

100 Gold Coins: Unveiling the Relationship between the US Economy and Video Game Industry

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Introduction

As the world economic troubles lengthen in time and deepen in severity people seek solace and distraction in a variety of outlets. The resilience and even success of the movie industry during time of financial hardship has been noted in previous research. Our group sought to understand if another important section of the entertainment market, video games, also exhibited a similar tendency to resist the downward pull of recession. All three members of the group are fans of the medium and were interested in its relevance to the overall economy, especially in light of the huge sales numbers driven by increasing social acceptance and prominence of modern systems.

Our hypothesis is that changes in the economy do not affect the video game industry.

Statistical Methods and Results

Part 1

In our first set of tests on the data we performed regression modeling for using average median income to examine the possibility of predicting expenditures for dining out and entertainment and with video game sales. These tests were chosen as they would indicate how well a growing, or failing economic environment, would affect the sales of video games. From our calculations and plots there is a clear connection between the yearly growth of average median income and a yearly growth in the money paid to dine out. The correlation test produces a high correlation coefficient (0.9799232) and a low p-value ($1.738e-10$) while the plot (Figure 1) clearly shows that increases in income closely predict increases in restaurant expenditure. A slightly lower, but still significant correlation can also be seen when examining the correlation of the entertainment expenditure (0.9383085, p-value $2.318e-07$). As it is most likely considered within entertainment expenses, video game sales and average median income show a similar predictive profile. We found significant correlation with correlation coefficient of (0.9253179) and a p-value of ($7.776e-07$). From the plot (Figure 2) it appears that correlation of video game sales is negatively affected by the increasing variability of data after 2003, this will be explored later. These findings are interesting in that they demonstrate a significant link between the economy and video game sales. Though common wisdom suggested that we would not find this connection the relatively narrow distribution of the plots and the confidence demonstrated through our correlation p-values seems to disprove this. Further investigation was necessary.

Part 2

In the second set of tests by our group we sought to examine a suspected latency in the game sales data that might reveal a connection between our economic indicator and game sales. Previous research has suggested that changes in the economy did not immediately reveal themselves in the sales numbers of the video game industry. However, in visualizing the data we noticed similarities that warranted exploration. In order to do this we used data on the rate of growth for videogame software sales and

the rate of growth of average median income. After normalizing the data as z-scores we plotted the results and measured the correlation between the original data (Figure 3) and the adjusted data which took into account a one year lag in income changes affecting video game sales (Figure 4). Visually, the shift seems to more closely match game sales and income growth. In order to perform a more rigorous test of this shift we decided to use the Granger Causality test, setting for a one year lag. The Granger test showed the probability of causality between changes in the normalized income growth rate and the normalized game sales rate with a one year lag to be significant with a p-value of 0.01008470. This measurement seems to verify our visual interpretation of the data, demonstrating that the video game industries sales are affected by economic changes, but that the affects are not seem immediately, perhaps leading to the erroneous assumption that the industry is not hurt by economic recession.

Part 3

Finally, we sought to explain the outliers seen in recent (03-09) sales data when plotted with median income in Part 1 to strengthen our understanding of the relations between games and the economy. We thought that the differences might be due to the video game industry of the last 5 to 6 years growing rapidly in prominence with the introduction of multiple high end systems and blockbuster game franchises that far surpassed previous industry records. To examine the variation seen in this more recent era we gathered sales and income data on a monthly basis from July 2004 to February 2009 and plotted it (Figure 5). The plot seemed to be unsatisfactorily noisy but though to the team it suggested the possibility of a negative correlation between the two rates. A correlation test was performed to check our assumption but proved unhelpful. It produced a negative correlation coefficient (-0.1767718) but with too high of a p-value (0.251) to be considered useful.

Conclusion

In conclusion, we cannot prove our hypothesis that video game sales are unaffected by changes in the economy. The results are somewhat complicated though as earlier data from the video game industry show a clear relationship between economic health and sales while more recent data is much less consistent, perhaps showing the disconnection we are looking more. More data, especially monthly data extending through 2009, would be valuable in measuring this new volatility.

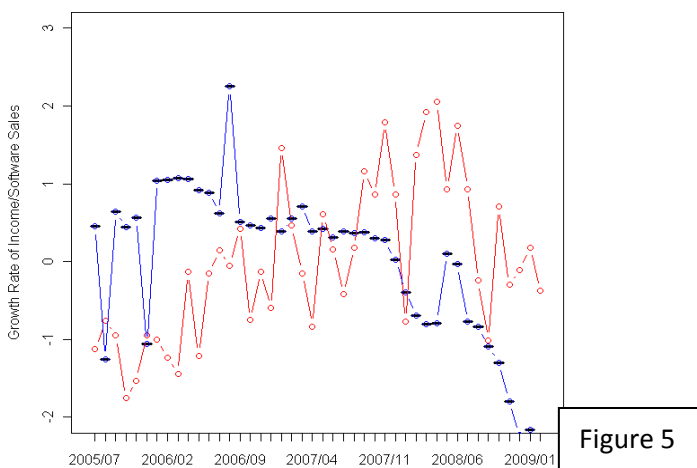
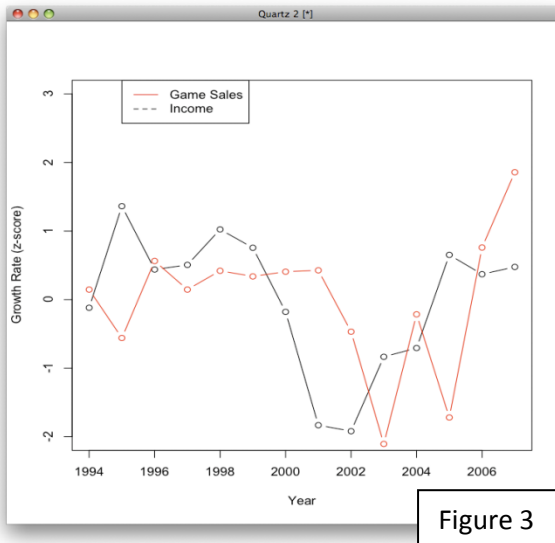
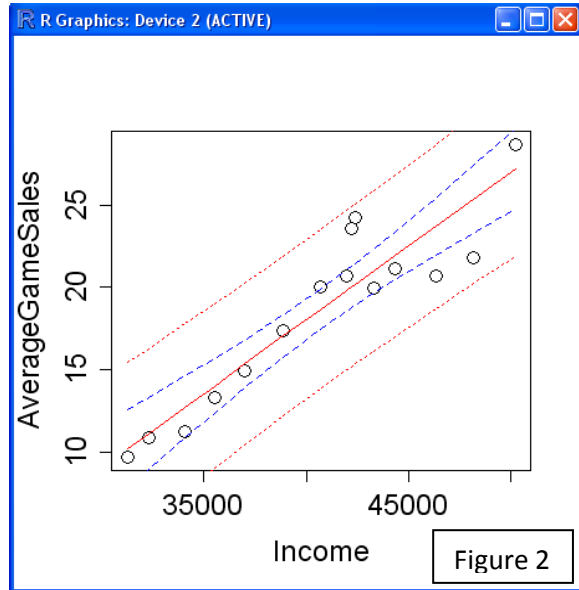
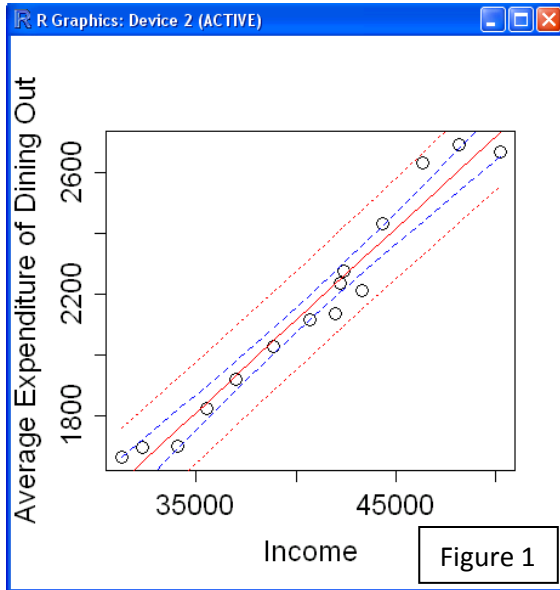
Possible Issues

Though the team found significant results and took pains to include as much data as possible there are issues that might confound our findings. It is possible that income is not the best indicator of the economic environment. An important consideration is that the financial and sales data is from the united states only and as the video game industry and economic depressions are global in their scope we may not have the most accurate picture of the connections between the two. We also found that in our testing and modeling that several market factors create outliers and other complications in the data: the introduction of new system hardware, the spike in sales seen during the holiday seasons and entries and exits of major companies from the industry all have confounding effects on the data that need to be considered. It is also possible that as video games were for a long period of their history seen as niche products and marketed towards very specific demographics that the populations represented video game sales data are not necessarily represented well by the measurements of average median income.

Permissions

- The data from this report can be used in future versions of the course, with credit given to the researchers
- This report can be posted to a public page

Plots



R Code

Part 1

```
pred.frame=data.frame(Income)
```

food expenditure

```
cor.test(Food,Income)
```

```
lm.game=lm(Food~Income, data=sif)
plot(Income,Food,xlab="Income",ylab="Average Expenditure of
Food",cex=1.5,cex.axis=1.5,cex.lab=1.5)
pp=predict(lm.game, int="p", newdata=pred.frame)
pc=predict(lm.game, int="c", newdata=pred.frame)
matlines(pred.frame, pc, lty=c(1,2,2), col="blue")
matlines(pred.frame, pp, lty=c(1,3,3), col="red")
```

entertainment expenditure

```
cor.test(Entertainment,Income)
```

Videogames Sales

```
cor.test(GameSales,Income)
```

```
lm.game=lm(Total~Income, data=sif)
plot(Income>Total,xlab="Income",ylab="AverageGameSales",cex=1.5,cex.ax
is=1.5,cex.lab=1.5)
pp=predict(lm.game, int="p", newdata=pred.frame)
pc=predict(lm.game, int="c", newdata=pred.frame)
matlines(pred.frame, pc, lty=c(1,2,2), col="blue")
matlines(pred.frame, pp, lty=c(1,3,3), col="red")
```

Part 2

load sale_income.txt

```
sale_income = read.table(file.choose(),header=T)
```

calculate Z-Score for Growth Rates

```
sale_income$IncomeGrowthRateZ = (sale_income$IncomeGrowthRate -
mean(sale_income$IncomeGrowthRate))/sd(sale_income$IncomeGrowthRate)
```

```
sale_income$SoftwareGrowthRateZ = (sale_income$SoftwareGrowthRate -
mean(sale_income$SoftwareGrowthRate))/sd(sale_income$SoftwareGrowthRate)
```

```
plot(sale_income$Year,sale_income$IncomeGrowthRateZ,col="black",ylim=c
(-2,3),type='b',ylab='Growth Rate (z-score)',xlab='Year')
```

```
points(sale_income$Year,sale_income$SoftwareGrowthRateZ,type='b',col='
red')
```

```

legend(1995, 3.2, legend=c("Game
Sales", "Income"), lty=c(1, 2, 3), col=c("red", "black"))

### Analyze adjusted data
### We pair the growth rate of income with next year's growth rate of
software or hardware sales

### load sale_income_adjust.txt

sale_income_adjust = read.table(file.choose(), header=T)

# calculate Z-Score for Growth Rates

sale_income_adjust$IncomeGrowthRateZ =
(sale_income_adjust$IncomeGrowthRate -
mean(sale_income_adjust$IncomeGrowthRate))/sd(sale_income_adjust$Incom
eGrowthRate)

sale_income_adjust$SoftwareGrowthRateZ =
(sale_income_adjust$SoftwareGrowthRate -
mean(sale_income_adjust$SoftwareGrowthRate))/sd(sale_income_adjust$Sof
twareGrowthRate)

plot(sale_income_adjust$Year, sale_income_adjust$IncomeGrowthRateZ, col=
"black", ylim=c(-2, 3), type='b', ylab='Growth Rate (z-score)', xlab='Year
of Income (Year of Game -1)')

points(sale_income_adjust$Year, sale_income_adjust$SoftwareGrowthRateZ,
type='b', col='red')

legend(1995, 3.2, legend=c("Game
Sales", "Income"), lty=c(1, 2, 3), col=c("red", "black"))

```

Part 3

```

# load the table3.txt

monthly=read.table(file=file.choose(), header=T)

# normalize the two rates
monthly$PIZ=(monthly$PIGrowthrate-
mean(monthly$PIGrowthrate))/sd(monthly$PIGrowthrate)
monthly$SWZ=( monthly$SWGrowthrate-
mean(monthly$SWGrowthrate))/sd(monthly$SWGrowthrate)

# caluclating the correlation between income rates and sales rates
cor.test(monthly$PIZ,monthly$SWZ)

attach(monthly)
plot(date,PIZ,type='b', col='red ')
points(date,SWZ,type='b', col='blue')

```

Sources

1. US Expenditure 2002-2006

<http://www.bls.gov/cex/#tables>

2. US Personal Income 1994 - 2009

<http://www.bea.gov/national/nipaweb/SelectTable.asp#S2>

3. US Population

<http://www.census.gov/popest/archives/1990s/popclockest.txt>

4. Game Sales

http://vgsales.wikia.com/wiki/NPD_sales_figures

<http://www.gamespot.com/news/6147802.html>

<http://www.gamespot.com/news/6157894.html>

<http://www.gamespot.com/news/6161710.html>

<http://www.gamespot.com/news/6160764.html>