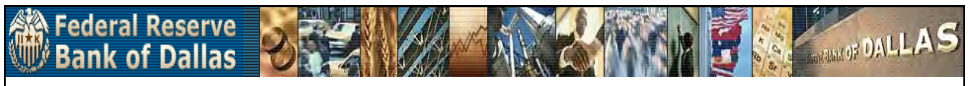


Estimating State Retail Sales
FTA Meetings

Keith Phillips

Texas Retail Sales

Monthly Texas Retail Sales

- Started production in mid-2000s – began formal production in October 2008
- Texas Comptroller of public accounts produces a quarterly retail series but its lack of timeliness sharply reduces it usefulness. We use this series as a benchmark to construct a timely monthly series.
- We adjust for a shift in 1997 from the U.S. (SIC) to the (NAICS) by adding in eating and drinking places.
- We distribute quarterly retail sales among the months in each quarter by using monthly sales tax rebates, retail employment and Texas CPI.

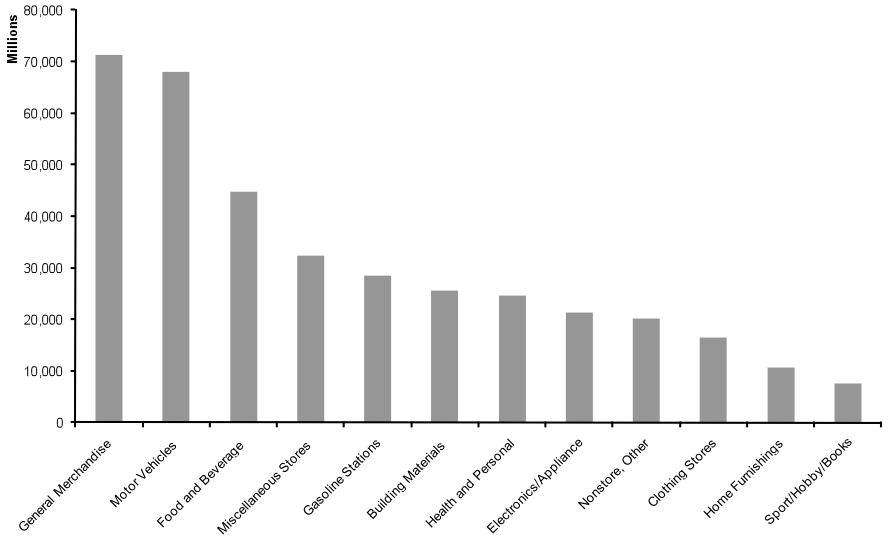
Statistical Technique and Data Description

- The process we use to distribute quarterly retail sales among the months in each quarter is best linear unbiased interpolation and extrapolation with autocorrelated errors by Gregory C. Chow and An-loh Lin
- The most direct measure is sales tax rebates from the state to cities
  - The rebates are a product of retail sales and tax rates. We take into account tax changes in largest 25 cities to make sure our measure reflects variations in taxable sales, not rates.
  - Rebates generally reflect sales with a two-month lag, so we adjust the data accordingly
- Texas CPI is the combined consumer price indexes for HOU and DAL-FWT.

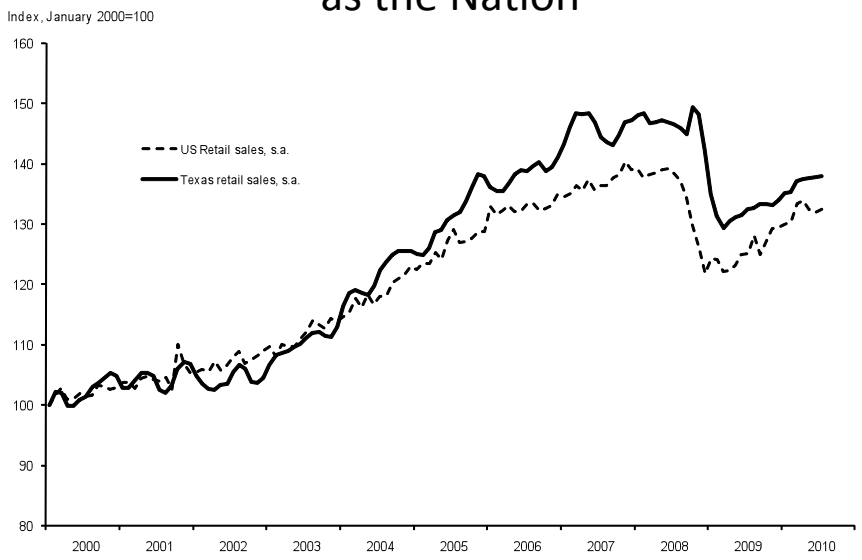
Benefits of Texas Retail Trade Series

- Our new measure fills a void that has existed since the Commerce Department ended its monthly estimates 12 years ago
- Up-to-date data are necessary to make better decisions in business and policymaking. As of mid-September, our monthly retail sales estimates were available through July, while the comptroller's quarterly series are available up to the last quarter of 2009.
- So far this year the data has been viewed on the Dallas Fed web site 1,688 times.
- Used internally for regional policy briefings.

General Merchandise, Autos Represent Largest Share of Texas Retail Sales



Texas Retail Sales has Followed a Similar Pattern as the Nation



SOURCE: Census Bureau for US retail sales; Authors' calculations for Texas monthly retail sales

Estimating Retail Sales for Other States

- No retail sales benchmark for other states
- Have retail tax collections and tax rate changes for many states (from Ron Alt)- start with 16 states (AZ CA CO FL IA ME MI NJ NY OH PA VA WA WI TX MA)
- Use changes in tax-rate adjusted retail tax collections to estimate retail sales
- Use modeling to estimate underlying trend-cycle movements for analysis and forecasting (Alan)

Calculating Taxable Retail Sales

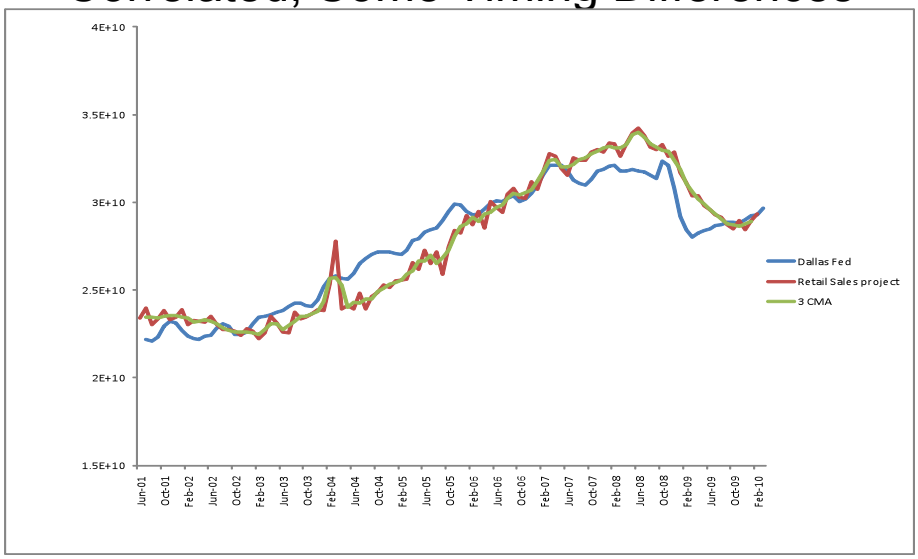
$$\frac{\text{Retail Sales tax collections}}{\text{retail sales tax rate}} = \text{retail sales}$$

- Sales Tax rates documented January each year
  - found month changed using Fiscal Survey of the States Report (and the internet)
- Rate changes instituted one month after change takes effect

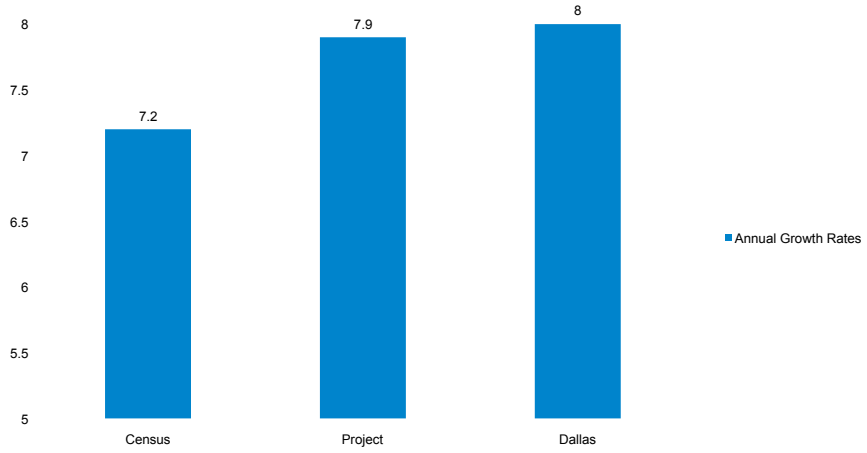
How Do We Know if Our Procedure is Useful?

- Very difficult to judge
- Two rough guidelines
  - Dallas Fed estimates for TX vs. our estimates - should be close
  - Change in Census of Retail between 2002 and 2007 – good data but only one observation

Texas Retail Sales Estimates Are Correlated, Some Timing Differences

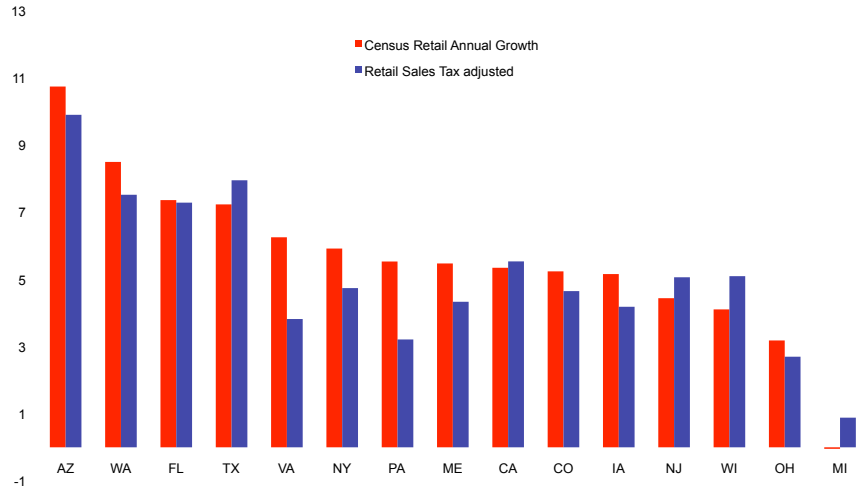


Both Texas Retail Estimates Close to Growth in Census 2002-2007



Census Check for Other States

Our Retail Growth Estimates Close to Census, 2002-2007



Notes:

- Correlation of two growth rates across states is .9
- Census growth rates larger most (70%) of the time
- Pennsylvania and Virginia are the most off
  - Base rate decreased for Virginia during the time period

Summary

- Project to estimate retail sales for states shows some promise
  - Texas Series Similar to Dallas Fed (Comptroller's) Retail Sales Estimates
  - Five-year growth rate close to Census
- Still have work to do
  - Tax revenues not adjusted for base changes

Structural Analysis of State Retail Sales Revenues

Alan Clayton-Matthews
Northeastern University

Decomposition of a Time Series

$y = tr + s + ir$

Where the time series is in log form, and

- tr : is a trend component;
- s : is a seasonal component; and
- ir: is an irregular component.

Each component can be modeled.

The series is modeled as a state space system and estimated using a Kalman filter with maximum likelihood.

How These Series Are Modeled

The trend is modeled as a local linear trend (a random walk with a random-walk drift):

tr ≡ $\mu_t = \mu_{t-1} + v_{t-1} + \xi_t$,

where the drift, v_t, is a random walk:

$v_t = v_{t-1} + \zeta_t$,

and ξ_t and ζ_t are independent white noise series.

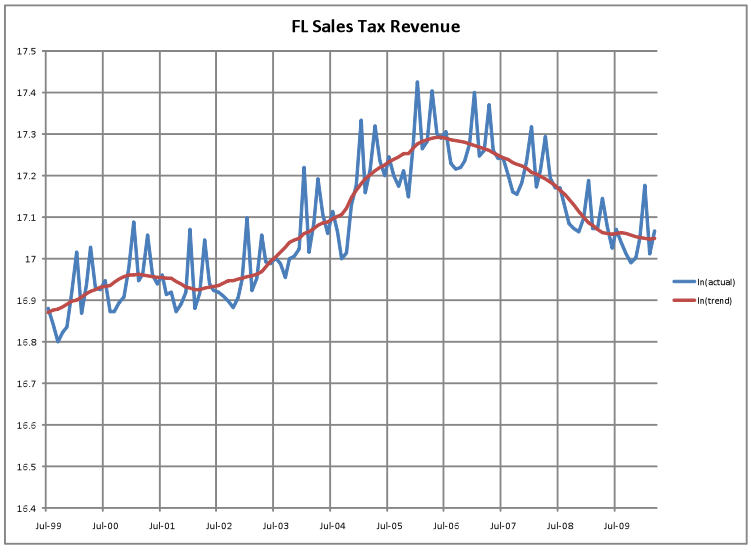
The seasonal, s_t, is allowed to evolve over time:

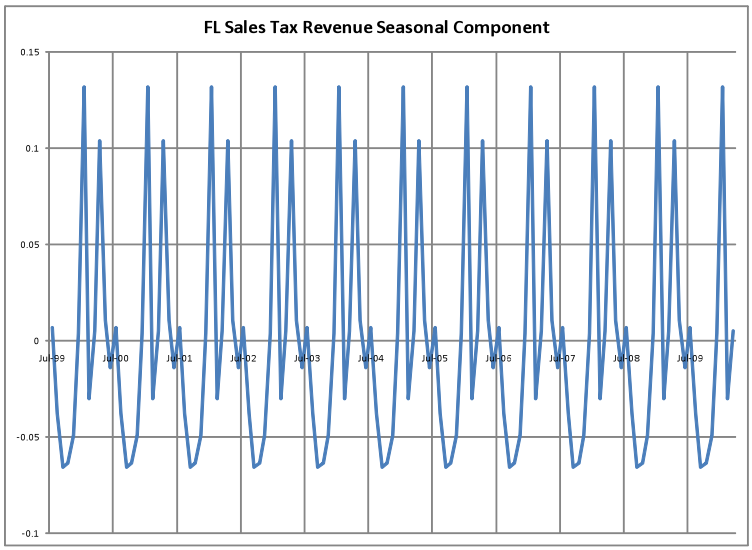
$\sum_{k=0}^{11} s_{t-k} = \omega_t$, where ω_t is a white noise series.

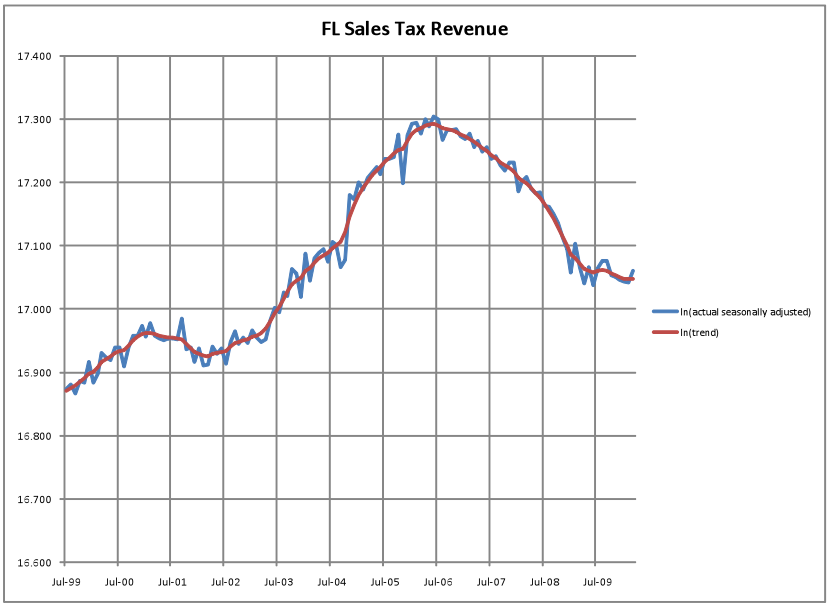
The irregular term, ir_t, is a white noise series.

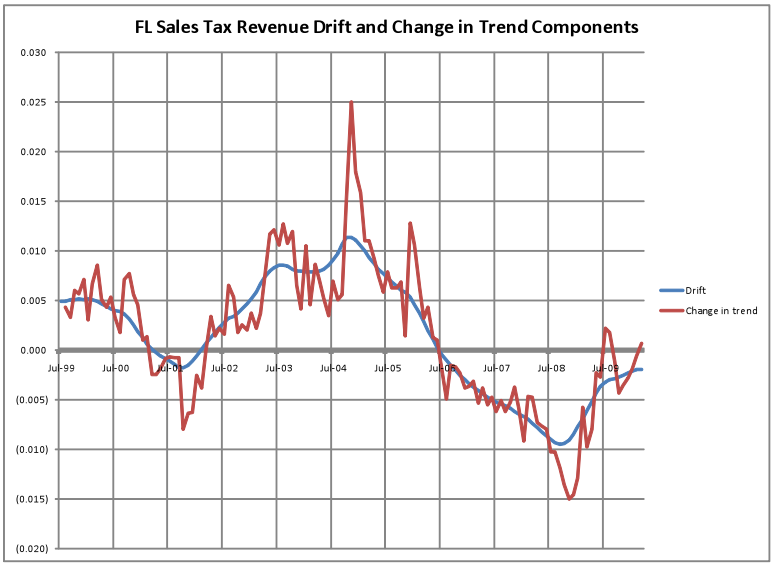
All the white noise series, ξ_t, ζ_t, ω_t, and ir_t, are independent of one another.

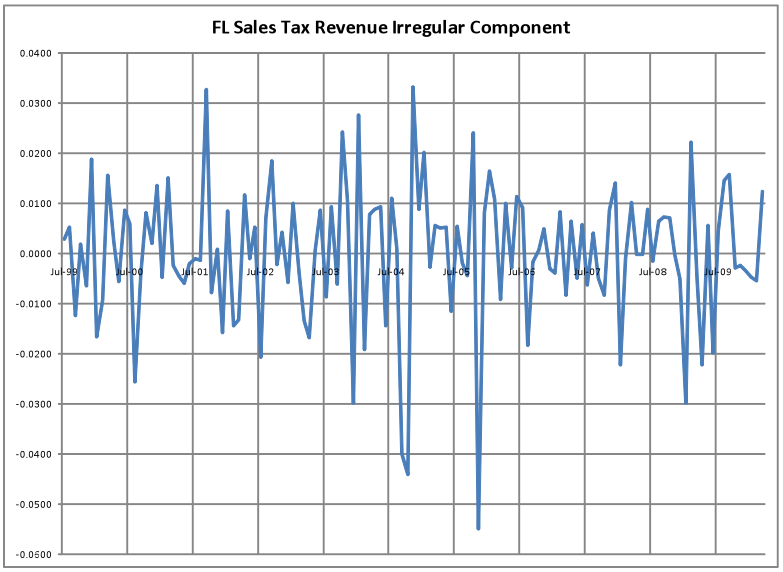
An Example, Florida




FL Sales Tax Revenue Seasonal Component
0.15
0.1
0.05
0
-0.05
-0.1
Jul-99
Jul-00
Jul-01
Jul-02
Jul-03
Jul-04
Jul-05
Jul-06
Jul-07
Jul-08
Jul-09


FL Sales Tax Revenue
17.400
17.300
17.200
17.100
17.000
16.900
16.800
16.700
16.600
Jul-99
Jul-00
Jul-01
Jul-02
Jul-03
Jul-04
Jul-05
Jul-06
Jul-07
Jul-08
Jul-09
ln(actual seasonally adjusted)
ln(trend)


FL Sales Tax Revenue Drift and Change in Trend Components
0.030
0.025
0.020
0.015
0.010
0.005
0.000
(0.005)
(0.010)
(0.015)
(0.020)
Jul-99
Jul-00
Jul-01
Jul-02
Jul-03
Jul-04
Jul-05
Jul-06
Jul-07
Jul-08
Jul-09
Drift
Change in trend


FL Sales Tax Revenue Irregular Component
0.0400
0.0300
0.0200
0.0100
0.0000
-0.0100
-0.0200
-0.0300
-0.0400
-0.0500
-0.0600
Jul-99
Jul-00
Jul-01
Jul-02
Jul-03
Jul-04
Jul-05
Jul-06
Jul-07
Jul-08
Jul-09

Using the Components to Estimate or Forecast Retail Sales

- The seasonally-adjusted component or the trend component can be used to estimate the current month (or quarter), depending on the amount of noise that can be tolerated.
- The model can be used for a simple short-term forecast.

Extensions of the Model

The model can be extended in several ways:

- Components can be modeled in a flexible manner, for example, the irregular term can be modeled as an ARMA process.
- Outliers can be ignored – treated as missing – or can be "dummied out".
- Dummy variables can be used to control for changes in tax law.
- Explanatory variables can be used to model the trend; and can also be used as a basis for prediction.
- Other tax components and economic indicators – for example, withholding taxes and payroll employment – can be combined with sales taxes to form an index of the state of the economy.