The Effect of Consulting Hours on Client Sales

Prepared for

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April 2019

## I.     Introduction

All clients of the SBDC have a common goal when they seek out the help of our Business Consultants; they want their business to succeed. Success can mean different things to every client, but one common measure of success is the amount of annual sales. Many factors impact sales, including the number of employees, location of the business, state of the economy, consulting hours, promotional deals, and advertisements. In this report, I focus on the effect of consulting hours on sales.

## II.     Data

Our sample is an unbalanced panel of 1,775 clients from 2013-2017. The data used was captured from the impact survey responses from the surveys in 2015-2018. The sample includes annual sales, consulting hours, and number of employees as variables for each client and year. To obtain the sample used in estimating this model, many clients' data were deleted due to various reasons. First, client responses were deleted if there were no values for hours or employees. Most often, the value for sales was an evident outlier, likely due to human error. For those clients who completed surveys two years in a row, they would report on the same year twice. Another common error was the inconsistency in the data for the same year. Typically, the most recently finished survey had more complete data, thus was the only data kept for that year. Otherwise, judgement calls were made on which data for that year was more accurate. For example, if the sales revenue for one response was $150,000 and the other was $151,457, the first response would be deleted from the data set, as the second value seemed more precise. Another common error that resulted in data deletion was when clients would enter very low values for their sales, as it seems they were not accurately reporting. A decision was made to delete the responses if the sales reported was less than $5. Finally, if their sales had a value of zero or NA, they were deleted from the sample. These clients were deleted because they either were a Pre-Venture client, or they refused to disclose the amount of sales they had. Since Pre-Ventures do not generate sales, they should not be included in the analysis of this model. The presence of clients with no sales data would create a downward bias on the estimates of the variables in our model.

Table 1 provides summary statistics for all values used in estimating the model. All variables have 2,473 observations. This sample averaged 14.53 hours of consulting per year, with a standard deviation of 22.92 hours. Additionally, clients averaged 9.5 employees with a standard deviation of 27.82 employees. Average sales were $3.3 million, with a standard deviation of $48 million. As evident by the large standard deviations, the values in this dataset are very widespread.

## III.    Empirical Model and Estimation

To estimate the effect of consulting hours on sales I estimate a panel regression of the form:

$$\ln(sales_{it}) = \beta_0 + \beta_1 hours_{it} + \beta_2 employees_{it} + \beta_3 hours_{it}^2 + \alpha_i + b_t + u_{it}$$

where all variables are subscripted according to client $i$ in year $t$, $\ln(sales)$ is the natural log of sales, $hours$ is the number of consulting hours, $employees$ is the number of employees, $hours^2$ is the number of consulting hours squared, $\alpha_i$ is the unobserved effect, $b_t$ is the year effect, and $u_{it}$ is the error term. The unobserved effects represent time–invariant client characteristics that are unobservable and unmeasurable. I estimate the model by Fixed Effects (FE) which controls for these unobservable client characteristics as well as the year effect. The coefficients of interest are $\beta_1$ and $\beta_3$, the average percentage increase in sales from an additional hours of consulting.


## IV.    Empirical Results

Table 2 reports my findings of the FE regression. With this, I find that an additional hour of consulting increases sales by .69% on average, holding all else constant. Not surprisingly, this value is not statistically significant. This is likely due to the limitations in the sample size, as well possible human error in the survey responses. From this regression I also find that an additional employee increases sales by 1.6% on average, ceteris paribus. Interestingly, the coefficient on employees is statistically significant at the 1%. While these results do provide insight into the effect of consulting hours and employees on sales, these parameter estimates are biased. This is due to an extremely weak model, as it only explains .02% of the variance in sales. Additionally, our adjusted $R^2$ is negative meaning the explanatory variables are insignificant. This could be improved with a larger sample size.


## V.    Conclusion

Using an unbalanced panel set of 1,775 clients from 2013–2017, I estimated a sales regression. I was interested to see the effect of consulting hours on client sales. Due to limitations in data, I was only able to control for number of employees, as well as client and year effects. The regression estimates that an additional consulting hour increases client sales by .69% on average. The parameter estimate on the number of employees provides additional insight to client sales. Numerous flaws in the data contributed to an extremely low $R^2$. One reason was the lack of available data, as not all clients of the SBDC responded to the impact survey. Additionally, many clients were dropped from the sample due to being clear outliers. This low $R^2$ value leads to biased estimates of the parameters. Further research should include more significant explanatory variables, including money spent on advertising, industry, and how long

the client's business has existed. This not only should lead to a more accurate estimate on hours and hours[2] but should also increase the variance in sales explained by the model.

## Table 1. Summary Statistics

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| Statistic | N | Mean | St. Dev. | Min | Max |
|---|---|---|---|---|---|
| hours | 2,473 | 14.53 | 22.92 | 0.25 | 405 |
| employees | 2,473 | 9.50 | 27.82 | 0 | 756 |
| sales | 2,473 | 3,319,695 | 48,073,947 | 10 | 1,805,000,000 |

## Table 2. Estimation of Sales with FE, 2013–2017

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|  | Dependent variable: |
|---|---|
|  | Sales |

| | |
|---|---|
| hours | 0.007 |
|  | (0.005) |
| employees | 0.016*** |
|  | (0.005) |
| hoursSq | -0.00005 |
|  | (0.0001) |

| | |
|---|---|
| Observations | 2,473 |
| R2 | 0.020 |
| Adjusted R2 | -2.501 |
| F Statistic | 4.717*** (df = 3; 692) |

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Note: *p<0.1; **p<0.05; ***p<0.01