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Economic, Revenue, and Spending Methodologies

Andrew M. Cuomo, Governor

Robert F. Mujica Jr., Budget Director

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Overview of the Methodology Process

The Division of the Budget (DOB) *Economic, Revenue, and Spending Methodologies* supplements the detailed forecast of the economy, tax, and spending forecasts presented in the Executive Budget and Quarterly Updates. The purpose of this volume is to provide background information on the methods and models used to generate the estimates for the major receipt and spending sources contained in the FY 2019 Mid-Year Update and the upcoming FY 2020 Executive Budget. DOB's forecast methodology utilizes sophisticated econometric models, augmented by the input of a panel of economic experts, and a thorough review of economic, revenue and spending data to form multi-year quarterly projections of economic, revenue, and spending changes.

The spending side analysis is designed to provide, in summary form, background information on the methods and analyses used to generate the spending estimates for a number of major program areas contained in the budget, and is meant to enhance the presentation and transparency of the State's spending forecast. The methodologies illustrate how spending forecasts are the product of many factors and sources of information, including past performance and trends, administrative constraints, expert judgment of agency staff, and information in the State's economic analysis and forecast, especially in cases where spending trends are sensitive to changes in economic conditions.

An Assessment of Forecast Risk

No matter how sophisticated the methods used, all forecasts are subject to error. For this reason, a proper assessment of the most significant forecast risks can be as critical to the budget process as the forecast itself. Therefore, we begin by reviewing the most important sources of forecast error and discuss how they affect the spending and receipt forecasts used to construct the Mid-Year Update.

Data Quality

Even the most accurate forecasting model is constrained by the accuracy of the available data. The data used by the Budget Division to produce a forecast typically undergo several stages of revision. For example, the quarterly components of real U.S. gross domestic product (GDP), the most widely cited measure of national economic activity, are revised no less than five times over a four-year period, not including the rebasing process. Each revision incorporates data that were not available when the prior estimate was made. Initial estimates are often based on sample information, though early vintages are sometimes based on the informed judgment of the analyst charged with tabulating the data. The monthly employment estimates produced under the Current Employment Statistics (CES) program undergo a similar revision process as better, more broad-based data become available and with the evolution of seasonal factors. For example, the total U.S. nonagricultural employment estimate for December 1989 has been revised no less than ten times since it was first published in January 1990.[1] Less frequently, data are revised based on new

[1] The current U.S. Bureau of Labor Statistics estimate for total employment for December 1989 of 108.8 million is 0.7 percent below the initial estimate of 109.5 million.

definitions of the underlying concepts.[2] Unfortunately, revisions tend to be largest at or near business cycle turning points, when accuracy is most critical to fiscal planners. Finally, as demonstrated below, the available data are sometimes not suitable for economic or revenue forecasting purposes, such as the U.S. Bureau of Economic Analysis estimate of wages at the state level.

Model Specification Error

Economic forecasting models are by necessity simplifications of complex social processes involving millions of decisions made by independent agents. Although economic and fiscal policy theory provides some guidance as to how these models should be specified, theory is often imprecise with respect to capturing behavioral dynamics and structural shifts. Moreover, modeled relationships may vary over time. Often one must choose between models that use the average behavior of the series over its entire history to forecast the future and models which give more weight to the more recent behavior of the series. Although more complicated models may do a better job of capturing history, they may be no better at forecasting the future, leading to the parsimony principle as a guiding precept in the model building process.

Reporting Model Coefficients: Fixed Points or Ranges?

Although model coefficients are generally treated as fixed in the forecasting process, coefficient estimates are themselves random variables, governed by probability distributions. Typically, the error distribution is assumed to be normal, a key to making statistical inference. Reporting the standard errors of the coefficient distributions gives some indication of how precisely one can measure the relationship between two variables. For many of the results reported below, point estimates of the coefficients are reported along with their standard errors. However, it would be more accurate to say that there is a 66 percent probability that the true coefficient lies within a range of the estimated coefficient plus and minus the standard error.

Economic Shocks

No model can adequately capture the multitude of unforeseeable events that can affect the economy, and hence revenue and spending results. September 11 is an example of such an event. Also, some economic variables are more sensitive to shocks than others. For example, equity markets rise and fall on the day's news, sometimes by large magnitudes. In contrast, GDP growth tends to fluctuate within a relatively narrow range. For all of these reasons, the probability of any forecast being precisely accurate is virtually zero. But although one cannot be confident about hitting any particular number correctly, one can feel more confident about specifying a range within which the actual number is likely to fall. Often economic forecasters use sophisticated techniques, such as Monte Carlo analysis, to estimate confidence bands based on model performance, the precision of the coefficient estimates, and the inherent volatility of the series. A 95 percent confidence band (or even a much less exacting band) often can be quite wide, suggesting the

[2] The switch from SIC to NAICS is a classic example of how changes in the definition of a data series can challenge the modeler. The switch not only changed the industrial classification scheme, but also robbed state modelers of decades of employment history.

possibility that the actual result could deviate substantially from the point estimate. Even with a 95 percent band, there is a 5 percent chance of a shock that results in an extremely unexpected outcome. Indeed, based on some of the events of the last 10 years – the high-tech/Internet bubble, September 11, and the recent financial crisis – it could be argued that this probability is much higher than 5 percent. Finally, from a practitioner's perspective, these techniques are only valid if the model is properly specified.

What sometimes appears to be a random economic shock may actually be a more permanent structural change. Shifts in the underlying economic, revenue, or spending structure are difficult to model in practice, particularly since the true causes of such shifts only become clear with hindsight. This can lead to large forecast errors when these shifts occur rapidly or when the cumulative impact is felt over the forecast horizon. Policy makers must be kept aware that even a well specified model can perform badly when structural changes occur.

Evaluating a Loss Function

The prevalence of sources of forecast error underscores the importance of assessing the risks to the forecast, and explains why the discussion of such risks consumes such a large portion of the economic backdrop presented with the Executive Budget. In light of all of the potential sources of forecast risk, how does a budgeting entity utilize the knowledge of risks to inform the forecast? Standard econometric theory tells us that the probability of any point forecast being correct is virtually zero, but a budget must be based on a single projection.

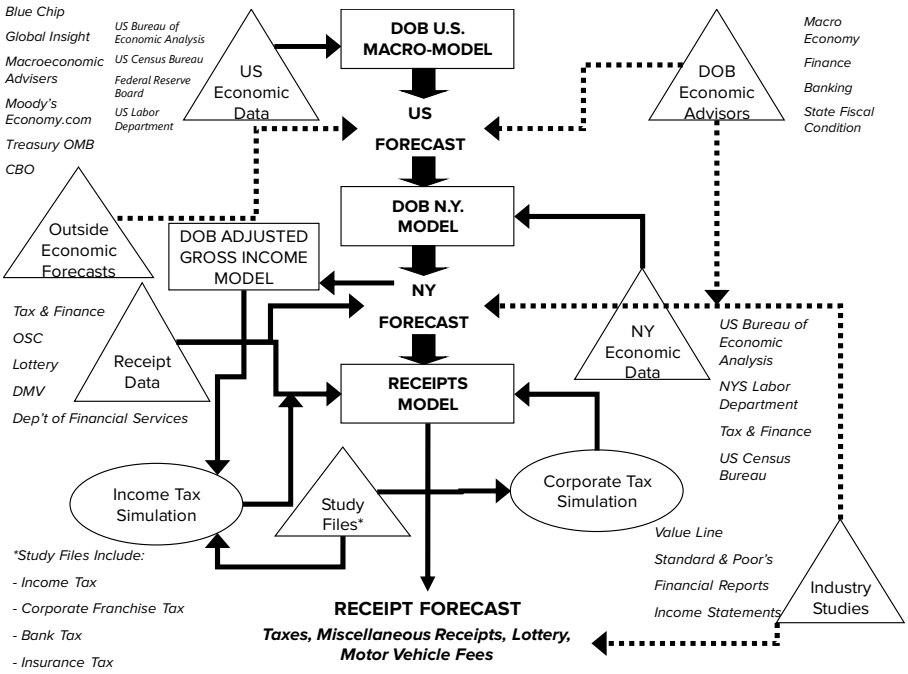
One way to reconcile these two facts is to evaluate the cost of one's forecasting errors, giving rise to the notion of a loss function. A conventional example of a loss function is the root-mean-squared forecast error (RMSFE). In constructing that measure, the "cost" of an inaccurate forecast is the square of the forecast error itself, implying that large forecast errors are weighted more heavily than small errors. Because positive and negative errors of equal magnitude are weighted the same, the RMSFE is symmetric. However, in the world of professional forecasting, as in our daily lives, the costs associated with an inaccurate forecast may not truly be symmetric. For example, how much time we give ourselves to get to the airport may not be based on the average travel time between home and the gate, since the cost of being late and missing the plane may outweigh the cost of arriving early and waiting awhile longer. Granger and Pesaran (2000) show that the forecast evaluation criterion derived from a decision-based approach can differ markedly from the usual RMSFE. They suggest a more general approach, known as generalized cost-of-error functions, to deal with asymmetries in the cost of over- and under-predicting.[3] In the revenue-estimating context, the cost of overestimating receipts for a fiscal year may outweigh the cost of underestimating receipts, given that ongoing spending decisions may be based on revenue resources projected to be available. In summary, errors are an inevitable part of the forecasting process and, as a result, policymakers must be fully informed of the forecast risks, both as to direction and magnitude.

[3] For a detailed discussion, see C.W.J. Granger, *Empirical Modeling in Economics: Specification and Evaluation*, Cambridge University Press, 1999.

Overview of the Methodology Process

The flow chart below provides an overview of the receipts forecasting process (an equivalent spending chart is included below). The entire forecast process, from the gathering of information to the running of various economic and receipt models, is designed to inform and improve the DOB receipt estimates. As with any large scale forecasting process, the qualitative judgment of experts plays an important role in the estimation process. It is the job of the DOB economic and revenue analysts to consider all of the sources of model errors and to assess the impact of changes in the revenue environment that models cannot be expected to capture. Adjustments that balance all of these risks while minimizing the appropriate loss function are key elements of the process. Nevertheless, in the final analysis, such adjustments tend to be relatively small. The Budget Division's forecasting process remains guided primarily by the results from the models described in detail below.

The Economic and Revenue Forecasting Process



The Economy

The economic environment is the most important factor influencing the receipts estimates and has an important impact on spending decisions. New York State's revenue base is dominated by tax sources, such as the personal income and sales taxes, which are sensitive to economic conditions. In addition, expenditures such as Medicaid, welfare, debt service, and nonpersonal service costs are directly related to the state of the economy. As a result, the first and most important step in the construction of receipts and spending projections requires an analysis of economic trends at both the State and national levels. The schedule below sketches the frequency and timing of forecasts performed over the course of the year.

ECONOMIC AND REVENUE FORECAST SCHEDULE

A brief overview of how the Budget Division forecasting process unfolds over the course of the calendar year is presented below. From one perspective, the following schedule begins at the end, since the submission of the Executive Budget in January represents the culmination of research and analysis done throughout the preceding year. For the remainder of the year, the Economic and Revenue Unit closely monitors all of the relevant economic and revenue data and regularly updates an extensive array of annual, quarterly, monthly, weekly, and daily databases. For example, estimates of U.S. Gross Domestic Product data are released at the end of each month for the preceding quarter. U.S. employment and unemployment rate data are released on the first Friday of each month for the preceding month, while unemployment benefits claims data are released on a weekly basis. Receipts data published by the Office of the State Comptroller are released by the 15th of each month for the preceding month, while similar data from the New York State Department of Taxation and Finance are monitored on both a monthly and daily basis. The Executive Budget forecast is updated four times during the year in compliance with State Finance Law.

JANUARY	Governor submits Executive Budget to the Legislature by the middle of the month, or by February 1 following a gubernatorial election.
FEBRUARY	Prepare forecast for *Executive Budget With 21-Day Amendments*.
MARCH	Joint Legislative-Executive Economic and Revenue Consensus Forecasting Conference.
APRIL	Statutory deadline (April 1) for enactment of State Budget by the Legislature.
JUNE/JULY	Prepare forecast for First Quarter Financial Plan Update (July Update).
SEPTEMBER /OCTOBER	Prepare forecast for Mid-Year Financial Plan Update.
DECEMBER /JANUARY	Prepare Executive Budget forecast and supporting documentation. Meet with DOB Economic Advisory Board for review and comment on mid-year forecast and incorporate comments of Advisory Board members.

The process begins with a forecast of the U.S. economy. The heart of the DOB U.S. forecast is the DOB macroeconomic model. The model employs recent advances in econometric modeling techniques to project the most likely path of the U.S. economy over the multi-year forecast horizon included in the Executive Budget. The model framework and its development are described in detail in this volume. Model output is combined with a qualitative assessment of economic conditions to complete a preliminary U.S. forecast. In addition, the Budget Division staff review the projections of other forecasters, which provide a yardstick against which to judge the DOB forecast.

The U.S. forecast serves as the key input to the New York macroeconomic forecast model. National trends in employment, income, financial markets, foreign trade, and consumer confidence can have a major impact on New York's economic performance. However, the New York economy is subject to idiosyncratic fluctuations, which can lead the State economy to perform much differently than the nation as a whole. The evolution of the New York economy is governed in part by a heavy concentration of jobs and income in the financial and business services industries. As a result, economic events that disproportionately affect these industries can have a greater impact on the New York economy than on the rest of the nation. The New York economic model is structured to capture both the obvious linkages to the national economy and the factors that may cause New York to deviate from the nation. The model estimates the future path of major elements of the New York economy, including employment, wages and other components of personal

income and makes explicit use of the linkages between employment and income earned in the financial services sector and the rest of the State economy.

To adequately forecast personal income tax receipts – the largest single component of the receipts base – projections of the income components that make up State taxable income are also required. For this purpose, DOB has constructed models for each of the components of New York State adjusted gross income. The results from this series of models serve as input to the income tax simulation model described below, which is the primary tool for calculating New York personal income tax liability.

A final part of the economic forecast process involves using tax collection data to assess the current state of the New York economy. Tax data are often the most current information available for judging economic conditions. For example, personal income tax withholding provides information on wage and employment growth, while sales tax collections serve as an indicator of consumer purchasing activity. Clearly, there are dangers in relying too heavily on tax information to forecast the economy, but these data are vital in assessing the plausibility of the existing economic forecast, particularly for the year in progress and at or near turning points when "real-time" data are most valuable.

Economic Advisory Board

At this point, a key component of the forecast process takes place: the staff confer with a panel of economists with expertise in macroeconomic forecasting, finance, the regional economy, and public sector economics to obtain valuable input on current and projected economic conditions, as well as an assessment of the reasonableness of the DOB estimates of revenue and spending. In addition, the panel provides insight on other key functions that may impact receipts growth, including financial services compensation and the performance of sectors of the economy difficult to capture in any model.

Forecasting Receipts

Once the economic forecast is complete, these projections are used to forecast selected revenues. Again, DOB combines qualitative assessments, the econometric analysis, and expert opinions on the New York revenue structure to produce a final receipts forecast.

Modeling and Forecasting

The DOB receipts estimates for the major tax sources rely on a sophisticated set of econometric models that link economic conditions to revenue-generating capacity. The models use the economic forecasts described above as inputs and are calibrated to capture the impact of policy changes. As part of the revenue estimating process, DOB staff analyze industry trends, tax collection experience, and other information necessary to better understand and predict receipts activity.

For large tax sources, receipt estimates are approached by constructing underlying taxpayer liability and then projecting liability into future periods based on results from econometric models specifically developed for each tax. Microsimulation models are employed to estimate future tax liabilities for the personal income and corporate business taxes. This technique starts with detailed taxpayer information taken directly from tax returns (the data are stripped of identifying taxpayer information) and allows for the actual computation of tax liability under alternative policy and economic scenarios. Microsimulation allows for a bottom-up estimate of tax liability for future years as taxpayer incomes are trended forward based on DOB estimates of economic growth. As with most DOB revenue models, the simulation models require projections of the economic variables that drive tax liability.

An advantage of the microsimulation approach is that it allows direct calculation of the revenue impact of already enacted and proposed tax law changes on future liability. But while DOB's tax simulation models evaluate the direct effect of a policy change on taxpayers, the models do not permit feedback from the taxpayer back to the macroeconomy.[4] For large policy changes intended to influence taxpayer behavior and trigger changes in the underlying economy, adjustments are made outside the modeling process. Simulating future tax liability is most important for the personal income tax, which accounts for over half of General Fund tax receipts and is discussed in greater detail later in this report. After liability is estimated for future taxable periods, it is converted to cash estimates on a fiscal year basis.

Forecasting Spending

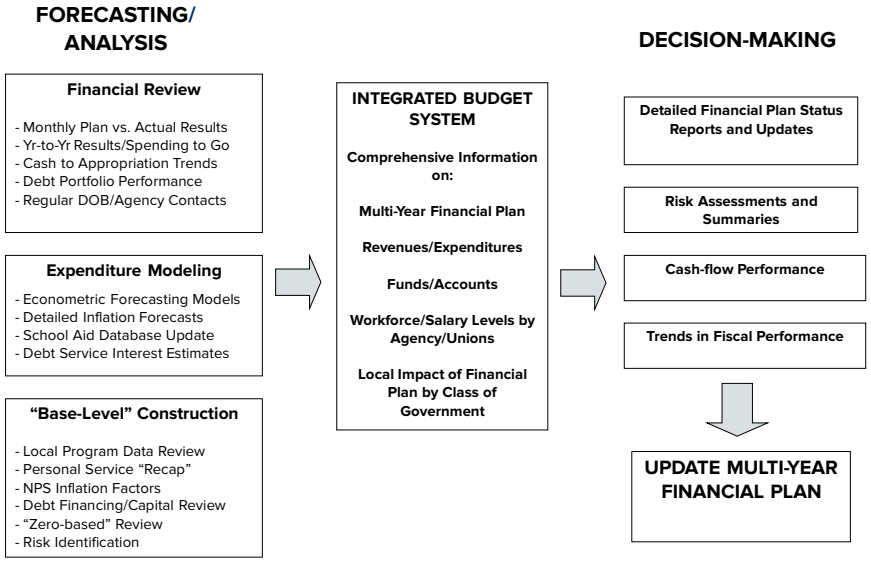
Like revenues, spending projections are often closely tied to the DOB economic forecast. In many cases, spending projections are also tied to institutional and demographic factors pertaining to a specific spending program.

Each spending methodology description below addresses at least four key components, including an overview of important program concepts, a description of relationships among variables and how they relate to the spending forecast, how the forecasts translate into the current Financial Plan estimates, and the risks and variations inherent in each forecast. These factors are described in more detail below for key program areas that drive roughly 80 percent of the State's overall spending forecast.

The following chart depicts, in broad terms, the multi-year forecasting process that DOB employs in constructing its spending forecasts.

[4] For examples of modeling efforts that attempt to incorporate such feedback, see Congressional Budget Office, *How CBO Analyzed the Macroeconomic Effects of the President's Budget*, July 2003.

Multi-Year Financial Plan Forecasting Overview



An Assessment of Forecast Accuracy

The forecast of tax receipts is a critical part of preparing the Financial Plan. The availability of receipts sets an important constraint on the ability of the State to finance spending priorities. The economic forecast provides the foundation upon which the revenue forecasts are based. As discussed above, all forecasts are subject to error. In an area as complex as economic and revenue forecasting, this error can be substantial. The size of the forecast errors can be mitigated by the proper application of forecast tools, but it cannot be eliminated. Below we provide an assessment of the accuracy with which the Budget Division has forecast some key economic variables in recent years, as well as the major revenue groups.

Forecast Accuracy for Selected U.S. Economy Variables

Forecasting the future of the economy is very difficult, due not only to the issues discussed above, but also to the occurrence of economic shocks, i.e., unpredictable events such as the September 11 attacks or Superstorm Sandy. Predicting business cycle turning points is a particularly difficult challenge for forecasters since the model coefficients on which future predictions are based are fixed at values that summarize the entire history of the data. For example, at the end of 2000, DOB predicted that the economy would experience a significant slowdown for the following year. However, we could not predict the events of September 11. On the other hand, we projected that the impact of September 11 would be less severe but longer lasting than it turned out to be. Here we select a few key economic variables and compare our one-year-ahead annual forecast to the

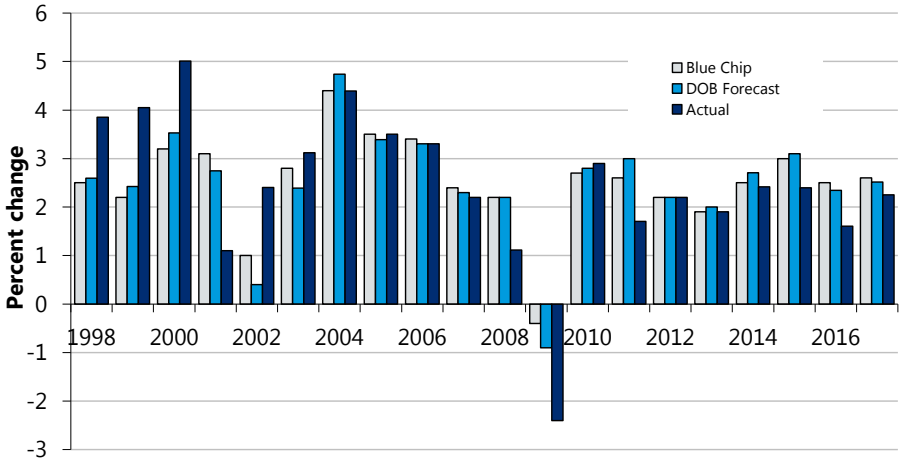
initial BEA and BLS estimates.[5] For comparison purposes, we also include the Blue Chip forecast where available.

As Figure 1 through Figure 4 indicate, when the economy is on a steady growth path, the forecast errors tend to be smaller than when the economy is actually changing direction. For both real U.S. GDP and inflation, DOB's forecast has tended to be very similar to the Blue Chip Consensus forecast. Like the Blue Chip consensus forecast, DOB overestimated the strength of real U.S. GDP during the 2001 recession, but underestimated strength of the economy coming out. There was a similar tendency to overestimate 2009 growth in real U.S. GDP, employment, and income in the wake of the 2007-2008 financial crisis. In contrast, because of the unusually long period by which the U.S. labor market recovery lagged the recovery in output, there was a tendency to over predict employment in 2002 and 2003 and income in 2003. There was a similar tendency to overestimate the pace of the recovery in employment and income for 2010 and 2011. As Figure 2 illustrates the difficulties presented by energy price volatility to forecasting inflation, particularly in recent years.

Figure 1

Executive Budget Forecast Accuracy: US Real GDP Growth

One year ahead



Note: "Actual" is based on BEA's advance estimate for the fourth quarter, released at the end of the following January; Blue Chip and DOB forecasts for 2009 date from November 2008 because of the unusually early release date for the 2009-10 Executive Budget.

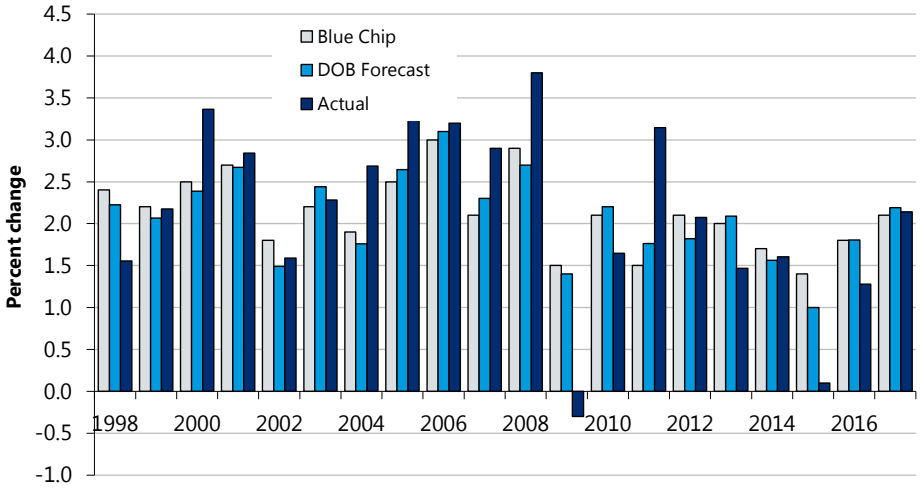
Source: Moody's Analytics; Blue Chip Economic Indicators (December forecast for following year); Federal Reserve Bank of Philadelphia; DOB staff estimates.

[5] We use the initial estimates rather than the most recent estimates as benchmarks to assess DOB's forecast accuracy since it would be impossible to forecast future revisions to the data.

Figure 2

Executive Budget Forecast Accuracy: US Inflation

One year ahead



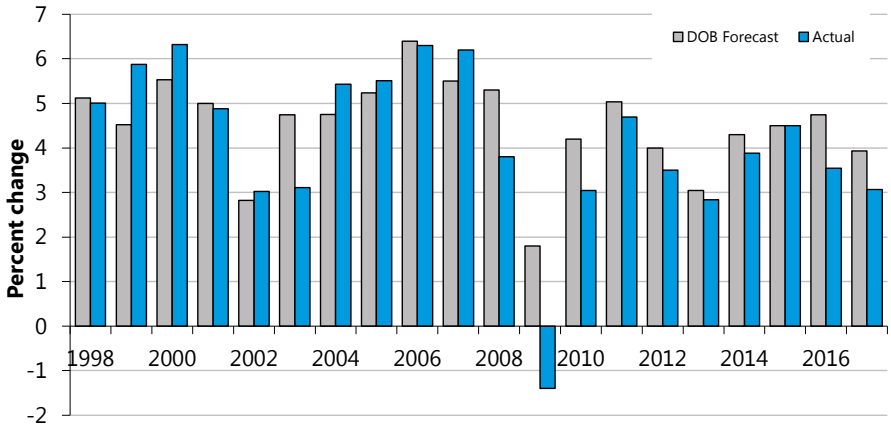
Note: "Actual" is as of BLS's preliminary estimate for December, released in the middle of the following January; Blue Chip and DOB forecasts for 2009 date from November 2008 because of the unusually early release date for the 2009-10 Executive Budget.

Source: Moody's Analytics; Blue Chip Economic Indicators (December forecast for following year); Federal Reserve Bank of Philadelphia; DOB staff estimates.

Figure 3

Executive Budget Forecast Accuracy: US Personal Income

One year ahead



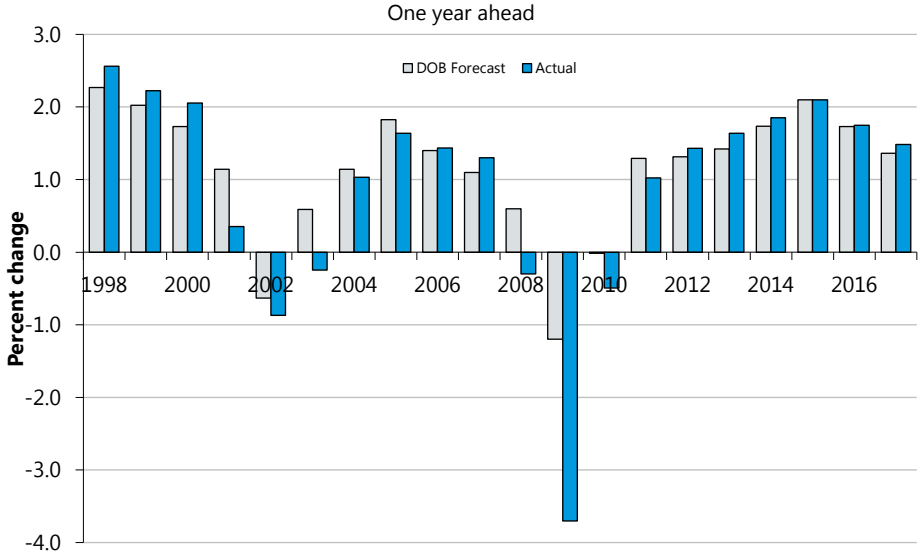
Note: "Actual" is based on BEA's advance estimate of the fourth quarter, released at the end of the following January.

Source: Moody's Analytics; Federal Reserve Bank of Philadelphia; DOB staff estimates.

Figure 4

Executive Budget Forecast Accuracy: US Employment

One year ahead



Note: "Actual" is based on BLS's preliminary estimate for December, released at the beginning of the following January.

Source: Moody's Analytics; Federal Reserve Bank of Philadelphia; DOB staff estimates.

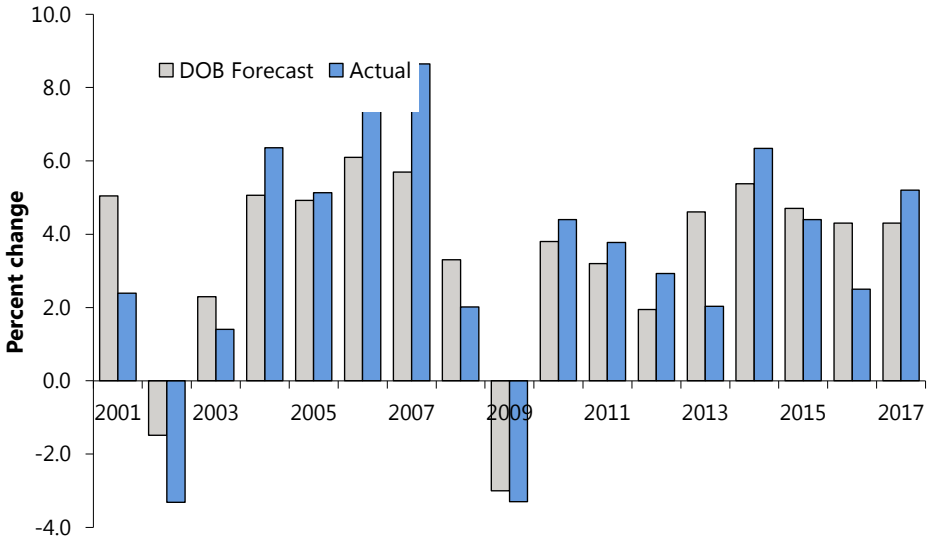
Forecast Accuracy for New York State Employment and Wages

In addition to the problems pertaining to forecasting accuracy discussed in the U.S. section, the constraints that exist for the State economic models are even more severe due to the limited amount of available data. Therefore, we are unable to construct a structural model of similar scale describing the relationships between income, consumption, and production. The main data source available for the New York model is Quarterly Census of Employment and Wages (QCEW) data obtained from the New York State Department of Labor. Figure 5 and Figure 6 compare DOB's one-year-ahead forecasts to actual QCEW data.

When the economy was doing well during the years of the technology and equity market bubble, DOB's forecast tended to underestimate State economic activity, as measured by employment and income. But in the wake of the events of September 11, economic activity contracted significantly more than predicted, resulting in overestimation of State employment growth. Indeed, for 2003 the Budget Division forecast a modest amount of growth, but employment actually continued to fall for that year. In contrast, DOB underestimated New York's labor market recovery for the period from 2010 to 2013. The wage forecast errors are similar to those for employment, with one notable exception. A portion of the underestimation for 2012 and overestimation for 2013 was related to the increase in the two top marginal Federal tax rates at the beginning of 2013 that prompted a shifting of income from early 2013 into the last quarter of 2012. Those increases were not anticipated when the 2012-13 Executive Budget forecast was constructed in January 2012. We note that prior to 2001, DOB used a different series to measure State wages. Therefore, forecast errors based on the former series are not included here.

Figure 5

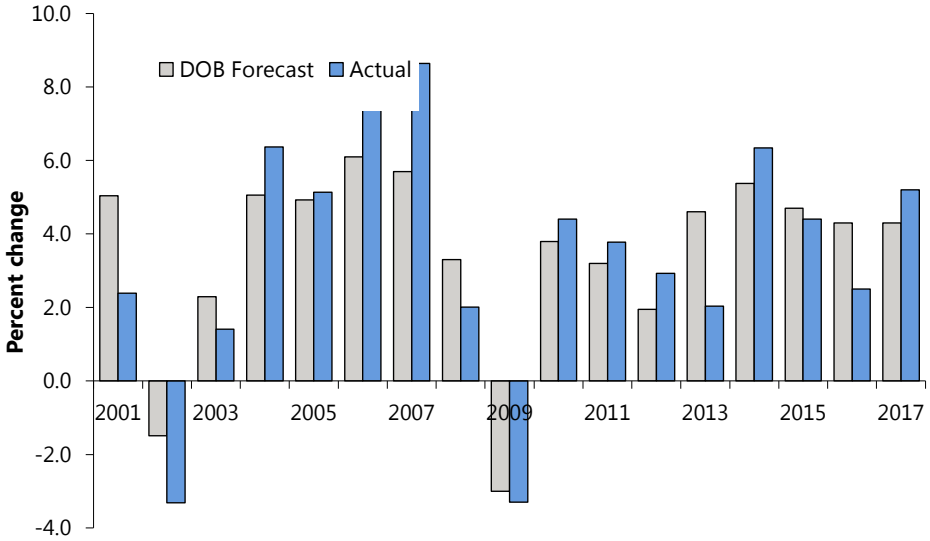
Executive Budget Forecast Accuracy: New York Wages
One year ahead



Source: NYS Department of Labor; DOB staff estimates.

Figure 6

Executive Budget Forecast Accuracy: New York Wages
One year ahead



Source: NYS Department of Labor; DOB staff estimates.

Forecast Accuracy for Revenues

As discussed above, forecast models are simplified versions of reality and as such are subject to error. Tax collections in New York are dependent on a host of specific factors that are difficult to accurately predict. Among the more specific factors that can impact New York receipt estimates are:

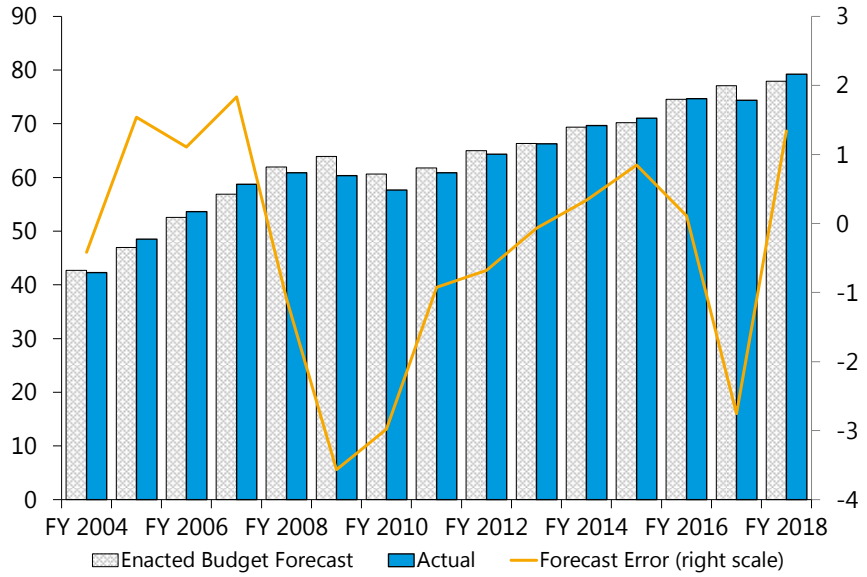
- National and State economic conditions, which are subject to shocks that are by definition unanticipated;
- One-time actions (that either spin up or delay collections and impact cash flow);
- Court decisions concerning the proper applicability of tax;
- State or Federal tax policy actions that could alter taxpayer behavior;
- Tax structures including tax rates and base subject to tax;
- Efficiency of tax collection systems;
- Enforcement efforts, audit activities and voluntary compliance;
- Timing of payments (shifting collections from one fiscal year to another);
- Tax Amnesty programs (1994, 1996, 2003, and 2010 covering personal income tax, corporate franchise tax, sales tax, estate and gift tax and other minor taxes);
- Timing of Budget enactment; and
- Statutorily mandated accounting changes.

The following summary graphs review the Division's recent All Funds forecast performance using several measures. In each figure, the error is defined as the actual collections minus the forecast. Figure 7 compares the total tax forecast to actual results and presents the historical pattern of the forecast errors (2009-10 Forecast includes the estimated receipts for the Metropolitan Commuter Transportation Mobility tax which was established after the Enacted Budget). The overall pattern reflects the difficulty in forecasting at and near business cycle turning points and the tendency to overestimate receipts during recessions and to underestimate during expansions. Figure 8 shows the share of the total dollar error contributed by each major tax category. In some years, there are offsetting errors. These graphs also show that while an error rate may be significant, the dollars involved may be less so.

Figure 7

Enacted Budget Forecast Errors: Total Taxes

($ Billions)

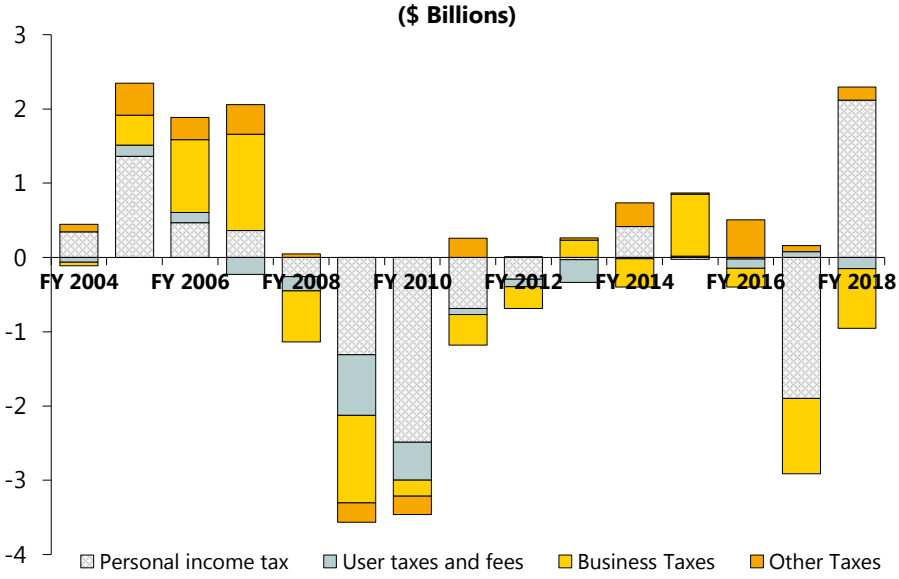


Source: NY State Department of Taxation and Finance; DOB staff estimates.

Figure 8

Enacted Budget Forecast Accuracy: Forecast Errors

($ Billions)



Note: Error is defined as actual receipts less forecast receipts.
Source: NY State Department of Taxation and Finance; DOB staff estimates.

Part I

Economic Methodologies

The Division of the Budget (DOB) Economic and Revenue Unit provides projections on a wide range of economic and demographic variables. These estimates are used in the development of State revenue and expenditure projections, debt capacity analysis, and for other budget planning purposes. This section provides a detailed description of the econometric models developed by the staff for forecasting the U.S. economy.

Basic Features of DOB/US

Macroeconomic modeling has undergone a number of important changes during the last four decades, primarily as a result of developments in economic and econometric theory. Many of the models now used by the world's central banks incorporate methodological choices that were once seen as stark alternatives to one another but empirical experience had proven otherwise. Michael Woodford (2008) cites the Federal Reserve Board's workhorse macroeconomic model, developed in the 1990s, as encompassing much of the progress of the preceding decades, such as endogenously evolving expectations and dynamics consistent with long-term equilibrium conditions. By drawing heavily on the methodology underlying the Federal Reserve model, the Budget Division's approach to macroeconomic modeling incorporates the theoretical advances of the last 40 years in an econometric model designed for forecasting and policy simulation.

The behavioral equations in the Budget Division's U.S. macroeconomic model (DOB/U.S.) are consistent with economic agents that optimize their behavior subject to economically meaningful constraints. The model addresses the Lucas (1976) critique regarding the role of expectations in more traditional macroeconomic models by specifying an information set that is common to all economic agents, who incorporate this information when forming their agent-specific expectations. Thus, expectations can evolve endogenously to changes in monetary and fiscal policy in a model-consistent fashion. Of course, modeling that evolution is only possible when all contingent future states of the economy are foreseeable. Recent experience dictates that all contingent future states are not foreseeable during times of great turbulence, and clearly they were not during the run-up to the Great Recession and thereafter (Guesnerie, 2013).

The model's long-run equilibrium is the solution to a dynamic optimization problem carried out by households and firms. This is also a consequence of the Lucas analysis, which also initiated the emergence of a new generation of econometric models explicitly incorporating coherent intertemporal general equilibrium foundations, where firms and households are assumed to make decisions based on optimization plans that are realized in the long run. This approach permits both short-term business cycle fluctuations and long-term equilibrium properties to be handled within a single consistent framework. This synthesis is made possible by adding adjustment frictions, as well as other departures from the perfectly competitive, instantaneous-adjustment model.

The model structure also incorporates an error-correction framework that ensures movement back to equilibrium in the long run. This reflects the work of Engle and Granger (1987), Johansen (1991), and Phillips (1991) on the presence of long-run equilibrium relationships among macroeconomic data series, known as cointegration. Although cointegrated series can deviate from their long-term trends for substantial periods, there is always a tendency to return to their common equilibrium paths. This behavior led to the development of a framework for dealing with nonstationary data in

an econometric setting, known as the error-correction model. This framework has permitted extensive research on how to best exploit the predictive power of cointegrating relationships. A result has been structural forecasting models that are more directly based on the series' underlying data-generating mechanism.

Of course, DOB/US takes into account developments stemming from the classic study by Nelson and Plosser (1982), which concluded that the hypothesis of nonstationarity cannot be rejected for a wide range of commonly used macroeconomic data series. Nonstationary time series have means and variances that change with time. Research surrounding nonstationarity prompted a revisiting of the problem of spurious regression described by Granger and Newbold (1974), which led to a more rigorous analysis of the time series properties of economic data and the implications of these properties for model specification and statistical inference.

Like the Federal Reserve Board model summarized in Brayton and Tinsley (1996), the assumptions that govern the long-run behavior of DOB/US are grounded in neoclassical microeconomic foundations. Consumers exhibit maximizing behavior over consumption and labor-supply decisions, while firms maximize profit. The model solution converges to a balanced growth path in the long run. Consumption is determined by expected wealth, which is determined, in part, by expected future output and interest rates. The value of investment is affected by the cost of capital and expectations about the future paths of output and inflation.

In addition to the microeconomic foundations that govern long-run behavior, DOB/US incorporates dynamic adjustment mechanisms, since even forward-looking agents do not adjust instantaneously to changes in economic conditions. Sources of “friction” within the economy include adjustment costs, the wage-setting process, and persistent spending habits among consumers. Frictions delay the adjustment of nonfinancial variables, producing periods when labor and capital can deviate from optimal paths. The presence of such imbalances constitutes signals that are important in wage and price setting because price setters must anticipate the actions of other agents. For example, firms set wages and prices in response to a set of expectations concerning productivity growth, available labor, and the consumption choices of households.

In contrast to the real sector, the financial sector is assumed to be unaffected by frictions, due to the negligible cost of transactions and the presence of well-developed primary and secondary markets for financial assets.[1] This contrast between the real and financial sectors permits monetary policy to have a short-run impact on output. It is now widely accepted that monetary policy can have an impact on both inflation and the economy's equilibrium response to a real shock, and consequently the course of the business cycle. Developments in economic theory, including game theory and the rational expectations hypothesis, appear to favor a rule-based monetary policy rather than a purely discretionary approach. Further, a generally simple, rule-based approach is believed to maximize the credibility of the central bank, a key input to the effectiveness of the policy itself.

[1] This assumption has recently been challenged in light of the role of asset price bubbles in the precipitation of the credit crisis of 2008. Alternatively, bubbles can be viewed as resulting from long-term asset market frictions (Brunnermeier, 2001).

Perhaps the most popular example of an interest rate-setting rule is Taylor's rule, proposed by John Taylor (1993). According to this rule, the monetary authority's policy choices are guided by the extent to which inflation and output deviate from target levels.[2] However, there is ongoing debate as to the rule's precise specification. For example, there is mounting empirical evidence that the Federal Reserve since the early 1980s has pursued more vigorously a policy of keeping inflation expectations well anchored. This evidence suggests that a policy rule which augments actual inflation by expectations may be optimal, under most circumstances.

A newer line of research suggests that a reformulation of the monetary policy rule using the natural rate of interest does a better job of tracking interest rate changes than does the traditional Taylor rule (Curdia, Ferrero, Ng and Tambalotti, 2015). The natural rate of interest is an inflation-adjusted interest rate that is consistent with an economy at full employment and with stable inflation (Curdia, 2015). It is thus unobservable and must itself be estimated. The model that Curdia et al. developed – a dynamic stochastic general equilibrium model (DSGE)[3] – is able to account for the effects of the Fed's forward guidance and so takes into account the effects of the zero lower bound of the nominal federal funds rate. They then augment the standard Taylor rule by modelling the monetary authority as also seeking to close the gap with the natural rate of interest as well.

Generally monetary policy is conducted primarily through interest rate changes via a federal funds rate policy target. Current and anticipated changes in the federal funds rate in turn influence agents' expectations regarding the rates of return on various financial assets. This framework remains largely in place in the DOB/US model, although in light of the Federal Reserve's maintenance of a near-zero federal funds rate target since December 2008, judgmental adjustments to monetary policy settings must be used, rather than adherence to more mechanical methods. Recent events have also demonstrated that interest rates alone can fail to capture every dimension of credit market functionality. Therefore, alternative credit market indicators, such as banks' willingness to lend, are used to supplement the information contained in interest rates.

However the federal funds rate being essentially at the zero bound spawned an unprecedented period of innovation on the part of the central bank, as it manipulated both the size and composition of its balance sheet in pursuit of its policy goals. Further complicating the modeling of monetary policy is the central bank's use of its communication tools as policy levers, with the Federal Open Market Committee (FOMC) appearing to respond almost instantaneously to recent research calling for further elucidation of its "forward guidance" (Woodford, 2012). Finally, a strict rule-based approach may only be efficacious during periods of "routine change," when economic agents can reasonably form expectations based on relevant prior experience (Woodford, 2013). But the last eight years have been anything but routine. Thus, the real-time evolution of central bank policy – and the economy's response to it – present a series of challenges for macroeconomic forecasting given the lack of historical experience with these unprecedented policy tools.

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[2] The Budget Division specification of the Taylor rule is presented below in Table 4 and the implied federal funds rate target is plotted alongside the effective rate in Figure 5.

[3] DSGE models directly address many of the theoretical concerns that are at the center of current debate and likely represent the next generation of large-scale forecasting models. While these models are being tested currently at the Federal Reserve Board, the Congressional Budget Office and other institutions, and have shown potential, it remains to be demonstrated whether detailed forecasts from these models will ultimately stand up to those of existing macroeconomic models. For a discussion see Edge, Kiley and Laforte (2009).

Overview of Model Structure

DOB/US comprises six modules of estimating equations, forecasting well over 200 variables. The first module estimates real potential U.S. output, measured by real U.S. gross domestic product (GDP). The next module estimates agent expectations, which play a key role in determining long-term equilibrium values of important economic variables, such as consumption and investment, which are estimated in the third module. A fourth module produces forecasts for variables thought to be influenced primarily by exogenous forces but which, in turn, play an important role in determining the economy's other major indicators. The fifth block of estimating equations is the core behavioral model, the largest part of DOB/US. Much of the discussion that follows focuses on this block. Inputs from the third and fourth modules feed into this block. The final module is made up of satellite models that use the core model variables as inputs, but do not feedback themselves into the core behavioral equations. The current estimation period for the model is the first quarter of 1965 through the second quarter of 2018, although some data series do not have historical values for the full period. Descriptions of each of the six modules follow below.

Potential Output and the Output Gap

Potential GDP is the level of output the economy can produce when all available resources are being utilized at their most efficient levels. It is one of the foundational elements of DOB/US and is the basis for the model's long-term equilibrium values and monetary policy forecasts. The economy can produce either above or below this level; when it does so for an extended period, economic agents can expect inflation to rise or fall, respectively, although the precise timing of that movement can depend on a multiplicity of factors. The "output gap" is defined as the difference between actual and potential output.

The Budget Division's method for estimating potential GDP largely follows that of the Congressional Budget Office (CBO) (1995, 2001). Potential GDP is estimated for each of the four major economic sectors defined under U.S. Bureau of Economic Analysis (BEA) National Income and Product Account (NIPA) data: private nonfarm business; private farm; government; and households and nonprofit institutions. The nonfarm business sector is by far the largest sector, accounting for about 76 percent of total GDP. A neoclassical growth model is specified for this sector incorporating three inputs to the production process: labor (measured by the number of hours worked), the capital stock, and total factor productivity. However total factor productivity is not directly measurable. It is estimated by substituting the log-values of hours worked and capital into a fixed coefficient Cobb-Douglas production function, where coefficients of 0.7 and 0.3 are applied to labor and to capital respectively. Total factor productivity is the residual resulting from a subtraction of the log value of output accounted for by labor and capital from the historical log value of output.

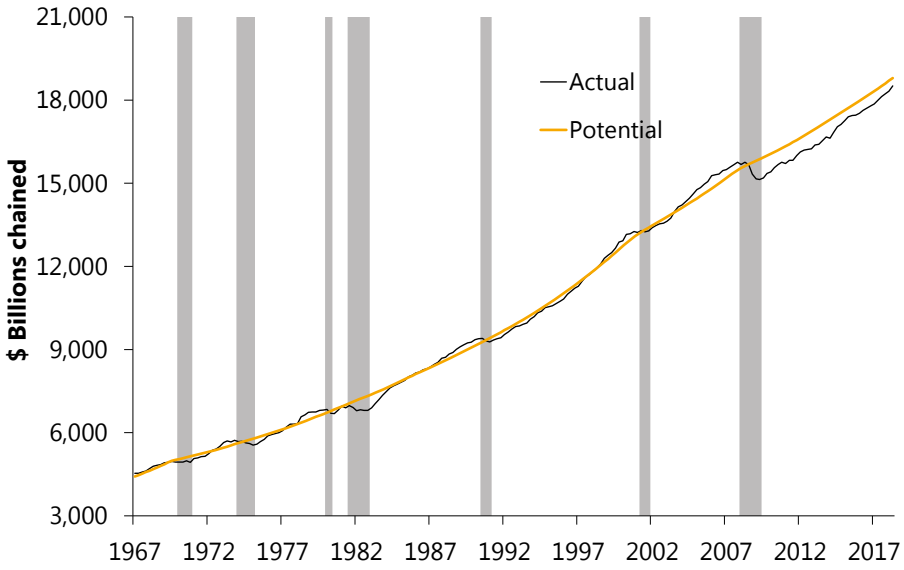
Each of the inputs to private nonfarm business production is assumed to contain two components: one that varies with the business cycle, and a long-term trend component that tracks the evolution of economy's capacity to produce. Estimation of the long-term trend component presumes that the "potential" level of an input grows smoothly over time, though not necessarily at a fixed growth

rate. Inputs are adjusted to their "potential" levels by estimating and then removing the cyclical component from the data series. For example, the cyclical component of the labor input is assumed to be reflected in the deviation of the actual unemployment rate from what economists define as the nonaccelerating inflation rate of unemployment, or NAIRU. When the unemployment rate falls below the NAIRU, indicating a tight labor market, the stage is set for higher wage growth and, in turn, higher inflation. An unemployment rate above the NAIRU has the opposite effect. Once the model is estimated, the potential level is defined as the fitted value from the regression, setting the unemployment rate deviations from the NAIRU equal to zero. This same method is applied to all three of the major inputs to private nonfarm business production.

To obtain a measure of potential private nonfarm business GDP, the potential levels of the three production inputs are substituted back into the production function where hours worked, capital, and total factor productivity are given coefficients of 0.7, 0.3, and 1.0, respectively. For the other three sectors of the economy, the cyclical component is removed directly from the series itself in accordance with the method used to estimate the potential levels of the inputs to private nonfarm business production. Nominal potential values for the four sectors are also estimated by multiplying the chained dollar estimates by the implicit price deflators, based on historical data for each quarter. The estimates for the four sectors are then "Fisher added' together to yield an estimate for total potential real U.S. GDP.[4] Figure 1 compares the DOB construction of potential GDP to actual and illustrates the severe impact of the 2007-2009 recession on national output relative to its potential.

[4] Throughout DOB/US, aggregates of chained dollar estimates are calculated by "Fisher adding" the component series. Correspondingly, components of chained dollar estimates constructed by DOB, such as non-computer nonresidential fixed investment and non-oil imports, are calculated using Fisher subtraction.

Figure 1
Potential vs. Actual U.S. GDP



Note: Shaded areas represent U.S. recessions.
Source: Moody's Analytics; DOB staff estimates.

Expectations Formation

Expectations influence most important macroeconomic relationships. When examining behavioral relationships in a full macroeconomic model, the general characteristics and policy implications of that model will depend upon precisely how expectations are formed.

Rational and Adaptive Expectations

Expectations play an important role in DOB/US in the determination of consumer and firm behavior. For example, when deciding expenditure levels, consumers are assumed to take a long-term view of their wealth prospects. Thus, when deciding how much to spend in a given period, they consider not only their current income but also their lifetime or "permanent income," as per the "life cycle" or "permanent income" hypothesis put forward by Friedman (1957) and others. In estimating their permanent incomes, consumers are assumed to use all the information available to them at the time they make purchases. Producers are also assumed to be forward-looking, basing decisions on their expectations of future prices, interest rates, and output. However, since both households and firms experience costs associated with adjusting their long-term expenditure plans, both are assumed to exhibit a degree of behavioral inertia, making adjustments only gradually.

DOB/US assumes that all economic agents form their expectations "rationally," meaning all available information is used, and that expectations are on average correct over the long-term.

This is yet another assumption seemingly challenged by the subprime debt bubble and other recent events. For example, if investors suspect a persistent mispricing within a certain class of assets, i.e., a bubble, and they know from past experience that arbitrageurs will ultimately correct the mispricing (the bubble will burst) then under the rational expectations hypothesis (REH) they will engage in trades that effectively eliminate it today. Brunnermeier and Nagel (2004) present an alternate view that rests on information asymmetries, funding frictions, and other market imperfections. Thus, since individual investors do not know when other investors will start trading against the bubble, they may be reluctant to "lean against the wind" because of potential lost gains. Rational investors could choose to "ride the bubble" instead, allowing the mispricing to persist. In other words, even a long-term mispricing of an asset may not be inconsistent with the rational formation of expectations. Thus, the REH remains a key underlying assumption in DOB/US, but is hybridized with an alternative behavioral assumption to better capture empirical reality.

Formally, the rational expectations hypothesis implies that the expectation of a variable *Y* at time *t*, Y_t, formed at period *t-1*, is the statistical expectation of Y_t based on all available information at time *t-1*. However, because of the empirical finding that agents adjust their expectations gradually, expectations in DOB/US are assumed to have an "adaptive" component as well, captured by including the term αY_{t-1}, where α is hypothesized to be between zero and one. Consistent with rational expectations theory, it is assumed that agents' long-run average forecast error is zero. This "hybrid" specification is inspired by Roberts (2001), Rudd and Whelan (2003), Sims (2003), and others who argue that adaptive and rational expectations should not be viewed as mutually exclusive, particularly in light of the high information costs associated with forecasting. Moreover, given the empirical importance of lags in forecasting inflation and other economic variables, it cannot be said that observable phenomena such as "habit persistence" and "price-stickiness" are model-inconsistent.

Model builders continue to be challenged in specifying expectations, whose importance is now well established. DOB/US estimates agent expectations in two stages. First, measures of expectations pertaining to three key economic variables are estimated within a vector autoregressive (VAR) framework. These expectations become part of an information set that is shared by all agents who then use them, in turn, to form expectations over variables that are specific to a particular subset of agents, such as households and firms. Details of this process are presented below.

Shared Expectations

All agents in DOB/US use a common information set to form expectations. It consists of three key macroeconomic variables: inflation, represented by the GDP price deflator; the federal funds rate; and the percentage output gap. The percentage output gap is defined as actual real GDP minus potential real GDP, divided by actual real GDP. Values for the early part of the forecast period are fixed by assumption, while values for the remaining quarters are estimated within a VAR framework, with the federal funds rate and the GDP inflation rate in first-difference form (see Table 1).

TABLE 1
SHARED EXPECTATIONS VAR MODEL

Federal Funds Rate (r)

$$\Delta r_t = \underset{(0.028)}{-0.059}\,(r - r_\infty)_{t-1} + \underset{(0.056)}{0.023}\,(\pi - \pi_\infty)_{t-1} + \underset{(0.071)}{0.187}\,\Delta r_{t-1} - \underset{(0.072)}{0.310}\,\Delta r_{t-2} + \underset{(0.073)}{0.154}\,\Delta r_{t-3} + \underset{(0.069)}{0.007}\,\Delta r_{t-4}$$
$$+ \underset{(0.071)}{0.016}\,\Delta\pi_{t-1} + \underset{(0.068)}{0.171}\,\Delta\pi_{t-2} + \underset{(0.064)}{0.088}\,\Delta\pi_{t-3} + \underset{(0.057)}{0.066}\,\Delta\pi_{t-4}$$
$$+ \underset{(0.078)}{0.342}\,\chi_{t-1} - \underset{(0.115)}{0.177}\,\chi_{t-2} - \underset{(0.113)}{0.131}\,\chi_{t-3} + \underset{(0.079)}{0.042}\,\chi_{t-4}$$

Adjusted $R^2 = 0.23$

GDP Deflator (π)

$$\Delta\pi_t = \underset{(0.036)}{-0.046}\,(r - r_\infty)_{t-1} - \underset{(0.070)}{0.115}\,(\pi - \pi_\infty)_{t-1} + \underset{(0.090)}{0.312}\,\Delta r_{t-1} + \underset{(0.092)}{0.053}\,\Delta r_{t-2} + \underset{(0.093)}{0.044}\,\Delta r_{t-3} + \underset{(0.088)}{0.080}\,\Delta r_{t-4}$$
$$- \underset{(0.090)}{0.345}\,\Delta\pi_{t-1} - \underset{(0.086)}{0.248}\,\Delta\pi_{t-2} - \underset{(0.081)}{0.139}\,\Delta\pi_{t-3} + \underset{(0.072)}{0.041}\,\Delta\pi_{t-4}$$
$$+ \underset{(0.098)}{0.058}\,\chi_{t-1} - \underset{(0.146)}{0.034}\,\chi_{t-2} + \underset{(0.143)}{0.077}\,\chi_{t-3} - \underset{(0.100)}{0.016}\,\chi_{t-4}$$

Adjusted $R^2 = 0.20$

Percentage Output Gap (χ)

$$\chi_t = \underset{(0.025)}{-0.008}\,(r - r_\infty)_{t-1} - \underset{(0.049)}{0.032}\,(\pi - \pi_\infty)_{t-1} + \underset{(0.062)}{0.104}\,\Delta r_{t-1} - \underset{(0.064)}{0.306}\,\Delta r_{t-2} + \underset{(0.064)}{0.086}\,\Delta r_{t-3} - \underset{(0.061)}{0.085}\,\Delta r_{t-4}$$
$$+ \underset{(0.063)}{0.045}\,\Delta\pi_{t-1} + \underset{(0.060)}{0.079}\,\Delta\pi_{t-2} - \underset{(0.056)}{0.010}\,\Delta\pi_{t-3} + \underset{(0.049)}{0.001}\,\Delta\pi_{t-4}$$
$$+ \underset{(0.068)}{1.180}\,\chi_{t-1} - \underset{(0.101)}{0.021}\,\chi_{t-2} - \underset{(0.099)}{0.211}\,\chi_{t-3} - \underset{(0.069)}{0.009}\,\chi_{t-4}$$

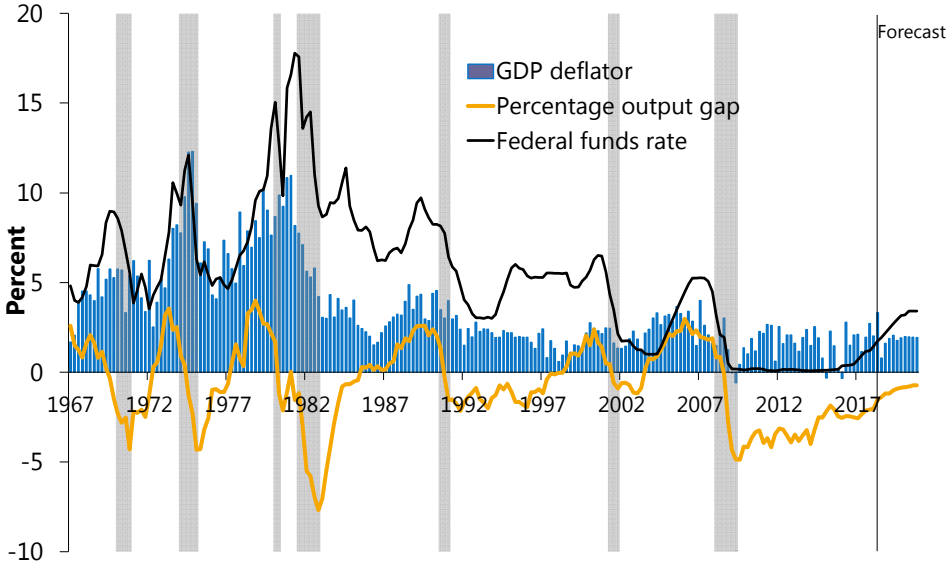
Adjusted $R^2 = 0.91$

Number of Obs = 232

Note: The subscript '∞' is used to indicate the endpoint condition; for the percentage output gap, the endpoint condition stipulates a long-run value of zero.Values in parentheses under coefficients represent standard errors.

The long-run values of these three variables are constrained by "endpoint" conditions. Endpoint restrictions for the federal funds rate and inflation are represented by the first two terms on the right-hand side of each equation in Table 1, while the assumption that the percentage output gap becomes zero in the long run is implied and therefore does not appear explicitly in the equations. The endpoint condition for the federal funds rate is computed from forward rates. For inflation, the terminal constraint is the 10-year inflation rate expectation, as measured by survey data developed by the Federal Reserve Bank of Philadelphia. Figure 2 illustrates how the three variables that make up shared expectations converge to their long-term equilibrium values over time.

Figure 2
Shared Expectations



Note: Shaded areas represent U.S. recessions.
Source: Moody's Analytics; DOB staff estimates.

Agent-Specific Expectations

The common information set is augmented by expectations of agents in specific sectors. For example, households base their consumption decisions on the expected lifetime accumulation of income and wealth. Therefore, the household-specific information set includes expectations over the components of real disposable personal income and values of securities- and non-securities-related wealth. Similarly, the firm sector-specific information set includes expectations over the relative prices of investment goods.

Long-Term Equilibrium Determination

The economy's long-term equilibrium is derived from a set of conditions that results from the optimizing behavior of economic agents, disregarding short-term adjustment costs. In the case of equilibrium consumption, households are assumed to be utility maximizers subject to a lifetime income constraint. Firms are assumed to maximize profits subject to a constant-returns-to-scale production function, and are assumed to exhibit price-taking behavior.

Equilibrium Consumption

In the household sector, optimizing behavior is based on a life-cycle model in which consumers maximize the present discounted value of their expected lifetime utility. Risk-averse consumers who have unconstrained access to capital markets will tend to smooth their consumption spending

over time, by borrowing, saving, or dissaving as circumstances demand, based on an estimate of expected future lifetime resources, commonly referred to as "permanent income." Expected permanent income is comprised of the present discounted value of current and future real disposable income plus the value of household wealth. In DOB/US, the expected value of household permanent income for each quarter in the forecast period is approximated by a relatively stable share of expected potential GDP plus expected values for securities-related and nonsecurities-related wealth. The expected values for all of the components of permanent income are determined in the agent-specific expectations module.

Real disposable income is made up of several income sources, including labor income, property income (including income from interest and dividends), and transfer income. For relatively young working-age household members, labor income will constitute a large share of permanent income, whereas for those in retirement, property and transfer income will predominate. Therefore, the precise composition of aggregate permanent income at any given point in time will depend on the age profile of the U.S. household population. Since this age profile varies over time, the various components of permanent income enter the equation for long-term equilibrium consumption separately. In addition, this equation includes the current and lagged values of the output gap, capturing the notion that the rate at which households discount future income may depend on household perceptions of income risk, which in turn is assumed to vary with the business cycle. In DOB/US, the variation in long-term equilibrium consumption is assumed to be best approximated by the variation in those components of total consumption that tend not to exhibit extreme volatility over the course of the business cycle, namely services and nondurable goods.[5]

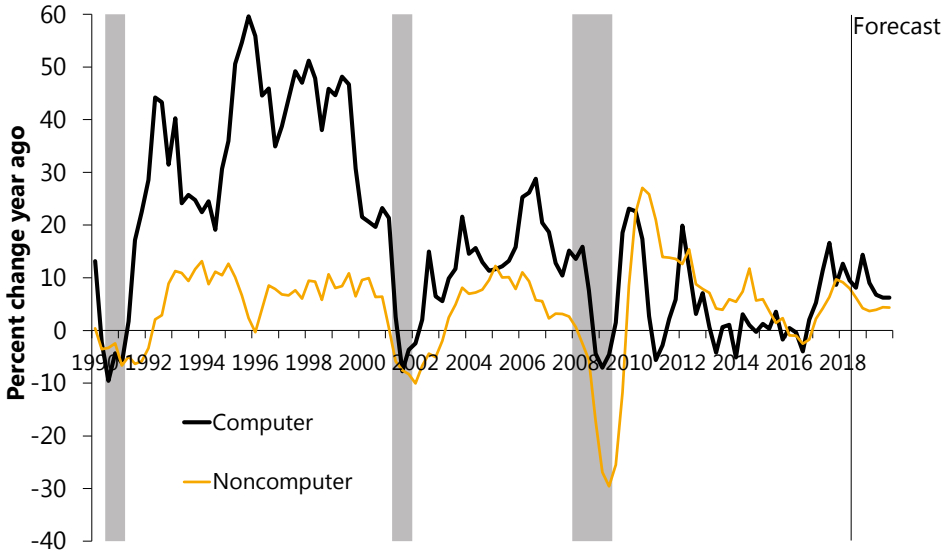
Equilibrium Investment in Producer Durable Equipment

Between 1992 and 2000, nonresidential investment in producer durable equipment grew at an average annual rate of 11 percent. However, most econometric models failed to capture this persistent and significant growth while it was occurring. Tevlin and Whelan (2000) postulate two reasons why so many models failed to capture the late 1990s investment boom. First, the average depreciation rate for producer durable equipment increased dramatically as computers grew as a share of the total. The rapid rate of advancement in digital technology rendered computer and related equipment obsolete in just a few years. Indeed, the depreciation rate for computers and related equipment is more than twice that for other equipment.[6] Second, investment became more sensitive to the user cost of capital. In order to address these problems, DOB/US estimates investment in computer equipment separately from the remainder of producer durable equipment.[7] Figure 3 compares the growth in the two investment components since 1990.

[5] A "Fisher addition" of nondurable and services consumption produces the noncyclical component of total consumption.
[6] See Fraumeni (1997).
[7] The brisk growth of computer equipment as a share of total producer durable equipment may represent in part an error in the data. Chain-weighting tends to overestimate real quantities when prices fall as quickly as those of computers and related equipment.

Figure 3

Real Producer Durable Equipment Growth



Note: Shaded areas represent U.S. recessions.
Source: Moody's Analytics; DOB staff estimates.

Profit-maximizing behavior dictates that the long-term rate of equilibrium investment is the rate of investment that maintains the optimum capital-output ratio. Assuming a standard Cobb-Douglas production function, the optimal capital-output ratio will be proportional to the ratio of the price of output to the rental rate of capital. This relationship holds for both types of producer durable equipment. Given this optimal ratio, desired growth in investment varies with output growth and changes in the rental rate of capital.

For each type of equipment, the rental rate of capital is defined as its purchase price, represented by the implicit price deflator, multiplied by the sum of the financial cost of capital and the rate of depreciation. The financial cost of capital, a measure of the cost of borrowing in equity and debt markets, is estimated by giving equal weight to an estimate of the after-tax cost of equity and the yield on Moody's Baa-rated corporate bonds.[8] As discussed above, different rates of depreciation are used for computer and noncomputer equipment.

Equilibrium Prices, Productivity, Wages, and Hours Worked

In equilibrium, the price level is determined by the condition that in competitive markets price equals marginal cost. Long-run productivity growth is determined by a time series model reflecting the belief that its own recent history is the best predictor of future growth. Long-term equilibrium nominal wage growth is determined by the sum of trend productivity growth and the long-term expected rate of inflation. The desired level of man-hours worked is constructed by dividing potential real GDP by trend labor productivity.

[8] The series that estimates the after-tax cost of borrowing in the equity market is created by IHS Economics.

Exogenous Variables

There are many economic variables for which economic theory provides little or no guidance as to either their long-term or short-term behavior. The exogenous variable module estimates future values for over 30 such variables; their inputs are variables from the shared information set and autoregressive terms. Although a few exogenous variables become inputs to the behavioral equations within the core behavioral module, most are incorporated into identity equations defined so as to arrive at NIPA concepts.

The Core Behavioral Module

The core behavioral module contains 133 estimating equations, 38 of which are behavioral. The behavioral equations summarize the behavior of representative agents acting with foresight to achieve optimal outcomes in the presence of constraints. In the economy's real sector, the short-run movement toward equilibrium is hampered by adjustment costs. Through the dynamic adjustment process, agents plan to close the gap between the current level of the variable in question and its desired level. The magnitude of an adjustment made by agents during any given period is based on the size of the gap, past values of the variable, and past and expected values of other variables that may affect agents' decisions.

In the financial sector, agents are assumed to adjust instantaneously when new information becomes available. Therefore, the equations for this sector do not contain any dynamic adjustment terms. The core behavioral module is composed of five sectors: households, firms, government, the financial sector, and the foreign sector. Each is described below.

The Household Sector

The main decision variables for households are consumption, housing investment, and labor supply. Following Brayton and Tinsley (1996), DOB/US assumes the existence of two groups of consumers. The larger class consists of forward-looking, utility-maximizing consumers whose consumption decisions are constrained by their permanent incomes as defined above. Implicit in the model is the recognition that this group of households is heterogeneous, representing various stages of the lifecycle. The second group is comprised of low-income households, who are assumed to base their consumption decisions on current-period income rather than permanent income. Such behavior may arise because of credit market constraints that prevent these households from borrowing for the purpose of smoothing their spending over time. Consequently, such households are referred to as "liquidity constrained."

TABLE 2
HOUSEHOLD SECTOR

Noncyclical Consumption

$$\Delta \ln C1_t = \underset{(0.0005)}{0.003} + \sum_{\tau=0}^{5} EZQC_{t+\tau} + \underset{(0.018)}{0.004}\,(\ln QC - \ln C1)_{t-1} + \underset{(0.060)}{0.288}\,\Delta \ln C1_{t-1} + \underset{(0.030)}{0.132}\,(\Delta \ln Y_t - \sum_{\tau=0}^{5} EZQC_{t+\tau})$$
$$+ \underset{(0.279)}{1.1124} \sum_{\tau=0}^{5} EZGAP_{t+\tau} + \underset{(0.028)}{0.055}\,\Delta \ln Y_{t-3} - \underset{(0.003)}{0.010}\,D1980Q2_t + \underset{(0.00002)}{0.00002}\,SLACB_t$$

Adjusted $R^2 = 0.44$

Cyclical Consumption

$$\Delta \ln C2_t = \sum_{\tau=0}^{5} EZQC_{t+\tau} + \underset{(0.001)}{0.003}\,(\ln QC - \ln C2)_{t-1} - \underset{(0.057)}{0.289}\,\Delta \ln C2_{t-1} + \underset{(0.173)}{0.370}\,\Delta \ln Y_t$$
$$+ \underset{(0.040)}{0.155}\,\Delta \ln INVH_{t-1} - \underset{(0.020)}{0.101}\,D1970Q4_t - \underset{(0.020)}{0.091}\,D1974Q4_t - \underset{(0.021)}{0.067}\,D1980Q2_t$$
$$- \underset{(0.020)}{0.070}\,D1981Q4_t - \underset{(0.020)}{0.089}\,D1987Q1_t + \underset{(0.020)}{0.083}\,D2001Q4_t + \underset{(0.00009)}{0.00057}\,SLACB_t$$

Adjusted $R^2 = 0.54$

Residential Fixed Investment

$$\Delta INVH_t = \underset{(3.009)}{-9.090} + \sum_{\tau=0}^{5} EZQC_{t+\tau} + \underset{(0.206)}{0.383}\,(QC / INVH)_{t-1} + \underset{(0.053)}{0.511}\,INVH_{t-1}$$
$$+ \underset{(0.054)}{0.224}\,SLACB_t + \underset{(0.124)}{0.366}\,\Delta PSH_t + \underset{(0.014)}{0.027}\,\Delta Y_t$$
$$+ \underset{(7.4)}{31.9}\,D1980Q2Q3Q4_t + \underset{(12.5)}{39.8}\,D1976Q4_t + \underset{(12.5)}{32.5}\,D1977Q2_t$$

Adjusted $R^2 = 0.57$

Banks' Willingness to Lend to Consumers

$$SLACB_t = \underset{(0.050)}{0.664}\,SLACB_{t-1} - \underset{(0.835)}{7.386}\,\Delta LIBOR3_t + \underset{(102.7)}{532.98}\,\Delta \ln GDPR_t$$

Adjusted $R^2 = 0.62$

Number of Obs = 201

Note: Values in parentheses under coefficients represent standard errors.

C1	Real noncyclical consumption
C2	Real cyclical consumption
QC	Desired real noncyclical consumption
Y	Real disposable personal income
EZQC	Expected desired noncyclical consumption
EZGAP	Expected potential GDP gap
SLACB	Willingness to lend to consumers
INVH	Residential fixed investment
PSH	Real new home price
LIBOR3	3-month LIBOR rate
GDPR	Real GDP

The four equations for the household sector incorporate expectations from either the shared information set VAR model or the agent-specific information set. The agent-specific information

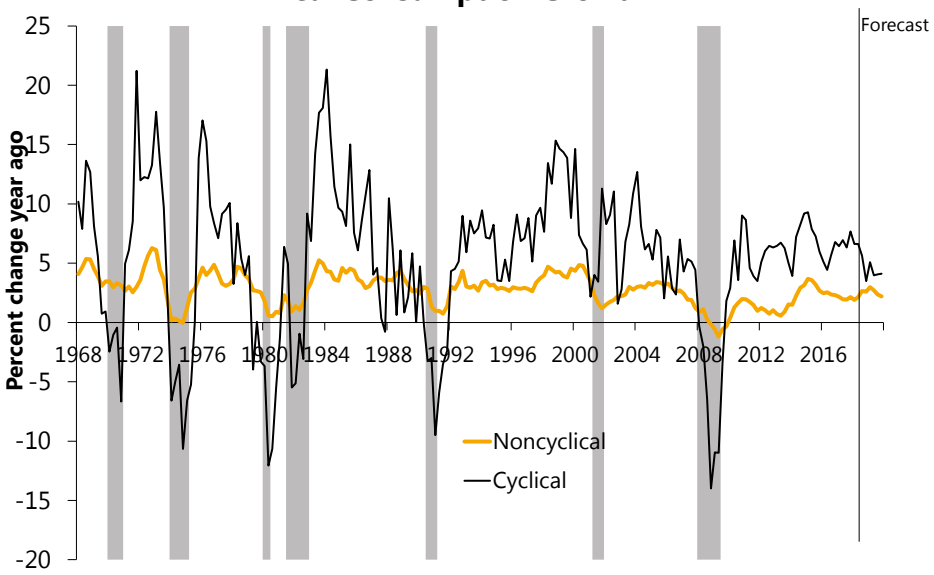
set for the household sector contains the expected value of wage and nonwage income, as well as the expected value of household wealth. The behavioral equations for the household sector balance the theoretically appealing notion of a long-term equilibrium with the empirically observed phenomenon of habit persistence and adjustment costs. The equations for the determination of cyclical consumption, noncyclical consumption, and housing investment appear in Table 2. Brief descriptions of the equations follow.

Consumption

Consumption is divided into cyclical (durable goods) and noncyclical (services and nondurables) components, since these two segments tend to exhibit significantly different growth rates over the course of a business cycle (see Figure 4). Noncyclical consumption is estimated using first differences of the logs of the data within a polynomial adjustment cost framework. The equation contains an error-correction term that captures the tendency toward long-run equilibrium, a lagged dependent variable that captures habit persistence, forward expectations of both desired noncyclical consumption and the output gap, bank willingness to lend to consumers, and real income. The latter term captures the behavior of liquidity-constrained households.

The specification for cyclical consumption is very similar to the noncyclical consumption specification, except for the exclusion of the error-correction and second expectations terms; the equation also includes real residential fixed investment, which tends to induce demand for household furniture, appliances, and other durable goods. Both equations contain dummy variables that account for extreme cyclical volatility and Federal policy shocks.

Figure 4
Cyclical vs Noncyclical
Real Consumption Growth



Note: Shaded areas represent U.S. recessions.
Source: Moody's Analytics; DOB staff estimates.

Residential Fixed Investment

Residential investment by households is estimated using a dynamic adjustment equation, which assumes that households adjust their rate of housing investment in accordance with a long-term equilibrium relation between desired noncyclical consumption and housing services. A home price variable is also included in order to capture features of both supply and demand in the housing market. Thus, the equation contains desired consumption divided by current housing investment, a lagged endogenous variable to capture habit persistence, forward-looking expectations of desired consumption, bank willingness to lend to consumers, and the real average purchase price of one-family homes.

Bank Willingness to Lend

Also appearing in Table 2 is the forecasting model for bank willingness to lend to consumers, based on the Federal Reserve Board Senior Loan Officer Survey. This captures the impact on consumer spending of credit market conditions beyond what the interest rate alone can capture. The model specification for bank willingness to lend includes its own lag, the 3-month LIBOR rate (to account for interbank lending costs), and real GDP growth (which is assumed to be inversely related to default risk).

Labor Supply

Households must make decisions about how much labor they will supply to the labor market. In DOB/US, the behavioral equation that determines the first difference of the labor force participation rate includes its own lags; real GDP lagged three quarters; a dummy variable capturing the influx of women into the labor market from the 1960s through 1980s; and dummy variables capturing the extraordinary increased hiring of federal government workers in the first quarter of 1990, 2000, and 2010 to conduct the Decennial Censuses. The labor supply is then determined by multiplying the labor force participation rate by an estimate of the working-age population (ages 16 through 64).

The Firm Sector

DOB/US incorporates the assumption that firms set their prices and levels of factor inputs used in production in order to maximize profits. This sector determines the levels of the two components of nonresidential fixed investment in equipment; private nonresidential structures; investment in intellectual property products; labor demand; real wages; and output prices. Like the behavioral equations describing the household sector, several of the firm-sector equations incorporate both error-correction terms to capture the impact of long-term equilibrium relationships, and dynamic adjustment terms to capture firm-level adjustment costs. The behavioral equations for investment in computer-related producer durable equipment, all other producer durable equipment, nonresidential structures, and intellectual property products appear in Table 3.

TABLE 3
FIRM SECTOR: NONRESIDENTIAL FIXED INVESTMENT

Computer and Related Equipment

$$\Delta lCO_t = \underset{(0.439)}{-1.263} + \sum_{\tau=0}^{5} \underset{}{EQICO_{t+\tau}} + \underset{(0.022)}{0.022}\ (QlCO - lCO)_{t-1} - \underset{(0.132)}{0.109}\ \Delta lCO_{t-1} + \underset{(0.007)}{0.026}\ \Delta POTGDP_t$$
$$- \underset{(0.005)}{0.001}\ \Delta RRC_{t-1} - \underset{(1.214)}{2.804}\ Y2KD_t - \underset{(1.759)}{2.563}\ D2008Q3_t - \underset{(1.812)}{5.029}\ D2008Q4_t$$
$$+ \underset{(1.747)}{7.685}\ D2009Q4_t - \underset{(0.160)}{0.119}\ AR1_t$$

Adjusted $R^2 = 0.21$

Noncomputer Equipment

$$\Delta lEXCO_t = \underset{(1.006)}{2.335} + \sum_{\tau=0}^{5} EQIEXCO_{t+\tau} + \underset{(0.016)}{0.063}\ (EQIEXCO - lEXCO)_{t-1} + \underset{(0.060)}{0.456}\ \Delta lEXCO_{t-1}$$
$$+ \underset{(0.416)}{0.504}\ GDPGAP_t - \underset{(209.7)}{479.2}\ \Delta RRO_{t-1} - \underset{(9.300)}{7.310}\ Y2KD_t$$

Adjusted $R^2 = 0.37$

Structures

$$\Delta \ln lS_t = \underset{(0.062)}{0.339}\ \Delta \ln lS_{t-1} + \underset{(0.063)}{0.147}\ \Delta \ln lS_{t-2} + \underset{(0.186)}{0.808}\ \Delta \ln GDP_t - \underset{(0.063)}{0.147}\ \Delta \ln RRS_{t-3}$$
$$+ \underset{(0.120)}{0.244}\ \Delta \ln RRO_t - \underset{(0.025)}{0.105}\ D1986Q2_t - \underset{(0.025)}{0.105}\ D2001Q4_t + \underset{(0.026)}{0.063}\ D1978Q2_t$$

Adjusted $R^2 = 0.40$

Intellectual Property Products

$$\Delta \ln lIPP_t = \underset{(0.065)}{0.427}\ \Delta \ln lIPP_{t-1} - \underset{(0.008)}{0.012}\ Y2KD_t + \underset{(0.177)}{1.255}\ \Delta \ln POTGDP_t$$

Adjusted $R^2 = 0.27$

Number of Obs = 201

Note: Values in parentheses under coefficients represent standard errors.

ICO	Nonres. fixed investment – computer and related equipment
EQICO	Expected desired computer investment
QICO	Desired computer investment – durable equipment
POTGDP	Potential GDP
RRC	Rental rate – computers
Y2KD	Post-Y2K dummy for 2001
AR1	First-order autocorrelation correction
IEXCO	Nonres. fixed investment – durable equip. excl. computers
EQIEXCO	Expected future desired investment – durable equip. excl. computers
QIEXCO	Desired investment – durable equip. excl. computers

GDPGAP	Percent real GDP gap
RRO	Rental rate of capital – other durable equipment
AR3	Third-order autocorrelation correction
IS	Nonres. fixed investment – structures
GDP	Real GDP
RRS	Rental rate – structures
D1986Q2	Dummy for Tax Reform Act of 1986
D2001Q4	Dummy for retroactive provision of Job Creation and Worker Assistance Act of 2002

Nonresidential Investment

With the release of the 2013 NIPA comprehensive revision in July, research and development, entertainment, literary, and artistic originals are capitalized and grouped with software, forming a new category of investment spending called intellectual property products. As a result, DOB/US now estimates four categories of real nonresidential investment: investment in computer-related producer durable equipment; investment in all other equipment; investment in nonresidential structures; and investment in intellectual property products. The estimating equations for investment in computer and related equipment and all other equipment are virtually identical. Both equations contain an error-correction term, defined as a lag difference between equilibrium and current investment; an autoregressive term; forward expectations of equilibrium investment; and the appropriate rental rate of capital, as defined above. The computer equipment equation contains the first difference of potential GDP growth, a dummy variable to capture the large decline in investment during the second and third quarters of 2001, as well as other dummies. The equation for noncomputer equipment contains the current period value of the output gap. Investment in nonresidential structures is determined by its own past values; real U.S. GDP growth; its own rental rate and the rental rate of noncomputer equipment; and dummy variables. Investment in intellectual property products is determined by its own past value, the first log difference of potential GDP growth, and a dummy variable to capture the large decline in investment during the second and third quarters of 2001.

Labor Demand: Hours Worked and Employment

In DOB/US, the level of national employment is determined by estimating equations for the number of hours worked and the length of the average workweek, which together capture the nonfarm private business sector's demand for labor. Total employment, in turn, affects the movements of many other economic variables, such as output, wages, consumption, and inflation. Hours worked are estimated using a dynamic adjustment equation that includes an error-correction term composed of the difference between long-term equilibrium hours and actual hours; real U.S. GDP growth; the expected one-period-ahead value of the output gap; and dummy variables.

The estimating equation for the average length of the workweek in the private nonfarm business sector also contains an error-correction term and the expected one-period-ahead value of the output gap. In addition, the model includes growth in real private nonfarm business GDP and dummy variables. The level of total private nonfarm employment is determined by dividing hours worked by the average length of the workweek multiplied by the number of weeks in a year.

The Wage Rate

The average hourly wage rate is defined as total private employee compensation (cash wages and salaries plus additional costs such as medical insurance premiums and employer contributions for social insurance) divided by hours worked. The long-run equilibrium growth in the wage rate is assumed to depend on trend productivity growth and the inflation rate, where inflation is measured by the private nonfarm chain-weighted GDP deflator and productivity is private nonfarm output divided by hours worked adjusted to remove the effects of the business cycle. Thus, the equilibrium wage rate at time *t* is its value at time *t-1* plus the sum of the growth rates for productivity and inflation. The actual quarterly wage rate is modeled in an error-correction framework but contains additional lags capturing the presence of "wage-stickiness." The model also includes the expected one-period-ahead value of the output gap to capture the impact of forward-looking behavior on the speed of adjustment toward equilibrium.

Output Prices

The price level is represented by the private nonfarm chain-weighted GDP deflator. Its growth is modeled within a dynamic adjustment framework in which the price level adjusts gradually from its current level to its long-term equilibrium value. The model also includes the expected one- and two-period-ahead values of the output gap, again to capture the impact of forward-looking behavior on the speed of adjustment toward equilibrium. In addition, the model contains the petroleum products component of the Producer Price Index (PPI) to capture the impact of wholesale energy prices, as well as dummy variables to capture the impact of the 1970s oil shocks above and beyond what is captured by the PPI.

The Government Sector

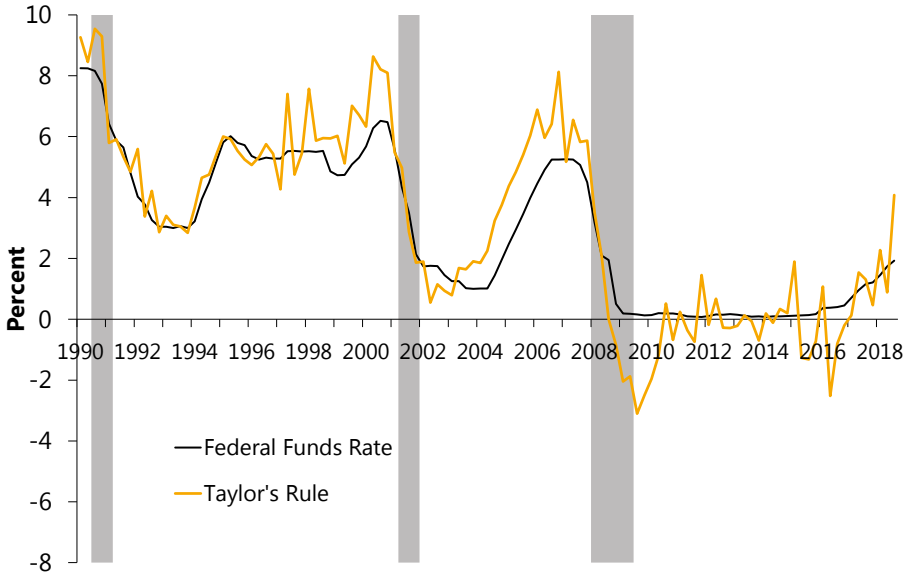
Monetary policy affects economic and financial decisions made by agents in the economy. The objective of monetary policy is to stabilize the economy's performance – as reflected in the behavior of inflation, output, and employment – by balancing the twin goals of full employment and price stability. This is accomplished by raising or lowering short-term interest rates through changes in the central bank's target federal funds rate in a manner that is consistent with its twin goals. Taylor's rule is a federal funds rate reaction function that responds to the deviation of inflation from its long-term target level and to the deviation of output growth from its potential level. The rule also yields a "normative prescription" for the direction of future policy.[9] As illustrated in Figure 5, Taylor's rule approximates the way the Federal Reserve has historically conducted monetary policy, particularly when the classic rule is augmented by expectations over future inflation and output. However, recent experience highlights the challenge to the central bank when the target approaches the zero lower bound.

Taylor's rule has several desirable features. First, it is formulated in terms of three components: the federal funds rate; a measure of inflation; and the output gap. Thus, the rule posits a direct relationship between the Federal Reserve's primary policy instrument and the two indicators most important in judging the success of its stabilization policy. No intermediate targets are necessary,

[9] See Woodford (2002), p. 39.

greatly increasing the rule's appeal to policy makers. Second, the rule possesses the simplicity of a linear relationship. Finally, although Taylor's rule represents an empirical relationship, it has also been demonstrated to possess desirable theoretical properties as well. For example, Taylor's rule leads to a determinate rational-expectations equilibrium that is robust to the introduction of a plausible dynamic learning process.

Figure 5
Federal Funds Rate vs. Rate Implied by Taylor's Rule



Note: Shaded areas represent U.S. recessions.
Source: Moody's Analytics; DOB staff estimates.

Within DOB/US, monetary policy is administered through a modified version of Taylor's classic monetary rule. Deviations from the Federal Reserve's assumed inflation target are weighed twice as heavily as deviations from its output growth target, i.e., inflation deviations have a weight of one while output-growth deviations have a weight of 0.5. In addition, the contemporaneous value of inflation is replaced by an average of actual inflation for the past three quarters and expected inflation for both the current quarter and the quarter ahead. A similar modification is made to the output growth term. Hence, this modified specification operationalizes the requirement that the central bank be able to project the effect of its policy alternatives on the output gap and inflation and that its policy choice be consistent with that projection. The DOB/US specification of Taylor's rule appears in Table 4.

TABLE 4
MONETARY POLICY: TAYLOR'S RULE

$$r_T = \bar{\pi}_t + R_t + 1(\bar{\pi}_t - \pi_T) + 0.5(\bar{g}_t - g_T)$$

$$\bar{\pi}_t = \frac{\pi_{t-3} + \pi_{t-2} + \pi_{t-1} + \pi_t + \pi_{t+1}}{5}$$

$$\bar{g}_t = \frac{g_{t-3} + g_{t-2} + g_{t-1} + g_t + g_{t+1}}{5}$$

$$\textit{where}, \quad R_t = r_t - \pi_t$$

r_T	Federal funds target rate	g	GDP growth rate
$\bar{\pi}$	Average GDP inflation	$\bar{g}$	Average GDP growth rate
R	Real rate of interest	g_T	GDP target growth rate
π	GDP inflation	r	Federal funds market rate
π_T	Inflation target		

DOB/US also contains equations that estimate the contribution to GDP from Federal, and state and local governments. Spending by both the Federal government and state and local governments depends on the revenues they collect. Although government revenues come from various sources – the personal income tax, sales taxes, corporate business taxes, and fees – we find that personal income tax revenues act as an adequate proxy for revenues from all these sources. Since the components of personal income grow at varying rates, the models for both Federal and state and local revenues include these components separately, as well as effective tax rates. All government sector variables are modeled in first-differenced logarithmic form.

Since government receipts are only available in nominal terms, final demand by the government sector is modeled in nominal terms as well. Real spending is calculated by deflating these nominal values by the appropriate price deflators. Because governments determine their budgets before they know how much revenue they will collect, they do not adjust quickly to current revenue shocks. In addition, Federal government spending is not constrained in the short run by contemporaneous-year revenues. Therefore, government spending models include past revenues with lags up to seven quarters, as well as the current period nonfarm GDP price deflator. The Federal government spending model also includes the percentage GDP gap, capturing the countercyclical nature of some government spending, and government employment, since employee compensation accounts for most of the state and local government contribution to final demand.

In addition, DOB/US estimates the impact of changes in fiscal policy on the macroeconomy. Because the primary determinant of consumer spending is households' long-term expectations of disposable income, modeling the impacts of fiscal policy plays an important role in forecasting household consumption when there is a policy change, such as the anticipated expiration of the payroll tax holiday at the end of 2012. For this purpose, DOB/US combines the most recent Joint Committee on Taxation and CBO estimates where available with results from Current Expenditure Survey data, disaggregated by income level, to estimate how much of the change in disposable income will affect consumption.

The Financial Sector

The financial sector of DOB/US is subdivided into two blocks of equations: one determining equity prices and the other determining interest rates. Many analysts believe that short-run changes in stock market prices follow a random walk and therefore it is impossible to forecast the day-to-day movements of individual stocks with any accuracy. However, long-run movements in price indices of large groups of stocks appear to move systematically with other economic variables. Much of the variation in the growth of the S&P 500 stock price index can be explained by the contemporaneous and expected growth of pre-tax corporate profits after normalizing by the interest rate on Baa corporate bonds. A lead term is added to capture the influence of profit expectations on investors' decisions to buy and sell equities, and, subsequently, on stock prices.

In addition to the federal funds rate, which is modeled based on Taylor's rule, DOB/US contains models for six interest rates: the three-month, one-year, five-year, and ten-year U.S. Treasury yields, as well as the Baa corporate bond rate and the 30-year conventional mortgage rate. These equations are specified within an error-correction framework based on the expectations theory of the term structure of interest rates, which posits that the yield on the long-term bond equals the expected yield on a series of short-term bonds over the life of the long-term bond, plus term and risk premiums. The theory implies that the rate on one-year government bonds can be used to explain the rate on five-year bonds, which, in turn, is used to explain the rate on bonds of longer maturities. Although the term and risk premiums are not explicitly captured in the estimated model, their impacts are embodied in the estimated coefficients. A real GDP gap term is added to most of the equations in order to capture the impact of expected (future) inflationary pressures on the current yield curve. Adjustments are made to account for the anticipated impact of the Federal Reserve's less traditional policies, such as quantitative easing and operation twist.

The Foreign Sector

Real U.S. exports are determined by the level of foreign economic activity, as measured by an estimate of the growth rate of global GDP, and by U.S. export prices relative to foreign prices. Real imports are divided into non-oil and oil goods and services. Non-oil imports are a function of real domestic demand and the ratio of import prices to domestic prices. Oil imports are a function of real domestic demand, as well as oil prices relative to domestic prices. Both imports and exports equations contain additional dummy variables to capture one-time shocks, such as the September 11 terrorist attacks and the oil shocks of the 1970s.

Satellite Models

Sectoral Employment

Total employment is disaggregated into 20 industrial sectors based on the North American Industry Classification System (NAICS). Individual equations incorporate "structural" variables that are forecast in prior modules, such as hours worked, real GDP, real personal income, the S&P 500 adjusted for inflation, interest rates, and demographic variables. The general approach is to estimate an error-correction model, although the error-correction term is dropped if it is not

significant. Some of the sectors are modeled in differences from the year-ago level, in order to remove seasonality. To capture seasonality in those sectors that are modeled in first differences, we add time-varying seasonal dummy variables, which are constructed using the X11 procedure developed by the U.S. Census Bureau.

Nominal Consumption Detail

DOB forecasts 16 detailed components of nominal consumption expenditures for the purpose of forecasting sales tax receipts (see the "Sales and Use Tax" section). Three examples of these forecasting models are presented in Table 5. All models are in first-differenced log form.

The three major components of consumption expenditures are durable goods, nondurable goods, and services. To help ensure that the detailed components add up to the projected totals, either the total or a function of the total appears on the right-hand side and is retained if the coefficient is statistically significant. For example, total durable consumption spending minus spending on motor vehicles and parts is on the right-hand side of furnishings and durable household equipment spending. Also included are its own lagged value, fixed residential investment, bank willingness to lend, and some dummy variables to account for large shocks that the other explanatory variables cannot account for. Given that the impact of credit market conditions are already to some extent accounted for by total durable spending, the negative coefficient on bank willingness to lend may be an indication that this component is less sensitive to credit market conditions than the total less spending on motor vehicles and parts.

TABLE 5
SELECTED CONSUMPTION MODELS

$$\Delta \ln CDFHEQ_t = \underset{(0.00058)}{-0.0005} + \underset{(0.036)}{0.815}\ \Delta \ln\left(CD_t - CDMVPQ_t\right) + \underset{(0.013)}{0.074}\ \Delta \ln IFIXR_t + \underset{(0.029)}{0.0745}\ \Delta \ln CDFHEQ_{t-2}$$

$$\underset{(0.00003)}{-\ 0.00008}\ SLACB_t - \underset{(0.005)}{0.026}\ D1986Q4_t + \underset{(0.005)}{0.0204}\ D1989Q1_t$$

$$\text{Adjusted } R^2 = 0.89$$

$$\Delta \ln CNGFOQ_t = \underset{(0.003)}{-0.0155} + \underset{(0.229)}{1.757}\ \Delta \ln CN_t + \underset{(0.025)}{0.458}\ \Delta \ln WPI057_t + \underset{(0.0001)}{0.0002}\ SLACB_t$$

$$\text{Adjusted } R^2 = 0.92$$

$$\Delta \ln CSTRSQ_t = \underset{(0.0017)}{-0.002} + \underset{(0.112)}{0.694}\ \Delta \ln\left(CS_t - CSMEDQ_t - CSHHOQ_t - CSFIQ_t\right) - \underset{(0.007)}{0.004}\ \Delta \ln WPI057_{t-1}$$

$$+ \underset{(0.074)}{0.072}\ \Delta \ln CSTRSQ_{t-1} + \underset{(0.00005)}{0.0002}\ SLACB_t + \underset{(0.199)}{0.789}\ \Delta \ln EEAP_t$$

$$\text{Adjusted } R^2 = 0.57$$

$$\text{Number of Obs} = 154$$

Note: Values in parentheses under coefficients represent standard errors.

CDFHEQ	PCE: Furnishings and Durable Household Equipment
CD	PCE: Durable Goods
CDMVPQ	PCE: Motor Vehicle and Parts
IFIXR	Residential Investment
SLACB	Willingness to lend to consumers
D1986Q4	Dummy (=1 for 1986Q4; 0 otherwise)
D1989Q1	Dummy (=1 for 1989Q1; 0 otherwise)
CNGFOQ	PCE: Gasoline and Other Energy Goods
CN	PCE: Nondurable Goods
WPI057	PPI: Finished Energy Goods
SLACB	Willingness to lend to consumers
CSTRSQ	PCE: Transportation Services
CS	PCE: Services
CSMEDQ	PCE: Medical Services
CSHHOQ	PCE: Housing Services
CSFIQ	PCE: Financial Services
EEAP	U.S. Private Employment

The model specification for consumer spending on gasoline and other energy goods includes total nondurable consumption, of which it is a component; the energy goods component of the Producer Price Index (PPI) for finished goods; and bank willingness to lend. The model specification for consumer spending for transportation services includes total services consumption less spending for medical, housing, and financial services; the energy goods component of the PPI for finished goods; bank willingness to lend; and total private sector employment to capture changes in aggregate demand.

Other Prices

The nonfarm private GDP deflator and other deflators from the core model are used to forecast several implicit price deflators for consumption, as well as the overall Consumer Price Index (CPI) and some of its components. The PPI for refined petroleum products and other implicit price deflators for consumption are used to forecast several components of the PPI.

Nonpersonal Service Inflation

DOB provides forecasts for 36 detailed price components specifically for the purpose of forecasting the nonpersonal service (NPS) expenditure component of the State budget. Since these forecasts are used by many different units within the Division for fiscal planning purposes, most are modeled on a State fiscal year basis. This set of forecast variables includes price deflators for medical equipment, office equipment, office supplies, energy-related products, business services, and real estate rentals. Right-hand-side variables for these models include the DOB/US forecasts for price indices described above. For example, the price index for light fuel oil explains much of the variation in the index for home heating oil. Likewise, the price index for medical equipment is well represented by the price index for total medical care excluding medical services and drugs and medical supplies. All three of the latter measures are forecast within DOB/US. Table 6 presents the model specifications for these two price series.

TABLE 6
SELECTED PRICE DEFLATORS

Home Heating Oil

$$\Delta \ln WPI057302_t = \underset{(0.014)}{0.995}\ \Delta \ln WPI0573_t$$

Adjusted $R^2 = 0.97$

Number of Obs $= 158$

Medical Equipment

$$\Delta \ln CPIUEMB_t = \underset{(0.004)}{-\ 0.018} + \underset{(1.440)}{6.446}\ \Delta \ln CPIMED_t - \underset{(1.233)}{4.716}\ \Delta \ln CPISVMED_t - \underset{(0.223)}{0.706}\ \Delta \ln CPIUEMA_t + \underset{(0.009)}{0.014}\ d1995$$

Adjusted $R^2 = 0.90$

Number of Obs $= 40$

Note: Values in parentheses under coefficients represent standard errors.

WPI057302	PPI: Fuel oil #2 home heating oil
WPI0573	PPI: Light fuel oils
XCPIUEMB	CPI: Medical equipment
CPIMED	CPI: Medical care
CPISVMED	CPI: Medical services
CPIUEMA	CPI: Drugs and medical supplies

Other Interest Rates and the Wilshire 5000

DOB/US also estimates eight additional interest rates, including commercial paper rates, Treasury bond rates, state and local municipal bond rates, London Interbank Offering Rate (LIBOR) rates, and mortgage rates. These rates are estimated in single-equation models using variables from the core model as inputs. The Wilshire 5000 stock price index is estimated using the S&P 500 stock price index as an explanatory variable.

Miscellaneous Variables

Many miscellaneous variables are forecast using variables from all the models discussed above, as well as the New York model. Forecasts of these miscellaneous variables are based on single-equation models.

Current Quarter Estimation

The DOB/US macroeconomic models described above are all quarterly models, consistent with their primary data source, the BEA's National Income and Product Accounts (NIPA) data. However, BEA's quarterly estimates are themselves based on data compiled (generally at a monthly frequency) by the U.S. Department of Labor Bureau of Labor Statistics (BLS); the U.S. Department of Commerce's Census Bureau; and the BEA itself. Much of these data – though not all – are reported to the public. The purpose of the Budget Division's current-quarter tracking system is to make maximum use of the available high frequency information at the time a forecast is made. This allows DOB to estimate more accurately the base quarters for both real and nominal GDP, as well as personal income. Since the DOB/US models discussed above tend to project equilibrium relationships assuming no exogenous shocks, the projected annual growth rate for the near term is heavily dependent upon the base quarter estimate. Hence the accuracy of the base quarter is crucial to the accuracy of the overall forecast.

The BEA produces three estimates in the months immediately following the quarter being estimated – an initial release followed by two revisions. These estimates are followed by at least three more annual revisions, typically released in July of each year. In addition, the BEA periodically releases a more comprehensive revision which includes an update of the reference year upon which measures of real activity are based. As an example, Table 7 presents a chronology of the BEA's first three releases of NIPA estimates, since these estimates are the most relevant to the Budget Division's current quarter estimation, for the four quarters of 2018. As the table indicates, the initial estimate for any given quarter is released at the end of the first month of the following quarter. For example, the first release of the estimate for the first quarter of 2018, known as the "advance" estimate, was available at the end of April 2018. With the second estimate, made public by the BEA at the end of May 2018, the first quarter estimate underwent the first of many revisions. The second revision of 2018Q1 was reported with the third estimate, at the end of June. Not included in the table are the annual revisions, the first of which for the first quarter was released at the end of the July, along with the advance estimate for the second quarter.

TABLE 7
NIPA RELEASE SCHEDULE FOR THE FOUR QUARTERS OF 2018

Release	2018Q1	2018Q2	2018Q3	2018Q4
Advance Estimate	Apr. 27, 2018	Jul. 27, 2018	Oct. 26, 2018	Jan. 30, 2019
Second Estimate	May 30, 2018	Aug. 29, 2018	Nov. 28, 2018	Feb. 28, 2019
Third Estimate	Jun. 28, 2018	Sep. 27, 2018	Dec. 21, 2018	Mar. 28, 2019

Source: U.S. Bureau of Economic Analysis.

DOB always incorporates the most recent NIPA data when doing a forecast. For example, the forecast completed in preparation for the Mid-Year Financial Plan Update included the final estimate of second quarter 2018 real GDP that became available at the end of September. However, a substantial volume of high frequency data related to the third quarter was already available by mid-October. DOB's current quarter methodology is designed to incorporate the full breadth of the available high frequency data to forecast the advance release of either the quarter

in progress or just ended. These data include monthly payroll employment; retail trade; the value of construction put in place; weekly initial unemployment insurance claims; and monthly personal income and personal consumption estimates, to name just a few.

The first step in DOB's current quarter estimation process pertains to those variables that are either policy-driven or whose inherent volatility makes them more suitable to the application of anecdotal evidence, trade association projections, or judgmental trending based on daily data, rather than formal modeling. Monthly estimates for these variables, which include the federal funds rate; the S&P 500; energy prices; the trade-weighted value of the dollar; Boeing aircraft deliveries; some employment series; and vehicle sales, are constructed to complete the quarter, making them available for the next step in the process.

TABLE 8
INDUSTRIAL PRODUCTION

$$\Delta \ln IP_t = \underset{(0.0003)}{-0.0007} + \underset{(0.038)}{0.135}\,\Delta \ln IP_{t-3} + \underset{(0.0004)}{0.002}\,\Delta RFED_t + \underset{(0.0001)}{0.0004}\,(TRATE10_t - RFED_t) + \underset{(0.139)}{1.970}\,\Delta \ln ETP_t$$
$$+ \underset{(0.143)}{0.438}\,\Delta \ln ETP_{t-1} - \underset{(0.141)}{0.430}\,\Delta \ln ETP_{t-2} - \underset{(0.147)}{0.694}\,\Delta \ln ETP_{t-3} - \underset{(0.004)}{0.016}\,HURR_t + \underset{(0.003)}{0.010}\,STRIKE1_t - \underset{(0.004)}{0.028}\,STRIKE2_t$$

Adjusted R^2 = 0.53
Number of Obs = 556
Note : Values in parentheses under coefficients represent standard errors.

IP	Industrial Production
RFED	Effective federal funds rate
TRATE10	10-Year Treasury rate
ETP	Private employment
HURR	Dummy variable for Hurricanes Rita and Wilma
STRIKE1	Dummy variable for end of GM strike
STRIKE2	Dummy variable for Boeing strike

A system of monthly models that forecast the primary inputs to BEA's quarterly estimates of the components of GDP and personal income makes up the second step.[10] For example, monthly industrial production is an input to private fixed investment in equipment and software, exports, and the change in private inventories. The model specification for monthly industrial production is presented in Table 8. In forecasting the quarterly GDP deflator and the deflators for many of the GDP components, DOB follows BEA by utilizing monthly CPI and PPI data, as well as monthly price indices for imports and exports. Forecasts for employment and interest rates are also inputs to models for several of the components of personal income. In turn, forecasts for personal income, mortgage interest rates, housing starts, and home sales are inputs to fixed residential investment. Additional models estimated at this stage include retail sales, the value of construction put in place, manufacturing orders and shipments, imports and exports, and Federal budgetary outlays.

[10] For a summary description of BEA's estimation methods and source data for the advance GDP release, see <http://www.bea.gov/scb/pdf/2007/11%20November/1107_nipamethod.pdf>, last referenced October 28, 2008.

Finally, in the third step, the real and nominal components of GDP are projected. In addition to the GDP price deflator, DOB has developed forecasting models for the following nominal and real GDP components: durable and nondurable consumption; housing-related and non-housing services consumption; new housing and other fixed residential investment; business sector fixed investment in computer and computer-related durable equipment and software, noncomputer equipment, and structures; federal government consumption and investment spending; state and local government consumption and investment spending; oil and non-oil imports; and exports. Real U.S. GDP is calculated two ways: first, by dividing the sum of the nominal components by the GDP price deflator, and second, by "Fisher adding" the real components. If the two methods produce different outcomes, adjustments are made before incorporating the results into DOB/US.

Current-quarter models have also been developed for the following components of national personal income: wages and salary disbursements; transfer payments to persons; personal contributions for social insurance; other labor income; rental income of persons with the capital consumption adjustment (CCA); personal dividend income; personal interest income; and proprietors' income with the inventory valuation adjustment (IVA) and CCA. Examples of models for the GDP deflator, real nondurable consumption, and two components of personal income appear below.

GDP Deflator

As alluded to above, the current-quarter GDP deflator is a function of the monthly CPI and the price deflators for imports and exports. The left-hand side variable is quarterly growth at seasonally adjusted annualized rates (SAAR). The right-hand side concepts are also annualized quarterly growth rates as shown in Table 9.

Table 10 shows how a recent set of estimates evolved over the quarter and compares them to BEA's advance release. The three vantages that appear in this table and those that follow refer to various points in time during the forecast period, with vantage 1 typically referring to a point in the second month of the current quarter, vantage 2 a point in the third month, and vantage 3 a point in the first month of the following quarter.

TABLE 9
GDP DEFLATOR

$$GGDF_t = \underset{(0.0005)}{0.003} + \underset{(0.056)}{0.357}\left[\left(\frac{\sum_{i=1}^{3} CPI_{t,i}}{\sum_{i=1}^{3} CPI_{t-1,i}}\right)^4 - 1\right] - \underset{(0.013)}{0.071}\left[\left(\frac{\sum_{i=1}^{3} PIB_{t,i}}{\sum_{i=1}^{3} PIB_{t-1,i}}\right)^4 - 1\right] + \underset{(0.021)}{0.094}\left[\left(\frac{\sum_{i=1}^{3} PEB_{t,i}}{\sum_{i=1}^{3} PEB_{t-1,i}}\right)^4 - 1\right]$$

$$+ \underset{(0.096)}{0.310}\, AR_{t-1} + \underset{(0.093)}{0.277}\, AR_{t-4}$$

Adjusted R^2 = 0.58

Number of Obs = 116

Note : Values in parentheses under coefficients represent standard errors.

GGDF	Annualized quarterly growth rate of GDP deflator
$CPI_{t,i}$	CPI for *i*th month of quarter *t*
$PIB_{t,i}$	Imports price deflator for *i*th month of quarter *t*
$PEB_{t,i,}$	Exports price deflator for *i*th month of quarter *t*
AR	Error autocorrelation correction

TABLE 10
CURRENT QUARTER ESTIMATES: GDP DEFLATOR
Percent Change (SAAR)

		Vantage 1	Vantage 2	Vantage 3	Advance
2012	Q1	1.1	1.8	1.9	1.5
	Q2	1.9	1.6	1.6	1.5
	Q3	1.8	2.0	2.6	0.6
	Q4	2.1	1.8	1.7	0.6
2013	Q1	1.5	1.5	1.4	1.2
	Q2	0.4	0.4	0.6	0.7
	Q3	1.8	1.8	1.8	1.9
	Q4	1.5	1.5	1.4	1.3
2014	Q1	2.0	1.8	1.8	1.3
	Q2	1.7	1.7	1.7	2.0
	Q3	1.8	1.5	1.5	1.3
	Q4	1.4	1.4	0.9	0.8
2015	Q1	(0.2)	(0.2)	0.0	(1.2)
	Q2	1.7	1.8	1.8	2.0
	Q3	1.9	1.9	1.9	1.2
	Q4	1.2	1.1	0.8	1.3
2016	Q1	0.8	0.5	0.7	0.7
	Q2	1.8	1.8	1.7	2.2
	Q3	1.5	1.7	1.7	1.5
	Q4	2.0	2.1	2.2	2.1
2017	Q1	2.2	2.2	2.2	2.2
	Q2	1.3	1.0	0.9	1.0
	Q3	1.4	1.8	1.8	2.1
	Q4	2.1	2.1	2.6	2.4
2018	Q1	1.9	2.5	2.5	2.0
	Q2	1.6	1.6	1.7	3.0
	Q3	2.2	2.2	2.2	

Source: Moody's Economy.com; DOB staff estimates.

Nondurable Consumption

NIPA data for consumption and personal income are available both monthly and quarterly. Based on BEA's methodology, the forecasting model for nondurable consumption includes nondurable retail sales, which is projected simultaneously and incorporates equity market performance, as measured by the S&P 500; the nondurable component of the CPI; and personal income. The implicit price deflator for nondurable consumption is estimated within the same system, with the nondurable component of the CPI and the spot price of West Texas Intermediate crude oil on the right-hand side. The estimation results appear in Table 11. Real nondurable consumption is

computed by dividing its nominal value by the implicit price deflator. Table 12 shows how a recent set of estimates evolved over the quarter and compares them to BEA's advance release.

TABLE 11
NONDURABLE CONSUMPTION

Nondurable Consumption

$$\Delta \ln CN_t = \underset{(0.0003)}{-0.0011} + \underset{(0.045)}{0.0540}\,\Delta \ln CN_{t-1} + \underset{(0.038)}{1.1066}\,\Delta \ln RTNF_t + \underset{(0.039)}{0.107}\,\Delta \ln RTNF_{t-1}$$

Adjusted R^2 = 0.78

Nondurable Retail Sales

$$\Delta \ln RTNF_t = \underset{(0.0003)}{0.002} + \underset{(0.008)}{0.052}\,\Delta \ln SP500_t + \underset{(0.030)}{0.587}\,\Delta \ln CPIUAN_{t-1} + \underset{(0.046)}{0.092}\,\Delta \ln YP_t - \underset{(0.066)}{0.456}\,AR_{t-1} - \underset{(0.066)}{0.081}\,AR_{t-2}$$

Adjusted R^2 = 0.61

Implicit Price Deflator for CN

$$\Delta \ln PICN_t = \underset{(0.016)}{0.834}\,\Delta \ln CPIUAN_t + \underset{(0.002)}{0.004}\,\Delta \ln WTI_t$$

Adjusted R^2 = 0.94

Number of Obs = 234

Note : Values in parentheses under coefficients represent standard errors.

CN	Nondurable consumption
RTNF	Nondurable retail sales
YP	Personal income
SP500	Standard and Poor's 500 index
CPIUAN	Nondurable goods CPI
AR	Error autocorrelation correction
PICN	Implicit price deflator for nondurable consumption
WTI	West Texas intermediate crude oil price

TABLE 12
CURRENT QUARTER ESTIMATES: REAL NONDURABLE CONSUMPTION
Percent Change (SAAR)

		Vantage 1	Vantage 2	Vantage 3	Advance
2012	Q1	3.0	0.8	0.6	2.1
	Q2	2.9	2.5	2.5	1.5
	Q3	1.1	1.8	2.4	2.4
	Q4	0.0	0.6	0.4	0.4
2013	Q1	2.8	4.9	4.4	1.0
	Q2	2.0	1.4	1.2	2.0
	Q3	4.1	2.7	2.7	2.7
	Q4	5.4	5.5	6.1	4.4
2014	Q1	0.5	0.4	(0.8)	0.1
	Q2	2.7	1.3	1.3	2.5
	Q3	0.8	1.6	1.5	1.1
	Q4	3.7	4.0	4.2	4.4
2015	Q1	0.9	0.8	0.6	(0.3)
	Q2	1.8	3.3	3.2	3.5
	Q3	4.1	5.2	4.8	3.5
	Q4	2.3	2.6	2.3	1.5
2016	Q1	2.6	(0.2)	(0.4)	1.0
	Q2	5.8	5.8	6.5	6.0
	Q3	2.0	0.0	(1.1)	(1.4)
	Q4	4.7	3.4	2.5	2.3
2017	Q1	2.6	2.6	2.6	1.5
	Q2	3.8	4.4	3.9	3.8
	Q3	0.7	0.9	(0.1)	2.1
	Q4	3.5	3.5	4.3	5.2
2018	Q1	3.2	0.3	(0.8)	0.1
	Q2	2.1	3.9	4.2	4.2
	Q3	4.7	5.7	5.7	

Source: Moody's Analytics; DOB staff estimates.

Personal Income

Personal income and its components data are available monthly. Since wages account for such a large part of personal income, employment-related data are critical inputs to the personal income models, as are initial claims for unemployment insurance compensation, interest rates, and the S&P 500. These variables are projected in step two of the current quarter forecasting process. To avoid nonstationarity, all variables are transformed as the difference between the logarithm of the

current month and the logarithm of the variable at the same month of the previous quarter (or three months earlier).

Table 13 presents the model specification and estimation results for wage and salary disbursements. The wage and salary disbursement model contains total private employment as the main driver. The model also includes dummy variables to account for income-shifting (in anticipation of tax law changes) that cannot be captured by the employment and earnings data alone. Table 14 shows how a recent set of estimates evolved over the quarter and compares them to BEA's advance release.

TABLE 13
WAGE AND SALARY DISBURSEMENTS

$$\Delta_3 \ln WS_t = \underset{(0.002)}{0.009} + \underset{(0.028)}{0.103}\,\Delta_3 \ln WS_{t-1} + \underset{(0.073)}{0.860}\,\Delta_3 \ln ETP_t - \underset{(0.003)}{0.005}\,\Delta_3 \ln UI_t + \underset{(0.003)}{0.059}\,D92M12_t$$
$$- \underset{(0.003)}{0.066}\,D93M3_t + \underset{(0.003)}{0.057}\,D93M12_t + \underset{(0.002)}{0.003}\,D94M1_t - \underset{(0.003)}{0.052}\,D94M3_t + \underset{(0.005)}{0.994}\,AR_{t-1} + \underset{(0.022)}{0.877}\,MA_{t-3}$$

Adjusted R^2 = 0.88

Number of Obs = 617

Note : Values in parentheses under coefficients represent standard errors.

Δ_3	Change from three months ago
WS	Wage and salary disbursements
ETP	Employment, total private
UI	Unemployment insurance claims
DYrMm	Dummy=1 for year=yr and month=m, 0 otherwise
AR	Error autocorrelation correction
MA	Error moving average correction

TABLE 14
CURRENT QUARTER ESTIMATES:
WAGE AND SALARY DISBURSEMENTS
PERCENT CHANGE (SAAR)

		Vantage 1	Vantage 2	Vantage 3	Advance
2012	Q1	5.0	4.4	3.8	4.2
	Q2	2.9	1.9	1.9	3.4
	Q3	5.2	3.1	2.4	2.5
	Q4	4.1	2.5	3.7	4.2
2013	Q1	2.3	2.8	2.7	3.2
	Q2	4.1	3.5	3.5	3.5
	Q3	2.0	2.3	2.4	2.3
	Q4	4.5	4.2	4.0	3.7
2014	Q1	2.9	2.6	2.7	3.4
	Q2	4.6	5.0	5.1	6.6
	Q3	3.9	4.2	4.3	4.2
	Q4	4.0	4.3	4.9	4.4
2015	Q1	5.6	5.4	5.3	4.8
	Q2	3.5	3.7	3.7	2.4
	Q3	4.5	5.2	5.1	5.3
	Q4	4.6	4.6	5.0	4.6
2016	Q1	5.6	3.7	4.5	3.9
	Q2	4.0	3.8	3.9	2.4
	Q3	3.7	5.3	4.9	4.8
	Q4	3.4	5.0	3.5	3.8
2017	Q1	4.3	4.6	4.5	4.1
	Q2	3.8	3.6	3.7	4.4
	Q3	3.8	4.6	3.5	4.2
	Q4	3.6	3.6	3.8	4.0
2018	Q1	4.2	5.5	6.1	5.6
	Q2	3.6	3.7	3.6	4.4
	Q3	4.3	4.8	4.7	

Source: Moody's Analytics; DOB staff estimates.

The driving forces for proprietors' income are total private employment, the 10-year Treasury bond yield, and past values of proprietors' income. Table 15 presents the model specification and estimation results for this income component; Table 16 presents a history of the model's accuracy.

TABLE 15
PROPRIETORS' INCOME

$$\Delta_3 \ln PRP_t = \underset{(0.0001)}{0.0002} + \underset{(0.008)}{0.987}\,\Delta_3 \ln PRP_{t-1} + \underset{(0.021)}{0.0096}\,\Delta_3 \ln ETP_t + \underset{(0.003)}{0.0005}\,\Delta_3 \ln TRATE10_t + \underset{(0.011)}{0.969}\,MA_{t-3}$$

Adjusted $R^2 = 0.76$

Number of Obs = 617

Note : Values in parenthesis under coefficients represent standard errors.

Δ_3	Change from three months ago
PRP	Proprietors' income
ETP	Employment, total private
TRATE10	10-year Treasury bond yield
MA	Moving average error correction

TABLE 16
CURRENT QUARTER ESTIMATES: PROPRIETORS' INCOME
PERCENT CHANGE (SAAR)

		Vantage 1	Vantage 2	Vantage 3	Advance
2012	Q1	4.0	4.5	2.4	4.7
	Q2	5.7	5.0	5.0	5.1
	Q3	6.3	5.4	5.1	6.2
	Q4	5.2	6.1	7.5	6.6
2013	Q1	7.4	9.4	9.3	11.4
	Q2	3.4	4.3	4.2	0.1
	Q3	(2.0)	4.0	4.0	5.1
	Q4	2.1	2.1	0.6	(2.5)
2014	Q1	1.1	2.9	2.9	3.8
	Q2	6.2	4.7	4.7	3.9
	Q3	4.8	3.1	3.1	2.1
	Q4	3.8	3.5	6.7	4.8
2015	Q1	1.7	(1.6)	(1.6)	(3.1)
	Q2	2.6	3.5	3.5	(2.8)
	Q3	8.7	6.5	6.5	7.6
	Q4	5.4	6.1	4.0	3.7
2016	Q1	7.1	3.9	8.9	1.8
	Q2	4.9	3.8	3.8	0.0
	Q3	7.8	6.2	2.5	2.3
	Q4	6.9	7.1	4.6	3.9
2017	Q1	6.8	5.3	5.2	5.2
	Q2	4.2	3.5	3.3	(1.8)
	Q3	4.5	3.0	1.2	0.9
	Q4	6.3	6.5	6.4	5.9
2018	Q1	5.4	3.9	6.0	4.7
	Q2	6.6	4.8	3.7	5.0
	Q3	5.1	4.6	4.6	

Source: Moody's Analytics; DOB staff estimates.

Nonfarm Payroll Employment

Early each month, BLS releases its initial estimate of national nonfarm payroll employment for the prior month, making it one of the timeliest indicators. Predictor variables for the DOB models constructed to estimate the initial monthly release include average weekly initial unemployment insurance claims and average weekly continuing unemployment insurance claims. Unemployment insurance claims are a useful measure of layoff activity in the job market, while continuing claims measure the accumulation of individuals no longer in the workforce and thus may be an indicator of the rate of job creation. Thus, increases in initial and continuing claims should indicate weaker employment growth, while decreases will suggest an improving labor market.

National nonfarm payroll employment is estimated at several levels of aggregation including total; private; private services; total government; and state and local government. The total and private-employment models use the endogenous variables in first differences. Both models include current and prior month average initial claims, and the first difference of monthly average continuing claims. Additional predictors for these models include the change in the number of workers striking during the month, the lag of the change in S&P 500 index, and the change in the number of workers temporarily employed by the Federal government to conduct the Decennial Census. To capture the persistence of each series each model has three lags of the endogenous variable. The specification and estimation results from the total employment model are presented in Table 17.

TABLE 17
MONTHLY NONFARM EMPLOYMENT ESTIMATE

$$\Delta TOTEMP_t = \underset{}{182.507} - \underset{(35.81)}{} \underset{}{0.002\ IC_t} + \underset{(0.0003)}{} \underset{}{0.0017\ IC_{t-1}} - \underset{(0.0003)}{} \underset{}{0.0004\ \Delta CC_t} + \underset{(0.00006)}{} \underset{}{0.2726\ \Delta SP500_{t-1}} \underset{(.1379)}{}$$

$$- \underset{(0.0001)}{0.001\ \Delta STRIKE_t} + \underset{(0.00014)}{0.00065\ \Delta CENSUS_t} + \underset{(0.036)}{0.237\ \Delta TOTEMP_{t-1}} + \underset{(0.033)}{0.267\ \Delta TOTEMP_{t-2}} + \underset{(0.034)}{0.187\ \Delta TOTEMP_{t-3}}$$

Adjusted $R^2 = .76$

Number of Obs $= 569$

Note: Values in parentheses under coefficients represent standard errors.

TOTEMP	Nonfarm employment
IC	Monthly average initial claims
CC	Monthly average continuing claims
SP500	SP500 stock index
STRIKE	Employees on strike
CENSUS	Employees working temporarily on Census

Private-sector service employment is modeled as an autoregressive process in first differences with the first difference of total private-sector employment used as an explanatory variable. The first difference of government employment is modeled using initial claims and the first difference of continuing claims as explanatory variables. A variable is included to capture the temporary

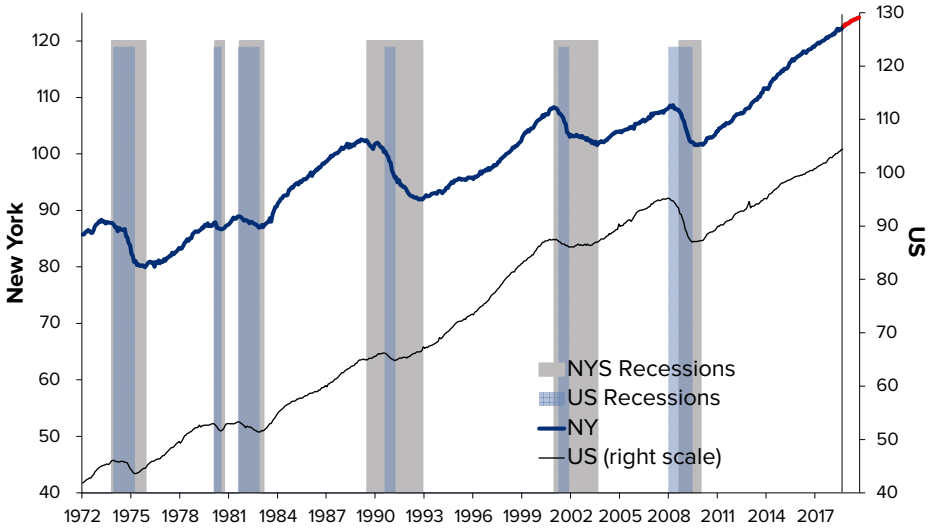
increase in federal employment caused by the Decennial Census. The second, third and fifth lags of the left-hand-side variable are also included. Meanwhile, the monthly change in state and local government employment is modeled using the first difference of total government employment and the change in the number of temporary Decennial Census workers as independent variables.

New York State Macroeconomic Model

The Division of the Budget's macroeconomic model for New York State attempts to capture the fundamental linkages between the economies of New York and the nation. As with all the states, New York's economy depends on the performance of the U.S. economy as a whole, usually expanding when the national economy is growing and contracting when the nation is in recession. However, this relationship is neither simple nor static. Figure 1 compares the lengths of the national recessions, as defined by the National Bureau of Economic Research (NBER) Business Cycle Dating Committee, with those of the State, as determined by the New York State Index of Coincident Economic Indicators, constructed by DOB.[1] The comparison demonstrates how much the two can differ in both length and severity. Due to the disproportionate impact of the September 11 attacks on New York, the State came out of the 2001 recession significantly later than the nation. In contrast, New York entered the most recent recession eight months after the nation and exited the downturn six months later than the country as a whole. Thus while the recessions were approximately of the same length (19 months for the U.S., 17 months for New York State), they were out of phase.

Figure 1

New York State Index of Coincident Economic Indicators



Note: NYS recession dates are DOB staff estimates; NYS forecast (in red) is derived from the New York State Leading Index.
Source: Moody's Analytics; DOB staff estimates.

The DOB macroeconomic model for the State (DOB/N.Y.) quantifies the linkages between the national and State economies within an econometric framework that specifically identifies the unique aspects of economic conditions in New York. DOB/N.Y. is a structural time-series model, with most of the exogenous variables derived from DOB/U.S. In general, the long-run equilibrium relationships between State and national economic variables are captured using

[1] For a detailed description see R. Megna, and Q. Xu (2003), "Forecasting the New York State Economy: The Coincident and Leading Indicators Approach," *International Journal of Forecasting*, Vol. 19, pp 701-713.

cointegration/error-correction specifications, while the State's unique dynamics are modeled within a restricted VAR (RVAR) framework.[2]

Model Structure

DOB/N.Y. has six major modules: nonfarm payroll employment, real nonbonus average wages, bonus payments, nonwage income, prices, and the unemployment rate. Because the state-level wage data published by BEA have proven unsatisfactory for the purpose of forecasting State personal income tax liability, the Budget Division constructs its own wage and personal income series based on the Quarterly Covered Employment and Wage (QCEW) data (also known as ES 202 data). Moreover, due to the importance of variable income trends – variable income being composed of bonus income and income derived from stock options and grants – to the understanding of trends in State wages overall, the Budget Division has developed a methodology (described below) for decomposing its wage series into bonus and nonbonus wages.

Employment

New York employment is disaggregated into 15 industrial sectors, in parallel with DOB/U.S. DOB/N.Y. is an "open economy" model, predicated on the assumption that most production factors and outputs are free to move across the State's borders. The relationship between the national economy and New York employment is captured through two channels. First, for those sectors where rates of State and national employment growth are significantly related, the national growth rate is specified as an exogenous variable in the equation. Second, overall U.S. economic conditions, as measured by the growth of real U.S. GDP, are included directly in the employment equations for some sectors and are allowed to influence employment of other sectors through VAR relationships.

For 13 industrial sectors, New York's unique employment growth pattern is captured within an RVAR setting in which the effect of one sector upon another is explicitly modeled. The choice as to which sectors to include on the right-hand side of a given equation is based on the results of an initial unrestricted VAR estimation. In the final RVAR specification, only those sectors that are well explained by the movements of other sectors are included in the final VAR model. As an example, Table 1 presents the final specification for manufacturing employment.

[2] Because the number of parameters to be estimated within an unrestricted VAR framework is often very large, the model can be expected to be unstable. To address this concern, those parameters found to be insignificant at the 5 percent level are constrained to equal zero. The resulting RVAR model is both more parsimonious and more stable.

TABLE 1
MANUFACTURING EMPLOYMENT

$$\Delta \ln E39_t = \underset{(0.067)}{0.423}\,\Delta \ln E39_{t-4} + \underset{(0.026)}{0.823}\,\Delta \ln EUS39_t - \underset{(0.060)}{0.326}\,\Delta \ln EUS39_{t-4} - \underset{(0.001)}{0.008}\,DQ1_t + \underset{(0.001)}{0.003}\,DQ2_t - \underset{(0.001)}{0.002}\,DQ3_t - \underset{(0.001)}{0.003}\,CORP_t$$

Adjusted $R^2 = 0.950$

Number of Obs $= 168$

Note: Values in parentheses under coefficients represent standard errors.

E39	Manufacturing employment
EUS39	National manufacturing employment
DQi	Seasonal dummy=1 for quarter *i*, 0 otherwise
CORP	Corporate restructuring dummy=1 for the period from 1982Q4 through 1994Q1, 0 otherwise

The two remaining industrial sectors are estimated individually. These equations are specified as autoregressive models, with a corresponding national employment term included in each equation as an exogenous variable.

Bonus and Stock Incentive Payments

Total New York State wages are broken down into two components: a base wage component, which is relatively uniformly distributed over the course of the firm's fiscal year; and a more-variable component made up primarily of bonus payments and income derived from the exercise of employee stock options, the vesting of stock grants, and other one-time payments. There are several reasons why the variable component of wages is modeled separately. First, bonuses have grown substantially since the early 1990s as a proportion of total wages. This strong growth is the result of primarily two factors: the robust performance of securities industry profits during that period, and the shift in the corporate wage structure away from fixed pay and toward performance-based bonuses.[3] Second, bonus payments play a significant role in the forecast of State government finances, since they tend to be concentrated among high-income taxpayers and thus are taxed at the top marginal income tax rate. Further, the timing of bonus payments affects the pattern of wage payments and consequently the State's cash flow. Tax collections from wages usually peak during December, January and February, corresponding to the timing of bonus payments. Finally, because they are performance-based, bonus payments display a much more volatile growth pattern than nonbonus average wages.

No government agency collects data on variable income as distinct from ordinary wages; thus, it must be estimated. The Division of the Budget derives its estimate of bonuses from firm-level QCEW data, as collected under the unemployment insurance program. Firm-level average wages are calculated for each quarter. We obtain the firm's base pay (that is, wages excluding variable pay) by taking the average over the two quarters with the lowest average wages. If the

[3] In the wake of the 2007-2008 financial crisis, the momentum toward bonus pay appears to have slowed, and may even be reversing, though it is still too early to gauge the permanence of this shift.

average wage for either of the remaining quarters is significantly above the base wage, then that quarter is assumed to contain variable income.[4] The average variable payment is then defined as total average wage minus the base average wage, after allowing for an inflation adjustment to base wages. Total variable pay is then calculated by multiplying the average bonus payment by the total number of firm employees. It is assumed that only private-sector employees, excluding those of private educational institutions and utilities, earn variable pay.

Projecting bonus payments by industry is a multi-step procedure. Since finance and insurance sector bonuses are largely exogenous to wages paid in the remainder of the State economy, a bonus payments model for this sector is estimated in the first step. Since bonus payments for the remaining sectors have been found to have long-term equilibrium relationships with finance and insurance sector bonuses, these relationships are estimated in the second step. The feedback from Wall Street to the other sectors of the State economy, especially business services, can be substantial. In the final step, these long-term relationships are incorporated into the bonus estimating equations for the remaining sectors within an error correction framework.

The volume of New York Stock Exchange (NYSE) member firm revenues explains much of the variation in finance and insurance sector bonuses. Among the major drivers of revenues are two types of Wall Street underwriting activities – the dollar volume of initial public offerings (IPOs) and the value of debt underwritings. We forecast these two variables first based on the interest rate and equity market forecasts provided by DOB/U.S. Traditionally, finance and insurance sector bonuses have been paid out in December or the following January and February, based roughly on the firm's performance for the calendar year ending in December. Consequently, the finance and insurance sector bonus series is converted from a quarterly to a fiscal year frequency, while the explanatory variables are annualized on a calendar year basis. The forecast is then converted back to quarterly series based on the most recent fiscal year's pattern. The finance and insurance sector bonus estimation equation appears in Table 2.

[4] The threshold adopted for this purpose was 25 percent. However, the variable income estimates are fairly robust to even a five percentage-point swing in this threshold.

TABLE 2
FINANCE AND INSURANCE SECTOR BONUSES

$$\Delta \ln B52_t = \underset{(0.072)}{1.008}\,\Delta \ln TRNYSE_t - \underset{(0.012)}{0.051}\,\Delta RFED_t - \underset{(0.043)}{0.243}\,DBHAT_t - \underset{(0.065)}{0.248}\,D2002_t + \underset{(0.061)}{0.262}\,D2004_t + \underset{(0.062)}{0.207}\,D2011_t$$

Adjusted $R^2 = 0.909$

Number of Obs $= 27$

Note: Values in parentheses under coefficients represent standard errors.

B52	Finance and insurance sector bonus
RFED	Real Federal Funds Rate
DBHAT	Dummy =1 for Fiscal Year 1999 and -1 for Fiscal Year 2000
D2002	Dummy for Fiscal Year 2002
D2004	Dummy for Fiscal Year 2004
D2011	Dummy for Fiscal Year 2011

As described above, finance and insurance sector bonuses have long-term equilibrium relationships with bonus payments in other sectors, i.e., they are cointegrated with bonuses paid in other sectors. Therefore, we use a cointegration/error correction framework in the third step to estimate bonuses for all of the other sectors. Table 3 gives an example of the specification for bonuses in manufacturing.

TABLE 3
MANUFACTURING BONUSES

$$\Delta B39_t = \underset{(0.127)}{0.629} - \underset{(0.106)}{0.475}\,\Delta B39_{t-1} - \underset{(0.104)}{0.481}\,\Delta B39_{t-2} - \underset{(0.098)}{0.355}\,\Delta B39_{t-3} + \underset{(0.078)}{0.115}\,\Delta B39_{t-4} + \underset{(0.003)}{0.011}\,\Delta B52_t$$
$$- \underset{(0.003)}{0.004}\,\Delta B52_{t-4} - \underset{(0.209)}{0.618}\,DQ1_t - \underset{(0.202)}{0.771}\,DQ2_t - \underset{(0.184)}{1.051}\,DQ3_t - \underset{(0.101)}{0.402}\,(B39_{t-1} - \underset{(0.084)}{1.384} + \underset{(0.003)}{0.019}\,B52_{t-1})$$

Adjusted $R^2 = 0.897$

Number of Obs $= 168$

Note: Values in parentheses under coefficients represent standard errors.

B39	Manufacturing bonuses
B52	Finance and insurance bonuses
DQ_i	Seasonal dummy for quarter i

Real Nonbonus Average Wages

Once average nonbonus wages have been identified, they are divided by a price deflator estimated specifically for the New York economy (see "New York State Inflation Measure" below) to create real nonbonus average wages. To forecast real nonbonus average wages, DOB/N.Y. estimates 15 stochastic equations, one for each major industrial sector.

Because statistical evidence suggests long-run equilibrium relationships exist between real nonbonus average wages for most of the State's economic sectors and real average wages in the corresponding national sectors, State real nonbonus average wages for most sectors are modeled in a cointegration/error-correction framework. This is based on the belief that, since both labor and capital are free to move in a market economy, regional differences in labor costs will tend to disappear, although the equilibrating process may work slowly. This formulation allows for short-run adjustments toward long-run equilibrium. These short-run dynamics help to account for the State's unique economic trends. Table 4 presents, as an example, the model specification for real nonbonus average wages in the finance and insurance sector.

For the few sectors where there is no statistical evidence of a long-term relationship with national real average wages, real nonbonus average wages are modeled within an autoregressive framework, with one or more U.S. series (current or lagged values) used as explanatory variables to capture the impact of national economic conditions.

TABLE 4
FINANCE AND INSURANCE SECTOR REAL NONBONUS AVERAGE WAGE

$$\Delta RWA52_t = \underset{(0.080)}{-0.369}\,\Delta RWA52_{t-1} \underset{(0.083)}{-0.467}\,\Delta RWA52_{t-2} \underset{(0.083)}{-0.196}\,\Delta RWA52_{t-3} + \underset{(0.080)}{0.280}\,\Delta RWA52_{t-4} + \underset{(0.00047)}{0.00054}\,\Delta USRA_{t-1}$$

$$\underset{(0.00049)}{+0.0011}\,\Delta USRA_{t-2} + \underset{(0.00049)}{0.00092}\,\Delta USRA_{t-3} - \underset{(0.00048)}{0.00024}\,\Delta USRA_{t-4} + \underset{(0.322)}{0.998}\,DQ1_t + \underset{(0.317)}{0.168}\,DQ2_t + \underset{(0.320)}{0.299}\,DQ3_t$$

$$\underset{(13.782)}{+17.406}\,\Delta lnGDP_{t-1} \underset{(0.0129)}{-0.0123}\,RTRATE3_t \underset{(0.000004)}{-0.000004}\,(RWA52_{t-1} - 29.790 - 3.287\,USRA_{t-1})$$

Adjusted $R^2 = 0.529$

Number of Obs $= 168$

Note: Values in parentheses under coefficients represent standard errors.

RWA52	Real nonbonus average wage for New York finance and insurance sector
USRA	U.S. real average wage
GDP	Real U.S. gross domestic product
RTRATE3	Real interest rate on 3-month Treasury notes
DQ*i*	Seasonal dummy variable for quarter *i*

Nonwage Income

DOB/N.Y. estimates six components of nonwage income: transfer income; property income, which includes dividend, interest, and rental income; proprietors' income; other labor income; personal contributions to social insurance programs; and the residence adjustment, which corrects for the fact that wages are measured according to place of employment rather than place of residence. The two largest components, transfer payments and property income, together account for almost 80 percent of total nonwage income.

TABLE 5
PROPERTY INCOME

$$\Delta \ln PROP_t = \underset{(0.001)}{0.001} + \underset{(0.042)}{0.806}\,\Delta \ln P_t + \underset{(0.065)}{0.230}\,\Delta \ln P_{t-1} - \underset{(0.067)}{0.450}\,\Delta \ln P_{t-2} + \underset{(0.072)}{0.069}\,\Delta \ln PROP_{t-1} + \underset{(0.068)}{0.435}\,\Delta \ln PROP_{t-2}$$

Adjusted $R^2 = 0.748$

Number of Obs $= 168$

Note: Values in parentheses under coefficients represent standard errors.

PROP	New York State property income
P	U.S. property income weighted by New York's share of total U.S. employment

Except for the residence adjustment, all of the components of New York nonwage income are driven by their national counterparts, since they are either governed by Federal regulations or influenced by national conditions. In each of these equations, the change in the New York component of nonwage income is estimated as a function of the change in its U.S. counterpart, along with lags of the independent and dependent variables (to account for short-term dynamics). Table 5 gives an example of the specification for property income.

State transfer income is first transformed by dividing by the New York population and then is estimated as a function of U.S. per capita transfer income. State contributions for social insurance is modeled as a function of national contributions multiplied by New York wages as a share of national wages. The residence adjustment is modeled as a function of New York earned income, which is comprised of wages, other labor income, and personal contributions for social insurance.

New York State Inflation Rate

DOB/N.Y. estimates a measure of State inflation by constructing a composite consumer price index for New York State (CPINY). CPINY is defined as a weighted average of the national CPI and the CPI for the New York City region. As shown in Table 6, CPINY is specified as a function of the current and year-ago value of the U.S. CPI, its own year-ago value, and the three-quarter-ago difference between the U.S and NY unemployment rates.

TABLE 6
COMPOSITE CPI FOR NEW YORK

$$\Delta \ln CPINY_t = \underset{(0.058)}{0.647}\,\Delta \ln CPINY_{t-4} + \underset{(0.027)}{0.904}\,\Delta \ln CPI_t - \underset{(0.059)}{0.566}\,\Delta \ln CPI_{t-4} - \underset{(0.0002)}{0.0005}\,(RUNY - RUUS)_{t-3} + \underset{(0.002)}{0.010}\,D1982Q4_t$$

Adjusted $R^2 = 0.920$

Number of Obs $= 168$

Note: Values in parentheses under coefficients represent standard errors.

CPINY	New York consumer price index
CPI	National consumer price index
RUNY	New York unemployment rate
RUUS	U.S. unemployment rate
D1982Q4	Dummy for 1982Q4

New York State Unemployment Rate

The New York unemployment rate equation, shown in Table 7, is specified as a simple autoregressive process with the national unemployment rate (current and lagged) as an explanatory variable.

TABLE 7
NEW YORK UNEMPLOYMENT RATE

$$RUNY_t = \underset{(0.020)}{0.937}\,RUNY_{t-1} + \underset{(0.055)}{0.830}\,RUUS_t - \underset{(0.060)}{0.771}\,RUUS_{t-1} + \underset{(0.048)}{0.883}\,DQ1_t - \underset{(0.050)}{0.579}\,DQ2_t + \underset{(0.048)}{0.226}\,DQ3_t$$

Adjusted $R^2 = 0.980$

Number of Obs $= 168$

Note: Values in parentheses under coefficients represent standard errors.

RUNY	New York unemployment rate
RUUS	U.S. unemployment rate
DQi	Seasonal dummy for quarter i

Prior to the 2015 tax year, the Division of the Budget used annual sample data on the number of tax returns and the components of New York State adjusted gross income (NYSAGI) created by the New York State Department of Taxation and Finance (DTF) from the State's taxpayer population. The last such sample, for tax year 2014, contained 733,702 weighted records. Beginning with the 2015 tax year the DTF began providing a population file; the current version contains 10.5 million returns; since this represents all State tax filers, it is no longer weighted.

Despite the change the taxpayer data file, single-equation econometric models are still used to project the number of returns and all the components of taxable income except for the largest component, wages. To ensure consistency with DOB's New York economic forecast, the forecast growth rate for State wages and salaries derived from DOB/N.Y. is applied to the wage base obtained from DTF's taxpayer data.

In almost all cases, the NYSAGI components data series are non-stationary. The Division performs a logarithmic transformation which is then first-differenced for all series where at least 26 observations are available, a standard procedure used to avoid being misled by spurious regression results. A few shorter series are modeled in levels.

The Department of Taxation and Finance attempted to capture as accurately as possible the characteristics of the State taxpayer population in the years when it was constructing the sample. Because it was unreasonable to expect that every component of income would be perfectly represented each year, binary ("dummy") variables were incorporated into the models where anomalies in the data were thought to be the product of sampling error. Detailed descriptions of the models for the number of returns and for the major components of NYSAGI, other than wages, are presented below. All estimation results presented below are based on tax return data -- prior to the 2015 tax year these were representative samples, but as of tax year 2015 the data represents the population of State tax filers.

Tax Returns

The number of tax returns is expected to vary with the number of households that earn any kind of taxable income during the year. The number of such households, in turn, should be closely associated with the number of individuals who are either self-employed, employed by others, or who earn taxable income from a source other than labor. Total State payroll employment, which is forecast within DOB/N.Y., is a key input to this model, because most taxable income is derived from wages and salaries and thus is employment-related.

New Yorkers can earn taxable income from sources other than payroll employment, such as self-employment and real and financial assets. Self-employment is expected to be closely related to proprietors' income, a component of the NIPA definition of State personal income that is available from BEA and forecast within DOB/N.Y. Another component of personal income that is forecast within DOB/N.Y., State property income, includes interest, dividend, and rental income. The DOB tax return model shown in Table 1 incorporates the sum of proprietors' and property income for New York, deflated by the Consumer Price Index for New York as constructed by DOB.

Historical data show that a one-time upward shift in the number of tax returns in occurred in 1987, thought to be related to the Tax Reform Act of 1986. Beginning in 1987, the two-earner deduction for married couples was eliminated, thereby reducing the incentive for married couples to file joint tax returns. To capture this effect, a dummy variable for 1987 is included in the model. A dummy variable for 2000 is included to account for unusual growth in tax returns generated by the stock market.

TABLE 1
TAX RETURNS

$$\Delta \ln RET_t = \underset{(0.002)}{0.004} + \underset{(0.110)}{0.410}\,\Delta \ln NYSEMP_t + \underset{(0.036)}{0.088}\,\Delta \ln((PROPNY + YENTNY)/CPINY)_t + \underset{(0.008)}{0.017}\,D87_t + \underset{(0.008)}{0.034}\,D00_t$$

$Adjusted\ R^2 = 0.68$

$Number\ of\ Obs = 39$

Note: Values in parentheses under coefficients represent standard errors.

RET	Number of tax returns
NYSEMP	Total State employment
PROPNY	State property income
YENTNY	State proprietors' income
CPINY	Consumer Price Index for New York
D87	Dummy variable for 1987 tax law change
D00	Dummy variable for 2000 stock-market effect

Positive Capital Gains Realizations

New York State's positive capital gains realizations forecasting model incorporates those factors that are most likely to influence realization behavior: expected and actual tax law changes, equity market activity, and real estate market activity. Realization behavior appears to exhibit two types of reactions to changes in tax law: a transitory response to an expected change in the law and a steady-state response to an actual change. For example, if the tax rate is expected to rise next year, then taxpayers may realize additional gains this year, to take advantage of the lower rate. However, in the long run, the higher tax rate should result in a lower level of current realizations, all things being equal. Based on Miller and Ozanne (2000), the transitory response variable is specified as the square of the difference between the rate expected to take effect next period and the current period rate, with the sign of the difference preserved. The long-term or steady-state response variable is the actual tax rate.

The growth in realizations is expected to be directly related to growth in equity prices. To capture the effect of equity prices, the average price of all stocks traded is incorporated into the model. Forecasts of the average stock price are based on the forecast for the S&P 500 from DOB/U.S. The average price of stocks traded responds more strongly to declines than to increases in the S&P 500.

Fluctuating levels of private equity and hedge fund activity and profitability contribute to capital gains realizations. Private equity firms own stakes in companies that are not listed on a public stock exchange and generally receive a return on their investment through a sale or merger of the company, a recapitalization, or by selling shares back to the public through an initial public offering (IPO). As Table 2 shows, to capture some of the dynamics of capital gains from private equity funds, the capital gains model includes the value of IPOs. Though small in magnitude, an increase in IPOs is associated with a significant increase in capital gains realizations.

The model also contains a measure of real estate market activity, which appears to have grown substantially since 2000 as a contributor to capital gains realizations. Taxpayers can exempt gains of up to $250,000 ($500,000 if filing jointly) from the sale of a primary residence, but all other capital gains from real estate transactions are fully taxable. Conditions in the real estate market are captured by including New York State real estate transfer tax collections.

TABLE 2
POSITIVE CAPITAL GAINS REALIZATIONS

$$\Delta \ln CG_t = \underset{(2.40)}{-6.20}\,\Delta TRSTX_t - \underset{(0.69)}{2.96}\,\Delta PRMTX_t + \underset{(0.190)}{1.07}\,\Delta \ln EQTYP_t + \underset{(0.121)}{0.579}\,\Delta \ln RETT_t + \underset{(0.027)}{0.072}\,\Delta \ln IPO_t + \underset{(0.103)}{0.235}\,D96\_97_t$$

$Adjusted\ R^2 = 0.82$

$Number\ of\ Obs = 43$

Note: Values in parentheses under coefficients represent standard errors.

CG	Positive capital gains realizations
TRSTX	Transitory tax measure
PRMTX	Permanent tax rate
EQTYP	Average price of stocks traded
RETT	Real estate transfer tax collections
IPO	Value of “true” IPOs
D96_97	Dummy variable, 1 for 1996, -1 for 1997, 0 otherwise

Positive Rent, Royalty, Partnership, S Corporation, and Trust Income

The largest contributor of New York’s positive partnership, S corporation, rent, royalty, estate and trust gains (PSG) is partnership income, much of which originates in the finance industry. Therefore, growth in PSG is believed to be closely related to overall economic conditions, represented by real U.S. GDP, as well as to the performance of the stock market, represented by the S&P 500.

Another large contributor to this income category is income from closely-held corporations organized under subchapter S of the Internal Revenue Code, (“S corporations”). Selection of S

corporation status allows firms to pass earnings through to a limited number of shareholders and thus avoid corporate taxation. Empirical work shows that the differential between personal income tax and corporate income tax rates can significantly affect election of S corporation status.[1] Personal income increases (other things being constant) as more firms elect S corporation status over C corporation status, which is taxed under the corporate franchise tax. Consequently, DOB's forecast model in Table 3 includes the difference between the corporate franchise tax rate and the maximum marginal personal income tax rate, with the rates being composites of both State and Federal rates.

Changes in tax law are believed to account for some of the volatility in PSG. The enactment of the Tax Reform Act of 1986, which created additional incentives to elect S corporation status, likely resulted in an unusually high rate of growth in this income component in the mid- to late 1980s. We observe a particularly high rate of growth in this component in 1988, followed by extremely low growth in 1989. Possible explanations are the expectation of a large tax increase after 1988, or an increase in the fee for electing S corporation status in 1989. This is captured by a dummy variable that assumes a value of one for 1988 and minus one for 1989.

TABLE 3
POSITIVE PARTNERSHIP, S CORPORATION, RENT, ROYALTY, ESTATE AND TRUST INCOME

$$\Delta \ln PSG_t = \underset{(0.013)}{0.015} + \underset{(0.090)}{0.410}\,\Delta MTR_t + \underset{(0.066)}{0.150}\,\Delta \ln SP_t + \underset{(0.457)}{2.10}\,\Delta \ln GDP_t + \underset{(.033)}{0.215}\,D88\_89_t$$

$Adjusted\ R^2 = 0.73$

$Number\ of\ Obs = 39$

Note: Values in parentheses under coefficients represent standard errors.

PSG	Partnership, S corporation, rent, royalty, estate and trust income
MTR	Difference between corporate and personal income maximum marginal tax rates
SP	Standard and Poor's 500 stock index
GDP	Real U.S. GDP
D88_89	Dummy variable, 1 for 1988, -1 for 1989, 0 otherwise

Dividend Income

Dividend income is linked to the fortunes of publicly held U.S. firms, which, in turn, are expected to vary with the business cycle. The inclusion of U.S. dividend income serves as a proxy for the profitability of publicly held U.S. firms and ensures consistency with DOB's macroeconomic forecast model. Dividend income is also thought to be associated with firms' expectations pertaining to their future profitability, which is should be tied to the future strength of the economy. Equity market prices, a leading economic indicator, should vary with expected future dividend

[1] See, for example, Carroll and Joulfaian (1997).

payouts and thus enters the specification shown in Table 4. Because interest rates incorporate inflation expectations, which in turn contain expectations regarding the future strength of the economy, they also represent a proxy for the latter. Interest rates are represented by the rate on the 10-year Treasury yield.

Historically, State dividend income has ranged from a decline of 29 percent in 2009 to an increase of 27 percent in 2004, proving much more variable than U.S. dividend income, a component of the NIPA definition of U.S. personal income. This may suggest the importance of factors affecting the way taxpayers report their income, rather than changes in the payment of dividends by firms. The Tax Reform Act of 1986 lowered the maximum tax rate on dividend income for New York taxpayers from 64 percent in 1986 to 36 percent in 1988. A dummy variable is included to control for what is assumed to be the impact of this Act on the reporting of taxable dividend income. Another dummy variable captures the extraordinary impact of recessions (1975, 1990, 1991, 1992, 2001, 2002, 2008, and 2009).

TABLE 4
DIVIDEND INCOME

$$\Delta \ln DIV_t = \underset{(0.092)}{0.540}\,\Delta \ln USDIV_t + \underset{(0.011)}{0.035}\,\Delta TRATE10_t + \underset{(0.085)}{0.232}\,\Delta \ln SP_t - \underset{(0.025)}{0.067}\,DREC_t + \underset{(0.048)}{0.143}\,D88\_89_t + \underset{(0.067)}{0.172}\,D05_t$$

Adjusted $R^2 = 0.70$

Number of Obs $= 45$

Note: Values in parentheses under coefficients represent standard errors.

DIV	Dividend income
USDIV	US dividend income under NIPA
TRATE10	10-year Treasury yield
SP	Standard and Poor's 500 stock Index
DREC	Recession dummy variable
D88_89	Dummy variable, 1 for 1988, -1 for 1989
D05	Dummy variable = 1 for 2005, 0 otherwise

Interest Income

For a given amount of assets, an increase in interest rates will increase interest income. DOB's forecasting model for interest income is based on this simple concept and so includes the U.S. federal funds interest rate. In addition, the overall trend in taxable interest income for New York has been found to track New York property income, a component of State personal income that combines interest, dividend, and rental income. The model specification in Table 5 further includes a dummy variable to capture the extraordinary impact of recessions (1975, 1990, 1991, 1992, 2001, 2002, 2008, and 2009) on interest income.

TABLE 5
INTEREST INCOME

$$\Delta \ln INT_t = \underset{(0.012)}{0.032}\,\Delta FFRATE_t + \underset{(0.188)}{0.952}\,\Delta \ln PROPNY_t - \underset{(0.043)}{0.091}\,DREC_t$$

Adjusted $R^2 = 0.65$

Number of Obs $= 41$

Note: *Values in parentheses under coefficients represent standard errors.*

INT	Interest income
FFRATE	Federal funds rate
PROPNY	New York property income
DREC	Recession dummy variable

Business Income

Business income combines income earned and reported due to operating a business, or practicing a profession as a sole proprietor, or from farming. Business income is expected to vary with the overall strength of the State and national economies. The inclusion in the model of State proprietors' income, a component of the NIPA definition of New York personal income, which is forecast within DOB/N.Y., insures consistency between DOB's New York forecast and the forecast of this NYSAGI component.

TABLE 6
BUSINESS INCOME

$$\Delta \ln BUS_t = \underset{(0.084)}{0.208}\,\Delta \ln YENTNY_t + \underset{(0.30)}{1.86}\,\Delta \ln GDP_t - \underset{(.050)}{0.162}\,D89_t$$

Adjusted $R^2 = 0.48$

Number of Obs $= 37$

Note: Values in parentheses under coefficients represent standard errors.

BUS	Sole proprietor and farm income
YENTNY	State proprietor income (NIPA definition)
GDP	Real U.S. GDP
D89	Dummy variable for 1989 onward

The impact of the national business cycle is captured using real GDP, which is forecasted in DOB/U.S., because it might not be captured by the NIPA definition of State proprietors' income. In addition, a dummy variable is included to capture the downward shift in reported business income growth for the period from 1989 onward, perhaps due to new firms registering as S corporations rather than sole proprietorships, thus taking advantage of more favorable tax laws. The model specification is shown in Table 6.

Pension Income

Pension income includes payments from retirement plans, life insurance annuity contracts, profit-sharing plans, military retirement pay, and employee savings plans. It is related to long-term interest rates, suggesting that firms base the level of pension and life-insurance benefits they offer to employees on their expectations of future profitability, which are tied to the future strength of the economy. As indicated above, interest rates represent a proxy for the latter. Pension income has grown steadily over the years, although the growth rate has declined considerably over time. While the average annual growth rate between 1978 and 1990 was 12.8 percent, it fell to 6.6 percent between 1991 and 2010. This coincides with a decline in the 10-year Treasury yield from 10.2 percent in the earlier years to 5.3 percent in the later years. The equation specification is shown in Table 7.

TABLE 7
PENSION INCOME

$$\Delta \ln PEN_t = \underset{(0.002)}{0.014}\,\Delta TRATE10_{t-1} - \underset{(0.136)}{0.215}\,\Delta \ln PEN_{t-1} - \underset{(0.036)}{0.106}\,D92_t + \underset{(0.036)}{0.131}\,D94_t$$

Adjusted $R^2 = 0.61$

Number of Obs $= 37$

Note: Values in parentheses under coefficients represent standard errors.

PEN	Pension income
TRATE10	Interest rate on 10-year Treasury notes
D89	Dummy variable for 1992
D94	Dummy variable for 1994

Risk Assessment and Fan Charts

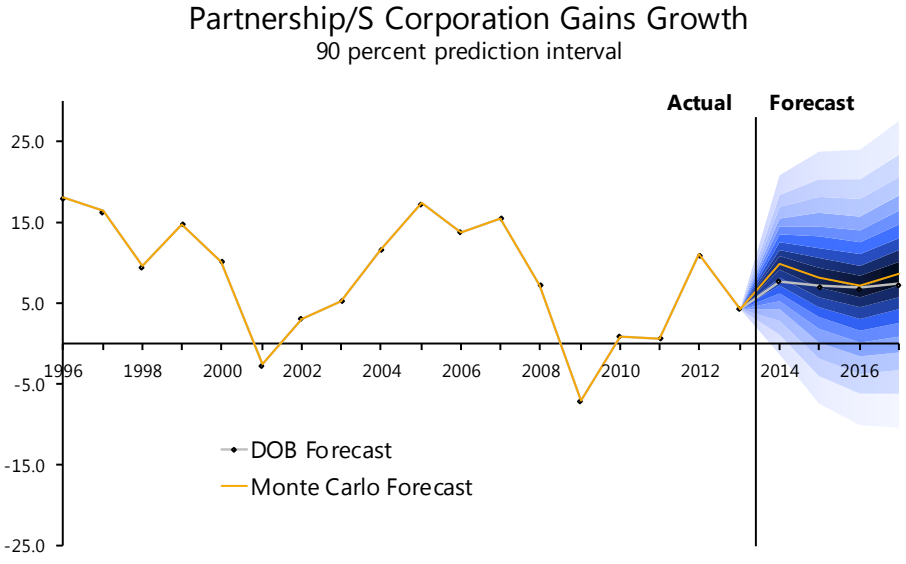
Introduction

The Division of the Budget uses forecasting models to project future values for the components of New York State adjusted gross income (NYSAGI). By and large, these models presume that the historical relationships between the components of income and a number of key economic indicators are useful for projecting their future behavior, and that these relationships are stable and can be estimated using standard statistical methods. Since all statistical models are simplifications of complex relationships, they are subject to model misspecification error. In addition, there are risks associated with the forecasts for the exogenous economic indicators. Even if a model is well specified and the future values of the exogenous inputs can be predicted with certainty, a statistical forecast remains subject to error. There is always a component that cannot be captured by the model, which is simply ascribed to random variation. And the estimated parameters of the model are themselves random variables and, as such, subject to estimation error.

The tool used by the Division of the Budget for presenting the risk to the forecast is the fan chart. Fan charts display prediction intervals as shown in the sample chart below (see Figure 1). It is estimated that with 90 percent probability, future values will fall into the shaded area of the fan. Each band within the shaded area reflects five percent probability regions. The chart "fans out" over time to reflect the increasing uncertainty and growing risk as the forecast departs further from the base year. Fan charts can exhibit skewness that reflects more downside or upside risk to the forecast, and the costs associated with erring on either side. Not only does the fan chart graphically depict the risks associated with a point forecast as time progresses, but it also highlights how realizations that are quite far from the point estimate can have a reasonably high likelihood of occurring.

The Budget Division's forecast for future years, also shown in the fan chart, can differ from the simulated forecast mean around which the fan chart is centered. In the sample chart for partnership and S corporation gains below, we lowered growth rates for 2014 and 2015 to reflect the possibility that the projected levels may be artificially inflated. Unlike the capital gains equation, nothing in the partnership and S corporation model controls for anticipated tax rate changes such as the increase in the personal income tax rate in 2013. The strong growth in 2012 suggests that taxpayers shifted some income from 2013 to 2012 leaving the 2012 level higher than the explanatory variables would have predicted. In 2013, the difference between the PSG total from the Tax Department's sample of taxpayers and the unverified PSG total from processed tax files was unusually large, casting some doubts on the low level of PSG found in 2013. The out-year growth rates are adjusted slightly downward to hedge against the risk introduced through the unexpected large fluctuations of the past two tax years.

Figure 1



Note: With 90 percent probability, partnership and S corporation gains growth will fall within the shaded region. Bands represent 5% probability regions.

Source: NYS Department of Taxation and Finance; DOB staff estimates.

Monte Carlo Simulation Study

The fan charts used by DOB are based on means and standard deviations derived from another tool, the Monte Carlo simulation study. For a given model specification and a given set of exogenous inputs, Monte Carlo simulation studies evaluate the risk to the forecast due to variation in the dependent variable that cannot be explained by the model, as well as the random variation in the model parameters. By assumption, the model errors are considered to be draws from a normally distributed random variable with mean zero. For purposes of the simulation, the model parameters are also considered to be random variables that are distributed as multivariate normal. The standard deviation of the regression errors, and the means and standard deviations of the parameter distribution are derived from the regression analysis.

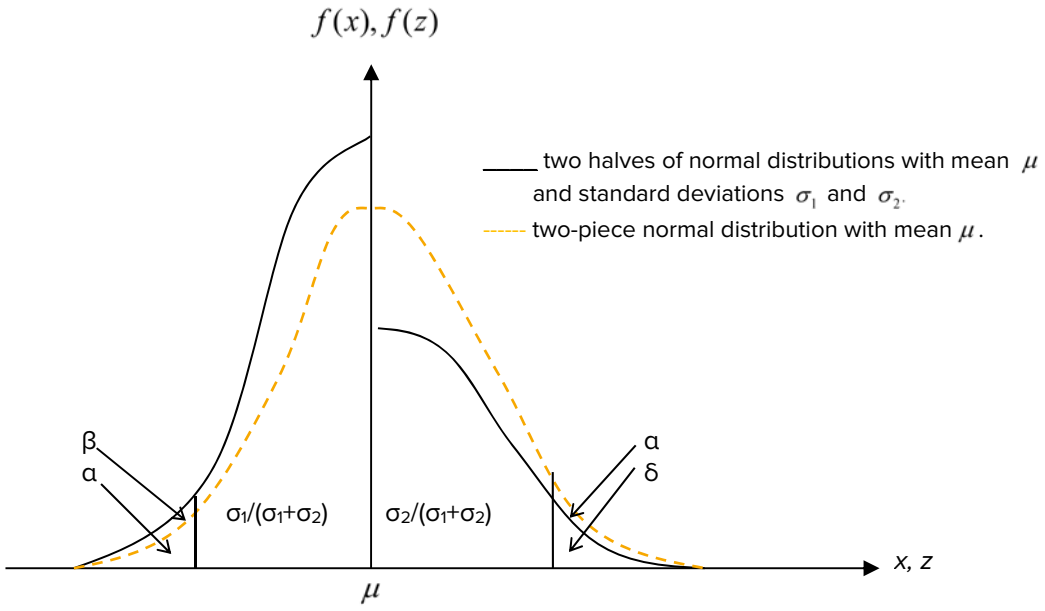
In order to simulate values for the dependent variable, a random number generator is used to generate a value for the model error and values for the parameters from each of the above probability distributions. Based on these draws and values from the input data set, which for purposes of the simulation is assumed to be fixed, the model is solved for the dependent variable. This "experiment" is typically repeated thousands of times, yielding thousands of simulated values for each observation of the dependent variable. The means and standard deviations of these simulated values provide the starting point for the fan chart.

The Fan Chart: Theoretical Underpinnings

To capture the notion of asymmetric risk, the fan chart used by DOB is based on a two-piece normal distribution for each of the forecast years following an approach due to Wallis (1999). A two-piece normal distribution of the form

$$f(x)=\begin{cases} A\exp[-(x-\mu)^2/2\sigma_1^2] & x\le\mu \\ A\exp[-(x-\mu)^2/2\sigma_2^2] & x\ge\mu \end{cases} \qquad (1)$$

with $A=(\sqrt{2\pi}(\sigma_1+\sigma_2)/2)^{-1}$, is formed by combining halves of two normal distributions having the same mean but different standard deviations, with parameters (μ,σ_1) and (μ,σ_2), and scaling them to give the common value $f(\mu)$. If $\sigma_1<\sigma_2$, the two-piece normal has positive skewness with the mean and median exceeding the mode. A smooth distribution $f(x)$ arises from scaling the discontinuous distribution $f(z)$ to the left of μ using $2\sigma_1/(\sigma_1+\sigma_2)$ and the original distribution $f(z)$ to the right of μ using $2\sigma_2/(\sigma_1+\sigma_2)$.



One can determine the cutoff values for the smooth probability density function $f(x)$ from the underlying standard normal cumulative distribution functions by recalling the scaling factors. For $\alpha < \sigma_1/(\sigma_1+\sigma_2)$, i.e. to the left of μ, the point of the two-piece normal distribution defined by $\text{Prob}(X \le x_\alpha) = \alpha$ is the same as the point that is defined by $\text{Prob}(Z \le z_\beta) = \beta$, with:

$$\beta = \frac{\alpha(\sigma_1+\sigma_2)}{2\sigma_1} \qquad \text{and} \qquad x_\alpha = \sigma_1 z_\beta + \mu$$

Likewise, for $(1-\alpha) < \sigma_2/(\sigma_1+\sigma_2)$, i.e. to the right of μ, the point of the two-piece normal distribution that is defined by $\text{Prob}(X \le x_\alpha) = \alpha$ is the same as the point that is defined by $\text{Prob}(Z \le z_\delta) = \delta$, with:

$$\delta = \frac{\alpha(\sigma_1+\sigma_2)}{2\sigma_2} \qquad \text{and} \qquad x_{1-\alpha} = \sigma_1 z_{1-\delta} + \mu$$

For the two-piece normal distribution, the mode remains at μ. The median of the distribution can be determined as the value defined by $\text{Prob}(X < x_\alpha) = 0.5$. The mean of the two-piece normal distribution depends on the skewness of the distribution and can be calculated as:

$$E(X) = \mu + \sqrt{\frac{2}{\pi}}(\sigma_2 - \sigma_1)$$

The Fan Chart: Choice of Parameters

In constructing its fan charts, DOB uses means from the Monte Carlo simulation study as the mean, μ, of the two underlying normal distributions. As mentioned above, if the two-piece normal distribution is skewed, the Monte Carlo mean becomes the mode or most likely outcome of the distribution and will differ from the median and the mean. In the sample fan chart above, the mode is displayed as the crossed line. Except for in extremely skewed cases the mode tends to fall close to the middle of the central 10 percent prediction interval. As Britton et al. (1998) point out in their discussion of the inflation fan chart by the Bank of England, the difference between the mean and the mode provides a measure of the skewness of the distribution. Given the skewness parameter, γ, DOB determines the two standard deviations, σ_1 and σ_2, as $\sigma_1 = (1+\gamma)\sigma$ and $\sigma_2 = (1-\gamma)\sigma$, where σ is the standard deviation from the Monte Carlo simulation study.

By definition, the mean of the distribution is the weighted average of the realizations of the variable under all possible scenarios, with the weights corresponding to the probability or likelihood of each scenario. In its forecasts, DOB aims to assess and incorporate the likely risks. Though no attempt is made to strictly calculate the probability weighted average, the forecast will be considered a close approximation of the mean. Thus, the skewness parameter, γ, is determined as the difference between DOB's forecast and the Monte Carlo mean. DOB's fan chart shows central prediction intervals with equal tail probabilities. For example, the region in the darkest two slivers represents the ten percent region in the center of the distribution. DOB adds regions with 5 percent probability on either side of the central interval to obtain the next prediction interval. If the distribution is skewed, the corresponding 5 percent prediction intervals will include different ranges of growth rates at the top and the bottom, thus leading to an asymmetric fan chart.

The 5 percent prediction regions encompass increasingly wider ranges of growth rates as one moves away from the center because the probability density of the two-piece normal distribution decreases as one moves further the tails. Thus, the limiting probability for any single outcome to occur is higher for the central prediction regions than for intervals further out because a smaller range of outcomes shares the same cumulative probability. Over time, risks become cumulative and uncertainties grow. DOB uses its own forecast history to determine the degree to which σ_1 and σ_2 need to be adjusted upward to maintain the appropriate probability regions.

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Part II

Revenue Methodologies

Background

The New York State (NYS) personal income tax (PIT) was originally enacted in 1919, six years after the ratification of the Sixteenth Amendment to the U.S. Constitution allowed the Federal government to levy a PIT. A top rate of 3 percent was imposed on taxable incomes above $50,000 and remained in force until 1930. The present system of conformity with the Federal definition of adjusted gross income and allowing itemized deductions began in 1960. The tax rate schedule changed several times during the 1970s, with the top rate peaking at 15.375 percent on taxable incomes above $25,000. Subsequently, the State underwent several major tax law reforms and rate reductions, culminating in a top statutory default tax rate of 6.85 percent as of 1997 and the implementation of numerous deductions and credits. In May 2003, two new top brackets were added temporarily for tax years 2003 through 2005 with a maximum rate of 7.7 percent on taxable income above $500,000. The State's tax rate schedule returned to 2002 law effective in 2006. For tax years 2009 through 2011, the top tax rate was temporarily increased to 8.97 percent on taxable income above $500,000. The PIT was reformed for tax years 2012 through 2017 by lowering rates for middle income taxpayers and adding three new brackets on taxable income above $150,000 with a top rate of 8.82 percent. Also, starting in tax year 2013, the tax brackets and standard deduction were indexed to the all urban Consumer Price Index (CPIU).

FY 2017 Enacted Budget legislation included additional middle-income tax rate reductions that started to phase-in during tax year 2018 and will continue through tax year 2025. Annual tax bracket and standard deduction indexing expired after tax year 2017, while the top bracket and associated rate of 8.82 percent both sunset on December 31, 2019.

In response to the Tax Cuts and Jobs Act (TCJA) of 2017, FY 2019 Enacted Budget legislation decoupled from Federal Tax Law by linking several aspects of State Tax Law to the Internal Revenue Code as it existed prior to the TCJA.

The Nature of the Forecasting Problem

Detailed knowledge of the composition and distribution of taxable income is critical in accurately projecting future PIT receipts. Consequently, the PIT forecasting process presents unique challenges. One complicating factor is the complex linkage between economic activity and PIT revenue. Individual taxpayer activities generate various forms of taxable income – such as wages, non-corporate business income, capital gains realizations, dividends, and interest income – that give rise to tax liability and, in turn, "cash" payments to the State. There can be long lags between the point in time when the liability is incurred and the cash payment is actually received by the New York State Department of Taxation and Finance. This lag is minimal for wages and salaries due to the withholding mechanism. However, for the non-wage components, such as capital gains realizations and business income, the lag can exceed one year.

A related challenge arises from the delay in the availability of liability data, of which the primary source is individual tax returns. The NYS Department of Taxation and Finance provides very timely information on the flow of PIT receipts throughout the tax year. Indeed, withholding data, which track wages and salaries closely, are compiled daily, while estimated payments are paid and compiled quarterly throughout the tax year. However, there is no detailed information on the income components that generated the underlying tax liability until tax returns are processed during the following year. The delay is compounded by the ability of taxpayers to request

extensions for filing their returns, a common practice among high-income taxpayers. Thus, a reliable estimate of 2017 tax liability will not become available until the end of 2018. This estimate will be further refined over the course of the first half of 2019 as Department of Taxation and Finance staff closely inspect and verify tax returns. The 2017 dataset, known as the PIT population file, is expected to become available during the summer of 2019.

Detailed information on both the components and distribution of taxable income is also necessary for analyzing the impact of proposed tax law changes on PIT liability. Tax law changes that affect particular income components may have variable effects on taxpayers depending on their income. For example, a change in the tax treatment of capital gains would tend to affect high-income taxpayers more than low-income taxpayers, all things being equal. Therefore, it is essential to be able to project not only the total value of the components of taxable income, but also how those components are distributed across taxpayers by income.

Computing PIT Liability

The computation of the PIT starts with the addition of the taxable components of income to arrive at Federal gross income.[1] The Internal Revenue Code permits certain exclusions and adjustments in arriving at Federal adjusted gross income (FAGI). The State requires certain additions and subtractions to FAGI in order to obtain New York State adjusted gross income (NYSAGI). NYSAGI is reduced by the larger of the State standard deduction or the total of itemized deductions. State itemized deductions generally conform to the Federal concept but with certain modifications, such as the add-back of State and local income taxes. Since tax year 2009, New York State has limited deductions to 50 percent of the charitable contribution for taxpayers with incomes above $1 million. Additionally, for tax years 2010 through 2019, the charitable deduction for taxpayers with incomes above $10 million has been further limited to 25 percent. State taxpayers may also subtract from NYSAGI a $1,000 exemption for each dependent, not including the taxpayer and spouse, in determining taxable income.

A graduated tax rate schedule is applied to taxable income to compute the tax owed. In addition, those with NYSAGI above $107,650 must calculate a supplemental tax that “recaptures” the benefit of the lower brackets. Taxpayers arrive at their final tax liability after subtracting the credits for which they qualify.[2] Taxpayers who qualify for refundable credits, such as the Earned Income Tax Credit and Empire State Child Credit, may even owe “negative” liability, entitling them to a payment from the State.

[1] The income components include: wages, salaries and tips; interest and dividends; State and local income tax refunds; alimony received; net business and farm incomes; capital gains and losses; IRA distributions and pensions and annuities; rents and royalties; incomes from partnerships, S corporations and trusts; unemployment compensation; and taxable Social Security benefits.

[2] Current State law allows the following major credits: Earned Income Tax Credit; Empire State Child Credit; household credit; child and dependent care credit; real property tax circuit breaker credit; agricultural property tax credit; long-term care insurance credit; college tuition credit; nursing home assessment credit; investment credit; Empire Zone credits, Excelsior Jobs Program credits; enhanced real property tax circuit breaker credit; the property tax relief credit; the new homeowner STAR credit; and the NYC STAR credit.

Data Sources

PIT data come primarily from the NYS Department of Taxation and Finance, although ancillary data are obtained from the U.S. Internal Revenue Service (IRS). Detailed descriptions of the various data sources appear below.

PIT Study Files

PIT study files are created every year by the NYS Department of Taxation and Finance specifically for the purpose of analysis and research. Prior to the 2015 tax year the study files were a statistical sample of income tax returns stratified by region; income; filer type; resident status; whether the taxpayer itemizes deductions or claims the standard deduction; and whether the taxpayer claims one or more business credits, one or more personal credits, or no credits. The most recent such study file pertained to the 2014 tax year and contained approximately 733,700 records. Because it contained only a sample of the taxpayer universe, each record had a weight assigned to it, such that when file components were multiplied by the weights, the results could be assumed to represent a statistically accurate portrait of the actual New York State taxpayer profile.

However, beginning with the 2015 tax year the NYS Department of Taxation and Finance began providing a "population study file." The most recent version, for tax year 2016, contains roughly 10.5 million records, reflecting all returns filed in that tax year. The study file contains detailed information, including: marital and resident status, components of income, Federal and NYS adjusted gross incomes, either the standard deduction or the components of itemized deductions, the number and amount of exemptions, tax liability, and credits. Since this is the universe of filer records there are no longer weights attached to each record.

Processing Reports

The Department of Taxation and Finance generates daily, weekly, and monthly collection reports on withholding, estimated payments, and those components of collections that are related to taxpayers' final settlement with the State for the previous tax year, i.e., their tax returns. The Division of the Budget monitors these data closely for the purposes of both forecasting and monthly cash flow analysis.

Each receipts component follows a different payment and reporting schedule. Withholding information is reported on a daily basis, while estimated payments follow a quarterly schedule (April, June, September, and January).[3] Final payments from taxpayers whose returns are accompanied by a remittance to the State tend to arrive during the March, April, and May period, as well as during October when returns are due for taxpayers receiving extensions. Refunds on timely filed returns must be issued within 45 days of the due date or within 45 days of the filing

[3] If an employer was required to remit $15,000 or more of withholding tax during the calendar year preceding the previous year, the employer must remit the tax on or before the third business day following the payroll date that accumulated tax withheld exceeds $700. If an employer was required to remit less than $15,000, the employer has up to five business days following the date of payroll to send payment for the withholding tax. Employers who are qualified educational organizations or health care providers must remit the tax on or before the fifth business day following the date of payment. Employers who have withheld, but not remitted, a cumulative aggregate amount of less than $700 at the close of a calendar quarter must remit the tax quarterly.

date, whichever is later. As a result, most refunds on timely filed returns are paid during the March, April, and May period.

Tax return processing reports provide year-to-date data on the number of returns filed, tax liability, and NYSAGI well before the study file for the same tax year becomes available. These reports can be used as a reality check for the NYSAGI forecasting models, with model results adjusted accordingly. Since the processing data also provide information on the distribution of returns, liability, and NYSAGI by income class and resident status, they also can be used to assess the results of the liability microsimulation model described in more detail below.

Federal Sources of Information

The Internal Revenue Service's Statistics of Income (SOI) program makes Federal data available on State resident taxpayers, through electronic data files and published reports. For instance, 2016 information on some of the income components for NYS residents was published in late spring of 2018 in the *SOI Bulletin*. Detailed information on the 2016 SOI public use data file became available during late summer of 2018. The SOI information is useful in that it provides valuable Federal tax information that is not available from New York tax returns.

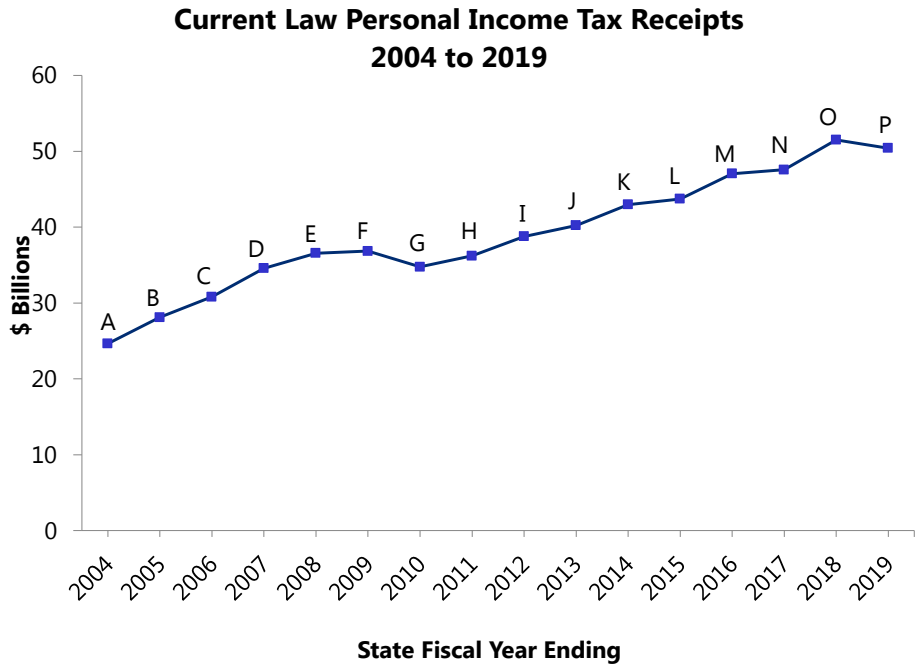
Statutory Changes

The FY 2019 Enacted Budget included several Tax Law changes that will affect PIT liability and receipts. Effective tax year 2018, Enacted Budget legislation decoupled from Federal Tax Law with respect to Tax Cuts and Jobs Act-related changes to adjusted gross income, itemized deductions, and credits. These changes include the retention of tax year 2017 treatment of 1) alimony payments, 2) the medical expenses itemized deduction, 3) the Child Tax Credit (for the purpose of calculating the value of and eligibility for the Empire State Child Tax Credit), and 4) the standard deduction for single filers. The FY 2019 Enacted Budget further decoupled from Federal Tax Law with respect to the $10,000 cap on state and local tax deductions and the elimination of qualified moving expense deductibility. Enacted Budget legislation also eliminated the requirement to itemize deductions on Federal forms as a condition of itemizing at the State level.

Furthermore, the Enacted Budget extended the statutory deadline for assessing amended tax returns, clarified New York State residency requirements for tax purposes, required employee wage reporting consistency between the Department of Taxation and Finance and the Department of Labor, and allowed warrantless tax debt to be assessed against unclaimed funds.

For a list of significant statutory changes made to the PIT, please see the *New York State Executive Budget-Economic and Revenue Outlook*.

As indicated in the "Background" section, State PIT law has been subjected to many changes over its history. The following graph shows actual and estimated PIT receipts for fiscal years 2004 to 2019 and the law changes that occurred during that period, thus indicating when PIT receipts were first affected. Note that the receipts are not adjusted for inflation.



A. FY 2004: Reflects the following changes – implemented a three year temporary surcharge on high-income taxpayers, adopted in 2003, with the second-highest rate falling from 7.5 percent in 2003 to 7.375 percent in 2004 and to 7.25 percent in 2005 and a top rate of 7.7 percent in all three years; increased the State EITC to 30 percent of the Federal credit; provided phase three of a three year reduction of the marriage penalty; and of the third phase of a four year phase-in of the tuition deduction/credit.

B. FY 2005: Reflects the following changes – continued application of the three-year temporary surcharge; increased the long-term care insurance credit from 10 to 20 percent; and included the gain from the sale of cooperative housing as NY-source income for nonresidents.

C. FY 2006: Reflects the following changes – continued application of the three-year temporary surcharge (expired on 1/1/06) and provided a new credit for individual payers of the nursing home assessment.

D. FY 2007: Reflects the following changes – expiration of the temporary personal income tax surcharge reducing the highest tax rate back to 6.85 percent, and provided the new Empire State Child Credit.

E. FY 2008: Reflects the following changes – eliminated the marriage penalty in the standard deduction; created a new earned income credit for noncustodial parents; expanded the farmers' school tax, film and commercial production credits; and provided new credits for replacing home heating systems and using bio-heat fuel.

F. FY 2009: Reflects the following changes – restructured fees on limited liability companies and provided various compliance and enforcement initiatives.

G. FY 2010: Reflects the following changes – implemented a three year temporary rate increase on high income taxpayers by increasing the highest tax rate to 8.97 percent and created two new tax brackets applicable to taxpayers with incomes over $300,000 and over $500,000; increased the limitation of itemized deductions applicable to high income taxpayers from 50 percent to 100 percent except for the deduction for charitable contributions; reformed the Empire Zones program by subjecting all companies that had been certified for at least three years to a performance review focusing on cost/benefit ratios; and levied fees on non-LLC partnerships with NY-source income at or above $1 million at the same rates applicable to LLC partnerships.

H. FY 2011: Reflects the following changes – implemented further restrictive three year limitation on the use of itemized deduction for charitable contributions through tax year 2012 for taxpayers with income above $10 million; clarified certain incomes of non-resident shareholders of S-corporations as taxable New York source income; limited the New York City PIT STAR rate reduction benefit to the first $500,000 of taxable income; and defined compensation of past services as taxable income.

I. FY 2012: Reflects the following major changes – Permitted the crediting of lottery prizes exceeding $600 against prize winner's liabilities for taxes owed to the State.

J. FY 2013: Reflects the following major changes – lowered the tax rate, for tax years 2012 through 2014, on taxpayers (married filing jointly returns) with taxable income in the $40,000 to $150,000 and $150,000 to $300,000 brackets to 6.45 percent and 6.65 percent respectively while keeping the rates unchanged from 2008 law on the $300,000 to $2 million tax bracket at 6.85 percent, increased the top rate for those earning $2 million and above (married filing jointly returns) to 8.82 percent, and indexed the tax brackets and standard deduction amounts to the Consumer Price Index (CPIU) starting in tax year 2013.

K. FY 2014: Reflects the following major changes – extended the itemized deduction limitations on taxpayers with NYSAGI in excess of $10 million for an additional 3 years; created a subtraction modification to AGI equal to three percent in 2014, 3.75 percent in 2015, and 5 percent in 2016 and after of small business or farm income.

L. FY 2015: Reflects the following changes – closed loopholes related to taxation of trust income; distributed payments related to the Family Tax Relief credit; provided real property tax relief with the Real Property Tax Freeze credit; created tax-free areas for certain businesses and allowed tax-free wages to employees of such businesses through the START-UP NY program.

M. FY 2016: Reflects the major following changes – provided tax relief for New York City residents with the Enhanced Real Property Tax Circuit Breaker credit; eliminated pre-payment of the Family Tax Relief credit; reduced property taxes for manufacturers through the Real Property Tax Relief Credit for Manufacturing.

N. FY 2017: Reflects the major following changes – implemented a new, four-year property tax relief credit; resumed payment of the Family Tax Relief credit as a "standard" credit

payment; and replaced the STAR property tax exemption with a STAR tax credit for new and relocated homeowners.

O. FY 2018: Reflects the major following changes – closed loopholes related to sales of housing cooperatives and certain assets by non-residents; converted the STAR credit for NYC residents from a credit against NYC PIT into a credit against NYS PIT; implemented the first year of middle-income tax cuts; and extended the 8.82 percent top-tax bracket and rate for an additional two years.

P. FY 2019: Reflects the major following changes – replaced the NYC STAR PIT rate reductions with a NYS STAR credit for NYC residents; extended the itemized deduction limitations on taxpayers with NYSAGI greater than $10 million for an additional two years; continued phase-in of middle-income tax cuts; extended the statute of limitations for assessing amended tax returns; and allowed for warrantless tax debt to be assessed against unclaimed funds.

Forecast Methodology

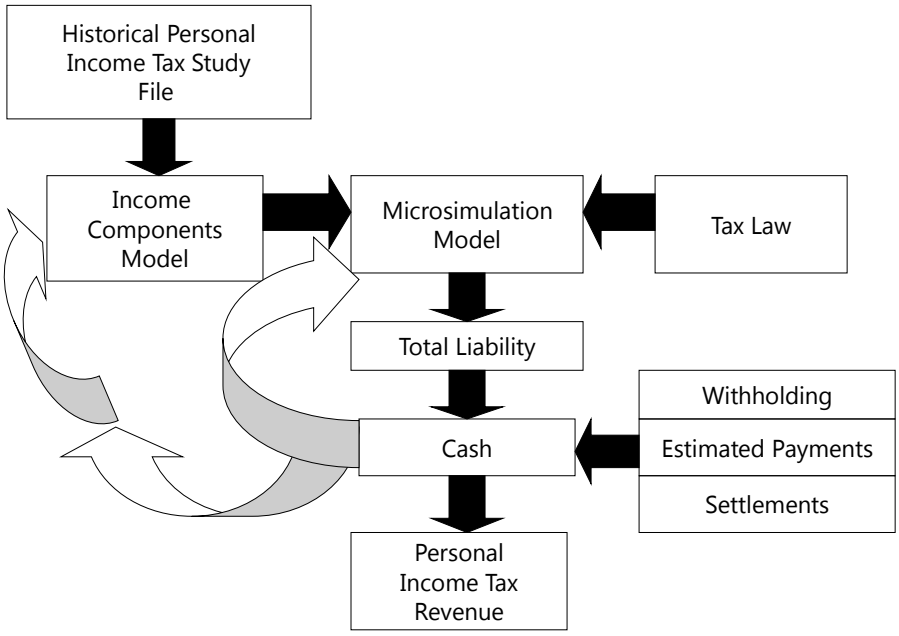
The estimating/forecasting process for the NYS PIT is composed of three major components. They are:

1. ***The NYS adjusted gross income (NYSAGI) models***, which are a set of single-equation econometric models that project the individual components of gross taxable income;

2. ***The PIT microsimulation model***, which combines the results from the NYSAGI models with the microdata from the PIT study file to forecast PIT liability. Microsimulation is also used to assess the impact of tax law changes; and

3. ***The liability-to-cash models***, which map calendar year liability to fiscal year cash estimates and monitor day-to-day actual cash receipts and refunds.

Components of the NYS PIT Forecasting Process



As shown in the figure above, all three components of the estimation and forecasting process are closely interconnected.

- Information on individual income components from historical PIT study files is used to construct a database for the various forecasting models for the components of NYSAGI. Given the lag with which tax return data become available (the 2016 PIT study file is the latest available), the forecast results from these models are often adjusted to reflect the latest available cash information, which as of November 2018 exists for almost all of tax year 2017 and much of 2018. The adjusted results become key inputs to the liability microsimulation model.

- The most recent PIT study file is the starting point for the microsimulation model. To compute liability beyond the base year, taxpayer incomes are trended forward by growing the individual components of income and by adjusting the weights created after the population study file base year to reflect the results from the NYSAGI models.

- The liability forecast from the PIT microsimulation model is used to project cash receipts for future years.

In the current fiscal year, cash information imposes constraints on the income components analysis and the microsimulation model outcome (see white arrows in the figure above). Conversely, for outyear projections, where no cash information is available, economic assumptions and microsimulation estimates of liability drive the cash estimates (see black arrows in the figure).

Details on the NYSAGI forecasting model can be found in the "New York State Adjusted Gross Income" chapter of this report. The following section describes each of the remaining components of the PIT forecasting process.

The PIT Microsimulation Model

The PIT microsimulation model generates forecasts of PIT liability for future years and can also be used to estimate the impact of tax law changes on overall liability and on different taxpayer groups. Examples of tax law changes include: changes in the standard deduction or exemption amounts, changes in the tax rate schedule, and changes in various tax credits.

The process of forecasting liability proceeds in two steps. The first step is to "advance" or "trend" the most recent study file into future tax years. This is done sequentially; for example, the PIT liability projections will require forecasts of aggregate gross income components and the number of tax returns from the NYSAGI models for 2017 and beyond. Thus, the 2016 study file forms the base for the "trended" 2017 dataset, which in turn becomes the base for creating the 2018 trended dataset, and so on. Once this is done for any given year, the new "trended" dataset can be submitted to the second step, which is the computation of tax liability, given taxpayers' trended incomes and existing tax law for that year. This second step is essentially the application of a PIT tax liability calculator that follows the structure of the State tax form.

The NYSAGI models forecast aggregate growth rates for all of the components of gross income. However, the microsimulation model allows these growth rates to vary by income for the six largest components of gross income for residents – wages and salaries, positive capital gains realizations, positive partnership and S corporation gains, dividend income, interest income, and proprietors and farm income – as well as for nonresident wages and salaries. These growth rates are determined by a set of econometric models that forecast the *shares* of the major components by income deciles. These shares are constrained to add to unity, ensuring that the aggregate income targets are met. Income deciles are determined based on the taxpayer's NYSAGI. For nonresidents, this measure of income is derived from that portion of gross income for which the source is designated by the taxpayer to be New York State. Prior to estimation, the deciles whose shares tend to rise and fall together over time are grouped. The share estimating equations typically include variables that are forecast within the U.S. and New York State macroeconomic models, as well as growth in the aggregate component itself.

After estimating the decile growth rates for the major income components, the most recent study file can be trended forward to the next year. Because the base tax year data set now contains all returns for that year (and so is unweighted), this requires the construction of a weight for each record. Residents and nonresidents are trended separately. In the first step of the trending process for residents, individual taxpayer record weights are advanced by the projected growth in the total number of resident returns.[4] In the second step, the six major components of gross income listed above are advanced by the projected decile-specific growth rates, discounted for the growth in the total number of returns. In the third step, the record weights are adjusted yet again to ensure that the aggregate income component targets implied by the NYSAGI model forecast are met precisely. Following the U.S. Treasury Department methodology, a loss function is constructed that equally penalizes upward and downward adjustments to the existing weights.

[4] Details on the forecasting model for the total number of resident returns can be found in the "New York State Adjusted Gross Income" chapter of this book.

Weight adjustments are chosen to minimize this loss function subject to meeting the aggregate income targets, implying an objective function of the following form:

$$\mathcal{L} = \sum_{i=1}^{I}\left[n_i w_i (x_i^4 + x_i^{-4}) \right] + \sum_{j=1}^{6} \lambda_j (y_j - \sum_{i=1}^{I} x_i w_i y_{ij})$$

Where: I is the number of weight classes, n_i is the number of records in the i^{th} weight class, w_i is the existing weight for the i^{th} weight class, x_i is the adjustment to the existing weight for the i^{th} weight class, λ_j is the Lagrange multiplier for the j^{th} major income component, y_j is the aggregate target for the j^{th} major income component, and y_{ij} is the unweighted total for the j^{th} major income component for income class i.

In the final step of the trending process, the remaining components of taxpayer income are trended forward at the rates projected by the NYSAGI models, discounted by the growth in the weights. The entire procedure is repeated for nonresidents, except that decile-specific rates are applied only to wages, and the minimization of the weight adjustment loss function is constrained only by the need to satisfy the total nonresident wage target. The final trended dataset forms the base for trending forward to the following year.

Once a trended dataset has been created, it can then be submitted to the "liability calculator." This component of the microsimulation makes use of all of the available information on each taxpayer's record to compute NYSAGI, allowable deductions and exemptions, taxable income, and all of the various allowable credits in order to compute that taxpayer's total tax liability. Total State liability is the weighted sum over all of the individual taxpayer records in the dataset, where the sum of the weights corresponds to the size of the total taxpaying population of the State. The impact of alternative tax regimes on total State liability can be simulated by adjusting model parameters, such as the tax rates, and repeating the tax calculating process.

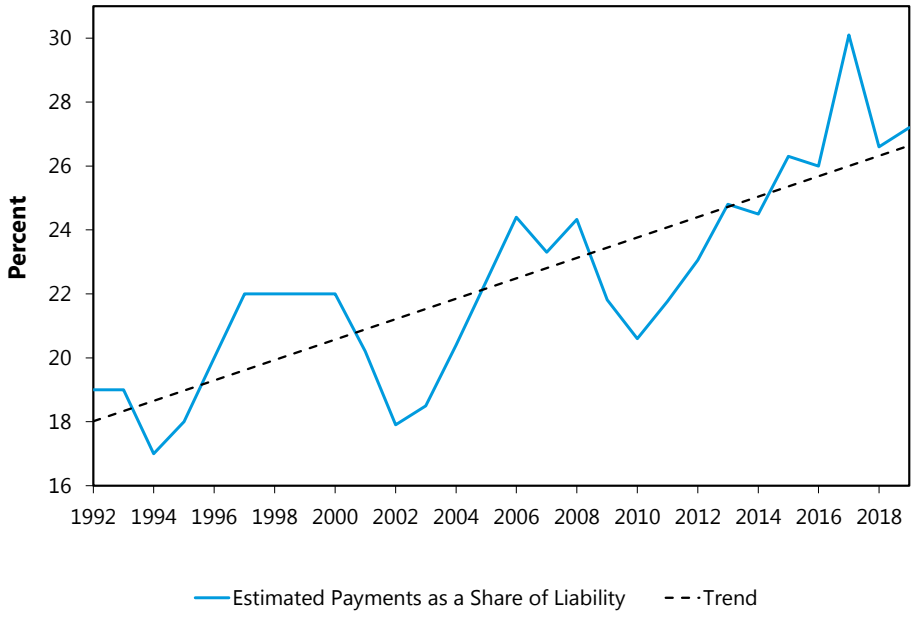
The Liability-to-Cash Process

The liability-to-cash process involves monitoring all available collection information for the different components of the PIT to better estimate current year receipts and to improve our estimates of current year liability. Year to year liability growth, along with the actual daily, weekly and monthly collections, is used as a guide for growth in cash collections.

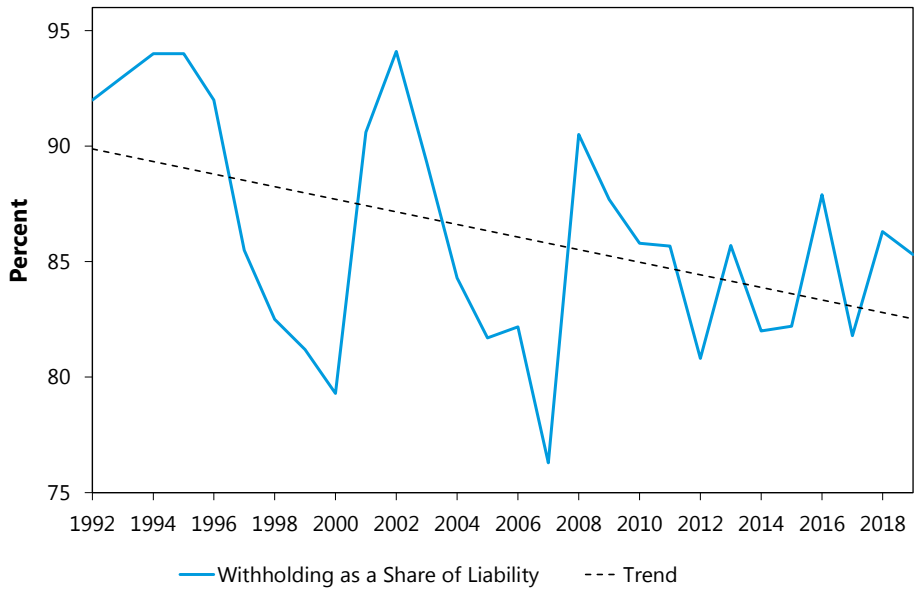
The components of PIT cash receipts for a fiscal year include withholding (current year and prior year), estimated payments (current year payments and extension payments for the prior tax year), final returns, delinquencies (assessments and payments related to prior year returns), and refunds (current, prior, minor offsets, State/City offsets, credit to estimated payments). Final returns, extension payments, and refunds comprise the components of taxpayers' final "settlement" of their tax liabilities.

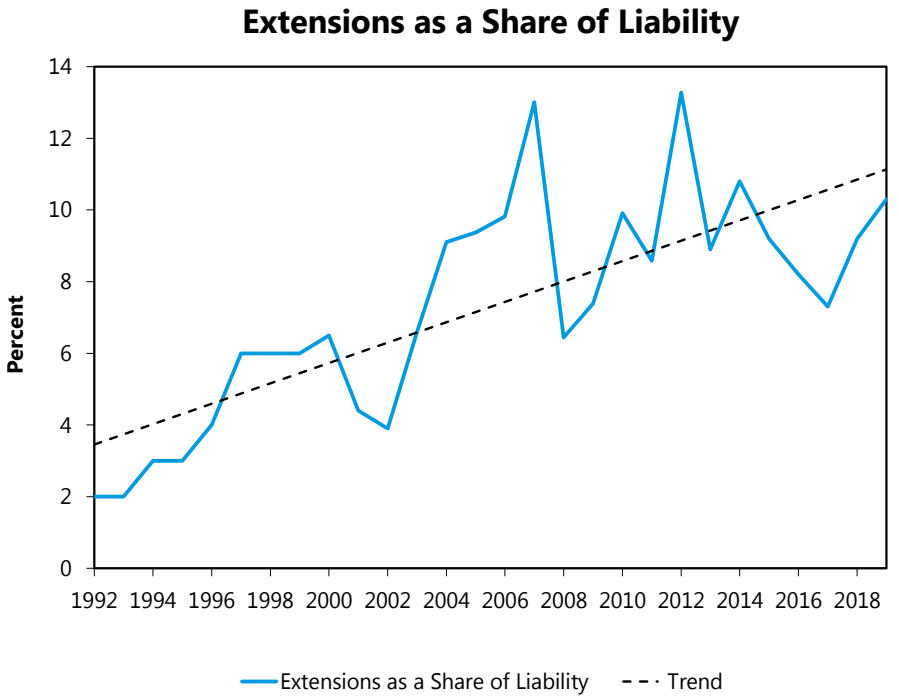
The following six graphs show the components of cash liability (i.e., estimated payments, withholding, extensions, and final return payments) over time as a percentage of tax year liability; refunds paid as a share of withholding collections; and the major components of PIT cash for FY 2018. Note the cyclical behavior of each of the cash components around a long-term trend.

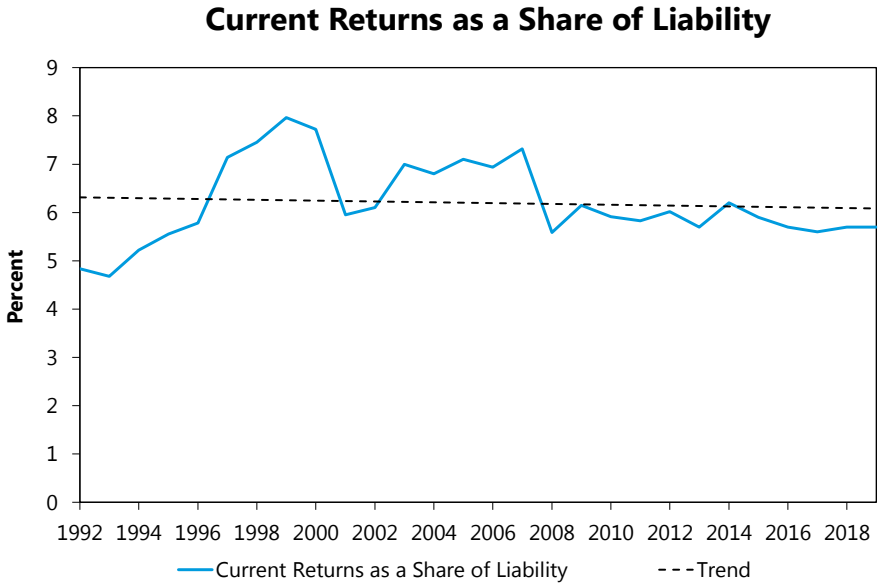
Estimated Payments as a Share of Liability

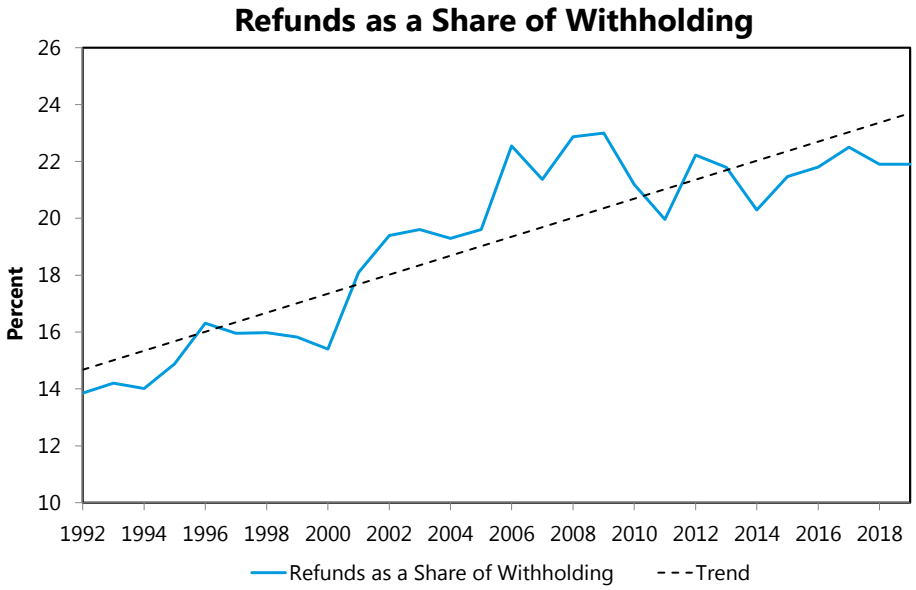


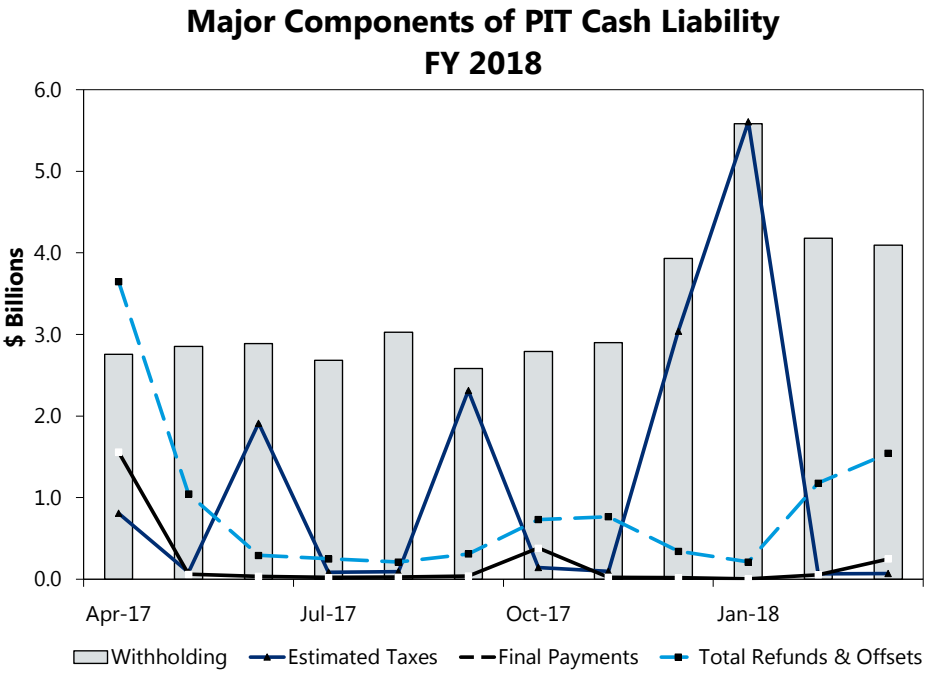
Withholding as a Share of Liability




Extensions as a Share of Liability
Percent
14
12
10
8
6
4
2
0
1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
Extensions as a Share of Liability
Trend


Current Returns as a Share of Liability
Percent
9
8
7
6
5
4
3
2
1
0
1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
Current Returns as a Share of Liability
Trend





As discussed earlier, information regarding the various components of tax collections is received on a daily, weekly, and monthly basis. Staff monitors tax collections and other information closely throughout the year to assess actual receipts performance versus estimates. For example, withholding collections (which amounted to $40.3 billion in FY 2018, or about 78 percent of total net collections) are generally monitored on a daily basis throughout the year, while payments with

returns and extension requests, as well as refunds, are monitored most intensively in April and May of each year.

A comprehensive PIT cash collection report is received from the Department of Taxation and Finance mid-month for the prior month. This report is used to determine the official cash flow for the prior month. Staff then compares the actual collections data in this report with the original estimates for the month, and for the entire fiscal year. At the end of each quarter, this information is used, along with historical information and Tax Law changes, to make necessary adjustments to the cash liability estimate.

Another critical aspect of the cash-to-liability process is forecasting the different components of receipts on a fiscal year basis, using results from the PIT simulation model as a benchmark. Various methodologies are applied for different components of receipts.

The largest component of income tax collections, withholding, is estimated based on quarterly forecasts of NYS wages. The withholding methodology begins with a model wherein withholding is the dependent variable and state wages are the main independent variable, with both variables in logarithmic form, allowing the coefficients to be interpreted as elasticities. The wage impact is expected to vary by quarter, due to the seasonal impact imparted by bonus payouts, combined with the progressive nature of the tax. To capture this effect, wages are represented by four variables constructed by multiplying the logarithm of wages by a dummy variable for each quarter. Some additional dummy variables are added to control for law changes, giving the resulting elasticities a constant-law interpretation; the elasticities are presented in the table below. Consistent with expectations, the estimated elasticities are all greater than one, implying that withholding increases (decreases) at a faster rate than wages as taxpayers move through the graduated tax brackets.

CONSTANT LAW WITHHOLDING ELASTICITIES

Calendar Quarter	Long-Run Elasticity*	Standard Error
Quarter 1	1.29	0.015
Quarter 2	1.23	0.015
Quarter 3	1.23	0.015
Quarter 4	1.22	0.015

*Percent change in withholding resulting from a one percent change in wages.

Future values of withholding growth are projected by applying the appropriate elasticity to the projected quarterly growth rates for wages. Growth rates are applied to withholding on an adjusted constant-law basis. The final withholding forecast is generated by incorporating tax law change estimates and adjustments for business day differences.

The wage-withholding elasticity model is estimated using quarterly data starting in 1977 and running through the latest available quarter.

WAGE-WITHHOLDING ELASTICITY

$$ln(WITH_t) = \underset{(0.08)}{-5.78} + \underset{(0.02)}{1.29 * ln(WAGE1_t)} + \underset{(0.02)}{1.23 * ln(WAGE2_t)} + \underset{(0.02)}{1.23 * ln(WAGE3_t)}$$

$$+ \underset{(0.02)}{1.22 * ln(WAGE4_t)} - \underset{(0.07)}{0.24 * S1_t} - \underset{(0.01)}{0.05 * DUM1_t} - \underset{(0.02)}{0.04 * DUM2_t}$$

$$- \underset{(0.02)}{0.11 * DUM3_t} + \underset{(0.01)}{0.03 * DUM4_t} - \underset{(0.01)}{0.03 * DUM5_t} + \underset{(0.01)}{0.04 * DUM6_t}$$

$$- \underset{(0.01)}{0.02 * DUM7_t} - \underset{(0.01)}{0.09 * DUM8_t} - \underset{(0.01)}{0.06 * DUM9_t} + \underset{(0.01)}{0.07 * DUM10_t}$$

$$+ \underset{(0.01)}{0.07 * DUM11_t} + \underset{(0.01)}{0.08 * DUM12_t} + \underset{(0.01)}{0.02 * DUM13_t} + \underset{(0.08)}{0.12 * AR_{t-1}}$$

$$- \underset{(0.08)}{0.41 * AR_{t-4}} + U_t$$

Adjusted R^2 = 0.998
Root Mean Square Error = 0.02
Number of Observations = 167
$U_t = Residual$

Note: Values in parentheses under coefficients represent standard errors.

ln(WITH)

- The logarithm of withholding.

ln(WAGE1)

- Equal to the logarithm of total NYS wages if Q1, 0 otherwise.

ln(WAGE2)

- Equal to the logarithm of total NYS wages if Q2, 0 otherwise.

ln(WAGE3)

- Equal to the logarithm of total NYS wages if Q3, 0 otherwise.

ln(WAGE4)

- Equal to the logarithm of total NYS wages if Q4, 0 otherwise.

S1

- Seasonal variable for the first quarter of each calendar year.

DUM1

- Indicator variable equal to 1 after 1985 Q2, 0 otherwise.

DUM2

- Indicator variable equal to 1 after 1987 Q1, 0 otherwise.

DUM3

- Indicator variable equal to 1 after 1987 Q3, 0 otherwise.

DUM4

- Indicator variable equal to 1 after 1988 Q3, 0 otherwise.

DUM5

- Indicator variable equal to 1 after 1989 Q3, 0 otherwise.

DUM6

- Indicator variable equal to 1 after 1991 Q3, 0 otherwise.

DUM7

- Indicator variable equal to 1 after 1995 Q2, 0 otherwise.

DUM8

- Indicator variable equal to 1 after 1996 Q1, 0 otherwise.

DUM9

- Indicator variable equal to 1 after 1997 Q1, 0 otherwise.

DUM10

- Indicator variable equal to 1 in 2003 Q3 and 2003 Q4, 0.5 in 2004, 0.45 in 2005, 0 otherwise.

DUM11

- Indicator variable equal to 1 between 2009 Q2 and 2009 Q4, 0 otherwise.

DUM12

- Indicator variable equal to 1 between 2010 Q1 and 2011 Q4, 0 otherwise.

DUM13

- Indicator variable equal to 1 after 2011 Q4, 0 otherwise.

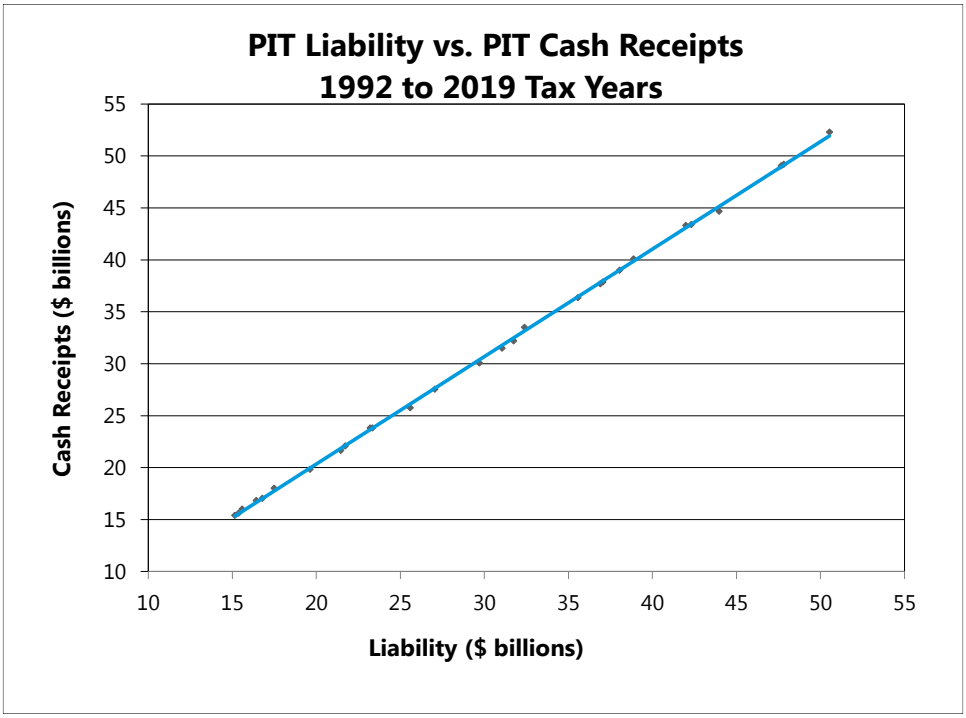
AR

- Autoregressive lag variable.

The method for estimating non-withholding cash components utilizes historical patterns of growth rates and examines the share of non-withholding liability to total liability normally provided by each component. This analysis is referred to as the ratio method. It is combined with estimates of liability growth to derive growth rates for the non-withholding cash components. These rates are then applied to the most recent actual cash information to produce the outyear forecast.

Since the sum of the positive (e.g., estimated tax) and negative (e.g., current year refunds) components of cash collections roughly equal total liability, movements in these components over time should ultimately be driven by changes in liability.[5] The graph below shows the extremely close relationship between cash received and liability reported on returns. However, the relationship between the individual cash components and liability has not been constant.

[5] Even if cash collections could be precisely identified with a tax year, collections and liability might not be exactly equal. Cash collections tend to exceed liability for a given tax year since, for example, not every taxpayer who has taxes withheld from a paycheck or makes a quarterly estimated payment files a tax return. Consequently, total cash collections corresponding to a particular tax year exceed the liability reported on returns filed for that year. The value of this discrepancy varies from year to year, averaging about 2.5 percent of liability over the period from 2007 to 2016, the most recent ten years for which data are available.



The relationship between the sum of total cash components and liability is used to as a reasonableness test for the ratio method. History dictates that total cash components should always exceed liability by a percentage that falls within a somewhat narrow range. However, small changes in this percentage can generate substantial differences in total cash, and this variation in the cash-to-liability ratio serves as a significant source of estimation error. Another significant source of estimation error arises from the difficulty in assigning the liability to the correct cash component in the appropriate fiscal year, though the primary source of forecast error is the uncertainty surrounding the forecasts for future tax liability.

Risks to the Liability Forecast

The PIT liability forecast is subject to all of the risks that pertain to the forecast of wages and the other components of taxable income. These risks are particularly pronounced for New York State since a significant portion of taxpayer income is tied to the performance of equity markets, financial services industry profits, and real estate activity, all of which have been shown to be extremely volatile. The predominance of those income components that are tied to these volatile areas of the economy, such as capital gains realizations, bonuses and stock incentive payouts, and the concentration of such income in the hands of a relatively small number of high-income taxpayers pose significant risks to the PIT forecast.

Background

For a detailed description of the sales and use tax (SUT) rate, base and administration please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Data Sources

The primary sources of data used in the estimation and forecasting methodology for the SUT are as follows:

- *AS043, Department of Taxation and Finance Monthly Report of Receipts*. This report contains gross and net receipts data.

- *Various reports, Department of Taxation and Finance*. These reports supplement the *AS043 by* providing information on data such as audit collections, prior period adjustments and daily receipts.

- *Various U.S. and New York government agencies,* including the *U.S. Bureau of Economic Analysis of the Commerce Department,* provide economic data used in the econometric equations.

Statutory Changes

For a list of significant statutory changes made to the SUT, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

The following steps are taken to forecast SUT receipts:

1. To adjust the sales tax series to more closely correspond to the underlying economic activity, quarterly cash collections are adjusted for credits and other statutory changes, non-voluntary collections (audit collections, tax compliance) are removed from the series, and collections from the first ten days of the quarter are placed in the previous quarter. To remove seasonality, the logarithm of this quarterly collections series is then differenced by subtracting the logarithm of collections for the same quarter of the prior year (Δ_4).

2. The resulting series serves as the dependent variable ln(SALESADJ) in the three econometric models described below.

3. The average of the three model results is then used as a base growth forecast, which is then adjusted to a cash receipts forecast by undoing timing adjustments and adding back the impact of statutory, administrative, and other relevant changes.

4. The current estimation period (limited by variable lags) is the second quarter of 1982 through the first quarter of 2017.

Equation 1: Error Correction Model with State Income and Employment

This model uses the long-run equilibrium relationship between sales tax receipts and New York State disposable income and total nonfarm employment. That relationship is estimated first since the lagged deviations appear on the right-hand-side of an error correction model framework that allows for a gradual dynamic adjustment back toward equilibrium.

ERROR CORRECTION MODEL INCLUDING INCOME AND EMPLOYMENT

$Long - Run\ Equilibrium\ Equation$:

$$ln(SALESADJ_t) = \underset{(0.005)}{1.101 * ln(EMPTOT_t)} + \underset{(0.007)}{0.721 * ln(YDNY_t)} + \underset{(0.007)}{0.049 * DQ_3} + U_t$$

$Adjusted\ R^2 = 0.99$
$Root\ Mean\ Squared\ Error = 0.03$
$Number\ of\ Observations = 144$
$U_t = Residual$

Error Correction Model:

$$\Delta_4 ln(SALESADJ_t) = \underset{(0.069)}{0.340 * \Delta_4 ln(SALESADJ_{t-1})} - \underset{(0.035)}{0.078 * RESID_t} + \underset{(0.160)}{0.678 * \Delta_4 ln(EMPTOT_t)}$$
$$+ \underset{(0.058)}{0.364 * \Delta_4 ln(YDNY_t)} + \underset{(0.014)}{0.058 * \Delta_4 ln(SP500_t)} - \underset{(0.013)}{0.034 * DCLOTH_t}$$
$$+ \underset{(0.024)}{0.057 * D1986_t} + \underset{(0.017)}{0.035 * D2004_t} + U_t$$

$Adjusted\ R^2 = 0.65$
$Root\ Mean\ Squared\ Error = 0.02$
$Number\ of\ Observations = 144$
$U_t = Residual$
$\Delta_4 = X_t - X_{t-4}$
Note: Values in parentheses under coefficients represent standard errors.

ln(EMPTOT)

- The logarithm of current-quarter total nonfarm New York State employment.

ln(YDNY)

- The logarithm of current-quarter New York disposable income.

DQ3

- A seasonal dummy variable for the third quarter.

RESID

- The error correction model uses the residual from the long-term equilibrium equation, for the same time *t,* to capture the theoretical tendency of taxable consumption to always move towards the derived equilibrium.

ln(SP500)

- The logarithm of the current period value of the S&P 500 index minus the log of the value for the same quarter of the prior year captures the importance of the financial sector to the New York economy.

DCLOTH

- On March 1, 2000, items of clothing and shoes costing less than $110 were exempted from the SUT. After September 11, 2001, the year-long exemption was temporarily suspended in favor of shorter exemption periods and the left-hand-side variable is adjusted for this change. The permanent exemption of clothing and footwear under $110 was reinstated on April 1, 2006. Beginning October 1, 2010, the permanent exemption was temporarily repealed until March 31, 2012, with a temporary $55 exemption in place from April 1, 2011 through March 31, 2012. The left-hand-side variable is adjusted for this change as well. Before 2001:Q1, DCLOTH = 0; for 2001:Q1, DCLOTH = 0.33; and DCLOTH = 1 for all subsequent quarters.

D1986 and D2004

- Dummy variables are used for outliers in 1986 and 2004.

PERCENT CHANGE IN EXOGENOUS VARIABLES — FY 2010 TO FY 2019

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019 (est.)
NY Disposable Income	2.9	4.4	6.3	0.4	4.3	4.1	4.1	6.5	4.9	4.5
NY Employment	0.7	1.3	1.2	1.6	1.9	1.9	1.4	1.4	1.4	1.1
S&P Index	15.6	8.1	11.0	21.2	15.4	2.2	7.6	16.7	10.4	4.9

Equation 2: Auto Sales and Retail Trade Employment

This model uses two alternative indicators to forecast growth in taxable sales. To capture the large portion of taxable sales that are attributable to the auto market, this model includes the dollar value of new vehicles sold in New York, itself a function of growth in the number of State vehicle

registrations. Retail trade employment represents another indicator of the strength of taxable sales and is also included in the model.

All variables, except for the five-year Treasury yield, are fourth-differenced and in natural logarithmic form. The model specification appears below.

VEHICLE SALES AND RETAIL EMPLOYMENT MODEL

$$\Delta_4 ln(SALESADJ_t) = \underset{(.003)}{0.001} + \underset{(0.075)}{0.936 * \Delta_4 ln(EMP46_t * CPICOMP_t)} + \underset{(0.015)}{0.055 * \Delta_4 ln(NOMCARS_t)}$$
$$+ \underset{(0.013)}{0.054 * \Delta_4 ln(SP500_t)} - \underset{(0.012)}{0.029 * DCLOTH_t} + \underset{(0.016)}{0.042 * D2004_t}$$
$$+ \underset{(0.022)}{0.061 * D1986_t} + U_t$$

$$NOMCARS_t = VEHREGNY_t * JPLV_t$$

$Adjusted\ R^2 = 0.69$
$Root\ Mean\ Squared\ Error = 0.02$
$Number\ of\ Observations = 144$
$U_t = Residual$
$\Delta_4 = X_t - X_{t-4}$

$$\Delta_4 \ln(VEHREGNY_t) = \underset{(0.067)}{0.734 * \Delta_4 ln(SQLV_t * EMPR_t)} + \underset{(0.071)}{0.077 * \Delta_4 ln(SQLV_{t-1} * EMPR_t)} + \underset{(0.051)}{0.059 * \Delta_4 ln(VEHREGNY_{t-2})}$$
$$- \underset{(0.004)}{0.010 * \Delta_4 RMGF5NS_{t-1}} + \underset{(0.032)}{0.288 * DUM1993_t} + U_t$$

$Adjusted\ R^2 = 0.73$
$Root\ Mean\ Squared\ Error = 0.06$
$Number\ of\ Observations = 144$
$U_t = Residual$
$\Delta_4 = X_t - X_{t-4}$

Note: Values in parentheses under coefficients represent standard errors.

*ln(EMP46*CPICOMP)*

- Retail employment is multiplied by a measure of the price level (Consumer Price Index - New York) constructed to capture inflation trends unique to New York, and converted to a natural logarithm.

ln(NOMCARS)

- The logarithm of the dollar value of new vehicles sold in New York.

ln(SP500)

- The log of the current period value of the S&P 500 index captures the importance of the financial sector to the New York economy.

DCLOTH

- Same in all three equations.

D1986 and D2004

- Same in all three equations.

JPLV

- The average price of a light vehicle in the U.S.

ln(VEHRGNY)

- The logarithm of New York new auto and light truck registrations. These data are not seasonally adjusted.

- The lagged value of this variable is also included as an explanatory variable to add a dynamic element to the model.

ln(SQLV)

- The logarithm of U.S. light vehicle sales.

ln(EMPR)

- The logarithm of the ratio of New York non-farm employment to U.S. non-farm employment.

RMGF5NS

- The five-year Treasury bill yield to capture borrowing costs.

DUM1993

- A dummy variable is used for an outlier in 1993.

PERCENT CHANGE IN EXOGENOUS VARIABLES — FY 2010 TO FY 2019

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019 (est.)
Nom. Value Autos/Light Trucks	22.1	4.4	10.9	6.7	6.0	9.6	2.2	3.3	(6.5)	1.5
CPI NY	1.7	3.1	1.9	1.5	1.1	0.4	1.6	1.9	2.3	2.4
Retail Trade Employment	2.2	2.1	1.7	1.9	1.5	0.2	(0.3)	(0.7)	0.1	0.3
S&P Index	15.6	8.1	11.0	21.2	15.4	2.2	7.6	16.7	10.4	4.9

Equation 3: Taxable Consumption

TAXABLE CONSUMPTION EQUATION

$$\Delta_4 ln(SALESADJ_t) = \underset{(.004)}{-0.012} + \underset{(0.083)}{0.436 * \Delta_4 ln(CDNTX_t)} + \underset{(0.107)}{0.575 * \Delta_4 ln(CSTX_t)} + \underset{(0.025)}{0.117 * \Delta_4 ln(IPDENR_{t-1})}$$
$$+ \underset{(0.013)}{0.025 * \Delta_4 ln(SP500_t)} - \underset{(0.011)}{0.046 * DCLOTH_t} + \underset{(0.020)}{0.084 * D1986_t} + \underset{(0.014)}{0.027 * D2004_t}$$
$$+ \underset{(0.011)}{0.026 * D1990_t} + U_t$$

$Adjusted\ R^2 = 0.74$
$Root\ Mean\ Squared\ Error = 0.02$
$Number\ of\ Observations = 144$
$U_t = Residual$
$\Delta_4 = X_t - X_{t-4}$

Note: Values in parentheses under coefficients represent standard errors.

ln(CDNTX)

- The logarithm of detailed components of nominal U.S. consumption of durable and non-durable goods. These components are weighted based on what percentage is estimated to be taxable in New York. These weighted components are then summed and multiplied by the ratio of New York to U.S. employment to estimate State taxable consumption of durable and non-durable goods. To more closely capture the lag between economic activity and tax collections, one-third of the prior quarter's State taxable consumption is added to two-thirds of the current quarter value.

ln(CSTX)

- Utilizes the same variable construction as ln(CDNTX) above to produce a consumption of services series.

ln(IPDENR)

- The logarithm of U.S. investment in equipment and software is used to capture the SUT paid by businesses.

ln(SP500)

- Same as Equation 2.

DCLOTH

- Same in all three equations.

D1986 and D2004

- Same in all three equations.

D1990

- A dummy variable that accounts for the exclusion of cable from the base.

PERCENT CHANGE IN EXOGENOUS VARIABLES — FY 2010 TO FY 2019

	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019 (est.)
Consumption of Goods in NY	4.3	3.7	3.2	3.0	5.2	4.4	3.0	3.8	3.8	3.8
Consumption of Services in NY	4.4	5.0	3.9	3.7	6.1	5.4	4.5	3.3	5.5	5.3
S&P Index	15.6	8.1	11.0	21.2	15.4	2.2	7.6	16.7	10.4	4.9

Risks to the Forecast

Errors in exogenous variable forecasts provide risk to the SUT forecast. Variation in the estimate may also occur as a result of administrative changes or unanticipated legislative action.

Background

For a detailed description of cigarette and tobacco tax (CTT) rates, bases and administration, please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Data Sources

The primary sources of data used in the estimation and forecasting methodology of the CTT are as follows:

- *AM043, Department of Taxation and Finance Monthly Report of Receipts.* This report contains gross and net receipts data.
- *Monthly and Fiscal Year Comparison of Cigarette Tax Collections, New York State Department of Taxation and Finance.* This report includes the number of stamps sold, assessments, and agents' commission.
- *The Tax Burden on Tobacco.* This annual data publication, produced by the economic consulting firm Orzechowski and Walker, is the source of the consumption and cigarette price data used in the cigarette consumption forecasting equation.
- *Various U.S. and New York government agencies* provide the Consumer Price Index (CPI) and population data used in the cigarette consumption equation.
- *Campaign for Tobacco-Free Kids.* Various reports prepared by the Campaign for Tobacco Free Kids available on their website.

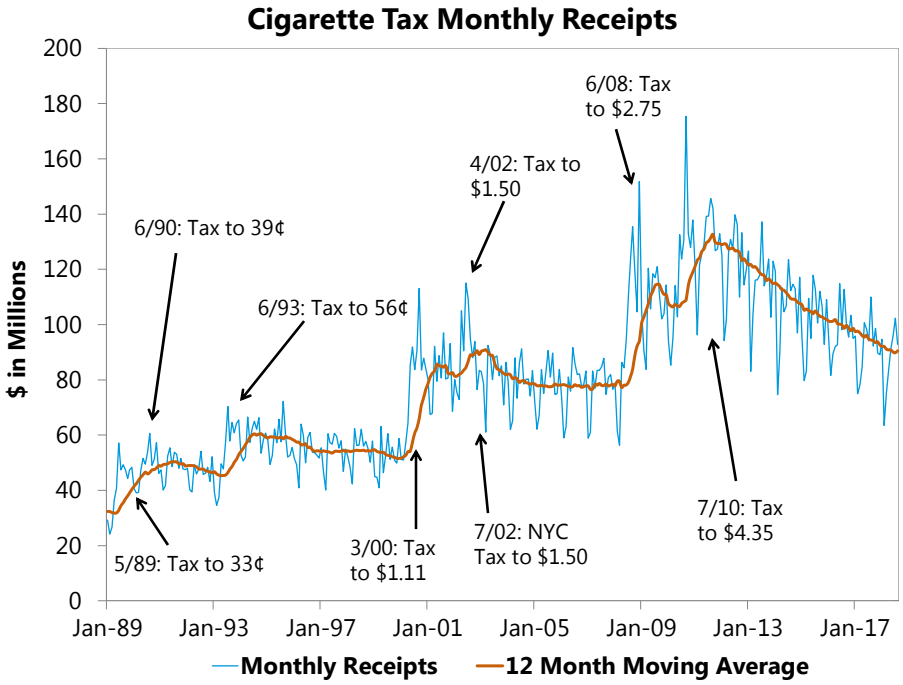
Statutory Changes

For a list of recent significant statutory changes made to the CTT, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

Econometric Model

The real price of cigarettes, which includes the tax amount, is the primary explanatory factor in determining consumption, and therefore receipts. The graph and chart below show the impact of taxes on both price and receipts.



STATE, FEDERAL AND NEW YORK CITY CIGARETTE EXCISE TAX RATES PER PACK OF 20 CIGARETTES (since 1950)

State	Rate (cents)	Federal	Rate (cents)	New York City	Rate (cents)
Before April 1, 1959	2	Before November 1,	7	Before May 1, 1959	1
January 1, 1948	3	November 1, 1951	8	May 1, 1959	2
April 1, 1959	5	January 1, 1983	16	June 1, 1963	4
April 1, 1965	10	January 1, 1991	20	January 1, 1976	8
June 1, 1968	12	January 1, 1993	24	July 2, 2002	150
February 1, 1972	15	January 1, 2000	34		
April 1, 1983	21	January 1, 2002	39		
May 1, 1989	33	April 1, 2009	101		
June 1, 1990	39				
June 1, 1993	56				
March 1, 2000	111				
April 3, 2002	150				
June 3, 2008	275				
July 1, 2010	435				

All variables in the model are monthly with stamp sales and the real price in logarithmic form. We adjust for seasonality via the use of dummies (March is omitted to maintain the intercept term). Note that the estimated coefficients for the trend and the logarithm of the real price without tax variables must be compounded over 12 months to be annualized (e.g., the estimated trend decline in stamp sales, all else equal, is approximately four percent annually). In the interest of succinct

presentation, the 11 seasonal dummies and their estimated values are omitted from the equation shown below.

TAXABLE CIGARETTE CONSUMPTION

$$ln(STAMPSALES)_t = \underset{(0.0192)}{18.8071} - \underset{(0.00013)}{0.0034} * TREND_t - \underset{(0.03107)}{0.1819} * ln(REAL\ PRICE)_t - \underset{(0.0000622)}{0.0014}\ TAX\ RATE_t + \underset{(0.0099)}{0.0486}\ PRE\ BUY + U_t$$

$Adjusted\ R^2 = 0.99$
$Root\ Mean\ Squared\ Error = 0.08172$
$Number\ of\ Observations = 414$
$U_t = Residual$

Note: Values in parentheses under coefficients represent standard errors.

ln(STAMPSALES)

- The logarithm of purchases of cigarettes tax stamps in New York.

TREND

- A time-series estimation technique that employs a numeric variable synonymous with the observation (i.e., at observation1, Time = 1; at observation2, Time = 2, etc.). This effectively is a substitute for a non-observable variable that both affects the dependent variable, and is substantially correlated with time.

ln(REAL PRICE)

- The logarithm of the average monthly price, excluding State tax, of cigarettes in New York.[1] This is indexed to 1982-84 and divided by the CPI to measure the price of cigarettes relative to the overall prevailing price level.

TAX RATE

- The State cigarette tax rate expressed in cents per pack.

PRE BUY

- Dummy variable equal to 1 in the month prior to a State tax increase, -1 in the month following a State tax increase and zero in all other months to capture the impacts of pre-buying on stamp sales.

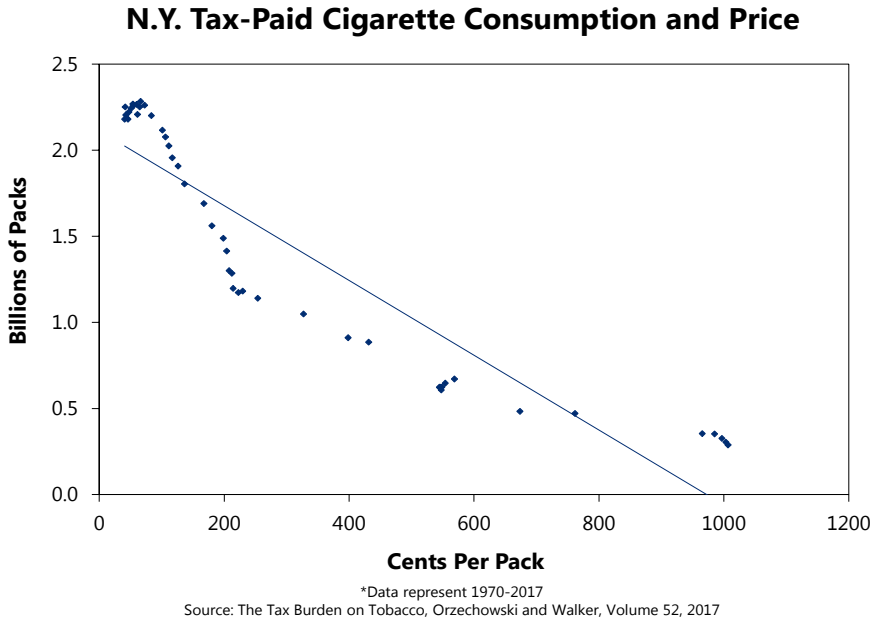
[1] As reported in The Tax Burden on Tobacco, Orzechowski and Walker, Volume 52, 2017.

To produce an updated cigarette tax forecast, the equation's results are supplemented with the estimated impact of discrete events, such as large price increases by manufacturers, federal and state cigarette excise tax changes, and enforcement efforts on cigarette tax revenues.

CIGARETTE TAX RATES
NEW YORK AND BORDERING STATES*
As of October 2018
(cents per pack)

	2012	2013	2014	2015	2016	2017	2018
Connecticut	340	340	340	365	390	390	435
Massachusetts	251	351	351	351	351	351	351
New Jersey	270	270	270	270	270	270	270
New York	435	435	435	435	435	435	435
Pennsylvania	160	160	160	160	260	260	260
Vermont	262	262	275	308	308	308	308

* As reported by The Campaign for Tobacco–Free Kids



*Data represent 1970-2017
Source: The Tax Burden on Tobacco, Orzechowski and Walker, Volume 52, 2017

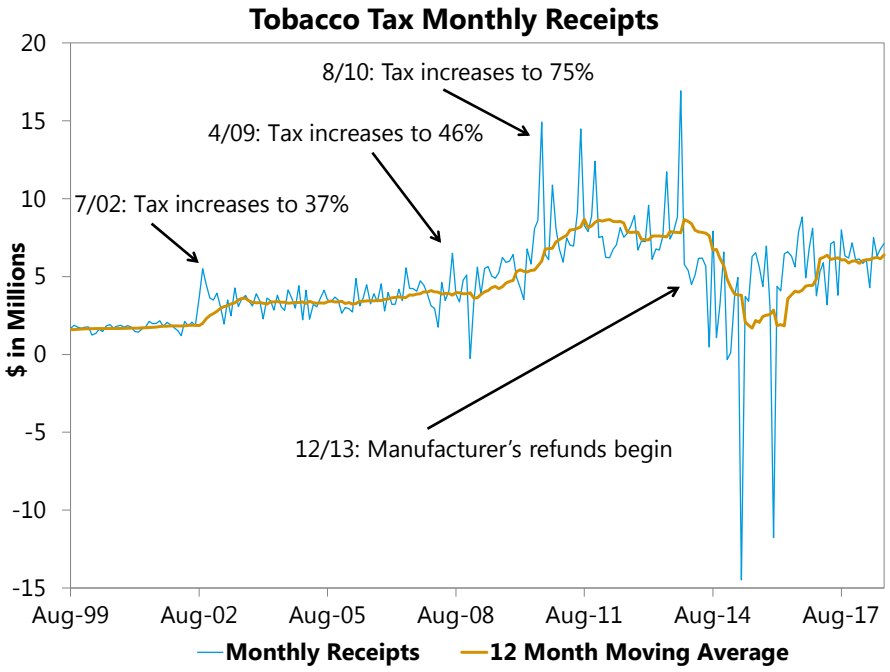
Tobacco Products Tax Forecast Methodology

Tobacco products tax receipts are a small component of the CTT. This tax is imposed on products such as cigars, pipe tobacco and chewing tobacco. DOB uses trend analysis to construct a tobacco products tax forecast.

Tobacco tax receipts dropped from $94.6 million in FY 2014 to $45.7 million in FY 2015 due to $32 million in refunds stemming from a Department of Taxation and Finance (DTF) technical memorandum issued December 5, 2013. This memo amended the wholesale cigar price

determination by allowing for the use of a 38 percent adjustment ratio (if an established price or manufacturer's invoice price is not available) or a lower adjustment ratio if supported by a manufacturer's invoice or other evidence. Similarly, in FY 2016, tobacco tax receipts dropped further to $22.1 million after refunds of $50 million. In FY 2017, tobacco tax receipts rebounded to $76.4 million as the vast majority of the prior liability period refunds stemming from the DTF technical memorandum concluded.

For a more detailed discussion, see the *New York State Executive Budget, Economic and Revenue Outlook*. The following graph shows monthly and 12 month moving average tobacco tax collections from August 1995 to August 2018.



Risks to the Forecast

Several factors impart a substantial amount of uncertainty on the cigarette and tobacco tax forecast. Increases in the price of cigarettes, primarily from tax increases, have had a significant impact on taxable consumption. Recent changes in price may lead to greater reductions over time. In addition, future price changes may have a greater or lesser impact than historical trends. The ability for distributors to show evidence to support using a lower adjustment ratio in calculating their large cigar tax liability poses a negative risk to revenue.

A new Cigarette Strike Force unit within the Department of Taxation and Finance's Criminal Investigations Division was created in 2014 to target illegal tobacco trafficking and sales. The actions taken by this unit are expected to continue to result in increased tax revenue compared to estimated revenue absent Strike Force actions.

Background

For a detailed description of the motor fuel tax (MFT) rate, base and administration, please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Data Sources

The primary sources of data used in the estimation and forecasting for the MFT are as follows:

- *AM043, Department of Taxation and Finance Monthly Report of Receipts.* This report contains gross and net receipts data.

- *Annual Energy Outlook, United States Energy Information Administration (EIA).* This report contains gasoline and diesel demand growth along with other industry specific information.

Statutory Changes

For a recent list of significant statutory changes made to the MFT, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

Refer to the petroleum business tax (PBT) methodology herein for a description of the detailed methodology used to produce a forecast of motor fuel taxable gallonage.

Risks to the Forecast

Due to the difficulty in predicting fuel prices, gasoline inventories, tax evasion and weather conditions, the MFT revenue estimate has certain inherent risks. Global economic and political conditions, as well as market forces, affect fuel prices.

Alcoholic Beverage Tax

Background

For a detailed description of alcoholic beverage tax (ABT) rates, bases and administration, please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Data Sources

The primary sources of data used in the estimation and forecasting methodology for the ABT are as follows:

- *AM043, Department of Taxation and Finance Monthly Report of Receipts*. This report contains gross and net receipts data.

- *Alcoholic Beverage Tax Monthly Statistical Report, Department of Taxation and Finance*. This report contains alcoholic beverage monthly consumption data.

Statutory Changes

For a list of recent significant statutory changes made to the ABT, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

New York alcohol consumption generally follows national trends. The chart below compares U.S. (using data from the National Institutes of Health) and New York annual per capita consumption data. Consumption changes have a major effect on changes in excise tax receipts.

ALCOHOL CONSUMPTION PER CAPITA - ANNUAL
(All Beverages)
(Gallons of Ethanol)

	FY 2005	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
NYS	1.99	2.09	2.11	2.17	2.21	2.20	2.18	2.22
Northeast Region	2.22	2.33	2.36	2.39	2.40	2.39	2.39	2.42
US	2.25	2.26	2.29	2.34	2.33	2.32	2.33	2.35

Source: National Institutes of Health
Population age 14 and older

The forecast for this tax source is primarily based on an analysis of historical alcoholic beverage consumption trends.

Two main growth rates are used to analyze and help project future cash receipts. The first, trend growth rate, quantifies the rate of growth over a specified period of time. The second, compound annual growth rate, is the uniform growth rate required each year over a specified period of time

to grow the series from the starting to the ending amount. The time period being analyzed includes historical collections data from FY 1998 through FY 2018.

Final estimates are constructed using the growth rate-based forecasts with adjustments made for audits, refunds, credits, enforcement issues, pay schedule lags, accounting delays, historical and year-to-date collection patterns, and tax policy and administrative changes.

Risks to Forecast

The forecast is based on historical analysis of alcoholic beverage consumption trends, which is subject to error due to unpredictable changes in consumption behavior that influence collections. The depletion or replenishment of inventories at the wholesale level can also have a significant impact on the amount of taxable gallons.

Background

For a detailed description of the administration of the highway use tax (HUT), please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Tax Rate and Base

For a detailed description of the HUT rate and base, please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Data Sources

The primary source of data used in the estimation and forecasting methodology for the HUT is as follows:

- *AM043, Department of Taxation and Finance Monthly Report of Receipts*. This report contains gross and net receipts data.

Statutory Changes

For a recent list of significant statutory changes made to the HUT, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

Truck Mileage Tax

The forecast for this tax is primarily based on analysis of historical truck mileage tax (TMT) trends.

Two main growth rates are used to analyze and help project future cash receipts for this tax source. The first, trend growth rate, quantifies the rate of growth over a specified period of time. The second, compound annual growth rate, is the uniform growth rate required each year over a specified period of time to grow the series from the starting to the ending amount. The time period being analyzed includes historical collections data from FY 1998 through FY 2018.

Final estimates are constructed using the growth rate-based forecasts with possible adjustments for audits, refunds, enforcement issues, year-to-date collection patterns, and tax policy and administrative changes.

Fuel Use Tax

Fuel use tax collections fluctuate with fuel consumption, especially diesel fuel, which is influenced by both economic conditions and fuel prices. The diesel forecast, which is detailed in the Petroleum Business Taxes section, is used as a proxy for fuel use tax collections. The fuel use tax is also affected by fuel prices since this can dictate if a driver purchases fuel in-State or out-of-State. When drivers purchase fuel out-of-State, but use it in-State, fuel use tax collections increase while motor fuel tax collections and sales tax collections on motor fuel both decline.

Registrations

Similar to the TMT forecast, historical trends are used to derive the amount of revenue collected from registrations along with any necessary adjustments. Recently, an adjustment was needed to reflect that the registration fee was reduced to $1.50 in the FY 2017 Enacted Budget (previously, the registration fee was $15 and the decal fee was $4). Also, an adjustment was necessary in FY 2019 to reflect a reclassification of monies from registrations to the truck mileage tax.

Background

For a detailed description of the corporation franchise tax (CFT) rate, base and administration please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Data Sources

The CFT estimate is derived using a variety of public and private sector data sources, including:

- *Department of Taxation and Finance Monthly Report of Corporation Tax (AC015).* This report, issued by the Office of Tax Policy Analysis (OTPA), provides reconciled monthly collections of corporate franchise tax receipts by filing period.

- *Article 9-A General Business Corporation Franchise Tax Credits through Tax Year 2014.* This data set, published annually by OTPA, provides an accounting of credit activity under Article 9-A.

- *Article 9-A Corporation Franchise Tax Study File*. This file is compiled annually by OTPA and includes all corporations filing under Article 9-A, except S corporations and certain fixed dollar minimum tax filers. It includes selected data items from the tax returns of each corporation. The most recent data available are from tax year 2014.

- Other Publications. *The Wall Street Journal, New York Times, Business Week, and Crain's*.

Statutory Changes

The FY 2019 Enacted Budget contained legislation that enhanced existing tax credit programs while others were extended. Additionally, legislation was enacted to extend the statute of limitations on amended returns and to allow New York State to preserve revenues that would otherwise have been lost due to passage of the Federal Tax Cuts and Jobs Act (TCJA) in 2017. The TCJA provisions allow for a deduction from corporate taxpayers' Federal taxable income for income earned through subsidiaries located overseas. The legislation included in the Enacted Budget requires taxpayers to add this income back for both State and New York City tax purposes. The Historic Building Rehabilitation Tax Credit was extended for an additional five years and modified to decouple from its Federal counterpart so that the entirety of the credit may continue to be claimed for a single year. The Low-Income Housing Credit was enhanced to allow credit transferability to third parties. The Hire A Veteran Credit was extended two years through 2020. The Empire State Musical and Theatrical Production Credit was extended four years through tax year 2022. The New York Youth Jobs Program was amended to increase the credit amounts for each certified hire and require employers to provide the State additional information pertaining to certified hires.

A number of previously enacted Tax Law changes have had a substantial impact on Article 9-A collections. For a listing of these changes, see the New York State Executive Budget - Economic and Revenue Outlook.

Forecast Methodology

Current year and outyear estimates are based on a blend of historical collection patterns, trending techniques, estimates of underlying company liability, and a microsimulation model that incorporates statutory changes. The microsimulation model generates growth rates for the outyear estimate for gross receipts.

The corporate tax reform enacted in the FY 2015 Budget established a single modern system of taxation for general business and banking corporations by repealing separate provisions of the Tax Law for banking corporations and amending the CFT to accommodate changes in the financial services industry and making other modernization changes. This was accomplished by replacing the entire net income base with a similar business income base. Due to the significant changes in the method of taxation an econometric approach for the CFT forecast is not currently feasible since the time series of receipts does not reflect the new calculation of tax liability.

Projecting corporate tax receipts is difficult given the large number of factors that can determine tax liability in any year, especially since the taxpayer computes tax liability under three different bases. In theory, estimating CFT cash receipts involves considering how general business conditions affect tax liability from year to year. While there is no single economic variable that mirrors the complexity of the tax code for corporations, corporate profits serve as a proxy for taxable income under the business income base that accounts for the bulk of liability in any tax year. It is important to note that the Bureau of Economic Analysis (BEA) defines corporate profits as the net income of organizations treated as corporations in the National Income and Product Accounts (NIPA). By contrast, taxable profits, or business income, are a function of the tax code, and the two measures of profits can differ significantly. The Division of the Budget uses corporate profits based on the BEA definition to model and forecast CFT receipts.

Elements of the Tax Law, such as tax credits and the carryforward of net operating losses (NOLs), can distort relationships between aggregate corporate profits and tax liability. For example, the investment tax credit allows manufacturing taxpayers to reduce liability during upswings in the business cycle, and credits are stockpiled during periods in which profits decline since liability itself often decreases. More recently, many new tax credits are refundable. This allows taxpayers to more than offset tax liability through requests for cash refunds or credit carry forwards. These factors are accounted for separately in the estimating process.

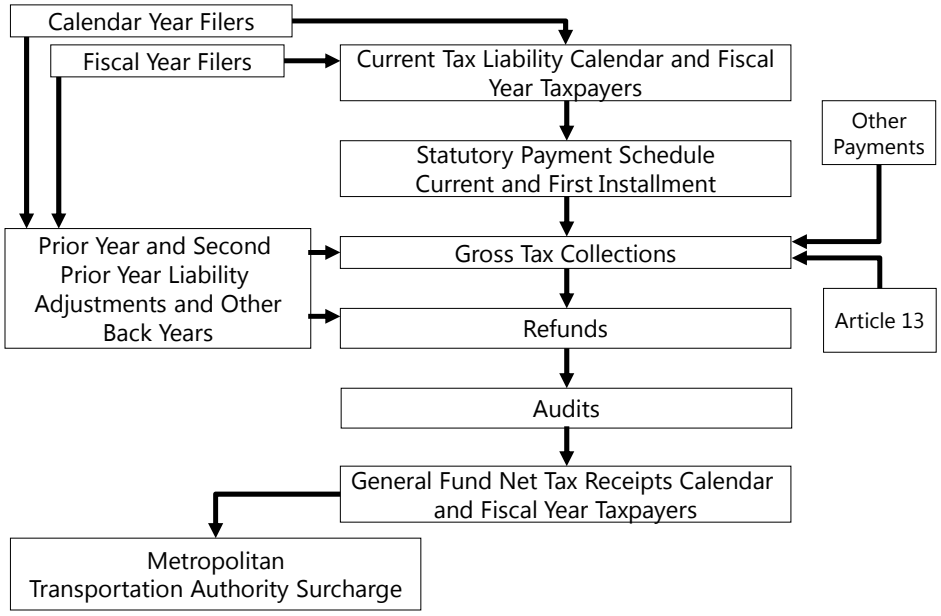
The cash estimation process involves attempting to allocate estimated liability to the State Fiscal Year in which it will be received. This is complicated by the CFT payment system.

State Fiscal Year CFT cash collections are the net result of payments on estimated current year liability, and adjustments to prior liability years as extension returns are filed. Audit collections, which represent administrative adjustments to prior liability years, are forecast separately using

historical trends and information from the New York State Department of Taxation and Finance (DTF). Changes in the payment rules on estimated payments, as well as statutorily allowed extensions to file amended returns, also impact cash collection patterns.

Finally, not all corporate taxpayers have matching liability years. Calendar year taxpayers base both their internal accounting and their accounting for tax purposes on the standard twelve month calendar year. By contrast, taxpayers may also choose a twelve month period which differs from the calendar year for both internal and tax accounting purposes (fiscal year filers). The following flowchart highlights the components of State Fiscal Year CFT collections as reported by the DTF.

Components of the Corporation Franchise Tax



Current Year Forecast

For the current fiscal year forecast, staff analyze trends in the components of cash collections. For example, year-to-date payments are compared to historical averages for the same portion of the fiscal year to estimate remaining receipts for the year. By tracking each of the individual components that make up State Fiscal Year collections, we are able to apply historical trends to forecast the components which are then aggregated.

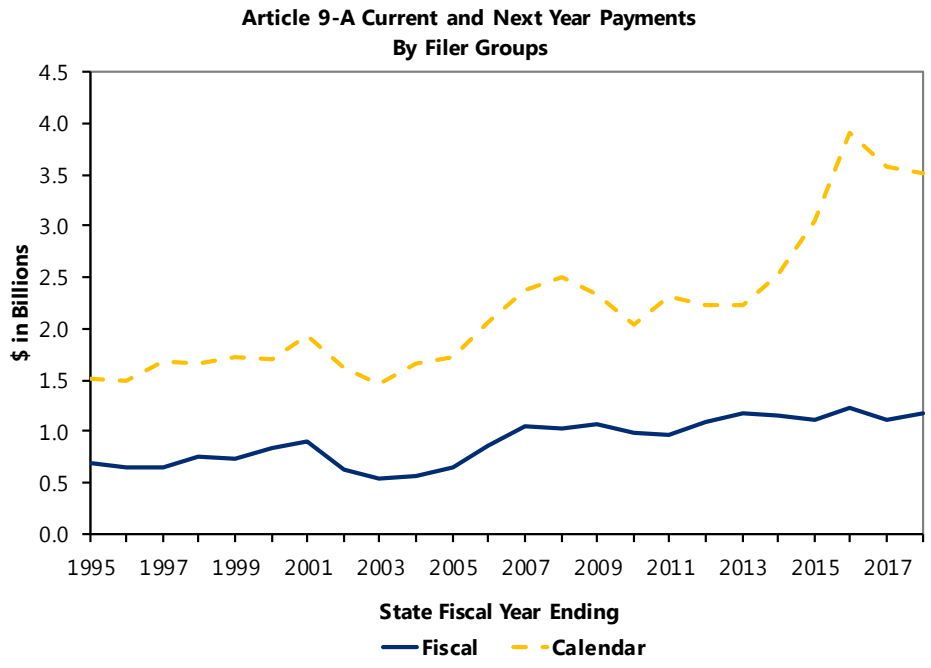
Historical trends are adjusted for abnormalities caused by administrative and Tax Law changes and economic shocks that may disrupt otherwise stable patterns observable over a number of years. Previous years exhibiting anomalous results may either be ignored entirely, or in some

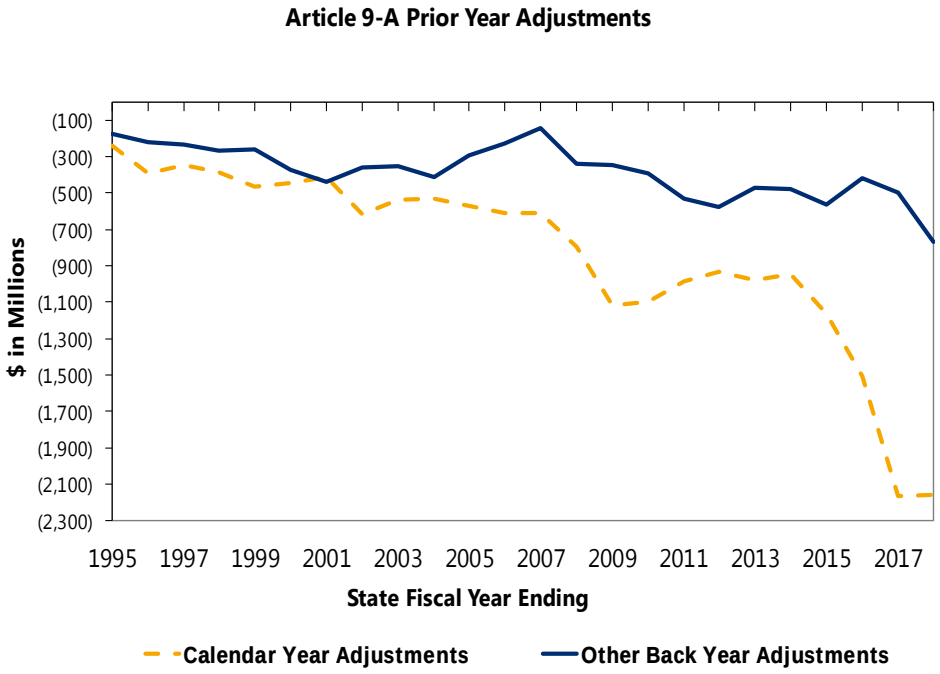
cases, extensive analysis may be performed in an attempt to uncover useful information that may continue to affect current results.

The current forecasting methodology tracks the liability payment streams for calendar year and fiscal year filers (current year, prior year adjustments and the prepayment on next year's liability) and the other unassigned liability payments (other payments, audit and compliance receipts and Article 13 receipts) indicated in the figure above to arrive at estimates of current State Fiscal Year collections. Considerable attention is also given to the tracking and estimation of audit and compliance receipts. While nearly impossible to predict, regular discussions with the DTF allow continual adjustment of estimated audit and compliance receipts for the current year.

The following two graphs illustrate the major payment streams analyzed within a State Fiscal Year (2nd prior calendar payments and other back year payments have been combined). The first graph shows the relatively stable upward trend in payments on current year estimated tax. However, the second graph shows the large and somewhat erratic negative adjustments to cash based on prior year adjustments. In general, as current and next payments increase, prior period adjustments increase (become more negative). This relationship has become more pronounced since the mid-2000's with prior period adjustments containing a greater proportion of refundable tax credit claims. Additionally, corporate tax reform (effective for tax years beginning on or after January 1, 2015) may also complicate the relationship between current and next year payments and prior period adjustments. Refundable credit claims are not correlated with current and next year payments and may result in a higher level (more negative) of prior period adjustments when compared to the increase in current and next year payments since refundable credit claims are paid at the conclusion of the audit review process, which is unique for each case.

Corporate tax reform led to further data complications. The March 2015 prepayment for calendar year Article 9-A taxpayers included payments from former bank taxpayers. Corporate tax reform required calendar year bank taxpayers to pay their tax year 2016 prepayment under Article 9-A instead of the bank tax resulting in a dramatic increase in calendar year current and next payments. In FY 2017, calendar year adjustments increased significantly (became more negative) compared to a small decline in current and next year payments. In addition to refundable credit claims paid in FY 2017, taxpayers overpaid for tax year 2015 which resulted in much higher prior period adjustments when taxpayers filed their 2015 final returns in December 2016 and March 2017 (fiscal year ending 2017). FY 2018 showed a similar pattern as the prior fiscal year.


Article 9-A Current and Next Year Payments
By Filer Groups
$ in Billions
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
State Fiscal Year Ending
Fiscal
Calendar


Article 9-A Prior Year Adjustments
$ in Millions
(100)
(300)
(500)
(700)
(900)
(1,100)
(1,300)
(1,500)
(1,700)
(1,900)
(2,100)
(2,300)
1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
State Fiscal Year Ending
Calendar Year Adjustments
Other Back Year Adjustments

Most importantly, the tracking of payments from different periods helps establish a sense for the relationship between tax liability and underlying economic fundamentals as previously discussed. Observation and analysis of this trend are useful in adjusting model results for outyear projections.

Outyear Forecast

The outyear estimation process involves several steps:

1. Derive annual growth rates for the business income base, the asset base and the fixed dollar minimum base;

2. Use the growth rates from (1) to trend tax year liability in a microsimulation model (separate models are used for the CFT and the bank tax) based on the actual calculation of tax due in each tax year based on current law. The base year is the tax year for which the most recent study file of returns is available (2014). *The bank tax was repealed and former bank taxpayers moved to the corporation franchise tax effective for tax year 2015. Until the study file of returns is available for tax year 2015, the outyear forecast uses the individual study files for the corporation franchise tax and bank tax adjusted for statutory changes as a result of corporate tax reform*;

3. Sum results from the separate CFT and bank tax microsimulation models to produce the CFT payment estimates for each forecast year.

4. Make 1) out-of-model adjustments for the estimated impact of Tax Law changes (e.g. non-refundable tax credits) and 2) any administrative actions;

5. Convert adjusted current year filer payment estimates to a State Fiscal Year cash estimate using historical relationships between current year payments and other payments (pre-payments, prior year adjustments, etc.); and

6. Add estimates for audit and compliance receipts from DTF.

Deriving Component Annual Growth Rates

The aggregate business income base is trended from the most recently available study file (currently 2014) using U.S. corporate profits. While there is no single economic variable that mirrors the complexity of the tax code for corporations, corporate profits often serve as a proxy for taxable income under the business income base. Industry profits outlook and anecdotal information on industrial sectors are also examined to monitor trends that could specifically impact tax receipts.

Cash and loans represent a significant portion of a bank's assets based on data from the Federal Deposit Insurance Corporation (FDIC). Using correlation analysis, the value of mortgages outstanding is highly correlated with the taxable assets of New York banks using study file data.

Therefore, the value of mortgages outstanding is used to trend the asset base forward for the outyear forecast for the portion of the forecast accounted for by former bank taxpayers. In contrast, the asset base under the CFT is trended using U.S. investment in equipment and software (variables from the DOB economic forecast). This variable is highly correlated with the total asset variable used to calculate the capital base tax for the CFT. The CFT capital base tax includes both financial and non-financial assets.

The U.S. CPI is used to trend the fixed dollar minimum tax base variable. The fixed dollar minimum tax base represents less than two percent of total tax liability. This percentage should grow with the repeal of the alternative minimum tax base (effective tax year 2015) and the phase out of the capital base (complete with tax year 2021).

Microsimulation Model

The growth rates generated are then entered into a simulation model that calculates liability for taxpayers included in the most recent study file, which currently reports information from corporation franchise and bank tax returns for the 2014 tax year. Liability is simulated from a 2014 base for years that have already occurred (i.e., 2015, 2016 and 2017) as well as the outyear forecast. The growth rates used in the trending for the just-released Mid-Year Update is shown in the following table.

ECONOMIC VARIABLES
CALENDAR YEAR
YEAR-OVER-YEAR
PERCENT CHANGE

	Value of Mortgages Outstanding	U.S. Corporate Profits	U.S. Investment in Plant & Equipment	U.S. CPI
2016	3.3	(1.1)	(2.5)	1.3
2017	3.7	3.2	5.5	2.1
2018	3.6	7.5	7.3	2.5
2019	3.4	6.4	5.1	2.3
2020	3.7	5.0	5.2	2.4
2021	4.0	4.8	4.9	2.3
2022	3.9	4.7	4.9	2.3
2023	3.9	4.7	4.9	2.3

The microsimulation model produces the baseline estimate for gross receipts. Separate estimates for audit and compliance receipts and refunds are added to the estimate for gross receipts to arrive at a baseline, net receipts cash estimate.

Cash Receipts

Adjustments are made for current year cash receipts, since the model generally fails to fully incorporate recent payment trends. While economic and business conditions are themselves volatile, so are the taxpayer's estimates of their tax liability; as a result, adjustments for recent

trends in the quarterly payment process are therefore an important step in the estimation process.

The baseline estimate is also adjusted for changes to the estimates for the impact of previously enacted Tax Law changes. As additional information from tax returns or other sources becomes available, revisions to the estimated impact of significant Tax Law changes can produce substantial revisions to the net receipts estimate.

Audit and compliance receipts often cover several liability years. Consequently, it is difficult, if not impossible, to attribute cash receipts from this source to any particular liability year for purposes of historical or trend analysis. Therefore, audit and compliance receipts are analyzed independently. The audit and compliance estimate is dependent on the issues and industries being audited. As a result, the estimate relies heavily on the DTF to provide feedback on achievable targets. Even in instances where awareness of compliance issues exists, the timing and dollar value of any ensuing assessment or settlement payments are nearly impossible to predict.

Refunds are forecast on the basis of historical trends and adjusted for the incremental impact of the larger refundable tax credits. This approach allows for the incorporation of recent refund activity while ensuring that the historical level of refunds are considered along with recently created or enhanced tax credits. Credit refund claims are paid at the conclusion of the audit review process which is unique for each case and can skew the percentage distribution of net receipts when they are paid.

Receipts from the MTA Surcharge are estimated in the current year using the same historical ratio analysis employed to estimate General Fund receipts with audit and compliance receipts estimated separately. Outyear estimates are generated by multiplying 1) the ratio of non-audit General Fund receipts to non-audit MTA Surcharge receipts, and 2) the applicable outyear General Fund estimates. Again, audit and compliance receipts are separately estimated.

Risks to the Forecast

The CFT forecast involves managing uncertainties, as follows:

- The most significant risks to the forecast come from the volatile relationships between economic and liability factors and from difficulties in estimating the State Fiscal Year in which cash receipts from that liability will be received. These relationships can be greatly altered by numerous factors through time;

- Audit and compliance results are closely and separately monitored. While posing a substantial risk, adjusting this revenue source independently of baseline receipts helps to isolate the portion of receipts that is largely behavioral and administrative in nature and not linked to economic fundamentals. This is a valuable risk management tool in projecting overall CFT net receipts;

- The estimated impacts of Tax Law changes introduce yet additional risk. This risk can stem from errors in the estimation of new provisions, or from timing issues related to taxpayer awareness of, and voluntary compliance with, new laws. For example, the recently enacted tax cuts for manufacturers beginning in tax year 2014 and the impact of corporate tax reform that started in tax year 2015;

- Outyear estimates may become more volatile as the capital base tax phases out and taxpayers pay on either the business income base or the fixed dollar minimum, whichever is higher; and

- Changes in the relationship between corporate profits and tax liability and errors in the forecast of corporate profits provide additional risk to the CFT estimate.

As a result, analyzing industry trends, monitoring the forecasts of other tax jurisdictions, constantly reevaluating the impact of large tax expenditures, and balancing risks resulting from audit and compliance receipts are necessary in adjusting the Division of the Budget's CFT forecast.

Background

For a detailed description of the corporation and utilities taxes (CUT) rate, base, and administration please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Data Sources

The corporation and utility tax estimate is derived using a variety of public and private sector data sources, including:

- *Department of Taxation and Finance Monthly Report of Corporation Tax (AC015).* This report, issued by the Office of Tax Policy Analysis (OTPA), provides reconciled monthly collections of corporation and utilities tax receipts by tax section and filing period.

- *Article 9 Corporation and Utilities Taxes Study File.* This file is compiled annually by OTPA and includes all corporations filing under certain tax sections of Article 9. It includes selected data items from the tax returns of each corporation for tax sections 183, 184, 185, 186, 186-e and 186-a. The most recent data available are from tax year 2015.

- *New York State Public Service Commission.* Reports annual utility data.

Other Publications: *The Wall Street Journal*, *New York Times*, *Business Week,* and *Crain's*.

Statutory Changes

For a list of recent significant statutory changes made to CUT, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

Current year and outyear estimates for public utilities and telecommunications companies are based on a combination of historical collection patterns, simple trending techniques, estimates of underlying company liability, econometric models for key components of the base responsive to economic and statutory changes or other unexpected occurrences that may affect collections.

Electricity and Natural Gas

Energy revenues (electricity and natural gas) typically include the sale of the commodity and charges for the transportation, transmission, distribution or delivery of energy. Under current law, total utility tax revenues come from transmission and distribution charges attributable to residential customers only. Therefore, the non-taxable commodity portion is removed from the final calculation of forecasted utility revenue.

The following table reports calendar year percent changes for major economic variables impacting the receipts estimates.

EXOGENOUS VARIABLES
Calendar Year
Percent Change

	2012	2013	2014	2015	2016	2017	2018 (Estimated)	2019 (Projected)
Personal Consumption of Electricity	(2.1)	3.6	4.2	0.8	(0.3)	0.4	4.7	2.8
Personal Consumption of Natural Gas	(15.0)	14.4	10.4	(14.2)	(8.8)	11.2	0.0	(4.0)

The tax rate and the percentage of utility revenue derived from transmission and distribution are applied to projections of energy revenues to generate tax liability estimates. Payment schedules are applied to the liability estimates to derive State Fiscal Year cash receipts, which are then adjusted to reflect the estimated effects of law changes and other non-economic factors that affect collections. Historical monthly patterns are applied to the fiscal year projections to derive monthly cash flow estimates. Although the payment schedules are fixed in statute, a small amount of receipts, (for example, the result of delayed returns, amended returns, audits and refunds) occur during months not specified in statute.

The econometric equations to estimate residential electricity and natural gas revenues of utility companies are shown below. These equations use annual data from the New York State Public Service Commission (PSC) from 1975 to 2015. The data used in the equations for the last several years are shown on a subsequent page. Model receipt estimates for the current year are compared to current year estimates derived from historical ratio analysis, and outyear estimates are adjusted if large discrepancies occur.

The specifications are corrected for first-order serial correlation, as shown by the second equation in each box below.

ELECTRICITY EQUATION

$$ln(ERES\_R) = \underset{(0.256)}{12.3383} + \underset{(0.058)}{0.6531} * ln(CSHHOPE) + U_t$$

$$U_t = \underset{(0.097)}{-0.7944} * U_{t-1} + \mathcal{E}_t$$

$$\begin{aligned} Adjusted\ R^2 &= 0.76 \\ Root\ Mean\ Squared\ Error &= 0.0645 \\ Number\ of\ Observations &= 42 \\ U_t &= Residual \end{aligned}$$

Note: Values in parentheses under coefficients represent standard errors.

ln(ERES_R)

- The logarithm of residential electricity revenue from the Public Service Commission.

ln(CSHHOPE)

- The logarithm of personal consumption expenditures of electricity from the National Income and Product Accounts.

NATURAL GAS EQUATION

$$ln(NGRES\_R) = \underset{(0.154)}{11.6362} + \underset{(0.044)}{0.922 * ln(CSHHOPG)} + U_t$$

$$U_t = \underset{(0.113)}{-0.7097} * U_{t-1} + \varepsilon_t$$

$Adjusted\ R^2$	=	0.92
$Root\ Mean\ Squared\ Error$	=	0.055
$Number\ of\ Observations$	=	42
U_t	=	$Residual$

Note: Values in parentheses under coefficients represent standard errors.

ln(NGRES_R)

- The logarithm of residential natural gas revenue from the Public Service Commission.

ln(CSHHOPG)

- The logarithm of personal consumption expenditures of natural gas from the National Income and Product Accounts.

The following table summarizes the predicted values from the equations described above. The table represents total receipts from sales to residential customers. Fifty percent of revenues are assumed to come from transmission and distribution. A tax rate of two percent is then applied to the revenue generated from transmission and distribution and the resulting receipt estimates are distributed to the proper fiscal year. The annual percent change from the model is used to calculate the outyear 186-a forecast. The model growth rates are evaluated against current year cash receipts and trends in collections. Discretionary adjustments may be made to the model growth rates for outliers.

NEW YORK UTILITY MODEL RESULTS		
	New York Utility Residential Revenues (Sales * Price) (in thousands)	Percent Change
FY 2019	9,757.8	5.4
FY 2020	9,991.7	2.4
FY 2021	10,418.7	4.3
FY 2022	10,795.8	3.6
FY 2023	11,140.6	3.2
FY 2024	11,449.5	2.8

The tables below report annual consumption and price data for electricity and natural gas for residential customers. The information is from the Five Year Book published by the New York State Public Service Commission (PSC). Calendar year 2015 represents the most recent year for which data are available for both electricity and natural gas.

CALENDAR YEAR HISTORY OF ELECTRICITY AND NATURAL GAS SALES
RESIDENTIAL CUSTOMERS
2010 - 2016

Year	Electricity Sales (kilowatt hours)	Percent Change	Gas Sales (MCF)	Percent Change
2010	37,402	4.3	323.4	(7.8)
2011	36,595	(2.2)	316.3	(2.2)
2012	36,203	(1.1)	285.7	(9.7)
2013	35,974	(0.6)	334.1	16.9
2014	35,086	(2.5)	365.1	9.3
2015	29,456	(16.0)	327.4	(10.3)
2016	30,518	3.6	316.7	(3.3)

Note: Quantities in millions.

CALENDAR YEAR HISTORY OF ELECTRICITY AND NATURAL GAS PRICES
RESIDENTIAL CUSTOMERS
2010 - 2016

Year	Electricity Price Per Kilowatt Hour Sold (cents)	Percent Change	Gas Price Per MCF Sold (dollars)	Percent Change
2010	17.13	5.0	12.69	(9.0)
2011	16.98	(0.9)	12.40	(2.3)
2012	16.46	(3.1)	12.71	2.5
2013	17.17	4.3	11.96	(5.9)
2014	18.46	7.5	11.66	(2.5)
2015	18.37	(0.5)	10.64	(8.7)
2016	17.19	(6.4)	10.27	(3.5)

Telecommunications

The growth rate of telecommunication revenue is kept flat during the forecast period. Due to the increase in use of internet-based communications (which is not taxable) and the competitive nature of the industry which can change the taxable base, no growth is forecast for current year liability for Section 186-e of the corporation and utilities tax.

Fund Distribution

Receipts for the Mass Transportation Operating Assistance Fund (MTOAF) and the Dedicated Highway and Bridge Trust Fund (DHBTF) are generated from the MTA Surcharge (100 percent dedicated to the MTOAF) and a dedicated portion of receipts from Section 183 and 184 and Section 186-e. The distribution to the MTOAF and the DHBTF for Sections 183, 184 and 186-e is detailed in the table below.

FUND DISTRIBUTION
SECTION 183, 184, 186-E TAX RECEIPTS (Percent)

Section	General Fund	MTOAF	DHBTF
183 and 184	0.0	80.0	20.0
186-e (effective 5/1/15)	92.4	6.08	1.52

Receipts from the MTA Surcharge are estimated in the current year using the same historical ratio analysis employed to estimate General Fund receipts with audit and compliance receipts estimated separately. Outyear estimates are generated by multiplying 1) the ratio of non-audit General Fund receipts to non-audit MTA Surcharge receipts and 2) the applicable outyear General Fund estimates. Again, audit and compliance receipts are separately estimated. Receipts from Sections 183 and 184 are estimated in the current year based on actual cash collections and the historical trend for the outyear estimates.

Risks to the Forecast

The corporate and utility tax forecast involves managing uncertainties, as follows:

- Examining economic factors such as energy prices, changes in supply and demand, business market conditions, changes in technology, and general inflation;
- Analyzing statutory, regulatory, and administrative changes, including Federal Tax Law changes that affect tax rates and bases;
- Monitoring changes and trends in residential energy consumption. Consumers are increasingly using renewable energy sources to power their homes in addition to making their homes more energy efficient, both of which may reduce residential energy costs;
- Monitoring changes in the way consumers communicate as they shift to mobile and non-cable company voice-over-internet-protocol telecommunications at the expense of

landline telecommunications and the established use of internet-based communications tools such as Twitter, Facebook and other messaging applications (apps) and services; and

- Trends in the wireless industry such as unsubsidized/subsidized phones and unlimited/limited data plans. The competitiveness of the industry requires the major carriers to frequently alter their offerings which can change the taxable base and affect excise tax revenue.

Background

For a detailed description of the insurance tax rate, base and administration of the taxes imposed on insurance companies please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Data Sources

The insurance tax estimate is derived using a variety of public and private sector data sources, including:

- *Department of Taxation and Finance Monthly Report of Corporation Tax (AC015).* This report, issued by the Office of Tax Policy Analysis (OTPA), provides reconciled monthly collections of insurance tax receipts by filing period.

- *Insurance Tax Study File.* This file is compiled annually by OTPA and includes all businesses filing under Article 33. It includes selected data items from the tax returns of each corporation. The most recent data available are from tax year 2015.

- *New York State Department of Financial Services.* Detail on lines of property and casualty insurance and data from premiums taxes and retaliatory taxes imposed under the Insurance Law.

- *Excess Lines Association of New York State (ELANYS).* Industry information on excess lines premiums written in the State of New York.

- Other Publications. *The Wall Street Journal, New York Times, Business Week,* and *Crain's.*

Statutory Changes

The FY 2019 Enacted Budget contained legislation that extended one existing tax credit program and modified several others. Additionally, legislation was enacted to allow New York State to preserve revenues that would otherwise have been lost due to passage of the Federal Tax Cuts and Jobs Act (TCJA) in 2017. The TCJA provision allows for a deduction from corporate taxpayers' Federal taxable income for income earned through subsidiaries located overseas. The legislation included in the Enacted Budget requires taxpayers to add this income back for both State and New York City tax purposes. The Historic Building Rehabilitation Tax Credit was extended for an additional five years and modified to decouple from its federal counterpart so that the entirety of the credit may continue to be claimed for a single year. The Low Income Housing credit was enhanced to allow credit transferability to third parties. Lastly, legislation was enacted which enabled the conversion of a non-profit managed care provider to a for-profit provider, thus increasing the taxable base.

For a list of recent significant statutory changes made to the insurance tax, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

Current year estimates are based on historical collection patterns using year to date receipts information. Historically, statutory payment requirements coupled with the relatively low volatility of the tax base have made this approach fairly reliable. However, this approach still requires adjustments for administrative factors such as audit and compliance receipts, accounting adjustments, and other issues that may distort year to date and year over year results.

The outyear estimation process involves several steps:

1. Use the economic forecast to derive annual growth rates for the major determinants of tax liability, specifically property and casualty premiums, accident and health premiums, life premiums, and the aggregate entire net income of life insurers;

2. Use the growth rates from (1) to trend tax year liability in a microsimulation model based on the actual calculation of tax due in each tax year. The base year is the tax year for which the most recent study file of returns is available (2015);

3. Compare simulated liability from years which have already occurred to payments on liability for that tax year to adjust results where appropriate;

4. Make additional adjustments for the estimated impact of law changes;

5. Convert adjusted current year payment estimates to a State Fiscal Year cash estimates using historical relationships between current year payments and other payments (pre-payments, prior year adjustments, etc.); and

6. Add estimates for audit and compliance receipts recovered by the Department of Taxation and Finance, and tax collections received by the Department of Financial Services.

Deriving Component Annual Growth Rates

Taxable property and casualty insurance premiums are regressed against the price deflator for residential construction to capture changes in homeowner's insurance premiums using annual data from 1985 to 2015. Homeowners insurance is one of the larger categories of the property and casualty market. Of all the components of the property and casualty market, this variable has the best fit for this series. Additionally, a correction for first-order serial correlation is made.

Annual taxable accident and health premiums from 1985 to 2015 are regressed against a one year, lagged-dependent variable and a dummy variable for a 1991 anomaly. The dynamic

approach results in a coefficient that is statistically significant, demonstrates the correct sign and is intuitive to interpret.

The aggregate taxable premiums of life insurers are trended from the most recently available study file, currently 2015, using a simple time trend and annual observations beginning in 1985 that reasonably fits the premiums series. The time trend results are compared to the compound annual growth rate for each series, which can serve as an alternative estimation method.

Finally, the aggregate entire net income of life insurers is regressed against U.S. corporate profits using annual data from 1985 to 2015. While the amount of variation explained by this approach is relatively modest, life insurance ENI is itself a modest contributor to total insurance tax liability. Life insurers represent approximately 20 percent of total insurance tax liability. However, the results can be adjusted as necessary using information from outside publications.

$$P/C\ PREMIUMS_t = \underset{(1{,}744.9)}{-4{,}204.1} + \underset{(2{,}176.4)}{36{,}992.9} * PIIFIXR_t + U_t$$

$$U_t = \underset{(0.155)}{0.5853} * U_{t-1} + \varepsilon_t$$

$Adjusted\ R^2$	=	0.97
$Root\ Mean\ Square\ Error$	=	1,252.7
$Number\ of\ Observations$	=	31
U_t	=	$Residual$

Note: Values in parentheses under coefficients represent the standard error.

P/C PREMIUMS

- Annual taxable property and casualty insurance premiums from the study file.

PIIFIXR

- Price deflator for residential construction. This variable measures the cost of new construction and repairs for residential construction.

$$A/H\ PREMIUMS_t = \underset{(442.6)}{549.8} + \underset{(0.04)}{1.0} * A/H\ PREMIUMS_{t-1} + \underset{(1{,}802.2)}{992.8} * DUMMY1991 + U_t$$

$Adjusted\ R^2$	=	0.95
$Root\ Mean\ Square\ Error$	=	1,750.4
$Number\ of\ Observations$	=	30
U_t	=	$Residual$

Note: Values in parentheses under coefficients represent the standard error.

A/H PREMIUMS

- Annual taxable accident and health insurance premiums from the study file. This variable also appears as an exogenous variable lagged a full year to capture the effect of the cyclical element of the accident and health insurance tax premium tax payment structure on future cash collections.

DUMMY1991

- A dummy variable that accounts for an anomaly in accident/health premiums for 1991.

$$LIFE\ PREMIUMS_t = \underset{(469.1)}{7{,}357.7} + \underset{(25.6)}{324.5} * TIME_t + U_t$$

$Adjusted\ R^2$	=	0.84
$Root\ Mean\ Square\ Error$	=	1274.3
$Number\ of\ Observations$	=	31
U_t	=	$Residual$

Note: Values in parentheses under coefficients represent the standard error.

LIFE PREMIUMS

- Annual taxable life insurance premiums from the study file.

TIME

- A time-series estimation technique that employs a numeric variable synonymous with the observation (i.e., at observation$_1$, Time=1; at observation$_2$, Time=2, etc.). This effectively is a substitute for a non-observable variable that both affects the dependent variable, and is substantially correlated with time.

$$ENILIFE_t = \underset{(3{,}116.6)}{-1825.4} + \underset{(2.6)}{11.9} * Z_t + U_t$$

$Adjusted\ R^2$	=	0.39
$Root\ Mean\ Square\ Error$	=	8,424.8
$Number\ of\ Observations$	=	31
U_t	=	$Residual$

Note: Values in parentheses under coefficients represent the standard error.

$ENILIFE_t$

- Aggregate entire net income of life insurers from the study file.

Z

- U.S. corporate profits from the National Income and Product Accounts.

Microsimulation Model

The growth rates generated from these equations are then entered into a simulation model that calculates liability for taxpayers included in the most recent study file, which currently reports information from insurance tax returns for the 2015 tax year. Liability is simulated from a 2015 base for years that have already occurred (i.e., 2016 and 2017). Model results are adjusted by comparing them to actual cash results for those years.

Total taxable property and casualty premiums are reported annually in the Insurance Tax Study File. Additional information from the Department of Financial Services (DFS) provides insight as to the composition of the five largest lines of property and casualty business – automobile, workers' compensation, commercial multi-peril, general liability, and homeowners' multi-peril. The growth rates of these lines are reported in the following table.

CALENDAR YEAR PREMIUMS GROWTH
(GROWTH RATE PERCENTAGES)
2010-2017

	2010	2011	2012	2013	2014	2015	2016	2017
Property/Casualty (Total Premiums)	0.4	3.4	5.3	5.7	3.4	3.2	3.5	2.2
Automobile	1.3	2.1	4.0	3.5	3.9	4.1	6.1	5.8
Workers Compensation	5.8	14.7	14.4	9.2	1.3	5.0	6.7	0.8
Commercial Multi-Peril	(1.3)	2.4	6.3	7.3	3.6	(0.6)	1.9	5.6
General Liability	(0.4)	(1.2)	9.2	11.5	6.8	7.5	2.1	(3.1)
Homeowners Multi-Peril	2.8	3.8	4.5	4.2	3.8	2.2	0.5	1.2

Source: Department of Financial Services Annual Report to the Governor and the Legislature and the NAIC's I-site for 2017.

While the more detailed information from the DFS is not used directly in the time trend (since this series does not represent taxable premiums), it is monitored for any distinctive trends within individual lines that may impact estimate results.

Cash Receipts

State Fiscal Year General Fund collections are the sum of taxpayers' payments on current liability, installments on the following year's liability, and adjustments to prior year's estimated liability. The adjusted simulation results effectively provide estimates of tax year liability. Historical relationships between payments on tax year liability and prior year adjustments are considered in converting the liability estimate to a State Fiscal Year net cash estimate.

Separate estimates for audit and compliance receipts as well as DFS collections are added to these amounts. Audit and compliance receipts estimates are made in conjunction with the

Department of Taxation and Finance, while estimates of DFS collections are partially based on excess lines premiums data from the Excess Lines Association of New York State (ELANYS) and overall collection trends.

The table below illustrates the differences in growth between a taxpayer's fiscal year (the majority of insurance taxpayers have a January-December fiscal year) and the State's Fiscal Year.

COMPARISON OF PERCENTAGE GROWTH RATES IN ESTIMATED LIABILITY, FINAL LIABILITY, AND STATE FISCAL YEAR COLLECTIONS

Calendar Year	Estimated Liability Growth Rate[1]	Study File Liability Growth Rate[2]	State Fiscal Year Ending	General Fund Net Collections Growth Rate[3]
2009	16.0	13.8	2010	22.6
2010	(2.3)	0.7[4]	2011	(8.5)
2011	3.2	5.7[4]	2012	3.2
2012	10.0	6.0[4]	2013	7.1
2013	(6.6)	(4.6)[4]	2014	(3.5)
2014	1.3	2.3[4]	2015	5.9
2015	1.4	(3.0)[4]	2016	3.2
2016	6.5	NA	2017	(0.7)
2017	10.8	NA	2018	14.1
2018 (est.)	9.5	NA	2019 (est.)	9.5

1 Estimated liability is the sum of the taxpayers' first installment, quarterly estimated payments and settlement payment on current liability from the AC015. Includes adjustments for accounting issues.
2 Information from Department of Taxation and Finance Insurance Tax Study File.
3 State fiscal year General Fund collections as reported by OSC.
4 Includes the impact of the temporary deferral of certain tax credits in effect for tax years 2010 through 2012 and subsequent payback beginning in tax year 2013.

Receipts from the MTA Surcharge are estimated in the current year using the same historical ratio analysis employed to estimate General Fund receipts with audit and compliance receipts estimated separately. For outyears, estimates are generated by multiplying 1) the ratio of non-audit General Fund receipts to non-audit MTA Surcharge receipts and 2) the applicable outyear General Fund estimates. Again, audit and compliance receipts are separately estimated.

Risks to the Forecast

The insurance tax forecast involves managing uncertainty about turning points in the premiums cycle, and therefore premiums growth, caused by:

- The underwriting discipline and performance of industry members;
- Changes in surplus and reserves resulting from investment portfolio and annuity sales and results;
- Changes in the demographic and competitive environment, including regulatory changes;

- Unexpected catastrophes;

- Changes in consumer behavior as it relates to the purchase of coverage for property and casualty insurance policies. Significant changes in the economy may result in consumers changing their level of property and casualty insurance coverage; and

- Effect on health care premiums from the Patient Protection and Affordable Care Act.

Background

For a detailed description of the petroleum business tax (PBT) rate, base and administration please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Data Sources

The primary sources of data used in the estimation and forecasting methodology for the PBT are as follows:

- *AM043, Department of Taxation and Finance Monthly Report of Receipts*. This report contains gross and net receipts data.

- *Gasoline and Petroleum Business Tax Monthly Statistical Report, Department of Taxation and Finance*. This report contains monthly gallonage data for gasoline, diesel and other PBT fuels.

- *Annual Energy Outlook, United States Energy Information Administration (EIA).* This report contains gasoline and diesel demand growth along with other industry specific information.

Statutory Changes

For a recent list of significant statutory changes made to the PBT, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

Forecasting PBT receipts is a two-step process. First, a forecast of demand (gallons consumed) is produced from annual (fiscal year) or quarterly data, then various tax rates are applied. The tax rates are indexed up or down by no more than five percent each January based on the percent change of the refined petroleum products Producer Price Index (PPI) for the 12-month period ending the previous August 31. The Division of the Budget forecasts the PPI used for indexing based on historical data. Second, various adjustments are made to arrive at the forecast of cash collections, since a direct relationship does not exist between reported gallonage and cash collections. Both steps are discussed below.

Estimate of Gallonage

Gasoline Equation

The estimate of gasoline consumption for the PBT is derived in the same manner as for the motor fuel tax. To derive a gasoline gas demand growth the Division takes an average of two different approaches.

- The first approach uses the Energy Information Administration (EIA) reported estimated relationships between changes in real Gross Domestic Product (GDP), national fuel prices and national gasoline demand. EIA estimates that a one percent increase in real GDP will raise gasoline demand by 0.1 percent, and a 10 percent increase in fuel prices will decrease demand by 0.3 percent. To derive a State level forecast, real New York disposable income growth is substituted for GDP.

PERCENT CHANGE IN EXOGENOUS VARIABLES

	Real NY Disposable Income	NY Gasoline Price
FY 2010	2.8	(13.5)
FY 2011	1.3	14.0
FY 2012	1.0	25.0
FY 2013	4.4	1.9
FY 2014	(0.9)	(5.1)
FY 2015	3.1	(12.0)
FY 2016	3.7	(26.0)
FY 2017	2.4	(1.9)
FY 2018	4.4	11.2
FY 2019 (est.)	2.4	17.8

- The second approach uses the gasoline demand growth from the EIA Annual Energy Outlook 2018.

Diesel Equation

The estimate of automotive diesel consumption for the PBT is derived primarily by using the diesel demand growth from the most recent EIA Annual Energy Outlook. However, since this is an annual report, adjustments are made throughout the forecast period if there are significant changes to real Gross Domestic Product. In addition, a trend growth rate is used for comparison purposes to the EIA estimated demand growth rate to determine if economic activity might have changed since the release of the annual report.

Adjustments

After generating a demand forecast and applying the appropriate tax rates, adjustments are made for refunds, credits, pay schedule lags, accounting delays, historical and year-to-date collection patterns and tax law and administrative changes.

Risks to the Forecast

Historically, PBT receipts have remained relatively stable under a wide variety of political and economic conditions. However, due to the difficulty in predicting fuel prices, inventories, and weather conditions, the current PBT revenue estimate has some inherent risks. Among these risks,

the variation of fuel prices is the most noteworthy. Global economic and political conditions, as well as market forces, can affect fuel prices. Changes in fuel prices may change fuel consumption, affect fuel inventories, the PBT index, and tax rates.

Background

For a detailed description of the estate tax rates, base and administration, please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Data Sources

The primary sources of data used in the estimation and forecasting of the estate tax are as follows:

- *AM043, Department of Taxation and Finance Monthly Report of Receipts.* This report contains gross and net monthly receipts data.
- *Various reports, Department of Taxation and Finance.* Other reports supplementing the *AM043* provide information on daily receipts and other relevant data.
- *Office of the State Comptroller.* Monthly reports containing collection data.
- *Various U.S. and New York government agencies, including the U.S. Bureau of Economic Analysis of the Commerce Department.* These agencies provide economic data used in the econometric equations.

Statutory Changes

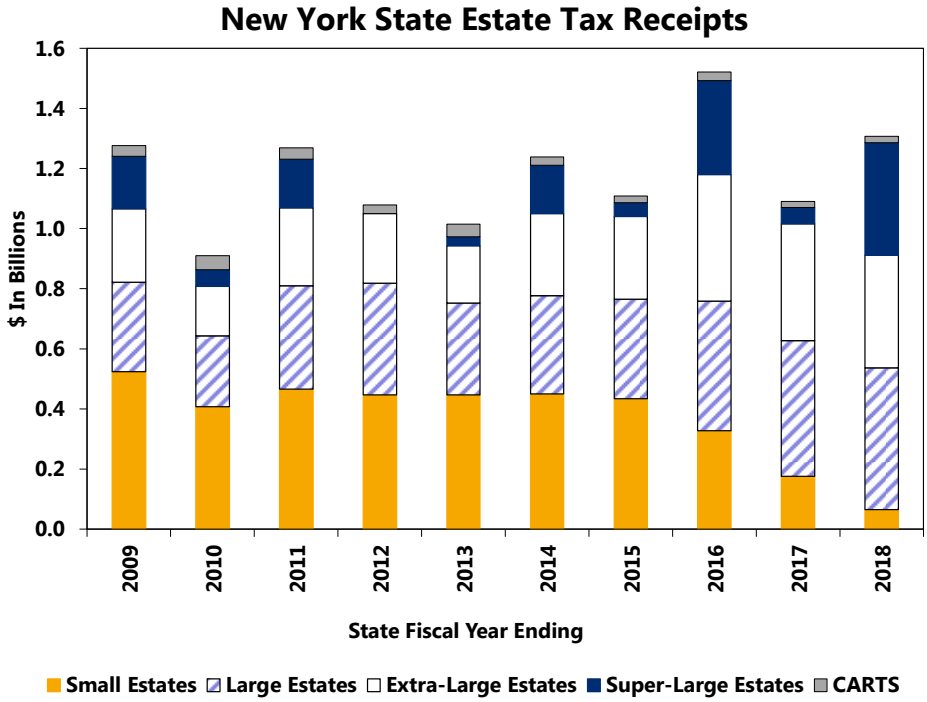
For a list of recent significant statutory changes made to the estate tax, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

The number of taxable estates is projected to decline by approximately 90 percent due to the statutory changes enacted in 2014 that increase the filing threshold to the Federal exemption level by 2019.

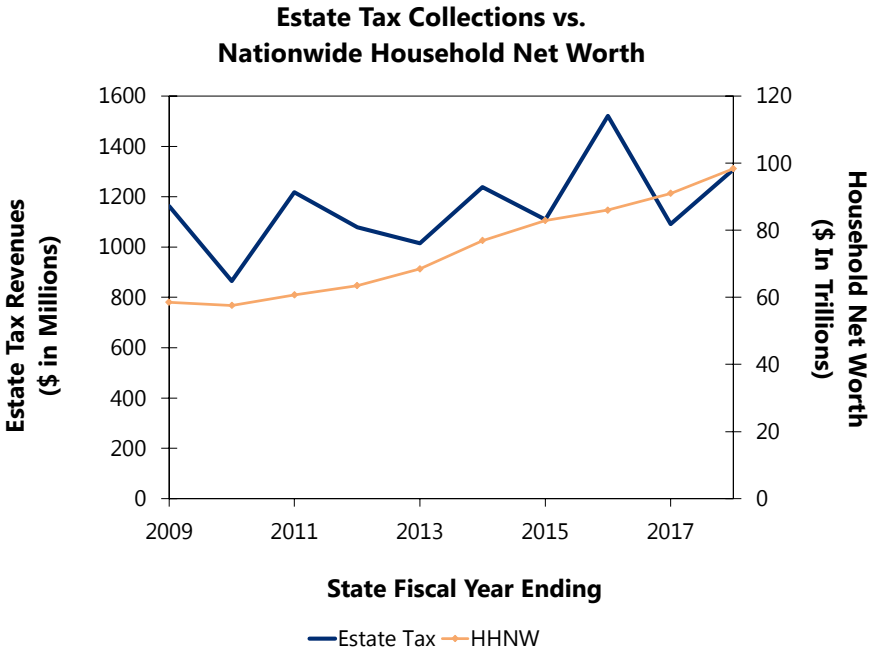
While a model using household assets and stock market indicators consistently explains the payment data for smaller estates, law changes and increases in the taxable estate threshold complicate the estimate. In estimating receipts for both the current and future years, analysis of historical trends supplements the econometric analysis, but it is crucial to account for the fact that historical receipts were generated by a substantially different tax scheme.

The following graph provides a history of collections (by size of estate payment) through the most recently completed fiscal year.



Econometric and Statistical Analysis

For the purposes of projecting estate tax receipts, collections are separated into categories of super-large estates (tax payment of at least $25 million), extra-large estates (tax payment of at least $4 million but less than $25 million), large estates (tax payment of at least $500,000 but less than $4 million), and small estates (less than $500,000). To forecast collections in the super-large and extra-large categories, the number of super-large and extra-large estates over the last 15 years are fit to a statistical distribution. This distribution is then used to predict the number of super- and extra-large filers in future fiscal years. The same method is applied to the average payment in each category. Once the predicted number of estates is multiplied by the average payment, a growth factor, based on estimated changes in household net worth, is applied to determine the nominal taxable base.



Large Estates

Quarterly collections from large estates are estimated by taking the average result of two regression equations. In both equations, the main independent variable is a measure of household net worth, which is a proxy for the value of the estates. The measure uses household net worth: [1] at the value at time of death in the first equation; and [2] its value two quarters later in the second equation. This generally corresponds to the statute, which allows the estate to pay the tax within nine months of the date of death. The unified credit exemption level, expressed in relative terms by dividing the nominal amount by an index of household net worth, is also used as an independent variable in both equations. Both equations also correct for first-order serial correlation in their respective error terms. The current estimation period is the third quarter of 1987 through the third quarter of 2018.

RECEIPTS FROM LARGE ESTATES

$$LARGE_t = \underset{(5{,}066)}{11{,}904} + \underset{(0.1313)}{0.9670 * HNW_t} + \underset{(0.00588)}{0.00195 * REL_t} + U_t$$

$$U_t = \underset{(0.0976)}{-0.2585 * U_{t-1}} + \varepsilon_t$$

$Adjusted\ R^2 = 0.64$
$Root\ Mean\ Square\ Error = 12{,}520$
$Number\ of\ Observations = 102$
$U_t = Residual$

$$LARGE_t = \underset{(5{,}059)}{11{,}536} + \underset{(0.1392)}{1.0271 * MHNW_t} + \underset{(0.00596)}{0.0015 * REL_t} + U_t$$

$$U_t = \underset{(0.1002)}{0.2609 * U_{t-1}} + \varepsilon_t$$

$Adjusted\ R^2 = 0.76$
$Root\ Mean\ Square\ Error = 12{,}430$
$Number\ of\ Observations = 102$
$U_t = Residual$

Note: Values in parentheses under coefficients represent standard errors.

LARGE

- Large estate tax collections.

HNW

- Household net worth as a function of financial assets and nominal home prices.

MHNW

- Household net worth as a function of financial assets and nominal home prices. The variable is lagged two quarters.

REL

- The unified credit exemption level, expressed in relative terms by dividing the nominal amount by an index of household net worth. Values after the 3rd quarter of 2014 include the phase-in of the higher filing threshold.

Small Estates

Receipts from this category have declined significantly since the tax reform enacted in 2014 and will continue to decline given the annual adjustment of the exemption level for changes in inflation. Receipt estimates from this category may be more influenced by out-of-model methods (such as cash flow analysis) during this transition period. Quarterly collections from small estates are currently estimated from two regression equations which are weighted to minimize model errors. The current estimation period is the first quarter of 1990 through the third quarter of 2018.

Equation 1

The first equation uses the Wilshire 5000 stock index and the average existing single family home price in New York as independent variables. These measures are also used at their minimum of the value at time of death or their value two quarters later. In addition, the top marginal tax rate of the estate tax and the unified credit exemption level, expressed in relative terms by dividing the nominal amount by an index of household net worth, and a trend variable beginning in 2000 are included in the equation.

RECEIPTS FROM SMALL ESTATES EQUATION ONE

$$SMALL_t = \underset{(30{,}516)}{-56{,}504} - \underset{(0.005)}{0.0278 * REL_t} + \underset{(122{,}341)}{683{,}086 * TOPR_t}$$

$$+ \underset{(0.570)}{1.313 * MWS_t} + \underset{(39.334)}{69.545 * MHV_t} + \underset{(129.4)}{928.909 * TREND_t} + U_t$$

$Adjusted\ R^2 = 0.66$
$Root\ Mean\ Square\ Error = 12{,}641$
$Number\ of\ Observations = 102$
$U_t = Residual$

Note: Values in parentheses under coefficients represent standard errors.

SMALL

- Small estate tax collections.

REL

- Same as Large Estates Equations.

TOPR

- The top marginal estate tax rate.

MWS

- The Wilshire 5000 equities index, used as a proxy to capture the contribution of equity investing to taxable estates.

MHV

- The average value of a single family home in New York State.

TREND

- A time trend variable.

Equation 2

The second small estates equation uses household net worth as an independent variable. Household net worth is squared to capture the larger change in small estate tax payments in relation to changes in household net worth. The top marginal tax rate of the estate tax and the unified credit exemption level, expressed in relative terms by dividing the nominal amount by an index of household net worth, is also used in the second equation.

RECEIPTS FROM SMALL ESTATES EQUATION TWO

$$SMALL_t = \underset{(18,719)}{-4{,}115} + \underset{(94{,}222)}{484{,}308 * TOPR_t} + \underset{(0.0000013)}{0.0000132 * MHNW_t^2} \underset{(0.0065)}{-0.0427 * REL_t} + U_t$$

$$U_t = \underset{(0.1001)}{-0.1668 * U_{t-1}} + \varepsilon_t$$

$Adjusted\ R^2 = 0.53$
$Root\ Mean\ Square\ Error = 13{,}677$
$Number\ of\ Observations = 102$
$U_t = Residual$

Note: Values in parentheses under coefficients represent standard errors.

SMALL

- Same as Small Estates Equation One.

TOPR

- Same as Small Estates Equation One.

MHNW

- Four-quarter lagged household net worth as a function of financial assets and nominal home prices. The variable is squared in order to capture the larger change in small estate tax payments in relation to household net worth.

REL

- Same as Large Estates Equations.

Risks to the Forecast

Errors in the exogenous variable forecasts provide risk to the estate tax forecast. However, economic variables alone cannot explain variances in revenues from this source. Not only is it impossible to forecast wealthy taxpayer mortality, it is also difficult to forecast the taxability of the decedent's estate. To the extent that the estate is left to a spouse, or to a charitable trust, there is no taxable liability. These issues provide complications in forecasting estate tax receipts.

Due to the volatility of estate receipts, a Monte Carlo Simulation has been added to assess the forecast risks associated with the econometric models for small estate and large estate receipts. This technique evaluates the risk to the forecast due to variation in the dependent variable that cannot be explained by the model, as well as the random variation in the model parameters. For more information, please refer to "Monte Carlo Simulation Study" in the *New York Adjusted Gross Income* section of this publication.

With the inherent difficulty of estimating the impact of significant tax law changes, the estimates associated with the 2014 enacted tax cuts present an additional risk, which could result in realized revenue that is significantly lower or higher than anticipated.

Background

For a detailed description of the real estate transfer tax (RETT) rate, base and administration, please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Data Sources

The primary sources of data used in the estimation and forecasting methodology for the RETT are as follows:

- *AM043, Department of Taxation and Finance Monthly Report of Receipts*. This report contains gross and net receipts data.
- *RETT 7, Department of Taxation and Finance*. This form reports the monthly liability for each county.
- *Various U.S., New York State and New York City government agencies, including the U.S. Bureau of Economic Analysis of the Commerce Department.* These agencies provide economic data used in the econometric equations.
- *Various real estate industry sources including: Moody's Economy.com, Coldwell Banker Richard Ellis (Vacancy Rates data); National Association of Realtors, and Prudential Douglass Ellison Real Estate (Market Reports).*

Statutory Changes

For a list of recent significant statutory changes made to the RETT, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

RETT collections are dependent on the total value of real estate conveyances, which in turn are a function of the number of conveyances and the price of each individual conveyance. For the last year of available data (August 2017 through July 2018), 76 percent of collections were the result of activity in New York City and Long Island. Real estate values and the number of transfers in this geographical area are subject to more cyclical behavior than in the remainder of the State. This is due to the nature of the local economy, which is more dependent on financial services than the remainder of the State or the nation as a whole, and at times the speculative nature of expected returns on commercial real estate transactions.

Non-Mansion Real Estate Transfer Tax Equation

Non-mansion RETT receipts are estimated separately since the luxury market is unique and the mansion tax is an additional tax imposed on the buyer. The equation below relies primarily on

average home prices and housing starts in New York, which is a proxy for transfer activity. The period of estimation is FY 1975 to FY 2018.

NON-MANSION REAL ESTATE TRANSFER TAX EQUATION

$$\ln(RETTN_t) = \underset{(0.0325)}{1.4068 * \ln(MHV_t)} + \underset{(0.0161)}{0.3475 * \ln(HUSTSNY_t)} - \underset{(0.0066)}{0.0100 * \Delta_1 VACNYC_t} - \underset{(0.0066)}{0.0122 * \Delta_1 VACNYC_{t-1}} + U_t$$

$Adjusted\ R^2 = 0.98$
$Root\ Mean\ Squared\ Error = 0.1354$
$Number\ of\ Observations = 42$
$U_t = Residual$
$\Delta_1 = X_n - X_{n-1}\ where\ n = t\ or\ t-1$

Note: Values in parentheses under coefficients represent standard errors.

ln(RETTN)

- The logarithm of fiscal year liability (excluding the mansion tax) divided by the tax rate, which yields the log of the dollar value of transfers.

ln(MHV)

- The logarithm of the average existing single-family home price in New York State.

ln(HUSTSNY)

- The logarithm of New York housing starts.

VACNYC

- The sum of office building vacancy rates for midtown and downtown Manhattan. The model employs this variable both at present and lagged one quarter.

Mansion Real Estate Transfer Tax Equation

As stated previously, mansion tax receipts are estimated separately to account for the additional tax levied on the buyer and the distinct market segment that comprises the taxable base. While some of the same independent variables incorporated in the non-mansion tax equation are utilized here, the derived coefficients need not be the same and reflect differing relationships between the variables and the variation of the receipts (i.e., mansion versus non-mansion) they attempt to explain. The annual estimation period is FY 1990 to FY 2018.

MANSION REAL ESTATE TRANSFER TAX EQUATION

$$In(RETTM_t) = \underset{(0.8812)}{-9.3915} + \underset{(0.2195)}{2.29 * \ln(MHV_t)} - \underset{(0.0326)}{0.1137 * RMMTGENS_{t-1}} + \underset{(0.1949)}{0.5178 * In(BONUS)_t} + \underset{(0.1611)}{0.3577 * D2001_t} + U_t$$

$Adjusted\ R^2 = 0.99$
$Root\ Mean\ Squared\ Error = 0.1359$
$Number\ of\ Observations = 29$
$U_t = Residual$

ln(RETTM)

- The logarithm of New York mansion tax receipts.

ln(MHV)

- The logarithm of the average existing single family home price in New York State.

RMMTGENS

- The 30-year mortgage rate lagged one year.

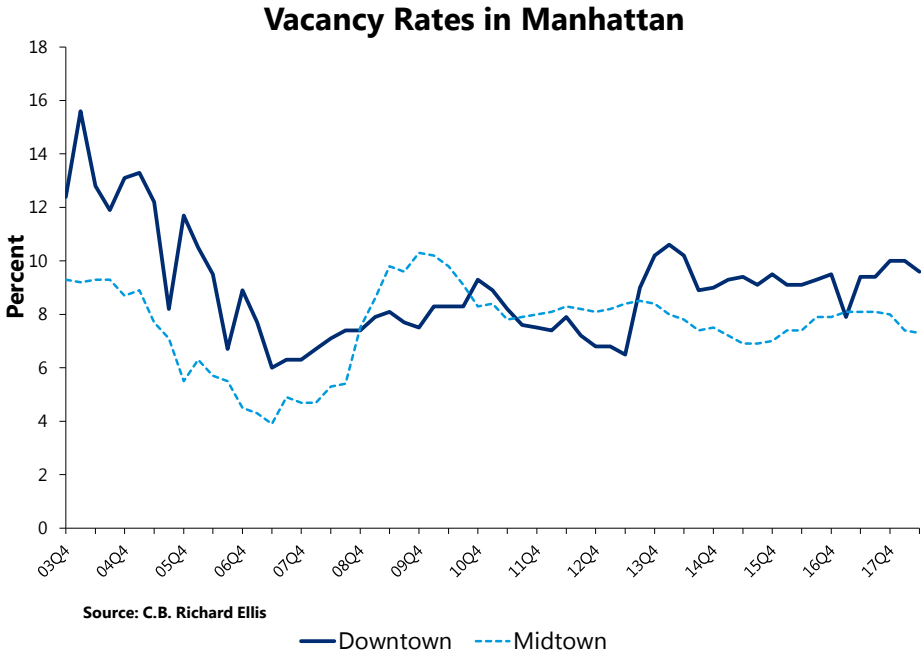
ln(BONUS)

- The logarithm of total bonus payments paid in New York State.

D2001

- Dummy variable = 1 for FY 2001; 0 otherwise. This dummy variable helps adjust for the unusually high receipts in FY 2001.

Exogenous Variable	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019 (est.)
Sum of Manhattan vac. rates (level)	15.6	15.4	17.4	16.8	16.3	16.8	17.6	16.4
Average NY house price (% change)	-2.7	3.6	5.3	0.6	-3.0	0.0	3.2	0.7
30-year Mortgage rate (level, %)	4.5	3.6	4.2	4.1	3.9	3.8	4.1	4.7
Total bonuses payments - NY (level, $Bill)	67.1	71.6	79.7	81.3	82.3	84.1	90.7	90.2



Risks to the Forecast

Errors in the forecasts of the exogenous variables provide risk to the RETT forecast. Forecast error in prior years can largely be attributed to the forecasts of the exogenous variables and large unanticipated transfers, typically in the downstate market. Variation in the estimate may also occur due to administrative changes or unanticipated legislative action. Other factors which could impact RETT collections include the strength of the dollar compared to other currencies, as well as the luxury housing market, especially in Manhattan. Therefore, out-of-model adjustments are often made, especially when evaluating the downstate market and its cycles.

Background

For a detailed description of the pari-mutuel tax (PMT) rates, base and administration, please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Data Sources

The primary sources of data used in the estimation and forecasting methodology for the PMT are as follows:

- *AM043, Department of Taxation and Finance Monthly Report of Receipts.* This report contains gross and net receipts data.

- *Annual Report – Track and OTB: Race Dates, Attendance, Handle, New York State Gaming Commission*. This report contains race date, attendance and handle data by racetrack and off-track betting parlor (OTB).

- *Annual Report - New York Track Handle and Additional Information, New York State Gaming Commission*. This report contains the distribution of on-track and off-track betting handle (regular, multiple, and exotic wagers) by racetrack and OTB.

Statutory Changes

The FY 2019 Enacted Budget extended the pari-mutuel betting and simulcasting provisions for one year. These provisions have been extended for over twenty years.

For a list of recent significant statutory changes made to the PMT, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

While several econometric methods have historically been implemented, the traditional econometric estimation has become less useful given changes to the tax base and increased competition from new racing venues, Video Lottery (VLTs), and casino gaming. Accordingly, trend analysis is performed to determine growth rates for thoroughbred, harness and OTB handles, which are then applied separately to the base year handles. Effective tax rates are then applied to the forecast of handles to determine tax revenues. Given the low tax rates, a variance of $1 million in handle creates only a $10,000 variance in receipts.

Risks to the Forecast

Increased competition from new racing venues, VLTs, and casinos could cause some OTB branches to close and lower receipts. Higher receipts could result from an increase in racing dates,

higher quality racing due to purse enhancements provided by VLT revenue and increased advance deposit wagering. Financial weakness at remaining OTBs could result in OTB mergers or closures. A closure could result in declines in handle and shifts towards other betting venues. OTB revenue has declined significantly since the closure of the New York City OTB in 2010.

Background

For a detailed description of commercial gaming tax rates, base, distributions and administration, please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Data Sources

Commercial gaming tax revenue data are collected and reported by the Gaming Commission.

Statutory Changes

The FY 2019 Enacted Budget contained legislation that eliminated the commercial gaming to Video Lottery (VLT) hold harmless transfer provision.

For a list of recent significant statutory changes made to the commercial gaming statue, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

Refer to the VLT methodology herein for a description of the detailed methodology used to produce a forecast of slot machine gross gaming revenue (GGR) (same concept as net machine income for VLTs) from a gaming facility. This methodology is supplemented by an analysis of historical and recent trends.

To generate estimates of GGR from table games at each facility, an industry rule-of-thumb of a 80/20 split between slot net machine income and table game net income is generally utilized, with adjustments made as necessary based on historical and recent trends.

Consideration is given to the timeline of construction, expansion, and improvements to the facilities and surrounding areas, free play percentages used, and competition from other gaming venues.

Final state tax revenue estimates are derived by applying the statutory tax rates set forth in the Upstate New York Gaming and Economic Development Act of 2013 (10 percent Statewide rate on table games; 39 percent on slot machine net income in the Catskills/Hudson Valley region; 45 percent in the Capital Region; and 37 percent in the Eastern Southern Tier region) to the slot and table game GGR estimates.

Adjustments

After generating both slot and table game GGR forecasts and applying the appropriate tax rates, adjustments are made for refunds, credits, accounting delays, historical and year-to-date collection patterns, and law and administrative changes.

Risks to the Forecast

The vast array of assumptions used in the estimation process, as well as competition from New York VLT facilities, Native American casinos, and casinos in neighboring states, provide substantial risk to the commercial gaming tax revenue estimate. The gaming market is extremely dynamic and interconnected, so any significant change that affects an individual facility often causes a cascading effect on the rest of the market, at least in the immediate market area. Variation in the estimate may also occur due to administrative or law changes (e.g., sports wagering is expected to have a positive impact on receipts, but the magnitude of the impact would depend on the precise programmatic parameters including the availability of the activity).

As has been seen with New York casinos, opening a facility when major projects and operational processes are still underway (e.g., hotels not completed, ongoing construction projects, lack of fully trained staff, poker room not opened, etc.) can have a significant impact on customer satisfaction and revenues. As of October 2018, there are still several vacant retail and business spaces in the immediate Mohawk Harbor area surrounding Rivers casino whereas the entertainment village, golf course, additional hotel, and waterpark near RW Catskills are not open. These factors and their uncertain timelines will continue to pose an additional risk to the forecast.

Interactive Fantasy Sports

Background

For a detailed description of the interactive fantasy sports (IFS) tax rate, base and administration, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Data Sources

IFS tax revenue data are collected and reported by the Gaming Commission.

Statutory Changes

For a list of recent significant statutory changes made to the IFS tax, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

The forecast for this tax source is primarily based on an analysis of recent IFS consumption trends and New York's resident percentage. Trend analysis is used to determine growth rates for IFS handle (IFS contest entry fees) and New York's resident percentage, which are then separately applied to base year IFS handle and New York resident percentage. Those two figures are multiplied to arrive at New York handle. The 15 percent tax rate is then applied to the estimate of New York handle to arrive at an IFS tax revenue estimate. The revenue generated by the additional tax rate of one-half of one percent is estimated to be minimal since it is capped at an annual amount of $50,000 per taxpayer.

After generating a growth-rate based forecast, adjustments are made for refunds, credits, historical and year-to-date collection patterns, and tax policy and administrative changes.

Risks to Forecast

Increased competition from other gaming sources such as casinos, Video Lottery Terminals, and pari-mutuel wagering could decrease receipts. The allowance of sports wagering at casinos could also have a potential negative impact on receipts. Significant changes in the popularity of a particular sport could also increase or decrease receipts. This is especially true for professional football since it is the sport that generates the highest amount of entry fees.

Background

For a detailed description of the games, distribution amounts and administration of lottery receipts please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Data Sources

Lottery operations data are collected and reported by the Gaming Commission.

Statutory Changes

For a list of recent significant statutory changes made to the lottery please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

Economic variables seem to have little explanatory power in predicting lottery receipts with the previously employed econometric models proved less successful from a forecasting perspective. Accordingly, cash sales for the various games are initially estimated using analysis of historical and recent trends and adjustments are subsequently made for the estimated impacts of marketing, operational, and promotional plans, new game introductions, and various other discrete events as mentioned below.

Jackpot Games - Lotto, Cash4Life, Mega Millions and Powerball

Sales of Mega Millions and Powerball tickets are volatile because the game jackpots can randomly "roll-up" to high amounts. High jackpots produce significant sales spikes. The forecast of these games is inherently risky because it requires an assumption of the number and level of "roll-ups" expected to occur in a particular State fiscal year. Analysis requires careful consideration of historical sales-to-jackpot relationships, seasonal effects, and other factors such as "jackpot fatigue" (i.e., the diminishing sales associated with a particular jackpot level over time) and the coverage ratio (the combinations actually bet, divided by the total number of combinations). These games can also be impacted by policy changes or other events such as changing the size of the matrix, changing the price of the game, and altering the jackpot structure. This is shown by the increased Mega Millions sales caused by the October 2017 price increase from $1 to $2, along with higher starting jackpots and faster "roll-ups".

Lotto and Cash4Life are also jackpot games, but the jackpot levels, and subsequently sales, are much lower compared to Mega Millions and Powerball. Therefore, sales of these games are much less volatile compared to the higher jackpot games. Typically, minimal growth has been assumed as there has been limited marketing and promotional effort put towards these games in recent years due to their lower level of sales and small but stable customer base.

Instant Games

Instant Games sales are forecast using trend analysis with adjustments typically made for marketing and operational plans. Instant games have either a 65 or 75 percent prize payout, with differing aid to education rates, so it is important to accurately forecast the split in sales between the two different types. Analysis requires careful consideration of the timeline of marketing and promotional efforts, the timing of the introduction of new games throughout the year and the seasonality of sales. The sales mix between games with 65 and 75 percent prize payouts has proven to be quite sensitive to marketing and promotional efforts.

Daily Games

Daily games include Numbers, Win 4, Quick Draw, Take 5 and Pick 10. Sales of these games are generally estimated using trend analysis, with a focus on trends of the last five years. Analysis requires careful consideration of seasonality of sales, the number of draws per day, marketing and promotional efforts, and any other game-specific factors, changes, or events. Sales of these games have proven to be much more stable compared to the jackpot games.

Adjustments

After generating sales forecasts and applying appropriate aid to education rates, adjustments are made for refunds, credits, accounting delays, historical and year-to-date collection patterns, and law and administrative changes.

Risks to the Forecast

Lower Instant Games sales may occur due to economic constraints experienced by consumers. As mentioned above, the Mega Millions and Powerball games may achieve lower or higher than forecasted sales if the number or level of large jackpots are less or more than expected or due to jackpot fatigue. Any significant shift in sales in a certain type of game may reduce sales from a similar, competing game type, potentially impacting aid to education receipts depending on the aid to education rates of such games. Competition from other gaming venues (Video Lottery facilities, casinos, off-track betting parlors, etc.) may also reduce lottery sales.

Background

For a detailed description of the video lottery (VLT) program distribution formulas, base and administration, please see the *New York State Executive Budget - Economic and Revenue Outlook.*

Data Sources

VLT operations data are collected and reported by the Gaming Commission.

Statutory Changes

The FY 2019 Enacted Budget contained legislation that eliminated the commercial gaming to VLT hold harmless transfer provision and extended the VLT capital awards program for one year.

For a list of recent significant statutory changes made to the VLT statute, please see the *New York State Executive Budget - Economic and Revenue Outlook*.

Forecast Methodology

The forecasting methodology used relies on a complex simulation model to forecast potential revenues from all facilities that either are in existence or are expected to begin operation during the forecast period. The methodology is modified after a specific facility has operated long enough to produce a sufficient number of observations. At that point, actual operating experience is used to recalibrate the model.

Forecast Methodology for Potential Gaming Facilities

Current simulation estimates are based on an approach flexible enough to respond to a rapidly changing policy environment. The adopted modeling strategy is capable of evaluating the impact of competition, alternative facility locations, varying numbers of facilities, and alternative plans for program expansion. The core of the forecasting method is a computer-based simulation model combining demographic, Geographical Information Systems (GIS) and market assumptions. The purpose of the model is to simulate gambling behavior at the census tract level, resulting in an assessment of the underlying market for VLTs by facility over a multi-year forecast horizon.

The VLT forecast begins by making certain assumptions concerning the structure and viability of the program. These assumptions include, but are not limited to:

- An average prize payout of at least 90 percent over the period of analysis.
- All facilities will operate for 365 days per year after they begin operations.
- All facilities will continue their current hours of operation.

- All facilities operate the expected number of machines.
- Marketing, advertising, food and beverage, entertainment, availability of free play, and the facilities' quality of experience are competitive.
- All facilities complete their currently anticipated expansion plans.
- All facilities qualifying for the VLT program begin operations at an estimated start date and continue to operate throughout the period of analysis.
- The statutory distribution of revenue does not change over the period of analysis, unless already enacted in statute.

Defining the Market Area

Estimating revenues for an existing New York facility requires an assessment of the facility's capacity to attract participants, adjusting for the impact of potential competitors. Since most studies assume that a VLT facility's market can range as far as 150 miles, the market area for New York State facilities outside the New York metropolitan area includes any competing facility within either 150 miles or 150 minutes travel time of a State-run facility. This leads to a definition of New York's market area that includes nine northeastern states — Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, Pennsylvania, Rhode Island, Vermont, and New York — and eastern Canada. The latitude and longitude of all current and proposed facilities in this area and of the more than 13,000 census tracts are key model inputs. The model assumes U.S. citizens may patronize Canadian facilities, but that Canadians do not patronize U.S. facilities. This last condition is the result of the unavailability of comparable Canadian data.

An evaluation of the market potential for video lottery terminals and slot machines in New York requires an assessment of four critical market characteristics:

1. Number of Participants

Estimating the potential number of participants begins with a national demographic profile of people who typically patronize casinos. The primary source of this data is gambling industry trade publications. These data indicate the percentage of potential gamblers for four demographic characteristics: age, income, gender, and education. The same data also give an aggregate participation rate for each state. To account for differences among the states' participation rates, national rates for each demographic variable are adjusted to reflect the state-specific participation rate. Using the adjusted data, the number of participants is estimated by applying state-specific participation rates to each of the four demographic characteristics for each census tract in the nine-state study area. This provides an indication by census tract of how many people in the nine-state market area are likely to visit a casino or VLT facility.

To arrive at a multi-year monthly forecast, each of the four demographic characteristics and participation rates are projected by month and census tract to the end of the State's Financial Plan

period. The appropriate monthly participation rate is applied to each of the four demographic categories in each census tract to arrive at four monthly estimates of the number of potential participants in each census tract. An un-weighted average of the four estimates is used to arrive at a final estimate. The estimated participation rates of some fully mature states, such as New Jersey and Connecticut, are generally increased modestly over the projection period. This provides an estimate of the number of gamblers in each census tract by month through the end of the State's Financial Plan period.

The available data contain estimates of participation rates only for people over 21. In New York, people 18 and older can visit VLT facilities (21 and older for casinos). To adjust for this, the latest Census population estimates are used, with the participation rate from the next highest age bracket applied to estimate the number of participants in the 18 to 20 age bracket.

The participation rate appears correlated with the availability of casinos, suggesting that additional participants are encouraged by access to casino venues. Therefore, it is assumed that as more casino facilities become available over time, the participation rates in New York and some surrounding states will increase.

2. Number of Visits

To estimate the frequency of visits, two approaches are combined. First, several published studies indicate that the closer an individual lives to a casino, the more frequent the visits. A KPMG study postulated that a typical person within the primary market area of a casino (less than 50 miles) would visit on average ten times per year. A person within the secondary market area (50 miles to 100 miles) would visit six times per year on average and in the tertiary area (100 miles to 150 miles), three times per year. The American Gaming Association survey found that nationally the average casino player visits a casino 6.1 times per year. In the Northeast region, the average casino player visits 8.5 times per year. Again, the profile gives the average number of visits by state; it appears that the number of visits increases in states with higher participation rates. The analysis has been calibrated using both studies, and the results from both approaches are relatively close. The number of visits is estimated monthly by census tract as population and participation rates rise over time, and are combined to produce a final forecast.

3. Amount Gambled

To determine the amount of income spent per visit, data from two studies are used. Oregon completed a study that indicated that the average person would gamble approximately 1.2 percent of annual income on all forms of gaming. On the other hand, KPMG, in its study of gambling in Michigan, postulated that people in the primary market area would be willing to lose $40 each time they visited a casino, in the secondary market area $50 each time, and in the tertiary market area $65 each time. To derive the amount of gambling dollars using the KPMG methodology, the loss per visit was increased or decreased by indexing these amounts by the ratio of the per capita income of each census tract to the per capita income in Michigan. To grow the amount gambled in each census tract, personal income and population are increased by the growth rate embodied in intervening censuses. This allows for growth in the amount gambled in the primary, secondary, and tertiary market areas by month through the end of the State's Financial Plan period. This also

allows calculation of the total amount of gambling dollars in each census tract by multiplying personal income by the Oregon average percentage of income gambled. Somewhat surprisingly, these two methodologies produce similar results. The amount gambled in each census tract is forecast monthly to the end of the State's Financial Plan period as a function of the growth in population, income, and participation rates.

4. Defining the Market Area for Each Facility

The VLT analysis next concentrates on allocating the aggregate number of visits and gaming dollars in New York's market area to potential venues. There are several existing facilities in New York and in the surrounding states and Canada. As of October 2018, all four of the recently authorized New York casinos have opened, and 1,000 VLT machines at Jake's 58 and 505 Nassau OTB at Resorts World VLT machines are now operational. Each facility is competing for potential VLT players and gaming dollars. While the number of players and the amount of gaming dollars is projected to grow over time, in the short run, they are relatively fixed. The introduction of a new facility anywhere in the nine-state-area will reduce the players and gaming dollars available to nearby facilities. The following describes two methods for determining the distribution of potential VLT customers and revenue among all competing facilities.

Concentric Rings

One method to establish a facility's market area begins with the industry accepted norms. The primary, secondary and tertiary markets are set at 0 to 50 miles, 50 to 100 miles, and 100 to 150 miles, respectively. This produces three concentric rings around each facility. The arc distance is calculated from the latitude and longitude of the geographic centroid of each census tract to the latitude and longitude of each facility, or the centroid of the census tract containing the facility. Where the actual location of the facility is unknown, a geographically logical location within the appropriate municipality or region is assumed. It is then determined whether a given census tract falls within the primary, secondary or tertiary market area of another facility. The attractiveness factor is used to adjust the facility's primary, secondary, and tertiary market area to reflect its relative drawing power.

Most census tracts fall into the market areas of several facilities. To allocate the visits (and the potential revenue from each census tract) to each facility, the probability that the participants in a census tract would visit each casino is calculated. To determine the probability that an individual would visit a casino, a gravity model approach is used which assumes that the propensity to visit a facility is inversely related to the square of the distance from the facility and directly related to the facility's attractiveness. This is a standard approach in location theory and is used widely by those in the gaming industry. For each census tract, the number of visits and gambling dollars for each facility are calculated using probabilities similar to those shown in the following table. The table below indicates how a representative gambler of any given census tract might divide his or her time under seven possible scenarios. For example, the first scenario indicates that the gambler lives in the primary market area of only a single facility. Therefore, 100 percent of his gambling will take place at that facility. Under scenario four, the gambler lives in the primary market area of one facility, the secondary area of a second facility, and the tertiary market area of a third, and divides his or her gambling visits according to the probabilities listed in the table. Many other, more

complex scenarios are possible. For example, if an individual gambler was within the primary market of one facility and in the secondary market of two facilities, he or she would allocate his or her visit 88.2 percent to the primary facility and 11.8 percent to each of the secondary facilities (see primary secondary in the following table). This would add to 111.8 percent. Obviously, this is impossible, so each percentage is divided by 111.8 percent to arrive at 78.8 percent for the primary facility and 10.6 percent to each secondary facility.

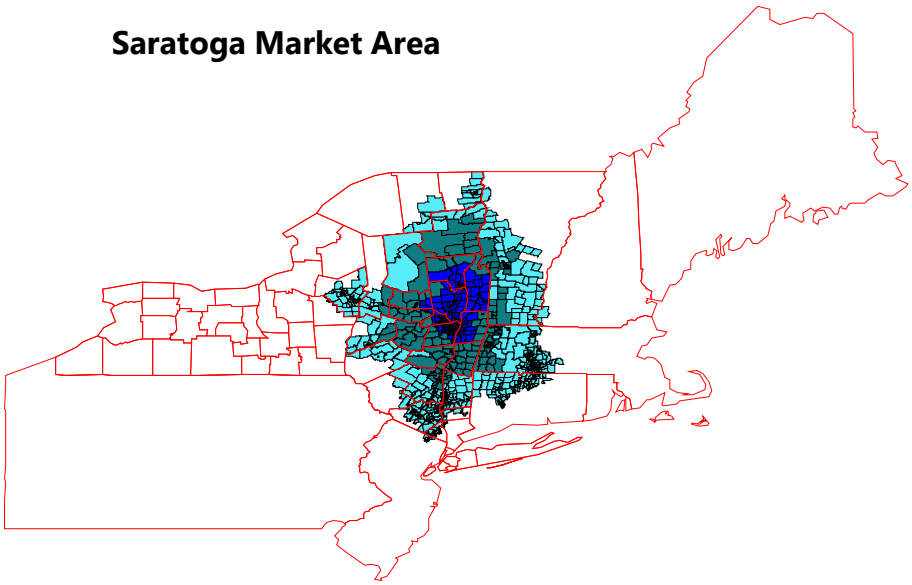
SAMPLE PROBABILITIES OF VISITING A CASINO (percent)

	Primary	Primary Secondary	Primary Tertiary	Primary Secondary Tertiary	Secondary	Secondary Tertiary	Tertiary
Primary	100.0	88.2	96.1	85.2			
Secondary		11.8		11.4	100.0	76.8	
Tertiary			3.9	3.4		23.2	100.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Travel Time

The most accurate method to establish a facility's market area considers travel times. Here the model assumes that people are more responsive to the time it takes to travel to a facility than the straight-line distance between their homes and the facility. Again, following the norms in other studies, the primary, secondary and tertiary market areas were established using travel times of 0 to 50 minutes, 51 to 100 minutes and 101 to 150 minutes, respectively. Assuming an average speed of 50 miles per hour and allowing 15 minutes to get to a major highway from a home and another 15 minutes to get from a major highway to the facility, these market areas are comparable in size to the concentric ring model. In this case, however, the market areas become irregular, generally following major highway systems, which could include census tracts with significantly different demographics than the census tracts identified using the concentric rings method. As already discussed, the size of the primary, secondary, and tertiary market areas is adjusted to reflect the attractiveness of facilities. The process for allocating visits and gambling dollars is identical to the concentric rings analysis (see table above). The preferred DOB model uses market areas defined by travel times in its simulations.

The following map shows an example of the market surrounding the Saratoga facility. The navy blue (dark) region is the primary market area. The green (medium-gray) region represents the secondary area. The light blue (lightest) region represents the tertiary market area.



Note: Black patches in the tertiary area are the result of intersecting borders of small census tracts.

Facility Limits

The model produces estimates of the number of participants, the number of visits, and total gaming revenue spent at each facility. However, other factors limit usage. The industry standard assumption is that a participant will spend three hours at a VLT per visit. In New York, the hours of operation are limited to 20 hours per day. This implies that each machine can accommodate 6.7 players per day. For example, if a facility operated for the maximum number of hours and had 2,000 machines, the maximum number of average duration visits the facility could accommodate is 13,320 per day. If the model results indicate that a facility market area would only support 6,660 visits per day, half of the machines would stand idle on average. Likewise, if the facility's market area produces 26,640 visits per day, the waiting time to use machines would be significant and the revenue-generating capacity of the facility would be capped by its physical limits regardless of how many visitors the market produces.

Overall, industry experts estimate optimal average facility utilization at 80 percent. Looking at the facility limitations above, these two parameters were combined and a sliding scale was created, which compares the number of visits that the facility's market area will produce and adjusts the facility's utilization factor to account for expected market demand. This allows the identification of areas of market saturation and areas with the greatest potential for expansion. In addition, the maximum revenue generation capacity of each facility is estimated and no facility is allowed to generate more than its maximum, regardless of market predictions.

Other Factors

Since the object of the model is to produce estimates of State fiscal year revenues, it is necessary to be sensitive to the actual period of operation during each fiscal year and to the competitive effects of other facilities. For VLT facilities, the most recent information available from the Gaming Commission is used to specify expected start dates and the initial number of machines, expansion of existing facilities, and changes in machine counts. The model is also able to incorporate new facilities anywhere in the Northeast and to adjust to any expansion plans anticipated by the tracks or other facilities.

Simulation Model Aggregate Results

Aggregate results depend upon the combination of gaming facilities open during a particular fiscal year and other factors such as start dates, quantity of VLTs offered, additional amenities, and several other situational gaming factors. Given an almost infinite number of different scenarios, estimated results of the quantity of gamblers, total NMI, and total visits can be illustrated in a low to high range. The accuracy of any such forecast is contingent upon the quality of the underlying assumptions made, particularly with respect to facility attractiveness, which is extremely challenging to quantify for new facilities.

Forecast Methodology Subsequent to the Opening of a VLT or Casino Facility

The factors affecting receipts for existing facilities are not unlike that for potential facilities. In addition to the assumptions concerning the market area, number of participants, number of visits and amount gambled, marketing and promotion data can be included in the analysis.

After a facility has been opened long enough to compile a historical data series, the simulation model is calibrated to approximate the attractiveness factor. Historical data on each facility's NMI trends can now be incorporated into the forecast. Consideration is also given to expansion and improvements to facilities, as well as competition from other gaming venues.

The NMI estimates for existing facilities generated by the model are supplemented by analysis of historical and recent trends. This analysis is at least as important as the model analysis due to the complex nature of the model estimation method and vast number of underlying assumptions that are incorporated. Other out-of-model adjustments are often made to fine-tune results.

Adjustments

After generating NMI forecasts and applying appropriate aid to education rates, adjustments are made for refunds, credits, accounting delays, historical and year-to-date collection patterns, and law and administrative changes.

Risks to the Forecast

As previously mentioned, the estimation process is highly dependent on several assumptions. Casinos compete with VLTs by increasing the amount paid out in prizes. Payouts of not less than 90 percent are assumed (this is the minimum allowed per law), but, if competition increases this number, it could have a significant impact on revenues. For example, if competition increases the prize payout from the FY 2018 average of 94 percent to 95 percent, the amount of revenue due to the state, holding other factors constant, falls by 17 percent.

Recently authorized casino gaming both in New York and in Massachusetts could have a greater impact on New York VLT facilities than anticipated as these casinos continue to ramp up operations and complete their full offering of amenities . A similar impact could also be felt due to continual expansions at competing facilities, including Foxwoods, Mohegan Sun, the Native American casinos in NYS, and other casinos in the Northeast.

On the other hand, the market for video lottery gaming could be greater than anticipated. As of October 2018, Jake's 58 is significantly outperforming Financial Plan projections, but the cap of 1,000 machines, per statute, will likely limit the potential future growth to some extent. Also, the cannibalization of VLT facilities in the same gaming region as a commercial casino has been less than originally expected as the casinos have underperformed revenue projections. If these trends continue, the NMI estimates could be understated and the estimate of losses due to competition might be too high.

Part III

Spending Methodologies

School Aid Forecast Methodology

Program Overview

School Aid provides funding to help finance elementary and secondary education for pupils enrolled in 674 major public school districts throughout the State. Funding is provided based on statutory aid formulas and through reimbursement for various grants and categorical programs.

2018-19 SY ENACTED SCHOOL AID (billions of dollars)	
Foundation Aid	$17.792
Other Formula-Based Aid Programs	$8.238
Grants and Categorical Programs	$0.523
Total School Aid	**$26.553**

The State FY 2019 Enacted Budget provides $26.55 billion in School Aid for the 2018-19 school year, including: $17.79 billion in Foundation Aid; $8.24 billion in other formula-based aid programs (e.g., Building Aid, Transportation Aid, Universal Prekindergarten); and $523 million in grants and categorical programs. The Enacted Budget also continues multiyear funding of $1.5 billion to support the phase-in of a Statewide Universal Full-Day Pre-Kindergarten program including $340 million for the 2018-19 school year.

School Aid is projected to increase by an additional $956 million (3.6 percent) in SY 2020, consistent with the Personal Income Growth Index in statute. Actual School Aid increases approved by the Legislature have exceeded the index in recent years.

The State pays approximately 70 percent of the annual school year commitment during the fiscal year it was enacted, with most of the remaining 30 percent spent in the first three months of the next fiscal year. Some programs deviate from this spending pattern. For example, the State pays 25 percent of the school year commitment for BOCES programs during the fiscal year it was enacted and 75 percent in the following year. Based on this funding schedule, School Aid spending in State Operating Funds for the State FY 2019 was projected to total $26.5 billion.

Key Forecasting Data and Assumptions

Under the growth cap, total spending for School Aid in future years is based on a personal income growth index. Total School Aid can deviate from the amount estimated in the Enacted Budget based upon periodic updates in school district claims and data.

School Aid Funding Cap

The State FY 2012 Enacted Budget amended Education Law to limit future School Aid increases to the rate of growth in New York State personal income. The level of School Aid in future years is a function of both a personal income growth index used to determine allowable growth and future legislation to allocate the allowable increase.

Personal Income Growth Index

Pursuant to Education Law, the personal income growth index is defined as the annual percentage change in New York State personal income in the State fiscal year that ends 15 months before the applicable school year begins. This rate is measured using U.S. Department of Commerce – Bureau of Economic Analysis (BEA) data published closest to October 31 prior to the start of the school year. In years where there is a negative annual change in personal income, allowable growth in School Aid will be zero.

Allowable Growth under the Growth Cap

Education Law prescribes how part of the allowable increase under the School Aid growth cap is used, but leaves a remaining balance to be allocated pursuant to a chapter of law.

Statute authorizes additional spending within the growth limit for the following purposes:

- $50 million for the Governor's performance grants initiative, which rewards school districts that demonstrate significant improvement in student performance or those that undertake long-term structural changes to reduce costs and improve efficiency.

- Increases in formula-based aid programs, outside of Foundation Aid, which primarily consist of expense-based reimbursement programs such as Building Aid and Transportation Aid.

After accounting for spending increases allowed under current law, any remaining balance of allowable growth can be allocated pursuant to a chapter of law for purposes including, but not limited to, additional spending for performance grants or increases in Foundation Aid. Unless a change is enacted into law, Foundation Aid is continued at the previous year's levels.

School Aid Database Updates

Education Law requires the State Education Department to release school district specific data three times a year for purposes of calculating School Aid: February 15, May 15, and November 15. The November 15 database forms the basis for Executive Budget forecasts. February and May database updates are used to revise forecasts of School Aid to individual districts. Typically, it is the revised data that is used for School Aid calculations for the Enacted Budget and for future adjustments to monies due to individual districts.

School Aid Spending Projections

Based on State FY 2019 Enacted Budget projections, spending under the School Aid growth cap was projected to total $27.51 billion for the 2019-20 school year, an increase of 3.6 percent or $956 million from the $26.55 billion Enacted Budget estimate for the 2018-19 school year. Total spending under the cap was expected to reach $29.98 billion in the 2021-22 school year.

PROJECTED SCHOOL AID SPENDING UNDER GROWTH CAP - FY 2019 ENACTED LEVELS SCHOOL YEAR
(millions of dollars)

	2018-19	2019-20	2020-21	2021-22
Total School Aid	**$26,553**	**$27,509**	**$28,692**	**$29,983**
$ Change	$914	$956	$1,183	$1,291
% Change	3.6%	3.6%	4.3%	4.5%

Risks and Variations to Forecasting Model

Personal Income Growth

All of the risks that apply to the national and State macroeconomic forecasts apply to the State personal income estimates as well. In particular, financial market volatility as it relates to Wall Street profits and bonuses represent a major risk to New York wages and, hence, personal income. Finally, forecast accuracy is limited by the accuracy of the available data. U.S. Bureau of Economic Analysis estimates of both the wage and nonwage components of state personal income are revised multiple times over the course of the year, representing yet another risk to the DOB forecast.

Medicaid Forecast

Program Overview

Medicaid, which is jointly financed by the Federal government, the State, and local governments (e.g., counties and New York City) provides health care services, including long term care, for low income, mentally-ill, disabled and elderly individuals. Prior to 2006, for most services the non-Federal share of Medicaid costs was shared equally between the State and local governments. Since that time, local contributions have been capped at the 2005 level, with a statutorily specified annual increase. Beginning in Fiscal Year 2014, the statutory growth in the local share was phased-out over a 3-year period. The Department of Health (DOH) is the single State agency responsible for administering the Medicaid program. A number of other State agencies, including the Office of Mental Health (OMH), the Office for People with Developmental Disabilities (OPWDD), the Office of Alcoholism and Substance Abuse Services (OASAS), the Office of Children and Family Services (OCFS) and the State Education Department (SED) use Medicaid to finance health care services provided to their clients.

New York provides nearly all services allowed by the Federal Government and other services as authorized through Federal waivers. There are approximately 6.2 million individuals who are enrolled in Medicaid and are served by a vast network of eligible health care providers or through managed care contracts with specific health plans. Roughly three-quarters of the State's Medicaid recipients are enrolled in managed care plans, while the balance access services on a fee-for-service basis**.** Currently, all New York State counties plus NYC participate in mandatory enrollment of Medicaid recipients in managed care plans, except for populations that are exempt.

The Medicaid program uses various methods to determine provider reimbursement levels. On a fee-for-service basis, these methods are tailored to the service provided and include service-based fees and provider specific rates. Managed care plans receive capitated (e.g., fixed) payments per enrolled member on a monthly basis. Various control mechanisms (e.g., utilization thresholds, prior authorization) are also employed to ensure that services are medically necessary and consistent with Federal guidelines.

Providers submit claims for fee-for-service reimbursement that are processed through a computerized claims payment system or Medicaid Management Information System (MMIS) – called eMedNY, which is operated by a private contractor under the oversight of the Department of Health. Medicaid Managed Care premiums are also paid through MMIS. Each year more than 300 million claims are processed through MMIS. This system generates a payment only after verifying that the claim does not deviate from established control mechanisms, including recipient eligibility, provider standing and service authorization. Providers are paid on a weekly basis, and generally on a two-week lag after the claim is approved.

Key Forecasting Data and Assumptions

Factors Impacting the Medicaid Forecast

Medicaid spending in any State fiscal year is determined by the price of the services provided through the program (e.g., nursing homes, hospitals, prescription drugs) and the utilization of those services (reflects both the number of individuals enrolled in Medicaid and the amount of services they use). Medicaid price and utilization, in turn, are influenced by a multitude of factors including economic conditions, litigation, changes in the health care market place, prescription drug pricing and product development by manufacturers, complex reimbursement formulas which themselves are affected by another set of factors (e.g., length of hospital stays), total enrollment in Medicaid and the behavior of recipients accessing services. The State share of Medicaid spending is also dependent on the local government contributions toward Medicaid costs – which is now determined pursuant to the FY 2013 Enacted Budget Local Medicaid Cap legislation – and Federal funding, which can be affected by both statutory and administrative changes at the Federal level. Due to the Affordable Care Act, which went into effect on January 1, 2014, Federal funding may also vary for certain newly eligible populations.

Forecasting Methodology/Data

State Medicaid disbursements are forecast on a cash basis and updated on a quarterly basis, consistent with the schedule for revising the State's Financial Plan. Disbursements are evaluated both on a weekly basis using data on aggregate weekly cycle payments and based upon a detailed review of monthly service category claims data generated by MMIS. The forecast is used to evaluate current year spending and projected spending for the next budget-year. Spending estimates in the out-years are developed based upon this methodology and compared for consistency with the Medicaid growth factors estimated by the Federal Congressional Budget Office.

The Medicaid forecast involves an evaluation of all major service categories using a specific approach, depending on whether expenditures are based on monthly plan premiums or fee-for-service payments. The forecast uses category-specific MMIS data provided by the Department of Health (DOH) on a monthly basis. This includes detail on total paid claims and premiums, retroactive spending adjustments, caseload and service utilization. This data is incorporated into mathematical models that are used to predict future expenditures based upon historical expenditure patterns and seasonal trends. The models also consider non-MMIS data (e.g., managed care enrollment, Federal Medicare premiums, and trends in the pharmaceutical industry) in certain areas to generate program specific expenditure projections. The forecast only applies to Medicaid spending in DOH's budget and does not reflect additional spending in OPWDD, OMH, OASAS, OCFS or SED.

In general, the monthly actual data for the current year is annualized with consideration of price (e.g., the cost of services) and utilization (which reflects caseload, or the number of recipients, and the level of services used by those recipients) trends and seasonal patterns. These estimates are then adjusted to incorporate planned changes that are not yet reflected in the actual claims data (e.g., pending reimbursement changes, State or Federal policy changes). This process develops a revised estimate of annual spending. The revised estimate is then compared to prior year disbursement estimates and variances are identified. Year-to-year variances are evaluated and quantified as impacting the price or utilization of the services. Significant variances form the basis for updating overall Medicaid disbursement estimates in the next State Financial Plan Update.

In addition to a detailed claims-based analysis, aggregate weekly cash disbursements are regularly evaluated against expected values to monitor variances and predict future spending levels. This provides another check of spending patterns, as different models may be more or less sensitive to seasonal variations or longer-term trends.

Forecast Projection Models

The following describes the specific forecasting methodologies used for estimating Medicaid State funds spending for services provided on a fee-for-service basis (costs are incurred based on the specific services provided); for services provided through managed care plans (costs are based on monthly plan premiums) and for the costs of the statutory cap on local government contributions towards their Medicaid costs. The same basic methodology is used to project fee-for-service across all service categories (e.g., hospitals, nursing homes, physicians) while managed care spending is projected using a different enrollment and premium based methodology. A sample forecast is provided for the hospital inpatient category and the specific methodology used for managed care is also described. A number of cash adjustments (e.g., HCRA revenues, fraud recoveries) are netted against the State funds spending estimate to calculate the Medicaid General Fund appropriations.

Fee-For-Service – (Sample Forecast for Hospital Inpatient)

Fee-for-service hospital inpatient Medicaid spending is based upon a complex reimbursement rate which is predicated primarily on the number of patient discharges and the costs associated with those discharges. There are also a number of other factors which are used in determining the specific reimbursement rates for over 180 hospitals in New York State (e.g., length of hospital stay, hospital patient volume, case mix, volume, capital costs). DOH updates hospital reimbursement rates annually.

DOB projects inpatient spending – for both current and future years – by using actual claims (e.g., spending) data generated by MMIS, and adjusting that data to produce an annual DOH hospital inpatient spending estimate for the current year.

Specifically, the claims data is adjusted for:

- Spending in State-operated Mental Health and substance abuse facilities (which is budgeted in other State agencies);
- Seasonal spending modifications based upon prior year patterns for price and utilization (e.g., more hospital spending may occur in winter months); Policy changes not yet implemented (from Enacted Budget or Federal actions); Utilization changes based on a comparison of prior year to current year actual spending;
- The timing of rate actions/Federal State Plan Amendment approvals; and
- "Off-line" payments not reflected in the claims data (generally one-time lump sum payments and other cash adjustments, e.g., hospital disproportionate share payments).

This current year estimate becomes the new base for projecting spending in the Budget-Year and out-years. Further adjustments to the Budget-Year projection include year-to-year price and utilization growth; incremental changes to policy initiatives; consideration of actions that will occur in that year; and an annual projection of savings from the continuation of shifting individuals from fee-for-service to managed care. Annual growth projections in price and utilization are determined by historical experience of year-to-year changes in discharges and price per discharge. DOB regularly reviews current claims data compared to historical data to detect trends. These trends, as well as Congressional Budget Office forecasts, are identified and incorporated into the recast.

Fee-For-Service Projection Model (Hospital Inpatient Services)

Current Year Projection

$$CY = S_{ytd} + R_{ytd} + ((S_{ytd}/AC)*(1+SES)*C_{yr})) + M_{1,2, \text{ etc.}}$$

Budget Year Projection

$$BY = (CY - S_{nr}) + (CY - S_{nr} * P) + (CY - S_{nr} * U) + M_{1, 2, \text{ etc}}$$

Current Year

CY = Current year projection
Sytd = Year to date spending
Rytd = Retroactive spending (e.g., payments made for prior periods) year to date
AC = Actual # of cycles to date
SES = Seasonal factor based on prior year claims data spending patterns

Cyr = # of Cycles remaining in year
M = Manual adjustments (e.g., lump sum and offline payments, managed care shift, Federal actions, timing adjustments, anticipated retroactive payments, etc.)

Budget Year

BY = Budget year projection
CY = Current year projection
Snr= Non-recurring spending
P = Price rate (based on historical trends)
U = Utilization rate (based on historical trends)
M = Manual adjustments (e.g., lump sum and offline payments, managed care shift, Federal actions, timing adjustments, anticipated retroactive payments, etc.)

Managed Care

Medicaid managed care expenditures result from set monthly premiums paid for clients enrolled in prepaid health insurance plans, generally referred to as Health Maintenance Organizations (HMOs). Currently, 18 plans participate in Managed Care and 61 plans in Managed Long Term Care. Managed care spending is a function of enrollment, the number and type of plans that participate and changes in premium rates.

Forecasting expenditures for the current year involves utilizing monthly MMIS data for the plans, including claims (expenditure) data, service units and beneficiary data. For price, the current year estimate uses annual premium costs submitted by DOH and approved by DOB. For utilization, monthly actuals create the basis for a per-member-per-month (PMPM) average premium price. An average premium price, based upon actual data, is used because premium rates vary widely by region, by plan, and by Medicaid eligibility group. For example, premium rates for Temporary Assistance for Needy Families (TANF) individuals – low income recipients who qualify for public assistance benefits – are generally lower than those for elderly, blind or disabled individuals who qualify for Supplemental Security Income (SSI).

Managed care enrollment projections are used in the estimation process for both current and out-year projections. Projections are based on current enrollment of plans, as well as anticipated new enrollment. Out-year adjustments are then made to reflect any pending administrative or statutory actions.

Managed Care Projection Model

Current year projection

$$CY = Sytd + Rytd + \Sigma(R_{MCMM} * A_{PMPM}) + M1,2, \text{ etc.}$$

Out-year projection

$$OY = CY - Snr + P + U + M1,2, \text{ etc.}$$

Current Year

CY = Current year projection
Sytd = Year to date spending
Rytd = Retroactive spending (e.g., payments made for prior periods) year to date
R_{MCMM} = Remaining monthly combined member months
A_{PMPM} = Average per-member-per-month premium rate
M = Manual adjustments (e.g., timing, overlap payments from fee-for-service to managed care, cost containment implementation, anticipated recurring payments)

Budget Year

OY = Out- year projection
Snr= Non-recurring spending
P = Price rate (sum of the projected annual combined member months times the Budget Year average premium cost)
U = Utilization rate (e.g., estimated number of new member months multiplied by cost of premiums)
M = Manual adjustments (e.g., timing, overlap payments from fee-for-service to managed care, cost containment implementation, anticipated recurring payments)

State Spending for Local Medicaid Cap

Since implementation of the Local Medicaid Cap in January 2006, the State has assumed all local government costs above statutorily established local cap payments. Local cap payments are determined on a county-specific basis using actual calendar year 2005 costs increased by 3.5 percent in 2006, another 3.25 percent in 2007, and an additional 3.0 percent annually starting in 2008. This calculation generates the county's local cap payments within a given State fiscal year.

The FY 2013 Enacted Budget reduced the annual growth of Local Medicaid payments for all counties (including NYC), effective April 1, 2013 by phasing-down the annual rate of Medicaid growth in local government payments from three to zero percent over three years. The local cap growth is limited to three percent in FY 2013, 2 percent in FY 2014, 1 percent in FY 2015, and 0 percent growth thereafter.

The State is responsible for all local costs above the maximum local payment level. These State costs are initially determined based upon historical trends in local expenditures and then subsequently adjusted to reflect the impact of Enacted Budget initiatives, changes in Medicaid claiming (in line with our projection of State share costs) and the results of a statutory reconciliation of local cap payments.

Medicaid Spending Projections

Price and utilization projections are based on DOB's analysis of MMIS data reflected in the Medicaid Data Warehouse (MDW) reports provided by DOH on a monthly basis, as detailed below. Specifically, the claims data provides total Medicaid expenditures, retroactive Medicaid payments and Salient recipient data that supplies information on total Medicaid beneficiaries and service units.

Category of Service	Price	Utilization
Inpatient	Total Expenditures (MDW claims data) divided by Total Beneficiaries (Salient Service Units); Retroactive Payments (retroactive adjustments) considered separately because they do not occur uniformly in a year	Total Beneficiaries (Salient)
Clinics	Total Expenditures (MDW claims data) divided by Total Visits (Salient Service Units); Retroactive Payments (retroactive adjustments) considered separately because they do not occur uniformly in a year	Total Visits (Salient)
Nursing Home	Total Expenditures (MDW claims data) divided by Total Bed Days (Salient Service Units); Retroactive Payments (retroactive adjustments) considered separately because they do not occur uniformly in a year	Total Bed Days (Salient)
Home Care	Total Expenditures (MDW claims data) divided by Total Hours (Salient Service Units); Retroactive Payments (retroactive adjustments) considered separately because they do not occur uniformly in a year	Total Hours (Salient)
Managed Care	Total Premium Payments based on DOH Rate Appeal	Total Member Months (i.e., monthly enrollment) (MDW claims data)
Pharmacy/Part D (budget includes State share rebates and Medicare Part D clawback payments)	Total Expenditures (MDW claims data) divided by Total Prescriptions (Salient Service Units)	Total Prescriptions (Salient)
Other Non-Institutional (e.g., physician, dental, eyeglasses, medical equipment, x-rays, laboratory services)	Total Expenditures (MDW claims data) divided by Total Service Units (Salient Service Units); If necessary, retroactive payments (retroactive adjustments) considered separately because they do not occur uniformly in a year	Total Service Units – Beneficiaries, Visits, Items (Salient)

Risks and Variations to Forecasting Models

Forecasting Risk

The Medicaid disbursement forecast provides a point-in-time estimate for program spending based on an analysis of current and historical claims and a number of other known factors (e.g., caseload trends, Federal Congressional Budget Office Medicaid growth estimates and other factors for the out-years). These estimates can be subject to considerable variance and are highly sensitive to economic conditions (although the impact of economic changes is usually lagged and do not immediately affect Medicaid spending); changes in State and Federal guidelines, policies, and statutes; litigation by providers or advocacy groups and developments in the health care marketplace.

For example, the application of a Pharmacy benefit in October 2011 drastically impacted Medicaid Managed Care and fee-for-service Pharmacy expenditure projections by creating a substantial shift in cost from fee-for-service Pharmacy to Managed Care. When forecasting Budget-Year expenditures in these categories it was necessary to forecast the increased costs from applying prescription drugs to the managed care benefit package and the net savings to fee-for-service Pharmacy resulting from decreased utilization offset by a decrease in rebates. Evaluating changes in drug mix, transition coverage, and manufacturer rebates were critical factors in adjusting the State's Medicaid projection for the shift in the Pharmacy benefit.

Public Assistance Program Forecast Methodology

Program Overview

The Office of Temporary and Disability Assistance (OTDA) local assistance programs provide cash benefits and supportive services to low-income families, children and adults living in New York State. OTDA's public assistance (PA) program is comprised of the Family Assistance and Safety Net Assistance programs. The Family Assistance program, which is financed by Federal Temporary Assistance for Needy Families (TANF) funds, provides cash assistance to those families who have been on assistance for less than five years. The Safety Net Assistance program, financed by the State and counties, provides cash assistance to single adults, childless couples, and families who have exhausted their five-year Federal time-limit on TANF.

Key Forecasting Data and Assumptions

There is a strong relationship between the PA caseload and economic factors such as the number of individuals employed in low-wage work. The costs associated with this caseload are dependent on factors such as the recipients' housing arrangements (homeless shelters and substance abuse residential programs are more expensive than regular housing) and shifting demographics (larger family sizes equal larger benefit payments).

The PA caseload model provides forecasts for families and singles on PA separately for New York City (NYC) and for the rest of the State (ROS). ROS includes rural upstate and western New York as well as the wealthier, more densely populated suburban counties of the Hudson Valley and Long Island. The forecast for families on PA includes those families that have exhausted their five-year Federal time-limit (Safety Net families).

Current Population Survey data indicates that PA recipients who work tend to be concentrated in industries that have large numbers of relatively low-wage entry level jobs. These industries include manufacturing; retail trade; administrative and support services; waste management and remediation services; arts, entertainment, and recreation services; accommodation and food services, and "other" services. For convenience, we refer to employment aggregated across these industries as "entry-level employment."

DOB uses econometric models to forecast entry-level employment separately for NYC and for ROS. Many of the input variables used in these models, such as statewide employment in entry-level industries and real wages in the finance and insurance sector, are derived from DOB's macroeconomic model for the New York State economy. In a second set of econometric models, PA caseload estimates are contingent upon the forecasts for entry-level employment levels and other relevant variables. Thus, the caseload forecasts are fully consistent with DOB's overall economic outlook.

Forecasting Public Assistance Caseloads

Table 1 shows the specifications for the PA caseload equations.[1] Caseloads are estimated to vary based on factors such as entry-level employment levels and the unemployment rate. The models also contain measures that attempt to capture the impact of administrative and programmatic efforts at the national, State, and local levels to reduce the dependency on PA, including changes in eligibility criteria such as the added work requirements and term limits introduced with the passage of the Federal Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA) - which replaced the old welfare program. Caseloads in NYC were also impacted by the devastation caused by Tropical Storm Sandy in the fourth quarter of 2012 and the first quarter of 2013.

Growth in the PA family population in NYC is a function of administrative efforts, economic conditions as measured by real U.S. Gross Domestic Product (GDP), and employment opportunities in the entry-level employment sectors. An increase in real GDP is associated with a decline in family cases in NYC. An increase in entry-level employment opportunities is also associated with a reduction in caseloads, however, this response takes about one year (four quarters) to materialize. At two times in recent history, a correction was made to shift families out of the Safety Net population into the TANF population. The model includes dummy variables for the third quarters of 2007 and 2013 to account for these one-time shifts in response to classification errors. In addition, almost immediately following the change in the mayoral administration, the caseload appears to have risen persistently through the fourth quarter of 2015, independent of what economic trends would have suggested. To account for this apparent shift in policy, a dummy variable is added for the period from the second quarter of 2014 through the fourth quarter of 2015. Finally, since caseload data are not seasonally adjusted, quarterly dummy variables are inserted to capture regular quarterly patterns in caseloads that are unrelated to changing economic or administrative conditions.

The growth in the PA family caseload for ROS depends on employment opportunities in entry-level sectors in ROS areas, administrative efforts, as well as dummy variables for the first and third quarters to control for seasonality in the caseload data.

Growth in NYC's PA singles caseload depends on administrative efforts and year-over-year NYC entry-level employment growth. A change to Federal regulations affected the number of NYC PA singles cases between the third quarter of 1987 and the fourth quarter of 1989; this effect is captured by dummy variables. Dummy variables for the third quarters of 2007 and 2013 account for one-time shifts in response to classification errors (as mentioned above for the NYC families model). Finally, a dummy variable for period from the second quarter of 2014 to the second quarter of 2015 controls for the shift in policy under the new administration.

The ROS PA singles caseload is a function of administrative efforts and the unemployment rate outside of NYC. An increase in the unemployment rate is associated with an increase in the ROS PA singles caseload. Dummy variables for the first quarter of 2002, the third quarter of 1992, and the first quarter of 1998 account for large increases in ROS PA singles caseloads that remain

[1] In this report, the "caseload" is defined as the number of recipients.

unexplained by changes in economic conditions and administrative efforts. Dummy variables for the first, second, and third quarters control for seasonality in the caseload data.

TABLE 1
TANF AND SAFETY NET CASELOAD MODELS

$$\Delta \ln TANF_{NYC,t} = \underset{(0.073)}{-0.194}\ \Delta_4 \ln GDPR_t \underset{(0.064)}{-0.123}\ \Delta_4 \ln WE_{NYC,t-4} \underset{(0.005)}{-0.019}\ ADMIN_t \underset{(0.009)}{+0.012}\ DSandy_t$$
$$\underset{(0.005)}{+0.045}\ D2007Q3_t \underset{(0.009)}{-0.042}\ D2008Q1_t \underset{(0.009)}{-0.015}\ D2013Q3_t \underset{(0.008)}{+0.022}\ Adm\ in\ TANF_t + e_t$$

Adjusted $R^2 = 0.64$

$$\Delta \ln TANF_{ROS,t} = \underset{(0.078)}{-0.161}\ \Delta_4 \ln WE_{ROS,t} \underset{(0.004)}{-0.028}\ ADMIN2_t \underset{(0.002)}{+0.005}\ Q1_t \underset{(0.002)}{-0.007}\ Q3_t + e_t$$

Adjusted $R^2 = 0.68$

$$\Delta \ln SN_{NYC,t} = \underset{(0.09)}{-0.33}\ \Delta_4 \ln WE_{NYC,t} \underset{(0.007)}{-0.049}\ ADMIN_t \underset{(0.012)}{-0.101}\ D2007Q3_t \underset{(0.020)}{-0.039}\ D2013Q3_t$$
$$\underset{(0.020)}{-0.062}\ D1987Q3_t \underset{(0.020)}{+0.070}\ D1989Q4_t \underset{(0.019)}{+0.025}\ DSandy_t + e_t$$

Adjusted $R^2 = 0.69$

$$\Delta \ln SN_{ROS,t} = \underset{(0.011)}{0.063}\ \Delta_4 UR_{ROS,t} \underset{(0.004)}{-0.033}\ ADMIN2_t \underset{(0.019)}{+0.068}\ D2002Q1_t \underset{(0.003)}{+0.032}\ Q1_t \underset{(0.003)}{-0.036}\ Q3_t$$
$$\underset{(0.018)}{-0.047}\ D1992Q3_t \underset{(0.019)}{-0.106}\ D1998Q1_t + e_t$$

Adjusted $R^2 = 0.76$

$TANF_{NYC}$	TANF caseload in New York City
$TANF_{ROS}$	TANF caseload in Rest of State
SN_{NYC}	Safety net caseload in New York City
SN_{ROS}	Safety net caseload in Rest of State
WE_{NYC}	New York City entry-level employment
WE_{ROS}	Rest-of-State entry-level employment
UR_{ROS}	Unemployment Rate in Rest of State
GDPR	Real US Gross Domestic Product, GDP
ADMIN	New York City administrative effort dummy, 1 between 1995Q1 and 2001Q3, 0 otherwise
ADMIN2	Rest of State administrative effort dummy, 1 between 1994Q3 and 2001Q3, 0 otherwise
Q*i*	Dummy=1 if quarter=*i*, *i*=1,2,3,4; 0 otherwise
D*y*Q*i*	Dummy=1 if quarter=*i* in year *y*; 0 otherwise
AdminTANF	NYC policy shift dummy=1 from 2014Q2 to 2015Q4, 0 otherwise
DSANDY	Dummy indicator for Sandy
Δ	change from previous quarter
Δ_4	change from same quarter a year ago

Forecasting Monthly Average Payments

The individual caseload number for each category of PA is multiplied by the monthly average payment (MAP) for each category to determine overall gross expenditures. The MAP is generated by dividing the total expenditure for the given category (from the latest available annual data) by the actual caseload for that year.

Risks and Variations to Forecasting Model

A major risk factor in the PA caseload forecast entails using monthly average payments that are one year old in the projection of future costs – the alternative would be to trend MAP for each category of public assistance. However, due to the variances in the growth patterns of these different groups, trending would most likely result in inflated projections. In addition to the MAP issue, there are numerous other factors that can impact costs, from a sudden downturn in the economy to policy and/or administrative changes that make it easier to become eligible for or remain on PA.

Child Welfare Services Forecast Methodology

Program Overview

The Office of Children and Family Services (OCFS) child welfare local assistance funding supports services delivered by local social services districts (LDSS) to at-risk youth and families. Services funded include district investigation of alleged child abuse (child protective services or CPS), initiatives intended to keep vulnerable children in the home rather than in foster care (preventive), independent living services for older children aging out of foster care, aftercare, and adoption administration. Child welfare services are financed jointly by the State, the Federal government, and local social services districts. Services are provided as an "entitlement" and are financed with an open-ended General Fund commitment of 62 percent State reimbursement of local social services districts' expenses net of available Federal funds. Gross spending (including local share) is projected to total $1.4 billion in FY 2019.

Child welfare spending is determined by the demand for services (e.g. the number of reports of child abuse and the number of families requiring intervention) and the cost of services provided by local social services districts, including the number of district workers and their salaries. Many districts contract out for preventive services and these costs are driven by similar factors. Local district costs vary depending upon CPS and preventive caseloads, the level of community awareness, and local discretion in child welfare services programming.

Key Forecasting Data and Assumptions

Local district claims serve as a proxy for child welfare caseload. Caseload shifts can be caused by any number and combination of factors, including increased public awareness of child abuse and neglect and decisions made at the local level regarding the range and duration of services. Since the program's inception in FY 2003, annual increases in claims can range up to double-digit growth. In FY 2019 and the outyears, DOB's forecast is based on claiming projections.

The estimates are applied to three quarters of actual claims and the projected final quarter in the current year to project budget year and outyear gross claims, as the final quarter of claims is not available at the time of the October update. (For example, FY 2019 claims run from October 2017 to September 2018, so the final quarter of claims is not available given a three-month lag in claims.) The final quarter is projected using the historical share of fourth quarter claims in prior years.

Finally, Federal funding is applied to gross claims to generate the State's 62 percent share net of Federal.

Risks in Child Welfare Services Forecast

Local district claiming is generally difficult to predict. Claiming patterns are affected by: the lack of predictability in service utilization as districts vary in their responses to child welfare service needs; varying individual service needs and costs; and variances in the financial capacity of districts to invest in child welfare services as districts must first invest in programs and then receive reimbursement.

While program volatility is mitigated by using historical trends to project future expenditures, large swings in claims and sudden environmental changes (e.g. a high-profile child abuse case that prompts additional reporting, the impact from the opioid epidemic, and the impact of the current economic climate on local district spending patterns) are difficult to anticipate.

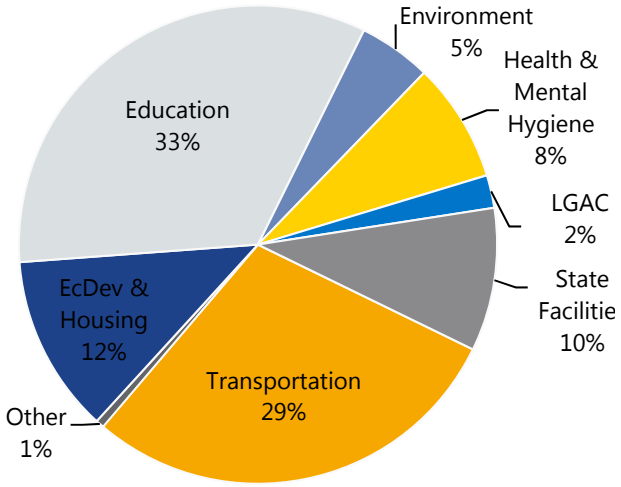
Debt Service Forecast Methodology

Program Overview

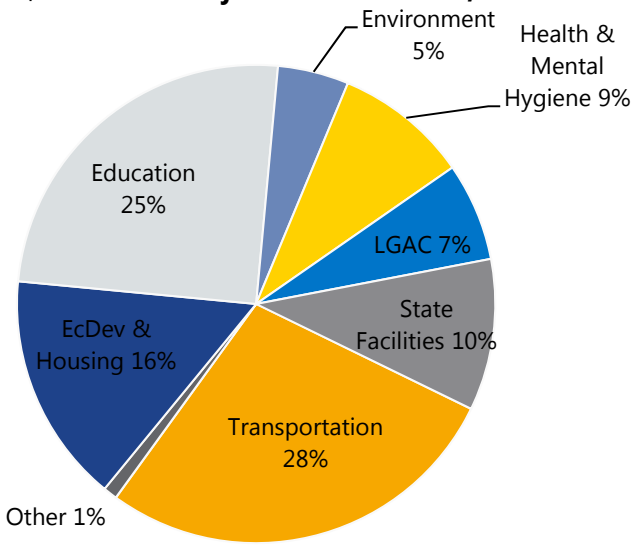
The State issues debt to fund capital projects. The State expects to have $53.9 billion in outstanding debt at the end of FY 2019, with the largest amounts issued to finance construction and reconstruction of roads and bridges and for higher educational facilities for SUNY and CUNY.

The debt service on this debt is projected at $5.6 billion in FY 2019. Debt service is comprised of principal, interest and related costs on bonds issued by the State and public authorities on the State's behalf (it does not include debt issued by authorities backed by authority revenues, e.g., tolls or fares). The costs include underwriter fees, rating agency costs, counsel fees, financial advisor fees, and bond issuance charges. Roughly 6 percent of the State's budget is spent on debt service costs. The major programmatic areas/purposes for State debt and debt service costs are summarized in the following pie charts:

Debt Outstanding by Function
$53.9 Billion Projected at March 31, 2019



Debt Service by Function
$5.6 Billion Projected at March 31, 2019



DOB prepares a detailed five-year projection of State debt levels and related costs twice annually, including all the major areas of existing and planned debt levels. This information (the "Capital Program and Financing Plan") is available on the DOB website (www.budget.ny.gov) and is provided with the Executive and Enacted Budgets and major data is updated quarterly with each Financial Plan Update.

Overview of Debt Service Forecast

The DOB uses a multi-faceted approach to forecast debt service costs as described in detail below. This includes forecasts for both fixed and variable interest rate costs and projections for the amount of new fixed and variable rate debt that is planned to be issued to finance capital projects over the next five-year period.

The State makes annual payments of roughly equal amounts over the life of a bond financing ("level debt service"), similar to the repayment terms of a typical home mortgage. Therefore, the State's annual costs for an individual bond financing generally remain the same each year until the debt is retired, with greater interest payments occurring in the earlier years and greater principal payments in the later years.

Many consider debt service to be a "fixed" cost: The State's debt service payments consist of specific principal and interest payments that must be made on precise dates (the State has never defaulted on a debt obligation). While that is true, debt service costs can change relatively quickly, and are affected by legislation that determines both the size of capital projects and whether the capital projects will be debt-financed (which drives future debt service costs) or "pay-as-you-go" where current resources are used to finance capital spending and no debt service costs result. To a lesser extent, debt service costs fluctuate due to the impact of refundings (which lower existing debt service costs), movements in interest rates for variable rate debt, changes in the demand for State debt, and other market dynamics.

The debt service forecast is comprised of two distinct, but related, components (1) the costs for debt obligations that have already been issued and (2) the projected new debt service costs for bonds that have yet to be issued to finance capital projects authorized by legislation. The debt service forecast is less likely to vary significantly for debt that has already been issued, and more subject to change for debt that has not yet been issued. The different factors affecting each category are summarized below.

Overall Debt Service Forecast

DOB currently forecasts total debt service costs from FY 2019 through FY 2023 as summarized in the following table.

PROJECTED DEBT SERVICE COSTS[1,2]
(millions of dollars)

	Results FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Grand Total Debt Service	**$6,617**	**$5,573**	**$6,671**	**$7,172**	**$7,148**	**$7,388**
State-Supported	**$5,858**	**$5,520**	**$6,620**	**$7,121**	**$7,097**	**$7,352**
Debt Service on Existing Debt	**5,858**	**5,456**	**6,139**	**6,027**	**5,411**	**5,064**
Fixed (Incl. Fixed Swaps)	5,853	5,452	6,134	6,022	5,406	5,060
Variable Rate Obligations	6	4	5	5	5	4
Projected New Debt Service	**-**	**64**	**481**	**1,094**	**1,686**	**2,287**
State Related	**$759**	**$53**	**$51**	**$51**	**$51**	**$36**
Tobacco Bonds	676	-	-	-	-	-
Secured Hospitals	38	12	9	9	9	5
All Other	45	42	41	41	41	31

[1]Reflects State-supported debt service estimates in the FY 2019 Mid-Year Update.
[2] Totals may not add due to rounding.

Debt Service Forecast – Existing Debt

For debt that has already been issued, there are only a few factors that can cause the debt service costs to vary from projections, and such variations are relatively modest:

Fixed Rate Debt. Fixed rate debt represents the largest category of debt service costs. It accounts for over 99 percent of State-supported debt service costs in FY 2020. Interest rates for these bonds are established when the bonds are issued and do not change while the bonds are outstanding. This category of debt should have no variance.

Variable Rate Obligations. One potential variance from the forecast for existing debt is that actual interest rates will vary on the net variable rate obligations of the State. Interest rates on the State's variable rate debt adjust periodically (i.e., weekly) and may differ from the DOB forecast. Such variable rate costs include the basis risk on interest rate swaps. The variable rate debt service costs are projected to total $5 million in FY 2020 based primarily on a projected 2.51 percent tax exempt interest rate.

Debt Service Forecast – New Debt

Some aspects for projecting new debt service costs are relatively straight forward, including the amount of debt that is statutorily authorized to be issued and the total amount of bond-financed capital spending that is statutorily authorized to be spent.

But some aspects are less clear until more specific information becomes available about the authorized capital projects, including:

- Whether certain types of capital projects are eligible for lower cost tax-exempt financing or require taxable financing.
- The length of time the debt will be outstanding (e.g., 10 years or 30 years), which is primarily determined by the useful life of the project being financed.
- The timing of annual spending for each of the approved capital projects which typically "ramp up" over a multi-year period (e.g., the State is still spending for general obligation capital projects approved by the voters in the 1980s).

The State's financing of prison facilities provides a good example of the forecasting process. The Capital Plan assumes the issuance of $727 million for prison facilities during the next three years. After consultation among the staff of DOB, the Department of Correctional and Community Supervision and Empire State Development, a forecast for the timing of the capital spending was developed. The annual debt service costs were based on the State's interest rate forecast (see details below), as summarized in the following chart. Since this program was for a government purpose, it can all be financed with tax exempt bonds. Because of the long-term useful life of prison facilities, the debt can likely be issued for a 30-year term. The forecast assumes that only a partial year debt service payment will be paid in the first year of issuance.

DEBT SERVICE COSTS (PRISONS EXAMPLE)
(millions of dollars)

	Timing of Spending/ Debt Issuance ($ in millions)*	Average Interest Forecast	FY 2019	FY 2020	FY 2021	Total (over life)
FY 2019	$276	4.54%	$5	$17	$17	$502
FY 2020	$239	4.94%	N/A	$5	$15	$497
FY 2021	$212	5.19%	N/A	N/A	$4	$458
Total	$727		$5	$22	$36	$1,457

*Includes $713 million of capital project spending and $14 million estimated costs of issuance.

This same model is used for all of the hundreds of capital projects that are included in the State's Five-Year Capital Program and Debt Financing Plan and are compiled in the reports contained in that plan.

New debt service for bonds yet to be sold is projected to total $52 million in FY 2019 growing to $481 million in FY 2020. The specific projections are based upon the amount of new capital spending and the timing of bond sales as summarized in the following table.

NEW DEBT SERVICE COSTS
(millions of dollars)

	FY 2019	FY 2020
Transportation	5	138
State Buildings/Facilities	6	25
SUNY/CUNY/Education	7	67
Economic Development	25	129
All Other	9	123
Total	**52**	**481**

Interest Rate Forecast

DOB forecasts interest rates for all State bond issues throughout the five-year Capital Program and Financing Plan. These rates are based upon – and consistent with – DOB's economic forecast of the Federal funds rate and other interest rates, including tax-exempt municipal bond long term rates, Treasury rates at various maturities, and short-term rates. DOB forecasts both State tax-exempt and taxable borrowing rates – both fixed rate and variable – across a variety of maturity terms. These rate forecasts are based upon various rate indexes from DOB's economic forecast. The following chart details DOB's interest rate assumptions through the current five-year Capital Plan period.

PROJECTED INTEREST RATES (SELECTED) MID-YEAR UPDATE						
	Maturity	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
AAA-rated	**3**	3.33%	3.53%	3.78%	3.78%	3.78%
Revenue Bonds	**5**	4.41%	4.61%	4.86%	4.86%	4.86%
	10	3.98%	4.38%	4.63%	4.63%	4.63%
	20	4.44%	4.84%	5.09%	5.09%	5.09%
	30	4.54%	4.94%	5.19%	5.19%	5.19%
	10 TX	4.46%	4.86%	5.11%	5.11%	5.11%
	Variable Rate TE	2.06%	2.51%	2.90%	2.90%	2.90%
	LIBOR (one month)	2.94%	3.59%	4.14%	4.14%	4.14%

Timing of Capital Spending and Bond Sales

DOB's bond issuance projections are based upon the capital spending estimates for bond-financed programs. These capital spending amounts, as also detailed in the Capital Program and Financing Plan, are undertaken in a variety of programmatic areas, including transportation, education, and economic development. The capital spending estimates are based upon the expected timing of projects based on input from the associated State agencies, public authorities, legislative fiscal staff and program sponsors.

Taxable vs. Tax Exempt Financing

Since tax-exempt financings result in the lowest costs of borrowing, the State seeks to maximize the amount of debt that can achieve this classification consistent with IRS guidelines. Investors require less interest on tax exempt bonds, since the interest income paid to them is exempt from Federal, State and/or local taxes. Since traditional taxable bonds are subject to taxes and do not enjoy a subsidy, investors demand - and the State pays - commensurately higher interest rates.

Consistent with IRS regulations, debt issued for a public benefit and use (e.g., roads, parks) can be issued as tax exempt. In contrast, debt financings that provide a benefit to a private company (e.g., private use) are taxable bonds. For example, loans or grants made to businesses for economic development purposes may benefit a private corporation, thereby requiring taxable financings.

Bond Maturities

The Debt Reform Act of 2000 restricts the issuance of state-supported debt to a maximum term of 30 years. The maturities vary for each bond sale depending on the specific component programs and projects that are being financed. Generally, debt maturities for ongoing projects are as follows:

- Transportation – 20 years
- Higher Education (SUNY and CUNY) – 30 years
- Mental Health – various up to 30 years
- Environment – 20 years
- Correctional Facilities – 30 years
- State office buildings and other facilities – primarily 20 years
- Housing programs – 30 years
- Economic development – various up to 20 years
- Taxable debt – 10 years

Variation in Forecast

As discussed previously, only a relatively small portion of the State's debt service spending forecast is subject to change since most of the costs are based on debt that has already been issued in a fixed rate mode. However, over time, bonds that are projected to be issued comprise a growing portion of the State's debt service spending.

The two key elements that have the greatest potential to result in variances from the projected annual level of debt service costs are: (1) the timing of new capital spending in each fiscal year, and the resultant timing and amount of new bond sales and; (2) the interest rate forecast, including whether rates are above or below projected levels, with the most immediate impact felt on variable rate bonds.

In terms of the interest rate forecast:

- An increase or decrease of 1 percent in variable interest rates from DOB's current forecast (from 2.06 percent to either 1.06 percent or 3.06 percent for tax exempt debt) would result in an $17million variance from FY 2020 projections.

- The impact of a consistent 1 percent change from DOB's projected fixed interest rate forecast (for example, from 4.54 percent to either 3.54 percent or 5.34 percent for 30-year tax exempt debt in FY 2019) has a cumulatively larger impact with each subsequent fiscal year – from $39 million in FY 2020 to $182 million by FY 2023.

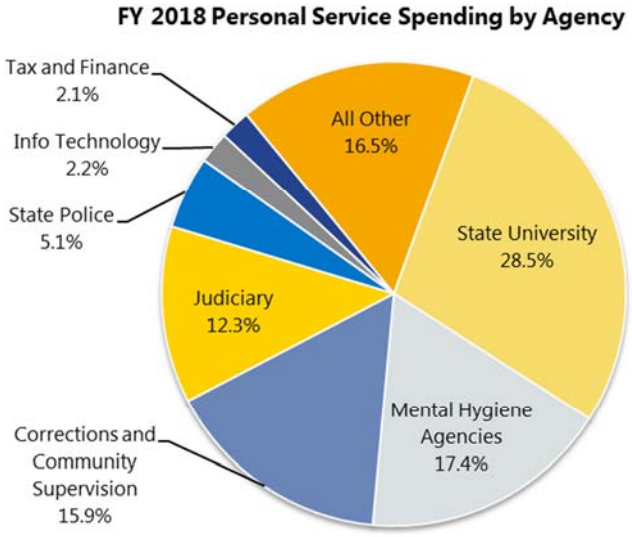
Personal Service Forecast Discussion

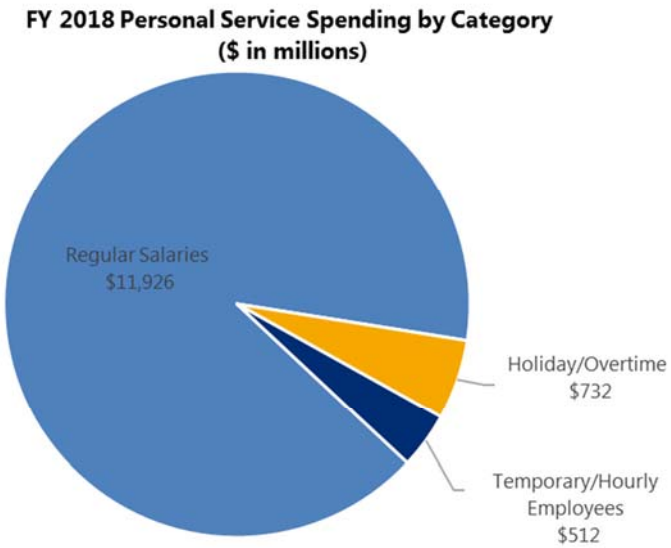
Program Overview

Personal service costs includes salaries of permanent State employees of the Executive, Legislature, Judiciary, and SUNY as well as overtime/holiday payments and costs of temporary and hourly paid employees. The costs also include uniform allowances for correctional and police officers, accrued vacation payments made upon separation from State service, and stipends. It does not include fringe benefits, which are accounted for under General State Charges.

In FY 2019, $13.7 billion or 13.7 percent of the State Operating Funds Budget is projected to be spent on personal service costs and supports 97,453 full-time equivalent (FTE) employees under direct Executive control, 46,038 FTEs in University Systems, and 18,176 FTEs within the Independently Elected Agencies, including the Legislature and Judiciary. Roughly 74 percent of all personal service spending occurs in four areas: the State University of New York, the Mental Hygiene agencies, the Department of Corrections and Community Supervision, and the Judiciary.

The following charts provide summary data on the shares of the actual FY 2018 State Operating Funds personal service spending totaling $13.2 billion by agency and category of spending.





The State's workforce is paid on a bi-weekly basis with weekly pay cycles that alternate between Administrative and Institutional payrolls. Employees of State-run Correctional, Health, Mental Hygiene and Education Department facilities comprise the Institutional payroll, while all other employees are included in the Administrative payroll. Salary changes pursuant to collective bargaining contracts are the single largest factor influencing changes in the personal service forecast. Other factors that affect the personal service forecast are salary adjustments (i.e., performance advances, longevity payments and promotions), changes in workforce levels, and overtime requirements. Each of these areas is described in more depth below.

The personal service forecast also includes consideration of the number of positions to be filled or vacated in a given year and the timing of those changes (e.g., whether a position is filled in May or January). In addition, consideration is given to the grade level changes associated with these workforce changes (i.e., a vacant position may be filled by an employee at a lower/higher salary grade).

The following table provides summary data on actual FY 2018 State Operating Funds personal service spending by agency and category of spending for State Operating Funds, as well as total FTEs by agency.

STATE OPERATING FUNDS
FY 2018 PERSONAL SERVICE SPENDING BY AGENCY
(millions of dollars)

	Dollars	FTEs
Subject to Direct Executive Control	**7,314**	**95,930**
Mental Hygiene Agencies	2,288	32,969
Corrections and Community Supervision	2,098	29,008
State Police	677	5,539
Information Technology Services	290	3,464
Tax and Finance	276	3,898
Health	253	3,437
Environmental Conservation	176	2,094
Children and Family Services	171	2,365
Financial Services	154	1,356
Parks, Recreation and Historic Preservation	131	1,314
All Other	800	10,486
University System	**3,806**	**46,255**
State University	3,753	45,880
City University	53	375
Independent Agencies	**2,050**	**18,245**
Law	132	1,543
Audit & Control	119	1,490
Judiciary	1,625	15,209
Legislature *	174	3
Total Spending / FTEs	**13,170**	**160,430**

* The majority of legislative employees are non-annual salaried.

Factors Affecting the Personal Service Forecast

The main factors affecting the personal service forecast include collective bargaining agreements, other salary adjustments (including longevity pay, performance advances and promotions), overtime/holiday pay, and changes in the size of the workforce, as described below.

Negotiated Salary Agreements/Reserve for Future Labor Settlements

The vast majority of the State workforce is represented by 11 unions representing employees in 14 bargaining units ranging from university professors to State Police officers. Approximately 93 percent of the State workforce is unionized. The largest unions include CSEA, which represents office support staff and administrative personnel, machine operators, skilled trade workers, and therapeutic and custodial care staff; PEF, which represents professional and technical personnel (i.e., attorneys, nurses, accountants, engineers, social workers, and institution teachers); UUP, which represents faculty and non-teaching professional staff within the State University system; and NYSCOPBA, which represents security personnel (correction officers, safety and security officers). The table below displays the workforce numbers by major union.

FY 2018 STATE OPERATING FUNDS ALL BRANCHES WORKFORCE NUMBERS BY UNIONS

	FTEs
Civil Service Employees Association	42,256
Public Employees Federation	36,301
United University Professions	28,445
New York State Correctional Officers and Police Benevolent Association	21,159
All Other	7,346
Statewide Unions Excluding Judiciary/Legislature	**135,507**
Non-Judiciary Management/Confidential	9,711
Statewide Excluding Judiciary/Legislature	**145,218**
Judiciary Unionized	14,045
Judiciary Management/Confidential	1,164
Legislature*	3
Judiciary/Legislature	**15,212**
Statewide Total	**160,430**

* The majority of legislative employees are non-annual salaried.

Nearly 7 percent of the workforce (10,875 employees in SOF) is Management/ Confidential (M/C) and not represented by a union. These employees include substantial appointed high-level policy influencing positions, as well as career, competitive class civil servants in clerical, paraprofessional, and professional titles. M/C compensation and benefits are at the discretion of the Director of the Division of the Budget. Compensation and benefits for M/C employees typically mirror those afforded unionized employees, however, general salary increases in FYs 2010 and 2011 were withheld, resulting in a salary differential with unionized employees of 7 percent. In the FY 2016 Enacted Budget, M/C employee parity legislation established the restoration of increases paid at the rates of 2 percent per year from FYs 2016 to 2018 and 1 percent in FY 2019.

The State has multi-year labor agreements in place with the majority of the unionized workforce. CSEA and DC-37 (Rent Regulation) employees have a five-year labor contract that provides annual salary increases of 2 percent for FYs 2017 through 2021 and additional compensation changes, offset by benefit design changes within NYSHIP and reductions in overtime costs.

On September 4, 2018, the United University Professions (UUP) ratified a six-year collective bargaining agreement that covers academic years 2017 through 2022. The agreement provides for a 2 percent general salary increase in each year of the contract and additional compensation changes, which are partly offset by benefit design changes within NYSHIP. The cost of the agreement (approximately $225 million in FY 2019) has been included in this Mid-Year Update and is primarily funded by SUNY with the exception of the related fringe benefit costs, which are paid by the State.

On October 10, 2018, the Police Benevolent Association of the New York State Troopers (NYSTPBA) ratified a five-year collective bargaining agreement for FY 2019 through FY 2023. The agreement provides for a 2 percent annual general salary increase in each year of the contract and additional compensation changes, which are partly offset by changes to health insurance benefit design within NYSHIP, similar to UUP and CSEA. The cost of this agreement is expected to be offset by agency management plan savings, consistent with past practice.

Employees represented by the Public Employees Federation (PEF) and the Graduate Student Employees Union (GSEU) have a three-year collective bargaining agreement providing 2 percent annual salary increases in FYs 2017 through 2019. Salary increases provided to PEF and GSEU employees have also been extended to Management/Confidential (M/C) employees.

The State is in negotiations with all other employee unions whose contracts concluded in previous fiscal years, including the New York State Police Investigators Association (NYSPIA), Council 82, and the New York State Correctional Officers and Police Benevolent Association (NYSCOPBA) following the March 2017 membership rejection of a tentative collective bargaining agreement on a five-year labor contract through FY 2021.[1] Negotiations also continue with the Police Benevolent Association of New York State (PBANYS), whose contract expired at the end of FY 2015.

[1] The five-year collective bargaining agreement with NYSCOPBA that was not ratified would have provided for annual 2 percent general salary increases through FY 2021, and differentials typically received within the law enforcement community (e.g., Hazardous Duty Pay), the costs of which were offset by benefit design changes within NYSHIP and reductions in overtime costs.

The Judiciary has reached agreements with all 12 unions represented within its workforce. The contract periods are as follows: FY 2018 to FY 2020 for CSEA; FY 2012 to FY 2019 for Court Officers Benevolent Association of Nassau County (COBANC); FY 2012 to FY 2021 for the NYS Supreme Court Officers Association, the NYS Court Officers Association and the Court Clerks Association; and FY 2017 to FY 2019 for seven other unions.

Salary Adjustments

Salary adjustments include performance advances which systematically raise an employees' salary annually from the initial "hiring rate" until the "job rate" is reached, which typically occurs over a six or seven year period; longevity payments which increase the salary for employees who are at their job rate for more than five years and ten years; and promotions.

Workforce Savings Plan

DOB continues to implement legislative and administrative savings measures to keep State agency operations spending flat. Savings actions include wage and benefit changes negotiated with the State's employee unions, operational efficiencies, hiring freezes, facility closures, eliminating positions through attrition, delaying planned hiring of staff, encouraging participation in the voluntary reduction in work schedule program, and enhancing controls for reducing overtime costs.

Change in Size of Workforce

Workforce change is forecasted by utilizing projected authorized FTE fill levels. The current FTE forecast projects an increase of 1,383 FTEs in statewide workforce as shown in the table below:

STATE OPERATING FUNDS WORKFORCE*
ANNUAL GROWTH TRENDS

	FY 2018 Actual	FY 2019 Estimated	Annual Change
Total FTEs	**145,218**	**146,601**	**1,383**
Subject to Direct Executive Control	**95,930**	**97,453**	**1,523**
Mental Hygiene Agencies	32,969	32,334	(635)
Corrections and Community Supervision	29,008	27,238	(1,770)
State Police	5,539	5,666	127
Tax and Finance	3,898	3,977	79
Information Technology Services	3,464	3,401	(63)
Health	3,437	3,974	537
Environmental Conservation	2,094	2,124	30
Children and Family Services	2,365	2,406	41
Financial Services	1,356	1,382	26
Parks, Recreation and Historic Preservation	1,314	1,304	(10)
Transportation	39	2,591	2,552
All Other	10,447	11,056	609
University System	**46,255**	**46,038**	**(217)**
State University	45,880	45,655	(225)
City University	375	383	8
Independent Agencies	**3,033**	**3,110**	**77**
Law	1,543	1,583	40
Audit & Control	1,490	1,527	37

* Excludes Legislature and Judiciary.

Projections for authorized fill levels are based on an agency by agency analysis that includes whether State-run facilities are planned to expand or contract through either the addition of a new facility to serve a growing population or consolidation of existing facilities to optimize service delivery, whether program commitments will require a greater or lesser degree of staffing to meet service delivery needs, and whether it is more cost effective to hire State staff instead of consulting services which would lower NPS costs but increase State payroll and fringe benefit costs.

To control the size of the workforce, the Executive can employ hiring freezes, retirement incentives (requires Legislation), severance buy-outs (requires Union negotiations), and Layoffs.

Overtime/Holiday Costs

In addition, overtime/holiday costs are also taken into consideration based on prior agency experience. Employees working in excess of 37.5 hours, but not exceeding 40 hours in a workweek, receive credit as non-compensatory overtime. Financial compensation is provided to overtime eligible employees who work in excess of 40 hours in any work week. Generally, employee positions allocated at or above Grade 23 are ineligible to receive overtime compensation. In rare emergency circumstances, the Budget Director may authorize overtime compensation for these employees. Overtime pay is typically at the rate of 1½ times of an employee's regular rate of pay.

Overtime/holiday costs comprised 5.6 percent of the State Operating Funds personal service spending in FY 2018. About 81 percent of overtime/holiday costs were generated by the Mental Hygiene agencies, Department of Corrections and Community Supervision and SUNY. Statewide, overtime/holiday costs were up by 4.3 percent from FY 2017 to FY 2018, primarily in State Police and SUNY.

STATE OPERATING FUNDS
ACTUAL OVERTIME/HOLIDAY SPENDING
(millions of dollars)

	FY 2017	FY 2018
Mental Hygiene Agencies	256	257
Corrections and Community Supervision	253	254
State University	76	81
State Police	44	65
Judiciary	22	26
Children and Family Services	15	13
Health	9	9
Environmental Conservation	8	9
All Other	19	18
Total Overtime/Holiday	**702**	**732**
Annual Change		**4.3%**

Overview of the Workforce Cost Projection Tool (WCPT)

To support the analysis of the above factors that influence annual payroll projections, DOB uses an automated system, the WCPT. The WCPT projects future salary requirements for existing State employees for use by agency fiscal officers in the development of their personal service budget requests and by budget examiners in the development of their personal service budget recommendations.

The WCPT projects future salary costs for existing State employees from a payroll file that is produced by the Office of the State Comptroller's (OSC's) payroll system. The projection methodology related to the various salary cost components is discussed in more detail below.

Annual-Salaried Employee Salary Projections

The WCPT projects annual-salaried employee costs by calculating the future salaries of each annual-salaried employee listed in the base payroll and aggregating the results. The system does this by using the full time annual salary that appears in the base payroll file as its starting point, and adding planned salary increases, performance advances, longevity payments and lump-sum payments where applicable. The addition of salary increases, including performance advances and longevity payments, is dependent upon union contract provisions.

"Additional" or "Other" Compensation

"Additional" or "other" compensation includes annual payments such as location pay, geographic differentials, and shift differentials, which are paid to employees in addition to their base salaries. Eligibility for various types of additional compensation depends upon a variety of factors including the bargaining unit to which the employee's position is assigned, the employee's work location, the employee's designated work hours and the nature of the employee's work responsibilities.

"Episodic" and "Non-Annual" Salaried Employee Costs

DOB began reporting "episodic" and "non-annual" salaried employee costs through the WCPT in 2010. Episodic earnings are those earnings, such as overtime/holiday and standby pay that are not as predictable as other contract terms. These earnings are summarized into earnings categories, such as non-annual salaried employee costs, overtime/holiday and lump-sum payments, and then aggregated by agency, fund, subfund, program, bargaining unit and union over 26 pay periods.

Adjustments for Changes in Workforce Composition

DOB methodologies for projecting outyear annual salaries, additional compensation, episodic earnings, and non-annual salaried employee costs assume that there will be no change in the composition of the State workforce, such as new hires, separations, promotions, transfers, or position reclassifications or reallocations. Therefore, for a given budget year, adjustments must be made to the WCPT's projections for these changes as well as for suballocations to other agencies and planned increases to non-statutory salaries. These adjustments are typically made by agency fiscal officers and DOB examiners during budget development.

Risks

Risks inherent in the personal service forecasts include potential changes resulting from the contract negotiation process, the timing of fills/attritions and the related grade level changes, and overtime/holiday requirements.

Spending Projections

A summary of the largest areas of projected personal service spending from FY 2019 to FY 2022 are depicted in the chart below.

STATE OPERATING FUNDS PERSONAL SERVICE SPENDING
(millions of dollars)

	FY 2019	FY 2020	Annual $ Change	FY 2021	Annual $ Change	FY 2022	Annual $ Change
Statewide	**13,716**	**13,990**	**274**	**14,547**	**557**	**14,393**	**(154)**
State University	3,974	4,015	41	4,153	138	4,093	(60)
Mental Hygiene	2,318	2,337	19	2,396	59	2,415	19
Corrections and Community Supervision	2,043	2,056	13	2,062	6	2,056	(6)
Judiciary	1,668	1,656	(12)	1,713	57	1,656	(57)
State Police	669	665	(4)	691	26	703	12
Information Technology Services	286	292	6	308	16	303	(5)
Health	280	284	4	291	7	286	(5)
Tax and Finance	264	264	0	273	9	264	(9)
Children and Family Services	192	261	69	315	54	315	0
Legislature	176	179	3	183	4	186	3
Environmental Conservation	170	168	(2)	177	9	170	(7)
Reserve for Costs of Labor Agreements[1]	626	741	115	856	115	856	0
Agency Financial Management Plan	(500)	(500)	0	(500)	0	(500)	0
All Other	1,550	1,572	22	1,629	57	1,590	(39)

1. Includes the estimated potential and settled cost for executive agencies.

In general, personal service spending increases reflect the impact of settled labor contracts, salary adjustments for performance advances, longevity payments and promotions. Implementation of solitary confinement reforms drive additional personal service costs in Corrections and Community Supervision. The Juvenile Justice Reform ("Raise the Age") results in personal service increases in OCFS. In FY 2021, there is an additional administration payroll, which drives higher costs for most state agencies.

Non-Personal Service Forecast Discussion

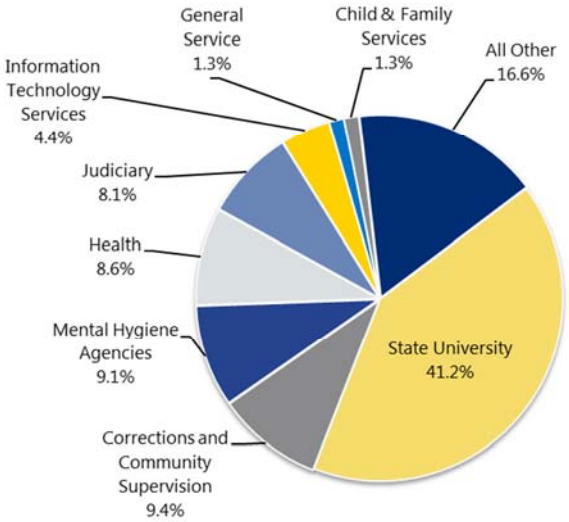
Program Overview

Non-personal service costs (NPS) represent operating costs of State agencies, including real estate rental, utilities, supplies and materials, equipment, telephone service, employee travel and contractual payments (e.g. consultants, information technology, and professional business services). Non-personal service spending in State Operating Funds (SOF) is projected to be $5.8 billion in FY 2019, or 5.8 percent of the total SOF Budget.

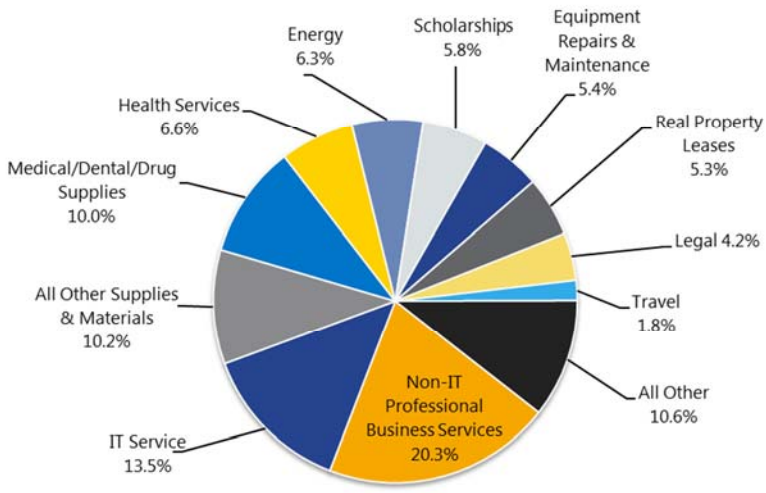
Roughly two-thirds of all NPS spending during FY 2019 is expected to occur across four areas: the State University System, the Department of Corrections and Community Supervision, the Mental Hygiene agencies, and the Department of Health. Typically, agencies that run State facilities have high NPS costs as they house and care for individuals. Over the past decade, on an average annual basis, actual non-personal service spending has remained flat, increasing by $28 million from FY 2008 to FY 2018.

The following charts provide summary data on the shares of FY 2018 SOF NPS spending that totaled $5.7 billion by agency and category of spending.

FY 2018 Non-Personal Service Spending by Agency



FY 2018 Non-Personal Service Spending by Category



Non-Personal Service

The largest components of non-personal service spending vary by individual agency. For example, in FY 2018, the largest areas of NPS spending by the Department of Corrections and Community Supervision were for inmate health care costs (45.3 percent) and energy expenses (11.9 percent). In contrast, the Department of Tax and Finance NPS spending included postage (26.4 percent), travel (18.6 percent) and information and telecommunications technology (15.9 percent).

The largest factors influencing the non-personal service estimates are inflationary forecasts and changes in program activity. DOB forecasts 36 detailed price series specifically for the purpose of forecasting the non-personal service expenditure component of the Financial Plan. These inflation factors are discussed in more detail later.

The following table provides summary data on FY 2018 NPS SOF spending by agency.

FY 2018 NON-PERSONAL SERVICE SPENDING BY AGENCY
(millions of dollars)

	State Operating Funds	Share of Total
Subject to Direct Executive Control	**2,690**	**47.5%**
Corrections and Community Supervision	529	9.4%
Mental Hygiene Agencies	516	9.1%
Health	488	8.6%
Information Technology Services	246	4.4%
General Service	76	1.3%
Children and Family Services	71	1.3%
State Police	65	1.2%
Gaming	60	1.1%
All Other	639	11.1%
University System	**2,377**	**42.1%**
City University	50	0.9%
State University	2,327	41.2%
Independent Agencies	**584**	**10.4%**
Law	51	0.9%
Audit & Control	28	0.5%
Judiciary	456	8.1%
Legislature	49	0.9%
Total	**5,651**	**100.0%**

Spending Projections

The agencies that are projected to have the most non-personal service spending from FY 2019 to FY 2022 are presented in the chart below.

STATE OPERATING FUNDS NON-PERSONAL SERVICE SPENDING *
(millions of dollars)

	FY 2019	FY 2020	Annual % Change	FY 2021	Annual % Change	FY 2022	Annual % Change
State University	2,226	2,247	0.9%	2,268	0.9%	2,289	0.9%
Corrections and Community Supervision	563	562	-0.2%	562	0.0%	559	-0.5%
Health	532	505	-5.1%	493	-2.4%	496	0.6%
Mental Hygiene Agencies	475	482	1.5%	501	3.9%	531	6.0%
Judiciary	465	465	0.0%	465	0.0%	465	0.0%
Information Technology Services	258	249	-3.5%	243	-2.4%	254	4.5%
Transportation	118	173	46.6%	174	0.6%	179	2.9%
Children and Family Services	97	114	17.5%	128	12.3%	130	1.6%
General Service	89	84	-5.6%	80	-4.8%	81	1.3%
State Police	62	60	-3.2%	60	0.0%	62	3.3%
Temporary and Disability Assistance	59	60	1.7%	61	1.7%	62	1.6%
Workers' Compensation Board	52	55	5.8%	55	0.0%	55	0.0%
All Other	793	784	-1.1%	792	1.0%	811	2.4%
Total Non-Personal Service Spending	**5,789**	**5,840**	**0.9%**	**5,882**	**0.7%**	**5,974**	**1.6%**

* Includes Indirect Costs

Spending is expected to grow by an average of 1.6 percent through FY 2022, primarily for expected operating cost increases for SUNY, Mental Hygiene, Children and Family Services (including the Raise the Age Implementation), and Transportation which includes the reclassification of certain operating costs from the Dedicated Highway and Bridge Trust Fund (Capital) to the General Fund.

Forecasting Methodologies

DOB provides forecasts for 36 detailed price series specifically for the purpose of forecasting the NPS expenditure component of the state budget. This set of forecast variables includes price deflators for medical equipment, office equipment, office supplies, energy-related products, business services and real estate rentals. In most cases, detailed producer price indexes (PPI) or consumer price indexes (CPI) are used to represent the price deflators of these variables. For example, for the home heating oil price deflator, the home heating oil component of the PPI is used.

The primary data source for CPI and PPI data is the U.S. Department of Labor Bureau of Labor Statistics (BLS), which releases updated data each month. When there is no CPI or PPI component that closely matches the required price concept, an appropriately chosen price deflator from the National Income and Product Accounts (NIPA) data is used. For example, the personal consumption expenditure price index for telephone and telegraph from NIPA data is used for the price deflator of telephone. The NIPA data are provided by the U.S. Department of Commerce Bureau of Economic Analysis (BEA) and is updated on a quarterly schedule. However, BEA's quarterly estimates are based on data compiled generally monthly by BLS, the U.S. Department of Commerce Census Bureau, and BEA itself. For two variables -- government purchase of computers, and information processing equipment and software -- nominal spending growth is projected rather than price growth alone, since the available price series are adjusted for changes in quality. When product quality is changing rapidly due to technological advances, the use of a quality-adjusted price series to project spending growth can be very misleading.

DOB converts the monthly and quarterly variables referred to above to fiscal year frequencies, and then use regression models to forecast them. Forecast variables from DOB's U.S. macroeconomic model are used as explanatory variables. Detailed models are described in the Economic Methodologies section.

Program Changes

The inflation factors are utilized in conjunction with program trends to determine overall NPS projections. These trends include whether State facilities plan to expand or contract to best deliver services, and whether it is more cost effective to provide services through competitive bidding, which drives NPS costs, or hire in-house staff that instead result in personal service and fringe benefit costs.

NPS INFLATION FACTORS BY STATE FISCAL YEAR
October 12, 2018

Object Code Description	Economic Description	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Supplies & Materials								
Medical/Dental Lab	Medical equipment and supplies	-0.32	0.18	0.45	0.46	0.46	0.45	0.50
Drugs/Prescriptions	Drugs and medical supplies	5.33	2.61	2.73	3.31	3.51	3.60	3.62
Other Supplies	State & Local Gov't GDP Intermediate Durable goods	-0.41	0.68	1.51	0.78	0.60	0.53	0.48
Unleaded Regular Gasoline	Unleaded Regular Gasoline	-5.81	13.96	25.06	1.78	0.12	0.06	0.08
Food & Beverage	Food	-1.60	0.27	0.73	2.05	2.40	2.35	2.28
Maintenance/Repair	Maintenance and repair construction	1.73	1.94	1.67	1.91	1.93	1.98	2.01
Home Heating Oil	Fuel Oil #2 Home Heating Oil	-4.74	18.78	37.02	-0.74	0.96	1.54	0.20
Office Supplies	Office supplies and accessories	1.14	1.33	5.12	2.81	2.30	2.04	1.93
Books	Educational books and supplies	5.23	0.19	2.59	3.13	3.55	4.08	4.41
Facility Household Sup	Housekeeping supplies	-0.51	-0.60	0.74	0.83	0.97	1.12	1.28
Clothing	Clothing and Shoes	-0.06	-0.73	1.66	0.75	0.62	0.56	0.54
Motor Equipment	Motor vehicle parts	-0.54	0.61	1.43	1.07	0.92	0.79	0.72
All Other Sup & Matls	State & Local Gov't GDP Intermediate Durable goods	-0.41	0.68	1.51	0.78	0.60	0.53	0.48
Travel Services								
Travel	Lodging away from home (hotel)	2.18	0.18	2.47	2.73	2.73	2.68	2.64
Travel	Public transportation	-1.30	-1.31	-1.88	0.76	1.06	1.19	1.47
Contractual Services								
Real Estate Rental	Real estate rental	3.83	3.75	3.65	3.58	3.47	3.38	3.28
Electricity	Commercial Electric Power	-0.01	2.63	0.34	0.82	1.39	1.53	1.69
Natural Gas	Commercial Natural Gas	3.34	7.52	0.09	1.80	1.63	1.16	0.94
Equipment Maintenance	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Telephone	Telecommunication Services	-2.09	-8.64	-0.10	-0.70	-0.80	-1.03	-1.15
Leases	Real estate rental	3.83	3.75	3.65	3.58	3.47	3.38	3.28
Leases	Automotive equip. leasing	-4.75	1.79	2.58	1.33	1.40	1.32	1.22
Other Utilities	Household Utilities	1.38	3.12	2.25	2.67	2.82	2.85	2.91
Water	Water Supply and Sanitation	3.56	3.14	3.33	3.57	3.76	3.88	4.00
Building Repair	Maintenance and repair construction	1.73	1.94	1.67	1.91	1.93	1.98	2.01
Sewage	Water Supply and Sanitation	3.56	3.14	3.33	3.57	3.76	3.88	4.00
EDP Telecomm	Telecommunication Services	-2.09	-8.64	-0.10	-0.70	-0.80	-1.03	-1.15
All Other Contract Svc	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Postage & Shipping	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Printing Services	General job printing	0.18	0.11	0.97	0.73	0.66	0.64	0.66
Equipment								
Personal Computer	See the Information Technology section below (blue shaded)							
IT Equipment - Other	Fixed investment in equipment excluding computers	-0.84	-0.54	0.31	0.92	0.97	0.88	0.77
Vehicles	Average Price of New light vehicle	2.66	2.23	2.97	2.86	2.90	2.95	3.01
Furniture	Commercial Furniture	0.55	1.65	3.37	2.25	2.08	1.99	1.92
Heavy Equipment	Construction machinery mfg	0.65	0.21	-0.02	0.75	1.11	1.47	1.73
Office Equipment	Office and store machines and equipment	0.33	-0.89	-1.03	0.39	0.43	0.46	0.48
Medical/Health Equipment	Medical equipment and supplies	-0.32	0.18	0.45	0.46	0.46	0.45	0.50
Comm. Network Equipment	See the Information Technology section below (blue shaded)							
All Other Equipment	Fixed investment in equipment excluding computers	-0.84	-0.54	0.31	0.92	0.97	0.88	0.77
OGS Telecommunication	Telecommunication Services	-2.09	-8.64	-0.10	-0.70	-0.80	-1.03	-1.15
OGS Computer	See the Information Technology section below (blue shaded)							
PASNY Electric	Commercial electric power	-0.01	2.63	0.34	0.82	1.39	1.53	1.69
Interagency Mail	CPI all items	1.65	2.06	2.45	2.42	2.42	2.32	2.30
Record Management Svcs	CPI all items	1.65	2.06	2.45	2.42	2.42	2.32	2.30
Professional & Business Services								
Prof Business Svcs	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Legal Services	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Client Services	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Clerical Services	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Jury Services	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Subscription Services	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Memberships	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Accounting/Auditing	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Total Prof Bus Svcs	State & Local Government GDP Services							

NPS INFLATION FACTORS BY STATE FISCAL YEAR (Continued)

Object Code Description	Economic Description	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Building Services								
Building Services	CPI all items	1.65	2.06	2.45	2.42	2.42	2.32	2.30
Building/Property Services	CPI all items	1.65	2.06	2.45	2.42	2.42	2.32	2.30
Security Services	CPI all items	1.65	2.06	2.45	2.42	2.42	2.32	2.30
Laundry/Linen Services	CPI all items	1.65	2.06	2.45	2.42	2.42	2.32	2.30
Total Bldg Services	CPI all items	1.65	2.06	2.45	2.42	2.42	2.32	2.30
Conf/Training Svcs	Tuition, other school fees	2.60	2.23	2.42	2.79	3.12	3.48	3.65
Advertising Services	Advertising agencies	0.94	0.77	0.38	0.95	1.04	1.13	1.18
Medical Services	CPI Medical service	3.88	2.06	2.18	2.83	3.23	3.15	3.15
All Other Services								
Other Services	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Interest Leases	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Interest Late Payment	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Highway Maintenance	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Interest Late Contracts	State & Local Government GDP Services	2.19	2.17	3.14	2.98	2.87	2.84	2.80
Total All Other Svcs	State & Local Government GDP Services							
Information Technology (forecasts represent total nominal *spending* growth rather than *price* growth)								
Personal Computer	Govt. Purchases of computers	3.07	13.30	6.92	3.67	3.41	3.34	3.26
Comm Network Eq	Information processing equip. investment	1.59	8.66	8.09	4.61	3.99	3.89	3.92
OGS Computer	Govt. Purchases of computers	3.07	13.30	6.92	3.67	3.41	3.34	3.26
Info Technology Svcs	Information processing equip. investment	1.59	8.66	8.09	4.61	3.99	3.89	3.92
IT Consultant Design	Information processing equip. investment	1.59	8.66	8.09	4.61	3.99	3.89	3.92
IT Software License	Information processing equip. investment	1.59	8.66	8.09	4.61	3.99	3.89	3.92
IT Software Install/Mtce	Information processing equip. investment	1.59	8.66	8.09	4.61	3.99	3.89	3.92
IT Hardware Maintenance	Information processing equip. investment	1.59	8.66	8.09	4.61	3.99	3.89	3.92
IT Other	Information processing equip. investment	1.59	8.66	8.09	4.61	3.99	3.89	3.92
Statewide NPS inflation**				**3.22**	**2.81**	**2.87**	**2.90**	**2.89**

**Spending weights are held fixed at their values for SFY 2015-16 to calculate the overall NPS inflation for SFY 2016-17 to 2020-21.

Price Deflators for School Years*								
	CPI all items	1.86	2.25	2.37	2.45	2.40	2.30	2.31
	Unleaded regular gasoline	4.77	18.77	20.36	-1.57	0.14	0.31	0.63
	Fuel oil #2 home heating oil	12.13	23.54	30.65	-7.31	5.43	0.15	0.29
Long-term Real Estate Rental Growth Rate								
	10 years	31.66	31.28	31.40	34.06	38.12	39.91	40.68
	15 years	54.23	54.55	55.86	57.03	57.72	56.87	55.70
	20 years	83.79	85.13	85.74	86.53	85.93	83.77	83.30

* School year is defined as the last two quarters of the prior year and the first two quarters of the current year.

Employee Health Insurance

Program Overview

The New York State Health Insurance Program (NYSHIP) provides comprehensive health insurance coverage to 616,000 public employees and retirees, and their dependents. NYSHIP offers the choice of health insurance coverage through the Empire Plan or 19 different Health Maintenance Organization (HMO) options. Roughly 89 percent of the covered enrollees and dependents (547,000) are enrolled in the Empire Plan, which is similar to preferred provider organization (PPO) plans offered by other large employers.

The Empire Plan became self-insured on January 1, 2014. This means the State is responsible for payment of health insurance claims and vendors provide administrative services such as claims processing, network management and premium development assistance. The four vendors that provide these administrative services for the Empire Plan are: 1) Empire Blue Cross Blue Shield (hospital), 2) UnitedHealth (medical), 3) CVS/Caremark (prescription drugs) and, 4) Beacon Health Options (mental health and substance abuse).

In Calendar Year 2018, the total cost (i.e. employer /employee) of family coverage in the Empire Plan was $23,448 -- $9,300 for individual coverage and $14,148 for the coverage of dependents. For HMO enrollees, the State will contribute the same percentage it contributes for the Empire Plan cost of hospital/medical/mental health and substance abuse premiums but will cap the dollar amount of that contribution at the amount it contributes for the Empire Plan. The State's share for HMO prescription drug coverage is not capped.

The collectively negotiated agreements dictate the percentage of premium to be paid by State employees. The State supports employees in positions Grade 9 or below with 88 percent of the premium cost for individual coverage and 73 percent for dependent coverage. For employees in positions Grade 10 or above, the State supports 84 percent for individual coverage and 69 percent for dependent coverage. For State employees who retired on or after January 1, 2012, the State provides the same level of premium contribution support as it did when the employee separated from service. In the aggregate, the State supports roughly 79 percent of the premium cost of family coverage for employees Grade 9 and below and 75 percent of the premium cost of family coverage for employees Grade 10 and above.

Key Forecasting Data and Assumptions

Premium development is a dynamic process with reviews occurring each quarter. The process for approving rates each year begins in earnest in early September with the carrier rate submissions and continues through rate finalization and approval by DOB followed by the release of premium rates to the Agency Health Benefits Administrators (HBAs), marking the beginning of the Option Transfer Period, usually in November.

For the Empire Plan, each vendor, as well as the Department of Civil Services' Benefits Consultant (currently Aon Hewitt), provides premium projections along with detailed information on recent trends which is subject to ongoing review and analysis by the State. The premium rate development process is based on a review of this current experience and trends, leading to a projection of increases in such factors as utilization, the cost of claims, administrative costs and the impact of any new statutes/regulations. Rates for the nineteen NYSHIP HMO options are community rated as developed by the HMOs and submitted to the Department of Financial Services for approval. Data on current and projected enrollments (employee and retiree) is provided by the Department of Civil Service, as the administrator for NYSHIP.

Consistent with collective bargaining agreements, the Joint Committees on Health benefits are briefed on the vendor rates projections in late September or early October. Ultimately, the Department of Civil Service will establish the rate recommendation, in consultation with staff of GOER and DOB prior to submitting the rates to the Director of the Division of the Budget for approval.

The employer share premium rates developed through this process drive the employee and retiree health insurance cost estimates that are contained in the Executive Budget.

Risks and Variations to Forecasting Model

The risks and variations to the forecasting model, include but are not limited to, unforeseen changes in the workforce, as well as State/Federal legislation; changes in program costs as a result of collective bargaining agreements; changes in the healthcare industry as a result of new technology or medical protocols that may drive up costs; and health care utilization.

Spending Projections

Once the premium rates are approved, the employee health insurance costs for the new fiscal year can be estimated. The State's health insurance premium cost is calculated by multiplying the enrollment figures for active State employees and retirees, by the respective employer share premium rates for individual and family coverage. The active State employee enrollment is based on both the current workforce as adjusted for any expected changes in the workforce. The retiree enrollment is based on current enrollment, adjusted for mortality rates and expected growth in the retiree population. Sick Leave credits are also factored into the State's cost.

The out-year forecasts are based on expected health insurance cost trends, utilization, and any expected enrollment changes that would result from anticipated fluctuations in the size of the State workforce.

Spending Trend

From FY 2012 to FY 2018, the State's cost for employee and retiree health insurance increased from $3,020 million to $3,659 million, an average annual cost increase for this period of $106.5 million (3.3 percent annually). This growth includes the collectively negotiated employer/employee health program changes, the Empire Plan's full conversion to self-funded status; entering into a new contract with CVS Caremark for prescription drugs (2014); and transitioning the State's Medicare retirees into a Medicare Part D prescription drug program with Empire plan "wrap-around" coverage in order to maximize reimbursement for program costs.

In FY 2019, spending for NYSHIP in the General State Charges budget is projected at $3,946 million (Executive Branch Agencies and the Legislature) (trending at 5.6 percent, on average, in the out years). The projected trend is consistent with current Empire Plan experience and national health care projections.

ACA Implementation

Various requirements of the Affordable Care Act (ACA) have been implemented since 2011. Beginning in 2015, employers such as NYS, must comply with two sets of ACA provisions. The first set of provisions are the ACA employer shared responsibility provisions, commonly known as the "employer mandate." Under the employer mandate, the State of New York is responsible for offering health insurance coverage to 95 percent of full-time employees on an annual basis. Compliance is critical, as non-compliance could result in a penalty of approximately $400 million to the State.

The second set of provisions pertain to the employer reporting requirement in which the State is responsible for providing an individualized tax form, known as Form 1095-C, to all full-time employees and Empire Plan retirees by January 31, 2019. These forms must also be electronically transmitted to the IRS no later than March 31, 2019. To comply with these requirements, the Department of Civil service contracted with EY (formerly Ernst and Young) to successfully meet the 2015, 2016 and 2017 requirements, and is is working with EY to ensure the deadlines for the 2018 plan year are met as well. EY's main responsibilities are determining which State employees meet the ACA full-time employee criteria, printing and mailing Form 1095-C to all required individuals, and electronically transmitting the necessary information to the IRS.

Another key provision of the ACA is the excise tax on high-cost health insurance plans, commonly known as the Cadillac tax. The Cadillac tax is a 40% excise tax on high-cost health insurance plans. In January 2018, Congress approved a two-year delay of the tax which changed the effective date from 2020 to 2022.The State's potential Cadillac tax liability will be largely influenced by Federal regulations that have yet to be issued – indeed, the continuation of current ACA provisions is unclear and subject to significant change at the Federal level.

Finally, long-term retiree health insurance obligations continue to present a challenge. The Governmental Accounting Standards Board (GASB) Statement No. 45 requires the State and other public employers to report their other post-employment benefit (OPEB) liabilities for current employees and retirees. As reported in the State's Basic Financial Statements for FY 2018, the unfunded actuarial accrued liability for FY 2018 is $90.5 billion ($72.830 billion for the State and $17.699 billion for SUNY). The unfunded actuarial accrued liability for FY 2018 used an actuarial valuation of OPEB liabilities as of April 1, 2016 for the State and for SUNY. These valuations were determined using the Frozen Entry Age actuarial cost method, and are amortized over an open period of 30 years using the level percentage of projected payroll amortization method.

The new GASB 75 accounting standards, which replaces GASB 45, is effective for employer fiscal years beginning after June 15, 2017. The GASB statement 75 will alter the actuarial methods used to calculate OPEB liabilities, standardize asset smoothing and discount rates, and require the unfunded net OPEB obligation to be reported by the State. The inclusions of the remaining balance of the unfunded OPEB liability is expected to significantly increase the State's total long-term liabilities and act to lower the State's overall Net Position. GASB 75 will also require the State to use the Entry Age Normal actuarial cost method to allocate liabilities between past future service periods. This new requirement is intended to make liabilities more comparable than the six different methods allowed under GASB 45. The State is currently developing a new valuation for April 1, 2017 that will reflect this actuarial cost method change and other GASB 75 requirements. The valuation results will be incorporated into the State's FY 2019 financial statements.

Although GASB 45, and now GASB 75, requires public employers to report their OPEB liabilities, it does not require pre-funding of those benefits. The State Health Insurance Council, consisting of the Director of Employee Relations, the President of the Civil Service Commission, and Director of the Budget, is continuing to evaluate long-term funding strategies for this liability. Legislation included in the enacted budget for the 2017/18 fiscal year established a Retiree Health Benefit Trust for the purpose of funding health benefits of retired State employees and their dependents.

GASB Statement 75 is not expected to alter Updated Financial Plan projections for health insurance, as the DOB methodology for forecasting these costs over a multi-year period already incorporate factors and considerations consistent with the new actuarial methods and calculations required by the statement.

Pensions

Program Overview

Most State employees are members of the New York State and Local Retirement System, which consists of the New York State and Local Employees' Retirement System (ERS) and the New York State and Local Police and Fire Retirement System (PFRS). These are defined benefit plans that provide varying pension benefits depending on the System and the benefit "tier" to which an individual employee belongs. All new employees that were not previously a member of one of the public retirement systems of the State are required to make employee contributions, whereas members in earlier pension tiers may or may not be required to make employee contributions. The State makes annual payments to the System to fund the pension benefits that are promised to State employees based on the Aggregate Cost funding methodology. This actuarial funding methodology is intended to ensure that sufficient employer and employee contributions have been made at the time of retirement to pre-finance (with future interest earnings) all future retirement benefits paid for an individual.

Although most State employees are members of ERS or PFRS, certain employees of the State University of New York, the State Education Department, and other agencies are enrolled in one of two other retirement systems: the New York State Teachers' Retirement System (TRS) or the Optional Retirement Program (ORP). Beginning July 1, 2013, new non-unionized employees earning over $75,000 also have the option to join the Voluntary Defined Contribution Plan. Unless specifically stated, the process and dollar amounts stated in this document apply only to State employees enrolled in ERS and PFRS.

A defined benefit pension system requires a sophisticated actuarial analysis of both assets and liabilities. When the liability exceeds assessed assets, all participating employers of ERS and PFRS pay an employer contribution, usually represented as a required percentage of reported salaries. The State's payments (as well as payments by local government employers for their employees, and employee contributions) go into the Common Retirement Fund (CRF), which, as of March 31, 2018, has a fiduciary net position of $207.4 billion. The CRF holds the assets of both ERS, the system for civilian State and local government employees, and PFRS, the system for State and local government police officers and firefighters. The State Comptroller is the sole trustee of both of these systems. Previous market changes have caused commensurate upward and downward shifts in the employer contribution rate. In the late 1990's, for example, the need for the State's annual pension payment was nearly eliminated by the extraordinary market returns of the Common Retirement Fund. Conversely, the financial crisis in 2007-08 caused a dramatic increase in the State's annual pension payment. Significant benefit enhancements (including the "tier equity" enhancements, the elimination of the required three percent employee contribution by Tier 3 and Tier 4 employees after ten years of service or ten years from date of membership and the implementation of cost of living adjustments) which were approved in 2000 also contributed to such increases. However, more recently the employer contribution rates have been declining due to improved investment performance and the assignment of new employees to Tier 6.

The new Tier 6 was enacted by Chapter 18 of the Laws of 2012 and all new employees hired on or after April 1, 2012, that were not previously a member of one of the public retirement systems of the State, are assigned to Tier 6.

The New Tier 6:

- Provides for increasing employee contributions ranging from 3% to 6% based on wages (an employee earning $45,000 or less contributes the minimum 3 percent of salary whereas an employee earning more than $100,000 contributes the maximum 6%). This is in contrast to the 3 percent of salary contribution required of all employees in Tier 5;

- Raises the retirement age for a full pension benefit from 62 to 63 for most employees;

- Modifies the pension multiplier for most employees from 2 percent to 1.75 percent on the first 20 years of service;

- Limits overtime and other payments used in calculating the final average salary for pension allowances; and

- Makes a defined contribution option available to certain employees.

Key Forecasting Data and Assumptions

Pension estimates result from the interplay of the two factors that determine the State's pension contribution, namely:

- The State's actual salary base from the prior fiscal year.

- The employer contribution rates promulgated by the Office of the State Comptroller (OSC), which are based on factors such as life expectancies, estimates of when employees typically retire, and the performance of the Common Retirement Fund.

Employer contribution rates are set at the higher of an actuarially-determined rate based on the above factors or a contribution rate of 4.5 percent, as required by Chapter 49 of the Laws of 2003.

The employer contribution rates set by OSC are multiplied by the State's salary base from the prior fiscal year to determine the State's annual pension contribution. This calculation is adjusted for other pension costs such as administrative costs, prior year reconciliations, any unique amortization costs, new legislation in some cases, and the Group Life Insurance Program.

Pension estimates are reviewed quarterly. The process for the updates is refined when OSC releases the projected employer contribution rates for the upcoming fiscal year, typically in early September. This estimate is later refined when the State receives the "October Estimate" from OSC. This estimate, which OSC is statutorily required to provide on October 15 each year, gives

an in-depth analysis of the State's pension payment for the budget year and breaks down the various components of the payment, including normal costs, administrative costs, charges stemming from any prior amortizations, reconciliation charges, group life insurance charges, and other charges associated with enacted legislation. OSC is also statutorily required to provide an updated estimate each year in the months of December and February.

The OSC does not provide an outyear forecast of projected pension contribution rates or overall salaries. However, DOB staff provides a forecast of rates and salary levels by regularly monitoring the State's salary base and tracking the performance of the Common Retirement Fund. Forecasting changes in the State's salary base includes a review of changes negotiated through the collective bargaining process and planned changes in the size of the State workforce.

Another factor that affects employer pension contribution rates is the use of the actuarial technique known as smoothing. Used to reduce the year-to-year fluctuations in employer contribution rates from volatile investment returns, this process "smoothes" asset values by recognizing changes due to gains or losses in equity investments over a five-year period. The smoothing process used by OSC recognizes the full annual impact of unexpected equity investment gains and losses at the rate of 20 percent per year for five years. As a result, the market performance in prior years affects employer contribution rates for upcoming fiscal years.

Part TT of Chapter 57 of the Laws of 2010 permits local governments and the State to amortize a portion of their pension costs beginning in FY 2011. Specifically, pension contribution costs in excess of the amortization thresholds may be amortized. The authorizing legislation also permits amortization in all future years if the actuarial contribution rate is greater than the amortization threshold, which generally may increase or decrease by no more than one percentage point each year. Chapter 48 Laws of 2017 changed the computation of the employer's graded rate under the Contribution Stabilization Program. Repayment of the amortized amounts is made over a ten-year period at an interest rate determined by the State Comptroller. The applicable interest rate for system employers who have elected to amortize in FY 2018 or FY 2019 is 2.84 percent and 3.64 percent, respectively. The Updated Financial Plan does not assume amortization of State pension costs beyond FY 2016.

Spending Projections

FY 2019. The State projections are based on the bill provided by OSC, and reflect payment of that bill in early April to minimize interest costs (the State made one $1,900 million payment in April, and the Judiciary has made payments totaling $280 million as of October 2018). The FY 2019 pension cost also reflects a slightly lower-than-expected billed salary base[1] and additional costs from enhanced pension benefits provided to veterans (Chapter 41 of 2016). In FY 2019, the State will be billed for Chapter 41 based on ERS participation through December 31, 2018.[2] All State and

[1] Salary experience in FY 2018 is used as the basis for the FY 2019 bill, and actual salaries were slightly lower than previously forecasted by OSC in the February 2018 pension estimate.

[2] For PFRS, the cost of veteran's pension credit legislation (Chapter 41 of 2016) will be distributed among participating employers and billed on a two-year lag (costs incurred in FY 2018 will be billed beginning in FY 2020).

Judiciary spending for FY 2019, including projected Chapter 41 costs of $30 million and interest credit of $123 million, is expected to total $2,207 million.

FY 2020. The current projection of $2,270 million incorporates estimates provided by the Comptroller's Office in October, and includes payment of prior amortizations in the amount of $432 million. It also includes $30 million of projected costs to the State for veterans' pension credit legislation (Chapter 41 of 2016).

Pension Estimates (millions of dollars)

	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
ERS and PFRS	$2,207	$2,270	$2,355	$2,558	$2,809

Risks and Variations from Forecasting Model

Because employer contribution rates are largely affected by the performance of the stock market, a significant downturn in the market, such as the one that occurred during FY 2009, can lead to a large increase in the State's annual pension contribution. Changes in the size and composition of the workforce, which together help to determine the salary base to which the rates are applied, also affect the pension obligation for a given year. Such changes may reflect modifications to programs and staffing patterns in response to new statutory mandates, outside certification requirements, recruitment and retention tools, or agency re-organizations.

The State has taken steps to ameliorate volatility, including the smoothing methodology used to "average" volatility over a multi-year period, the billing lag described earlier, and the ability to amortize certain costs over a multi-year period. These approaches provide the State and local governments more advance notice and some greater predictability of their required pension contribution.