An econometric exercise in "stoutonomics"

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Jason O'Connor sets out to prove that econometrics can find an answer to almost any question when he analyses the puzzling issue of why a pint is significantly more expensive in Dublin than outside the capital. O'Connor posits that the price of a pint will decline as one moves farther away from the city centre. This article attempts to construct a model which would predict the price of a pint of Guinness based on the public house's distance from the Spire.

Introduction

Guinness in Ireland is brewed at St. James' Gate Brewery in County Dublin. One would expect that the price of a pint in Dublin would be lower, or at least the same as, that prevailing in rest of the country. Yet this is not the case. This investigation found prices to be as high as €5 per pint in Dublin and as low as €3 a pint outside of Dublin. This analysis will attempt to explain this price discrepancy of €2. In particular, does this variation follow a pattern whereby the further one travels from Dublin the cheaper a pint of Guinness becomes?

This paper will consider the dependence of the price of Guinness on four variables: distance from Dublin (in miles), the population of a district, the disposable income per person in each area surveyed and the level of infrastructural development as indicated by the town's proximity to a national road.

Literature review

In the same way as *The Economist's* 'Big Mac Index' denotes how much international currencies are overvalued and undervalued, the aim will be to expose how the price level, normally measured by the Consumer Price Index (CPI), is less reliable for those who frequent public houses. A typical complaint often heard among the nation's stout drinkers is as follows: "If Guinness is brewed in Dublin,

then why is it more expensive there?" This article hopes to provide a quantitative justification for this quandary.

Moreover, Guinness is not that far removed from the realm of statistics. It was a statistician working for Guinness, William Sealy Gosset (1876-1937), who formulated 'Students' T-distribution (Raju, 2005), but he was unable to publish under his own name due to a contractual obligation owing to the company.

The Central Statistics Office (CSO) conducts a bi-annual Average Price Analysis (APA) for prices in and outside Dublin, derived from data gathered for the CPI. In November 2008, the CSO concluded that a pint of draught stout, consumed on licensed premises during May 2008, was 9.9 percent higher in the nation's capital when compared with the rest of the country. Of the 30 observations, which covered all of Dublin not just the city-centre, the CSO found the average price of a pint of stout to be €4.351. The averages of the five lowest and highest quotes were €4.020 and €4.766 respectively. This amounted to an 18.6 per cent differential between the lowest and highest price quotes. Outside of Dublin, the average price was €3.960, with the averages of the five lowest and highest quotes being €3.629 and €4.389 respectively. This amounted to a differential of 20.9 percent. The national average was found to be €4.094. In boarder terms, of the 79 items included in the CSO survey, prices were found to be higher in Dublin on 51 occasions or 64.6 per cent of the time. Prices were found to be lower in Dublin for 26 items, while only two of the items priced were the same.

Empirical approach

In order to quantify the hypothesised relationship between the variables specified above, the following regression was estimated:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + u_i$$

Where:

Y_i = PRC: The price of a pint of Guinness (in euro).
X_1 = DIST: The distance from Dublin (in miles).[1]
X_2 = POP: The population of the town in each observation.
X_3 = DINC: The average level of disposable income per person in each county of observation.
X_4 = INF: A dummy variable set equal to one if the town was within one mile of a national road to indicate the level of local infrastructure.

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[1] The "Spire" was taken as the point of reference.

$\textbf{u}_\textbf{i}$ = an error term of statistical residuals.

A negative relationship between PRC and DIST was anticipated. Conversely, a positive relationship should be observed between PRC and the other variables: POP, DINC, and INF.

There are, however, other factors which affect the price of a pint of stout. Publicans in Dublin are subject to higher rents and higher local rates. That said it is reasonable to assume that these inflated costs are offset by the extra business they attract, owing to their city-centre location. Furthermore, the Guinness Brewery offers publicans one free keg for every ten ordered, therefore small publicans may not be in a position to sell such a quantity due to insufficient demand. As a result, Dublin-based publicans are better placed to exploit such economies of scale and avail of this bonus. A crucial factor in pricing decisions is the prevalence of union membership among Dublin bar staff. These unions set the wage level well above the prevailing minimum rate. Public houses outside of Dublin are typically family run and are not unionised. Therefore, such high labour costs can be avoided[2].

Description of the dataset

Sources
The investigation employed cross-sectional data analysis. Price data was gathered by a telephone survey of public houses. The Ordinance Survey Ireland (OSI) trails map software, which conveniently divided the island of Ireland into over 90 equal blocks, was used to obtain an unbiased sample selection[3]. The town closest to the centre of each of these blocks was chosen and a public house, from the chosen town, randomly selected from the telephone directory. This provided a convenient and unbiased method for obtaining random observations. For the Dublin prices, 15 public houses were chosen at random from the Dublin 1 postal area and another 15 were randomly selected from the Dublin 2 postal area. This resulted in a sample of 30 observations for the city-centre.

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[2] The intuition behind this is based on anecdotal evidence from discussions held with publicans regarding the determinants of pricing decisions. Publicans report unionised bartending staff wage rates of approximately €15 per hour.

[3] Owing to a different currency and price level, blocks in Northern Ireland were not included in the survey.

The OSI software's measurement tool was employed to estimate the distance ('as the crow flies') of each town from Dublin. This tool was employed for measurement of the infrastructure variable[4].

For the data on town population, the CSO's Census 2006, which classified population by area, was consulted. Data on disposable income for each county was obtained from the CSO's County Incomes and Regional Gross Domestic Product (GDP) statistics.

Summary statistics

The national average price of a pint of Guinness was found to be €4.0435. For Dublin, the average price was found to be €4.4999, while the extra-Dublin (outside of Dublin) average price was €3.8521. A spread of €0.6478, or 16.8 per cent, is considerable and merits further explanation.

A scatter plot dipicting the relationship between the variables PRC and DIST showed the existence of a negative relationship between Dublin and extra-Dublin prices. Excluding the Dublin prices, however, there appears to be no relationship among the other observations regarding distance from Dublin.

Empirical Results

First regression

Using the Microfit statistical software package, PRC was regressed on DIST, POP, DINC and INF, yielding the following Ordinary Least Squares Estimations. It produced the following model:

$$\widehat{PRC} = 2.667 - 1.54DIST + 7.65POP + 5.97DINC + 0.064INF$$
$$(0.463) \quad (5.67) \quad (2.27) \quad (2.30) \quad (0.054)$$

The regression exhibited a high R^2, impling that 67.7 per cent of the variation in PRC is explained by the model. Diagnostic tests did not detect heteroscedasticity at the one per cent significance level or serial correlation, indicating that the correct functional form has been specified.

Surprisingly, however, the variable DIST was not found to be statistically significant ($p > 0.05$). The dummy variable INF would likewise be rejected at the five per cent level ($p > 0.05$). POP and DINC were found to be statistically significant at the one per cent and five per cent levels respectively.

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[4] This was used as a proxy to indicate the development of the town or village selected, since only very remote towns are more than one mile from a national road.

Second regression
In an attempt to improve the explanatory power of the model, the INF variable was excluded and logs were taken of the independent variables in order to account for nonlinearities.

The above actions caused the explanatory power of my model to fall; R^2 fell to 16.68 per cent and again, the variable DIST failed at the five per cent level of significance.

Third regression
Excluding DIST, the new regression model of PRC on LPOP and LDINC was estimated. It produced the following model:

$$\overline{PRC} = \text{-12.5456} + 0.0554 LPOP + 1.621 LDINC$$
$$(3.491) \qquad (0.0122) \qquad (0.361)$$

The value of R^2 rose to 66.68 per cent and both LPOP and LDINC proved significant at the one per cent level. The software diagnostic tests did not detect heteroscedasticity at the five per cent level. Furthermore, no serial correlation was detected and the results indicated the model was specified in the correct functional form.

Possible extensions

Clearly the model is lacking in variables. As noted above, had it been possible to obtain data for labour costs and rent for premises the model could have been extended. Furthermore, there were exogenous factors at play, such as the price freeze imposed on all members of the Licensed Vintners Association (LVA) in December 2008[5]. It may also be instructive to take preferences and substitutes into account. For example, consumers may prefer lager such as Tennants in Ulster or the local brand of stout, such Murphy's, in Munster. Furthermore, since alcohol is relatively demand inelastic, it is a prime target for taxation. That said, this would not have affected the regression since it applies to prices nationwide.

Fundamentally, the price of Guinness seems to be demand determined since both population and disposable income were found to be significant. It is disappointing that the originally hypothesised relationship between the price of a pint of Guinness and the distance of a public house from Dublin was not observed. However, a very narrow sample was taken from the population. Furthermore, given

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[5] http://www.irishtimes.com/newspaper/breaking/2008/1201/breaking38.html

the strong anecdotal evidence suggesting such a relationship, it is conceivable that, due to such small sample size, the above analysis failed to reveal this population parameter.

Conclusion

Initially, this study hoped to specify an equation whereby one could predict the price of a pint of Guinnes based on distance from Dublin. The actual equation obtained is:

$$\widehat{PRC} = -12.5456 + 0.0554LPOP + 1.621LDINC$$
$$(3.491) \qquad (0.0122) \qquad (0.361)$$

This equation is inaccurate because, owing to the extremely negative intercept, it predicts a negative price. Rather it appears that the decline in the price of Guinness is discrete and falls to the extra-Dublin average of €3.85 once one leaves the city.

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