



Regional Economic Cycles

Building Arizona Coincident and Leading Indicators for Tax Administration

The Logic and Use of Composite Indicators for Anticipating State Tax Revenue

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A Presentation for the
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Highlights

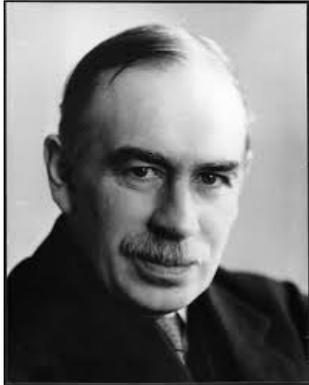


Measuring and Forecasting Arizona Business Activity

- Why is the Cyclical Approach Useful?
- The NBER's Classical-Cycle Analysis
- Compiling a Coincident Indicator for the Arizona Business Cycle
- Developing and Using a Leading Indicator Composite
- Probability of an Arizona Business Downturn

Using the Cyclical Indicator System to Forecast State Revenue

- The Relationship of Business Activity and State Revenue
- Harnessing the Leading Indicator Information for State Planning



**John Maynard
Keynes --**

***The General
Theory of
Employment,
Interest and
Money***

Why are Turning Points Important?

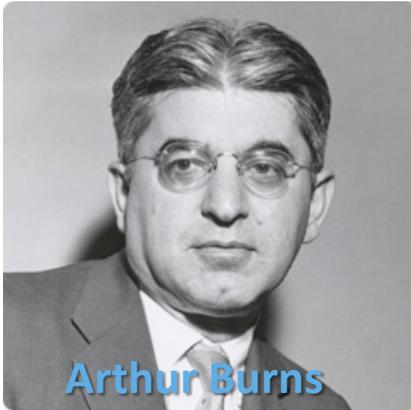
“By a *cyclical* movement we mean that as the system progresses in, *e.g.*, the upward direction, the forces propelling it upwards at first gather force and have a cumulative effect on one another but gradually lose their strength until at a certain point they tend to be replaced by forces operating in the opposite direction; which in turn gather force for a time and accentuate one another, until they too, having reached their maximum development, wane and give place to their opposite.

“The Trade Cycle ... explanation must cover, if it is to be adequate, ... the phenomenon of the *crisis* — the fact that the substitution of a downward for an upward tendency often takes place suddenly and violently, whereas there is, as a rule, no such sharp turning-point when an upward is substituted for a downward tendency.”

ANSWER: To understand a dynamic of the economy.



Wesley Mitchell



Arthur Burns

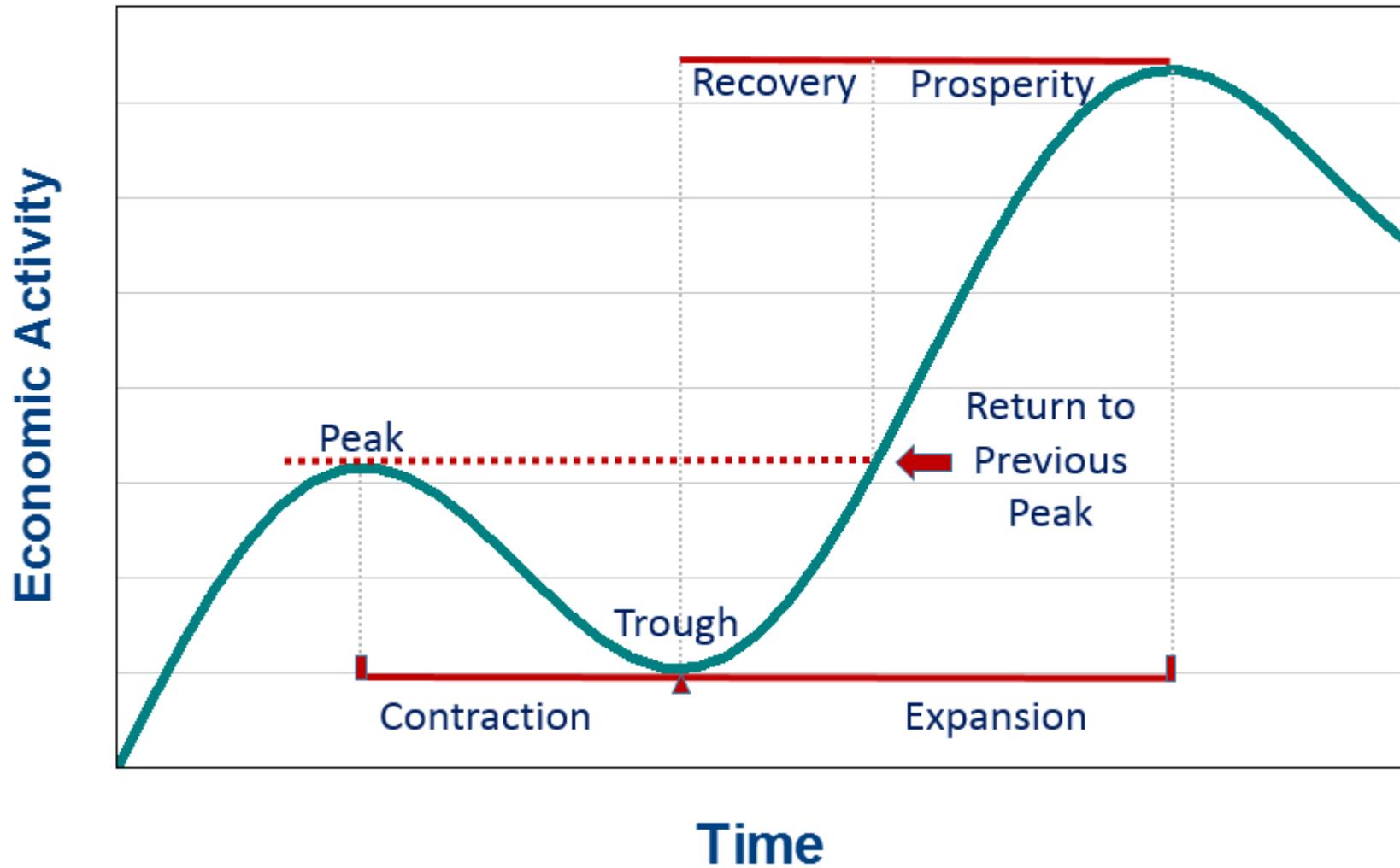
The Bureau's Traditional Paradigm

“Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: **a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle;** this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own.”

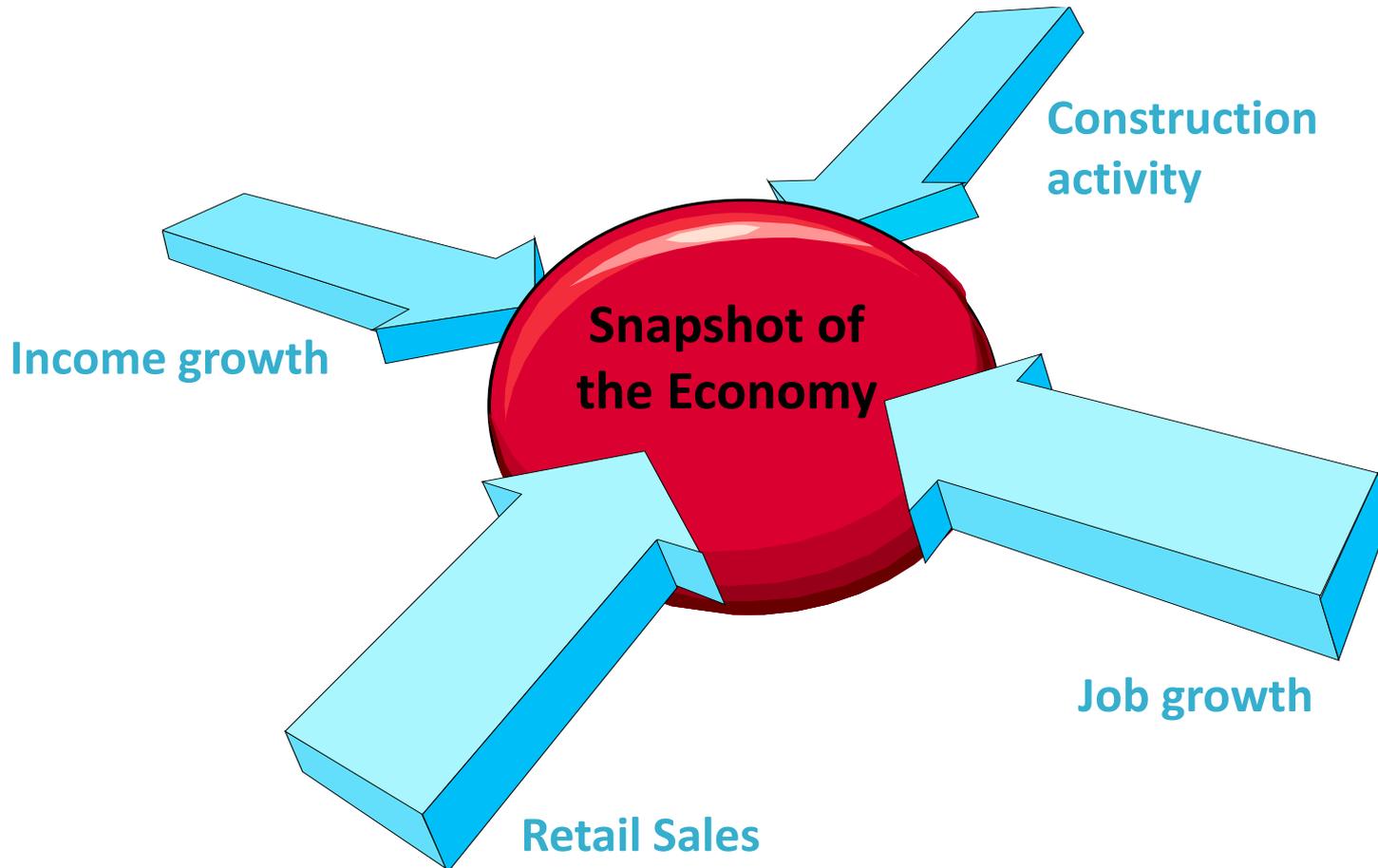
Arthur F. Burns and Wesley C. Mitchell. *Measuring Business Cycles*, National Bureau of Economic Research, 1946, p. 3.

The Stylized Classical Business Cycle

Tracking the Business Cycle



A Composite Index Compiles Various Types of Data into a “Market Basket” Measure Based on Some Common Objective and Data Criteria.



Why Develop Cyclical Indicators?

- They are *easy to interpret*.
- They are *easy to communicate*.
- They are *relatively inexpensive to formulate, update, re-engineer*
- They provide perspective on drivers of international, national, and local business activity.

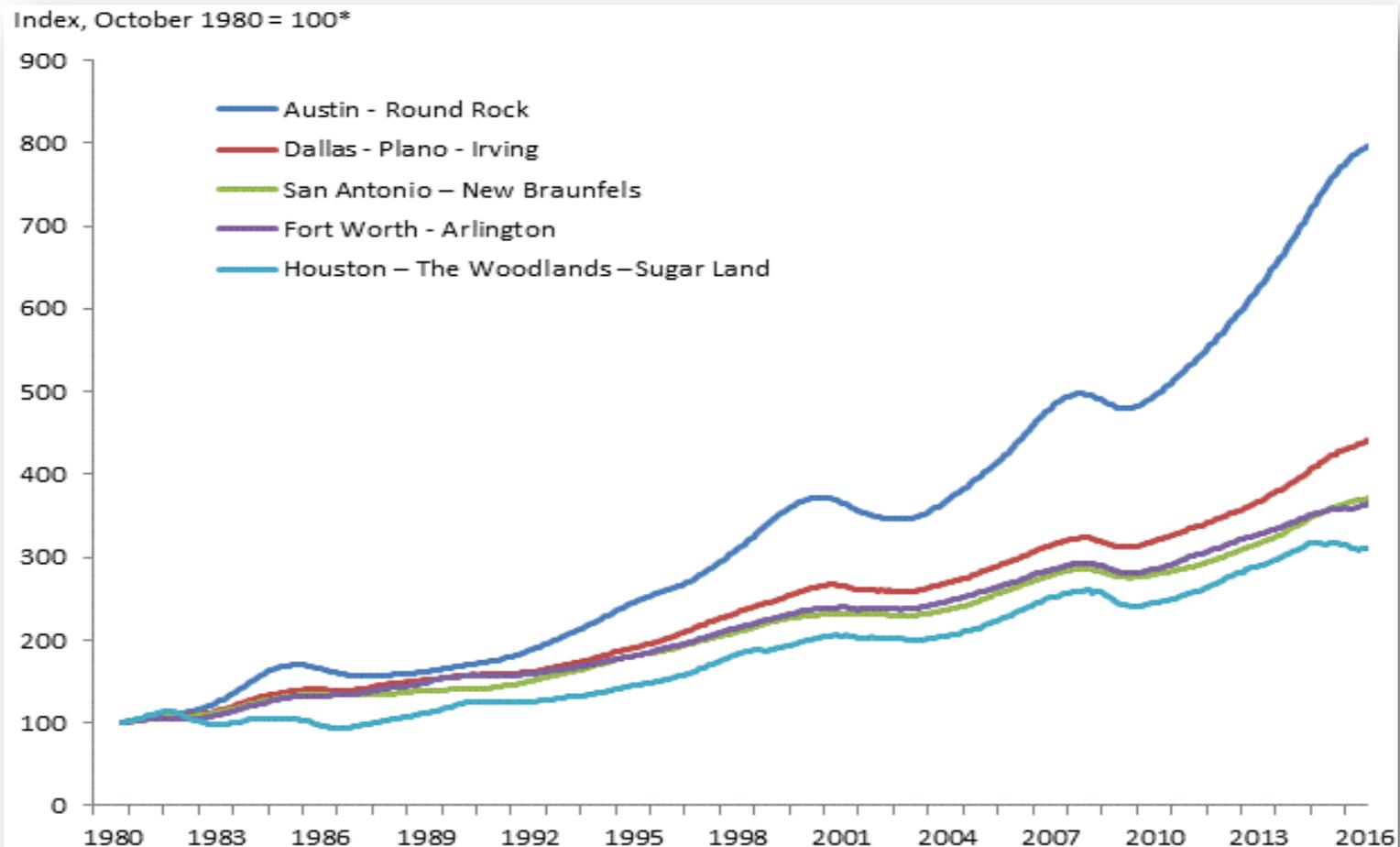
Features of Philly Fed's Approach

Coincident Index Components	Leading Index Components
Nonfarm Jobs	Housing permits
Average hours worked in manufacturing	Delivery times, survey of manufacturing
Unemployment Rate	Unemployment insurance claims
Wage & salary disbursements	Interest rate spread 10-year & 3-month Treasury Bonds

Benefits: Covers all 50 states and the U.S. using the same variables, thereby allowing for state-to-state comparisons as well as comparing states to the nation. Leading index deftly blends state and national macroeconomic level data.

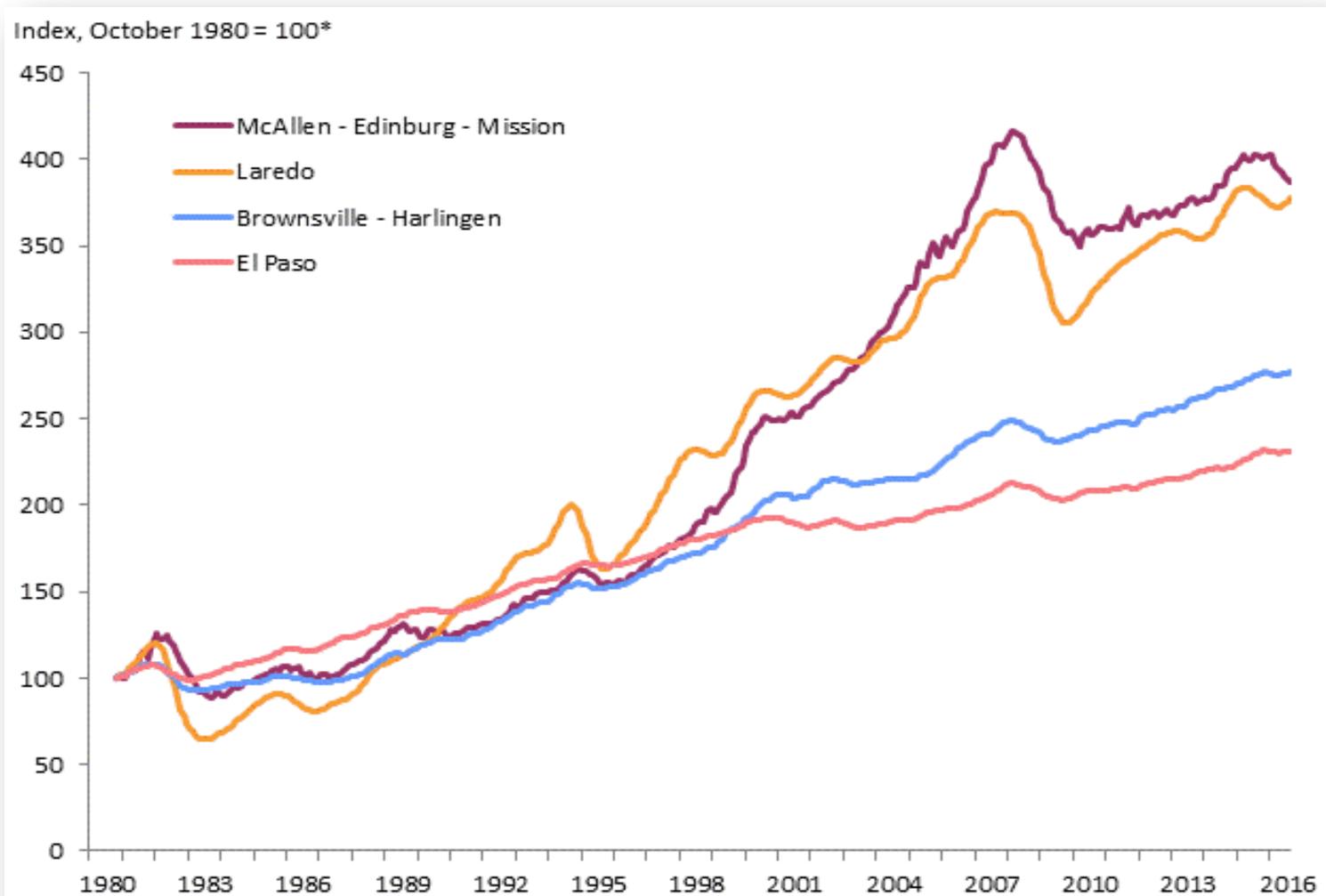
Drawbacks: “One size fits all” necessitates the use of “least common denominator” variables that may not be suitable for all states and omits more useful indicators that may only be available in one or more states. Coincident Index is an admixture of coincident, leading, and lagging indicators —it is more of a labor market indicator than a genuine business cycle indicator

Federal Reserve Bank of Dallas produces coincident indexes for Texas's 5 largest metros...



*Monthly, seasonally adjusted.
Last data entry August 2016.

...and the 4 largest border area metros.



*Monthly, seasonally adjusted.
Last data entry August 2016.

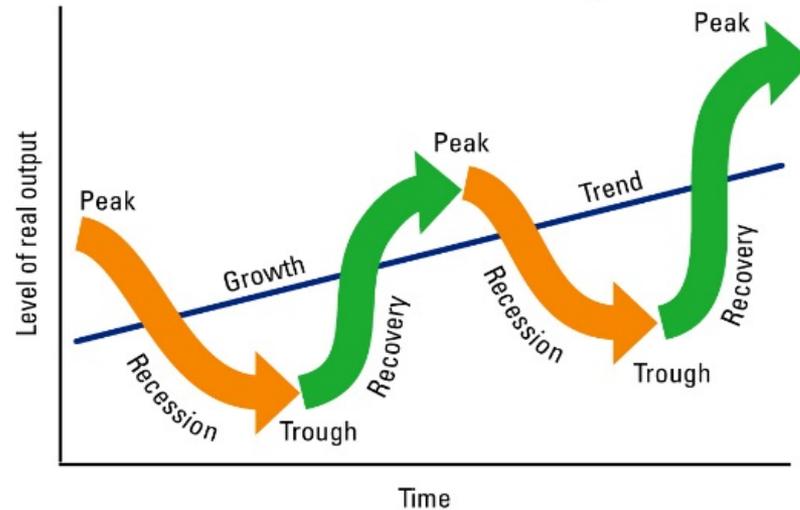
Dallas Fed's approach features fewer labor market variables and more localized indicators

Coincident Index Components (9 Metros & State)	Texas Leading Index Components
Nonfarm Jobs	Real Oil Price
Unemployment Rate	Unemployment insurance claims
Real wages	Average hours worked in manufacturing
Real retail sales	Oil Well Permits
	Value of Texas Dollar
	U.S. Leading Index
	TX stock index
	TX Help Wanted Index

Relevance to Arizona Governments & Businesses

- Arizona currently lacks a coincident and leading index that adequately captures the State's economic base
- Arizona government agencies and businesses produce data that may be more useful leading indicators, but may not be comparable or available across all states
- Approach taken to creating the Arizona Coincident and Leading Index is intended to be extended to other jurisdictions across Arizona including counties and metropolitan areas

The Economic Cycle



Steps to Formulate a Leading Economic Indicator System

- **Determine the Reference Measure to Track**
- **Analyze that Reference Indicator**
- **Screen Data to Find Leading Indicators**
- **Compile Composite Indexes**
- **Develop an Interpretation System**

Summary of Steps to Form a Composite Index.

For Levels		For Percentage Change and Differences
<i>For Individual Components of Index</i>		
Step 1	$C = 200 (X_t - X_{t-1}) / (X_t + X_{t-1})$	or, $(X_t - X_{t-1})$
Step 2	$A = \text{Mean absolute change of } C$	Same
Step 3	$S = C/A$	Same
<i>For Sum of Components in Index</i>		
Step 4	$R = \text{Average of all } S \text{ per period with weighting factors}$	
Step 5	$r = R \text{ adjusted for coincident index standard change}$	
Step 6	$I = (200 + r) / (200 - r)$ multiplied by lagged value of the composite index with the initial value set equal to 100	
<i>For Sum of Components with Trend Adjustment</i>		
Step 7	$T = \text{Composite index trend from initial cycle peak to terminal cycle peak}$	
Step 8	$G = \text{Average of monthly trends of individual components of the composite, called the "target trend"}$	
Step 9	$r' = r + (G - T)$, which yields the trend-adjusted change	
Step 10	$I' = (200 + r') / (200 - r')$ multiplied by the lagged value of the composite index with the initial value set equal to 100	
<i>For Base Year Changes</i>		
Step 11	$B = \text{Calendar year mean of } I' \text{ for new base year}$	
Step 12	$I^B = (I'/B) \times 100$, which yields the new base year composite	

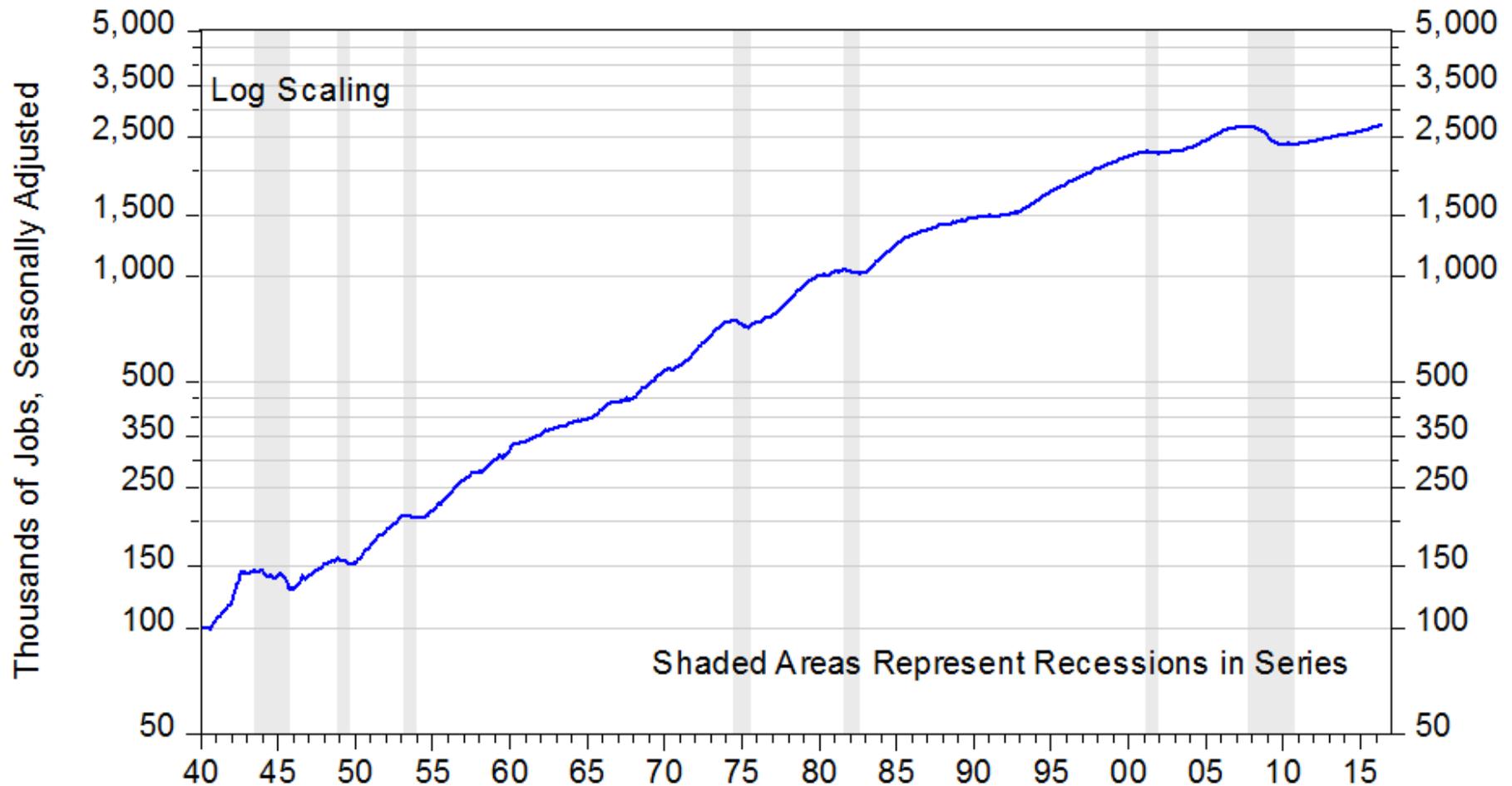
Traditional "NBER/ Commerce Department" Method

Applying These Concepts and Methods to the Arizona Business Activity Measures

How Should Arizona Business Activity Be Defined?

- Rely on Past Research and Practice
- What Makes Sense Conceptually for the State?
- Look to See that Turning Points are Roughly Coincident With Other Candidate Measures
- Select and Compile the Most Appropriate Indicators

Arizona Non-Farm Employment

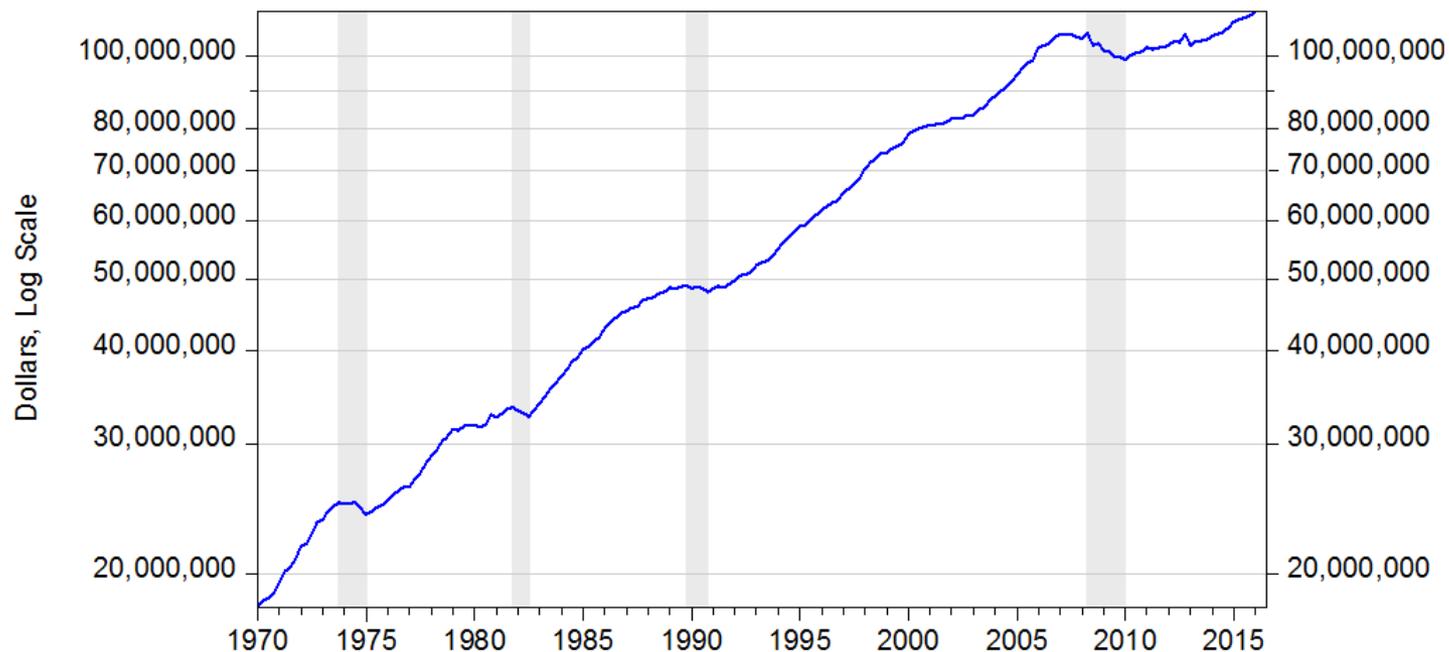


Source: U.S. Bureau of Labor Statistics

Turning Points in Arizona Nonfarm Employment, 1939-2016

Peak	Trough	Recession— Peak-to-Trough Duration in Months	Expansion— Trough-to-Peak Duration in Months	Cumulative % Change from Peak to Trough	Cumulative % Change from Trough to Peak
1943-Jul		27		-11.9%	
	1945-Oct		37		+22.8%
1948-Nov		9		-4.1	
	1949-Aug		43		+37.9
1953-Mar		9		-1.7	
	1953-Dec		247		+265.7
1974-Jul		12		-4.7	
	1975-Jul		73		+46.4
1981-Aug		12		-2.5	
	1982-Aug		223		+122.7
2001-Mar		9		-1.4	
	2001-Dec		70		+19.6
2007-Oct		35		-11.7	
	2010-Sep				
Averages:		16.1	115.5	-5.4%	+85.8%

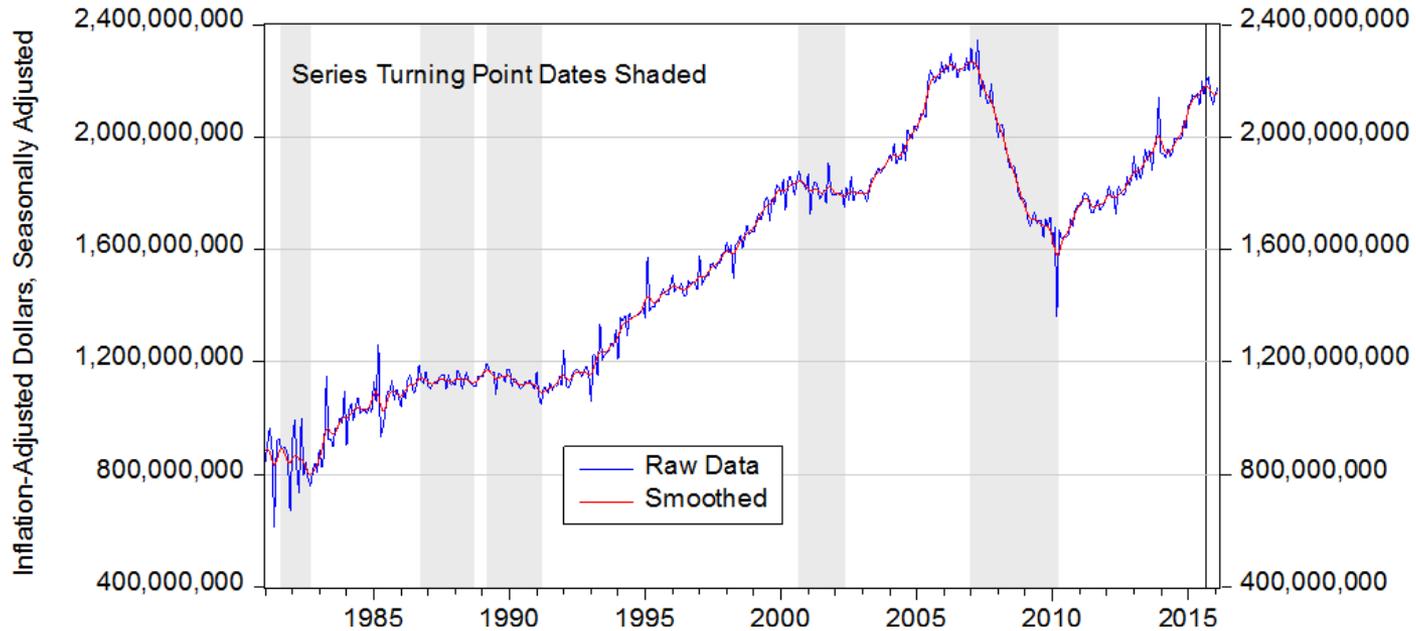
Real Personal Income for Arizona



Turning Points in Quarterly Real Personal Income for Arizona

Peak	Trough	Recession— Peak-to-Trough Duration in Quarters	Expansion— Trough-to-Peak Duration in Quarters	Cumulative % Change from Peak to Trough	Cumulative % Change from Trough to Peak
1973-Q4		5		-3.6%	
	1975-Q1		27		+39.5%
1981-Q4		3		-2.8	
	1982-Q3		29		+50.3
1989-Q4		4		-2.0	
	1990-Q4		70		+123.9
2008-Q2		7		-7.9	
	2010-Q1				
Averages:		4.8	42.0	-4.1%	+71.2%

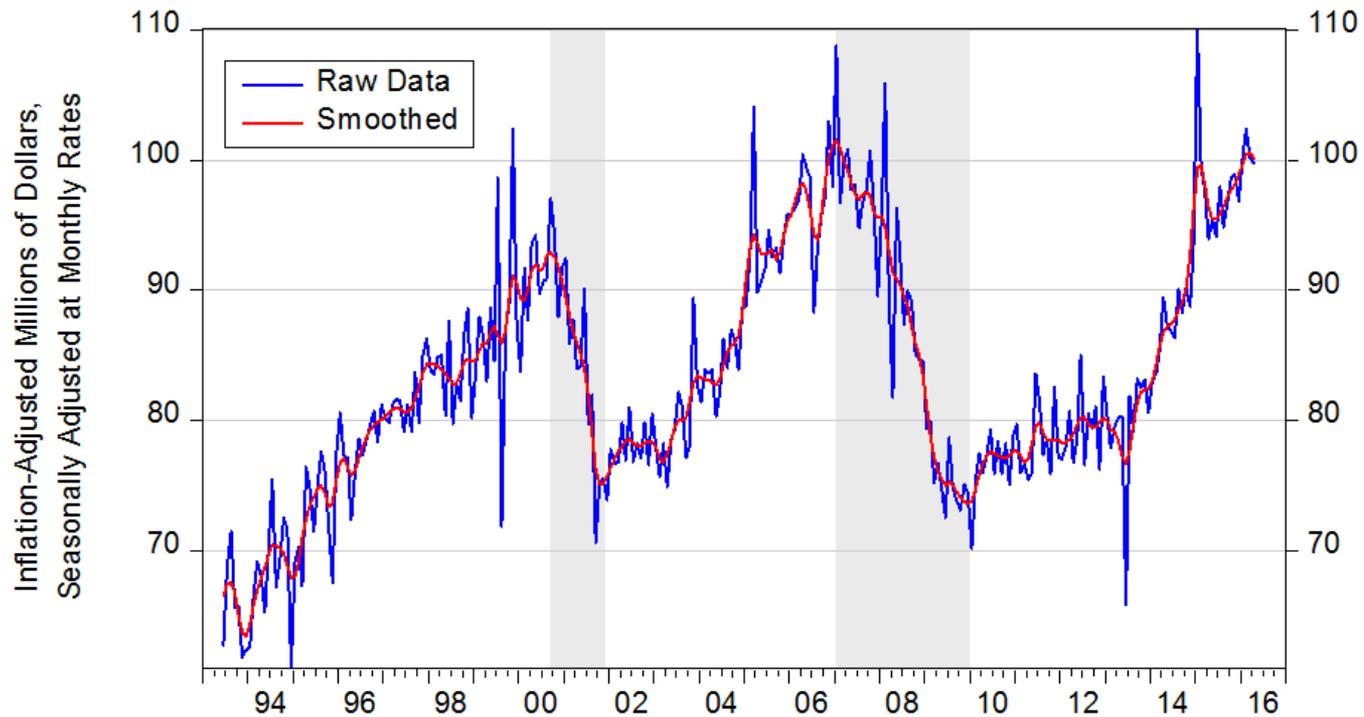
Real Taxable Retail Sales for Arizona



Turning Points in Arizona Real Taxable Retail Sales, 1981-2016

Peak	Trough	Recession— Peak-to-Trough Duration in Months	Expansion— Trough-to-Peak Duration in Months	Cumulative % Change from Peak to Trough	Cumulative % Change from Trough to Peak
1981-Aug		13		-10.5%	
	1982-Sep		49		+43.2%
1986-Oct		23		-1.7	
	1988-Sep		6		+4.2
1989-Mar		24		-7.0	
	1991-Mar		114		+69.1
2000-Sep		20		-2.9	
	2002-May		56		+26.6
2007-Jan		38		-30.4	
	2010-Mar		60		+38.2
2015-Sep ^T					
Averages:		23.6	57.0	-10.5%	+35.8%

Inflation-Adjusted AZ Hotel Revenue

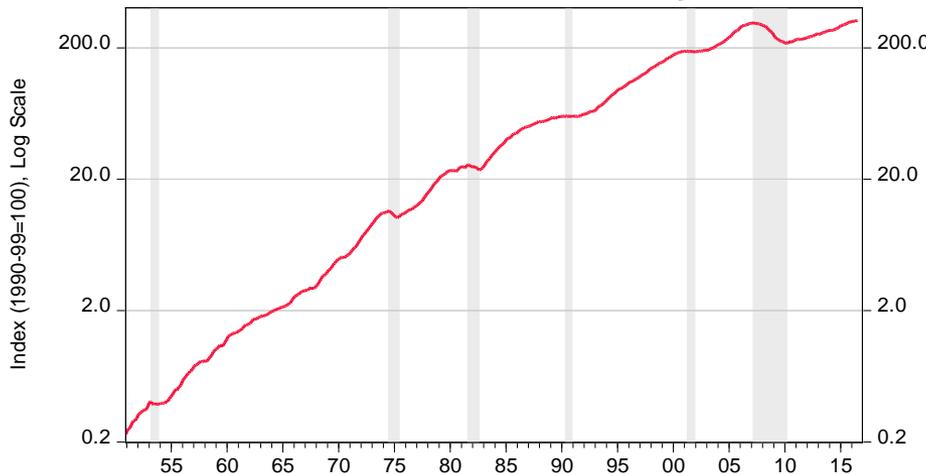


Turning Points in Arizona Gross Sales for Hotels and Motels, 1993-2016

Peak	Trough	Recession— Peak-to-Trough Duration in Months	Expansion— Trough-to-Peak Duration in Months	Cumulative % Change from Peak to Trough	Cumulative % Change from Trough to Peak
2000-Sep		14		-19.2	
	2001-Nov		50		+35.2
2007-Jan		35		-27.5	
	2009-Dec				

Defining the Arizona Business Cycle based on Experimental Coincident Index

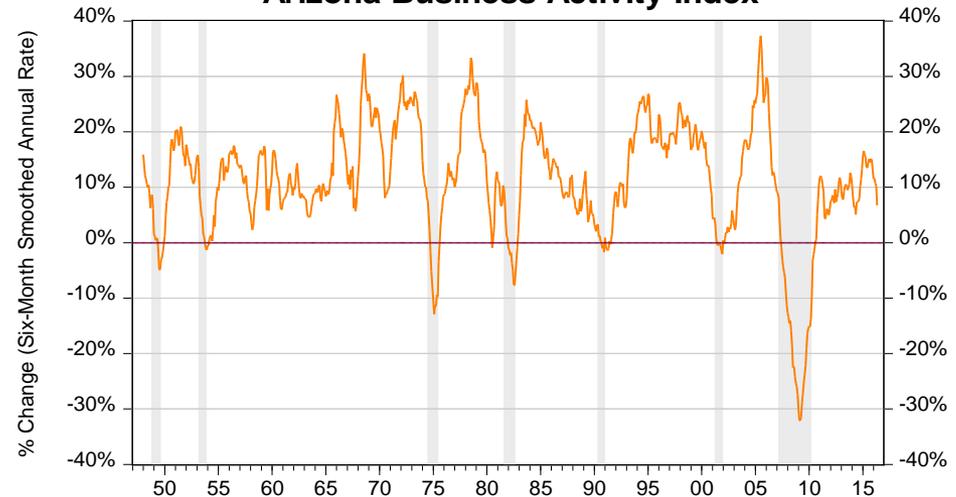
Experimental Coincident Index of Arizona Business Activity



Composite index of four Arizona coincident indicators: (1) Real Hotel Receipts; (2) Real Retail Sales; (3) Real Personal Income; and (4) Payroll Employment.

Same indicator as above, but expressed as a six-month smoothed annualized growth rate.

Arizona Business Activity Index



Turning Points in Arizona Experimental Coincident Index, 1947-2016

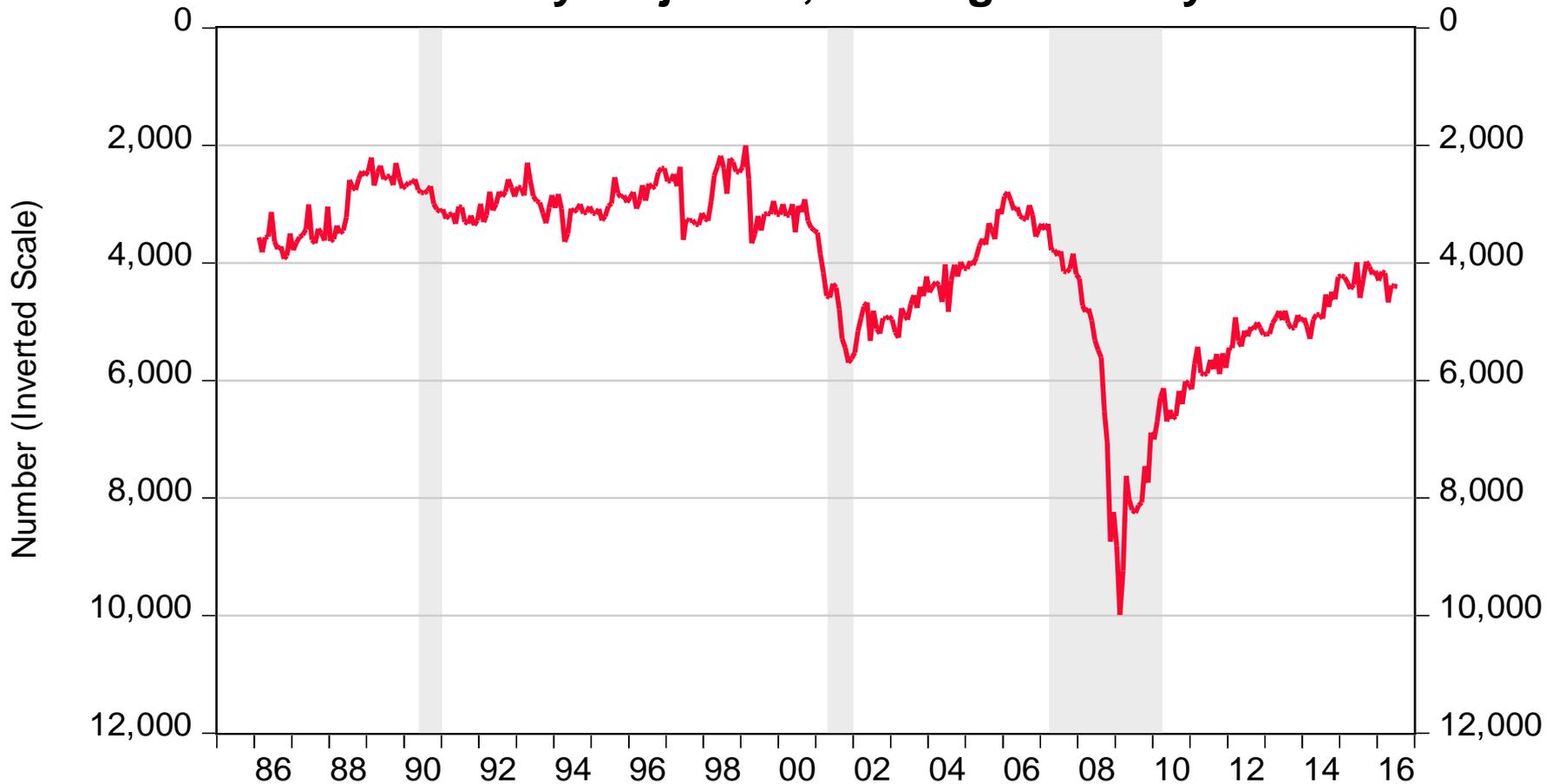
Peak	Trough	Recession— Peak-to-Trough Duration in Months	Expansion— Trough-to-Peak Duration in Months	Cumulative % Change from Peak to Trough	Cumulative % Change from Trough to Peak
1948-Nov		9		-7.1%	
	1949-Aug		43		+140.6%
1953-Mar		7		-4.3	
	1953-Oct		249		+2856.8
1974-Jul		9		-10.8	
	1975-Apr		76		+152.5
1981-Aug		12		-8.9	
	1982-Aug		93		+157.7
1990-May		7		-1.2	
	1990-Dec		123		+215.8
2001-Mar		9		-1.7	
	2001-Dec		64		+67.1
2007-Mar		36		-30.4	
	2010-Mar				
Averages:		13.3	107.8	-9.2%	+598.4%

In Search of Leading Indicators

- **Numerous series scanned for their cyclical characteristics**
- **Eleven measures found to be acceptable leading indicators covering the following concepts:**
 - **Labor**
 - **Housing**
 - **Consumer Confidence**
 - **Motor Vehicles**
 - **Passenger Air Traffic**
 - **Financial**
 - **Trade**
 - **Copper Industry**
 - **Neighboring States' Business**

1. LABOR INPUT

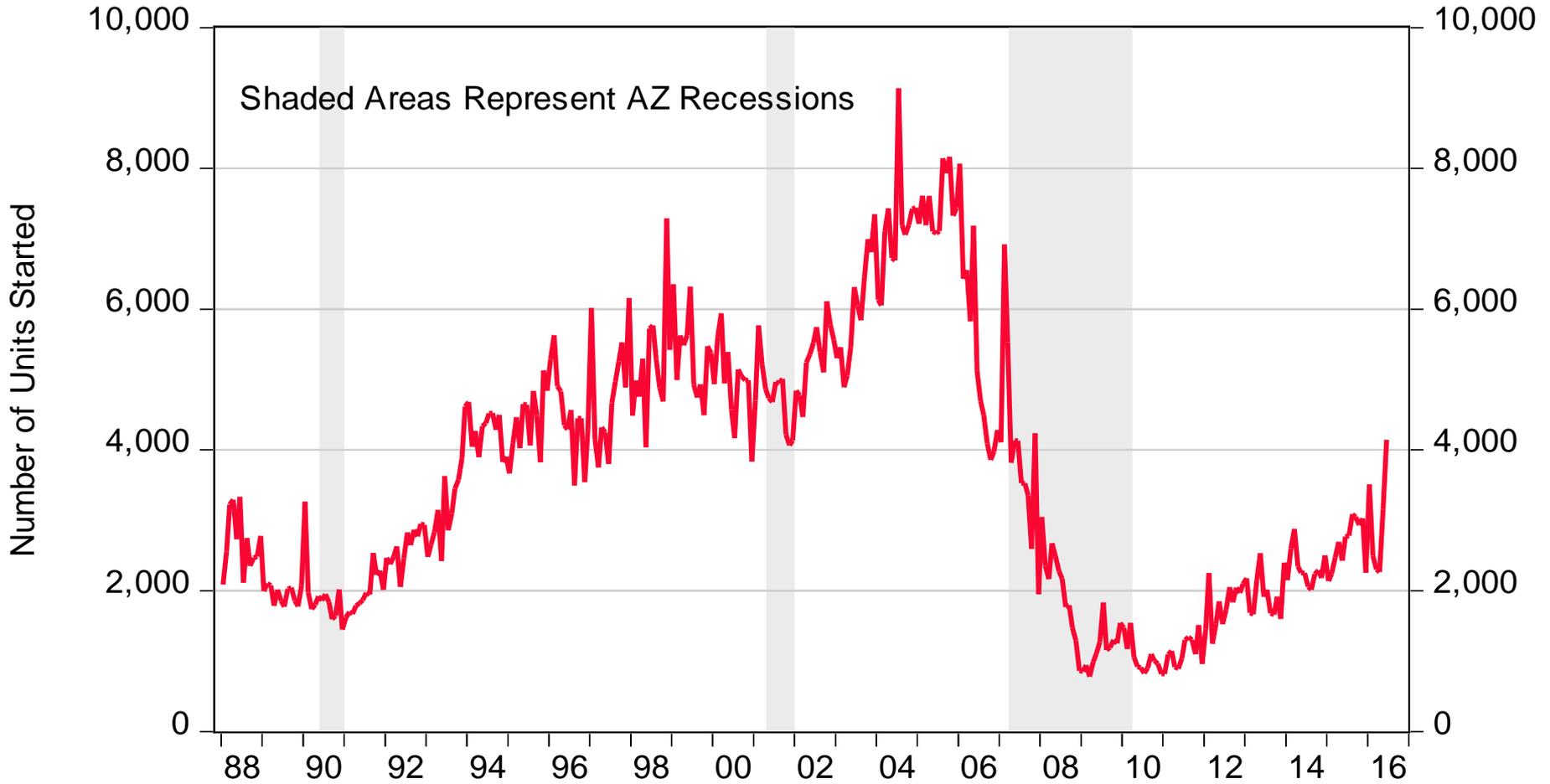
Initial Claims for State Unemployment Insurance Seasonally Adjusted, Average Weekly Rate



Sources: Arizona Office of Employment and Population Statistics & Arizona Department of Economic Security

2. HOUSING INPUT

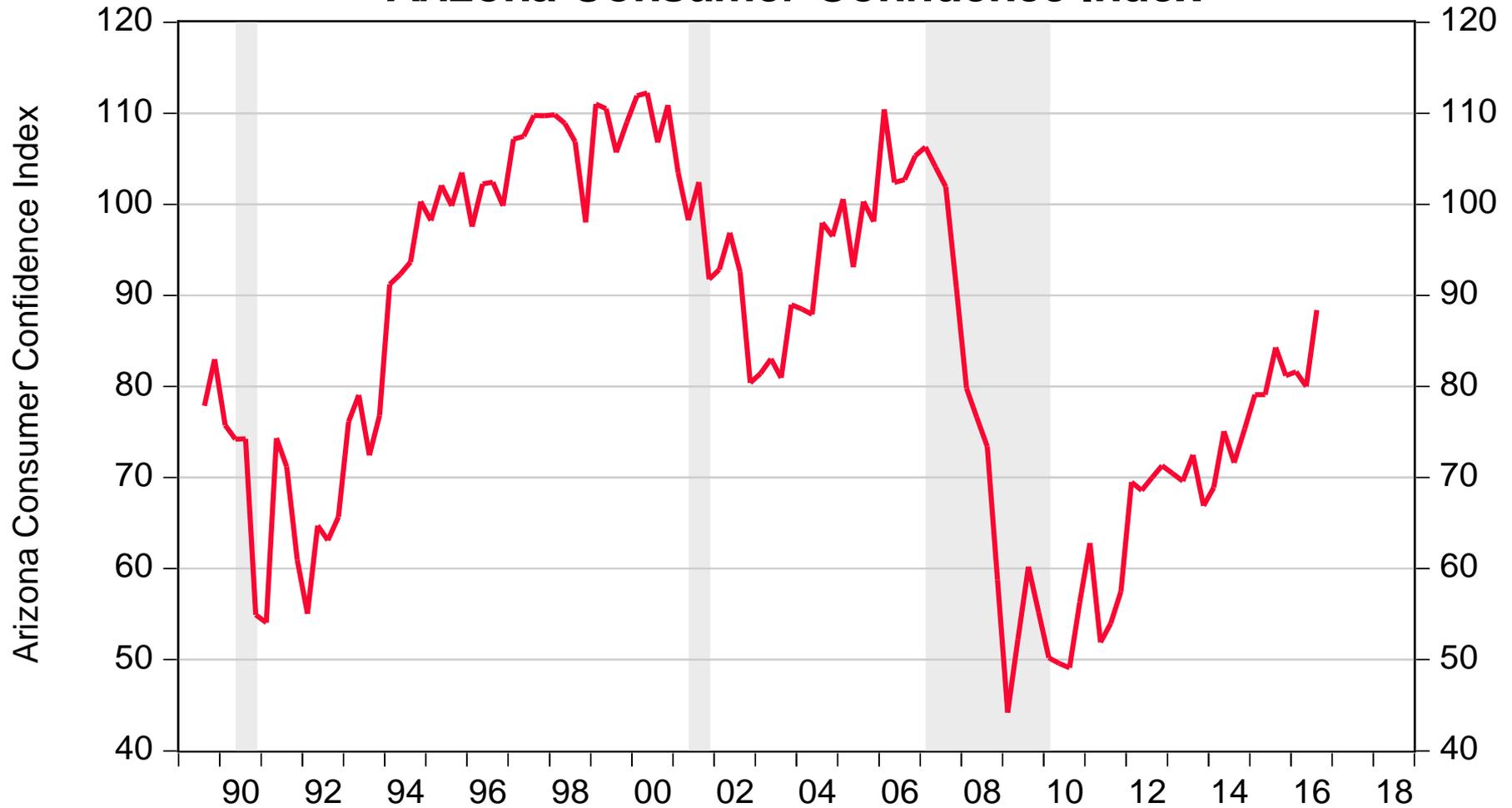
Arizona Building Permits



Source: U.S. Census Bureau

3. CONSUMER CONFIDENCE INPUT

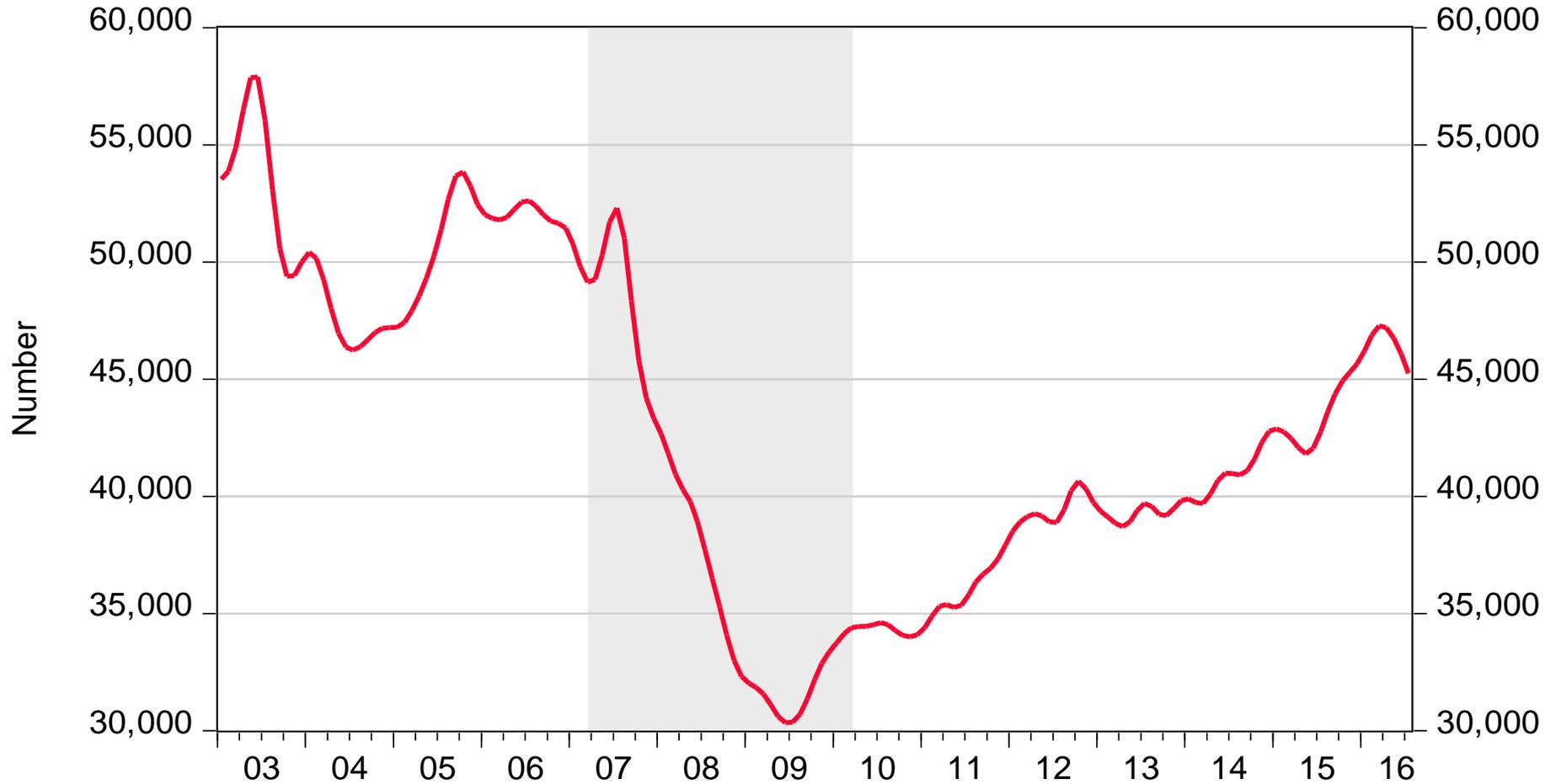
Arizona Consumer Confidence Index



Source: Behavior Research Center, Rocky Mountain Poll - Arizona

4. MOTOR VEHICLE INPUT

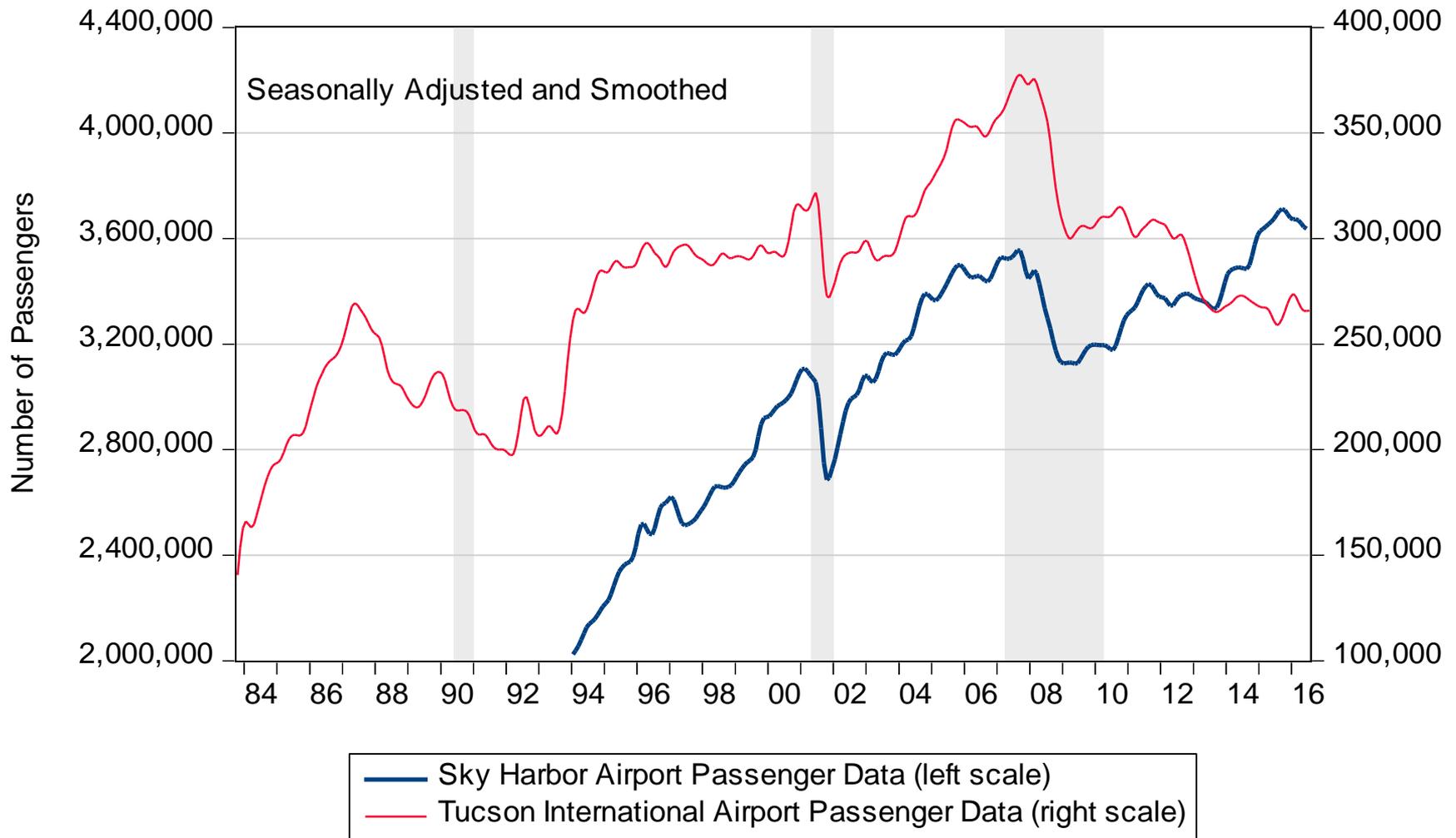
AZ New Motor Vehicle Registrations



Source: Motor Vehicle Division, Arizona Department of Transportation

5. AIR-TRAVEL PASSENGERS INPUT (SKY HARBOR ONLY)

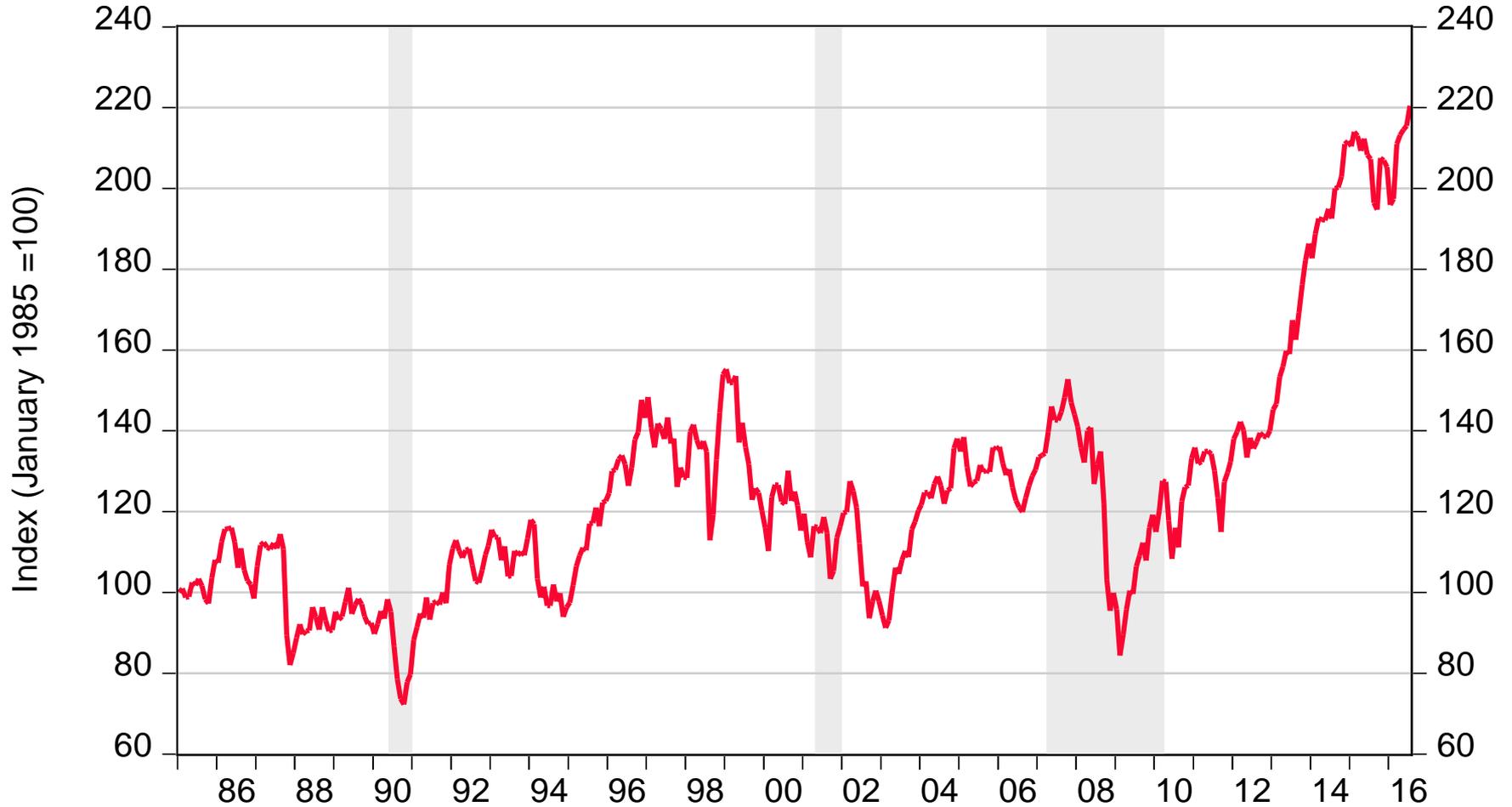
Arizona Airports Passengers Arriving and Departing



Sources: Sky Harbor International Airport, City of Phoenix & Tucson International Airport

6. FINANCIAL INPUT

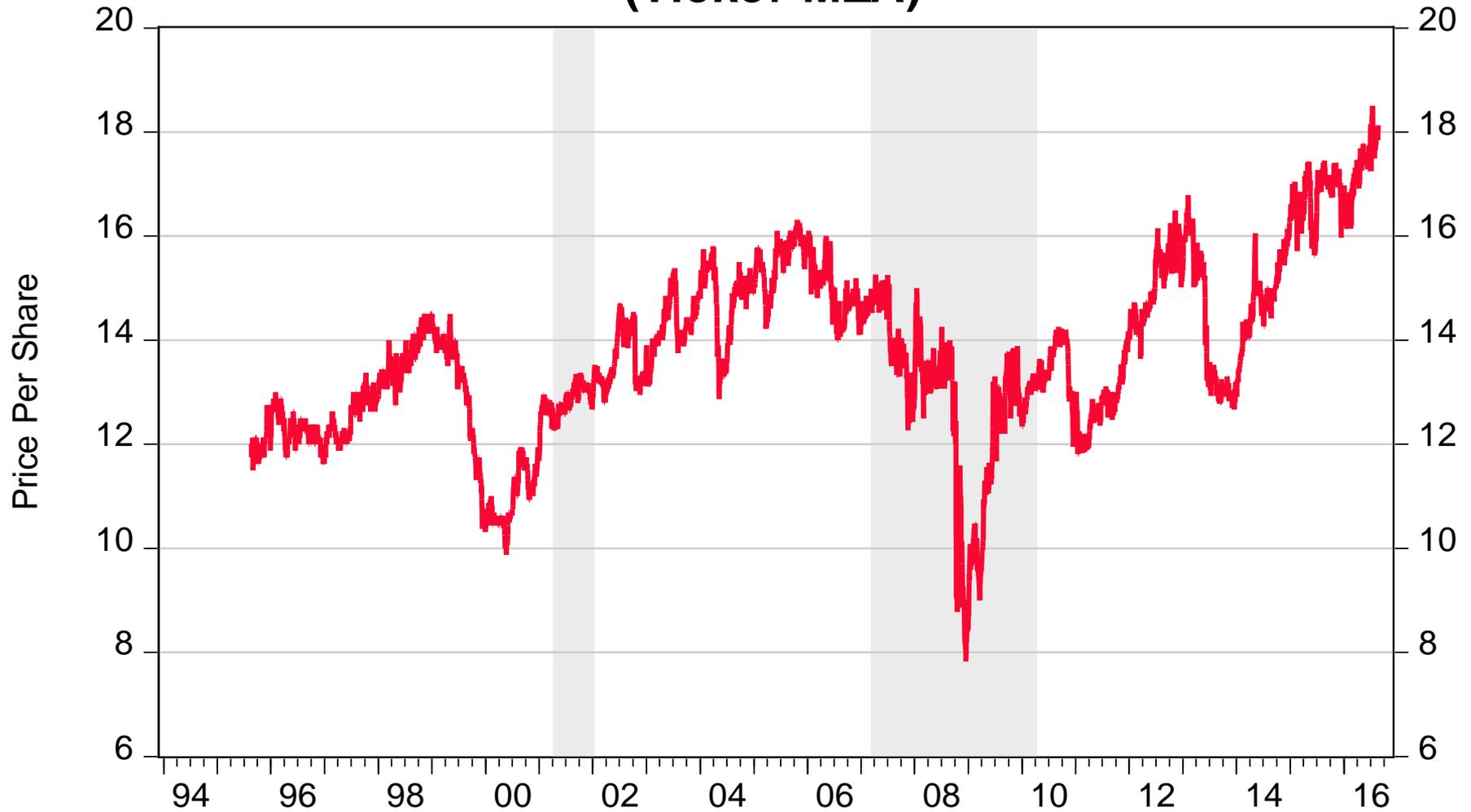
Arizona Stock Price Index



Sources: Arizona Department of Revenue & Federal Reserve Bank of Dallas

6. FINANCIAL INPUT

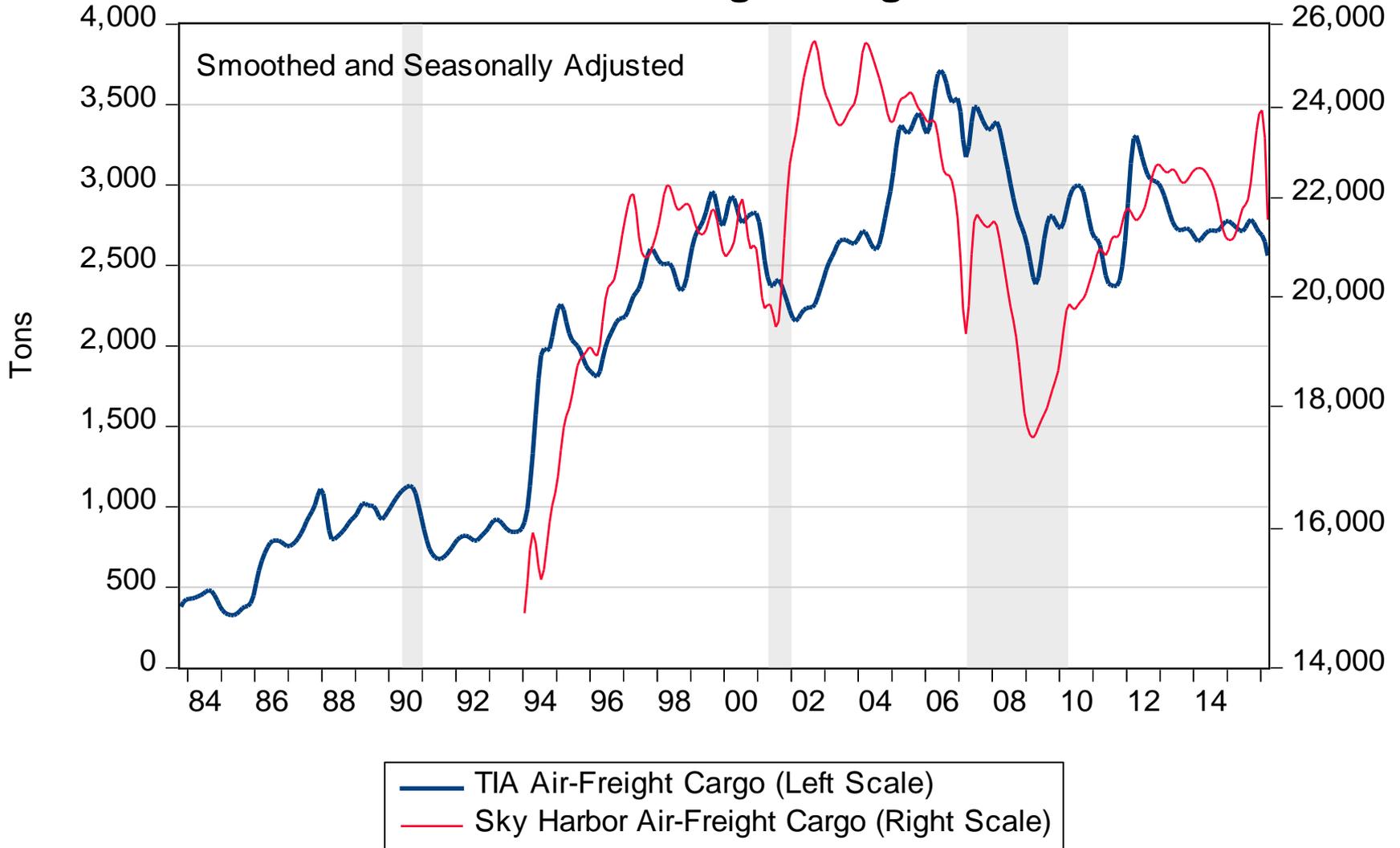
Blackrock's Arizona Municipal Bond Fund (Ticker MZA)



Source: BlackRock

7. AIR-FREIGHT CARGO INPUT

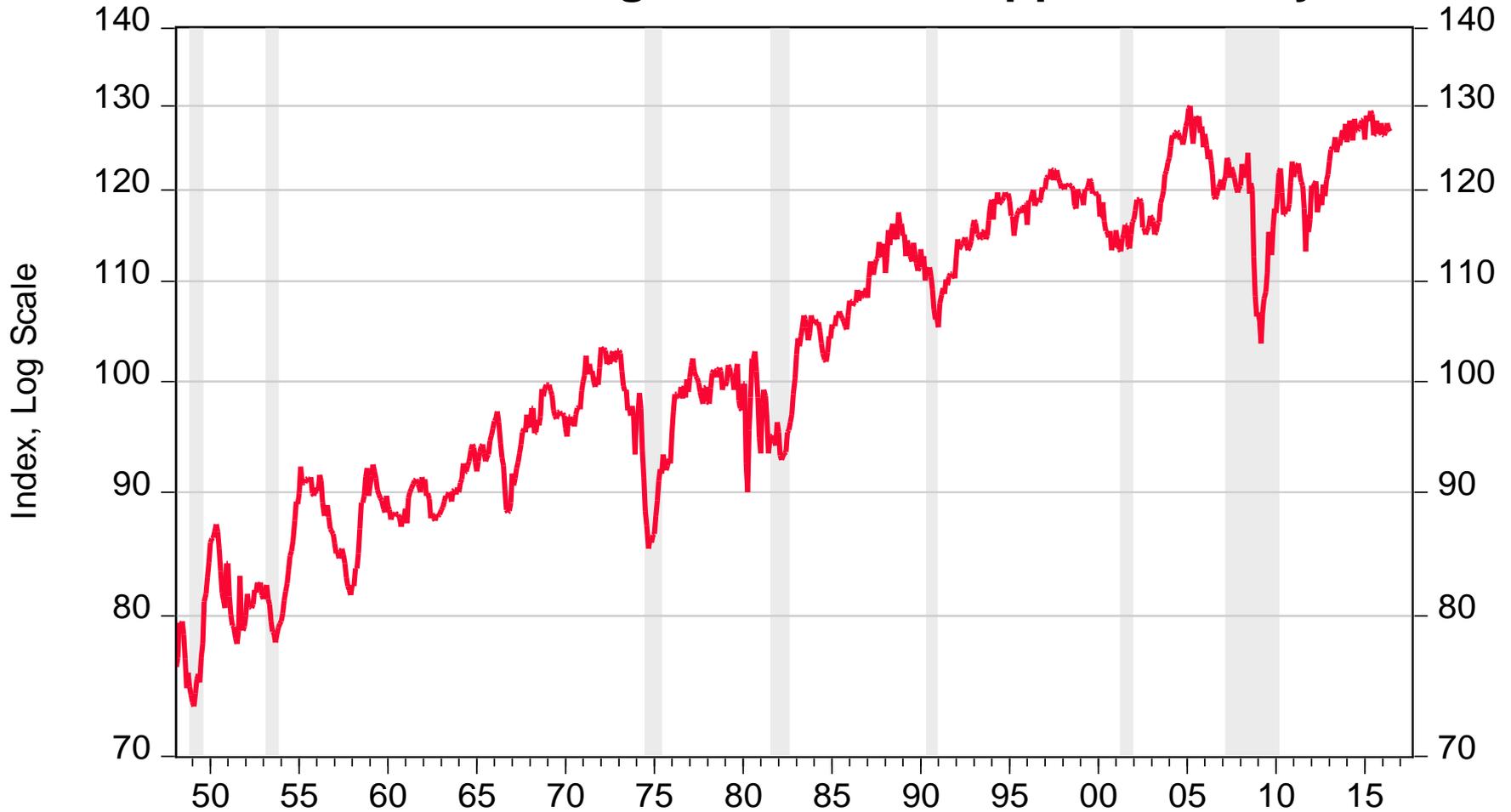
Phoenix Sky Harbor and Tucson International Air-Freight Cargo



Sources: Sky Harbor International Airport, City of Phoenix & Tucson International Airport

8. COPPER INDUSTRY INPUT

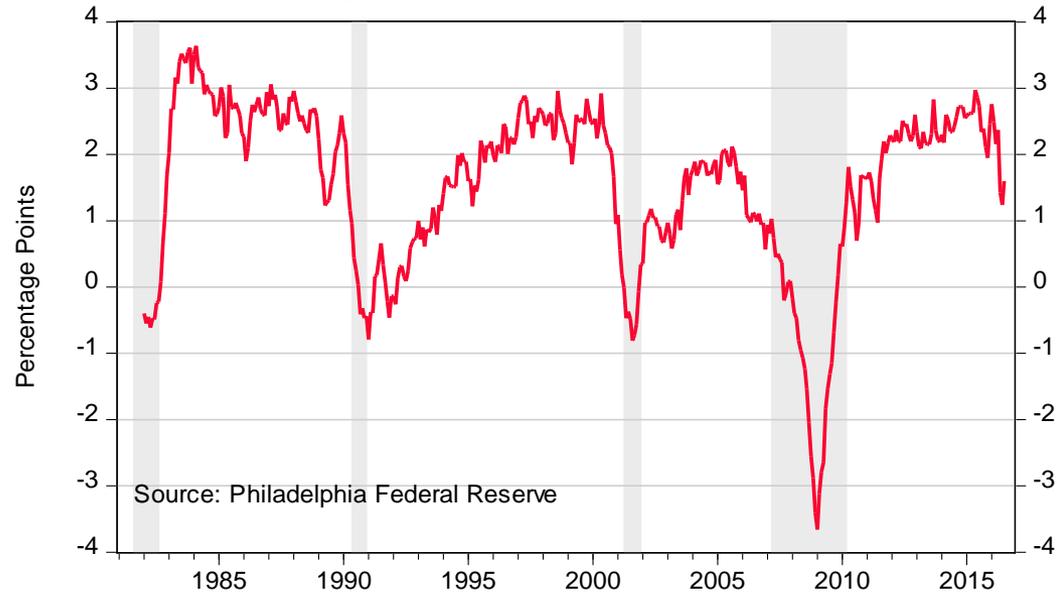
USGS Leading Indicator of Copper Industry



Source: U.S. Geological Survey

9. NEIGHBORING STATES' ECONOMY INPUT

Leading Indicator of California Economy

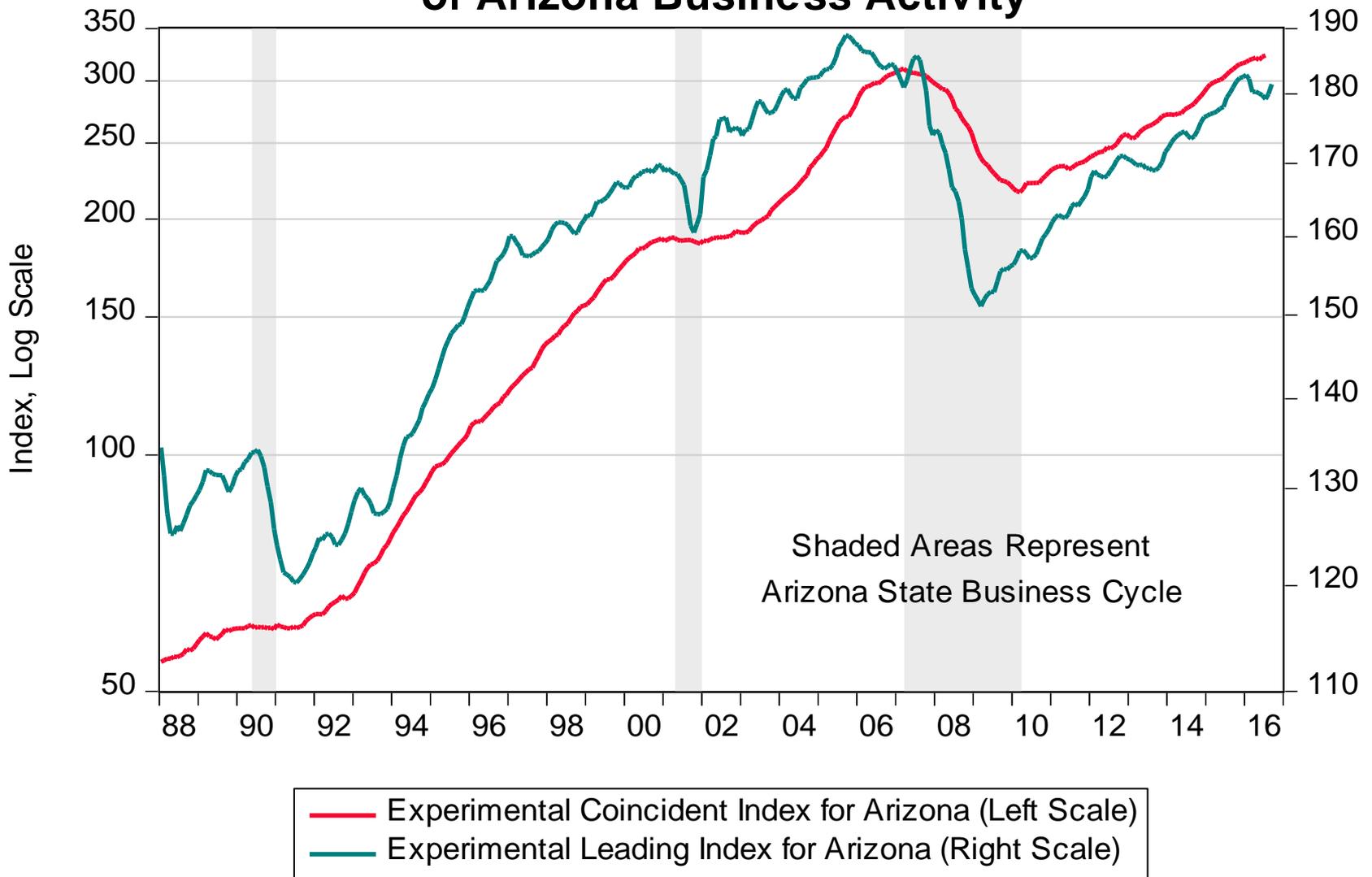


Leading Indicator of Texas Economy

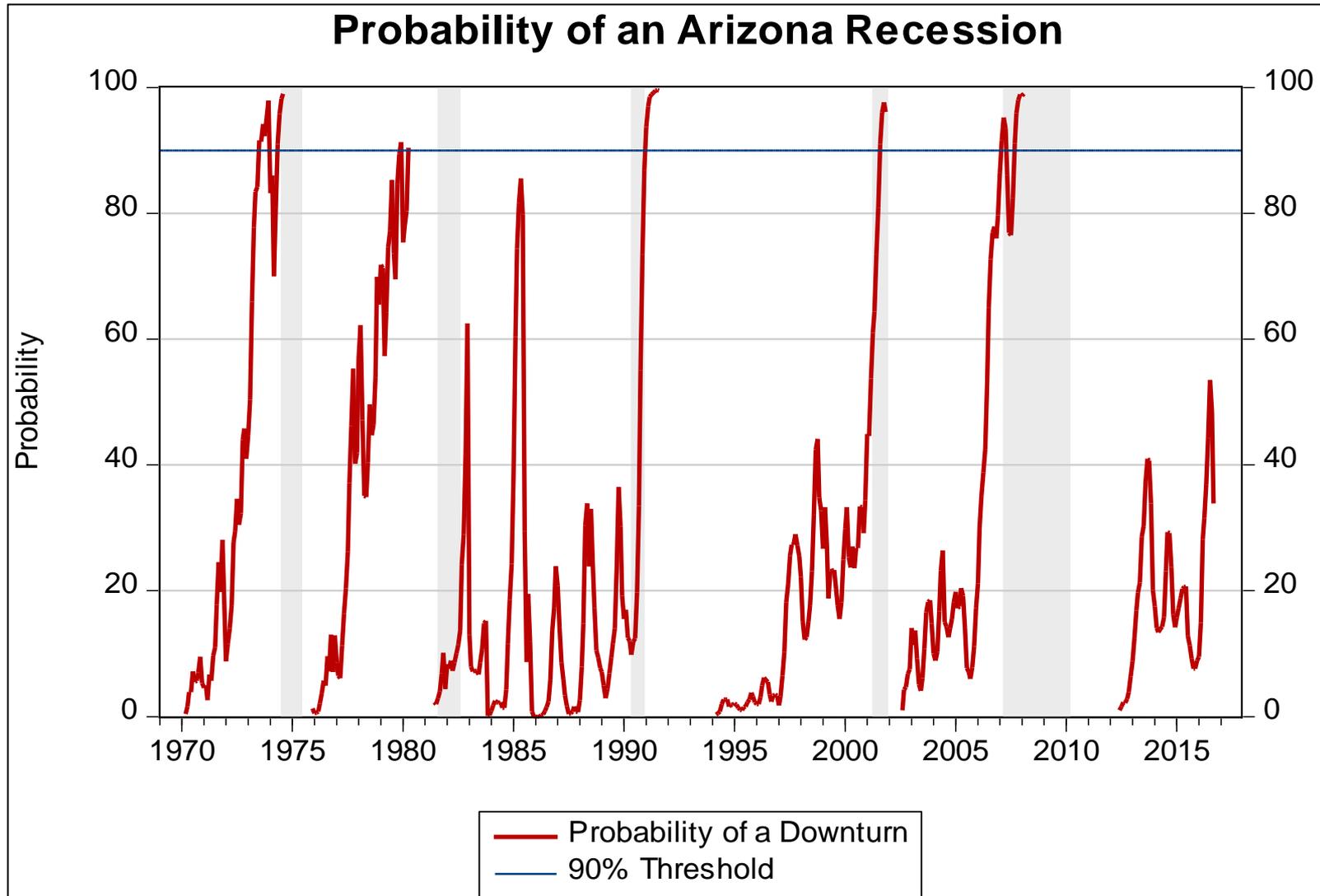


Source: Federal Reserve Bank of Philadelphia

Experimental Coincident and Leading Indexes of Arizona Business Activity



Leading indicator quantifies likelihood of AZ Recession



For leading indicators what was not used, what remains to be examined?

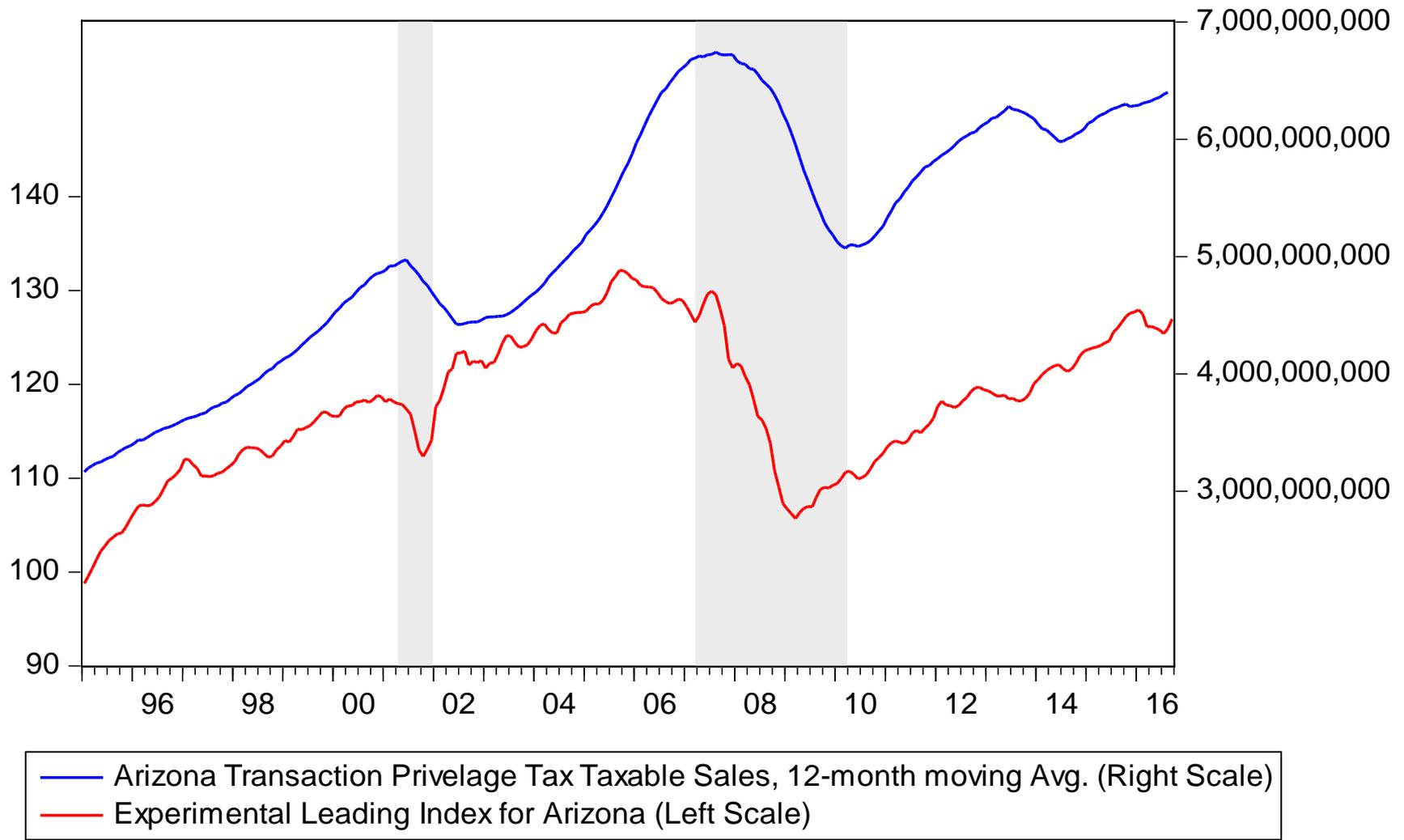
- **Examined, not used**

- New Corporation Filings (Corporation Commission)
- Private Sector Hours Worked (U.S. Bureau of Labor Stats)
- Vehicle Border Crossings (U.S. Customs)
- Value of Arizona Dollar (Dallas Fed)
- New Contractor Licenses (Registrar of Contractors)

- **Remains to be examined**

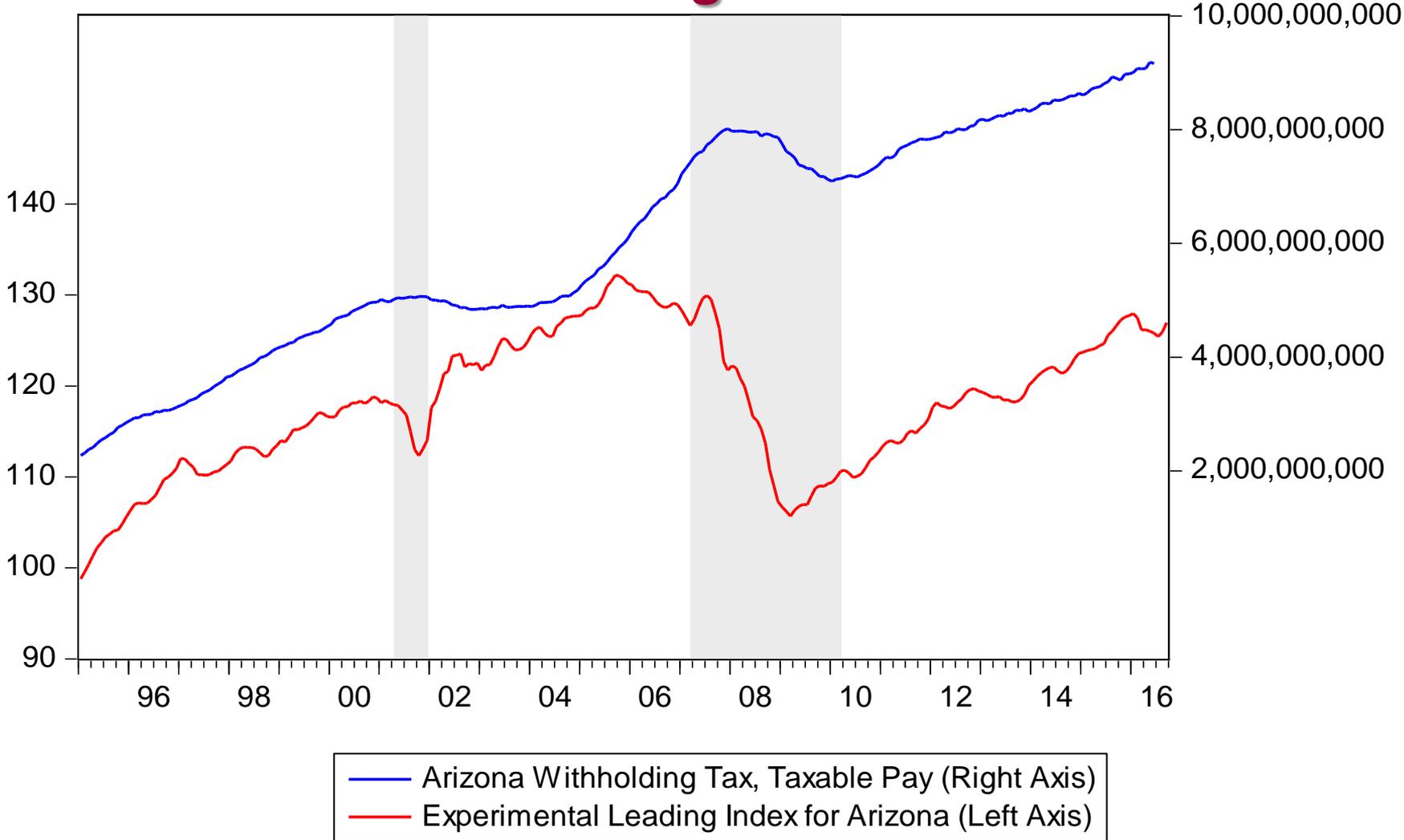
- New Transaction Privilege Tax Licenses (Dept. of Revenue)
- Truck Traffic, AZ Ports of Entry (ADOT)
- Tourism Indicators (AZ Tourism Office)
- Interest Rate Spreads – Risk Spread, Term Spread
- Utilization of “Temp” employees (Survey of Temp Agencies)

Leading Index aids in forecasting State revenues



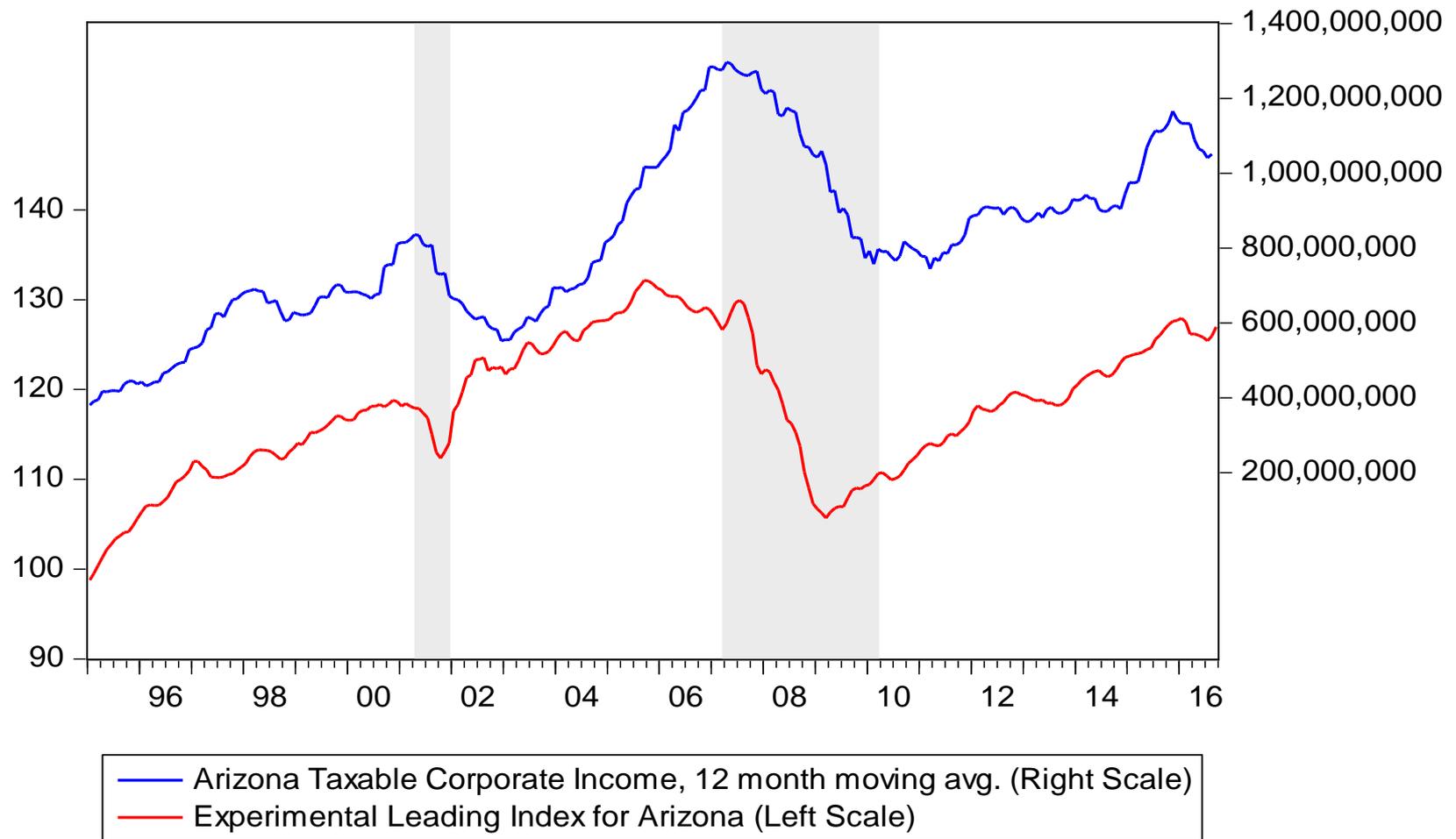
Source: Arizona Department of Revenue

Withholding Tax collections tend to lag onset of recession longer than TPT



Source: Arizona Department of Revenue

Changes in Corporate Income Tax collections tend to mirror business cycle



Source: Arizona Department of Revenue

Final Thoughts

- **This research is very promising as a tool to track and anticipate changes in state economic activity and state tax revenues**
- **Peer review and further experimentation with candidate series will finalize indexes**
- **Need to develop a Purchasing Managers Survey as a lead indicator to add to lead index**
- **Incorporate measures directly into revenue forecasting efforts**
- **Future research will drill down and expand the methods to AZ counties and/or major AZ cities**

Thank You

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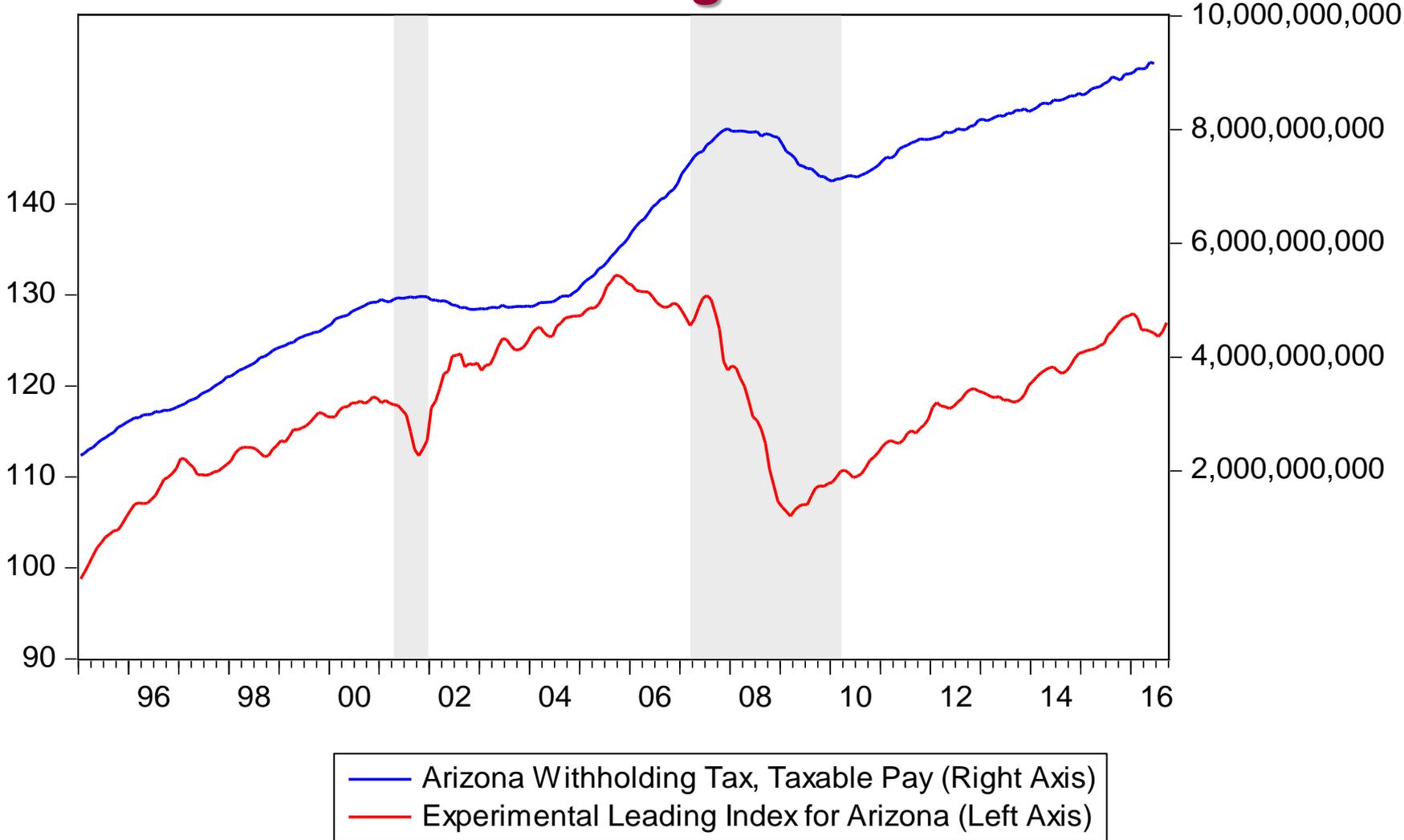
Comparison of the Arizona and U.S. Business Cycles

(Timing Measured Relative to the Arizona Cycle;

Minus Indicates AZ Cycle Leads U.S. cycle, Plus Indicates AZ Cycle Lags)

AZ COINCIDENT INDEX		U.S. BUSINESS CYCLE DATES		Timing Relationship (in Months)		
Peak	Trough	Peak	Trough	Peak	Trough	
1948-Nov		1948-Nov		0		
	1949-Aug		1949-Oct		-2	
1953-Mar		1953-Jul		-4		
	1953-Nov		1954-May		-6	
1974-Jul		1973-Nov		+8		
	1975-Jun		1975-Mar		+3	
1981-Aug		1981-Jul		+1		
	1982-Aug		1982-Nov		-3	
1990-May		1990-Jul		-2		
	1990-Dec		1991-Mar		+3	
2001-Apr		2001-Mar		+1		
	2001-Dec		2001-Nov		+1	
2007-Mar		2007-Dec		-8		
	2010-Mar		2009-Jun		+9	
				Mean	-0.6	0.7
				Median	0	1

Withholding Tax collections tend to lag onset of recession longer than TPT



Source: Arizona Department of Revenue