A Forecast of Economic Activity:
Selected Industries in West Virginia's Workforce Investment Region 1

September 2003

Michael J. Hicks, Ph.D.
Center for Business and Economic Research
Marshall University

Contents

Contact:
Michael J. Hicks, Ph.D.
Center for Business and Economic Research
Marshall University
One John Marshall Drive
Huntington, West Virginia 25504
304.696.6251

INTRODUCTION

Formal projections of economic activity serve a central role in policy decisions regarding the deployment of public resources. Such projections are especially important for decisions regarding investments in training and infrastructure with a high degree of specificity. This is because specificity in training and infrastructure investment potentially represent costs that are sunk. Ill chosen investments in sunk costs represent failed policy. It is for this reason the Workforce Investment Region 1 has requested an analysis of selected industries within the region, the State of West Virginia and the nation as a whole.

THE INDUSTRIES

Specific industries chosen for this forecast are detailed in Table 1. These industries represent those of interest to regional and State policymakers, which were identified by the Region 1 Workforce Investment Board Staff.

One important consideration for this study is the deployment of Workforce Investment resources. So identifying industry sectors from the common names was an important part of the forecast effort. In selecting specific industry categories to conform to the common industry name we attempted to choose as broadly as possible. We used *County Business Patterns* data from the *U.S. Census* to find employment and payroll. *The North American Industrial Classification System* or NAICS was used to categorize firms.[1]

Using the industry descriptions we were able to identify firms from the two to six digit NAICS categories. This provided a very disaggregated effort to forecast economic activity for the region, state and nation as a whole. See Table 1.

[1] The NAICS replaced the Standard Industrial Classification (SIC) in a phased in process from 998 through 2002. Currently only NAICS is reported.

Table 1, Industries Selected for Forecast

Common Name	NAICS	NAICS Name
HEALTHCARE	62	Healthcare & Social Assistance
RETAIL/WHOLESALE	42	Wholesale Trade
	44-45	Retail Trade
AEROSPACE PRODUCTS	3364	Aerospace Product & Parts Manufacturing
BIOMEDICAL TECHNOLOGY	54171	R&D in Physical, Engineering & Life Sciences
BUSINESS SERVICES	5614	Business Support Services
	5412	Accounting, Tax Prep, Bookkeeping, Payroll Services
	5418	Advertising & Related Services
TOURISM	71	Arts, Entertainment & Recreation
HOSPITALITY	72	Accommodation & Food Services
ENERGY & ENVIRONMENTAL TECHNOLOGY	211	Oil & Gas Extraction
	2121	Coal Mining
	213111	Drilling Oil & Gas Wells
	213112	Oil & Gas Operations Support Activities
	213113	Support Activities for Coal Mining
	22	Utilities
	562	Waste Management & Remediation Services
INFORMATION TECHNOLOGY	514	Information Services and Data Processing Services
	334	Computer & Electronic Product Manufacturing
	5415	Computer Systems Design & Related Services
METAL WORKING & MACHINERY	331	Primary Metal Manufacturing
	332	Fabricated Metal Product Manufacturing
	333	Machinery Manufacturing
MOTOR VEHICLE PARTS & EQUIPMENT MANUFACTURING	3361	Motor Vehicle Manufacturing
	3362	Motor Vehicle Body & Trailer Manufacturing
	3363	Motor Vehicle Parts Manufacturing
PLASTICS, SPECIALTY CHEMICALS & ADVANCED MATERIALS	326	Plastics & Rubber Product Manufacturing
	325	Chemical Manufacturing
VALUE ADDED WOOD PRODUCTS	321	Wood Product Manufacturing
	33711	Wood Kitchen Cabinet & Countertop Manufacturing
	337129	Wood TV, Radio & Sewing Machine Cabinet MFG.
	337211	Wood Office Furniture Manufacturing
WAREHOUSING & DISTRIBUTION	48-49	Transportation & Warehousing

FORECAST METHOD

Projecting economic activity is typically performed using models that attempt to capture the dynamic relationship between a variable (e.g. employment) and other

variables chosen to predict it. The selection of the predictor or dependent variables is made through the application of economic theory and statistical inference concerning the effectiveness of these variables.[2]

In this effort we were confronted with a primary problem concerning the absence of a long time series due to the SIC/NAICS changeover, which affected the data prior to 1998. This gave us but four time series observations.

In order to predict the overall economy we chose a basic national forecast from the well known FAIRMODEL.[3] This model has been available since 1996 and was authored by Ray Fair of the Cowles Commission at Yale. The model is a quarterly forecast model with 31 stochastic and roughly 100 identity equations for the United States. There are additional international elements. The current version of this model provides the basis for *The West Virginia Econometric Model* (Hicks and Simpson, 2000), which estimates the West Virginia economy through a sixteen endogenous variable Vector Autoregressive model (exogenous). This model forecasts several important U.S. variables through 2015 using the most recent release of the *National Income and Product Accounts*. The most recent federal tax law changes have been incorporated into this model. The Center staff performs the actual estimation of the FAIRMODEL.

The performance of the national FAIRMODEL was compared to the Global Insight forecast, which provides the national estimates for the other West Virginia forecasting effort, the *West Virginia Economic Outlook* published by West Virginia University.[4] There were no substantial differences in the FAIRMODEL and the Global Insight estimates that could not be explained by the timing of the forecasts. The proximity between this forecast and that of the *West Virginia Economic Outlook* provided us with great confidence in the models. Also, the proximity in the forecast between the

[2] Formally, the modeling process used here (and in most forecasting applications) is a stochastic model. Stochastic models differ from deterministic models in that they permit the data to 'speak for themselves' through a statistical estimation process. Deterministic models, in contrast, impose a defined relationship between different variables. An example of a deterministic model relationship would be the multiplier effect so well known in economic development research.

[3] This model and the accompanying documentation is available from Yale University at fairmodel.econ.yale.edu.

[4] Dr. George Hammond at WVU's Bureau of Business and Economic Research produces this annual forecast using Global Insight as the national forecast model.

two models aids in removing the danger of policy dissonance within the state's differing policy efforts.

Using this forecast of national economic activity, the Center staff was able to estimate economic activity within each of the industries at the national, state and regional level. The paucity of time series data precluded single equation estimates and time series models that rely upon long lag lengths. Estimation of time series cross sectional models with fixed effects was a natural choice. Using this technique for employment we were able to generate forecasts for each of the fourteen industries at the national, state and regional level. From these estimates we were able to combine productivity growth and income growth adjusted for inflation to provide estimates of income in these industries. What follows are graphical representations of employment and income for these industries. The result is a projection of 84 variables through 2015. These are illustrated separately in the appendices.

FORECAST RESULTS

We were able to estimate effectively annualized employment growth for each industry as well as inflation adjusted wages for each job. These forecasts are presented in Tables 2 and 3. They are illustrated graphically in the appendices.

Table 2, Forecast Average Annual Employment Change (2004-2015)

	Employment		
Industry	Region 1	WV	US
Aerospace	0.00%	1.36%	-0.86%
Biomedical	6.60%	7.07%	2.39%
Information Technology	3.63%	0.43%	2.06%
Motor Vehicle Parts & Equipment	-4.94%	2.81%	2.79%
Business Services	4.26%	1.80%	0.27%
Tourism	0.41%	2.82%	1.68%
Value-Added Wood Products	3.43%	2.45%	-2.27%
Warehousing & Distribution	1.00%	0.41%	0.49%
Energy & Environmental Technology	-0.59%	-2.88%	-0.70%
Healthcare	0.81%	0.94%	1.07%
Hospitality	0.95%	0.44%	1.07%
Retail & Wholesale	-0.07%	-0.01%	0.73%
Plastics, Chemicals & Advanced Materials	-1.28%	-0.67%	0.07%
Metal Working & Machinery	-0.72%	-0.40%	-0.67%

Clearly there are marked differences between growth rates in Region 1, the State as a whole and the nation. These differences are most stark in the aerospace, motor vehicle parts and equipment, hospitality, business services and warehousing and distribution.

Wage rate growth changes should be much less pronounced since many productivity changes are diffused quickly across industries without regard to borders. It is critical to note that it is this productivity that dictates long run wage and compensation levels.

This observation should not be construed to suggest that levels will not differ, only that growth rates will show modest variation. This is consistent with the projection illustrated in Table 3.

Table 3, Real Annualized Wage Growth Rate (2004-2015)

	Real Wage Growth Rate		
Industry	US	WV	Region 1
Healthcare	0.53%	0.37%	0.24%
Retail & Wholesale	0.66%	0.51%	0.56%
Aerospace	0.58%	0.09%	0.09%
Biomedical	0.90%	0.90%	0.90%
Business Services	0.61%	1.32%	1.94%
Tourism	0.64%	0.64%	0.25%
Hospitality	0.53%	0.35%	0.27%
Energy & Environmental Technology	0.69%	0.49%	-0.82%
Information Technology	0.64%	0.70%	0.88%
Metal Working & Machinery	0.20%	0.10%	0.64%
Motor Vehicle Parts & Equipment	0.28%	0.62%	0.91%
Plastics, Chemicals & Advanced Materials	0.37%	0.20%	-0.04%
Value-Added Wood Products	0.32%	0.19%	0.05%
Warehousing & Distribution	0.47%	0.09%	0.28%

Summary and Conclusions

There are stark regional differences in employment growth rates across Region 1, West Virginia and the nation as a whole. This is fully consistent with expectations. There are much smaller variations within inflation adjusted growth rates. This too is to be expected. As decisions regarding the deployment of resources for public policy is undertaken it is important to include disaggregated data and predications wherever feasible.

In addition to this forecast of employment and wage growth it is helpful to examine the levels of income associated with each industry within the different regions. The stark regional differences apparent in these data also provide clear guidance for the deployment of resources at the regional, state and federal level.

Table 4, Average Annual Wage, 2001

Industry	Region 1	WV	US
Healthcare	$24,829	$27,277	$32,041
Retail & Wholesale	$19,357	$20,096	$28,083
Aerospace	$43,832	$43,832	$58,313
Biomedical	$66,711	$66,711	$66,711
Business Services	$27,880	$22,743	$33,149
Tourism	$16,778	$14,657	$25,912
Hospitality	$13,163	$10,529	$12,901
Energy & Environmental Technology	$37,864	$51,211	$55,299
Information Technology	$35,851	$43,813	$58,755
Metal Working & Machinery	$37,365	$37,674	$38,225
Motor Vehicle Parts & Equip	$44,865	$41,126	$45,013
Plastics, Chemicals & Advanced Materials	$33,502	$52,243	$42,214
Value-Added Wood Products	$25,952	$23,674	$28,271
Warehousing & Distribution	$26,147	$31,215	$34,529

REFERENCES

Akaike, H. 1974, A New Look at Statistical Model Identification, *IEEE Trans. Auto. Control* 19, 716–723.

Davidson, R. and J. MacKinnon, 1993. *Estimation and Inference In Econometrics*. (Oxford University Press: New York).

Fair, Ray C. Fair "FAIRMODEL" url http://fairmodel.econ.yale.edu

—— "What Happened to Macroeconometric Models?" *American Economic Review*, May 1993. p 289-293.

Granger, C., 1981, “Some Properties of Time Series Data and Their Use in Econometric Model Specification,” *Journal of Econometrics* 16, 121–130.

Hamilton, J., 1994, *Time Series Analysis* (Princeton: Princeton University Press).

Hicks, M. J. and Simpson M.W. "Forecast Error Decomposition in Regional Forecast Models" *Lewis College Of Business*, Working Paper 00-01-A, 2000.

Johansen, S. 1991. “Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models”, *Econometrica* 59, 1551–80.

Phillips, P. and P. Perron, 1988, “Testing for a Unit Root in Time Series Regression”, *Biometrika* 75, 335–346.

Sims, Christopher. “Bayesian Skepticism on Unit Root Econometrics” *Journal of Economic Dynamics and Control* 12 (1988) pp 463-74.

APPENDICES

The following graphics display the forecast data graphically.

Figure A, Selected Employment Forecast through 2015

(Average Annual Growth)

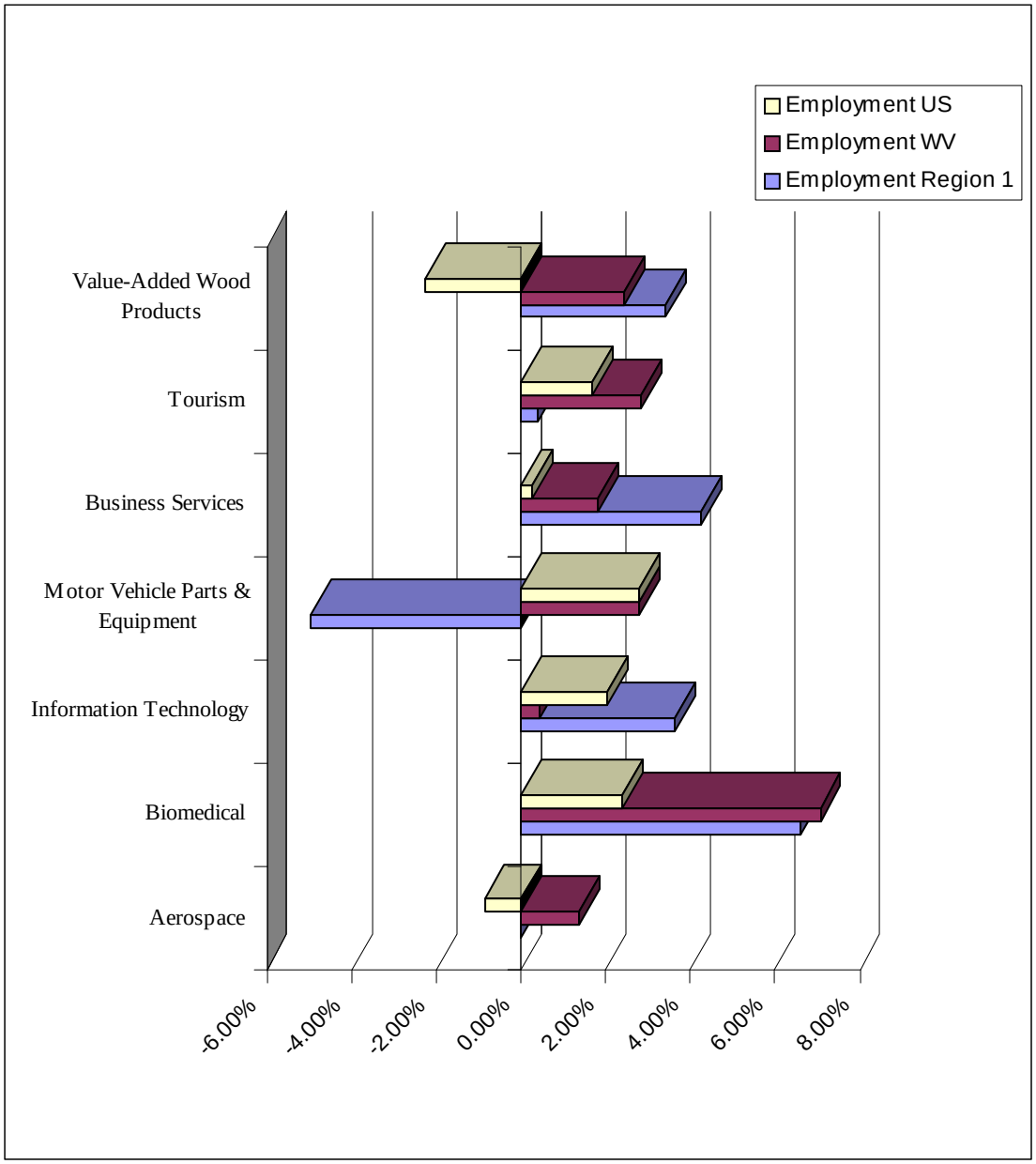

Figure B, Selected Employment Forecast through 2015
(Average Annual Growth)

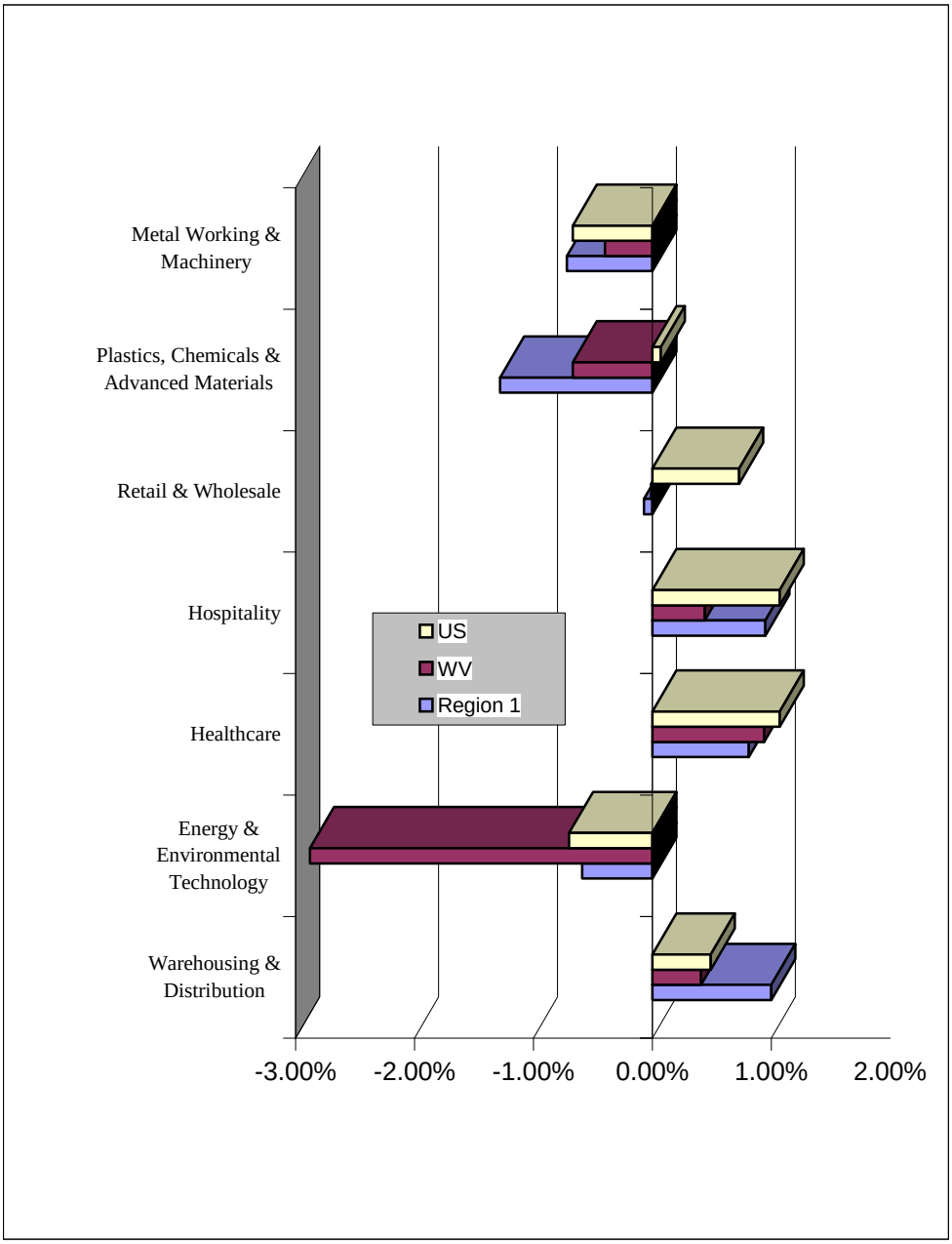

Figure C, Selected Industry Forecast Through 2015

(Average Annual Growth)

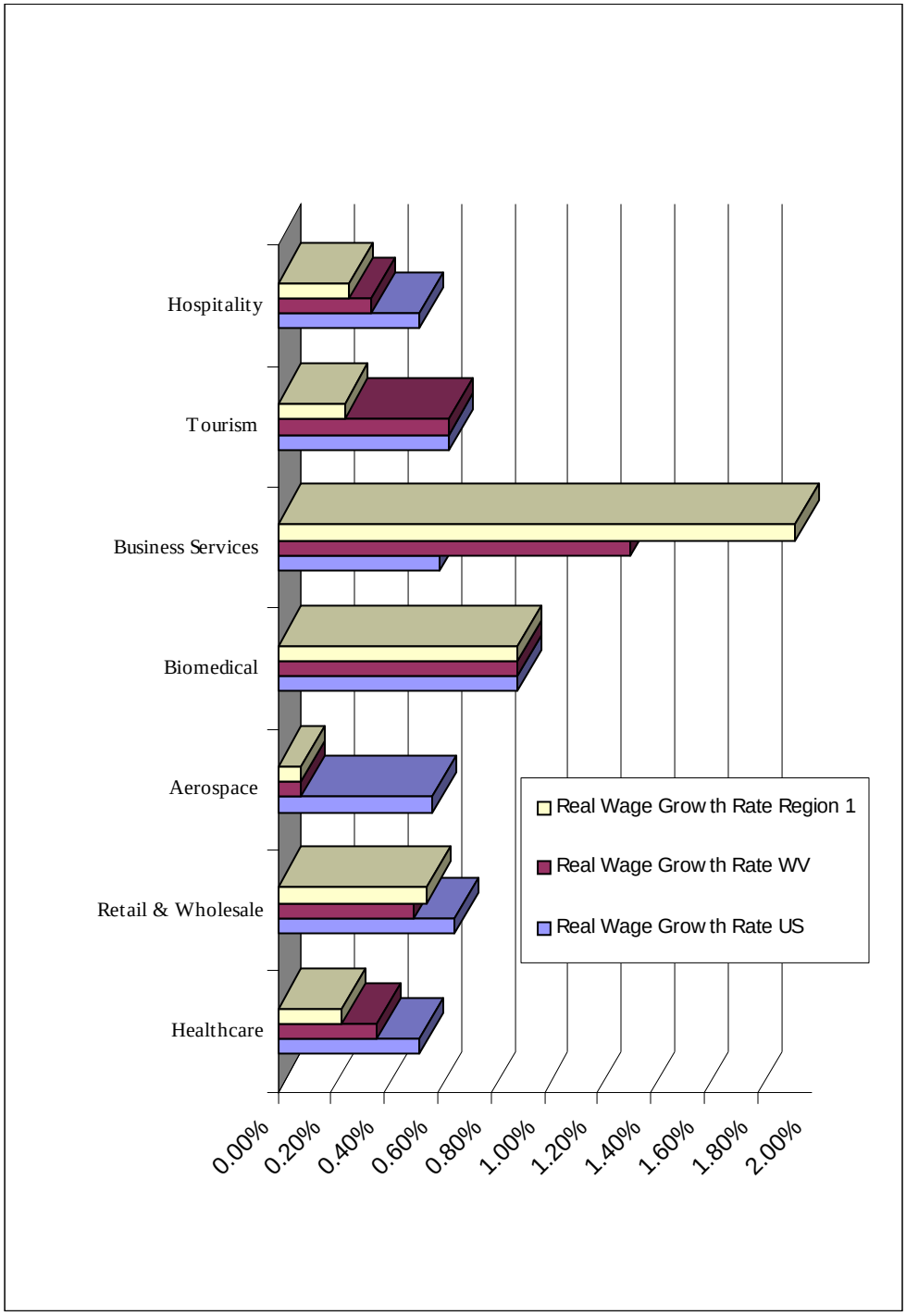

Figure D, Selected Industry Forecast through 2015

(Average Annual Growth)