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The Effect of Time, Price of Stock Research and Development, and Number of Bugs on Net Revenue for Intel Corporation

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Abstract

Intel Corporation studied the effect of bugs in the revenue of the company. In this paper, we look at the factors affecting the revenue of Intel Corporation with respect to how bugs affect the revenue. By doing research on the development and number of Intel employees, we examined the effect it has on stock price, and how bugs affect this in the corporation.

Key Words: Net Revenue, Intel Corporation, Price of Stock Research

Introduction

In a computer, software and hardware work hand-in-hand. Computer software is a collection of data and instructions that tell the computer how to function. On the contrary, computer hardware is actually computer system that is built and performs the work. Computer software includes computer programs, libraries, and data. Both computer hardware and software are necessarily for each other in order for the computer program to work properly.

In computer software, an error or failure in the computer program can occur that causes it to produce an incorrect result, also known as a software bug. In this failure, the computer program can crash and will not operate properly for the user. These bugs are often caused by human errors in the source code or design ("Software Bug", n.d.). Hardware bugs work similarly, but instead they attack the hardware portion of a computer system ("What is a Bug?", 2017). Problem with the Bloomberg Businessweek's report claiming that Chinese government agents used the supply chain of server hardware vendor Supermicro, during an interview with BuzzFeed News (Sanders, J, 2018).

Intel Corporation is a technology company that is the world's largest semiconductor chip maker based on revenue. They work with companies to produce needed technology like integrated circuits for computing and communication. Their website on www.intel.com aims to instruct their viewers about annual progress reports and safety/health compliance. Intel works to provide many products for their customers that range from

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microprocessors with few processor cores to software products and services that help enable and advance the computing ecosystem (Intel Reports, n.d.).
   1) Discussion of the effects of meltdown on this corporation
   2) Methodology (using XLSTAT to get the OLS model)

Intel Corporation has a security dimension in its protocol mentioned on their website. Specifically, Intel builds hardware-enabled security capabilities directly into their silicon in order to help protect all layers of the computer including hardware, firmware, operating systems, applications, networks and the cloud ("hard-ware enabled security", 2019).

However, in 2018, there was evidence for a flaw in the security of Intel's chips. One of Intel's security measures, called Software Guard Extensions, allows programs to establish "secure" enclaves on Intel processors. This secured enclave creates a safe-haven against malware or other comprises to the computer. Recently, researchers have found that SGX mostly repels Spectre and Meltdown attacks and a related attack can bypass its defenses (Newman, 2018).

Yuriy Bulygin, the former Intel Corporation chief threat researcher, has recently discovered that hackers can exploit previously discloses problems in microprocessors to access a computer's firmware to get the most sensitive information (Robertson, 2018).

Academic partnership for Intel Corporation is a very high priority for them. Specifically, they are committed to being an active partner in the security ecosystem and do so by strengthening cybersecurity partnerships with academia to advance research. Intel has paired with Purdue to continue to strive for this goal (Echevarria, 2018).

Data

Database compiled for this paper source from Intel's annual report from year 2007 to year 2017. In this paper, it is reasonable to set Bugs as dummy variable since it is not a continual data. When the number of bugs is larger or equal to 2, it's set as 1, which means bugs exist during this period; otherwise, it doesn't necessarily have a bug.

Figure 1: Descriptive Statistics _ Bugs (Mean 1.75; Median 1.00)
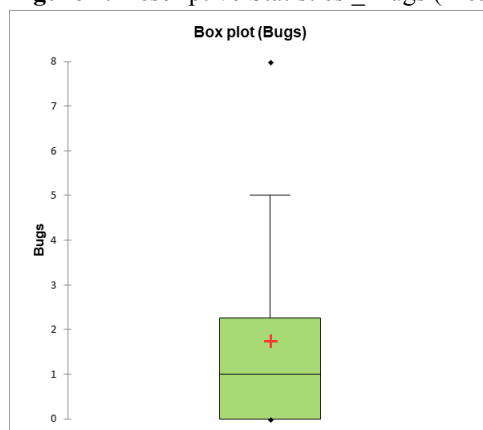
Methodology

The least square model is used in this paper. There are two models to illustrate the relationship between Bugs and other commercial factors like revenue and the number of employees.
Firstly, estimating whether the bugs can affect Intel's net revenue:

$$ln\_Revenue_i = \beta_0 + \beta_1 Time_i + \beta_2 Stock\_price_i + \beta_3 Bugs_i + \varepsilon_i$$

Where, ln_Revenue$_i$ is the net revenue Intel Corporate gets each quarter; Bugs$_i$ is a dummy variable.

Next, examining how the number of employees and the amount of Research and Development affect Bugs:

$$Bugs_i = \beta_0 + \beta_1 Employees_i + \beta_2 ln\_Research_i + \varepsilon_i$$

Where, $Bugs_i$ represents whether there are bugs or not.

Empirical Findings

Tables 1 shows the results of OLS (Ordinary Least Square) regressions. It tells that Time is significantly positive and affects the net revenue of Intel Corporation; when the stock price increases by 1 unit, net revenue will have 0.003 more likely chance to increase. However, there is an opposite relationship between the Bugs and the Revenue; also, this is not statistically significant which means that even though the number of bugs have a relationship with the net revenue for Intel Corporation, the relationship of the number of bugs to revenue for Intel is not significant. It seems that the only significant independent variable to predict the net revenue for Intel Corporation are time and price of stock. However, the price of stock is only significant at less than 0.057.

Table 1: estimates for Net Revenue [a,b]

Independent Variables	Coef. Estimate	Std. Error	Pr > |t|
Intercept	9.895	0.0303	**< 0.0001**
Time	0.005	0.0009***	**< 0.0001**
Stock_price	0.003	0.002	0.057
Bugs	-0.016	0.015	0.282

   a.   The dependent is natural logarithm of net worth Intel Corporation price of stock;
    b.   The symbols (***), (**) and (*) indicate statistical significance at $p < 0.01$, $p < 0.05$ and $p < 0.10$, respectively.

ln_Revenue = 9.89517+0.00491*Time+0.00335*Stock_price-0.01597*Bugs

Table 2: In-Revenue

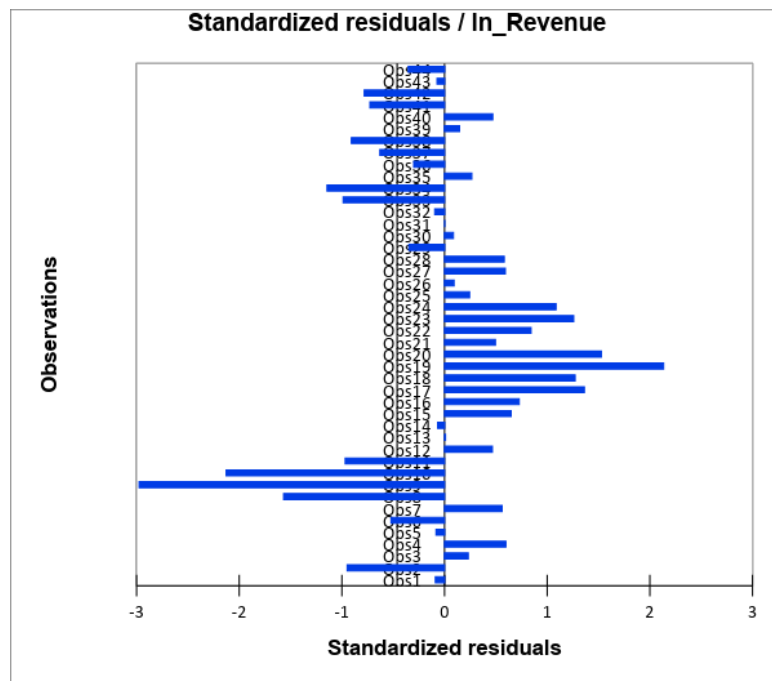| Source	Value	Standard error	t	Pr > |t|	Lower bound (95%)	Upper bound (95%)
Time	0.691	0.131	5.279	**< 0.0001**	0.426	0.955
Stock_price	0.256	0.131	1.956	0.057	-0.009	0.521
Bugs	-0.086	0.079	-1.090	0.282	-0.246	0.074

Figure 2. Graph of In-Revenue
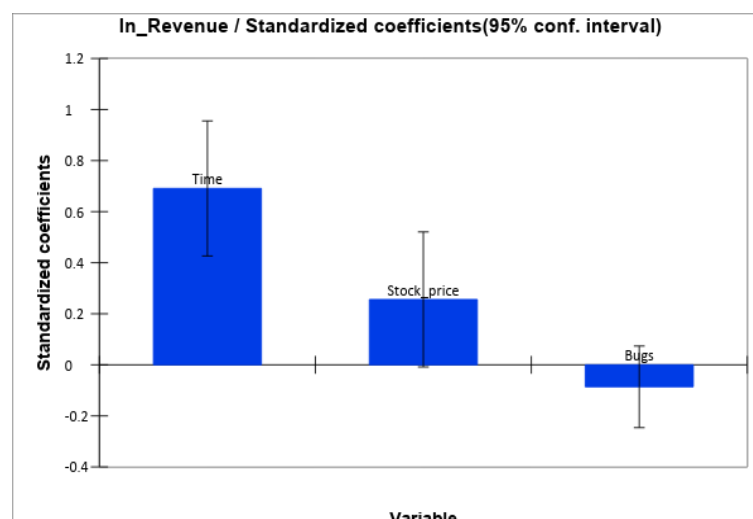
Figure 3: Standardized residuals vs. in-revenue

Table 3 shows how the Intel Corporation related factors effect the bugs. It tells that Time does not influence the number of bugs. The estimate of Employees, -0.00007, indicated that if the Intel Corporation has one than more employee, it has 0.00007 possibility to avoid having a problem concerning bugs and effects the net revenue of the corporation significantly. However, the more funds are in Research & Development, it become more likely to have an effect on the bugs significantly. Specifically, the more money invested in Research and Development indicates a possibility of fewer bugs. For example, in this model the independent variables are time, number of employees, and investment in research and development to predict Intel Corporation's number of hardware bugs.

Table 3: estimates for Bugs [a,b]

| Independent Variables	Coef. Estimate	Std. Error	Pr > |t|
Intercept	-46.411	8.963	**< 0.0001**
Time	0.000	0.000	
Employees	-0.00007	0.00001***	**< 0.0001**
Research & Development	5.738	1.097***	**< 0.0001**

    c.   The independent variable of Research is natural logarithm of net worth Intel Corporation price of stock;
    d.   The symbols (***), (**) and (*) indicate statistical significance at $p < 0.01$, $p < 0.05$ and $p < 0.10$, respectively.

Bugs = -46.41094-0.00007*Employees+5.73817*ln_Research

Table 4: Standardized coefficients (Bugs)

Source	Value	Standard error	t	Pr > |t|	Lower bound (95%)	Upper bound (95%)
Time	0.000	0.000				
Employees	-1.563	0.324	-4.828	**< 0.0001**	-2.217	-0.909
ln_Research	1.692	0.324	5.227	**< 0.0001**	1.039	2.346

Figure 4. Bugs/ Standardized coefficients (95% conf. interval)
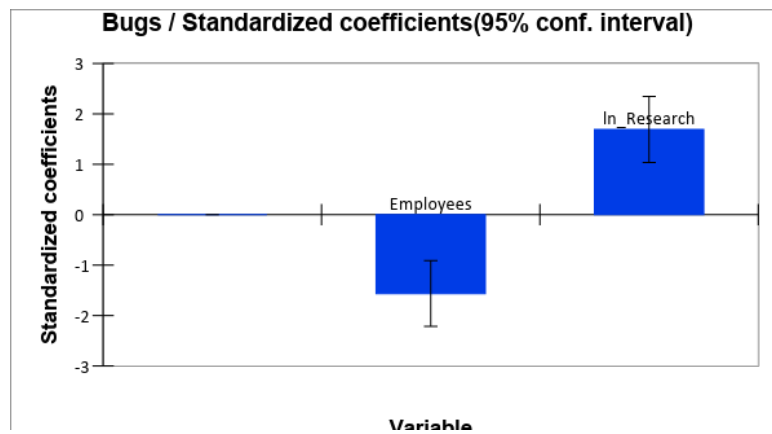
Figure 5: Standardized residuals vs. Bugs
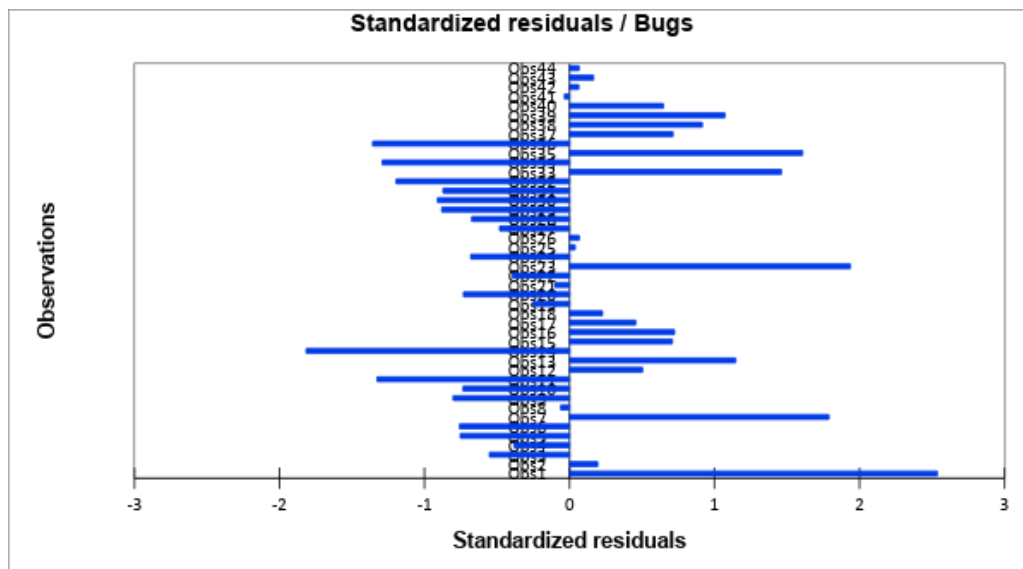
Conclusion

We try to show in this paper how the bugs, time, number of employees and amount of research development affects the net revenue of Intel Corporation. We were able to show that both time and price of stock of Intel Corporation significantly affects the net revenue of Intel Corporation. However, most importantly, we were able to show that Research & Development significantly affects the number of bugs in Intel Corporation.

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