
FRBSF WEEKLY LETTER

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Forecasting Nevada's Economy

Nevada has been one of the fastest growing states in terms of employment for the past three decades. Some of its observers, especially those who portray gaming as a panacea for local employment and fiscal problems, claim that the state's gaming-based economy insulates it from swings in the national economy while providing a stable source of revenue to finance state and local government spending.

Policymakers in Nevada, however, are finding evidence that their state is growing more sensitive to the national economy. For example, fluctuations in the unemployment rate have closely matched movements in the national rate (see Chart). The state government also is feeling increasing pressure to finance an infrastructure to support rapid population growth and a more diverse regional economy. Like their counterparts in other states, Nevada's policymakers are realizing that the uncertainties of future economic performance require a better understanding of the structure of their state's economy and how that economy is interrelated with the nation's. In particular, they have found a need to forecast key economic variables.

In this *Letter*, we first describe the structure of Nevada's economy and demonstrate its sensitivity to movements in the national economy. Then we describe past efforts to model and forecast Nevada's economy and present a new approach with a number of advantages over past efforts.

Structure of Nevada's economy

Nevada's gaming-based economy was established by legislation in 1931 that permitted casino gaming statewide. Not until after World War II, however, did the gaming industry come to dominate the state's economy. Estimates indicate that gaming activity now directly and indirectly accounts for over 60 percent of Nevada's employment. Gaming tax revenues provide about 45 percent of state revenues to the general fund in any given year. The dominant role of gaming and the tourist orientation of Nevada's economy sharply differentiates it from other

regions. In July 1985, the hotel-gaming-recreational sector in Nevada accounted for 28.8 percent of total nonagricultural employment.

Three characteristics unique to Nevada's economy make it interesting to the regional economist. First, the state is less diversified than most other states and remains highly dependent on the gaming industry as its economic base. Second, the uneven geographic distribution of economic activity presents policymakers with a set of problems that are simultaneously urban and rural. Despite the physical size of the state, population and economic activity are concentrated in three economic regions: Las Vegas (Clark County), Reno-Sparks (Washoe County), and South Lake Tahoe (Douglas County and Carson City). In 1985, these three regions accounted for 55.8 percent, 27.6 percent, and 6.0 percent of the state's total nonagricultural employment, respectively.

Third, the state has grown quickly as a result of the rapid growth of the gaming industry. Between 1960 and 1985, total civilian employment rose at an average annual rate of 5.5 percent compared to the 2.0 percent rate for the United States. Nevada continues to grow faster than most regions in the U.S., and is projected to do so through the end of the century.

Employment in the hotel-gaming-recreation sector increased at an average annual rate of 6.6 percent over the 1960-85 period. There is evidence, however, that the gaming industry has reached a stage of slower growth in Nevada because of market saturation and competition from other parts of the country. Casino gaming in Atlantic City and a variety of state lotteries such as the one recently introduced in California now compete for the consumer's gaming dollar.

Nevada is recognizing that gaming can no longer sustain future growth and that a narrowly diversified economy presents high risks. As a result, both the governmental and private sectors have mounted major efforts to encourage non-gaming business activity and to diversify the

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state's economy. A state-sponsored trade mission in April 1986 to Japan and Korea is the most recent example of this diversification effort.

Nevada and the national economy

Nevada's rapid growth during the 1970s was responsible for an oft-expressed view that a gaming-based economy is "recession proof." This view undoubtedly accounts for part of the interest other areas of the country have expressed in gaming as a solution to their employment and fiscal problems. Taxpayer efforts to limit local taxes, such as Proposition 13 in California, as well as federal spending cuts that have reduced funding for state programs, have created a restrictive fiscal environment for local and state governments. There are however, reasons to doubt the effectiveness of the gaming industry as a stable alternative source of government revenue.

The demand for Nevada's gaming services depends heavily on the economic performances of California and other areas which themselves are sensitive to changes in the national environment. Moreover, construction plays an important role in a rapidly growing economy such as Nevada's, and construction activity is sensitive to national financial conditions. Research by Thomas F. Cargill in 1979, based on industrial employment trends through 1975, suggested that Nevada's economy was indeed sensitive to the national business cycle, although not as sensitive as most other regions because of its strong growth trend. Since then, the sharp national recession between July 1981 and November 1982 was clearly reflected in economic activity in Nevada as the state's unemployment rate rose from 6.7 percent to 10.8 percent. This evidence certainly suggests that Nevada is not isolated from national economic forces.

Forecasting Nevada's economy

As Nevada continues to grow in size and diversity, the need to forecast key economic measures has become critical. Recently, movements in the state's unemployment rate have fallen out of step with the national trend (see Chart). How much longer this can continue is a case in point. Nevada's policymakers would also like to forecast the amount of revenue realizable from gaming taxes and monies that could support investments in economic infrastructure.

The construction and estimation of an economic model provides a widely used method for making the needed forecasts. A model of a state economy consists of a set of relationships among selected variables that measure and determine key elements of the state economy. The framework used is determined by the model's purpose, the availability of data, and the amount of detail analyzed.

Regional forecasting models have proliferated since the early 1960s. These models have been developed for cities, SMSAs, counties, states, and groups of states, and have often been the focal points of public debate and policy formulation. Nevada has not been an exception to this development.

In the past decade, several attempts have been made to model the Nevada economy using traditional methods of model construction, estimation, and forecasting. At least one large multi-equation model was developed based on the framework commonly used in large national models. Other modeling approaches developed specifically for the regional context also were developed.

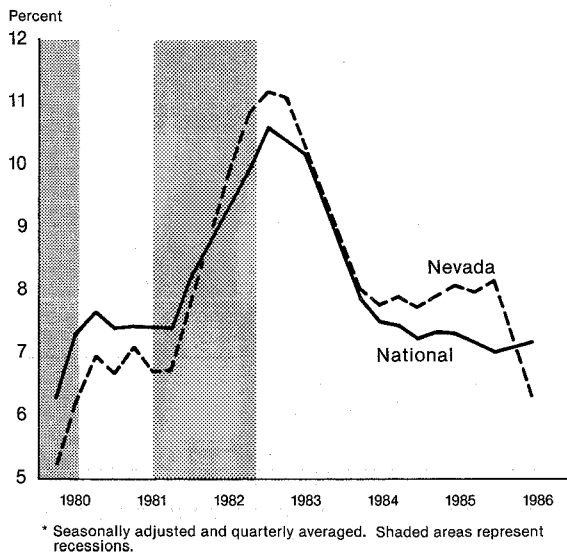
Unfortunately, many modeling efforts proved unsatisfactory. The data requirements were often so specific and detailed that models frequently were incapable of taking into account the changes in economic structure that accompany rapid growth. They were expensive to construct and maintain, and their forecasting performances left something to be desired given their costs of construction and maintenance. Moreover, the models became obsolete soon after they were constructed.

Dissatisfaction with efforts to forecast Nevada's economy reflects a growing more general dissatisfaction with traditional models, especially large models of the national economy. Errors from these models often are so large that forecasts are no more accurate than those obtained from "naive" methods.

A new approach

The last few years have witnessed the emergence of a new approach to modeling and forecasting that offers a great advantage at the regional level. The vector autoregression, or VAR, method departs from the traditional multi-equation structure of large models. It does not rely on a detailed specification of how each variable is determined by other variables and, hence, is less structured. The VAR method uses

Nevada and National Unemployment Rates*



only a small group of variables (referred to as a vector of variables) — those considered most relevant to the purpose at hand.

In the case of Nevada, two sets of variables constitute the vector. First, three variables represent key measures of economic activity: total civilian employment, taxable sales, and "gross gaming revenues." Gross gaming revenues are the net winnings of gaming operations and, together with taxable sales, provide the major tax base for the state. Second, four national variables represent influences on Nevada's economy: real GNP, the GNP price index, total civilian employment, and the 3-month Treasury bill rate.

The VAR approach is flexible in that it allows the modeler to impose prior beliefs about how the selected variables interact with one another. If, for example, the modeler believes that real GNP plays a more important role in influencing gross gaming revenues than taxable sales, this belief can be made part of the VAR estimation process. Their simplicity makes VAR models less expensive to develop and maintain than traditional large-model methods, and allows them to be run on a personal computer.

The Nevada model is only one of several applications of the VAR method. VAR has already been applied to forecasting national and regional economic activity by economists at the Federal Reserve Banks of Dallas, Minneapolis, and Richmond. Some VAR modelers claim that the method yields as accurate, if not more accurate, forecasts than traditional methods, although this assertion has not been tested extensively to date. One comparison of the forecasting performance of a national VAR model with several well-known traditional models yielded mixed results, but VAR modelers consider even mixed results to favor the VAR method given its lesser cost and greater flexibility.

The VAR approach is not without limitations. It is designed primarily to generate forecasts and is not as suitable as traditional methods for testing specific theories of how, for example, real GNP influences taxable sales in the case of Nevada. VAR modelers argue, however, that our data and knowledge of the economy are not precise enough to specify how variables interact with other variables anyway.

Conclusions

Initial forecasts of Nevada's economy using the VAR method appear promising. We estimated a VAR model based on quarterly data from 1960 through 1982. Based on these estimates, forecasts of the three key Nevada variables were generated over the next eight quarters to gain some insight into the forecasting accuracy of the model. The average values of the absolute forecast error for gaming revenues, taxable sales, and employment were 3.71 percent, 1.19 percent, and 2.14 percent, respectively. The absolute forecast errors for 1984 averaged 6.95 percent, 6.65 percent, and 3.48 percent, respectively. These are acceptable forecast errors and justify continued work to refine the Nevada VAR model.

Despite its limitations, therefore, the VAR method offers a new approach to modeling the regional economy that has much promise. It gives policymakers a simpler, more flexible, and lower cost method of forecasting the economy.

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BANKING DATA—TWELFTH FEDERAL RESERVE DISTRICT
(Dollar amounts in millions)

Selected Assets and Liabilities Large Commercial Banks	Amount	Change	Change from 8/28/85	
	Outstanding 8/27/86	from 8/20/86	Dollar	Percent ⁷
Loans, Leases and Investments ^{1 2}	201,423	330	6,453	3.3
Loans and Leases ^{1 6}	182,248	154	5,774	3.2
Commercial and Industrial	50,593	71	558	1.0
Real estate	67,298	63	2,965	4.6
Loans to Individuals	39,605	251	2,404	6.4
Leases	5,523	22	100	1.8
U.S. Treasury and Agency Securities ²	11,374	81	7	0.0
Other Securities ²	7,801	95	671	9.4
Total Deposits	204,773	2	7,855	3.9
Demand Deposits	51,055	42	5,266	11.5
Demand Deposits Adjusted ³	34,426	640	3,174	10.1
Other Transaction Balances ⁴	16,716	108	3,126	23.0
Total Non-Transaction Balances ⁶	137,002	148	536	0.3
Money Market Deposit Accounts—Total	46,975	36	1,871	4.1
Time Deposits in Amounts of \$100,000 or more	35,004	129	3,184	8.3
Other Liabilities for Borrowed Money ⁵	23,875	688	192	0.7
Two Week Averages of Daily Figures	Period ended 8/25/86	Period ended 8/11/86		
Reserve Position, All Reporting Banks				
Excess Reserves (+)/Deficiency (-)	36	3,582		
Borrowings	25	13		
Net free reserves (+)/Net borrowed(-)	12	3,569		

¹ Includes loss reserves, unearned income, excludes interbank loans

² Excludes trading account securities

³ Excludes U.S. government and depository institution deposits and cash items

⁴ ATS, NOW, Super NOW and savings accounts with telephone transfers

⁵ Includes borrowing via FRB, TT&L notes, Fed Funds, RPs and other sources

⁶ Includes items not shown separately

⁷ Annualized percent change