate estimates were prepared for the years 2015 through 2040 as part of the Employment Model. These estimates are conceptually comparable to the state DOL figures used for intercensal years; however, total and unemployed labor force figures were not developed as part of the Employment Model. It was therefore necessary to calculate subregional rates as the weighted average of the county rates.

4.1.5 Employment

The employment inputs reflect the number of available jobs in a given subregion at each five-year interval, and combine the amount of nonfarm payroll employment and the number of proprietors. Nonfarm employment includes jobs in ten major industrial sectors, and several subsectors as defined by NAICS: Natural Resources/Mining/Construction; Manufacturing; Trade, Transportation and Utilities; Information Services; Financial Activities; Professional and Business Services; Education and Health Services; Leisure and Hospitality; Other Services; and Government. Proprietors include self-employed persons, partners in non-limited partnerships, and non-farm proprietors.

The Labor Force Model incorporates employment figures for each five-year interval from 1970 to 2010, as derived from the Employment Model. Within the Labor Force Model it will be necessary to disaggregate these figures for inclusion in each racial/ethnic sub-model. For purposes of disaggregation it is assumed that the racial/ethnic distribution of total employment is proportional to that of the supply of local commutation-adjusted workers within each subregion, which reflects their relative differences in unemployment. This figure is generated in the supply-side of the Labor Force Model for each racial/ethnic group based on the size of the labor force, Unemployment Rates, and net-commutation levels.

For the forecast years, the Labor Force Model depends on the Employment Model for inputs of nonfarm employment and proprietors. The Employment Model generates annual subregional totals for each of these groups. These totals are disaggregated by racial/ethnic group following the same methodology used for the historical years, as described above.

4.1.6 Work-at-Home Employment

Table 15 presents total Work-at-Home employment by subregion for 2000 and 2010. Recent data show an escalation in the absolute and relative share of regional employment performed at home, from 3.0 to 4.0 percent between 2000 and 2010. Based on Work-at-Home employment from 1970 through 2010, future levels are forecasted at the county-level by trend analysis. Results on a regional and subregional basis were evaluated against recent research findings at the national level. Work-at-Home employment then was incorporated in the Labor Force Model because of the necessity to exclude workers that do not generate commuting trips from transportation modeling.

Up to Census 2000, historical Work-at-Home levels were derived by county for each subregion from Census county-to-county journey-to-work data. For 2010, data were gathered from ACS. Within the Labor Force Model, it is necessary to disaggregate these total figures for inclusion in each racial/ethnic sub-model. For disaggregation purposes, it is assumed that Work-at-Home levels are proportional to the racial/ethnic distribution of residents employed within the subregion. For the intercensal years, with the exception of 2005, Work-at-Home levels are estimated based on the preceding and following Census years.

Total Work-at-Home employment for the forecast years is forecasted at the county level, using ordinary least squares regression analysis with 1970-2005 data, a timeline and other variables such as the forecasted number of proprietors. These figures are disaggregated by racial/ethnic group using the same methodology as for the historical period, described above.

4.1.7 Dual Job Rate

To account for workers holding two or more jobs within the jobs-labor force matching process in the forecast years, the Labor Force Model applies a Dual Job Rate for each racial/ethnic group at every five-year interval. The Dual Job Rate for all forecast years is calculated based on the average for all historical periods. The latter are calculated in the reconciliation of historical labor force and employment series as the ratio of locally-employed labor force to local trip-based employment.

4.1.8 Net Commutation

Net Commutation figures are input to the Labor Force Model at each five-year interval as part of the subregional labor force-employment match. They are calculated at the subregional level and are defined as the difference between the number of non-resident workers commuting into the subregion and the number of resident workers commuting out of the subregion. Net Commutation levels are positive for New York City and negative for the other subregions, reflecting the continued importance of the Manhattan CBD as an employment center. Table 16 presents trends in gross out-commutation by county and subregion of residence between 2005 and 2010. The data show an increase of three hundred thousand out-commuters in the Region over the five year period, compared to just over a half million increase in intra-county work trips.

For Census years, historical Net Commutation levels of each subregion are available by county from the Census county-to-county Journey-to-Work flows of the Census Transportation Planning Package (CTPP). Prior versions of the Labor Force Model had net commutation levels for 1970, 1980 and 1990. Labor Force Model net commutation numbers do not always correspond to Census numbers because of several adjustments: Census flow data reflect travel patterns of respondents during a spring week of the decennial year. The labor force model adjusts spring travel to reflect commutation between place of work and place of residence on an annual average basis.

In addition, 2000 Journey-to-Work flows had to be evaluated from the undercount perspective. The acknowledged deficiency in enumeration of resident labor force, by the Census Bureau, has resulted in an inaccurate representation of gross in- and out-commutation flows. Using secondary data sources, such as hub bound travel, together with the LAUS reported levels of civilian labor force; a tentative correction was made to the 2000 gross commutation flows. This adjustment was reviewed with regional transit agencies and assumed for Labor Force Model purposes unless further research is performed under separate contract to precisely model the 2000 county-to-county work trip flows.

Within the Labor Force Model it was also necessary to disaggregate total figures for incorporation into each racial/ethnic sub-model. For the purpose of disaggregation it is assumed that Net Commutation levels are proportional to the racial/ethnic distribution of employed workers within the subregion, as described in the formula:

$$NETCOM_R = NETCOM_{TOTAL} \times \frac{EMP_R}{EMP_{TOTAL}}$$

where NETCOM indicates subregional Net Commutation, EMP indicates subregional resident employed workers, R indicates a given racial/ethnic group, and TOTAL indicates the total for all racial/ethnic groups. For the intercensal years, Net Commutation levels were estimated based on the preceding and following Census years.

Total Net Commutation levels were forecasted for each racial/ethnic group at every five-year interval in relation to two factors: first, the number of employed workers in the group at the given time period; second, historical ratios of Net Commuters to employed workers. Because of the difficulties of forecasting Net Commutation ratios by racial/ethnic group, the (weighted) average historical ratio between Net Commuters and employed workers in Census years, a constant, have been used for each racial/ethnic group. This can be expressed as the equation:

$$NETCOM_i = EMPL_i \times \frac{(NETCOM_{1970} + NETCOM_{1980} + NETCOM_{1990})}{(EMPL_{1970} + EMPL_{1980} + EMPL_{1990})}$$

where i is the forecast year. A deflation factor was applied to results for 1995, in order to account for the slump in New York City employment during that period.

4.2 Methodology

The methodology described below applies to the racial/ethnic sub-models incorporated into each subregional model. As mentioned above, each subregional model incorporates submodels for every racial/ethnic group. These submodels are interdependent where necessary to aggregate racial/ethnic shares of overall employment, Net Commutation, and Work-at-Home employment to subregional totals. For the sake of convenience, this disaggregation process is described in the above section. Thus, all figures discussed below are for individual racial/ethnic groups.

The methodology involved a three-step process. First, an initial, unadjusted estimate is made of Civilian Labor Force, by age and sex, and in total. This corresponds to the supply of labor available based on prior-period population, natural increase, and historical rates of net migration, not modified by the anticipated demand for labor. Second, this expected supply of laborers is matched against the expected demand for workers, input from the Employment Model, to determine if there would be a surplus or deficit of workers. Any such surplus or deficit is assumed to induce a net in- or out-migration of an equal number of workers. Finally, this net migration figure is disaggregated by age/sex group and added to the initial CLF figures to yield an adjusted CLF for each group. The disaggregated net migration also becomes an input to the Population Model, where it is factored up to population by application of the labor force participation rate (LFPR) and used to adjust net migration levels forecasted within that model.

4.2.1 Unadjusted Civilian Labor Force Forecast

Unadjusted Civilian Labor Force is calculated separately for each age/sex group, based upon the forecasted ‘closed’ population and Labor Force Participation Rates for each time period. The CLF is simply the product of these two figures:

$$CLF_i = POP_i \times LFPR_i$$

where i represents the age/sex group. The total Civilian Labor Force is the sum of these age/sex-specific Civilian Labor Force figures:

$$CLF = \sum CLF_i$$

4.2.2 Labor Force-Employment Match

In the labor force-employment match, the forecasted labor supply is compared to demand, with any difference forming the basis of an induced in- or out-migration of workers. For the purpose of this matching process, labor force supply is defined as Local Employment, and demand as Primary Jobs, which are calculated as follows:

Local Employment is defined as equal to total Civilian Labor Force after unemployed workers have been excluded and net in- or out-commuters have been accounted for; that is:

$$LOCALEMP = CLF - UNEMP + NETCOM$$

where CLF is the total Civilian Labor Force carried from above, UNEMP is the total number of unemployed workers and NETCOM is the net number of commuters (a positive value if there is net in-commutation and a negative value if there is net out-commutation).

The number of Primary Jobs is calculated by first determining the level of Trip-Based Employment, which is equal to the sum of all nonfarm employees and individual proprietors less the level of Work-at-Home employment, as follows:

$$TRIPBASED = (NONAG + PROP) - WORKATHOME$$

The number of Primary Jobs then is calculated by excluding secondary jobs from the Trip-Based Employment. This is done by dividing Trip-Based Employment by the Dual Job Rate (i.e., the ratio of all jobs to Primary Jobs):

$$PRIMJOB = TRIPBASED \div DUALJOB$$

The Dual Job Rate for forecast years is calculated in the Model's historical section. The rate for each historical interval is calculated as the ratio of Trip-Based Employment to Local Employment. The Dual Job Rate for forecast years calculated as the average of rates for historical years on a racial/ethnic basis by subregion.

Jobs-Labor Force Match

In the jobs-labor force match, a net in- or out-flow of workers is induced by comparing local employment with the forecasted number of primary jobs. The level of net migration is calculated by subtracting the former from the latter,

$$NETMIG = PRIMJOB - LOCAL\_EMP$$

resulting in a positive figure if jobs exceed labor force (generating a net in-flow of workers) and a negative figure if there are insufficient jobs for local workers (generating a net out-flow of workers).

4.2.3 Disaggregation of Induced Net Migration by Age & Sex

Age-group allocation of induced in- or out-migration is based upon the age-group distribution of the initial unadjusted labor force estimate for each racial/ethnic group. In the historical period there is no induced net migration calculation since this dynamic is incorporated in the residual of population growth and natural increase by each age-group.

4.2.4 Adjustment of Labor Force Net Migration to Population Net Migration

The migration of workers brings with it an additional migration of non-workers. Therefore, the labor force net-migration figures, discussed above, are adjusted for this additional migration before incorporation into the Population. Total net-migration calculated based upon age/sex-specific figures for net-migration of workers and LFPR, following the equation:

$$NETMIG_{T_i} = NETMIG_{W_i} \div LFPR_i$$

where T denotes total net migration, W denotes net-migration of workers, and i denotes age/sex group. These age/sex-specific figures were incorporated as inputs into the Population Model.

Additional net in-migration of dependent children of adult workers was not included because of the lack of availability of historical data on which to base forecasts by race/ethnicity.

The resulting forecasts of civilian labor force and employed resident labor force were evaluated for reasonableness by county. Modifications were made to smooth trends in relation to state DOL time series and forecasts reviewed by state and county agencies.

5. Household Formation Model

The Household Formation and Housing Stock Preference Model represents a recalibration and extension of work performed under the Transportation Models and Data Initiative (TMDI) project. This project was a major program undertaken by NYMTC to forecast the transportation needs of the New York Metropolitan Region through the year 2020. The subsequent Demographic and Socioeconomic Forecasting project extended the forecast period for the Household Formation Model to 2025, 2030, 2035 and now 2040.

Inputs to the Household Formation Model included results of the Population Model and historical data collected on housing for the period 1970 through 2010. Additionally, the Model incorporates state, county, and national level household data drawn from the U.S. Census sources including the decennial censuses, the American Community Survey, and several Public Use Macrodata Samples (PUMS).

The Model produces outputs at the subregional level, aggregated by mutually exclusive racial/ethnic group, age of head of householder, household type or composition, household size, and household income. Total households are then disaggregated to the county level.

The household model estimates the future number of households as the product of two factors: household population by age group, and age-specific household formation rates. The latter, also known as headship rates, represent the share of householders (or household heads) in a given age group. These age-specific household estimates are summed to produce the total household estimate for a given subregion and racial/ethnic group. Grouping of households by type, size and income range are performed by using a series of matrices that crosstabulate the historical and estimated rates of these parameters. The disaggregation of subregional household forecasts to the county level is based upon the projection of county household trends, calculated as a function of forecasted household population and anticipated trends in average household size.

5.1 Data Inputs

Tabulations from the Census 2000 long form questionnaires of Summary File 4 (SF4), and the 2010 Census by county provide the basis for current inputs to the Household Formation Model. The 2000 Census file represents a complete cross-tabulation of household characteristics by racial-ethnic detail. Used together, with inputs from the Population Model, these data sources can provide a comprehensive and current characterization of family and nonfamily households by age of head, type and size of household, income bracket, tenure and housing preference. The following tables provide an overview of household and housing trends in the Region, as well as current patterns of household formation. The Model contains comparable data by subregion on a racial-ethnic basis.

Table 17 depicts the increase in household population, the number of households and the average household size region wide, by subregion and county over the 2000 to 2010 period. These changes are reflected in the model calibration of the historical section, including the racial-ethnic submodels with corresponding racial-ethnic data.

Table 17. Trends in Household Population & Households by County & Subregion in the New York Metropolitan Region, 2000, 2005, 2010 (*in 000s of persons & households)*

	Household Population			Households			Avg Household Size		
	2000	**2005**	**2010**	**2000**	**2005**	**2010**	**2000**	**2005**	**2010**
New York City	**7,825.5**	**8,028.7**	**7,989.9**	**3,021.6**	**3,052.7**	**3,109.8**	**2.59**	**2.63**	**2.61**
Bronx	1,285.4	1,317.1	1,338.7	463.2	470.4	483.4	2.78	2.8	2.77
Kings	2,425.8	2,471.0	2,469.1	880.7	892.1	916.9	2.75	2.77	2.69
New York	1,477.2	1,544.2	1,518.5	738.6	738.9	763.8	2.00	2.09	1.99
Queens	2,202.5	2,230.5	2,202.7	782.7	788.2	780.1	2.81	2.83	2.82
Richmond	434.5	465.9	460.9	156.3	165.8	165.5	2.78	2.81	2.78
Long Island	**2,703.7**	**2,749.6**	**2,781.8**	**916.7**	**919.6**	**948.5**	**2.95**	**2.99**	**2.94**
Nassau	1,312.9	1,307.7	1,317.9	447.4	435.9	448.5	2.93	3.00	2.94
Suffolk	1,390.8	1,441.9	1,463.9	469.3	483.9	499.9	2.96	2.98	2.93
Mid Hudson	**2,097.7**	**2,184.4**	**2,204.6**	**772.0**	**785.8**	**816.6**	**2.72**	**2.78**	**2.68**
Dutchess	262.0	276.0	277.5	99.5	101.8	108.0	2.63	2.71	2.57
Orange	327.7	358.6	360.6	114.8	123.3	125.9	2.85	2.91	2.86
Putnam	93.6	98.3	97.1	32.7	34.5	35.0	2.86	2.85	2.77
Rockland	279.1	286.8	304.5	92.7	93.4	99.2	3.01	3.07	3.07
Sullivan	69.1	71.4	73.7	27.7	29.1	30.1	2.50	2.45	2.45
Ulster	166.5	170.7	170.7	67.5	68.3	71.0	2.47	2.50	2.40
Westchester	899.8	922.6	920.4	337.1	335.5	347.2	2.67	2.75	2.65
New Jersey	**6,519.3**	**6,730.4**	**6,806.4**	**2,423.2**	**2,465.4**	**2,531.9**	**2.69**	**2.73**	**2.68**
Bergen	872.8	891.0	894.7	330.8	332.5	335.7	2.64	2.68	2.66
Essex	772.2	767.7	760.2	283.7	283.3	283.7	2.72	2.71	2.68
Hudson	599.5	593.5	624.9	230.5	229.2	246.4	2.60	2.59	2.54
Hunterdon	117.6	125.8	123.8	43.7	46.1	47.2	2.69	2.73	2.62
Mercer	329.7	344.9	347.7	125.8	127.3	133.2	2.62	2.71	2.61
Middlesex	729.3	768.5	786.0	265.8	267.8	281.2	2.74	2.87	2.8
Monmouth	605.3	624.8	622.7	224.2	230.5	234.0	2.70	2.71	2.66
Morris	461.0	480.6	483.4	169.7	172.3	180.5	2.72	2.79	2.68
Ocean	503.0	550.3	569.4	200.4	221.0	221.1	2.51	2.49	2.58
Passaic	477.7	485.7	490.2	163.9	163.0	166.8	2.92	2.98	2.94
Somerset	293.0	314.9	319.5	109.0	113.7	117.8	2.69	2.77	2.71
Sussex	142.5	151.0	147.5	50.8	55.1	54.8	2.80	2.74	2.69
Union	514.7	522.9	529.7	186.1	182.2	188.1	2.77	2.87	2.82
Warren	101.0	108.9	106.7	38.7	43.2	41.5	2.61	2.52	2.57
Connecticut	**1,840.6**	**1,885.4**	**1,918.1**	**714.8**	**722.4**	**746.7**	**2.57**	**2.61**	**2.54**
Fairfield	864.6	882.6	897.661	324.2	324.5	335.5	2.67	2.72	2.68
Litchfield	179.7	186.8	187.123	71.6	73.6	76.6	2.51	2.54	2.44
New Haven	796.3	816.0	833.279	319.0	323.8	334.5	2.50	2.52	2.49
Region Total	**20,986.9**	**21,578.5**	**21,700.7**	**7,848.3**	**7,923.7**	**8,153.4**	**2.67**	**2.72**	**2.66**

Source: 2010 United States Census Bureau

Tables 18 to 20 portrays the characteristics of household formation, such as age of head by household type; size of household; and income by age of household head.

Table 18. Household Formation by Age of Head & Type of Household, by Subregion in the New York Metropolitan Region, 2010

Age of Head by Household Type	Total Households, 2010					
	NYC	Long Island	Mid Hudson	New Jersey	Connecticut	Region
Family households	**1,850,221**	**711,420**	**564,838**	**1,754,715**	**500,175**	**5,381,369**
Householder 15 to 24	50,107	6,899	10,326	29,016	8,866	105,214
Householder 25 to 34	305,060	63,687	63,390	226,005	60,823	718,965
Householder 35 to 44	425,861	152,931	124,439	400,749	111,108	1,215,088
Householder 45 to 54	438,075	197,729	151,917	458,707	132,181	1,378,609
Householder 55 to 64	327,117	146,917	111,297	329,459	95,251	1,010,041
Householder 65 to 74	178,736	81,440	60,629	179,373	52,385	552,563
Householder 75 to 84	95,009	47,738	33,408	100,747	29,645	306,547
Householder 85 & over	30,256	14,079	9,432	30,659	9,916	94,342
Nonfamily households	**1,259,563**	**237,030**	**251,755**	**777,196**	**246,512**	**2,772,056**
Householder 15 to 24	69,210	4,781	8,677	26,624	11,057	120,349
Householder 25 to 34	278,477	23,732	29,367	114,555	35,002	481,133
Householder 35 to 44	183,523	25,149	28,352	96,820	28,272	362,116
Householder 45 to 54	192,874	39,246	44,820	130,283	42,831	450,054
Householder 55 to 64	203,919	45,234	50,022	138,861	45,277	483,313
Householder 65 to 74	154,230	38,001	38,777	108,438	33,635	373,081
Householder 75 to 84	115,147	38,076	33,223	100,021	30,174	316,641
Householder 85 & over	62,183	22,811	18,517	61,594	20,264	185,369
Total Households	**3,109,784**	**948,450**	**816,593**	**2,531,911**	**746,687**	**8,153,425**

Source: 2010 Census of Population

Table 19. Household Formation by Size of Household, by Subregion in the New York Metropolitan Region, 2010

Size of Household	Total Household Size 2010					
	NYC	Long Island	Mid Hudson	New Jersey	Connecticut	Region
1-person	995,755	193,192	207,904	638,307	200,414	**2,235,572**
2-person	858,781	272,920	243,962	745,243	233,371	**2,354,277**
3-person	496,643	165,452	136,000	441,192	124,378	**1,363,665**
4-person	377,689	168,082	125,661	402,982	111,051	**1,185,465**
5-person	198,515	85,820	60,701	184,167	49,604	**578,807**
6-person	92,634	33,820	23,573	69,584	17,685	**237,296**
7-or-more person	89,767	29,164	18,792	50,436	10,184	**198,343**
Total Households	**3,109,784**	**948,450**	**816,593**	**2,531,911**	**746,687**	**8,153,425**

Source: 2010 Census of Population

Table 20. Household Formation by Age of Head & Income Bracket, by Subregion in the New York Metropolitan Region, 2010

Income by Age of Household Head	Income Bracket 2010					
	NYC	Long Island	Mid Hudson	New Jersey	Connecticut	Region
Heads < 25 years	**104,402**	**9,375**	**14,986**	**47,006**	**18,505**	**194,274**
Less than $10,000	21,921	1,171	3,085	8,271	3,152	37,600
$10,000 to $14,999	7,298	1,125	1,386	3,413	1,829	15,051
$15,000 to $19,999	7,528	550	1,336	4,100	1,836	15,350
$20,000 to $24,999	6,489	484	1,731	2,416	1,236	12,356
$25,000 to $29,999	6,474	506	1,133	3,485	1,322	12,920
$30,000 to $34,999	6,237	259	962	2,488	1,358	11,304
$35,000 to $39,999	5,666	390	700	2,028	1,034	9,818
$40,000 to $44,999	4,492	847	707	3,153	1,680	10,879
$45,000 to $49,999	4,541	388	257	1,383	563	7,132
$50,000 to $59,999	6,537	683	1,058	4,471	1,127	13,876
$60,000 to $74,999	6,356	699	981	5,039	1,002	14,077
$75,000 to $99,999	8,872	982	422	4,013	1625	15,914
$100,000 to $124,999	5,040	688	810	1,204	422	8,164
$125,000 to $149,999	2,249	198	49	859	117	3,472
$150,000 to $199,999	2,943	242	260	362	78	3,885
$200,000 or more	1,759	163	109	321	124	2,476
Heads 25 to 44 years	**1,180,367**	**267,898**	**248,951**	**834,078**	**234,992**	**2,766,286**
Less than $10,000	98,515	6,155	9,437	40,221	11,893	166,221
$10,000 to $14,999	50,931	4,421	7,449	23,370	7,405	93,576
$15,000 to $19,999	53,001	5,482	6,450	23,884	9,320	98,137
$20,000 to $24,999	55,256	5,206	8,270	32,684	8,474	109,890
$25,000 to $29,999	52,515	6,306	6,593	26,593	10,327	102,334
$30,000 to $34,999	55,156	5,905	10,485	29,682	6,624	107,852
$35,000 to $39,999	51,965	6,805	10,765	27,778	9,667	106,980
$40,000 to $44,999	50,993	11,126	9,373	32,063	10,761	114,316
$45,000 to $49,999	47,870	6,952	7,131	30,531	7,515	99,999
$50,000 to $59,999	93,654	15,152	20,388	65,265	20,355	214,814
$60,000 to $74,999	120,355	28,521	27,859	80,061	22,815	279,611
$75,000 to $99,999	139,596	43,010	37,370	120,592	33,824	374,392
$100,000 to $124,999	99,182	35,101	28,171	97,292	23,277	283,023
$125,000 to $149,999	57,427	26,420	17,071	60,257	16,834	178,009
$150,000 to $199,999	66,802	32,539	19,046	69,637	14,931	202,955
$200,000 or more	87,149	28,797	23,093	74,168	20,970	234,177

Table 20. Household Formation by Age of Head & Income Bracket, by Subregion in the New York Metropolitan Region, 2010 (continued)

Income by Age of Household Head	Income Bracket 2010					
	NYC	Long Island	Mid Hudson	New Jersey	Connecticut	Region
Heads 45 to 64 years	**1,143,83**	**427,978**	**357,830**	**1,054,454**	**314,442**	**3,298,54**
Less than $10,000	114,623	12,381	14,848	49,321	20,018	211,191
$10,000to $14,999	57,354	5,318	9,448	28,351	8,796	109,267
$15,000 to $19,999	57,617	8,118	8,792	27,499	8,008	110,034
$20,000 to $24,999	53,962	7,914	10,961	30,236	8,120	111,193
$25,000 to $29,999	49,726	8,120	10,374	29,724	8,234	106,178
$30,000 to $34,999	51,926	8,601	12,241	34,815	11,053	118,636
$35,000 to $39,999	49,296	8,564	10,495	32,621	9,027	110,003
$40,000 to $44,999	54,566	11,051	10,487	32,515	12,132	120,751
$45,000 to $49,999	46,481	12,134	9,380	30,542	9,977	108,514
$50,000 to $59,999	83,309	25,053	26,652	67,130	20,468	222,612
$60,000 to $74,999	105,219	38,376	31,428	101,872	28,629	305,524
$75,000 to $99,999	127,354	58,889	50,366	140,135	43,454	420,198
$100,000 to $124,999	94,426	59,396	41,672	122,372	35,841	353,707
$125,000 to $149,999	57,821	45,513	28,911	87,531	23,034	242,810
$150,000 to $199,999	65,182	55,199	34,985	110,372	29,011	294,749
$200,000 or more	74,976	63,351	46,790	129,418	38,640	353,175
Heads 65 and over	**610,860**	**233,744**	**187,383**	**560,251**	**167,145**	**1,759,38**
Less than $10,000	99,249	10,781	10,983	38,758	8,995	168,766
$10,000 to $14,999	70,169	12,450	14,261	43,874	14,783	155,537
$15,000 to $19,999	53,816	16,936	15,284	47,906	15,942	149,884
$20,000 to $24,999	54,911	15,437	13,073	42,875	12,490	138,786
$25,000 to $29,999	38,986	12,260	11,443	37,541	11,376	111,606
$30,000 to $34,999	32,590	13,154	9,329	31,138	10,296	96,507
$35,000 to $39,999	26,885	11,582	9,630	25,320	8,341	81,758
$40,000 to $44,999	24,561	11,476	8,283	27,783	8,553	80,656
$45,000 to $49,999	20,088	9,602	7,860	23,108	6,674	67,332
$50,000 to $59,999	35,046	18,372	12,167	39,806	11,058	116,449
$60,000 to $74,999	34,939	22,250	16,626	51,254	14,318	139,387
$75,000 to $99,999	39,364	27,129	18,943	54,889	13,984	154,309
$100,000 to $124,999	27,606	17,394	11,847	32,793	9,601	99,241
$125,000 to $149,999	15,843	10,826	6,916	21,535	6,395	61,515
$150,000 to $199,999	16,259	12,417	9,080	21,724	6,268	65,748
$200,000 or more	20,548	11,678	11,658	19,947	8,071	71,902

Source: 2010 Census of Population

Population figures by age, sex and mutually exclusive racial/ethnic group drive the household forecasts. Household population, or total persons excluding those in group quarters, is available from the 2010 Census. It can be derived from the total population forecasted by the Population Model for 2010 to 2040 by assuming constant shares of institutional population. Households are projected as a function of the forecasted population in households and projected household formation rates. Household population is then aggregated by ten-year age-of-householder on a mutually exclusive racial/ethnic basis. Household formation rates, or the share of each age cohort heading a household, were compiled from decennial Census data, as depicted in Table 18 for all races by household type in 2010. Household formation rate inputs estimated by racial/ethnic and age group for the years 2010 through 2040, based on past trends.

Inputs for estimation of household size were produced by racial-ethnic household type in 2000 and 2010, as shown for all races in Table 19. Trend analysis forecasts changes in household size distribution through 2040. At each five year interval in the forecast period, the projected implications of household size distribution are controlled by the forecast in household population by race-ethnicity.

Inputs for estimation of household income are compiled by age of head and race-ethnicity from Census data for the years 1990 and 2010, as shown for all races and subregions in Table 20. Trend analysis forecasts changes in household income distribution by age of head through 2010.

The Region's changing racial/ethnic composition is expected to influence future patterns of household composition. These trends in part reflect the growing proportion of immigrant households with their larger than average household sizes. As Table 17 shows, upward pressure on average household size is already apparent in the Region, throughout all subregions, after decades of decline. Trends in income distribution also reflect racial-ethnic and immigrant influences, as growth becomes more bipolar, with gains reflected in both upper and lower income brackets. Household size and income are major determinants of housing preference, expressed as changes in tenure, or ownership, and unit size. A further matrix disaggregates projected households by housing stock preference and tenure based on income and racial/ethnic characteristics.

Table 21 depicts the overall increase of 465,500 housing units in the Region between 2000 and 2010 that accompanied the growth of 305,100 new households (Table 17). The difference between households, or occupied housing units, and total housing largely reflects vacant units for sale or rent and seasonal housing. Increasing affluence in the Region has resulted in a growth in second homes, or seasonally occupied units, forecasted separately as a function of income. Primary housing demand or the preference of households for year-round occupancy by tenure and housing type (single family, townhouse, apartment, etc) is driven by the forecasted changes in income cross-tabulated by tenure and housing type. Household size is a determinant of housing type by unit size. Table 22 provides evidence of recent changes in housing tenure, and Table 23, by housing type.

Table 21. Trends in Housing Units by County & Subregion in the New York Metropolitan Region, 2000, 2005 and 2010 *(in 000s)*

Area Name	Housing Units			Change 2000-2010	
	2000	2005	2010	Absolute	Percent
New York City	**3,200.9**	**3,275.4**	**3,343.4**	**142.5**	**4.45%**
Bronx	490.7	502.2	509.67	19.0	3.86%
Kings	930.9	947.6	986.48	55.6	5.97%
New York	798.1	819.8	839.01	40.9	5.13%
Queens	817.3	831.8	832.36	15.1	1.84%
Richmond	164.0	174.0	175.91	11.9	7.26%
Long Island	**980.5**	**996.8**	**1,031.4**	**50.9**	**5.19%**
Nassau	458.2	458.0	466.7	8.5	1.86%
Suffolk	522.3	538.8	564.7	42.4	8.11%
Mid Hudson	**830.7**	**858.0**	**893.1**	**62.4**	**7.51%**
Dutchess	106.1	110.7	116.9	10.8	10.22%
Orange	122.8	131.4	135.6	12.8	10.39%
Putnam	35.0	36.4	37.9	2.9	8.23%
Rockland	95.0	96.7	102.5	7.5	7.93%
Sullivan	44.7	47.0	48.7	4.0	8.89%
Ulster	77.7	80.5	83.0	5.3	6.83%
Westchester	349.4	355.2	368.5	19.1	5.47%
New Jersey	**2,570.1**	**2,663.3**	**2,735.0**	**164.9**	**6.41%**
Bergen	339.8	346.0	351.1	11.3	3.33%
Essex	301.0	306.4	311.7	10.7	3.57%
Hudson	240.6	247.4	264.8	24.2	10.08%
Hunterdon	45.0	48.1	49.2	4.2	9.24%
Mercer	133.3	138.9	142.4	9.1	6.81%
Middlesex	273.6	282.9	292.5	18.9	6.91%
Monmouth	240.9	252.6	256.5	15.6	6.48%
Morris	174.4	182.3	188.3	13.9	7.99%
Ocean	248.7	268.8	275.8	27.1	10.89%
Passaic	170.0	171.3	175.2	5.2	3.07%
Somerset	112.0	119.3	122.2	10.2	9.15%
Sussex	56.5	59.5	61.6	5.1	8.97%
Union	192.9	195.1	198.7	5.8	2.99%
Warren	41.2	44.6	44.9	3.7	8.97%
Connecticut	**759.5**	**776.2**	**804.2**	**44.7**	**5.89%**
Fairfield	339.5	346.9	358.1	18.6	5.49%
Litchfield	79.3	82.4	86.6	7.3	9.21%
New Haven	340.7	346.9	359.5	18.8	5.52%
Region	**8,341.6**	**8,569.8**	**8,807.1**	**465.5**	**5.58%**

Source: United States Census. Bureau

Table 22. Trends in Housing Units by Tenure in the New York Metropolitan Region, 2000 & 2010 *(in 000s)*

Area Name	2000				2010			
	Owner	Percent	Renter	Percent	Owner	Percent	Renter	Percent
New York City	**912.3**	**30.2%**	**2,109.3**	**69.8%**	**1,006.7**	**33.0%**	**2,040.6**	**67.0%**
Bronx	90.7	19.6%	372.5	80.4%	97.8	20.7%	374.7	79.3%
Kings	238.4	27.1%	642.4	72.9%	274.2	30.3%	629.8	69.7%
New York	148.7	20.1%	589.9	79.9%	167.0	22.8%	565.2	77.2%
Queens	334.8	42.8%	447.8	57.2%	352.1	45.5%	422.2	54.5%
Richmond	99.7	63.8%	56.6	36.2%	115.5	70.3%	48.8	29.7%
Long Island	**733.6**	**80.0%**	**183.1**	**20.0%**	**766.5**	**81.7%**	**171.7**	**18.3%**
Nassau	359.3	80.3%	88.1	19.7%	363.4	82.1%	79.5	17.9%
Suffolk	374.4	79.8%	94.9	20.2%	403.1	81.4%	92.2	18.6%
Mid Hudson	**506.3**	**65.6%**	**265.7**	**34.4%**	**549.0**	**67.8%**	**261.0**	**32.2%**
Dutchess	68.6	68.9%	30.9	31.1%	75.5	70.6%	31.5	29.4%
Orange	77.0	67.1%	37.8	32.9%	88.6	71.3%	35.7	28.7%
Putnam	26.9	82.3%	5.8	17.7%	29.5	84.6%	5.4	15.4%
Rockland	66.4	71.6%	26.3	28.4%	69.3	71.0%	28.3	29.0%
Sullivan	18.8	68.1%	8.8	31.9%	20.1	67.5%	9.6	32.5%
Ulster	45.9	68.0%	21.6	32.0%	49.2	69.6%	21.5	30.4%
Westchester	202.7	60.1%	134.5	39.9%	216.8	62.7%	129.0	37.3%
New Jersey	**1,544.0**	**63.7%**	**879.3**	**36.3%**	**1,621.2**	**65.0%**	**873.3**	**35.0%**
Bergen	222.3	67.2%	108.5	32.8%	225.3	67.5%	108.6	32.5%
Essex	129.4	45.6%	154.3	54.4%	131.0	47.2%	146.5	52.8%
Hudson	70.7	30.7%	159.9	69.3%	81.6	34.3%	156.1	65.7%
Hunterdon	36.5	83.7%	7.1	16.3%	40.4	85.6%	6.8	14.4%
Mercer	84.3	67.0%	41.5	33.0%	87.7	67.9%	41.5	32.1%
Middlesex	177.4	66.7%	88.4	33.3%	185.8	67.0%	91.6	33.0%
Monmouth	167.3	74.6%	56.9	25.4%	176.4	75.9%	56.1	24.1%
Morris	129.0	76.0%	40.7	24.0%	136.8	76.6%	41.8	23.4%
Ocean	166.8	83.2%	33.6	16.8%	183.3	82.4%	39.1	17.6%
Passaic	91.2	55.6%	72.7	44.4%	89.2	55.3%	72.2	44.7%
Somerset	84.2	77.2%	24.8	22.8%	91.2	79.7%	23.2	20.3%
Sussex	42.0	82.7%	8.8	17.3%	47.4	84.8%	8.5	15.2%
Union	114.6	61.6%	71.5	38.4%	113.7	61.5%	71.1	38.5%
Warren	28.1	72.6%	10.6	27.4%	31.5	75.8%	10.1	24.2%
Connecticut	**479.6**	**67.1%**	**235.2**	**32.9%**	**510.9**	**69.1%**	**228.4**	**30.9%**
Fairfield	224.5	69.2%	99.7	30.8%	234.4	70.7%	97.4	29.3%
Litchfield	53.8	75.1%	17.8	24.9%	60.3	78.7%	16.3	21.3%
New Haven	201.3	63.1%	117.7	36.9%	216.1	65.3%	114.7	34.7%
Region	**4,175.8**	**53.2%**	**3,672.5**	**46.8%**	**4,454.2**	**55.5%**	**3,574.9**	**44.5%**

Source: United States Census. Bureau2000, 2010

Table 23. Trends in Housing Units by Type in the New York Metropolitan Region, 2000 & 2010 *(in 000s)*

Area Name	2000			2010		
	Single family unit	**Building with two or more apartments**	**Mobile home or other type of housing**	**Single family unit**	**Building with two or more apartments**	**Mobile home or other type of housing**
New York City	**536,054**	**2,661,598**	**3,260**	**548,284**	**2,789,164**	**3,760**
Bronx	55,001	435,144	514	54,473	454,084	609
Kings	127,610	802,371	885	141,025	844,099	1,085
New York	6,424	791,146	574	11,889	825,739	408
Queens	251,947	564,350	953	236,848	594,066	1,038
Richmond	95,072	68,587	334	104,049	71,176	620
Long Island	**815,456**	**159,039**	**5,979**	**846,855**	**178,053**	**6,437**
Nassau	367,371	90,274	506	368,038	97,808	818
Suffolk	448,085	68,765	5,473	478,817	80,245	5,619
Mid Hudson	**515,249**	**294,670**	**20,772**	**553,671**	**318,416**	**20,885**
Dutchess	73,437	28,253	4,413	78,673	33,445	4,812
Orange	84,466	34,631	3,657	93,539	38,516	3,481
Putnam	30,035	4,646	349	31,798	5,710	373
Rockland	65,355	28,404	1,214	68,624	32,481	1,428
Sullivan	31,722	8,159	4,849	34,883	8,435	5,357
Ulster	54,886	16,686	6,084	59,912	18,059	5,036
Westchester	175,348	173,891	206	186,242	181,770	398
New Jersey	**1,542,567**	**1,010,872**	**16,634**	**1,636,85**	**1,079,165**	**18,192**
Bergen	201,353	137,344	1,123	206,590	143,448	1,001
Essex	115,031	185,724	256	122,611	188,540	454
Hudson	37,620	202,602	396	42,954	221,331	439
Hunterdon	38,634	6,225	173	42,000	7,015	144
Mercer	94,204	38,666	410	99,249	42,688	388
Middlesex	176,969	94,232	2,436	189,393	100,674	2,406
Monmouth	180,814	56,775	3,295	188,493	64,524	3,453
Morris	132,837	40,975	567	140,563	47,150	585
Ocean	209,232	33,606	5,873	233,319	35,746	6,728
Passaic	81,213	88,512	323	81,454	93,061	613
Somerset	84,073	27,714	236	90,854	31,117	251
Sussex	47,992	7,712	824	52,488	8,448	616
Union	110,745	81,948	252	111,483	86,510	534
Warren	31,850	8,837	470	35,404	8,913	580
Connecticut	**481,546**	**274,026**	**3,893**	**511,311**	**288,754**	**4,007**
Fairfield	221,046	117,142	1,278	229,564	127,229	1,288
Litchfield	60,596	18,073	598	67,152	18,779	609
New Haven	199,904	138,811	2,017	214,595	142,746	2,110
Region	**3,890,872**	**4,400,205**	**50,538**	**4,096,97**	**4,653,552**	**53,281**

5.2 Methodology

National level household projections are produced by the US Census Bureau on a periodic basis. The Bureau produces three series, which make possible an analysis of the factors influencing the projected number of households. Series 1 uses projections of household formation rates produced through a time series analysis using a statistical function yielding a linear projection, with recent years weighted more heavily than earlier years in determining the slope. Projected changes in household formation rates are modest, especially in comparison with trends in the 1990s. Projections of rates are disaggregated by age group but not by racial/ethnic group.

Series 2 holds baseline household formation rates constant and reflects just the effect of changing age structure on household formation, for the total population. Series 3 also holds baseline household formation rates constant, but utilizes separate matrices for the different racial groups and the Hispanic population, and therefore is a reflection of the effects of both age and race.

A comparison of the different series reveals the nation's changing age structure to be the dominant influence on household formation, both in terms of numbers and composition. For example, Series 2 households in 2010 differ from Series 1 households by just 0.5%, and Series 3 differ by just 1.2%, which indicates the modest influence of shifts in family structure and racial/ethnic composition on household growth. In terms of household composition, the main driver of change is the aging of the baby-boomers. Consequently, the projections show a declining share of households with children and an increase in married couples without children. Aging baby-boomers are also expected to account for the majority of the increased share of single-person households.

In the New York Metropolitan Region, the effects of racial/ethnic restructuring are expected to be more significant than for the nation as a whole, and the Region's racial/ethnic minorities reflect a large component of foreign immigration. Because of the substantial changes in racial/ethnic composition anticipated throughout the Region, the Household Formation Model is projected for each racial/ethnic group separately. For each group, the following projections are made:

- Household population
- Households by age of householder
- Households by type
- Households by size
- Households by income range
- Housing stock preference by tenure

All projections are made at the subregional level for the period 2005 through 2035 and aggregated by mutually exclusive racial/ethnic group and five-year age group for the population 15 years and over.[12] Projections of households are then disaggregated to the county level.

Projected households are calculated as a function of projected population and household formation rates. The former was adopted from the Population Model and reduced to reflect population in households, as discussed below. Household formation rates, also referred to as headship rates, indicate the percentage of a given population group that are classified as householders by the US Census Bureau. Because one householder is designated for each household, an estimate of the number of householders is equivalent to an estimate of the number of households.[13]

Disaggregation of households by type, size, income range and housing stock preference are performed using a series of matrices that cross tabulate percent breakdown of age of householder by household type, household type by size, household size by income range, and household income range by housing stock preference and tenure. Household formation rates are estimated for every five years from 2015through 2040. For group quarters rates and all other rates, 2010 actual rates are held constant, but external controls such as aggregate household population and income are used to normalize results upward or downward.

The estimation of future household formation rates used methodology based on that employed by the Harvard University Joint Center for Housing Studies in their 1994 state-level household projections.[14] This involves use of a cohort model that starts with the 2000 headship rate estimates, and trends these rates forward according to the adjustments that age cohorts made in the recent past. The rate of change in headship, over a five-year period, for a given cohort as it ages in the future is assumed to be the same as the rate of change experienced by cohorts of the same age in the 1990s.

5.2.1 Household Formation Rates

Household formation is calculated as the ratio of householders to household population for a given age cohort:

$$F_a = \frac{H_a}{P_{h \bullet a}}$$

where F is the household formation rate, H is the number of householders, Ph is household population, and a represents a given age cohort. Household population is calculated as total population times the percentage of population residing in households. The latter is equal to the total population minus the population residing in group quarters facilities, (e.g., dormitories, prisons, etc.).

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12 By Census definitions a householder must be at least 15 year of age.

13 Housing units and households, however, differ in number because of existence of unoccupied housing units for which there is no household.

14 Working Paper W94-4, Harvard University Joint Center for Housing Studies.

Household formation rates are estimated from the best available decennial census sources. Published tabulations are the preferred source, but since these are not available for geographies below the state level, PUMS data are used as a supplement. (Unadjusted PUMS cross tabulations by the required level of geographic, age and race detail may produce significant levels of sampling error for some age groups.) State-level household formation is calculated from printed tables and state-level rates then factored down to the subregional level based on the PUMS subregional-to-state ratio of household formation for each racial/ethnic and age group:

$$F_a = D_{a \bullet s} \times \frac{P_{a \bullet r}}{P_{a \bullet s}}$$

where F indicates the estimated household formation rate, D indicates the decennial census household formation rate, P indicates the PUMS household formation rate, r indicates subregional level geography, s indicates state-level geography, and a indicates the particular age and racial/ethnic group.

5.2.2 Estimation of Other Rates

Estimation of rates necessary to disaggregate the household forecasts by type, size and income is hampered by a scarcity of published data at the adequate level of geographic and demographic detail. It is therefore necessary to directly use the custom crosstabulations produced from the PUMS (Public Use Microdata Samples) data set for 2000. In some instances, 2005 PUMS data from the American Community Survey may be used. The approach differs from the methodology described above for household formation rates, where PUMS crosstabs are used to regionalize state level figures derived from published sources. For the other rates, PUMS crosstabs are produced at the subregional level.

5.2.3 Estimation of Rates for 2015 through 2040

Household formation rates projected forward from the year 2015 through the year 2040 using a method based on the Harvard University Joint Center for Housing's cohort methodology. In this method, the future changes in household formation of a given cohort as it ages are expected to mirror those of comparable cohorts in the past. For example, the cohort of 25 to 34 year olds might show a household formation rate of 45% in 1990; in 2000, the same group; now aged 35 to 44 might show a rate of 55%, a 22% increase. The same rate of increase could be applied to the year 2000 cohort of 25 to 34 year olds to estimate the 2010 rate for 35 to 45 year olds. Comparable factors are applied to all age groups, and the intervening years then interpolated.

Model Controls
Outputs of the household model are controlled at three points:

1. Figures for total households by racial/ethnic group (as calculated based on household population and headship rates) are controlled to match available 2000 Census enumerated figures by racial/ethnic group. This is accomplished by adjusting 2000 household formation rates for all age groups on a proportional basis.
2. Outputs of household type by size are controlled to match projections of household population generated in the model.
3. Projections of household size by income range are adjusted based on external forecasts of aggregate income from the Employment Model. Aggregate money income is forecasted for each subregion by analyzing historic trends in per capita personal income by place of residence, in the relationship between worker earnings and commuter shares, and in the proportion of money income to personal income. Personal income is a complete income concept of the US Bureau of Economic Analysis, including all earnings, property, transfer, imputed and in-kind income sources. Money income is conceptually equivalent to household income, and a self-reported value in the decennial Census, largely reflecting earnings and transfer payments. The level of annual personal income per capita is forecasted by subregion from the period 1970-2010 expressed in constant 2005 dollars, to 2040 using linear regression analysis. Average worker earnings by subregion, forecasted to 2040 by the Employment Model, was converted to average commuter earnings by subregion and used to evaluate forecasted levels of per capita personal income. After further adjustments to per capita personal income forecasts, aggregate personal income was computed using forecasted population levels. The relationship between money and personal income was then applied to estimate future levels of aggregate money income.

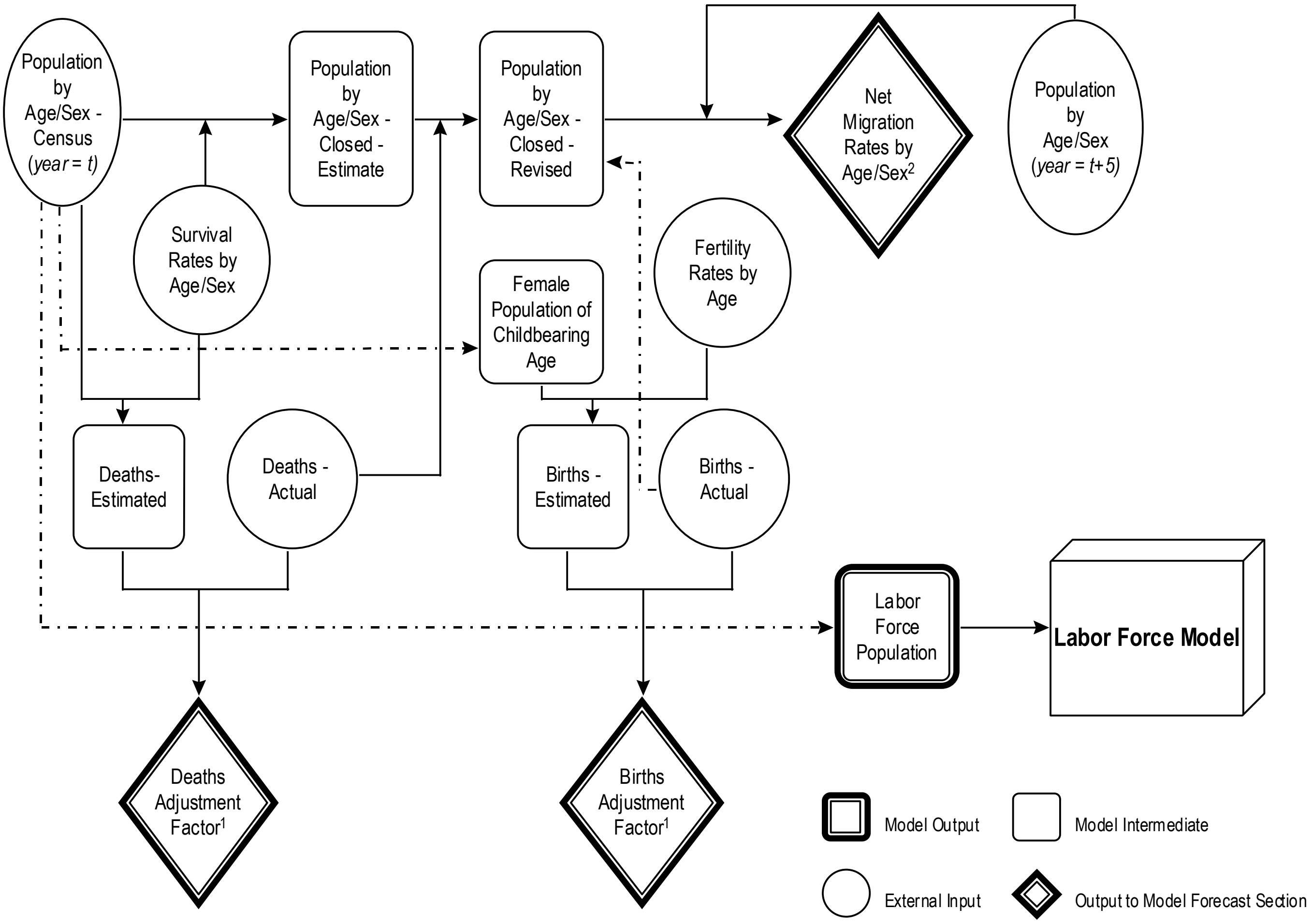
   Though the structure of the household model did not facilitate an exact match between these two series, household model outputs had to be reconciled to within plus or minus 3% of the aggregate income series for the total population in households. The aggregate income control was then applied through a feedback process in the development of household income distribution rates for years after 2010.

5.3 Disaggregation to the County Level

Disaggregation of subregional household projections to the county level is based on the projection of county household trends, which was in turn estimated as a function of forecasted household population and anticipated trends in average household size. The long-term trend toward smaller average household size which prevailed in the post-war years has reversed itself in many areas since the 1990s. The earlier downward trend was related to demographic factors such as a decreasing fertility rates for women, the rising number of single-parent families, an increasing number of elderly-headed households without children, and a general rising affluence. The more recent upward trend can be related to the moderation of a number of the above demographic factors, a rise in housing costs in many areas, and, not least, a growing number of immigrant households, which tend to be larger on average than those of the native born population. The average household size in any given area is the result of the particular combination of a number of such factors.

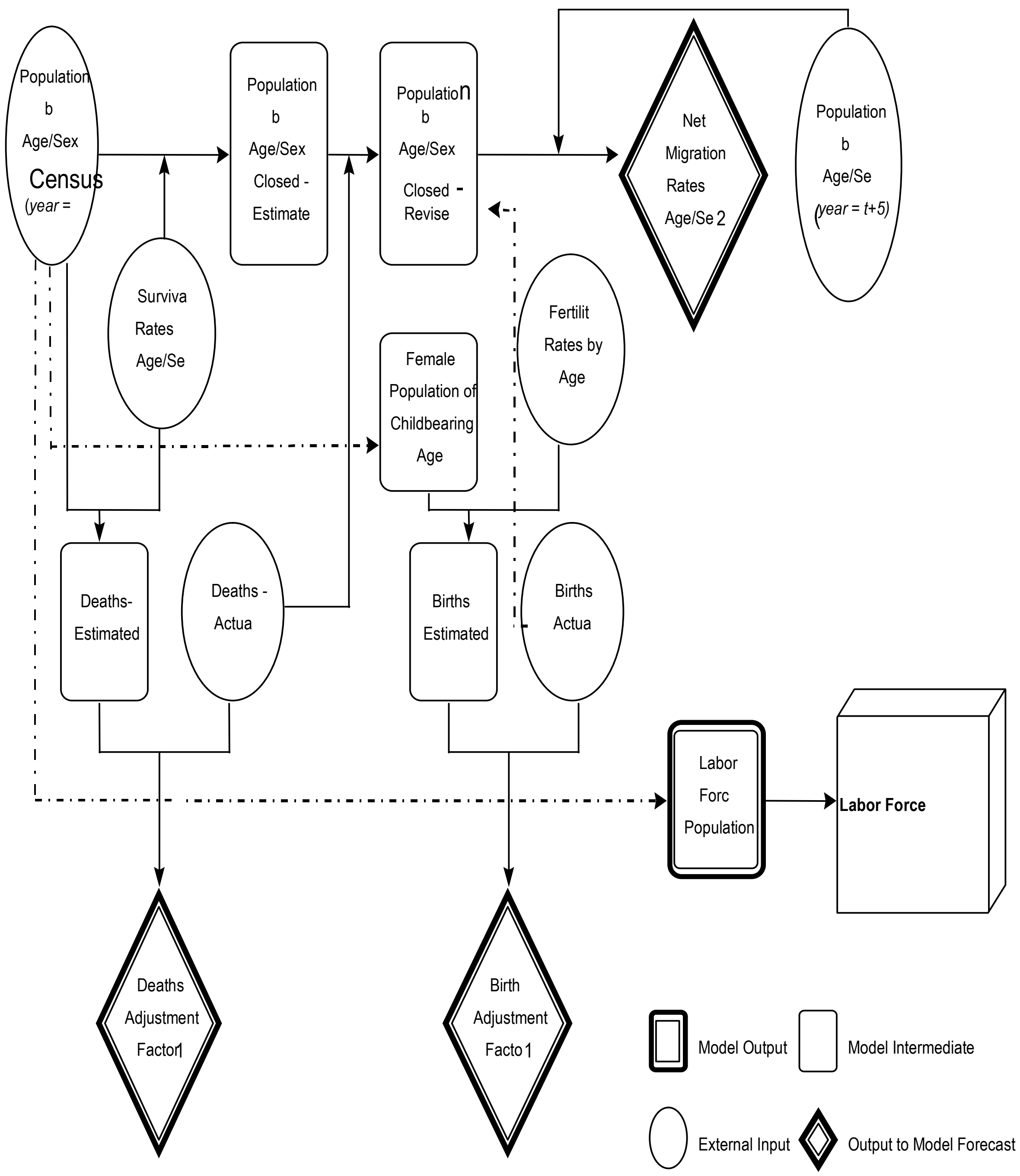
Subregional trends in average household size may not be fully reflected at the county level because of wide differences in population and housing unit composition. In an effort to best approximate likely future trends, county level estimates were made individually based upon a combination of two approaches: 1) linear extrapolation of the 1990-2005 county-level trends, and 2) a comparative technique in which anticipated patterns for some counties were modified in light of the historical experience of nearby counties whose patterns they are expected to resemble in future years. County level estimates were calibrated to subregional forecasts of households and household population.

Figure 1. Population Model - Historical Section



[1]Output based on 1985 to 2000 time intervals only
[2]Output based on 1995 to 2000 time inteval only

Figure 2: Population Flow Chart



1Output based on 1985 to 2005 time intervals
2Output based on 1995 to 2005 time interval

Figure 3. Labor Force Flow Chart

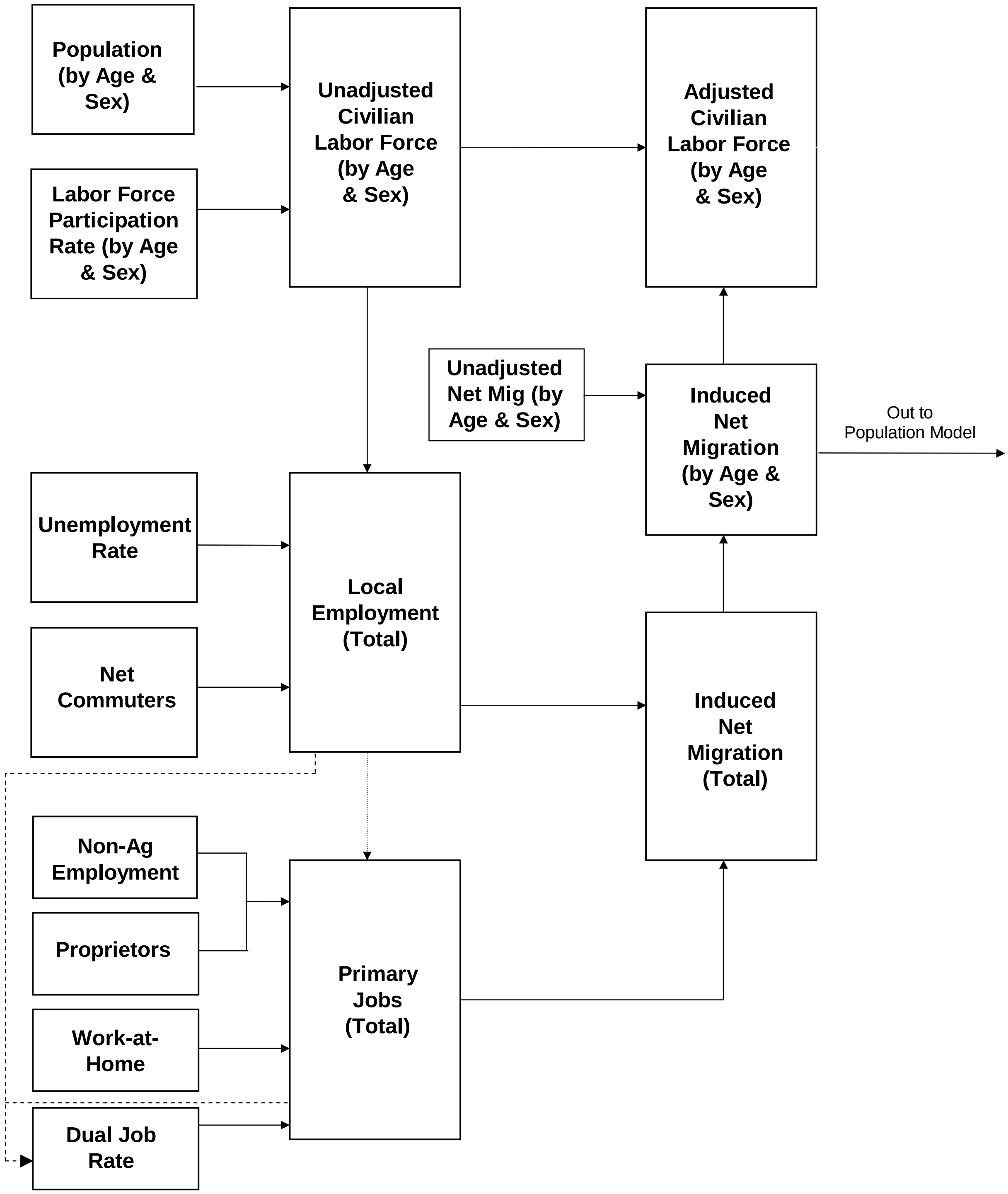


Figure 4. Employment Flow Chart

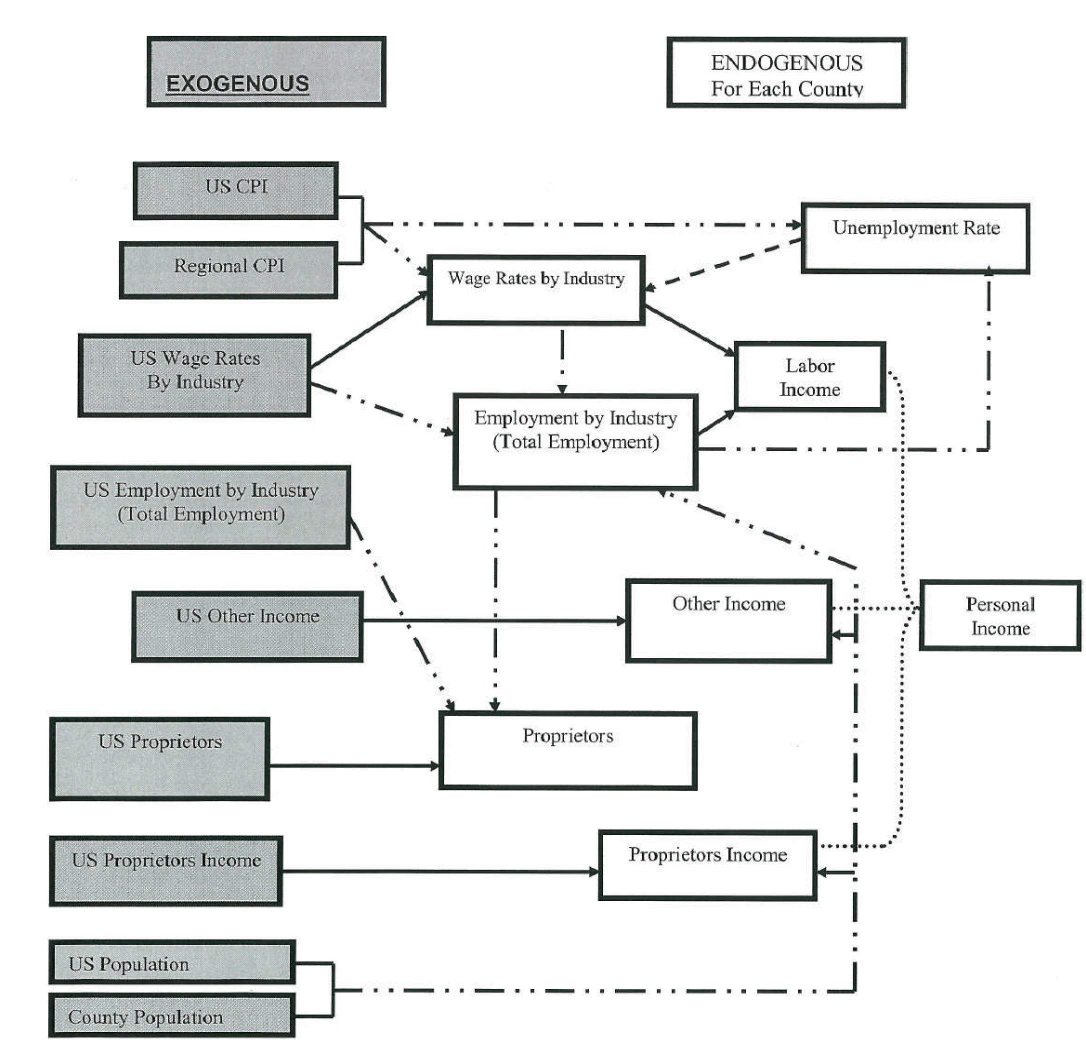


Figure 5. Household Flow Chart

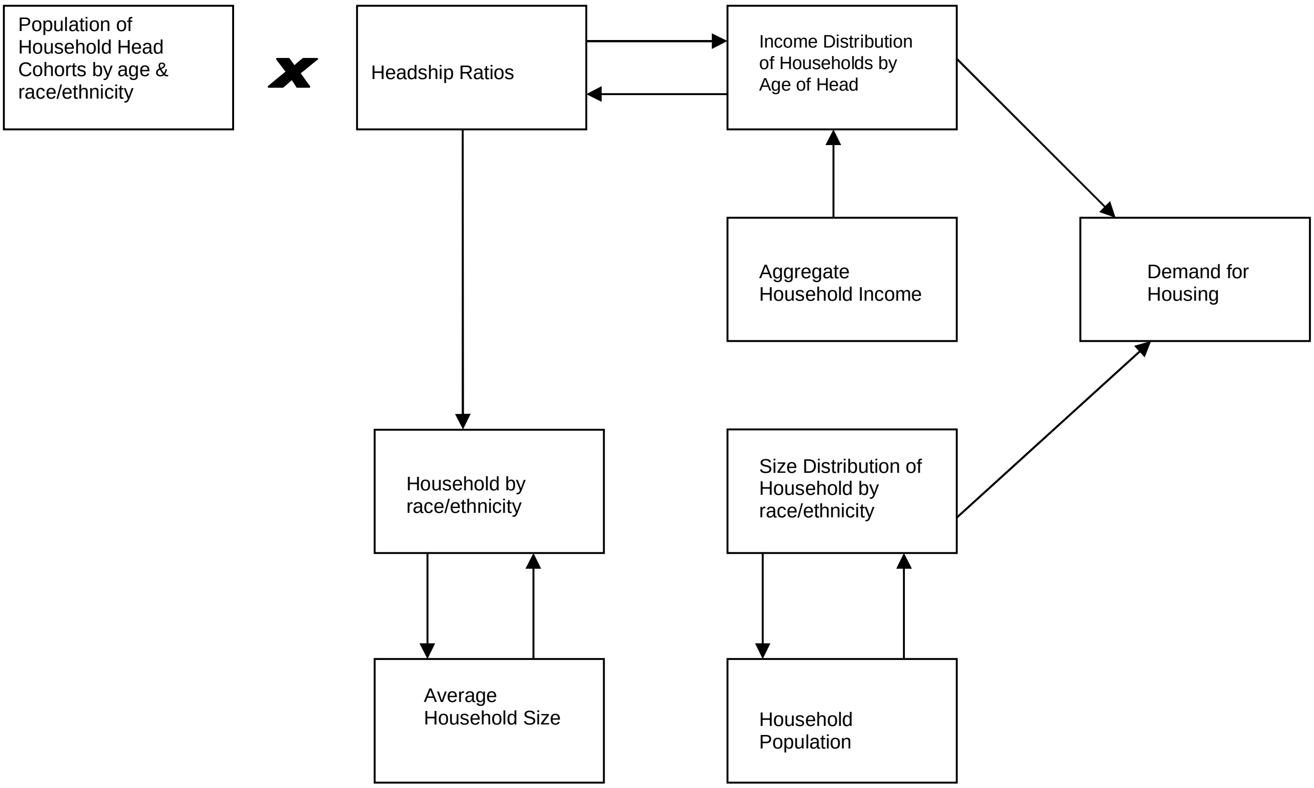
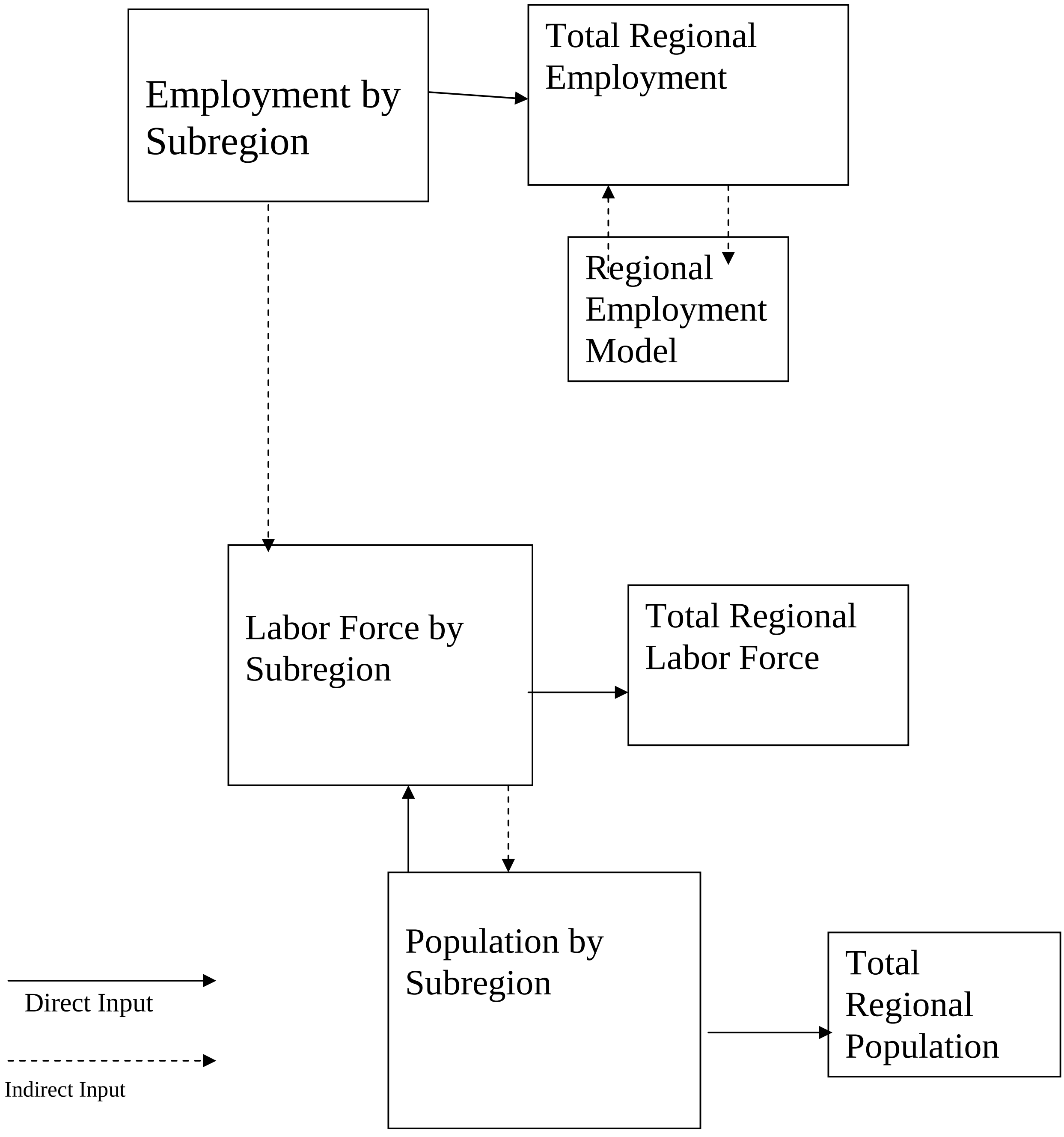


Figure 6. Forecasting Model Relationships:

Employment, Labor Force, Population



6. Appendices

Appendix 1 *National Level Survival Rates by Age/Sex/Race-Ethnicity, for 1992-2032 Forecast Period*

White Population:

Age	1992	1997	2002	2007	2012	2017	2022	2027	2032
White Males									
Births	0.99257	0.99381	0.99405	0.99428	0.99450	0.99473	0.99496	0.99519	0.99542
Under 5	0.99832	0.99858	0.99874	0.99879	0.99884	0.99889	0.99894	0.99899	0.99904
5 to 9	0.99891	0.99907	0.99910	0.99914	0.99918	0.99921	0.99925	0.99929	0.99932
10 to 14	0.99649	0.99675	0.99745	0.99754	0.99763	0.99772	0.99780	0.99789	0.99798
15 to 19	0.99348	0.99369	0.99454	0.99472	0.99490	0.99508	0.99526	0.99544	0.99562
20 to 24	0.99313	0.99305	0.99467	0.99484	0.99501	0.99518	0.99534	0.99551	0.99568
25 to 29	0.99262	0.99146	0.99419	0.99437	0.99455	0.99473	0.99490	0.99508	0.99526
30 to 34	0.99000	0.98769	0.99212	0.99237	0.99263	0.99288	0.99313	0.99339	0.99364
35 to 39	0.98669	0.98520	0.98934	0.98970	0.99006	0.99042	0.99077	0.99113	0.99149
40 to 44	0.98273	0.98282	0.98483	0.98536	0.98588	0.98641	0.98693	0.98746	0.98798
45 to 49	0.97441	0.97646	0.97694	0.97774	0.97854	0.97935	0.98015	0.98095	0.98176
50 to 54	0.95873	0.96272	0.96356	0.96483	0.96610	0.96736	0.96863	0.96990	0.97117
55 to 59	0.93329	0.93879	0.94194	0.94395	0.94597	0.94799	0.95000	0.95202	0.95404
60 to 64	0.89747	0.90639	0.90740	0.91042	0.91344	0.91645	0.91947	0.92249	0.92550
65 to 69	0.84726	0.86085	0.86011	0.86446	0.86881	0.87316	0.87751	0.88186	0.88621
70 to 74	0.77186	0.78733	0.78863	0.79513	0.80164	0.80815	0.81466	0.82116	0.82767
75 to 80	0.66673	0.67995	0.68806	0.69743	0.70680	0.71617	0.72555	0.73492	0.74429
80 to 84	0.53474	0.54848	0.56795	0.58048	0.59300	0.60553	0.61806	0.63058	0.64311
85+	0.42882	0.44975	0.47684	0.49607	0.51531	0.53454	0.55377	0.57301	0.59224
White Females									
Births	0.99389	0.99495	0.99531	0.99549	0.99566	0.99584	0.99601	0.99619	0.99636
Under 5	0.99872	0.99891	0.99903	0.99906	0.99910	0.99914	0.99918	0.99921	0.99925
5 to 9	0.99928	0.99937	0.99932	0.99934	0.99937	0.99940	0.99943	0.99946	0.99948
10 to 14	0.99839	0.99845	0.99858	0.99863	0.99868	0.99873	0.99879	0.99884	0.99889
15 to 19	0.99762	0.99776	0.99781	0.99789	0.99797	0.99804	0.99812	0.99820	0.99827
20 to 24	0.99762	0.99777	0.99776	0.99784	0.99791	0.99799	0.99807	0.99814	0.99822
25 to 29	0.99718	0.99724	0.99720	0.99730	0.99739	0.99749	0.99758	0.99768	0.99777
30 to 34	0.99614	0.99628	0.99605	0.99619	0.99633	0.99646	0.99660	0.99674	0.99687
35 to 39	0.99434	0.99482	0.99422	0.99442	0.99463	0.99483	0.99503	0.99524	0.99544
40 to 44	0.99110	0.99195	0.99124	0.99154	0.99185	0.99215	0.99246	0.99276	0.99307
45 to 49	0.98548	0.98649	0.98606	0.98654	0.98701	0.98749	0.98797	0.98845	0.98893
50 to 54	0.97555	0.97672	0.97696	0.97776	0.97856	0.97936	0.98016	0.98096	0.98176
55 to 59	0.95991	0.96121	0.96319	0.96448	0.96576	0.96705	0.96834	0.96963	0.97091
60 to 64	0.93893	0.94060	0.94186	0.94377	0.94568	0.94759	0.94950	0.95141	0.95332
65 to 69	0.90832	0.91102	0.91091	0.91372	0.91653	0.91934	0.92215	0.92496	0.92777
70 to 74	0.86009	0.86472	0.86241	0.86675	0.87109	0.87543	0.87977	0.88411	0.88845
75 to 80	0.78383	0.79192	0.78654	0.79317	0.79980	0.80644	0.81307	0.81970	0.82634
80 to 84	0.66701	0.68069	0.67318	0.68305	0.69292	0.70279	0.71266	0.72253	0.73240
85+	0.57178	0.59488	0.58607	0.60325	0.62044	0.63762	0.65481	0.67199	0.68918

Black Population:

Age	1992	1997	2002	2007	2012	2017	2022	2027	2032
Black Males									
Births	0.98158	0.98314	0.98522	0.98588	0.98654	0.98719	0.98785	0.98850	0.98916
Under 5	0.99699	0.99716	0.99757	0.99768	0.99778	0.99789	0.99800	0.99811	0.99821
5 to 9	0.99857	0.99865	0.99858	0.99864	0.99870	0.99876	0.99882	0.99889	0.99895
10 to 14	0.99345	0.99226	0.99563	0.99580	0.99598	0.99615	0.99633	0.99650	0.99668
15 to 19	0.98544	0.98227	0.98890	0.98934	0.98979	0.99023	0.99068	0.99112	0.99157
20 to 24	0.98378	0.98095	0.98825	0.98872	0.98919	0.98965	0.99012	0.99058	0.99105
25 to 29	0.98248	0.97813	0.98729	0.98778	0.98827	0.98877	0.98926	0.98976	0.99025
30 to 34	0.97601	0.96852	0.98280	0.98348	0.98417	0.98485	0.98553	0.98621	0.98689
35 to 39	0.96881	0.96195	0.97707	0.97799	0.97891	0.97984	0.98076	0.98168	0.98261
40 to 44	0.95997	0.95483	0.96680	0.96817	0.96954	0.97090	0.97227	0.97364	0.97500
45 to 49	0.94635	0.94537	0.95205	0.95402	0.95600	0.95797	0.95994	0.96192	0.96389
50 to 54	0.92225	0.92583	0.93185	0.93460	0.93735	0.94011	0.94286	0.94562	0.94837
55 to 59	0.88723	0.89224	0.90447	0.90825	0.91202	0.91579	0.91956	0.92333	0.92711
60 to 64	0.84081	0.84641	0.86183	0.86692	0.87200	0.87709	0.88218	0.88727	0.89235
65 to 69	0.78478	0.79158	0.81198	0.81846	0.82494	0.83141	0.83789	0.84437	0.85085
70 to 74	0.71862	0.72383	0.74077	0.74938	0.75799	0.76660	0.77521	0.78381	0.79242
75 to 80	0.63821	0.63519	0.66048	0.67104	0.68160	0.69215	0.70271	0.71327	0.72382
80 to 84	0.56164	0.56889	0.58836	0.60003	0.61170	0.62337	0.63503	0.64670	0.65837
85+	0.53172	0.56992	0.56270	0.57860	0.59450	0.61040	0.62630	0.64220	0.65810
Black Females									
Births	0.98439	0.98580	0.98774	0.98828	0.98882	0.98936	0.98990	0.99044	0.99097
Under 5	0.99754	0.99768	0.99800	0.99808	0.99817	0.99826	0.99835	0.99843	0.99852
5 to 9	0.99869	0.99871	0.99891	0.99896	0.99901	0.99906	0.99910	0.99915	0.99920
10 to 14	0.99783	0.99789	0.99822	0.99829	0.99836	0.99843	0.99850	0.99857	0.99864
15 to 19	0.99625	0.99607	0.99700	0.99711	0.99723	0.99734	0.99746	0.99757	0.99769
20 to 24	0.99485	0.99444	0.99569	0.99586	0.99603	0.99621	0.99638	0.99655	0.99672
25 to 29	0.99282	0.99156	0.99375	0.99400	0.99426	0.99451	0.99477	0.99502	0.99528
30 to 34	0.98910	0.98712	0.99043	0.99083	0.99123	0.99163	0.99203	0.99243	0.99283
35 to 39	0.98460	0.98370	0.98628	0.98686	0.98743	0.98801	0.98859	0.98917	0.98975
40 to 44	0.97910	0.97949	0.98054	0.98135	0.98216	0.98296	0.98377	0.98458	0.98539
45 to 49	0.96948	0.97107	0.97137	0.97254	0.97371	0.97488	0.97604	0.97721	0.97838
50 to 54	0.95427	0.95662	0.95776	0.95945	0.96115	0.96284	0.96454	0.96623	0.96793
55 to 59	0.93105	0.93238	0.93783	0.94029	0.94275	0.94521	0.94767	0.95013	0.95259
60 to 64	0.89805	0.89755	0.90422	0.90784	0.91147	0.91509	0.91871	0.92233	0.92596
65 to 69	0.86365	0.86585	0.86824	0.87297	0.87769	0.88241	0.88714	0.89186	0.89659
70 to 74	0.81886	0.82483	0.82556	0.83153	0.83750	0.84347	0.84944	0.85541	0.86138
75 to 80	0.75373	0.75470	0.75976	0.76755	0.77534	0.78313	0.79092	0.79871	0.80650
80 to 84	0.67785	0.68407	0.68244	0.69189	0.70135	0.71081	0.72027	0.72973	0.73919
85+	0.65436	0.68004	0.65646	0.67086	0.68526	0.69966	0.71406	0.72846	0.74286

Asian Population:

Age	1992	1997	2002	2007	2012	2017	2022	2027	2032
Asian Males									
Births	0.99483	0.99569	0.99602	0.99616	0.99629	0.99643	0.99657	0.99670	0.99684
Under 5	0.99866	0.99888	0.99893	0.99897	0.99901	0.99905	0.99909	0.99913	0.99917
5 to 9	0.99940	0.99950	0.99918	0.99921	0.99924	0.99928	0.99931	0.99934	0.99937
10 to 14	0.99789	0.99803	0.99787	0.99794	0.99801	0.99808	0.99815	0.99822	0.99829
15 to 19	0.99643	0.99674	0.99609	0.99620	0.99632	0.99643	0.99654	0.99665	0.99677
20 to 24	0.99601	0.99636	0.99623	0.99633	0.99643	0.99654	0.99664	0.99674	0.99684
25 to 29	0.99496	0.99492	0.99637	0.99645	0.99654	0.99663	0.99671	0.99680	0.99689
30 to 34	0.99311	0.99263	0.99578	0.99587	0.99596	0.99605	0.99614	0.99623	0.99633
35 to 39	0.99196	0.99180	0.99378	0.99394	0.99410	0.99426	0.99442	0.99457	0.99473
40 to 44	0.98981	0.99054	0.99049	0.99076	0.99103	0.99130	0.99157	0.99184	0.99211
45 to 49	0.98332	0.98513	0.98449	0.98495	0.98541	0.98588	0.98634	0.98681	0.98727
50 to 54	0.97649	0.97899	0.97620	0.97690	0.97760	0.97830	0.97900	0.97970	0.98039
55 to 59	0.96096	0.96439	0.96341	0.96447	0.96552	0.96658	0.96764	0.96870	0.96976
60 to 64	0.93829	0.94397	0.94166	0.94316	0.94466	0.94616	0.94766	0.94916	0.95066
65 to 69	0.90319	0.91223	0.91481	0.91674	0.91868	0.92062	0.92255	0.92449	0.92643
70 to 74	0.84694	0.85796	0.87341	0.87619	0.87898	0.88177	0.88456	0.88735	0.89014
75 to 80	0.78876	0.79808	0.80669	0.81091	0.81513	0.81935	0.82357	0.82779	0.83201
80 to 84	0.70632	0.71655	0.73274	0.73826	0.74377	0.74928	0.75479	0.76030	0.76582
85+	0.67852	0.69657	0.70372	0.71365	0.72359	0.73353	0.74347	0.75341	0.76335
Asian Females									
Births	0.99666	0.99724	0.99688	0.99698	0.99708	0.99718	0.99728	0.99737	0.99747
Under 5	0.99873	0.99893	0.99909	0.99912	0.99916	0.99919	0.99923	0.99926	0.99930
5 to 9	0.99925	0.99934	0.99928	0.99931	0.99934	0.99937	0.99940	0.99943	0.99946
10 to 14	0.99900	0.99905	0.99863	0.99868	0.99873	0.99879	0.99884	0.99889	0.99894
15 to 19	0.99891	0.99899	0.99824	0.99830	0.99835	0.99841	0.99847	0.99853	0.99859
20 to 24	0.99894	0.99903	0.99826	0.99832	0.99837	0.99842	0.99848	0.99853	0.99858
25 to 29	0.99822	0.99830	0.99841	0.99845	0.99849	0.99852	0.99856	0.99860	0.99864
30 to 34	0.99650	0.99671	0.99752	0.99759	0.99765	0.99772	0.99779	0.99786	0.99793
35 to 39	0.99457	0.99509	0.99608	0.99620	0.99631	0.99643	0.99655	0.99666	0.99678
40 to 44	0.99327	0.99394	0.99426	0.99443	0.99460	0.99476	0.99493	0.99509	0.99526
45 to 49	0.99149	0.99221	0.99155	0.99177	0.99200	0.99223	0.99245	0.99268	0.99290
50 to 54	0.98195	0.98304	0.98639	0.98675	0.98711	0.98747	0.98784	0.98820	0.98856
55 to 59	0.97269	0.97385	0.98003	0.98054	0.98105	0.98156	0.98207	0.98258	0.98309
60 to 64	0.96418	0.96536	0.96957	0.97025	0.97093	0.97160	0.97228	0.97296	0.97364
65 to 69	0.94749	0.94926	0.95333	0.95427	0.95521	0.95615	0.95710	0.95804	0.95898
70 to 74	0.91530	0.91838	0.92603	0.92753	0.92904	0.93054	0.93204	0.93355	0.93505
75 to 80	0.86913	0.87444	0.87997	0.88245	0.88493	0.88741	0.88989	0.89236	0.89484
80 to 84	0.80186	0.81095	0.81262	0.81637	0.82012	0.82388	0.82763	0.83139	0.83514
85+	0.80114	0.81879	0.80785	0.81556	0.82328	0.83100	0.83871	0.84643	0.85414

Hispanic Population:

Age	1992	1997	2002	2007	2012	2017	2022	2027	2032
Hispanic Males									
Births	0.9911	0.9926	0.9924	0.9927	0.9930	0.9933	0.9936	0.99396	0.99427
Under 5	0.9981	0.9982	0.9984	0.9985	0.9985	0.9986	0.9987	0.99873	0.99879
5 to 9	0.9991	0.9992	0.9991	0.9991	0.9992	0.9992	0.9992	0.99928	0.99931
10 to 14	0.9957	0.9961	0.9970	0.9971	0.9972	0.9974	0.9975	0.99757	0.99768
15 to 19	0.9917	0.9915	0.9934	0.9937	0.9939	0.9941	0.9944	0.99459	0.99483
20 to 24	0.9904	0.9895	0.9923	0.9926	0.9929	0.9931	0.9934	0.99370	0.99398
25 to 29	0.9888	0.9859	0.9915	0.9918	0.9921	0.9924	0.9927	0.99300	0.99331
30 to 34	0.9864	0.9814	0.9896	0.9900	0.9903	0.9907	0.9911	0.99146	0.99183
35 to 39	0.9828	0.9788	0.9878	0.9882	0.9887	0.9891	0.9895	0.98995	0.99038
40 to 44	0.9805	0.9780	0.9854	0.9859	0.9864	0.9869	0.9874	0.98789	0.98838
45 to 49	0.9737	0.9739	0.9792	0.9799	0.9806	0.9813	0.9820	0.98270	0.98339
50 to 54	0.9633	0.9658	0.9690	0.9701	0.9711	0.9721	0.9731	0.97413	0.97514
55 to 59	0.9461	0.9493	0.9529	0.9544	0.9560	0.9575	0.9590	0.96052	0.96204
60 to 64	0.9211	0.9269	0.9296	0.9316	0.9337	0.9357	0.9377	0.93975	0.94178
65 to 69	0.8864	0.8955	0.8973	0.9000	0.9027	0.9054	0.9081	0.91079	0.91350
70 to 74	0.8315	0.8423	0.8520	0.8557	0.8595	0.8632	0.8669	0.87063	0.87435
75 to 80	0.7528	0.7621	0.7838	0.7890	0.7942	0.7995	0.8047	0.80991	0.81513
80 to 84	0.6558	0.6664	0.6922	0.6994	0.7066	0.7139	0.7211	0.72836	0.73560
85+	0.6152	0.6333	0.6371	0.6498	0.6625	0.6752	0.6879	0.70057	0.71327
Hispanic Females									
Births	0.99281	0.99404	0.99377	0.99402	0.99427	0.99452	0.99477	0.99502	0.99527
Under 5	0.99852	0.99866	0.99882	0.99887	0.99892	0.99897	0.99901	0.99906	0.99911
5 to 9	0.99927	0.99932	0.99936	0.99939	0.99942	0.99944	0.99947	0.99949	0.99952
10 to 14	0.99850	0.99855	0.99886	0.99890	0.99893	0.99897	0.99901	0.99905	0.99909
15 to 19	0.99790	0.99822	0.99845	0.99850	0.99854	0.99859	0.99864	0.99868	0.99873
20 to 24	0.99763	0.99781	0.99811	0.99817	0.99823	0.99829	0.99835	0.99841	0.99847
25 to 29	0.99685	0.99633	0.99773	0.99780	0.99787	0.99794	0.99801	0.99808	0.99815
30 to 34	0.99604	0.99538	0.99696	0.99705	0.99715	0.99724	0.99733	0.99743	0.99752
35 to 39	0.99443	0.99422	0.99579	0.99592	0.99605	0.99617	0.99630	0.99643	0.99656
40 to 44	0.99189	0.99201	0.99333	0.99353	0.99374	0.99395	0.99415	0.99436	0.99456
45 to 49	0.98720	0.98785	0.98945	0.98978	0.99010	0.99042	0.99074	0.99106	0.99138
50 to 54	0.98044	0.98157	0.98330	0.98381	0.98431	0.98482	0.98533	0.98583	0.98634
55 to 59	0.96999	0.97108	0.97446	0.97523	0.97599	0.97676	0.97752	0.97829	0.97906
60 to 64	0.95277	0.95419	0.95795	0.95912	0.96029	0.96146	0.96263	0.96380	0.96497
65 to 69	0.92690	0.92920	0.93345	0.93524	0.93703	0.93881	0.94060	0.94239	0.94418
70 to 74	0.89383	0.89751	0.90380	0.90630	0.90880	0.91130	0.91380	0.91630	0.91880
75 to 80	0.84015	0.84642	0.84862	0.85251	0.85640	0.86030	0.86419	0.86808	0.87198
80 to 84	0.74919	0.76022	0.76765	0.77342	0.77918	0.78494	0.79071	0.79647	0.80223
85+	0.70746	0.72777	0.73986	0.75054	0.76122	0.77190	0.78258	0.79326	0.80394

Source: United States Census Bureau; Population Projections of the United States, by Age, Sex, Race, and Hispanic Origin: 1993 to 2050 (Current Population Reports series P25-1104, November 1993).

Appendix 2. ***National Level Total Fertility Rates by Race-Ethnicity, Middle Series for 1990-2100 Forecast Period, (in 000s)***

Race & Hispanic Origin	***Middle Series***							
	1998	***2003***	***2008***	***2013***	***2018***	***2023***	***2028***	***2033***
White non-Hispanic	1824.5	1863.4	1901.2	1939.1	1977.0	2014.9	2031.6	2034.3
Black non-Hispanic	2390.5	2084.8	2092.8	2100.8	2108.8	2116.8	2119.2	2117.9
Asian non-Hispanic	1924.0	2220.2	2209.0	2197.9	2186.8	2175.7	2169.2	2165.9
Hispanic	2981.0	2883.0	2836.3	2789.5	2742.7	2696.0	2663.5	2640.6

Source: United States Census Bureau, *Population Division Working Paper No. 38, January 2000*

Appendix 3. National Level Age-Specific Fertility Rates by Race-Ethnicity, Middle Series for 1998 & the Forecast Period

Births per 1000 women:	***Age-Specific Fertility Rates by Race-Ethnicity***							
	1998	***2003***	***2008***	***2013***	***2018***	***2023***	***2028***	***2033***
White non-Hispanic								
10-14 years	0.50	0.44	0.45	0.47	0.46	0.45	0.48	0.48
15-19 years	41.80	41.15	42.39	43.37	44.01	44.50	44.76	44.98
20-24 years	96.60	94.45	96.42	98.41	100.35	102.21	103.01	103.15
25-29 years	113.30	108.50	110.74	112.98	115.26	117.45	118.40	118.51
30-34 years	77.70	85.66	88.49	90.26	91.80	93.26	94.00	94.22