Fake It 'Til You Make It?: Gendered Effects of Confidence in Early Education on Later Life Outcomes

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Abstract I explore how the impacts of over- and under-confidence on later life outcomes differ between genders. Specifically, I look at how over- and under- confidence in academic contexts in primary and secondary school affects education and employment outcomes among the children of PSID households. The initial hypothesis was that overconfidence in males would lead to more positive results than overconfidence in females, but that underconfidence would be more prized in females. My results actually show the opposite: for the most part, there is no statistically significant difference along gender lines, given that one is over or underconfident. However, even when there is a statistically significant difference, overconfidence actually benefits women more than men, whereas underconfidence disproportionally hurts women. Previous work has shown that overconfidence in math is correlated with overall better outcomes. Here, I extend these results to look at the effects of overconfidence in reading results, which I found to have mixed impacts. Namely, greater overconfidence in reading is correlated with better test scores and college graduation rates, but worse wages, but this might be related to relative salaries in STEM vs non-STEM fields.

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1 Introduction

Our lives do not happen by chance — instead, they are defined by a combination of the choices and perceptions that we make and by the financial and other resources provided by our parents and others around us. For example, we decide when to get out of bed, whether to have kids, and what route to take to work, and when making these decisions we might factor in our financial situation and our past life experiences. Perhaps more importantly, we make perceptions regarding ourselves — for example how smart we perceive ourselves to be — which lead to a variety of choices like how much effort we choose to put into tasks or what job we pursue. These inner self-conceptions do not just live in our minds and instead can affect the way we present, articulate, and express ourselves in the world, which affects how others interact with us. If they think we are smarter, other people might be more likely to provide help or resource as they think you will be more likely to succeed. An interesting question then is about the extent to which self-perception can impact later life outcomes. Specifically in this paper, we will focus on the metric of confidence during grade school years and how varying levels of confidence is correlated with later life outcomes. By looking specifically at grade school, we can identify how the effects of initial differences in self-perception might compound over time. Additionally, during the ages of 8 and 12, students begin to express their independence more, as well as become more conscious of the opinions and presence of others. This means that their comparative self-perception might be more top-of-mind, and since they have more say in their day-to-day effort and activities, there's more room for variance in how they act and achieve (Centers for Disease and Prevention).

Defined more concretely, confidence can be seen as a metric of how one's perception of their abilities relates to their innate abilities. Thus, over-confidence occurs when one's perception of their own abilities is significantly greater than their true innate abilities, whereas under-confidence occurs when one's perception of their own abilities is significantly less than their innate abilities.

In my research paper, by regressing on data from the Panel Study of Income Dynamics, I will specifically focus on how over- and under- confidence has different impacts along gender lines. In other words, how might an over-confidence effect aspects like education level or income in male differently than women?

1.1 Motivation

The paper that motivated me to write this paper was Ruebeck and Page's (2022) "Childhood confidence, schooling, and the Labor Market: Evidence from the PSID." This study does clearly identify that women are more likely to be under-confident and less likely to be overconfident compared with men in regards to their math score performance. Notably, they also show that overconfidence in math leads to higher future test scores by 2.7 percentiles, 6.2% higher graduation rates, higher rates of studying STEM subjects in college, and 5.9% higher wages for those one standard deviation higher confidence. Under-confidence in math leads to the opposite results: students score 5.9 percentiles lower in future test scores, are 5.8% less likely to graduation from college, and are less likely to work in a STEM occupation.

Within the professional world, extensive work has been done looking at the impacts of confidence on outcomes. For example, studies have been done looking into how men and women fare differently in wage negotiations, which are sensitive conversations where confidence in oneself and one's demands might affect an employer's responses. Smith (2022) in one such paper found that not only are the results of wage negotiation largely dependent on actions of the employee involved not the employer, but more importantly for my purposes, found that men were able to negotiate for 5.49% than women (2022). Gayle Kaufman has also done similar work showing that men who are more overconfident can get greater wage increases through negotiation than women.

There is still more room for insights and applications within education. In the 2021 paper "Choice of majors: are women really different from men?" by Kugler, Tinsley, and Ukhaneva, they found that women are more affected by negative feedback than men, seen by the greater tendency of women to switch majors following low grades in an introductory class in a major. Although not as directly translatable, this shows that with a decrease in perceived ability, women are less likely to keep pursuing that specific academic path.

More directly related to confidence, Owen (2020) found that male college students tend to overestimate their own STEM abilities while underestimating the abilities of others, whereas women are more likely to overestimate others' abilities. The most overconfident group is low-performing men as they over-predict their own performance by 34.4%. Providing students with information about their actual abilities helped reduce these gender gaps in ability beliefs and STEM course-taking. Since our results show that these tendencies persist even in younger children, I can use the idea that young children have more malleable perspectives to suggest that confidence interventions earlier on may translate to better life outcomes and success in fields later on.

1.2 Furthering the Research

What was lacking in previous literature is the question of looking at the impacts of early confidence levels in education settings across gender lines. In my paper I seek to close this gap and better understand the relationship between the effect of confidence on later life outcomes and gender. More specifically, the research question I seek to answer is how does over-confidence or under-confidence impact later life outcomes differently for a man versus a woman? Inspired by past findings related to wage negotiations as well as generally cultural norms regarding prized alpha males, my hypothesis is that overconfidence has a more positive impact on male outcomes than on female outcomes, and that under-confidence does not hurt women as much as it hurts men. This could translate into higher future test scores, higher wages or greater college degree completion rates, or other positive benefits like lower rates of depression, conditioned on someone being under or over confident. Additionally, past research finds that females tend to respond more negatively to bad feedback, meaning that if they perform worse than they expect, they might be deterred to pursue future goals of theirs.

My paper seeks to build upon the work of pre-existing scholars regarding impacts of early academic confidence, especially on the work done by Ruebeck and Page in 2022. However, the focus was specifically on how confidence as it relates to mathematical abilities impacts later life outcomes. Their justification for this was that mathematical scores were a stronger predictor of outcomes than reading scores. However, I incorporate confidence as relates to reading abilities as well, and I see how these measures might play into a student's ambition and effort later on. Beyond these measures, the key difference in my research is that I am specifically focusing my analysis on how the impacts of confidence differ across gender lines. Ruebeck and Page looked minimally at gender. They do clearly identify that women are more likely to be under-confident and less likely to be overconfident compared to men in regards to their math score performance, but they do not differentiate between outcomes across gender, given that an individual is over- or under- confident.

Over- and under- confidence might be prized for different reasons. Overconfidence can appear as simple confidence, making one appear more self-assured, and it can also make one more likely to go for higher positions, higher degrees, or higher-paying roles as they have more confidence in their ability to secure the position. On the other hand, overconfidence might lead to bad decision-making and risk-taking and so in some roles a more cautious outlook from an underconfident person might be appreciated, for example in stock trading. In this study, I aim to look at how these are valued across gender lines, if there is a difference.

2 Data

2.1 Data Source

I center our research around the datasets available from the Panel Study of Income Dynamics (PSID). Conducted by the University of Michigan, this is a longitudinal panel survey of American families, covering an extensive number of features. First collected in 1968, the PSID looks at 5,000 nationally representative households from two independent samples: a national sample of low-income families from the Survey of Economic Opportunity (the "SEO sample") and a national sample drawn by the Survey Research Center (the "SRC sample"). The PSID surveyed the descendant households of the original sample annually from 1968 to 1997 and then switched to biennial sampling. However in 1997, they adjusted the sample to again make it nationally representative.

Funded by the National Institutes of Health and the National Science Foundation, the main PSID study contains information on demographics, income, wealth, employment, health, education, and family dynamics, among other factors, collected on a biennial basis starting in 1968. But what makes the PSID a particularly compelling dataset for this use case is the presence of supplements that ask the children of the PSID families extensive questions and assessments while in school before also documenting their transition into adulthood, including their education and career progressions 20 years down the line.

More concretely, these are the Child Development Supplement (CDS) and the Transition to Adulthood Supplement(TAS). Both of these are add-on modules to the main Panel Study of Income Dynamics (PSID) that collects additional data those in the PSID sample families. The CDS collects data on the physical health, cognitive development, emotional well-being, and social behavioron development and well-being of children, whereas the TAS collects data on young adults on the experiences, challenges, and trajectories of young people as they move from their late teens into their 20s and 30s. The CDS is collected every five years from 1997, but the PSID is looking to collect it more frequently. It focuses on those who are 0-12 at the time of collection. The TAS is collected more frequently than the CDS: It has been conducted every 2 years, timed to align with the main PSID biennial interviews, since 2005 and focuses on PSID sample members who are between the ages of 18-28 at the time of each survey wave.

2.2 Reweighting

The racial breakdown of our dataset is as follows: 45.6 percent Black, 44.3 percent White, 5.3 percent Hispanic, 1.3 percent Asian, 0.4 percent American Indian, and 3.1 percent multiracial. We can compare this to the U.S. Census Bureau reports from 2000, where 69.1 percent of the US residents were White, 12.1 percent Black, and 12.5 percent Hispanic. This indicates that our sample is disproportionately Black, likely due to the SEO sample component. In order to make our results more representative of the national population, we will utilize population weights, specifically the provided cross-sectional PSID weights, named ER34651.

Our sample is fairly evenly split along gender, with 49.9 percent male and 50.1 percent female, of those who reported binary sex.

2.3 Variables of Interest

I am centering my study on students who are older than 8 in the 2002 Child Development Study. This is because some metrics of self-reported ability are only noted for individuals in this age range. Additionally, since this narrows our sample to students aged 8 through 17, as shown in Figure 1, they are pre-college and thus we can measure the effects of confidence during primary and secondary school years on later life outcomes. Additionally, since we have data from the 2013, 2015, and 2017 Transition to Adulthood study, we can look at their later life outcomes, such as further education and wages, when they are in their late-20s.

There are some variables of interest here. In the CDS, the PSID facilitators asked the students to rate their math abilities. Specifically, they asked them to self-report their abilities on a 1 to 7 scale, where 1 is not at all good, 7 is very good, and 4 would thus be OK. Not only did they ask the students to provide a self-report on an absolute scale, but also on a comparative scale. For the first metric, which I will call the `Absolute Math Self-Report` the students were asked the question "How good at math are you?". For the second metric, which I will call the `Comparative Math Self-Report` the students were asked the question "If you were to list all the students in your class from the worst to the best in math, where would you put yourself?" For this question, a 1 means worst, whereas a 7 means best. The PSID also administers a test to measure "innate" math ability. The CDS assesses children's math skills using the Woodcock-Johnson Psycho-Educational Battery-Revised (WJ-R), a commonly used academic achievement test for school psychologists in the 1990s. Specifically, the CDS administers the Applied Problems subtest of the WJ-R, which consists of 60 word problems of increasing difficulty to evaluate math reasoning and knowledge. For the assessment, each child completes only a subset of the full test. They start at a "basal" level, where they answer six consecutive questions correctly, and continue until they reach a "ceiling" level, where they get six consecutive questions wrong. The CDS then reports each child's percentile rank compared to a nationally representative sample of their age group on the WJ-R norming data. These percentile ranks are used as the measure of each child's demonstrated math ability. I will call these values `Math Percentile Rank`.

We have the same data, but for reading abilities and results. The corresponding variable names then are `Absolute Reading Self-Report` , `Comparative Reading Self-Report`, and `Reading Percentile Rank`.

We are also interested in looking at the gender of the students, as well as other demographic factors, as outlined in Table 1, which also contains additional information on the above scoring and self-reporting variables.

2.4 Outcome Variables

Through this study, we are looking to examine the effect on confidence on a variety of outcome variables. First, we will look at the relationship between over- and under- confidence on current test scores. Then, we will look at the relationship between confidence metrics and later test scores, both those reported from the CDS tests as well as the ever-prevalent SAT scores, along the lines of math and reading subscores as well as overall scores (which are the sum of math and reading). Afterwards, we will look at how under- and over-confidence are related to college graduation rates as well as choice of college major. We will conclude by looking at the relationship with future wages, post the age 25.

3 Methodology

I used Stata to perform my calculations and do my regression analysis. I gathered my data online from the PSID portal, which allows the public to select variables across its different studies to analyze.

3.1 Confidence Overview

One of the core challenges in this research study was determining a system for defining over- and under-confidence that could be used in regressions and other statistical analysis. Fundamentally, underconfidence means that a student perceives their own abilities as being worse than they actually are, and overconfidence is the opposite, or a student perceives their own abilities as being better than they actually are. This is where the PSID is such a helpful dataset, as it asks students to evaluate their own abilities through their

`Comparative Self-Report` and `Absolute Self-Report` variables, and it also has more objective and external measurements of ability through the test scores and corresponding percentile ranks.

3.2 Discrete Confidence Metrics

I first attempted to construct discrete confidence metrics, specifically I categorize individuals into categories of "Underconfident", "Overconfident", or "Confident." To do this, I define the following framework, using the tabulations from Table 4 and Table 5, following that used by Ruebeck and Page in their 2022 study. If someone scored above the 75th percentile nationally in math and ranked their own ability at 1 to 4, corresponding to the bottom 46 percent of the subjective-ability distribution in our sample, or if they scored above the 50th percentile nationally and ranked themselves at 1 to 3, corresponding to the bottom 13 percent of the subjective-ability distribution, I will call them "Underconfident". Similarly, I call someone "Overconfident" if they scored below the 25th percentile nationally and rated their own ability at 6 or 7, corresponding to the top 30 percent of the subjective-ability distribution in our sample, or if they scored below the 50th percentile while rating themselves at 7, corresponding to the top 9 percent of the subjective-ability distribution. I categorize individuals into the 3 categories for reading confidence using the same process.

This type of framework has some positives. Namely, it is easy to define and comprehend. Additionally, by not relying too much on the magnitude of overconfidence or underconfidence past a certain point, it allows us to not place too much stake on how one interprets the 1-7 scale. However, this is still a relatively simplistic categorization system. The other continuous metric that I'll define next was ultimately more representative and thus the one that I used in the regressions since it factored in the important aspect of magnitude of over and underconfidence in a more individualized fashion.

3.3 Continuous Confidence Metrics

For this, I used the variables to construct a continuous metric of confidence, with a magnitude that reflects the measured level of over- or under- confidence.

I was planning to use the `Comparative Reading Self-Report` as part of the constructed metric for confidence, since I thought that I could compare how well each student thought they were doing compared to their peers to how well they were actually doing through the percentile ranks. However, I realized that the answers to this question should vary significantly based on what friend group the student was in, so a person who has smarter friends might perceive themselves as comparatively lower even if they still they are themselves smart. Furthermore, the friend groups might be formed on the basis of attributes very separate from academic performance such as which bus they take to get to school or whether they are in the spring musical, and thus are not necessarily predictive of ability. Additionally, stated social comparisons may differ from true belief in one's ability. Research has shown that when asked to make a social comparison in an academic settings, females are consistently more likely to make upward social comparisons (meaning they perceive others to be better than them) whereas males do the opposite, even given the same baseline confidence level (Pulford et al. 2018). This could mean that even if a female is very confident in her own abilities, she might still rank herself lower than others due to other factors. In order to construct the continuous confidence metric then, I will use `Absolute Math Self-Report`, as this might be a better indicator of innate student perception.

As seen by the Figures in Appendix 8.3.1 as well as Tables 4 and 5, most students tend to rate themselves on the higher end of the 1-7 scale, with 54.08 % giving themselves ratings of of 5, 6, or 7 for the `Absolute Math Self-Report` and 61.42% giving themselves ratings of 5, 6, or 7 for the `Absolute Reading Self-Report`. I also see that for math self-reports, the densities decrease for 5, 6, and 7, whereas for the reading self-reports, they increase. This is likely driven by the changes in female self-reporting as the male self-reporting is relatively stable between math and reading, as depicted in later figures, whereas females report themselves as significantly higher for reading than for math.

Within confidence, I want to be able to compare these self-reports and the percentile ranks, so I want to transform the self-reports to be on a 0 to 100 scale as well. In order to do this, I tabulate each subject's percentile rank as shown in Tables 4 and 5. Then, I assign each value from 1 to 7, within each of the two subjects, an `Adjusted Actual Self-Report` value. To find this value, we find the average between the previous category's cumulative percentile rank and this category's, to find the "average" percentile rank value for a person within this category. Because of the extreme discretization of the Actual Self-Reports, this is a crude measurement, but it is fairly representative given the constraints and allows me to work on the same scale as the percentile ranks.

After constructing this, I can create my over- and under- confidence metrics. I will describe the process for the math variables, but the reading variable process is identical. I determine a `Math Confidence Gap` for each individual for each subject by subtracting the `Math Percentile Rank` from the `Adjusted Actual Math Self-Report`. Then, I create two variables to designate whether an individual is overconfident or not, `Math Overconfident` and `Math Underconfident`. If `Math Confidence Gap` is greater than 0, then I label this person as Overconfident and assign `Math Overconfident` to be the value of `Math Confidence Gap`. Otherwise, I set `Math Overconfident` to be 0. Similarly, if `Math Confidence Gap` is less than 0, then I label this person as Overconfident and assign `Math Underconfident` to be the absolute value of `Math Confidence Gap`; otherwise, I set `Math Underconfident` to be 0.

This means that these variables both serve as indicators for over- and under-confidence in math, but they also reflect the magnitude of this under or over confidence. If someone is vastly overestimating their abilities in a subject, they will probably be perceived very differently from someone whose gap is small and thus the discrepancy in their self-perception and actual ability as that would probably be negligible or easily impacted by day-off performance.

As mentioned earlier, I construct the same variables for the Reading Scores. In Table 6, one can see more statistics summarizing the results of this construction. Of interest in this table is that fact that the confidence gaps within categories are fairly similar across gender lines. However, like the graphs also showed, females tend to be significantly more overconfident and less underconfident in reading compared to men, and the opposite holds true for math. This is in line with results that Ruebeck and Page found in their 2022 study on over and under- confidence between genders in math, as they also found that men are more likely than women to be overconfident in math and women are more likely to be underconfident.

3.4 Regression Setup

In order to compute the effects of various variables, I implement an Ordinary Least Squares (OLS) Regression, with varying parameters. Specifically, I aim to study 4 different sets of base variables: reading underconfidence, reading overconfidence, math overconfidence, and math underconfidence. For each of these, we can define `Confidence Gap` to simply be the absolute value of the difference between the adjusted self-report for that subject and the percentile rank. We can also use the corresponding percentile rank and also define an interaction variable between the Confidence Gap and Gender.

Our final regression looks as follows:

$$V_1 = \beta_1 \cdot g + \beta_2 \cdot p + \beta_3 \cdot c + \beta_4 \cdot I + \epsilon$$

with Variables as defined in Table 7.

We can complicate the regression further using race, family income, school type, and whether or not the student ever attended a gifted program as follows, with description of the variables again found within the Appendix in Table 7.:

$$V_1 = \beta_1' \cdot g + \beta_2' \cdot p + \beta_3' \cdot c + \beta_4' \cdot I + \beta_5' \cdot r + \beta_6' \cdot f + \beta_7' \cdot s + \beta_8' \cdot t + \epsilon'$$

4 Results

In this study, I look at the impacts of over and under-confidence within the 2002 CDS on a variety of metrics, namely future performance in 2007 on the WJR tests from the CDS, future SAT scores, future college degree attainment, and future wages. Below I will provide the resulting regression tables, as well as analysis of statistically significant components of the regression within the notes section of the table.

In Ruebeck and Page's 2022 study, they found that overconfidence in math leads to higher future test scores, higher graduation rates, and higher wages. Here, I see that overconfidence in math is actually associated with lower future test scores, but higher wages and higher degree completion — likely because of a willingness to seek high paying STEM jobs or to believe that one can finish their major. I also see that for overconfidence in reading, this leads to greater performance in some future test scores and higher degree completion, but worse wages. Perhaps this is because it is harder to objectively measure how skilled one is at reading, as opposed to very black-or-white correct answers in computation, which means that negative feedback (where they perform worse than they thought they would do) does not prevent one from still trying in the future.

4.1 Regression Tables

4.1.1 Future Performance

Table 1: Regression Table for Math Percentile Rank in 2007

Variable	Math UC	Math OC	Math UC Complex	Math OC Complex
Percentile Rank	0.709***	0.755***	0.995**	1.084**
	(0.114)	(0.115)	(0.506)	(0.499)
Confidence Gap	-0.216	.248	-0.528	-0.072
	(0.206)	(.212)	(0.891)	(0.895)
Gender	1.226	1.654	51.572*	31.754
	(7.470)	(6.969)	(30.056)	(27.989)
Gap X Gender	0.103	0.199	0.132	2.48*
	(0.288)	(0.319)	(1.407)	(1.31)
Family Income	-	-	12.040	10.138
	-	-	(16.107)	(15.811)
Race	-	-	28.158***	28.167***
	-	-	(10.473)	(10.235)
Gifted	-	-	10.116	10.090
	-	-	(8.087)	(7.897)
School Type	-	-	9.005	11.208
	-	-	(26.147)	(25.689)
R-squared	0.062	0.066	0.114	0.147

Notes: Here is a regression table looking at different effects of over- and under- confidence in reading and math in 2002 on later math percentile rank in 2007. Here, each column is regressing on a different confidence metric, where UC means underconfidence and OC means overconfidence. The confidence gap means the corresponding under or over confidence absolute value measurement, as described in the Methodology section as the difference between adjusted self-report and percentile rank. The percentile rank, similarly, is the corresponding percentile rank. We note the relatively low R-squared values. Here, we see that the strongest relationships are with the current percentile rank in math, which makes sense as both are measures of innate math ability. We also see that the regression with respect to race is statistically significant, but this is a bit hard to interpret because of the categorical nature of the race variable. Notably, we also see that the interaction between confidence gap and gender is significant for math overconfidence, meaning that given that someone is overconfident and they are female, they will score higher. I use the following convention for notating the significance of coefficients: * if p-value is less than 0.1, ** if p-value is less than 0.05, and *** if p-value is less than 0.01. [Source: PSID]

Table 2: Regression Table for Reading Percentile Rank in 2007

Variable	Reading UC	Reading OC	Reading UC Complex	Reading OC Complex
Percentile Rank	0.879***	0.863***	0.889***	0.854***
	(0.025)	(0.026)	(0.061)	(0.061)
Confidence Gap	-0.073**	0.033	-0.107	0.000
	(0.036)	(0.043)	(0.085)	(0.075)
Gender	-1.442	0.403	-3.436	-2.948
	(1.449)	(1.526)	(2.947)	(3.466)
Gap X Gender	0.057	-0.069	0.010	0.065**
	(0.046)	(0.057)	(0.124)	(0.101)
Family Income	-	-	-2.140	-2.204
	-	-	(1.679)	(1.666)
Race	-	-	2.212**	1.945*
	-	-	(1.116)	(1.137)
Gifted	-	-	-0.779	-0.829
	-	-	(0.857)	(0.846)
School Type	-	-	4.652	4.497
	-	-	(2.768)	(2.801)
R-squared	0.700	0.698	0.788	0.794

Notes: Here is a regression table looking at different effects of over- and under- confidence in reading and math in 2002 on later reading percentile rank in 2007. Here, each column is regressing on a different confidence metric, where UC means underconfidence and OC means overconfidence. The confidence gap means the corresponding under or over confidence absolute value measurement, as described in the Methodology section as the difference between adjusted self-report and percentile rank. The percentile rank, similarly, is the corresponding percentile rank. We note the relatively low R-squared values. Here, we see that the strongest relationships are with the current percentile rank in reading, which makes sense as both are measures of innate reading ability. We also see that the regression with respect to race is statistically significant, but this is a bit hard to interpret because of the categorical nature of the race variable. Notably, we also see that the interaction between confidence gap and gender is significant for reading overconfidence, meaning that given that someone is overconfident and they are female, their scores are higher. I use the following convention for notating the significance of coefficients: * if p-value is less than 0.1, ** if p-value is less than 0.05, and *** if p-value is less than 0.01. [Source: PSID]

4.1.2 Mental health

Table 3: Regression Table for Prevalence of Depression

Variable	Reading UC	Reading OC	Math UC	Math OC
Percentile Rank	-0.0472	-0.0356	-0.006	-0.0055
	(0.017)	(0.020)	(0.019)	(0.019)
Confidence Gap	0.0815*	-0.0194	-0.014	0.0434
	(0.041)	(0.023)	(0.032)	(0.065)
Gender	-0.199	-0.619	-0.318	-1.046
	(0.932)	(1.136)	(1.189)	(1.174)
Gap X Gender	-0.042	0.003	-0.062	-0.002
	(0.045)	(0.051)	(0.045)	(0.069)
Family Income	0.782	0.580	0.303	0.437
	(0.322)	(0.362)	(0.346)	(0.371)
Race	0.670	0.361	0.649	0.356
	(0.377)	(0.412)	(0.439)	(0.437)
School Type	-0.246	-0.112	0.777	0.107
	(0.777)	(0.974)	(0.991)	(0.947)
Gifted	0.042	-0.003	0.342	0.174
	(0.259)	(0.290)	(0.275)	(0.280)
R-squared	0.523	0.351	0.396	0.320

Notes: Here is a regression table looking at different effects of over- and under- confidence in reading and math on Depresssion Prevalence, where individuals have scores of 1 for Depression if they have a reported history and 0 otherwise. Here, each column is regressing on a different confidence metric, where UC means underconfidence and OC means overconfidence. The confidence gap means the corresponding under or over confidence absolute value measurement, as described in the Methodology section as the difference between adjusted self-report and percentile rank. The percentile rank, similarly, is the corresponding percentile rank. However, the only variable that is statistically significant is the confidence gap, for reading underconfidence. This means sense because if a student are underconfident in their abilities in reading, this might be because they have depression or other mental illnesses that affect their self-perception. However, overall this means that none of these variables are in themselves highly correlated with depression, so perhaps confidence gap in this setting is not relevant towards mental health. I use the following convention for notating the significance of coefficients: * if p-value is less than 0.1, ** if p-value is less than 0.05, and *** if p-value is less than 0.01.[Source: PSID]

4.1.3 SAT Score

Table 4: Regression Table for Reading SAT Score

Variable	Reading UC	Reading OC	Reading UC Complex	Reading OC Complex
Percentile Rank	0.709***	0.755***	0.995*	1.084**
	(0.114)	(0.115)	(0.506)	(0.499)
Confidence Gap	-0.216**	0.249	-0.528	-0.072
	(0.206)	(0.212)	(0.891)	(0.895)
Gender	1.226	1.654	51.572	31.754
	(7.470)	(6.969)	(30.056)	(27.989)
Gap X Gender	0.103	0.199	0.132	2.484
	(0.288)	(0.319)	(1.407)	(1.313)
Family Income	-	-	12.040	10.138
	-	-	(16.107)	(15.811)
Race	-	-	28.158	28.167
	-	-	(10.473)	(10.235)
Gifted	-	-	10.116	10.090
	-	-	(8.087)	(7.897)
School Type	-	-	9.005	11.208
	-	-	(26.147)	(25.689)
R-squared	0.062	0.066	0.114	0.147

Notes: Here is a regression table looking at different effects of over- and under- confidence in reading and math on which Reading SAT Scores. Here, each column is regressing on a different confidence metric, where UC means underconfidence and OC means overconfidence. The confidence gap means the corresponding under or over confidence absolute value measurement, as described in the Methodology section as the difference between adjusted self-report and percentile rank. The percentile rank, similarly, is the corresponding percentile rank. We note the relatively low R-squared values. Additionally, the only variable with statistically significant coefficients is the percentile rank in the WJR readiing test, which makes intuitive sense as it shows the ability in math. I use the following convention for notating the significance of coefficients: * if p-value is less than 0.1, ** if p-value is less than 0.05, and *** if p-value is less than 0.01. [Source: PSID]

Table 5: Regression Table for Math SAT Score

Variable	Math UC	Math OC	Math UC Complex	Math OC Complex
Percentile Rank	2.720***	2.849***	4.284***	4.202***
	(0.358)	(0.375)	(0.798)	(0.818)
Confidence Gap	-0.600	1.183	0.803	-1.515
	(0.581)	(0.804)	(1.122)	(1.787)
Gender	-18.280	-20.015	67.306	-23.326
	(23.664)	(21.735)	(46.724)	(42.269)
Gap X Gender	-0.274	0.142	-3.363	4.247*
	(0.851)	(1.106)	(2.044)	(2.459)
Family Income	-	-	50.367**	44.111**
	-	-	(23.777)	(22.383)
Race	-	-	14.897	8.255
	-	-	(15.600)	(15.696)
Gifted	-	-	15.193	16.270
	-	-	(11.032)	(11.054)
School Type	-	-	-28.825	-47.618
	-	-	(33.040)	(31.756)
R-squared	0.298	0.304	0.558	0.563

Notes: Here is a regression table looking at different effects of over- and under- confidence in reading and math on which Math SAT Scores. Here, each column is regressing on a different confidence metric, where UC means underconfidence and OC means overconfidence. The confidence gap means the corresponding under or over confidence absolute value measurement, as described in the Methodology section as the difference between adjusted self-report and percentile rank. The percentile rank, similarly, is the corresponding percentile rank. We note the relatively high R-squared values. Additionally, the only variable with statistically significant coefficients is the percentile rank in the WJR math test, which makes intuitive sense as it shows the ability in math, as well as family income. I use the following convention for notating the significance of coefficients: * if p-value is less than 0.1, ** if p-value is less than 0.05, and *** if p-value is less than 0.01. [Source: PSID]

4.1.4 College Degree

Table 6: Regression Table for College Degree

Variable	Reading UC	Math UC	Reading OC	Math OC
`Gender`	-0.0812	-0.0057	0.00734	0.0134
	(0.0011)	(0.0659)	(0.0587)	(0.0697)
`Confidence Gap`	-0.0036***	0.000623	0.00401	0.00152
	(0.0013)	(0.00189)	(0.00367)	(0.00280)
`Percentile Rank`	0.00176	-0.000523	0.00134	0.000633
	(0.0011)	(0.00111)	(0.00108)	(0.00132)
`Gap X Gender`	0.00333	0.00224	-0.00331	-0.00142
	(0.00274)	(0.00294)	(0.00393)	(0.00360)
`Total SAT`	0.000263**	0.000306**	0.000256*	0.000289*
	(0.000138)	(0.000155)	(0.000146)	(0.000158)
`R-squared`	0.089	0.061	0.058	0.044

Notes: Here is a regression table looking at different effects of over- and under- confidence in reading and math on which individuals have obtained a college degree. The college degree variable is further specified in Table 1. Here, each column is regressing on a different confidence metric, where UC means underconfidence and OC means overconfidence. The confidence gap means the corresponding under or over confidence absolute value measurement, as described in the Methodology section as the difference between adjusted self-report and percentile rank. The percentile rank, similarly, is the corresponding percentile rank. The number of observations is 155. We note the relatively low R-squared values. Additionally, the only variable with statistically significant coefficients is the Total SAT score, which makes intuitive sense as it is a determinant of getting into college. The other variable that is statistically significant is reading underconfidence. The more underconfident a student is in reading, the less likely they are to have received a degree. This may relate to probability of applying in the first place if they perceive themselves as not being able to keep up with the reading and writing load. I use the following convention for notating the significance of coefficients: * if p-value is less than 0.1, ** if p-value is less than 0.05, and *** if p-value is less than 0.01. [Source: PSID]

4.1.5 Wages

Table 7: Regression Results for Wages and Reading

Variable	Reading UC	Reading OC	Math UC	Math OC
Gender	0.0774	0.168**	0.013	0.199
	(0.157)	(0.185)	(0.156)	(0.179)
Confidence Gap	0.2345**	-9.15 e-06	-0.00291	0.00221
	(0.00319)	(0.004)	(0.00307)	(0.00387)
Percentile Rank	0.00579**	0.00584**	0.0102***	0.00737***
	(0.00195)	(0.00267)	(0.00204)	(0.00234)
Gap X Gender	-0.0117***	-0.00320	0.00459	-0.00620
	(0.00461)	(0.209)	(0.310)	(0.00543)
R-squared	0.0771	0.0645	0.0825	0.0771

Note: I use the following convention for notating the significance of coefficients: * if p-value is less than 0.1, ** if p-value is less than 0.05, and *** if p-value is less than 0.01. Here, each column is regressing on a different confidence metric, where UC means underconfidence and OC means overconfidence. The confidence gap means the corresponding under or over confidence absolute value measurement, as described in the Methodology section as the difference between adjusted self-report and percentile rank. The percentile rank, similarly, is the corresponding percentile rank. The number of observations is 567. We note the relatively low R-squared values.

Of note in this table in particular is the fact that the interaction between the confidence gap and gender is statistically significant for reading underconfidence. This means that females who are more underconfident in reading, will actually do worse in terms of wages, which is directly opposed to my hypothesis. [Source: PSID]

Table 8: Regression Results: Dependent Variable Log Wages

Variable	Reading UC	Reading OC	Math UC	Math OC
Percentile Rank	0.00615**	0.00681**	0.00971***	0.00909**
	(0.00289)	(0.00293)	(0.00281)	(0.00284)
Confidence Gap	0.0113**	-0.0113**	0.00126	-0.00450
	(0.00512)	(0.00439)	(0.00463)	(0.00585)
Gender	0.191	-0.139	0.249	0.0568
	(0.152)	(0.159)	(0.164)	(0.151)
Gap X Gender	-0.0113*	0.0121**	-0.00716	0.0102
	(0.00633)	(0.00532)	(0.00721)	(0.00744)
Race	-0.0283	-0.0442	-0.0159	-0.0103
	(0.0619)	(0.0621)	(0.0603)	(0.0604)
Gifted	-0.0381	-0.0352	-0.0241	-0.0258
	(0.0397)	(0.0394)	(0.0404)	(0.0402)
Family Income	-0.0679	-0.0548	-0.00251	-0.00420
	(0.0784)	(0.0775)	(0.0791)	(0.0790)
School Type	0.0608	0.121	0.118	0.131
	(0.120)	(0.118)	(0.119)	(0.119)
Constant	10.1	10.3	9.60	9.70
	(0.459)	(0.473)	(0.505)	(0.508)
R-squared	0.154	0.165	0.140	0.145

Note: This table is similar to the one above but with more variables factored into the regression model. I use the following convention for notating the significance of coefficients: * if p-value is less than 0.1, ** if p-value is less than 0.05, and *** if p-value is less than 0.01. The number of observations is 160. With this complicated regression, we see similar results as the above simplified regression, where percentile rank is statistically significant for all the categories, and where confidence gap and the interaction term are significant for reading underconfidence. However, we also see that the confidence gap and interaction term are significant for reading overconfidence, and they have the opposite effect. Specifically, we see that overall overconfidence in reading is negatively associated with log wages overall, but is a positive if the person is female. [Source: PSID]

5 Conclusion and Analysis

Ultimately, through my analysis, my hypothesis that overconfidence is better for men and worse for women, whereas underconfidence has the opposite relationship was proven wrong. In most cases, the interaction between gender and confidence gaps does not have a statistically significant impact on the outcome variable at large, and in the few instances where it does (most prominently in the log wages regressions), I see that instead, women who are overconfident in reading have better outcomes, whereas women who are underconfident in reading have worse outcomes. Given the gender gap in who works within STEM fields, women are more likely to be in jobs that require lots of reading and writing. Thus, overconfidence might be helpful for them within these types of professions as they will be more likely to volunteer themselves for tasks or apply for harder jobs and thus get higher-paying jobs or become promoted.

Otherwise, my results are in line with that of Ruebeck and Page where I find that math overconfidence as a whole has positive impacts on future test scores, as well as graduation and wages, with the opposite results for underconfidence. Here, I also look into the impact of reading over- and under- confidence on the outcome variables, which has mixed results. I find that reading underconfidence negatively impacts future performance on the CDS-associated tests, but also is associated with higher prevalance of depression. Higher levels of reading underconfidence also is associated with lower SAT reading scores and lower levels of college degree attainment, whereas reading overconfidence has the opposite effects. However, I found that reading underconfidence leads to greater wages unconditionally on gender. Perhaps it makes sense that overconfidence in reading has more of an impact on long-term outcomes because it might be harder to internally measure oneself objectively in this criteria compared to math. Additionally, overconfidence in reading might crop up in subtler ways across all jobs like if one's emails are badly written or if they misuse words in speech, which can hurt during job interviews as well. This could also be because someone sees themselves as underconfident in reading, then they might switch to pursue STEM related interests and professions (as suggested by the previous study that looks at deviations in major after bad grades in introductory classes), which might have higher salaries.

Through this research experience, I learned a lot about handling large amounts of data and variables as well as constructing studies. Since the PSID is a longitudinal dataset and also has somewhat particular sampling techniques, I also gained insight into how to use population weights in order to make my results more representative. Originally, I had not done this, and had gotten different results (most notably, many of the test scores were worse). One challenge I faced was that although most of the relevant data for my purposes are part of the public variables presented by the PSID, there were some other variables that are more sensitive that only available in the restricted dataset. This includes information such as geospatial data that is more specific than the state level, criminal justice system exposure, school identifiers, and Medicaid claims, along other categories. However, in order to gain access to this restricted additional dataset, one must write a proposal and apply for approval as well as pay significant fees, which was outside the scope of this project given the limited funding and timeline for an undergraduate class. Additionally, since these variables are not core to the analysis, it was less essential. Still, it should be noted, as potentially knowing school identifiers could give more insight into the environments different students were raised in (which could then further explain results), or knowing aspects like criminal justice system exposure could potentially lead to different personalities, risk tolerances, or confidence levels. These might be good to include in future research.

Ultimately, confidence is an important research topic within education, as metrics of self-perception and self-portrayal can have large impacts on how students approach their classes and later-life goals, as well in how teachers interact with students. In future research, I would be curious to look into how attributes like how proud students are in themselves, or how resilient they perceive themselves to be affects later performance. Additionally, I would be interested to look into whether the No Child Left Behind Act, and resultant greater efforts towards standardized testing, changed confidence gaps in any noticeable way within students. It would also be interesting to look into the gender breakdown of specific professions as well as the under and over- confidence gaps of people who enter a variety of professions. For example, I wonder if doctors or stock traders are more likely to be over-confident or under-confident. One argument that could be made is that if someone is overconfident, then they are more likely to trust their own abilities to perform this high-risk task well; however, the opposite argument could also be made, where those who are overconfident will fail early on in careers that want risk-aversion, so even if they start in the career, they might not last long. I would like to to study this empirically, but unfortunately it likely necessitates using another dataset because the PSID has limited dataset on professions.

6 Bibliography

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7 Appendix

7.1 Variable Definitions

Table 9: Variable Descriptions

Variable Name	Description	Mean	Std
Gender	0 if reported to be male, 1 if female	0.500	0.0149
Absolute Math Self-Report	Values 1 through 7 where 1 is the lowest and 7 is the highest, answering the question "How good at math are you?"	4.77	1.45
Absolute Reading Self-Report	Values 1 through 7 where 1 is the lowest and 7 is the highest, answering the question "How good at reading are you?"	5.25	1.44
Comparative Math Self-Report	Values 1 through 7 where 1 is the lowest and 7 is the highest, answering the question "If you were to list all the students in your class from the worst to the best in math, where would you put yourself?"	4.74	1.29
Comparative Reading Self-Report	Values 1 through 7 where 1 is the lowest and 7 is the highest, answering the question "If you were to list all the students in your class from the worst to the best in reading, where would you put yourself?"	4.98	1.25
Math Percentile Rank	Percentile Rank (ranging from 0 to 100) of performance compared to others the students age on the WJ-R Applied Problems Subtest	52.1	29.5
Reading Percentile Rank	Percentile Rank (ranging from 0 to 100) of performance compared to others the students age on the WJ-R Broad Reading Subtest	51.7	29.3
Reading SAT	Score on the Reading Portion of the SAT if taken, ranges from 200 to 800	587	126
Math SAT	Score on the Math Portion of the SAT if taken, ranges from 200 to 800	578	136
Total SAT	Overall score on the SAT if taken, ranges from 400 to 1600	1173	227
College Degree	0 if no degree completed, 1 if at least one degree completed	0.134	.341
STEM Major	0 if degree is not in STEM, 1 if it is	0.328	0.18
Log Wages	Natural log of wages reported in Transition to Adulthood Supplement for those over 25	9.99	0.943
Race	Values 1 through 6 for different races		
Confidence Gap	0 if accurate, -100 if most underconfident and 100 if most overconfident for each subject		

Notes: This table serves as a basic description for the core variables used in my analysis. [Source: PSID]

7.2 Descriptive Statistics

Table 10: Self-Reported and Percentile Rank Scores, Divided by Gender

Quantity	Overall		Male		Female	
	Mean	STD	Mean	STD	Mean	STD
`Absolute Math Self-Report`	4.77	1.45	4.95	1.47	4.59	1.42
`Comparative Math Self-Report`	4.74	1.29	4.82	1.33	4.66	1.24
`Math Percentile Rank`	52.1	29.5	53.6	30.4	50.5	28.5
`Absolute Reading Self-Report`	5.25	1.44	5.09	1.49	5.42	1.41
`Comparative Reading Self-Report`	4.98	1.25	4.85	1.26	5.11	1.22
`Reading Percentile Rank`	51.7	29.3	49.1	29.8	54.5	28.6

Notes: See Table 1 for descriptions of the variables. I report the overall mean and standard deviation, as well as the mean and standard deviation for men and women separately. See Table 3 for more analysis on the differences between men and women across subjects [Source: PSID]

Table 11: Percent Differences between Men and Women

Quantity	Percent Difference (%)
`Absolute Math Self-Report`	-7.2
`Comparative Math Self-Report`	-3.3
`Math Percentile Rank`	-5.8
`Absolute Reading Self-Report`	6.1
`Comparative Reading Self-Report`	5.1
`Reading Percentile Rank`	11.0

Notes: See Table 1 for descriptions of the variables. Using the statistics found in Table 2, I calculate the percent differences in values between the means for Males and Females. Specifically, I calculate the difference between Female and Male Means and then divide by the Male Mean. Note how overall men perform and report themselves as better in math, whereas the same holds true for females for reading. However, the degrees to which this occurs varies for men and women. Specifically, females report on average self-reports that at 7.2% lower than men for the absolute math self-report, but they only perform 5.8% worse, whereas for reading they only report self-reports that are 6.1% better than men, but they actually perform on average 11% better according to percentile ranks. This is in line with the findings from Ruebeck and Page's study that men tend to outperform women in math, but overall women tend to report lower self-reported abilities for math. [Source: PSID]

Table 12: Tabulated Results for Absolute Math Self-Report

Answer	Percent	Cumulative Percentile	Adjusted Absolute Self-Report
1	1.79	1.79	0.90
2	2.28	4.08	2.94
3	8.80	12.88	8.48
4	33.04	45.92	29.40
5	24.57	70.49	58.21
6	20.22	90.71	80.60
7	9.29	100.00	95.36

Notes: Here I tabulate the absolute math self-reports to find the percent of students in each category. In order to calculate the adjusted absolute self-report, I average the current and previous group's cumulative percentiles, to find an average percentile for each bucket. A visualization of this tabulation, as well as additional figures by gender, can be found in Appendix 8.3.1. [Source: PSID]

Table 13: Tabulated Results for Absolute Reading Self-Report

Answer	Percent	Cumulative Percentile	Adjusted Absolute Self-Report
1	0.71	0.71	0.36
2	1.74	2.45	1.58
3	6.31	8.76	5.61
4	29.82	38.57	23.67
5	25.46	64.04	51.32
6	23.61	87.65	75.86
7	12.35	100.00	93.83

Notes: Here I tabulate the absolute reading self-reports to find the percent of students in each category. In order to calculate the adjusted absolute reading self-report, I average the current and previous group's cumulative percentiles, to find an average percentile for each bucket. A visualization of this tabulation, as well as additional figures by gender, can be found in Appendix 8.3.1. [Source: PSID]

Table 14: Over and Underconfidence, based on Gender

Quantity	Overall		Male		Female	
	Mean	STD	Mean	STD	Mean	STD
`% Underconfident Math`	38.0%	–	36.8%	–	39.1%	–
`% Overconfident Math`	45.4%	–	47.5%	–	43.6%	–
`% Underconfident Reading`	32.4%	–	33.0%	–	31.8%	–
`% Overconfident Reading`	53.3%	–	52.4%	–	54.2%	–
`Math Confidence Gap if Underconfident`	9.26	17.1	8.92	17.0	9.60	17.2
`Reading Confidence Gap if Underconfident`	8.64	17.25	8.95	17.5	8.33	17.0
`Math Confidence Gap if Overconfident`	11.81	19.7	13.4	21.6	10.2	17.4
`Reading Confidence Gap if Overconfident`	17.1	23.7	16.6	23.5	17.6	24.0

Notes: In this table, I deep dive into the statistics behind the over and under-confidence gaps, and furthermore look at differences along gender lines. These confidence gaps are determined as the difference in the absolute adjusted self-report and the actual percentile rank for each subject. I then look at those who have gaps above more than 2 percentile differences to determine over and under confidence, and the gaps once we have differentiated along these categories are the absolute values of the differences. Of interest in this table is that fact that the confidence gaps within categories are fairly similar across gender lines. However, like the graphs also showed, females tend to be significantly more overconfident and less underconfident in reading compared to men, and the opposite holds true for math. [Source: PSID]

Table 15: Variables for Regression

v	Outcome Variable
g	Gender
p	Percentile Rank
c	Confidence gap
I	Interaction between Confidence Gap and Gender
r	Race
f	Family Income
t	Whether Attended Gifted Program
s	Type of School

Notes: This is a table of the variables used in the regression [Source: PSID]

7.3 Score Visualizations

7.3.1 Absolute Self-Reports

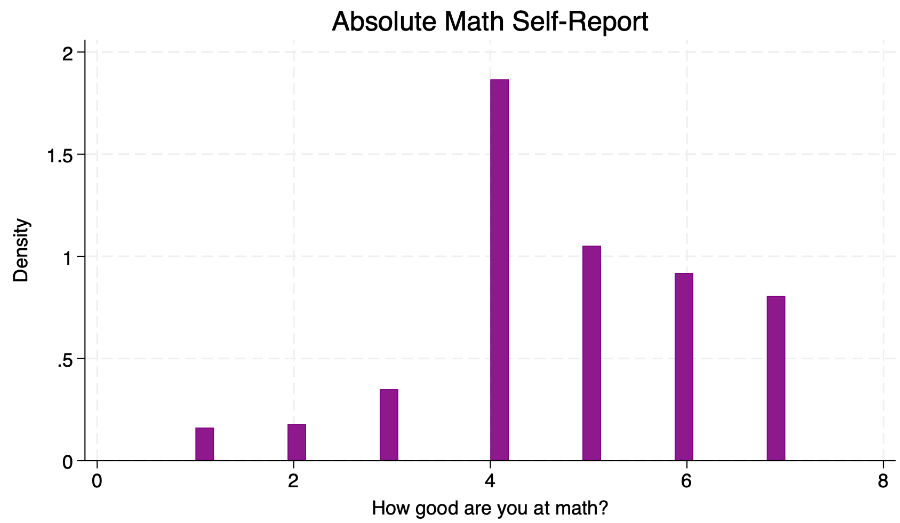

Figure 1: This is a histogram of the Absolute Math Self-Report (as described in Table 1) across all students in the sample. [Source: PSID]

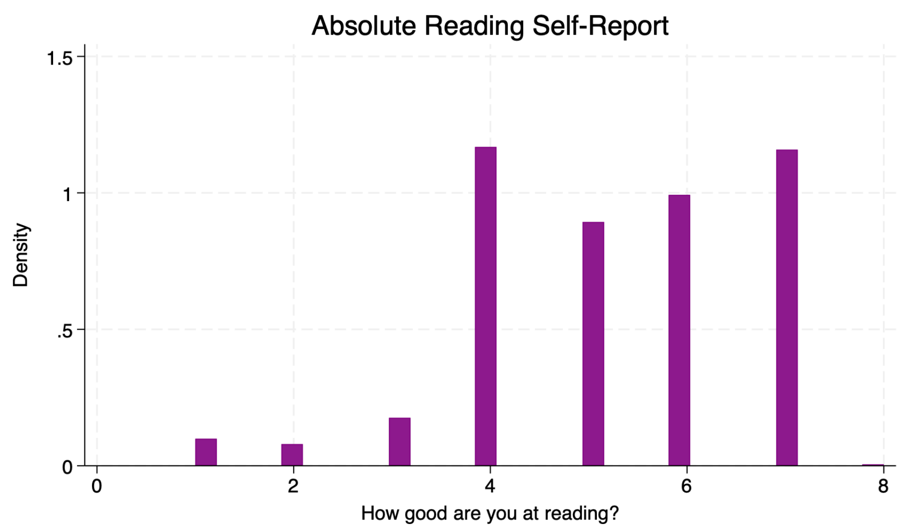

Figure 2: This is a histogram of the Absolute Reading Self-Report (as described in Table 1) across all students in the sample. Note how in the previous figure, for math self-reports, the densities decrease for 5, 6, and 7, whereas for this one, they increase. This is likely driven by the changes in female self-reporting as the male self-reporting is relatively stable between math and reading, as depicted in later figures [Source: PSID]

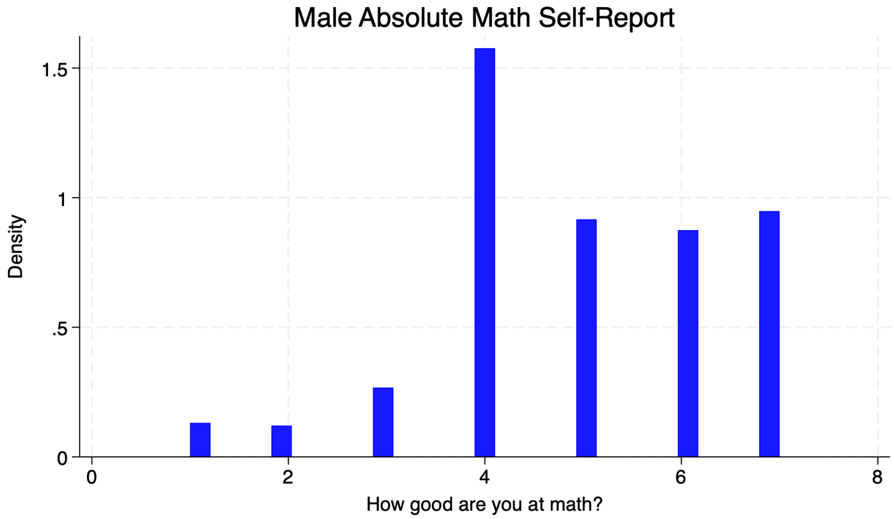

Figure 3: This is a histogram of the Absolute Math Self-Report (as described in Table 1), specifically looking at male students. [Source: PSID]

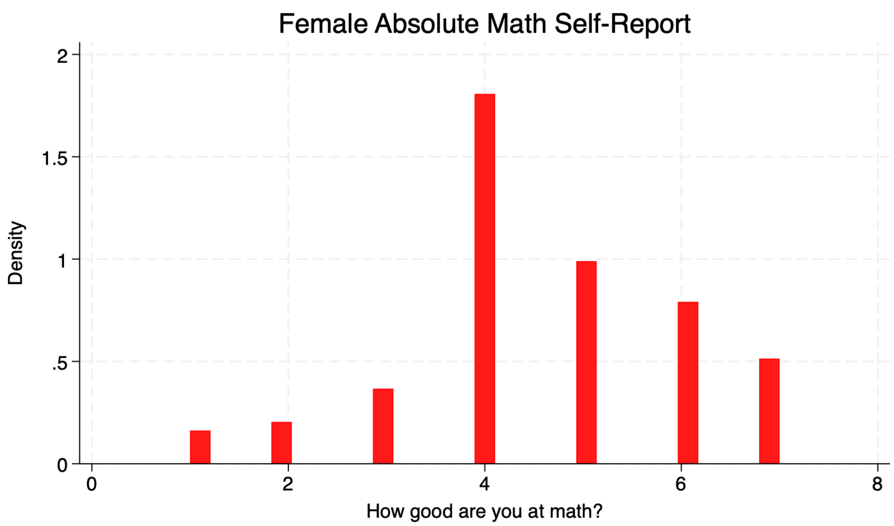

Figure 4: This is a histogram of the Absolute Math Self-Report (as described in Table 1), specifically looking at female students. Note the descending densities for ratings of 5, 6, and 7, compared to the male histogram where the densities for these ratings are relatively constant. [Source: PSID]

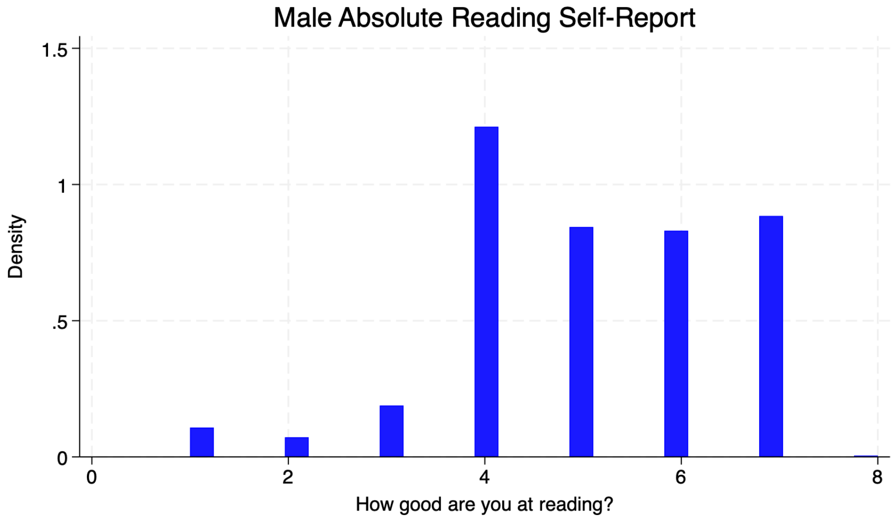

Figure 5: This is a histogram of the Absolute Reading Self-Report (as described in Table 1), specifically looking at male students. [Source: PSID]

Figure 6: This is a histogram of the Absolute Reading Self-Report (as described in Table 1), specifically looking at female students. Note the high proportion of female students who rate themselves as a 7, especially compared to female self-reports for math as well as male self-reports for reading. [Source: PSID]

7.3.2 Confidence Gaps

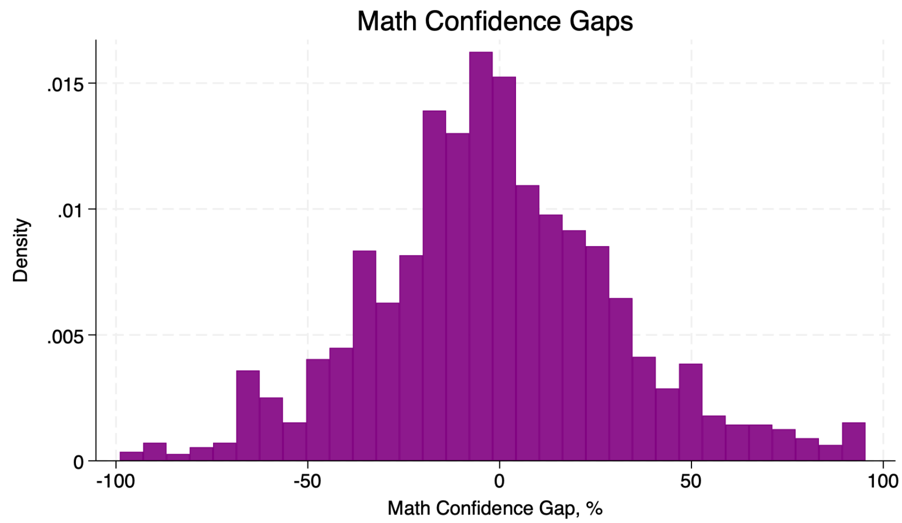

Figure 7: This is a histogram of math confidence gaps, where the confidence gap is defined as the difference between an individual's Math Percentile Rank and their Adjusted Absolute Math Self-Report (as described in Table 4). [Source: PSID]

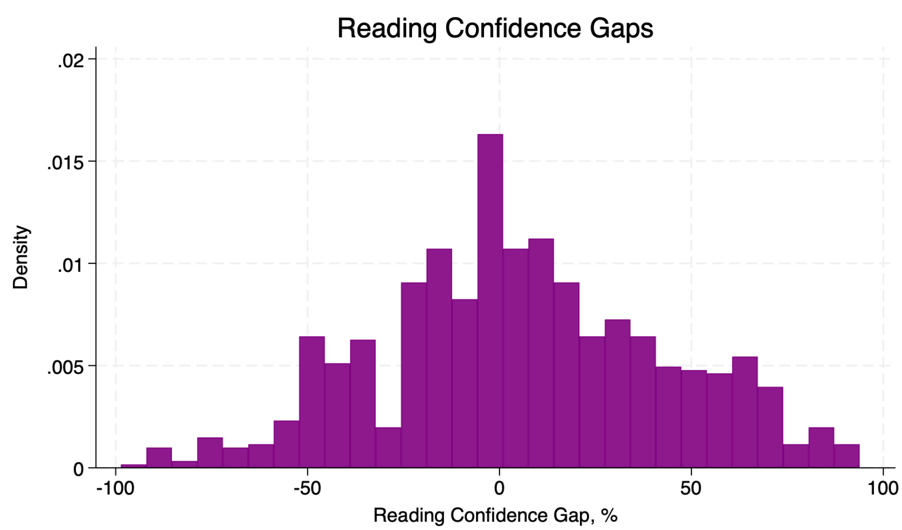

Figure 8: This is a histogram of reading confidence gaps, where the confidence gap is defined as the difference between an individual's Reading Percentile Rank and their Adjusted Absolute Reading Self-Report (as described in Table 5). [Source: PSID]

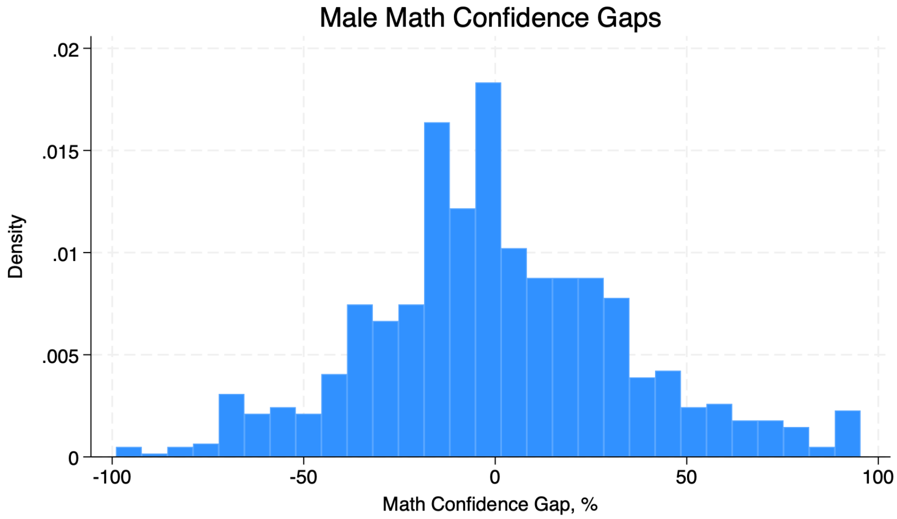

Figure 9: This is a histogram of math confidence gaps, where the confidence gap is defined as the difference between an individual's Math Percentile Rank and their Adjusted Absolute Math Self-Report (as described in Table 4), but specifically for male students. [Source: PSID]

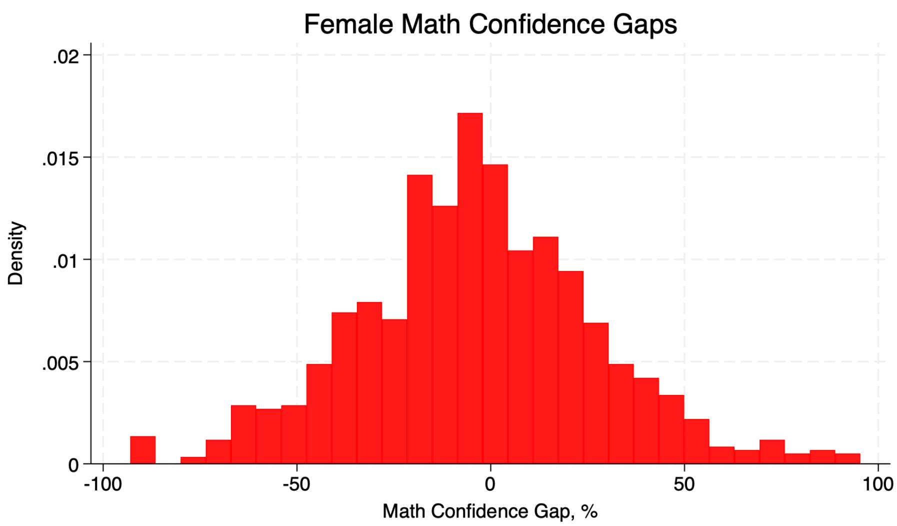

Figure 10: This is a histogram of math confidence gaps, where the confidence gap is defined as the difference between an individual's Math Percentile Rank and their Adjusted Absolute Math Self-Report (as described in Table 4), but specifically for female students. Note how it is largely similar to the male confidence gap chart, except perhaps with slightly fewer instances of overconfidence. [Source: PSID]

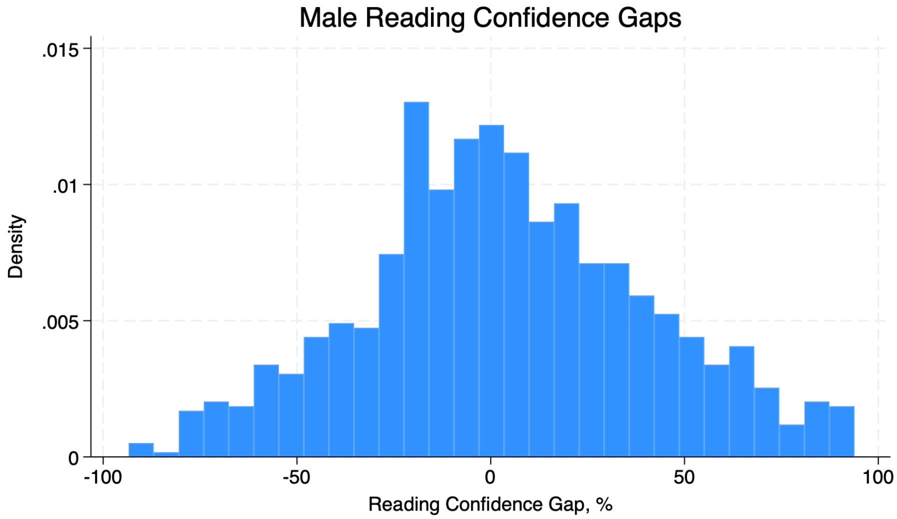

Figure 11: This is a histogram of reading confidence gaps, where the confidence gap is defined as the difference between an individual's Reading Percentile Rank and their Adjusted Absolute Reading Self-Report (as described in Table 5), but specifically for male students. [Source: PSID]

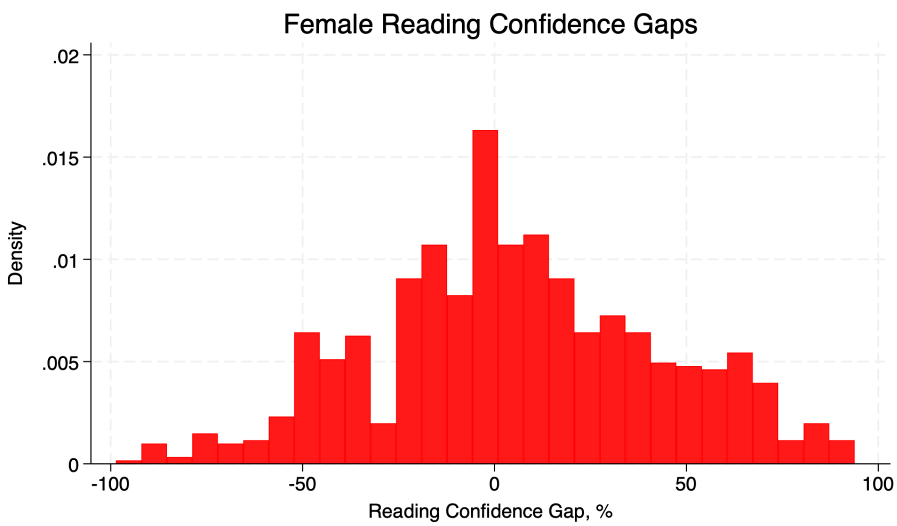

Figure 12: This is a histogram of reading confidence gaps, where the confidence gap is defined as the difference between an individual's Reading Percentile Rank and their Adjusted Absolute Reading Self-Report (as described in Table 5), but specifically for female students. They are largely similar for male and female students. [Source: PSID]