A Revenue Forecasting Model for the Pima RTA: Updated to 2016

Prepared for:
Regional Transportation Authority

Submitted by:
George Hammond, Ph.D.
Director and Research Professor
Alberta H. Charney, Ph.D.
Senior Research Economist

Economic and Business Research Center
Eller College of Management
University of Arizona

March 28, 2017

Table of Contents

A Revenue Forecasting Model for the Pima RTA: Updated to 2016

Executive Summary

On May 16, 2006, voters in Pima County approved a $2.1 billion regional transportation plan to be funded by a ½ percent sales tax and to be executed over 20 years expiring on June 30, 2026. The $2.1 billion revenue forecast was produced by the Economic and Business Research Center (EBRC) at the Eller College of Management, University of Arizona. In total, 51 transportation related projects in four elements (roadway, safety, transit, environment and economic vitality) were identified in the regional transportation plan consuming $1.998 billion of the forecasted revenues. The additional monies in the referendum were to cover financing and administrative expenses.

The RTA is now in its 11th year of the 20-year plan approved by voters in 2006. Over the RTA's first 10 years, over 770 individual projects or services have been implemented. These projects include projects in all four elements of the RTA plan, distributed throughout the region.

The severe economic downturn beginning in late 2007 has resulted in $98.3 million less revenue than originally forecasted through fiscal year 2013. Project costs were also lower than anticipated partly because of a favorable construction cost environment. The 2013 forecast predicted 17 percent lower total revenues from the original $2.1 billion to $1.736 billion. EBRC's 2013 forecasts for 2014-2016 RTA revenues over-predicted actuals, as the Tucson economic recovery lagged the national and statewide recovery from the economic downturn.

The forecasts presented in this forecast uses HIS Global Insight's national model, using baseline, optimistic and pessimistic sets of assumptions and forecasts. Under the baseline scenario, projected 5-year RTA revenues (2017-2021) are $415.6 million, projected 10-year revenues (2017-2026) are $907.7 million, 20-year revenues (2017-2036) are $2,153.9, and 30-year revenues (2017-2046) are $3,898 million. The optimistic scenario results for the same time periods are $428.1 million for the 5-year, $942.8 million for the 10-year, $2,282.3 million for the 20-year, and $4,206.7 million for the 30-year projection. The pessimistic scenario results for the 5-, 10-, 20-, and 30-year revenue projects (in millions of dollars) are $402.3, $881.9. $, $2,121.9 and $3,956.2. In nominal dollars, the projected RTA revenues under the pessimistic scenario are higher than the baseline for the 30-year projection time period because the pessimistic scenario has higher inflation than the baseline. When deflated, the projections in the pessimistic scenario are substantially below the baseline.

The baseline scenario forecast, together with actual collections, from 2006-2016, yields a total revenue estimate of $1.598 billion, 24 percent less than the original $2.1 billion estimate.

A Revenue Forecasting Model for the Pima RTA: Updated to 2016

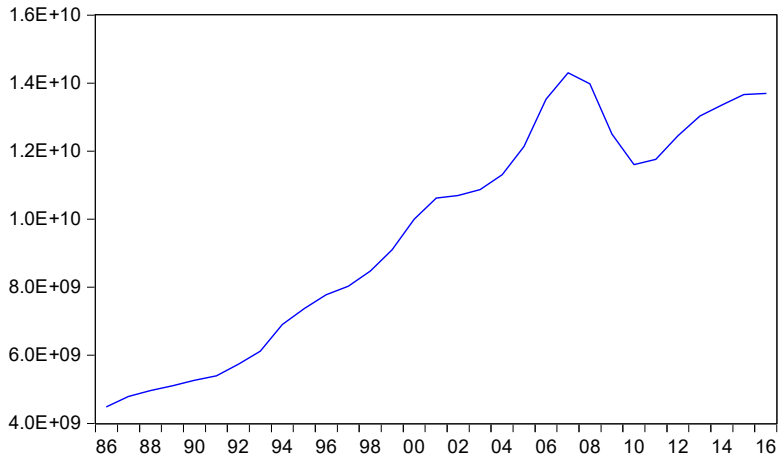
Introduction

This report and the model described within are updated versions of those submitted in November 2013, which projected revenues to the RTA (Regional Transportation Authority) through 2028. This version of the model is used to produce projections through 2045. The original enabling legislation allowed counties to set up a referendum that, if passed, would impose a sales tax rate on taxable sales categories at 10 percent of the Arizona state sales tax rate. The resulting RTA tax rate for most taxable sales categories 0.5 percent. A notable exception is the tax on hotels/motels (sometimes referred to as the bed tax), which is taxed at 0.55 percent.

To get a longer time series than the RTA data permits, taxable sales in Pima County (updated with RTA data in recent years) are used in estimating model regressions and in graphs. For graphing purposes, an estimate of the total tax base of the RTA is computed by summing the six largest taxable sales categories in Pima County. Because hotel/motel sales are taxed at a slightly higher rate, it is given a slightly higher weight in the sum than the other five (it is multiplied by 0.0055/0.005 before summing).

This estimated RTA taxable sales base is in Figure 1. The economic bubble is clearly visible in the 2004-2007 period, followed by a steep decline until it hit its trough in 2010. Since then, the nominal tax base of the RTA has grown by 18 percent, which is an average annual compound rate of growth of 3 percent. According to Figure 1, the tax base is not all that far below the 2007 peak level.

Figure 1. Total Estimated Tax Base of the RTA (FY$)



When the total tax base is deflated ($2016), the situation looks very different (Figure 2). The deflated tax base has grown by 8 percent since the 2011 trough but it is still almost 22 percent below the peak. It is hard to imagine real RTA revenues ever returning to 2007 levels.

Dividing deflated revenues by population (Figure 3) shows an even bleaker picture. The real per capita tax base increased by 6 percent between 2011 and 2015 but remains more than 25 percent below the peak and far below the overall trend line from 1992 through 2007.

Figure 2. Total Deflated Estimated Tax Base of the RTA (FY$2016)

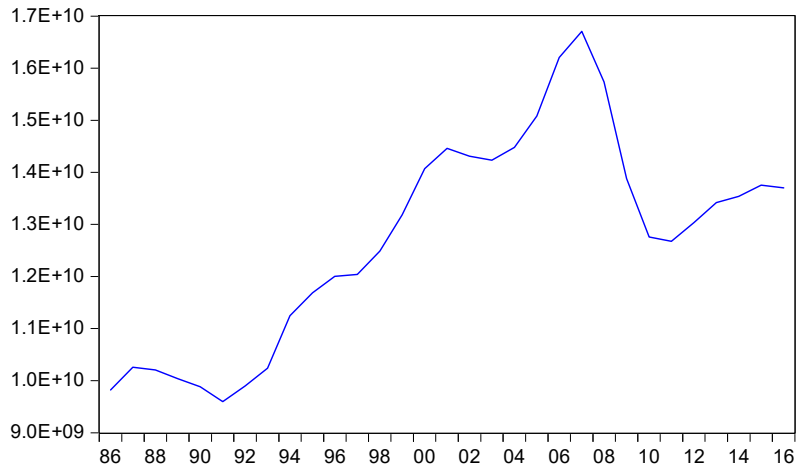
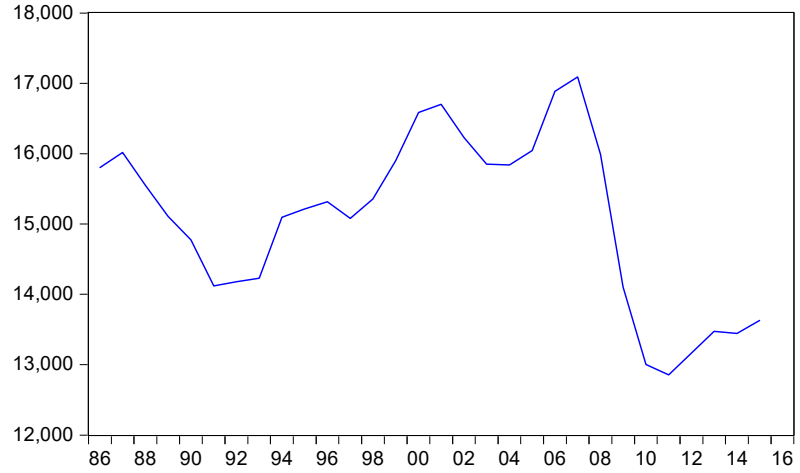


Figure 3. Per Capita Deflated RTA Tax Base (FY$2016/person)



The primary cause of the declining sales tax base is the relentless downward trend in the share of personal income that is taxable (Figure 4). The RTA tax base as a share of Pima County personal income has fallen from 52 percent in 1986 to approximately 36 percent in recent years. Although there was a small increase in the share since 2011, it has flattened and remains close to the all-time low. The tax base, as a share of income, has fallen 37 percent since 1986. This declining ratio represents the shrinking taxing capacity of the sales tax base, as currently defined.

One major reason for this long-term decline is that there has been a national shift from the consumption of goods, which are taxable in Arizona, to services, which generally are not. Figure 5 shows the ratio of U.S. consumption expenditures on goods divided by the U.S. disposable personal income. This ratio has dropped from approximately 35 percent to 27 percent, a decline in the ratio of 30 percent. Based on these two graphs, the national downward trend in the consumption of goods to total consumption explains approximately three-quarters of the severe decline in the RTA sales tax base relative to personal income.

Figure 4. RTA Tax Base Relative to Pima County Personal Income

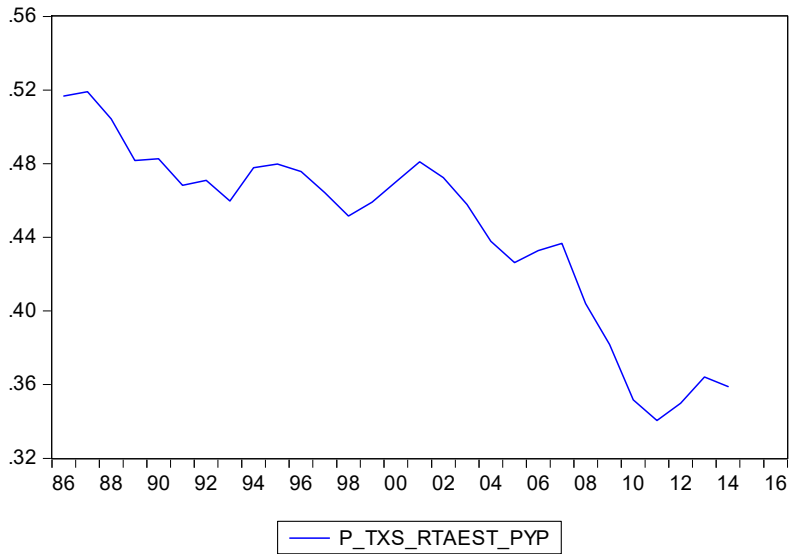
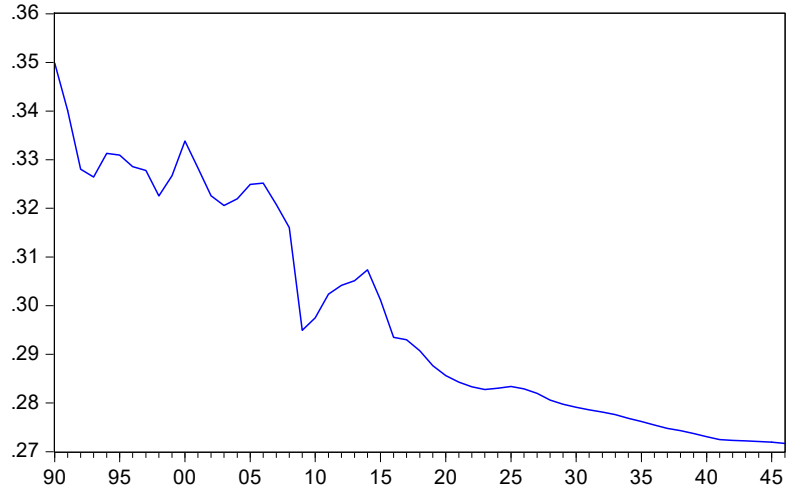


Figure 5. U.S. Consumption Goods Relative to U.S. Disposable Personal Income



Trends in the composition of personal income, which were used as proxies for income distribution, have not improved since the last report. Transfer payments, as a share of personal income, remains at very high levels by historical standards (Figure 6). Transfer payments include income categories such as social security, disability insurance payments, unemployment compensation, railroad retirement, workers compensation, and government payment to medical providers for government provided healthcare. Income from transfer payments, by their nature, are spent differently than income derived from wages and salaries received for performing work. The wage and salary share of personal income, although no longer falling, is not recovering either (Figure 7).

Figure 6. Share of Personal Income that is Transfer Payments

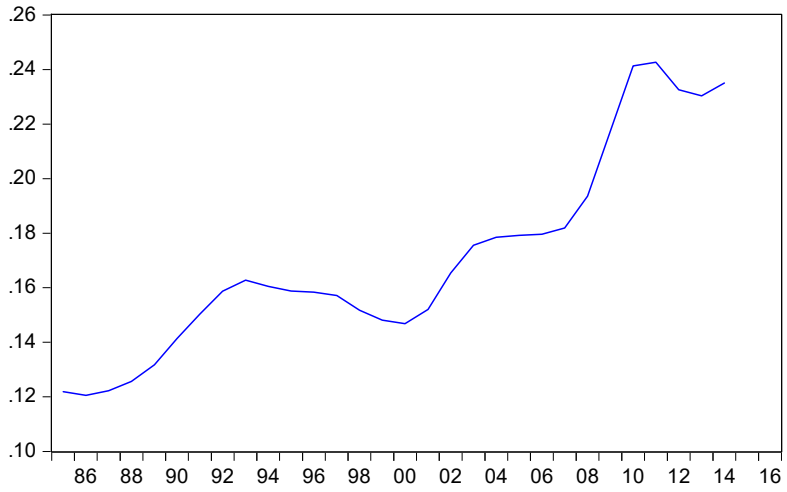
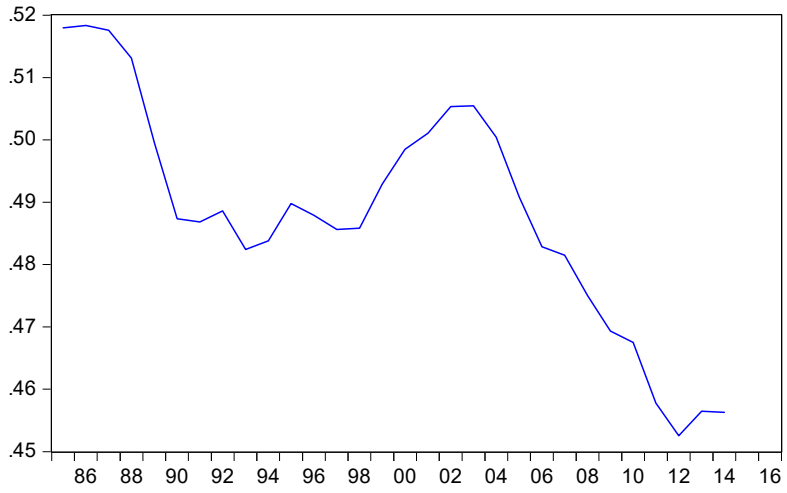


Figure 7. Share of Pima County's Personal Income in Wages and Salaries



Data Used in This Study

Two sets of data on taxable sales in Pima County have been available from the Arizona Department of Revenue. The first set is the monthly data series that was available for decades, but is now becoming more difficult to get. These data are maintained by the state but obtaining this data by county, by taxable sales classification codes, e.g., retailing (classification code 17), restaurants and bars (classification code 11), etc. has become problematic. For the last two years, the Economic and Business Research Center has only been receiving data on four categories of taxable sales at the county level – retailing, hotel/motel, amusements and restaurant and bars. This set is referred to the TXS (Taxable Sales) series.

The other set of data is the revenues collected for the RTA, by category, since the RTA tax was implemented. This set of revenue data can be converted to taxable sales by dividing each category of revenues by the legislated RTA sales tax rate. For most of the categories, the sales tax rate is ½ of one percent, so revenues can be converted to taxable sales by dividing by 0.005. For the category associated with hotel/motel sales, the tax rate is 0.0055 and for non-metal mining (stone, clay, gravel), the tax rate is 0.00312. This set of data is referred to as the RTA taxable sales series.

Although these series are similar, there are some underlying differences. First, the TXS data are disaggregated according to the legal definitions of the sales tax categories, which are based on the nature of the sale. In contrast, the RTA data series is based on the NAICS (North American Industrial Classification System) code of the business submitting the tax payments. NAICS codes are assigned to businesses based on their primary economic function, but any particular business must report more than one type of sale, based on the legal definitions of taxable sales.

A straightforward example of this might be a hotel that also operates a restaurant and a gift shop. When this hotel submits its monthly sales tax report to state and local governments, it reports sales in three different legal classifications: hotel/motel (bed) sales, classification 25; restaurant and bar sales, classification 11; and retail sales, classification 17. When these tax bases are multiplied by the relevant RTA tax rates, the resulting revenues are combined and reported to the RTA under the NAICS category of hotels/motels (specifically, accommodations, NAICS code 721). The RTA hotel/motel series would include not only room sales but also other taxable sales made by the hotel. The TXS database for hotels/motels includes only the room rental portion of hotel/motels' sales. Note that if this were the only difference, the sum of all taxable sales in the TXS dataset and the computed taxable sales in the RTA dataset would be equal. They are not identical because there are other differences, as well.

Another difference relates to the fact that the TXS data and the RTA data contain a slightly different list of taxable categories. The primary example of this is the RTA tax on real property rentals (state tax classification 13). The state tax rate on this sales classification was reduced over time and set to zero in 1996. Once the state sales tax rate was set to zero, the state no longer tracked that activity so it no longer appears in their total taxable sales figures. That category is taxed by the RTA so the revenues from this classification are included in RTA figures.

Finally, there is a difference in how/when delinquent taxes are recorded between the TXS and RTA series. If a sales tax filer is late, the TXS database is revised so the data represents when those sales occurred, not when the delinquent tax was paid. In contrast, the RTA dataset records when the taxes are paid to the RTA. Since this dataset represents tax revenue received by the RTA, they are never revised backward. A delinquent tax payment would simply be posted at the time it was deposited into the RTA account.

For modeling purposes, a fairly long time-series of data is required. The RTA revenue data series begins in July 2006, but there are almost zero revenues reported for that month. Without July, there is insufficient data to compute an annual figure for the fiscal year ending in June 2007. Therefore, the first full-year of data in the RTA dataset is FY2008. The last year is FY2016, for a total of only nine years of annual fiscal year data.

Despite these differences, the required long time-series requires us to use the TXS dataset. However, because of the lack of availability of TXS data, by county, by category, in recent years, a hybrid dataset was developed. The RTA revenue data, by category, were converted to taxable sales by dividing by the

relevant RTA tax rate. Then the last three fiscal years of this constructed taxable sales data (2014-2016) were concatenated onto the longer TXS series. In other words, the longer time-series TXS data were updated in recent years using RTA data

Model

The model described below produces forecasts of the revenues derived from the RTA's one-half percent sales tax. The model is a structural model that forecasts revenues based on Pima County's economic activity and national economic conditions. Forecasts of Pima County's economic activity were obtained from the Forecasting Project, which regularly produces forecasts for the State of Arizona, the Phoenix Metropolitan Area and the Tucson Metropolitan Area (Pima County). Forecasts of national economic activity are obtained from Global Insight. This version of the RTA model is of annual frequency and produces forecasts of fiscal-year RTA revenue from 2016 through 2045.

In this report, we present equations designed to forecast the following sales tax categories:
p_txs_bed25cbfr = Pima County taxable sales in hotel/motel sales, collection basis, fiscal year
p_txs_com5cbfr = Pima County taxable sales in communications, collection basis, fiscal year
p_txs_con15cbfr = Pima County taxable sales in contracting, collection basis, fiscal year
p_txs_rb11cbfr = Pima County taxable sales in restaurant and bar sales, collection basis, fiscal year
p_txs_re14cbfr = Pima County taxable sales in personal rentals, collection basis, fiscal year
p_txs_rs17lfcbfr = Pima County taxable sales in retail, collection basis, fiscal year
p_txs_ut4cbfr = Pima County taxable sales in utilities, collection basis, fiscal year
p_rta_re13cbf = Pima County RTA revenues from real commerciall rentals
p_revrescbf = RTA revenues that remain after subtracting p_rta_re13cbf and the sum of the multiplicands of the first seven modeled taxable sales categories times their corresponding tax rates from total RTA revenues
Note that the "r" at the end of the p_txs_ variables indicate that they have been updated using RTA data.

The tax bases taxed at ½ percent were added together:
p_txs_modeled5 = p_txs_com5cbfr + p_txs_con15cbfr + p_txs_rb11cbfr + p_txs_re14cbfr + p_txs_rs17lfcbfr + p_txs_ut4cbfr

Then total estimated RTA revenues are as follows:
p_rta_totcbf = p_txs_modeled5 * 0.005 + p_txs_bed25cbfr * 0.0055 + p_rta_re13cbf + p_revrescb1f

This equation simply says that total RTA revenues are equal to the sum of all the modeled taxable sales that are taxable at ½ percent times 0.005, plus the hotel/motel tax base times 0.0055 plus an estimate of RTA revenues from the real property portion of the tax, plus a residual. That residual represents all of the un-modeled categories and adjusts for the timing difference between the TXS and the RTA data series. The un-modeled RTA revenue categories include transportation and towing ($0), railroads and aircraft, private railcar/pipelines, publishing, printing, amusements, rental of real property, jet fuel tax and other. These categories combined represent approximately $1.5 million, or 2 percent of the total in FY2016.

Variable Notation and Format of Estimated Equations

Descriptions of each of the equations are presented below. The method of estimation for each equation is Ordinary Least Squares and the time period used in estimation is provided for each equation. Some important notations:

suffix "f" or "fy" means fiscal year [if no suffix "f" or "fy," data is calendar]
suffix "cb" means "collection basis" so
suffix "cbf" means "collection basis, fiscal year"
prefix "p_txs_" means "Pima County taxable sales in category.."
prefix "p_rta_ " means "RTA revenues in category ... "
numbers in the p_rta_ and the p_txs_ variable names represent the taxable sales legal classification code
log( ) means that the variable enters the equation as a logarithm to allow for non-linear relationships

To understand the tables describing each estimated equation, consider the following simple linear equation: dependent variable = constant + coefficient1 * variable 1 + coefficient2 * variable2. In the regression table, the dependent variable is listed at the top, the constant term is identified as the variable C, and variable1 and variable2 (and more) are listed down the left-hand column. The first column of numbers contains the estimated coefficients. The second column of numbers contains the standard errors of the coefficients, which represent the precision of the coefficient estimators. The 3rd column of numbers contain the t-statistics (the ratio of the first two columns), which measure the statistical significance of the coefficient. Generally, a coefficient with a t-statistic greater than or equal to 2 (in absolute value) is said to be "statistically significant," meaning the variable corresponding to that coefficient is important in explaining the variation in the variable on the left-hand side of the equation.

Among the statistics presented at the bottom of the equation, the easiest to describe is the one labeled "R-squared." This is a "goodness-of-fit" measure that describes the portion of the variation of the left-hand variable that is explained by the right-hand side variables. An R-square of 0.95 means that the variables on the right-side of the equation explain 95 percent of the variation in the dependent variable.

When both the left- and right-hand side variables are written as logarithms (i.e., log( )), the coefficients in the equation are the estimated "elasticities." Elasticity is a measure of the responsiveness of the left-hand side variables to changes in the right-hand side variables. An elasticity greater than 1 is said to be "elastic," because the left-hand side variable responds in a more than proportional way to changes in the right-hand side variable. An elasticity less than 1 is "inelastic," meaning that the left-hand variable changes less than proportionally to changes in the right-hand side variables. An elasticity of 1 is said be "unitary" and represents a proportional response.

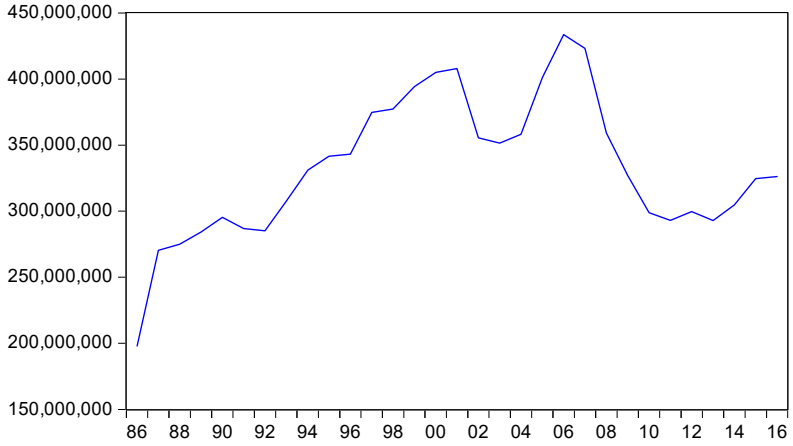
In some equations there is an added "variable" that appears as AR(1). This is a serial autocorrelation correction term. Often, when using time-series data, the errors from a regression are not independent from each other. Instead, consecutive errors are correlated to each other. When this occurs, the coefficients are not affected (i.e., they are not biased), but the t-statistics are inflated. The presence of autocorrelation therefore makes some variables appear statistically significant when they are not. To correct for this, some of the equations have been corrected for serial autocorrelation and this will be noted by the presence of AR(1) among the list of variables.

Model Equations

Taxable Sales: Hotels and Motels (Category Bed25)

Figure 8 is a graph of taxable sales in hotels/motels in Pima County. The history of this series showed a strong upward trend, except for the period following 9/11 and the ensuing recession. Substantial numbers of hotel/motel beds had been built over the previous decade and expectations were that the hospitality industry would return to the trend line. It took a few years, but by 2006, deflated taxable sales returned to the long-term trend. But at the end of 2007, the national housing crises created a major recession that hit Arizona harder than most of the rest of the country. Real hotel/motel sales in Pima County have shown very weak recovery. Currently, deflated taxable sales in hotels/motels in Pima County are on par with deflated sales back in the mid-1990s.

Figure 8. Pima County Taxable Hotel/Motel Sales ($2016)



The equation for deflated Pima County hotel/motel sales uses the deflated US consumption of accommodation services a/nd a trend. The equation explains approximately 83 percent of the variation in hotel/motel sales. The US consumption variable has the expected positive sign and is very significant in explaining the variation in the dependent variable.

Dependent Variable: LOG(P_TXS_BED25CBFY/CPIFY)
Method: Least Squares
Date: 02/14/17 Time: 15:02
Sample: 1987 2016
Included observations: 30
Convergence achieved after 8 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11.13359	2.465657	4.515466	0.0001
LOG(CSVACFY/CPIFY)	0.933992	0.281560	3.317209	0.0027
1/NPFY	1290.594	538.1013	2.398422	0.0239
AR(1)	0.832132	0.079567	10.45821	0.0000

R-squared	0.827766	Mean dependent var	18.75993
Adjusted R-squared	0.807892	S.D. dependent var	0.138495
S.E. of regression	0.060703	Akaike info criterion	-2.642095
Sum squared resid	0.095805	Schwarz criterion	-2.455269
Log likelihood	43.63143	Hannan-Quinn criter.	-2.582328
F-statistic	41.65237	Durbin-Watson stat	1.701556
Prob(F-statistic)	0.000000		

Inverted AR Roots	.83

CSVACFY = US personal consumption expenditures on accommodations, fiscal year
CPIFY – consumer price index, fiscal year
NPFY = US population, fiscal year

Taxable Sales: Communications (Category COM5)

Taxable sales in communications was estimated as a function of a nationally forecasted variable for communications sales, adjusted for Pima County disposable personal relative to the US disposable income. The equation explains 96 percent of the variation in the logarithm of taxable sales in communications. The estimated elasticity is 1.0, indicating that taxable sales in communications grow at the same rate as the national variable, adjusted for relative income.

Dependent Variable: LOG((P_TXS_COM5CBFY))
Method: Least Squares
Date: 02/13/17 Time: 12:45
Sample: 1986 2015
Included observations: 30
Convergence achieved after 4 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.85420	0.391200	35.41459	0.0000
LOG(P_YPD(-1)*CSVOCTFY(-1)/YPDFY(-1))	1.003221	0.069941	14.34378	0.0000
AR(1)	0.385643	0.190475	2.024641	0.0529

R-squared	0.955708	Mean dependent var	19.42184
Adjusted R-squared	0.952427	S.D. dependent var	0.499762
S.E. of regression	0.109004	Akaike info criterion	-1.500220
Sum squared resid	0.320812	Schwarz criterion	-1.360101
Log likelihood	25.50331	Hannan-Quinn criter.	-1.455395
F-statistic	291.2954	Durbin-Watson stat	1.713343
Prob(F-statistic)	0.000000		

Inverted AR Roots	.39

CSVOCT_0FY(-1) = U.S. fiscal consumption of telecommunication services lagged one year
P_YPD = Pima County disposable personal income
YPDFY = US disposable personal income

Taxable Sales: Contracting (Category CON15)

The equation for contracting is driven by national fixed investment in residential structures. The dependent variable, specified as a logarithm, is Pima County's taxable sales in contracting, adjusted for inflation. The national figures are adjusted to correspond to the relative size of Pima County's economy. The elasticity on the national investment variable is 0.61, meaning we are trailing behind the growth in this national variable when that variable is adjusted for relative population size.

Dependent Variable: LOG(P_TXS_CON15CBFY)
Method: Least Squares
Date: 02/13/17 Time: 12:45
Sample: 1987 2015
Included observations: 29
Convergence achieved after 7 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.960178	0.953398	10.44703	0.0000
LOG(P_YPDFY/YPDFY)	2.531205	0.741549	3.413405	0.0022
LOG((P_POPFY/NPFY)*(IFRES(-1)))	0.613548	0.101253	6.059563	0.0000
AR(1)	0.492635	0.173339	2.842027	0.0088

R-squared	0.972057	Mean dependent var	20.90077
Adjusted R-squared	0.968704	S.D. dependent var	0.431213
S.E. of regression	0.076284	Akaike info criterion	-2.181263
Sum squared resid	0.145481	Schwarz criterion	-1.992671
Log likelihood	35.62832	Hannan-Quinn criter.	-2.122198
F-statistic	289.8974	Durbin-Watson stat	1.391297
Prob(F-statistic)	0.000000		

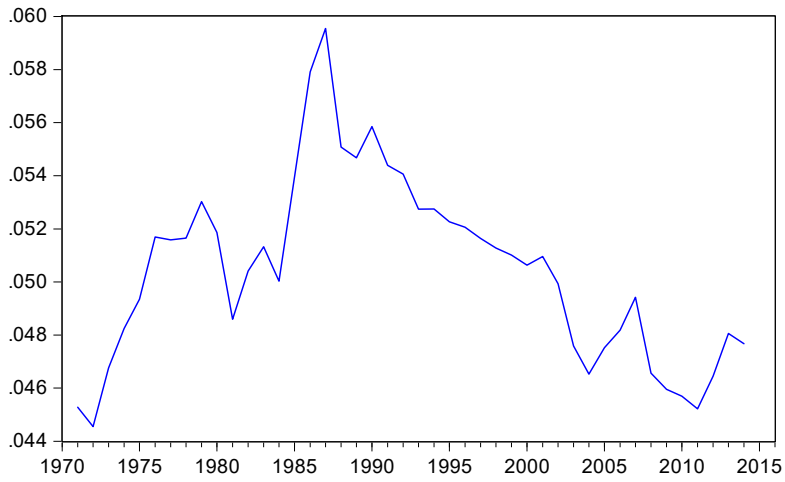
Inverted AR Roots	.49

P_YPDFY = Pima County disposable personal income, fiscal year
YPD_0FY = US disposable personal income, fiscal yer
P_POPFY = Pima County population, fiscal year
NPFY = US population, fiscal year
IFRES = U.S. fixed investment in residential structures

Taxable Sales: Restaurant and Bars (Category RB11)

Pima County's taxable sales in restaurant and bars, relative to disposable income, have declined steadily since the mid-1980s (Figure 9). This category is modelled using U.S. consumption of food away from home, CSVF, adjusted by dividing by U.S. disposable personal income and multiplying by Pima County's disposable personal income. A second variable is the relative Pima County to US shares of income that is transfer payments. This variable controls for differences in the characteristics of income, which can affect consumption patterns.

Figure 9. Pima County Taxable Sales in Restaurants and Bars Relative to Personal Income



The regression explains over 99 percent of the variation over time in Pima County's taxable restaurant and bar sales. The sign on the ratio of transfer payment share of income is negative, as expected, since a relatively high share of income in transfer payments reflects an economy that may be performing below potential.

Dependent Variable: LOG(P_TXS_RB11CBFY)
Method: Least Squares
Date: 02/13/17 Time: 12:45
Sample: 1986 2015
Included observations: 30
Convergence achieved after 4 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.55083	0.193791	69.92505	0.0000
LOG(P_YPDFY/YPDFY*CSVFFY)	1.072362	0.032903	32.59164	0.0000
LOG((P_YTPFY/P_YPFY)/(YPTRFFY/YPFY))	-0.970256	0.177335	-5.471306	0.0000
AR(1)	0.400196	0.170977	2.340637	0.0272

R-squared	0.997911	Mean dependent var	20.63952
Adjusted R-squared	0.997670	S.D. dependent var	0.421127
S.E. of regression	0.020327	Akaike info criterion	-4.830179
Sum squared resid	0.010743	Schwarz criterion	-4.643353
Log likelihood	76.45269	Hannan-Quinn criter.	-4.770412
F-statistic	4140.516	Durbin-Watson stat	1.253457
Prob(F-statistic)	0.000000		

Inverted AR Roots	.40

P_YPDFY = Pima County disposable personal income, fiscal year
YPDFY = U.S. disposable personal income, fiscal year
CSVF_0FY = U.S. consumer expenditures on food services
P_YPTFY = Pima County transfer payments, fiscal year
P_YPFY = Pima County personal income, fiscal year
YPTRFFY = U.S. transfer payments, fiscal year
YPFY = U.S. personal income, fiscal year

Taxable Sales: Personal Rentals (Category RE14)

The largest component of this category is automobile leasing. Taxable sales in personal rentals in Pima County are run off a similar national variable CSVTSMV, personal consumption expenditures on motor vehicle services. This national variable was adjusted by dividing U.S. disposable personal income and multiplying by Pima County disposable income. The specification also includes Pima County contracting sales because of the use heavy vehicle rentals by construction firms.

The set of single-year dummies are all zeros with a one in the year designated in the name. Data in the time period 1998 through 2004 could not be explained with any of the logical national or county-specific variables. Rather than truncating the equation by cutting off all the observations prior to 2004, six years of data were essentially removed from the regression through the use of a set of dummy variables. In addition, the deepest part of the recession (2009-2011) was removed using dummy variables because inclusion of those years biased the elasticities on the equation variables upward.

Dependent Variable: P_TXS_RE14CBFY
Method: Least Squares
Date: 02/14/17 Time: 15:02
Sample: 1988 2015
Included observations: 28
Convergence achieved after 38 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	93732091	38091370	2.460717	0.0265
CSVTSMVFY*P_YPDFY/YPDFY	390188.6	89203.84	4.374123	0.0005
P_TXS_CON15CBFY	0.048062	0.020818	2.308646	0.0356
D_SPIKE_1998	20024337	17667821	1.133379	0.2748
D_SPIKE_1999	43848024	22640985	1.936666	0.0719
D_SPIKE_2000	61272094	24475981	2.503356	0.0243
D_SPIKE_2001	72159250	23624628	3.054408	0.0080
D_SPIKE_2002	96100041	20736740	4.634289	0.0003
D_SPIKE_2003	84779375	15874438	5.340622	0.0001
D_SPIKE_2009	-31525368	14924051	-2.112387	0.0518
D_SPIKE_2010	-27706071	18998727	-1.458312	0.1654
D_SPIKE_2011	-20962491	15294418	-1.370598	0.1907
AR(1)	0.730582	0.252573	2.892555	0.0112

R-squared	0.983975	Mean dependent var	3.43E+08
Adjusted R-squared	0.971154	S.D. dependent var	89010153
S.E. of regression	15117538	Akaike info criterion	36.20503
Sum squared resid	3.43E+15	Schwarz criterion	36.82355
Log likelihood	-493.8704	Hannan-Quinn criter.	36.39412
F-statistic	76.75088	Durbin-Watson stat	1.475114
Prob(F-statistic)	0.000000		

Inverted AR Roots	.73

CSVTSMVFY = U.S. personal consumption expenditures on motor vehicle services
P_YPDFY = Pima County disposable personal income
YPDFY = U.S. disposable personal income
PASAIRFY = passengers through Tucson International Airport, fiscal year
P_TXS_CON15CBFR = Pima taxable sales in contracting, collection basis, fiscal year
D_SPIKE_yyyy is a dummy variable that is 1 in yyyy and 0 otherwise

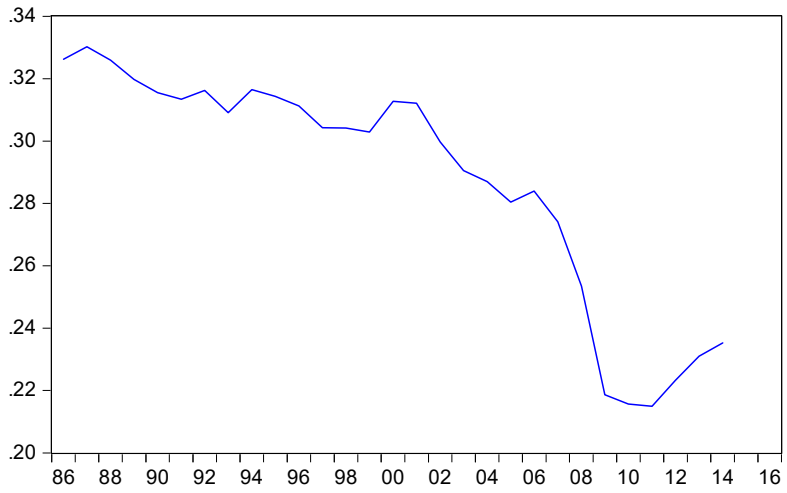
Taxable Sales: Retail Sales (Category RS17)

Sales of food for home consumption were exempted from the retail sales tax in 1980, so the entire series used in estimation excludes food. In Arizona, taxable retail sales figures also exclude services so this tax base is comprised primarily of goods purchased locally. This has always been the largest of all the sales tax categories, but it is diminishing as a share of personal income (Figure 10). The data shown in Figure 10 are the ratio of Pima County's fiscal-year taxable sales in retail sales, on a collection basis, divided by disposable personal income.

This graph shows that in 1986, Pima County's taxable retail sales were approximately 33 percent of disposable personal income, but by 2009, this share had fallen to just a little over 21 percent of income. It has been diminishing through the entire period shown, but starting in 2000 and particularly since 2006, the downward trend became much steeper. The low point in this series occurred in FY2011. Between FY2011 and FY2014, this ratio has grown 9 percent, or about 3 percent per year. Thus, as a share of income, retail sales has been growing. However, based on the long-run trends in this ratio, it will not return to pre-Great Recession levels.

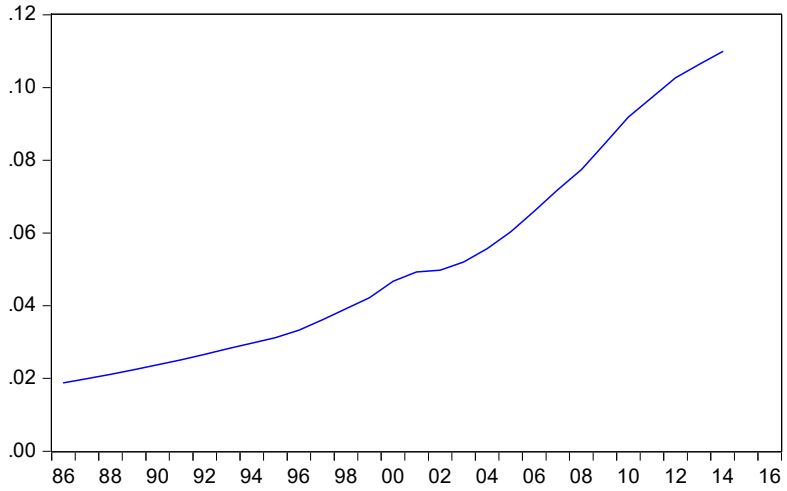
As discussed in the introduction, one reason for the downward decline in this ratio is the national trend away from goods to services, but that only explained a portion of the decline in the total tax base. Similarly, the national shift from goods to services only explains a little more than half of the decline in retail sales relative to income.

Figure 10. Taxable Sales in Retailing in Pima County Relative to Disposable Income



Online sales diminish the sales of in-county brick and mortar businesses. A data series was derived from the US Census Bureau's Annual Survey of Retail Trade. Online sales were divided by US retail categories that are taxable in Arizona and this ratio is shown in Figure 11. A portion of the online sales would be taxed if those online purchases were from stores that have a legal nexus to the county. Specifically, online purchases from stores like Best Buy, Home Depot, Macy's would all charge state and local sales taxes as though those purchases were made locally in the stores. So the RTA loses online purchases from totally out-of-area businesses, e.g., LLBean, Zappos.com, which would not be charged the local ½ percent sales tax that would go to the RTA.

Figure 11. U.S. Online Sales as a Share of Total U.S. Retailing (Arizona Definition)



The final equation specification has the taxable retail sales (as the logarithm) as the left-hand side variable. This is estimated as a function of the US personal consumption of goods, adjusted for Pima County to US relative disposable income. The ONLINESALESNEWFY variable is to control for the growth in non-taxable online retail sales. The trough years of the recession were removed from the regression by including dummy variables for FY2009, 10, and 11. Leaving these years in the regression would have biased the coefficient on the goods variable upward. This equation explains 98 percent of the variation in the dependent variable.

Dependent Variable: P_TXS_RS17LFCBFY/P_YPDFY
Method: Least Squares
Date: 02/14/17 Time: 15:02
Sample (adjusted): 1986 2015
Included observations: 30 after adjustments
Convergence achieved after 12 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	135452.4	101250.3	1.337798	0.1940
CGOODSFY/YPDFY	601509.2	292940.1	2.053352	0.0516
ONLINESALESNEWFY	-758941.5	187634.7	-4.044781	0.0005
D_SPIKE_2009	-16938.44	7989.931	-2.119973	0.0450
D_SPIKE_2010	-15391.68	7742.459	-1.987957	0.0588
D_SPIKE_2011	-13611.43	6131.436	-2.219942	0.0366
AR(1)	0.780367	0.138360	5.640126	0.0000

R-squared	0.978511	Mean dependent var	285873.6
Adjusted R-squared	0.972905	S.D. dependent var	38054.21
S.E. of regression	6263.916	Akaike info criterion	20.52396
Sum squared resid	9.02E+08	Schwarz criterion	20.85091
Log likelihood	-300.8594	Hannan-Quinn criter.	20.62856
F-statistic	174.5525	Durbin-Watson stat	1.651750
Prob(F-statistic)	0.000000		

Inverted AR Roots	.78

ONLINESALESNEWFY = the ratio of total retail sales (including on-line sales) to retail sales without on-line sales
YPDFY = US disposable personal income
P_YPDFY = Pima County disposable personal income
CGOODSFY = US consumption of goods
NPFY = US population, fiscal year

Taxable Sales: Utilities (Category UT4)

Utility sales as a share of personal income has fallen dramatically since the energy-price induced hyper-inflation period of the late 1970s/early 1980s. Since then, Pima County utility sales, relative to disposable personal income, has fallen steadily (Figure 12). This general decline is also seen in national deflated utility data, except for the period 2004 through 2006, which showed some growth (Figure 13).

Figure 12. Taxable Sales on Utilities in Pima County Divided by Disposable Personal Income

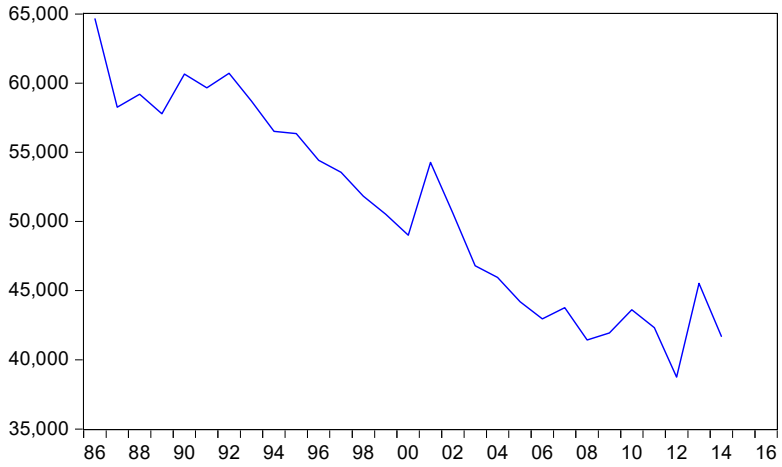
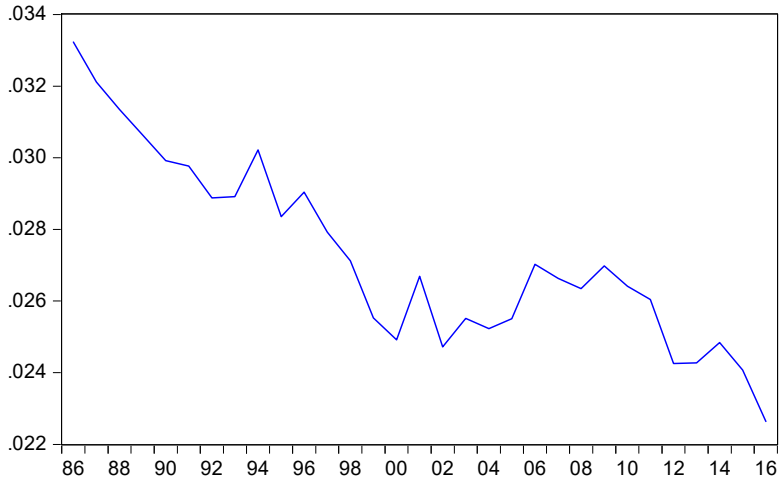


Figure 13. U.S. Utility Sales Divided by U.S. Disposable Personal Income



The equation explains 99 percent of the variation in logarithm of taxable utility sales. However, Pima County's utilities tax base is projected to grow considerably slower than the national variable, adjusted for relative population growth. The elasticity of 0.8 indicates that utility sales have grown approximately 80 percent as fast as the national variable.

Dependent Variable: LOG(P_TXS_UT4CBFY)
Method: Least Squares
Date: 02/14/17 Time: 15:02
Sample: 1986 2016
Included observations: 31
Convergence achieved after 4 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.00790	0.440414	22.72386	0.0000
LOG((CSVUFY/NPFY)*P_POPFY)	0.801831	0.033093	24.22956	0.0000
AR(1)	0.457340	0.171076	2.673312	0.0124

R-squared	0.986607	Mean dependent var	20.64463
Adjusted R-squared	0.985650	S.D. dependent var	0.352743
S.E. of regression	0.042256	Akaike info criterion	-3.398391
Sum squared resid	0.049995	Schwarz criterion	-3.259618
Log likelihood	55.67506	Hannan-Quinn criter.	-3.353154
F-statistic	1031.291	Durbin-Watson stat	2.100796
Prob(F-statistic)	0.000000		

Inverted AR Roots	.46

CSVUFY = U.S. Consumer expenditures on utility services, fiscal year
NPFY = U.S. population, fiscal year
P_POPFY = Pima county's population, fiscal year

Taxable Sales: Real Rentals (Category RE13) and Other

The tax on real rentals effectively was repealed at the state level because the state tax rate on this category is set to zero. The RTA taxes this category because the enabling legislation defined the categories as what existed in the state in a year prior to the repeal. Because no TXS time series exists for real rentals, the RTA revenue data is used. However, the RTA revenue data series is still too short to obtain an adequate equation for this category so it is projected by assuming it grows with population.

After all the above modeled TXS categories of the sales tax base are multiplied by the corresponding RTA tax rate and added to collections from real rentals (P_RTA_RE13CBF), the result is subtracted from total RTA revenues. The remainder is a residual that includes several very small categories of taxable sales (listed earlier in the report) and also includes various adjustments to control for other differences between the RTA and the TXS data series. The residual P_REVRES1CBF is forecast by assumption and is assumed to grow with population growth.

Total RTA Revenues

Total RTA revenues are computed using two identities that were reported in the introduction and are repeated here. The first adds together the modeled components that are taxable at ½ percent. The second multiplies this sum times 0.005, add the bed tax revenue and adds the estimated residual.

P_txs_modeledcbf5 = p_txs_rs17cbfr + p_txs_con15cbfr + p_txs_ut4cbfr + p_txs_rb11cbfr + p_txs_re14cbfr + p_txs_com5cbfr

After all the pieces are modeled, then forecasted total revenue is:

P_rta_totcb1f = p_txs_modeledcbf5 *0.005 + p_txs_bed25cbfr * 0.0055 + p_rta_re13cbf + p_revrescb1f

Forecasted Yield for RTA

Tables 1, 2, and 3 contain RTA forecasts for 5 years, 10 years, 20 years and 30 years for a Baseline Scenario, an Optimistic Scenario, and a Pessimistic Scenario. Global Insight's baseline, optimistic and pessimistic scenarios were used to drive both the Pima County Economic Model and the RTA Revenue Forecasting Model. The Baseline cumulative forecast is $415.6 million over the next five years, $907.6 million over the next 10 years, $2,153.9 million over the next 20 years and $3,898.7 million over the next 30 years.

The first five-year cumulative total is $415.6 million in the Baseline Scenario, $428.1 million in the Optimistic Scenario and $402.3 in the Pessimistic Scenario. These relative positions continue for the 10-year cumulative figures and the 20-year cumulative figures. However, for the 30-year cumulative figures, both the Optimistic and Pessimistic scenarios produce higher RTA revenues than the baseline. The reason for this is that Pessimistic scenarios frequently assume higher inflation rates. In Pessimistic scenarios, real economic measures, such as employment, are always below the baseline but forecasted variables measured in nominal dollars, such as revenues, are sometimes higher. It should be assumed that road construction costs and related financing costs will be higher in a high-inflation Pessimistic scenario.

Table 1

Projected Yield for RTA, Pima County (Thousands of Current Dollars): Baseline Scenario
Fiscal years 2017 through 2046, cumulative by 10-year intervals

	Actual				Cumulative Over Period			
	2013	2014	2015	2016	5 years 2017-2021	10 years 2017-2026	20 Years 2017-2036	30 years 2017-2046
Hotel/Motel	1,560	1,640	1,760	1,810	9,390	19,270	41,100	67,590
Communications	2,070	2,140	1,840	1,650	8,330	18,390	44,300	75,370
Contracting	7,240	7,450	6,420	4,630	31,710	74,160	182,650	337,980
Restaurant & Bar	7,750	7,950	8,460	8,810	52,120	118,240	295,410	552,390
Rental - Personal	1,890	1,920	2,110	2,040	11,630	24,900	57,100	104,950
Retail	37,310	38,710	40,630	42,180	228,120	494,670	1,171,830	2,130,470
Utilities	7,340	6,990	7,120	7,350	40,610	88,990	217,360	405,080
Other	5,220	5,810	5,490	6,570	33,700	69,010	144,190	224,820
Total	70,380	72,610	73,830	75,040	415,610	907,630	2,153,940	3,898,650

Source: Economic and Business Research Center, Eller College, University of Arizona
Updated 2-15-17

Table 2

Projected Yield for RTA, Pima County (Thousands of Current Dollars): Optimistic Scenario
Fiscal years 2017 through 2046, cumulative by 10-year intervals

	Actual				Cumulative Over Period			
					5 years	10 years	20 Years	30 years
	2013	2014	2015	2016	2017-2021	2017-2026	2017-2036	2017-2046
Hotel/Motel	1,560	1,640	1,760	1,810	9,390	19,260	41,070	67,550
Communications	2,070	2,140	1,840	1,650	8,670	20,180	53,320	99,300
Contracting	7,240	7,450	6,420	4,630	34,370	81,430	209,010	399,780
Restaurant & Bar	7,750	7,950	8,460	8,810	53,010	120,200	301,740	569,330
Rental - Personal	1,890	1,920	2,110	2,040	11,950	25,820	61,150	115,730
Retail	37,310	38,710	40,630	42,180	235,770	516,120	1,247,370	2,307,060
Utilities	7,340	6,990	7,120	7,350	40,930	90,000	221,600	416,840
Other	5,220	5,810	5,490	6,570	33,980	69,830	147,000	231,080
Total	70,380	72,610	73,830	75,040	428,070	942,840	2,282,260	4,206,670

Source: Economic and Business Research Center, Eller College, University of Arizona
Updated 2-15-17

Table 3

Projected Yield for RTA, Pima County (Thousands of Current Dollars): Pessimistic Scenario
Fiscal years 2017 through 2046, cumulative by 10-year intervals

	Actual				Cumulative Over Period			
					5 years	10 years	20 Years	30 years
	2013	2014	2015	2016	2017-2021	2017-2026	2017-2036	2017-2046
Hotel/Motel	1,560	1,640	1,760	1,810	9,400	19,310	41,300	68,250
Communications	2,070	2,140	1,840	1,650	7,370	15,860	36,150	51,560
Contracting	7,240	7,450	6,420	4,630	28,760	67,900	167,820	329,930
Restaurant & Bar	7,750	7,950	8,460	8,810	51,500	118,410	307,570	620,720
Rental - Personal	1,890	1,920	2,110	2,040	11,320	24,190	56,450	111,430
Retail	37,310	38,710	40,630	42,180	220,270	479,740	1,156,430	2,157,870
Utilities	7,340	6,990	7,120	7,350	40,280	88,130	214,130	396,270
Other	5,220	5,810	5,490	6,570	33,410	68,320	142,040	220,130
Total	70,380	72,610	73,830	75,040	402,310	881,860	2,121,890	3,956,160

Source: Economic and Business Research Center, Eller College, University of Arizona
Updated 2-15-17

Figures 14 and 15 present graphs of the level and annual percent changes of the projected RTA revenue Baseline Scenario, respectively. Annual revenues are expected to reach a high of a little over $200 million by 2045. The annual percent change is projected to be approximately 3.5 percent per year through most of the projection period.

Figure 14

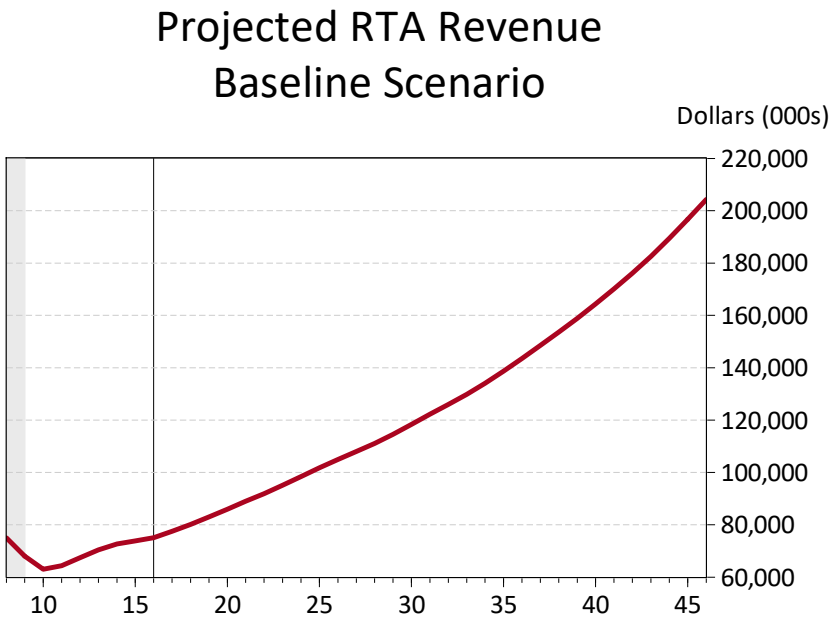
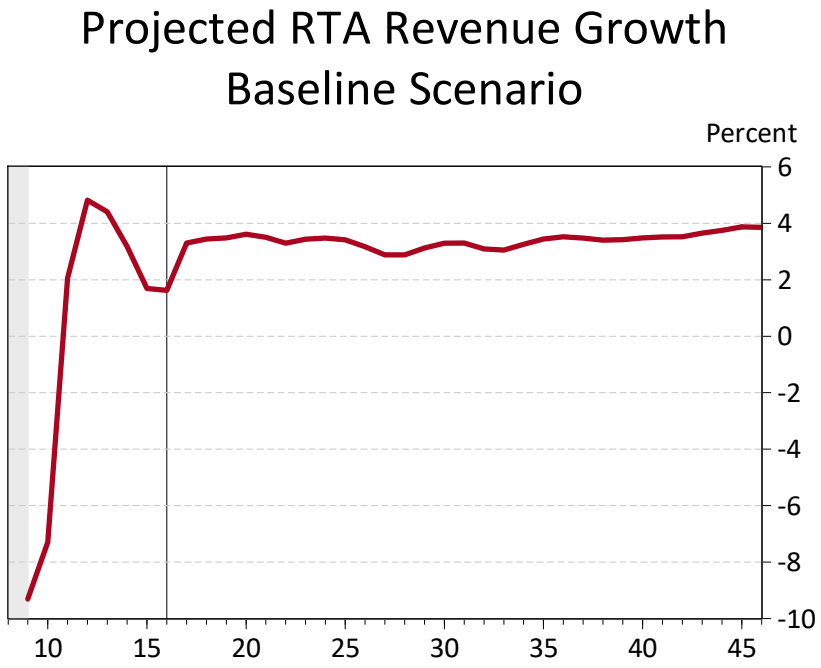


Figure 15



Figures 16 and 17 show the levels and percent change in the projected RTA revenues under the three scenarios – Baseline, Optimistic, and Pessimistic. As noted in the discussion of Tables 1-3, the optimistic scenario is consistently above the baseline. However, the pessimistic scenario starts out below the baseline and then cross it around 2033 and then is above. This is because of the high inflation rate built into the pessimistic scenario assumptions of the Global Insight forecasts.

Figure 16

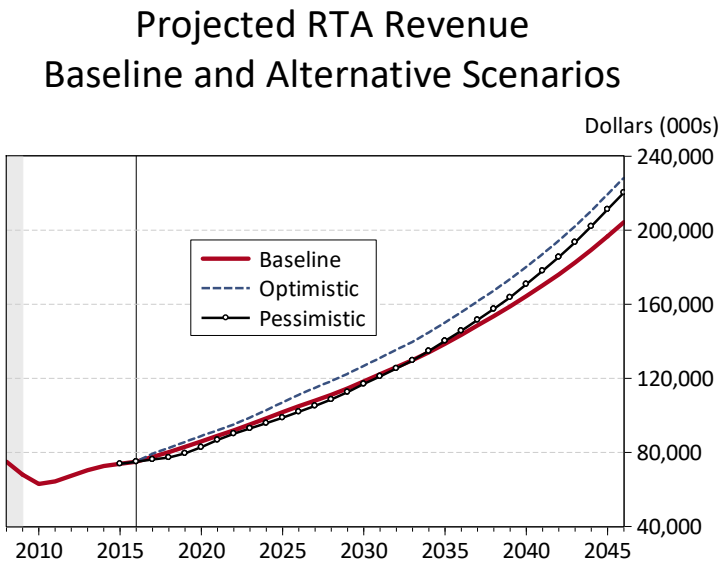
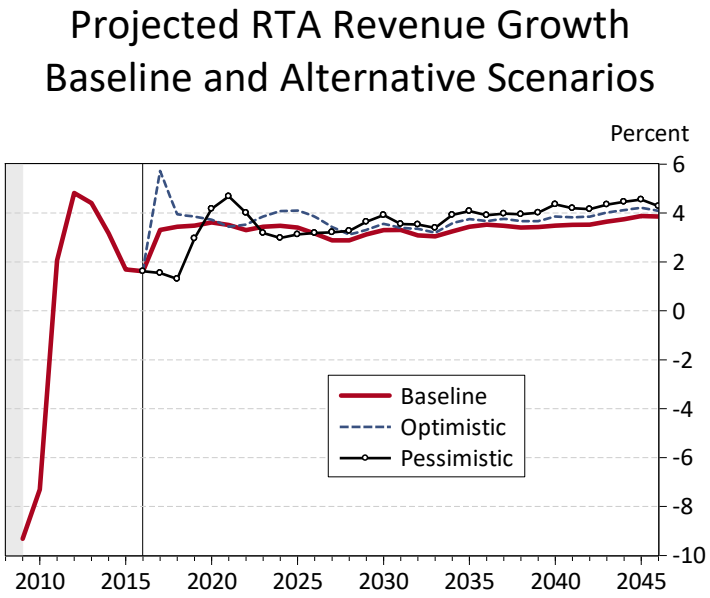


Figure 17



Figures 18 and 19 show inflation adjusted RTA revenues under the three scenarios. When revenues in the three scenarios are inflation-adjusted, the pessimistic scenario is substantially below and the optimistic scenario is substantially above the baseline. The growth rates of the inflation-adjusted revenues are different as well. The growth rate of the inflation-adjusted pessimistic scenario goes negative in several years of the forecast period.

Figure 18

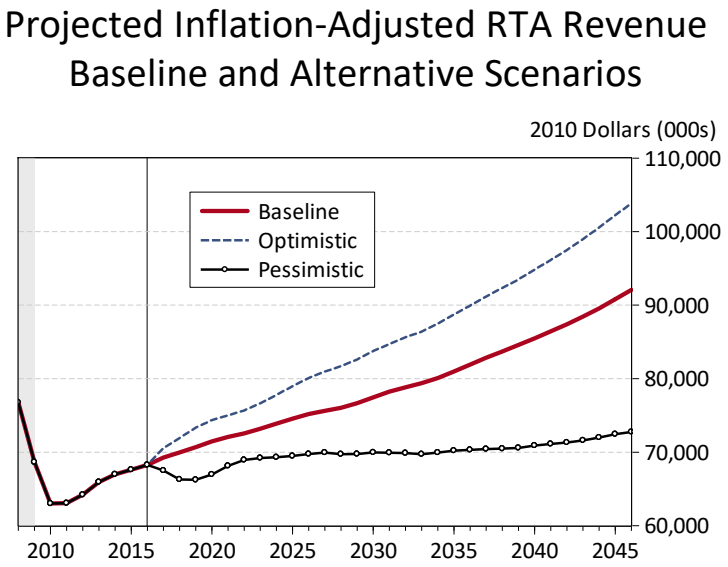


Figure 19