2013 Economic and Revenue Forecast Update for the City of Omaha, Nebraska

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Background

Dr. Kenneth A. Kriz was asked in November 2009 by the Finance Director of the City of Omaha to develop a quantitative revenue forecasting model for the major City revenue sources. Work on the quantitative forecasting model was directed by Dr. Kenneth A. Kriz with the assistance of Dr. Arwiphawee Srithongrung. The work on this model was completed during the spring of 2010 with final estimates reached in May 2010. The city requested an update of the forecasting model in July of 2013. The results of the model updates are presented in this report along with a description of the methods employed in developing the forecasts. Further details are available on request from the author.

Following standard practice for revenue forecasting, measures of the economic base of revenues were first estimated. Then revenue forecasts were developed for each revenue source, taking into account their historical information and information on the relationship between the revenue source and the economic base.

Economic Forecast

The basis for many of our forecasts is the economic condition of the region. The health of the regional economy is important because it drives current and expected future income, which is spent by citizens generating sales taxes, because it represents increased economic activity which leads to many fee and charge based income, and because it ultimately may lead to changes in housing demand, translating into changes in property taxes. Therefore the first step in creating revenue forecasts is to forecast the state of the economy.

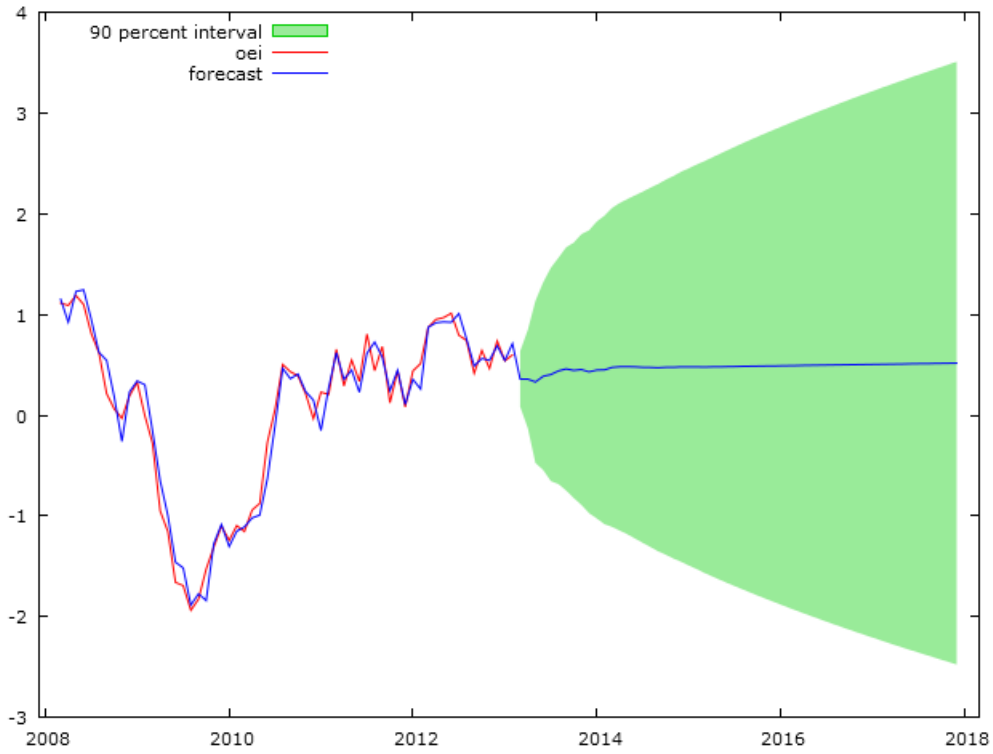
Continuing from our last report, we use our Omaha metropolitan area economic index, the UNO/World-Herald Omaha Economic Index as a measure of the health of the local economy.[1] The index is created using a methodology that detects common trends in five economic indicators (nonfarm payrolls, residential building permits, commercial/industrial electrical sales, taxable retail sales, and construction employment). Figure 1 shows the Omaha Economic Index growth since 2000, along with our forecast model. Our model is a time-series model of the type mentioned in the 2010 revenue forecast report.

The index shows that the Omaha economy grew strongly during the 2000s, but then entered a recession during the first quarter of 2009. The metro economy reached its trough during the summer of 2010 and began a slow but steady recovery. Recently, in a pattern mirroring that of the US economy as a whole, the pace of economic growth in the metro area has slowed.

[1] Dr. Kriz works with Dr. Mark Wohar and Dr. Christopher Decker of UNO's College of Business Administration to develop this index, which is published monthly by the Omaha World-Herald.

As of the date of this report, our point estimate is for continued slow to moderate growth in the local economy. However, as shown in Figure 1 there is much more uncertainty regarding the growth rate of the local economy as we wait for data from the summer months. We estimate a probability of 30 percent that the economy will slide back into recession as the combined effects of federal fiscal tightening and growing monetary policy restraint filter into the real economy. It will be incumbent to monitor the growth path of the economy as our revenue estimates are based on these forecasts.

Figure 1. Omaha Economic Index, 2008 – 2017.

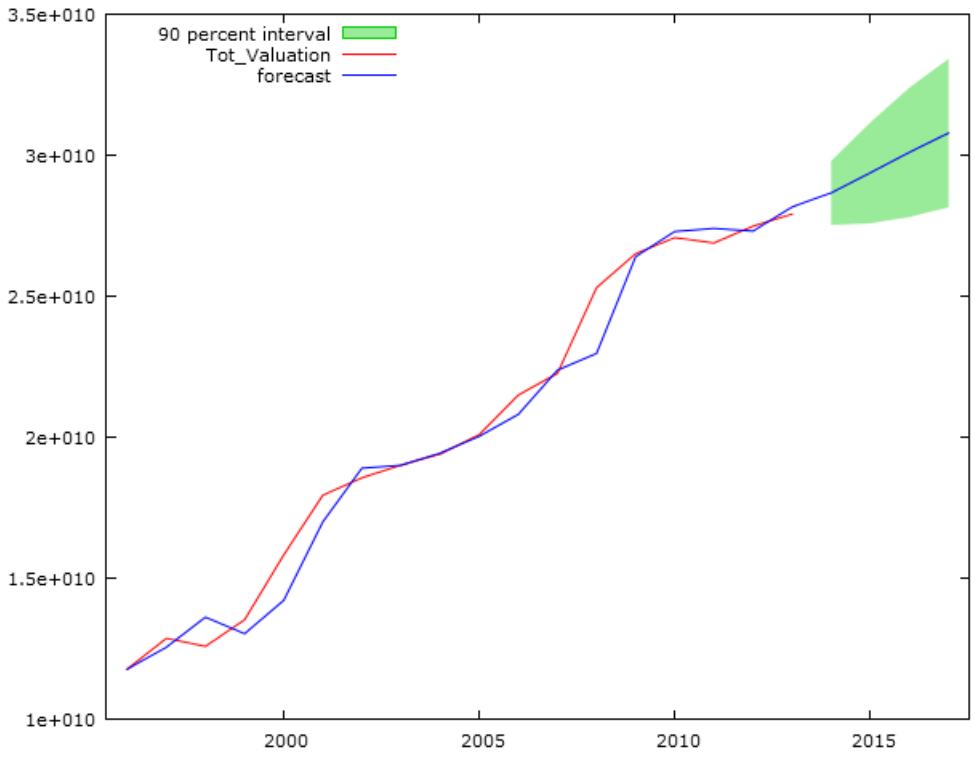


Revenue Forecasts

Property Taxes

Based on our results from previous efforts to forecast the property tax, we made some changes to the methodology. We now forecast only total property valuation and then simulate collection rates using a naïve model that takes into account the entire range of previous collection rates. This differs from our prior approach where we attempted to forecast the collection rate. That method seemed to introduce greater error into the model. We forecast property valuation using a simple time-series forecasting methodology. The results of this forecast are shown in Figure 2. The model appears to fit the data fairly well, with the exception of "turning points" where trends in valuation change direction due to changes in the economy.

Figure 2. Predicted, Actual, and Forecast Total Property Valuation, 1998-2017.



The results of our simulation of property tax revenues is shown in Table 1. Our point estimate is that property taxes will grow at an average 2.5 percent rate throughout the forecast period. Our low estimates reflect a stagnation of the property tax while our high estimates suggest property taxes will grow at nearly 4.5 percent per year.

Table 1. Annual Estimates for Property Tax Revenues, 2013-2017.

Year	Property Tax Revenue Point Estimate	Standard Error	Low 90%	High 90%
2013	138,148,312	1,250,004	135,926,870	140,003,095
2014	141,864,748	3,643,853	135,856,716	147,850,169
2015	145,354,034	5,537,209	136,260,366	154,470,674
2016	148,988,737	7,015,844	137,490,120	160,559,426
2017	152,334,283	8,036,722	139,127,840	165,535,748

Sales Taxes

Continuing the same forecasting methodology from last year's report, we use a time series forecasting model on actual receipts and LB775 data provided by the City Finance Department. Our model incorporates the projected Omaha Economic Index as an explanatory variable. For the LB775 refund data, we used time-series models on the data itself, as we found no useful explanatory variables for the data.

The results of the models and forward looking forecasts are shown in Figure 3 (Sales Tax Receipts) and Figure 4 (LB775 Refunds). As you can see, the model for sales tax revenues fits fairly well. However, the LB775 Refunds model does not predict the observed data very well. This is due to the inherent uncertainty of the realization of refunds. LB775 magnifies the uncertainties associated with revenue forecasting because of the unpredictability of refund requests. Our model essentially conservatively forecasts monthly realizations to "hedge" against the rare but evident large spike in refund realizations.

Monthly estimates of sales tax receipts were then "netted" by subtracting LB775 refunds and then were aggregated to provide annual estimates through simulation methods described in the Technical Appendix of the July 2010 report. Table 2 shows the annual estimates of net sales tax receipts and the associated 90% confidence interval. Our base forecast for net sales tax indicates moderate growth for 2013 as the economy continues to recover, but then slightly stronger growth (averaging around 2.5 percent per year) in 2014 – 2017. There is considerable uncertainty in these forecasts, however, driven by macroeconomic uncertainty described above as well as the uncertainty surrounding LB775 realizations.

Figure 3. Predicted, Actual, and Forecast Sales Tax Receipts, 2004-2017.

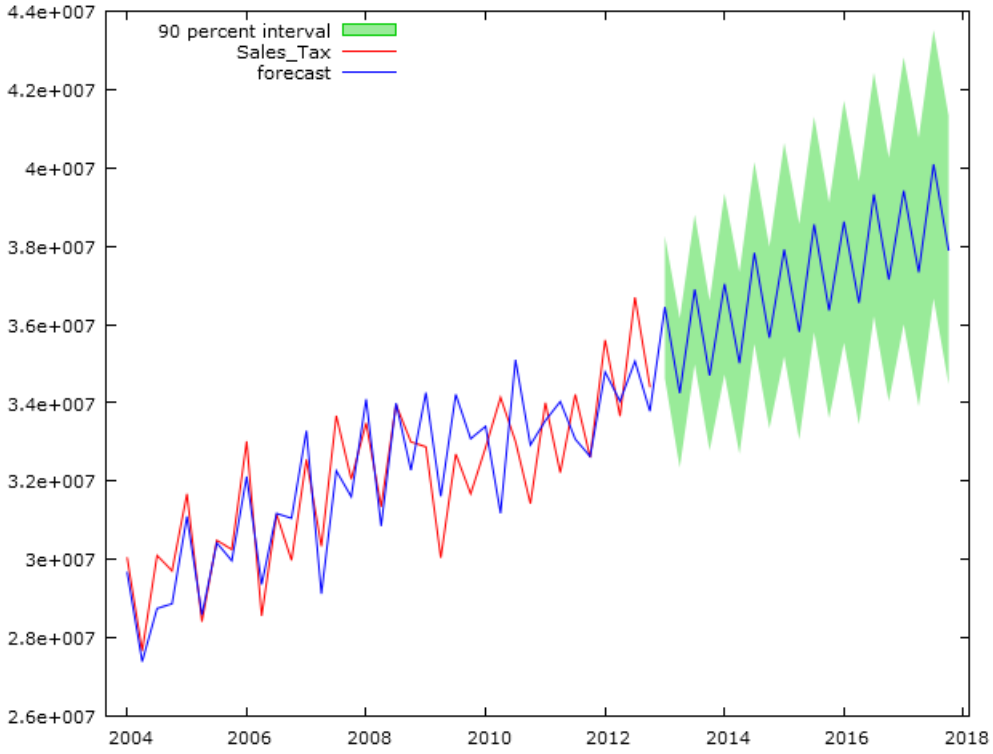


Figure 4. Predicted, Actual, and Forecast LB775 Refunds, 2003-2017.

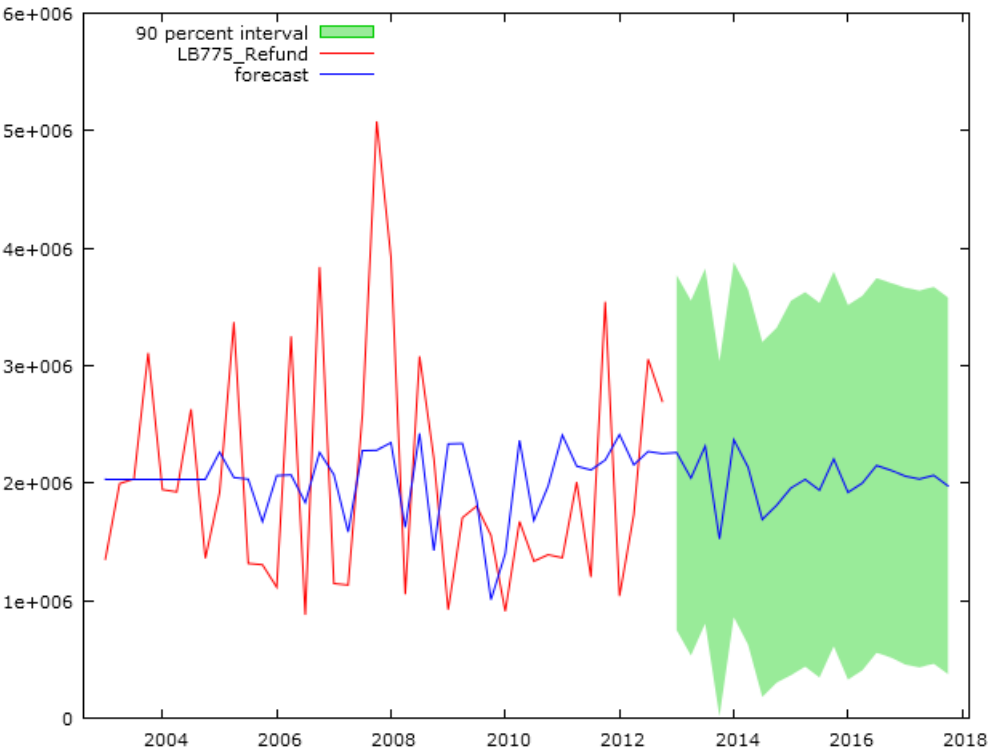


Table 2. Annual Estimates for Net Sales Tax Revenues (Sales Tax Revenue – LB775 Refunds), 2013-2017.

Year	Net Sales Tax Revenue Point Estimate	Standard Error	Low 90%	High 90%
2013	134,142,649	2,932,075	129,317,133	138,952,171
2014	137,563,640	3,371,353	132,020,207	143,128,518
2015	140,499,320	3,842,276	134,189,923	146,820,121
2016	143,476,892	4,247,504	136,520,280	150,434,111
2017	146,626,269	4,608,880	139,053,073	154,203,947

In Lieu of Taxes – MUD

In order to forecast revenue from the payments received in lieu of taxes from the Metropolitan Utilities District (MUD), we followed a four-step process to create a "recursive" economic model of MUDs revenue from provision of heating through natural gas. MUDs revenues appear to be much more affected by natural gas consumption and price than by changes in water services.

In creating our revenue model we first forecast the number of Heating Degree Days (HDD) into the future using a time-series forecasting model.[2] Heating degree days represent an estimate of how intensive the effort must be to heat buildings, which should affect both regional prices and the consumption of heating energy. We then forecast the regional price of natural gas (data from the US Energy Information Administration) into the future as a function of past data and forecast HDD. In the third step, we forecast consumption into the future as a function of past data, HDD, and price. Finally, we forecast revenue from the in lieu of taxes as a function of past data, price, and consumption.

The results of our model are shown in Figure 5. The model fits very well with the exception of an error in the late 2009/early 2010 period. This is attributable to a sudden shock in natural gas prices. As with sales tax revenues, we created annual forecasts from the quarterly forecasts through simulation methods. The results of these simulations are shown in Table 3. We forecast that revenues from the MUD in lieu of tax will fall gradually during the forecast period. This is due to a steady or slightly falling projected price along with slow consumption growth. However, it should be pointed out that the potential errors in this model are very large relative to the errors in the sales tax and property tax models. There is much more risk inherent in this revenue source because many more things can change that may affect revenue realization (weather/climate changes, price changes, individual consumption patterns just to mention a few).

[2] The individual models for HDD, natural gas prices and consumption will not be presented here, but the results are available from the author.

Figure 5. Predicted, Actual, and Forecast In Lieu of Taxes from MUD, 2004-2017.

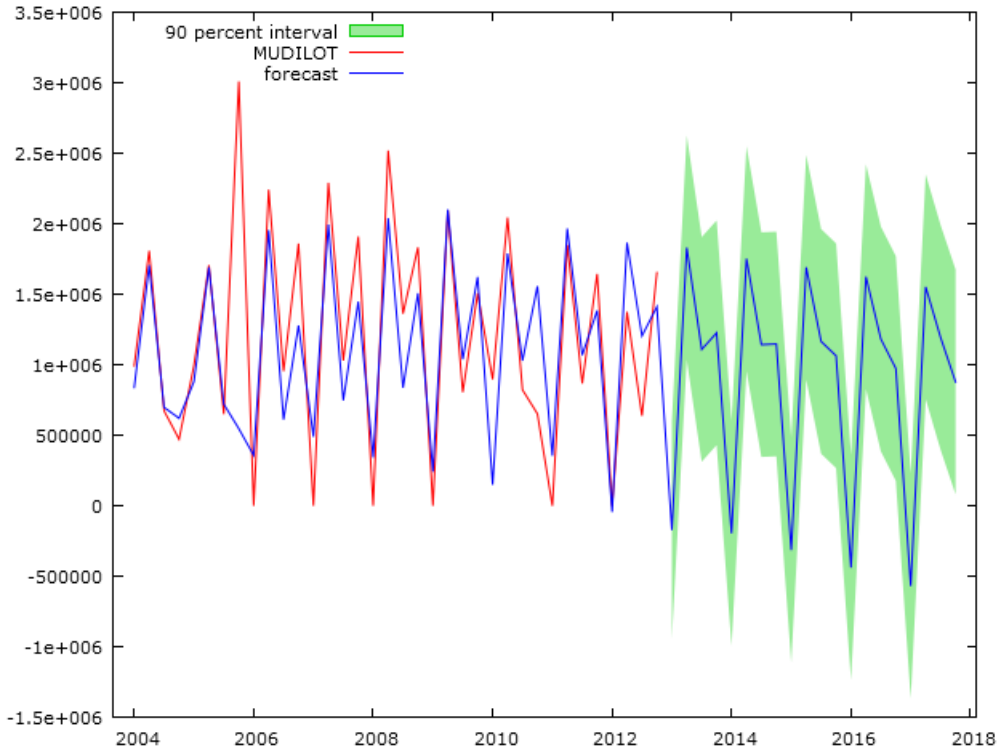


Table 3. Annual Estimates of In Lieu of Tax - MUD, 2013-2017.

Year	MUD In Lieu of Tax Point Estimate	Standard Error	Low 90%	High 90%
2013	4,288,102	858,205	2,889,471	5,712,299
2014	4,158,338	857,453	2,759,497	5,576,783
2015	3,999,899	851,593	2,618,804	5,416,210
2016	3,835,458	841,568	2,461,673	5,230,180
2017	3,662,161	834,142	2,297,525	5,043,472

Restaurant Tax

The restaurant tax is a relatively new revenue source for the city, having been implemented in late 2010. As such, this is a difficult source to forecast using traditional methods because of the lack of historical data on revenue realizations. However, there is monthly data available on taxable sales at Omaha bars and restaurants since 2006. Therefore, we approached our forecast for restaurant taxes similar to that for property taxes, first forecasting bar and restaurant sales and then applying the statutory tax rate to this base to obtain a forecast of the revenue from the tax (2.5%). The results of our forecast model are shown in Figure 6 for bar and restaurant sales and in Table 4 for the corresponding revenue. Our model fits the historical data fairly well. We predict that revenue from the bar and restaurant sales tax will grow by a 4-6% annual rate throughout the forecast period. There is some uncertainty in out-year forecasts (past 2014) but overall the pattern of growth is much more stable than sales taxes as a whole.

Figure 6. Predicted, Actual, and Forecast Omaha Bar and Restaurant Sales, 2007-2017.

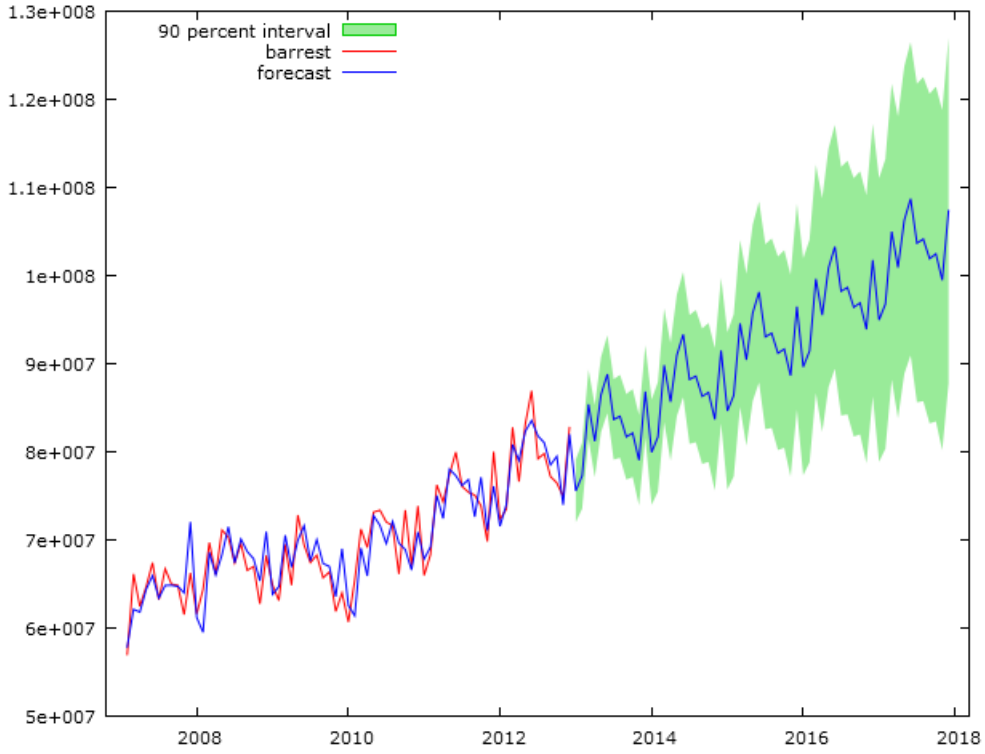


Table 4. Annual Revenue Forecasts for Restaurant Tax, 2013-2017.

Year	Restaurant Tax Point Estimate	Standard Error	Low 90%	High 90%
2013	26,545,398	252,844	26,128,893	26,960,573
2014	27,996,016	405,963	27,327,244	28,663,345
2015	29,546,536	585,122	28,584,853	30,505,038
2016	31,199,658	785,602	29,908,101	32,496,715
2017	32,954,385	1,004,378	31,296,386	34,608,365

Minor Revenue Sources

For most of the other more minor revenue sources, we followed a similar pattern. We transformed the monthly revenue data into quarterly revenue estimates, tested for the appropriate time-series model, estimated the model, and forecast future revenue using the parameters of the "best fit" time-series model in a simulation model.

Figures 7 through 14 show the results of the forecast models on quarterly data for the minor revenue sources. Most of the models perform well, with relatively modest errors. Particularly well performing models are those for Cable Franchise Fees, Utility Occupation Taxes, Hotel/Motel Occupancy Taxes and Vehicle Rental Occupancy Taxes. The worst performing models are for Intrusion Alarms and Impound Lot Fees, which exhibit high levels of random variation and therefore are extremely difficult to forecast.

Annual revenue forecasts and confidence intervals were estimated using simulation models. The results are shown in Table 5. As is suggested with the major revenue sources, most of the minor sources of revenue are expected to grow slowly over time, with the exception of the Hotel/Motel and Vehicle Rental Occupancy Taxes. Both of these taxes have proved to be very responsive to economic conditions, so as the economy recovers the growth rate of these sources should be strong. However, if the economy reenters a downturn, these sources will be a drag on overall revenue growth.

Table 5. Annual Revenue Forecasts for Minor Revenue Sources, 2013-2017.

Building Permits				
Year	Building Permit Revenue Point Estimate	Standard Error	Low 90%	High 90%
2013	2,624,851	180,338	2,328,803	2,920,644
2014	2,681,107	228,090	2,305,931	3,058,009
2015	2,735,248	247,960	2,327,195	3,141,639
2016	2,712,564	264,236	2,277,837	3,149,198
2017	2,735,983	274,395	2,285,673	3,186,624
Telephone Utility Occupation Tax				
Year	Occupation Tax - Telephone Cos. Point Estimate	Standard Error	Low 90%	High 90%
2013	17,287,712	682,945	16,169,331	18,414,575
2014	17,537,127	1,031,914	15,842,970	19,242,208
2015	17,800,443	1,307,322	15,650,019	19,943,386
2016	18,151,950	1,565,322	15,590,548	20,727,131
2017	18,391,722	1,807,958	15,409,593	21,356,322
OPPD Utility Occupation Tax				
Year	Occupation Tax - OPPD Point Estimate	Standard Error	Low 90%	High 90%
2013	5,833,080	349,464	5,258,263	6,407,897
2014	6,148,920	507,773	5,313,708	6,984,132
2015	6,481,860	639,246	5,430,394	7,533,326
2016	6,832,830	759,085	5,584,246	8,081,414
2017	7,202,800	873,169	5,766,565	8,639,035
Cable Franchise Fees				
Year	Cable Franchise Fees Point Estimate	Standard Error	Low 90%	High 90%
2013	5,681,654	195,380	5,359,340	6,002,841
2014	5,902,009	283,513	5,433,265	6,369,936
2015	6,111,500	349,154	5,535,282	6,681,703
2016	6,311,933	405,454	5,644,434	6,977,759
2017	6,520,410	453,047	5,772,603	7,262,675

Hotel/Motel Occupancy Tax				
Year	Hotel/Motel Occupancy Tax Point Estimate	Standard Error	Low 90%	High 90%
2013	8,048,214	256,956	7,626,480	8,471,337
2014	8,567,314	311,869	8,053,416	9,078,481
2015	9,040,376	370,328	8,431,816	9,652,026
2016	9,518,935	417,939	8,830,696	10,209,931
2017	9,986,144	461,578	9,229,730	10,745,892
Intrusion Alarm Fees				
Year	Intrusion Alarm Fees Point Estimate	Standard Error	Low 90%	High 90%
2013	949,182	152,699	697,824	1,200,127
2014	985,641	156,979	726,975	1,243,158
2015	998,358	161,969	732,122	1,264,893
2016	1,001,196	165,778	727,115	1,273,688
2017	1,001,959	169,580	722,120	1,281,152
Impound Lot Fees				
Year	Impound Lot Fees Point Estimate	Standard Error	Low 90%	High 90%
2013	2,739,179	167,199	2,463,483	3,014,033
2014	2,782,729	204,259	2,447,114	3,120,350
2015	2,831,321	218,109	2,471,008	3,190,720
2016	2,873,961	225,224	2,504,338	3,245,060
2017	2,903,783	227,783	2,527,786	3,278,774
Vehicle Rental Occupancy Tax				
Year	Vehicle Rental Occupancy Tax Point Estimate	Standard Error	Low 90%	High 90%
2013	2,977,634	207,528	2,637,037	3,318,812
2014	3,167,815	276,385	2,711,205	3,621,907
2015	3,356,962	331,726	2,812,121	3,903,565
2016	3,544,466	379,877	2,923,663	4,170,867
2017	3,733,099	423,098	3,037,828	4,426,767

Figure 7. Predicted, Actual, and Forecast Building Permit Fees, 2003-2017.

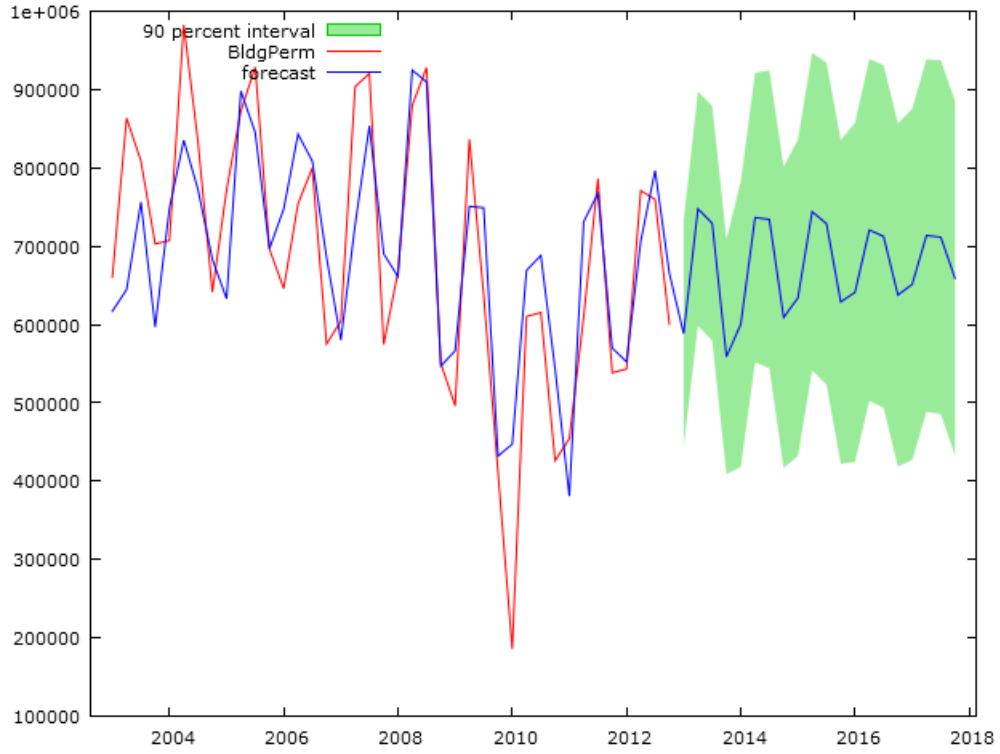


Figure 8. Predicted, Actual, and Forecast Telephone Utility Occupation Taxes, 2003-2017.

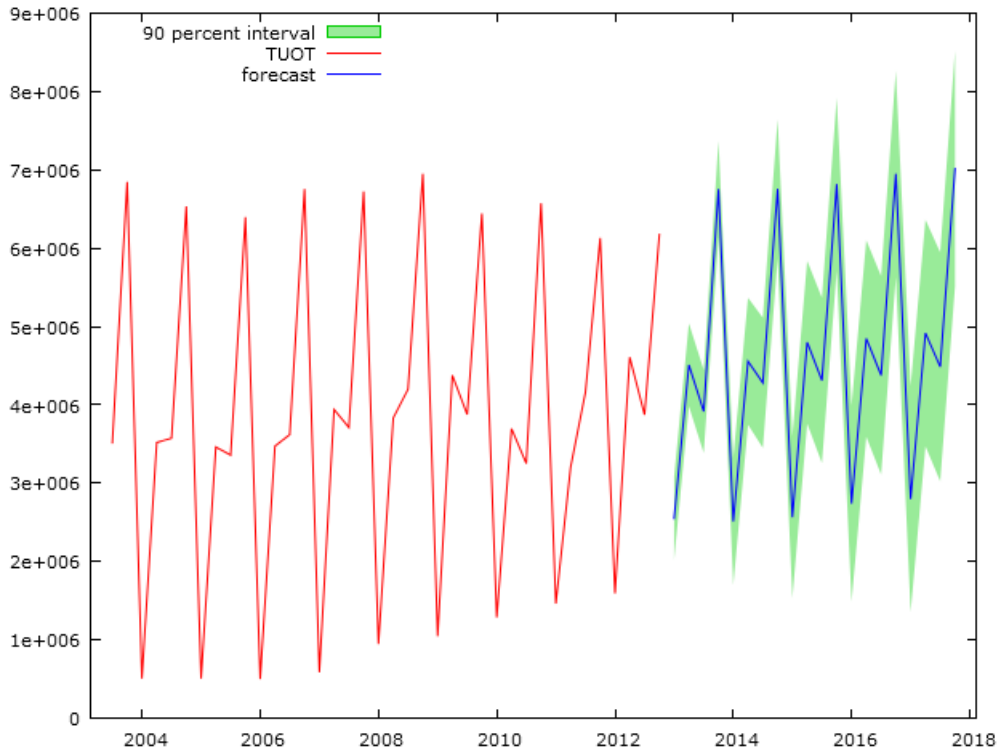


Figure 9. Predicted, Actual, and Forecast OPPD Utility Occupation Taxes, 2004-2017.

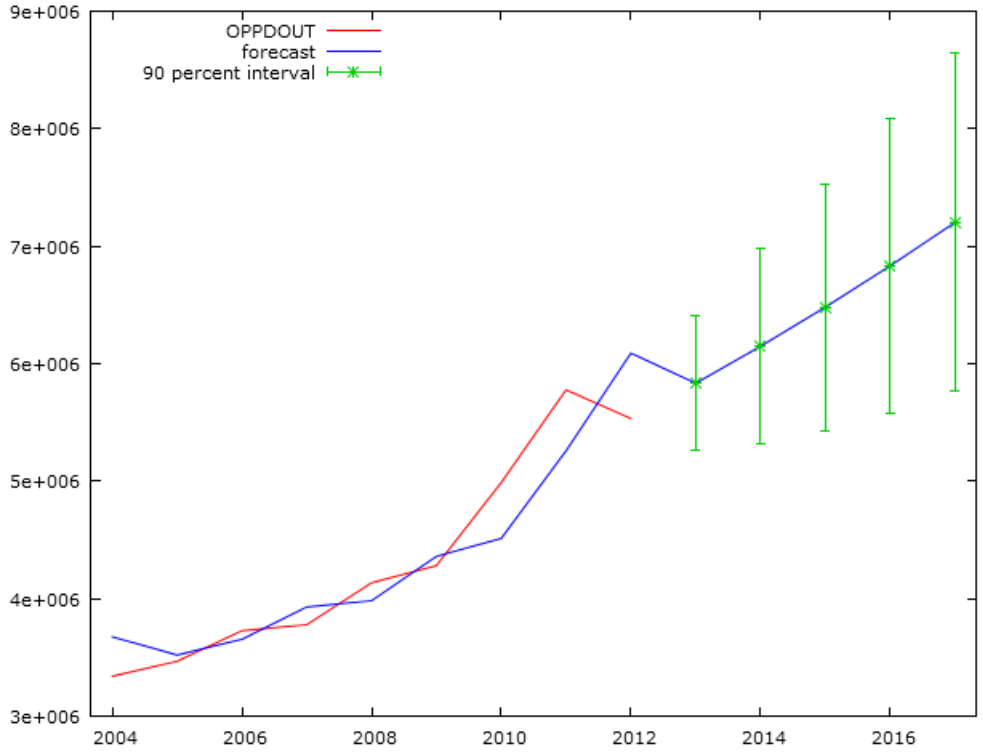


Figure 10. Predicted, Actual, and Forecast Cable Franchise Fees, 2003-2017.

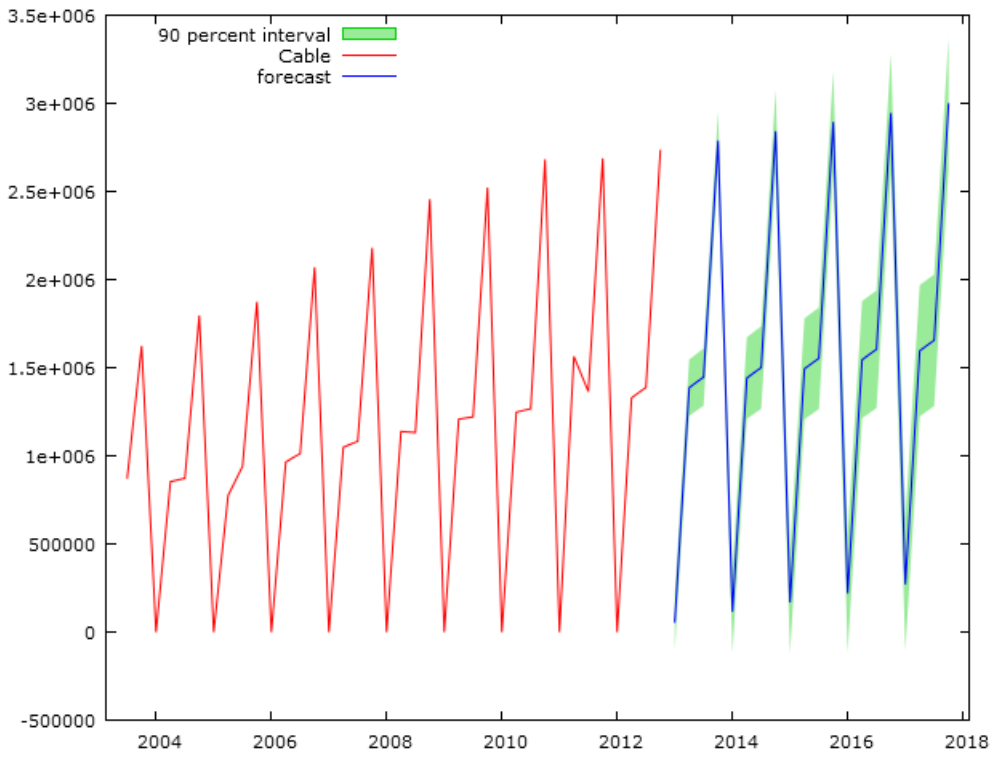


Figure 11. Predicted, Actual, and Forecast Hotel/Motel Occupancy Taxes, 2003-2017.

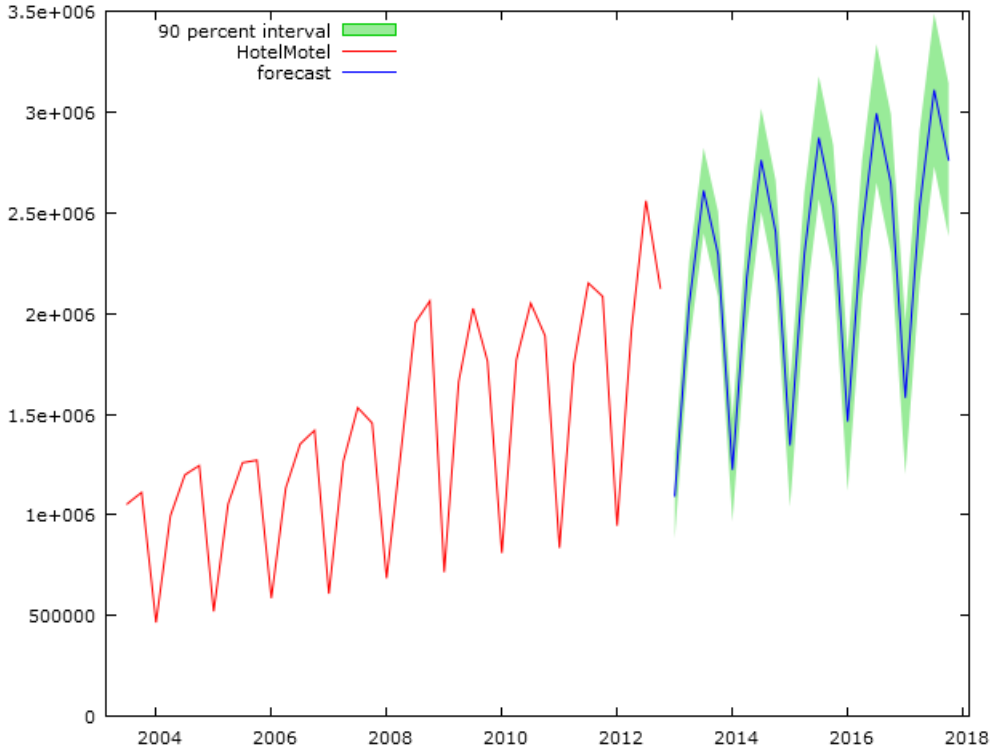


Figure 12. Predicted, Actual, and Forecast Intrusion Alarm Fees, 2005-2017.

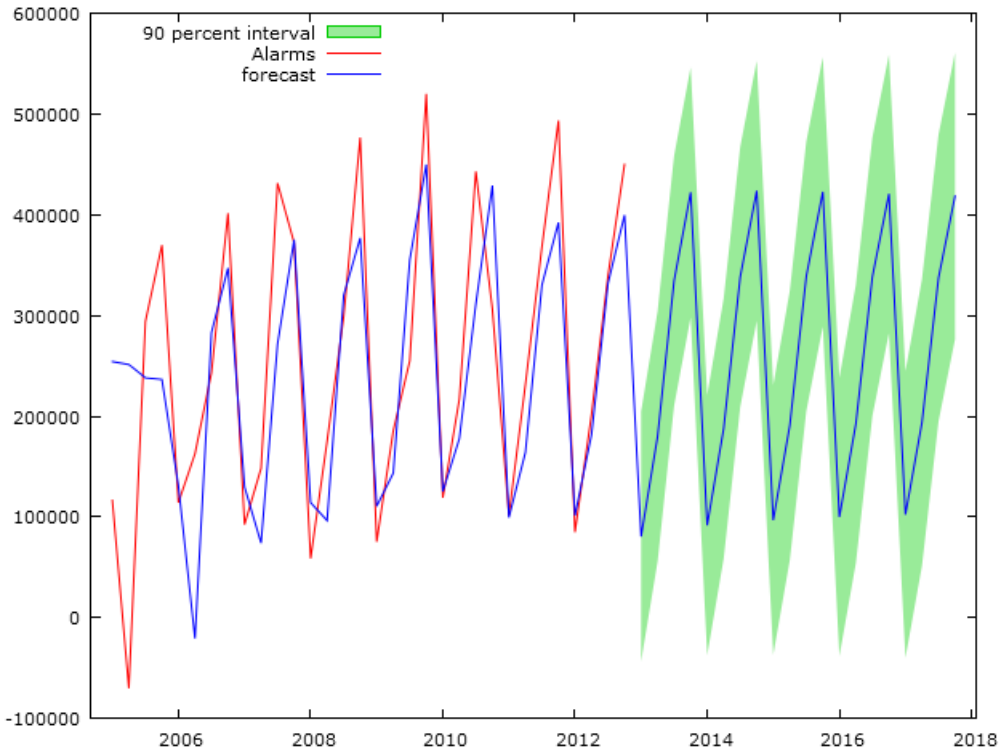


Figure 13. Predicted, Actual, and Forecast Impound Lot Fees, 2003-2017.

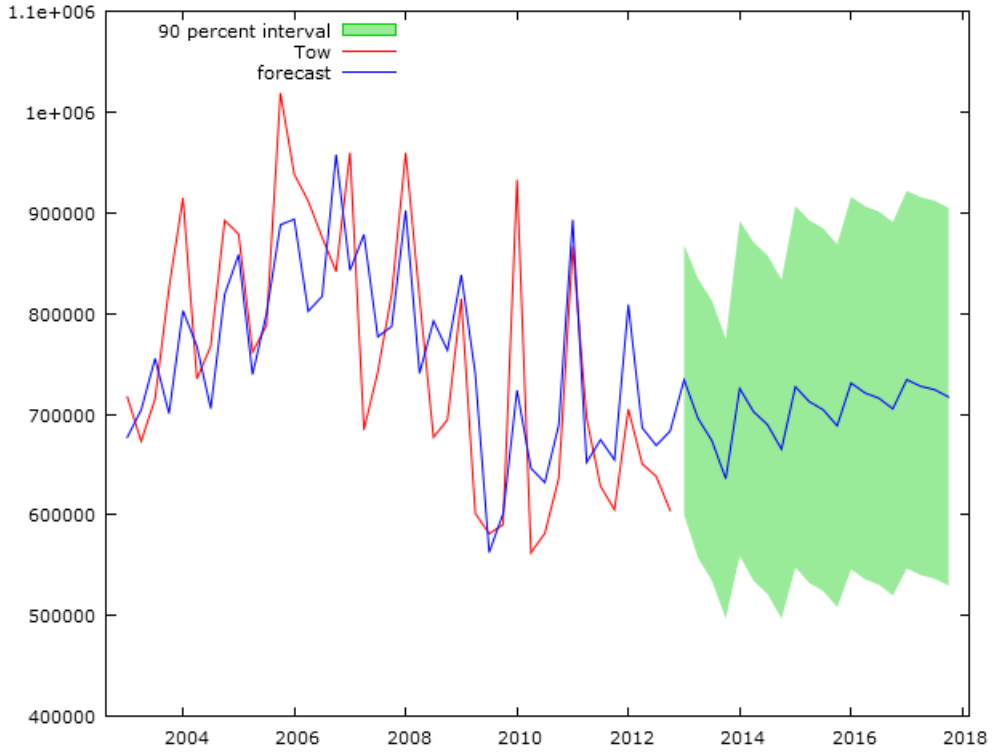


Figure 14. Predicted, Actual, and Forecast Vehicle Rental Occupancy Taxes, 2003-2017.