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Measuring the Impact of Tourism on Rural Development: An Econometric Approach

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Abstract. Research on economic base analysis has consistently favored approaches that measure the level of basic employment in all sectors rather than simply assuming that certain sectors (such as manufacturing) are inherently basic. Measurement of economic base in these studies, however, has often used techniques that have a tendency to be imprecise, either underestimating (location quotients) or overestimating (minimum requirements) basic employment. Such techniques are necessary since it is often difficult to identify approaches (other than costly surveys) to identify the level of basic activity in each sector. In this research, I propose an econometric approach to estimate the level of basic employment in a key service industry (lodging) with substantial potential to be part of a region's economic base. The model is run for counties in the State of Nebraska, a state where tourism is not a large part of the economy, and, therefore, standard techniques such as location quotients are unlikely to identify basic employment. The econometric approach was able to isolate the level of basic tourism activity in the each Nebraska county. However, further analysis did not consistently identify a statistically significant relationship between basic tourism activity and total employment in Nebraska counties.

1. Introduction

Research into the efficacy of alternative measures of economic base has consistently favored methods that measure the level of basic employment in each industry (Brown, Coulson and Engle 1992; Harris, Ebai and Shonkwiler, 1999), rather than simply assigning certain industries, such as manufacturing, as basic. Techniques that identify the level of basic activity within industries include location quotients, minimum requirements, and survey methods. Among these, techniques such as location quotients or minimum requirements offer a straightforward approach to identifying basic activity, and they are certainly more feasible than alternatives such as survey methods. However, these techniques have a tendency to either underestimate (location quotients) or overestimate (minimum requirements) the level of basic employment in a region's industries. Considering the case of location quotients for employment, the problem of cross-hauling suggests that some employment identified as non-basic using location quotients would actually be basic. In other words, while a county may have a below average share of employment in a particular industry, some of its firms in that industry may service external rather than internal demand.

For select industries, alternatives may exist between costly survey methods and the biases of calculations such as location quotients. Researchers such as Carrington (1996) and Black, McKinnish and Sanders (2005) have identified methods to isolate basic employment in selective industries. Carrington looked at the construction sector in Alaska during the period when the Trans-Alaska oil pipeline was built. Black, McKinnish, and Sanders (2005) developed instruments to determine when changes in Appalachian coal industry employment were related to external factors such as world market prices rather than local factors, such as labor supply.

This paper utilizes econometric techniques to identify the level of basic activity in the tourism sector (as measured by lodging activity) in counties in non-metropolitan Nebraska. As Nebraska is not a major tourism state, the level of basic activity would be diffi-

cult to identify with standard approaches such as location quotients. However, other data is available that permits the use of econometric techniques. While tourism is not a major sector in the Nebraska economy, there are successful attractions in Nebraska, and it is a sector that the state promotes. As a result, detailed statistics on lodging sales and attendance at specific tourism attractions in the state are kept by the Nebraska Department of Economic Development. This provides an opportunity to isolate changes in lodging sales that can be tied directly to tourism activity, such as visits to tourism attractions. In addition, we utilize an econometric model to estimate the "multiplier" for the basic lodging sales, as in the previous studies (Brown, Coulson and Engle 1992; Harris, Ebai and Shonkwiler 1999; Carrington (1996); and Black, McKinnish and Sanders (2005)). These multipliers are then compared to multipliers generated by the IMPLAN model.

2. Literature Review

There is a vast literature examining the relationship between particular projects and local economic growth. These studies primarily have examined how particular infrastructure projects or policies influence local economic growth. For example, Chandra and Thompson (2000) utilized an OLS regression framework to assess how the introduction of an interstate highway into non-metropolitan areas influenced subsequent growth in worker earnings in counties. Carlino and Mills (1987) used a two-stage least squares approach (employment and population determined simultaneously) to examine how highway infrastructure and the use of development bonds are related to employment growth in U.S. counties. For states, Brown, Hayes and Taylor (2003) examined the relationship between public investment and economic growth using a regression framework.

Other studies have directly examined how growth in a particular set of basic (exporting) industries has effected growth in the balance of the economy. These studies have focused on identifying basic sectors and then calculating the economic multiplier between basic and non-basic employment (Brown, Coulson and Engle 1992; Harris, Ebai and Shonkwiler 1999; Cutler, England and Weiler 2003).

Other studies have focused on identifying multipliers for individual industries. Carrington (1996) examined growth in the Alaska economy due to the construction of the Trans-Alaska oil pipeline. This major project represented a nearly 50% increase in employment and earnings in the state's economy concentrated in the state's construction activity. Growth in the construction industry led to increases in employment and earnings throughout the economy. Black, McKinnish and Sanders (2005) looked at the rapid expansion of earnings in the coal industry in Central Appalachia during the 1970s followed by the rapid decline in the 1980s. These changes were driven by the boom and bust in the price of coal during the two decades. Again, change in earnings in the local major industry led to changes in earnings throughout the economy. Both papers used a relatively simple regression model to estimate the impact of industry growth on growth in the larger economy. Growth in earnings in secondary industries was regressed on measures of growth in earnings in the key industry.

Both of these examples represent cases where exogenous factors lead to rapid expansion in major local industries. This is an ideal situation in which to estimate the overall economic impact from industry growth using an econometric technique. The question is whether this econometric approach can only work in the case of such large "natural experiments," or whether the technique can be useful in the case of more modest changes in export expansion in an industry. A positive finding would suggest there is potential for more widespread use of econometric techniques to conduct local economic impact analyses.

3. Method

Relative to the examples considered by Carrington (1996) and Black, McKinnish and Sanders (2005), the tourism industry is a minor part of the Nebraska economy. For example, the value of the employment location quotient for lodging in Nebraska was just 0.61 in 2003. There are tens of millions of visitors coming to Nebraska in any given year, but the state attracts relatively few visitors given the size of its economy and population.

Given the relatively modest role of tourism in most Nebraska counties, it is not appropriate to simply estimate a bivariate relationship between growth in tourism activity and total employment in the county. Instead, a more general model of county employment change is estimated, where change in total employment (TOTEMP) in each county in a particular year is a function of change in population (POP), general business climate factors (BCLIM), change in tourism-related lodging sales (TOUR), and change in other key sectors (OKEYSEC). There is also a set of annual dummy variables to account for macroeconomic conditions. Estimating the relationship between the change in tourism-related lodging sales and change in total employment implies that estimates are marginal multipliers. Following Carlino and Mills (1987), esti-

mated population growth is substituted for actual population growth in some versions of the model. Estimating this model requires an estimate of the increase in final demand in the tourism industry, so the first step is to generate the estimate of the change in tourism-related sales.

3.1 Tourism-Related Lodging Sales

The tourism sector is composed of a variety of industries including lodging, recreation, dining, and retail. Many of these sectors serve local customers as well as tourists from outside of the area. Among the industries, lodging most closely tracks visitors from outside of the region. Our estimate of tourism activity therefore utilizes a measure of lodging activity: taxable lodging sales.

Data were gathered on taxable lodging sales for Nebraska counties for the period 1993 through 2004. Data were gathered on annual lodging tax collections and tax rates, and then tax revenue was divided by rates to yield taxable lodging sales. The CPI for all urban consumers was then used to calculate real taxable lodging sales. The 1993 to 2004 period was chosen in order to utilize data on attraction attendance that the Nebraska Department of Economic Development has been developing since 1993.

County lodging sales data in any particular year is available for every county that has a lodging tax. While not all Nebraska counties assess a tax on lodging, most larger non-metropolitan counties in Nebraska have had the tax since the early 1990s. By the end of the data set in 2004, nearly two-thirds of Nebraska counties assessed a lodging tax, and taxable lodging sales in these counties accounted for 95% of the statewide total. In total, there are 442 observations of annual lodging sales in non-metropolitan counties from 1993 to 2004. This is out of a possible 1020 observations since we have data for 12 years for 85 non-metropolitan counties in Nebraska. Thus, there is sufficient data for approximately 42% of potential observations.[1]

Real taxable lodging sales (TLS) in Nebraska is modeled as a function of four factors: the population of each county (POP), visits to attractions in each county (ATT), travel on interstate highways running through each county (AADT), and level of urban influence on the non-metropolitan economy (URBINF).

Of the four explanatory variables, population accounts for visits that are incidental to the local economy and not driven by tourism. People will visit relatives living in Nebraska counties whether or not there are tourist attractions present. A portion of these visitors will stay at hotels, particularly for large gatherings such as graduations, weddings, and family reunions. Counties also will attract business travelers, and the population variable will capture this to the extent that population is correlated with employment.

While local residents (and their relatives) often visit local tourist attractions, a share of visitors to attractions in a county will be visitors who have traveled a distance. A portion of these will seek lodging in the same county as an attraction. We utilize the model to establish the relationship between attendance at county attractions and taxable lodging in the county, after controlling for local demand (population), using detailed attendance data that the state of Nebraska has collected at over 150 state attractions every year since 1993. Attendance data at each attraction can be aggregated in order to measure annual visits to all attractions in each county.

Travel through non-metropolitan Nebraska on the way to Denver, Omaha, or points east and west is another source of "tourism" in the state. Thus, we measure AADT, or average annual daily trips along the interstate highway, if any, running through each county. While many of those traveling through will not visit attractions, these visitors will patronize hotels, restaurants, service stations and even retail venues, and thus contribute to tourism activity in the state.

The level of urban influence in a county also will impact growth in lodging activity. Counties adjacent to metropolitan areas may have more opportunity to locate lodging activity given nearby markets. At the same time, counties located further away from metropolitan areas will have a greater opportunity to locate lodging activity if these counties have larger towns. We thus include a variable for urban influence based on the coding system developed by the Economic Research Service of the United States Department of Agriculture. The six codes for non-metropolitan counties are listed in the footnote below.[2] The level of ur-

[1] The level of unreported data in this taxable lodging sales data is similar to the amount of suppressed county data on lodging available in the 1997 and 2002 Economic Census.

[2] Urban influence code=5 for counties adjacent to a small metro area and a city with population > 10,000. Urban influence code=6 for counties adjacent to a small metro area and no city with population > 10,000. Urban influence code=7 for counties not adjacent to a metro area and a city with population > 10,000. Urban influence code=8 for counties not adjacent to a metro area and a city with 2,500 < pop < 10,000. Urban influence code=9 for counties not adjacent to a metro area and no city with population > 2,500.
There are no large metro areas in Nebraska or on its borders, so there were no non-metropolitan counties where the urban influence code would equal 3 or 4. A small metropolitan area has population of less than 1 million.

ban influence falls as the value of the urban influence code rises. A lower level of growth in taxable lodging sales would be expected in communities with higher values for the urban influence code.

Urban influence also would have an important impact when a county's tourist attractions grow and draw more visitors. A small county without a large town may have limited potential for siting hotels and other lodging, and therefore, growth in the number of attraction visitors may not translate into more lodging sales. Attraction visitors would lodge in nearby counties with larger towns. For this reason, we also interact the number of attraction visitors with the level of urban influence.

Descriptive statistics are provided in Table 1 for short-differences in real taxable lodging sales and these four explanatory variables. Statistics also are provided for the urban influence code.

Table 1. Descriptive Statistics for County Variables

Variable (Annual Change)*	Mean	Standard Deviation	Min	Max
Tourism Model				
Real Taxable Lodging Sales	$46,722	$254,118	-$584,870	$2,538,988
Annual Attraction Attendance	2,468	71,265	-683,394	546,728
Annual Average Daily Traffic	90	339	0	1,990
Population	24	158	-392	703
Urban Influence	7.79	1.13	5	9
Impact Model				
Total Employment	105	291	-818	1,985
Effective Local Per Capital Taxes	$1,398	$300	$963	$2,036
Interstate 80 Runs Through County	0.24	0.43	0	1
Beef – Acres * Price Index	$140,124	$990,060	-$4,130,503	$5,083,696
Corn – Acres * Price Index	$59,235	$1,750,515	-$6,243,033	$7,319.418
Real Tourism-related Lodging Sales (estimated based on Short-differences)	$185	$87,350	-$719,454	$897,881
Real Tourism-related Lodging Sales (estimate based on Long-differences)	$1,198	$40,625	-$119,174	$197,961

*Based on Short-difference unless noted.

Equation (1) shows the OLS model that is used to estimate the change in real taxable lodging sales in Nebraska counties. The change in taxable lodging in each county is a function of the change in population, the change in attendance, and the change in AADT, urban influence, and the interaction between change in attendance and urban influence. Year dummies (not shown) also are included in the regression.

$$\Delta TLS_{it} = b_0 + b_1\Delta POP_{it} + b_2\Delta ATT_{it} + b_3\Delta AADT_{it} + b_4 URBINF + b_5\Delta ATT_{it} * URBINF \quad (1)$$

Results of estimating Equation (1) using annual data are reported in Table 2. The annual data are referred to as short differences in Table 2. Estimates are provided for Equation (1) both with and without the interaction term between change in attraction attendance and urban influence. Results for the (annual) short-differences are reported in the first two results columns in Table 2. Coefficients on the year dummies are not reported to save space, but are available from the author on request.

Table 2. Model of Taxable Lodging Sales

Variable	Short Differences No Interaction Term	Short Differences With Interaction Term	Long Differences No Interaction Term	Long Differences With InteractionTerm
Intercept	282,396***	244,214**	842,109**	715,443*
	(95,675)	(96,934)	(389,409)	(409,409)
Population	-7.11	29.91	113.08	126.40
	(105.34)	(106.54)	(136.94)	(137.74)
Attendance	0.87*	10.54**	1.88**	11.62**
	(0.53)	(4.70)	(0.86)	(5.19)
Annual Average Daily Traffic	-11.50	-21.50	-31.90	-36.32
	(30.41)	(35.57)	(54.00)	(53.83)
Urban Influence	-24.675**	-19,104*	-85,759*	-65,742
	(11,371)	(11,541)	(47,942)	(50,241)
Attendance*Urban Influence		-1.28**		-1.30**
		(0.57)		(0.64)
Adjusted R^2	0.120	0.168	0.111	0.134
N	400	400	74	74

*Significant at 10% level; **Significant at 5% level; ***Significant at 1% level.

Results for a regression of 5-year changes in taxable lodging sales and the independent variables also are reported in Table 2, in the third and fourth results columns. These longer changes are referred to as long-differences. This longer term perspective may allow counties time to change lodging room capacity in response to increases in attendance, highway travel, or population growth.

The coefficient on the population variable and the annual average daily traffic (AADT) variable are statistically insignificant in all regressions. Annual or even 5-year changes in population do not directly correspond to higher real lodging sales. The coefficient on annual attendance is positive and statistically significant in all models. Without the interaction term, the coefficient value in the short-difference equation indicates that there is an additional $0.87 in real taxable lodging sales for every additional visitor to county attractions. This value rises to $1.88 in the long-difference regression.

Results for the regression without the interaction term fail to consider that counties may differ systematically in their ability to convert attraction visits into additional overnight stays within the county. As was noted earlier, the smaller counties may lack the lodging infrastructure (which would depend on overnight visitors from all sources, not just tourism) to reap overnight stays from local attractions. The interaction term adjusts for this possibility. The interaction term is statistically significant in both the short-difference and long-difference regression, as expected. Indeed, coefficient values for the interaction terms and the attraction attendance variable are quite similar whether a long-difference or short-difference regression is run. This result implies that the relationship between attraction visits and local lodging sales falls as urban influence falls (i.e., higher values for the urban influence index). For example, among counties without a town of 2,500 and not adjacent to a metropolitan area (urban influence code= 9), additional attraction visits has no effect (long-difference equation) or even a small negative impact (short-difference) on lodging sales in the county. More attendance has a positive impact on lodging sales in all other classes of non-metropolitan counties, particularly counties adjacent to metropolitan areas or non-adjacent counties with a town of at least 10,000 persons.

Results from the regressions with an interaction term were used to estimate the change in county lodging sales attributable to tourism related factors such as attendance. This was done for both short-differences (annual) and long-differences (5-year). A value for the change in tourism-related lodging sales was estimated for each county and year. Summary statistics for these variables also were reported in Table 1. Note that the mean value for the annual change in tourism-related

lodging sales was much smaller than the value for all lodging sales. This is consistent with the idea that a significant share of lodging activity cannot be explained by tourism-related activity but is due to local demand factors. The correlation between estimated change in tourism-related lodging sales and change in all lodging sales was only 0.35 for the short-differences and 0.39 for the long-differences equations.

3.2 Economic Impact

In the economic impact model, the relationship is estimated between the change in tourism-related lodging sales and the change in total employment in counties. The change in tourism-related lodging sales variable (TRLS) is added to a general model of county employment change. Other variables include county population change (POP), change in the value of agricultural commodities (BEEFV and CORNV), effective tax rates (TAX), and presence of an interstate highway (INT). There also are year dummy variables to control for general macroeconomic conditions. Both actual and estimated values were used for the change in population when estimating Equation (2). Estimated population change was developed using a separate regression.[3] The change in the value of cattle farming was estimated by taking the inventory of cattle in each county in the 1992 Census of Agriculture multiplied by the price index for beef for each year 1993 through 2004. The change in the value of corn farming was estimated by taking the acres of corn production in each county in the 1992 Census of Agriculture multiplied by the 1993 to 2004 price index for corn. Counties with a four-lane interstate highway running through were assigned a value of 1 for the interstate variable, while other counties had a value of 0. The tax variable was per capita local taxes paid in each county according to the 2002 Census of Government. Year dummies (not shown) also are included in the regression.

$$\Delta TOTEMP_{it} = b_0 + b_1 \Delta POP_{it} + b_2 \Delta TRLS_{it} + b_3 \Delta BEEFV_{it} + b_4 \Delta CORNFV_{it} + b_5 INT + b_6 TAX_{it} \quad (2)$$

Regression results for Equation (2) are presented in Table 3. For the short-difference model, the coefficient on the actual population change variable was positive and statistically significant. The coefficient value was close to 1 suggesting that population changes at roughly the same magnitude as employment. In that model, the coefficient on tourism related lodging revenue is positive and statistically significant. Coefficients on the other variables are not statistically significant.

Results differ when estimated population change is substituted for actual population change in the short-difference model, in order to address the potential endogeneity of the population change variable. The coefficient on the population change variable remains positive and statistically significant. However, the coefficient on the change in tourism-related lodging sales falls by approximately 50%, and is no longer statistically significant. Coefficients on the change in the value of corn production and presence of an interstate are both positive and statistically significant. These results illustrate that both agriculture and economic activity attracted by an interstate encourage overall growth in the economy. The latter result is consistent with Chandra and Thompson (2000), which found that non-metropolitan interstate highways led to faster earnings growth in the counties these highways pass through (though slower earnings growth in adjacent counties).

Similar results are found for the long-difference model. The main difference is that in the long-difference model the coefficient on the change in tourism-related sales is never statistically significant, regardless of whether actual or predicted population change is used. The point estimate (i.e., the coefficient) for tourism-related lodging sales remains positive, however.

4. Discussion

Point estimates in the various models for the contribution of a change in tourism-related lodging sales to total employment change in non-metropolitan counties varied from 0.00015 to 0.00048. The point estimate was only statistically significant in the case of the short-differences regression that utilized the actual change in population in the county rather than the estimated change. This result is problematic given the likely endogeneity of the actual change in population. However, it remains useful to look at the point estimates from the short-difference model.

The point estimate was 0.00037 for the short-difference model that used actual population change. The estimate implies that each additional $1 million in tourism-related lodging sales would lead to an additional 370 jobs in a county. The point estimate for the regression which used estimated population change yields an estimate that each $1 million in tourism-related lodging sales leads to an additional 150 jobs in a county. Both results suggest a rather large job effect.

[3] The change in log population was a function of local amenities (January temperature, July temperature, July humidity, and percent of county surface area covered in water), and urban influence.

Table 3. Model of Total Employment Growth

Variable	Short Differences Actual Population	Short Differences Estimated Population	Long Differences Actual Population	Long Differences Estimated Population
Intercept	338.94***	302.33***	213.27	134.28
	(89.09)	(83.77)	(397.95)	(404.14)
Δ(Pop)	0.90***	1.29***	0.89***	1.22***
	(0.13)	(0.20)	(0.28)	(0.26)
Δ(Tourism-related lodging)	0.00037**	0.00015	0.00048	0.00032
	(0.00017)	(0.00020)	(0.00045)	(0.00051)
Δ(Beef Value)	-0.0000029	0.000013	-0.000024	0.000010
	(0.0000014)	(0.000012)	(0.000028)	(0.000020)
Δ(Corn Value)	0.000015	0.0000195**	-0.000039	-0.000015
	(0.000010)	(0.0000096)	(0.000057)	(0.000062)
Presence of Interstate	54.55	101.61***	163.12	399.80**
	(33.56)	(32.25)	(233.61)	(193.86)
Local Effective Tax Rate	-0.0096	0.0031	-0.014	-0.007
	(0.042)	(0.045)	(0.28)	(0.27)
Adjusted R^2	0.389	0.361	0.437	0.479
N	400	400	74	74

*Significant at 10% level; **Significant at 5% level; ***Significant at 1% level.

But, there are several reasons to expect this. In the first case, the lodging industry includes many part-time and lower wage jobs, so that each $1 million in sales is associated with between 30 and 40 new jobs.

In the second case, there are other types of spending associated with tourism besides spending on lodging. For example, a 1990 study of tourism spending in the state of Nebraska found there was $2 of additional direct tourist spending in industries such as restaurants or service stations for each $1 in lodging expenditure.[4] The econometric approach would implicitly reflect these other types of associated spending in the coefficient estimate on the lodging variable. Similarly, the regression coefficient also would reflect any sort of multiplier effect. This, in fact, is one of the advantages of the regression based approach − that these other effects would be implicitly included and would not need to be estimated separately.

How do the point estimate values from the regression model compare with the results of an input-output type model, such as IMPLAN? Table 4 shows such a comparison. Table 4 in the first place lists the estimated total employment impact using the IMPLAN model from a $1 million increase in final demand in the tourism industry. This total impact was calculated for each Nebraska county that was included in the short-difference model. The average impact is roughly 36 additional jobs for each $1 million in new final demand in the lodging industry. This approach, however, does not incorporate the additional tourist spending in associated industries such as restaurants and service stations. Recall that there was $2 in spending in these industries for every $1 in lodging. Adding an additional $2 million in final demand to these industries yields a total impact of 77 jobs, just 20 to 50 percent of the point estimate from the two short-difference regression models. Thus, the econometrically estimated impact values are within the same order of magnitude as the impact estimates from the IMPLAN model, but are consistently higher. The higher estimates may simply reflect the imprecision with which coefficients on tourism-related lodging sales were estimated. Another possibility is that out-of-county day trips to an attraction are closely correlated with overnight trips, and the coefficients on the lodging sales variable are simply capturing the impact of day trips as well.

[4] "Breakdown of Average Dollars Spent In Nebraska By Visitors." Travel, Tourism and Recreation Resource Centers, Kearney State College. 1989 Nebraska Visitors Survey.

Table 4. Total Employment Impact Associated with an Additional $1 Million in Tourism-related Lodging Sales in Nebraska Counties

Variable	Total Employment Impact
IMPLAN Estimates	
Lodging Only	36
All Tourism	77
Econometric Estimates	
Short Difference Actual Population	370
Short Difference Estimated Population	150

5. Summary

In planning for economic development, non-metropolitan counties need to understand which industries contribute to county economic base. In identifying basic industries, research has consistently favored methods that measure the level of basic employment in each industry rather than simply assigning selected industries as basic (Brown, Coulson and Engle 1992, Harris, Ebai and Shonkwiler 1999). However, non-survey techniques to identify basic activity within industries have a tendency to either underestimate (location quotients) or overestimate (minimum requirements) the level of basic employment in a region's industries. Researchers such as Carrington (1996) and Black, McKinnish and Sanders (2005) demonstrated the feasibility of isolating exogenously-generated economic activity within a single industry and using econometric models to estimate its multiplier effect on growth in local and state economies. These two authors, however, focused their analyses on specific natural experiments where there were large exogenous shocks to primarily rural economies. This raised the question: can such an econometric approach work in the case of smaller, less prominent industries.

The current study examines this question for the case of the Nebraska tourism industry, an industry that is not typically a large part of local economies in the state. The econometric model examined the relationship between the change in total county employment in responses to a change in tourism-related lodging sales. The econometric approach was able to isolate the level of basic tourism activity in the each Nebraska county. However, regression results failed under most specifications to find a statistically significant relationship between the change in tourism-related lodging sales and the change in total employment in Nebraska counties. Point estimates of the economic impact of lodging sales consistently showed impacts that were of the same order of magnitude as those calculated using the input-output based IMPLAN model and were always higher than the IMPLAN impacts.

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