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Effects of physical activity on earnings in the Brazilian labor market☆

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Abstract

This article investigates the effects of physical activity on earnings in the Brazilian labor market, analyzing workers aged between 30 and 50 years. To that end, quantile regression was applied to analyze microdata from the 2008 National Household Sample Survey (PNAD). The results showed that workers who engage in regular physical exercise exhibit better social and economic conditions compared to sedentary individuals. Sedentary lifestyles are typically more common among female employees than their male counterparts and this is reflected in earnings in the labor market. The impact of physical activity on wages varied from 15.0 to 31.0% and was greater among the highest quantiles. The lowest salaries were recorded among non-white sedentary women.

JEL classification: I15; I19; J21

Keywords: Physical activity; Earnings; Labor market; Health

1. Introduction

The growing numbers of obese and overweight people in Brazilian and global populations have caused concern among policymakers and researchers. This has contributed to an increase in research highlighting the role of economic factors in relation to obesity, sport participation and healthy lifestyle choices, as addressed by Brown and Roberts (2011), Chau et al. (2008) and Vaughan et al. (2008).

Despite the importance of physical activity and healthy lifestyle choices highlighted by the growing literature on participation in sporting activities, discussion about the consequences of these activities in the labor market is still recent, as reported by Lechner (2009) and Kosteas (2012). However, according to Downward and Riordan (2007), Kosteas (2011) and Gidlow et al. (2006), discussion regarding the economic determinants of engaging in physical activity and its impact on the labor market is still new and there are scarce literature.

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For illustrative purposes, we conducted a literature search on the PUBMED database using the terms "physical activity" and "economics". We found in this search more than 28,000 articles that investigate adult participation in physical activities.[1] However, we found, only 49 articles published between 1980 and 2013 that exploring the economics aspects in the sport participation.

The discussion about sport participation stems from research into the effect of human capital and obesity on individual earnings. Baum and Ford (2004), Cawley (2004), Register and Williams (1990), Loh (1989) and Caliendo and Gehrsitz (2014) showed that obese employees are penalized by the job market, earning between 5.5 and 24% less than their non-obese counterparts. Wage penalties caused by obesity are higher for women. The authors report that obese people receive lower salaries because they are less productive due to obesity-related health problems. Moreover, Hamermesh and Biddle (1994) showed that people who consider themselves physically attractive earn between 5 and 10% more than others. Much like attractive and slim individuals, tall people are also paid higher wages, according to Schultz (2002). Two studies, one conducted by Lechner (2009) in Germany and the other by Kosteas (2012) in the United States, showed that sedentary individuals earn 5–10% less than those who practice some type of sport.

In this context, the present study aims to investigate the effects of physical activity on earnings in the Brazilian labor market, analyzing workers aged between 30 and 50 years. The goal is to broaden the evidence regarding the results already found in order to confirm them using an econometric model. It is important to note the significance of investigating wage differences between those engaging in physical activity and sedentary employees, given the absence of such research in Brazil. Furthermore, the evidence found may contribute to public knowledge of the benefits of physical activity in the labor market, as well as encourage individuals to adopt a more active lifestyle.

The article also contributes by measuring the effects of physical activity on wage gains. In addition to demonstrating the impact of schooling on salary, the econometric results also indicate that white workers residing in urban centers who engaged in physical activity tend to command higher wages in the job market. Lower wage returns from physical activity are recorded for women, particularly non-white females. On the other hand, more active and therefore healthier employees are typically more productive and, as such, may have higher incomes.

The present study is divided into five sections, including this introduction. Section 2 contains a brief theoretical review of Grossman's human capital model and empirical studies, while Section 3 addresses methodological aspects and estimates the econometric model. Section 4 contains an analysis of results and the conclusions are laid out in Section 5.

2. The influence of human capital and health capital on physical activity

Different theories and models have been used to study physical activity and vary according to areas of knowledge. In the economic arena, most of the models used to study determinants in sporting activity take a theoretical and empirical stance toward the choice between leisure and work, as well as use of time and Grossman's (1972) approach to the formation of health capital.[2] However, the effects of health on the labor market are studied using either human or health capital theory. The human capital theory, advocated by Gary Becker, Jacob Mincer, and Theodore Schultz, suggests that education and training improve workers' skills and increase their productivity, consequently raising their future income throughout their careers. In addition, salaries are determined by the productivity of each employee and measured according to the time individuals invested in education and training. Schultz (1961) addresses human capital from a broader perspective, incorporating the knowledge, skills and physique of workers. The relationship between health and salary was first addressed by Schultz (1961), Mushkin (1962), Grossman (1972), Grossman and Benham (1974) and Luft (1975).

Grossman (1972) expanded the concept of human capital presented by Becker (1962, 1964, 1965), compiling a model of demand for health in which consumption choices throughout life are viewed as an investment problem, where the consumer can choose between investing in their own health or other assets. In this model, health can be considered a commodity that plays a direct role in the utility function of individuals, as well as an investment good that leads to fewer sick days. Grossman demonstrated that the formation of capital health determines the amount of time people can

[1] Physical activities ensure better mental functions, as demonstrated by Ettner (1996), Hillman et al. (2008), Gomez-Pinilla (2008), Lindwall and Hülya (2013) and Tomporowski (2003), and improved psychological conditions, in the view of Folkins and Sime (1981), Spence et al. (2005), and increase social capital, that is, social abilities, as addressed by Aguilera and Bernabé (2005) and Eccles et al. (2003).

[2] Studies in this regard include those conducted by Becker (1964), Gronaur (1974), Kosteas (2012), Lechner (2009), Farrel and Shields (2002), Downward and Riordan (2007), Ebert and Smith (2010), Humphreys and Ruseski (2010) and Ruseski et al. (2011) inter alia.

spend on work and obtaining income, as well as other activities. Thus, an increase in health stock reduces the amount of time lost due to illness, allowing higher earnings.

In Grossman's model, health production is subject to monetary and time constraints. As a result, individuals choose how to allocate their time between leisure (including physical activity), paid and unpaid activities. These individuals also decide how to allocate their income between consumption goods and intermediate goods for the production of health (such as spending on sporting activities). Budget constraints take into account the present value of income, which is equal to the present value of goods consumed by individual i, as expressed by Eq. (1):

$$\sum \frac{P_i M_i + V_i X_i}{(1+r)^i} = \sum \frac{W_i \mathrm{TW}_i}{(1+r)^i} + A_0 \tag{1}$$

where P_i and V_i are the prices of M_i, which corresponds to health production, X_i represents other goods, W_i is the wage rate, TW_i depicts hours worked, A_o is deducted income and r is the interest rate.

In simple terms, it can be said that the main points of the Grossman model are: (a) age is negatively correlated with health capital, but positively associated with investment in health care; (b) wage rate is positively correlated with both demand for health and demand for healthcare; (c) education is positively associated with health capital, but negatively correlated with investment in health care; (d) individuals with higher schooling levels demand better optimal health stock; (e) health is an individually produced commodity. For Rosenzweig and Schultz (1983), in addition to higher wages, education alters the perceived risk of unhealthy lifestyle habits and enables people to make better health choices, such as eating fruits and vegetables, engaging in physical activity and opting to stop smoking.

In this respect, Grossman's model (1972) is applied to explain the influence of physical activity on earnings in the labor market and the role of human capital in the formation of health capital. Recent studies, such as those conducted by Thomas and Strauss (1997), Currie and Madrian (1999) and Godoy et al. (2007), indicate that health impacts the labor market. For example, the decision to enter the job market or not, hours worked and wages are subject to employees' health status.

The relationship between health status and wages can be explained as follows: (a) better health increases employees' marginal productivity, which in turn leads to wage benefits; (b) employers generally expect healthier workers to be more productive; this implies that employers are willing to pay healthier workers more; (c) workers in poor health, regardless of whether their productivity is low or not, are discriminated against in the labor market in the form of lower wages, as reported by Currie and Madrian (1999).

In this context, Farrel and Shields (2002) examined the influence of family, income and ethnicity on participation in sports in England, using data from the Health Survey of England. Also in England, Downward and Riordan (2007) investigated the relationship between economy and physical activity based on information from the UK General Household Survey. Similarly, in Scotland Ebert and Smith (2010) used the Scottish Health Survey to analyze participation in and time spent on physical activities. In the United States, Humphreys and Ruseski (2010) and Ruseski et al. (2011) used data from the US Behavioral Risk Factor Surveillance System to analyze the decision to participate in and time allocated to physical and recreational activities. In general, these studies showed that physical inactivity is more prevalent in people with low socioeconomic status, the disabled, those who are married, elderly, or have young children, and women. People with higher incomes and better schooling tend to be more physically active. The studies also indicated that physical activity declines with age, beginning primarily during adolescence and falling through adulthood. Ruhm (2005, 2007) investigated the effect of economic fluctuations on the practice of sports. The author found evidence that, during recessions, obesity falls and participation in sports increases, largely due to the decline in hours worked.

Lechner (2009) applied a microeconometric model to analyze the effects of engagement in sporting activities on the labor market in terms of hourly wages. He used data from a longitudinal study (the German Socio-Economic Panel Study (GSOEP)) covering 1984–2006, with a sample of 6651 individuals aged between 18 and 45 years. Over the years, the active subjects reported feeling more satisfied with life and less concerned about economic issues. Lechner (2009) found that physically active people earned around EUR 1200.00 more than inactive or rarely active individuals. The wage return due to sporting activity was estimated at between 5 and 10%.

According to the author, the effects of participation in sports follow three pathways. The first is related to the effects on productivity. Better health resulting from physical activity leads to productivity gains, which are rewarded in the labor market. The second concerns impacts in terms of the network of social relationships provided by group sports. Finally, engaging in sports participation can signal employers that the individual in question is healthy, motivated and competitive.

Kosteas (2012) studied the effect of physical activity on the salaries of American employees using data from the National Longitudinal Surveys of Youth (NLSY), a longitudinal study conducted between 1985 and 2006, with a sample of 12,686 young Americans. In order to determine the impact of physical activity on the earnings of the participants, Kosteas (2012) analyzed data from the 1998 and 200 waves, that is, when the subjects were between 33 and 41 years old. The econometric method applied was propensity score matching. The results showed that those who engaged in physical activities earned salaries between 6 and 10% higher than the sedentary participants.

3. Methodological aspects and estimation

We applied the quantile regression for estimation purposes. This method was proposed by Koenker and Basset (1978) for analysis of the wage determinants. Since then, the quantile regression has been used as an instrument in several empirical studies, mainly in labor economics, as reported by Koenker (2005).

Koenker (2005), Buschinsky (1998) and Silveira Neto and Campelo (2003) compared the behavior of curves estimated by quantile regression (QR) and by the ordinary leat squares (OLS) method. The authors showed that the results obtained by QR provide a better fit and demonstrate the effect of experience and the study years in different quantiles of conditional income distribution, since distribution is not constant along conditional wage distribution. This methodological approach has a number of advantages. The first is that quantile regression estimators give less weight to unusual observations or outliers in the dependent variable than the least ordinary squares approach. The second benefit is that parameters for the marginal effects of the explanatory variables can be estimated for the conditional quantiles of the dependent variable. Thirdly, when an error term does not follow normal distribution, quantile regression estimators may be more efficient than least ordinary squares estimators. Another advantage is the semiparametric nature of estimation, which reduces the importance of how constant the parameters can be, through the distribution of the dependent variable. The quantile regression model can be expressed as:

$$y_i = X'\beta_\theta + U_{\theta i} \tag{2}$$

where y_i is the matrix of dependent variables i and X' is the matrix of independent variables, β_θ are the estimated parameters and $U_{\theta i}$ are the errors in those captured by the model with normal distribution, zero mean and constant variance. Based on the definition of Eq. (2), the quantiles can be reformulated in accordance with Expression (3).

$$Q_\theta = (y_i : X_i) = X_i'\beta_\theta, \theta \in (0, 1) \tag{3}$$

The quantile regression equation of θ is defined as:

$$\min_\beta \frac{1}{n}\left[\sum_{i:y_i \geq x_i'\beta} \theta|y_i - x_i'\beta_\theta| + \sum_{i:y_i \leq x_i'\beta} (1-\theta)|y_i - x_i'\beta_\theta|\right] = \min_\beta \frac{1}{n}\sum_{i=1}^{n}\rho_\theta(u_{\theta i}) \tag{4}$$

with $\rho_\theta(.)$ of Eq. (12) defined as follows:

$$\rho_\theta(.)\begin{cases} \theta u_{\theta i} & se \quad u_{\theta i} \geq 0 \\ (\theta - 1)u_{\theta i} & se \quad u_{\theta i} < 0 \end{cases} \tag{5}$$

In addition, regression is performed between quantiles with the dependent variable expressed as a logarithm. In this case, the estimated coefficients represent how much each explanatory variable influences the income equation. Quantile regression is an estimate resulting from minimization of the weighted sum of the absolute value of errors, where the positive errors are weighted by the negative errors.[3] Buschinsky (1998) and Silveira Neto and Campelo (2003) showed that, unlike ordinary least squares estimation models, the effects of education on salaries can be determined in different parts of the wage distribution, since distribution is not constant along conditional wage distribution. To investigate the impact of physical activity on individual earnings in Brazil, we estimate Eq. (6):

$$\ln \text{wage}_i = \alpha(\theta)_i + \beta_1(\theta)\text{age}_i + \beta_2(\theta)\text{age}_i^2 + \beta_3(\theta)\text{schooling}_i + \beta_4(\theta)\text{white}_i + \beta_5(\theta)\text{sport}_i + u_{\theta i} \tag{6}$$

[3] Quantile regression of 0.25 is the result of a weighting of 0.25 of positive errors and a weighting of 0.75 of negative errors, as addressed by Greene (2003) and Wooldridge (2002).

Table 1
Descriptive statistics for active and sedentary men aged 30–50 years.

Variable	Active		Sedentary	
	Average	Standard deviation	Average	Standard deviation
Household income per capita (USD) PPP	691.38	1032.9	377.18	655.97
Monthly salary USD PPP	1328.39	1742.12	788.71	1183.24
Age (years)	39.09	5.66	40.33	5.68
Years of schooling	10.44	4.17	7.67	4.39
Whites (%)	48.08	50.04	42.41	50.58
Health insurance (%)	41.52	49.28	21.14	40.83
Smokers (%)	33.04	47.07	28.35	45.08
No. of doctor's appointments	3.12	3.55	3.48	4.49
No. of chronic diseases (years)	0.38	0.70	0.49	0.83
Good health (%)	85.88	34.83	73.05	44.37
Family with children (%)	37.10	48.31	33.46	47.18
Family size	3.52	1.38	3.75	1.51
Urban zone (%)	89.68	30.43	82.30	38.17
Employed (%)	91.67		88.38	

Source: IBGE—PNAD Microdata/2008.

where: (a) ln wage corresponds to the logarithm of monthly income per hours of core work; (b) age is individual's age in years; (c) age squared; (d) schooling represents the individual's years of schooling; (e) white a binary variable equal to 1 is used for individuals who declared themselves white and 0 for those who answered black or mixed race; and (f) sport is the binary variable equal to 1 for people who exercise and 0 for those who do not,[4] (j) $u_{\theta i}$ is the stochastic error term.[4] Data analysis will be conducted based on the econometric model, with a view to identifying increased employee income due to physical exercise; (k) θ denotes the quantile to be estimated, which are 0.10, 0.25, 0.50, 0.75, 0.90.

The database used was the 2008 Brazilian National Household Sample Survey (PNAD), a household-based study conducted by the Brazilian Institute of Statistics and Geography (IBGE) that interviewed 391,868 people in 150,591 households across Brazil. In addition to information on physical activity, the survey also contains socioeconomic, demographic, health and household conditions data on the interviewees. In light of its national scope, the 2008 PNAD is a source of detailed information on the Brazilian population and its engagement in physical activities. The sample used for estimation consisted of individuals aged between 30 and 50 years, with data analyzed by gender.

4. Description and analysis of results

4.1. Descriptive analysis

Descriptive statistics selected for active and sedentary men are shown in Table 1. It is evident that, in general, the best indicators were exhibited by active workers. Earnings measured by the salaries of employees classified as active, that is, those who engaged in regular physical activity, displayed mean values higher than for workers considered sedentary. Household income per capita was almost double in the first group, that is, USD 691.38 against USD 377.18 for sedentary men. Monthly salary showed the same similarity. However, both household income per capita and individual wages salaries varied significantly, evident in the higher standard deviation in relation to the mean itself.

The mean age of those who exercised was 39.1 years against an average 40.3 years for sedentary participants. Moreover, average schooling was longer for the first group in relation to the second, with 10.4 and 7.6 years of study, respectively. The data also revealed that, on average, white workers accounted for 48.8% of those who exercised regularly against 42.4% for sedentary men, and double the number of active men had health insurance. Additionally, 33% of the physically active men were self-declared smokers, as opposed to 28.3% among those deemed sedentary.

[4] Engagement in physical activity refers to the yes/no question in the Pnad/2008 "Have you participated in any type of physical activity or sport in the last three months?" For the different types, frequency and duration of physical activities practiced by the interviewees, see Tables A1–A3 in Appendix A.

Table 2
Descriptive statistics for active and sedentary women aged 30–50 years.

Variable	Active		Sedentary	
	Average	Standard deviation	Average	Standard deviation
Household income per capita (USD) PPP	719.00	962.99	362.12	521.83
Monthly salary USD PPP	1028.82	2017.28	566.97	1183.24
Age (years)	40.22	5.71	39.95	5.68
Years of schooling	11.17	4.04	7.67	4.39
Whites (%)	55.43	50.29	43.77	50.39
Health insurance (%)	45.30	49.78	24.10	42.77
Smokers (%)	11.12	31.64	18.57	38.89
No. of doctor's appointments	4.42	5.27	4.40	5.26
No. of chronic diseases (years)	0.65	0.99	0.68	1.02
Good health (%)	79.48	40.38	68.94	46.27
Family with children (%)	28.19	44.99	28.86	45.31
Family size	3.45	1.26	3.78	1.47
Urban zone (%)	93.72	24.27	85.45	35.26
Employed (%)	66.52		62.63	

Source: IBGE—PNAD Microdata/2008.

With respect to good health, the indicator reveals that active employees held a large portion of 12.8% points of the total in comparison to their sedentary colleagues, that is, 85.8% against 73.0%, respectively. This improvement is ratified by the questions regarding number of chronic diseases and number of doctor's appointments, favoring physically active men. The average number of children aged 14 years and younger was slightly lower among active participants when compared to sedentary subjects, whereas the reverse was true for family size. This can be explained by the fact that the first group of workers also exhibited higher schooling levels and had fewer children. In the last two questions, men living in urban centers who worked, those who exercised were around 7.1 and 3.3% points higher than sedentary subjects.

Table 2 shows the descriptive statistics selected for physically active and sedentary women, exhibiting a marked difference in relation to men. Thus, indicators tend to favor those who exercise regularly over sedentary individuals. Household income per capita and average salaries among active workers are far higher than in their sedentary counterparts, although both segments also display substantial variation. For active women, average household income per capita showed an even greater difference than that recorded for men, that is, USD 719.0 against USD 362.12 for the latter. There is also an overwhelming difference in favor of active subjects in terms of wages. This group earned around 81% more than sedentary people, that is, an average of USD 1028.82 against an average of USD 566.27, respectively.

It is also noteworthy that the average age of physically active women was 40.2 years and about 40.0 years for sedentary females. Average schooling was also longer among active females, with 10.4 years in relation 8.5 years of study for the second group. White female employees also tend to be more physically active than non-whites and invest more in health care in the form of health insurance. Moreover, 11% of physically active women reported that they were smokers against 18.6% of sedentary women, that is, much smaller numbers than those observed for men.

In regard to general health, 79.5% of active women considered their health good compared to 69.0% of sedentary females. This result is confirmed by the items number of chronic diseases and number of doctor's appointments, which favor women who participate in physical activity. Two other indicators, family size and families with children, show almost no differences between the two groups analyzed. On the other hand, women who lived in urban centers and worked corresponded 93.7% and 66.5% among active women, against 85.4% and 62.6% for sedentary females, respectively.

Table 3 indicates the prevalence of sedentary lifestyles among men and women by age range. Here, sedentary lifestyle percentages are higher among women than men, approximately 78.5% and 66.2% of the total, respectively. Specifically, across all ages among women, this proportion is greater than 75%. In women, physical activity remains almost unchanged up to the age of 39 years, after which it intensifies slightly from 20.8% to 24.7% for the 56 to 65-year-old age group. The reverse is true for men. Regular physical activity is higher among men aged 18–24 years, reaching more than 50.0% of the total. Thus, as this group ages, the number of sedentary individuals rises. A higher

Table 3
Prevalence of sedentary lifestyle by sex and age range from 18 to 65 years (%).

Age range (years)	Men	Women
18–24	47.99	79.86
25–29	56.17	79.45
30–34	64.26	79.80
35–39	70.12	79.23
40–44	73.98	78.86
45–49	76.46	77.55
50–55	79.62	76.73
56–65	79.77	75.29
Total	66.20	78.54

Source: BGE—PNAD Microdata/2008.

Table 4
Prevalence of sedentary lifestyles among workers by salary range.

Salary range (USD PPP)	Men	Women
Up to 350.99	81.39	84.35
From 351.00 to 700.99	74.14	84.35
From 701.00 to 1050.99	66.57	76.98
From 1051.00 to 2100.99	58.12	62.10
From 2101.00 to 3500.99	47.85	51.43
From 3501.00 to 5250.99	46.21	43.09
From 5251.00 to 7000.99	43.39	45.25
From 7001.00 to 8750.99	35.51	43.59
From 8751.00 to 10,500.99	34.52	37.50
More than 10,501.00	21.18	28.23

Source: IBGE—PNAD Microdata/2008.

Table 5
Average salary among men according to schooling (in USD PPP).

Years of schooling	Active		Sedentary	
	White	Non-white	White	Non-white
Uneducated and less that 1 year of schooling	592.99	342.48	420.56	324.43
1–3 years	564.11	411.37	483.52	393.08
4–7 years	744.49	522.02	679.57	345.59
8–10 years	885.55	686.19	817.24	436.85
11–14 years	1417.07	1058.53	1188.07	691.23
Over 15 years	3408.21	2681.69	2710.89	1673.83

Source: IBGE—PNAD Microdata/2008.

percentage of sedentary men is observed from the age of 56 years, with 79.8% of the total. This number is virtually identical to that of women at the other end of the spectrum, that is, females aged 18–24 years.

Table 4 shows the percentage of sedentary workers by salary range. Note that there is a greater concentration of sedentary workers at lower salary levels, that is, more than 80.0% for men and over 84.0% for women, with a salary of up to USD 350.00. The data clearly show that the highest salary level is associated with a larger portion of physically active workers. These percentages are almost halved for men in the seventh salary range and for women slightly above the eighth salary range. There is a notably lower sedentary level for the last salary range of amounts over USD 10,500.00. In this case, 78.8% of men were physically active compared to 81.8% of women. Based on this result, it can be inferred that employees with greater purchasing power tend to be in a better position to demand gym services. Moreover, their higher schooling levels mean they are aware of the health and wellness benefits of physical activities, in addition to being more productive in the labor market.

Table 6
Average salary among women according to schooling (in USD PPP).

Years of schooling	Active		Sedentary	
	White	Non-white	White	Non-white
Uneducated and less that 1 year of schooling	609.47	300.36	276.04	221.53
1–3 years	317.92	300.90	283.69	233.51
4–7 years	407.05	522.02	345.59	514.97
8–10 years	858.03	355.51	354.80	354.80
11–14 years	858.03	631.39	691.23	510.64
Over 15 years	2145.19	1833.56	1673.83	1355.78

Source: IBGE—PNAD Microdata/2008.

Table 5 shows the average salary per year of schooling for physically active and sedentary men. As expected, the labor market tends to significantly favor white men with 15 years of schooling or more who are physically active. The average wage for these workers is 5.7 times higher than those with only 1 year of schooling. This difference is even greater among non-white physically active employees, for whom gains are 7.8 times higher. For sedentary individuals, average earnings are 6.4 times greater among white men and 5.2 times higher for non-white employees, comparing the items uneducated and less than one year of schooling with 15 years of schooling or more. It is important to underscore that higher salary differences are recorded between white physically active workers and non-white sedentary employees, which vary between 44.0% and 115.0%, depending on years of schooling.

Table 6 shows the average salary per year of schooling for physically active and sedentary women. Similarly to men, it is evident that the labor market tends to provide greater benefits to physically active white women with 15 years of schooling or more, albeit with a slightly smaller variation. The average salary for these workers increases only 3.5 times in relation to women with only one year of schooling, rising from USD 609.47 to USD 2145.19. Among non-white female workers who also exercised regularly, white and non-white sedentary employees, wage increases are multiplied by a factor of 6.1.

Comparative analysis between men and women reveals that non-white sedentary females earn less in the labor market, followed by sedentary white females and non-white physically active women. Fourth among the lowest salaries are non-white sedentary men. At the other extreme, in terms of higher average salaries, are, in order, white physically active men, white sedentary males and physically active white women.

The most common physical activities reported across Brazil were walking for women and football for men, that is, exercise that requires few financial resources.[5] This result may indicate the preferred activities of interviewees, but also suggests a possible shortage of public spaces aimed at other types of exercise or insufficient income for sports that require a degree of financial investment of specialized supervision, such as gym membership or water aerobics.

4.2. Econometric results

The results of quantile regression for the quantiles 0.25, 0.50, 0.75 and 0.90 for men and women aged between 30 and 50 years are reported in Tables 7 and 8. In general, all coefficients were statistically significant for both groups. The only exception was for the variable age, in both specifications for men, and quartile 0.25 for women. The results indicate a positive association between level of schooling and earnings in both sexes, with an increasingly greater impact from quantile 0.25 to 0.90. For men, the effects of schooling level on earnings are slightly higher in the first two quantiles (lower levels of income) than for women, in the range of 9.0–9.6%. In the last two quantiles the effects are slightly higher for women, varying between 11.0 and 12.0%.

The non-white workers variable has a highly negative relationship with earnings in the labor market. The estimated impact tends to be slightly higher for women, varying between 20.0% in quantile 0.25 and 26.2% in quantile 0.90, whereas for men this range is 19.8–22.3%, respectively. The urban variable indicates that employees residing in urban centers earn less. The magnitude of the coefficient, in turn, is far higher among women, varying from 30.0% in quantile 0.25 to 17.1% in quantile 0.90, while for men this proportion is approximately 16.7–3.7%.

[5] This result is shown in Table A1 of Appendix A.

Table 7
Results of quantile regression for men aged 30–50 years.

Variables	q. 25	*T*	q. 50	*t*	q 75	*t*	q 90	*t*
Const	2.6195	10.45	2.8500	12.11	3.0388	11.27	3.1019	7.34
Age	−0.0003	−0.23	0.0017	0.15	0.0035	0.26	0.0194	0.91
Age^2	0.0002	1.00	0.0001	0.98	0.0002	1.16	0.0000	−0.04
Schooling level	0.0897	85.90*	0.0963	91.4*	0.1100	81.1*	0.1199	52.9*
Color	−0.1987	−21.27*	−0.2040	−23.32*	−0.2208	−22.3*	−0.2231	−14.52*
Urban	0.1667	9.58*	0.0990	6.02*	0.0533	2.84**	0.0374	1.28
Physically active	0.1499	13.27*	0.1785	17.03*	0.2357	19.98*	0.3156	17.02*
R^2	14.35		19.09		24.15		24.19	
Sample	32,537							

Observation: the dependent variable is defined by the logarithm for hourly wages.
*** Significance level of 10%.
* Significance level of 1%.
** Significance level of 5%.

Table 8
Results of quantile regression for women aged 30–50 years.

Variables	q. 25	*t*	q. 50	*t*	q 75	*t*	q 90	*T*
Const	2.4014	11.09	2.4065	12.77	2.3588	9.79*	2.4367	7.14*
Age	0.0211	1.94	0.0345	3.64	0.0474	3.94*	0.0537	3.01*
Age^2	−0.0001	−0.91	−0.0002	−2.01	−0.0003	−2.22**	−0.0004	−1.61
Schooling level	0.0759	78.57*	0.0919	106.71*	0.1110	94.29*	0.1241	66.97*
Color	−0.2004	−24.34*	−0.2093	−29.44*	−0.2363	−26.30*	−0.2621	−19.77*
Urban	0.3002	25.82*	0.2071	20.40*	0.1814	13.98*	0.1710	8.89*
Physically active	0.1516	16.48*	0.1754	22.11*	0.1933	19.29*	0.1934	13.19*
R^2	16.19		20.12		24.59		26.39	
Sample	44,285							

Observation: the logarithm for hourly wages is the independent variable.
*** Significance level of 10%.
* Significance level of 1%.
** Significance level of 5%.

Physical activity showed a highly positive relationship with the income and wages of respondents. These effects vary between 15.0 and 31.0% among males, depending on the quantile, that is, the impact is greater in higher income quantiles. Wage benefits due to physical activity are lower for women, ranging from 15.2 to 19.3%. This is corroborated by the literature, as demonstrated by Lechner (2009) and Kosteas (2011).[6] Finally, it is important to note that employee health is the channel through which salary gains are manifested. Thus, the healthier workers are the greater their productivity and, consequently, the higher their earnings. Moreover, this issue is also connected to level of schooling and physical activity which, together, have contributed to workers' well-being.

5. Conclusion

Exploratory analysis of the data made the differences between sedentary and physically active workers quite clear. Physically active employees displayed better social and economic indicators compared to sedentary personnel. The results show that physical health status, reflected by the lower incidence of chronic disease and fewer doctor's appointments, as well as higher average schooling are observed in workers who participate in physical activities.

The findings also indicate that the prevalence of sedentary lifestyles tends to be higher in women than in men. However, the opposite is true when analyzed according to age range. Regular physical activity among women only

[6] Kosteas (2011) and Lechner (2009) found that the salary gains of physically active individuals may grow from 5.0 to 10.0% in relation to sedentary people.

increases slightly after the age of 39 years. For men, physical activity is more common at younger ages, declining with ageing. Additionally, it can be concluded that lower income levels are associated with sedentary workers. In this case, non-white sedentary women earn the lowest salaries in the labor market.

Econometric tests show a positive relationship between level of schooling and earnings for both sexes, with greater impacts for men. White workers living in urban areas tend to secure higher wages in the labor market. It is noteworthy that the same result is observed for physically active individuals, whose salaries are between 15.0 and 31.0% higher than those of their sedentary counterparts. However, this wage gain is smaller for women, ranging from 15.2 to 19.3%.

Finally, it is suggested that future studies investigate other potential benefits in the labor market of regular physical activity by workers, considering aspects such as unemployment rate, staff turnover rate and job promotion politics. Furthermore, the impact of physical activity throughout the worker's life could be demonstrated by implementing a continuous PNAD, that is, the collection of longitudinal data.

Appendix A.

Table A1
Participation in sports by modality and gender (%).

Indicators	Women	Men
Walking (except on a treadmill)	65.5	25.1
Football, basketball, aerobics, running (including on a treadmill) or tennis	22.6	63.0
Other	10.8	10.9
No longer physically active	1.1	1.0
Total	100.0	100.0

Source: IBGE— PNAD Microdata/2008.

Table A2
Duration of sporting activities by gender (%).

Indicators	Women	Men
Less than 20 min	2.7	1.7
Between 20 and 29 min	5.3	3.7
30 min or more	92.0	94.6
Total	100.00	100.0

Source: IBGE—PNAD Microdata/2008.

Table A3
Frequency of sporting activities by gender (%).

Indicators	Women	Men
1–2 days a week	28.0	57.6
3–4 days a week	37.4	24.6
5–6 days a week	20.4	9.6
Every day	14.2	8.2
Total	100.0	100.0

Source: IBGE—PNAD Microdata/2008.

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