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Analysis of Earnings Volatility Between Groups

Abstract

With this project, the intent is to take a detailed look at how the level of earnings volatility varies between groups. In order to do this, statistical comparison tests will be performed on earnings data. The initial hypothesis is that earnings volatility will be positively correlated to earnings level due to higher earners having more to gain or lose at a given time. The results from the analysis, however, will indicate otherwise. The overall findings of this paper will show varying levels of earnings volatility for different groups, findings I hope will be expanded on in the future.

Analysis of Earnings Volatility Between Groups

JJ Lindquist

I. Introduction

Although there is extensive research done on the fluctuations and risks faced in financial and capital markets, in most cases the American household is primarily concerned with the risks and volatility in the labor market. There is the possibility an individual's earnings could cease, decrease, or increase at nearly any time. Commonly, these fluctuations are out of the individual's control, due to events related to layoffs and work schedule changes. These unexpected fluctuations have steadily become more common over the past 40 years, indicating there is a growing possibility for any given household to be experiencing earnings volatility (Gottschalk & Moffitt, 2009; Income Volatility, 2016). Regardless of earnings fluctuations occurring weekly, monthly, or quarterly, it is up to the household to cope with volatility in their earnings.

When it comes to long-term household financial planning, a certain amount of earnings stability is required in order to build a plan that leads to financial health. Without an accurate estimation of future earnings, planning a household's financial future is much more difficult because it is not clear how much wealth a family will be able to build over time. This is especially prevalent when it comes to saving for college or retirement. In the short-term, an

unexpected expense during a period of low earnings could leave the household unable to meet that financial obligation. Therefore, fluctuating earnings is not just a nominal change, but has real effects that alter the ability of a household to become financially healthy.

Coping with earnings volatility is a burden that many American households face. For long-term fluctuations in household income, it has been found that from 1979-2011, 43% of households experienced an income gain or drop of more than 25% over a given two-year period (Currier, 2015). Given that labor earnings make up the largest portion of a household's income, this statistic indicates there are fluctuations in overall earnings as well. Within this large population of people experiencing these dramatic gains and losses in earnings, there are discrepancies in volatility between different genders, races, and income brackets. The scholars who have primarily moved this topic forward, Gottschalk and Moffitt, find that higher-educated individuals experience slightly higher volatility in their earnings. Additionally, prior research shows fluctuating earnings is more common in low income households when compared to middle and upper income households (Currier, 2015; Gottschalk & Moffitt, 2009).

Prior research on this topic has focused on the negative effects of fluctuating earnings and how it has

changed over time (Gottschalk & Moffitt, 2009). With this project, the intent is to take a detailed look at how the level of earnings volatility varies between groups. In order to do this, statistical comparison tests will be performed on earnings data. The initial hypothesis is that earnings volatility will be positively correlated to earnings level due to higher earners having more to gain or lose at a given time. The results from the analysis, however, will indicate otherwise. The overall findings of this paper will show varying levels of earnings volatility for different groups, findings I hope will be expanded on in the future.

II. Literature Review

Most works on earnings volatility are fairly recent, but the idea of income having a random or unexpected component was first introduced in 1957 in Milton Friedman's "Permanent Income Hypothesis." Although the primary goal of this work was to explain the determinants of consumer spending, within the theory Friedman defined two components of income: "permanent" and "transitory." The permanent component is income that is long-term and consistent from period to period. The transitory component, the component that is most relevant to this paper, is an accidental and temporary change to income.

For the next 3 decades, the responses and additions to Friedman's "Permanent Income Hypothesis" focused on the core of the theory: consumer spending (Laumas, 1969; Campbell, 1987).

It was not until 1994 when Gottschalk and Moffitt used Friedman's theory of two separate components of income to propose an explanation for the widening wage distribution in the 1970s and 1980s. An empirical analysis on prime-aged white males was performed, using the Panel Study of Income Dynamics (PSID) data. For each individual, they calculated the deviation of yearly earnings from the individual's average earnings. The variances of these deviation values were computed to find the transitory variance across the entire sample. Their findings showed the transitory component of people's incomes contributed to the widening of the wage distribution over the data frame (Gottschalk & Moffitt, 1994). Given that the thesis around Gottschalk and Moffitt's 1994 paper was in regards to the widening wage distribution, the focus was on the emergence of transitory income volatility over time. It was, however, the first to make a connection between transitory income and a topic outside of consumption.

Many additions and refinements followed from Gottschalk and Moffitt's 1994 paper, mostly in response to the impact transitory income had in their findings (Haider, 2001; Hardy, 2011; Ludwig, 2015). In 2009, Gottschalk and Moffitt refined their 1994 work, focusing on how the transitory component of income has changed over time. Also, using empirical results from their 1994 paper, they expanded their analysis to a comparison of transitory

income variances between groups. Within this dataset, however, their analysis was limited to comparisons between education levels and permanent income levels. The results showed that low-income and higher-educated individuals generally have higher transitory income variances. Given that this data is for only prime-age white males, there is room for further analysis between different genders and races. Additionally, the authors formally begin referring to the transitory component as a measure of “income instability” in this paper. In most modern papers, this terminology is used to describe fluctuating household incomes (Gottschalk & Moffitt, 2009). Although the paper does address comparisons between groups, its analysis is brief because the main thesis of the paper is in regards to the growth of income instability over time. With most of the focus being directed towards the growth of the phenomenon over time while the group analysis is at the fringe, there is a need for additional research that focuses on the discrepancies between groups.

While other works have used micro data to perform empirical analysis, this paper will utilize macro-level earnings data to capture large-scale trends at the median. Just as Gottschalk and Moffitt analyze transitory variance for different types of workers, this paper will analyze aggregated earnings data to find if earnings are more volatile for different groups. However, beyond Gottschalk and Moffitt, this

work will delve into Gender, Race, and Education Level groups. Additionally, a single measurement of volatility, variance, will be used across all groups. With most research failing to perform a focused, in-depth analysis of the comparisons between groups, there is room for further research.

III. Data and Methods

Median Usual Weekly Earnings data was extracted from the Federal Reserve Economic Database. This metric is reported quarterly by the Bureau of Labor Statistics (BLS) and contains data provided by the Current Population Survey. In the survey, full-time workers were asked what their usual weekly earnings were for the past four to five months. Although this does not provide insight into how earnings vary from week to week, it does provide an instrument for analyzing how earnings fluctuate on a quarter to quarter basis. Data from different genders, races, and education levels were extracted. The races studied were Whites, Blacks and Hispanics; and the education levels were Advanced Degree, Bachelor’s Degree, Some College, High School Diploma, and Less than High School. The timeframes studied varied between groups, as gender data was Q1 1979 to Q3 2017, while the study for the other groups were from Q1 2000 to Q3 2017. Additionally, the respondents for the education data were limited to those over the age of 25, while the respondents for gender and race data were ages 16 and older. This results in the education

data yielding much higher earnings values because the respondents are older and likely more advanced in their careers. The education data, unlike the other series, is not adjusted for inflation, which results in inflated earnings values for the education series. Over this timeframe, the data did not indicate a long-term trend for growing or diminishing earnings volatility over time.

The Median Usual Weekly Earnings data are shown Figures 1, 2, and 3. Before looking into the volatility of earnings, the mean earnings values were calculated for each series. The means provide a single summary value to indicate earnings level, and will allow a comparison of earnings level with earnings volatility. Before the mean earnings data can be properly compared, the t-test for equality of means was performed, using EViews, to test if the means are statistically different. Since this is a two-sample test, numerous pairwise tests must be done for the races and education levels in order to cover all comparisons. Due to the large amount of groups contained within the education data, the study was limited to the comparisons containing High School and College Graduates. The results of these tests will show if there is a statistically significant difference in the means of the groups' earnings.

To test for the level of volatility in earnings, variances will be used. Variances are a tool for measuring the amount of spread or variability in a

series, making it ideal for measuring the level of volatility in earnings. Variance values were calculated for each Gender, Race, and Education group. Before the variance values can be properly compared, the F-test for equality of variances was employed to test for statistical significance. Similar to the comparison of means, numerous pairwise F-tests were performed to cover all comparisons. The results of these tests will show if there is a statistically significant difference in the variance of groups' earnings.

The methods employed in this project are limited in that they can only be used as an instrument for comparing earnings volatility between groups. These methods will only allow us to conclude that earnings volatility is more prevalent in some groups than others, and will provide little insight to causality of the discrepancies. In order to refine the methods of this work and explain causality, an analysis must be performed on longitudinal panel studies. This will allow for the researcher to follow individuals' earnings through time, providing a more accurate measure of volatility. However, the methods used in this work are intended to reach a conclusion about which groups experience more earnings volatility than others.

IV. Findings

Firstly, for the results of the comparison between genders, the t-test for comparison of means shows that men earn higher than women on average. This difference, as shown in Table 2, is statistically

significant. The results for the F-test for comparison of variances show that women have an earnings variance over four times as large as men. This indicates that women's earnings are much more volatile than men on a quarter to quarter basis.

Next, for the findings for Whites, Blacks, and Hispanics, the mean earnings calculations show Whites had the highest earnings, followed by Blacks and Hispanics. The t-tests for equality of means indicate statistically significant differences for all comparisons. Then, for the comparison of variances, the initial results show that Hispanics have earnings variances that are nearly double those of Whites and Blacks. This indicates that Hispanics experience the highest level of earnings volatility in comparison to Whites and Blacks. Additionally, there is not a significant difference between the earnings variances for Whites and Blacks, indicating that Whites and Blacks have the same level of earnings volatility.

For an analysis of the differences between education levels, five levels of educational attainment were used: Advanced Degree, Bachelor's Degree, Some College, High School Diploma, and Less than High School. Additionally, unlike the other data, the data for educational attainment is not adjusted for inflation. Despite this, nominal data still provides meaningful results for comparisons between groups because it is reasonable to assume that the general cost of living impacts all groups uniformly, independent

of education level. The calculation of means indicate progressively higher earnings as educational attainment increases, with all t-tests for equality of means yielding statistically different means. This indicates that higher levels of educational attainment do, in fact, lead to higher earnings. With regards to the findings for variances, the results indicate higher variance values as educational attainment increases. The only test to yield equal variances was the comparison between High School Graduates and those with Some College. Overall, Advanced Degree recipients experience the highest earnings volatility.

Based on the results from the different Genders, Races, and Education Levels, there is minimal evidence to show that earnings level determines the level of earnings volatility. This is shown firstly by women having higher volatility than men, despite women having lower earnings. Additionally, Hispanics have the highest degree of earnings volatility even though they earn less than both Whites and Blacks. These two findings are contradicted by the results from educational attainment, which indicate higher earners have higher earnings volatility. Thus, the overall findings indicate there is not a correlation between earnings level and volatility.

V. Conclusions

This paper performed a comparison of earnings volatility between Gender, Race, and Education

Levels through analysis of Median Usual Weekly Earnings data from the Bureau of Labor Statistics. This metric was used to provide quarterly values to summarize a group's earnings over time. No initial transformations were done, but two calculations were performed on each group's time series data: mean and variance. With the descriptive statistics calculated, the t-test for equality of means and F-test for equality of variances were completed. After these calculations, all comparisons of means showed statistically significant differences. In addition, the only comparisons of variances to yield statistically equal variances were Whites vs. Blacks and High School Graduates vs. Some College. All other comparisons of variances show statistically significant differences in their earnings variances.

The initial research question set out to study if there were differences in the magnitude of earnings volatility between groups. With the findings shown, it is safe to conclude that the degree of earnings volatility varies between groups. More specifically, Women's earnings fluctuate more than Men's. Hispanic's earnings have higher volatility than both Whites and Blacks. Finally, Advanced Degree recipients experience the highest level of earnings volatility compared to the other education levels. The initial hypothesis stated that earnings volatility would be more prevalent at higher earnings levels based on the intuition that higher earners have more to gain or

lose. However, after performing the statistical tests, the initial hypothesis failed to be validated by the data and there is not any consistent correlation between earnings level and volatility. Therefore, earnings level can be eliminated as a potential explanatory variable of earnings volatility.

To connect these results with prior literature: Gottschalk and Moffitt's group comparison results showed those with post-high school education had slightly higher volatility in their income than those without. This result is consistent with this paper's finding that higher educated people have higher earnings volatility. Also, Gottschalk and Moffitt's findings indicated higher volatility for those who earn less (Gottschalk and Moffitt, 2009). This is different than this paper's conclusion that earnings level does not correlate with volatility.

This paper establishes that earnings volatility varies between groups. With this foundational knowledge set, future work can be done to quantify the earnings fluctuations that members of different groups are experiencing on an individual level. To gain such information, analysis on longitudinal panel data must be performed. Within this future study, it will be important to take scale into account; that is, taking into account one's income level when determining the impact of a certain fluctuation in earnings. This will provide results that show the real impact that short-term earnings fluctuations can have on an individual or

household's well-being.

The intention of pointing out these discrepancies in earnings volatility is not to suggest there is any discrimination occurring, or that it is a problem that needs fixing. Quite simply, this paper is intended to compare the degree of earnings volatility between groups, with further analysis as to what could be driving variance values. For the purposes of earnings volatility research, this dataset cannot yield much more insight; but the hope is more detailed data will be sought out and analyzed in the future so this topic may be expanded further.

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Appendix

Table 1: Earnings Summary Statistics

Group	Mean	Variance	Standard Deviation
Men	\$373	\$105	\$10
Women	\$280	\$456	\$21
White	\$348	\$45	\$7
Black	\$275	\$37	\$6
Hispanic	\$246	\$84	\$9
Advanced	\$1,267	\$18,235	\$135
Bachelor's	\$1,005	\$10,759	\$104
Some College	\$706	\$3,342	\$58
High School	\$612	\$3,298	\$57
Less than HS	\$439	\$1,930	\$44

Table 2: Test Results

	2-sample t-test for equality of means	2-sample F-test for equality of variances
	T value	F value
Men vs. Women	48.49***	4.34***
Bachelor's vs. Advanced	12.97***	1.69**
Bachelor's vs. Some College	21.25***	3.22***
Bachelor's vs. High	27.97***	3.26***
Bachelors vs. Less HS	42.31***	5.58***
High vs. Advanced	37.64***	5.53***
High vs. Some College	9.72***	1.01
High vs. Less HS	20.07***	1.71**
White vs. Black	67.45***	1.20
White vs. Hispanic	75.74***	1.89***
Black vs. Hispanic	22.63***	2.26***

Figure 1:
Gender

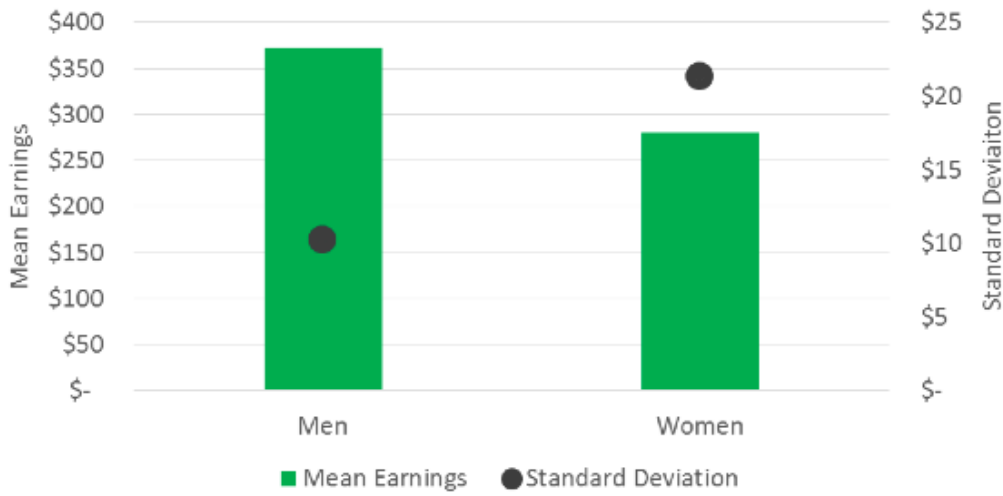


Figure 2:
Race



Figure 3:
Education Level

