BMI and Wage Disparities

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Abstract

Body Mass Index (BMI) has been increasingly recognized as a factor influencing wage disparities, but its impact remains complex and diverse. Using data from the Panel Study of Income Dynamics (PSID) collected by the University of Michigan, this study investigates the relationship between BMI and income across a sample of over 5,000 individuals in the years of 2020 and 2021, controlling for variables including age, gender, employment status, and educational attainment. Previous research indicates various findings, with certain research finding that higher BMI correlates with a wage penalty, especially for specific demographic groups. I examined both linear and non-linear relationships between BMI and wages so as to better understand these dynamics. The results demonstrated that individuals with BMIs below 30 typically earn more money than individuals with higher BMIs. A threshold effect is further implied by the non-linear analysis: wages plateau and eventually fall at higher BMI levels, reflecting a diminishing return, even though moderate increases in BMI are correlated with income growth. The findings highlight the socioeconomic implications of BMI and expand a more elaborate understanding of the connection between economic outcomes and physical health indicators, highlighting the significance that BMI plays in wage inequality.

I. Introduction

While many studies examine the connection between economic outcomes and appearance, fewer particularly look into the significance that body mass index (BMI) plays in earnings. My study's goal was to examine how BMI affects wages while taking other crucial factors like education and work status into consideration. This subject appeals to me personally as I have often wondered if social views about body weight influence a person's earning potential. Like many others, I experienced weight-related concerns, which has piqued my curiosity in analyzing its measurable impact on financial outcomes.

Using data from the Panel Study of Income Dynamics (PSID) for 2020–2021, I conducted a cross-sectional analysis to examine the relationship between BMI and wages. The dependent variable was observed as earnings within the years, with key independent variables included as education, age, race, sex, and employment status. Ordinary Least Squares (OLS) regression was used, with a log transformation of wages to capture changes in percentage terms. The findings suggest that higher BMI negatively impacts wages in physically demanding jobs, while the effect is less pronounced or even neutral in less physically intensive roles.

My research's findings demonstrate the complexity of this relationship, with prior research delivering a variety of perspectives. The idea that BMI has a major impact on wages has been challenged by some authors, including Inafuku R. (2023), Mukhopadhyay, S. (2021), and Slade, P. (2017), who argue that the impact may be overstated or context-dependent. On the contrary, research by Böckerman et al. (2019), Carson (2021), and Hu et al. (2020) encourages my hypothesis by highlighting how BMI determines wage differences, particularly in areas where perceived productivity is influenced by physical appearance. With evidence that BMI has various impacts on wages across job environments, with negative effects in physically demanding roles and weaker or neutral effects in less physically demanding occupations, my analysis lends support to a nuanced viewpoint.

II. <u>Literature Review</u>

I reviewed six journal articles examining the relationship between body weight, BMI, and their impact on earnings, employment, and labor market dynamics. These articles offer a variety of viewpoints that assist in providing insight on the broader connections between physical appearance and economic results, even if many of the studies have similarities to my own. They involve concerns such as the effects of workplace and societal biases, the penalty of earnings for those with higher BMIs, and how economic situations worsen weight-based disparities. When regarded as a whole, these studies offer essential context for understanding the results of my study of the relationship between BMI and wage disparities.

In Inafuku's (2023) research, "Only the Fit Survive Recessions: Estimating Labor Market Penalties for the Obese over the Business Cycle," economic downturns make the difference in employment and income between workers who are obese compared to those who are healthy-weight larger. The study, which uses data from the NLSY and BRFSS, reveals that the wage penalty for obese people increases significantly during recessions and that income losses for these persons follow a countercyclical trend. Specifically, obese females experience the greatest income losses, while the employment gap expands for obese males. Regardless of the type of occupation, the results show that obese workers have higher income and employment reductions than their healthy-weight peers. This suggests that employer discrimination, rather than career choices, is the root cause of these disparities. Furthermore, the countercyclical patterns remain valid for both datasets and genders, suggesting that economic circumstances intensify the existing disadvantages that obese people experience in the labor market. In order to decrease the gap in the labor market between obese and non-obese workers, Inafuku's research emphasizes the critical need to address workplace discrimination and health implications as obesity rates in the United States keep rising.

Building on Inafuku's findings, Mukhopadhyay (2021) in "Do Employers Discriminate against Obese Employees? Evidence from Individuals Who Are Simultaneously Self-Employed and Working for an Employer" measures the wage penalties obese employees face in traditional employment compared to self-employment. Using data from the NLSY, the study reveals that white obese women earn 11.4% less than their healthy-weight peers, while white overweight women face a penalty of 9.1%. These disparities persist after controlling for productivity, as approximated by wages earned in self-employment, suggesting employer discrimination rather than productivity differences. The complex structure of weight-based disparities in earnings is demonstrated by the analysis's inconsistent results across different race-gender groups. Individuals who work for themselves seem to be resilient to these presumptions, which further connects persistent bias in traditional places of employment. According to Mukhopadhyay's research, many employees are at risk of weight-based discrimination because the Americans with Disabilities Act Amendments Act's (ADAAA) present safeguards primarily apply to those who are obese. As wages penalties for overweight and obese people reflect entrenched social and employer biases rather than productivity-based disparities, the study argues for extending these safeguards to encompass both populations.

Further elaborating on the subject, Slade (2017) uses an unconditional quantile estimator to examine the relationship between BMI and wages in "Body Mass and Wages: New Evidence from Quantile Estimation." Slade's study differs from previous studies by emphasizing notable variations in the impact of BMI throughout the wage distribution. The findings suggest that there is a "glass ceiling" effect for white and Hispanic people, meaning that having a higher BMI is associated with lower earnings, especially in higher-paying positions. It is interesting to note that the data for Black males contradict this trend, showing a distinct positive relationship between body size and outcomes in the job market for this group. Slade also examines the association between socioeconomic status and BMI, suggesting that those with higher potential incomes are more likely to be penalized for being overweight, which encourages them to maintain lower BMIs. In addition, the research highlights the wider consequences of cultural standards concerning body size and health, implying that the stigma related to obesity increases by financial incentives that encourage weight loss among individuals with higher incomes.

In "The Effect of Weight on Labor Market Outcomes: An Application of Genetic Instrumental Variables," Böckerman et al. (2019) investigate how BMI influences various labor market metrics, including wages, employment duration, and social income transfers. Utilizing administrative data from Finland, the study employs both Instrumental Variables (IV) and Ordinary Least Squares (OLS) techniques, using genetic risk scores for BMI based on Single Nucleotide Polymorphisms (SNPs) as instruments. The findings reveal that a one-unit increase in BMI correlates with a 6.9% decrease in earnings, a 2.1% reduction in years worked, and a 3.7% increase in the likelihood of receiving social income transfers, with the exception that an additional risky allele is associated with a 10.6% increase in the probability of receiving any social income transfers. These findings highlight the financial costs associated with obesity and the significance of using an appropriate instrument for genetic research. Although the study's accurate genetic and administrative data are its strongest points, its limited sample size, and concerns about the accuracy of some genetic scores serve as an example of the difficulties that come with performing this kind of research.

Carson (2021) takes a historical perspective in "Family Size, Household Wealth and Socio-economic Status Across the Body Mass Index Distribution During US Economic Development," exploring how BMI affects family size, wealth, and agricultural status within households. Utilizing census records and state-level data from the Integrated Public Use Microdata Series (IPUMS), the study employs quantile regression to assess how family size and socioeconomic factors correlate with BMI. Results indicate that larger households positively influenced nutritional outcomes and, consequently, BMI during the 19th century. Notably, agricultural workers exhibited higher BMIs compared to workers in other sectors, suggesting better health outcomes in rural areas. Although the study provides valuable insights into historical health trends, its reliance on cross-sectional data and limited variables may hinder its capacity to draw comprehensive conclusions regarding overall health dynamics.

Finally, Hu et al. (2020) examine the connection between relative body weight and earnings in "The Labor Market Impact of Relative Body Weight in Taiwan--A Semiparametric Analysis." Utilizing data from the Panel Study of Family Dynamics in Taiwan, the authors employ a semiparametric partially linear model to analyze how gender and age influence the relationship between Relative BMI (RBMI) and earnings. The study uncovers an inverted U-shaped RBMI-wage profile for females in the same age group, while revealing a linear and positive relationship for middle-aged and older males. The results also show that gender differences in RBMI-wage profiles become less pronounced with age. Although the study has several advantages, such as flexible modeling techniques and longitudinal data, its focus on a Taiwanese population may restrict the generalization of its findings. Hu's research, however, advances our knowledge of the ways in which relative body weight affects earnings in various demographic categories.

While the relationship differs depending on the job sector, my hypothesis proposes that increased body weight, or BMI, should be correlated with higher wages or earnings. In particular, occupations involving a lot of labor are likely to have a negative relationship between BMI and income since being overweight might be seen as a productivity disadvantage. On the other hand, there could be a positive or neutral association between jobs that require little physical work and those that prioritize other talents, such interpersonal or cognitive ability. This implies that body weight has a very context-dependent economic impact, with overweight people experiencing disadvantages in physically demanding occupations while obtaining neutral or even beneficial outcomes in less physically demanding situations.

The studies' findings provide a broader perspective on my hypothesis. According to Inafuku's (2023) research, there is a negative correlation between economic conditions and obesity. Specifically, high body mass index (BMI) has been linked to a decreased potential for income, especially during recessions. This suggests a potential disagreement with my assumption of an overall positive relationship between BMI and income. It also agrees with my theory in terms of the negative correlation between BMI and income in physically demanding occupations. Mukhopadhyay (2021) argues in favor of the idea that obese employees in traditional work settings experience discrimination, particularly women, which could result in lower wages despite their potential for revenue. Slade (2017) highlights the glass ceiling effect that affects white and Hispanic people, implying that having a higher BMI may result in fewer opportunities for advancement in jobs with higher salaries.

On the other hand, data from Böckerman et al. (2019) provide evidence that, in some circumstances, it is associated with better economic outcomes, which confirms my theory. Carson's (2021) historical analysis similarly suggests that larger families, often with higher BMIs, experienced better economic stability, indicating a potential connection between BMI and higher income. Finally, Hu et al. (2020) offer support of a U-shaped connection between relative body weight and earnings, especially for women, strengthening the hypothesis that, in some demographic groups, greater BMI may link to higher income.

III. Theoretical and Empirical Models

To evaluate my hypothesis that higher BMI or bodyweight correlates with higher income, I used the Human Capital Model as the analytical structure. According to this model, individual characteristics that affect earnings include education, experience, and health (specifically, BMI). Both the Ordinary Least Squares Model, also known as the OLS Model, and Log Regression was used in the empirical model, with earnings serving as the dependent variable and BMI/bodyweight, along with additional demographic variables, functioning as the independent variables. It is likely that labor supply and labor demand factors are what cause the behavior seen in this model. Depending on the nature of the job, physical attributes such as body weight can influence the demand and supply of labor in labor markets. According to the hypothesis, individuals who have higher BMIs may receive different rewards in the workplace based on how their physical features affect social preferences and perceived productivity.

To further test the hypothesis empirically, I first used the OLS Model. The relationship between earnings (the dependent variable) and independent variables such as BMI, age, sex, race, education, and employment status is represented by:

$$Earnings = \alpha + \beta_1 \mathrm{BMI} + \beta_2 \mathrm{Age} + \beta_3 \mathrm{Sex} + \beta_4 \mathrm{Race} + \beta_5 \mathrm{Education} + \beta_6 \mathrm{EmploymentStatus}$$

The Log Regression Model was used to interpret the coefficients in terms of percentage changes in earnings for a one-unit change in the independent variables:

$$\ln(Earnings) = \alpha + \beta_1 \mathrm{BMI} + \beta_2 \mathrm{Age} + \beta_3 \mathrm{Sex} + \beta_4 \mathrm{Race} + \beta_5 \mathrm{Education} + \beta_6 \mathrm{EmploymentStatus}$$

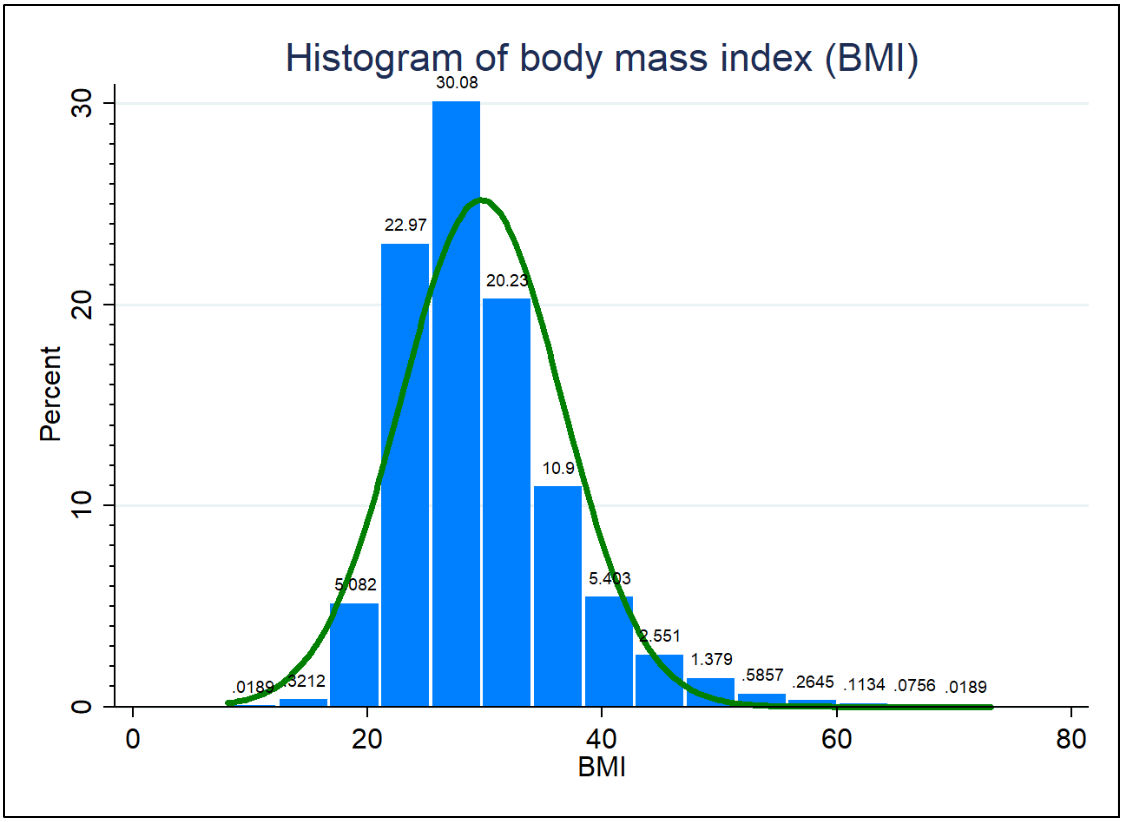
The hypothesis can be tested using these models by analyzing the significance and sign of the coefficients related to bodyweight and BMI. Positive coefficients would support the idea that greater BMI/bodyweight correlates with higher earnings or better employment opportunities, depending on the model.

IV. Data Summarization

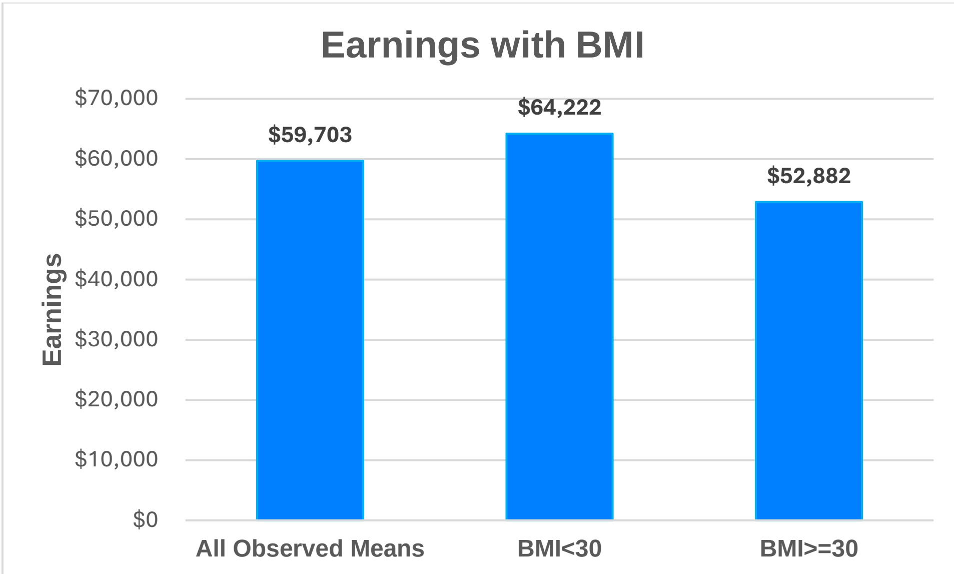
The data that was utilized for this study is derived from the Panel Study of Income Dynamics (PSID), most notably from the 2020–2021 Family-Level and Individual-Level datasets. The dataset includes approximately 5,200 observations and offers a solid foundation for examining the relationship between bodyweight (as measured by BMI) and earnings. It is collected through annual or biennial surveys from a representative sample of U.S. individuals and families, capturing self-reported information. The independent variables are age, sex, employment status, BMI, race, and education, with salary/earnings functioning as the dependent variable. While considering significant demographic and employment factors, these variables allow for an extensive analysis of the connection between BMI and earnings.

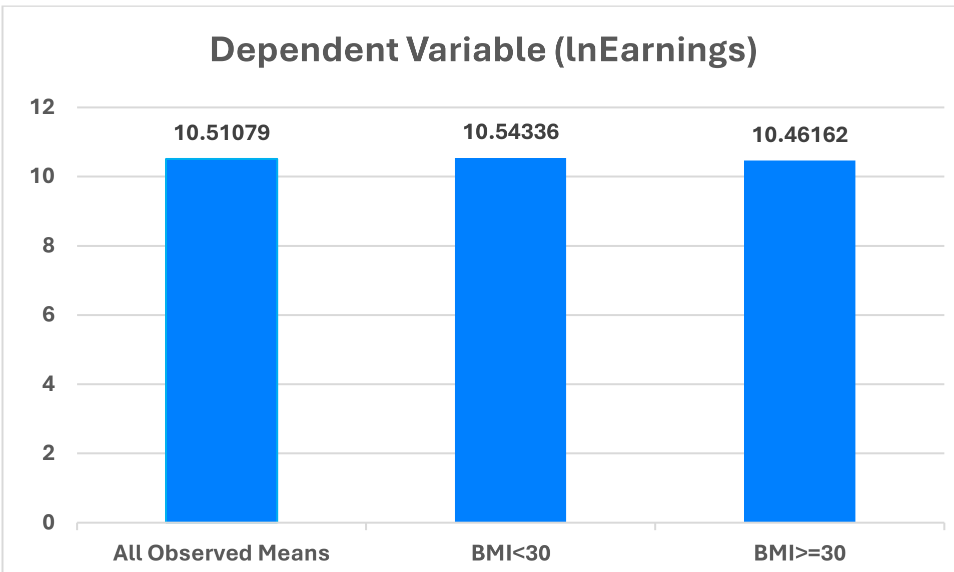
Summary Statistics	All Observed Means (Std. Dev.)	BMI Less than 30	BMI Greater Than/Equal to 30
Dep Var (Earnings)	59,703 (87,113.58)	64,222 (105850)	52,882 (45340.78)
Indep Var (Age)	42.36 (13.23)	41.98 (13.82)	42.92 (12.28)
Male	0.696 (0.459)	0.740 (0.438)	0.629 (0.483)
Employed	0.865 (0.341)	0.863 (0.343)	0.867 (0.338)
BMI	29.69 (6.86)	25.35 (2.934)	36.25 (5.826)
White	0.589 (0.491)	0.636 (0.480)	0.518 (0.499)
Black	0.388 (0.487)	0.335 (0.472)	0.467 (0.499)
Amer. Ind.	0.006 (0.081)	0.005 (0.074)	0.008 (0.089)
Asian	0.013 (0.115)	0.019 (0.137)	0.005 (0.072)
Pacisl.	0.001 (0.041)	0.002 (0.050)	0.000 (0.021)
GED	0.073 (0.260)	0.070 (0.255)	0.077 (0.267)
HS	0.872 (0.333)	0.875 (0.330)	0.869 (0.336)
Associate's Deg	0.084 (0.278)	0.075 (0.264)	0.098 (0.297)
Bachelor's Deg	0.226 (0.418)	0.253 (0.435)	0.186 (0.389)
Master's Deg	0.080 (0.272)	0.090 (0.286)	0.065 (0.248)
Doctorate Deg	0.009 (0.098)	0.013 (0.116)	0.003 (0.061)
# of Observations	5,293	3,184	2,109

The summary statistics table indicates that individuals with a BMI lower than 30 tend to have higher earnings, more males, a larger proportion of white individuals, and a higher percentage of those with bachelor's degrees. The group with BMI greater than or equal to 30 has slightly older ages on average, more black individuals, and lower earnings. There are fewer individuals with higher levels of education in this group as well.



The histogram illustrates a bell-shaped distribution of BMI, with most individuals (30.08%) having a BMI around 30. As BMI increased above 30 or decreases below 20, the proportion of individuals declines significantly, showing that extreme BMI values are uncommon. The data skews to the right more than the left, indicating that there are more people with higher BMI (above 30) compared to those with low BMI (below 20).





The bar graphs display the relationship between earnings and BMI categories, highlighting income disparities based on body weight. In terms of average earnings, individuals with a BMI less than 30 earn $64,222, which is higher than the $52,882 earned by individuals with a BMI greater than or equal to 30. The overall mean earnings across all BMI groups are $59,703, showing that those with lower BMI tend to have higher incomes on average.

When looking at the logarithmic transformation of earnings (lnEarnings), a similar pattern is observed. The average lnEarnings for individuals with a BMI less than 30 is 10.54336, slightly higher than the 10.46162 average for those with a BMI greater than or equal to 30. These graphical representations provide a clear visualization of the differences in earnings associated with BMI categories. The data indicates a negative relationship between higher BMI and income, contrasting with the hypothesis that a higher BMI would correlate with higher income.

V. <u>Statistical Analysis</u>

VARIABLES	*salarywage*	*ln(salarywage)*	*ln(salarywage)*
Age	359.1*** (86.89)	0.00220** (0.00104)	0.00185* (0.00104)
Male	22,266*** (2,552)	0.418*** (0.0304)	0.409*** (0.0306)
Employed	32,726*** (3,376)	1.232*** (0.0403)	1.226*** (0.0403)
BMI	-150.4 (167.5)	0.00398** (0.00200)	0.0370*** (0.0115)
BMIsq			-0.000489*** (0.000168)
Black	-14,323*** (2,468)	-0.231*** (0.0294)	-0.233*** (0.0294)
Amerinnat	-11,999 (13,922)	-0.344** (0.166)	-0.341** (0.166)
Asian	3,386 (9,810)	0.294** (0.117)	0.299** (0.117)
Nathpacisl	-18,466 (27,280)	0.0362 (0.325)	0.0344 (0.325)
GED	2,950 (6,389)	0.167** (0.0762)	0.167** (0.0762)
HS	10,343** (5,130)	0.416*** (0.0612)	0.417*** (0.0612)
Associate	6,194 (4,168)	0.200*** (0.0497)	0.194*** (0.0497)

Bachelors	32,138*** (2,908)	0.483*** (0.0347)	0.484*** (0.0347)
Masters	60,663*** (4,320)	0.707*** (0.0515)	0.709*** (0.0515)
Doctorate	56,111*** (11,569)	0.579*** (0.138)	0.595*** (0.138)
Observations	5,293	5,293	5,293
R-squared	0.123	0.298	0.299

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The regression table presents three models examining the influences of earnings. The first column applies a standard OLS regression with raw salary/wages as the dependent variable. The second column introduces a logarithmic transformation of salary/earnings (ln(salarywage)) to evaluate proportional changes in earnings. The third column further extends the logarithmic model by incorporating BMI squared (BMIsq) to investigate potential nonlinear effects of BMI on earnings.

The results demonstrate that across all models, the primary variables impacting earnings are gender, age, employment, and education. The logarithmic regressions indicate that being male is associated with an approximate 41% increase in earnings, illustrating that men consistently earn significantly more than women. Additionally, age has a favorable and substantial impact; every extra year adds to a slight increase in earnings. The most significant factor is employment status, with individuals who are employed earning significantly greater wages. Higher degrees, such as bachelor's, master's, and doctorate, are associated with significant and statistically significant increases in earnings, suggesting the importance of education. These advanced degrees correspond into proportional gains in the logarithmic models; for example, a master's degree raises earnings by approximately 70% over the baseline.

Ethnicity and race have distinct implications. Compared to White people, Asian people earn more, while Black and Amerindian people experience notable wage penalties. Other racial categories show no consistent or significant effects across the models. BMI presents an evolving relationship with earnings. In the first model, BMI shows a small, negative, and statistically insignificant effect. However, in the second model, with the logarithmic transformation, BMI becomes significant with a positive coefficient, suggesting a slight increase in earnings with higher BMI. The third model, which includes BMI squared, reveals a nonlinear relationship: While BMI initially has a positive effect on earnings, the negative coefficient for BMIsq indicates diminishing returns at higher BMI levels, leading to a decline in earnings. This implies that the effect of BMI on income is complex and varies according to its range.

Including logarithmic transformations improves the ability to further elaborate these models. Better predictive power is demonstrated by the logarithmic models, which raise the R-squared values to 0.298 and 0.299 respectively, while the first model only accounts for 12.3% of the variance in earnings. These results demonstrate a complex nonlinear relationship between BMI and earnings as well as the significance of demographic, employment, and educational factors. The outcomes emphasize how essential it is to take nonlinearities and proportional changes into consideration when assessing the connection between earnings and individual characteristics.

VI. Conclusion

Thus, while the relationship is more complex than first thought, this study partially supports the notion that a higher BMI is associated with higher wages. The results show that, although BMI has a minor and statistically insignificant impact on wages in the raw model, when logarithmic transformations and BMI squared are taken into consideration, a nonlinear relationship is revealed. At lower levels, earnings seem to rise slightly with BMI; however, as

BMI increases further, the returns diminish, and wages eventually decline. This result is in part consistent with earlier research, including Mukhopadhyay (2021) and Inafuku (2023), which highlights the complex relationship between BMI and labor market outcomes, which is frequently affected by prejudice and discrimination. This study, however, suggests a more complex dynamic than a simple wage penalty. Unlike Mukhopadhyay's research, which found wage penalties for higher BMI levels, it suggests that there may be modest earnings gains at lower BMI levels before diminishing returns occur.

Despite these valuable insights, the study's limitations must be acknowledged. Unobserved factors such as individual health behaviors, lifestyle choices, or personality traits could influence both BMI and earnings but were not captured in the model. Additionally, the absence of industry-specific data restricts the analysis, as the relationship between BMI and wages may vary across different sectors, especially between physically demanding and stationary jobs. A longitudinal approach would offer a more thorough understanding of how BMI affects earnings over time, as the cross-sectional nature of the data further restricts the ability to establish causal relationships.

Finally, conducting experiments or applying natural experiments, like adjustments to anti-discrimination laws, could provide stronger evidence of causality and assist with directing policy interventions meant to reduce labor market disparities. To improve the depth and relevance of the analysis, if this study were to be repeated, I would allocate the greatest attention to obtaining additional data and investigating the impact of BMI on specific industries or careers.

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