



**New York
Metropolitan
Transportation
Council**

The Metropolitan Planning Organization

Demographic and Socioeconomic Forecasting

Technical Memorandum

Task 1.4.5.1

*White Paper on Methodology to be Used at County/
Subregional Level*

Submitted by:

Urbanomics

October 10, 2007

NEW YORK METROPOLITAN TRANSPORTATION COUNCIL

**DEMOGRAPHIC AND SOCIOECONOMIC
FORECASTING**

**TECHNICAL MEMORANDUM No. 1.4.5.1
WHITE PAPER ON METHODOLOGY TO BE USED AT COUNTY/
SUBREGIONAL LEVEL**

This study is funded by a matching grant from the Federal Highway Administration, under NYSDOT PIN PT 1949911.

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The preparation of this report was financed in part through funds from the Federal Highway Administration and Federal Transit Authority (FTA). This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The contents of this report reflect the views of the author who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration, FTA, nor of the New York Metropolitan Transportation Council. This report does not constitute a standard, specification or regulation.

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WHITE PAPER ON METHODOLOGY TO BE USED AT COUNTY/ SUBREGIONAL LEVEL

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White Paper on Methodology to be Used at County/Subregional Level

1.1 INTRODUCTION

Background

Three previous forecast series have been adopted by the Program, Finance and Administration Committee (PFAC) of the New York Metropolitan Transportation Council (NYMTC) for utilization in the Best Practices Model (BPM), as required by the Federal Transit Administration (FTA). These forecast series produced different interim and end year values at the county and subregional level for the socioeconomic variables. These differences can be explained by changes in the economic and demographic history of the Region¹ and Nation, as well as the national forecast assumptions that reflect emerging or diverging trends and policy issues. However, significant changes in regional socioeconomic forecasts do affect travel demand forecasts and the long term transportation improvement programs and capital budget requirements of operating agencies. As a consequence, this technical memorandum has been prepared to identify methods that will assist in producing more stable long term socioeconomic forecasts.

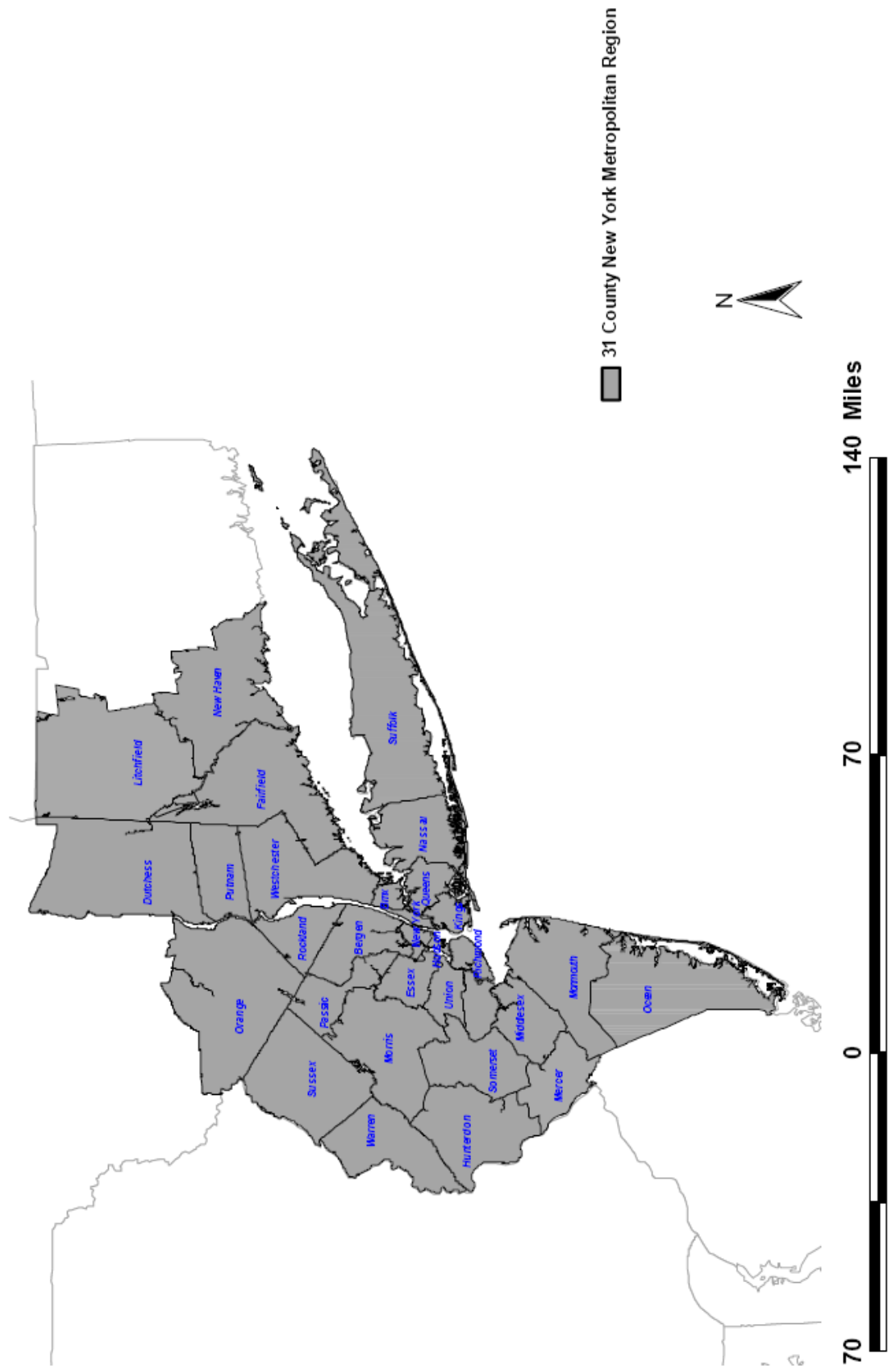
A brief description is provided of the overall approach taken in three previous forecast series, to end years 2020, 2025 and 2030. This description is illustrated by a chart depicting the aggregate regional history and forecast for employment and population by series, interim and end year. It is followed by a brief overview of the proposed approach for the new forecast series to 2035, with the history of employment and population updated through 2005. Thereafter, a description of transportation agency concerns is provided to further illuminate the problem and a summary response illustrates the alternative approaches in socioeconomic modeling that are intended to achieve greater forecast stability.

Previous Forecasts: 2020, 2025 & 2030

An integrated set of four (4) models was developed to forecast employment, population, labor force and household formation, based upon historical data on an annual or five-year incremental basis (see flow chart 1). The first two series, 2020 and 2025, were benchmarked upon historical employment data from 1970 to the base year (1996 or 2000), annually, classified by the

¹ The New York Metro Region includes the following counties, by subregion: New York City subregion: Bronx, Kings, New York, Queens, Richmond Counties; Long Island subregion: Nassau & Suffolk Counties; Mid-Hudson subregion: Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, Westchester Counties; New Jersey subregion: Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Sussex, Union, Warren Counties; Connecticut subregion: Fairfield, Litchfield, New Haven Counties (See Map 1).

1.4.5.1-3



Standard Industrial Classification (SIC) Code. The third series was required to use quarterly data from 1990 to the base year (2002), classified by the newly adopted North American Industrial Classification System (NAICS). Regional NAICS data were not available prior to 1990.

Table 1. Comparison of Adopted Regional Employment & Population Aggregates of NYMTC Forecast Series for 2020, 2025, & 2030 (In 000s)

History & Forecast Years	2020 Socioeconomic Forecasts Adopted 1999	2025 Socioeconomic Forecasts Adopted 2002	2030 Socioeconomic Forecasts Adopted 2004
Total Employment			
1990	10,673	10,720	10,737
1995	10,483	10,460	10,470
2000	10,897	11,425	11,628
2005	11,406	11,953	11,744
2010	11,949	12,373	12,412
2015	12,469	12,722	12,967
2020	12,979	13,214	13,557
2025	n/a	13,601	14,113
2030	n/a	n/a	14,727
Resident Population			
1990	19,843	19,843	19,861
1995	20,179	20,134	20,923
2000	20,547	20,567	21,492
2005	21,024	20,956	22,245
2010	21,551	21,369	22,870
2015	22,164	21,778	23,525
2020	22,841	22,342	24,298
2025	n/a	23,130	25,315
2030	n/a	n/a	26,077

Source: NYMTC Demographic & Socioeconomic Forecasting

Task 1.3.1, Population Forecasting And Analysis, December 7, 200

Task. 1.3.2, Employment Forecasting & Analysis, January 10, 2001

Task 4.1.2, County Level Demographic and Socioeconomic Forecast Extensions, 2025-2030, March 18, 2004

Historical demographic data was compiled from county and subregional level census enumerations and estimates, state and local administrative employment and vital statistics records, and comparable national level sources. 2020 and 2025 forecasts were driven by national *Long Term Trend* forecasts of Data Resources Inc. for Fall 1999, while 2030 forecasts

were driven by Global Insight's *Long Term Trend* forecasts of Fall 2003. All forecasts reflected Census Bureau and Bureau of Labor Statistics projections of fertility, mortality, labor force participation, and other rates adjusted to regional conditions. Forecasts were prepared for a tri-state Region (see map), five (5) subregions, 31 counties, and more than 4000 traffic analysis zone (TAZ) units of geography.

As Table 1 shows, the forecast series differed in historical as well as forecasted values of regional employment and population. On a historical basis, corrections to the Census of Population and the Interim Population Estimates of the U.S. Bureau of the Census added, respectively, 18,000 and 744,000 more persons to 1990 and 1995 values between the 2020 and 2030 forecast series. By 2000, the margin of difference increased to 945,000 residents as major additions to the Master Address File in New York City captured more of the undercount. Revisions in the historical employment series were less important for 1990 and 1995, but expansion in the U.S. economy that was not predicted by national drivers of the 2020 series led to significant differences in year 2000 job levels. Those short term corrections account for more than all of the out-year employment discrepancies by 2020.

Proposed Forecasts: 2035

In accordance with direction from NYMTC and the New York State Department of Transportation, the existing demographic and socioeconomic forecasting models will be recalibrated with quarterly and annual data from 1990 to the present (2006). With the exception of more recent data and new national forecasts, they will be utilized in the method which was established by the 2030 forecasts, with the exception of several enhancements. As specified in the scope of services for Supplemental Agreement #3, these enhancements will consist of the following:

- Use of new macroeconomic assumptions and national level forecasts to 2035 from the most recent long term U.S. trend forecast of *Global Insight, Inc.* (Fall 2006 or Spring 2007), as provided by the New York State Department of Transportation
- Estimation and calibration of county level cohort-survival population and labor force forecasting models for NYMTC partner counties, with resulting forecasts at the county level to 2035
- Development of an occupational model at the subregional level, converting industry employment into major occupational titles
- Development of a school enrollment model at the subregional level, forecasting school enrollment by location for K-12 and university level

It is noted that direct integration of land use development requirements as a feedback loop into county and subregional forecasts of residential and nonresidential growth will not be an enhancement of the proposed 2035 forecasts because of budgetary constraints. Newly collected land use and development trend data will be utilized in the allocation of county level forecasts to traffic analysis zones (TAZs), by establishing a TAZ level index of relative development potential for small areas based on such factors as recent growth trends, availability of vacant land, and estimates of feasible development densities.

The proposed forecast method will implement an enhancement to improve interoperability between the employment, population, labor force and household models for simulation purposes. In addition, the flow of data from spreadsheets to database and GIS applications, and back again, will be streamlined. Lastly, the 2035 forecast approach will devote considerable effort to improving communications between NYMTC and its partners, the consultants, technical advisors and forecasting working group. This will be achieved by means of a project web site and web applications for presenting and reviewing forecasting materials, and by extensive in-person meetings with County Executives and their staffs regarding forecasting inputs, modeling outcomes, and forecast implications.

Stating the Problem

Representatives of the Metropolitan Transportation Authority (MTA), a NYMTC partner, report that major changes to socioeconomic forecasts could put “new starts” projects in jeopardy. In order to assure federal funding, the MTA requires a fundamentally stable set of population and employment projections that are not influenced by current economic conditions. Forecasting assumptions that are changeable should have factors that mitigate them. The methodology should be augmented with elements to ensure long term outlooks represent only essential economic factors, such as immigration, and predictable development trends that occur at the regional and national level. Base year conditions should not influence trends if historical data does not encompass a full business cycle through recovery. Consideration should also be given to other forecasting methodologies that are not dependent upon the base year. Of secondary importance, local constraints such as land use ought to be taken into consideration.

Furthermore, there is concern that NYMTC’s county partners be brought into the forecasting process at an early stage. They should be shown how their county’s forecasts are a means for achieving their transportation and development goals, and for securing federal funding. The vision of each county’s Executive should be explored and the forecasts should be explained so that it is apparent to what degree market-driven trends support or diverge from this vision. County staff should be consulted on development trends and the allocation of forecasted growth to traffic analysis zones for use in the Best Practices Model. NYMTC and its consultants should ensure that long term socioeconomic forecasts are properly vetted before adoption.

Approach

As a consequence of these concerns, and budgetary implications on scope of work, the 2035 forecasting approach will rely on minor modifications to past modeling methods and extensive outreach to technical advisors and knowledgeable county representatives. To effectively ensure that long term forecasts remain relatively stable, models need to be recalibrated annually and year-over-year differences both tracked and explained by changes in historical data and national forecast assumptions. NYMTC forecasts, however, are prepared on a less frequent basis that does not allow for integration of finely calibrated changes. Steps that can be taken to ensure continuity between forecast series include the following:

- Use as much history as possible, with data from the same starting point in any recalibration
- Adjust or eliminate aberrant historical years with dummy variables

- Complete a current business cycle based on previous cyclical patterns, prior to forecasting
- Backcast to test model accuracy in replication
- Provide alternative scenarios with assumptions that are acceptable to everyone

Several factors mitigate against adoption of such approaches in order to ensure stability between the 2030 and 2035 forecast series. For one, budgetary constraints eliminated the preparation of high and low forecasts, based upon optimistic and pessimistic versions of the national driver assumptions, or alternative forecasts based upon client-specified simulations in the national model. For another, the replacement of the SIC code with the NAICS code in the industrial classification of employment has eliminated twenty (20) years of regional data from modeling trends. With a starting point now established at 1990, rather than 1970, historical industry patterns could exhibit markedly different long term trends than would otherwise result from more data. Lastly, considerable debate exists as to whether the current business cycle will tip into a hard or soft landing in 2007, having undergone an exceptionally long course from the earlier turning point in 2000. With uncertainty as to its completion, the business cycle shape may factor more prominently into the future forecast.

Given these concerns, our approach to modeling 2035 county and subregional trends will be as follows:

- Methodology of the 2030 NYMTC forecast series will be strictly maintained. Enhancements will be limited to the development of county level cohort-survival models for ten (12) NYMTC partner counties, and occupational and enrollment models for five (5) subregions.
- National drivers will be acquired from the same vendor, Global Insight, Inc., and from the same forecast series, the *long term trend*, as used in the 2030 NYMTC forecasts. National drivers will represent the baseline forecast of the current model calibration.
- Latest re-benchmarks and updates of county and subregional socioeconomic data will be incorporated in model estimation and recalibration. As many data points as possible will be utilized per variable, or a maximum of 68 from quarterly and 17 from annual time series, 1990-2006.
- Differences in national assumptions and regional historic trends between the 2030 and 2035 forecast series will be clearly articulated in written and graphic form. Whenever possible, short term and out-year differences will be explained in quantitative terms (such as numeric changes in national immigration assumptions or energy price increases).
- Limited sensitivity tests will be performed on the recalibrated county and subregional equations of the 2035 forecast series for all models-employment, population, labor force, and household. These tests will take the longest look possible for limited variables and will forecast outcomes from different stopping points in historical data. In certain cases values for aberrant years may be eliminated or replaced by dummy

variables, and add factors may be utilized. Sensitivity tests may consider alternative ends to the current business cycle and compare a forecast based on actual history with one that tracks a non-actual near term end to the cycle as the base year. Given sensitivity test results, a judgment will be made as to the more stable long term equation for each variable.

- Preliminary forecast results will be vetted with the Forecasting Working Group and the Technical Advisory Committee, as well as with official representatives of NYMTC's partners. Final forecasts will reflect their judgments.

1.2 METHODOLOGY AT SUBREGIONAL LEVEL

This section enumerates the various methodologies, model inputs, their sources, and, where relevant, it discusses the proposed steps to improve model stability for forecast years.

Employment & Earnings

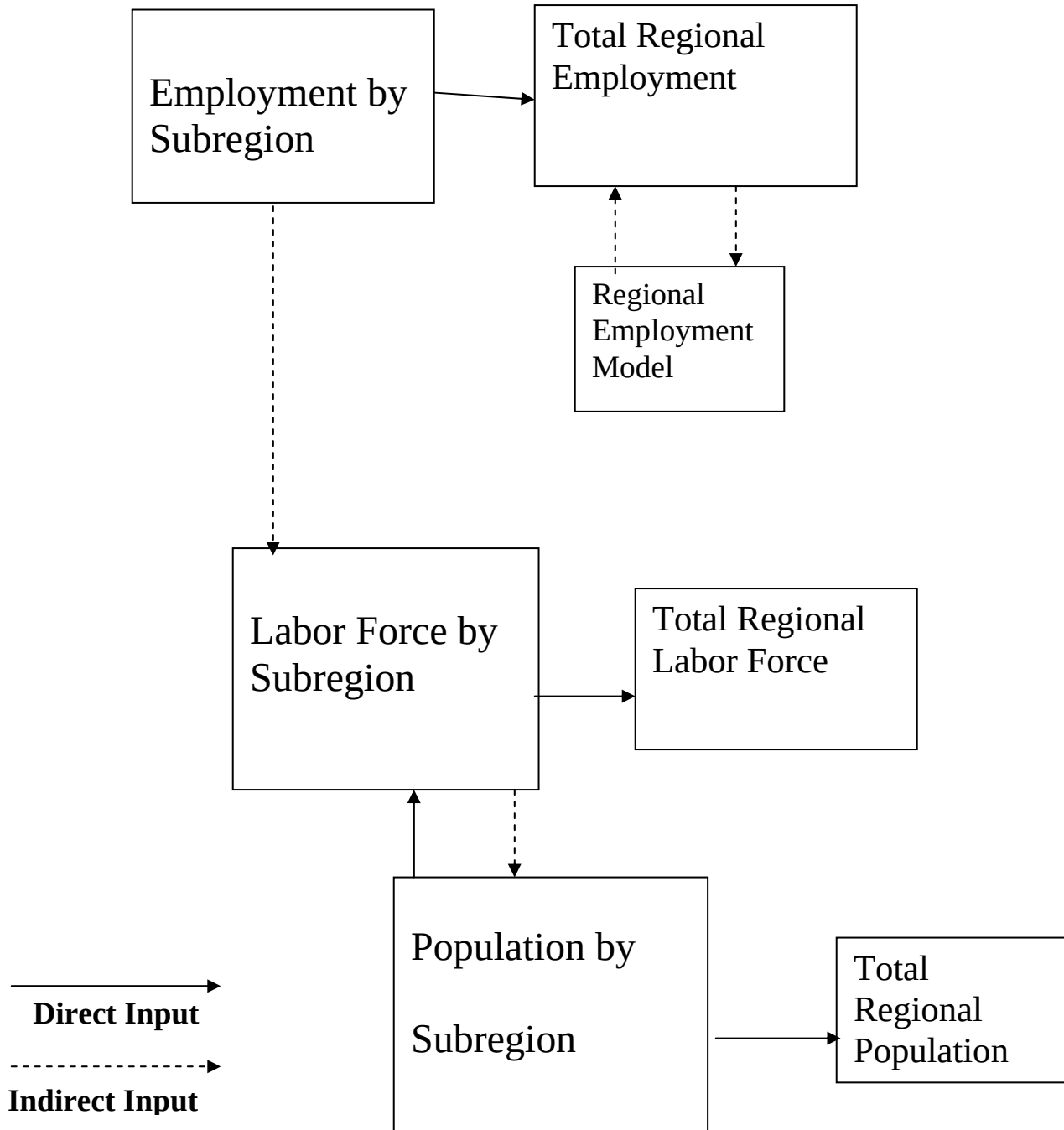
Employment and earnings will be forecasted on a major industry to sector basis (12-14 sectors) at the regional and subregional level, by several hundred econometric equations that incorporate national drivers and historical data on employment, output, earnings, relative costs, financial rates, and other demographic and socioeconomic variables. Equations will be calibrated on quarterly (NAICS) employment and earnings data at the regional and subregional level from 1990 to 2007. Forecasts will be generated on an annual basis to 2035 for the following sectors:

- Total employment and earnings
- Proprietors and proprietor's income
- Payroll employment and earnings, by:
 - o Construction and Natural Resources
 - o Manufacturing
 - o Transportation, Trade and Utilities
 - o Information
 - o Finance, Insurance, Real Estate and Leasing
 - o Professional and Business Services
 - o Education and Health Services
 - o Leisure and Hospitality
 - o Other Services
 - o Government

Employment forecasts will enter population and labor force models as Figure 1 shows, while earnings forecasts will enter household formation models.

Figure 1. FORECASTING MODEL RELATIONSHIPS:

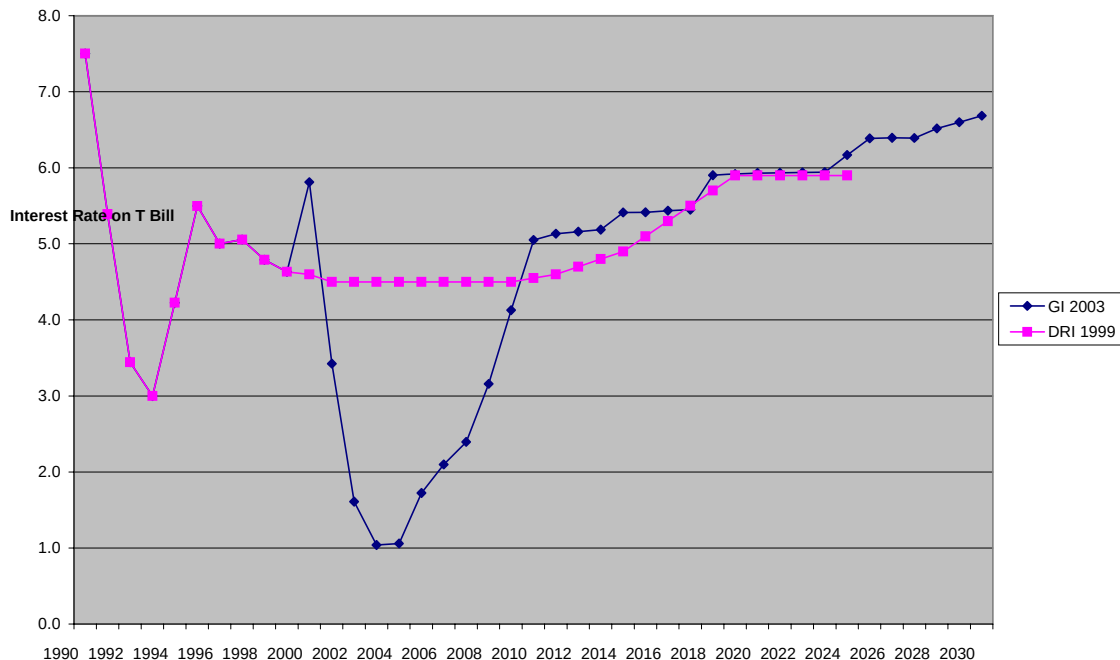
Employment, Labor Force, Population



Proposed Steps to Improve Stability

Where sharp differences occur in sector level forecasts, between current and prior forecast series at the subregional level, the national drivers of each equation will be examined. For example, the national interest rate assumptions are important explanatory variables in forecasting the employment and earnings of New York City's financial services. Where dramatic differences are evident, as illustrated by Chart 1 which compares the 3-Month Treasury Bill Rate projection of the 2020 and 2025 forecast series, the national drivers will be tested for significance. This will occur by simulating offline assumptions of alternative values for the national variables. Depending upon results, the current drivers may be modified to reflect expert judgment and a more stable long term trend.

Chart 1. Comparison of Global Insight 2003 Drivers with Data Resources Inc. 1999 Drivers: 3-Month Treasury Bill Rate



Alternative Approaches

Feasible alternative approaches for consideration include the elimination of aberrant years in historical employment and earnings at the subregional level, or the short term modeling of business cycle patterns at the regional level prior to forecasting the long term trend in employment and earnings.

Approaches that are not feasible because of budgetary constraints, but worth consideration in future forecasting efforts, include simulations of alternative values in Global Insight's national long term model or the use of alternative national forecasting

models. Regional Economic Models, Inc., (*REMI*) offers a structural model at the national level that is built upon both econometric and inter-industry relationships that might prove to be more stable. Lastly, supply side constraints to economic forecasts will tend to moderate exuberant trends. These constraints can be applied from the perspective of land use availability or from capacity measures of existing infrastructure systems. Although current land use data will be available at the subregional level, the necessary enhancements requiring feedback loops to existing models has not been funded for this round of 2035 forecasts.

Population

Previously developed subregional cohort-survival models will be updated for purposes of forecasting mutually exclusive racial-ethnic population (4 race-ethnicities) on an age/sex-specific basis to 2040. The 5-year age/sex/race-ethnicity cohorts for each subregion will be enumerated by the decennial Census (MARS & MRS data) from 1970 to 2000, and by the Interim Census estimates in 2005. Components of change (births, deaths, migration) will be determined on an historic basis by state and local administrative records, Census estimates of migration, and foreign immigration data. Forecasts will reflect national moderate fertility and survival rates modified by subregional differences, past rates of net migration, and the employment model demand for labor. Commutation between subregions, as well as differences in double job holding, work at home, and unemployment rates, will be taken into consideration. Population forecasts of working ages by race-ethnicity and sex will enter the labor force model, as Figure 2 shows. When modified by the labor force model, forecasts will re-enter the population model and adjust migration in each five (5) year period before forecasting forward.

The four race-ethnicities and 18 age cohorts are as follows:

Race-Ethnicity:

- White non-Hispanic
- Black non-Hispanic
- Asian/Other non-Hispanic
- Hispanic

Age Cohort

- Under 5 years
- 5 – 9 years
- 10 – 14 years
- 15 – 19 years
- 20 – 24 years
- 25 – 29 years
- 30 – 34 years
- 35 – 39 years
- 40 – 44 years
- 45 – 49 years

- 50 – 54 years
- 55 – 59 years
- 60 – 64 years
- 65 – 69 years
- 70 – 74 years
- 75 – 79 years
- 80 – 84 years
- 85 years & older

Proposed Steps to Improve Stability

Because employment demand for labor largely establishes the working age population, comprised of naturally aging residents as well as domestic and foreign in-migrants, the greater variability in regional population growth will stem from fertility assumptions (less so, mortality) on an age-specific racial-ethnic basis. At the subregional scale, forecast stability can also be challenged by commutation relationships that control the flow of persons not living but working in an area.

Steps will be taken to test the impact of alternative fertility and commutation assumptions on subregional population growth. These steps may consist of computing the growth differential caused by low or high fertility assumptions of the Census Bureau across all race-ethnicities, or modeling the moderate fertility of immigrant ethnicities on the declining fertility rates of white non-Hispanics.

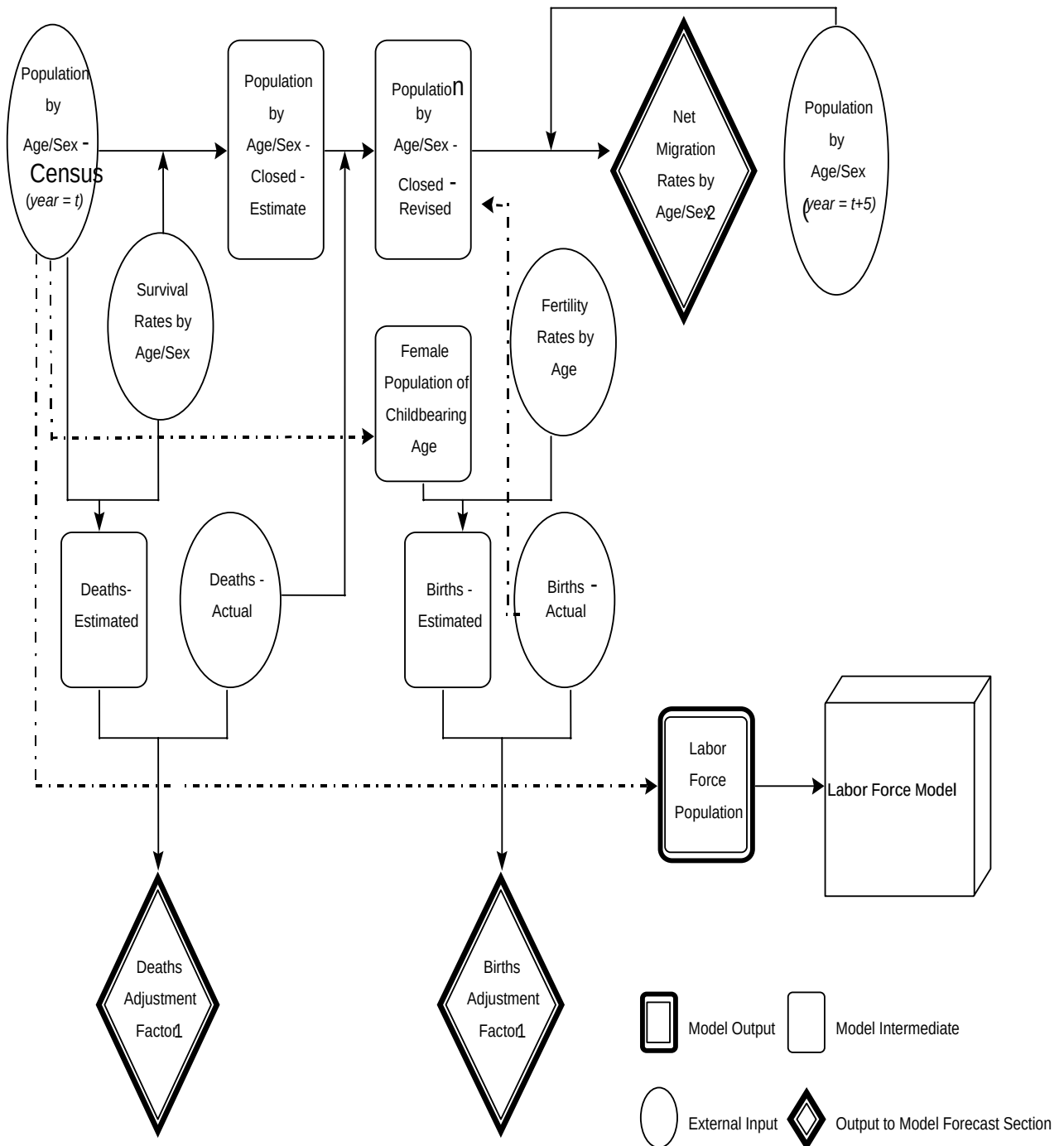
In addition, one anomaly of historic population data for the New York City subregion will be addressed. An effort to expand the Master Address File of the *2000 Census of Population* resulted in an increased coverage of roughly 250,000 resident households and a dramatic growth in City population from 7.1 to 8 million inhabitants between 1990 and 2000. Research performed by the New York City Department of City Planning segregated the impact of increased coverage from actual population growth, permitting a more accurate assessment of the component of growth due to net in-migration. This data will be utilized in constructing the historic rates of in-migration by age/sex/race-ethnicity for New York City.

Lastly, as a subsequent section will discuss, subregional population forecasts will be enhanced for counties in the NYMTC territory by the development of mutually-exclusive racial-ethnic cohort survival models at the county level. For New York City, Long Island and portions of the Mid Hudson subregions, results of the county level models will inform the subregional models and must reconcile with them wherever geographically possible.

Alternative Approaches

An alternative approach to ensuring stable population forecasts once proposed for undertaking has now been eliminated by budgetary constraints. This approach proposed an enhancement to the population models that would reflect use of land capacity to control subregional growth. Where capacity constraints would have been exceeded, a feedback loop would have been created to the subregional population and labor force models to reconcile demand for housing with developable supply on a

Figure 2: Population Flow Chart



¹Output based on 1985 to 2005 time intervals only

²Output based on 1995 to 2005 time interval only

age/sex/race-ethnicity and commutation basis. Land availability will be used, however, as a guide in allocating population to small areas within counties and subregions.

Labor Force

The Labor Force Model will depend on the Population Model for inputs by age/sex/race-ethnicity for persons 16 years and older, at each five-year interval of population. The seven age cohorts will be 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+: Retirement ages.

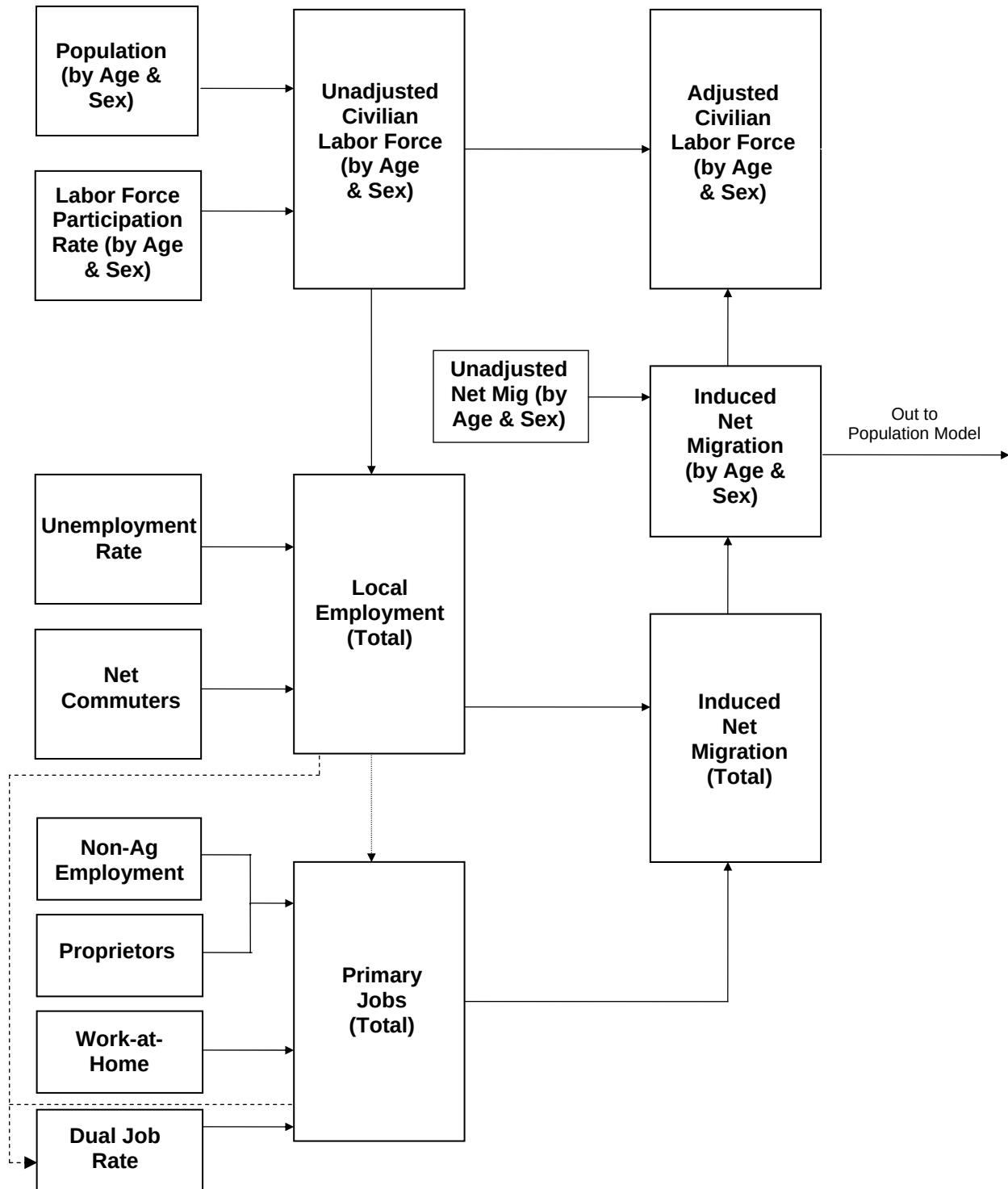
Labor force participation rates of working ages will be determined on an age/sex/race-ethnicity basis or the historic period, 1970 to 2000, and forecasted forward by five (5) year interval based upon subregional/national relationships. The labor force participation rate is defined as the percentage of all residents of a particular population group who are in the civilian labor force. Historical racial/ethnic rates will be provided by the Census Bureau's *Census/Equal Employment Opportunity (EEO) Special File* while the national rates are forecasted by the U.S. Bureau of Labor Statistics.

By applying labor force participation rates to each five (5) year forecast of population -- aged by natural increase and the historic rates of net migration rates -- the resulting labor supply will generate a surplus or deficit of potential workers with respect to the employment demand for labor. The model will determine an equilibrium correction to the working age and dependent population that maintains the relative proportion of racial-ethnic groups.

Proposed Steps to Improve Stability

There is no source for detailed intercensal labor force estimates by racial/ethnic group, sex and age for subnational areas, comparable to the Census Bureau's annual series of population estimates. Therefore it will be necessary to estimate 2005 rates based on the 2000 decennial Census figures, in combination with national estimates and forecasts of labor force participation rates. In this regard, the *Local Area Unemployment Survey (LAUS)* of the state Departments of Labor (DOL) will provide the numeric control for all civilian labor force by subregion of residence in 2005. Given acknowledged problems with the civilian labor force enumeration of the *2000 Census/EEO Special File*, the LAUS estimates will also serve as the overall control for the 2000 historical estimates.

Figure 3. Labor Force Flow Chart



In addition to properly estimating the resident labor force under current conditions, model assumptions regarding the following factors will be carefully evaluated to ensure forecast stability:

- Net commutation
- Telecommuting
- Dual job holding

Net commutation estimates are inputs to the Labor Force Model at each five-year interval and serve as integral parts of the subregional labor force-employment match. These estimates, which will not impact the regional population forecasts, will be defined as the difference between the number of non-resident workers commuting into each subregion and the number of resident workers commuting out of each subregion, for a regional balance. Net commutation levels have historically been positive for New York City and negative for all other subregions, reflecting the continued importance of the Manhattan CBD as an employment center. By sharply increasing the net out-commutation flows from the New Jersey subregion, for example, the Labor Force Model will correspondingly reduce the resident population growth of the suburban New York subregions.

For decennial years, historical net commutation estimates will be calculated from the Census Transportation Planning Package (CTPP) which reports county-to-county journey-to-work flows. Historical mid-decade estimates will be interpolated from the decennial levels. Census flow data reflect travel patterns of respondents during a spring week (April 1) of the decennial year, and the Labor Force Model will adjust spring travel to reflect commutation on an annual average basis. More significant adjustments will be necessary, however, for historical 2000 and 2005 estimates of subregional commutation. This is because the journey-to-work data of the 2000 CTPP were acknowledged to be deficient in accurately reporting the volume and distribution of work trip flows.

For 2000 work trip flows, steps will be taken to revise aggregate data of the regional commuter shed and independently validate gross in- and out-commutation flows of the subregional markets. We will consult public transit and hub bound data of regional transportation agencies, including the Metropolitan Transportation Authority, NJTransit, The Port Authority of New York and New Jersey, the New York State Bridge Authority, and other relevant providers and sources, as well as analyze resident labor force and employment trends. A range of net commutation estimates will be prepared by subregion, and the implications of each will be tested in the Labor Force Model on altering future population forecasts. Commutation flows in 2005 will be modeled upon the best 2000 estimate.

Trends in telecommuting can impact commutation flows and therefore affect population forecast stability at the subregional level. Historical levels of work-at-home employment are not significant according to the decennial *Census*, but careful consideration will be given before extending these numeric trends into the future. Recent research on telecommuting will be consulted and alternative assumptions will be tested to determine their impact on the distribution of resident population and labor force by subregion.

Unlike prior factors, the rate of dual job holding assumed in the Labor Force Model can impact the regional level of population growth. The Labor Force Model applies a dual job holding rate for each racial/ethnic group at every five-year interval to account for workers holding two or more jobs within the jobs-labor force matching process. For all forecast years, the dual job holding rate is calculated based upon the average of all historical periods. With respect to the 2035 forecast, the rate would conform to the average for 1990 through 2005, a period of relative declining dual job holding. By assuming a change from this average, for example to a higher rate justified by the rise in 24/7 employment, the labor force requirements and hence resident population would exhibit less growth.

We will examine the literature regarding trends in dual job holding nationally and with respect to business cycle conditions. Alternative assumptions will be tested in the Labor Force Model to determine the impact of varying historical assumptions. Expert judgment will select those rates, by racial/ethnic group, that are best expected to ensure long term stability in population and labor force forecasts.

Alternative Approaches

All alternative approaches will be considered under the proposed steps, with the exception of a land use constraint on residential development that would limit growth in civilian labor force by subregion. As noted previously, this approach will not be undertaken due to budgetary constraints.

Household Formation

Household formation rates, or headship ratios, will be calculated by ten (10) year age interval to 85 years and over on a mutually exclusive racial-ethnic basis by sex, for the historic period, 1970 to 2005 and forecasted forward based upon subregional/national relationships. Applied to each five (5) year forecast of population – aged by natural increase and the labor force adjusted rates of net migration – the headship ratios will generate households on a racial-ethnic basis. Population in households (excluding group quarters) divided by the trend in average household size will be compared to the aggregate household forecast. Necessary adjustments will be made to the households by headship age/sex/race-ethnicity where sharp deviations are evident from historic trends in average household size. Once established, the level of future households by age of head will be converted to a distribution in household size, type, income and housing preferences, based on past relationships.

Proposed Steps to Improve Stability

Previously developed subregional household formation models will be updated with new headship rates by age/sex/race-ethnicity, for purposes of forecasting household formation to 2035. In addition to the *2005 American Community Survey* which can be cross-tabulated by such variables through the *ACS PUMS* capacity, other current data sources and literature will be consulted. Where dramatic differences emerge in current headship rates, from historical data, sensitivity tests will be performed to determine the impact on forecasting household formation.

Alternative Approaches

If budgetary resources were available, the household model could be enhanced at the subregional level by reconciling household growth with residential development capacity.

1.3 Methodology at County Level

Employment & Earnings

Given the absence of county (not labor market area) employment data on a quarterly NAICS basis for the historic period, 1990 to 2006, subregional employment forecasts will be disaggregated to the county level for private, public, nonfarm total, proprietors, and total employment, using linear regression techniques.

Proposed Steps to Improve Stability

Linear regression equations will be prepared on a county level basis with annual employment of proprietors, private and public wage and salary workers, used in comparison to subregional employment as historic time shares, for purposes of allocating future subregional employment and earnings to component counties. Other relevant county level data, such as population trends, will be taken into consideration and existing projections of county planning departments and other metropolitan planning organizations will be used to evaluate these forecasts. Modifications will be made to smooth trends and forecasts will be reviewed by relevant public agencies.

Alternative Approaches

No alternative approaches are envisioned.

Disaggregation of Population, Labor Force & Household Formation

Subregional totals will be disaggregated to component counties using regression analysis procedures. Historical labor force estimates of the state DOLs will be related to resident population estimates of the Census Bureau on an annual basis by county. SPSS, a software package of SPSS, Inc., provides statistical data analysis capability to fit linear, cubic and quadratic equations to the population-labor force relationship of each county. Using time as an independent variable, the best fitting form of equation will then be used to predict future population-labor force ratios on a county-by-county basis.

Ratios will be applied to the predicted level of resident population by county for the forecast period, in order to yield initial estimates of resident civilian labor force. Prevailing county-to-subregion differences in resident unemployment rates will be continued over the forecast period and applied to the labor force forecasts for future estimates of employed residents. The component county estimates will then be summed to subregional totals and normalized to equal the subregional controls. County-level forecasts will be made for total and employed labor force only, with no race, age, or sex detail.

Households and average household size will be forecasted at the county level from historic data, the respective subregional household forecasts, share relationships, and linear regression techniques. Forecasts of county planning departments, New York City Department of City Planning, and other metropolitan planning organizations will be taken into consideration.

Proposed Steps to Improve Stability

The resulting forecasts of population, employed resident labor force and household formation will be evaluated for reasonableness. With respect to NYMTC partner counties, special enhancements provided with budgetary resources will improve forecasting stability.

County level cohort-survival models will be developed on a mutually exclusive racial-ethnic basis for 12 counties in New York State, including each borough of New York City. County level population data (life tables for survival rates, age-specific fertility rates, MARS(modified age/race/sex data set) /MRS (modified race data summary file) population (, births, deaths and birth sex ratios) will be utilized for the historic period 1970 to 2005, and age-specific migration rates will be derived and forecasted for each county. The 12 New York State counties with individual cohort-survival models will also have separate labor force models that reflect local differences in labor force participation rates and separate household formation models that reflect local differences in headship rates by race-ethnicity.

Alternative Approaches

No alternative approaches are envisioned.

1.4 REVIEW, FEEDBACK & ADOPTION

Model development and forecast results will be periodically reviewed by a Forecasting Working Group, consisting of NYMTC partner representatives and other invited experts. Detailed technical memoranda (TMs) will be prepared and distributed, describing methods and results. Special outreach will be established with County Executives or Borough Presidents, and their Planning Department staffs. Meetings will be held to discuss the importance of long term forecasts and to reach consensus on forecasting results.

A web-based program will be developed to allow county Planning Departments to review maps of forecasted growth and suggest changes. Model development and forecast results will be periodically reviewed by the Forecasting Working Group, consisting of NYMTC partner representatives and other invited experts. The long term population and employment forecasts will be adopted by NYMTC's Program, Finance and Administration Committee (PFAC), after which forecasts and Technical Memorandum's will be downloadable from NYMTC's web site.

1.5 WORK PRODUCTS

The text of this memorandum is contained in a Microsoft Word file. The table and figures presented in this report are also delivered in Microsoft Word.

