

How to Predict the Future And Forecast Sales Taxes

Doug Macdonald

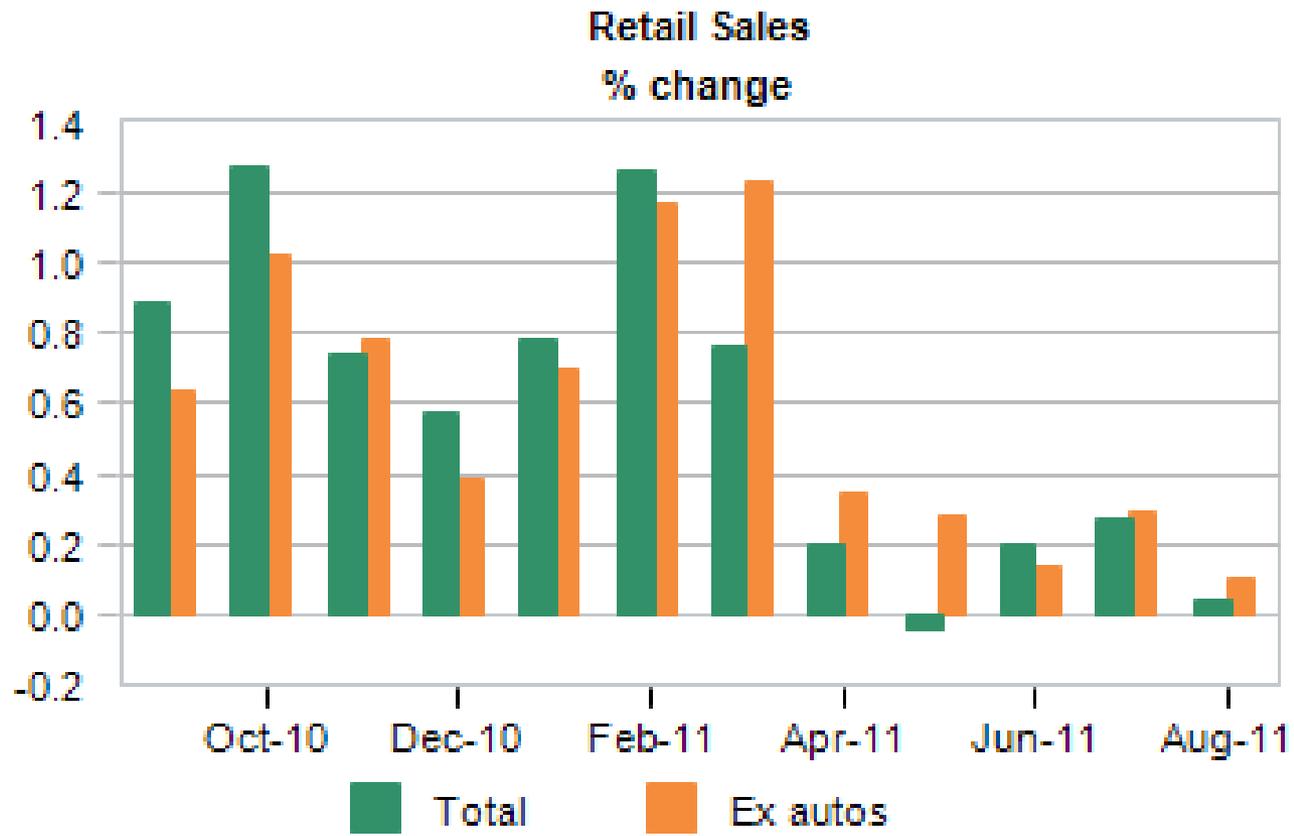
Economic Policy Analyst

Utah League of Cities and Towns

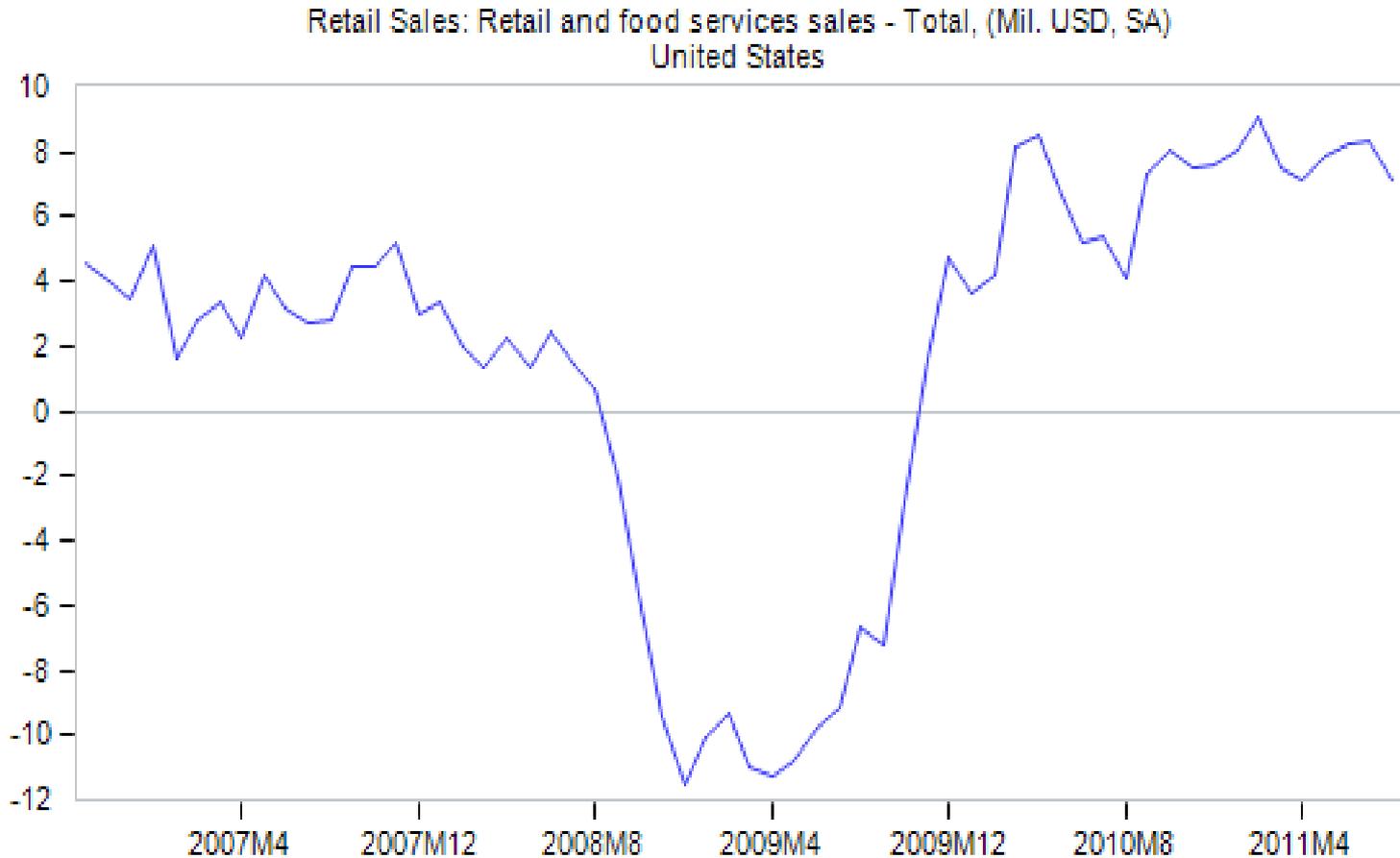
Economists are Evolving



Retail Sales Flat in August



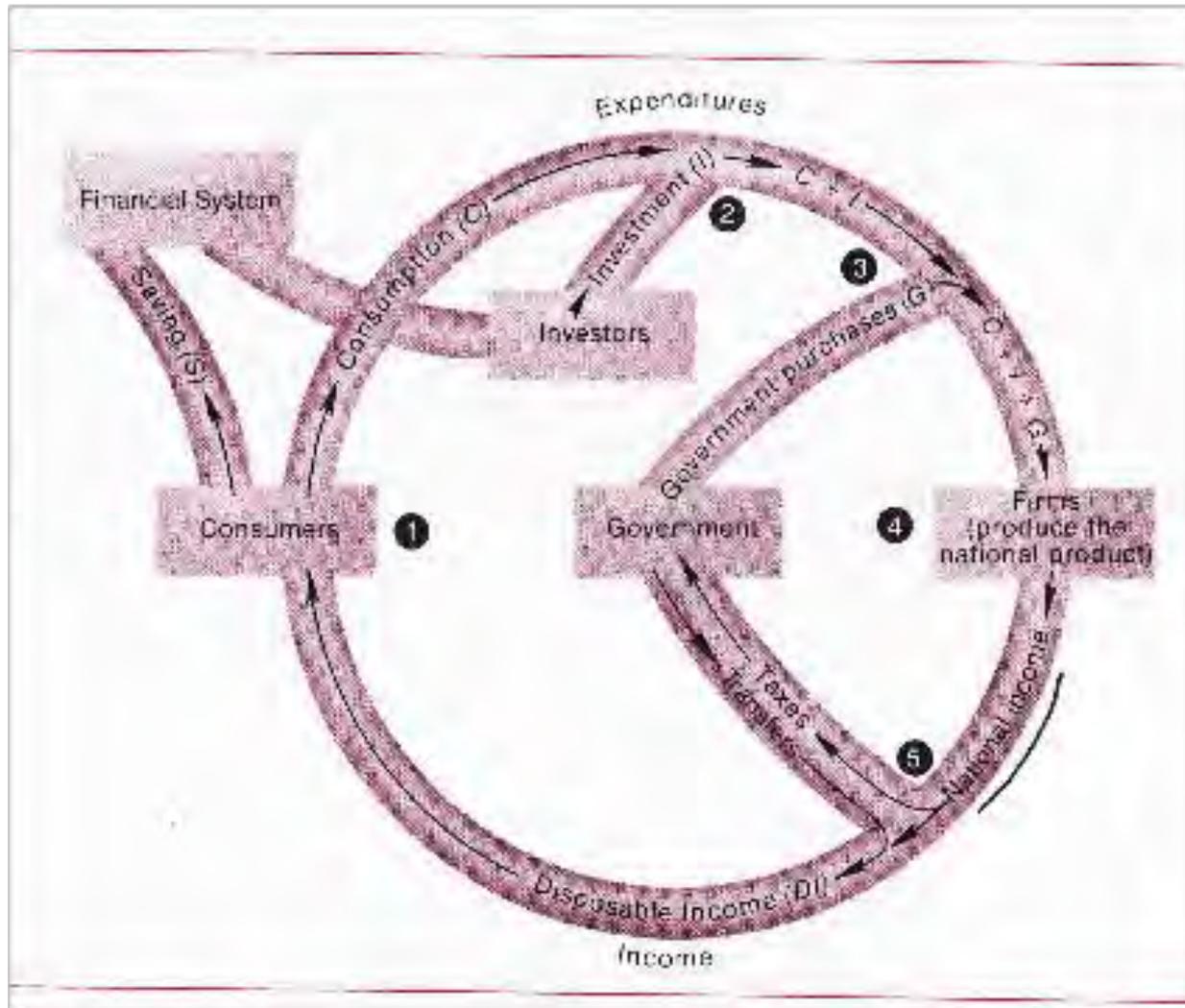
But Compared to Last Year Still Up 7%



http://abc.go.com/shows/jimmy-kimmel-live/video-detail/featured/republican-debate-promo/pl_PL5520977/vd_VD55142095

$$\begin{aligned} \text{GDP} &= \text{Consumption} \\ &+ \text{Investment} \\ &+ \text{Government} \\ &+ \text{Net EXports} \end{aligned}$$

Why the Stock Market is Just One Factor to Watch in the Economy



Taxable Sales = Consumption

+ Investment

~~+ Government~~

~~+ Net Exports~~

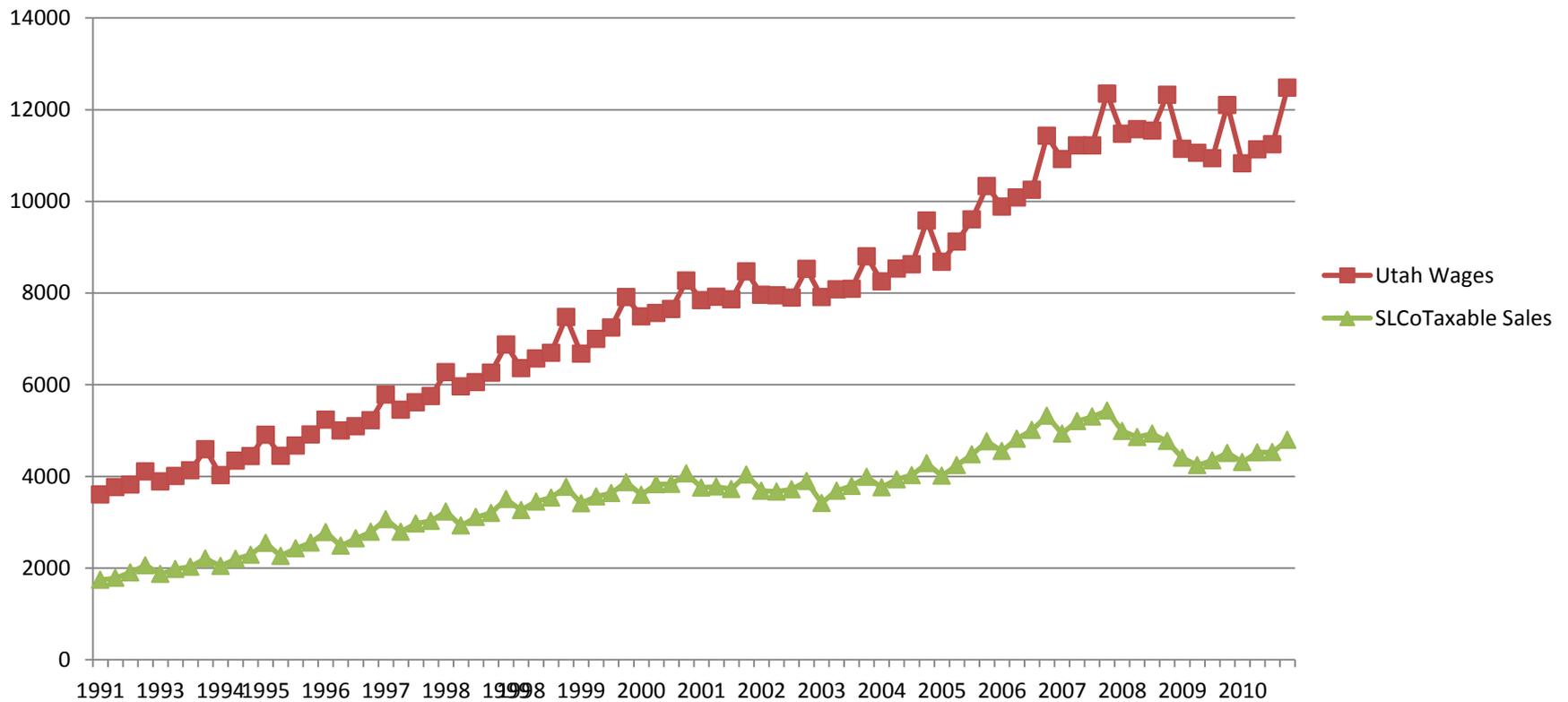
state law = “tangible personal property” plus certain services

CONSUMPTION depends on:

- 1) **Consumer Income** (wages, salaries, business income, transfers) **(up)**
- 2) **Population** **(up)**
- 3) **Prices and availability of goods** **(up)**
- 4) **Tastes**
- 5) **Consumer Confidence** **(down)**

Taxable Sales v. Wages

Correlation $\geq 90\%$



Taxable Sales = Consumption

+ Investment

~~+ Government~~

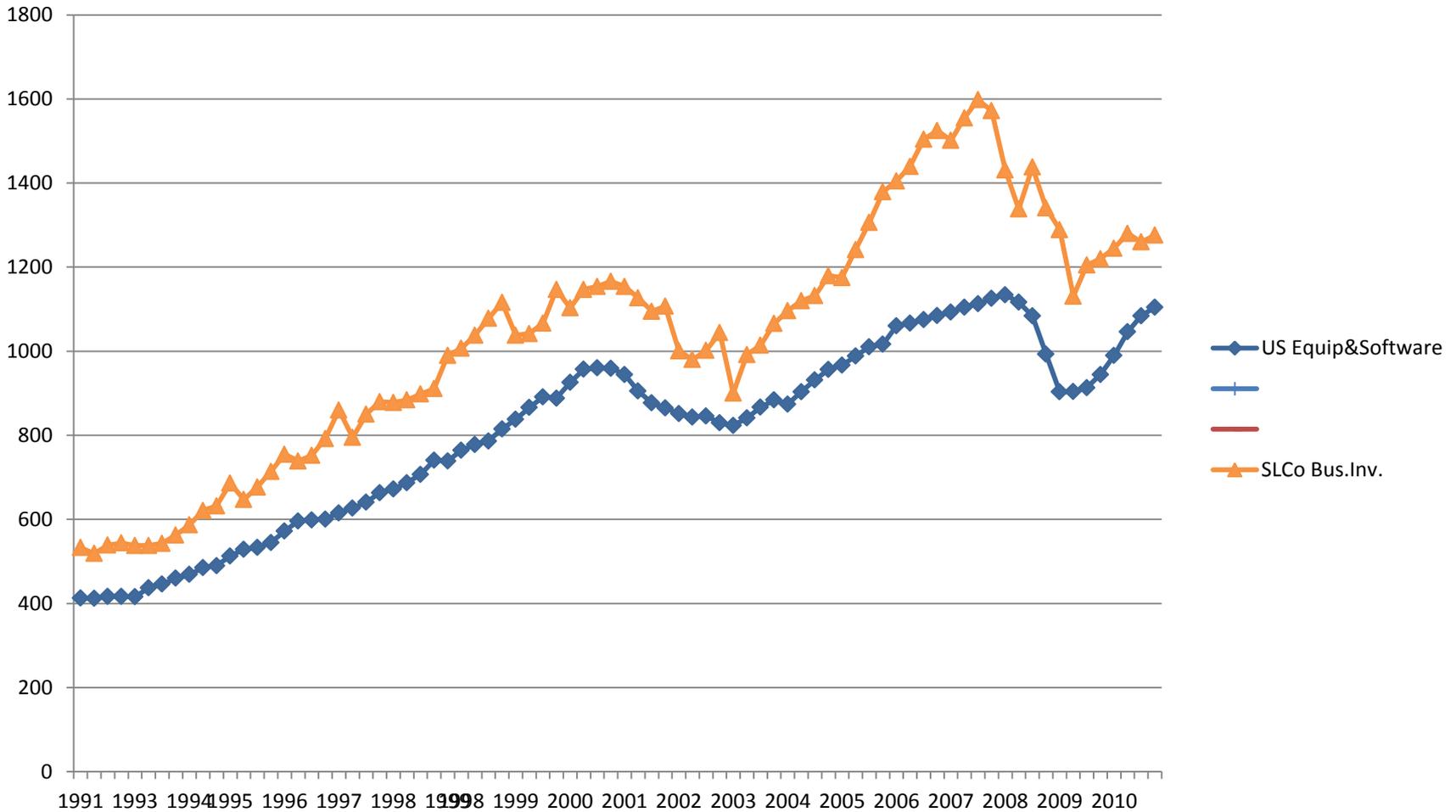
~~+ Net Exports~~

state law = “tangible personal property” plus certain services

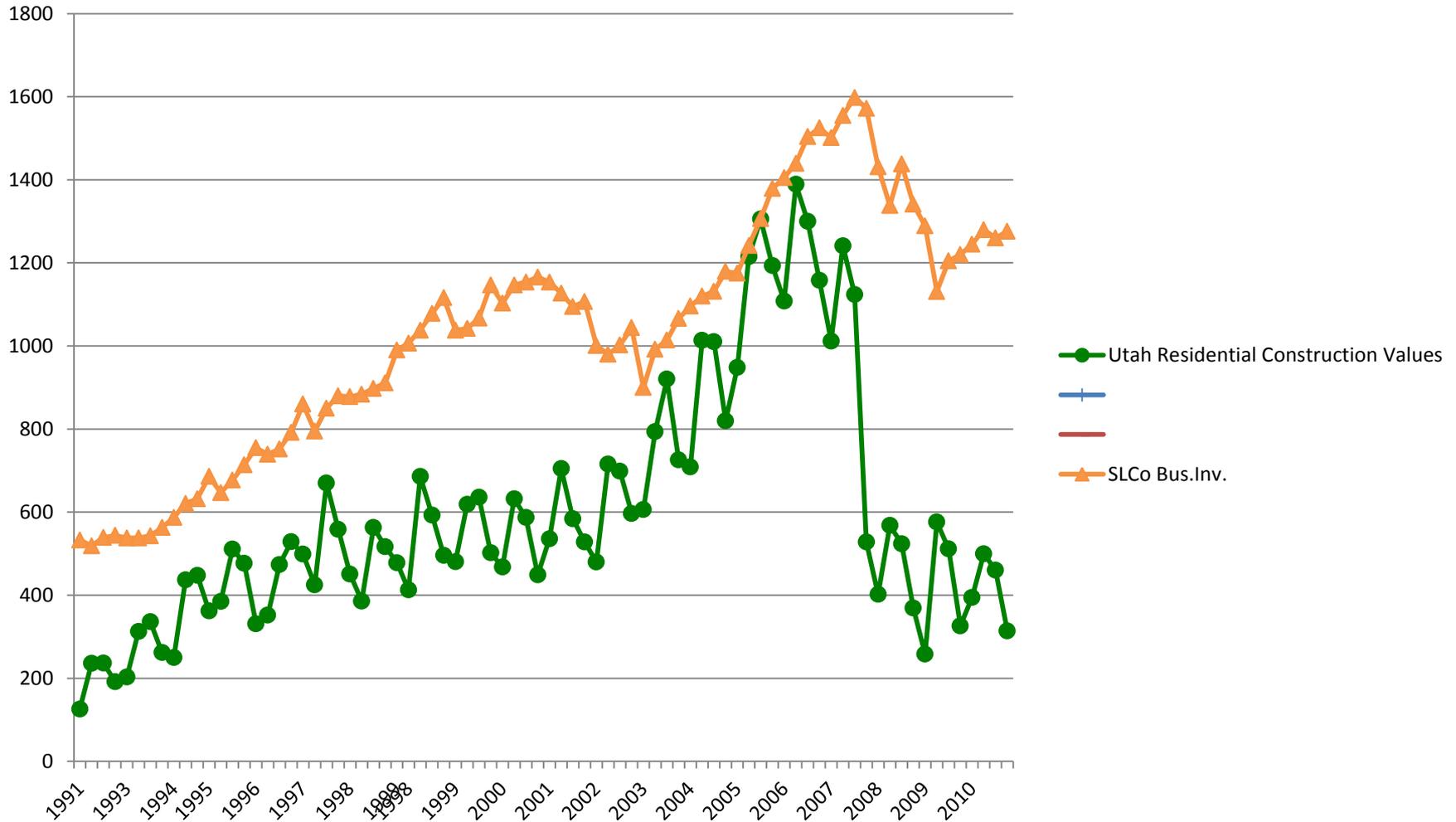
Investment depends on:

- 1) Last year's production
- 2) Technological progress (up)
- 3) Interest rates (flat) & other input prices (up)
- 4) Prices of related goods (up)
- 5) Business confidence (down)

Business Investment Purchases Correlate with U.S. Equipment & Software



Business Investment also correlates with Residential Construction Values



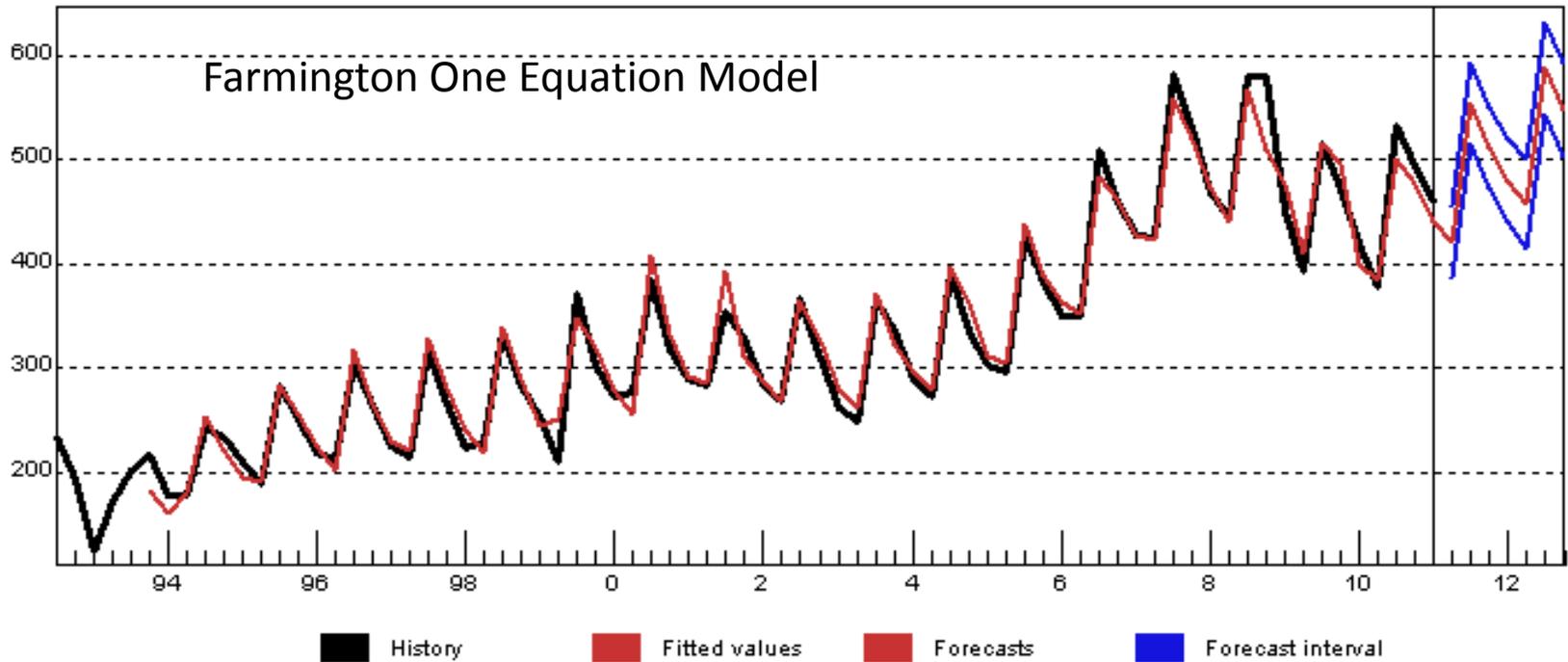
Salt Lake County 4-Equation Model

1. Retail Nondurable Sales = Utah wages
2. Retail Durable Sales = Utah wages, SLCo Residential Construction, U.S. Consumer Sentiment Index
3. Business Investment = U.S. Equipment & Software, Utah wages, SLCo Residential Construction
4. Services = Utah wages, SLCo Nonresidential Construction Value, U.S. Equipment & Software

Farmington 1-Equation Model

- Utah wages
- Utah unemployment rate
- Lagged Farmington sales taxes

FARMCITY - Farmington Stax Dist. (000)



Forecast Report for FARMCITY

Model Details

Dynamic regression

Regression(4 regressors, 1 lagged errors)

Term	Coefficient	Normalized	Elasticity	Std. Error	t-Statistic	Percentile
DWAGE	0.0202	0.4225	0.4803	0.003948	5.117	1
Q3DMY	124.3	0.5063	0.08898	10.75	11.57	1
UTUNEMP	-5.098	-0.05819	-0.06561	2.122	-2.402	0.9808
FARMCITY[-1]	0.5086	0.5096	0.5021	0.08302	6.127	1
_AUTO[- 4]	0.4621			0.1018	4.538	1

Within-Sample Statistics

Sample size	70	No. parameters	5
Mean	338.58	Std. deviation	106.04
R-square	0.97	Adj. R-square	0.97
Durbin-Watson	2.01	Ljung-Box(18)	14.4 P=0.29
Forecast error	18.24		20.45
MAPE	4.02		17.57
MAD	13.09		

Andre Baksh
Senior Economist
Utah State Tax Commission

Forecasting with Leading Indicators

- Why leading indicators?
- What leading indicators and where do we find them?
- How do we model leading indicators?

Why leading indicators?

- Although univariate forecasts tend to be more reliable than multivariate forecasts, they don't explain why a forecast is up, down or flat.
- Leading indicators allow us to infer and explain our forecasts.

What leading indicators and where do we find them?

- State Level Indicators:
 - Utah manufacturing work hours (Bureau of Labor Statistics)
 - Utah single family housing, building permits (FRED—Federal Reserve Bank, St. Louis)
 - Utah initial claims (United State Department of Labor)

What leading indicators and where do we find them (cont'd)?

- National indicators:

United States index of leading indicators (Federal Reserve Bank, Philadelphia)

How do we model leading indicators?

- Transfer function models (multivariate ARIMA)
- State-space modeling (Kalman filter)
- Vector Autoregression and Bayesian Vector Autoregression.
- Dynamic regression (family)—my favorite is the full information maximum likelihood (FIML) method because it takes care of multicollinearity.

My approach

- Forecasting is foremost an art. Judgment based on current information is key.
- I like to use a combination of univariate and multivariate methods rather than just one.
- Check for reasonableness. Again judgment is key.
- The models are run to provide an upper and lower bound for forecasts.

How to Predict the Future And Forecast Sales Taxes

Doug Macdonald

Economic Policy Analyst

Utah League of Cities and Towns

Simple Sale Tax Model

Percent Change

- Utah (or your county) wage growth
- Utah unemployment rate (up 1%, lower 1%)
- U.S. Equipment & software (up 10%, up 3%)
- County residential construction values (up 30%, then add 3%)
- County nonresidential construction values (up 30%, then add 1.5%)