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THE ECONOMIC IMPACT OF THE  
WINE INDUSTRY ON HOTELS AND  
RESTAURANTS IN WALLA WALLA

Karl Storchmann

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# The Economic Impact of the Wine Industry on Hotels and Restaurants in Walla Walla\*

by Karl Storchmann<sup>a</sup>

## Abstract

Walla Walla enjoys the fastest growing wine industry in the State of Washington, if not in the whole U.S. This paper examines the impact of this extraordinary growth on the revenue of regional hotels and restaurants. Employing a dynamic quarterly panel model at the county level we show that the regional reputation as high quality wine county, as expressed by critical wine points in the national wine press, has a significant effect on the tourism industry. Less than 17% of all restaurant and approximately 40% of all hotel revenue is tied to the wine cluster (2007). However, regional reputation is short-living and needs to be constantly re-earned.

## I. Introduction

Winegrapes have been cultivated in Washington State and in the Walla Walla Valley since the mid 1800s (Irvine and Clore, 1997). However, a ‘wine industry’ did not develop until the mid 1970s, when a few pioneer wineries started making premium wine in Walla Walla. In 1984, the Walla Walla Valley was granted “American Viticultural Area (AVA)” status. In the early 1990s, the number of wineries started to increase and has soared since the late 1990s. As of 2008, there are more than 130 bonded wineries in the Walla Walla AVA.

According to an article in the Seattle Times, “*wine is pouring money into the valley. While most of Eastern Washington — and the state — struggles with an economic downturn, Walla Walla is enjoying the best economy in the state. Accommodations and eating places, a direct tie to wine tourism, boasted nearly 6,000 jobs in Walla Walla County in the fourth quarter of 2002, with an economic impact worth \$18.5 million.*” (Mapes, 2003).

In fact, as shown in Table 1, eating and drinking places, as well as hotels, exhibit a disproportionate increase in both employment and annual payroll.<sup>1</sup> While the overall

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<sup>a</sup> Economics Department, Whitman College, Walla Walla, WA 99362, email: [storchkh@whitman.edu](mailto:storchkh@whitman.edu)

county employment between 1993 and 2002 grew by 7.6%, eating and drinking place employment grew by 14.4%. During the same time, hotel employment increased by almost 40%. Hotel payrolls increased even by 158%, compared to an overall increase of 45%. Despite these growth rates, the employment share of the accommodation and food and drinking service industry is still below 10%. Due to below-average wages, the payroll share is even below 4%.

*Table 1*  
**Hotel and Restaurant Employment, Payroll and Establishments  
in Walla Walla County 1993 and 2002<sup>a</sup>**

	1993	2002	Change in %	Share 1993 in %	Share 2002 in %
	Employees <sup>1</sup>				
Total	15800	16995	7.56		
Eating and Drinking Places <sup>2</sup>	1251	1431	14.39	7.92	8.42
Hotels <sup>3</sup>	123	172	39.84	0.78	1.01
	Annual Payroll (\$1,000)				
Total	298743	434549	45.46		
Eating and Drinking Places <sup>2</sup>	9296	14620	57.27	3.11	3.36
Hotels <sup>3</sup>	952	2458	158.19	0.32	0.57
	Number of Establishments				
Eating and Drinking Places <sup>2</sup>	87	88	1		
Hotels <sup>3</sup>	16	16	0		

Source: U.S. Census Bureau (1995, 2004). <sup>a</sup> All figures are nominal. <sup>1</sup> Number of employees for week including March 12; <sup>2</sup> NAICS code 722; <sup>3</sup> NAICS code 72111.

Several studies (e.g., Tourism Development Associates, 2004) suggest that this increase is due to a growing number of wine tourists demanding hotel and food services. Although there is a growing body of literature on wine tourism and its interactions with other businesses (e.g., Carlsen and Charters, 2006; Hall et al., 2000, Getz, 2000), most of these analyses are descriptive and/or qualitative in nature.

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<sup>1</sup> However, given the county's population of approximately 55,000 in 2002, 6000 accommodation and eating place jobs, as claimed in the *Seattle Times*, appears to be unrealistic. In fact, the U.S. Bureau of Census in its Country Business Pattern report for 2003 reports 142 employees for the hotel sector and 1510 for 'food services & drinking places' (U.S. Census Bureau, 2005). A large fraction of the latter is related to the three colleges, three hospitals and the state penitentiary in Walla Walla.

In contrast, there are numerous studies analyzing the impact of the wine and wine grape industry on local, regional or national economies (e.g., Folwell et al., 1999; MFK, 2001; MFK, 2007). Most of them employ input-output models that aside from the direct effect, also compute indirect and induced effects.<sup>2</sup> For instance, a recent study estimated the economic impact of Washington State's wine and wine grape industry at \$2.4 billion (MFK, 2001). Although regional input-output models provide very detailed information regarding the proliferation of economic impulses, they draw on a number of major assumptions. (1) The supply of labor and other intermediate resources is not limited, so growth does not increase wages or prices, (2) the percentage of imported supplies remains constant, (3) household consumption of each item increases proportionally to income, (4) there is neither underemployment (5) nor economies of scale, and (6) there will be no substitution between inputs due to price changes. Since most of these assumptions do not hold the impacts are likely to be overestimated.

In contrast to input-output analyses, this study is aimed at quantifying the wine industry-induced effects on the revenues of hotels and of eating and drinking places only. Secondary effects, although not explicitly modeled, are to a certain extent covered implicitly. We will isolate the wine sector's role regarding the growth of these two industries employing a quarterly cross-section time-series model (panel model) comprising all Washington State counties from 1995 to 2006. Compared to a pure time-series model for Walla Walla county, a panel model has the advantage of also encompassing non-wine counties. Hence, it allows us to separate the impact of wine indicators from universal factors that affect all counties in the same way.

This paper is organized as follows. Section 2 briefly recaps recent economic trends in the county of WallaWalla. Section 3 describes the data and the econometric approach. Section 4 compares the results of several model variants. Section 5 summarizes the main findings and discusses further research.

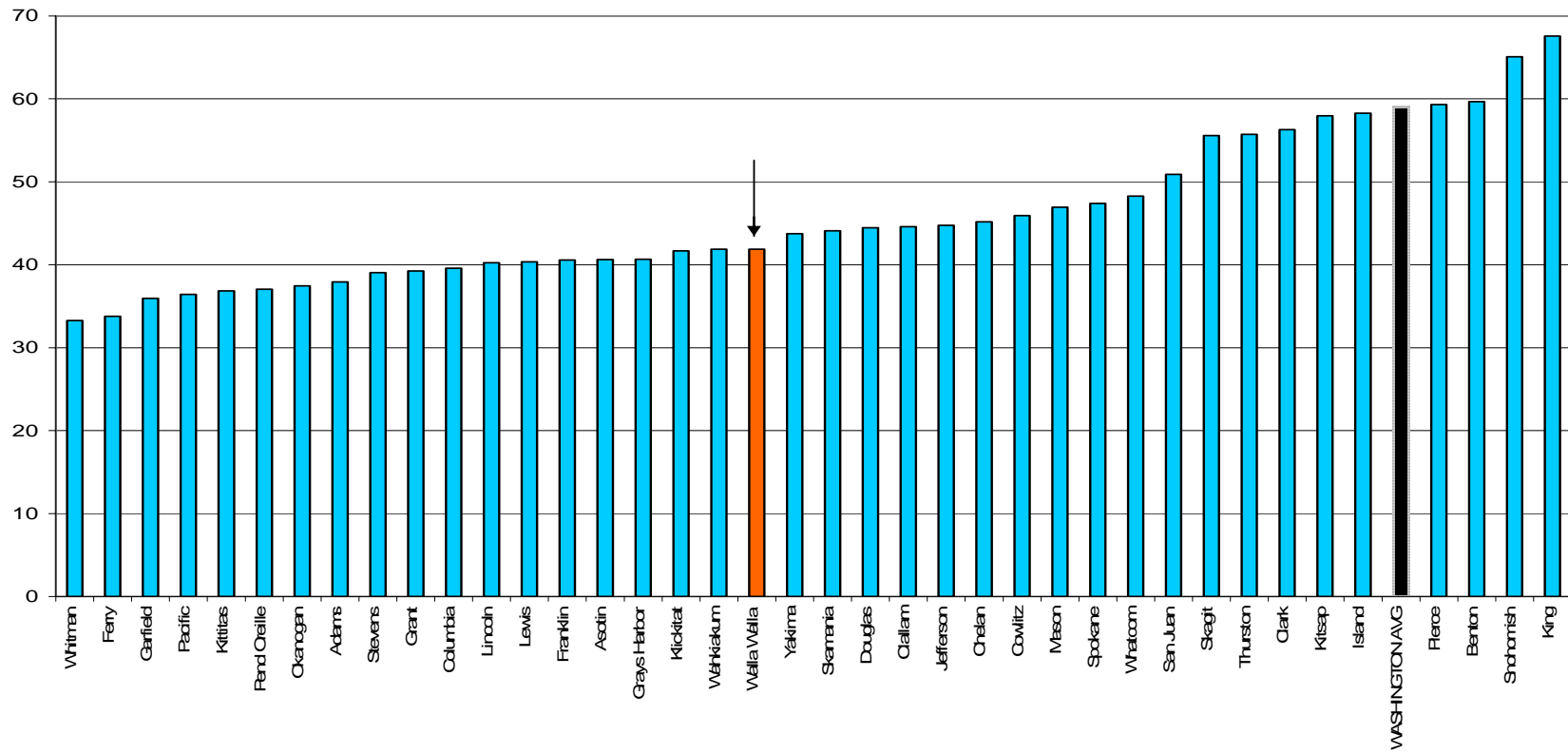
## **II. Economic Trends in Walla Walla County**

In contrast to common beliefs, Walla Walla county's prosperity is below the state's average. As shown in Figure 1, median household income lags behind other counties. In 2006, the median household income in Walla Walla county was approximately 70% of the state's average and 62% of King county's (Seattle) income. The gap has widened particularly since 2000, i.e., during the time of assumed wine induced prosperity (Figure 2). In fact, since 2000, real incomes in Walla Walla county have experienced a real decline and, even in 2007, are still 8% below the 2000 figures (Figure 3).

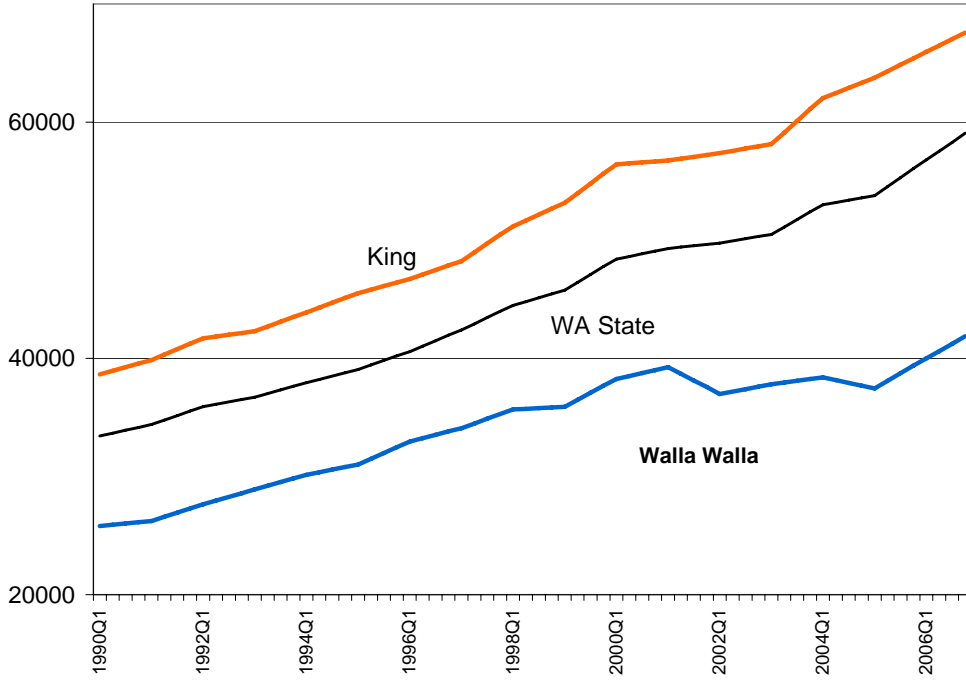
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<sup>2</sup> All of these studies employ the IMPLAN model which uses input-output tables for over 500 industries at the county level.

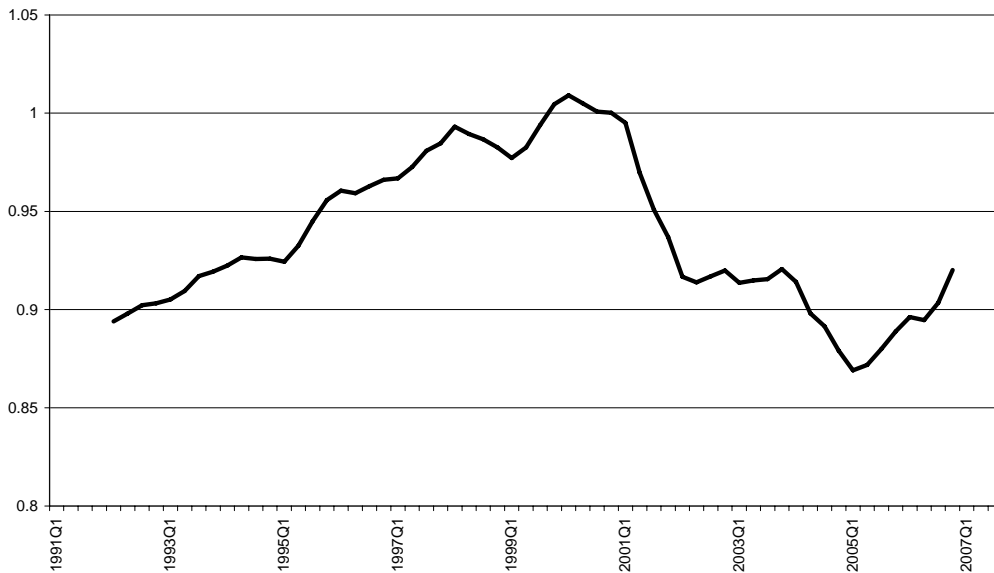
*Figure 1*  
**Median Household Income in Washington State in 2006 by county in \$1000**



*Figure 2*  
**Median Household Income in  
 King County, Walla Walla County and Washington State 1990 to 2006**



*Figure 3*  
**Real Median Household Income in Walla Walla County**  
 1<sup>st</sup> Quarter of 2000 = 1



The below-average income in Walla Walla county is reflected by below-average taxable sales. As reported in Table 2, per capita sales in Walla Walla county are approximately 20% lower than in Benton and Spokane and almost 50% lower than in King county. Many industries, such as retail or service, grow significantly slower in Walla Walla than in other counties. This is especially true for the retail and service segments, as well as for the restaurant sector, one of the suspected beneficiaries of wine induced tourism. Restaurants' nominal revenue growth in Walla Walla has hardly exceeded 1% per quarter.

However, Table 3 also shows above-average growth for the finance (banking, insurance, real estate) and the hotel sector, the other potential wine tourism beneficiaries. In fact, with a nominal rate of 2.75% per quarter, Walla Walla's hotel revenue growth rate belongs to the highest in the state. Only Asotin (4.75%) and Wahkiakum (3.07%) counties exhibit stronger growth.

*Table 2*  
**Per Capita Taxable Sales In Selected Counties**  
4<sup>th</sup> Quarter 2006 in \$

	Counties			
	Walla Walla	Benton	Spokane	King
Retail	1330	2214	2218	2779
Services	251	321	399	714
Contracting	519	566	492	953
Wholesale	287	235	317	531
Transportation	103	159	164	260
Finance	61	94	46	79
<b>All</b>	<b>3169</b>	<b>3636</b>	<b>3782</b>	<b>6162</b>
Hotel	66	63	82	167
Eating & Drinking Places	217	285	309	499

*Table 3*  
**Average Quarterly Growth Rate of Nominal Taxable Sales in Selected Counties<sup>a</sup>**  
 3<sup>rd</sup> Quarter 1995 to 3<sup>rd</sup> Quarter 2006

	Counties			
	Walla Walla	Benton	Spokane	King
Retail	1.03	1.61	1.10	1.16
Services	0.14	1.15	0.66	0.81
Contracting	1.55	1.49	0.97	1.74
Wholesale	0.56	-0.56	-0.54	0.81
Transportation	0.94	1.89	1.80	1.02
Finance	2.46	3.77	1.89	1.74
<b>All</b>	<b>1.23</b>	<b>1.53</b>	<b>0.89</b>	<b>1.00</b>
Hotel	2.70	1.19	1.14	1.06
Eating & Drinking Places	1.01	1.46	1.09	1.40

<sup>a</sup> Computed by regressing the natural logarithm of taxable sales on a trend variable and a constant term

### III. Model and Data

In order to quantify the impact of the wine industry on restaurant and hotel revenue, we employ a formal econometric panel model. The model draws on quarterly taxable revenue data on a county basis. It comprises all 39 counties in the state of Washington for the time period from the 3<sup>rd</sup> quarter of 1995 to the 3<sup>rd</sup> quarter of 2006. A panel model has the particular advantage of not only tracing revenue over time but also across counties, wine and non-wine counties alike. Wine induced revenue should, therefore, not only change over time (with the wine variable) but should also vary across counties. Thus, the wine variable should only impact wine counties and leave non-wine counties unaffected.

We estimate real per capita retail revenue  $R_{it}$  of each industry, i.e., hotels and eating and drinking places (restaurants), in county  $i$  at time  $t$  as a function of a vector of socio-economic variables  $X_{it}$  and a wine-related variable  $W_{it}$ :

$$(1) \ln(R_{it}) = \alpha \sum X_{it} + \beta_1 W_{it} + \beta_2 C_i + \beta_3 T_t + \gamma \sum Q_t + \varepsilon_{it}$$

The trend variable  $T$  captures time effects that are identical for all counties. The fixed effect  $C_i$  denotes a county-specific but time-invariant constant term. It captures county-specific characteristics related to the county's geography, climate, infrastructure or socio-economic environment. Since hotel and restaurant revenue follow a pronounced seasonal pattern with peaks in the 2<sup>nd</sup> and 3<sup>rd</sup> quarter and troughs in the 1<sup>st</sup> and 4<sup>th</sup> quarter, we also included several quarter dummy variables ( $Q_t$ ).



Nominal taxable revenue by industry and county is provided by the Department of Revenue on a quarterly basis (Department of Revenue, 1996-2007). We computed per capita real revenue by dividing the revenue figures by the county population as provided by the Office of Financial Management (2007) and the CPI for the West (1982-84=100) (Bureau of Labor Statistics, 2007). The Office of Financial Management also provides median income data on a county basis (Bureau of Labor Statistics, 2007).

Wine related data for Washington State, such as wine production or acreage under vines, are available only at the state level. Crush and acreage data on a district or county level, as available for California or Oregon (California Department of Food and Agriculture, 2006 and 2007; National Agricultural Statistics Service, 2007), do not exist for Washington State.

However, we do not assume any positive impact of the sheer quantity of wine produced on local tourism. In fact, we assume that wine tourism is attracted by wine quality rather than quantity. Similar to the impact of producer and regional reputation on wine prices (Landon and Smith, 1998; Schamel and Anderson, 2003; Stanziani, 2004; Noev, 2005), we hypothesize that the regional reputation as high-end wine producing region influences regional (wine) tourism. This paper, therefore, draws on the following reasoning. As a region gets increasingly known for its high quality wine, more wine tourists will stream in and the demand curve for local tourist service will shift outwards, leading to an increasing quantity consumed, higher prices or a combination of both.

In order to quantify the “regional reputation” we draw on the national wine press. With a paid circulation of more than 200,000 copies per month, the *Wine Spectator* is by far the most widely distributed wine publication in the U.S. In each issue, the *Wine Spectator* publishes the results of (blind) wine tastings and assigns points to wines coming from different regions and different vintages. The *Wine Spectator* employs a 100-point scale where 95-100 points means “classic” (exceptional), 90-94 “outstanding”, 85-89 “very good”, 80-84 “good”, “75-79” mediocre and 50-74 “not recommended.” Drawing on the *Wine Spectator Data Base* (Wine Spectator, 2008) we compute a wine point variable for all wines from Washington State by quarter and county. This variable comprises all wines with a minimum score of 91 points. Over the last 12 years, 12 of the 39 counties in Washington State had at least one wine that received 91 Wine Spectator points or more.<sup>3</sup>

The wine point variable is defined as ‘all scores that have been accrued in the previous quarter.’ For instance, since we do not assume that critical wine scores earned on March 31 can affect revenue of the first quarter anymore the wine point variable is partially lagged. That is, all scores earned from January to March are relevant for the second quarter.

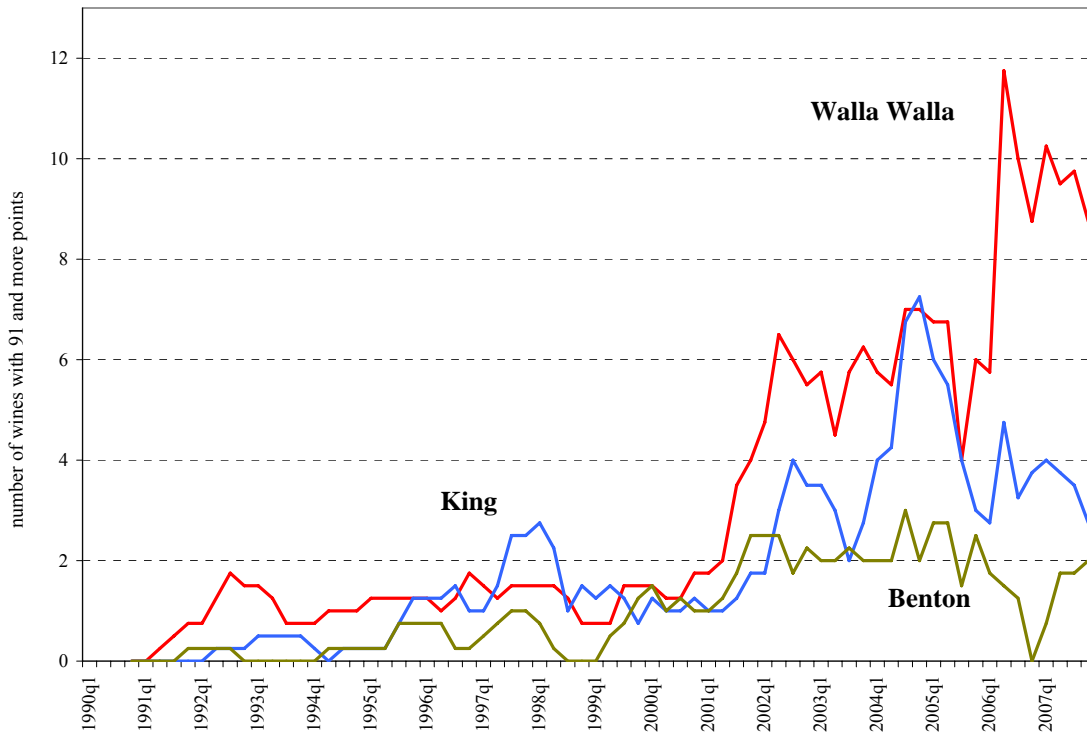
Figure 4 shows the critical point variable for the three dominating quality wine counties in Washington State from 1990 to 2006. Accordingly, Walla Walla county has

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<sup>3</sup> These wine counties are Benton, Chelan, Columbia, Douglas, Franklin, King, Mason, Okanogan, Snohomish, Spokane, Walla Walla and Yakima.

established itself as the leading quality wine county in the state, especially since the year 2000.

*Figure 4*  
**Number of Wines with 91+ Spectator Points**  
**in Walla Walla, King and Benton County**  
 1990Q1 to 2007Q4, moving four quarter average



#### IV. Results

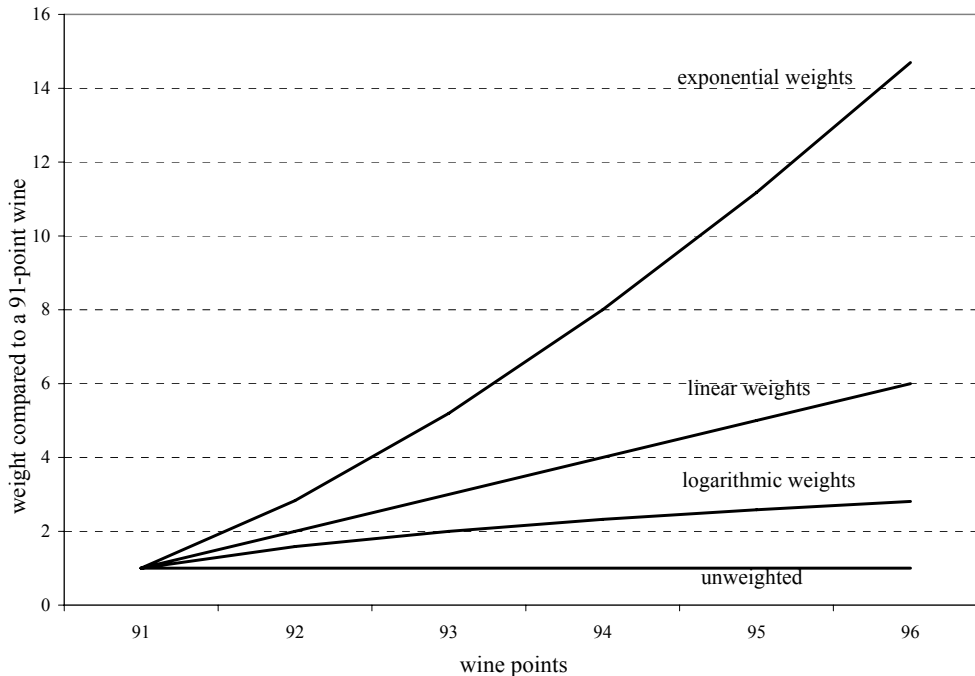
Table 4a and 4b report the results of a static county panel model for Washington State. The dependent variable is the natural logarithm of real (in 1982-84 prices) per capita revenue for the hotel (Table 4a) and the restaurant sector (Table 4b), respectively. The model relies on a trend variable, quarterly dummy variables, county fixed effects and the wine quality variable. In addition, since most wine tourists originate from the Seattle metropolitan area (Tourism Development Associates, 2004) we also included the median household income in King county (Seattle).

Column 1 of each table reports the estimates of the basic equation when wine scores are not weighted, i.e., a wine that received 95 points has the same weight as one that got 91

points. However, assuming that a 96-point-wine has the same impact as a 91-point wine contradicts our expectations and is not *a priori* plausible. We, therefore, also tried to include wine points as different variables (e.g., as pts96, pts95, pts94, etc.) without any predetermined weight. The model would then assign a certain value to each point level. However, due to the sporadic character of some point variables, this procedure did not yield stable results.

Instead, we tested numerous weighting schemes ranging from logarithmic to exponential weights and compared their goodness-to-fit. A few basic variants are shown in Figure 5 where the weight of a 96-point wine ranges from 1 (unweighted) to 14.7 (exponential weights with an exponent of 1.5).<sup>4</sup>

*Figure 5*  
**Weights for Wine Point Variable**



We report the results for selected weighted point variables in column (2) to (5) of Table 4a and 4b, respectively. The F-test for fixed effects indicates that county specific intercepts are significantly different from zero, i.e., different from a common constant term. Overall, the results for weighted and unweighted schemes are very similar suggesting a relatively robust model. For both hotels and eating and drinking places the goodness-to-fit is higher than 90% and the point variable exhibits a significant positive influence. Given that hotel revenue is more dependent on tourism than is restaurant revenue the marginal effects as well as the significance of wine quality is more

<sup>4</sup> The weights in Figure 5 are calculated as follows: normalized logarithmic weights:  $\ln(\text{pts}-89)/\ln(2)$ ; linear weights:  $(\text{pts}-90)$ ; exponential weights:  $(\text{pts}-90)^{1.5}$ . In this manner, we evaluated a multitude of weighting schemes with different exponents.

pronounced for hotels. In addition, both models show a slight edge for the model employing logarithmic weights for the wine quality variable. Thus, the marginal effect of wine points above 91 increases – but at a decreasing rate.

Referring to the logarithmic weights model (column 2 in both tables), a 91-point wine increases hotel revenue by approximately 2.16%. In contrast, restaurant revenue will increase by 0.71%. The marginal impact of a 95-point wine would be 5.58% for hotels and 1.8% for restaurants, respectively.

*Table 4a*  
**Static Panel Estimates of per Capita Hotel Revenue**  
 all Washington State Counties from 1995q3 to 2007q4

	dependent variable ln(hotel revenue)				
	(1)	(2)	(3)	(4)	(5)
	unweighted	logarithmic weights <sup>a</sup>	root weights <sup>b</sup>	linear weights <sup>c</sup>	exponential weights <sup>d</sup>
wine points	0.0174*** (3.76)	0.0216*** (4.25)	0.0115*** (3.65)	0.0094*** (3.62)	0.0058*** (3.60)
median household income King county (in \$1000)	0.0357*** (3.51)	0.0363*** (3.56)	0.0357** (3.51)	0.0357*** (3.51)	0.0356*** (3.50)
trend	-0.0145*** (-3.05)	-0.0148*** (-3.11)	-0.0145*** (-3.05)	-0.0144*** (-3.05)	-0.0144*** (-3.04)
dummy first quarter	-0.2464*** (-11.31)	-0.2469*** (-11.35)	-0.2468*** (-11.34)	-0.2470*** (-11.35)	-0.2475*** (-11.37)
dummy second quarter	0.2411*** (14.05)	0.2421*** (14.09)	0.2411*** (14.05)	0.2410*** (14.05)	0.2407*** (14.04)
dummy third quarter	0.5690*** (28.31)	0.5696*** (28.34)	0.5688*** (28.30)	0.5687*** (28.29)	0.5685*** (28.27)
R2	0.9004	0.9005	0.9004	0.9004	0.9004
RMSE	0.31075	0.31065	0.31071	0.31071	0.31072
F statistic	257.44	256.94	256.59	256.39	256.00
County Fixed Effects	yes	yes	yes	yes	yes
F statistic for Fixed Effects	392.93	392.13	392.98	393.01	393.03
n	1891	1891	1891	1891	1891

\*\*\* 1%, \*\*2%, \*5% significance level. Robust t-statistics in parentheses.

The weights are calculated as follows: a  $(\ln(\text{pts}-89)/\ln(2))$ ; b  $(\text{pts}-90)^{0.75}$ ; c  $(\text{pts}-90)$ ; d  $(\text{pts}-09)^{1.5}$

*Table 4b*  
**Static Panel Estimates of per Capita Restaurant Revenue**  
all Washington State Counties from 1995q3 to 2007q4

	dependent variable ln(restaurant revenue)				
	(1)	(2)	(3)	(4)	(5)
	unweighted	logarithmic weights <sup>a</sup>	root weights <sup>b</sup>	linear weights <sup>c</sup>	exponential weights <sup>d</sup>
wine points	0.0043* (2.11)	0.0071*** (3.26)	0.0034* (2.08)	0.0024* (2.03)	0.0015* (1.97)
median household income King county (in \$1000)	0.0233*** (5.63)	0.0236*** (5.68)	0.0233*** (5.63)	0.0233*** (5.63)	0.0233*** (5.63)
trend	-0.0099*** (-5.15)	-0.0100*** (-5.22)	-0.0099*** (-5.16)	-0.0099*** (-5.16)	-0.0099*** (-5.15)
dummy first quarter	-0.0747*** (-7.58)	-0.0747*** (-7.58)	-0.0747*** (-7.58)	-0.0748*** (-7.60)	-0.0749*** (-7.61)
dummy second quarter	0.0922*** (12.51)	0.0929*** (12.57)	0.0922*** (12.51)	0.0922*** (12.52)	0.0921*** (12.52)
dummy third quarter	0.1846*** (18.92)	0.1848*** (18.95)	0.1846*** (18.92)	0.1845*** (18.91)	0.1845*** (18.90)
R2	0.9145	0.9146	0.9145	0.9145	0.9145
RMSE	0.14438	0.14430	0.14438	0.14437	0.14437
F statistic	125.68	126.20	125.49	125.35	125.26
County Fixed Effects	yes	yes	yes	yes	yes
F statistic for Fixed Effects	502.57	497.71	502.52	502.60	502.84
n	1940	1940	1940	1940	1940

\*\*\* 1%, \*\*2%, \*5% significance level. Robust t-statistics in parentheses.

The weights are calculated as follows: <sup>a</sup> ln(pts-89)/ln(2); <sup>b</sup> (pts-90)<sup>0.75</sup>; <sup>c</sup> (pts-90); <sup>d</sup> (pts-09)<sup>1.5</sup>

However, it seems unrealistic to presume that critical wine points unfold their economic impact only in one quarter and that their impact completely disappears thereafter. In fact, we assume that the impact of the wine point variable is the strongest immediately after publication in the *Wine Spectator* and slowly wears off thereafter. In order to quantify the duration of the impact and the slope of its decline we dynamize the model and employ a distributed lag model with a geometrical lag structure (Koyck lag model).

These modifications yield equation (2):

$$(2) \ln(R_{it}) = \lambda \ln(R_{it-1}) + \alpha \sum X_{it} + \beta_1 W_{it} + \beta_2 C_i + \beta_3 T_t + \gamma \sum Q_t + \varepsilon_{it}$$

Due to the inclusion of the lagged dependent variable OLS estimates of equation (2) will suffer from severe serial correlation. In addition, as first shown by Nickell (1981), estimating dynamic panel models with fixed effects yield biased coefficient estimates

because the fixed effects are correlated with the lagged dependent variable (see also Baltagi, 2005; Bond, 2002). The coefficient bias is especially severe with a short time series and a large cross section sample size.

Anderson and Hsiao (1991) suggested a first-difference transformation that rids the equation of the fixed effects as well as of the constant term. However, a correlation still remains between the differenced lagged dependent variable and the differenced error term. We can then use the second and third lag of the dependent variable as instruments for the lagged differenced dependent variable.

Arellano and Bond (1991), however, argue that the Anderson-Hsiao estimator leads to consistent but not to efficient estimates since it fails to take all orthogonality conditions into account. Instead, they propose, as an extension of the Anderson-Hsiao method, a generalized method of moments (GMM) procedure in which they specify the model as a system of equations, one per time period, and allow the instruments, i.e., the lagged values, to differ from period to period (e.g., in later periods more lags of the instruments become available). The Arellano-Bond estimator is often called difference GMM estimators.

Arellano and Bover (1995) and Blundell and Bond (1998) show that lagged levels can be poor instruments for first-differenced variables, especially for stationary series, and suggest the inclusion of lagged differences as instruments. This estimator is often called system GMM estimator.

We estimate the model given by equation (2) using both the difference and the system GMM estimator. We employ the *xtabond2* estimator by David Roodman (2006), which is more flexible than the official Stata *xtabond* estimator. Table 5a and 5b present the results for several weighting schemes.

In general, compared to the static models, the GMM estimates exhibit substantially lower coefficients and lower significance levels. As shown in Table 4a for the hotel revenue model, critical wine points still have a significantly positive influence. However, the difference GMM estimator for the logarithmic weighting scheme computes a marginal effect of a 91-point wine of only 1.08%, compared to 2.16% in the static OLS model. In contrast, the system GMM estimator lifts the coefficient to 1.44%. This pattern, i.e., higher estimates for the system GMM than for the difference GMM, appears to be true for most weighting schemes and squares with the findings of Hayakawa (2007) and Blundell and Bond (1998) that the difference GMM estimator tends to exhibit a downward bias.

Referring to the Wald test, the system GMM exhibits the best overall fit for exponential weighting schemes – but at the expense of significance of the critical wine point variable.

Like for the static model, the best model overall fit with a significant wine variable is reached for the logarithmic weighting scheme.<sup>5</sup>

In the system GMM models shown in Table 5a, we restricted the number of instruments to 239 by limiting the lags to four. However, the model results are robust to changes in the number of instruments. There are no significant changes in the variable coefficients or their significance levels with an increase or decrease in the number of instruments (see also Roodman, 2007).

As shown in Table 5b, this is not true for the restaurant model. Similar to the hotel revenue model, but with considerably lower coefficients, the wine point variable is significant in most model variants. Similarly to the hotel revenue estimates, the system GMM model exhibits the best overall fit with significant wine point variables for the logarithmic weighting scheme. However, the model results are very responsive to changes in the weighting scheme and sometimes yield coefficients of larger than one for the lagged endogenous variable. In addition, reducing the number of instruments leads to substantial changes in level and significance of the wine point variable.

The Arellano-Bond test for second order serial correlation (for the residuals in differences) casts further doubt on the restaurant model. In all model versions we reject the hypothesis of no second order autocorrelation rendering the used instruments invalid. Restricting the instruments to levels deeper than the second lag does not remedy the autocorrelation problem. Hence, although we find a significant effect of critical wine points on restaurant revenue in the static panel model, our specification is not able to dynamize these effects.

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<sup>5</sup> We estimate two-step system GMM where the standard covariance matrix is robust to panel-specific autocorrelation and heteroskedasticity, but the standard errors are downward biased (Windmeijer, 2005). We therefore incorporate the Windmeijer correction to the standard errors..

*Table 5a*  
**Dynamic Panel Estimates of per Capita Hotel Revenue**  
 Difference and System GMM Estimates for all Washington State Counties 1995q3 to 2007q4

	dependent variable ln(hotel revenue)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	unweighted		logarithmic weights <sup>a</sup>				exponential weights			
					exponent = 0.75 <sup>b</sup>		exponent=1 <sup>c</sup>		exponent=1.5 <sup>d</sup>	
	GMM <sub>D</sub>	GMM <sub>S</sub>	GMM <sub>D</sub>	GMM <sub>S</sub>	GMM <sub>D</sub>	GMM <sub>S</sub>	GMM <sub>D</sub>	GMM <sub>S</sub>	GMM <sub>D</sub>	GMM <sub>S</sub>
lagged endogenous variable	0.2485** (2.35)	0.8324*** (6.82)	0.2180* (2.05)	0.8517*** (6.38)	0.2480** (2.32)	0.9051*** (11.42)	0.2524** (2.33)	0.9045*** (11.47)	0.2383* (2.06)	0.9053*** (13.13)
wine points	0.0088*** (3.55)	0.0111 <sup>+</sup> (1.83)	0.0108*** (2.73)	0.0144** (2.41)	0.0058*** (3.66)	0.0061 <sup>+</sup> (1.83)	0.0050*** (3.65)	0.0048 <sup>+</sup> (1.92)	0.0034*** (3.92)	0.0031* (2.05)
median household income King county (in \$1000)	0.0177 (1.09)	0.0275*** (3.26)	0.0200 (1.25)	0.0252*** (2.98)	0.0178 (1.09)	0.0274*** (3.35)	0.0170 (1.05)	0.0250*** (3.15)	0.0157 (0.95)	0.0243*** (3.11)
trend	-0.0040* (-0.47)	-0.0124*** (-3.10)	-0.0051 (-0.62)	-0.0114*** (-2.85)	-0.0039 (-0.46)	-0.0125*** (-3.25)	-0.0036 (-0.42)	-0.0113*** (-3.01)	-0.0031 (-0.36)	-0.0110*** (-2.97)
dummy first quarter	-0.0844 (-1.23)	0.2703*** (2.66)	-0.1026 (-1.48)	0.2524** (2.55)	-0.0848 (-1.22)	0.3275*** (4.62)	-0.0824 (-1.17)	0.2993*** (3.39)	-0.0907 (-1.22)	0.2909*** (3.92)
dummy second quarter	0.4274*** (5.28)	0.9184*** (6.15)	0.4042*** (4.96)	0.9218*** (6.32)	0.4270*** (5.21)	0.9816*** (8.35)	0.4304*** (5.17)	0.9577*** (6.70)	0.4197*** (4.75)	0.9474*** (7.79)
dummy third quarter	0.6419*** (10.78)	0.8643*** (6.72)	0.6333*** (10.65)	0.8446*** (6.74)	0.6416*** (10.64)	0.9057*** (7.94)	0.6429*** (10.56)	0.8745*** (6.56)	0.6390*** (10.55)	0.8576*** (7.39)
Wald test for overall fit $\chi(7)$	255.51	534.67	192.71	603.91	243.63	556.24	242.50	723.03	225.62	779.17
number of instruments	210	239	210	239	210	239	210	239	210	239
Hansen test for over-ident. restrictions (p-value)	11.42 (1.00)	12.24 (1.00)	11.91 (1.00)	12.46(1.00)	11.31 (1.00)	12.60(1.00)	12.19 (1.00)	11.86(1.00)	13.41 (1.00)	11.96(1.00)
Arellano-Bond AR(2) test (p value)	-1.88 (0.06)	-1.38(0.17)	-1.92 (0.05)	-1.31((0.19)	-1.88(0.06)	-1.40(0.16)	-1.88(0.06)	-1.35(0.18)	-1.90(0.06)	-1.33(0.18)
number of counties	39	39	39	39	39	39	39	39	39	39
n	1793	1838	1793	1838	1793	1838	1793	1838	1793	1838

\*\*\* 1%, \*\*2%, \*5% +10% significance level. Robust z-statistics in parentheses. The system GMM is estimated two-step and the z-statistics reflect the incorporation of the Windermeyer (2005) correction. The weights are calculated as follows: <sup>a</sup> ln(pts-89)/ln(2); <sup>b</sup> (pts-90)<sup>0.75</sup>; <sup>c</sup> (pts-90); <sup>d</sup> (pts-90)<sup>1.5</sup>



*Table 5b*  
**Dynamic Panel Estimates of per Capita Restaurant Revenue**  
 Difference and System GMM estimates for all Washington State Counties 1995q3 to 2007q4

	dependent variable ln(restaurant revenue)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	unweighted		logarithmic weights <sup>a</sup>		exponent = 0.75 <sup>b</sup>		exponent=1 <sup>c</sup>		exponent=1.5 <sup>d</sup>	
	GMM <sub>D</sub>	GMM <sub>S</sub>	GMM <sub>D</sub>	GMM <sub>S</sub>	GMM <sub>D</sub>	GMM <sub>S</sub>	GMM <sub>D</sub>	GMM <sub>S</sub>	GMM <sub>D</sub>	GMM <sub>S</sub>
lagged endogenous variable	0.1376 <sup>+</sup> (1.83)	0.9484*** (20.93)	0.1476* (2.22)	0.9432*** (20.95)	0.4405** (2.50)	0.9670*** (23.00)	0.1638*** (2.32)	0.9627*** (33.06)	0.1551* (2.19)	1.0471*** (7.93)
wine points	0.0025 (1.28)	0.0043 <sup>+</sup> (1.92)	0.0046* (2.15)	0.0061*** (2.68)	0.0096*** (3.47)	0.0025* (2.01)	0.0013 (1.33)	0.0021* (2.15)	0.0008 (1.39)	0.0008 (0.91)
median household income King county (in \$1000)	0.0151*** (4.38)	0.0075** (2.35)	0.0157*** (4.59)	0.0076** (2.36)	0.0109 (0.58)	0.0065 <sup>+</sup> (1.91)	0.0149*** (4.43)	0.0074** (2.40)	0.0152*** (4.57)	0.0050 (1.23)
trend	-0.0054*** (-3.08)	-0.0034** (-2.34)	-0.0058*** (-3.32)	-0.0035** (-2.35)	-0.0022 (-0.22)	-0.0030 <sup>+</sup> (-1.88)	-0.0053*** (-3.09)	-0.0034** (-2.39)	-0.0055*** (-3.17)	-0.0024 (-1.43)
dummy first quarter	-0.0467*** (-3.14)	0.0987*** (2.84)	-0.0449*** (-3.44)	0.0980*** (2.80)	-0.1475*** (-3.48)	0.0935* (2.04)	-0.0420*** (-3.14)	0.1025*** (3.25)	-0.0443*** (-3.36)	0.1038*** (3.99)
dummy second quarter	0.1256*** (6.07)	0.3154*** (5.85)	0.1235*** (6.79)	0.3167*** (5.84)	0.3455*** (6.73)	0.3148*** (4.41)	0.1269*** (6.75)	0.3219*** (6.02)	0.1239*** (6.60)	0.3239*** (7.24)
dummy third quarter	0.1919*** (5.77)	0.2533*** (4.65)	0.1929*** (5.80)	0.2542*** (4.61)	0.6053*** (10.30)	0.2442*** (3.36)	0.1939*** (8.81)	0.2571*** (4.79)	0.1930*** (5.79)	0.2444*** (5.44)
Wald test for overall fit $\chi(7)$	128.73	3498.23	136.19	3283.48	164.25	2691.89	144.43	5059.22	141.50	842.34
number of instruments	232	256	232	256	232	256	232	256	232	256
Hansen test for over- identifying restrictions (p- value)	11.25(1.00)	11.09(1.00)	10.26(1.00)	11.06(1.00)	11.64(1.00)	10.93(1.00)	10.61(1.00)	10.42(1.00)	12.83(1.00)	11.82(1.100)
Arellano-Bond test for AR(2) (p-value)	-2.12(0.03)	-1.91(0.06)	-2.11(0.04)	-1.91(0.06)	-2.15(0.03)	-1.91(0.06)	-2.11(0.04)	-1.92(0.06)	-2.11(0.04)	-1.92((0.06)
number of counties	39	39	39	39	39	39	39	39	39	39
n	1854	1897	1854	1897	1854	1897	1854	1897	1854	1897

\*\*\* 1%, \*\*2%, \*5% +10% significance level. Robust z-statistics in parentheses. The system GMM is estimated two-step and the z-statistics reflect the incorporation of the Windermeyer (2005) correction. The weights are calculated as follows: <sup>a</sup> ln(pts-89)/ln(2); <sup>b</sup> (pts-90)<sup>0.75</sup>; <sup>c</sup> (pts-90); <sup>d</sup> (pts-90)<sup>1.5</sup>

For the hotel sector, the long-run economic effect of a marginal wine having 91 points, calculated as  $(\frac{\hat{\beta}_1}{1-\hat{\lambda}})$ , equals 9.7%. For a 95-point wine this effect is 25%.<sup>6</sup> That is, although the biggest impact of *Wine Spectator* points occurs immediately after their publication, the effect carries on for a few more quarters before phasing out. Table 6 shows that the reputation effect of a high *Wine Spectator* score wears off relatively quickly and almost disappears about two year after publication.<sup>7</sup>

Nevertheless, given the steady production of high-end wines in Walla Walla and their recognition in the wine press, the wine sector plays an important role for the tourism industry. For instance, from April 1 to June 30 of 2007, that is, by the beginning of the 3<sup>rd</sup> quarter, a total of 23 wines were awarded 91 points or more.<sup>8</sup> This led to an immediate increase in hotel revenue of 44.6% (compared to the reference case of no 91+ wines). Thus, approximately a third (44.6/144.6) of all 3<sup>rd</sup> quarter hotel revenue in Walla Walla county was caused by the wine industry. Since this effect carries on over many more quarters, the long term impact of these 23 wines is substantially higher. This makes the wine sector the driving force behind Walla Walla's "hotel boom."

The wine industry's impact on the restaurant sector is much smaller than on the hotel sector. The static model (see Table 4b) suggests that all wines that received critical points of 91 and above by the beginning of the 3<sup>rd</sup> quarter of 2007 added approximately 20% to the restaurant revenue. However, the same static model suggests that hotel revenues increased by 67%.

It appears reasonable to assume that between 30% (dynamic model) and 40% (static model) of the 2007 hotel revenue in Walla Walla is wine-related. On the other hand, not more than 17% (static model) of the 2007 restaurant revenue is wine induced. These results square with the fact that the hotel industry is much more dependent on tourists than the restaurant sector is.

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<sup>6</sup> From the July 1995 to December 2007, the *Wine Spectator* granted 95 points to only 8 Washington State wines.

<sup>7</sup> The slope coefficient for each lag is calculated as  $\hat{\beta}_1 \hat{\lambda}^z$ , where  $z$  stands for the number of lags.

<sup>8</sup> The critical point distribution was a follows: 91 points (14 wines), 92 points (4 wines), 93 points (3 wines), 94 points (2 wines).

*Table 6*  
**Distribution of the Percentage Impact of Wine Quality  
on Hotel Revenue in Washington State Over Time**

Quarters after Publication	Percentage Impact of a	
	91-point wine	95-point wine
1	1.44	3.72
2	1.23	3.16
3	1.04	2.70
4	0.76	2.30
5	0.65	1.95
6	0.55	1.67
Total Effect	9.71	25.05

## V. Summary

The wine industry in Walla Walla is the most dynamically growing one in the State of Washington, if not in the whole U.S. Within 15 years the number of wineries has grown from about 10 to well above 120. Whether the wine industry has led to a booming economy, as assumed in the media and beyond, is not evident *a priori*. In fact, given the decline in real incomes in Walla Walla county since 2000, i.e., during the most dynamic growth in the number of wineries in Walla Walla, the wine industry’s positive impact on regional incomes may be questioned.

This paper employs an econometric dynamic panel model to quantify the wine industry’s impact on the assumingly most direct beneficiaries of wine tourism, hotels and restaurants. We hypothesize that wine tourism is driven by wine quality rather than wine quantity. In order to quantify the “regional reputation” as quality wine producing county we refer to critical points awarded to Washington State wines by the *Wine Spectator*.

Drawing on quarterly hotel and restaurant revenue data for all 39 counties in Washington State ranging from 1995 to 2007 we find that critical wine points of 91+ indeed affect the county’s tourism industry. Less than 17% of Walla Walla’s restaurant revenue and about 40% of all hotel revenue in 2007 is driven by the local wine production. That is, the local wine industry is becoming increasingly important for the accommodation industry. In other words, without the wine industry the economic decline might have been substantially stronger than observed. However, regional reputation is short-living and needs to be constantly re-earned. The effect of a positive mentioning in the national wine press wears out after two years.

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