

# ***LEARN Conference***

## **Federal Reserve Bank of Atlanta**

Samuel Addy, Ph.D., *Director*  
Center for Business and Economic Research  
Culverhouse College of Commerce  
The University of Alabama

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# ***Forecasting Process***

- Data collection
- Exogenous or U.S. economic outlook scenarios
- Specification of model
- Specification and estimation of equations
- Simulations and Forecasts

# ***Data Collection***

- GDP data, all sectors and industries (Bureau of Economic Analysis)
- Employment data, all sectors and industries (Alabama Department of Industrial Relations and Bureau of Labor Statistics or Bureau of Economic Analysis)
- Income and Earnings (Bureau of Economic Analysis)
- Tax receipts, total tax, corporate and individual income tax, sales tax, all other taxes, Alabama Education Trust Fund and Alabama General Fund (Alabama Department of Revenue and Alabama State Budget Office)

# ***Exogenous Economic Outlook Scenarios***

- U.S. Long-Term outlook (Global Insight Inc.)
  - Baseline scenario
  - High-growth scenario
  - Low-growth scenario
- U.S. Short-Term outlook (Global Insight Inc.)
  - Baseline scenario
  - High-growth scenario
  - Low-growth scenario

# ***Alabama Econometric Model***

- Simultaneous Equation Model
  - Powerful tool for forecasting both state and regional economies
  - Captures the relationships and feedbacks among economic variables
  - Based on sound statistical methodology
  - Possible to test estimated structural relationships

# ***Basic Structure of Alabama Econometric Model***

- Four main components
  - Output
  - Employment
  - Wage rates
  - Income, includes personal income and its components and detail wages and salaries by industries

# *Output*

- Contains Alabama gross domestic product in 2000 dollars of major industrial sectors of the state, namely one, two and three-digit North American Industrial Classification System (NAICS) industries
- State GDP originating from a certain industry is influenced by national counterpart or industrial production, aggregate demand in the state represented by total personal income, and relative competitive factors such as relative tax burden or relative wage rates

# Output Continued

- The general functional form of the output equation is:

*State Real Output in Sector  $i = F(\text{The Corresponding U.S. Sector Output or Industrial Production, The Relative Sector Wage Rate, The Relative Tax Burden,...})$*

- U.S. GDP, industrial production and state personal income are positively related to the state GDP
- Negative coefficient of relative tax burden implies that higher state and local taxes reduce state GDP. Similarly a lower relative wage rate tends to increase investment and production. Total GDP is obtained by summing up the output originating from each industrial sector

# ***Output Continued***

- Some sectors such as wholesale and retail trade, financial institutions can also be specified as a function of real Alabama personal income because internal demand tend to play a stronger role and introduces more feedback effects in the simultaneous model through output-employment-income relationship
- The final selection of driver variables depends on the fit of the equations and the model and are therefore determined empirically

# *Employment*

- The general functional form of the employment equation is:

*State Wage and Salary Employment in Sector  $i = F(\text{The Corresponding State Industrial Real Output, The Real Industry Wage Rate, ...})$*

- This component represents demand for labor
- Each sector's level of payroll employment is determined by sector's GDP and real wage rate
- GDP has a positive relationship with employment while real wage rate has a negative relationship
- Total nonagricultural employment is derived as a sum of the employment of each contributing industrial sector

# ***Unemployment Rate***

- The general functional form of the unemployment rate equation is:

*State Unemployment Rate = F( U.S. Unemployment Rate, State Total Employment or Change in Total State Employment,...)*

- State unemployment rate is explained by the U.S. unemployment rate or total state employment or change in total state employment
- State unemployment is positively related to the U.S. unemployment rate and negatively related to the state employment or change in state employment as rising employment creates additional aggregate demand generating downward pressure on unemployment

# *Wage Rate*

- The general functional form of the wage rate equation is :  
*State Wage Rate in Sector  $i$  = F(The Corresponding U.S. Sectoral Wage Rate, The State Unemployment Rate,...)*
- State wages are driven corresponding sector's wages in the U.S. and the state unemployment rate
- While the state wages have the tendency to move together with the national wages, their rise is tempered by a relatively high state unemployment rate and vice versa
- The sectors modeled for wages are the same as in the GDP and employment

# *Income*

- The general functional form of the income equations are:

*State Income category = F(The Corresponding U.S. Income Category,...)*

- For all industries and sectors, wage and salary income is obtained by multiplying wage and salary employment by wage rate and then by summing up across the industries
- Other income categories such as dividends, interest, and rent; transfer payments; other labor income; proprietor's income; and adjustments for residence are driven by their U.S. counterparts

# *Taxes*

- Tax equations are linked to the state economic conditions, driven primarily by employment, income, consumer spending and industrial production, corporate profits
- Difference variables or combination of variables is used to find the best empirical fit
- Tax forecasts are also based on fiscal year instead of calendar year and are therefore modeled as a subset of the state econometric model

# ***Industries Modeled***

- Agriculture, Forestry, Fishing and Hunting (NAICS 11);
- Mining (NAICS 21);
- Utilities (NAICS 22);
- Construction (NAICS 23);
- Manufacturing (NAICS 311-339); All industries included in manufacturing sector are modeled
- Wholesale Trade (NAICS 42);
- Retail Trade (NAICS 44-45);
- Transportation and Warehousing (NAICS 48-49);
- Information (NAICS 51);
- Finance and Insurance (NAICS 52);
- Real Estate, Rental, and Leasing (NAICS 53);
- Professional, Scientific, and Technical Services (NAICS 54);
- Management of Companies and Enterprises (NAICS 55);
- Administrative and Waste Services (NAICS 56);
- Educational Services (NAICS 61);
- Health Care and Social Assistance (NAICS 62);
- Arts, Entertainment, and Recreation (NAICS 71);
- Accommodations and Food Services (NAICS 72);
- Other Services (NAICS 82);
- Government (Federal Civilian and Military, and State and Local)

# ***Specification and Estimation of Equations***

- The first step involves specification of the model based on sound economic and financial relationships
- Once the equations have been initially specified, each equation is then estimated using various estimation methodologies and corrected for any autocorrelation or multicollinearity
- Several variables are tested (deleted and added from the estimation process to find the best fit for each equation

# ***Simulation and Forecasts***

- Once the final version of the equations are specified, the model is compiled and ready to produce forecasts
- It should be noted that specification of equations is a continuous process, as the data is updated each month or quarter, the specifications of equations can change significantly, it's a continuous process of determining and trying to find the best set of exogenous variables and estimation methodologies to empirically determine the best possible fit

# ***Simulation and Forecasts***

- Medium-term forecasts are produced for the next 10 years while long term forecasts are produced for the next 30-year time frame
- In order to produce a consistent set of forecasts, it may be necessary to change specification of certain equations to achieve accuracy and maintain consistency through out the forecast time frame and across the industries

# *Frequency of Updates*

- State variables are updated every month or as they are released
- Exogenous forecast scenarios are updated every month
- Forecasts are updated every quarter
- Equations are re-specified and re-estimated once a year or as the state GDP data is released
- All models and databases utilize Global Insight's econometric software called AREMOS

## ***Forecast Publications***

- Quarterly economic outlook and forecasts are published in a publication called “Alabama Business”, a quarterly publication
- Annual economic outlook and forecasts are published in an annual publication “Alabama Economic Outlook” and “Alabama Economic Outlook, Forecast Tables” respectively

## ***Other Modeling Efforts***

- In addition to the state econometric model, CBER also maintains several regional and county level models utilized for contract research and other purposes
- CBER also has an extensive experience in building economic impact models using Input-Output modeling methodology utilized for contract research for both public and private organizations

**TABLE 1.00 ALABAMA ECONOMIC OUTLOOK, 2008**  
**ALABAMA GROSS DOMESTIC PRODUCT (MILLIONS OF 2000 DOLLARS)**

	<b>2007</b>	<b>2008</b>	<b>2009</b>
TOTAL REAL ALABAMA GROSS DOMESTIC PRODUCT	141082	144224	148240
AGRICULTURE, FORESTRY, FISHING and HUNTING	2431	2485	2548
MINING	929	935	969
UTILITIES	3601	3655	3720
CONSTRUCTION	5628	5626	5686
MANUFACTURING	29187	30176	31703
NONDURABLE	9178	9318	9451
FOOD PRODUCTS	1676	1726	1766
TEXTILES and PRODUCT MILLS	1155	1124	1116
APPAREL	643	629	616
PAPER	3084	3100	3137
PRINTING and RELATED ACTIVITIES	300	298	303
PETROLEUM and COAL PRODUCTS	348	377	415
CHEMICALS	2210	2271	2387
RUBBER, PLASTICS	955	947	962
DURABLE	16174	16392	16555
WOOD PRODUCTS	1117	917	950
NONMETALLIC MINERAL PRODUCTS	9178	9318	9451
PRIMARY METALS	2099	2121	2190
FABRICATED METALS	2315	2371	2416
MACHINERY	1031	1010	1085
COMPUTER and ELECTRONIC PRODUCTS	2835	3259	3683
ELECTRICAL EQUIPMENT and APPLIANCES	656	626	657
MOTOR VEHICLE BODY, TRAILERS and PARTS	5269	5861	6276
OTHER TRANSPORTATION EQUIPMENT	1236	1312	1425
FURNITURE and RELATED PRODUCTS	882	835	866
MISCELLANEOUS	583	621	673
WHOLESALE TRADE	8121	8275	8449
RETAIL TRADE	12844	13224	13655

**TABLE 1.00 ALABAMA ECONOMIC OUTLOOK, 2008**  
**ALABAMA GROSS DOMESTIC PRODUCT (MILLIONS OF 2000 DOLLARS)**  
**(CONTINUED)**

	<b>2007</b>	<b>2008</b>	<b>2009</b>
TRANSPORTATION and WAREHOUSING	3853	3932	4055
INFORMATION	5663	5849	6060
FINANCE and INSURANCE	7056	7217	7399
REAL ESTATE, RENTAL, and LEASING	13147	13342	13562
PROFESSIONAL and TECHNICAL SERVICES	8686	8986	9315
MANAGEMENT OF COMPANIES	1025	1021	1036
ADMINISTRATIVE and WASTE SERVICES	3151	3206	3267
EDUCATIONAL SERVICES	551	560	579
HEALTHCARE and SOCIAL ASSISTANCE	9560	9751	9948
ARTS, ENTERTAINMENT, and RECREATION	509	520	531
ACCOMMODATION and FOOD SERVICES	3062	3098	3138
OTHER SERVICES	3019	3027	3051
GOVERNMENT	19062	19340	19570
FEDERAL CIVILIAN	4388	4440	4487
FEDERAL MILITARY	1888	1933	1961
STATE and LOCAL	12786	12966	13122

SOURCE: U.S. DEPARTMENT OF COMMERCE and CENTER FOR BUSINESS and ECONOMIC RESEARCH,  
 THE UNIVERSITY OF ALABAMA, JANUARY 2008.

# ***Forecast Summary (Preliminary 2009)***

- AL GDP **1.7%** to \$144.4 billion
- Employment **1.3%** to 2.05 million
- Taxes below trend **2.5%** (trend is 5.2%)
- Unemployment Rate **5.5%**