

# **Business and Occupation Tax Revenue Forecasts Huntington, West Virginia**

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## **1. Purpose**

The Business and Occupation Tax (B&O)<sup>1</sup> provides roughly 45% of the annual revenues for Huntington, West Virginia. The B&O tax is assessed against revenues collected by firms located within the city, and is thus sensitive to regional economic activity. Economic activity is cyclical, making an already difficult process more challenging. This document outlines a forecast method and forecast evaluation as well as revenue collection forecasts for FY 2002-4 for the city of Huntington.

## **2. The Forecast Approach**

Projecting economic activity may be performed through several methods. Three methods provide the most common approaches to this problem. Each presents different benefits and costs. These are outlined below.

The first is a simple projection (e.g. a linear, one-year-ahead projection). This method is probably the most typical used by city and local government revenue forecasters. While this technique is often adjusted for visible changes to economic activity, it is unlikely to effectively capture cyclical economic activity, or non-linear changes to trend. This is especially problematic for the B&O tax due to its gross revenue base. This is the least costly and typically least effective method for revenue forecasts.

The second method of projecting tax revenues is through a structural model of the economy. These models take into account differing factors that may lead to variation in revenue collections. These factors are mathematically constructed, often with several hundred equations, and solved in a single model to generate forecasts. This technique is extremely costly, but often provides good revenue projections. This method also provides relative ease of interpretation for policymakers.

A third method, and the one employed in this forecast, is a time-series structural model. This model uses features from both techniques above, and combines them with equations that estimate long term equilibrium linkages between factors. Clearly, these types of forecast require considerable technical support. However, while these techniques are typically more expensive than the first method they are much less costly than the last. Their forecasts have proven extremely efficient, dramatically increasing the application of these models to policy.

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<sup>1</sup> For more information see Mark L. Burton, Calvin A. Kent and Michael J. Hicks "Evaluating Comprehensive Tax Reform: Lessons from West Virginia. *State Tax Notes*, V. 17, no. 19. November 1999.

### 3. The Model

For the purposes of projecting the B&O Tax Revenues for Huntington the Center constructed a vector error correction model with the form:

$$\frac{\partial(B \& O)}{\partial t} = \delta * 2.282846754 \left[ -7445553.311 + \frac{\partial(B \& O)_{t-1}}{\partial t_{t-1}} - 61.24278966 * \frac{\partial(Employment)_{t-1}}{\partial t_{t-1}} - 279974.6605 * (TREND_{1990}) \right] + 0.4256052575 * \frac{\partial(B \& O)_{t-1}}{\partial t_{t-1}} - 372.8383025 * \frac{\partial(Employment)_{t-1}}{\partial t_{t-1}} + 5653.630001 + 23007.02566 * (TREND_{1990}) + \varepsilon_t$$

Equation 1

where the dependent variable is the annual change in B&O tax receipts (for fiscal years). The independent variables are the lagged values of the dependent variable, the annual changes in City employment (summed Wayne and Cabell values from the *Bureau of Labor Statistics*). A trend is included. The first expression in brackets preceded by \* is an equilibrium adjustment for the model known as a cointegrating equation. This technique is widely used in finance and economics to analyze and project economic variables. The final expression  $\varepsilon_t$  is the error term assumed to be iid $N(0, \Phi^2)$ . This model was very statistically significant and explained 82% of the annual changes in B&O taxes over the decade it analyzed.

### 4. Model Results

The first iteration of this model was estimated on data from 1990 through 2000. These results were then used to project tax collections for 2001. These projections were then compared to known values for 2001 (published in 2002) to provide a basis for comparing the forecast error of this model with actual history. This is known as out of sample forecasting, and is an important technique in model evaluation. Results of this are shown in table 1.

**Table 1, Forecast Evaluation, CBER Model with Actual 2000-2001 Results**

Years	Actual Collections	2000 Forecast CBER	2000 Forecast Error of 2001 Revenues	Percent Error (weighted mean)
1998-1999	11,584,810			
1999-2000	11,802,113			
2000-2001	12,389,761	12,320,334	-69,427	-0.56%

These results suggest that this model is performing well in the one-year-ahead forecasts of B&O Tax revenues. Indeed, if this model had been used in 1999 to project

revenues for FY 2000-2001, the projection would have resulted in an underestimate of tax collections of just under \$65,000. This translates into an error of less than 1 percent.

The only data collection challenge in implementing this model is that estimates of annual employment are available with a two to three month lag. This requires estimating employment for these months to provide the city with a timely forecast in March or April this year. This made little qualitative difference in the model. Indeed, using employment data for the previous calendar, not fiscal year simply increased the forecast error to -1.47 percent for 2000-2001, or an underestimate of city revenues of just under \$182,500 for the year. It is clear that this model provides a proximal estimate of revenue forecasts to actual receipts using the period 2000-2001.

## 5. The Forecast

Using the model methodology described above, the Center re-calibrated the model using actual 2000-2001 data. Annual employment data was used to replicate the process the City must implement to provide revenue estimates in March prior to the June beginning of the fiscal year. All values are in nominal dollars. The results are illustrated in Table 2.

**Table 2, B&O Revenue Projections, CBER Model**

<b>Years</b>	<b>Forecast</b>
2002-2003	\$12,534,000
2003-2004	\$12,893,000
2004-2005	\$13,236,000

These projections are consistent with expectations regarding the regional economy. In particular, slow, but more stable growth is expected during the forecast period. The forecast annual changes in revenue are under 1.5 percent for each of the next three years, making this a more stable period. These projections assume no changes in either state or local option tax rates. Also, this forecast does not include dramatic variations in local economic conditions due to unforeseen policy actions. These, and other variables may be introduced into this model to provide better projections. However, when compared with historical revenue collections this simple model provides forecast errors that are less than 1.5 percent of actual values. More importantly for planning purposes, this model underestimated the 2000-2001 revenues making potential end of year shortfalls less onerous for policymakers.

## 6. For Further Information Contact

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