Leading Indicators of Cyclical State Revenues: Beyond the Regional Indicators

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A Priori Questions

1. Are revenue forecasts degraded by regional data problems?
2. Are leading indicators present in the revenue lines?
3. Are state-specific LEI constructions possible with selected revenue lines?
4. Is a two-stage forecast model efficient for revenue forecasting? Are the models stable (and representative)?
5. Have regression models for revenue forecasting been abandoned prematurely?

Related Literature

Bram et al (2003)

Clayton-Mathews and Stock (1989/1999)

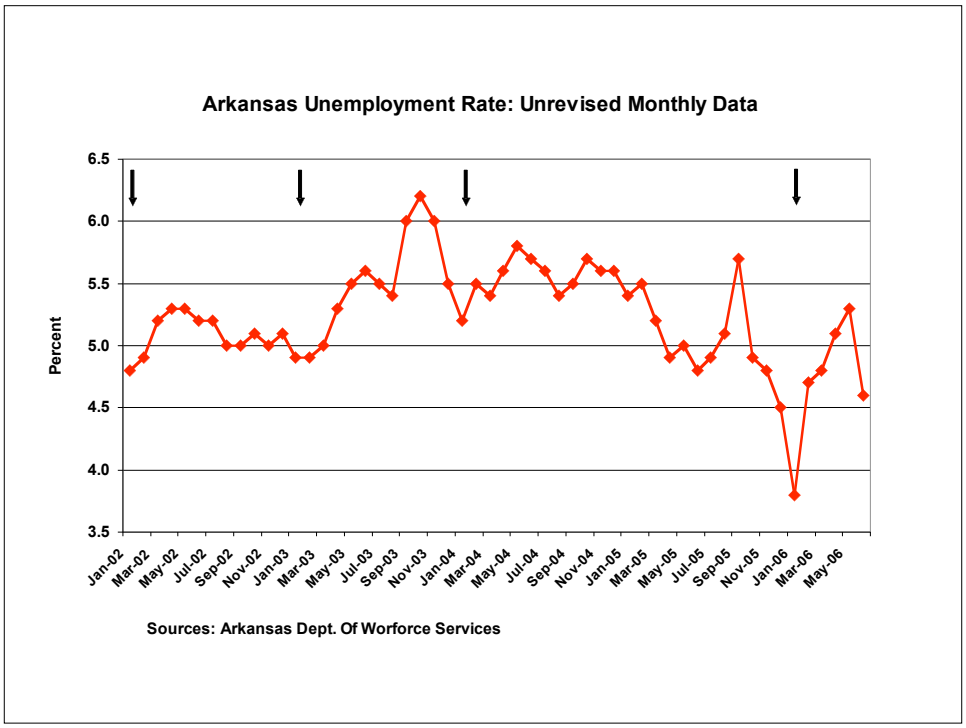
Stock and Watson (1989, 1991, 1993)

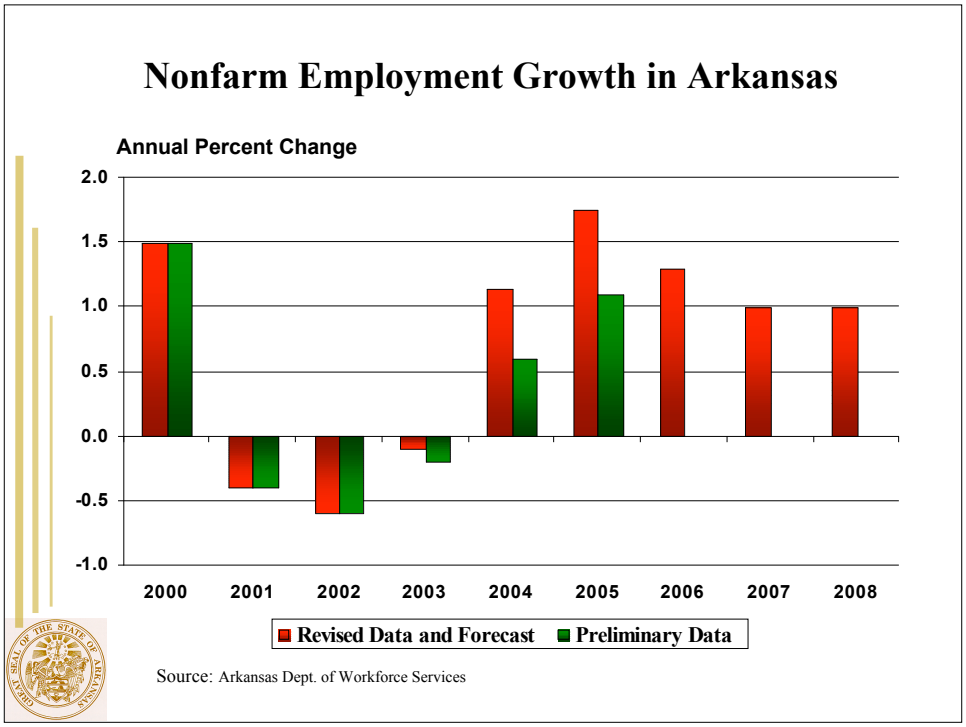
Regional Economic Data Concerns

(Questioning the Sausage Factory Results)

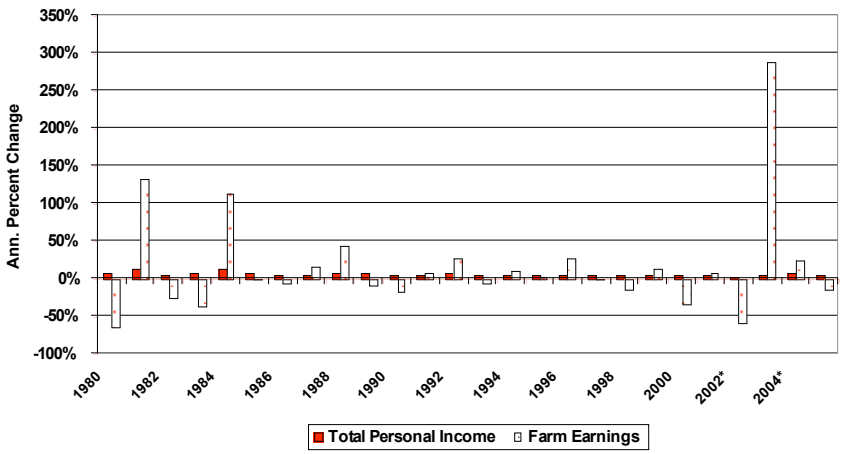
The Arkansas Case: Small State Issues

- Labor Force Data: Components of the Household Survey and the Regional Averaging Methodology
- Personal Income: Revision Rate and Component Volatility
- Housing and Auto Consumption Measures: Issues of Revision Processes and Coverage
- GSP and Others: An Issue of Timeliness


Arkansas Unemployment Rate: Unrevised Monthly Data
Percent
6.5
6.0
5.5
5.0
4.5
4.0
3.5
Jan-02
Mar-02
May-02
Jul-02
Sep-02
Nov-02
Jan-03
Mar-03
May-03
Jul-03
Sep-03
Nov-03
Jan-04
Mar-04
May-04
Jul-04
Sep-04
Nov-04
Jan-05
Mar-05
May-05
Jul-05
Sep-05
Nov-05
Jan-06
Mar-06
May-06
Sources: Arkansas Dept. Of Worforce Services


Nonfarm Employment Growth in Arkansas
Annual Percent Change
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
2000
2001
2002
2003
2004
2005
2006
2007
2008
Revised Data and Forecast
Preliminary Data
Source: Arkansas Dept. of Workforce Services

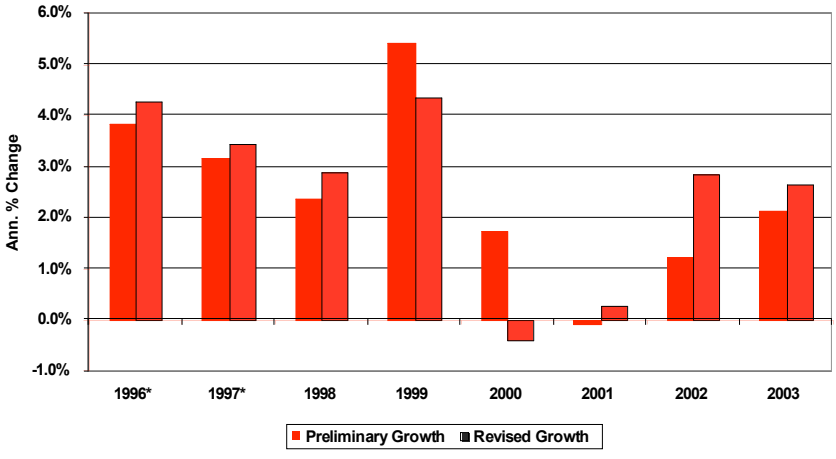
State Personal Income Growth: 1980-2005



Source: Bureau of Economic Analysis

* NAICS Basis

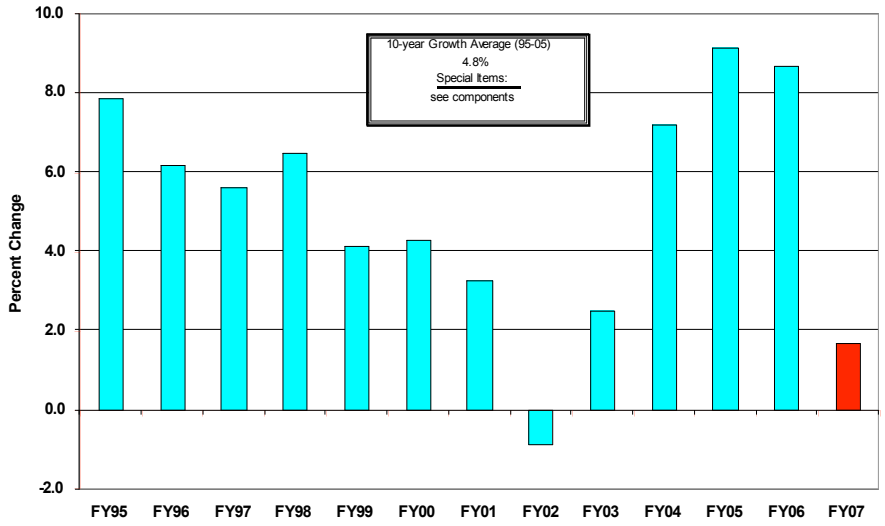
Real Gross State Product: Revision of Turning Point



Source: BEA and Composite of Data Calculations by the Author

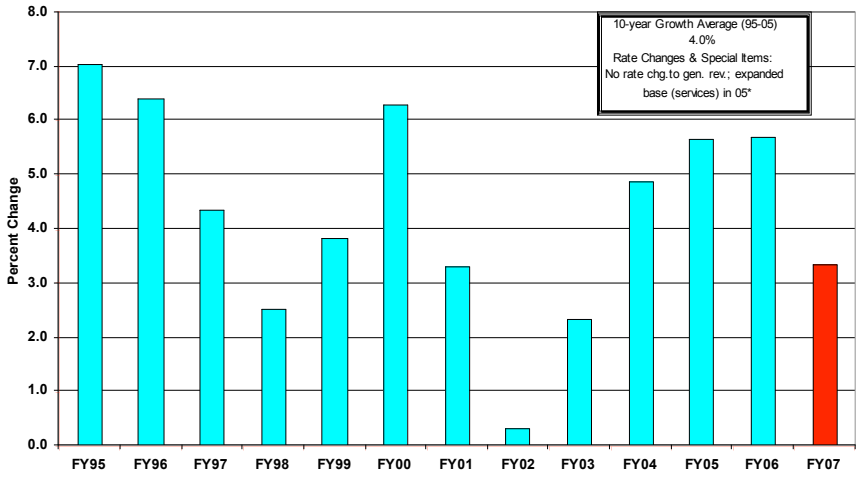
* SIC Basis

Annual Growth in Arkansas Gross General Tax Collections



Source: DFA, Economic Analysis and Tax Research

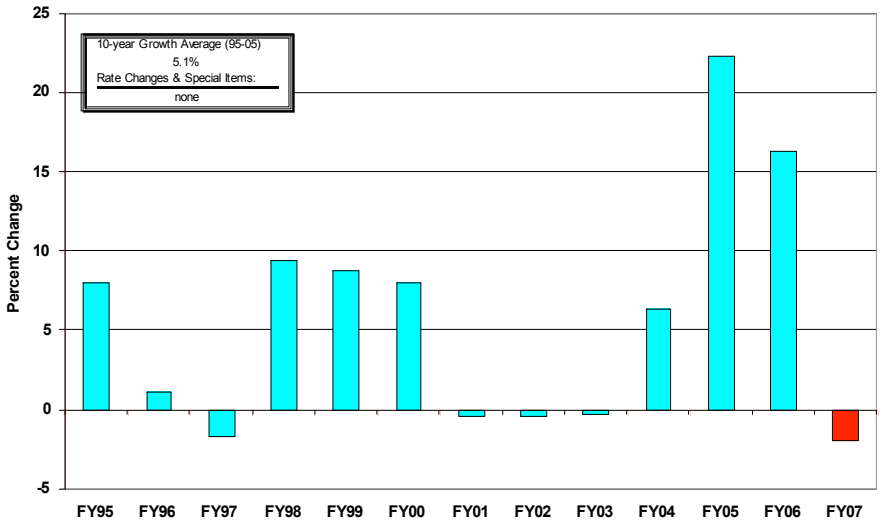
Annual Growth in Arkansas Sales Tax Collections



*Expanded services is included in gross general revenue but not in net available revenue

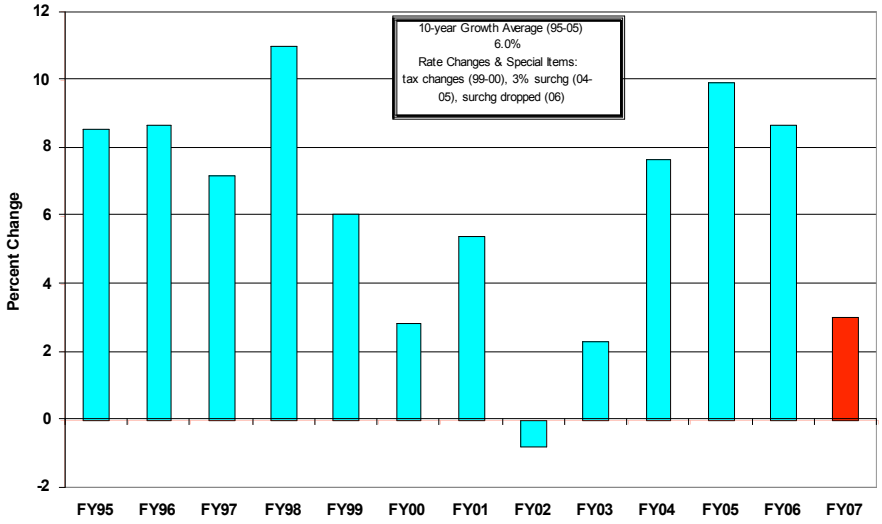
Source: DFA, Economic Analysis and Tax Research

Annual Growth in Arkansas Use Tax Collections



Source: DFA, Economic Analysis and Tax Research

Annual Growth in Individual Income Tax Revenue



Source: DFA, Economic Analysis and Tax Research

Structural Model Framework

Traditional Model Approach (1 or 2-Step)

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 Z_t + \varepsilon_t$$

Where X is a vector of region-specific exogenous variables and Z is a vector of national, sector-specific, leading or coincident indicators

Modified Regional Approach

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 Z_t + \beta_2 R_{t-k} + \varepsilon_t$$

Where R_{t-k} is a vector of distributed lag formulations for select revenue series with cycle-leading characteristics

Table 1
Variable Definitions and Descriptive Statistics

Variable Definitions and Descriptive Statistics

	Mean (Std. Dev.)		
Variable	Variable	Ln(Variable)	Description
Part A: Dependent Variables			
Salesper1	70.856 (14.568)	4.2390 (0.215)	Sales Tax Revenue Per One Cent, SA
Indwith	297.11 (10.160)	5.6940 (0.0369)	Individual Income Tax Withholding, SA
Usetax	51.344 (14.6685)	3.8983 (0.2890)	Use Tax Revenue Series Per One Cent, SA
Part B: Independent Variables			
Variable	Variable	Ln(Variable)	Description
Enag	1118.2 (82.375)	6.9877 (0.0784)	Nonfarm Payroll Employment, SA
PPIelec	135.25 (10.245)	4.9045 (0.0731)	Producer Price Index, Industrial Electric Users
PPIgas	134.16 (84.862)	4.7523 (0.5097)	Producer Price Index, Gas Fuels
Nonresfix	953.38 (240.91)	6.8258 (0.2693)	U.S. Nonresidential Fixed Investment
Beftxprof	768.686 (315.18)	6.5740 (0.3693)	U.S. Corp. Profit, Before Tax
CPIcore	1.7158 (0.2035)	0.5328 (0.1209)	CPI-U, excluding energy and food
Dum911	-	-	Dummy Var. for Sept. 11, 2001
Wsdus	4143.8 (1005.2)	8.2996 (0.2477)	U.S. Wage and Salary Disbursements
Part C: Independent Variables from Revenue Set			
Realest	5062.1 (2720.8)	8.3756 (0.5886)	Real Estate Transfer Tax, Value of Transactions
Frantx	2215.4 (999.89)	7.6205 (0.3999)	Franchise Tax Revenue Series
Saless04	-	-	Dummy Variable for Tax Base Change in Services
Autotot	44275.4 (11072.4)	10.6612 (0.2879)	Sales and Use Tax from New Vehicle Sales

Table 2: Regression Results

Regression Results

	Dependent Variables			
	Ln(Salesper1)	Ln(Salesper1)	Ln(Indwith)	Ln(Usetax)
Independent Var.				
Ln(Realest.), Distr. Lag	0.0695**	0.05782*		0.10532*
	(2.664)	(2.547)		(2.243)
Ln(enag)	1.2402**			
	(6.850)			
Saless04	-0.0297			0.1396**
	(1.421)			(3.129)
Ln(autotot)	0.1622**	0.19222**		
	(3.473)	(5.031)		
Ln(PPIelec)	0.2652**	0.03264		
	(3.847)	(0.539)		
Ln(PPIgas)	0.05847**	0.02674**		0.0303
	(6.042)	(2.669)		(1.001)
Ln(Indwith)		0.4033**		
		(8.449)		
Ln(wsdus)			-0.03302	
			(0.392)	
Ln(CPIcore)			2.1501**	
			(13.715)	
Dum911			-0.0381	
			(1.978)	
Ln(beftxprof)				0.1615
				(1.877)
Ln(nonresfix)			0.2139**	0.3557**
			(6.352)	(2.688)
Constant	-8.3143**	-.84785*	3.2953**	-.6172
	(8.363)	(2.345)	(6.076)	(-1.099)
R Squared	0.9922	0.9934	0.9961	0.9733
Adj R-Sq.	0.9912	0.9927	0.9957	0.9690
Std Error	0.0202	0.0184	0.0190	0.0472
# of Obs.	64	64	65	66

Notes: * denotes 5% significance, ** denotes 1% significance, and t-statistics are in parentheses.

Conclusions

- An improved set of leading indicators with local reference may be present in state revenue series.
- Small revenue lines may be good candidates for structural forecast models of major revenue sources.
- Other uses of leading measures with included revenue lines may include turning point probability models and improved LEI instruments.
- Regional (and macro) data problems will not be eliminated, but they may be reduced with carefully tested revenue indicator variables.

Questions?